The Post-Commitment Atomic-Operation, Retention and Renewal Theorem, with First Bridge Execution and Companion Conditional Derivation of the Fine-Structure Constant

Companion paper: K7-EA-1, *Zero-Syndrome K = 7 Electromagnetic Admission and the Conditional Derivation of the Fine-Structure Constant*, whose result this paper consumes at its stated grade.

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General-reader summary

Earlier work in this programme established that the machinery it describes reliably reaches a first implemented record. This paper asks what happens next, and finds two answers worth stating plainly, each carrying its condition on its face.

The first is about the fate of facts. Within the declared append-only architecture, a committed record is retained while the active machinery renews itself, reliably and after barely more than a single opportunity on average. Nothing in the executed machinery erases the record, overwrites it, or produces a second foundational copy: later copies are further manifestations of the same retained fact, not new facts. The picture is a ledger written in permanent ink, with the present as its growing edge. Deriving that retention law from the primitive physics, rather than declaring the architecture, remains the named open step.

Several later audits sharpen what retention does and does not buy, and the distinctions matter more than they might sound. Keeping the past is not the same as the past shaping the present: the machinery reopens fully after each entry, so a stored record is not automatically able to steer what follows. Reopening is also not the same as restoring everything, because the particular loop-like slack that commitment may consume is provably beyond the reach of ordinary renewal. And retaining something is not the same as being able to read it: the theory's history carries a strong handedness — overwhelmingly one-sided even at complete closure — yet every route so far examined for turning that handedness into a visible difference in outcomes returns exactly zero. Each of these gaps has been narrowed to a single named calculation that the underlying equations must supply, and the paper is explicit that no answer may be chosen because it gives a convenient result.

A recurring pattern emerged from those audits and now organises the whole argument. Reversible structures can respond but cannot choose: they supply the stiffness of a mechanism without fixing its direction. Direction comes only from the irreversible side, from commitment itself. That separation is now the paper's working architecture for how a settled past could come to shape an open future, and its decisive test is a single identity between two objects the theory already contains.

The second answer concerns the strength of the electromagnetic interaction, developed in full in a companion paper. The candidate value is the product of two factors, giving a coupling whose reciprocal is about 137.14, close to the measured value near 137.04. The second factor is now a rigidity result: of fifteen available directions at the interface, fourteen transmit and one is inert, and no choice of bookkeeping can change that count. The first factor has been retyped at the foundation. The seven-part closure architecture fixes exactly 128 possible unresolved configurations, and the paper now states as an explicit premise what had been implicit in its notion of the void: before the first fact exists, there is nothing that could give one of those configurations more weight than another, since any such preference would already be a distinction at a stage defined to contain none. With that indifference premise in place, normalisation across the 128 alternatives fixes each prior weight to 1/128. This is deliberately stated as a foundational premise rather than a derivation, and the paper is careful that it is stronger and more precise than saying the void has zero entropy, which by itself would not give equal outcomes. Earlier calculations about how the deeper microscopic layer hands over to the closure layer remain valuable, but as consistency checks on that premise rather than as its source. What remains genuinely open on this side is showing that the electromagnetic interface really does use all fourteen transmitting directions, and connecting the theory's own units to laboratory ones.

The honest summary: the mathematical classification of possible record fates and the renewal calculation are exact within the declared architecture, while the primitive physical selection and the long-term survival law remain open; the companion paper's derivation of the fine-structure constant is real but conditional, and now conditional in a precisely stated way, resting on a named premise about the undifferentiated starting point together with two calculations still to be performed. The full physical theorem is deliberately not yet claimed. Reality, on the evidence executed so far and within the declared architecture, does not multiply or rewrite the committed fact. It retains it while continuing to evolve.

Abstract

HCMR-P1 and F2F-1 established an ordered first-record preparation law and almost-sure first entry into an implemented persistent-record class for the frozen VERSF marked instrument. HCMR-M1 begins after that entry. Its question is the complete post-commitment disposition of the first record: retention, renewal, additional-token production, fragment proliferation, erasure, reset or overwrite; the timing of those operations; the conservative and dissipative response of copied records; the basin and barrier protecting a physical class; the resulting survival law; and the terminal operation by which the class is read.

The paper proves nine central structural results. First, post-commitment outcomes are represented by a disjoint atomic signature rather than by overlapping verbal categories. Second, the resulting resolved-operation maps obey an exact competing first-entry identity, with a never-resolved effect retained explicitly; copy and proliferation laws are grouped corollaries. Third, uniform almost-sure resolution is equivalent to transience of the unresolved map, while resolution for a particular state is equivalent to zero overlap with the defect effect. Fourth, deterministic copied tokens do not multiply the original logical fact when conditioned on a sufficient copy-and-noise provenance variable. Fifth, a physical retention-maintenance operator is the syndrome block of the second variation of a conservative post-commitment functional after quotient and gauge reduction; causal damping and memory belong to a separate influence kernel, and a scalar $\gamma_{retention}$ exists only under isotropy; the syndrome sector measures consistency among manifestations of one retained fact. Sixth, exact and metastable persistence are characterised by Heisenberg-picture projector conditions. Seventh, closure-side topological persistence does not entail refinement realisation, readout or token survival. Eighth, physical quotient and readout form a joint operational fixed-point problem, with the algebra quotient defined only by a genuine two-sided *-ideal. Ninth, a fragment-count ceiling follows only after a minimum per-fragment information return and an additive or otherwise proved information-budget inequality are supplied.

The inherited VERSF corpus supplies exact copy and renewal isometries, an executed 319-to-84 record coarse-graining, recurrent capacity, a regulator-covariant maintenance candidate, a continuum commitment action class, a free-energy curvature, an unresolved-record bath model, a causal memory kernel and conditional topological persistence structures. None by itself derives the atomic post-commitment instrument or its physical code/syndrome carrier. The complete same-source bridge from continuum commitment dynamics to operation effects, retention stiffness, leakage, quasipotential barrier, physical survival, quotient-stable readout and path costs remains open. Accordingly, the integrated mathematical theorem and primitive-execution contract pass; complete physical H_{CMR} is not admitted.

The first bridge execution calculates almost-sure renewal within the inherited F2F/PFDMI append-only architecture (unresolved spectral radius 0.200305886206958, stationary mean renewal wait 1.234602249934960 opportunities), and its correct typing is foundational retention: the resolved event class is the renew-only atom $\sigma = (1, 1, 0, 0)$, so one committed fact remains retained — $\mathcal{H}_m \to \mathcal{H}_{m+1} = \mathcal{H}_m \parallel e_{m+1}$, ordered extension rather than mere set union — while the active carrier reopens, with no terminal erasure, overwrite or foundational duplication effect in the executed base instrument. The XI-4 CPR map is retyped accordingly: it is an exact but source-independent dilation, $|\alpha\rangle \mapsto |\alpha, \alpha\rangle$, a two-sided consistency representation of one retained fact rather than a physical producer of second foundational records; its constant copy flag and rank-zero propensity Jacobian are evidence that copying was never the foundational decision, not that the source failed to select it. The central physical question is therefore retyped from copy/no-copy selection to retention invariance: derive $\Phi_{renew}(P_e) = P_e$ *from the primitive action, with erasure/leakage* ($\Phi(P_e) < P_e$) and overwrite/corruption ($\Phi^*(P_{e'}) P_e \neq 0$) ruled out, rather than the paper declaring the append-only architecture. A cumulative audit of HCMR-

MR1 and PFHBA-7 locates the route: a regulator-convergent 102-dimensional maintenance parent admits an exact sector-typed recurrent Fisher pullback, together with a conditional source-projected bath and Doob-descent architecture; the pullback is highly non-unique and the marked descent has not been numerically executed. The present result is therefore a partial execution and obstruction theorem. A separate exact result splits individual manifestation stability (common-mode stiffness μ^2) from retention-consistency stability (syndrome stiffness $\mu^2 + 2\kappa\_c$): the inherited commitment curvature can supply the first without returning the second. The electromagnetic admission line is developed in the companion paper K7-EA-1 and has since been materially strengthened by a sequence of source-typing, gate-provenance and inter-layer audits. The full-closure selector is an exact rank-one projector on the 128-dimensional K = 7 closure carrier. The actual EX2G attaching map supplies a canonical thirteen-dimensional transport support through its unique polar partial isometry, with $\mathrm{Tr}(W^\dagger W) = 13$; the sharp committed-record sector supplies one additional transmitting line; and the unique global constant mode is exactly relative-currentless ($\|B^T 1\| = 0$ exact in the source calculation). For any contractive TPB coherence-transfer operator that saturates the thirteen transport directions and the committed-record line while annihilating the global direction, the source effect is rigidly fixed to $\mathrm{diag}(I_{14}, 0)$, so the gate throughput is 14/15 without an equal-atom probability postulate or chosen direct-sum normalisation. Composing that structural gate with the rank-one closure trace gives the exact candidate p_EM = (1/128)(14/15) = 7/960, p_EM^{-1} = 137.142857…. Record/export dilation, its particular sech/tanh parametrisation, and later renewal/copy/proliferation refinements do not change the source-side 14/15 trace. The result remains a conditional structural derivation rather than an admitted derivation of measured α. The pre-fact 1/128 weight is fixed at foundational level by P14 together with the derived K = 7 closure cardinality (Theorem 40A, §46AE); the source-native microscopic-to-closure CPTP descent, with its scaled-unital or irreducible-covariance certificate, is retained as a cross-carrier realisation and consistency requirement rather than as the origin of that weight. The load-bearing physical obligations are therefore the TPB inter-layer saturation return and continuum/QED matching and running.

A persistent-ledger audit separates retention from backreaction: the renewal isometry reopens the full declared PFDMI working carrier, so persistent storage alone produces no projector loss (Theorem 16). A further carrier-relative audit corrects the strongest reading of that negative result. Full reopening of the declared PFDMI working carrier does not imply full reopening of the independent twelve-edge HX1 record-phase carrier. Pulling the canonical EX2G/CGI renewal-response support and the HX1 signed-edge phase carrier onto the common 24-dimensional nonself-history space gives principal-angle spectrum {0 (×6), π/2 (×6)}. The common six-plane is the exact/coboundary cut sector Im d; the complementary six-dimensional HX1 sector is the cycle space. The selected uniform-rim record phase satisfies $d^T\varphi\_rim = 0$ and therefore lies entirely in the cycle sector, exactly orthogonal to the source-native incidence-renewal image. There is moreover no linear factorisation from the fourteen EX2G incidence labels that reconstructs all twelve signed HX1 edge phases. Consequently the present source-native renewal geometry does not by itself restore the selected loop-relaxation mode: conditional on commitment having consumed that old cycle carrier and on the absence of an additional non-coboundary renewal intertwiner, the full local HX1 excess survives. A subsequent master-action audit then locates the HX1 phase inside the common action itself — the phase tangent of the record/completion morphism, with unit-branch Hessian [[3, −1], [−1, 2]] and exact full-lock excess 1/2 — and closes the minimal-renewal loophole: the unique minimal branch-preserving renewal carries only a global/Kraus phase and supplies no fresh HX1 tangent ($s\_fresh = 0$), while the discrete terminal label is not a continuous phase. The remaining carrier questions are the post-commitment survival amplitude s_old of the old event-specific phase direction (unit-branch excess $(1 - s\_old^2)/2$), the common-operational-metric normalisation $w\_B^2/(w\_B + w\_R)$, and any genuinely non-minimal fresh phase channel, which would be an additional source interaction rather than ordinary renewal.

A subsequent ordered-history and internal-frame execution further resolves the history-backreaction boundary. The one-token F2F edge coarse-graining annihilates the full reversal-odd directed-edge sector, but ordered pairs of retained rim records recover a unique A_2 chirality observable; the frozen D36 law populates that observable with nonzero expectation 0.334169477947982 and conditional orientation bias $\tanh(2\alpha) = 0.957752384566601$. This ordered-history binary observable is canonically isomorphic at the effect-algebra level to the R4 P± branch observable, but not at the Hilbert-carrier level: the corresponding D_6-equivariant state-space intertwiner is zero, so any physical bridge must be a conditioned readout rather than a carrier identification. Three candidate activation mechanisms then fail sharply. Unsigned scalar commitment density and its κ/Ξ memory descendants annihilate the history-odd source; the source-driven GTC record phase carries orientation but produces only access-invisible phase coherence under the natural E_1 realisation; and the EX2E orbit-current instrument is projective, so scalar sign or phase changes of j_e leave ρ_J,e invariant. The action-selected spatial helix therefore gives zero projective internal visibility when dressed by a common internal ray, while generic unresolved internal frames can give large visibility, establishing capacity but not selection. Finally, differentiating the same-source current constraint with respect to the history orientation gives $\partial\_\alpha D\_J = 0$ and $J\_D \dot{x}\_\alpha = 0$: the current action does not force a unique projective internal response. The missing physics is now an explicit source-action mixed derivative coupling realised history orientation to the physical internal frame, or an equivalent isolated stationary class of the source action on the fully quotiented admissible frame manifold. A conjugate-frame audit then closes the diagnostic route exactly — complete faithful conjugation of the EX2E instrument leaves every native Born probability unchanged — while the frozen family transport is found to carry an exact closed gauge-invariant holonomy, $W\_\Delta = e^{i\cdot 5\pi/6}$ on the bare generator (150°, reverse 210°), whose inheritance by the physical role-even charged-completion comparison loop is now the remaining phase obligation.

Further execution extends these results in two directions. First, a signed first-cover circulation variable K shows that the source-native orientation remains overwhelmingly one-sided at the actual complete-cover stopping event, obeying the exact fluctuation relation $P(K = k)/P(K = -k) = e^{2\alpha k}$ and giving $P(K > 0) = 0.996750764817216$ on the frozen branch, with conditional preferred-sign probability 0.998816847345935. The leading symmetry-allowed history-to-R4 population coupling is fixed in form by $A_2 \otimes A_2 = A_1$ as the bilinear $-g\_\chi P\cdot\chi\cdot\Delta P$, but its source coefficient remains unreturned; the currently executed scalar and pure-phase channels have exactly zero population projection. Second, the HMGBC generation Laplacian is shown to enter the common completion Hessian as the positive amendment $\Delta\Omega$ and to survive the declared HFB auxiliary Schur reduction exactly. HCMR-MR1 already contains this history geometry in its completion block, but its direct-sum carrier prevents that block from reaching the charged Yukawa selectors — the direct transmission is exactly zero. Re-executing the independent CY3′ route with the strict generation-Hessian amendment does not close the discrepancy: the level-six maximum residual is 0.521795, improving the lepton sectors while worsening the quark sectors. The Standard-Model closure debt is thereby reduced to a nonzero same-action completion–charged mixed block B_Xch, rather than a missing universal history stiffness.

A subsequent differential-order execution corrects the interpretation of the completion–charged boundary. The primitive fermion action already contains a completion-dependent left–right bilinear, so its ordinary completion–fermion Hessian vanishes at the zero-fermion background while the first nonzero interaction is the mixed third jet $T\_X\psi\psi = \partial^3 A\_source/\partial X \partial\bar{\psi}\_L \partial\psi\_R$. The archived full charged and neutral mixed tensors descend through the complete declared source projection at residuals below approximately 1.15×10^{-15}. Thus the CY3′ obstruction is not absence of completion-to-fermion coupling. The old law instead fails because it is representation-blind: unitary reorientation cannot repair its singular-value structure and no scalar spectral function of the universal completion operator closes the charged hierarchy. A representation-resolved ordered transfer Y = U_role D_score closes the independently differentiated CY3′ test conditionally to approximately 1.9×10^{-14}, but the primitive source derivation of D_score and U_role remains open. PFDMI now derives maximal physical score rank 72 but not unique weights; the recovered completion graph naturally separates quark and lepton response sectors. On the lepton side, maintenance demand has exact Schur form and persistent-distinguishability fixes a positive tau-minus-muon demand increment without mass input, while the full branch-covariant Gram operator is not yet derived. The projected K7 Gram geometry rules out a direct Fourier-generation identification. A conditional bridge through a surviving Z_7 holonomy has the correct real three-plane representation and a fixed positive response spectrum, but the actual vacuum-complex topology, holonomy occupancy and PFD-to-vacuum-loop identification remain open.

A subsequent irreversible-selector audit further separates the remaining source and readout debts. The PFDMI current/readout channel is unital for every admissible η, so the canonical internal reverse produces zero pathwise entropy and the one-Bit condition cannot select η. The ordered-history-to-R4 readout is classified exactly as a one-parameter binary symmetric channel; exact readout would fix its gain, but global Bit retention does not. The IORC orientation score is then identified exactly with the HMGBC canonical-wheel closure score and its finite exponential family. This identity does not extend directly to the Gate-3 flat Z_7 connection: the uniform rim score has nonzero curvature on every simple wheel cycle and cannot be a flat class on any nonempty simple-cycle wheel completion. MASD nevertheless contains the correctly typed curvature variable as its vacuum-relative plaquette-holonomy defect. Its reversal-symmetric quadratic action supplies stiffness but no signed source. The remaining same-source target is therefore a precise one: prove that the IORC odd score is the physical C-defect score of the common HMGBC/MASD history operator, in which case the one-Bit-fixed affinity supplies a linear source and the master curvature Hessian supplies the response.

Headline result

first fact → first record token → foundational retention + atomic disposition of the active carrier → physical persistence/readout

The first two arrows have implemented VERSF witnesses. The third arrow is now executed exactly within the inherited architecture, and its correct typing is foundational retention with almost-sure active-carrier renewal: the resolved event class is the renew-only atom $\sigma = (1, 1, 0, 0)$, the committed projector staying invariant while the active carrier reopens. The XI-4 map proves exact dilation capacity, not a foundational operation: it is a fixed universal postprocessor, so its rank-zero propensity is evidence that copying was never the foundational decision, not that the source failed to make one. The controlling cumulative chain for the remaining arrows is

first record → record-preserving recurrence → H_CMR^(102) → recurrent Fisher pullback → source-projected bath/descent → post-commitment operation instrument → physical quotient and readout,

and the decisive unexecuted step is the source-projected marked Doob–Kraus descent. The companion paper K7-EA-1 supplies a conditional structural derivation of p_EM = 7/960, p_EM^{-1} = 137.142857…. Its status has strengthened since the original R3 wording: the 14/15 interface factor is now a support-rigidity result rather than a chosen gate normalisation — conditional on a contractive TPB inter-layer map fully transmitting the canonical thirteen-dimensional EX2G polar support and the one sharp committed-record line, while annihilating the source-derived global currentless direction, the effect is forced to be $\mathrm{diag}(I_{14}, 0)$. Downstream post-commitment operation selection is not load-bearing for that trace. The remaining electromagnetic obligations are therefore source/interface provenance and continuum matching, not later record fate. In this typing the theorem is a foundational-retention and present-renewal law: the record layer grows as an ordered history $\mathcal{H}$_n ↪ $\mathcal{H}$_{n+1} = $\mathcal{H}$_n ∥ e_{n+1}, and the executed renewal law is the law by which the open present interface is reconstituted after each commitment — not yet the law by which the next fact is selected (§46N). Physical operation selection and the fourth arrow therefore remain open.

> **Headline theorem. [exact given the instrument]**
>
> Given a frozen post-commitment instrument whose unresolved map and mutually exclusive atomic resolved-operation maps are derived from the same source, the complete disposition effects obey Σ_α F_α + F_∞ = I. Every verbal question about retention, renewal, copying, proliferation, erasure or overwrite is a grouping of these atomic effects. Uniform resolution occurs exactly when F_∞ = 0; state-specific resolution occurs exactly when Tr(ρ F_∞) = 0. A physical record is then maintained only if the source-derived later channel preserves its terminal

projector or satisfies a quantified leakage inequality, and is readable only after the admissible readout family and operational quotient close consistently.

Contents

PART I — QUESTION, SOURCE HIERARCHY AND CLAIM DISCIPLINE

1. Exact question and starting point

The paper starts after one implemented first-record event has occurred. Let ρ_e be a post-commitment state supported on an active carrier A and an implemented ledger sector P_e^{impl}. The implemented label becomes a physical record class only after the terminal operational quotient and readout-realisation test are executed.

$\rho_e \in \mathcal{S}(H_A \otimes P_e^{impl} H_L)$.

The required physical return is not merely a copy isometry. It is the joint object

{ atomic operation maps $\mathcal{D}_\alpha$, unresolved map $\mathcal{N}$, waiting law, carrier bridge, H_{cons}, K_{diss}, $\Gamma_{retention}$, basins, barriers, survival, quotient, R_{phys}, path costs }.

All members must descend forward from one frozen post-commitment source stack. Different mathematical objects may appear at different reduction levels, but the derivation chain must be explicit and may not be reconstructed backwards from RCMO, Standard Model targets, preferred scales or desired experimental behaviour.

2. Source hierarchy

Source family	Consumed return	Explicit non-consumption
HCMR-P1 / F2F-1	First-record partition, first-entry effects, $r(\mathcal{N}\_R) < 1$ and implemented $319 \rightarrow 84 \cup \{\emptyset\}$ coarse-graining	Does not derive later disposition or readout
GSJB-15/16	One fact under two-sided readout; write-then-copy factorisation; one-token conditional branch; static basin witness	Economy is not dynamics; basin witness is not survival
HCMR-XI-1/2/3/4	Binary and microscopic copy witnesses; source-native residual instrument; selected 1,950-mark finite instrument; exact CPR postprocessor	Exact copy capacity does not select copying; XI-4 contains no competing no-copy terminal effect
K7-CBR / PFDMI	Recurrent renewal candidates and exact ledger-preserving isometries	Waiting hazards and renewal selection remain conditional
RCMO-1	Regulator-covariant signed maintenance candidate	Not identified with the physical conservative Hessian or syndrome response
QC-1 / realised-information work	Terminal equivalence framework and operational admission criteria	Actual readout family and valid quotient remain to be executed
Continuum action and stress-energy papers	Candidate conservative continuum sectors, κ dynamics, memory, transport and constrained conservation	Continuum effective architecture is not the discrete post-commitment instrument
Memory-kernel papers	Commitment free-energy curvature; unresolved bath model; causal influence kernel and ODE–Volterra hierarchy	Bath spectrum, couplings and record-carrier pullback remain to be derived
Gate-3 / refinement-realisation papers	Conditional closure-side topological persistence and a computable negative transport obstruction	Persistence does not imply refinement realisation, readability or token survival

3. Strongest admissible parent dynamics

The strongest inherited continuum parent is not treated here as a single ordinary real action with a purely retarded kernel. An ordinary quadratic bilocal action varies through its symmetric kernel and cannot, without additional structure, generate a strictly retarded dissipative equation. The post-commitment parent is therefore typed as a conservative functional plus a causal influence functional or equivalent open-system generator:

$G\_post = \{ S\_cons[z], I\_bath[z^+, z^-] \text{ or } L\_open, q\_carrier, \mathcal{R}\_adm \}$.

S_cons supplies stationary backgrounds and conservative second variations. I_bath or L_open supplies noise, dissipation, memory and reduced channels. q_carrier maps continuum or microscopic source variables onto implemented record carriers. $\mathcal{R}$_adm supplies candidate physical interrogations. This typing prevents a conservative curvature, a damping rate and a stochastic path cost from being renamed as one quantity.

4. Claim grades

1. **Exact mathematical theorem —** follows from declared maps, algebras or inequalities.
2. **Construction identity —** an implemented factorisation, isometry or coarse-graining; existence, not source selection.
3. **Imported VERSF execution —** a frozen numerical calculation consumed at its declared level.
4. **Conditional physical theorem —** follows after named physical premises and carrier identifications.
5. **Effective parent-dynamics pass —** a continuum or reduced action/generator exists in a controlled approximation class.
6. **Primitive physical admission —** one source chain returns the operation instrument, physical quotient, maintenance response, survival and readout across regulators and branches.

Machine-zero agreement is reproduction rather than independent corroboration unless the two derivation chains are demonstrably disjoint. A downstream quantity generated from the same frozen source cannot be used to validate that source as though it were independent data.

5. Premises

Premise	Content
P0 — Post-commitment start	One implemented first-record label has already been entered.
P1 — One fact, possibly many carriers	Additional deterministic tokens do not create additional selections of the original event.
P2 — Sufficient provenance	Copy-redundancy statements condition on a variable containing all copy, routing and noise data needed to determine the final token tuple.
P3 — Atomic outcomes	Resolved outcomes are classified by disjoint physical signatures, not overlapping verbal names.

Premise	Content
P4 — Same-source selection	Operation, timing, stiffness, noise, basin, readout and cost descend forward from a frozen source stack.
P5 — Capacity typing	Commitment, persistence, fragment and topological capacities are distinct.
P6 — Conservative/dissipative typing	The Hessian of a conservative functional is distinct from causal response, damping and noise kernels.
P7 — Physical event classes	Physical records are operational equivalence classes after a valid quotient, not raw implementation labels.
P8 — Persistence/realisation separation	Internal or topological survival does not by itself imply transport visibility or readout.
P9 — Cost typing	Path entropy, thermodynamic entropy, heat, work and action are not interchangeable.
P10 — Regulator currency	The complete law must descend at n = 3, 4, 5, 6 and both retained branches unless a source-derived branch gap selects one.
P11 — No-copy admissibility	A stable one-token physical record is an allowed outcome.
P12 — No readout insertion	The readout family may not be chosen solely to produce the desired quotient.
P13 — No target selection	Standard Model values, preferred scales and phenomenological targets may test a frozen result but may not choose it.
P14 — Pre-Fact Indifference	At the void-facing first-differentiation stage, once the minimal closure architecture has fixed the finite set of unresolved alternatives but before any one alternative is realised, the primitive preparation contains no physical datum capable of assigning different prior weights to those alternatives. Equivalently, a non-uniform prior would itself constitute pre-existing distinguishability at a stage defined to contain none. This is a foundational VERSF premise, not a consequence of later Hamming recovery, code/syndrome classification or post-commitment dynamics. Zero entropy alone is not sufficient to establish the result; the load-bearing statement is absence of pre-fact distinguishing structure.

PART II — RECORD ONTOLOGY AND THE ATOMIC OPERATION ALGEBRA

6. Fact, token, fragment, provenance and readout

A fact is the committed terminal distinction. A record token is one carrier encoding that fact. A fragment is a locally accessible partial or complete carrier. Provenance records whether, when, where and through which noisy route a token or fragment was produced. A readout is an admissible operation that distinguishes physical terminal classes.

fact count ≠ token count ≠ fragment count ≠ provenance count ≠ readout count.

7. Atomic operation signature

Ordinary-language categories overlap. Copying may occur with renewal; proliferation may occur with renewal; erase may be followed by reset or by overwrite. The resolved event is therefore assigned the signature

$\sigma = (s, a, n, w)$,

where $s \in \{0,1\}$ records whether the original physical label survives, $a \in \{0,1\}$ records whether the working carrier reopens, $n \in \mathbb{N}_0$ is the number of additional candidate fragments created at the declared grain, and $w \in \{0,1\}$ records whether a different physical label is written. The classification is derived from terminal effects, not mark names.

Signature	Convenient name	Terminal meaning
(1,0,0,0)	terminal retention	old label survives; active carrier remains closed
(1,1,0,0)	renew only	old label survives; active carrier reopens
(1,0,1,0)	copy only	one additional token; no renewal
(1,1,1,0)	copy + renew	one additional token and reopened carrier
(1,0,n≥2,0)	proliferate only	multiple candidate fragments; no renewal
(1,1,n≥2,0)	proliferate + renew	multiple fragments and reopened carrier
(0,0,0,0)	erase without reset	old label removed; no replacement or renewal
(0,1,0,0)	erase + reset	old label removed; active carrier reopens blank
(0,a,n,1)	overwrite family	old label removed and a different label written

A finer signature may include token identity, destination region, order retention, disturbance class and ledger/bath branch. At execution time the signature is extended to (s, a, n, w, ℓ), where ℓ is the readable-label class returned by the terminal effect. The minimal four-component signature above is sufficient to repair mutual exclusivity at the level of the central first-entry theorem.

Typing note. Token production ($n \geq 1$) creates additional manifestations of the one retained fact, never additional foundational facts (Theorem 2). “Copy” in the signature names is token-level vocabulary. The foundational disposition alphabet is retain / erase / overwrite (the s and w components); renewal (a) and manifestation production (n) are orthogonal structure on top of it — see §46M.

> **Theorem 1 — Atomic partition. [exact given the classification]**
>
> If every resolved post-commitment mark is classified by its terminal physical signature and signatures are evaluated at a fixed quotient and grain, then the resulting resolved-operation maps $\mathcal{D}_\alpha$ are mutually exclusive. Verbal operations are measurable groupings of these atomic maps, not primitive disjoint alternatives.

Proof. The signature map σ assigns each resolved mark exactly one value in a discrete product set, since s, a, w are binary and n is a single non-negative integer once the quotient and grain fixing "label survives", "carrier reopens" and "candidate fragment" are declared. Distinct signature values are disjoint events by construction, so the induced resolved maps have pairwise disjoint terminal effects. Any verbal category is the union of the signature cells it admits — e.g. "any copying" is the set $\{\sigma : s = 1, n \geq 1, w = 0\}$ — and is therefore a measurable grouping. ■

8. Copy redundancy without fact multiplication

Let E be the original committed label. Let C be a sufficient copy-and-noise provenance variable containing every routing, timing, carrier and corruption variable needed to determine the final token tuple. Let $F_j = f_j(E, C)$ almost surely. Then

$H(E, F_1, \ldots, F_m \mid C) = H(E \mid C)$, $H(F_1, \ldots, F_m \mid E, C) = 0$.

Thus copied tokens do not add a second selection entropy for E. They may add provenance information, physical entropy production and independent failure insurance. If noise variables are not included in C, the second equality is not asserted.

> **Theorem 2 — One fact under sufficient provenance. [exact]**
>
> Conditioned on a sufficient copy-and-noise provenance variable, deterministic additional tokens of one committed event add no independent logical fact about the original event. The copy event can nevertheless create new physical information about its own occurrence, route and later agreement.

Proof. By the chain rule, $H(E, F_1, \ldots, F_m \mid C) = H(E \mid C) + H(F_1, \ldots, F_m \mid E, C)$. Sufficiency of C means each $F_j = f_j(E, C)$ almost surely, so the conditional tuple is a deterministic function of the conditioning variables and $H(F_1, \ldots, F_m \mid E, C) = 0$. The two displayed identities follow. The unconditional quantities $H(F_j)$ and $I(F_j : C)$ may still be strictly positive, which is exactly the provenance information the theorem permits. ■

9. Primitive birth and later copying

The inherited conditional one-token branch and $\gamma_{birth} = 0$ concern the carrier at first writing. They do not imply $\chi_{copy} = 0$, $\gamma_{retention} = 0$ or zero copy cost. A later multi-token carrier introduces new syndrome and provenance directions and must obtain their dynamics from the post-commitment source.

10. Grouped operation observables

Once atomic effects F_α are known, physically useful questions are obtained by grouping:

$F_{\text{any-copy}} = \Sigma_{\{\alpha : n_\alpha \geq 1, s_\alpha = 1, w_\alpha = 0\}} F_\alpha$,

$F_{\text{any-renew}} = \Sigma_{\{\alpha : a_\alpha = 1\}} F_\alpha$, $F_{\text{erase/overwrite}} = \Sigma_{\{\alpha : s_\alpha = 0\}} F_\alpha$.

PART III — COMPETING-OPERATION FIRST ENTRY AND RENEWAL TIMING

11. Frozen post-commitment instrument

Let $\mathcal{N}$ collect all marks that leave the disposition unresolved. Let $\{\mathcal{D}_\alpha\}$ be the mutually exclusive atomic resolved-operation maps. Trace preservation gives

$\mathcal{N}(I) + \Sigma_\alpha \mathcal{D}_\alpha(I) = I$.

Transient waiting marks, including temporary retention that does not terminally settle the record, belong in $\mathcal{N}$. Terminal retention belongs among the $\mathcal{D}_\alpha$. This distinction prevents a "retain" mark from being counted both as waiting and as resolution.

12. Competing-operation first-entry theorem

$F_\alpha = \Sigma_{\{m\geq 0\}} (\mathcal{N}^*)^m[\mathcal{D}_\alpha^*(I)]$,

$F_\infty = \lim_{\{m\to\infty\}} (\mathcal{N}^*)^m(I)$.

> **Theorem 3 — Complete first-entry identity. [exact]**
>
> For a completely positive trace-non-increasing unresolved map $\mathcal{N}$ and mutually exclusive resolved maps $\mathcal{D}_\alpha$ satisfying instrument completeness, the effects obey $\Sigma_\alpha F_\alpha + F_\infty = I$. For every state ρ, $\mathrm{Tr}(\rho F_\alpha)$ is the probability that α is the first resolved disposition, and $\mathrm{Tr}(\rho F_\infty)$ is the probability that the disposition never resolves.

Proof. Finite partial sums telescope: $\Sigma_\alpha \Sigma_{\{m=0\}}^{\{M\}} (\mathcal{N})^m[\mathcal{D}_\alpha^*(I)] = \Sigma_{\{m=0\}}^{\{M\}} (\mathcal{N})^m[I - \mathcal{N}^*(I)] = I - (\mathcal{N})^{\{M+1\}}(I)$. *The sequence* $(\mathcal{N})^m(I)$ is positive and decreasing, since $\mathcal{N}^*$ is positive and unital-dominated ($\mathcal{N}^*(I) \leq I$), and therefore has a strong limit F_∞ in finite dimension. Taking $M \to \infty$ gives the identity. The probabilistic reading follows by pairing each side with ρ and noting that $\mathrm{Tr}[\rho\, (\mathcal{N})^m\, \mathcal{D}\_\alpha(I)] = \mathrm{Tr}[\mathcal{D}\_\alpha(\mathcal{N}^m(\rho))]$ is the probability of m unresolved steps followed by first resolution into α. ■

13. Uniform and state-specific resolution

Theorem 4 — Resolution criteria. [exact with stated finite-dimensional conditions]

Uniform almost-sure resolution for every initial state is equivalent to $F\_\infty = 0$. In the finite-dimensional implemented carrier, $r(\mathcal{N}) < 1$ is a sufficient and, under the standard peripheral fixed-point conditions for completely positive contractions, equivalent transience criterion. For a particular state ρ, almost-sure resolution is equivalent to $\mathrm{Tr}(\rho\, F\_\infty) = 0$, even when $r(\mathcal{N}) = 1$ on an invariant sector orthogonal to ρ.

Proof sketch. Uniform resolution means $\mathrm{Tr}(\rho\, F\_\infty) = 0$ for every ρ, which for a positive operator F_∞ is equivalent to $F\_\infty = 0$. If $r(\mathcal{N}) < 1$ then $\|(\mathcal{N}^*)^m(I)\|$ is geometrically dominated by $r(\mathcal{N})^m$ up to polynomial factors, forcing $F\_\infty = 0$. Conversely, if $r(\mathcal{N}) = 1$ with a peripheral fixed sector, the associated Perron eigenoperator survives every iterate and contributes a nonzero F_∞ on that sector; states orthogonal to it still satisfy $\mathrm{Tr}(\rho\, F\_\infty) = 0$, which is the state-specific clause. ■

The same distinction applies after conditioning on non-erasure or another branch. A stable no-copy sector may exist globally while a particular initial state still copies almost surely, or conversely.

14. Waiting law and physical clock boundary

$S\_\mathrm{res}(m \mid \rho) = \mathrm{Tr}[\mathcal{N}^m(\rho)]$, $E\_\rho[\tau\_\mathrm{res}] = \Sigma\_\{m\geq 0\}\, S\_\mathrm{res}(m \mid \rho)$.

The index m counts intrinsic post-commitment opportunities. It is not seconds. A physical time law requires a derived clock map from source trajectories to emergent duration. The manifestation-production waiting law is defined analogously after grouping copy-producing atoms and specifying which resolved outcomes have been conditioned away.

15. Manifestation-production law as a grouped corollary

Let $\mathcal{C}\_f$ refine the copy-producing atomic maps by destination fragment class f, and let $\mathcal{N}\_\mathrm{copy}$ contain the waiting marks of the explicitly conditioned branch. Then

$F\_f = \Sigma\_\{m\geq 0\}\, (\mathcal{N}\_\mathrm{copy}^*)^m[\mathcal{C}\_f^*(I)]$.

Completeness of $\{F\_f\}$ is conditional: non-copy terminal outcomes must be explicitly removed by conditioning or included as separate effects. The unconditional theorem remains Theorem 3.

PART IV — THE ACTION-TO-INSTRUMENT AND CARRIER BRIDGE

16. What the wider corpus now supplies

The wider VERSF corpus supplies a candidate conservative commitment sector, an effective continuum geometry, a κ-field sourced by commitment density, a memory field, an unresolved-mode bath model and a causal reduction hierarchy. In particular, a committed background is treated as a stationary point of a commitment free-energy functional, with local restoring curvature $F''(\rho_0)$, while unresolved sub-threshold modes generate a nonlocal influence kernel after they are integrated out.

This materially narrows HCMR-M1. The programme is no longer searching for any conceivable origin of maintenance. It must now show how these inherited variables act on the actual event-record carrier.

17. Conservative action plus causal influence functional

Write the post-commitment parent at a declared reduction level as

$$S\_cons[z, q] = S\_rec[z] + S\_bath[q] + S\_int[z, q],$$

where z denotes candidate record variables and q unresolved modes. Integrating out q produces an influence functional $I\_bath[z^+, z^-]$, or equivalently a causal memory/noise generator. The reduced dynamics may be represented schematically by

$$\delta S\_cons/\delta z(t) + \int_0^t K\_diss(t - s)\, z(s)\, ds = \xi\_noise(t).$$

The conservative second variation, the retarded response kernel and the noise covariance are three different returns. A strictly retarded dissipative law is not claimed to descend from an ordinary single-copy symmetric bilocal action without a closed-time-path or equivalent causal construction.

18. Implemented carrier bridge

The executed first stage is the coarse-graining

$$q\_F2F : \mathcal{A}_{319} \to \mathcal{E}_{84} \cup \{\emptyset\}.$$

The remaining bridge must extend this map to the binary copy code, recurrent renewal carrier, continuum parent variables and physical quotient. At regulator n and branch k, require intertwiners

$$\iota\_nk : H\_rec\text{^}(n,k) \to X\_post\text{^}(n,k),\ \pi\_nk : X\_post\text{^}(n,k) \to H\_rec\text{^}(n,k),$$

with $\pi_{nk} \iota_{nk}$ equal to the identity on the admitted record subspace and with operation effects, labels, order, code/syndrome sectors, blocking and readout probabilities preserved to the declared residual.

1. Preserve physical event labels and terminal equivalence.
2. Preserve the atomic operation signature, including compound copy-plus-renew outcomes.
3. Preserve the order of birth, copy, renewal and overwrite.
4. Carry conservative variations and causal kernels to the record tangent space.
5. Intertwine regulator blocking and retained branches.
6. Preserve all admitted readout probabilities and disturbances.

19. From parent dynamics to a marked instrument

An action or influence functional alone does not return a discrete operation effect. HCMR-M1 requires an explicit instrument-construction rule. Let Ω be the source path space over one declared post-commitment observation interval, let $P_\rho[d\omega]$ be its state-dependent path measure, and let $c(\omega) = \alpha$ assign each resolved trajectory to one atomic terminal signature. The instrument must be obtained by coarse-graining those trajectories, not by naming an operation after the calculation.

parent paths $\Omega \to$ terminal record effects $\to$ atomic classes $\alpha \to$ CP maps $\{\mathcal{N}, \mathcal{D}_\alpha\}$.

In a dilation representation with environment B and mutually exclusive terminal effects Π_α, a resolved map has the schematic form

$\mathcal{D}_\alpha(\rho) = \mathrm{Tr}_B[\Pi_\alpha\, U\, (\rho \otimes \sigma_B)\, U^\dagger\, \Pi_\alpha]$,

with $\mathcal{N}$ formed from the complementary unresolved effect. More general non-Markovian constructions may require an enlarged memory state, but the reduced maps must still be completely positive at the declared step, exclusive, normalised and traceable to source paths.

1. Declare the observation grain, environmental state and terminal record algebra.
2. Derive the terminal effects from the source dynamics and the fixed quotient; do not label them by intention.
3. Prove exclusivity of atomic signatures and complete positivity of the induced maps.
4. Retain microscopic path provenance for waiting laws, costs and independence tests.
5. Show that changing the embedding or memory-state enlargement does not alter physical operation probabilities beyond tolerance.

Instrument-admission condition. [primitive bridge requirement]

The continuum parent dynamics enter HCMR only when a declared trajectory-to-effect coarse-graining returns a completely positive unresolved map and exclusive atomic resolved maps satisfying instrument completeness on the record carrier. Until then the parent dynamics are a mechanism candidate, not the post-commitment decision law.

PART V — CONSERVATIVE STIFFNESS, CAUSAL MEMORY AND RETENTION-CONSISTENCY SYNDROME

20. Physical code and syndrome sectors

After the operational quotient returns the physical event alphabet $\mathcal{E}_{phys}$, define on a two-manifestation carrier

$$P_{code} = \Sigma_{e \in \mathcal{E}_{phys}} |e,e\rangle\langle e,e|, \quad P_{syn} = I - P_{code}.$$

P_{syn} contains disagreement, invalid encoding and provenance mismatch directions. The physical carrier may be larger than the inherited binary witness; the source must derive its rank and metric.

21. Conservative maintenance Hessian

Let F_{post} be the conservative post-commitment free energy, Euclidean effective action or quasistatic potential after pullback to the physical record variables. Let z_e^* be a consistent-manifestation stationary background. After removing gauge and operationally null directions, define

$$H_{cons}^{(e)} = \Pi_{phys} [\delta^2 F_{post}/\delta z^2]_{z = z_e^*} \Pi_{phys}.$$

In the code/syndrome decomposition,

$$H_{cons} = \begin{bmatrix} H_{code} & K_{cs} \\ K_{cs}^\dagger & \Gamma_{retention} \end{bmatrix}.$$

This is a block matrix, not a direct sum unless $K_{cs} = 0$. H_{code} may contain legitimate record-dependent energies. K_{cs} measures linear mixing between logical and disagreement directions. $\Gamma_{retention}$ is the conservative syndrome curvature.

> **Theorem 5 — Syndrome localisation of conservative stiffness. [conditional physical theorem]**
>
> If the consistent-manifestation background is stationary on the physical quotient and $K_{cs} = 0$, then the independent conservative disagreement response is $\Gamma_{retention} = P_{syn} H_{cons} P_{syn}$. Its signed spectrum classifies restoring, flat and unstable physical syndrome directions. A single $\gamma_{retention}$ is complete if and only if $\Gamma_{retention} = \gamma_{retention} P_{syn}$ with respect to the physical syndrome metric.

22. Dynamic response and memory kernel

The full linear response is frequency dependent. Schematically,

$R_{syn}(\omega) = \Gamma_{retention} + \Sigma_{ret}(\omega)$,

where Σ_{ret} contains dissipative and memory contributions induced by unresolved modes. The low-frequency real symmetric part may renormalise conservative curvature; the odd or imaginary part controls dissipation under the declared convention. Noise covariance must satisfy whatever source-derived fluctuation relation applies; no equilibrium relation is inserted by default.

The inherited unresolved-record bath and ODE–Volterra hierarchy provide a candidate mechanism for Σ_{ret}. They do not fix its pullback onto the event-record syndrome until the carrier bridge is built and the bath spectral density and couplings are source-derived.

$R_{syn}(\omega) = \Gamma_{retention} - i\omega D_{syn} + K_{mem}(\omega)$.

Here D_{syn} denotes the local dissipative part when such a reduction exists and K_{mem} the genuinely nonlocal remainder. Stability of the linearised causal system is a pole condition on the full retarded response, not merely positivity of $\Gamma_{retention}$. Conversely, a positive damping rate cannot rescue a conservative direction whose full causal poles lie in the unstable half-plane.

The execution must therefore publish both the static physical curvature and the analytic structure of the retarded syndrome response: low-frequency coefficients, poles or branch cuts, regulator behaviour and the noise covariance associated with the same bath reduction.

23. Negative-mode discipline and RCMO

The imported RCMO spectrum contains a substantial negative eigenvalue. Its meaning depends on object typing. If RCMO is independently shown to equal the gauge-reduced conservative Hessian on the physical syndrome carrier, a negative eigenvalue is a local instability. If RCMO is a signed response kernel, generator or role-odd operator, the same conclusion does not follow without analysing its metric, frequency and null structure.

The admitted comparison order is: derive H_{cons} and Σ_{ret} forward from the post-commitment source; freeze them; construct the physical syndrome pullback; only then compare with RCMO. Inversion or differentiation of RCMO to manufacture the source remains forbidden.

Negative-mode stop rule. [exact typing rule]

A negative eigenvalue warrants the name retention-consistency instability only when it belongs to the gauge-reduced conservative syndrome Hessian in the physical metric. If it belongs to a role-odd response operator, a finite-frequency kernel or a direction removed by the operational quotient, the instability conclusion does not follow. The object type and pullback are part of the result.

24. Scalar stiffness and reported spectrum

$\varepsilon_\gamma = \min_\gamma \|\Gamma_{retention} - \gamma P_{syn}\| / \|\Gamma_{retention}\|$.

If ε_γ is not within the declared regulator tolerance, report the full signed spectrum $\mathrm{spec}(\Gamma_{retention})$, its eigenmodes and the physical metric. Do not report an average, weakest eigenvalue or preferred-scale value as “the” retention stiffness.

PART VI — PERSISTENCE, TOPOLOGICAL PROTECTION, BASINS AND SURVIVAL

25. Exact physical record persistence

Let P_e be a physical terminal projector after the valid operational quotient, and let Φ be a later admissible trace-preserving channel.

> **Theorem 6 — Exact channel invariance. [exact]**
>
> The probability of record class e is preserved for every state if and only if $\Phi^*(P_e) = P_e$. This condition rules out both net leakage from and net inflow into the class at the declared grain.

Proof. Preservation for every state means $\mathrm{Tr}[P_e \Phi(\rho)] = \mathrm{Tr}[P_e \rho]$ for all ρ. By duality, $\mathrm{Tr}[P_e \Phi(\rho)] = \mathrm{Tr}[\Phi^*(P_e) \rho]$, so the condition reads $\mathrm{Tr}[(\Phi^*(P_e) - P_e) \rho] = 0$ for all ρ, which for a self-adjoint operator forces $\Phi(P_e) = P_e$. *Conversely, invariance of P_e under Φ* gives equality of both traces for every ρ. Leakage and inflow are the two signs the difference operator could take on P_e-supported and P_e-orthogonal states respectively; the identity excludes both. ■

$\varepsilon_{e\to e'} = \sup_{\rho = P_e \rho P_e} \mathrm{Tr}[P_{e'} \Phi(\rho)]$, $e' \neq e$.

A stable classical record requires the cross-record leakage matrix to vanish or remain below an explicitly declared approximation threshold.

26. Separate-ledger and shared-bath conservation

For multiple carrier modes j, define the label-resolved occupation operator

$N_e = \Sigma_j P_{e,j}$.

The sum need not be a projector when several tokens can coexist. Two physically distinct branches are:

- **Separate-ledger branch:** $\Phi^*(P_{e,j}) = P_{e,j}$ for each token mode j. Individual token identity and readability persist.
- **Shared-bath branch:** $\Phi^*(N_e) = N_e$ while individual $P_{e,j}$ need not be invariant. Only total label-resolved occupation is conserved; token identity may migrate or blend.

The source must decide the branch. Copy count, syndrome carrier and readout meaning depend on it.

27. Metastable survival bound

Theorem 7 — Operator survival bound. [exact]

If $\Phi^*(P_e) \geq (1 - \varepsilon_e) P_e$, then for every initial state supported in P_e, $S_e(m) = \mathrm{Tr}[P_e \Phi^m(\rho)] \geq (1 - \varepsilon_e)^m$.

Proof. Φ^* is positive and unital, so it preserves operator inequalities. Iterating the hypothesis, $(\Phi^*)^m(P_e) \geq (1 - \varepsilon_e)(\Phi^*)^{m-1}(P_e) \geq \ldots \geq (1 - \varepsilon_e)^m P_e$. Pairing with any ρ supported in P_e gives $S_e(m) = \mathrm{Tr}[\rho (\Phi^*)^m(P_e)] \geq (1 - \varepsilon_e)^m \mathrm{Tr}[\rho P_e] = (1 - \varepsilon_e)^m$. No support-invariance assumption is used, which is why the bound tolerates departure and re-entry. ■

The result is in opportunity units. It permits departure and re-entry because the proof iterates a Heisenberg operator inequality rather than a trajectory-support assumption.

28. Topological persistence is not physical realisation

The Gate-3 line supplies a conditional closure-side persistence witness: under irreversibility and essentialness, a primitive-Fact cycle may remain non-bounding. The refinement-realisation analysis proves that such persistence does not imply that an admissible reversible transport loop reaches the cycle. These are properties of different objects.

closure persistence $\not\Rightarrow$ refinement realisation $\not\Rightarrow$ local physical readout.

Accordingly, a protected holonomy may support a candidate memory sector without proving that a particular event-record token survives or can be interrogated. HCMR consumes topological persistence as a possible protective mechanism, not as a substitute for $\Phi^*(P_e) = P_e$.

29. Homological disqualifier

Let $\tau_* : H_1(\Gamma_{MS}) \to H_1(C_{cl})$ be the induced transport map and γ_D the primitive-Fact cycle. Refinement realisation implies $[\gamma_D] \in \tau_*(H_1)$. Therefore

$[\gamma_D] \notin \tau_*(H_1) \Rightarrow$ no refinement realisation.

This is a finite negative test once the integer transport matrix and target coordinates are supplied. Passing the homological test is necessary, not sufficient, because a homology class reached by a chain need not be reached by one admissible reversible loop.

30. Dynamical basin and maintenance barrier

A static partition of microstates proves availability, not attraction or lifetime. Let z_e* be a stable physical record representative and let I_[0,T][z] be the source-derived path-rate or action functional under the admitted noise law. Define a quasipotential

V_e(z) = inf_{T>0} inf_{paths z_e* → z} I_[0,T][path],

ΔV_e = inf_{z ∈ ∂B_e} [V_e(z) − V_e(z_e*)].

A physical barrier requires the noise covariance, admissible perturbations, metric, basin boundary, escape paths, clock map and regulator behaviour. Local positive Hessian curvature is necessary for a strict local minimum but does not by itself determine the global barrier or lifetime.

PART VII — PHYSICAL QUOTIENT, TRANSPORT REALISATION AND READOUT

31. Operational null space and valid quotient

Let A_K be the implemented record algebra and $\mathcal{R}$_adm a candidate family of admissible readout functionals or instruments. Define the common operational null space

$\mathfrak{N}$_$\mathcal{R}$ = { X ∈ A_K : R(X) = 0 for every R ∈ $\mathcal{R}$_adm }.

$\mathfrak{N}$_$\mathcal{R}$ is generally only a linear subspace. It need not be a two-sided *-ideal. Therefore the algebra quotient A_K/$\mathfrak{N}$_$\mathcal{R}$ is not asserted.

$\mathfrak{J}$_$\mathcal{R}$ = largest closed two-sided *-ideal contained in $\mathfrak{N}$_$\mathcal{R}$.

When such an ideal carries the intended nullity, the physical algebra candidate is A_K/$\mathfrak{J}$_$\mathcal{R}$. If the physically relevant null space is not ideal-generated, use the corresponding operator-system or ordered-vector-space quotient and state that algebra multiplication does not descend.

> **Theorem 8 — Valid operational quotient. [exact]**
>
> A quotient of the implemented record algebra by readout nullity is a well-defined -*algebra quotient only when the null subspace is a two-sided* -ideal. In general, the valid algebraic null object is the largest closed two-sided *-ideal contained in the common readout kernel; otherwise an operator-system quotient is required.

Proof. For $A_K/\mathfrak{N}$ to inherit a well-defined product, $(X + \mathfrak{N})(Y + \mathfrak{N})$ must be independent of representatives, which requires $X\mathfrak{N} \subseteq \mathfrak{N}$ and $\mathfrak{N}Y \subseteq \mathfrak{N}$ for all $X, Y \in A_K$ — precisely the two-sided ideal property — and closure under the adjoint for the *-structure. The family of closed two-sided* -ideals contained in $\mathfrak{N}_\mathcal{R}$ is closed under sums and closures, so it has a unique largest element $\mathfrak{J}_\mathcal{R}$; quotienting by anything larger inside $\mathfrak{N}_\mathcal{R}$ breaks multiplicativity, and by anything smaller retains readout-null directions. When $\mathfrak{J}_\mathcal{R}$ does not exhaust the physically intended nullity, only the linear/order structure descends, which is the operator-system quotient. ■

32. Quotient–readout fixed-point contract

Readout and physical equivalence cannot be solved by choosing either one arbitrarily first. An admissible pair $(\mathfrak{J}, \mathcal{R}_{adm})$ must satisfy:

1. $\mathfrak{J}$ is the valid ideal or operational null object generated by $\mathcal{R}_{adm}$.
2. Every readout descends to the quotient and is insensitive to $\mathfrak{J}$.
3. The descended readouts separate the claimed physical terminal classes.
4. The source-derived carrier and transport support each readout locally.
5. Recomputing admissibility on the quotient does not change the pair beyond tolerance.

This is a fixed-point execution contract. HCMR-M1 does not claim existence or uniqueness for an arbitrary source. Failure to converge, non-unique fixed points or a trivial quotient are physical outcomes that must be reported.

33. Physical readout instrument

$R_{phys} = \{R_{[e]}\}, R_{[e]} \geq 0, \Sigma_{[e]} R_{[e]} = I_{readable},$

$Q_{[e][e']} = \mathrm{Tr}[R_{[e]}\, \rho_{[e']}].$

Exact readout has Q equal to the identity on physical classes. Approximate readout reports confusion, support region, disturbance, post-readout survival and whether order is retained. Nondemolition readout requires $\Phi_{read}^*(P_e) = P_e$ or a quantified disturbance bound; it is not assumed.

34. Local readability, stability and correlation support

- **Local readability:** an allowed operation in the declared region distinguishes the class.
- **Dynamical stability:** the distinction survives for the declared maintenance horizon.
- **Correlation support:** the record cannot be removed by a merely local change of presentation.

- **Transport realisation:** the relevant terminal class lies in the image of admitted physical transport, not only in an internal closure complex.

35. Ordered history and context covariance

A readout must declare whether it returns the current label, a multiset of labels, token provenance or the append-only order of commitments. Label-preserving proliferation can lose chronology. It is not equivalent to reading the full physical history.

Readout equivalence must also be stable across every context admitted by the source. Two implementation labels are physically equivalent only if no admissible terminal context separates them; one convenient laboratory interrogation is insufficient. Conversely, a context that is not source-realised cannot be introduced solely to refine the quotient.

The fixed-point execution may terminate in several scientifically meaningful ways: a separated finite physical alphabet; a smaller quotient than the 84 implemented labels; contextual classes that require an operator-system description; a non-unique readout family; or a trivial readable algebra. HCMR reports the returned case rather than assuming that 84 physical classes survive.

physical readout = source-realised transport + class separation + bounded disturbance + post-readout survival.

PART VIII — PROLIFERATION CAPACITY AND INDEPENDENT FRAGMENTS

36. Minimum information per realised fragment

Let E be the physical event label and F_j candidate fragments in region A. A fragment is independently realised at resolution ℓ only if it meets the readout, stability and correlation criteria and carries at least a declared amount of event information:

$I(E : F_j) \geq I_{min} > 0.$

For an exact unbiased binary record, I_{min} may equal $\ln 2$. For biased, partial or approximate records it generally does not.

37. Conditional information-budget theorem

A count bound requires an additional theorem controlling the sum of fragment information. Assume the source supplies a boundary-supported budget $B_\ell(A)$ and proves, for the admitted independence structure,

$\Sigma_{j=1}^{N_{real}} I(E : F_j) \leq B_\ell(A).$

Theorem 9 — Conditional fragment ceiling. [conditional]

Under the minimum-information condition $I(E : F_j) \geq I_{min}$ and a proved additive or otherwise valid budget inequality $\Sigma_j I(E : F_j) \leq B_\ell(A)$, the number of independently realised fragments obeys $N_{real} \leq B_\ell(A)/I_{min}$. The special expression $B_\ell(A)/\ln 2$ applies only to full unbiased binary fragments.

Proof. Immediate from the two hypotheses: $N_{real} \cdot I_{min} \leq \Sigma_j I(E : F_j) \leq B_\ell(A)$. The content of the theorem is the explicit conditionality — neither hypothesis is supplied by mutual information alone. ■

Ordinary mutual information $I(A : A^c)$ does not by itself guarantee the required additivity across redundant fragments. The source must prove the budget inequality rather than invoke redundancy rhetoric.

38. Topological capacity is a different object

A $\mathbb{Z}_7$-valued protected tally carries at most log 7 per independent protected cycle, giving a candidate topological capacity proportional to rank H_1. This is a capacity for independent holonomy channels, not automatically a count of environmental copies. It may be bounded per cycle while unbounded in aggregate if the number of independent cycles grows.

PART IX — OPERATION-SPECIFIC COSTS AND CLOCK BOUNDARIES

39. Five operations and four cost types

Return	Type	Required structure
Σ_{op}	dimensionless stochastic/path entropy production	requires forward and reverse path measures
$\Delta S_{th,op}$	thermodynamic entropy	requires a thermodynamic bridge and environment
Q_{op}, W_{op}	heat and work	requires Hamiltonian, driving protocol and clock
$\mathcal{A}_{op}$	action cost	requires absolute action normalisation

Birth, copy, maintenance, readout and erasure each have separately typed costs. $\gamma_{birth} = 0$ is a curvature statement and does not imply zero entropy, heat, work or action.

40. Reduced-channel non-identifiability

Theorem 10 — Realised implementation cost is not fixed by the reduced channel. [exact]

> Tensoring any dilation of a reduced channel with a closed ancillary cycle can leave the reduced channel unchanged while changing realised work and entropy production. Therefore the reduced channel alone does not uniquely identify the actual implementation cost. It may still support lower bounds or optima after an implementation class, bath, Hamiltonian and reverse process are fixed.

Proof. Let (H_B, σ_B, U) dilate Φ. Adjoin an ancilla H_C in state σ_C and a unitary V on H_C alone that implements a closed cycle of arbitrarily large driving work; then $(H_B \otimes H_C, \sigma_B \otimes \sigma_C, U \otimes V)$ dilates the same Φ, since tracing out $B \otimes C$ removes V entirely. Realised work and entropy production of the two implementations differ by the cycle's cost, which can be made arbitrary while the reduced channel is fixed. Hence the map from implementations to reduced channels is many-to-one in cost. ■

41. Path-level return

$\Sigma_{op}(\omega) = \ln[P_F(\omega)/P_R(\tilde{\omega})]$.

The reverse process, support conditions and path involution must be defined, with absolute continuity $P_F \ll P_R \circ$ (involution) on the support where Σ_{op} is reported. Extension information $-\ln p$, path entropy production, thermodynamic entropy and action remain different currencies.

42. Clock boundary

Before the absolute clock map is returned, HCMR may report opportunity counts, Fold counts, intrinsic survival steps and dimensionless path ratios. It may not convert them into seconds, joules or thermodynamic entropy. Landauer-type costs apply to specified logically irreversible erasure protocols, not universally to copying, reading or maintenance.

PART X — REGULATOR EXECUTION AND MACHINE-READABLE CONTRACT

43. Complete certificate

1. source hashes; reduction level; parent conservative functional and causal influence object;
2. implemented and physical record class counts;
3. atomic operation signature for every post-commitment mark;
4. completeness, positivity and derivative residuals;
5. unresolved map $\mathcal{N}$, $r(\mathcal{N})$, F_∞ and state-specific defect overlaps;
6. all atomic effects F_α and grouped retain/renew/copy/proliferate/erase effects;
7. copy waiting distribution and intrinsic mean;
8. carrier-bridge intertwiners and residuals;

9. physical code/syndrome ranks and metric;
10. conservative block matrix H_code, K_cs, Γ_retention and full signed spectrum;
11. causal response/noise kernels and bath provenance;
12. separate-ledger or shared-bath branch and occupation invariants;
13. projector invariance, leakage matrix and survival curves;
14. basins, quasipotentials, barriers and escape paths;
15. valid quotient certificate, readout effects, confusion and disturbance;
16. fragment distribution, I_min and proved information budget;
17. path costs and clock/action-normalisation returns;
18. n = 3, 4, 5, 6 and k = 1, 6 blocking and branch residuals;
19. RCMO independence certificate and non-insertion seal.

44. Updated machine-readable execution contract


```
designation: HCMR-M1-R15
source_hashes:
regulator_levels: [3,4,5,6]
branches: [1,6]
parent_conservative_functional:
causal_influence_or_open_generator:
carrier_bridge_maps:
implemented_record_labels:
physical_record_classes:
quotient_type: [star_algebra, operator_system, ordered_vector_space]
quotient_null_object:
readout_fixed_point_status:
post_commitment_mark_count:
atomic_signature_by_mark:
unresolved_marks:
resolved_atomic_maps_D_alpha:
completeness_residual:
unresolved_spectral_radius:
never_resolved_effect_F_inf:
state_specific_defect_overlaps:
atomic_effects_F_alpha:
grouped_manifestation_effect:
grouped_renew_effect:
grouped_erase_overwrite_effect:
mean_resolution_opportunities:
mean_manifestation_opportunities:
conditional_renewal_probability:
stationary_renewal_wait:
cpr_isometry_residual:
cpr_propensity_jacobian_rank:
no_copy_complement_present:
selector_gram_rank:
selector_gram_spectrum:
```

selector_isotropy_residual:
selector_convergence_orders:
hcmr_mr1_parent_certificate:
recurrent_pullback_residual:
exact_lift_family_dimension:
typed_lift_selection:
marked_doob_kraus_descent_status:
retention_invariance_residual:
erasure_leakage_residual:
overwrite_residual:
companion_paper: K7-EA-1
closure_raw_word_count: 128
pre_fact_indifference_premise: P14_declared_bedrock
pre_fact_indifference_scope: "void-facing first-differentiation law on unreso
lved K=7 closure configurations"
pre_fact_zero_entropy_alone_sufficient: false
pre_fact_distinguishability_allowed: false
pre_fact_word_prior: "1/128 for every w in F_2^7"
pre_fact_word_prior_grade: exact_under_P14_and_K7
hamming_message_syndrome_factorisation_role: "post-realisation classification
, not generative probability factorisation"
selector_preparation_feedback_allowed: false
existing_full_closure_selector_rank: 1
full_closure_probability_pre_fact: "1/128"
closure_trace_origin: "P14 pre-fact indifference + K=7 cardinality"
microscopic_source_carrier_dimension: 350
direct_full_350D_sharp_uniform_128_sector_status: exact_fail_representation_o
nly
direct_full_350D_uniform_word_required_projector_rank: "350/128 = 175/64 noni
nteger"
closure_descent_channel:
closure_descent_domain_dimension: 350
closure_descent_codomain_dimension: 128
closure_descent_CPTP_status: open_cross_carrier_realisation
closure_descent_scaled_unital_target: "Phi_cl(I_350) = (175/64) I_128"
closure_descent_maximally_mixed_target: "Phi_cl(I_350/350) = I_128/128"
closure_descent_role: "microscopic implementation/consistency certificate; no
t origin of 1/128"
closure_descent_scaled_unital_residual:
closure_descent_covariance_group:
closure_output_commutant_dimension:
closure_descent_depolarising_or_imposed_twirl_allowed: false
closure_trace_provenance_status: "closed_foundationally_under_P14; microscopi
c implementation open"
code_rank:
syndrome_rank:
physical_syndrome_metric:
H_code:
K_cs:
Gamma_retention_signed_spectrum:

retention_isotropy_residual:
retarded_response_kernel:
noise_covariance:
bath_spectral_provenance:
ledger_vs_bath_branch:
record_occupation_invariants:
record_projector_invariance_residual:
cross_record_leakage_matrix:
basin_definition:
quasipotential_barriers:
survival_curves:
transport_realisation_test:
readout_effects:
readout_confusion_matrix:
readout_disturbance:
fragment_distribution:
minimum_information_per_fragment:
proved_information_budget:
manifestation_path_entropy:
maintenance_path_entropy:
readout_path_entropy:
erasure_path_entropy:
physical_clock_return:
action_normalisation:
regulator_convergence_order:
branch_covariance_or_gap:
RCMO_independence_certificate:
renewal_to_HX1_carrier_map:
common_nonself_mark_carrier_dimension: 24
CGI_Dirichlet_support_rank: 12
HX1_record_phase_rank: 12
CGI_HX1_principal_angles: "0 (x6), pi/2 (x6)"
cut_sector_rank: 6
cycle_sector_rank: 6
selected_rim_mode_cycle_projection: 1
incidence_to_signed_edge_factorisation_status: impossible_triangle_no_go
extra_noncoboundary_renewal_map:
selected_mode_old_survival_s_old:
conditional_DeltaK_cycle_spectrum: "Delta_k_loc (x6), 0 (x18)"
conditional_selected_mode_Delta_k: Delta_k_loc
master_record_phase_identification: "y_HX1 = phase tangent of Pol(Phi)"
master_record_bond_Hessian:
unit_uniform_H_qy: "[[3,-1],[-1,2]]"
unit_uniform_pre_relaxed_stiffness: 2.5
unit_uniform_post_locked_stiffness: 3
unit_uniform_full_Delta_k: 0.5
physical_record_weight_W_R:
physical_bond_weight_W_B:
physical_full_lock_Delta_k: "w_B^2/(w_B+w_R)"
old_phase_survival_s_old:

post_commitment_old_phase_projector:
unit_partial_Delta_k: "(1-s_old^2)/2"
minimal_GPU_renewal_phase_derivative_link: 0
minimal_GPU_renewal_phase_derivative_density: 0
minimal_renewal_to_HX1_phase_tangent: 0
minimal_fresh_phase_survival_s_fresh: 0
nonminimal_fresh_phase_map:
nonminimal_fresh_phase_status: open
non_insertion_seal:
single_token_orientation: erased_exact
reversal_odd_kernel_dim: 12
ordered_chirality_observable: A2_pseudoscalar
two_turn_P_plus: 0.341539787759487
two_turn_P_minus: 0.007370309811505
chirality_expectation: 0.334169477947982
conditional_orientation_bias: 0.957752384566601
bias_source_identity: tanh_2alpha
A2_amplitude: 0.0964664190241121
history_R4_effect_map: exact_algebraic
history_R4_carrier_intertwiner: 0
history_to_R4_bridge_type: conditioned_CP_readout
scalar_chirality_transmission: 0
rim_self_probability: 0.200305886206958
gtc_blank_record_derivative: "-sigma*3*sqrt(3)*w_B"
gtc_unit_branch_minimum: "sigma*pi/6"
gtc_phase_population_readout: 0
signed_maintenance_load_current: 0_construction_zero
signed_load_lowest_form: "j*(c_P*ln S_P + c_I*ln S_I)"
signed_load_coefficients: open
ex2e_projective_invariance: exact
common_ray_helix_V_J: 0
diagnostic_frame_V_J_range: "4.80-4.89"
V_J_maximum: 4.898979485566356
physical_V_J: non_identified
orientation_constraint_derivative: 0
residual_frame_tangent_dim: 920
post_gauge_frame_tangent_bound: 836
orientation_frame_forcing_B_alphaF: open
pfdmi_s1_selection_status: criterion_exact_execution_open
ex2e_complete_conjugation_probability_difference: 0_exact
ex2e_complete_conjugation_terminal_TV: 0_exact
conjugate_frame_born_readout_status: exact_no_go
family_triangle_definition: "direct 1->3 versus indirect 1->2->3 on Hermitian
H_q = -i Omega_q"
family_triangle_gauge_invariance: exact
family_triangle_holonomy_bare: "exp(i*5*pi/6)"
family_triangle_phase_bare_deg: 150
family_triangle_reverse_phase_deg: 210
family_triangle_phase_level3_deg: 176.5074504467
family_triangle_phase_level4_deg: 155.8501772202

family_triangle_refinement_target_deg: "150 conditional on bounded RCMO corre
ction"
family_triangle_physical_grade: "exact reduced-family closed-loop invariant"
HCFC_L_ax_equals_family_triangle: open
HCFC_comparison_loop_realisability: open
physical_axle_holonomy_value: open
first_cover_signed_coordinate: K_forward_minus_reverse
first_cover_fluctuation_relation: "P(K=k)/P(K=-k)=exp(2*alpha*k)"
first_cover_positive_probability: 0.996750764817216
first_cover_negative_probability: 0.001180705267406
first_cover_zero_probability: 0.002068529915369
first_cover_positive_conditional_nonzero: 0.998816847345935
first_cover_orientation_odds: 844.199473258
history_population_observable: "DeltaP=P_plus-P_minus"
history_population_irrep: A2
R4_population_irrep: A2
history_population_bilinear_form: "-g_chiP*chi*DeltaP"
g_chiP_current: 0_construction_absence
g_chiP_physical: open
population_susceptibility: "-D_F DeltaP * K_F^+ * B_eff"
scalar_population_susceptibility: 0_exact
pure_phase_population_susceptibility: 0_exact
HMGBC_MASD_Hessian_amendment: "Delta_H_XX=Delta_Omega"
HMGBC_Schur_survival: exact
HMGBC_reduced_amendment: "E_X Delta_Omega E_X^dagger"
HCMR_completion_history_geometry_already_present: true
HCMR_completion_charged_direct_sum: true
HCMR_completion_to_charged_direct_transmission: 0_exact
CY3_old_residuals: "[u=0.373851,d=0.381211,e=0.493033,nu=0.448473]"
CY3_strict_history_amended_L6: "[u=0.521795,d=0.495390,e=0.142094,nu=0.193624
]"
CY3_strict_history_amended_max_L3_L6: "[0.520086,0.521512,0.521739,0.521795]"
CY3_full_completion_amended_L6: "[u=0.572233,d=0.591714,e=0.448308,nu=0.40570
4]"
completion_fermion_second_jet: 0_exact_at_zero_fermion_background
completion_fermion_physical_differential_order: mixed_third_jet
completion_fermion_mixed_third_jet: nonzero_exact
completion_fermion_third_jet_form: "D_XH D_barPsiL D_PsiR Gamma"
full_CAR_completion_tensor_residual_max: "~1.15e-15"
D_HM29_status: closed_in_declared_execution_chart
completion_fermion_primitive_uniqueness: open
physical_source_metric_reissue: open
CY3_universal_spectral_repair: exact_fail
CY3_RRHF_representation_resolved_L3: "~1.934e-14"
CY3_RRHF_representation_resolved_L4: "~1.937e-14"
CY3_RRHF_grade: conditional_action_level_pass
primitive_D_score: open
primitive_U_role: open
PFDMI_physical_score_rank: 72
PFDMI_eta_physical: open

PFDMI_full_rank_eta_interval_exists: true_exact
PFDMI_physical_endpoint_frame: open
completion_graph_rank: 4
completion_graph_components: "[Q,u,d] | [L,e,N]"
universal_quark_lepton_bath_required: false
same_action_Cq_Bq: open
same_action_Cl_Bl: open
lepton_maintenance_Gram_form: "D_M=L_M^dagger G_M L_M"
lepton_maintenance_Schur_equivalence: exact
persistent_sigma_e_relative: 0
persistent_sigma_mu: "1+xi_phi+2*eta"
persistent_sigma_tau: "2+xi_phi+2*eta"
persistent_tau_minus_mu_gap: 1_exact_within_counting_law
lepton_branch_covariance: open
K7_Q6_overlap_Gram_identified: true
K7_Q6_trace_sigma_over_d_0p8: 31.771654
direct_Fourier_generation_assignment: fail
persistence_class_attaching_map: open
wheel_cycle_to_refinement_lift: exact_construction
C6_to_Z7_equivariant_identification: impossible
Z7_algebraic_kernel: exact_under_strong_transport_model
Z7_real_character_planes: "[1,6] | [2,5] | [3,4]"
Z7_character_type_matches_Q6: true
Z7_holonomy_positive_response_spectrum: "[0.753020396283,2.445041867913,3.801937735805]"
Z7_holonomy_positive_response_rank_nonzero: 6
Z7_actual_vacuum_topological_availability: open
Z7_actual_holonomy_occupancy: open
Z7_integral_7_torsion: open
PFD_loop_equals_vacuum_holonomy_loop: not_established
pfdmi_current_channel_unital_all_eta: true
pfdmi_canonical_internal_entropy_production: 0_pathwise
pfdmi_physical_reverse_law: open
eta_one_bit_selector_status: fail_for_current_channel
history_R4_covariant_channel_family: "Phi_a"
history_R4_readout_parameter_a: open
history_R4_readout_gain: "2*a-1"
exact_history_R4_readout_condition: "a=1 up to label swap"
BCB_forces_exact_R4_readout: false
append_only_retention_forces_exact_R4_readout: false
direct_history_population_cubic_jet: forbidden_by_A2_parity
first_higher_direct_sign_transmitting_order: 4
iorc_score_equals_HMGBC_F_C: exact_canonical_wheel
iorc_HMGBC_finite_kernel_identity: "epsilon_C=sigma*alpha"
iorc_alpha_star: 0.959001109719975
iorc_score_full_physical_lift: open
iorc_j_prep_equals_MASD_J: false_type_error
Gate3_Z7_real_additive_tangent: impossible_exact
Gate3_single_face_k_physical: false_gauge
Gate3_primitive_commitment_equals_successor_step: open

```
wheel_uniform_rim_sum_mod7: "plus_orientation:6=-1; reverse:-6=+1"
wheel_uniform_rim_flat_simple_cycle_completion: fail_all_nonempty
wheel_uniform_rim_best_type: curvature_candidate
physical_Gamma_vac_boundary_operator: open
MASD_D_C_type: vacuum_relative_logarithmic_plaquette_curvature
MASD_quadratic_C_sign_selection: impossible_exact
HMGBC_KL_linear_C_source: 0_exact_at_reference
HMGBC_C_stiffness: "W_CC=d2I/depsilon_C2"
HMGBC_history_current_j_n: derived_antisymmetric
HMGBC_history_current_enters_Delta_Omega: false
HMGBC_Delta_Omega_source: symmetric_conductance_only
same_history_IORC_to_physical_C_score_identity: open
conditional_signed_curvature_response: "c_star_sigma=sigma*alpha_star*K_C^+*s
_C"
signed_curvature_background_branch_selection: open
next_selector_calculation: "S_C=d/d epsilon_C log K_n^epsilon |0 ?= omega_C"
overall_verdict:
```

45. RCMO consumer test

The post-commitment source is differentiated and reduced forward without using RCMO arrays or blocking maps. The resulting conservative and dynamic responses are frozen. Only then may RCMO be compared. Agreement is independent corroboration only if the source chains are disjoint; otherwise it is reproduction. The comparison must state which object is being compared: conservative Hessian, static response, finite-frequency kernel or generator.

46. Stop rules

- If atomic operation classes are not exclusive at the declared grain, the first-entry execution stops.
- If the common readout kernel is not an ideal, an algebra quotient is forbidden; switch to the appropriate operational quotient.
- If K_cs is nonzero beyond tolerance, clean copy/syndrome decoupling fails.
- If a negative physical conservative syndrome mode survives gauge and quotient reduction, the consistent-manifestation background is locally unstable.
- If F_∞ has nonzero overlap with the initial state, almost-sure resolution is not claimed for that state.
- If the fragment information budget is not proved, no numerical proliferation ceiling is claimed.
- If causal dissipation is represented by an ordinary symmetric single-copy action without a valid influence-functional construction, causal variational closure is not admitted.

46A. Failure outcomes are physical returns

The execution contract is deliberately two-sided. A stable no-copy sector, a nonzero never-resolved effect, an empty physical syndrome, a trivial readout quotient, an unstable copied-record background, a zero fragment budget or a failure of refinement realisation are not numerical accidents to be repaired by changing the model. Each is an admissible physical verdict of the frozen source.

A successful execution therefore publishes negative results with the same prominence as positive ones. The programme passes by allowing the source to say no, not by arranging every intermediate construction so that copying, maintenance and readout must occur.

PART X-A — FIRST POST-COMMITMENT BRIDGE EXECUTION

46B. Execution sources and classification firewall

The execution consumes the frozen F2F-1, HCMR-XI-2, HCMR-XI-3 and HCMR-XI-4 reproducibility packages. It distinguishes two questions that had previously been adjacent but unexecuted: whether the declared recurrent ledger architecture produces a definite post-record renewal law, and whether the later selected source instrument itself chooses copying rather than merely supporting a copy map.

No Standard Model output, preferred scale or RCMO inversion is used to classify a record operation. The F2F classification is consumed only at its declared append-only ledger grain. XI-4 is audited through its stored source labels, Fisher arrays and sparse CPR isometry. A completion outcome such as $L\_L \to e\_R$ is not renamed as a record renewal, copy or erase operation.

46C. Theorem 11 — Conditional append-only renewal execution

Under the declared recurrent F2F/PFDMI ledger architecture, take the seven self-history marks as the unresolved map $\mathcal{N}$ and every nonself history transition as a resolved record-preserving renewal. The stored kernels are column-stochastic and satisfy the split residual 2.220×10^{-16}. The unresolved spectral radius is

$\rho(\mathcal{N}) = 0.200305886206958 < 1.$

The first-renewal effect $R(I - \mathcal{N})^{-1}$ is complete for every history start to 2.220×10^{-16}. The never-resolved defect is zero in the infinite-step limit; after 256 opportunities its computed norm is numerically zero. The mean waits are $7/6 = 1.166666666667$ opportunities from the hub and 1.250478130015 from each boundary state, with stationary mean

$E\_\pi[\tau\_renew] = 1.234602249934960$ opportunities.

Therefore, at this declared grain, renewal occurs with probability one and the base instrument contains no terminal retention-without-renewal, copy, proliferation or erase/overwrite branch. This is an exact execution of the declared append-only architecture. It is not a proof that the frozen master action uniquely selects that architecture.

Consistency notes (verified independently of the reproducibility package). The split residual and completeness residual both sit at double-precision machine epsilon (2.220×10^{-16}), the correct floor for an exactly column-stochastic kernel. The unresolved spectral radius and stationary mean wait coincide with the F2F no-record spectral radius and stationary mean first-record wait of Appendix A, as they must: the renewal instrument reuses the same frozen kernel with the self/nonself split re-read as unresolved/resolved. The exact hub value 7/6 is consistent with a seven-state self-history hub under the declared uniform opportunity grain.

46D. Theorem 12 — XI-4 fixed-postprocessor copy-selection no-go

The selected XI-4 source has 199 coordinates, 195 residual directions, 390 oriented source marks and five matter-completion outcomes, giving 1,950 combined marks. The semantic factors are gauge, record, completion, charged and neutral source residuals plus the five matter-completion outcomes. None is a post-commitment disposition coordinate.

The stored CPR object has shape 3,802,500 × 1,950 and exactly 1,950 nonzero entries. Every column has one nonzero and maps source mark i to the diagonal pair (i, i). Its isometry residual is exactly zero:

$\|C^\dagger C - I\|_F = 0$.

Conditional on appending CPR, $P(\text{copy} \mid \alpha) = 1$ for every source mark α. The copy flag consequently has zero variance, zero entropy, zero mutual information with the source mark and source-propensity Jacobian rank zero. There is no complementary no-copy map. XI-4 therefore proves exact copying capacity but cannot select whether or when copying occurs. A source-sensitive terminal disposition effect must be added or derived before the competing-operation theorem can be executed physically.

Consistency notes (verified independently). The combined-mark count factorises exactly as declared: 390 oriented marks = 2 × 195 residual directions, and 1,950 = 390 × 5 completion outcomes. The CPR row dimension $3{,}802{,}500 = 1{,}950^2$, the correct dimension for the diagonal-pair target (i, i) inside the two-token product space. One nonzero per column with unit modulus is exactly the structure whose Gram is the identity, so $\|C^\dagger C - I\|_F = 0$ is forced by the sparsity pattern, not merely observed. The no-go is then immediate: a map applied identically to every mark carries zero mutual information with the mark, hence a rank-zero propensity Jacobian, by construction rather than by numerical accident. (§46M retypes this result: the constancy is evidence that copying was never the foundational decision, not that the source failed to make it.)

46E. Record-selector Gram audit

The existing terminal-record block is positive, rank five and contains one normalisation null. At level six its positive spectrum is

(0.001817865573, 0.306404963045, 0.565154769100, 1.112063996617, 3.905417882516).

Its positive-support condition number is 2.148354×10^3. The Frobenius-best scalar is γ = 1.178171895370, but the isotropy residual is ε_γ = 0.767709415254, so no single retention stiffness represents this block. Successive spectral drifts give measured orders 2.01364587 and 2.00337693, confirming approximately second-order regulator convergence.

This does not return physical $\Gamma_{retention}$. The block is an RCMO-selector/Fisher Gram, not an independently derived conservative syndrome Hessian, and its rank five does not match the inherited binary syndrome witness of rank two. A source-derived carrier intertwiner and physical syndrome metric remain mandatory.

Verification note. The three reported diagnostics were recomputed here from the published spectrum alone and agree to all stated digits: the Frobenius-best scalar equals the support-trace mean, $\gamma = \mathrm{tr}(\Gamma)/5 = 1.1781718954$; the isotropy residual $\varepsilon_\gamma = \|\Gamma - \gamma P\|_F/\|\Gamma\|_F = 0.7677094153$; and the positive-support condition number $\lambda_{max}/\lambda_{min} = 2.1483535 \times 10^3$. The residual being close to unity is itself informative: the largest eigenvalue alone carries over 90% of the Frobenius weight of the block, so any scalar summary discards the block's dominant structure.

46F. Theorem 13 — Individual stability is not retention-consistency stability

For two record deviations y_1 and y_2, the most general exchange-symmetric quadratic local model at this grain may be written

$$F_{post} = (\mu^2/2)(y_1^2 + y_2^2) + (\kappa_c/2)(y_1 - y_2)^2.$$

In common and disagreement coordinates, the common-mode stiffness is μ^2 and the syndrome stiffness is $\mu^2 + 2\kappa_c$. The retention-consistency excess stiffness is therefore $2\kappa_c$. The inherited commitment curvature $F''(\rho_0)$ can stabilise each token individually, but it does not by itself force two carriers to agree.

Proof. Pass to normal coordinates $y_c = (y_1 + y_2)/\sqrt{2}$ and $y_s = (y_1 - y_2)/\sqrt{2}$, an orthogonal change of variables. Then $y_1^2 + y_2^2 = y_c^2 + y_s^2$ and $(y_1 - y_2)^2 = 2y_s^2$, so

$$F_{post} = (\mu^2/2)\, y_c^2 + ((\mu^2 + 2\kappa_c)/2)\, y_s^2.$$

The Hessian is diagonal with common-mode eigenvalue μ^2 and syndrome eigenvalue $\mu^2 + 2\kappa_c$. Setting $\kappa_c = 0$ leaves both tokens individually stable ($\mu^2 > 0$) with zero copy-specific restoring force; setting $\kappa_c < 0$ with $\mu^2 + 2\kappa_c < 0$ gives individually stable tokens whose disagreement mode is unstable. Individual stability therefore neither implies nor bounds agreement stability. ■

If the two tokens couple identically to every unresolved bath mode, the syndrome bath spectral density vanishes. Common noise is rejected, but an existing disagreement is not damped. In an Ohmic syndrome reduction, deterministic correction requires both $\gamma\_syn > 0$ and $\mu^2 + 2\kappa\_c > 0$. Restoring agreement curvature and syndrome damping are separately required returns.

Grading. Theorem 13 is a general reduction theorem, not a completed source calculation. The inherited commitment free-energy curvature $F''(\rho_0)$ can supply a candidate μ^2 — the resistance of each record to local perturbation — but it does not, without an additional bridge, return the cross-manifestation consistency coupling κ_c or its higher-dimensional operator analogue. Individual record stability ≠ retention-consistency stiffness: a complete HCMR execution must derive κ_c from the same parent action and carrier descent.

Execution return	Value	Grade
Conditional unresolved spectral radius	0.200305886206958	PASS < 1
Conditional stationary renewal wait	1.234602249934960 opportunities	EXACT in declared architecture
Conditional renewal probability	1 for every history start	EXACT in declared architecture
XI-4 combined source marks	1,950	EXECUTED
CPR copy-isometry residual	0	EXACT CAPACITY PASS
CPR copy-propensity Jacobian rank	0	COPY-SELECTION NO-GO
Complementary no-copy effect	Absent	PHYSICAL DECISION NOT RETURNED
Record candidate rank / nullity	5 / 1	POSITIVE SELECTOR GRAM
Record level-6 positive spectrum	0.0018179, 0.3064050, 0.5651548, 1.1120640, 3.9054179	ANISOTROPIC
Record isotropy residual	0.767709415254	SCALAR γ FAIL
Record convergence order	2.01365, 2.00338	APPROX. SECOND ORDER
Physical Γ_retention	Not returned	OPEN

46G. Execution verdict

The first execution closes one conditional branch and eliminates one shortcut. The declared append-only architecture has a complete, almost-sure renewal law, graded exactly within that inherited architecture and correctly typed in §46M as foundational retention with almost-sure active-carrier renewal. The existing XI-4 CPR isometry is not the source's copy decision; it is a fixed universal postprocessor, and the no-go it yields is local to that construction. The next physical step is no longer to construct another isometry, and it is not to re-audit XI-4 either: it is to execute the cumulative descent of Part X-B, which begins from the full candidate maintenance parent rather than from an already fixed copy map.

> **Execution verdict. [corrected grade]**
>
> The bridge execution is a valid partial execution and obstruction audit, not yet the complete first physical bridge execution; the companion paper K7-EA-1 materially strengthens the electromagnetic line at the finite level.

PART X-B — CUMULATIVE PRIOR-PAPER AUDIT AND CORRECTED INTERPRETATION

46H. Cumulative source chain and retained grades

The bridge execution of Part X-A must be read against the complete upstream maintenance, recurrent-pullback, bath and physical-admission chain, not only against the immediate F2F and HCMR-XI execution packages. The controlling cumulative chain is

first record → record-preserving recurrence → $H\_CMR^{(102)}$ → recurrent Fisher pullback → source-projected bath/descent → post-commitment operation instrument → physical quotient and readout.

The earlier HCMR source registry already recorded that its listed sources were not expanded completely one dependency level further upstream; this Part performs that expansion for the sources relevant to the execution. The machine returns of Part X-A are retained in full; what the audit corrects is their scientific grade.

Renewal. Within the inherited F2F/PFDMI append-only architecture, $r(\mathcal{N}\_renew) = 0.200305886206958 < 1$ and $E\_\pi[\tau\_renew] = 1.234602249934960$ opportunities, so renewal occurs almost surely.

> **Retained grade.** EXACT FIRST-ENTRY EXECUTION WITHIN THE INHERITED APPEND-ONLY RENEWAL ARCHITECTURE — typed in §46M as FOUNDATIONAL RETENTION WITH ALMOST-SURE ACTIVE-CARRIER RENEWAL.

It is not a proof that the primitive master action uniquely selects append-only renewal. The prior papers distinguish construction and capacity from source selection: F2F assumes a renewal architecture, PFDMI implements one exactly, and K7-CBR supplies a viable recurrent law whose particular hazards and reset map remain conditional.

Copy capacity. XI-4 contains 1,950 finite combined marks and an exact CPR isometry mapping each completed mark to two identical record tokens, with isometry residual exactly zero.

> **Retained grade.** EXACT MICROSCOPIC CAPACITY TO COPY A COMPLETED ORTHOGONAL MARK — retyped in §46M as representation-level dilation capacity, not a foundational operation.

It does not, by itself, prove that the source dynamically selects copying over no-copying, renewal without copying, proliferation or erasure.

Selector Gram. The six-coordinate record-selector Gram has rank five with one normalisation null and positive level-six spectrum (0.001817865573, 0.306404963045, 0.565154769100, 1.112063996617, 3.905417882516) — positive, regulator-convergent, strongly anisotropic, and therefore not legitimately represented by one scalar stiffness. It remains a typed record-response object, not automatically the physical copied-record syndrome Hessian.

46I. The larger maintenance parent

The rank-five record-selector block is not the strongest available maintenance candidate. HCMR-MR1 constructed the much larger object

$H\_CMR^{(n,k)} \in \mathbb{R}^{(102\times102)}$,

with 96 non-record directions and six record directions; after removal of nine auxiliary directions, its relaxed physical candidate acts on an 87-dimensional retained carrier. That candidate was executed at regulator levels n = 3, 4, 5, 6 and both surviving conjugate branches. Its nonterminal and relaxed sectors were positive and displayed approximately second-order convergence. Physical admission was nevertheless refused, because:

1. the nonzero branches k = 1 and k = 6 remained exactly degenerate;
2. the proposed Yukawa projector was full rank and non-selective;
3. the physical ledger provenance remained conditional;
4. an independent completion test disagreed with the internal construction by approximately 0.37–0.49;
5. the completion/record structure was incomplete at the physical-admission level.

HCMR-MR1 is therefore a successful candidate execution, not an admitted physical maintenance action. The consequence for HCMR-M1 is structural:

> **Block placement rule.** H_R must be interpreted as one block within H_CMR^(102), not as the complete maintenance law.

The physical copied-record response must be obtained by a typed reduction

$H\_CMR^{(102)} \rightarrow G\_red \rightarrow \mathcal{H}\_record^{phys} \rightarrow \mathcal{H}\_code \oplus \mathcal{H}\_syn \rightarrow \Gamma\_retention.$

Until the associated intertwiners and quotient are supplied, neither the rank-five selector Gram nor the earlier signed RCMO matrix may be renamed Γ_retention.

46J. The recurrent Fisher pullback substantially narrows the bridge

PFHBA-7 proves that the recurrent record-preserving K = 7 × neutral process has 930 positive edge-logit coordinates and Fisher rank 867, decomposing exactly as

867 = 216_history + 147_neutral + 504_interaction.

It further proves that the complete HCMR-MR1 parent, including its record-null structure, admits an exact sector-typed recurrent Fisher pullback at all four regulators and both surviving conjugate branches, with maximum relative reconstruction residual 8.85×10^{-16}. This is a strong existence and capacity result: the recurrent marked carrier is large enough to reproduce the full candidate maintenance parent. (The rank 867 coincides with the K7-CBR K7 × renewal edge-score rank recorded in Appendix A, as it must — the pullback lives on that carrier.)

The pullback is not, however, uniquely identified. Even after sector typing, the minimum-null exact-lift family has real dimension 34,152, and distinct typed lifts can reproduce the same parent while producing nearly orthogonal mark-score responses.

PFHBA-7 therefore supplies: exact recurrent pullback existence; a quadratic source-defect factorisation; a conditional source-projected bath; and a conditional unmarked Doob population descent. It does not yet supply: a uniquely selected primitive lift; an executed marked Doob–Kraus decomposition; source-derived Kraus amplitudes for post-commitment operation types; a physical clock; branch orientation; or terminal readout admission.

> **Cumulative bridge status.** THE CARRIER BRIDGE EXISTS AT THE FISHER/PULLBACK LEVEL, BUT ITS PHYSICAL MARKED DESCENT IS NOT YET UNIQUE OR EXECUTED.

46K. Corrected scope of the copy-selection no-go

The XI-4 CPR isometry maps every completed mark according to $|\alpha\rangle \mapsto |\alpha\rangle|\alpha\rangle$. It contains no independently derived complementary no-copy effect, so the copy flag is constant across the existing marked alphabet and

$\partial p\_copy/\partial X^a = 0$

for every source coordinate X^a within that fixed postprocessing construction. This is an exact local result:

> **Theorem 14 — Fixed-postprocessor non-selection. [exact]**

> Let $\{\mathcal{M}_\alpha(X)\}$ be a source-dependent marked instrument, and let a fixed isometry C with $C|\alpha\rangle = |\alpha, \alpha\rangle$ be applied after every resolved mark. Then the composition $(I \otimes C) W_X$ proves exact copy compatibility but cannot provide a source-dependent decision between copying and no-copying, because the copy disposition is constant on the mark alphabet.

Proof. Conditional on the construction, the copy indicator is the constant function 1 on the alphabet: every resolved mark α is followed by C regardless of X. A constant random variable has zero variance and zero mutual information with any source coordinate, so every directional derivative of p_{copy} in X vanishes and the propensity Jacobian has rank zero identically — by construction, not by numerical accident. No refinement of the fixed postprocessor changes this, since the constancy is inherited by any grouping of marks. ■

The XI-4 CPR construction is therefore an exact copying postprocessor, not a derived competing copy/no-copy instrument. The scope of this no-go must be stated precisely: it is a statement about the present XI-4 construction, not a no-go theorem against the wider VERSF source stack. PFHBA-7 leaves open a broader source-projected bath and marked Doob–Kraus descent, and a future execution of that descent could in principle return distinct terminal effects for no copy, copy, copy plus renewal, proliferation and erase/overwrite. The correct statement of the result is: the XI-4 CPR postprocessor does not itself select copy versus no-copy; the broader PFHBA-7 source-projected marked descent remains unexecuted.

46L. The ledger/bath branch must be decided before copy maintenance is defined

The Bath Criterion proves that two conservation structures produce different physical transformation laws. In the separate-ledger branch, each copy retains a separately conserved transport account: continuous blending between copies is forbidden, and only permutation and relative-phase structure survive. In the shared-bath branch, only the total transport weight of the copy family is conserved, and continuous transfer between copies becomes possible. The Bath Criterion proves the consequences of each branch but explicitly does not derive which branch the substrate selects.

That paper concerns identical closure sectors rather than multiple manifestations of a retained record, so it cannot be inserted directly as a proof of record copying. Once two event-record carriers have been shown to realise the same physical closure class, however, its conservation distinction becomes controlling for their later dynamics. Before defining physical record persistence, HCMR-M1 must therefore determine whether the post-copy carrier obeys $\Phi(P_{e,j}) = P_{e,j}$ *for every token j (separate-ledger token persistence) or only* $\Phi(N_e) = N_e$ with $N_e = \Sigma_j P_{e,j}$ (shared-bath conservation of total record occupation), in the sense of §26. The two branches carry different notions of token identity, syndrome carriers, leakage matrices, readout algebras, fragment counts, and maintenance and transport laws. The branch may not be selected by convention.

46M. Foundational retention, not copying

The executed base instrument of §46C contains renewal but no terminal retention-without-renewal, copy, proliferation or erasure branch. Correctly typed by the atomic signature of §7, the resolved event class is the renew-only atom

$\sigma = (1, 1, 0, 0)$:

the original foundational label survives; the active carrier reopens; no additional foundational token is created; no different label overwrites it. There is not an original foundational record plus a second foundational copy. There is one committed fact that remains retained while the active machinery renews:

commitment → foundational retention → renewed active machinery.

The committed fact is not recreated before the machinery moves on. It remains constitutive of the enlarged history, in the append-only ordered sense

$\mathcal{H}_m \to \mathcal{H}_{m+1} = \mathcal{H}_m \parallel e_{m+1}$.

Retyping the XI-4 map. The map $|\alpha\rangle \mapsto |\alpha, \alpha\rangle$ is not to be interpreted as physical production of a second foundational record. At most it is a mathematical dilation; a two-sided consistency representation; a model of two accessible manifestations of one retained fact; or a redundancy/readout construction at a later layer. Its rank-zero propensity (Theorem 14) is therefore not evidence that the source failed to choose copying — it is evidence that copying was never the foundational decision being made. The map copies a representation because it was constructed to do so; it does not describe the ontology of the retained fact. Environmental records may later proliferate as manifestations of the retained fact, but those are not additional foundational facts or foundational copies (Theorem 2).

The central question, retyped. The decisive physical condition is no longer whether the source chooses copying or no-copying. It is whether the committed foundational projector remains invariant when the active carrier renews:

$\Phi_{renew}^*(P_e) = P_e$,

with the simultaneous renewal condition that the active carrier returns to its available sector,

$\Phi_{renew} : P_e H_L \otimes H_A^{closed} \to P_e H_L \otimes H_A^{open}$,

the ledger factor remaining P_e while only the active factor changes. Under this condition the probability and identity of the already committed fact remain unchanged for every admissible state (Theorem 6). The corrected typing of the §46C execution is therefore:

> **Execution typing.** FOUNDATIONAL RETENTION WITH ALMOST-SURE ACTIVE-CARRIER RENEWAL, within the declared append-only architecture.

What remains genuinely open. The remaining question is not whether the fact gets copied. It is whether the primitive action itself uniquely derives the append-only retention law rather than the paper declaring that architecture. The unresolved bridge is

primitive action → invariant foundational record + renewed active carrier,

and the source must derive Φ_renew*(P_e) = P_e while ruling out Φ*(P_e) < P_e (erasure or leakage) and $\Phi^*(P_{e'})\, P_e \neq 0$ for $e' \neq e$ (overwrite or corruption).

Terminology. Throughout this paper: Γ_retention is the retention-consistency syndrome curvature; the syndrome sector measures consistency among manifestations of one retained fact; the foundational disposition alphabet is retain / erase / overwrite, with renewal and manifestation production as orthogonal token-level structure; and additional environmental tokens are manifestations or readouts of one foundational record, never additional foundational facts. The clean conclusion:

> **Reality does not copy the committed fact. It retains it while continuing to evolve.**

46N. The present interface: retention, renewal and entropy-motivated advance

The retention typing gives the theory a clean account of the present moment. Committed events are not copies of one another. They are successively retained additions to an ordered history. Write

$\mathcal{H}_0 \hookrightarrow \mathcal{H}_1 \hookrightarrow \mathcal{H}_2 \hookrightarrow \cdots, \mathcal{H}_{n+1} = \mathcal{H}_n \parallel e_{n+1}$,

where $\parallel$ denotes ordered extension by the newly committed fact e_{n+1}. The concatenation symbol is used rather than ordinary set union because physical history retains order as well as membership (§35).

The present as the active boundary. The present is not simply another element of the retained sequence. It is the active boundary between the irreversibly retained history and the continuations that remain admissible given that history. Represent this interface schematically by

$\mathcal{P}_n = (\mathcal{H}_n, A_n, \Omega(\mathcal{H}_n))$,

where $\mathcal{H}_n$ is the ordered retained history, A_n is the active commitment carrier, and $\Omega(\mathcal{H}_n)$ is the source-derived space of admissible continuations. The continuation space is conditioned by the entire retained history:

$\Omega_{n+1} = \Omega(\mathcal{H}_n \parallel e_{n+1})$.

History retention versus history backreaction. The ordered ledger guarantees that earlier commitments remain part of the physical state on which a later theory may condition its evolution. It does not, by itself, prove that the reopened active carrier has fewer or different available directions. The executed PFDMI renewal isometry reopens its declared working carrier at full rank while retaining the completed label in an orthogonal ledger (§46P). Thus the statement that $\Omega(\mathcal{H}_{n+1})$ is genuinely restricted or reweighted by the retained history is presently a physical target, not an already executed consequence of persistent storage. The required source return is a nontrivial history-to-dynamics map $\mathcal{B} : \mathcal{H}_n \mapsto \Phi_{n+1}$, or its equivalent causal memory kernel, projector restriction or response modification. If instead the later dynamics factorises as $I_L \otimes \Phi_{work}$, the ledger remains perfectly persistent but dynamically spectator. The programme must therefore derive not only that the past survives, but how the survived past changes the admissible future. This is fully consistent with this section's acknowledgement that deriving $\Omega(\mathcal{H}_n)$ remains open.

A later carrier-relative audit adds a nontrivial refinement. Although the PFDMI working carrier reopens at full rank in its own declared variables, the source-native Fold-to-incidence renewal response is not isomorphic to the full twelve-edge HX1 record-phase carrier. On the common fine history-mark carrier the two twelve-dimensional spaces share only the six-dimensional endpoint/coboundary sector, while the six cycle directions are orthogonal; the registered uniform-rim HX1 mode lies entirely in the cycle sector (§46Q). Thus "the active carrier reopens" and "the old loop-relaxation degree of freedom is recreated" are distinct statements. The latter now requires a specific non-coboundary renewal intertwiner and cannot be inferred from full PFDMI rank or retained edge identity.

Commitment and renewal are distinct transitions. One complete cycle contains two logically different operations. First, commitment selects one continuation:

$$(\mathcal{H}_n, A^{open}, \Omega(\mathcal{H}_n)) \to (\mathcal{H}_{n+1}, A^{closed}), \mathcal{H}_{n+1} = \mathcal{H}_n \parallel e_{n+1}.$$

Second, renewal reopens the active carrier without altering the newly enlarged history:

$$(\mathcal{H}_{n+1}, A^{closed}) \to (\mathcal{H}_{n+1}, A^{open}, \Omega(\mathcal{H}_{n+1})).$$

The foundational record is retained through the second transition, $\Phi_{renew}^*(P_{\mathcal{H}_{n+1}}) = P_{\mathcal{H}_{n+1}}$: the active carrier changes state; the retained history does not.

What the present execution proves. The renewal calculation gives

$$r(\mathcal{N}_{renew}) = 0.200305886206958 < 1, E[\tau_{renew}] = 1.234602249934960$$

intrinsic opportunities. It therefore proves, within the declared append-only architecture, that the active carrier does not remain permanently closed after commitment. It reopens almost surely, and the mean number of renewal opportunities is finite. The calculated quantity is:

> **the mean number of opportunities required to reconstitute the open present interface after commitment.**

It is not yet the waiting time to the next committed fact. A separate first-entry calculation is required for the transition from the open continuation space to e_{n+1}.

Entropy as the proposed direction of advance. The natural physical proposal is that commitment is entropy-motivated: one admissible continuation becomes fixed while entropy is exported into unresolved or environmental degrees of freedom,

unresolved continuation space → one committed continuation + environmental entropy production.

The corresponding path-level quantity would be

$\Sigma\_commit(\omega) = \ln[P\_F(\omega)/P\_R(\tilde{\omega})]$,

and an entropy-driven arrow would require the source to return a forward bias such as $\langle\Sigma\_commit\rangle \geq 0$, together with the declared reverse process, environmental degrees of freedom and entropy currency (§§39–42). These quantities have not yet been executed. Entropy therefore supplies the motivated physical direction of commitment, but not yet its completed quantitative derivation.

Corrected interpretation of time. The ordered growth of history is produced by successive commitments, $\mathcal{H}\_n \to \mathcal{H}\_\{n+1\}$. Renewal ensures that, after each such commitment, an active present interface is available again: $\mathcal{P}_n$^closed → $\mathcal{P}_n$^open. The complete proposed account is therefore:

> **Entropy motivates commitment; foundational retention fixes the result; renewal recreates the active present interface.**

The executed paper establishes the latter two statements within the declared architecture. The source-derived entropy law governing commitment advance remains an open return.

> **Strongest formulation.** The present moment is the active commitment interface between an ordered, irreversibly retained history and the continuations still permitted by that history. Commitment adds the next foundational fact; retention preserves it; renewal reopens the interface. Entropy is the proposed physical source of the direction of advance, but its quantitative path law remains to be derived.

In this typing HCMR is a foundational-retention and present-renewal theorem, not a copy-maintenance theorem, and the clean next calculation is the entropy-biased first-entry law from $\Omega(\mathcal{H}\_n)$ to e_{n+1}.

46O. Electromagnetic inter-layer support rigidity and post-commitment invariance

Subsequent execution of the K7-EA-1 companion programme materially strengthens the electromagnetic-admission line consumed by this paper. The original 14/15 construction assembled thirteen transport directions, one permanent-record line and one screened global line. The latest calculation shows that the resulting rank is not dependent on that particular direct-sum matrix representation.

Let the source-typed interface carrier be

$H_{int} = T \oplus R \oplus G$, $\dim T = 13$, $\dim R = 1$, $\dim G = 1$,

where T is the canonical polar support of the actual EX2G attaching map, R is the resolved sharp committed-record line, and G is the unique global constant direction. The EX2G map has rank thirteen and a unique polar decomposition $A = WH$, with W a partial isometry satisfying $W^\dagger W = P_T$, $\mathrm{Tr}\, P_T = 13$. The global direction is source-derived and exactly relative-currentless.

> **Theorem 15 — Inter-layer support-rank rigidity. [exact conditional theorem]**
>
> Let $\Pi_{coh} : H_{int} \to H_{out}$ be a contractive physical coherence-transfer map, so $0 \le E := \Pi_{coh}^\dagger \Pi_{coh} \le I$. Suppose Π_{coh} is norm-saturating on T and R, $\|\Pi_{coh} x\| = \|x\|$ for $x \in T \oplus R$, and annihilates G, $\Pi_{coh}\, g = 0$ for $g \in G$. Then
>
> $E = P_T + P_R = \mathrm{diag}(I_{14}, 0)$,
>
> so $\mathrm{rank}\, \Pi_{coh} = 14$, $\mathrm{Tr}(\Pi_{coh}^\dagger \Pi_{coh}) = 14$, and the carrier-wide interface throughput is exactly
>
> **$\eta_{gate} = 14/15$.**

Proof. For any unit vector $x \in T \oplus R$, norm saturation gives $\langle x, Ex\rangle = 1$. Since $0 \le E \le I$, $\langle x, (I - E)x\rangle = 0$, and positivity of $I - E$ implies $(I - E)^{1/2} x = 0$, hence $Ex = x$: E is the identity on all fourteen transmitting directions — no orthogonality of the outputs is assumed or needed. Global nontransmission gives $Eg = 0$ on the remaining one-dimensional sector, and self-adjointness of E kills the cross terms: $\langle g, Ex\rangle = \langle Eg, x\rangle = 0$. These conditions exhaust the fifteen-dimensional source carrier and therefore determine E uniquely. ■

The theorem removes two assumptions that were previously implicit in the companion construction. First, the fourteen transmitting outputs need not be declared orthogonal: contraction plus unit saturation already forces the corresponding source effect to be the identity on their support. Second, no equal-probability measure on fifteen source atoms is required to obtain 14/15; the factor is the normalised Hilbert–Schmidt trace of the rigid source effect.

The result is also invariant under later post-commitment processing. If a family of downstream completely positive operations $\{K_\alpha\}$ — renewal, copy-plus-renewal, proliferation-plus-renewal or another record-preserving refinement — satisfies

$\Sigma_\alpha K_\alpha^\dagger K_\alpha = P_{adm}$, $P_{adm} = P_T + P_R$,

then $(1/15)\, \Sigma_\alpha \mathrm{Tr}(K_\alpha^\dagger K_\alpha) = \mathrm{Tr}\, P_{adm} / 15 = 14/15$. Thus unresolved downstream operation probabilities do not feed back into the electromagnetic admission normalisation. Exact persistence separately excludes any branch that truly destroys the already physical record, but persistence does not select renewal over copying or proliferation; that remains an HCMR question rather than an electromagnetic-normalisation question.

The record/export realisation is likewise representation-insensitive. Minimal norm-preserving record/export dilations are unique only as an isometry class; the particular sech/tanh parametrisation used by EX2D is a canonical hyperbolic chart rather than a load-bearing electromagnetic law. In the sharp rank-one Lüders class, the minimal committed-record dilation is fixed up to Stinespring output-unitary freedom, which again changes no source-side admission dimension.

Combining the interface theorem with the exact rank-one full-closure selector P_full on the 128-dimensional K = 7 closure carrier gives the structural candidate

$$\eta_{EM} = (\mathrm{Tr}\, P_{full} / 128) \cdot (\mathrm{Tr}\, P_{adm} / 15) = (1/128)(14/15) = 7/960,$$

with reciprocal 960/7 = 137.142857142857....

Updated grade. The rank-one full-closure selector is exact algebraically; the pre-fact 1/128 weight is now fixed at foundational level by P14 together with the derived K = 7 closure cardinality; the thirteen-dimensional EX2G polar support is source-derived and canonical; global nontransmission is source-derived and exact; and the 14/15 rank result is an exact rigidity theorem once physical TPB saturation on the canonical fourteen transmitting directions is supplied. A source-native microscopic-to-closure CPTP descent remains required as a cross-carrier realisation and consistency certificate, but it is no longer the origin of the 1/128 prior. The remaining load-bearing electromagnetic physical obligations are the same-source proof of TPB saturation and the interface-to-continuum/QED matching and running. The theorem therefore materially strengthens the conditional derivation without yet promoting 137.142857... to the measured low-energy fine-structure constant. K7-IPB-2 had already established that the earlier explicit map has singular spectrum of fourteen ones, rank 14 and throughput 14/15; the rigidity theorem explains why that spectrum is forced once the physical restriction conditions hold.

46P. Persistent-ledger retention does not by itself generate working-carrier backreaction

The preceding sections distinguish foundational retention from active-carrier renewal. A further distinction is now necessary. Preservation of a committed fact in a persistent ledger does not, by itself, imply that the retained fact modifies the local degrees of freedom available to the renewed working carrier.

The declared PFDMI renewal isometry is

$V_{renew} : H_{dom} \to H_{ledger} \otimes H_{work}$, $V_{renew} |\psi; e, r\rangle = |e, r\rangle_L \otimes |\psi_{open}\rangle$,

with e the edge label and r the terminal record type. It has full rank on its declared domain and exact isometry residual $\|V_{renew}^\dagger V_{renew} - I\| = 0$. The construction therefore retains the completed label while reopening the working carrier.

Define the active-carrier projector

$P_{act} = I_L \otimes P_{work}$,

with P_work the projector onto the reopened working sector. Then

$$V\_renew^\dagger (I\_L \otimes P\_work)\, V\_renew = I\_dom.$$

Hence the renewal map removes no direction from the completed-record domain: the pullback of the active-carrier projector is the full identity. The working carrier is not merely non-empty after renewal. At the level implemented by this isometry it is fully reopened.

The same conclusion holds at the edge-label level. Let

$$P\_e\^L = |e\rangle\langle e|\_L \otimes I\_work.$$

Because renewal preserves the edge label,

$$V\_renew^\dagger\, P\_e\^L\, V\_renew = \Pi\_e$$

for every edge e, where Π_e is the domain projector onto label-e states. Therefore any later edge-resolved response which is connected to the PFDMI working carrier by the natural label-preserving coarse-graining sees no edge removed merely because the corresponding completed fact has been entered in the persistent ledger.

> **Theorem 16 — Persistent-ledger non-backreaction theorem. [exact within the declared renewal architecture]**
>
> The PFDMI record-preserving renewal isometry retains the completed edge/type label in an orthogonal ledger while reopening the complete declared active carrier. Consequently, ledger retention alone supplies no projector loss on the reopened working carrier. Any physical reduction of later available response directions must arise from an additional ledger-dependent post-commitment action, channel, constraint or source-derived carrier map; it does not follow from the renewal isometry itself.

This resolves an ambiguity in the phrase “history conditions the future.” The append-only ledger establishes that past facts remain available as persistent physical distinctions. It does not yet prove dynamical backreaction of those distinctions on the next active carrier.

If subsequent working dynamics factorises as

$$U\_next = I\_L \otimes U\_work,$$

then every ledger projector commutes with it:

$[P\_h, U\_next] = 0$ for every history projector P_h on H_ledger.

The stored history may therefore persist exactly while remaining dynamically spectator to the next local working operation. The correct stronger target is a source-derived ledger-dependent law

$$\Phi\_next = \Phi[\mathcal{H}\_n],$$

or, equivalently, a nontrivial post-commitment response $\delta\Phi\_work/\delta P\_h \neq 0$, rather than the factorised form $I\_L \otimes \Phi\_work$.

46P.1 Consequence for the record-relaxation programme — carrier-relative correction. The distinction above must be applied at the level of the actual relaxation carrier. The exact statement $V\_renew^\dagger(I\_L \otimes P\_work)V\_renew = I\_dom$ proves that the declared PFDMI working carrier is fully reopened. It does not prove that an independently defined auxiliary carrier in another reduction — in particular the twelve-edge MASD/HX1 record-phase space — is also reopened at full rank. That stronger conclusion requires a source-derived intertwiner between the two carriers.

Let $\mathcal{V}\_HX1 \cong \mathbb{R}^{12}$ be the HX1 record-phase carrier and let P_regen denote the projector onto those $\mathcal{V}$_HX1-directions actually regenerated by the post-commitment renewal descent. For a normalised HX1 mode φ, define the carrier-relative survival amplitude

$s\_cyc(\varphi) = \|P\_regen\ \varphi\|$.

If s_cyc = 1, the neutral Schur relaxation is fully restored and the commitment excess is zero; renewal which restores only the fraction s_cyc < 1 gives

$\Delta\_relax(\varphi) = (1 - s\_cyc(\varphi)^2) \cdot \Delta k\_loc$.

Thus s_cyc = 1 gives zero commitment excess, while s_cyc = 0 gives the full local lost-relaxation penalty Δk_loc. The PFDMI renewal isometry alone determines neither value. It proves $V^\dagger(I \otimes P\_work)V = I$ on its own declared working carrier, not P_regen = I on the HX1 phase carrier. Identifying these projectors by equality of dimensions, by preservation of the discrete edge label, or by the phrase “full working-carrier reopening” would be a carrier-type error (F34).

Subsequent execution now further constrains this. The HX1 record phase has been identified directly as the polar-phase tangent of the common master-action record/completion morphism Φ (§46R), while the minimal source-selected GPU renewal has zero tangent into that phase sector: its free renewal phase is global/Kraus phase and cancels from both the nearest-neighbour connection and the conditioned renewed density state, and the terminal PFDMI record type is a discrete central-projector label, not a continuous phase. Thus the canonical/minimal renewal branch does more than fail to reconstruct the cycle sector by incidence descent: it supplies no independent fresh HX1 phase tangent at all (s_fresh = 0). The remaining physical quantity is the survival of the old event-specific y-phase relaxation direction under commitment, s_old. A larger non-minimal source-derived phase channel remains open, but its existence must be explicitly returned by the primitive action.

46P.2 Relation to persistent commitment memory. The continuum Fact-Momentum and history-dependent-memory papers already motivate dynamics in which the evolution law depends on accumulated commitment history. Their role must now be stated more sharply. A history-dependent equation such as

$dX/d\tau = F(X, M\_n)$, M_n the accumulated commitment memory, or

$\Phi_{n+1} = \Phi[\mathcal{H}_n]$,

is not merely a mathematical description of memory. For HCMR it is a candidate mechanism by which an otherwise spectator ledger can acquire physical backreaction. The missing bridge is therefore not the existence of an append-only ledger — the present paper already has that at construction level. It is the derivation of the map

$\mathcal{B} : \mathcal{H}_n \mapsto$ (modified generator, Hessian, causal kernel or active projector),

which tells the next active carrier which transitions, auxiliary relaxations, response directions or continuation classes have actually been altered by the retained history. Until that map is returned from the same source, the following three statements must remain distinct: (i) the committed fact persists exactly; (ii) the persisted fact is available for later conditioning; (iii) the persisted fact dynamically alters the next active carrier. The present execution proves the first within the declared architecture. It establishes a route toward the second. The third remains a physical derivation target.

46Q. Renewal-carrier principal-angle obstruction and the cycle-sector lock

The carrier bridge can now be tested more sharply, because the later PFDMI/EX2G and CGI calculations supply a source-native endpoint-incidence response carrier, while HX1 supplies an independently executed twelve-edge record-phase carrier.

46Q.1 Common fine carrier. The PFDMI history support contains seven self marks and twenty-four directed nonself transitions, the latter represented by twelve signed wheel-edge labels. Let $\mathcal{M} \cong \mathbb{R}^{24}$ denote this twenty-four-dimensional directed-nonself-mark carrier. The twelve HX1 edge phases embed canonically as the reversal-odd subspace: for each undirected wheel edge $\{x, y\}$,

$\varphi_{xy} \mapsto (\delta_{(x\to y)} - \delta_{(y\to x)})/\sqrt{2}$,

so $\mathcal{V}_{HX1} \subset \mathcal{M}$ with $\dim \mathcal{V}_{HX1} = 12$. The source-derived EX2G attaching map sends a directed history mark to $A(x\to y) = C_y^+ + C_x^-$ in the fourteen-dimensional incidence-label space. The CGI Dirichlet physical-response support removes the two global rays $\mathrm{span}\{\Sigma_x C_x^+\}$ and $\mathrm{span}\{\Sigma_x C_x^-\}$, and is therefore twelve-dimensional. Pulling this support back through A — a vector with coefficients (a, b) takes the value $a_y + b_x$ on the directed mark $(x\to y)$ — gives the CGI response subspace $\mathcal{V}_{CGI} \subset \mathcal{M}$, $\dim \mathcal{V}_{CGI} = 12$.

46Q.2 Exact six-plus-six decomposition. Under mark reversal $(x\to y) \leftrightarrow (y\to x)$, the CGI value $a_y + b_x$ maps to $a_x + b_y$. The reversal-odd part of a CGI vector is therefore $\frac{1}{2}[(a - b)_y - (a - b)_x]$ on each directed mark — with $f := (a - b)/\sqrt{2}$, this is precisely the coboundary $(df)_{xy} = (f_y - f_x)/\sqrt{2}$, the image of the wheel edge–vertex incidence operator d. Since the wheel is connected, rank $d = 7 - 1 = 6$ on the Dirichlet sector. The complementary six CGI directions are reversal-even and are automatically orthogonal to the entire reversal-odd HX1 carrier. Consequently

$\mathcal{V}$_CGI ∩ $\mathcal{V}$_HX1 = Im d (dimension 6),

and the exact principal-angle spectrum between the two twelve-dimensional carriers is

{0 (×6), π/2 (×6)} — equivalently, the singular values of the orthonormal-basis overlap are {1 (×6), 0 (×6)}.

This is stronger than a mere dimension mismatch: the two carriers share exactly one six-dimensional sector and are exactly orthogonal on the remaining six directions.

46Q.3 Identification of the common six-plane. On the canonical wheel, the incidence identity BB^T = L_W_7 holds for the edge–vertex incidence operator, and the twelve-dimensional HX1 phase carrier has the exact orthogonal decomposition

$\mathcal{V}$_HX1 = Cut ⊕ Cyc, Cut = Im d (rank 6), Cyc = ker d^T (rank 6),

the cut space being the endpoint-generated or exact/coboundary sector, and Cyc the cycle-response sector (twelve edges minus seven vertices plus one connected component).

46Q.4 The selected uniform-rim mode lies wholly in the orthogonal cycle sector. For the registered uniform-rim record phase φ_rim — the consistent circulation on the six rim edges — direct execution gives

d^Tφ_rim = 0, hence φ_rim ∈ Cyc and P_Cut φ_rim = 0.

Thus the source-native EX2G/CGI endpoint-incidence renewal route has zero overlap with the particular HX1 loop mode whose neutral relaxation contributes the registered local excess Δk_loc.

> **Theorem 17 — Canonical incidence-renewal obstruction. [exact on the declared finite carriers]**
>
> On the common twenty-four-dimensional directed-nonself-mark carrier, the CGI Dirichlet response support and the HX1 twelve-edge phase carrier have principal-angle spectrum {0 (×6), π/2 (×6)}. Their intersection is exactly the endpoint-generated cut space Im d. The selected uniform-rim HX1 record phase lies in the orthogonal cycle space Cyc, and therefore cannot be regenerated through the canonical EX2G/CGI incidence–coboundary descent alone.

Verification notes (re-derived independently). The full construction was reproduced here from first principles on the explicit W_7 carrier: CGI Dirichlet support rank 12; overlap singular values exactly six ones and six zeros; Cut of rank 6 contained in both carriers with dim($\mathcal{V}$_CGI ∩ $\mathcal{V}$_HX1) = 6; and ||d^Tφ_rim|| = 0 with ||P_Cut φ_rim|| and ||P_CGI φ_rim|| both at machine zero (10^{-16}).

46Q.5 No linear incidence-to-signed-edge reconstruction. Suppose a fixed linear map T from the fourteen EX2G incidence labels reconstructed every signed HX1 edge, T(C_y^+ + C_x^-) = φ_{xy} = −φ_{yx} for every wheel edge. Write u_x = T(C_x^+), v_x = T(C_x^-). The two orientations of each edge give $u_y + v_x = \varphi_{xy}$ and $u_x + v_y = -\varphi_{xy}$; adding them, $(u + v)_x + (u + v)_y = 0$ *for every adjacent pair. Because the wheel contains triangles, traversal around any triangle forces* $(u + v) = 0$ *on all three vertices, and connectivity gives* $(u + v) \equiv 0$, *hence* $v = -u$ *and the edge equation becomes* $u_y - u_x = \varphi_{xy}$. Summing this relation around a triangle gives zero on the left but the sum of three distinct signed edge basis vectors on the right — a contradiction. Therefore no such T exists: the fourteen-channel incidence record has insufficient information to reconstruct the full twelve-edge signed phase carrier by fixed linear postprocessing. (Numerical check: the least-squares reconstruction over all such T leaves residual $2\sqrt{3} \approx 3.464$, strictly positive.)

46Q.6 Local consequence after master-action identification. The subsequent master-action audit (§46R) identifies the HX1 record-phase carrier with the phase tangent of the independently varied record/completion morphism Φ. Consequently the cycle-sector Schur operator derived here is a restriction of the common physical master Hessian rather than an external diagnostic operator. In the unit branch the selected uniform-rim mode has Hessian $[[3, -1], [-1, 2]]$, and complete removal of its old y-relaxation gives $\Delta k_{loc} = 1/2$ exactly. More generally, if commitment leaves survival amplitude s_{old} on the old cycle-phase direction, the unit-branch excess is $\Delta k = (1 - s_{old}^2)/2$ for the selected mode. The physical coefficient prior to unit normalisation is determined by the common operational metric; on the selected mode the full-lock excess is $w_B^2/(w_B + w_R)$, reducing to $1/2$ at unit weights (F40).

46Q.7 Renewal loophole narrowed to a non-minimal fresh-phase map. The retained PFDMI label is discrete and does not itself generate a continuous phase tangent. More strongly, the unique minimal source-selected branch-preserving renewal has no physical derivative into the HX1 phase sector: its free phase cancels from both the renewed nearest-neighbour connection and the renewed density operator (§46R.4). Therefore the minimal renewal supplies $s_{fresh} = 0$ exactly. The old R5 question — “does the retained discrete class regenerate the cycle phase?” — is consequently answered negatively for the canonical/minimal renewal architecture. The remaining loophole is strictly narrower: whether the primitive source generates an additional non-minimal, non-coboundary continuous phase channel beyond the minimal GPU renewal (D25). Separately, the commitment law must decide whether the old event-specific phase remains available at all (D24). These are distinct: the current minimal architecture gives exactly $s_{fresh} = 0$ and leaves s_{old} open.

46R. Master-action identification of the HX1 phase and the post-commitment availability audit

The carrier-relative obstruction of §46Q leaves two logically separate questions. First, is the HX1 uniform record-phase coordinate merely an independently constructed diagnostic degree of freedom, or does it occur inside the common VERSF master action? Second, once its source identity is fixed, does commitment actually remove that old relaxation direction, and can subsequent renewal recreate an equivalent one? The following audit answers the first question affirmatively, closes the minimal-renewal recreation loophole negatively, and reduces the second question to one event-specific availability return.

46R.1 The HX1 phase is a tangent of the master record/completion morphism. The common bosonic master action uses independent variables including the record/completion morphism Φ, and contains, among its primitive defects, the record-composition defect together with the polar bond-compatibility defect relating Pol(Φ) to the physical link. The master action is the common quadratic norm of these and the remaining primitive defects in one inherited operational metric: the record map and physical link are independent variables whose relation is dynamically penalised rather than imposed kinematically. Restricting locally to the scalar phase sector at the common zero-defect background, linearising the polar bond-compatibility defect gives exactly the GTC/HX1 bond linearisation in the link and record-phase coordinates, while the record-composition defect supplies the independent cycle rigidity acting on the same y-coordinates on the corresponding finite $K = 7$ record sector. The HX1 relaxation direction is therefore no longer merely co-typed with the physical master Hessian: it is a concrete tangent of one of its primitive independently varied fields, y_{HX1} = the phase tangent of Pol(Φ).

46R.2 Same-action quadratic block. At quadratic order the relevant record/bond action gives the Hessian block in the (link, record-phase) coordinates; eliminating an available record-phase auxiliary mode gives the exact Schur softening, and for the isotropic finite-wheel specialisation this becomes exactly the independently executed HX1 lost-relaxation operator. The HX1 Schur mechanism is thus the finite record/link restriction of the common master Hessian, not a separate phenomenological construction.

46R.3 Selected uniform mode. For the unit diagnostic branch, the normalised uniform link and record-phase modes give the Hessian block

$H_{qy} = [[3, -1], [-1, 2]]$,

with eigenvalues $(5 \pm \sqrt{5})/2$, both positive. For a fixed link amplitude, pre-commitment relaxation of the record phase gives the Schur-softened link stiffness $3 - 1^2/2 = 5/2$. If the old y-direction is unavailable after commitment, the link stiffness returns to 3, so

$\Delta k_{loc} = 3 - 5/2 = 1/2$ exactly (unit branch).

This reproduces the earlier HX1 uniform-cycle result without using it as an input. The physical master coefficient is not yet fixed to this unit value: in the common metric the record and bond weights w_R, w_B are pullbacks of one stationary operational metric — the master architecture forbids arbitrary independent coefficients — and the physical full-lock excess is $w_B^2/(w_B + w_R)$, which reduces to 1/2 at $w_B = w_R = 1$. That physical metric has not yet been numerically executed, so 1/2 is an exact same-action unit-branch return, not yet the final normalised physical value (F40).

46R.4 Minimal renewal does not recreate the phase carrier. The source-selected minimal branch-preserving renewal carries one free phase. The renewed nearest-neighbour connection is independent of that phase — it cancels from every link ratio — and the conditioned renewed density state is likewise independent of it. The free renewal phase is therefore a global/Kraus-phase freedom, not the physical HX1 y-coordinate: in tangent language, the minimal renewal has zero derivative into the HX1 phase sector. The terminal PFDMI record index does not repair this: it is a discrete representation/projector label in the seven-atom central support decomposition, and the current source supplies no map identifying that label with a continuous phase. Therefore the minimal source-selected renewal gives $s_{fresh} = 0$ exactly for the HX1 phase carrier.

46R.5 Old-mode survival is now the remaining local question. Let φ_{old} be the event-specific normalised HX1 phase mode available immediately before commitment. The Fold architecture proves that commitment is irreversible and that the committed state cannot locally return to the pre-commitment configuration. It does not yet prove the stronger tangent statement that every continuous phase relaxation tangent of the old event is removed, because a continuous auxiliary phase variation could in principle survive while leaving the discrete committed record invariant. Accordingly define the old-mode post-commitment survival amplitude $s_{old} = \|P_{avail}\, \varphi_{old}\|$, with P_{avail} the post-commitment tangent projector on the y-phase carrier. For the partial-access HX1 block the unit-branch excess is

$$\Delta k = (1 - s_{old}^2)/2,$$

so $s_{old} = 0$ returns the full 1/2 while $s_{old} = 1$ returns zero. Minimal renewal supplies no fresh compensating y-mode, so within the minimal architecture the commitment answer is final. A larger non-minimal source-derived phase channel remains logically possible, but it must be explicitly returned from the primitive action; it cannot be inferred from full PFDMI working-carrier rank, from the retained edge/type label, or from the arbitrary renewal phase.

> **Theorem 18 — Master-phase identification and minimal-renewal no-regeneration theorem. [exact on the declared finite/master and minimal-renewal carriers]**
>
> The HX1 uniform record-phase coordinate is a physical phase tangent of the master-action record/completion field Φ. Its link coupling and record-cycle stiffness are the polar-compatibility and record-composition contributions to one common Hessian, whose unit diagnostic uniform-mode Schur softening is exactly 1/2. The unique minimal branch-preserving renewal does not regenerate this tangent: its only free phase is physically vertical, with zero derivative on the renewed link ratios and density state, and the discrete terminal type supplies no continuous replacement. Consequently ordinary minimal renewal cannot undo a commitment-induced loss of the old HX1 relaxation direction. The sole remaining local commitment question is whether the primitive post-commitment constraint makes that old y-phase tangent unavailable; the unit-branch excess is $(1 - s_{old}^2)/2$, and the physical normalisation remains determined by the unevaluated common operational metric.

Verification notes. The unit-branch numerics were re-derived here: H_{qy} eigenvalues exactly $(5 \pm \sqrt{5})/2$ (positive block); Schur-softened stiffness $3 - 1/2 = 5/2$; full-lock excess 1/2; $w_B^2/(w_B + w_R) = 1/2$ at unit weights; and the partial-survival law's endpoints. The global/Kraus-phase cancellation from ratios and from the density operator is structural. The master-action structure, the GPU minimal-renewal uniqueness and the polar/record defect definitions are imported from the MASD-1, K7-HYR-1 and K7-PCA-1/GPU-1 sources at their stated grades.

46S. Ordered-history chirality, scalarisation no-go and the internal-frame forcing boundary

46S.1 A single retained fact loses traversal orientation. Let $\mathcal{M}\_\mathrm{dir} \cong \mathbb{R}^{24}$ be the nonself directed-history carrier and $E \cong \mathbb{R}^{12}$ the persistent edge-label carrier. The F2F record map is $C : \mathcal{M}\_\mathrm{dir} \to E$, $C|x\to y\rangle = |e(x, y)\rangle$, where the two orientations of one wheel edge have the same retained edge label. For each edge define $|e, \pm\rangle = (|x\to y\rangle \pm |y\to x\rangle)/\sqrt{2}$. Then $C|e, +\rangle = \sqrt{2}\ |e\rangle$ and $C|e, -\rangle = 0$. The executable map has rank $C = 12$ and $CC^T = 2I_{12}$, and therefore ker $C = \mathcal{M}\_\mathrm{reversal\text{-}odd}$ with dim ker $C = 12$. Thus no single persistent (e, r) token can itself be the reversal-odd history carrier.

> **Theorem 19 — Single-record orientation-erasure theorem. [exact at the F2F record grain]**
>
> The F2F directed-nonself-to-edge coarse-graining retains the complete reversal-even sector and annihilates the complete reversal-odd sector. Traversal chirality is therefore not a property of one persistent edge/type token.

46S.2 Ordered persistent history recovers chirality. Let ρ_i denote the six rim edges and define the ordered adjacent-turn records $p\_i^+ = (\rho\_i, \rho\_\{i+1\})$ and $p\_i^- = (\rho\_i, \rho\_\{i-1\})$, $i = 0, \ldots, 5$. Define $\chi_2(p\_i^+) = +1$, $\chi_2(p\_i^-) = -1$, and zero elsewhere. Rotation preserves χ_2 while reflection reverses its sign: $R\chi_2 = \chi_2$, $S\chi_2 = -\chi_2$. Hence χ_2 is an A_2 pseudoscalar of the ordered history. The frozen D36/PFDMI source gives

$P_+ = 0.341539787759487$, $P_- = 0.007370309811505$,

so $\langle\chi_2\rangle = P_+ - P_- = 0.334169477947982$ and $P\_\chi = P_+ + P_- = 0.348910097570992$. Conditioned on the oriented adjacent-rim-turn sector, $P(+|\chi) = 0.978876192283300$ and $P(-|\chi) = 0.021123807716700$, with

$(P_+ - P_-)/(P_+ + P_-) = 0.957752384566601 = \tanh(2\alpha)$.

For the normalised twelve-turn vector $\hat{\chi}_2 = \chi_2/\sqrt{12}$, the amplitude is $a\_A_2 = \langle\chi_2\rangle/\sqrt{12} = 0.0964664190241121$. Thus an individual fact is orientation-even but the ordered relation between retained facts is orientation-odd.

> **Theorem 20 — Ordered-history chirality recovery. [exact for the frozen history law]**
>
> The append-only persistent history contains a nonzero source-populated A_2 chirality observable even though each individual retained edge token is reversal-even. Orientation is relational information carried by record order.

46S.3 The ordered-history and R4 branch observables coincide only at effect level. On the twelve ordered-turn states define $Q_+ = \Sigma_i |p\_i^+\rangle\langle p\_i^+|$ and $Q_- = \Sigma_i |p\_i^-\rangle\langle p\_i^-|$. Then $Q_+Q_- = 0$, $Q_+ + Q_- = I\_turn$, rank $Q\pm = 6$. With two independently retained terminal labels, the corresponding F2F subspaces have rank $6 \times 7^2 = 294$ per chirality branch. Rotation fixes Q± and reflection exchanges them; within the ledger-diagonal binary readout class this is the unique nontrivial rotation-invariant, reflection-swapped partition up to + ↔ −. The R4 access carrier independently has the unique binary PVM $\{P_+, P_-\}$. The observable algebras therefore admit the canonical map $\Theta(Q_+) = P_+$, $\Theta(Q_-) = P_-$. However the underlying representations are not equivalent: the full ledger branch ranks are 294 whereas the R4 effects are rank one, and even on the two uniform history rays $|\chi\pm\rangle = (1/\sqrt{6})\Sigma_i|p\_i\pm\rangle$ rotation acts trivially, while on the R4 chiral rays it has eigenvalues $e^{\mp i\pi/3}$. The simultaneous D_6-intertwining equations therefore have only the zero solution:

$$\mathrm{Hom}_{D_6}(H\_\chi, E_1) = 0.$$

The natural bridge is consequently a conditioned CP readout, $\Phi_{\chi\to R4}(\rho) = \mathrm{Tr}(Q_+\rho)P_+ + \mathrm{Tr}(Q_-\rho)P_-$, not an isometry identifying the two state carriers.

> **Theorem 21 — Effect correspondence without carrier identity. [exact algebraically]**
>
> The ordered persistent history and the R4 sector carry canonically corresponding binary chirality observables, but no nonzero D_6-equivariant Hilbert-space identification exists between their natural carriers. A physical history-to-R4 bridge must therefore be a conditioned readout or equivalent layer-changing map.

46S.4 Scalar commitment density cannot transmit the ordered chirality. The continuum commitment source used by the scalar κ line is the positive event density ρ_committed(x, t), not the internal edge-order label. For two histories with the same two event locations and times but opposite rim orientation, $\rho_{p^+}(x, t) = \rho_{p^-}(x, t)$. The six rim states also have the same self/no-record probability, s_rim = 0.200305886206958, so the clockwise and counter-clockwise branches have identical subsequent waiting-time distributions: orientation cannot leak indirectly into the scalar source through event timing. Writing S_scalar for the map from the ordered-turn carrier to commitment density, $S\_scalar\ \chi_2 = 0$. Consequently, for linear retarded propagation and causal memory, $\kappa\_odd = G\_ret * S\_scalar\ \chi_2 = 0$, $\Xi\_odd = K * S\_scalar\ \chi_2 = 0$, and therefore $(s\_eff)\_odd = 0$.

> **Theorem 22 — Scalarisation no-go. [exact for the presently defined scalar source chain]**
>
> Ordered-history chirality is annihilated when the record is reduced to unsigned commitment-event density. Linear κ propagation and causal memory cannot recreate that lost orientation. Any physical chirality readout must couple before this scalarisation or through an additional non-scalar source.

46S.5 The GTC phase precursor carries orientation but not branch population. The source-selected history branch fixes $\theta\_\sigma = \sigma\pi/3$. For the finite GTC record/bond action $E(y; \theta) = 6w\_R(1 - \cos y) + 6w\_B[1 - \cos(\theta - y)]$, the blank-record derivative is $\partial E/\partial y|$*{y=0} =*

$-6w_B \sin\theta$, so $\partial E/\partial y|_{0,\sigma} = -\sigma\cdot 3\sqrt{3}\cdot w_B$, nonzero for $w_B > 0$; in the unit branch $w_R = w_B = 1$ the minimum is $y^*(\sigma) = \sigma\pi/6$. Thus the orientation survives into the record-phase precursor. However a conjugate phase on the E_1/R4 doublet acts as $U_y = e^{-iy\Delta P/2}$; for the reflection-symmetric initial state $R_0 = ½(I + x\sigma_x)$ one obtains $R(y) = ½[I + x \cos y\, \sigma_x + x \sin y\, \sigma_y]$. There is no $\Delta P = \sigma_z$ term, so $\mathrm{Tr}(P_+R(y)) = \mathrm{Tr}(P_-R(y)) = ½$ for every y, and the first derivative is purely σ_y: $dR/dy|_0 = (x/2)\sigma_y$. Likewise the relaxed scalar GTC energy depends on θ only through cos θ, so $E_{min}(+\theta) = E_{min}(-\theta)$. The GTC phase is a genuine orientation-memory precursor but is not, by itself, a $P_+ - P_-$ population selector.

> **Theorem 23 — Phase-memory/readout separation. [exact for the natural pure-phase E_1 realisation]**
>
> The source-selected history orientation drives a nonzero GTC record phase, but a pure conjugate phase produces only access-invisible odd coherence and no P± population difference. Phase memory and branch-population readout are distinct physical operations.

46S.6 The present closure action contains no signed real maintenance load. The presently executable closure source contains the fixed record matrix M_{record} but no realised-history scalar m entering through a signed real term of the form $-m\cdot M_\chi$. Therefore $\partial\langle H_c\rangle/\partial m|_{m=0}^{current} = 0$, so the access-visible load coefficient $b_{current} = ½\mathrm{Tr}_{E_1}[\Delta P\, \partial H_c/\partial m|_0] = 0$ — equivalently the marginal-load coefficient is $\Lambda_c^{current} = 0$ as a construction zero. This is not a theorem that a completed primitive action must have $\Lambda_c = 0$. The inherited persistent-distinguishability and interface-transport maintenance magnitudes S_P and S_I are themselves reversal-even, so neither S_P, S_I nor $S_P S_I$ can alone be the signed maintenance functional. If j denotes an orientation-odd source current, analyticity and reversal symmetry force $M_\chi(j, p, t) = j\cdot F(j^2, p, t)$ with $p = \ln S_P$, $t = \ln S_I$; if the maintenance contribution vanishes at $p = t = 0$, the lowest-order form is

$$M_\chi^{LO} = j(c_P \ln S_P + c_I \ln S_I).$$

The coefficients c_P, c_I are not returned by the present action.

46S.7 EX2E projectivises away scalar current sign and phase. The EX2E current channel depends on $\rho_{J,e} = |j_e\rangle\langle j_e|/\langle j_e|j_e\rangle$. For every nonzero complex scalar z_e, $\rho_{J,e}[z_e j_e] = \rho_{J,e}[j_e]$: EX2E is exactly insensitive to current magnitude, overall sign and overall phase — $j_e^{(-)} = -j_e^{(+)}$ or $j_e^{(-)} = e^{i\varphi_e} j_e^{(+)}$ gives identical current effects. Consequently the source-selected spatial helix dressed with one common internal ray, $j_e^{(\sigma)} = h_e^{(\sigma)} v$, has $\rho_{J,e}^{(+)} = \rho_{J,e}^{(-)} = |v\rangle\langle v|$ and zero projective orientation visibility. Define $V_J^2 = \Sigma_{e=1}^{12} \|\rho_{J,e}^{(+)} - \rho_{J,R(e)}^{(-)}\|_F^2$, so $0 \le V_J \le \sqrt{24}$. The common-ray helix has $V_J = 0$. Diagnostic conjugate versions of the five equally admissible EX2E endpoint witnesses instead give values approximately 4.80–4.89, close to the mathematical maximum $\sqrt{24} = 4.898979485566356$ — capacity witnesses only: the large value varies with the unresolved endpoint frame and is not a physical action return. Hence the correct result is that $V_J^{physical}$ is not identified by the present source action.

46S.8 The orientation parameter does not force the internal frame. The EX2E same-source constraint is $D_{J,e} = j_e - (\psi_{t(e)} - U_e(A)\psi_{s(e)}) = 0$. Let $x(\alpha)$ denote a putative orientation-dependent on-shell source configuration; differentiation gives $J_D \dot{x}_\alpha = -\partial D_J/\partial\alpha$. But α enters the D36 history kernel, not D_J itself. Therefore $\partial D_J/\partial\alpha = 0$ and hence $J_D \dot{x}_\alpha = 0$. The residual tangent has dimension $2120 - 1200 = 920$; removing the currently declared 84-dimensional local gauge orbit leaves the preliminary upper bound 836, before further physical equivalences are exhausted. The zero response $\dot{x}_\alpha = 0$ is therefore an exact admissible solution; nonzero responses are also possible along unresolved tangent directions, but the existing source does not identify which, if any, represents a physical variation of α. For $\rho_J = |j\rangle\langle j|/\langle j|j\rangle$ the projective derivative is $\dot{\rho}J = [P_\perp|j\rangle\langle j| + |j\rangle\langle j|P_\perp]/\langle j|j\rangle$ *with* $P_\perp = I - \rho_J$: only a transverse internal rotation contributes, $P_\perp j \neq 0$. Define $R_\alpha^2 = \Sigma_e \|d\rho_{J,e}/d\alpha\|_F^2$. The present action permits $R_\alpha = 0$ but does not select its physical value.

> **Theorem 24 — Internal-frame non-forcing theorem. [exact for the current EX2E source constraint]**
>
> The D36 orientation parameter has no explicit forcing term in the EX2E endpoint/current residual. Its on-shell response equation is homogeneous, $J_D \dot{x}_\alpha = 0$. Consequently the same-source constraint can transmit an internal variation once supplied but does not generate a unique internal projective variation from history orientation. The physical value of R_α is therefore not identified.

46S.9 Exact remaining forcing term. The history-to-internal-frame problem is consequently reduced to one source-action object. A nontrivial dynamical orientation transfer requires an action term for which

$B_\alpha F = \partial^2 A_{source}/\partial\alpha\partial F_{int}|_\star \neq 0,$

or an equivalent source-derived relation producing $J_D \dot{x}_\alpha = b_\alpha$ with $b_\alpha \neq 0$. PFDMI-S1 gives the correct frame-selection criterion on the fully admissible physical quotient M_{adm}: the selected class must be stationary, $dA_{source}|_{[F\star]} = 0$, *and the quotient Hessian must have no unexplained continuous kernel, ker Hess*$_{M_{adm}} A_{source}(F\star) = \{0\}$, up to declared discrete or conjugate equivalence, while preserving all source constraints and physical score ranks. That criterion is exact; its physical execution remains open. The resulting hierarchy is now: ordered history chirality → source-selected spatial phase → record-phase precursor is derived, while history orientation → selected internal projective frame → physical P± readout still requires the missing mixed source-action forcing.

Verification notes. The two-turn statistics were re-derived here from the quoted P±: expectation 0.334169477947982, sector weight 0.348910097570992, conditional bias 0.957752384566601 and conditionals 0.978876192283300 / 0.021123807716700, A_2 amplitude 0.0964664190241121 (all exact to the stated digits); $\sqrt{24} = 4.898979485566356$; $6 \times 7^2 = 294$; the tangent counts $2120 - 1200 = 920$ and $920 - 84 = 836$. The GTC derivative $-6w_B \sin\theta = -\sigma\cdot3\sqrt{3}\cdot w_B$ at $\theta = \sigma\pi/3$ and the unit-branch stationary point $y = \theta/2$ were re-derived symbolically, as was the pure-phase E_1 result (rotation of σ_x into σ_y with zero σ_z component and populations exactly ½ for all y). The coarse-graining identities $C|e, \pm\rangle$, $CC^T = 2I_{12}$ and the kernel identification, χ_2's A_2 transformation law, the $\mathrm{Hom}_{D_6} = 0$ Schur argument and the CP structure of $\Phi_{\chi\to R4}$

are structural. Imported at source precision: the D36 P± values, s_rim, the EX2E dimensions and witness range 4.80–4.89, and the constraint form D_J,e.

46T. Conjugate-frame readout no-go and the closed family-triangle holonomy

46T.1 Complete conjugation leaves the EX2E Born law invariant. The EX2E current instrument is built from the projective current densities ρ_J,e = |j_e⟩⟨j_e|/⟨j_e|j_e⟩ and the native effect family — the thirteen current-outcome effects and the seven terminal-type projectors — evaluated in the source state ρ_src, with Born probabilities p = Tr(ρ_src E). Consider the two complete faithful branch presentations related by complex conjugation: j_e → j_e*, gauge generators G → G*, terminal projectors Π_r → Π_r*, and source state ρ_src → ρ_src*. Then every current density conjugates, ρ_J,e → ρ_J,e*, hence every native effect conjugates, E → E*. Consequently the conjugated Born probability is p̄ = Tr(ρ_src* E*) = [Tr(ρ_src E)]* = p, since the trace is a real probability. Therefore

Δp = 0 exactly,

for every edge e, every one of the thirteen current outcomes, and every one of the seven terminal types, under complete faithful conjugation. An independent reconstruction of the full frozen EX2E instrument on the five existing diagnostic endpoint witnesses gives zero, to double precision, for the maximum individual mark-probability difference, terminal-population difference and terminal total-variation difference between the two fully conjugated presentations.

> **Theorem 25 — Conjugate-Frame Born-Readout No-Go. [exact for the present EX2E instrument]**
>
> Exact conjugation of the complete faithful EX2E endpoint/current carrier can produce a large projective separation between its two branch presentations while leaving every native mark and terminal Born probability unchanged. Projective current separation is therefore not sufficient for physical orientation readout. A physical branch asymmetry requires a source-native reference or interaction which is not merely co-conjugated with the branch.

This result is consistent with the existing nonzero physical score rank. The score rank establishes sensitivity to physical Wilson perturbations. It does not imply that two complete antiunitarily related experiments must have different probabilities. The result also sharpens the interpretation of the previously found diagnostic range 4.80–4.89 near the maximum √24 = 4.898979485566356: those values remain valid capacity witnesses, but they cannot be promoted into branch-readout witnesses merely by propagating the conjugate frames through the existing Born instrument (F46).

46T.2 A closed gauge-invariant phase already exists on the frozen family carrier. The frozen role-odd quark generator Ω_q is anti-Hermitian on the three-generation carrier;

define the associated Hermitian transport object $H_q = -i\Omega_q$. The family graph contains two reduced routes with the same endpoints: the direct route $1 \to 3$ through the link H_{31}, and the indirect route $1 \to 2 \to 3$ through the links H_{21} and H_{32}. For each nonzero link define its unit phase $\hat{u}(H_{ij}) = H_{ij}/|H_{ij}|$. The resulting closed triangle quantity is

$W_\Delta = \hat{u}(H_{32}) \cdot \hat{u}(H_{21}) \cdot \hat{u}(H_{31})^*$,

the indirect transport compared against the direct one around the closed $1 \to 2 \to 3 \to 1$ loop. For the frozen generator the three link phases return

$W_\Delta = e^{i\cdot 5\pi/6}$ exactly — $\arg W_\Delta = 5\pi/6$ (one hundred and fifty degrees),

and reversing the loop gives the conjugate value, $\arg W_\Delta^{\mathrm{rev}} = -5\pi/6 \equiv 210°$. This phase is invariant under arbitrary family rephasings $\psi_g \to e^{i\theta_g}\psi_g$: each individual link then receives an endpoint phase, $\hat{u}(H_{ij}) \to e^{i\theta_i}\hat{u}(H_{ij})e^{-i\theta_j}$, but around the closed triangle every endpoint phase cancels. Thus W_Δ is a genuine closed-family rephasing invariant rather than the absolute phase of one generator entry.

> **Theorem 26 — Reduced-Family Triangle-Holonomy Theorem. [exact on the frozen family carrier]**
>
> The frozen three-generation transport possesses a closed, gauge-invariant reduced-family comparison phase. The direct route $1 \to 3$ and the indirect route $1 \to 2 \to 3$ return $W_\Delta = e^{i\cdot 5\pi/6}$, so the oriented family triangle has phase 150°, with the reverse orientation giving 210°. No local family rephasing changes this result.

The theorem is deliberately carrier-typed. It establishes a closed holonomy on the frozen reduced family transport. It does not by itself prove that this loop is the physical HCFC axle loop.

46T.3 Finite-regulator continuation. The RRMK/RRHF continuation attaches the stored finite-regulator generators to the bare transport under the declared refinement law. Applying the same normalised Hermitian triangle construction to the stored finite-regulator generators gives

$\arg W_\Delta^{(\text{level } 3)} = 176.5074504467°$ and $\arg W_\Delta^{(\text{level } 4)} = 155.8501772202°$,

while the bare generator gives exactly 150°, the declared refinement target provided the regulator correction remains bounded so that its explicit contribution vanishes in the limit. Only two finite levels are presently available for this diagnostic, so no numerical convergence order is claimed. The important result is instead that the finite-regulator triangle is a well-defined gauge invariant and that the declared bare transport to which the continuation is attached has the exact value $5\pi/6$.

46T.4 The family triangle is not yet the HCFC axle loop. HCFC-1 defines the physical phase object L_{ax} through two admissible charged-completion histories γ_0 and γ_{ax}, which have the same preparation and the same final charged record, but where γ_{ax} contains the role-even axle transport. The newly isolated W_Δ satisfies the mathematical closed-loop and gauge-invariance requirements on the reduced family carrier, but no same-action theorem presently identifies L_ax = W_Δ. In particular, RRHF-AX1 cannot be used to prove this identification, because AX1 explicitly installs the role-even axle as a conditional additional history step; using that construction to establish the physical existence of the axle comparison history would be circular. The updated status is therefore: closed family holonomy EXISTS, with exact value $e^{i\cdot 5\pi/6}$ — but the physical identification L_ax = W_Δ remains OPEN. The former substantially strengthens the phase provenance: the physical axle phase is no longer merely a phase assigned to an open matrix component or inferred from its phenomenological success — a closed source-frozen family holonomy carrying exactly that value exists independently. The remaining obligation is a same-action carrier/history theorem proving that the physical role-even charged-completion comparison loop descends to, or inherits, this already existing closed family holonomy.

46T.5 Updated orientation/readout boundary. Combining §§46S and 46T, the derived chain now runs: ordered history chirality → source-selected spatial phase → record-phase precursor → exact closed family holonomy — while the physical readout chain, history orientation → fixed physical internal frame → P± branch readout, remains open. Three distinct statements are therefore now established: orientation is physically retained in ordered history; the frozen family transport contains a nontrivial closed phase invariant; and complete conjugation of the present EX2E readout instrument remains Born-probability invisible. The missing physics is not the existence of orientation information or the existence of a closed phase. It is their same-action installation into a fixed physical readout reference. This may occur through the already identified mixed forcing B_αF, through an equivalent isolated physical frame on the quotient (PFDMI-S1), or through a same-action charged-completion history map proving that the relevant role-even comparison loop inherits W_Δ.

Verification notes. Both structural claims were re-derived here: the conjugation invariance is the one-line trace identity $\mathrm{Tr}(\rho^* E) = \overline{[\mathrm{Tr}(\rho E)]} = \mathrm{Tr}(\rho E)$ for a real probability, and the gauge invariance of W_Δ is the exact cancellation of endpoint phases around a closed loop; $5\pi/6 = 150°$ and the reverse value 210° are consistent as a conjugate pair. Imported at source precision: the frozen Ω_q link phases and the stored level-3/level-4 finite-regulator generators (RRHF thread), and the five-witness zero-difference reconstruction.

46U. Population-visible forcing, first-cover chirality and the readout bottleneck

46U.1 The population-visible response reduces to one invariant susceptibility. The ordered-history analysis of §46S establishes a nonzero chirality observable, while the R4 access carrier contains the binary observable $\Delta P = P_+ - P_-$. The next question can be posed without identifying it with any particular phenomenological sector: does the source action convert retained history orientation into unequal occupation of the two conjugate R4 branches? Let F denote coordinates on the fully quotiented admissible internal-frame manifold and define the population gradient D_F ΔP along those coordinates. At the reflection-symmetric point F_0, $\Delta P(F_0) = 0$. For a source action A(F, α, a), where α is the signed history-orientation parameter and a denotes all relaxable auxiliary variables, eliminate a by the common Schur reduction. The effective physical-frame Hessian and effective orientation forcing are

$$K_F = A_{FF} - A_{Fa} A_{aa}^{-1} A_{aF} \text{ and } B_{eff} = A_{F\alpha} - A_{Fa} A_{aa}^{-1} A_{a\alpha}.$$

Stationarity gives $K_F \dot{F}_\alpha = -B_{eff}$, and therefore, on the nonsingular physical quotient, $\dot{F}_\alpha = -K_F^{+} B_{eff}$. The first-order orientation-to-population transfer is consequently the single invariant susceptibility

$$\chi_{pop} = d\Delta P/d\alpha = -(D_F \Delta P) \cdot K_F^{+} \cdot B_{eff}.$$

The large unresolved internal-frame tangent therefore does not itself imply an equally large physical ambiguity. For branch-population readout the entire problem reduces to whether the source-selected frame response has a nonzero projection onto the single ΔP-visible direction.

> **Theorem 27 — Population-visible forcing reduction. [exact at linear order on the declared quotient]**
>
> After all relaxable internal variables are Schur-reduced, first-order transfer of retained history orientation into conjugate R4 branch population is controlled by the scalar susceptibility $\chi_{pop} = -(D_F \Delta P)\cdot K_F^{+}\cdot B_{eff}$. Nonzero internal-frame motion is insufficient: the response must have a nonzero $D_F \Delta P$ projection.

46U.2 Existing scalar and pure-phase routes have exactly zero population projection. The scalar route already fails before the frame problem is reached: $S_{scalar}\, \chi_2 = 0$, so every linear descendant remains orientation-even (§46S.4). The phase route survives further. The GTC/HX1 mechanism drives the orientation-dependent record phase, and the common master action contains the nonzero link–record block already identified in §46R. But in the natural R4/E_1 realisation the pure conjugate phase rotates the Bloch vector within the coherence plane, $R(y) = ½[I + x \cos y\, \sigma_x + x \sin y\, \sigma_y]$, and since $\Delta\hat{P} = \sigma_z$ one has $\mathrm{Tr}(\Delta\hat{P}\, R(y)) = 0$ for every y. Thus $\chi_{pop}^{scalar} = 0$ and $\chi_{pop}^{phase} = 0$ exactly. This is an exact orthogonality result, not a small-coupling approximation: the record phase moves the Bloch vector in the coherence plane, while the branch-population observable lies on the orthogonal axis.

46U.3 Symmetry permits a direct chirality–population scalar. The ordered-history chirality is rotation-even and reflection-odd, hence it transforms as the A_2 pseudoscalar. The R4 population observable has the same transformation law: rotation fixes the two rank-one projectors individually, while reflection exchanges them, so ΔP is likewise A_2-odd. Consequently $A_2 \otimes A_2 = A_1$, and the leading symmetry-allowed coupling between these specified one-dimensional lines is the bilinear

$$-g_{\chi P} \cdot \chi \cdot \Delta P.$$

Linear terms in either pseudoscalar separately are forbidden by the reflection symmetry, but their product is a scalar. This uniqueness statement is deliberately carrier-local: the full master theory contains more than one copy of A_2, including the link and record-phase carriers; representation theory therefore fixes the form of the coupling between the chosen history and population lines but does not say that only one carrier exists in the complete theory (F50). The presently executable action contains no such activated population term, so $g_\chi P^{current} = 0$ is a construction-level absence, while $g_\chi P^{physical}$ remains open.

46U.4 The actual first-cover history is even more strongly oriented. The two-turn observable proves local ordered-history chirality. A stronger test asks whether this orientation survives to the actual first complete-cover event at which the recurrent history has visited the entire seven-state wheel and returned to its starting state. For a completed first-cover history γ, define the signed circulation

$K(\gamma)$ = (number of forward rim traversals) − (number of reverse rim traversals),

counting only directed rim traversals; hub and self moves contribute zero. Reflection maps $K \to -K$ while preserving the first-cover event. Since the frozen D36 forward and reverse rim probabilities differ by the factor $e^{2\alpha}$ per rim step, every reflected path pair satisfies $P(\gamma)/P(S\gamma) = e^{2\alpha K(\gamma)}$. Grouping first-cover paths by K therefore gives the exact fluctuation relation

$P(K = k)/P(K = -k) = e^{2\alpha k}$.

The augmented EX2G first-passage execution reproduces this relation with the maximum log-ratio residual at the execution's numerical precision. On the complete first-cover ensemble,

$P(K > 0) = 0.996750764817216$, $P(K < 0) = 0.001180705267406$, $P(K = 0) = 0.002068529915369$.

Conditioning on histories with nonzero net orientation gives $P(K > 0 \mid K \neq 0) = 0.998816847345935$. The preferred-to-conjugate odds are 844.199473258, with signed conditional bias 0.997633694691869. Thus the source-native orientation is not confined to the exceptional minimum-length seven-Fold closures. It remains overwhelmingly one-sided at the typical first-cover event.

> **Theorem 28 — First-cover chirality fluctuation theorem. [exact path-pair relation; numerical first-passage execution]**
>
> For the frozen D36 wheel process, the signed first-cover circulation obeys $P(K = k)/P(K = -k) = e^{2\alpha k}$. On the executed branch, more than 99.88% of nonzero-orientation first covers carry the preferred sign. The recurrent history therefore arrives at complete closure with a strong source-native orientation already present.

The first-cover event itself remains reflection-even. What is signed is the complete retained history arriving at it. A terminal readout may therefore use K without inventing a new orientation at closure.

46V. History-derived completion geometry inside the common Hessian

46V.1 HMGBC changes the completion Hessian, not merely the completion target. The history-derived HMGBC completion functional carries the generation-history geometry inside its quadratic form. Expanding the functional about the common background and collecting the exact quadratic term shows that the completion-strain Hessian is the old isotropic MASD completion block plus a definite amendment:

$$H_{XX} = H_{XX}^{MASD} + \Delta\Omega, \quad \Delta\Omega \succeq 0,$$

where $\Delta\Omega$ is the history-derived generation operator. The history geometry therefore enters the bosonic completion precision matrix itself; it is not merely a post-processing resolvent or a changed equilibrium target. Completing the square yields the shifted completion target together with a positive reduced backreaction term, and the old isotropic MASD branch is recovered exactly when the scalar-access support lies in the null space of $\Delta\Omega$.

> **Theorem 29 — History-derived completion-Hessian amendment. [exact]**
>
> The HMGBC completion functional modifies the common bosonic completion Hessian by the positive operator $\Delta\Omega$. The MASD isotropic branch is recovered precisely on the $\Delta\Omega$-null support.

46V.2 The history amendment survives ordinary HFB auxiliary relaxation exactly. The later HFB/RPC carrier census places completion-strain modes among the retained physical coordinates rather than among the Schur-eliminated auxiliaries, and HMGBC Stage A computes $\Delta\Omega$ and the selected history geometry before Stage B, where those returns are frozen into the MASD boundary execution. Write the post-quotient Hessian in retained/auxiliary block form. If E_X embeds the retained completion-strain carrier, the history amendment is $E_X \Delta\Omega E_X^\dagger$, supported entirely in the retained block. The auxiliary Schur reduction eliminates only the auxiliary block, so

$$\mathrm{Schur}_a(H + E_X \Delta\Omega E_X^\dagger) = \mathrm{Schur}_a(H) + E_X \Delta\Omega E_X^\dagger \text{ exactly.}$$

No ordinary Stage-B auxiliary relaxation can screen this term. Because $\Delta\Omega \succeq 0$, it follows that the amendment may increase retained stiffness or vanish on the $\Delta\Omega$-null support, but cannot be reduced by the declared auxiliary elimination.

> **Theorem 30 — HMGBC completion Schur-survival theorem. [exact under the declared HMGBC→HFB stage ordering]**
>
> A history-derived amendment frozen in the retained completion-strain block survives the complete ordinary auxiliary Schur reduction unchanged. It may increase retained stiffness or vanish on $\ker \Delta\Omega$, but cannot be screened by the declared HFB auxiliary elimination.

46W. Completion–charged transmission no-go and the corrected CY3′ boundary

46W.1 HCMR-MR1 already contains the history geometry in its completion block. The HCMR-MR1 candidate completion operator carries the generation-history stiffness within its completion block. Accordingly, the history-derived generation geometry is already represented there, and the correct update is not to add $\Delta\Omega$ to that block a second time (F52). The relevant question is instead whether that completion geometry reaches the charged/Yukawa Hessian.

46W.2 In the executed direct-sum parent the transmission is exactly zero. HCMR-MR1 uses a candidate parent whose completion and charged sectors occupy disjoint carrier ranges of the 102-dimensional executable; the paper itself correctly grades this direct-sum structure as a construction rather than a primitive proof that every physical cross-block vanishes, and the present paper already cites the independent completion disagreement as one reason the HCMR-MR1 physical certificate was refused. Machine inspection of the exported charged selectors shows that every charged chiral embedding, for all four sectors, is supported entirely on the charged block and has zero support on the completion block. Therefore, for any amendment confined to completion space — including $E_X \, \Delta\Omega \, E_X^\dagger$ — the direct charged pullback vanishes identically, and the executable returns exactly zero transmission. The fact that the history geometry survives the common Schur reduction does not mean that it reaches the charged Yukawa Hessian: the current direct-sum candidate keeps the completion and charged sectors as separate islands.

> **Theorem 31 — Completion–charged transmission no-go for HCMR-MR1. [exact for the executed direct-sum carrier]**
>
> Any Hessian amendment supported only on the HCMR-MR1 completion sector has exactly zero direct effect on the extracted charged Yukawa matrices, because the exported charged chiral embeddings have disjoint support from the completion block.

46W.3 Adding the generation Laplacian directly to the independent Hessian route does not close CY3′. The old independent CY3′ residuals were

u: 0.373851, d: 0.381211, e: 0.493033, ν: 0.448473.

The first strict test adds only the generation lift to the independently typed closure-Hessian route while leaving the separately derived mixed route untouched. At level six the residues become

u: 0.521795, d: 0.495390, e: 0.142094, ν: 0.193624.

The amendment materially improves the charged-lepton and neutral sectors but worsens both quark sectors, so the maximum residual changes as 0.493033 → 0.521795. Across regulator levels three to six, the amended maximum residues are 0.520086, 0.521512, 0.521739, 0.521795, which converge to a nonzero structural mismatch. The stronger full-completion insertion gives level-six residuals u: 0.572233, d: 0.591714, e: 0.448308, ν:

0.405704. Therefore neither natural universal completion amendment closes the independent CY3′ condition.

46W.4 The required correction is sector-sensitive, but the missing object is not a second-order completion–fermion Hessian block. The universal-history-stiffness failure remains decisive: the same generation amendment points approximately toward the required correction in the charged-lepton and neutral sectors while pointing oppositely in the quark sectors, so no single positive universal completion multiplier can close CY3′. However, the subsequent differential-order audit corrects the identification of the missing transmission object. The primitive MASD fermion action already contains the completion-dependent left–right interaction

$A\_int = \bar{\psi}\_L\ \Gamma(X)\ \psi\_R + h.c.,$

linear in the completion field X and bilinear in the fermion fields. Consequently, at the zero-fermion background, the ordinary completion–fermion Hessian $\partial^2 A/\partial X \partial \psi$ vanishes identically. The vanishing block is therefore a differential-order consequence of the trilinear interaction and is not evidence that the completion and charged sectors are physically uncoupled. The first nonzero completion–fermion object is instead the mixed third jet

$T\_X\psi\psi = \partial^3 A\_source/\partial X\ \partial\bar{\psi}\_L\ \partial\psi\_R,$

with action on a completion tangent δX given by the vertex Γ(δX). Thus the correct transmission chain is not X → B_Xch → charged Hessian, but X → T_Xψψ → representation-resolved Yukawa response. The universal-stiffness CY3′ no-go therefore survives unchanged, but its interpretation is sharpened: the failure is not caused by absence of a completion–fermion interaction. It is caused by the inability of the old representation-blind completion law to generate the required sector-dependent magnitude and orientation structure.

> **Theorem 32 — Universal-stiffness CY3′ no-go. [machine-executed on the frozen HCMR/MHPE candidate; differential-order interpretation corrected]**
>
> The history-derived generation Laplacian is a real nondegenerate completion stiffness, but inserting it universally into the existing independent Hessian route does not close CY3′. It improves the lepton sectors while worsening the quark sectors, and the residual remains regulator-stable and nonzero. The primitive action already contains completion–fermion coupling at mixed third order, so the remaining physical repair must be representation-resolved within that same-action transmission rather than supplied by another universal completion multiplier.

Verification notes. Re-derived here: the first-cover ensemble statistics from the three pinned probabilities (sum 1; conditional 0.998816847345935; odds 844.199473258; signed conditional bias 0.997633694691869), and the three-way consistency of the orientation parameter — the fluctuation-relation slope 2α uses the same α = 0.9590011097 returned by the two-turn conditional bias tanh(2α) = 0.957752384566601 and by the independent ISG-1 one-bit condition, with per-step ratio e^{2α} = 6.8073; the

Schur-survival identity was checked exactly on random block Hessians (residual 10^{-15}); the pure-phase population orthogonality $\mathrm{Tr}(\sigma_z R(y)) = 0$ is the §46S.5 result; $A_2 \otimes A_2 = A_1$ is structural; the CY3′ ordering (lepton improvement, quark worsening, monotone level sequence, maxima 0.493033 → 0.521795) reproduces from the quoted residues. Imported at source precision: the first-passage execution itself, the HMGBC functional and ΔΩ construction, the 102-dimensional selector supports, and the CY3′ residual values; the §46W.4 direction cosines and sector multipliers are stated qualitatively here because their numerical values are recorded in the source report.

46X. Completion–CAR differential order and full mixed-tensor descent

46X.1 The second-order block vanishes while the mixed third jet is nonzero. The same-action completion-to-matter coupling is already present in the primitive fermionic term displayed in §46W.4. Since that term is trilinear in $(X, \bar{\psi}, \psi)$, its gradient and ordinary completion–fermion Hessian vanish at the total zero-fermion background, while the mixed third derivative does not. The previously sought object $B_{Xch} = \partial^2 A_{source}/\partial X \partial \psi_{ch}$ therefore has the exact grade

$B_{Xch} = 0$ at the zero-fermion vacuum — a correct differential-order zero, not a physical decoupling,

and the first nonzero completion–fermion object is the mixed third jet

$T_{X\psi\psi} = \partial^3 A_{source}/\partial X\, \partial\bar{\psi}_L\, \partial\psi_R$, acting on a completion tangent δX through the vertex $\Gamma(\delta X)$.

This retypes the direct-sum HCMR zero. The direct-sum candidate omitted transmission because it represented the completion and charged sectors as independent quadratic blocks. The primitive action itself is not independent in that stronger sense.

46X.2 History geometry enters the fermionic vertex through the completion response. For the HMGBC completion functional, the stationarity condition ties the completion field to the scalar background, so the scalar dependence of the stationary completion response carries the amendment ΔΩ directly into the trilinear vertex: differentiating the action with respect to the scalar/Yukawa background produces, through the chain rule on the completion response, a completion-stretch contribution mediated by Γ. History-derived geometry therefore enters the fermionic vertex through the actual scalar dependence of the completion field rather than through an independently inserted charged Hessian amendment.

46X.3 Full archived CAR/Fock tensor test. The previously open full mixed-tensor certificate projects only the primitive completion leg through the complete physical source projector while retaining the external left/right CAR/Fock legs. For the archived charged tensors at levels three and four and neutral tensors at levels three through six, direct reconstruction gives residuals at machine level, with the maximum below approximately

1.15×10^{-15}. The independently realified charged CAR vertices agree with the stored complex external tensors at machine-level relative residuals, so the full-tensor pass is not a normalisation artefact of the external legs.

> **Theorem 33 — Completion–CAR Differential-Order and Full-Tensor Descent Theorem. [exact typing; full archived tensor execution]**
>
> The primitive MASD action contains a completion–fermion interaction linear in X and bilinear in the left/right fermionic fields. At the zero-fermion vacuum the ordinary completion–fermion Hessian vanishes identically, while the first nonzero coupling is the mixed third derivative $T_{X\psi\psi}$. For the archived charged and neutral completion tensors, the full mixed-third-order tensor passes projection through the complete declared source stack at residual no larger than approximately 1.15×10^{-15}. Completion-to-fermion transmission therefore exists at its correctly typed differential order. Primitive uniqueness and the final physical source metric remain open.

The earlier D-HM29 full-tensor obligation is therefore closed in the declared execution chart. It is not promoted to primitive physical admission because the microscopic uniqueness of the representation-resolved return remains unresolved.

46Y. Representation-resolved CY3′ attribution and conditional action-level closure

46Y.1 The old mismatch is predominantly spectral rather than a frame error. The old universal completion law produces the wrong singular-value architecture: in the charged-target audit the basis-independent singular-value residual already accounts for the dominant share of the full tensor residual, so most of the squared discrepancy survives every possible unitary frame reorientation. The conclusion is structural. More generally, allowing arbitrary scalar spectral functions of the universal completion operator does not repair the charged structure — the best such scalar spectral response still leaves a large residual. Replacing $\Delta\Omega$ by another universal function of the same operator cannot supply the missing physics.

46Y.2 Ordered representation-resolved transfer. The successful conditional RRHF construction instead uses the ordered transfer $Y = U_{role} D_{score}$. Because U_{role} is unitary, D_{score} fixes the sector-dependent singular-value hierarchy, while U_{role} fixes the relative flavour frames and phase structure. This separates two physical jobs which the old universal completion law attempted to perform with one operator. When the bosonic and CAR/Fock derivatives are independently taken from this same ordered transfer, the independent CY3′ residual becomes approximately 1.9×10^{-14} at both stored regulator levels three and four, instead of the old order-one-half discrepancy.

> **Theorem 34 — Representation-Resolved CY3′ Residue Attribution Theorem. [conditional action-level execution]**

The old MASD–HMGBC CY3′ failure cannot be repaired by a universal spectral completion response or by unitary frame rotation alone. A representation-resolved ordered transfer separates magnitude from orientation: D_score fixes sector-dependent singular values and U_role fixes relative flavour frames. When both independent CY3′ routes descend from this same ordered transfer, their discrepancy falls to approximately 1.9×10^{-14} at the two stored regulators. This is a conditional action-level closure, not yet a primitive MASD–HMGBC derivation of the representation-resolved law.

The remaining question is therefore no longer whether a consistent action-level repair exists. It does. The remaining question is whether the primitive source uniquely forces D_score and U_role.

46Z. Native-score non-identifiability and sector-resolved bath topology

46Z.1 PFDMI derives score capacity but not unique score weights. The PFDMI sequence now derives nontrivial field dependence, the representation census, the four admissible completion channels and a physical score carrier of rank 72. However, the native EX2E current instrument contains a continuous normalisation parameter η. At one value of η the physical population score vanishes, while at the declared saturated endpoint the physical score has rank 72. Expanding about the vanishing point shows that η controls physical score strength and is not a harmless Kraus normalisation. Since rank 72 is achieved at the endpoint and the score Jacobian depends continuously on η, a nontrivial interval below the endpoint must also have rank 72. Positivity, completeness and maximal rank consequently do not select the saturated endpoint. Different admissible endpoint/current frames likewise retain physical rank 72 while producing substantially different physical score Gram matrices.

Theorem 35 — Native-Score Weight Non-Identifiability Theorem. [exact structural result]

The current PFDMI source derives a complete noncentral physical score carrier of maximal rank but does not uniquely determine its numerical score law. Positivity permits a continuous η-interval, maximal rank persists on a nontrivial subset of that interval, and multiple full-rank endpoint frames produce inequivalent score metrics. Positivity, completeness, rank closure and genericity therefore do not uniquely select η_physical.

46Z.2 The four completion channels define two components. On the six matter-address slots {Q, u, d, L, e, N}, the four blind-recovered completion channels have an incidence matrix of rank 4, and its address graph has exactly two connected components: {Q, u, d} and {L, e, N}. Subsequent bath-selection results show that this disconnectedness is not a defect: quark and lepton addresses are physically distinguishable sectors, so no theorem requires them to be combined into one universal relaxation bath. The correctly typed reduced response is therefore of sector-resolved form — separate quark and lepton relaxation blocks — unless the source independently returns an inter-sector coupling.

> **Theorem 36 — Completion-Transfer Two-Component Theorem. [exact on the recovered completion graph]**
>
> The four source-recovered completion channels span a four-dimensional transfer space whose address graph has exactly two connected components, quark and lepton. The completion topology therefore supports separate sector-resolved relaxation blocks. A universal quark–lepton bath is neither required by the graph nor to be inserted by convention.

The numerical same-action blocks remain open.

46AA. Charged-lepton maintenance, Schur response and persistence-demand ordering

46AA.1 Maintenance demand is exactly a Schur-softening form. The charged-lepton maintenance architecture defines the positive maintenance demand $D_M = L_M^\dagger G_M L_M$. Introduce an auxiliary maintenance variable m and the quadratic parent $E(x, m) = \frac{1}{2}x^\dagger(K + L_M^\dagger G_M L_M)x - x^\dagger L_M^\dagger G_M m + \frac{1}{2}m^\dagger G_M m$. Eliminating m at its optimum $m = L_M x$ gives $\frac{1}{2}x^\dagger Kx$: the demand D_M is exactly the auxiliary Schur softening of the parent. This also supplies the future same-action falsifier: if the maintenance system is to be identified with the auxiliary relaxation behind the physically projected charged-lepton block, the same L_M and G_M must be returned by that relaxation.

46AA.2 Maintenance magnitudes do not generate flavour orientation under branch covariance. If D_M commutes with the branch projectors — $D_M = \Sigma_b d_b P_b$ — then every hard or soft spectral maintenance response preserves the same branch projectors. Hence a branch-covariant maintenance law may alter branch magnitudes and participation but cannot generate a new charged-lepton flavour frame.

46AA.3 Persistent-distinguishability fixes the tau-minus-muon scalar increment. The charged-lepton persistence count gives, relative to the electron, $\sigma_e = 0$, $\sigma_\mu = 1 + \xi_\varphi + 2\eta_{inf}$, $\sigma_\tau = 2 + \xi_\varphi + 2\eta_{inf}$, where ξ_φ is shared phase infrastructure and η_{inf} the refinement-identity and admissible-transport infrastructure. Therefore

$\sigma_\tau - \sigma_\mu = 1$ exactly,

independently of the uncertain phase- and refinement-infrastructure costs. Any strictly increasing branch-preserving map from persistence demand to maintenance cost then gives $D_\tau > D_\mu > D_e$ without using the observed lepton masses. However, the scalar loads do not determine the full Gram operator: a literal shared-infrastructure embedding produces a nonzero cross term, whereas a branch-superselected embedding produces a diagonal G_M. Both reproduce the same scalar counts.

> **Theorem 37 — Maintenance–Schur Equivalence and Persistence-Demand Ordering Theorem. [exact algebraic structure; conditional physical bridge]**

The positive charged-lepton maintenance demand is exactly representable as an auxiliary Schur softening, while the source-native persistence count fixes the sign of the charged-lepton demand ordering and the tau-minus-muon increment without mass input. The scalar persistence law does not, however, uniquely determine the physical demand Gram matrix or prove branch covariance. Magnitude ordering is substantially supported; physical orientation and the exact G_M remain separate source returns.

46AB. Genuine K7 Gram geometry and the direct generation-assignment no-go

The actual projected K7 carrier has a genuine overlap matrix G and stiffness S. On the six-dimensional nonuniform carrier Q_6 the whitened generalised operator decomposes into the three real Fourier planes. At the representative width $\sigma/d = 0.8$, the overlap-corrected trace is 31.771654, and across the declared width scan the trace remains a stable common-carrier spectral invariant. It is not, however, the charged-lepton persistence count: the tempting assignment of the three ordered K7 Fourier planes directly to the three generations gives a successive spectral-gap ratio irreconcilable with the independently derived persistence-count law, and no common additive or multiplicative normalisation changes either ratio.

Theorem 38 — Common K7 Gram–Stiffness and Direct Fourier-Generation No-Go. [executed]

The physical K7 overlap geometry possesses a well-defined six-dimensional generalised Gram–stiffness spectrum and a stable overlap-corrected trace. However, direct identification of the three ordered K7 Fourier planes with the three charged-lepton generations cannot reproduce the independent persistence-count hierarchy under any common affine normalisation. The common K7 stiffness is therefore not itself the charged-lepton persistence operator; a G_M-dependent persistence construction or nontrivial attaching map is required.

46AC. Persistence-class operators and the attaching-map obstruction

The source persistence rules admit a minimal class-space operator family, built from the additional persistent-cycle commitments together with shared phase infrastructure and refinement-identity/admissible-transport infrastructure. In the minimal class-space realisation the demand difference operator is rank one. Let V be the physical attaching map from persistence commitment classes into the projected K7 carrier. Exact reproduction of the scalar counts fixes only selected diagonal dual-Gram norms; it does not determine the relative geometry of the commitment directions — any G-orthonormal five-frame reproduces the scalar law exactly, leaving a continuous family of compatible embeddings. Therefore agreement of one scalar trace with the persistence count is an existence check rather than a provenance certificate (F60). A further canonical-wheel calculation constructs an exact cyclic lift from the six triangle-cycle coefficients into the six-dimensional wheel-refinement space. However, that wheel carrier transforms under the sixfold rotation with characteristic polynomial $t^6 - 1$, while the physical projected Gram complement transforms under the sevenfold generator with characteristic polynomial $t^6 + t^5 + t^4 + t^3 + t^2 + t + 1$; the two polynomials share no root, so there is no invertible cyclic-equivariant identification between the two carriers.

> **Theorem 39 — Persistence Embedding and Cross-Carrier No-Go. [exact construction plus exact representation obstruction]**
>
> The persistence-count rules determine a nested positive class-space operator family and admit physical embeddings reproducing the scalar hierarchy exactly, but they do not determine the physical attaching map. An exact cycle-to-refinement lift exists on the canonical six-rim wheel, while direct identification of that refinement carrier with the projected Gram carrier is impossible by representation type. A further symmetry-changing physical bridge is required.

46AD. Conditional holonomy–character bridge

46AD.1 The representation type now matches. The strong transport construction supplies an orientation-blind algebraic Z_7 kernel. Once a nontrivial observable holonomy channel survives, the real carrier decomposes into the three two-dimensional real character planes pairing the conjugate characters {1, 6}, {2, 5} and {3, 4}. This is precisely the representation type of the physical Gram complement Q_6. Thus the representation mismatch of §46AC disappears if the physical bridge passes through the actual transport/holonomy representation rather than through a direct identification.

46AD.2 Minimal positive holonomy-response construction. Conditionally take a surviving holonomy of class $k \in Z_7$, acting on plane m through the character e^{2πikm/7}. The minimal coefficient-free positive response which vanishes for trivial holonomy assigns to plane m the weight $2 - 2\cos(2\pi km/7)$. For any nonzero k, the unordered three-plane spectrum is

$\{2 - 2\cos(2\pi/7), 2 - 2\cos(4\pi/7), 2 - 2\cos(6\pi/7)\} = \{0.753020396283, 2.445041867913, 3.801937735805\}$,

whose three values sum to exactly 7 and are the roots of $\lambda^3 - 7\lambda^2 + 14\lambda - 7$. Every nonzero holonomy therefore gives a rank-six positive response; modulo inversion, the three nontrivial holonomy classes merely permute the three plane weights. The positive response is insensitive to orientation — k and −k give the same spectrum — so it cannot by itself supply a CP or chirality sign. That information remains in the unsquared unitary holonomy.

46AD.3 The physical occupancy gate is still open. The existence of the algebraic kernel does not prove that a nontrivial observable class is physically populated. For the actual vacuum complex, a nontrivial class exists if and only if $H^2(K\_vac; Z_7) \neq 0$. The actual VERSF vacuum cell complex and its plaquette boundary operator have not yet been executed, nor has the stronger integral Smith-normal-form test established whether the sevenfold sector is intrinsic through order-seven torsion or merely appears because Z_7 was selected as the coefficient group. Finally, the refinement-persistent charged-lepton loops used in the classification have not yet been identified with the vacuum holonomy loops.

Theorem 40 — Conditional Holonomy–Character Response Theorem. [exact conditional representation calculation]

If a nontrivial observable holonomy survives on the physical vacuum transport complex, its standard real character representation acts on exactly the same three two-dimensional irreducible sectors as the nonuniform projected K7 Gram carrier. The minimal positive obstruction response has rank six for every nonzero class and fixes the three plane weights {0.753020396283, 2.445041867913, 3.801937735805} up to permutation. This supplies a correctly typed candidate representation bridge into G_M, but physical topological availability, occupancy, intrinsic sevenfoldness and identification with the charged-lepton persistence loops remain open.

Verification notes. Re-derived here: the holonomy response spectrum equals $\{2 - 2\cos(2\pi m/7)\}$ exactly, matching all twelve quoted digits, with sum exactly 7 and minimal cubic $\lambda^3 - 7\lambda^2 + 14\lambda - 7$ (elementary symmetric functions 7, 14, 7); the C_6/Z_7 obstruction — $\gcd(t^6 - 1, t^6 + \cdots + 1) = 1$, no shared eigenvalue, hence no equivariant identification; the Schur representation of the maintenance demand (auxiliary elimination returns exactly K, so D_M = L_M†G_M L_M is the eliminated softening); the persistence increment σ_τ − σ_μ = 1 independent of ξ_φ and η_inf; and the two-component reading of the completion graph given the stated channel supports. Imported at source precision: the archived tensor residual bound 1.15×10^{-15}, the RRHF residuals 1.9×10^{-14}, the rank-72 score carrier and η-interval structure, the trace 31.771654 at σ/d = 0.8, and the spectral-vs-frame attribution shares; the §46Y.1 percentage split and §46AB gap ratios are stated qualitatively because their numerical values were not carried by this instruction set.

46AE. Pre-Fact Indifference and the foundational origin of the 1/128 closure weight

The preceding pre-readout audits were useful because they separated several statements that had previously been conflated. In particular, zero entropy by itself does not imply an equiprobable distribution of later measurement outcomes: a pure state can produce a non-uniform outcome law. Nor does the existence of $2^7 = 128$ mathematically possible closure words by itself assign probability 1/128 to each word. The missing statement is more primitive and is now made explicit as Premise P14: at the void-facing first-differentiation stage, before any closure word is realised, the pre-fact state contains no physical distinction capable of assigning different prior weights to the unresolved alternatives.

This premise is part of the foundational definition of the VERSF void interface rather than a dynamical theorem to be reconstructed from later Hamming mechanics. Let $\Omega_7 = \mathbb{F}_2^7$ be the unresolved configuration set of the minimal K = 7 closure carrier; the K7 derivation fixes $|\Omega_7| = 2^7 = 128$. Premise P14 states that for any $w, w' \in \Omega_7$,

$p_0(w) = p_0(w')$,

because a pre-existing difference between those weights would itself encode information distinguishing w from w′ before either had become a fact. Normalisation therefore gives $1 = \Sigma_{w \in \Omega_7} p_0(w) = 128\, p_0(w)$, and hence

$p_0(w) = 1/128$

for every unresolved raw closure configuration.

> **Theorem 40A — Pre-Fact Uniformity Theorem. [exact under P14]**
>
> If the minimal pre-fact closure carrier has K binary coordinates and the void-facing preparation obeys Pre-Fact Indifference — no primitive datum exists at that stage which distinguishes one unresolved configuration by prior weight from another — then the unique pre-fact law is uniform on $\mathbb{F}_2^K$: $p_0(w) = 2^{-K}$. For $K = 7$, $p_0(w) = 1/128$.

The theorem should not be described as a consequence of "zero entropy implies maximum entropy". Those are different quantities. The void may be a zero-entropy, zero-distinguishability pre-fact state while the unresolved set of possible first outcomes has Shannon entropy $H(W) = \log_2 128 = 7$ bits under the uniform law. What is excluded by P14 is not entropy itself but predictive distinguishability before the fact: a non-uniform law would carry positive prior information about which unresolved configuration is favoured, contrary to the premise defining the undifferentiated interface.

Birth precedes Hamming classification. The Hamming structure remains essential, but its role must be correctly ordered. Once a raw word $W \in \mathbb{F}_2^7$ has been realised, one may calculate its syndrome, logical basin and closure status: $S = s(W)$, $C = 1_{\{s(W) = 0\}}$, $F = 1_{\{W = 1111111\}}$. Likewise the perfect-code identity $W = c(M) \oplus e_S$ gives an exact retrospective factorisation of every realised seven-bit word into a logical codeword and a syndrome/error label. It does not imply that Nature first chooses a logical message with some probability, then independently chooses a syndrome, and thereby generates the raw word. Consequently the equality $1/128 = (1/16)(1/8)$ is a valid mathematical factorisation of the uniform raw measure but is not the physical derivation of that measure: no separate 1/16 logical prior or 1/8 syndrome prior has to be derived in order to establish the pre-fact 1/128.

This also resolves the stage-order issue. Hamming recovery is a maintenance operation applied after commitment and cannot feed backwards into the pre-fact law. Code membership, syndrome and exact full closure are predicates subsequently evaluated on the realised word; they do not provide a prior weighting mechanism unless additional pre-fact structure is explicitly introduced, and P14 excludes precisely such an additional weighting structure.

Selector–preparation separation. The full-closure selector $P_{full} = |1111111\rangle\langle 1111111|$ is nevertheless a legitimate structural effect. Its existence before a particular outcome is realised does not imply that it biases the preparation: a measurement architecture may possess a well-defined selector without the selector feeding back into the source ensemble. Under P14 the pre-fact word probabilities satisfy

$\langle w| \rho\_pre |w\rangle = 1/128$

for every raw closure word w. No claim that ρ_pre is fully maximally mixed is required: a state may in principle carry equal diagonal weights together with nonzero off-diagonal coherence, and nothing in the argument excludes or needs to exclude that. Since P_full is the rank-one word projector for 1111111, its expectation depends only on the corresponding diagonal element, and therefore

$p\_closure = Tr(\rho\_pre\ P\_full) = \langle 1111111| \rho\_pre |1111111\rangle = 1/128.$

Thus the trace expression is the operator representation of the foundational pre-fact indifference law, obtained under the weaker diagonal statement alone. It is not an additional equiprobability postulate and does not require seven independent fair success/failure coins.

Retyping the 350-dimensional projective obstruction. The earlier 350D projective calculation remains exact but its scientific role changes. If the full 350-dimensional microscopic carrier were itself required to decompose into 128 mutually orthogonal, equal-probability sharp sectors under the isotropic density $I_{350}/350$, each sector would require rank 350/128 = 175/64, which is impossible; therefore that particular equal-rank projective realisation is excluded. This is a representation-level result. It does not determine the foundational pre-fact measure.

Similarly, a CPTP map $\Phi\_cl : B(\mathbb{C}^{350}) \to B(\mathbb{C}^{128})$ satisfying $\Phi\_cl(I_{350}/350) = I_{128}/128$ remains a valuable microscopic realisation and consistency certificate. Scaled unitality, $\Phi\_cl(I_{350}) = (175/64)\ I_{128}$, or source-derived irreducible covariance under an output action with scalar commutant, remains sufficient to establish that a proposed 350D implementation faithfully realises the foundational closure measure. It is no longer the derivation of that measure.

Accordingly, failure of a proposed microscopic descent to reproduce the foundational pre-fact word weights is not permission to replace the foundational prior with whatever non-uniform pushforward that particular candidate channel happens to generate. It is a falsifier of that candidate as the correct microscopic implementation of the P14 closure interface, or else a signal that the foundational premise itself must be reconsidered. No twirl, fitted reweighting or retrospective channel selection may be used to repair such a failure.

Electromagnetic consequence. The electromagnetic chain is therefore now cleanly separated into foundational, structural and physical-interface stages: Pre-Fact Indifference → $K = 7 \to |\Omega_7| = 128 \to p\_closure = 1/128$, followed independently by the interface support result $\eta\_gate = 14/15$. Hence

$p\_EM = (1/128)(14/15) = 7/960,\ p\_EM^{-1} = 960/7 = 137.142857142857\ldots$

as the strict structural candidate. The 1/128 factor is now closed at the foundational VERSF level under P14. It is not derived from Hamming error rates, seven fair success/failure bits, the Fold orientation doublet, a 350D equal-rank PVM, or a subsequently chosen CPTP twirl. The remaining electromagnetic physical obligations are different: the TPB layer-change must be shown to saturate the canonical thirteen-dimensional EX2G transport support plus the sharp committed-record direction while annihilating the global mode; the microscopic carrier must admit a source-compatible implementation of the foundational closure interface; and the resulting structural coupling must be matched to continuum QED at a declared scale and run to the measured low-energy value.

The Fourier identity $P_{c^*} = (1/128)\ \Sigma_a\ (-1)^{(a\cdot c^*)}\ Z(a)$ remains separately typed. Its coefficient 1/128 is character normalisation and is not being used to derive the probability; the probability has already been fixed by P14 and the K = 7 cardinality before that operator expansion is invoked.

Updated grade. PRE-FACT 1/128: EXACT FOUNDATIONAL CONSEQUENCE OF P14 + K = 7. Microscopic 350D → 128D descent: OPEN AS A REALISATION/CONSISTENCY BRIDGE, NOT AS THE ORIGIN OF THE PRIOR. Electromagnetic 14/15: EXACT SUPPORT-RIGIDITY THEOREM CONDITIONAL ON PHYSICAL TPB SATURATION. Complete low-energy α: NOT YET ADMITTED PENDING TPB PHYSICAL SATURATION AND CONTINUUM/QED MATCHING AND RUNNING.

Verification notes. Re-derived here: under P14 the normalisation $128\ p_0 = 1$ forces $p_0 = 1/128$ exactly, and for a rank-one word projector P_full the trace depends only on the corresponding diagonal element, $\mathrm{Tr}(\rho_{pre}\ P_{full}) = \langle 1111111|\ \rho_{pre}\ |1111111\rangle = 1/128$, so the diagonal statement suffices and no maximally mixed pre-fact state need be assumed; the entropy distinction is exact, since a pure pre-fact state carries zero von Neumann entropy while the uniform law on $\mathbb{F}_2^7$ carries exactly 7 bits of Shannon entropy, so purity alone cannot supply the uniformity (F67); the Hamming factorisation 128 = 16 × 8 is arithmetically exact but generatively inert without a stage-ordering theorem (F69); and the earlier obstruction $350/128 = 175/64 \notin \mathbb{Z}$ and the scaled-unital identity $\Phi(I_D) = (D/d)I_d \Rightarrow \Phi(I_D/D) = I_d/d$ both remain exactly as previously verified, now carrying implementation-certificate rather than derivational status. Retained from the earlier audit: the fair Fold doublet result $P(\Pi\pm) = 1/2$ under Fubini–Study preparation, and the typed failure of complement symmetry for h_Δ — neither of which is load-bearing for 1/128 under P14.

46AF. Irreversible selection, current-channel reversibility and the η no-go

The preceding readout calculations suggest a more general separation between reversible response and irreversible selection. The source-derived D36 history law contains an orientation-odd current and a nonzero forward/reverse affinity, whereas the EX2E/PFDMI internal-current instrument contains an independent event-strength parameter η. A direct audit tests whether the one-Bit irreversible normalisation which fixes the D36 affinity can also determine η.

For one edge, the PFDMI current Kraus family is $C_0(\eta) = \sqrt{(I - \eta S)}$ and $C\_a(\eta) = \sqrt{\eta} \cdot K\_a$, with $K\_a = i[T\_a, \rho\_J]$. Since the faithful generators and ρ_J are Hermitian, $K\_a† = K\_a$, and consequently every current Kraus operator is Hermitian. Completeness therefore implies both $\Sigma\_\alpha\ C\_\alpha†C\_\alpha = I$ and $\Sigma\_\alpha\ C\_\alpha C\_\alpha† = I$: the nonselective current channel is unital for every admissible η. The same remains true after the terminal projective readout, because the terminal projectors form an orthogonal resolution of the identity. Hence the complete pre-ledger internal map preserves the maximally mixed state independently of η.

For the canonical adjoint/Petz reverse based on that maximally mixed stationary state, let an ordered marked trajectory have operator $A = L\_N \cdots L\_1$. Then $p\_F = \mathrm{Tr}(AA†)/d$ and $p\_R = \mathrm{Tr}(A†A)/d$, and cyclicity of trace gives $p\_F = p\_R$ pathwise. Therefore the canonical stochastic entropy production of the internal current/readout channel is

$\Sigma\_\mathrm{current}(\eta) = 0$

for every admissible η. This is a mathematical reverse, not yet the uniquely derived physical thermodynamic reverse process — the latter remains an explicit source debt. Nevertheless it establishes a decisive no-selection result: the existing PFDMI current channel does not contain an irreversible η-dependent affinity from which $\dot{\Sigma}(\eta) = \ln 2$ could select one physical endpoint. Under the natural product construction with the already-derived D36 history reverse, the internal contribution cancels and the total path affinity reduces to the D36 history affinity. At the one-Bit value $\alpha\star$, the total entropy increment is therefore ln 2 independently of η.

> **Theorem 41 — Internal-current entropy-selection no-go. [exact for the canonical reverse; physical reverse still open]**
>
> The PFDMI current and terminal-readout channel is unital for every admissible η. Relative to its canonical maximally mixed adjoint/Petz reverse, forward and reversed marked trajectories have identical probabilities and the internal stochastic entropy production is zero pathwise. Consequently the one-Bit commitment condition cannot select η_physical within the currently executed PFDMI current channel. The irreversible one-Bit normalisation acts on the D36 history affinity α, not on the reversible current-channel strength η.

This sharpens the programme architecture. The scalar entropy-production rate is reversal-even and can normalise the magnitude of an irreversible process. The oriented history current carries the sign. A reversible susceptibility can respond to such a source, but it cannot manufacture the source itself.

46AG. Complete classification of the ordered-history to R4 readout

The ordered-history chirality and the R4 population difference are both one-dimensional A_2 pseudoscalars. Let $q\pm = \mathrm{Tr}(Q\pm\rho)$ be the probabilities of the two ordered-history classes. Record locality requires any layer-changing measure-and-prepare readout to have the form $\Phi(\rho) = q_+\sigma_+ + q_-\sigma_-$. Rotation covariance forces $\sigma\pm$ to be diagonal in the $P\pm$ basis, and reflection covariance exchanges the two output states. Therefore every record-local D_6-covariant readout in the binary R4 class is exactly

$$\Phi\_a(\rho) = [aq_+ + (1 - a)q_-]\, P_+ + [(1 - a)q_+ + aq_-]\, P_-$$

for one parameter $0 \le a \le 1$. Equivalently, $\Phi\_a^*(\Delta P) = (2a - 1)(Q_+ - Q_-)$. Define g_read = 2a − 1. Then g_read = 0 is complete orientation erasure, 0 < |g_read| < 1 is partial readout, and |g_read| = 1 is exact readout up to interchange of the two branch names. If the readout is required to preserve the established correspondence $Q_+ \mapsto P_+$, $Q_- \mapsto P_-$, exact readout gives uniquely a = 1.

However neither append-only retention nor Bit Conservation and Balance forces this result. A ledger may retain the orientation mark perfectly while the R4 channel carries an arbitrary noisy fraction of it. Indeed, with an exact ledger variable L = σ, I(σ : L, Y) = ln 2 for every a, while I(σ : Y) = ln 2 − h(a). Thus global retention of one full Bit does not imply one full Bit of information in this particular readout.

Theorem 42 — Covariant binary-readout classification. [exact]

Record locality and D_6 covariance reduce every ordered-history to R4 binary readout to one real parameter a. Exact physical branch readout together with the fixed history/R4 label correspondence forces a = 1, but global Bit conservation, append-only retention and the one-Bit entropy-production law do not. The physical readout gain remains a separate source return.

This also retypes the earlier action coefficient. The microscopic coefficient g_χP in a possible interaction −g_χP·χ·ΔP and the operational gain g_read = 2a − 1 are not the same object: the former belongs to the source action; the latter describes the realised readout channel after all dynamics and coarse-graining.

The attempted electromagnetic route does not supply the missing bridge. The existing continuum interaction −J^μA_μ couples a spacetime record current to a U(1) connection, not the internal R4 population coordinate. A local linear map A_μ → ΔP is not gauge invariant without additional physical structure, and the naive insertion J^μA_μΔP acquires a gauge variation proportional to J^μ∂_μΔP. No source law forcing this term to vanish has been returned. The existing Maxwell coupling therefore does not generate g_χP.

46AH. Differential-order selection rule and the true master-action attachment of the irreversible score

A vanishing mixed Hessian can sometimes hide a nonzero higher-order interaction, as occurs in the completion–fermion sector. The history/R4 problem has a different symmetry. Under reflection, χ ↦ −χ and ΔP ↦ −ΔP, so reflection invariance gives A(χ, ΔP) = A(−χ, −ΔP). Hence an expansion A = Σ_{m,n} c_mn χ^m (ΔP)^n obeys c_mn = 0 for odd m + n. The direct cubic candidates $\chi^2\Delta P$ and $\chi(\Delta P)^2$ are therefore forbidden. If the bilinear χΔP is absent, the next direct sign-transmitting terms occur at fourth order, such as $\chi^3\Delta P$ and

$\chi(\Delta P)^3$. Thus the completion–fermion "hidden third jet" mechanism does not transfer to this problem.

There is a deeper carrier issue. The independent MASD variables are $(\rho, U, J, \Phi; \Psi, \bar{\Psi})$. Neither the ordered-history coordinate χ nor the R4 population coordinate ΔP is a primitive differentiable MASD field. Higher derivatives with respect to those quantities cannot be generated merely by differentiating the same action to higher order; source-native attachment maps into and out of the primitive tangent carrier are required first.

A direct audit of the proposed history-current attachment also changes its typing. IORC's stationary probability current $j\_prep(x, y) = \pi(x)K(y|x) - \pi(y)K(x|y)$ is not MASD's independent current field J: the wheel representative of the MASD J-defect is a symmetric radial conductance direction and is detailed-balance preserving to first order. The exact match occurs instead in the closure defect. IORC defines the orientation score $\omega\_C(b\_i, b\_\{i+1\}) = +1$, $\omega\_C(b\_i, b\_\{i-1\}) = -1$, while HMGBC defines the closure score F_C by the identical rule. Therefore, on the canonical wheel,

$F\_C = \omega\_C$.

The corresponding finite exponential families also coincide. HMGBC's general defect deformation is $T\_\varepsilon(x, y) \propto T_0(x, y) \exp(\Sigma\_A\ \varepsilon\_A\ F\_A(x, y))$; setting only the closure coordinate nonzero and identifying $\varepsilon\_C = \sigma\alpha$ gives exactly $T\_\{\varepsilon\_C = \sigma\alpha\} = K\_\{\sigma,\alpha\}$. Thus the IORC irreversible current is the stationary flux generated by a finite displacement along the HMGBC closure-score direction, not by the MASD current field.

> **Theorem 43 — IORC/HMGBC closure-score identity. [exact on the canonical wheel]**
>
> The IORC orientation score and the HMGBC closure-defect score are the same wheel function, and their complete row-normalised finite exponential families coincide under $\varepsilon\_C = \sigma\alpha$. The one-Bit value $\alpha\star$ therefore fixes the magnitude of a finite oriented closure-score deformation on the executed wheel. This is a score/history identity; promotion to the full physical Gate-3/MASD closure carrier still requires the physical defect lift.

The closure score has also survived a nontrivial two-cell history lift with its orientation and positive Fisher weight intact, but that execution remains explicitly a wheel-score lift rather than the full physical Z_7 inter-hub closure connection.

46AI. Gate-3 flat-holonomy no-go and curvature retyping

The physical Gate-3 object and the IORC/HMGBC score are not identical. Gate 3 returns a loop-supported flat connection $\rho \in C^1(\Gamma\_vac; Z_7)$ whose physical information is carried by its cohomology class after local frame offsets are quotiented. The coefficient group is discrete, and $\mathrm{Hom}(Z_7, \mathbb{R}) = 0$: there is no nonzero additive real infinitesimal tangent obtained directly from the Z_7 charge. A phase embedding into U(1) is possible under the declared phase-substrate premise, but this does not by itself produce the real D36 affinity α.

Nor does “primitive”, “nonzero generator” or “one Bit” force a unit Z_7 charge. Since 7 is prime, every nonzero element is a generator, and each binary alphabet {±1}, {±2}, {±3} carries the same one-Bit entropy when unbiased. The physical cyclic-successor structure does single out ±1 as the elementary adjacent successor moves, but the source has not proved that one primitive commitment executes precisely one such successor move.

The local hub-completion rule does not repair the problem. The current completion object $H : F \to \{0, 1\}$ is a Boolean admission predicate: it says whether a candidate hub is complete, not which s^k state-update operation completed it. Furthermore a single inter-hub k is gauge dependent; the physical Gate-3 datum is a loop composite, not one edge offset.

A cycle-level audit gives a stronger result. On the canonical wheel the uniform oriented closure cochain is $\rho_{rim} = (0, \ldots, 0, 1, 1, 1, 1, 1, 1)$, zero on the six spokes and +1 on the preferred six rim edges. Its pairing with a simple wheel cycle containing a rim arc of length m is $\langle \rho_{rim}, z_m \rangle = \pm m \pmod 7$, $m = 1, \ldots, 6$. Every value is nonzero. Therefore $d\rho_{rim} \neq 0$ on every possible simple-cycle 2-cell of the canonical wheel, and the exhaustive D_6-symmetric completion audit returns no nonempty simple-cycle completion for which this uniform rim score is a flat Z_7 closure connection. In particular, around the complete preferred rim, $\oint F_C = 6 \equiv -1 \pmod 7$, with the opposite traversal giving +1. If the rim is interpreted as the boundary of a physical completion cell, this is not unit flat holonomy. It is unit signed curvature.

> **Theorem 44 — Canonical-wheel flat-class obstruction. [exact on the wheel proxy]**
>
> The uniform D_6-pseudoscalar rim score has nonzero Z_7 circulation on every simple wheel cycle. Consequently it cannot be the flat Gate-3 cohomology class on any nontrivially completed canonical wheel built from simple-cycle plaquettes. If the physical completion boundary inherits this score, its natural interpretation is a signed curvature defect rather than a flat holonomy class.

This result does not determine the actual vacuum topology. The physical transport 2-complex Γ_{vac}, its boundary matrix ∂_2, the integral Smith normal form and its operational occupancy remain open. A different physical graph, a non-simple attaching map with zero net rim winding, or a different admissible cochain remain logically possible. The topology and selector roles must therefore be kept distinct: flat cohomology ≠ orientation-selecting curvature. The former may encode protected global memory. The latter is the better-typed candidate for local irreversible selection.

46AJ. MASD closure curvature, reversible stiffness and the missing odd source

The curvature reinterpretation has a direct home in the master action. For an oriented face p, $H_p[U] = \Pi_{e \in \partial p} U_e^{\sigma(p,e)}$, and MASD defines

$$D_C(p) = (-i/|p|)\, \mathrm{Log}_0(H_{p,\star}^{-1} H_p).$$

For infinitesimal connection variation this tends to the embedded continuum curvature. Thus a signed physical closure-curvature variable has the correct type to live in D_C.

The declared bosonic action, however, is reversal symmetric and quadratic in the complete defect vector: $\Gamma_{bos} = \Gamma_V + ½\langle D, W_{prim} D\rangle$. Let $c = D_C$ and let a collect every relaxable auxiliary residual. After exact Schur elimination, $\Gamma_{eff}^{(2)}(c) = ½c^\dagger K_C c$, where $K_C = W_{CC} - W_{Ca} W_{aa}^{-1} W_{aC}$. Consequently $\Gamma_{eff}(c) = \Gamma_{eff}(-c)$: a positive K_C drives the residual to $c = 0$, a physical null mode leaves $+c$ and $-c$ degenerate, and cross-defect blocks alter susceptibility and stiffness but cannot by themselves generate an orientation sign.

The same conclusion holds for the HMGBC history-derived metric. Its KL/Radon–Nikodym rate is minimised on the reference branch, so $\partial_{\varepsilon_C} I|_0 = 0$, while $W_{CC} = \partial^2_{\varepsilon_C} I|_0$ provides only positive curvature/stiffness. HMGBC separately derives an antisymmetric stationary current $j_n(x, y) = ½[m_n(x, y) - m_n(y, x)]$ which carries the history arrow and entropy production. But the universal completion Laplacian $\Delta\Omega = B_\Omega^\dagger C_\Omega B_\Omega$ is built from the symmetric conductance c_n, not the antisymmetric current j_n. Therefore the current is not currently inserted as a source for D_C or $\Delta\Omega$.

This isolates the missing structure exactly. IORC already contains an orientation-odd linear source:

$$\Gamma_x[k; \sigma, \alpha] = \Sigma_y k_y \ln(k_y / T_0(y|x)) - \sigma\alpha \Sigma_y k_y \omega_C(x, y).$$

The first term supplies the convex reversible/readiness cost; the second supplies the orientation-odd source. The one-Bit condition fixes $\alpha\star = 0.959001109719975$. If the physical HMGBC/MASD closure-score tangent s_C is shown to be the same source-native direction as ω_C, then after Schur reduction the effective physical curvature action has the form

$$\Gamma_{eff}(c \mid \sigma) = ½c^\dagger K_C c - \sigma\alpha\star\langle s_C, c\rangle,$$

and stationarity gives $c\star_\sigma = \sigma\alpha\star K_C^+ s_C$, *provided s_C lies in the supported range of K_C, with an ordinary inverse when K_C is nondegenerate. Hence* $c\star_{-\sigma} = -c\star_\sigma$.

> **Theorem 45 — Irreversible-source/reversible-curvature response theorem. [exact conditional]**
>
> A reversal-symmetric quadratic MASD/HMGBC curvature sector supplies susceptibility but cannot create or select a signed curvature. If the IORC orientation-odd closure score lifts source-natively to the physical MASD C-defect tangent and the retained commitment sign is held fixed rather than co-conjugated, then the one-Bit-fixed affinity provides the missing linear source and the physical curvature response is $c\star_\sigma = \sigma\alpha\star K_C^+ s_C$. The unresolved physical theorem is the same-history-operator identity of the IORC score and the physical C-defect score.

A separate possibility is that the absolute signed curvature resides in the frozen background holonomy $H_{p,\star}^{(\sigma)}$, with $D_C = 0$ relative to each branch. In that case the sign problem moves into physical branch selection: existing even Gaussian/holonomy sector comparisons can favour the smallest nonzero magnitude while leaving conjugate signs exactly degenerate, and an independently derived commitment orientation is still required. The selector architecture is consequently now: irreversible commitment sign → orientation-odd source → reversible curvature susceptibility → signed physical response. The irreversible sector supplies what the reversible sector cannot: the held-fixed sign reference.

Verification notes. Re-derived here: unitality of the current channel from Hermitian Kraus operators and completeness; the pathwise entropy zero from trace cyclicity, $p_F = \mathrm{Tr}(AA^\dagger)/d = \mathrm{Tr}(A^\dagger A)/d = p_R$; the readout information identity $I(\sigma : Y) = \ln 2 - h(a)$ with $I(\sigma : L, Y) = \ln 2$ for an exact ledger; the A_2 parity selection rule $c_{mn} = 0$ for odd $m + n$; and the wheel circulation audit by complete enumeration — all 31 simple cycles of the canonical wheel carry nonzero Z_7 rim circulation, with the outer rim at $6 \equiv -1 \pmod 7$ and its reverse at +1, so the flat-class obstruction holds exhaustively, not only on the fan family. The quoted $\alpha\star = 0.959001109719975$ agrees to all digits with the independently computed artanh value from the two-turn bias. Imported at source precision: the PFDMI Kraus family and generators, the IORC stationary-current construction and its Fisher-weighted two-cell lift, the HMGBC deformation family and metric derivatives, and the MASD defect definitions.

PART XI — MAIN THEOREM, DEBT LEDGER AND SCIENTIFIC VERDICT

47. Theorem HCMR-M1-R15 — Cumulative post-commitment bridge status

Given the inherited VERSF source stack:

1. Foundational retention with renewal first entry. The declared F2F/PFDMI append-only architecture has transient unresolved sector, $r(\mathcal{N}_{renew}) = 0.200305886206958$, and almost-sure renewal with stationary mean wait 1.234602249934960 opportunities. The resolved event class is the renew-only atom $\sigma = (1, 1, 0, 0)$: the committed projector is retained while the active carrier reopens, and the executed base instrument contains no terminal erasure, overwrite or foundational duplication effect (§46M).

2. Retention-law selection. The calculation proves the behaviour of that architecture; it does not prove that the primitive master action uniquely derives the append-only retention law. The unresolved bridge is primitive action → invariant foundational record + renewed active carrier: derive Φ_{renew}*(P_e) = P_e and rule out Φ*$(P_e) < P_e$ (erasure/leakage) and $\Phi^*(P_{e'}) P_e \neq 0$ (overwrite/corruption).

3. Dilation capacity. XI-4 implements an exact dilation of every completed orthogonal mark, $|\alpha\rangle \mapsto |\alpha, \alpha\rangle$, with zero isometry residual — a two-sided consistency representation of one retained fact, not a foundational operation.

4. Foundational typing of the fixed postprocessor. Because the XI-4 map is applied identically to every resolved mark, it returns no source-dependent disposition (Theorem 14); correctly typed, its rank-zero propensity is evidence that copying was never the foundational decision being made, not that the source failed to make it (§46M).

5. Larger maintenance parent. HCMR-MR1 supplies a regulator-convergent 102-dimensional candidate maintenance parent and an 87-dimensional relaxed response, but its physical certificate remains refused.

6. Recurrent pullback existence. PFHBA-7 supplies an exact recurrent Fisher pullback of that parent at all four regulators and both surviving branches, with maximum relative reconstruction residual 8.85×10^{-16}.

7. Primitive identifiability. The exact recurrent lift is highly non-unique — the minimum-null exact-lift family has real dimension 34,152 — and the source-projected marked Doob–Kraus descent remains unexecuted.

8. Record block. The positive rank-five selector Gram is a valid typed response block but is not yet the physical Γ_retention; it must be read as one block within H_CMR^(102).

9. Bath branch. Separate-ledger and shared-bath conservation lead to different post-copy physics; the source has not yet selected between them for event-record tokens.

10. Physical maintenance. Individual commitment curvature does not by itself derive inter-token agreement stiffness (Theorem 13), causal syndrome damping, basin barriers or record survival.

11. Physical readout. Terminal quotient, transport realisation, readout separation and disturbance remain unexecuted on the cumulatively derived post-copy carrier.

12. Present-interface reading (part one). Commitment and renewal are distinct transitions: commitment selects e_{n+1} and extends the ordered history, (𝓗_n, A^open, Ω(𝓗_n)) → (𝓗_{n+1}, A^closed); renewal reopens the carrier with the enlarged history retained, (𝓗_{n+1}, A^closed) → (𝓗_{n+1}, A^open, Ω(𝓗_{n+1})). The executed calculation proves the second transition: r(𝓝_renew) < 1 and the stationary mean wait 1.234602249934960 give the mean number of intrinsic opportunities required to reconstitute the open present interface after commitment. It is not yet the waiting time to the next committed fact; the entropy-biased first-entry law from Ω(𝓗_n) to e_{n+1}, the derivation of Ω(𝓗_n), and the clock bridge remain open returns (§46N).

13. Persistent-ledger backreaction boundary. The exact PFDMI renewal map preserves the completed edge/type label while reopening the full declared PFDMI working carrier. Consequently the renewal isometry itself supplies no projector loss on that carrier: V_renew†(I_L ⊗ P_work)V_renew = I_dom. This remains an exact no-backreaction theorem for persistent storage alone. It does not, however, identify the PFDMI working carrier with every downstream continuous auxiliary carrier. In particular, full PFDMI rank does not imply P_regen = I on the HX1 record-phase carrier.

14. Master-action identification of the HX1 relaxation carrier. The HX1 uniform record-phase direction is exactly the phase tangent of the common master-action record/completion morphism Φ. The master action contains both the polar bond-compatibility defect, whose linearisation is the executed GTC/HX1 bond form, and the independent record-composition defect, which gives its cycle stiffness. The corresponding record/link Hessian's isotropic finite-wheel reduction reproduces the HX1 operator exactly. On the unit diagnostic uniform mode H_qy = [[3, −1], [−1, 2]], so complete loss of the old relaxation mode returns Δk_loc = 1/2 exactly (Theorem 18, §46R). The physically normalised coefficient — $w\_B^2/(w\_B + w\_R)$ on the selected mode — remains a common-operational-metric output. The carrier-relative principal-angle obstruction of §46Q stands: principal angles {0 (×6), π/2 (×6)}, the uniform-rim phase wholly in the cycle sector, and the triangle no-go against linear incidence-to-edge reconstruction.

15. Minimal-renewal no-regeneration and remaining commitment lock. The unique minimal source-selected branch-preserving renewal has no tangent into the HX1/master-Φ phase direction. Its free phase is global/Kraus phase, with zero derivative on the renewed link ratios and on the renewed density state, while the discrete PFDMI terminal type supplies no continuous replacement. Thus s_fresh = 0 exactly. What remains open is the survival of the event-specific pre-commitment phase under the commitment constraint itself: in the unit branch, $\Delta k = (1 - s\_old^2)/2$. Therefore ordinary minimal renewal cannot soften a loss already imposed by commitment; a larger non-minimal source-derived phase channel would have to be demonstrated explicitly (D25).

16. Electromagnetic admission (consumed, foundational measure retyped). The companion K7-EA-1 line returns the structural candidate p_EM = (1/128)(14/15) = 7/960, p_EM^{-1} = 137.142857…. The 1/128 factor is now closed at the foundational VERSF level under P14: K = 7 fixes the unresolved closure alphabet $\Omega_7 = \mathbb{F}_2^7$ with 128 elements, and Pre-Fact Indifference excludes any differential prior weighting before first differentiation, so normalisation gives $p_0(w) = 1/128$ exactly (Theorem 40A, §46AE). This is not a consequence of zero entropy alone and does not require seven independent fair closure bits. Hamming code/syndrome structure and the rank-one 1111111 full-closure selector classify the realised word without feeding back into its prior. The previous 350D projective obstruction remains exact but is now representation-level only; a source-derived 350D → 128D CPTP descent remains an important microscopic realisation and consistency test, not the origin of the closure measure. The 14/15 factor remains the exact support-rigidity return conditional on physical TPB saturation of the thirteen EX2G transport directions plus the sharp record direction while annihilating the global mode. Complete physical α remains unadmitted pending that TPB saturation and continuum/QED matching and running.

17. Ordered-history chirality. One persistent F2F edge/type token is exactly reversal-even at the declared record grain: the directed-to-edge coarse-graining annihilates the twelve-dimensional reversal-odd sector. Ordered pairs of retained rim records nevertheless recover a unique A_2 chirality observable. The frozen D36 law populates it with $P_+ = 0.341539787759487$, $P_- = 0.007370309811505$, expectation 0.334169477947982, and conditioned orientation bias tanh(2α) = 0.957752384566601

(Theorems 19–20, §46S). Orientation is therefore relationally retained in record order rather than in an individual fact.

18. History/R4 readout typing. The ordered clockwise/counter-clockwise projectors Q± and the R4 P± projectors define canonically corresponding binary observable algebras, but their natural Hilbert carriers are not D_6-equivalent (Theorem 21). The history-to-R4 bridge, if activated physically, is a conditioned CP readout rather than a carrier isometry. The presently defined scalar κ/Ξ chain annihilates the ordered A_2 source (Theorem 22), while the source-driven GTC record phase survives but produces access-invisible phase coherence rather than a P± population imbalance (Theorem 23).

19. Projective-current boundary. EX2E uses the normalised current density ρ_J,e = |j_e⟩⟨j_e|/⟨j_e|j_e⟩; scalar magnitude, sign and phase are therefore exactly invisible. The action-selected spatial helix dressed by one common internal ray has zero projective branch visibility. Generic diagnostic EX2E endpoint frames can support large branch visibility, but those frames are not dynamically selected. The physical projective current orientation is therefore non-identified rather than zero.

20. Orientation-forcing boundary. The EX2E source constraint contains no explicit D36 orientation parameter, so ∂_α D_J = 0 and every on-shell orientation response obeys J_D ẋ_α = 0 (Theorem 24). Zero internal-frame motion is admissible, while nonzero motion remains possible on unresolved frame tangents. The missing dynamical object is now an orientation-to-internal-frame mixed source-action derivative, or equivalently an isolated stationary endpoint/current frame on the fully admissible quotient. PFDMI-S1 supplies the exact selection criterion but not the physical execution (D28, D30).

21. Conjugate-frame Born-readout boundary. Complete faithful conjugation of the EX2E source state, projective current, gauge generators and terminal projectors leaves every native current/terminal Born probability unchanged. The branch difference is therefore exactly zero for the present fully co-conjugated instrument, despite potentially large projective current separation (Theorem 25, §46T). The existing EX2E carrier has branch-separation capacity but no fixed antiunitary-breaking readout reference. Large projective separation alone cannot resolve D29.

22. Closed family holonomy. The frozen role-odd three-generation transport contains a gauge-invariant reduced-family comparison loop: direct transport 1 → 3 versus indirect transport 1 → 2 → 3. On the bare generator its normalised Hermitian loop product is exactly W_Δ = e^{i·5π/6}, giving 150°, with conjugate reversal 210°. The stored RRHF continuations give 176.5074504467° at level 3 and 155.8501772202° at level 4 and are attached to the bare generator by the declared continuation. This closes the existence and value of a nontrivial closed family holonomy on that carrier (Theorem 26). It does not close physical axle-loop realisability: the same-action identification L_ax = W_Δ, or an equivalent inheritance theorem for the physical axle phase, remains open (D33).

23. First-cover orientation. The retained history remains strongly oriented at the actual first complete-cover stopping event, not merely at two-turn order. With K the signed rim circulation, reflected first-cover histories obey P(K = k)/P(K = −k) = e^{2αk}. The frozen execution gives P(K > 0) = 0.996750764817216, P(K < 0) = 0.001180705267406, P(K = 0)

$= 0.002068529915369$, and $P(K > 0 \mid K \neq 0) = 0.998816847345935$ (Theorem 28, §46U). The first-cover event is reflection-even, but the complete history arriving at it carries a strongly signed source-native statistic.

24. Population-visible forcing. The history chirality and R4 population difference both transform as A_2, so their specified one-dimensional carriers admit the scalar bilinear $-g\_\chi P \cdot \chi \cdot \Delta P$. The current scalar and pure-phase routes have exact zero projection into ΔP, and the present action contains no activated physical coefficient g_χP. The general linear response is the single susceptibility χ_pop = −(D_F ΔP)·K_F⁺·B_eff (Theorem 27); physical execution remains open (D35).

25. History-derived completion Hessian. The HMGBC completion functional adds the positive operator ΔΩ to the retained completion-strain Hessian. Since Stage A freezes ΔΩ before HFB Stage B and completion strain is retained rather than auxiliary, the amendment survives ordinary Schur relaxation exactly: Schur_a(H + E_X ΔΩ E_X†) = Schur_a(H) + E_X ΔΩ E_X† (Theorems 29–30, §46V).

26. Completion–charged transmission. HCMR-MR1 already contains the history generation geometry in its completion block. Its executable parent is nevertheless block-direct-sum at the candidate level, and the exported charged embeddings have zero support on the completion block. Therefore every completion-only amendment has exactly zero direct effect on the extracted charged Yukawa matrices (Theorem 31, §46W). The direct-sum candidate therefore has zero quadratic transmission. This is not a primitive decoupling theorem: as established below, the same-action completion–fermion interaction first appears at mixed third order, T_Xψψ, and that full tensor descent is nonzero.

27. Corrected CY3′ status. Adding the strict universal generation lift to the independently typed closure-Hessian route does not close CY3′. At level six the residuals become 0.521795, 0.495390, 0.142094, 0.193624 for u, d, e, ν respectively, and the maximum residual converges to approximately 0.522. The history stiffness points in the required direction for the lepton sectors but in the opposite direction for the two quark sectors. A universal positive stiffness multiplier is therefore insufficient; sector-sensitive same-action transmission is required (Theorem 32, D37–D38).

28. Completion–fermion differential order. The ordinary completion–fermion Hessian is exactly zero at the zero-fermion vacuum because the primitive completion–fermion interaction is trilinear. The first nonzero coupling is the mixed third jet T_Xψψ = ∂^3A_source/∂X∂ψ̄_L∂ψ_R, not a second-order B_Xch (Theorem 33, §46X).

29. Full mixed-tensor descent. The archived charged and neutral completion–CAR tensors pass the complete declared source projection at residuals below approximately 1.15×10^{-15}. Completion-to-fermion transmission therefore exists at the correct differential order; primitive uniqueness and the final source metric remain open.

30. Representation-resolved CY3′ repair. The old universal completion law cannot be repaired by unitary reorientation or any scalar spectral function of the universal completion operator. The ordered representation-resolved transfer Y = U_role D_score separates hierarchy from orientation and closes the two independently differentiated CY3′ routes conditionally to approximately 1.9×10^{-14} at levels three and four (Theorem 34, §46Y).

31. Score provenance. PFDMI derives a maximal-rank physical score carrier (rank 72) but not a unique physical score law. Positivity supplies a continuous η-interval, full rank persists on a nontrivial subset, and several full-rank endpoint frames give different score metrics. Primitive η_physical remains open (Theorem 35, §46Z).

32. Sector-resolved relaxation. The four recovered completion channels produce a rank-four transfer graph with two components, {Q, u, d} and {L, e, N}. No universal quark–lepton bath is required. Numerical same-action sector blocks remain open (Theorem 36).

33. Charged-lepton maintenance provenance. The lepton maintenance demand is exactly a positive auxiliary Schur correction, D_M = L_M†G_M L_M. Persistent-distinguishability fixes σ_τ − σ_μ = 1 within its counting law and therefore supports tau-last demand ordering without mass input under a monotone branch-preserving bridge. The full physical Gram operator and branch covariance remain open (Theorem 37, §46AA).

34. K7 attaching and holonomy boundary. The genuine projected K7 Gram geometry is now identified and rules out direct identification of the three ordered Fourier planes with the three charged-lepton generations. The persistence count admits many physical embeddings, while direct carrier identification is forbidden by representation type. A surviving Z_7 holonomy would supply the correct three-plane representation and a fixed conditional response spectrum {0.753020396283, 2.445041867913, 3.801937735805}, but the actual vacuum-complex rank/SNF calculation and physical occupancy remain open (Theorems 38–40, §§46AB–46AD).

35. Internal-current entropy and η. The PFDMI current and terminal-readout channel is unital for every admissible η. Under the canonical maximally mixed adjoint/Petz reverse its internal marked path entropy production is exactly zero, so the one-Bit commitment condition does not determine η_physical. The physical microscopic reverse law remains to be derived (Theorem 41, §46AF).

36. History-to-R4 readout classification. Record locality and D_6 covariance reduce every binary ordered-history-to-R4 readout to the one-parameter channel Φ_a, with Φ_a*(ΔP) = (2a − 1)χ. Exact readout with the established label correspondence forces a = 1, but append-only retention, BCB and ΔΣ = ln 2 do not. Physical readout activation and gain remain open (Theorem 42, §46AG).

37. Irreversible closure-score identification. On the canonical wheel the IORC orientation score is exactly the HMGBC closure score, F_C = ω_C, and the complete finite deformed kernels coincide under ε_C = σα. The IORC stationary current is therefore the flux generated by an oriented finite displacement along the wheel C-defect family, not the MASD current field J (Theorem 43, §46AH).

38. Gate-3 flat-class boundary. The physical Gate-3 Z_7 closure object is loop-supported and has no nonzero additive real tangent. On the canonical wheel the uniform C-score has nonzero Z_7 circulation on every simple cycle, so it cannot be a flat physical cohomology class on any nonempty simple-cycle completion. The candidate is consequently retyped as curvature rather than flat holonomy; the actual vacuum 2-complex remains open (Theorem 44, §46AI).

39. Curvature-source boundary. MASD's D_C is the correctly typed vacuum-relative curvature defect. The reversal-symmetric quadratic MASD/HMGBC action supplies only curvature stiffness and cannot select its sign; the HMGBC KL rate likewise has zero first derivative at the reference branch. IORC independently supplies the missing orientation-odd linear score term. If its score lifts to the physical MASD C-defect tangent, the signed response is $c\star\_\sigma = \sigma\alpha\star\ K\_C^{+}\ s\_C$. The same-history-operator score identity is the next decisive obligation (Theorem 45, §46AJ, D48–D49).

Therefore:

> **R15 is a materially strengthened partial execution, obstruction audit and information-flow classification. It now establishes not only that ordered history retains orientation while the present EX2E current action fails to force its physical internal readout, but also that complete faithful conjugation cannot be distinguished by the native EX2E Born instrument, and that the frozen family transport already contains a genuine closed gauge-invariant holonomy. The phase problem has therefore narrowed from "find a source-native nontrivial phase" to "prove that the physical charged-completion comparison loop inherits the already existing closed family holonomy, and install the orientation in a fixed physical readout frame." The HX1 phase carrier has now been identified directly with the phase tangent of the master-action record/completion morphism Φ, and its lost-relaxation operator is therefore a same-action mechanical Hessian return. On the unit diagnostic uniform mode, complete removal of that old relaxation direction gives the exact Schur excess Δk_loc = 1/2. The canonical/minimal source-selected renewal does not recreate this direction: its free phase is physically vertical and the discrete PFDMI record type is not a continuous phase — the former fresh-renewal loophole is closed on the minimal branch (s_fresh = 0). The decisive remaining local question is whether commitment itself makes the old event-specific y-phase tangent unavailable: if its survival amplitude is s_old, the unit-branch excess is $(1 - s\_old^2)/2$ — s_old = 0 gives the full 1/2, s_old = 1 gives zero. The physical normalisation of that excess must still be returned by the common operational metric, and a genuinely new non-minimal phase channel remains logically possible only if generated by the primitive action. Primitive admission therefore still requires the retention-law derivation, the marked Doob–Kraus descent, the commitment-to-y-availability projector, the common metric return, replicated-wall propagation and scale/continuum bridges; the electromagnetic admission line is consumed from the companion at its stated conditional grade.**

The exact structural results of Parts II–IX — the atomic partition, the competing first-entry identity $\Sigma_\alpha F_\alpha + F_\infty = I$, the resolution criteria, one fact under sufficient provenance, the persistence criteria $\Phi^*(P_e) = P_e$ and $S_e(m) \geq (1 - \varepsilon_e)^m$, the valid-quotient theorem, the conditional fragment ceiling and the cost non-identifiability theorem — stand unchanged and are consumed by this cumulative statement at their stated grades.

48. Original contract grade, revised

Required return	Revised result
Which operation occurs first	Conditional append-only renewal executed; full same-action atomic choice open
Whether copying occurs	XI-4 construction-level no-go: CPR is a fixed all-mark postprocessor with no no-copy complement; PFHBA-7 marked descent unexecuted; source decision open
When copying occurs	No source timing returned; CPR application point remains architectural
Parent dynamics	Continuum conservative/influence architecture inherited; HCMR-MR1 102-dimensional candidate executed but refused; recurrent Fisher pullback exists (PFHBA-7); marked descent open
V_copy / V_renew	Renewal implementation and CPR copy isometry exact; renewal selection conditional and copy selection absent
Γ_retention	Rank-five positive selector Gram audited; $\varepsilon_\gamma = 0.767709415254$ and rank/provenance bridge fails; to be read as one block within $H_{CMR}^{(102)}$; physical operator open
Damping/noise	Candidate unresolved-bath mechanism inherited; carrier pullback and spectrum open
Basin/barrier	Local curvature origin supplied; global quasipotential and escape law open
Survival	Exact criteria and bounds; physical channel execution open
Topological protection	Conditional closure-side witness; refinement realisation open
Physical quotient/readout	Valid mathematical contract; effects not executed
Proliferation capacity	Conditional theorem only; budget proof open
Costs	Typing and non-identifiability theorem; path returns open
n = 3:6, k = 1,6 certificate	Record candidate converges approximately second order; complete operation certificate remains incomplete
Complete physical H_CMR	NOT ADMITTED

49. Immediate execution

The next execution does not begin with XI-4's already fixed copy map. It begins with the full candidate maintenance parent and its recurrent pullback:

$H\_CMR^{(102)}$ —(PFHBA-7)→ J_recurrent → source-projected bath → marked Doob–Kraus descent.

The execution must then:

1. Freeze one typed recurrent lift without using downstream HCMR targets to select it.
2. Execute the source-projected bath and marked Doob–Kraus descent numerically.
3. Derive terminal effects rather than appending a fixed copy flag.
4. Classify every terminal effect by the atomic signature (s, a, n, w, ℓ), representing survival, reopening, new-token count, overwrite and readable label.
5. Calculate $\mathcal{N}$, $\mathcal{D}\_\alpha$, F_α and F_∞.
6. Determine from the resulting effects the foundational disposition — whether the source retains, erases or overwrites the committed label — and, orthogonally, whether it renews the active carrier and produces additional manifestations (renew-only, manifestation production, proliferation).
7. Verify the retention invariance Φ_renew*(P_e) = P_e on the derived instrument, and compute the erasure/leakage residual and the overwrite residual* Φ(P_{e′}) P_e.
8. Decide the separate-ledger versus shared-bath branch.
9. Execute the physical quotient and obtain the actual record and syndrome carrier.
10. Pull the conservative Hessian and causal bath response onto that carrier.
11. Calculate H_code, K_cs, $\Gamma\_retention$ and $\Sigma\_ret(\omega)$.
12. Calculate leakage, barriers, survival and readout from the same source.

Only this cumulative execution can promote HCMR-M1 from a structural theorem and partial obstruction audit to the physical post-commitment measurement-maintenance law.

The carrier-relative audit adds four steps to this queue, to be executed before any promotion of the cycle lock: construct the source-derived post-renewal map from the retained class and renewed PFDMI working carrier into the continuous twelve-edge MASD/HX1 record-phase tangent space; reproduce the common-carrier principal-angle certificate {0 (×6), π/2 (×6)} and verify $d^T\varphi\_rim = 0$ with $P\_Cut\ \varphi\_rim = 0$; search specifically for a source-derived non-coboundary renewal intertwiner into Cyc, noting that retaining the discrete edge label is not sufficient; and compute the selected-mode cycle survival factor s_cyc — if s_cyc = 0, retain the full local excess Δk_loc; if 0 < s_cyc < 1, report the partial excess $(1 - s\_cyc^2)\Delta k\_loc$; if s_cyc = 1, the local commitment lock is erased by renewal. Only after this carrier decision, promote the result into the replicated-wall and regulator-convergence calculations. The master-action audit adds three further steps: identify the physical post-commitment tangent projector P_avail on the master-action y-phase carrier and calculate $s\_old = \|P\_avail\ \varphi\_old\|$; retain the exact minimal-renewal result s_fresh = 0, distinguishing any subsequently discovered non-minimal fresh phase as a new source return rather than as ordinary renewal; and evaluate the common operational metric on the selected record and bond residuals, returning w_R and w_B and therefore the physical local excess $w_B^2/(w_B + w_R)$. Only after s_{old} and the common metric are frozen may the result be propagated into the replicated-wall and commitment-front energy calculations.

The orientation/phase frontier has now changed. It is no longer necessary to search generically for a nontrivial family phase: the frozen family carrier already contains the exact closed invariant $W_\Delta = e^{i\cdot 5\pi/6}$. The next phase calculation is therefore a same-action loop-identification test. Construct, without AX1 insertion and without CKM comparison, the actual charged-completion histories γ_0 and γ_{ax} from the primitive/source-derived history stack. Verify that they have identical preparation and terminal charged record. Only if that co-terminality and admissibility pass may one calculate L_{ax}. Then determine whether the source-derived carrier/history map gives $L_{ax} = W_\Delta$, its conjugate, another value, or no realised loop at all. A positive result would close the numerical phase-carrier problem without selecting a phase from CKM. A negative result would be equally decisive: the newly identified family holonomy would remain a real invariant of the role-odd family transport but would not be the role-even axle holonomy. Updated immediate selector execution. The next calculation is no longer another attempt to infer orientation from a reversible frame, from the electromagnetic $J^\mu A_\mu$ interaction, from Bit Conservation, from a higher mixed jet, or from a local Gate-3 edge offset — each of those routes has now been either classified or eliminated. The decisive calculation is the common-history score identity:

$$S_C(x, y) = \partial/\partial\varepsilon_C \log K_n^\varepsilon(y|x) \big|_{\varepsilon_C = 0} \overset{?}{=} \omega_C(x, y).$$

This must be executed on the physically typed HMGBC/MASD history carrier, not merely on the canonical-wheel proxy. A positive result would make the one-Bit-fixed IORC source and the MASD curvature susceptibility two derivatives of the same microscopic object; the ensuing physical calculation would be $c\star_\sigma = \sigma\alpha\star K_C^+ s_C$, followed by the already isolated history-to-readout question (D47). A negative result would cleanly retire the proposed same-source irreversible-curvature selector and leave the wheel equality as a finite proxy coincidence.

Updated electromagnetic pre-readout execution. No further execution should attempt to derive the equality of the 128 pre-fact closure alternatives from post-birth Hamming dynamics, bit-flip rates, code/syndrome frequencies or a specially chosen microscopic descent. That equality is now explicit foundational input P14: once the K = 7 architecture fixes the unresolved alphabet $\mathbb{F}_2^7$, absence of pre-fact distinguishing structure forces the prior $p_0(w) = 1/128$. The immediate microscopic task is therefore a consistency and realisation audit, not a probability-selection calculation. Construct the physical 350D → 128D operational descent from the actual 319-mark source and test whether it faithfully realises the already fixed pre-fact law while preserving closure/code/syndrome semantics and admission-before-maintenance ordering; scaled unitality or irreducible covariance remains a clean sufficient certificate. Failure is a falsifier of that candidate descent, or ultimately of the compatibility of the microscopic construction with P14; it is not permission to replace the foundational prior by a fitted non-uniform distribution. In parallel, execute the genuinely load-bearing electromagnetic calculations: prove physical

TPB saturation of the canonical fourteen transmitting directions, then identify the structural coupling at a declared continuum scale and perform the QED matching and running. The 1/128 search itself is closed at foundational level.

50. Debt ledger

Debt and falsifier labels below are local to HCMR-M1-R15. This edition rebuilds its ledgers from a fresh count; the labels do not coincide with the HCMR-P1 ledgers or with any earlier HCMR-M1 numbering.

Debt	Required return	Status
D1	Derive the action/influence-to-instrument map	Partly executed: XI-4 source instrument exists; recurrent Fisher pullback of the HCMR-MR1 parent exists (PFHBA-7); terminal disposition map absent
D2	Complete the carrier bridge and regulator intertwiners	Open
D3	Execute the quotient–readout fixed point with a valid null object	Open
D4	Classify marks by exclusive atomic signatures	Conditional renewal classification executed; full atomic classification open
D5	Return $\mathcal{N}$, $\mathcal{D}$_α, F_α, F_∞ and waiting laws	Renewal $\mathcal{N}$ and $\mathcal{D}$ returned conditionally; copy/no-copy maps absent
D6	Derive the physical code/syndrome carrier and metric	Rank mismatch identified: selector rank 5 versus binary syndrome rank 2
D7	Return H_code, K_cs and Γ_retention	Candidate selector spectrum audited; H_CMR^(102) block reduction unexecuted; physical Γ_retention open
D8	Return causal syndrome response, noise and bath spectrum	Open
D9	Decide ledger/bath conservation branch	Open
D10	Compute leakage and survival	Open
D11	Derive basins, quasipotentials, barriers and escape laws	Open
D12	Execute refinement-realisation tests for claimed topological protection	Open
D13	Construct physical readout, confusion and disturbance	Open
D14	Return fragment distribution and prove an information budget	Open

Debt	Required return	Status
D15	Return operation-specific path and physical costs	Open
D16	Select physical clock and absolute action normalisation	Open
D17	Execute n = 3:6 and k = 1,6 certificate	Partial: record spectrum shows approximately second-order convergence
D18	Compare with RCMO through an independent forward chain	Open
D19	Feed admitted result into complete physical H_CMR	Open
D20	Derive the foundational retain/erase/overwrite disposition from the source — in particular Φ_renew*(P_e) = P_e with erasure/leakage and overwrite residuals — with manifestation production as an orthogonal token-level return	Open; XI-4 CPR propensity rank 0 (retyped as dilation, §46M); the designated route is the PFHBA-7 marked descent, not another XI-4 postprocessor
D21	Freeze one typed recurrent lift without downstream target selection and execute the source-projected bath and marked Doob–Kraus descent numerically	Open; exact-lift family has real dimension 34,152
D22	Derive the continuation space Ω(𝓗_n) and the entropy-biased first-entry law from Ω(𝓗_n) to e_{n+1} — the commitment-advance law, with declared reverse process, environmental degrees of freedom and entropy currency (⟨Σ_commit⟩ ≥ 0 or its refutation)	Open; interface reconstitution (renewal) is the executed half; connects to D15 (costs) and D16 (clock). The continuation-space calculation must now explicitly consume D23: Ω(𝓗_n) may not be called history-conditioned merely because 𝓗_n is persistently stored
D23	History-to-active backreaction: derive from the same source a non-factorising dependence of later dynamics on retained history	Narrowed twice. The §46Q audit located the carrier boundary; the §46S audits now locate the information boundary: the ordered history retains a source-populated A_2 chirality observable (expectation 0.334169477947982), but the presently defined scalar κ/Ξ chain exactly annihilates it, the GTC phase precursor produces only access-invisible coherence, and the EX2E current constraint contains no orientation forcing term. General history-dependent

Debt	Required return	Status
		modification of the future generator, Hessian, causal kernel or continuation space remains open, and now demands a non-scalar, pre-scalarisation coupling.
D24	Post-commitment old-phase availability: derive from the same master action the post-commitment tangent projector P_avail on the y-phase carrier and return s_old = ‖P_avail φ_old‖	OPEN. The Fold law proves irreversible commitment/no-uncommit but does not yet prove that every continuous phase relaxation tangent of the old event is removed. Unit-branch excess $(1 - s\_old^2)/2$; s_old = 0 gives the full 1/2 (Theorem 18). Old-mode availability (this debt) and branch-population readout of retained orientation (D27–D30) are separate debts: neither implies the other.
D25	Fresh renewal phase carrier: derive or exclude a non-minimal source-native continuous phase channel generated during renewal	MINIMAL BRANCH CLOSED NEGATIVELY. The unique minimal branch-preserving renewal gives s_fresh = 0 exactly — its free phase cancels from the renewed connection and density state — and the discrete terminal type supplies no continuous tangent. Any nonzero s_fresh must arise from a genuinely additional source-derived renewal interaction.
D26	Physical record/bond metric normalisation: evaluate the stationary operational metric and its record/bond pullbacks w_R, w_B, and return the selected-mode physical Schur excess $w\_B^2/(w\_B + w\_R)$	OPEN. Unit diagnostic branch gives H_qy = [[3, −1], [−1, 2]] and Δk_loc = 1/2; the physical normalisation may not be inferred from that branch (F40).
D27	Signed maintenance-load functional: derive from the primitive action the orientation-odd real load M_χ with its coefficients — lowest admissible form M_χ^LO = j(c_P ln S_P + c_I ln S_I) — and return the access-visible load coefficient b and hence Λ_c	OPEN. The present closure action contains no signed real maintenance term (Λ_c^current = 0 is a construction zero, not a derived physical zero); S_P and S_I are reversal-even, so the signed functional requires the odd current factor j (§46S.6).
D28	Orientation-to-internal-frame forcing: derive the mixed source-action derivative B_αF = ∂^2A_source/∂α∂F_int at the physical class, or an equivalent	OPEN. The current EX2E constraint has ∂_α D_J = 0 exactly (Theorem 24); zero response is admissible and nothing selects a nonzero one.

Debt	Required return	Status
	inhomogeneous response $J_D \dot{x}_\alpha = b_\alpha \neq 0$	
D29	Physical projective branch visibility: identify the physical internal endpoint frame and return $V_J^{physical}$ and R_α on the fully quotiented admissible manifold	OPEN. Common-ray helix gives $V_J = 0$; diagnostic frames reach ≈ 4.80–4.89 of maximum $\sqrt{24} = 4.898979485566356$ — capacity established, selection not (§46S.7–46S.8).
D30	PFDMI-S1 frame-selection execution: exhibit the stationary class $dA_{source} = 0$ with trivial quotient-Hessian kernel on M_{adm}, preserving all source constraints and physical score ranks	OPEN. The criterion is exact; its execution on the residual (≤ 836-dimensional) frame tangent is the outstanding calculation (§46S.9).
D31	Determine whether complete conjugate EX2E branch presentations can be separated by the existing native Born instrument	CLOSED NEGATIVELY. Exact co-conjugation gives $\Delta p = 0$ for every native mark and terminal effect (Theorem 25). Large projective current separation does not imply Born-readout separation.
D32	Identify and evaluate a source-frozen closed family holonomy without using CKM targets	CLOSED ON THE REDUCED FAMILY CARRIER. Direct 1 → 3 versus indirect 1 → 2 → 3 gives $W_\Delta = e^{i\cdot 5\pi/6}$, hence 150°; reverse loop 210° (Theorem 26). Gauge invariant under arbitrary family rephasing; level-3/level-4 continuations 176.5074504467° / 155.8501772202° attached to the bare value.
D33	Prove physical axle-loop realisability and identify the HCFC comparison loop with the closed family holonomy, $L_{ax} = W_\Delta$, or derive another same-action inheritance map fixing the physical axle phase	OPEN. The reduced family loop is real and numerically fixed, but no source theorem yet proves $L_{ax} = W_\Delta$. RRHF-AX1 cannot supply that proof because it installs the axle conditionally.
D34	First-cover-to-readout activation: derive from the source action whether the signed terminal history statistic K activates the R4/terminal binary readout, rather than merely existing as a history observable	OPEN. First-cover chirality is strongly nonzero and obeys an exact fluctuation relation; physical terminal coupling coefficient unreturned (F49).
D35	Population-visible forcing coefficient: return $g_\chi P$, or equivalently a nonzero χ_{pop} =	OPEN. Scalar and pure-phase routes give exact zero population projection.

Debt	Required return	Status
	$-(D\_F\ \Delta P)\cdot K\_F^{+}\cdot B\_eff$, from the primitive action	
D36	Complete HMGBC→MASD Hessian handoff with the frozen physical ΔΩ and common metric at all admitted regulator levels	STRUCTURAL FORM CLOSED / PHYSICAL EXECUTION OPEN. ΔH_XX = ΔΩ and Schur survival are exact; physical metric/branch certificate still required.
D37	Correct differential-order completion–fermion transmission: identify the first nonzero same-action jet and execute its full physical tensor descent	CLOSED AT DECLARED EXECUTION LEVEL. The ordinary second jet is exactly zero at the zero-fermion vacuum; the mixed third jet T_Xψψ is nonzero and the archived full tensors pass at $\approx 1.15 \times 10^{-15}$. Primitive uniqueness and physical metric remain open.
D38	Re-execute independent CY3′ from one representation-resolved common action	CONDITIONAL ACTION-LEVEL PASS / PRIMITIVE PROVENANCE OPEN. RRHF gives $\approx 1.9 \times 10^{-14}$ at levels 3 and 4, but the primitive MASD–HMGBC derivation of D_score and U_role is not established.
D39	Derive D_score and U_role from the primitive marked transition law without RRHF score insertion	OPEN; maximal score rank exists but numerical score law is non-identified.
D40	Derive physical score normalisation/frame η_physical and the sector-resolved same-action bath blocks	OPEN; positivity and full rank do not select η; quark and lepton completion graphs are separate components.
D41	Derive the physical charged-lepton maintenance map L_M, metric G_M and branch covariance	OPEN; Schur form and scalar ordering are established, full Gram operator is not.
D42	Derive the physical attaching map V from persistence commitment classes into the projected K7 carrier	OPEN; scalar trace agreement is non-identifying and direct C_6-carrier identification is excluded.
D43	Build the actual finite vacuum cell complex and compute $H^2(K\_vac; Z_7)$	OPEN, with canonical-wheel obstruction now executed. The uniform D_6-pseudoscalar rim cochain is non-flat on every nonempty simple-cycle completion of the canonical wheel (Theorem 44), so it cannot be promoted to the physical flat Z_7 class on that proxy. The actual Γ_vac, ∂_2 and physical cohomology calculation remain mandatory.

Debt	Required return	Status
D44	Compute the integral Smith normal form of the actual vacuum complex	OPEN; decides whether sevenfoldness is intrinsic through order-7 torsion rather than merely the coefficient group.
D45	If the Z_7 sector is available, execute its operational occupancy and identify or refute the charged-lepton PFD-loop → vacuum-holonomy-loop map	OPEN; required before any holonomy response is promoted to flavour physics.
D46	Derive the physical microscopic reverse process for the PFDMI current/record channel and determine whether any physical entropy-production contribution depends on η beyond the canonical unital reverse	OPEN. Canonical adjoint/Petz reverse gives zero internal entropy production for every η; one-Bit η-selection fails for the current channel (Theorem 41).
D47	Derive the physical ordered-history → R4 readout gain a, or equivalently g_read = 2a − 1, from the primitive source	OPEN. D_6 + record locality gives the exact one-parameter family; exact readout would force a = 1, but BCB, retention and ln 2 do not (Theorem 42).
D48	Prove or refute that the IORC score ω_C is the physical C-defect score $S\_C = \partial\_\{\varepsilon\_C\} \log K\_n\^\varepsilon\|_0$ of the same HMGBC/MASD history operator after the full typed lift	OPEN — THE DECISIVE SELECTOR OBLIGATION. Exact on the canonical wheel (Theorem 43); the physical carrier identity is the outstanding theorem.
D49	If D48 passes, calculate the physical Schur-reduced curvature stiffness K_C, lifted score s_C and signed response $c\star\_\sigma = \sigma\alpha\star K\_C^+ s\_C$; alternatively determine whether signed curvature resides in conjugate background branches and execute their common-Perron comparison	OPEN. Existing quadratic action supplies stiffness only; current branch machinery does not yet break the conjugate sign tie (Theorem 45).
—	Electromagnetic-admission debts (companion K7-EA-1)	**(i) Pre-fact closure measure: CLOSED AT FOUNDATIONAL LEVEL.** P14 plus the derived K = 7 cardinality gives $p_0(w)$ = 1/128 for all unresolved closure words. Zero entropy alone is not the argument; the load-bearing premise is absence of pre-fact distinguishability. The 350D → 128D CPTP descent remains open as a microscopic implementation/consistency bridge and must preserve the foundational law and

Debt	Required return	Status
		closure semantics, but it no longer determines the prior. **(ii) Physical TPB support saturation: OPEN.** Prove that the electromagnetic layer-change saturates the canonical thirteen EX2G transport directions plus the sharp committed-record line and annihilates the global mode, physically instantiating the exact 14/15 support-rigidity theorem. **(iii) Continuum/QED matching: OPEN.** Identify the structural coupling at a declared interface scale and execute matching and running to measured low-energy α.

51. Final scientific verdict

Object	Corrected grade
Foundational retention with active-carrier renewal	EXECUTED EXACT PASS WITHIN DECLARED ARCHITECTURE — RENEW-ONLY ATOM σ = (1,1,0,0)
F2F append-only renewal spectral calculation	EXACT WITHIN INHERITED RENEWAL ARCHITECTURE
Primitive derivation of the append-only retention law	OPEN — Φ_renew*(P_e) = P_e with erasure and overwrite exclusions to be derived
XI-4 completed-mark dilation	EXACT MICROSCOPIC PASS; REPRESENTATION-LEVEL, NOT A FOUNDATIONAL OPERATION
XI-4 as a foundational disposition selector	NOT APPLICABLE: FIXED DILATION — COPYING WAS NEVER THE FOUNDATIONAL DECISION
Foundational retain/erase/overwrite derivation from the primitive action	OPEN; PFHBA-7 MARKED DESCENT UNEXECUTED
HCMR-MR1 102-dimensional maintenance parent	FOUR-REGULATOR CANDIDATE PASS; PHYSICAL CERTIFICATE REFUSED
PFHBA-7 recurrent Fisher pullback	EXACT EXISTENCE/CAPACITY PASS
Primitive pullback uniqueness	FAIL: LARGE EXACT-LIFT NON-IDENTIFIABILITY (DIMENSION 34,152)
Source-projected bath and Doob descent	CONDITIONAL ARCHITECTURE; NUMERICAL MARKED DESCENT OPEN
Rank-five selector Gram	POSITIVE CONVERGENT TYPED BLOCK; NOT YET Γ_retention

Object	Corrected grade
Individual manifestation curvature	INHERITED CANDIDATE MECHANISM
Cross-manifestation consistency stiffness	NOT RETURNED
Ledger-versus-bath branch	OPEN FOR MULTIPLE MANIFESTATIONS OF A RETAINED RECORD
Physical basin, barrier and survival	NOT RETURNED
Physical quotient and readout	NOT EXECUTED
Persistent-ledger storage	EXACT PASS WITHIN DECLARED PFDMI RENEWAL ARCHITECTURE
Reopened active-carrier rank after ledger renewal	FULL ON THE DECLARED PFDMI WORKING CARRIER — NO PROJECTOR LOSS IN THE DECLARED RENEWAL MAP
Automatic history backreaction from persistent storage	FORWARD-FROZEN NEGATIVE
History-dependent modification of later active dynamics	OPEN — REQUIRES SAME-SOURCE POST-COMMITMENT BACKREACTION MAP (D23)
PFDMI working carrier = HX1 record-phase carrier	NOT DERIVED; IDENTITY IDENTIFICATION REFUTED AS A TYPE SHORTCUT (F34)
CGI/HX1 common-carrier principal angles	EXACT ON DECLARED FINITE CARRIERS: {0 (×6), π/2 (×6)}
Common renewal/HX1 sector	EXACT: CUT SPACE Im d, RANK 6
HX1 cycle sector	EXACT: Cyc = ker d^T, RANK 6
Uniform-rim HX1 phase versus canonical incidence renewal	EXACT ORTHOGONALITY — d^Tφ_rim = 0, P_Cut φ_rim = 0
Linear EX2G-incidence → all twelve signed HX1 edges	IMPOSSIBLE BY TRIANGLE FACTORISATION NO-GO
Automatic recreation of old cycle relaxation under renewal	NOT DERIVED; CANONICAL INCIDENCE ROUTE DOES NOT RECREATE IT
HX1 record phase = master Φ-phase tangent	EXACT TYPE IDENTIFICATION (THM 18)
HX1 lost-relaxation operator as master-Hessian Schur block	EXACT SAME-ACTION REDUCTION
Unit uniform-mode Hessian	[[3, −1], [−1, 2]] — EXACT; EIGENVALUES $(5 \pm \sqrt{5})/2$
Unit full old-mode loss	Δk_loc = 1/2 — EXACT SAME-ACTION UNIT-BRANCH RETURN
Physical normalised Δk	OPEN — COMMON OPERATIONAL METRIC UNEVALUATED; FORM $w_B^2/(w_B + w_R)$ (D26)
Minimal renewal fresh HX1 phase	EXACT ZERO: s_fresh = 0

Object	Corrected grade
GPU renewal phase = HX1 record phase	REFUTED — GLOBAL/KRAUS PHASE, CANCELS FROM CONNECTION AND DENSITY STATE (F38)
PFDMI discrete terminal type = continuous HX1 phase	NOT DERIVED / TYPE-INVALID SHORTCUT (F39)
Old event-specific phase survives commitment	OPEN — s_old, THE DECISIVE LOCAL QUESTION (D24)
Unit partial-survival law	$\Delta k = (1 - s\_old^2)/2$ — EXACT
Non-minimal fresh renewal phase	OPEN, BUT NOW AN ADDITIONAL INTERACTION RATHER THAN ORDINARY RENEWAL (D25)
Commitment-energy transfer into the propagating sector	STILL OPEN AS SAME-ACTION ENERGY-FLOW BRIDGE
Electromagnetic 14/15	EXACT SUPPORT-RIGIDITY RESULT CONDITIONAL ON PHYSICAL TPB SATURATION
Electromagnetic p_EM = 7/960	EXACT STRUCTURAL CANDIDATE UNDER P14 + TPB SATURATION
Complete measured low-energy α derivation	NOT ADMITTED — TPB PHYSICAL SATURATION + CONTINUUM/QED MATCHING/RUNNING OPEN
Single-token traversal chirality	EXACTLY ERASED — REVERSAL-ODD SECTOR = ker C (THM 19)
Ordered-history A_2 chirality observable	EXACT; SOURCE-POPULATED, $\langle\chi_2\rangle$ = 0.334169477947982 (THM 20)
Conditional two-turn orientation bias	0.957752384566601 = $\tanh(2\alpha)$ — EXACT SOURCE IDENTITY
History/R4 effect correspondence	EXACT ALGEBRAIC MAP $\Theta(Q\pm) = P\pm$
History/R4 carrier identification	EXCLUDED — $\mathrm{Hom}_{D_6}(H_\chi, E_1) = 0$ (THM 21); BRIDGE MUST BE CONDITIONED CP READOUT
Scalar κ/Ξ transmission of chirality	EXACT ZERO — $S\_scalar\ \chi_2 = 0$; IDENTICAL RIM WAITING LAW (THM 22)
GTC record-phase precursor	EXACT AND ORIENTATION-ODD — $\partial E/\partial y$
GTC phase as P± population readout	EXCLUDED IN PURE-PHASE E_1 REALISATION — POPULATIONS EXACTLY ½ FOR ALL y (THM 23)
Signed real maintenance load in present action	ABSENT — Λ_c^current = 0 AS CONSTRUCTION ZERO; NOT A DERIVED PHYSICAL ZERO (D27)
Lowest admissible signed load form	M_χ^LO = j(c_P ln S_P + c_I ln S_I); c_P, c_I OPEN
EX2E projective invariance	EXACT — ρ_J,e INVARIANT UNDER ALL SCALAR DRESSINGS
Common-ray helix projective visibility	EXACT ZERO — V_J = 0

Object	Corrected grade
Diagnostic-frame visibility capacity	≈ 4.80–4.89 OF MAXIMUM $\sqrt{24}$ = 4.898979485566356 — CAPACITY ONLY, FRAME NOT SELECTED
Physical projective branch visibility V_J	NON-IDENTIFIED (D29)
Orientation forcing in EX2E constraint	ABSENT — $\partial_\alpha D_J = 0$ EXACTLY; $J_D \dot{x}_\alpha = 0$ (THM 24)
Residual internal-frame tangent	2120 − 1200 = 920; ≤ 836 AFTER DECLARED GAUGE ORBIT
Orientation-to-frame mixed forcing $B_{\alpha F}$	OPEN — THE DECISIVE READOUT DEBT (D28)
PFDMI-S1 stationary-frame selection	CRITERION EXACT; EXECUTION OPEN (D30)
Complete faithful EX2E conjugation as a native Born readout	EXACTLY INVISIBLE — ALL NATIVE MARK/TERMINAL PROBABILITIES IDENTICAL (THM 25)
Large conjugate projective-current separation as evidence of physical readout	REFUTED — CAPACITY DOES NOT IMPLY READOUT
Reduced-family closed triangle W_Δ	EXACT GAUGE-INVARIANT LOOP (THM 26)
Bare family-triangle holonomy	$e^{i\cdot 5\pi/6}$ = 150° — EXACT
Reverse family-triangle holonomy	210° — EXACT
RRHF finite-regulator family-triangle phases	LEVEL 3: 176.5074504467°; LEVEL 4: 155.8501772202°
Identification $L_{ax} = W_\Delta$	OPEN — SAME-ACTION HISTORY/CARRIER BRIDGE NOT DERIVED (D33)
Physical axle phase	STILL OPEN, BUT NOW WITH AN EXISTING CLOSED SOURCE-FROZEN CANDIDATE HOLONOMY
First-cover signed history variable K	EXACTLY DEFINED; REFLECTION-PAIRED FLUCTUATION RELATION EXACT
First-cover orientation statistics	$P(K > 0)$ = 0.996750764817216; CONDITIONAL PREFERRED SIGN 0.998816847345935 — EXECUTED
History × R4 population bilinear $-g_{\chi P}\cdot\chi\cdot\Delta P$	SYMMETRY-ALLOWED; UNIQUE BETWEEN THE SPECIFIED ONE-DIMENSIONAL LINES
Current scalar/phase route to ΔP	EXACT ZERO
Physical history-to-population coefficient $g_{\chi P}$	OPEN (D35)

Object	Corrected grade
HMGBC completion-Hessian amendment $\Delta H\_XX = \Delta\Omega$	EXACT
Survival of $\Delta\Omega$ through declared HFB Schur reduction	EXACT
HCMR completion-to-charged direct transmission	EXACT ZERO IN THE EXECUTED DIRECT-SUM CANDIDATE
Universal repair of independent CY3′	FAIL — LEVEL-SIX MAX RESIDUAL 0.521795
Ordinary completion–fermion Hessian at zero-fermion vacuum	EXACT ZERO — CORRECT DIFFERENTIAL-ORDER ZERO
Completion–fermion mixed third jet T_Xψψ	EXACT NONZERO
Full archived completion–CAR/Fock tensor descent	PASS, $\approx 1.15 \times 10^{-15}$
Absence of completion–fermion interaction as explanation of CY3′	REFUTED
Universal scalar spectral completion repair	NO-GO
Representation-resolved transfer Y = U_role D_score	CONDITIONAL ACTION-LEVEL PASS
RRHF independent CY3′	$\approx 1.9 \times 10^{-14}$ AT STORED LEVELS 3–4
Primitive D_score, U_role derivation	OPEN (D39)
PFDMI physical score rank	EXACT 72
Positivity/rank selection of physical η	NO
Quark/lepton universal completion bath	NOT REQUIRED
Two-component completion graph	EXACT: {Q, u, d}
Lepton maintenance demand as Schur response	EXACT ALGEBRAIC EQUIVALENCE
Persistent demand increment σ_τ − σ_μ	EXACTLY 1 WITHIN DECLARED COUNTING LAW
Full branch-covariant G_M	OPEN (D41)
Genuine projected K7 Gram geometry	IDENTIFIED
Overlap-corrected trace at σ/d = 0.8	31.771654 — EXECUTED COMMON-CARRIER INVARIANT
Direct Fourier planes = generations	FAIL

Object	Corrected grade
Persistence scalar trace as provenance certificate	NO-GO
Exact wheel cycle→refinement lift	CONSTRUCTION PASS
Direct C_6/Z_7 equivariant carrier identity	IMPOSSIBLE
Z_7 real-character type versus Q_6	MATCHES
Conditional nonzero-holonomy response rank	6 — SPECTRUM {0.753020396283, 2.445041867913, 3.801937735805}
Actual nontrivial H^2(K_vac; Z_7) availability	OPEN (D43)
Actual observable holonomy occupancy	OPEN (D45)
Integral order-7 torsion	OPEN (D44)
Holonomy response as physical flavour stiffness	NOT ADMITTED
Closure-generated Fold pair Π_+, Π_-	EXACT — ORTHOGONAL, EQUAL-RANK, EXHAUSTIVE ON THE FOLD DOUBLET
Fubini–Study preparation on the Fold doublet	EXACT — $P(\Pi_+) = P(\Pi_-) = 1/2$
Fold orientation binary = success/failure binary	NOT RETURNED
Pre-Fact Indifference P14	FOUNDATIONAL VERSF PREMISE — NO DIFFERENTIAL PRIOR WEIGHT BEFORE FIRST DIFFERENTIATION
Zero entropy alone ⇒ uniform 128-word law	NO — EXPLICITLY NOT THE ARGUMENT
K = 7 unresolved closure alphabet	EXACT — $\lvert\mathbb{F}_2{}^7\rvert = 128$
Pre-fact raw-word law	EXACT UNDER P14 — $p_0(w) = 1/128$
Rank-one full-closure selector	EXACT — P_full = $\lvert 1111111\rangle\langle 1111111\rvert$
Full-closure pre-fact probability	EXACT UNDER P14 + K7 — 1/128
Hamming 16 × 8 factorisation as origin of probability	NO — RETROSPECTIVE CLASSIFICATION ONLY
Physical complement symmetry of h_Δ	FAIL BY TYPE, BUT NO LONGER LOAD-BEARING FOR 1/128
350D equal-rank 128-word sharp PVM	EXACT FAIL — REPRESENTATION-LEVEL OBSTRUCTION ONLY
CPTP 350D → 128D closure descent	OPEN AS MICROSCOPIC REALISATION/CONSISTENCY BRIDGE

Object	Corrected grade
Scaled-unital / irreducible-covariance certificate	SUFFICIENT IMPLEMENTATION CERTIFICATE; NOT ORIGIN OF PRIOR
Physical normalised-trace origin of 1/128	CLOSED FOUNDATIONALLY: P14 + K = 7
PFDMI current channel unitality	EXACT FOR ALL ADMISSIBLE η
Canonical current-channel entropy production	EXACT ZERO PATHWISE; PHYSICAL REVERSE LAW STILL OPEN
One-Bit entropy as selector of η	FAIL FOR CURRENT PFDMI CHANNEL
Ordered-history → R4 covariant readout family	EXACT ONE-PARAMETER CLASSIFICATION Φ_a
Exact R4 readout	a = 1 UP TO LABEL SWAP, CONDITIONAL ON EXACT READOUT
BCB / global retention fixing a	FAIL EXACT
Direct $A_2 \times A_2$ history-population bilinear	SYMMETRY ALLOWED
Direct mixed cubic history-population rescue	FORBIDDEN EXACT BY A_2 PARITY
IORC score = HMGBC wheel C-score	EXACT
IORC finite deformation = HMGBC C-deformation	EXACT ON CANONICAL WHEEL, ε_C = σα
IORC j_prep = MASD primitive J	REFUTED BY TYPE
Gate-3 Z_7 connection = real F_C tangent	REFUTED — NO NONZERO $Z_7 \to \mathbb{R}$ ADDITIVE TANGENT
Primitive one-Bit / generator minimality ⇒ ±1 charge	FAIL EXACT
Elementary successor move ⇒ ±1	EXACT, BUT COMMITMENT = SUCCESSOR MOVE OPEN
Hub-completion predicate returns s^k	NO — BOOLEAN PREDICATE ONLY
Single-face Gate-3 k as physical datum	REFUTED — GAUGE
Uniform rim F_C as flat wheel completion class	FAIL ON EVERY NONEMPTY SIMPLE-CYCLE COMPLETION
Outer-rim F_C circulation	±6 ≡ ∓1 MOD 7 — CURVATURE IF BOUNDING A CELL
MASD D_C as physical curvature variable	EXACT TYPE MATCH
Quadratic MASD/HMGBC curvature stiffness selecting sign	IMPOSSIBLE EXACT

Object	Corrected grade
HMGBC KL first derivative in C direction	EXACT ZERO AT REFERENCE
HMGBC irreversible j_n enters ΔΩ	NO — ΔΩ USES SYMMETRIC CONDUCTANCE
IORC odd score as source for MASD curvature	PHYSICALLY OPEN; EXACT CONDITIONAL RESPONSE IF LIFT PASSES
Complete physical H_CMR	NOT ADMITTED

The programme has now separated retention, renewal and backreaction at operator level. The declared append-only F2F/PFDMI architecture retains the foundational fact and almost surely reopens the active carrier — unresolved spectral radius 0.200305886206958, stationary mean wait 1.234602249934960 opportunities, resolved event class σ = (1, 1, 0, 0) — exact within the inherited architecture, silent on primitive selection. A further audit shows that these two successes do not themselves make the retained ledger dynamically restrictive: the renewal isometry reopens the complete declared working carrier, so persistent storage alone leaves the later active projector unchanged (Theorem 16). The theory therefore has a genuine persistent history, but the stronger claim that the retained history changes subsequent dynamics requires a further same-source backreaction theorem (D23). The committed fact is not recreated as the machinery moves on; it remains constitutive of the enlarged history. The XI-4 audit confirms this from the other side: its exact CPR map is a fixed all-mark dilation with no complementary effect and no source-sensitive propensity, which is evidence that copying was never the foundational decision being made, not that the source failed to make one. The artificial copy-selection problem is thereby removed, and the renewal calculation becomes the centre of the theorem. Upstream, HCMR-MR1's 102-dimensional maintenance parent is regulator-convergent but refused at the physical-admission level, and PFHBA-7 proves that the recurrent record-preserving carrier reproduces that parent exactly while leaving the typed lift massively non-unique and the marked Doob–Kraus descent unexecuted. The remaining physical problem is therefore sharply located: freeze one typed recurrent lift without downstream selection, execute the source-projected marked descent, derive Φ_renew*(P_e) = P_e with erasure/leakage and overwrite ruled out — letting the source confirm or refute the append-only retention law rather than the paper declaring it — decide the ledger/bath branch, and only then return Γ_retention, causal correction, survival, readout and cost. In sum, the companion K7-EA-1 line now constitutes a substantially stronger conditional structural derivation of the candidate electromagnetic coupling. The exact structural candidate 7/960 no longer depends on an independently inserted equiprobability assumption: equality of the 128 pre-fact word weights is now the explicit foundational consequence of P14 together with the derived K = 7 cardinality. It likewise no longer depends on an equal fifteen-atom pushforward measure, a chosen direct-sum gate, the literal form of the record/export parametrisation, or the later choice among record-preserving post-commitment operations. The remaining electromagnetic uncertainty is therefore not the origin of the 1/128 prior, but whether the microscopic source faithfully realises that foundational closure interface, whether the physical TPB map saturates the canonical fourteen transmitting directions — the thirteen transport directions and the sharp record direction, while annihilating the global mode — and how the resulting structural coupling matches and runs into continuum QED. Until those returns are obtained, 7/960 is an exact structural result under named physical premises, not yet the final measured fine-structure constant. Until that cumulative execution passes, HCMR-M1-R15 is a materially strengthened partial execution and obstruction audit — in structure a foundational-retention and present-renewal theorem, not a copy-maintenance theorem, and not yet the final physical measurement theorem. The confinement/commitment side is now more sharply resolved. The relaxation coordinate responsible for the HX1 Schur softening is a genuine phase tangent of the common master record/completion field, and its unit-branch loss raises the selected local stiffness by exactly 1/2. Ordinary minimal renewal does not recreate that coordinate. The unresolved local question is therefore whether commitment itself consumes the old event-specific phase freedom. The physical answer is encoded by s_old, not by the rank of the renewed PFDMI carrier: in the unit branch $\Delta k = (1 - s\_old^2)/2$, with its final normalisation supplied by the common operational metric. If the master action returns s_old = 0, the full local lost-relaxation result survives renewal automatically; if it returns s_old = 1, the mechanism closes negatively. No intermediate value may be selected after comparison with the desired confinement behaviour. HCMR-M1-R15 is therefore no longer merely asking whether a cycle relaxation carrier might be related to the persistent record. That carrier has now been located inside the common master action, and minimal renewal has been shown not to regenerate it. The decisive remaining calculation is the post-commitment availability projector of the old y-phase direction, followed by the common-metric normalisation and same-action transfer of the resulting stiffness into the propagating commitment sector.

The programme now has more than a local indication of history orientation and substantially more than a capacity witness for Standard-Model flavour closure. The frozen history carries a nonzero ordered chirality and remains overwhelmingly oriented at first complete cover; the history-derived generation geometry enters the completion Hessian and survives the declared auxiliary relaxation exactly. The subsequent differential-order audit now corrects the strongest remaining misinterpretation of the HCMR direct-sum failure. Completion-to-fermion coupling is not absent: the primitive MASD action already contains it, but its first nonzero return is a mixed third derivative rather than an ordinary completion–fermion Hessian. The archived full charged and neutral mixed tensors pass the complete declared source projection at approximately 1.15×10^{-15}. The old CY3′ failure must therefore be attributed elsewhere.

That attribution is now sharp. The universal completion law is too representation-blind: its singular-value structure is wrong, and neither unitary frame rotation nor any scalar spectral function of the universal completion operator repairs it. A representation-resolved ordered transfer does close the independent bosonic and CAR/Fock CY3′ routes conditionally to approximately 1.9×10^{-14}, proving that the required action-level structure exists. What remains open is its primitive provenance. PFDMI derives a maximal-rank physical score carrier but does not uniquely select its weights, positivity normalisation or endpoint frame; the four recovered completion channels naturally split into quark and lepton components rather than one universal bath. On the charged-lepton side, maintenance demand has exact Schur form and the persistent-distinguishability count fixes the tau-minus-muon demand increment without mass input, while the physical branch-covariant Gram embedding remains unreturned.

The K7 overlap and topology programme further narrows that provenance problem. The genuine projected Gram carrier has now been identified, and direct assignment of its three ordered Fourier planes to the three charged-lepton generations fails the independently derived persistence hierarchy. The persistence rules admit many operator embeddings with the same scalar trace, so trace agreement alone is not a microscopic derivation. An exact cycle-to-refinement lift can be constructed on the canonical wheel, but the sixfold wheel carrier cannot be directly identified with the sevenfold projected Gram carrier. A possible correctly typed bridge now appears through the actual transport holonomy: its real character representation has exactly the same three two-dimensional irreducible sectors as the Gram complement, and a nontrivial holonomy would generate a fixed rank-six positive response with spectrum {0.753020396283, 2.445041867913, 3.801937735805} up to permutation. This is still conditional. The actual vacuum cell complex has not yet been shown to possess a nontrivial cohomology class, to carry intrinsic order-seven torsion, or to populate such a class operationally, and the charged-lepton PFD loops have not yet been identified with the relevant vacuum holonomy loops.

The Standard-Model closure frontier has therefore moved again. It is no longer “find a completion–charged coupling”: that coupling is already present at the correct differential order. Nor is it “find some representation-resolved law”: one such law already closes CY3′ conditionally. The decisive problem is now primitive selection and attaching-map provenance — derive the representation-resolved score and role transfer from the primitive marked source, derive the sector-specific bath/maintenance blocks, and determine whether the actual K7 vacuum topology supplies and occupies the holonomy needed to attach persistent commitment structure to the physical Gram carrier. Complete physical Standard-Model admission therefore remains open, but the unresolved content is now concentrated in specific source-returned operators and topology tests rather than in missing capacity or an unspecified flavour mechanism.

The electromagnetic pre-readout problem has now been retyped at a more fundamental level. The previous 350D projective and channel calculations remain valid, but they were answering a stronger implementation question than is required to fix the prior. The $K = 7$ theorem supplies the finite unresolved closure alphabet of 128 configurations. Premise P14 now states explicitly what had previously remained implicit in the VERSF void concept: before first differentiation, there is no physical datum capable of giving one unresolved alternative a different prior weight from another, and a non-uniform prior would itself constitute pre-existing distinguishability. Normalisation therefore fixes the pre-fact law to 1/128 per raw word, and the exact rank-one full-closure selector returns $p_{closure} = 1/128$. This conclusion does not follow from zero entropy alone, nor from seven fair success/failure bits, nor from Hamming recovery. The 350D → 128D CPTP descent remains an important microscopic realisation test: if the proposed microscopic implementation is correct it must preserve the foundational measure and the closure semantics, with scaled unitality or irreducible covariance providing sufficient certificates. But it is no longer the origin of the 1/128 factor. The electromagnetic frontier is therefore reduced to physical TPB support saturation and the continuum/QED matching and running, together with the general microscopic consistency requirement that the deeper carrier correctly realise the foundational closure interface.

APPENDICES

Appendix A — Inherited numerical baseline

Source return	Value
F2F no-record spectral radius	0.200305886206958
F2F stationary mean first-record wait	1.234602249934960 Fold opportunities
HCMR-XI-2 microscopic carrier	$\mathbb{C}^7 \otimes \mathbb{C}^{50}$, dimension 350
Raw seven-bit closure-word count	$2^7 = 128$
Full-350D equal-word sharp FS multiplicity required	350/128 = 175/64 — impossible projector rank
Direct sharp 350D → 128 equal-word PVM route	EXACT FAIL
Equal-multiplicity projective subcarrier dimensions ≤ 350	128 or 256 — direct-subspace branch only
CPTP closure descent dimension	350 → 128
Required scaled-unital coefficient	350/128 = 175/64
Required scaled-unital identity	$\Phi\_cl(I_{350}) = (175/64)\ I_{128}$
Resulting isotropic closure preparation	$\Phi\_cl(I_{350}/350) = I_{128}/128$
Irreducible-covariance sufficient condition	$\dim V(G)' = 1$
Z-only closure stabiliser sufficient	NO
Source-derived physical closure descent/covariance	OPEN
HCMR-XI-2 mark count	319
HCMR-XI-2 completeness residual	2.471×10^{-14}
HCMR-XI-2 copy-isometry residual	0
PFDMI implemented record classes	84
PFDMI renewal-isometry residual	0
PFDMI level-3 nonzero full marks	15,631
PFDMI physical score rank	72
GSJB-16 primitive tokens at birth	1, conditional
GSJB-16 γ_birth	0 on selected carrier
GSJB-16 static basin sizes	8 and 8

Source return	Value
HCMR-XI-1 code/syndrome ranks	2 / 2
K7-CBR working carrier / outcomes	9 / 10
K7-CBR benchmark mean cycle	4.7459301206 proto-ticks
K7-CBR neutral recurrent rank	21
K7-CBR K7 × renewal edge-score rank	867
RCMO measured blocking order	1.99670
RCMO level-6 spectrum	(−0.943711, 0.024991, 1.000000)
HCMR-M1-R3 conditional renewal probability (inherited)	1 for every history start
HCMR-XI-4 selected source / combined marks	199 coordinates / 1,950 marks
HCMR-XI-4 CPR propensity Jacobian rank	0
Record selector level-6 positive spectrum	(0.001817866, 0.306404963, 0.565154769, 1.112063997, 3.905417883)
Record selector isotropy residual	0.767709415254
Record selector measured convergence orders	2.01364587 / 2.00337693
Full-closure projector rank	1
Conditional F2F record-law residual	2.220×10^{-16}

Every value retains its original grade. No preferred scale, benchmark timing or downstream target is used to select a post-commitment operation. # Appendix B — Falsifier ledger

Falsifier labels are local to HCMR-M1-R15. Electromagnetic-admission falsifiers (formerly F33–F48) are maintained in the companion paper K7-EA-1 as its F1–F16.

- **F1 — Fact/token conflation:** an additional carrier is counted as a second selection of the original event.
- **F2 — Overlapping operation partition:** copy-plus-renew is forced into one of two allegedly exclusive classes.
- **F3 —** Temporary retention conflated with terminal retention.
- **F4 — Isometry overclaim:** existence of V is called source execution.
- **F5 — Continuum-action overclaim:** an effective field action is called the discrete operation instrument.
- **F6 — Retarded-action overclaim:** a strictly causal dissipative kernel is derived from an ordinary symmetric single-copy bilocal action without a valid causal formalism.
- **F7 — Hessian/response conflation:** conservative curvature, damping and noise are called one stiffness.

- **F8 — Negative-mode overclaim:** a signed response eigenvalue is called an energetic instability without object typing and gauge reduction.
- **F9 — Static basin overclaim:** basin size is called a barrier or lifetime.
- **F10 — Topological persistence overclaim:** a non-bounding cycle is called a readable physical token.
- **F11 — Homology overclaim:** passing the necessary transport-image test is called loop realisation.
- **F12 — Convenient quotient:** an arbitrary common readout kernel is treated as a two-sided ideal.
- **F13 — Readout circularity:** readouts are chosen to generate a desired quotient and the quotient is then cited to validate the readouts.
- **F14 — Scalar compression:** anisotropic Γ_retention is replaced by one fitted number.
- **F15 —** Copy inevitability assumed; F_∞ or a no-copy invariant sector is not reported.
- **F16 —** Uniform/state-specific resolution conflation.
- **F17 —** Shared-bath occupation conservation called individual-token invariance.
- **F18 — Mutual-information count overclaim:** redundant fragments are assumed additive without proof.
- **F19 —** Topological per-cycle capacity called an environmental copy count.
- **F20 —** Landauer insertion or extension information identified with heat.
- **F21 —** Opportunity counts converted into seconds without a clock bridge.
- **F22 —** RCMO inversion or reproduction cited as independent corroboration.
- **F23 —** Preferred scales or Standard Model targets used to select the law.
- **F24 —** Regulator stability of inherited blocks presented as a complete same-source sweep.
- **F25 — Postprocessor promotion:** a fixed universal postprocessor applied identically to every mark is counted as a source-selected operation, a source mark or a copy decision.
- **F26 — Selector-Gram substitution:** a selector or Fisher Gram is identified with the physical conservative syndrome Hessian without an independently derived carrier intertwiner, metric and rank match.
- **F27 — Scope inflation:** a no-go proved against one fixed construction is cited as a no-go against the full source stack, or an execution is graded against only its immediate source packages while the cumulative upstream chain is available and controlling.
- **F28 — Downstream lift selection:** a typed recurrent lift from the non-unique exact-lift family is chosen using downstream HCMR targets, preferred scales or desired operation outcomes.
- **F29 — Dilation ontologised:** a representation-level dilation or two-sided consistency construction is interpreted as physical production of a second foundational record.

- **F30 — Retention/copy conflation:** the foundational retain/erase/overwrite disposition is replaced by a token-level copy/no-copy question, or manifestation production is graded as a foundational decision.
- **F31 — Declared continuation space:** $\Omega(\mathcal{H}_n)$ is asserted rather than derived from the retained history and the source dynamics, or the entropic advance schematic is converted into a quantitative time or entropy law without the clock bridge and a declared cost currency.
- **F32 — Renewal/commitment conflation:** the interface-reconstitution waiting law (renewal of the active carrier) is cited as the waiting law for the next committed fact, or the mean renewal wait is described as the time before the present advances.
- **F33 — Persistence/backreaction conflation:** exact survival of a ledger projector or append-only history is cited as proving that subsequent active dynamics depends on that history, without a non-factorising ledger-to-generator, ledger-to-projector or memory-kernel return.
- **F34 — Working-carrier/HX1-carrier conflation:** full reopening of the PFDMI working carrier is cited as proving $P_{regen} = I$ on the HX1 record-phase carrier without a source-derived carrier intertwiner.
- **F35 — Dimension-equality identification:** two twelve-dimensional carriers are declared physically identical merely because both have dimension twelve, despite a nontrivial or singular principal-angle spectrum.
- **F36 — Incidence-to-edge insertion:** an arbitrary map from the fourteen EX2G incidence labels to the twelve signed HX1 edge phases is introduced despite the triangle factorisation obstruction, or is selected to obtain a desired confinement coefficient.
- **F37 — Conditional cycle-lock promotion:** the local value Δk_{loc} is promoted to physical confinement before both the commitment-to-cycle-consumption step and the absence of an additional non-coboundary renewal map have been established.
- **F38 — Renewal-phase conflation:** the arbitrary global/Kraus phase of the minimal renewed ray is identified with the physical HX1/master-Φ record phase despite its exact cancellation from the renewed nearest-neighbour connection and the renewed density state.
- **F39 — Discrete-record/continuous-phase conflation:** the seven-valued PFDMI terminal projector index is converted into a continuous relaxation coordinate without a source-derived tangent map.
- **F40 — Unit-metric promotion:** the diagnostic unit branch and its exact $\Delta k_{loc} = 1/2$ are promoted to the physical normalised confinement coefficient before the common operational metric is evaluated.
- **F41 — Token-chirality attribution:** traversal orientation is attributed to a single persistent edge/type token although the F2F coarse-graining exactly annihilates the reversal-odd sector (Theorem 19).
- **F42 — Carrier-identity smuggling (history/R4):** the effect-algebra correspondence $\Theta(Q\pm) = P\pm$ is promoted to a Hilbert-carrier identification although $\mathrm{Hom}_{D_6}(H_\chi, E_1) = 0$ (Theorem 21).

- **F43 — Scalar-chirality recreation:** an unsigned commitment-density chain (κ, Ξ, s_eff) is claimed to carry or recreate ordered-history orientation despite S_scalar $\chi_2 = 0$ and the identical rim waiting law (Theorem 22).
- **F44 — Phase/population conflation:** the nonzero GTC record-phase precursor is cited as a P± branch-population readout although the pure conjugate phase leaves both populations exactly ½ (Theorem 23).
- **F45 — Construction-zero promotion:** Λ_c^current = 0 (absence of a signed maintenance term in the present action) is cited as a derived physical theorem that the completed primitive action has Λ_c = 0.
- **F46 — Diagnostic-frame promotion:** a large conjugate-witness branch visibility (≈ 4.80–4.89) obtained in an unselected internal endpoint frame is reported as the physical V_J, despite the frame not being dynamically returned.
- **F47 — Projective-invariance violation:** current sign or phase flips of j_e are counted as physical branch distinctions although ρ_J,e is exactly invariant under all scalar dressings.
- **F48 — Homogeneous-response overreach:** the admissibility of nonzero solutions of J_D ẋ_α = 0 is cited as the derivation of a physical orientation-to-frame response, despite ∂_α D_J = 0 and the absence of a forcing term (Theorem 24).
- **F49 — First-cover/branch-readout conflation:** a strongly biased K distribution is presented as a physical R4 or matter-sector population prediction without an action-derived terminal coupling.
- **F50 — $A_2 \otimes A_2$ uniqueness inflation:** uniqueness of the bilinear between the specified one-dimensional history and population lines is presented as uniqueness of all A_2 carriers or couplings in the complete theory.
- **F51 — Schur-survival/transmission conflation:** survival of ΔΩ in the retained completion Hessian is cited as proving that the history geometry reaches the charged Yukawa Hessian, despite the direct-sum carrier giving zero completion support for the charged selectors.
- **F52 — History-stiffness double counting:** ΔΩ is inserted a second time into HCMR-MR1 even though its completion operator already contains the generation-history geometry.
- **F53 — Universal-stiffness repair:** an arbitrary common multiplier of the generation Laplacian is fitted to close CY3′ despite the quark and lepton sectors requiring opposite projected corrections. A physical repair must arise from a source-derived same-action mixed block.
- **F54 — Differential-order conflation:** the exact vanishing of $\partial^2 A/\partial X \partial \psi$ at the zero-fermion vacuum is cited as absence of completion–fermion interaction although the primitive interaction first appears at mixed third order.
- **F55 — Full-tensor/provenance conflation:** machine-level descent of the archived third-order tensor is cited as proof that the primitive source uniquely selects the representation-resolved physical tensor.
- **F56 — Universal-spectral repair:** an arbitrary function of the universal completion operator or a fitted universal coefficient is used to manufacture the charged hierarchy despite the representation-resolved no-go.

- **F57 — Rank-selection overclaim:** physical η is set to its positivity endpoint merely because rank 72 occurs there, despite full rank persisting on an interval.
- **F58 — Dimension/weight conflation:** a four-dimensional completion transfer space is renamed a relaxation weight of four, or channel count is used as numerical score without a source metric.
- **F59 — Universal-bath insertion:** the quark and lepton completion components are forcibly connected without a source-derived inter-sector transfer.
- **F60 — Maintenance trace promotion:** agreement of a scalar trace with the persistence count is called a microscopic derivation despite non-uniqueness of the attaching map.
- **F61 — Dimension identification:** the six-dimensional wheel refinement carrier is identified with the six-dimensional nonuniform Gram carrier merely because their dimensions agree.
- **F62 — Holonomy availability/occupancy conflation:** a nonzero algebraic Z_7 kernel, or even nonzero $H^2(K\_vac; Z_7)$, is cited as proof that the physical source occupies a nontrivial observable holonomy.
- **F63 — Coefficient/torsion conflation:** the use of Z_7 coefficients in cohomology is cited as proof of intrinsic order-seven topology without the integral Smith-normal-form/torsion calculation.
- **F64 — Subspace/descent conflation:** failure to find a rank-128 or rank-256 reducing subspace of the 350-dimensional microscopic carrier is cited as excluding a CPTP operational descent to the 128-dimensional closure carrier. The divisibility obstruction applies to equal-rank sharp projective sectors, not to scaled-unital completely positive maps.
- **F65 — Covariance/twirl insertion:** a depolarising channel, Pauli twirl or other symmetrisation is appended because it produces $I_{128}/128$ and is then described as source-derived. Covariance must be inherited from the primitive descent itself, and the same channel must preserve the physical closure/code/syndrome and causal-order structure.
- **F66 — Stabiliser/irreducibility conflation:** covariance under the commuting Z-type closure/stabiliser algebra is cited as forcing $\Phi\_cl(I_{350}) \propto I_{128}$. The Schur argument is valid only after the output commutant is proved to be scalar; diagonal Z covariance alone leaves a nontrivial diagonal commutant.
- **F67 — Zero-entropy/equiprobability conflation:** zero von Neumann or thermodynamic entropy of the void is cited by itself as proof of a uniform future-outcome distribution. The foundational result requires P14, the absence of pre-fact distinguishing structure; purity alone is insufficient.
- **F68 — Bedrock/dynamics inversion:** the pre-fact 1/128 law fixed by P14 is treated as something that must be derived from later Hamming recovery, error frequencies, post-commitment dynamics or a chosen microscopic channel. Those structures may realise or test the foundational prior but do not generate it.
- **F69 — Hamming-factorisation probability promotion:** the exact identity $W = c(M) \oplus e\_S$, or $128 = 16 \times 8$, is interpreted as a physical generative probability law $P(w) = P(m)P(s)$ without a source theorem establishing that stage ordering. The

message/syndrome decomposition is a classification of the realised raw word unless separately promoted by the source. # Appendix C — Source-currency registry

Source	Status in HCMR-M1-R15	Consumed role
HCMR-P1 / F2F-1	controlling predecessor	First record and executed coarse-graining
GSJB-15/16	supporting, conditional/construction	Fact/token/provenance and one-token branch
HCMR-XI-1/2/3/4	supporting imported and source-native executions	Exact copy capacity, selected residual source and finite instrument; XI-4 CPR audited as fixed postprocessor rather than operation selection
K7-CBR / PFDMI	supporting construction/execution	Renewal architecture and recurrent capacity
RCMO-1	supporting candidate	Maintenance response and blocking; physical identity open
PFDMI-EX2G	controlling carrier geometry	Canonical Fold-to-oriented-incidence attaching map; 14 × 31 rank-13 transport image; seven-Fold completed-cover geometry
K7-CGI-1	controlling finite carrier audit	Exact 14 → 12 Dirichlet support descent; global null rays; source-native twelve-dimensional response support
HX1 / GTC-1 / K7-HRA1	controlling local relaxation precursor	Twelve-edge link/record-phase carrier; selected uniform-rim mode and registered local excess Δk_loc; exact bond overlap
Canonical wheel incidence audit	controlling topology/typing check	$BB^T = L\_W_7$; rank-6 cut/cycle decomposition; prevents endpoint incidence from being renamed as cycle response

Source	Status in HCMR-M1-R15	Consumed role
MASD-1 / common master-action construction	controlling same-action parent	Independent variables including Φ; explicit record-composition and polar bond-compatibility defects; one operational metric; full Gauss–Newton Hessian and common Schur reduction; establishes the physical parent in which the HX1 phase lives
K7-HYR-1	controlling phase/Hessian audit	Identifies y_HX1 with the master-Φ phase tangent; derives the record/bond Hessian block and reproduces the unit uniform-mode [[3, −1], [−1, 2]]
K7-PCA-1 / GPU-1 renewal tangent audit	controlling renewal audit	Proves minimal renewal has zero physical tangent into the HX1 phase sector; separates old-mode survival from fresh-mode recreation
F2F record coarse-graining audit	controlling record-grain typing	Directed-to-edge map C, $CC^T = 2I_{12}$; exact reversal-odd kernel; single-token orientation erasure (§46S.1)
D36-R1 ordered-turn statistics	controlling frozen history law	Two-turn probabilities P±, chirality expectation, conditional bias tanh(2α); rim self-probability (§46S.2, §46S.4)
K7-CHR-1 chirality/readout audit	controlling observable typing	A_2 pseudoscalar construction; Q±/P± effect correspondence; Hom_{D_6} = 0 carrier exclusion; conditioned CP bridge (§46S.3)
Scalar κ/Ξ source-chain audit	controlling scalarisation no-go	S_scalar χ_2 = 0; retarded/memory chain

Source	Status in HCMR-M1-R15	Consumed role
		annihilation; identical rim waiting law (§46S.4)
GTC phase-precursor audit	controlling phase/readout separation	Blank-record derivative $-\sigma\cdot 3\sqrt{3}\cdot w\_B$; unit minimum $\sigma\pi/6$; pure-phase E_1 population invariance (§46S.5)
Closure-action signed-load audit	controlling maintenance-load typing	Λ_c^current = 0 as construction zero; reversal-even S_P, S_I; lowest signed form j(c_P ln S_P + c_I ln S_I) (§46S.6)
EX2E projective-current audit	controlling current typing	Exact scalar-dressing invariance of ρ_J,e; common-ray helix V_J = 0; diagnostic-frame capacity 4.80–4.89 (§46S.7)
EX2E orientation-response audit / PFDMI-S1	controlling forcing boundary	∂_α D_J = 0; homogeneous response J_D ẋ_α = 0; tangent counts 920/836; stationary-frame selection criterion (§46S.8–46S.9)
First-cover chirality augmented EX2G execution	controlling new history audit	Signed first-passage distribution; fluctuation relation P(K = k)/P(K = −k) = e^{2αk}; terminal orientation statistics (§46U.4)
HMGBC-1 completion-Hessian audit	controlling same-action completion geometry	Exact Hessian amendment ΔH_XX = ΔΩ; completed-square form; positive reduced backreaction (§46V.1)
HFB/RPC retained-carrier census	controlling Schur typing	Establishes completion strain as retained and ΔΩ as a frozen Stage-A return before Stage-B Schur reduction (§46V.2)
HCMR-MR1 reproducibility package re-execution	controlling CY3′ transmission audit	Exact block supports, charged selector support, completion-to-charged

Source	Status in HCMR-M1-R15	Consumed role
		zero-transmission theorem and amended independent CY3′ residues (§46W)
HM4-EX4A / HM4-EX4B completion-CAR derivative audits	controlling differential-order execution	Zero gradient/Hessian at origin; nonzero mixed third jet; full completion CAR/Fock source-projection descent (§46X)
RRHF / FRDT representation-resolved flavour audits	controlling conditional CY3′ repair	Ordered transfer Y = U_role D_score; spectral attribution; conditional independent CY3′ closure $\approx 1.9 \times 10^{-14}$ (§46Y)
PFDMI EX2 sequence / PFDMI-S1	controlling score provenance	Field-dependent score carrier, rank 72, positivity interval, endpoint-frame and score-selection boundary (§46Z.1)
Blind completion-channel census	controlling relaxation topology	Four completion channels; quark/lepton two-component graph (§46Z.2)
SMPτ / variational maintenance series	supporting lepton response architecture	D_M = L_M†G_M L_M; hard/soft maintenance response; branch-covariance criterion (§46AA)
First-Principles Enumeration of Persistent Distinguishability in Charged-Lepton PFDs	controlling lepton persistence count	σ_e, σ_μ, σ_τ; exact tau-minus-muon unit increment (§46AA.3)
Full projected K7 closure-operator execution	controlling overlap geometry	Genuine Gram G, stiffness S, Fourier decomposition and generalised spectrum (§46AB)
Explicit Construction and Spectral Analysis of the K=7 Closure-Transition Graph	supporting cycle/refinement bridge	Six-cycle basis, wheel refinement spectrum and explicit cycle-lift construction (§46AC)
The Transport Group of the K=7 Closure	controlling holonomy typing	Z_7 transport, algebraic kernel, loop-supported holonomy and occupancy boundary (§46AD)

Source	Status in HCMR-M1-R15	Consumed role
The Topology of the Vacuum Transport Complex	controlling topological availability	$H^2(K\_vac; Z_7)$ criterion; torsion fork; actual cell calculation open (§46AD.3)
Deriving Operational Distinguishability Geometry from Finite Packing Structure	supporting character decomposition	Real Z_7 decomposition and complex character upgrade (§46AD.1)
K7-EA-1 and subsequent K7-IPB/GPU/CLA/ER4/MDU/RLD/PCI/SRR audits	controlling companion execution	Conditional structural derivation p_EM = 7/960; canonical rank-13 EX2G polar transport support; source-derived global nontransmission; sharp minimal record-dilation class; post-commitment refinement invariance; inter-layer support-rank rigidity forcing 14/15 once physical TPB saturation is supplied. Remaining physical fronts: microscopic 350D → 128D realisation/consistency of the foundational P14 closure law; physical TPB support saturation; continuum/QED matching and running. Scaled unitality or irreducible covariance remains a sufficient microscopic consistency certificate, not a necessary origin of the 1/128 prior.
HCMR-MR1	supporting candidate parent, certificate refused	102-dimensional maintenance parent and 87-dimensional relaxed response; four-regulator convergence; physical admission refused
PFHBA-7	controlling pullback existence	Exact sector-typed recurrent Fisher pullback of the HCMR-MR1 parent;

Source	Status in HCMR-M1-R15	Consumed role
		typed lift non-unique; marked Doob–Kraus descent unexecuted
Bath Criterion	controlling branch decision	Separate-ledger versus shared-bath conservation consequences; branch selection open; stated for closure sectors, applied to record tokens only after class identity is shown
QC-1	controlling readout boundary	Terminal equivalence; actual quotient open
Area scaling / realised information	supporting conditional	Admission criteria; fragment budget not automatically additive
Fact Momentum / history-dependent dynamics	supporting continuum mechanism	κ propagation and persistent memory
Memory Kernel from First Principles	supporting candidate mechanism	Free-energy curvature and unresolved bath; parameter closure incomplete
Coherence Scale and Memory Kernel Reduction	supporting conditional derivation	Worldline projection and reduction hierarchy
Effective Stress-Energy / Einstein Dynamics / Unified Action	supporting effective parent architecture	Continuum conservative sectors; substrate and causal variational closure incomplete
Gate-3, Continuum Lift, Phase as Memory	supporting conditional topology	Protected closure residue and U(1) relation; occupancy/pinning/realisation open
Refinement Realisation Criterion	controlling transport caution	Persistence ≠ realisation and homological disqualifier
Clock/action-normalisation papers	controlling currency boundary	No premature seconds, joules or absolute action

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