

CLSN-1

The Physical Changing Link Source Representation Resolved History Metric and Gauge Normalisation Closure Attempt in VERSF

D41 geometry, chiral positivity, Fact-Lock, source selection and joint refinement

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VERSF Standard-Model Derivation Programme

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Claim level: exact finite-dimensional identities, inherited VERSF source results, and declared regulator or quantum constructions are kept separate from physical source selection. The Fact-Commitment Axiom and Fact-Lock Principle are explicit foundational premises rather than derived claim grades: a completed admissible closure produces a persistent Fact, and the event-local degree of freedom that physically records that Fact cannot subsequently vary so as to rewrite it. The central open tasks are to identify the Fact-bearing record carrier and to derive the independently normalised kinetic or event-work scale. No measured Standard-Model observable is used to select either input.

General Reader Summary

This paper asks how far VERSF can go from microscopic change to the physical strengths of the gauge forces without borrowing those strengths from experiment. Much of the structure is already fixed: matter can be transported consistently, flux changes can be followed around closed loops, and the same source can be tested across different descriptions. The remaining difficulty is to determine the physical cost of a field change rather than merely write down a mathematically compatible cost.

The record problem also becomes much simpler. Existing record machinery reads five independent combinations of six loop directions and misses one alternating combination. Once the ordinary terminal record has thrown that combination away, no later processing can recover it. In that sense the situation is like six dials with only five readings written into the ledger: the mathematics identifies exactly which reading is missing and the unique symmetry type a sixth reading would have to carry.

VERSF treats an irreversible Fact like an append-only ledger entry. The entry that constitutes a Fact cannot later be rewritten, but the working machinery is not frozen: after one event is committed, a fresh event-local degree of freedom is prepared for the next event while the earlier record remains in the growing ledger. The unresolved question is therefore not what force keeps the past true, but which physical degree of freedom actually writes the committed distinction into the record.

Two release routes remain. One can derive the energy cost directly from source-returned work done by a known quantized flux change, or one can identify the Fact-bearing record direction and combine it with the already derived same-branch current-link response. Either route still needs the physical kinetic and time normalisation before gauge couplings can be issued. Measured couplings, masses and mixings are reserved for testing a frozen result, not choosing it.

Abstract

We study physical source selection in the VERSF changing-link and history-normalisation programme. The paper separates graph roughness from holonomy curvature, fixes the relevant face and compact-link geometry, develops a closed-loop work reconstruction of the retained gauge kinetic response, and preserves the action/Fisher and data-selection firewalls. A positive nonfactorising current-link parent can always be constructed for the simultaneously diagonal diagnostic spectra considered here; the nontrivial result is the exact coincidence, in the unit diagnostic convention, between the specific mixed mode function required by the CLI/RCHS pair and the native record-locked response.

The commitment analysis isolates a single alternating Fourier direction that is missed by the existing six-cycle record attachment and annihilated by the ordinary antipodal terminal quotient. Its minimal linear symmetry-covariant record extension is unique up to one gain. VERSF is supplemented by an explicit Fact-Lock Principle: each commitment fixes its own Fact-bearing record coordinate while renewal prepares a fresh event-local coordinate for later commitments, so irreversibility does not progressively freeze a finite working carrier. The physical release remains conditional on identifying the missing direction as the event-local Fact record and on deriving the independent kinetic or event-work normalisation; no physical gauge coupling is issued.

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1 Objective, claim grade and data firewall

The physical-normalisation objective is to determine what the primitive VERSF source must return before a changing-link curvature or history metric can be called physical. The conditional objective extends through gauge-covariant sequential transport, static and dynamic response, an explicit chiral completion, finite relative matching, current-magnitude response, native activation of dark states, free and static positivity, conditional decoupling and source-scale tests. No observed coupling, mass or mixing angle selects these constructions. The analysis includes native transport, loop influence, fixed-input potential exclusion, metric self-consistency, process-geometry and joint-law calculations, together with the full-text corpus audit [75–81].

The paper distinguishes four evidential claim grades and one separate foundational-premise category. Grade A comprises exact finite-dimensional identities and local-response theorems. Grade B comprises inherited VERSF source results. Grade C is the still-open physical execution of the changing-link source or its work-normalised susceptibility; no Grade-C number is invented. Grade D comprises declared regulator and quantum-event constructions, their analytic free and static positivity and conditional spectral bounds, and numerical response, matching and survival results. Foundational premises are not promoted into Grades A-D: the Fact-Commitment Axiom states that completion of an admissible primitive closure produces one persistent Fact, and the Fact-Lock Principle states that the event-local degree of freedom which physically records that Fact is fixed thereafter while later events use freshly prepared active coordinates. Sections 17.83-17.85 test the consequences of those premises without treating them as source-derived theorems. Fact-Lock has the explicit falsifier in Section 18.

The data firewall is strict. Stage A may consume only VERSF source objects and their declared regulator data. Standard-Model observables may enter only after Stage-A outputs have been frozen and versioned. A downstream comparison may falsify a source realization; it may not modify the source or choose a coefficient.

2 Corpus-wide frontier audit

The earlier 1,070-entry screen [64] is superseded for the current closure decision by the enlarged full-text audit [80]. All 589 distinct PDF URLs discovered in the current public catalogues were retrieved, comprising 21,959 pages. A paginated inventory of 17,655 saved file entries supported selection of 115 additional PDF representatives and 399 recent named research documents. The combined screen contains 1,103 extracted entries and 1,094 distinct text hashes. These are entries and versions, not independent papers. Every entry was screened, followed by detailed reading of the action/source dependency chain and stronger closure claims. This is not an independent proof audit of every page, a mathematical-layout verification of every extraction, or an exhaustive inspection of unnamed uploads and undiscovered URLs.

Object	Controlling corpus line	Current status
Physical changing-link source	RCHS-35 / PJCK-1 [3,89]	Exact semidirect off-diagonal kernel architecture is available, but the continuous magnitude-bearing increment law remains unselected. A stopped configuration-diagonal instrument cannot supply it.

Object	Controlling corpus line	Current status
Retained changing-link curvature	PSAC / master-action continuation [8,87,88]	Face/connection geometry is fixed and the graph-Wilson edge operator is type-wrong for closure circulation. Physical retained curvature still requires the source-selected operational metric or an independent work-normalised response.
Finite-source current action	RCHS-1	Positive rank-six current action derived; unit diagnostic $KJ = 48/53$ and current-link reciprocity exact; absolute physical metric open.
Absolute current/history scale	PCRS / PJCK / BCTR-6 [5,89,90]	Relative current geometry is rigid, but D36/PFDMI permits magnitude-changing radial rescalings and the implemented binary-eligibility route is exhausted. One common physical scale remains.
History architecture	HMGBC	Bath-resolved positive history transfer and operational-metric architecture available; physical embedding/normalization remains source dependent.
Neutrino source amplitude	SFNMR-1 / SFNMR-2 [13,85]	Archived amplitude 0.1663661412 is reproducible and conditional. $R_v \approx 0.1696 q $ at tested points; comparator centres require about 5.6–6.3% higher amplitude. Direct action/Fisher identification is inadmissible on typing grounds; its numerical output is diagnostic only.
Universal flavour parent	UFG-1	Common-parent step conditional; first minimal isometric-address blind realization falsified.
Typed sector descent	UFG blind test	Representation-dependent non-isometric addresses and physical current bridges remain the first downstream flavour bottleneck after the parent is fixed.
Gauge coefficients	Compact-link / Wilson / event-work route [91–94]	Gauge coordinate and standard Wilson interface normalisation are fixed. The exact event-work inversion would return the electric kinetic matrix, but the primitive physical work differences are not yet supplied; Z_3, Z_2, Z_q remain unissued.
Generator and geometric refinement	RHFU-1 / RCHS-36F [65,66]	Explicit constructions and relative link scaling exist; transfer selection and absolute physical scale remain separate.
Coupled candidate actions and maintenance refinement	NFDMA-1/2 / RCMO-1 [67–69]	Genuinely interacting candidate levels and seven-level maintenance blocking exist; constitutive and physical-selection premises remain.

Object	Controlling corpus line	Current status
Exact source-visible bath reduction	NFDMA-2 continuation [72]	28 bath modes reduce exactly to six for three fixed channels. Complete midpoint corrections returned; source strength not selected.
Primitive joint-law selection	Full audit / joint refinement / PJCK [80,81,89]	Semidirect composition and positive compatible lifts are explicit. The direct gradient-to-cycle linear bridge is exactly zero; a nonlinear record-stretch response exists but is not history eligibility. The physical amplitude law remains unselected.
Continuum kinetic / event-work normalisation	Fact-to-gauge / K7-ICN / event-energy [91–94]	Exact flux impulse, faithful link-phase normalisation, $c_{\text{norm}}=1$ in the declared Wilson map, and an exact inversion from source work to the retained kinetic matrix. Physical source work remains open.
Fact-Lock and Fact-bearing record carrier	PSAC / PMS / post-commitment audit [8,9,96]	Fact-Lock is a declared append-only admissibility premise, not a restoring-force theorem. The source still has to identify the event-local physical record direction. The six-cycle audit leaves one alternating D6 Fourier mode unresolved; carrier identification and gain remain open.

The corrected frontier explicitly includes RHFU-1 heat-generator tests [65], RCHS-36F ordered-holonomy refinement [66], the genuinely interacting two-level NFDMA-1/2 candidate actions [67,68], and RCMO-1 maintenance-record blocking over seven levels [69]. The link map fixes relative metric scaling and exact Laplacian intertwining while retaining absolute scale freedom. The action and maintenance constructions retain their stated constitutive and physical-selection premises. A unique logarithm of a given positive transfer is also distinct from a physical principle selecting that transfer. These constructions must be reused at their actual grades; generators and refinement maps are not absent from the corpus.

No complete, physically selected common construction supplying all carrier, amplitude measure, relative source normalisation, coupled blocks, matter attachment and compatible regulator maps required for the full action was located in the inspected chain [80]. This is a scoped retrieval and source-premise conclusion, not an absence theorem. The NFDMA bath, RCMO maintenance operator and CGN metric remain distinct. Later HM4 faithful derivatives, MFKR mixed CAR/Fock completion and neutral compression results must be credited at their stated conditional grades; they do not remove the physical common-source requirement.

Gauge energetic matching, neutrino source normalisation and universal flavour share the need for the physical common source. Conditional fermion universality also has a concrete calculational route: Sections 17.13–17.20 execute the gauged transfer, its response, a chiral completion and relative finite matching. Sections 17.33–17.38 add the positive free spectral representation and transfer reconstruction. Sections 17.39–17.50 extend the analysis to static gauge fields, establish a finite-step obstruction and prove its conditional refinement decoupling. Sections 17.51–17.53 test whether a protected Higgs metric supplies the missing scale and establish that it is insufficient within the stated finite-source construction. The stronger physical-source requirement is kept separate from those declared regulator results. Sections 17.54–17.55 record the scale-admission and native-work tests. Sections 17.56–17.60 reuse the recovered NFDMA-2 parent, close its exact source-visible bath reduction and test whether that matching selects its source strength.

The audit also updates the clock and units boundary. The local homogeneous opportunity-to-Lorentzian-time relation is available under its stated source premises [83]. Its attachment to a complete selected dynamics and laboratory calibration remain distinct. PFDMI permits quotienting a common mechanical-action rescaling within its specified observational convention [84]; this does not permit changing relative gauge stiffnesses or identifying probability cost with energetic action. A dimensionless prediction need not await an arbitrary SI unit choice.

3 Why the changing-link source is the correct target

RCHS-29 shows that a fixed-link record process can carry rich current and phase information while remaining blind to an independent pure-link functional. A full configuration transition law can, within a specified split class, reconstruct a relative link potential; a fixed-link marginal cannot. RCHS-35 generalizes the same lesson to changing-link schedules: normalised endpoint conditionals do not assign prior weights to the schedules themselves. The source must provide that weighting or a physically equivalent response.

The current full-corpus audit places primitive joint configuration-law selection first on the path to full action closure [80]. Explicit candidate actions, conditional transfers and refinement maps already exist. The configuration/history route must identify its preparation, event grain, reference kinetics, retained memory and complete law. An independently work-normalised direct response remains a shorter route to a leading quadratic gauge milestone, but such a Hessian does not determine the entire nonlinear, matter and global action. These are route-specific requirements; neither a new binary occurrence mechanism nor a classical continuous-time embedding is compulsory for every route.

The neutrino calculation supplies a useful independent reason to respect this boundary. The same Fold/history geometry produces a plausible hierarchy only after a history normalization is chosen. The new finite-source current action does not remove that need, because action curvature and path-score curvature are not the same object. The physical-source programme must therefore fix the source-to-history normalization at its origin rather than infer it from the success of one sector.

4 Physical objects and notation

Let x denote a local physical quotient coordinate of the full finite-regulator configuration. Split $x = (\theta, a)$, where θ is the retained transverse changing-link/current coordinate and a collects every same-order auxiliary coordinate that the source allows to relax: record, completion, support, unresolved/bath, matter and other link/current components. Let $\Gamma(x)$ be the source action or work functional when such an object has been physically identified.

$$H = D^2\Gamma(x_0) = [[H\theta\theta, H\theta a], [Ha\theta, Haa]].$$

The retained physical curvature is the minimum quadratic action at fixed θ after all allowed auxiliaries are relaxed. On a positive quotient and with the standard range condition,

$$H_{ret} = H\theta\theta - H\theta a Haa^+ Ha\theta.$$

The full-configuration route uses a positive raw transfer $\mathbb{T}$ or its Doob-normalized transition kernel $\mathbb{K}$ together with a source-derived kinetic reference Q , reference measure and clock a_t . The work route uses a conjugate force f whose physical work pairing with θ is fixed independently of the desired response. The history route uses the derivative of the same source-derived raw transfer and the corresponding normalized path score.

The notation W_{prim} is reserved for the physical history/operational metric after the declared history/bath reduction. A source-action Hessian, a finite observation Fisher matrix, a fixed-link likelihood Hessian and a completion resolvent are not called W_{prim} by notation alone.

5 Exhausted routes and non-promotion firewalls

The source and consistency tests identify several insufficient routes to physical closure.

First, fixed-link marginal information is not a changing-link law. The current/link record channel can be differentiated exactly and can have positive rank without assigning a relative physical weight to different link histories. Repeating longer versions of the same conditional record experiment cannot create a pure-link source that the experiment has conditioned away.

Second, synthetic inverse reconstruction is a method test, not source selection. If a full kernel K and reference Q are deliberately generated from a known potential, the inverse can recover that potential. That validates the reconstruction theorem. It does not make the synthetic price physical.

Third, the positive current action is not automatically the history/Fisher metric. RCHS-1 derives a positive current action after complete auxiliary relaxation and an exact current-link reciprocity relation. PCRS proves that a common rescaling of a magnitude-bearing event process can leave all relative geometry intact. The action/Fisher scale bridge is therefore a source theorem, not a naming convention.

Fourth, the canonical $K7$ scalar, the typed κE_2 candidate, and the history-normalized neutrino source amplitude are comparison or conditional branch quantities. None may be promoted simply because it lies near a phenomenologically useful value. The same prohibition applies to a successful gauge or flavour output.

Fifth, fixing a protected Higgs metric does not by itself select the operational metric in the directions that produce current and gauge defects. Sections 17.51–17.53 give an explicit positive family preserving the whole protected sector and the effective current–link conversion while changing both stiffnesses. The conditional Gaussian identities and reciprocity therefore cannot be treated as an absolute normalisation rule.

Sixth, compatibility is not selection. Exact endpoint subdivision, metric/action self-consistency or a chosen process-information metric cannot replace a derivation of the full update-amplitude law. Conversely, failure of one additional homogeneous independent joint-refinement prescription does not exclude state-dependent laws, retained memory or controlled approximate refinement. Sections 17.65–17.80 supply the precise tests and their limits.

6 Full-configuration reconstruction route

RCHS-34/35 establish a useful exact inverse within a specified positive split-transfer class. Let $\mathbb{K}$ be the admitted configuration transition kernel and Q the source-derived kinetic reference on the same state space and event grain. On the diagonal, the Perron/Doob factors cancel in the ratio that isolates the state potential. Relative to a reference configuration z_0 ,

$$V(z) - V(z_0) = -a_t^{-1} \log\{ [\mathbb{K}_{zz} / Q_{zz}] / [\mathbb{K}_{z_0 z_0} / Q_{z_0 z_0}] \}.$$

On an admitted smooth chart, differentiating this relation gives a candidate split-potential curvature. That curvature is not yet W_{prim} . Kinetic field-dependence, current, records, completion, support and matter must enter the same physical parent before the retained Schur reduction is formed. The full kernel must also pass the compatibility test that it is actually the Doob transform of the reconstructed raw operator rather than sharing only the same diagonal.

The value of this route is conceptual and practical. If the primitive source returns the full changing-link configuration law, the relative potential need not be guessed. The kernel and kinetic reference determine it. The remaining common additive constant in V disappears from the Hessian and therefore cannot masquerade as a force-strength selector.

7 Work-normalized susceptibility route

A full stochastic kernel is not the only admissible release route. RCHS-35C shows that, at quadratic order, an independently normalized conjugate source can return the retained action without separately identifying the kinetic map. The key requirement is that the force and the unforced response belong to the same physical source and that the work pairing is fixed before the output is inspected.

Let f be the physical generalized force conjugate to θ , so the perturbed quadratic action is $\Gamma_f(x) = \frac{1}{2} x^T H x - f^T \theta$. At stationarity, after auxiliary relaxation,

$$H \text{ret } \theta = f.$$

The static susceptibility is therefore

$$\chi \theta = \partial \theta / \partial f |_0 = H \text{ret}^{-1}$$

on the retained positive quotient. If null directions remain, the statement is made on the source-specified quotient with the Moore-Penrose inverse and the appropriate range condition. The work-normalized route thus determines $H \text{ret}$ directly from the response, provided the force is genuinely conjugate to the retained physical coordinate.

A symmetric positive susceptibility is not by itself a calibration certificate. RCHS-35 gives explicit examples in which an incorrectly forced benchmark remains symmetric but changes the retained coefficient. The independent work pairing is therefore a load-bearing source input.

Section 17.55 tests a concrete possible attachment: the native mean recording kick as a conservative static work gradient on the supplied preparation. Its nonzero two-coordinate curl rules out that direct identification. The susceptibility theorem remains valid for an independently derived physical conjugate force; the failed attachment does not invalidate that route [70].

8 Dual-route retained-curvature theorem

The two routes give one exact release condition.

Theorem 1: Dual-route retained-curvature theorem.

Assume one physical finite-regulator source admits both (i) a full configuration kernel with its kinetic reference, measure and clock, and (ii) an independently work-normalized force-response experiment on the same quotient. Let the full-kernel route reconstruct the same-source Hessian H and let the work route return $\chi \theta$. Then, after the same auxiliary relaxation and quotienting,

$$H \text{ret}(\text{kernel}) = H \theta \theta - H \theta a H a a^+ H a \theta = \chi \theta^{-1} = H \text{ret}(\text{work}).$$

Proof. The first equality is the standard Schur reduction of the same quadratic parent. The second follows from stationary response to the conjugate force. Both represent the minimum quadratic action at fixed θ , so equality is necessary whenever the two experiments describe the same physical source. ■

Corollary 1.1: Physical-source falsifier.

A regulator-stable disagreement between the two retained curvatures cannot be repaired by rescaling a downstream observable. It means that at least one of the following is wrong or incomplete: the claimed full configuration source, the kinetic reference/clock, the work pairing, the retained tangent, the auxiliary set, or the assumption that the two calculations belong to one source.

This theorem is deliberately modest. It does not manufacture a physical source. It turns “choose a normalization” into a consistency equation that a source-derived normalization must satisfy.

9 From changing-link source to the physical history score

The retained action is still not automatically the HMGBc history metric. The source-to-history bridge must be executed rather than named. The correct object is the derivative of the source-derived raw positive transfer with respect to the already-normalized physical changing-link/current coordinate.

$$\mathbb{T}\varepsilon = \mathbb{T}_0 + \varepsilon \mathbb{T}h + O(\varepsilon^2), \quad h \in E_2 \otimes (C, W, Y).$$

The current-score audit has already fixed the residual-level unit of the physical cycle current. The missing magnitude is therefore not a coordinate convention on h ; it is the source derivative $\mathbb{T}h$ itself. Once that derivative is known, normalized path scores follow from Perron perturbation and no second current-score gain may be inserted.

For the changing-link paper the source requirement is stronger than a single six-vector. Because the physical source is graded, colour, weak, hypercharge, record, completion and CAR/Fock contributions can enter at different differential orders. At a nonzero admitted background, higher source jets can contribute through background contraction. The object to be returned is the complete representation-resolved derivative on the physical $E_2 \otimes (C, W, Y)$ tangent, with every same-order source term included.

10 Perron/Doob source-to-history release theorem

Let $\mathbb{T}\varepsilon$ be a positive raw transfer with Perron data $\lambda\varepsilon$, $r\varepsilon$ and $\ell\varepsilon$, normalized by $\ell\varepsilon \dagger r\varepsilon = 1$. The Doob kernel is

$$P\varepsilon(i, j) = \mathbb{T}\varepsilon(i, j) r\varepsilon(j) / [\lambda\varepsilon r\varepsilon(i)].$$

For a fixed physical changing-link/current direction h , define $\mathbb{T}h = \partial\varepsilon \mathbb{T}\varepsilon|_0$. Perron perturbation gives

$$\begin{aligned} \lambda h &= \ell_0 \dagger \mathbb{T}h r_0, \\ (\mathbb{T}_0 - \lambda_0 I) r h &= -(\mathbb{T}h - \lambda h I) r_0, \quad \text{with } \ell_0 \dagger r h = 0. \end{aligned}$$

The normalized one-step score is then

$$Sh(i, j) = \mathbb{T}h(i, j)/\mathbb{T}_0(i, j) + r h(j)/r_0(j) - r h(i)/r_0(i) - \lambda h/\lambda_0.$$

Theorem 2: Source-to-history release theorem.

Once the primitive source returns $\mathbb{T}h$ in the physical current/link coordinate, the normalized score Sh is unique. The corresponding stationary score covariance is therefore fixed, and after the declared HMGBc bath/defect Schur reduction the physical W_{prim} is fixed at that regulator. No additional history-score normalization may be chosen independently.

This is the key reason the changing-link source is higher leverage than another flavour calculation. It is the last place where the amplitude can be selected legitimately. Downstream completion, neutral and flavour calculations must consume the returned score rather than choose its norm.

11 Current-link reciprocity and the action/Fisher firewall

The primitive source already supplies an important constraint on the changing-link solution. RCHS-1 derives, within one common four-variable source block, an exact current-link reciprocity relation. In the scalar branch,

$$1/KJ_{\text{relaxed}} = 1/wJ + \kappa^2/(2K\theta).$$

On the unit diagnostic branch $K\theta = 24/5$ and $KJ_{\text{relaxed}} = 48/53$. At full matrix level the corresponding Woodbury identity relates the relaxed current metric, the bare current metric, the link stiffness and the constitutive current-link map. These are two Schur views of one source action, not independent normalizations.

This result sharply constrains the eventual physical changing-link source, but it does not turn the action Hessian into W_{prim} . PCRS proves an exact action/Fisher scale firewall: agreement of relative matrix shape does not fix the statistical event/history scale unless the source derives the action-to-transfer or action-to-mark map. A common action rescaling changes the source stiffness while leaving many relative structures unchanged.

The present paper therefore treats current-link reciprocity as a same-parent fingerprint that the physical source must pass. It is not used as a substitute for the raw-transfer derivative required by Theorem 2.

The protected-metric test in Sections 17.51–17.53 makes this freedom explicit on the full native source: it survives even when the entire defect-silent sector and a nonzero effective current–link conversion are held fixed. The result concerns direct action normalisation. RCHS-1 Section 14 Branch D [4] permits that route without requiring binary Fact occurrence to become current dependent; any claimed history or completed-Fact prediction must still supply its own physical attachment. Section 17.54 establishes that varying this family changes upstream source data in its Gaussian realization; no second fully admitted physical model is thereby produced.

12 Neutrino amplitude sensitivity and the source-type check

SFNMR-1 supplies a reproducible downstream test of the source-to-history conversion [13, Section 12.6]. Write for the scalar history normalisation before multiplication by the fixed projected source vector, whose norm is one half. The archived value is ; the vector actually inserted therefore has norm . The reconstructed history solve and six-state neutral parent give

$$m_1:m_2:m_3 = 1:1.04682488:2.09668389, R_v = 0.02822143.$$

At the four tested amplitudes spanning approximately 0.05885–0.17099, the ratios are 0.1684–0.16970. Thus

$$R_v \simeq 0.1696 |q|,$$

to within about 1% at the tested points, with finite-amplitude secant slopes near 0.17. This is a measured response of the declared projected-source calculation, not a theorem for all amplitudes or source laws. It means that a fractional change in the source-to-history conversion produces approximately the same fractional change in the neutrino ratio on this branch.

The independently motivated values and 0.17099000 give and 0.02901776. They lie only 0.18% and 2.78% above the archived amplitude, respectively. Their nearby outputs follow from the measured near-linearity; they do not establish insensitivity to normalisation or independently validate the archived value. Their source provenance remains distinct from the question of which value is physically selected.

The experimental comparisons make this sensitivity quantitative. SFNMR-1 retains its NuFIT 6.0 normal-ordering benchmark; SFNMR-2 records the NuFIT 6.1 comparison with the atmospheric tables included [13,85]. The following amplitudes describe matching the comparator centres while retaining the same projected-source map.

Comparator	Central ratio	Matching amplitude	Increase over archive	Approximate residual
NuFIT 6.0	0.0298050	0.1756	5.6%	−2.0σ
NuFIT 6.1	0.0300159	0.1769	6.3%	−3.9σ

The 6.0 amplitude is the secant diagnostic reported in SFNMR-1. The 6.1 estimate follows by extending the measured secant slope near 0.17 from the archived point. Both matching estimates lie beyond the upper

scan point and require an exact downstream evaluation for any physical Stage-A return; their displayed digits are not a certified amplitude tolerance. A 6.3% increase relative to the archived amplitude corresponds to a ratio about 6.0% below the 6.1 comparator when the deficit is expressed relative to that comparator.

The residuals use the same symmetrised-one-sigma, Gaussian, zero-covariance approximation. With and ,

$$\sigma_R^2 \simeq \frac{\sigma_S^2}{D^2} + \frac{S^2 \sigma_D^2}{D^4}, \quad z = \frac{R_v - S/D}{\sigma_R}.$$

For 6.0 the inputs are , , and , all in eV^2 . For 6.1 they are , , and eV^2 , obtained by symmetrising the intervals quoted in SFNMR-2. These give ratio uncertainties 0.0007924 and 0.0004575 and signed residuals -2.00 and -3.92 . Neither is a formal exclusion significance: that requires the joint likelihood or covariance, a declared decision threshold and justified treatment of theoretical uncertainty.

Direct action/Fisher identification is inadmissible on the PCRS typing grounds in Section 11, independently of neutrino data: no physical map identifying those differently typed stiffnesses has been derived. Evaluating this shortcut only as a post-freeze diagnostic gives and , lower than the archived amplitude and ratio by factors of about 2.83 and 2.85, respectively. The numerical discrepancy illustrates the consequence of the unsupported identification; it is not the reason for rejecting it and cannot select a replacement normalisation.

CLSN-1 therefore has a quantitative downstream test: derive and freeze the physical source-to-history conversion without using neutrino data, then evaluate its ratio through the unchanged projected-source chain. Matching the stated comparator centres would require an independently derived amplitude roughly 5.6–6.3% above 0.1664. This is a Stage-B benchmark, not a Stage-A selection rule or an acceptance interval. A statistically incompatible result under the declared comparison protocol rejects that specified branch at the tested order. Any independently derived correction or change of source map must be frozen and reported as a successor prediction, not used to retune the archived one.

The conditional mark score retains centred factor information, while a magnitude-bearing event-rate process also contains a rank-one total-rate contribution. The shared source problem is to derive that channel's strength and its physical dynamical attachment. The occurrence and survival constructions in Sections 17.26–17.32 do not supply a selected replacement amplitude; the archived mass shape remains the conditional result on record.

13 Handoff to universal completion geometry

Once W_{prim} and the physical terminal-history geometry are returned, the common completion route is already defined. Stationary history flow produces the terminal conductance geometry and the universal generation Laplacian $\Delta\Omega$. The universal completion resolvent is

$$R\Omega = (WH + \Delta\Omega)^{-1} WH, \quad R\Omega^{\text{or}} = VH^\dagger R\Omega.$$

The NSD Fold quotient fixes the primitive source representative before this nonlinear response. A physically derived changing-link/history normalization then fixes the source amplitude that enters the history law. The output of CLSN-1 should therefore be a frozen universal parent: source ledger, W_{prim} , terminal conductances, $\Delta\Omega$, $R\Omega^{\text{or}}$, and regulator/provenance certificates.

This is the physical-normalization handoff to the flavour programme. The first blind UFG execution showed that the minimal isometric address compression is not the physical flavour descent: the charged and quark hierarchies are too shallow, and identity current bridges fail. Sector-specific fitted weights are not

introduced. The conditional gauge and matter calculations in Section 17 can nevertheless be pursued before this physical flavour handoff is completed.

14 Consequences for gauge energetic matching

The same output is the first item on the gauge critical path. RCHS-35 gives the locked route

physical changing-link source $\rightarrow W_{\text{prim}} / \text{Gred}(\text{phys}) \rightarrow$ generator-differentiated gauge columns $\rightarrow$
(Z_3, Z_2, Z_q) $\rightarrow$ canonical gauge fields and RG.

The physical source must be inserted into the complete same-source Hessian before auxiliary reduction. Only then may the fixed representation/generator columns be used to form the strong, weak and hypercharge kinetic coefficients. The structural K7 scalar remains a post-derivation comparator, not an input.

Current-link reciprocity provides an additional release test: the current and matched connection blocks returned by the physical source must be compatible with one parent. A failure of the matrix reciprocity residual after all required fields and nulls are included means that the source contains additional structure and the simplified scalar branch must be replaced.

The extra Higgs anchor does not close this requirement. The source must select the operational metric on defect-producing directions, including its current-link cross terms, and its physical reduction. Protected-sector normalisation alone leaves the scale family in Section 17.52 unresolved. Sections 17.59–17.60 additionally show, on the NFDMA-2 candidate, that all three effective blocks must descend from one parent and that exact matching alone still leaves the source amplitude unselected.

15 Consequences for universal flavour

The universal-flavour programme requires one source ledger for the up, down, charged-lepton and neutral sectors. The first minimal blind execution passed the Fold quotient and a conditional common parent but failed the physical typed-address and current-bridge gates. Its charged and quark singular-value ratios were only of order two, and the identity-current CKM/PMNS witnesses failed strongly.

Therefore the correct downstream task after CLSN-1 is not “fit the four sectors.” It is to derive the representation-dependent non-isometric physical addresses BQ, Bu, Bd, BL, Be and BN, together with the physical relative current bridges Jq and Jc, from the same physically normalized source. The large charged/quark hierarchies and nontrivial relative flavour frames must emerge from typed compression, not from four independently declared generation matrices.

The physical-normalization branch of CLSN-1 is judged on whether it derives the common parent; its conditional dynamics are assessed by the operator identities and response calculations below. The subsequent universal-flavour paper must establish whether the Master Action’s typed descent converts that physical parent into the observed hierarchy pattern without tuning.

16 Source-only execution protocol

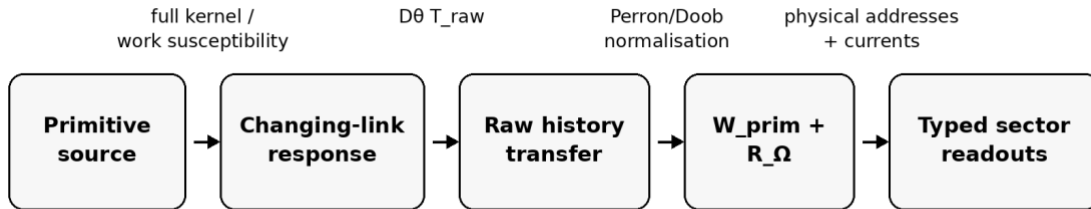
The execution separates source derivation from comparison. The Section 12 comparators are already known, so this protocol does not claim historical blinding. Before computing a successor result, register the source premises, permitted corrections, comparator version, comparison statistic, treatment of uncertainty and acceptance or rejection criterion. Experimental targets must not select the Stage-A source, normalisation or correction terms.

Stage A: source-only.

1. Freeze the physical branch, regulator level, event grain, clock, reference measure, primitive current/link tangent and admissibility criteria using source premises alone; record their provenance before executing the downstream comparison.
2. Return either (A) the full physical changing-link configuration kernel plus kinetic reference, or (B) an independently work-normalized susceptibility on the same physical quotient.
3. Construct the complete same-source quadratic parent, including all same-order current, record, completion, support, unresolved/bath and matter contributions; perform the allowed Schur reduction.
4. If both release routes exist, require $H_{ret}(\text{kernel}) = H_{ret}(\text{work})$ within the pre-declared regulator/numerical tolerance.
5. Return the raw history-transfer derivative Th on the $E_2 \otimes (C, W, Y)$ tangent; apply Perron/Doob normalization and the declared history/bath reduction to obtain W_{prim} .
6. Compute the terminal conductances, $\Delta\Omega$ and $R\Omega^{\text{or}}$. For a neutrino claim, return the physical amplitude and its uncertainty in the source convention of Section 12, together with the required action-to-history map. Freeze the complete output, correction terms and source hashes before Stage B.

Stage B: comparison only.

7. Run the frozen SFNMR source chain with the physical Stage-A amplitude and report R_v without adjustment. Report its displacement from 0.1663661412 and compare the exact output against the separately labelled NuFIT 6.0 and 6.1 benchmarks in Section 12. The approximate matching amplitudes 0.1756 and 0.1769 are post-freeze diagnostics, not inputs or an acceptance band.
8. Pass the same frozen parent to the typed-address/current-bridge calculation and report the four-sector masses/mixings without changing Stage A.
9. Pass the same physical gauge parent to the gauge energetic reduction and report Z_3 , Z_2 and Z_q only after canonical normalization.
10. Report the result under the predeclared comparison criterion, including numerical and justified theoretical uncertainty. A statistically incompatible result rejects the specified branch at the tested order. No downstream observable may change its source normalisation or select a correction; any independently derived successor has separate provenance and leaves the archived prediction on record.



No Standard Model observable is allowed upstream of the frozen Stage-A output.

Figure 1. The source-normalization release chain proposed in CLSN-1. The physical changing-link source sits upstream of both gauge energetic matching and flavour.

17 Executed D41 and the joint dynamical continuation

The executed results below distinguish exact identities and conditional constructions from the unreturned physical source. Each result retains its stated branch, regulator and numerical scope.

Required Stage-A object	Corpus return	Verdict
Physically selected full changing-link configuration kernel	Exact architecture / physical amplitude open	PJCK-1 gives the semidirect primitive increment measure, raw pushforward and Perron/Doob chain. The source-selected continuous increment distribution remains missing.
Physical kinetic reference + clock on the full carrier	Partial / conditional	Several branches provide declared references; no source-selected complete changing-link package is returned.
Work-normalized physical susceptibility	Method and conditional benchmarks only	RCHS-35C gives the exact route and verifies it on declared benchmarks; the physical conjugate source is not returned.
Complete same-source quadratic parent	Strong partial	Current-link source action and reciprocity are derived; full physical W_{prim} / changing-link response still open.
Raw-transfer derivative Th on $E_2 \otimes (C, W, Y)$	Open	The normalized score formula is known and unique once the raw derivative is supplied. D36/PFDMI discrete history data do not select its magnitude.
Physical W_{prim}	Open	Conditional history metrics exist; source audit reports no physical W_{prim} is returned.
Universal completion parent	Conditional	Executable once a history normalization is supplied; physical parent normalization remains open.
Typed addresses/current bridges	Open downstream	Minimal isometric proxies are falsified by the blind UFG test.
Source-derived event work / electric kinetic matrix	Exact inversion / physical work open	Charge-normalised flux impulses and work-difference inversion reconstruct the retained kinetic matrix exactly. Existing native-work calculations assume the kinetic coefficient; the primitive physical work return is still absent.

D41 is executable at its stated conditional grade. The representation-resolved operators, current-cycle history score and conditional bath reduction are executable. What remains unreturned is the primitive same-source weighting that would make the resulting tensor the physical action/history response rather than a conditional history branch.

17.1 Exact zero of the factorised history×mark route

For a product architecture $p(h, m) = p(h)p(m|h)$, the conditional internal score obeys $E[s_{\text{int}}|h] = 0$ because $\Sigma_m p(m|h) = 1$. Hence any history-only bath score $B_a(h)$ satisfies $C_{\{a\mu\}} = E[B_a s_{\mu}^{\text{int}}] = 0$ exactly. The

frozen PFDMI/irreversible-wheel execution returns $\|C\|_F = 1.99 \times 10^{-16}$, maximum entry 3.10×10^{-17} and numerical rank zero. The factorised attachment is therefore closed negatively, not merely unresolved.

$C_{\text{factorised}} = 0$.

17.2 Nonfactorised current-cycle history return

The current-cycle raw-transfer audit supplies the full MASD E_2 current-cycle score on the irreversible history law under the declared HM12 attachment. The direct real Fisher coefficient is $0.0551296278772322 I_2$. Its spatial decomposition is 0.0405907994798115 from the uniform $m=0$ circulation plus 0.0145388283974207 from the indispensable $m=2/4$ component. Eliminating the six state-function bath modes gives $0.0504814732865564 I_2$, an 8.43131863873% total screening.

$W_{\text{cyc}}^{\text{direct}} = 0.0551296278772322 I_2$, $W_{\text{cyc}}^{\text{red}} = 0.0504814732865564 I_2$.

17.3 Representation-resolved D41 lift

RCCS] supplies terminal-sector probabilities $p_r = (2, 6, 2, 9, 9, 18, 3)/49$ and central factor signatures χ_C, χ_W, χ_Y . At the reference branch the marked rate score factorises as $s_{\{A\mu\}} = g_{\text{cyc}} \chi_A(r) s_{\mu}^{\{\text{cyc}\}}$. Therefore the history-bath cross covariance lifts across factor space with the mean signature $\bar{\chi} = (36, 26, 47)^T / 49$. Writing $d = 0.0551296278772322$ and $\Delta = d - 0.0504814732865564 = 0.004648154590676$ gives

$W_{D41}^{\text{red}} = g_{\text{cyc}}^2 [d H_{CWY} - \Delta \bar{\chi} \bar{\chi}^T] \otimes I_2$.

The three-by-three factor block evaluates numerically to

$[[0.03799444, 0.01843967, 0.03722782], [0.01843967, 0.02794377, 0.02688676], [0.03722782, 0.02688676, 0.04860298]]$.

Its eigenvalues are approximately $(0.00432107, 0.01393100, 0.09628913)$, each doubled by the two E_2 quadratures. The tensor is therefore positive definite and rank six. The history bath removes about 6.6001% of the factor-resolved trace.

17.4 D41 is genuinely nonfactorising

The bath-reduced tensor is not exactly a common scalar multiple of H_{CWY} . Its best Frobenius scalar fit leaves a 1.25515% relative shape residual. For the $m=2/4$ sector alone, the corresponding reduced factor block has eigenvalues approximately $(0.00114258, 0.00367411, 0.02688393)$, trace screening about 1.9815%, and only a 0.35636% residual from the best scalar H_{CWY} fit. Thus the nonuniform representation-resolved current mode is highly rigid but not perfectly factor blind.

17.5 Factor-blind 144-link branch falsifier

The exact canonical-wheel factor-blind HMGB branch was previously carried through the full 144-link, rank-72 curvature pullback. After the correct link-to-face coordinate conversion it yields a definite gauge triple, but the two independent coupling ratios correspond to one-loop Standard-Model matching scales separated by 4.537 decades. No single one-loop matching scale reproduces both ratios. This is a branch-level falsification of that factor-blind continuation, not a falsification of VERSF. It raises the scientific priority of the nonfactorising D41/same-source route.

17.6 Source-authority boundary after D41

The direct same-source HM4 assembly was also tested. HM4-EX4A faithfully contains the 144-dimensional gauge carrier and completion descent, but its gauge quadratic explicitly uses the prior RRHF reduced stiffnesses $(1, 5/2, 298)$. Its calculation report therefore grades the gauge Hessian as conditional on RRHF-1.

Record and CAR/Fock source derivatives also do not inhabit one common independently weighted primitive parent there. Using that stack to derive those same weights would be circular. The non-circular stopping point is therefore the D41 tensor above plus the demand for a primitive same-source physical quadratic parent.

17.7 Exact D41 portal alignment and native response comparison

The D41 continuation [23] identifies an exact relation to the RCHS Abelian portal. Let denote the factor Gram matrix in §17.3, , and . The terminal support identity gives . Per real quadrature, write

$$W_0 = g_{cyc}^2 dH, \quad W = W_0 - g_{cyc}^2 \Delta u u^T.$$

For nonzero gain this is a positive rank-one reduction. Its affected generalized eigenvalue and dimensionless portal strength are

$$r_Y = 1 - \frac{\Delta}{d} H_{YY} = 0.919128168159,$$

$$\alpha_Y = r_Y^{-1} - 1 = 0.0879875458532.$$

The other two generalized eigenvalues are exactly one. Each eigenvalue occurs twice on the two real current quadratures. Thus four directions on the six-dimensional carrier are protected and two are screened by 8.08718318409%. The determinant and inverse identities reproduce the single-portal matrix form exactly. This is a relation between conditional statistical matrices; it does not identify the active history-bath coordinate with a physical closure coordinate, and it leaves the common source gain undetermined.

The native four-variable current-link block was also reduced directly. The inherited unit-weight diagnostic gives 9.43396226415% screening, compared with 8.08718318409% for the D41 direction. This comparison does not falsify physical identification because the unit weights are a diagnostic, not a selected physical background. Positive families can satisfy an imposed matching condition, demonstrating why that condition alone does not select the primitive weights. The native mixed response must include the actual current and endpoint correlations, the full defect metric and its derivatives, and all responding fields. The 22 portal checks and 10 additional native-block checks pass [23].

17.8 Static handshake and sequential record transport

The proposed hard endpoint rule was tested on one simultaneous shared-vertex configuration [24]. At flat links, imposing a minus-sign handshake on every edge of the triangular wheel forces a nonzero endpoint to equal its negative after an odd loop, so the only shared field satisfying all constraints is zero. A soft unit-norm continuation has explicit minima, but endpoint-relaxed link curvature depends on the internal coherent background and can be negative. Those are limitations of the declared simultaneous construction.

The chronological native instrument was then evaluated separately [25]. Its three-step composition carries the internal state and appends records without equating an endpoint at the final time with the endpoint at the initial time. All 343 terminal words were evaluated on the archived nonzero-current witness. They are positive and normalized. The carried-state probability for the Q Q Q word is 0.341541559015283; independent fresh resets instead give 0.049571182075496. Retaining the carried state is therefore numerically consequential.

The same witness has a stationary-density family of real affine dimension at least 45. Repeating that channel cannot select a unique stationary preparation. Its carried density and terminal record are also distinct from the full endpoint, link and Fold configuration. The 50 static-handshake checks and 53

sequential-instrument checks verify these respective claims [24,25]. The static zero must not be transferred to sequential dynamics as a no-go theorem.

17.9 Joint matter and flux after a transport event

The shared-link CAR source admits an explicit conditional matter–flux evolution [26]. For an oriented edge from a to b and integer compact charge n , its transport factor is

$$T_e = c_b^\dagger e^{in\theta_e} c_a.$$

For a supplied joint density, conditioning on this branch gives

$$\rho_e = \frac{T_e \rho T_e^\dagger}{\text{Tr}(T_e \rho T_e^\dagger)}.$$

The later state is obtained by the specified joint Hamiltonian evolution, with the appended record retained. In the isolated two-state kinetic projection the resulting occupation, dressed coherence, current, electric flux and energy are obtained exactly. This projected solution is conditional on its kinetic matrix elements and event preparation. In particular, tracing out the distinct flux states can remove the reduced matter coherence while leaving a nonzero gauge-dressed current. Local occupation probabilities or fermion one-point functions cannot reconstruct the independent MASD endpoint amplitude.

With all twelve wheel hopping edges restored, the finite-order propagation verifies Gauss preservation and a triangular branch in which the particle returns while the cycle flux changes. The 28 checks in [26] verify the conditional state and these full-wheel terms. The event factor is not a complete selected Fact instrument with a derived occurrence probability or commitment energy budget.

17.10 Exact six-loop coordinates and inherited spatial normalization

The source results [27,31] establish two scope distinctions. The normalized spatial Dirac/Weyl principal symbol is already supplied at the declared three-dimensional refinement grade. Moreover, moving charge is compatible with six independent loop fluxes once the charge-carrying reference flux is retained.

Let B be the vertex-by-edge incidence matrix of the seven-vertex wheel. Orient rim edges and spokes. Let Z have columns, and choose, . In the sector with one mobile charge n and a stationary charge $-n$ at the hub,

$$Bp = n(e_v - e_h), \quad p = n\gamma_v + Zk, \quad k \in \mathbb{Z}^6.$$

The decomposition is exact and unique: subtract the reference path, read the six rim entries as k , and note that a divergence-free flux supported only on the remaining spoke tree must vanish. Consequently

$$\mathcal{H}_{\text{phys}} \simeq \mathbb{C}^7 \otimes \ell^2(\mathbb{Z}^6),$$

with a spin factor when required. For an edge e from a to b , define . Transport maps to . In this tree convention spoke increments vanish and rim increments are the six unit vectors. The charge boundary is carried by the particle-dependent reference term, not discarded.

On the conditional independent-edge Wilson branch, the dimensionless electric energy remains exactly

$$\tilde{E}_E(v, k) = \sum_e -\log \frac{I_{|n\gamma_{v,e} + (Zk)_e|}(\beta_e)}{I_0(\beta_e)}.$$

Six independent coordinates retain all twelve inherited edge-energy contributions. Positive finite makes each kinetic eigenvalue positive, without asserting a uniformly bounded inverse. This is a coordinate equivalence of the specified Wilson action, not an identification with a different field-only cycle action.

MFKR [31] independently fixes the spatial infrared moment tensor to the canonical identity, modulo the declared spin-frame convention. On the minimal anti-adjoint branch its edge spin coefficient is . The first-order infrared normalization does not supply every microscopic edge direction or weight, and an allowed adjoint-even edge contribution can modify finite-momentum terms without changing that first-order result. The 58 checks in [27] verify the Gauss bijection, transport, reference-path covariance, electric spectrum and spin amplitudes through fourth order, including nonzero even edge terms. The earlier charge-independent field-only support failure remains scoped to that factorized construction.

17.11 The exchange ratio and the full-wheel leakage test

For a strictly positive transfer T on a two-dimensional invariant sector, define and the signed detuning ratio

$$R = \frac{H_{BB} - H_{AA}}{2|H_{AB}|} = \frac{T_{AA} - T_{BB}}{2|T_{AB}|}.$$

The equality follows from the spectral logarithm of a two-by-two Hermitian matrix; it requires nonzero off-diagonal coupling. The clock and common transfer normalization cancel. They do not fix the relative transfer entries [28]. For the conditional comparison ,

$$R = \frac{\tanh(\delta/2)}{\sinh x}, \quad \delta = -\log \frac{I_1(\beta)}{I_0(\beta)}.$$

The temporal coefficient β remains present. Identifying x with a spatial edge weight requires the declared temporal attachment; it is not supplied by the ratio cancellation.

The hub–rim pair is not invariant under the full primitive wheel hopping Hamiltonian. If P projects onto that paired spin sector and Q is its complement, the exact first-step leakage is

$$(QHP)^\dagger(QHP) = \text{diag} \left(\frac{1}{4} \sum_{j=1}^5 w_{s_j}^2, \frac{1}{4} (w_{r_0}^2 + w_{r_5}^2) \right).$$

For positive edge weights it cannot vanish. The two-state maximum transfer probability is therefore a projected result, not a full-wheel prediction. Nor can one generally replace the compressed logarithmic generator by the logarithm of the compressed transfer. The 26 checks in [28] verify the ratio, finite-step correction, β dependence, leakage and noncommutation. A full calculation must retain the coupled states or justify their dynamical elimination.

17.12 Auxiliary integration with fermions retained

Configuration Dynamics XIII already supplies the frequency-dependent bosonic parent reduction [3]. Retaining a fermion bilinear source gives an exact additional identity on the Gaussian, linear-auxiliary class. Write

$$S = 1/2 a^T A a + a^T B \eta + 1/2 \eta^T D \eta + S_{F,0} + \eta^T J_F.$$

For positive auxiliary kernel D on the declared quotient, integration gives

$$S_{\text{eff}} = 1/2 a^T (A - B D^{-1} B^T) a + S_{F,0} - a^T B D^{-1} J_F$$

$$-1/2 J_F^T D^{-1} J_F + 1/2 \log \det D + \text{constant}.$$

The same auxiliary inverse determines the bosonic response, mixed bilinear correction and induced four-fermion interaction. Nonlinear dependence of the original kinetic matrix on the auxiliaries can also change its averaged bilinear. This integration does not by itself equate electric and fermion-transfer coefficients [29].

The earlier no-sewing test assumed only within-interface fermion terms and a product fermion measure, with no cross-interface sewing in the regulator, boundaries or insertions. That starting point has an independent fermion parity at each interface; bosonic integration preserves it and cannot generate a cross-interface bilinear. The resulting zero is a control for that incomplete action. It is not a VERSF no-go or evidence that coherent propagation is absent from the corpus. The 21 checks in [29] retain this narrow interpretation.

17.13 Conditional gauged sequential transfer and exact vertices

The Chiral Regulator Universality Matching source [30, §18.6] already constructs the signed sequential kernel

$$D_{\text{HT}}(\omega, q) = \frac{I - e^{-a_t K(q)} e^{i\omega a_t}}{a_t}.$$

On its specified spatial Wilson branch and simultaneous refinement, it returns the unit-normalized Weyl pole and a unique free zero in the fundamental zones. These are inherited conditional results. MFKR [31, §§25–28] distinguishes them from the stronger theorem that the complete microscopic source uniquely selects the physical chiral family. It explicitly allows local one-loop universality to be pursued without first closing that stronger identity.

For a declared gauge-covariant spatial family, the continuation [29] constructs

$$A_n[U, \Omega] = \Omega_n e^{-a_t K_n[U_n]}, \quad (D\psi)_{n+1} = \frac{\psi_{n+1} - A_n \psi_n}{a_t}.$$

Here Ω maps the lower-interface colour fibre to the upper one. It is a sequential identification, not a new primitive spatial direction. The displayed ordering is a conditional extension of the admitted family; unique microscopic selection is not asserted. Under independent interface frames,

$$\begin{aligned} K_n' &= G_n K_n G_n^\dagger, & \Omega_n' &= G_{n+1} \Omega_n G_n^\dagger, \\ A_n' &= G_{n+1} A_n G_n^\dagger, & D' &= \mathcal{G} D \mathcal{G}^\dagger. \end{aligned}$$

No independent matter–gauge multiplier is introduced. With , the smooth-background limit is in this convention. The signed K is retained; replacing it by its absolute value would remove the spinorial orientation needed for the Weyl operator.

Put . The exact first variation is

$$\begin{aligned} \delta E &= -a_t \int_0^1 e^{-a_t(1-s)K} (\delta K) e^{-a_t s K} ds, \\ \delta A &= (\delta \Omega) E + \Omega \delta E. \end{aligned}$$

Writing and for the first and second Fréchet derivatives gives

$$\delta^2 E = L_{\text{exp}}(-a_t K, -a_t \delta^2 K) + D^2 \exp_{-a_t K}[-a_t \delta K, -a_t \delta K],$$

$$\delta^2 A = (\delta^2 \Omega)E + 2(\delta \Omega)(\delta E) + \Omega \delta^2 E.$$

Thus the one-gauge-field vertex and the two-gauge-field contact term are both explicit, including noncommuting matrix response. Differentiating the full gauge orbit gives

$$\delta_A D = i[A, D], \quad \delta_A^2 D = -[A, [A, D]].$$

There is also a direct locality bound. If K has graph range R and is bounded along refinement, blocks at distance d first occur at order . For distinct vertices,

$$\| (e^{-a_t K})_{xy} \| \leq \sum_{j \geq m} \frac{v^j}{j!} \leq 2^{-m} e^{2v}.$$

An onsite Ω preserves this spatial bound. The finite matrix exponential is analytic in smooth link coordinates. This establishes useful properties of the constructed family; the chiral measure and full refinement power counting require their own treatment.

The execution retains seven vertices, all twelve edges, two spin components, two $SU(2)$ colour components and three interfaces, giving an 84-dimensional matrix. These noncommuting backgrounds are verification fixtures, not the full faithful Standard Model carrier. Finite gauge covariance has residual , composition , the first Ward identity and the second . Independent link differences reproduce both vertices, including the contact term, within their declared tolerances. All ten new checks pass [29].

17.14 Determinant boundaries and the chiral response prescription

The open-chain matrix used for the finite composition tests is triangular and has a background-independent determinant, so it cannot supply vacuum polarization. Section 17.15 implements a closed antiperiodic trace at a declared conditional grade. Sections 17.17–17.19 construct and differentiate a finite chiral completion with moving projectors, retaining both first vertices and contact terms.

For an invertible unprojected family, the starting determinant identity is

$$\Gamma_+ = -\text{Relogdet} D,$$

$$\delta^2 \Gamma_+ = \text{ReTr}[D^{-1}(\delta D)D^{-1}(\delta D) - D^{-1}\delta^2 D].$$

A Weyl determinant additionally requires its chiral projectors and measure. The 84-dimensional fixture and free-pole theorem alone do not supply them. The following sections separate the raw HT Dirac loop, the projected overlap response and the transfer-derived chiral completion. Only the latter two specified chiral operators enter the finite matching in Section 17.19; their global phase is not fixed by the parity-even modulus calculation.

Unique physical source selection remains a separate requirement for a parameter-free force-strength prediction. The record-to-fermion map, physical event grain and temporal attachment must be fixed where that stronger claim requires them. They are not a reason to discard the existing conditional transfer or restart its already established spatial infrared normalization. The broader corpus also distinguishes primitive sequencing from metric clock calibration and classical sharp-record preservation from quantum-coherence transport [32,33].

17.15 Closed transfer and the static one loop response

The determinant boundary requirement in Section 17.14 is implemented at a declared conditional regulator grade [34]. For an antiperiodic sequence of transfer steps, the dimensionless closed matrix satisfies

$$\det \mathcal{D}_{AP} = \det(I + A_{N_t-1} \cdots A_0).$$

This is a closed trace prescription, not a derivation of physical record closure. Its background-independent normalization is held fixed. On a static signed Wilson branch the zero-temperature Dirac effective action per temporal extent tends to . Normal ordering away this background-dependent vacuum term separately at every gauge field would remove the response being calculated.

On the canonical three-dimensional reference carrier,

$$K(k) = \sum_{i=1}^3 \alpha_i \sin k_i + \beta r \sum_{i=1}^3 (1 - \cos k_i).$$

The carrier is a spatial refinement reference repeated along a sequence. It is not an identification of one seven-site wheel with an entire continuum regulator. Including the first vertex and contact term, the static Dirac electric and magnetic coefficients return the leading logarithm

$$\mathcal{F}_D(p) = \frac{1}{6\pi^2} \log(1/p) + C_D + o(1).$$

For , the smallest tested momentum pair gives Weyl-normalized coefficients 0.6667005 in the magnetic channel and 0.6666845–0.6666883 in the electric channel. The expected Weyl coefficient is . At this stage the half-Dirac interpretation is a parity-even universality comparison; it is not a construction of a finite chiral HT determinant. A separate overlap-reference Weyl matrix is evaluated with its moving projectors. The static programme passes 26 finite checks [34].

With the inherited three-generation representation ledger, the index sums are , and . The conditional fermionic contributions are consequently in order. The representations, gauge and ghost contributions, scalar contribution and absolute couplings are not derived by this loop calculation.

17.16 Frequency dependent response and exact finite Ward checks

The dynamic continuation retains nonzero Euclidean frequency and the complete electric, magnetic and mixed tensor [35]. Put , , and . In dimensionless spatial units define

$$d(k) = (\sin k_1, \sin k_2, \sin k_3, rW(k)), \quad E = |d|, \quad n = d/E, \\ k_{\pm} = k \pm p/2, \quad S = E_- + E_+, \quad C = 1 - n_- \cdot n_+.$$

The spatial link tangent and second tangent have components

$$v_{i,a} = \delta_{ai} \cos k_i + \delta_{a4} r \sin k_i, \quad w_{i,a} = -\delta_{ai} \sin k_i + \delta_{a4} r \cos k_i.$$

Set and

$$T_{ij} = (v_i \cdot v_j)(1 + n_- \cdot n_+) - (n_- \cdot v_i)(n_+ \cdot v_j) - (n_- \cdot v_j)(n_+ \cdot v_i).$$

The exact frequency weights are

$$R = \frac{\sinh(\zeta S)}{\cosh(\zeta S) - \cos\theta}, \quad F_0 = \zeta R, \quad F_{0s} = -\frac{2\sin(\theta/2)}{S}R,$$

$$J = \frac{2}{S} - \frac{2(1 - \cos\theta)}{\zeta S^2}R.$$

All integrals below use the normalized spatial Brillouin-zone measure. The parity-even Dirac tensor is

$$\Pi_{00} = \int_k F_0 C, \quad \Pi_{0i} = \int_k F_{0s} \Delta_i,$$

$$\Pi_{ij} = - \int_k J T_{ij} - 2\delta_{ij} \int_k \frac{d \cdot w_i}{E}.$$

The last term is the contact contribution. The identities , and , together with the static contact identity, give . The weights are obtained by their continuous-time limits.

Verification	Result
Direct 384-dimensional closed determinant versus spectral formula	Full Hessian error 1.22×10^{-15}
Nine finite torus tensors including oblique momenta	Maximum Ward residual 7.70×10^{-16}
Actual 162-dimensional overlap-reference Weyl Hessian	Ward residual 8.51×10^{-16}
Frozen-projector control	Ward error 4.77

All 17 new finite checks pass. They are distinct from bulk quadrature accuracy. In the raw HT Dirac calculation, the finite electric and magnetic constants differ. Keeping the magnetic remainder fixed and shifting the electric coefficient by supplies a declared local anisotropic matching convention. At the static estimate is . Applied unchanged at , the residual from the leading matched tensor falls to approximately at the smallest tested momentum. These are raw HT Dirac coefficients, not the chiral completion matching constants below.

17.17 An explicit transfer derived chiral completion

The static and dynamic responses are connected by a finite chiral candidate [36]. This uses the standard overlap functional calculus [38,39], while retaining a seed explicitly obtained from sequential transfer. On the canonical branch , let be the spatial shared-link shifts and the sequential shift. With Hermitian Euclidean matrices and , define

$$S_U = \frac{1}{2} \sum_i \gamma_i (T_i - T_i^\dagger) + \frac{1}{2} \sum_i (2 - T_i - T_i^\dagger), \quad K = \beta S_U.$$

Then . Choose , so . If , its -Hermitian part obeys the exact identity

$$\frac{1}{2}(B + \gamma_5 B^\dagger \gamma_5) = \beta \sinh K + \frac{\beta}{2}(T^\dagger - T).$$

This holds on noncommuting, time-dependent gauge backgrounds. It does not assume that and commute. Adding a declared sequential Wilson stiffness and the overlap mass gives the family

$$X_\lambda = \beta[(1 - \lambda)K + \lambda \sinh K] + \frac{\beta}{2}(T^\dagger - T) + \frac{1}{2}(2 - T - T^\dagger) - I,$$

$$H_\lambda = \gamma_5 X_\lambda, \quad D_\lambda = I + \gamma_5 \text{sgn} H_\lambda, \quad 0 \leq \lambda \leq 1.$$

The endpoint is the previous Wilson-overlap reference and is the transfer-derived candidate. The temporal Wilson term removes a second overlap zero at temporal momentum . Its coefficient and the completion prescription are declared regulator choices, not uniquely selected microscopic source data.

Let and . The exact finite identities are

$$D_\lambda \gamma_5 + \gamma_5 D_\lambda = D_\lambda \gamma_5 D_\lambda, \quad D_\lambda P_\lambda = \bar{P} D_\lambda.$$

For orthonormal frames and of these subspaces, the actual finite Weyl matrix is

$$M_\lambda[U] = \bar{V}^\dagger D_\lambda[U] V_\lambda[U] = 2\bar{V}^\dagger V_\lambda[U].$$

All operations are gauge covariant under the supplied shared-link representation. The construction changes the raw HT determinant. Its completed operator is exponentially local on the neighbourhood established next, but it is not a strictly forward one-step recurrence. Sections 17.33–17.37 establish reflection positivity and positive transfer reconstruction for its free canonical family. Sections 17.39–17.49 prove fixed-static link-reflection positivity but disprove universally nonnegative one-step transfer; the negative covariance sector decouples under the stated refinement assumptions. Time-dependent and dynamical gauge positivity and unique physical source identity remain unproved.

17.18 The gap and species count of the completed family

Write , , and

$$f_\lambda(E) = 1 + \lambda \left(\frac{\sinh E}{E} - 1 \right) \geq 1.$$

The free Hermitian squared eigenvalue is

$$R_\lambda^2 = f_\lambda^2 \sum_i \sin^2 p_i + \sin^2 p_4 + (f_\lambda W + w_4 - 1)^2.$$

At , . Since ,

$$\frac{\partial R^2}{\partial f} = 2f \left(\sum_i \sin^2 p_i + W^2 \right) + 2W(w_4 - 1) \geq 2W(1 + w_4) \geq 0.$$

Thus for all momenta and all interpolation parameters. This is an analytic bound. An overlap zero requires every kinetic sine to vanish and the scalar seed part to be negative. Only the origin satisfies both conditions; at the other 15 corners . Since , the principal symbol is with unit coefficient. The projected operator therefore retains one Weyl branch per supplied representation and no additional free mirror or doubler branch.

There is also a uniform nonzero gauge neighbourhood. If each link is within operator-norm distance of the flat link in a fixed trivialisation,

$$\| H_\lambda[U] - H_\lambda[0] \| \leq 6\epsilon e^{6+6\epsilon} + 2\epsilon.$$

For this is 0.2424025541, leaving the uniform gap at least 0.7575974459. Finite range of , the exponential path bound and gapped Hermitian functional calculus give exponential locality throughout that neighbourhood and path. The gapped projector interpolation preserves the local index and supplies a

comparison of the chiral bundles. It does not evaluate a global measure phase or certify every topological component.

The actual 162-dimensional candidate Weyl matrix was differentiated with moving projectors, including all second derivatives of . All 19 finite checks pass. Its dynamic Ward residual is ; an independent log-determinant curvature differs by . Freezing the projector produces a Ward error of 3.78. These tests establish a concrete constructed chiral response, not the selection of the physical Standard Model operator.

17.19 Finite electric and magnetic matching

The relative coefficients between the two specified chiral operators are evaluated [37]. This comparison is candidate minus reference, per unit-charge Weyl fermion. In ordering set

$$\begin{aligned}\Delta\Pi_{\mu\nu} &= C_E T_{\mu\nu}^E + C_M T_{\mu\nu}^M + o(q^2), \\ T_{tt}^E &= \hat{\mathbf{q}}^2, \quad T_{ti}^E = -\hat{q}_t \hat{q}_i, \quad T_{ij}^E = \hat{q}_t^2 \delta_{ij}, \\ T_{ij}^M &= \hat{\mathbf{q}}^2 \delta_{ij} - \hat{q}_i \hat{q}_j, \quad T_{t\mu}^M = 0.\end{aligned}$$

Here . The action difference in this convention is

$$\Delta\Gamma = \frac{C_E}{2} \int \sum_i F_{ti}^2 + \frac{C_M}{2} \int \sum_{i<j} F_{ij}^2 + \dots.$$

To match the candidate to the reference, subtract these two local terms. Their trace factor for a supplied representation is . No experimental coupling is used.

The response is computed from , not defined by halving a Dirac determinant. The momentum-pair implementation reproduces both complete direct finite Weyl Hessians, with errors and . First vertices, contact terms, functional-calculus derivatives and moving chiral projectors are all retained.

Before integration the two response integrands are subtracted, followed by their zero-external-momentum value. The latter integrates to zero because a constant Abelian potential translates the periodic Brillouin-zone integral. This is an exact integration identity rather than a fitted mass counterterm. For ,

$$E(p, \omega) = \frac{\Delta\Pi_{tt}}{\hat{p}^2}, \quad M(p, \omega) = \frac{\Delta\Pi_{yy} - \hat{\omega}^2 E(p, \omega)}{\hat{p}^2}.$$

Only the static points calibrate the constants. A three-point extrapolation in is compared with a two-point extrapolation in . This is a stated numerical extrapolation model, not a proof of the complete asymptotic expansion.

Integration and static extrapolation	C_E	C_M
Radial Gauss order 10	0.000380586	-0.001049434
Radial Gauss order 14	0.000389332	-0.001012051
Eight independent Sobol scrambles	0.000387800	-0.001013536
Sobol replicate standard error	0.000002341	0.000003121

Each Sobol scramble uses 16,384 base points. The radial integrations use 40,000 and 153,664 points. The two final methods differ by approximately in each coefficient. The order change is larger, so conservative

empirical uncertainty scales are and . These are working precision estimates, not rigorous error bounds. The defensible headline is

$$C_E \approx +3.9 \times 10^{-4}, \quad C_M \approx -1.0 \times 10^{-3},$$

with a few percent conservative precision. Extra table digits document convergence only. Changing the extrapolation model shifts the order-14 estimates by and .

The same static constants predict the nonzero-frequency pair at without refitting:

$p = \omega$	Radial order 14 residual	Sobol mean residual
0.05	1.97%	2.10%
0.025	0.555%	1.08%

The residual is the norm of the difference from the predicted pair divided by the norm of the measured response difference. It is not a full-tensor norm or an error relative to either individual regulator response. The tested small-momentum difference approaches finite constants rather than revealing a second growing infrared logarithm. The analytic locality and gap results supply the broader perturbative justification; the numerical plateau alone is not a theorem.

17.20 Scope of the completed comparison and its remaining requirements

The calculation has progressed through a closed HT response, a dynamic tensor with contact terms, an explicit transfer-derived chiral completion, a uniformly gapped reference path and numerical finite matching of both electric and magnetic coefficients. These are distinct results with distinct normalisations. In particular, the raw HT Dirac electric correction in Section 17.16 must not be reused as either chiral matching constant in Section 17.19.

The relative local matching is evaluated at the stated numerical precision for the canonical completion. An equal finite shift applied to both regulators remains a shared scheme freedom. Neither this comparison nor the inherited Standard Model representation ledger selects absolute physical force strengths.

Chiral measure phase and anomaly compatibility form a separate operator-level programme. The free positivity certificate in Sections 17.33–17.37 is extended to static link-reflection positivity in Sections 17.39–17.41. Exact nonnegative one-step transfer fails generally, as shown in Sections 17.42–17.43, while Sections 17.45–17.49 establish conditional cutoff decoupling. Section 17.50 states the remaining time-dependent and dynamical gauge questions. Unique physical source selection, physical time calibration and identity with the unmodified microscopic HT transfer remain separate. No all-background or complete Standard Model quantisation theorem is claimed.

17.21 Primitive PFDMI score closure and the exact centered/uncentred identity

The 28 September EX2E primitive-score execution returns a full-rank 72-dimensional Fisher carrier on the Wilson quotient and a recurrent D36-weighted score covariance. Its absolute promotion remains conditional on the post-birth endpoint/current preparation law, but its factor geometry can already be compared exactly with the current-cycle factor matrix. For the unresolved Fubini-Study/Haar current ray it gives

$$C_{\text{Haar}} = (1/1225) [[234, -27, 36], [-27, 299, 26], [36, 26, 47]].$$

With $H_CWY = (1/49)[[36,18,36],[18,26,26],[36,26,47]]$ and $\mu = (36,26,47)^T/49$, exact rational arithmetic gives

$$C_Haar = (49/50)(H_CWY - \mu\mu^T), \quad H_CWY = (50/49)C_Haar + \mu\mu^T.$$

This is not a numerical fit. The generalized spectrum of the pair (H_CWY, C_Haar) is exactly $\{50/49, 50/49, 25\}$. The special generalized eigenvector is $e_Y = (0,0,1)^T$ because $H_CWY e_Y = \mu$. Thus two relative factor directions differ only by the universal projective centering factor $50/49$, while the third direction is the identity/Abelian mean channel removed most strongly by conditioning on the projective mark law.

17.22 Event-rate decomposition and the D41 radial-screening theorem

The commitment-hazard source theorem distinguishes an uncentred realised-event rate Gram from the Fisher matrix of the conditional mark distribution. In the same factor coordinates,

$$F_mark = 4(H_CWY - \mu\mu^T), \quad M_event = 4H_CWY = F_mark + 4\mu\mu^T.$$

Using the PFDMI identity above gives $F_mark = (200/49)C_Haar$ exactly. Hence the entire difference between the conditional primitive mark geometry and the uncentred magnitude-bearing event geometry is one rank-one term $4\mu\mu^T$. Equivalently, the missing total-rate log-score direction is fixed up to the common event scale; it is not an arbitrary three-by-three factor matrix.

D41 respects exactly this decomposition. Writing $d = 0.0551296278772322$ and $d_red = 0.0504814732865564$,

$$\begin{aligned} W_D41^{red} &= g_cyc^2 [d(H_CWY - \mu\mu^T) + d_red \mu\mu^T] \otimes I_2 \\ &= g_cyc^2 [(50d/49) C_Haar + d_red \mu\mu^T] \otimes I_2. \end{aligned}$$

The bath therefore leaves the centered relative-mark block at coefficient d and screens only the rank-one mean/radial channel from d to d_red . In generalized H_CWY coordinates the two protected eigenvalues are d and the single screened eigenvalue is $d - (47/49)(d - d_red) = 0.0506711938821$, corresponding to 8.087183% screening of that channel. This gives a source-natural explanation of the exact single-Abelian-portal alignment found in Section 17.7.

17.23 Event-grain correction and the field-motion no-go

The endpoint-law audit separates pre-Fact relaxation from any post-completion hard relation. A finite pre-Fact coherence and a conditional hard post-completion relation $\gamma^* = -1$ are differently typed quantities and may not be averaged or substituted for one another. The simultaneous hard handshake also fails as a static nonzero shared-endpoint field on the full wheel because the odd loops force the flat shared solution to zero. A sequential instrument avoids that static contradiction but does not select a unique endpoint/current ensemble.

More decisively, the Fact-stopped field-update audit proves an immobility theorem for the present configuration-controlled instrument class. If every elementary operation is diagonal in the independent physical configuration $z = (U, j)$, then arbitrary first-entry or history-dependent stopping preserves that support and

$$K_Fact(dz'|z) = \delta_z(dz').$$

Changing the history state, internal state or retained ledger is therefore not yet a physical update of the independent link/current configuration. EPM1 cannot be derived merely by stopping the present controlled

instrument. A physical changing-link source must contain at least one genuinely off-diagonal joint field/current operation.

17.24 Conditional D36 pre-Fact generator and stopped E_2 occupation

Conditional on the explicit same-event premise EPM1, RCHS-26 fixes the source-even D36 stationary traffic without a fitted heat depth. The spoke and rim conductances are

$$c_{\text{spoke}} = 0.027060532986541, \quad c_{\text{rim}} = 0.040487489437977, \quad c_{\text{rim}}/c_{\text{spoke}} = \cosh(\alpha^*) = 1.496182261380952.$$

The physical E_2 doublet then has one-Fold multiplier $\mu_{E_2} = -0.099388227586084$ and squared multiplier $q_{E_2} = 0.009878019782703$. Stopping on the actual first-cover record law gives $H_{\text{cover}}(q_{E_2}) = 1.009976568523946$ and the source-stopped raw-current occupation coefficient

$$\eta_J = (3 c_{\text{rim}}^2 + c_{\text{spoke}}^2) H_{\text{cover}}(q_{E_2}) = 0.005706350289534.$$

The resulting $C/W/Y \times E_2$ occupation Gram has the same H_{CWY} factor shape up to one activation scalar h_{phys} . This is a strong compatibility result, but it does not identify covariance with action stiffness or Fisher information. EPM1 and h_{phys} remain separate physical gates.

17.25 Source release target after the primitive score comparison

After the calculations above, the current source problem has a more precise form. The relative $C/W/Y$ geometry, the centered conditional score, the mean/radial direction, the D41 screening direction and the source-stopped E_2 spatial propagation are all fixed on their declared branches. The load-bearing missing object is a primitive joint one-Fold operation with genuine support at different physical field/current configurations, or an independently work-normalised equivalent. In classical notation the target is

$$K(dU', dj', dx', dr \mid U, j, x, \text{record history}),$$

with nonzero support for $(U', j') \neq (U, j)$, a source-selected event grain and a fixed absolute occurrence scale. Only after this object is returned may its no-record/terminal parts be stopped, its score covariance be promoted to W_{prim} , and the physical current-link duality test be executed. No neutrino or Standard-Model target enters this release condition.

17.26 Occurrence curvature and first order information

The occurrence audit [46] reproduces the BCTR-4 conditional conversion $\lambda_J = 7.624971107276631 \alpha$. BCTR-5/6 return zero implemented current-to-eligibility feedback for their factorised history selector; this is a zero for that mechanism, not a zero physical force. The coefficient α , event grain and action-to-history conversion remain source inputs. Eleven continuation checks pass.

At a regular symmetric current origin, the distinction between rate curvature and statistical information is exact. For strictly positive baseline probabilities s and $h = 1 - s$, let the self/fact contrast be $\Delta q = \alpha J^T T_6 J$, with $T_6 = H_{\text{CWY}} \otimes I_2$. Normalization gives

$$p_0 = \frac{s}{s + h e^{\Delta q}}, \quad p_1 = \frac{h e^{\Delta q}}{s + h e^{\Delta q}}, \quad \Gamma = -\log p_0$$

$$F_{\text{occ}} = \sum_{b=0}^1 p_b \nabla \log p_b \nabla \log p_b^T = p_0 p_1 \nabla \Delta q \nabla \Delta q^T$$

$$F_{\text{occ}}(0) = 0, \quad D_J^2 \Gamma(0) = 2 h \alpha T_6$$

A nonzero hazard Hessian therefore coexists with zero first-order occurrence Fisher information at $J = 0$. Along this quadratic family, relative entropy begins at fourth order in the Cartesian current displacement.

This result leaves open a nonzero first-order response at a source-selected nonzero background; it does not apply a logarithmic radial coordinate at the zero current.

The same audit tests whether a finite yes/no opportunity, with its waiting history discarded, reproduces D41 screening. Under the stated conditional radial-rate attachment, the endpoint Fisher matrix is $4[a(H_{CWY} - \mu\mu^T) + b\mu\mu^T]$. The frozen baseline gives $a = 0.810576269094213$ and $b = 0.644456832099798$, hence $b/a = 0.795060078454989$. D41 instead has $d_{red}/d = 0.915686813612696$. Matching only the centered coefficient leaves an 11.8909% relative Frobenius discrepancy. This rejects that endpoint-coarse-graining identification, not the D41 bath reduction.

A physical release must return the first derivative of the normalized occurrence law at its selected background, in addition to the absolute rate and coordinate map. A rate Hessian or the existing first-record baseline cannot supply that derivative by itself.

17.27 The nonzero native current response

The unchanged QCA-1 operator [22,47] uses the current ray $u = j/\|j\|$ on the fifty-dimensional carrier. For its twelve generators and seven terminal sectors,

$$u = j/\|j\|, \quad p_j = uu^\dagger, \quad K_a = i[T_a, p_j], \quad s_j = 1/2 \operatorname{tr} \sum_a K_a^\dagger K_a$$

$$C_a = K_a/\sqrt{s_j}, \quad C_0 = \sqrt{I - S_j/s_j}, \quad S_j = \sum_{a=1}^{12} K_a^\dagger K_a$$

$$C_a(e^z j) = C_a(j) \Rightarrow \partial_z p(h) = 0, \quad F_{zz} = 0$$

The radial identity applies to fixed preparations and compositions without another dependence on current magnitude. The declared NTR field release retains this premise. On the inherited occupied preparation $\rho_0 = P/49$, where sterile address 45 is excluded, the current-pointer excitation probability is exactly $2/49$. It is not a completed-Fact probability or a physical force coefficient.

The continuation differentiates all 151 retained impulse-history probabilities at the inherited nonzero chirp current. Three probe coordinates multiply the C, W and Y sector indicators relative to that current; a fourth multiplies the entire current by e^z . The three relative directions remain observable. Their history Fisher eigenvalues are 0.00002217697, 0.00122545539 and 0.00272032793; the common radial row and column vanish. These probe directions are not identified with the universal C/W/Y event-rate Gram.

Independent finite differences agree with the analytic probability derivatives within 1.17×10^{-11} . Common current rescalings from 0.01 to 100 change the history probabilities by at most 4.34×10^{-18} . The seventeen checks establish a relative response on this declared history, with the known radial null preserved.

17.28 Limits of scalar gain and selector feedback

Multiplying every native excitation Kraus operator by $\sqrt{c}$ and completing with $(I - cS/s)^{1/2}$ requires $0 \leq c \leq 1$. The inherited native law is saturated at $c = 1$. For a differentiable two-sided log-magnitude coordinate about that baseline,

$$0 \leq c(z) \leq 1, \quad c(0) = 1, \quad c \in C^1 \Rightarrow c'(0) = 0$$

This restricted scalar-gain family cannot create a first-order radial excitation score while preserving the saturated baseline and the regular occupied preparation. It does not constrain arbitrary changes of the instrument, preparation or propagation. Interior gain families permit different radial slopes and hence demonstrate that positivity alone does not select the physical slope [47].

Nor does a trace-preserving field update alter a factorised scalar history gate at a fixed history state. If the self/fact effects are $s_x I$ and $h_x I$, the adjoint of a trace-preserving channel fixes them. Field motion, internal

current excitation and completed-Fact occurrence are separately defined operations. Deriving their joint attachment remains necessary.

17.29 A quantum consistent magnitude sensitive first event operation

The unnormalised current survives in the action before projectivization. MBCI-1 proposes raw jump amplitudes using that current [50]. The survival continuation [48] keeps these proposed amplitudes and tests their quantum interpretation:

$$\tilde{K}_a = i(T_a j j^\dagger - j j^\dagger T_a), \quad B_r = v_j \sum_a \tilde{K}_a^\dagger P_r \tilde{K}_a, \quad G = \sum_r B_r$$

$$\ell_r(\rho) = \text{tr}(B_r \rho), \quad p_0^{\text{scalar}}(\rho) = e^{-\text{tr}(G\rho)}$$

At fixed current, apparatus and history, a quantum outcome probability must be affine in the incoming density matrix ρ . The scalar survival law $\exp[-\text{tr}(G\rho)]$ fails this condition unless G is scalar on the admitted support. On the inherited full-rank occupied mixture witness, the scalar probability of the unresolved mixture is 0.938687481961, while the equal average of the component probabilities is 0.938822122795. The gap is 0.000134640834. The scalar rule remains a valid classical law if the preparation parameter is supplied as an additional physical control; it does not define a fixed quantum instrument on ρ [48,51].

A standard absorbing first-event completion gives a consistent candidate. Hold the current and terminal projectors fixed during $t \in [0,1]$ and set the additional Hamiltonian to zero. These are explicit premises, not an identification of this interval with a physical Fold:

$$N(t) = e^{-tG/2}, \quad L_{ra}(t) = P_r \sqrt{v_j} \tilde{K}_a N(t), \quad 0 \leq t \leq 1$$

$$J_0(\rho) = N(1)\rho N(1)^\dagger, \quad J_r(\rho) = \int_0^1 \sum_a L_{ra}(t) \rho L_{ra}(t)^\dagger dt$$

$$E_0 = e^{-G}, \quad E_r = \int_0^1 N(t)^\dagger B_r N(t) dt, \quad E_0 + \sum_r E_r = I$$

Every operation is completely positive and linear. Integrating $-d \exp(-tG)/dt = N(t)^\dagger G N(t)$ proves completeness, including on the dark kernel. The generator label is summed; an event writes a terminal label and stops. Applying the operator survival law before taking the trace restores quantum mixture consistency.

Survival changes the conditional state and therefore its subsequent intensity. The operator probability $\text{tr}(\rho e^{-G})$ is at least $\exp[-\text{tr}(\rho G)]$; for $G = xS$ their difference starts at x^2 times half the variance of S . Consequently the finite-window terminal probabilities need not preserve the scalar proposal's instantaneous factorization.

At unit current j_0 , use $S = \sum_a K_a^\dagger K_a$. For $j = e^z j_0$ and fixed positive v_j , the exposure is $x = v_j e^{4z}$ and

$$j = e^z j_0, \quad S = \sum_a K_a^\dagger K_a, \quad G = xS, \quad x = v_j e^{4z}, \quad \partial_z p_0 = -4x \text{tr}(\rho S e^{-xS})$$

The raw candidate thus has a nonzero first-order magnitude response outside the premises of the projective null. At the declared comparison exposure $x = 1$, the event probability is 0.0452167004009 and the full radial Fisher information, retaining survival and seven terminal marks, is 0.417380116713. The binary contribution is 0.416279566705; the remainder comes from the survival-filtered terminal distribution. Twenty-one checks pass, including independent Kraus integration, output-state affinity and gauge covariance.

The coefficient is still unselected. The exact transformation $(v|,j) \mapsto (v|/a^4,aj)$ leaves the whole operation unchanged. The calculation selects neither a physical preparation nor a Fact interval or occurrence scale. An action cost alone does not establish this action-to-instrument map.

17.30 Native recording activates part of the dark subspace

For the frozen raw-current candidate, the jump Gram has rank thirteen on the inherited witness. Its occupied kernel has dimension 36, so the single-interval large-exposure event probability tends to 13/49. That ceiling assumes no intervening terminal record on survival. The next calculation [49] tests the actual native record operation [52], which records a terminal label after every nonself hop, including the vacuum current-pointer outcome.

At flat links, define terminal dephasing and the native no-excitation subchannel by

$$C_0 = (I - S/s)^{1/2}, \quad C_a = K_a/\sqrt{s}, \quad \mathcal{D}(X) = \sum_r P_r X P_r$$

$$\Phi_0(X) = \mathcal{D}(C_0 X C_0), \quad p_{\text{exc}}(X) = \text{tr}(SX)/s$$

Here S and s refer to the unit-current native construction in Section 17.27. Let D project onto its occupied kernel and use $\rho_D = D/36$. The first hop has zero excitation probability and C_0 acts as the identity, but terminal recording can remove coherences whose cancellation made the input dark. The second-hop excitation probability is 0.0291840211483, independently reproduced by summing all first terminal labels and second excitation Kraus operators.

The maximal subspace that remains dark after arbitrarily many such hops is the occupied orthogonal complement of $\text{span}_r P_r \text{ran } S$. A vector has unit first-hop survival only in $\ker S$; unit second-hop survival requires every terminal component to remain in that kernel. Those components are then invariant under further C_0 operations and terminal projections. The recorded bright span has rank 38, leaving a persistent dark dimension of eleven.

Sector	Occupied	Recorded bright	Persistent dark
Q	18	12	6
U	9	9	0
D	9	9	0
L	6	4	2
E	3	1	2
N	2	1	1
H	2	2	0
Total	49	38	11

The active remainder contracts under repeated native hops. Thus

$$\lim_{m \rightarrow \infty} \text{tr} \Phi_0^m(D/36) = \frac{11}{36}, \quad \lim_{m \rightarrow \infty} \text{tr} \Phi_0^m(P/49) = \frac{11}{49}$$

The corresponding eventual excitation probabilities are 25/36 from the original uniform dark preparation and 38/49 from the occupied maximally mixed preparation. The index counts indefinitely continued nonself hops at fixed current and flat links. Idle traffic, physical time, first-cover stopping and completed-Fact production are not replaced by this index.

17.31 Survival composition and transport invariant directions

Appending the native terminal record to the surviving branch of the new raw first-event operation gives a separately declared composition $\Psi_{0,x}(X) = \sum_r P_r N_x X N_x P_r$, with $N_x = \exp(-xS/2)$. This changes the previous observation protocol. For every $x > 0$, its unit-survival space is again $\ker S$, giving the same persistent dimension eleven. At $x = 1$ its second-interval event probability on ρD is 0.0318868744254, different from the native pointer result. The equal asymptotic dimensions do not identify the two operations.

Nonself hops or candidate intervals	Native cumulative excitation from ρD	Raw candidate with records at $x = 1$
1	0	0
2	0.029184021	0.031886874
10	0.172764779	0.195596025
100	0.495410172	0.538752215
3000	0.689921616	0.692903026
Limit	0.694444444	0.694444444

Independent 328-dimensional active superoperators reproduce the density iterations within 3.9×10^{-13} . Their largest eigenvalues are 0.999357198964 for the native map and 0.999026563190 for the survival composition, explaining the slow approach to the common limit. The dark-evolution execution passes all 36 checks [49].

The central transport $\exp(i\theta Q)$, with $Q = 6Y$ and seven distinct terminal charges, can activate the original dark preparation relative to a held current. Its common invariant dark subspace is also eleven-dimensional because the terminal projectors are polynomials in Q . Closing the bright span under all twelve supplied gauge generators instead gives dimensions 13, 44, 44 and an occupied common dark kernel of dimension five: two directions in L , two in E and one in N . This is an algebraic test over all supplied gauge operators, not a claim that a selected physical trajectory explores every remaining direction.

Simultaneously rotating current and carrier preserves darkness by gauge covariance. Relative transport at a held current must not be confused with that change of frame. Likewise, the field-only kinetic release of NTR-1 acts as $I_{\text{internal}} \otimes U_v$ and commutes with the internal dark projector [53]. The existing CAR matter-flux calculations have their stated charge and spin carriers; the source has not yet identified them with an evolving independent MASD current on this full event carrier.

17.32 Consolidated physical source requirement

The four continuations close the stated occurrence, magnitude-response and activation tests. They show why a quadratic hazard, a normalized current ray, a saturated scalar gain or field motion alone does not select the physical occurrence score. They also supply a complete magnitude-sensitive quantum candidate and a positive native activation mechanism. The five-dimensional gauge-invariant remainder applies at the fixed current and does not rule out further source-derived flavour, current or completion dynamics.

Physical promotion still requires the joint source described in Section 17.25: selected propagation of the independent current and field, the admitted matter/current attachment, preparation and event grain, and a complete occurrence/record instrument in physical units. The source must determine how current excitation, terminal recording and completed Facts are related. A first-excitation calculation supplies no post-excitation renewal theorem. The current/link reciprocity, mixture-affinity and same-source score tests must be passed before the new candidate can replace W_{prim} or the conditional neutrino normalization.

17.33 Positive free spectral measure of the completed family

The free-positivity continuation [54] uses exactly the canonical family in Section 17.17, with all gauge links equal to the identity. The spatial reduction follows from $K^2 = E_s^2 I$. Define the following real quantities; the local shorthand c below denotes $\sqrt{1+B}$, not a newly adjustable physical constant:

$$\begin{aligned} W &= \sum_i (1 - \cos p_i), \quad E_s^2 = \sum_i \sin^2 p_i + W^2, \quad f_\lambda = 1 - \lambda + \lambda \frac{\sinh E_s}{E_s}, \\ a_i &= f_\lambda \sin p_i, \quad A = f_\lambda W \geq 0, \quad B = \sum_i a_i^2, \quad b = \sqrt{B}, \quad c = \sqrt{1+B}. \\ X &= i\gamma_4 \sin p_0 + i\boldsymbol{\gamma} \cdot \mathbf{a} + A - \cos p_0, \quad R^2 = 1 + A^2 + B - 2A \cos p_0. \end{aligned}$$

Subtract the local contact term from the free inverse. It cannot connect sites across the reflection plane, so it does not affect the cross-plane test. The square root R is positive on the real frequency axis.

$$C(p_0) = D^{-1}(p_0) - \frac{1}{2}I = \frac{-i\gamma_4 \sin p_0 - i\boldsymbol{\gamma} \cdot \mathbf{a}}{2(R + A - \cos p_0)}.$$

For $A > 0$, the only square-root cut in the upper frequency half-plane begins at iE_1 . A possible particle pole lies at iE_p . Their order follows from an exact square:

$$\begin{aligned} E_p &= \operatorname{arsinh} b, \quad E_1 = \operatorname{arcosh} \frac{1 + A^2 + B}{2A}, \\ \cosh E_1 - c &= \frac{(A - c)^2}{2A} \geq 0, \quad E_1 \geq E_p, \end{aligned}$$

The pole exists on the physical sheet precisely when $A < c$. Its weight tends to zero when A approaches c . When $A > c$, the apparent pole of a rationalized expression is canceled by its numerator. There is no second pole at real frequency π because A is nonnegative.

$$\begin{aligned} J &= -i \sum_i \gamma_i \gamma_4 a_i, \quad J^\dagger = J, \quad J^2 = BI. \\ C(t)\gamma_4 &= e^{-E_p t} W_p + \int_{E_1}^{\infty} e^{-Et} W_c(E) dE, \quad t \geq 1, \\ W_p &= \mathbf{1}_{A < c} \frac{c - A}{2bc} (bI + J), \quad b > 0, \\ W_c(E) &= \frac{\sqrt{2A \cosh E - (1 + A^2 + B)}}{2\pi(\sinh^2 E - B)} (\sinh E I + J). \end{aligned}$$

These formulas use $C(t) = \int dp_0 \exp(ip_0 t) C(p_0)/(2\pi)$. The pole coefficient comes from the residue of $2(R + A - \cos p_0)$; the cut coefficient comes from the two opposite values of R on its two banks. The factor $1/(2\pi)$ in the continuum weight is independently checked by direct Fourier inversion.

$$\operatorname{spec}(bI + J) = \{0, 2b\}, \quad \operatorname{spec}(\sinh E I + J) = \{\sinh E - b, \sinh E + b\}.$$

Both weights are positive semidefinite: the pole scalar is positive when the pole is present, and $\sinh E \geq b$ throughout the cut. Each listed spin eigenvalue has multiplicity two. The result holds for all momenta and λ , rather than only for the numerical sample.

17.34 Positive free evolution from the spectral measure

Let $d\Sigma$ be the positive matrix measure formed by the pole atom and continuum density. The reflection plane lies between integer times zero and one. For any finitely supported collection of spinors on positive times, the exact cross-plane quadratic form is

$$\sum_{t,s \geq 1} v_t^\dagger C(t+s-1) \gamma_4 v_s = \int e^E \left(\sum_t e^{-Et} v_t \right)^\dagger d\Sigma(E) \left(\sum_s e^{-Es} v_s \right) \geq 0.$$

Spatial Fourier integration, or a finite periodic spatial sum, preserves this inequality. After quotienting zero-norm vectors, the spectral Hilbert space carries the transfer and Hamiltonian

$$(\mathcal{T}\phi)(E) = e^{-E}\phi(E), \quad 0 \leq \mathcal{T} \leq I, \quad (\mathcal{H}\phi)(E) = E\phi(E).$$

This is a positive contraction and a nonnegative self-adjoint energy operator. Second quantization gives the free fermion evolution. The continuum is part of the finite-spacing spectral measure; positivity does not require the completed lattice action to be a nearest-neighbour recurrence.

17.35 Fermionic action reflection factorization

For the full free Gaussian reflection inequality, the relevant cut matrices and their two eigenvalues are

$$\begin{aligned} M_+(E) &= -\gamma_4 X(iE), & M_-(E) &= \gamma_4 X(-iE), \\ \text{spec} M_\pm(E) &= \sinh E \pm \sqrt{B + (A - \cosh E)^2}, \\ \sinh^2 E - [B + (A - \cosh E)^2] &= 2A \cosh E - (1 + A^2 + B) \geq 0. \end{aligned}$$

Thus both matrices have positive square roots. The noncontact action kernel for positive time separation is

$$D(t, \mathbf{p}) = \int_{E_1}^{\infty} \frac{e^{-Et} X(iE, \mathbf{p})}{\pi \sqrt{2A \cosh E - (1 + A^2 + B)}} dE, \quad t \geq 1.$$

Factoring the cut matrices expresses the cross-plane action as reflected Grassmann products with nonnegative weights. Reflection also interchanges the two same-side pieces of the action. These are the operator-specific conditions in the Kikukawa–Usui free-overlap proof [55]; its Grassmann positivity argument then applies. On even temporal lattices the antiperiodic image terms have the same positive factorization. The overall factor of two between our D and the convention of [55] changes no sign.

The argument uses time reflection and spatial Fourier resolution. The nonlocal spatial function $\sinh K$ does not obstruct it at flat links. Its time-dependent gauged version does not share this scalar Fourier reduction, so no gauged theorem follows by continuity alone.

17.36 Weyl observables and limiting cases

For the existing Weyl completion, the positive projector P and the fixed barred projector obey

$$\begin{aligned} P &= \frac{I + \text{sgn} H}{2} = Q_- + \frac{1}{2} \gamma_5 D, & Q_\pm &= \frac{I \pm \gamma_5}{2}, & \bar{P} &= Q_+, \\ PD^{-1} &= Q_- D^{-1} + \frac{1}{2} \gamma_5 = D^{-1} \bar{P}, & Q_- PD^{-1} Q_+ &= Q_- D^{-1} Q_+. \end{aligned}$$

Choose the usual Weyl observables consisting of the Q_- components of ψ and Q_+ components of the barred field at positive times. Their contractions equal the corresponding Dirac contractions; the extra term in the identity is diagonal in chirality and local. Wick factorization therefore transfers the free reflection inequality to this observable algebra. Its cross-plane one-particle measure is explicitly

$$Q_- C(t) \gamma_4 Q_- = \int e^{-Et} Q_- d\Sigma(E) Q_- \geq 0.$$

This uses the standard free Weyl restriction, including its specified observable algebra [55]. It does not establish reflection positivity of a background-dependent chiral determinant phase or permit arbitrary time-local manipulations of every component of the nonlocal projected field.

Zero momentum and the merging threshold

$$A = B = 0: \quad D(p_0) = I - \cos p_0 + i\gamma_4 \sin p_0, \quad C(t)\gamma_4 = \frac{1}{2}I \quad (t \geq 1).$$

The massless zero mode is defined by symmetric frequency integration, equivalently by the antiperiodic temporal regulator followed by its infinite-size limit. Its measure is a positive zero-energy atom $I/2$. In the action, the only cross-plane terms are $D(1) = -(I + \gamma_4)/2$ and $D(-1) = -(I - \gamma_4)/2$, which have the required reflection factorization. This treats the $A = 0$ case without using the cut formula with a vanishing denominator.

At $A = c$ the pole has disappeared and the cut density has an integrable inverse-square-root threshold. The substitution $E = E_1 + u^2$ makes numerical quadrature regular. At nonzero spatial corners, $B = 0$ while $A \geq 2$, so there is no particle pole; the continuum remains nonnegative. These corner modes do not supply an additional light species.

A directional limit toward zero spatial momentum can retain a spin projector before the energy tends to zero. The symmetric massless zero-mode convention instead gives $I/2$. Both are positive; the convention must be stated when comparing finite-volume zero modes.

17.37 Independent numerical verification of free positivity

The reproducibility code builds the seed directly from 4 by 4 matrix exponentials of K and compares it with the reduced symbol. It then inverts the overlap matrix on real frequencies and Fourier transforms it, independently of the pole and cut calculation. All execution assertions pass.

Check	Coverage	Largest error or smallest eigenvalue
Original seed against reduced symbol	40 random momenta and λ values	Relative error 5.0×10^{-15}
Fourier inverse against spectral integral	45 cases at 11 time separations	Absolute error 1.42×10^{-13}
Reflection Gram matrix	24 by 24 in each of 45 cases	Minimum -8.13×10^{-15}
Grid and quadrature refinement	Low momentum and three threshold cases	Difference 6.61×10^{-15}
Action cut eigenvalue formula	500 random momenta and λ values	Relative error 7.91×10^{-16}
Action cut matrix positivity	Same 500 samples	Minimum eigenvalue 0.04219

The 45 cases cover $\lambda = 0, 0.25, 0.5, 0.75$ and 1, with low, generic and large momentum; zero and nonzero corners; and points at, just below and just above pole-cut coalescence. The base frequency grid has 16,384 points, doubled for refinement. Tiny negative Gram eigenvalues are compatible with floating-point roundoff and are not the basis of the positivity claim. The analytic spectral weights prove the sign.

17.38 Scope of the free certificate and the static extension

The certificate closes the free version of the positivity requirement left open in Section 17.17. It is an application of the established free-overlap reflection method [55] to this specific hyperbolic spatial family, not a new general derivation of overlap positivity. The supplied representation content, regulator completion and canonical parameters remain premises. The proof changes no physical occurrence scale, neutrino ratio or gauge coupling.

Sections 17.39–17.49 establish the static-background test of the free certificate. It yields a positive link-reflection theorem and a counterexample to the stronger claim of nonnegative one-step transfer. A further uniform spectral bound excludes survival of the negative covariance sector in the stated separated-time

refinement limit. These conclusions concern the unchanged completion and distinguish state-norm positivity, finite-step evolution and continuum decoupling.

A dynamical gauge theorem additionally requires the selected gauge action, chiral measure and gauge integration. It cannot be inferred from either the free or fixed-static certificate. Identifying the reconstructed transfer with the primitive microscopic evolution and deriving the full joint current-field-matter-completion source remain independent physical requirements.

Reproduction is supplied by CLSN1_Free_Positivity_Reproducibility.zip [54], containing the fixed operator sources, calculate.py, results.json and hashes. The largest seed-symbol discrepancy is 5.0×10^{-15} . No measured Standard Model observable enters the proof or numerical comparison.

17.39 Static gauge fields and the unchanged completion

The static continuation [56] retains the canonical family of Section 17.17 on finite periodic spatial lattices, with time-independent spatial links and $U_0 = I$. It proves link-reflection positivity for a gapped seed, including the neighbourhood in Section 17.18. The auxiliary matrices W , A and B below are local notation for this spectral calculation; W is not the physical history metric W_{prim} . No spatial link commutativity is assumed.

Use the inherited dimensionless parameters $h = c = a_t = r = \rho = 1$ and the original covariant spatial shifts. Work on a finite periodic spatial lattice, with infinite integer time or even antiperiodic temporal closure. The background is time independent and $U_0 = I$. The gamma matrices are Hermitian. All spin, colour and spatial indices are retained in the following slice matrices.

$$G = \gamma_4, \quad F = F_\lambda(K) = (1 - \lambda)K + \lambda \sinh K, \quad K = -GS, \quad 0 \leq \lambda \leq 1.$$

$$S = \frac{1}{2} \sum_{i=1}^3 \gamma_i (T_i - T_i^\dagger) + \frac{1}{2} \sum_{i=1}^3 (2I - T_i - T_i^\dagger).$$

$$X(p) = -GF + iG \sin p - I \cosh p, \quad D(p) = I + X(p)[X(p)^\dagger X(p)]^{-1/2}.$$

Here F is Hermitian and the seed gap is uniform in real temporal frequency. Section 17.18 guarantees that gap throughout the link neighbourhood of radius 10^{-4} , uniformly for λ in $[0,1]$. Representation content and the overlap completion remain declared inputs.

17.40 Matrix branch cuts for a static background

The key identity uses only $F^\dagger = F$ and $G^2 = I$. In particular, W need not be a scalar or a nonnegative matrix:

$$W = -\frac{1}{2} \{G, F\}, \quad A = I + F^2, \quad Y(p) = X(p)^\dagger X(p) = A - 2W \cosh p.$$

$$A - 2W = (F + G)^2 > 0, \quad A + 2W = (F - G)^2 > 0.$$

The two strict inequalities follow from the gap at temporal frequencies zero and π . They imply the bound below. Each nonzero eigenvalue b locates a square-root threshold at the height given below. Positive b places the cut at real frequency zero; negative b places it at real frequency π .

$$B = 2A^{-1/2}WA^{-1/2}, \quad -I < B < I, \quad E_b = \text{arcosh}(1/|b|) \quad (b \neq 0).$$

There are no other branch cuts of the principal inverse square root in the upper frequency strip. To see this, let $z = \cos p$. If $A - 2zW$ had an eigenvalue on the nonpositive real axis for nonreal z , its eigenvector would satisfy $v^\dagger W v = 0$ by taking the imaginary part. Its real expectation would then equal $v^\dagger A v > 0$, a contradiction. On $-1 \leq z \leq 1$ the matrix is strictly positive. All cuts therefore lie on the two vertical lines just identified.

Write $\sigma = +1$ for the zero-frequency cut and $\sigma = -1$ for the π cut. At either cut introduce

$$N_\sigma(E) = F + \sigma G \cosh E, \quad Y_\sigma(E) = A - 2\sigma W \cosh E = N_\sigma^2 - \sinh^2 E I.$$

$$R_\sigma(E) = \mathbf{1}_{(-\infty, 0)}(Y_\sigma) (-Y_\sigma)^{-1/2}.$$

The inverse in the last expression acts only on the negative spectral subspace and is zero on its complement. At a threshold it is understood through the integrable limiting density. N_σ commutes with Y_σ and R_σ . On that subspace its eigenvalues v satisfy $|v| < \sinh E$. Consequently both matrices below are positive semidefinite:

$$Q_\sigma = \frac{1}{\pi} (\sinh E I + \sigma N_\sigma) R_\sigma \geq 0,$$

$$\tilde{Q}_\sigma = \frac{1}{\pi} (\sinh E I - \sigma N_\sigma) R_\sigma \geq 0.$$

This is the noncommuting-background replacement for the scalar free cut calculation. The square roots of Q_σ and its backward counterpart give the required reflection factors.

17.41 Static link reflection positivity and the Weyl restriction

With $D(n) = \int dp \exp(ipn) D(p) / (2\pi)$, deforming the contour gives the forward and backward noncontact kernels

$$-GD(n) = \int_0^\infty e^{-nE} [Q_+(E) + (-1)^{n+1} Q_-(E)] dE, \quad n \geq 1.$$

$$GD(-n) = \int_0^\infty e^{-nE} [\tilde{Q}_+(E) + (-1)^{n+1} \tilde{Q}_-(E)] dE.$$

These equations first hold when W is nonsingular. Its eigenvalues may have either sign. The large semicircle vanishes for $n \geq 1$ because the integrand grows at most as $\exp(E/2)$. For singular W , take $F\delta = F - \delta G$, so $W\delta = W + \delta I$, choose nonsingular values tending to zero, and pass to the continuous finite-lattice kernel. This also includes nearest-neighbour terms arising from thresholds at infinity.

The sign from the π cut is essential. For reflection through the link between times zero and one, the separation is $n = t + s - 1$, and $(-1)^{n+1} = (-1)^t (-1)^s$. Thus, for finitely supported slice vectors,

$$a_\sigma(E) = \sum_{t \geq 1} \sigma^t e^{-Et} v_t,$$

$$\sum_{t,s \geq 1} v_t^\dagger [-GD(t + s - 1)] v_s = \int_0^\infty e^E \sum_{\sigma = \pm 1} a_\sigma^\dagger Q_\sigma a_\sigma dE \geq 0.$$

The backward kernel has the same Gram factorization with the positive matrices $\tilde{Q}_\sigma$. Taking their square roots puts both cross-plane terms of the fermion action in the closure of reflected Grassmann squares. Also $D(-p) = G D(p)^\dagger G$, so reflection exchanges the two same-side actions. The Grassmann algebra argument used for overlap fermions [55] establishes the full Dirac Gaussian link-reflection inequality, not merely the positivity of a few sampled propagator matrices.

On an even temporal circle, antiperiodic images give positive factors $1/(1 + \exp(-N_t E))$; the π phase is unchanged because N_t is even. The paired real frequencies make the determinant a product of absolute squares. It is nonzero: for $\sin p \neq 0$, the imaginary part of $GD(p)$ is $\sin p$ times the positive inverse square root. Hence the normalized Gaussian functional is well defined. Infinite-time limits inherit the inequality whenever the regulated correlations exist; zero modes require the same limiting prescription as in the free note.

The physical Weyl observable restriction

$$Q_\pm^{\text{ch}} = \frac{I \pm \gamma_5}{2}, \quad P = Q_-^{\text{ch}} + \frac{1}{2} \gamma_5 D, \quad Q_-^{\text{ch}} P D^{-1} Q_+^{\text{ch}} = Q_-^{\text{ch}} D^{-1} Q_+^{\text{ch}}.$$

The ordinary Q_-^{ch} components of ψ and Q_+^{ch} components of the barred field have exactly the corresponding Dirac contractions. Wick factorization therefore transfers the fixed-background inequality to this physical Weyl observable algebra. This does not select a gauge-dependent determinant phase or prove positivity after dynamical gauge integration.

17.42 The obstruction to nonnegative one step evolution

Link reflection builds the inner product using time separations $t + s - 1$. One-step translation instead introduces $t + s$. The π contribution then changes sign. The distinction between lattice link reflection, site reflection and a nonnegative one-step transfer operator is standard [58]; it cannot be dropped when promoting the free result.

If W has a negative direction, $Y_- = A + 2W \cosh E$ acquires a negative spectral subspace for sufficiently large E . This creates a π cut. To show that this is a genuine propagator contribution, rather than an artifact canceled upon inversion, take the bank with inverse-square-root value equal to the positive-subspace part minus iR_- . Then

$$\mathcal{B}_\pi = GD(\pi + iE + 0) = G + (\sinh E I - N_-)(Y_-^{-1/2})_{\text{bank}},$$

$$J_\pi(E) = \frac{1}{\pi} \text{Im} \mathcal{B}_\pi^{-1} = \mathcal{B}_\pi^{-\dagger} Q_-(E) \mathcal{B}_\pi^{-1} \geq 0.$$

Here $\text{Im } M$ means $(M - M^\dagger)/(2i)$. The second identity is the inverse-matrix identity for the imaginary part. Q_- is strictly positive on the cut subspace, so J_π is nonzero wherever that subspace is nonempty and the inverse exists. Isolated pole locations do not remove an open continuum contribution. Subtracting the contact term does not change this imaginary part.

$$[C(n)G]_{\pi \text{ cut}} = (-1)^{n+1} \int e^{-nE} J_\pi(E) dE, \quad C = D^{-1} - \frac{1}{2}I.$$

In the Hilbert space reconstructed with link reflection, the contribution has a nonnegative norm weight $\exp(-E)J_\pi$. Its one-step translation multiplier is

$$r_\pi(E) = -e^{-E} < 0, \quad r_\pi(E)^2 = e^{-2E} > 0.$$

A nonzero contribution on these negative multipliers excludes a representation with a nonnegative one-step transfer operator and hence excludes $T = \exp(-H)$ with self-adjoint H at the same unit time step. It is compatible with the link-reflection theorem and with a nonnegative two-step transfer. Replacing the primitive step by two steps would require a separate physical justification.

This argument diagnoses the propagator itself. A negative eigenvalue of W alone would not be a sufficient numerical reflection-positivity test; the cut and inverse identities supply the missing connection. The next section gives an admissible field for which that connection is nonzero.

17.43 An explicit non Abelian counterexample

On a spatial $2 \times 2 \times 2$ periodic lattice take the following links, independent of time. The σ_i are colour Pauli matrices, and $\varepsilon > 0$ is a dimensionless link angle.

$$U_x(x, y, z) = e^{i\varepsilon(-1)^{y+z}\sigma_1}, \quad U_y(x, y, z) = e^{i\varepsilon\sigma_2}, \quad U_z = U_0 = I.$$

The same pattern repeats on any even lattice. In the forward-transport convention, at a site with $(-1)^{y+z} = 1$ put $A_1 = \exp(i\varepsilon\sigma_1)$ and $A_2 = \exp(i\varepsilon\sigma_2)$. The based plaquettes $P_{xy} = A_2^\dagger A_1 A_2 A_1$ and $P_{xz} = A_1^2$ do not commute. Their nonzero commutator is gauge invariant up to conjugation, confirming a genuinely non-Abelian background.

There is an invariant slice subspace with spatial momenta $(0,0,0)$ and $(0,\pi,\pi)$. Use τ_i for Pauli matrices on this two-mode space. The resulting colour shifts are

$$T_x = \cos \varepsilon I + i \sin \varepsilon \tau_1 \otimes \sigma_1,$$

$$T_y = \tau_3 \otimes (\cos\epsilon I + i\sin\epsilon \sigma_2), \quad T_z = \tau_3 \otimes I.$$

Including four Dirac components gives an exact 16-dimensional block of the 64-dimensional spatial operator. Its spatial seed is

$$W_s = [(3 - \cos\epsilon)I - (1 + \cos\epsilon)\tau_3] \otimes I_{\text{colour}},$$

$$S = W_s \otimes I_{\text{spin}} + i\sin\epsilon(\tau_1 \otimes \sigma_1 \otimes \gamma_1 + \tau_3 \otimes \sigma_2 \otimes \gamma_2).$$

The coefficient of ϵ^2 can be derived without numerical fitting. At $\epsilon = 0$ the low mode has $K = 0$ and the high mode has K eigenvalues ± 4 . The direct low-mode Wilson term contributes $+\epsilon^2$. The kinetic low-high mixing contributes $-(\sinh 4 - 4)\epsilon^2/16$, using the repeated divided difference of $\sinh$ at $0, \pm 4, 0$. The constant y-link kinetic term stays within the low mode and first contributes at higher order to W . For the normalized basis vector below,

$$v = (1,0)_\tau \otimes (1,0)_{\text{colour}} \otimes (1,0,0,0)_{\text{spin}}.$$

$$v^\dagger W_\lambda v = [1 - \lambda \frac{\sinh 4 - 4}{16}] \epsilon^2 + O(\epsilon^4).$$

$$\frac{20 - \sinh 4}{16} = -0.4556198248204845 \dots, \quad \lambda_c = \frac{16}{\sinh 4 - 4} = 0.6869925669797234 \dots$$

At $\lambda = 1$ the leading coefficient is strictly negative. Analyticity and the even ϵ dependence of this Rayleigh quotient imply a negative direction for every sufficiently small nonzero ϵ . Hence no open link neighbourhood around the identity can give positive one-step evolution for every static background of the hyperbolic endpoint. The displayed λ_c is the small-field threshold for this fixture, not a classification of all backgrounds.

17.43.1 High precision verification in the certified neighbourhood

Set $\epsilon = 10^{-4}$ and $\lambda = 1$ without changing any operator coefficient. Every link obeys $\|U - I\|_2 \leq 2 \sin(\epsilon/2) = 0.00009999999999583333\dots$, strictly inside the inherited neighbourhood. The main paper's uniform seed-gap bound ≥ 0.7575974459 therefore still applies. The obstruction occurs while the gap and the established locality control remain intact.

$$b_{\min} = \lambda_{\min}(2A^{-1/2}WA^{-1/2}), \quad E_\pi = \text{arcosh}(-1/b_{\min}).$$

Quantity	Reproduced value
Smallest eigenvalue of W	$-4.5561981519855765 \times 10^{-9}$
Explicit low-mode Rayleigh quotient	$-4.5561981442214304 \times 10^{-9}$
Smallest eigenvalue b of B	$-9.1123919713734093 \times 10^{-9}$
First π -cut threshold E_π	19.2067777752351667
Edge of the negative transfer interval	$-\exp(-E_\pi) = -4.5561959856867048 \times 10^{-9}$
$\text{tr } J\pi$ at $E = E_\pi + 1$	$5.5949386836974417 \times 10^{-9}$
$\text{tr } Q_-^{\text{ch}} J\pi$ at the same E	$2.7974693418487208 \times 10^{-9}$
Based plaquette commutator Frobenius norm	$1.1313708329279134 \times 10^{-11}$

high_precision.py constructs the 16-dimensional matrices directly from the Pauli matrices and trigonometric links. It evaluates $\sinh K$ with two matrix exponentials and repeats all calculations at 55 and 85 decimal digits. The displayed numbers agree at both precisions. At 85 digits the inverse residual is below

4×10^{-81} . The eight nonzero eigenvalues of $J\pi$ are approximately $6.9936733546 \times 10^{-10}$; the other eight are zero within precision. This is a continuum contribution with a nonzero physical Weyl restriction.

Ordinary double precision is inadequate for the weakest-field covariance discontinuity: it subtracts quantities involving $\cosh E$ of order 10^8 . The high-precision calculation addresses that concrete cancellation risk. The analytic small-field sign and the matrix cut proof supply the structural argument; precision agreement is a numerical verification, not an interval-arithmetic certification.

The negative interval lies very close to zero in transfer value and produces strongly suppressed, alternating contributions at the lattice scale. Its small size does not remove the exact finite-step obstruction. Sections 17.45–17.49 bound all negative covariance spectral support, including possible poles, and establish conditional decoupling under refinement.

17.44 Independent static checks

`verify.py` reconstructs the full spatial link operator independently and checks its invariant block. It also compares real-frequency Fourier evaluation of the unchanged overlap action against the two-cut matrix integral. These checks test the cut orientation, matrix ordering and normalization used in the proof.

Static checker field	Action Fourier versus cuts	Minimum link Gram eigenvalue
$\varepsilon = 0.1, \lambda = 0$	2.30e-11	8.85e-14
$\varepsilon = 0.1, \lambda = 0.5$	1.03e-09	-1.73e-16
$\varepsilon = 0.1, \lambda = 1$	2.03e-09	8.43e-17
$\varepsilon = 0.3, \lambda = 1$	3.30e-10	1.40e-15

The independent full-lattice embedding residual is $6.36\text{e-}16$, and the Hermitian spectral evaluation of $\sinh K$ differs from the matrix-exponential construction by $1.60\text{e-}13$. A separate 64-dimensional random $SU(2)$ fixture gives minimum link-covariance Gram eigenvalue $-6.29\text{e-}17$. Small negative sampled values at machine precision are roundoff; the analytic factorization establishes the inequality.

The Fourier checks use 2,048 midpoint frequencies and time separations 1 through 8. Four positive-time slices form each displayed Gram matrix. The random fixture uses 1,024 frequencies. Cut integrals are split at every distinct matrix threshold and use a $\sin^2$ substitution, with a documented small endpoint regularization; agreement is at the stated numerical precision, not a substitute for the proof. The archive records quadrature estimates and every input.

17.45 Excluding negative transfer cuts and poles near the unit circle

The decoupling continuation [57] uses the same static operator. Let W_- denote the negative part of W and assume the following bound. It can be evaluated on an individual spatial operator or replaced by the volume-independent estimate in Section 17.47.

$$\delta = \|W_-\| = \max\{0, -\lambda_{\min}(W)\} < \frac{1}{2}.$$

$$q_\delta = \frac{2\delta}{1 + \sqrt{1 - 4\delta^2}}, \quad E_\delta = -\log q_\delta = \operatorname{arcosh} \frac{1}{2\delta}.$$

For $\delta = 0$ set $q_\delta = 0$ and $E_\delta = \infty$. The theorem states that the positive spectral measure reconstructed from link reflection has no negative support outside the interval below. Here T is one-step translation on the covariance-generated Hilbert space and P_- is its negative spectral projection. The matrix norm is the Hilbert-space operator norm.

$$\operatorname{supp} \mu \cap [-1, 0) \subseteq [-q_\delta, 0), \quad \|T^n P_-\| \leq q_\delta^n.$$

To prove the required analytic gap, continue temporal frequency to the negative real transfer axis:

$$p = \pi + iE, \quad q = e^{-E}, \quad Y_\pi = A + 2W \cosh E, \quad X_\pi = -GF + G \sinh E + I \cosh E.$$

Since $A \geq I$ and $W \geq -\delta I$, the inverse square root has no branch cut as long as $q > q\delta$:

$$Y_\pi \geq [1 - \delta(q + q^{-1})]I > 0 \quad (q\delta < q \leq 1).$$

The covariance could in principle have a pole before that cut. The Hermitian part of X excludes this possibility. The minimum eigenvalue of $\cosh E I + \sinh E G$ is $\exp(-E) = q$, so

$$\operatorname{Re} X_\pi = W + I \cosh E + G \sinh E \geq (q - \delta)I > 0.$$

$$D(\pi + iE) = (Y_\pi^{1/2} + X_\pi)Y_\pi^{-1/2}.$$

The first factor in the last expression has strictly positive Hermitian part and is therefore invertible. Thus D^{-1} is analytic across every point of $-1 \leq z < -q\delta$, where $z = \exp(ip)$. This establishes an interval free of both branch singularities and propagator poles. It uses only $F^\dagger = F$, $G^2 = I$ and the stated bound on W , without commuting spatial links.

17.46 Spectral reconstruction and a bound on normalized amplitudes

A small auxiliary mass makes the reconstruction argument independent of massless zero-mode conventions. Set

$$D_m = \alpha D + mI = \beta I + \alpha XY^{-1/2}, \quad \alpha = 1 - \frac{m}{2}, \quad \beta = 1 + \frac{m}{2}, \quad 0 < m < 2.$$

For real p the overlap factor $XY^{-1/2}$ is unitary, hence the smallest singular value of D_m is at least m . Scaling the previously proved reflected cross terms by $\alpha > 0$ and adding an on-site mass preserves link-reflection positivity. The normalized massive covariance therefore exists, and its Fourier coefficients are bounded uniformly in the time index. This mass is an infrared regulator in the proof, not a change to the claimed massless completion.

Define $C_m(p) = D_m(p)^{-1} - I/2$ and let $C_m(n)$ be its Fourier coefficient. The contact subtraction does not affect $n \geq 1$. The link-reflection inequality makes every block Hankel matrix with entries $M_{i+j} = C_m(i+j+1)G$ nonnegative. It gives the matrix spectral representation

$$M_n = C_m(n+1)G = \int_{-1}^1 r^n d\mu_m(r), \quad n \geq 0, \quad d\mu_m \geq 0.$$

For completeness, build the Hilbert space of vector polynomials with inner product determined by these Hankel matrices. Multiplication by r is symmetric. For any polynomial v the sequence $\|r^n v\|^2$ is bounded, because the moments are bounded, and log-convex by Cauchy-Schwarz. A bounded nonnegative log-convex sequence cannot increase. Therefore multiplication by r is a contraction; after quotienting null vectors it extends to a self-adjoint contraction T . Its spectral measure gives the displayed representation on $[-1, 1]$.

The two-sided Fourier series separates into a Cauchy transform of this measure and a function analytic inside the unit disk:

$$C_m(p)G = C_m(0)G + \int_{-1}^1 \frac{d\mu_m(r)}{z - r} + H_m(z), \quad z = e^{ip}.$$

$$H_m(z) = \sum_{n \geq 1} C_m(-n)Gz^n, \quad |z| < 1.$$

Here $C_m(0)$ is the zero Fourier coefficient. Continue the identity from its convergent Fourier region. The backward coefficients are bounded, so H_m is analytic for $|z| < 1$ and Hermitian on the real axis. On the interval of Section 17.45, $D_m = (\beta Y^{1/2} + \alpha X)Y^{-1/2}$ is invertible by the same accretivity argument. Also GD_m is Hermitian: $F - G \cosh E$ commutes with $Y_\pi = (F - G \cosh E)^2 - \sinh^2 E I$. Thus $C_m(p)G$ is Hermitian there.

The Cauchy transform therefore extends analytically with Hermitian values through $(-1, -q\delta)$. Its positive measure has no support there; analyticity at $z = -1$ excludes an endpoint atom. The spectral theorem gives $\|T^n P_-\| \leq q\delta^n$, independently of m .

The inherited symmetric antiperiodic massless limit also has bounded Fourier coefficients. Its only possible real-frequency pole is at $p = 0$. There $GD(p) = GD(0) + ipY(0)^{-1/2} + O(p^2)$; $Y(0)^{-1/2}$ is strictly positive on the nullspace of the Hermitian $GD(0)$. The pole is therefore at most simple, and the symmetric Fourier prescription is bounded. The same moment argument applies directly. The backward sector has the same exclusion. Wick contractions carry suppression to fixed-degree Gaussian observables with bounded normalized factors.

17.47 A uniform bound in the admitted gauge neighbourhood

For a background that can be put in a gauge with $\max \|U_i(x) - I\| \leq \varepsilon$, the existing spatial estimate is $\|K_u - K_0\| \leq 6\varepsilon$ and $\|K_0\| \leq 6$. The Duhamel formula for the two matrix exponentials in $\sinh$ gives

$$\|F_U - F_0\| \leq 6\varepsilon e^{6+6\varepsilon}, \quad \delta_U \leq \Delta(\varepsilon) := 6\varepsilon e^{6+6\varepsilon}.$$

The second inequality follows because the free W_0 is nonnegative. In each free spatial momentum block, $K_0^2 = \kappa^2 I$ and

$$F_0 = h_\lambda(\kappa)K_0, \quad h_\lambda(\kappa) = 1 - \lambda + \lambda \frac{\sinh \kappa}{\kappa} > 0, \quad W_0 = h_\lambda(\kappa)W_{s,0} \geq 0.$$

At $\kappa = 0$ use $\sinh \kappa/\kappa = 1$. $W_{s,0} = \sum_i (1 - \cos k_i)I$ is nonnegative. The estimate holds for every λ in $[0,1]$ and every spatial volume. A gauge transformation conjugates W , so the spectral conclusion also holds on the gauge orbit of this neighbourhood. This is a sufficient small-link condition, not a statement about every field satisfying only a plaquette bound.

$$\epsilon_* = 10^{-4}, \quad \Delta_* = 0.2422025540403 \dots, \quad q_* = 0.2583709136676 \dots$$

Since $\Delta^* < 1/2$, Section 17.45 applies throughout the earlier certified neighbourhood. The inherited conservative seed-gap bound remains 0.7575974459597. The number q^* bounds all negative covariance spectral values; it is deliberately much weaker than the bound obtained for the explicit weak $SU(2)$ fixture.

Number of one-step translations n	Upper bound for $\ T^n P_-\ $
1	0.2583709137
5	$1.151378473 \times 10^{-3}$
10	$1.325672386 \times 10^{-6}$
20	$1.757407275 \times 10^{-12}$
100	$1.676339966 \times 10^{-59}$

These are bounds for normalized Hilbert-space amplitudes in the covariance sector. They are not percentages of an arbitrary raw lattice correlator, whose normalization may depend on the regulator. For polynomially growing state norms or field renormalizations, the exponential suppression still dominates at fixed positive physical separation.

Decay energy

For a negative transfer value r , define its decay energy from $|r|$. This describes the envelope of its alternating Euclidean contribution and does not assert a self-adjoint logarithm of the negative one-step operator.

$$\mathcal{E}_-(a_t) := -\frac{\log|r|}{a_t} \geq \frac{1.3533590766154 \dots}{a_t}.$$

17.48 Conditional decoupling under physical refinement

Consider any sequence of the admitted static backgrounds, with spatial volume allowed to grow, and assign physical durations $a_t \rightarrow 0$ to their dimensionless time steps. Let n_a be integers with $n_a a_t \rightarrow t > 0$. For states of bounded norm, the uniform estimate proves

$$|\langle \psi_a, T_a^{n_a} P_{-,a} \phi_a \rangle| \leq q_*^{n_a} \|\psi_a\| \|\phi_a\| \rightarrow 0, \quad n_a a_t \rightarrow t > 0.$$

No fit, even-time projection or replacement of the local kernel is used. The two parities of n_a have the same vanishing bound. Negative spectral values can remain present at every finite lattice spacing; their decay energies diverge at least as $1/a_t$. The theorem rules out their survival in separated-time limits within this static Gaussian sector. It does not control contact terms at $t = 0$.

Smooth fixed physical backgrounds

For a fixed smooth static connection with a globally bounded gauge potential $\mathcal{A}_i$ on the region under study, the path-ordered link exponential obeys the elementary integral bound below. The gauge coupling, if any, is absorbed into $\mathcal{A}_i$. Hence sufficiently fine spatial lattices enter the admitted neighbourhood, and the bound improves as they are refined:

$$\epsilon(a_s) \leq a_s \sup_{x,i} \|\mathcal{A}_i(x)\|, \quad q_{\Delta(\epsilon(a_s))} = O(a_s).$$

$$\|T_a^{n_a} P_{-,a}\| \leq (C a_s)^{n_a} = \exp[-n_a \log \frac{1}{C a_s}] \quad (C a_s < 1).$$

Here C is independent of lattice volume and spacing. For a_t proportional to a_s , the magnitude of the suppression exponent grows at least proportionally to $(t/a_t) \log(1/a_s)$. Backgrounds requiring several gauge patches or lying outside a globally small-link orbit require a separate argument.

The checker field is not a fixed smooth field

The explicit counterexample flips sign at the lattice scale. Its P_{xz} plaquette differs from identity by $O(\epsilon)$. For an isotropic spacing a , its physical curvature scale is therefore $O(\epsilon/a^2)$. Keeping ϵ fixed, or taking ϵ proportional to a , does not approximate a fixed bounded-curvature continuum connection. Taking ϵ proportional to a^2 bounds this curvature scale but retains rapid oscillations and does not by itself establish smooth convergence.

The small- ϵ sweep in Section 17.49 tests the spectral mechanism; it is not a smooth-background continuum extrapolation. The uniform theorem supplies the refinement conclusion, and the smooth-link inequality states an explicit class of fixed physical backgrounds to which it applies.

Existence and source selection remain separate

The positive spectral part must still converge with the required locality, field normalization and continuum symmetries. A static calculation also cannot replace control of time-dependent gauge fields or the gauge-integrated chiral measure. The VERSF source treats sequential opportunities and physical duration as different objects: the record-to-fermion map and the map to physical time are still unselected in the cited source theorem [31, Sections 24–27]. A mathematical limit $a_t \rightarrow 0$ cannot supply those selections.

17.49 High precision refinement checks on the invariant block

The same exact 16-dimensional $SU(2)$ block in Section 17.43 is evaluated at five link amplitudes, without changing any operator coefficient. The table compares the first negative cut edge q_{cut} with the bound $q\delta$ that also covers possible poles. The two largest amplitudes test individual blocks outside the uniformly certified 10^{-4} neighbourhood; they are not claimed to lie inside that neighbourhood.

Link angle ϵ	Cut magnitude q_{cut}	Bound $q\delta$	Cut height $\epsilon\pi$
1e-02	4.5337064905e-05	4.5552360691e-05	10.00138565

Link angle ε	Cut magnitude q_{cut}	Bound $q\delta$	Cut height $E\pi$
1e-03	4.5559720097e-07	4.5561886263e-07	14.60165675
1e-04	4.5561959857e-09	4.5561981520e-09	19.20677778
1e-05	4.5561982256e-11	4.5561982472e-11	23.81194747
1e-06	4.5561982480e-13	4.5561982482e-13	28.41711765

All five cases were evaluated independently at 60 and 90 decimal digits. The recorded δ , q_{cut} , $q\delta$, $E\pi$ and covariance cut trace agree to relative error below 10^{-35} . The code also checks the two matrix lower bounds and direct invertibility of D at three heights below $E\delta$ for each case. These checks verify the implementation of the analytic exclusion; they are not interval-arithmetic certificates.

At $\varepsilon = 10^{-4}$, the all-negative bound on this invariant block is $q\delta = 4.556198151985577 \times 10^{-9}$. It is slightly larger than the cut edge $4.556195985686705 \times 10^{-9}$, as expected because the theorem must also cover possible poles. For this block,

$$\|T^{10}P_{-}\| \leq (4.556198151986 \times 10^{-9})^{10} < 3.9 \times 10^{-84}.$$

The sharper numerical bound concerns the invariant block computed here; the uniform theorem covers the full spatial operator. The ratio $q_{\text{cut}}/\varepsilon^2$ approaches 0.4556198248, consistent with the analytic small-field mechanism. At $E = E\pi + 1$ the covariance cut trace divided by ε^2 approaches 0.5594940132; its physical Weyl restriction has half that trace. The cut persists while its temporal range becomes shorter. The finite-step obstruction remains.

17.50 Scope of the static results and the next consistency task

The fixed-static link-reflection question is resolved for the gapped canonical family. Exact nonnegative one-step evolution is ruled out generally at the hyperbolic endpoint. Within the admitted neighbourhood, the negative covariance sector has a volume-independent decay bound and disappears at fixed positive time under the specified $a_t \rightarrow 0$ calibration. The invariant-block bound in Section 17.49 is sharper than the uniform full-operator bound; it is not substituted for the latter.

The general distinction between link and site reflection, and the role of a positive two-step transfer, are standard [58]. Negative temporal transfer modes and cutoff-scale oscillations also occur in domain-wall fermions [59]. The result here is the explicit matrix proof, admissible $SU(2)$ obstruction and uniform spectral exclusion for this declared sequential completion. These calculations do not constitute a new general overlap-positivity theorem.

A time-dependent test must specify a genuinely time-dependent non-Abelian background compatible with the temporal reflection being tested and evaluate the full fermion covariance. The static Fourier reduction no longer applies. A reflection-compatible counterexample would identify a further obstruction; a proof would need a corresponding time-dependent factorization. A dynamical gauge theorem must then include the gauge action, chiral measure and integration. The existence of a positive-sector continuum limit, physical time calibration and unique microscopic source selection remain distinct requirements [31,32].

References [56,57] provide CLSN1_Static_Gauge_Positivity_Reproducibility.zip and CLSN1_Static_Transfer_Decoupling_Reproducibility.zip. They contain the exact fixture, high-precision scripts, independent Fourier and embedding checks, full numeric outputs, native equations and SHA-256 manifests. The decoupling proof retains signed K , introduces no fitted coefficient, and does not replace the primitive step by a two-step evolution. No Standard Model coupling, occurrence scale or neutrino normalization is determined by these results.

17.51 A protected metric does not determine the current gauge scale

This is a supporting sufficiency test of the physical-normalisation route, separate from the static positivity results. The original EPMD-1 source [60] has 226 variables, 39 exact kinematic nulls and a 187-dimensional quotient. Its complete defect differential has 243 rows and rank 183. Let Q be the archived orthonormal quotient basis, let A and V be the native defect and potential Jacobians, and use the Moore–Penrose inverse on the realizable support:

$$A = J_D Q \in \mathbb{R}^{243 \times 187}, \quad V = J_V Q, \quad \text{rank} A = 183, \quad \dim \ker A = 4.$$

$$P = A^+ A, \quad R_D = A A^+, \quad W_0 = (A A^T)^+.$$

Here N spans the four-dimensional kernel of A , P projects onto defect-producing tangent directions, and projects onto realizable defect amplitudes. HSPR-1 already identifies the protected common Higgs line inside this kernel and retains its distance-functional bridge as premise P8 [62]. For the present test we grant the stronger reference condition that the entire protected metric is the identity. This is a hypothesis of the sufficiency test, not a derivation of P8.

$$G_s = I + s A^T A, \quad s \geq 0.$$

$$N^T G_s N = I_4, \quad N^T G_s P = 0.$$

Every member is positive definite on the quotient, agrees on the full protected sector and has zero protected–visible cross block. Apply the operational minimum-norm construction already established conditionally in RPC-1 [61]:

$$E_s = G_s^{-1} A^T (A G_s^{-1} A^T)^+ = A^+,$$

$$W_s = (A G_s^{-1} A^T)^+ = W_0 + s R_D = E_s^T G_s E_s.$$

Proof. In a thin singular-value decomposition of A on its rank-183 support, has eigenvalues $1 + s \sigma_i^2$ on the right singular vectors and one on the kernel. The support covariance A inverse A transpose has eigenvalues $\sigma_i^2 / (1 + s \sigma_i^2)$. Its support inverse is $+ s$, and substitution into the lift cancels the same factors to give A^+ . Thus the lift and Fisher pullback identities hold for every nonnegative s .

For realizable d , the prescribed Gaussian proposal and its correctly normalized information rate are

$$\xi \mid d \sim \mathcal{N}(a_t E_s d, a_t G_s^{-1}), \quad \frac{D_{\text{KL}}(Q_d \parallel Q_0)}{a_t} = \frac{1}{2} d^T W_s d.$$

These identities hold throughout the family and cannot select s . s is positive on the rank-183 realizable image and has a 60-dimensional null complement in the ambient 243-dimensional residual carrier. Keeping the original potential fixed gives

$$H_s = V^T V + A^T W_s A = V^T V + P + s A^T A.$$

The parent is positive because P controls the defect-producing complement and the native potential controls the remaining four directions. The $s = 0$ identity response is the previously quarantined whitening control [61], not a physical gauge prediction. Distinct positive- s members already suffice for the non-uniqueness result.

17.52 Fixed conversion and an explicit full source witness

The source face-incidence product has eigenvalues $\ell = 1, 2, 2, 4, 4, 5$. In each of the three scalar factor copies, retain the normalized current cycle p , with $= \text{cycle}/\sqrt{2}$ and $= -\text{cycle}/\sqrt{2}$, and its matched link coordinate θ . On current p , its conjugate partner q , link θ and record phase y , the native invariant cycle block is the extension of the RCHS-1 block [4]:

$$H_4(\ell) = \begin{pmatrix} 1 & 0 & -1/\sqrt{2} & 0 \\ 0 & 1 & 1/\sqrt{2} & 0 \\ -1/\sqrt{2} & 1/\sqrt{2} & \ell + 2 & -1 \\ 0 & 0 & -1 & \ell + 1 \end{pmatrix}.$$

The potential vanishes on this invariant block, which lies in the defect-producing tangent space. Therefore restricts to $I_4 + s H_4(\ell)$. Define $a = 1 + s$, $b = s/\sqrt{2}$, $d_0 = 1 + s(\ell + 2)$, and $e = 1 + s(\ell + 1)$. Eliminating q and y gives

$$S_s(\ell) = \begin{pmatrix} a & -b \\ -b & D \end{pmatrix}, \quad D = d_0 - \frac{b^2}{a} - \frac{s^2}{e}.$$

The fully relaxed link and current stiffnesses are $K_\theta = D - b^2/a$ and $K_J = a - b^2/D$. Their effective mixed map and reciprocity relation are

$$B_{\text{eff}} = \frac{s}{\sqrt{2}(1+s)}, \quad K_J^{-1} = (1+s)^{-1} + B_{\text{eff}}^2 K_\theta^{-1}.$$

The induced residual metric has cross terms, so the effective reduced map must be extracted from the actual mixed block. It is not automatically the diagonal-weight value $1/\sqrt{2}$, even though the bare constitutive coefficient in the native source equations remains one. To show that non-uniqueness survives a fixed effective conversion as well, hold a positive s fixed and vary c only in the defect-producing directions:

$$G_{c,s} = I - P + c(P + sA^T A), \quad W_{c,s} = c(W_0 + sR_D), \quad c > 0.$$

$$H_{c,s} = V^T V + c(P + sA^T A).$$

The same singular-value proof gives lift A^+ , while the protected metric remains I_4 and its cross block stays zero. The entire cycle response scales by c because the potential vanishes there:

$$S_{c,s} = cS_s, \quad K_{\theta,c,s} = cK_\theta(s), \quad K_{J,c,s} = cK_J(s).$$

The effective current-link map is unchanged. For $s = 1$ and $\ell = 4$ the exact witness is:

Visible scale c	Protected metric	Effective B	K_θ	K_J
1/2	I_4	$\sqrt{2}/4$	19/6	76/79
1	I_4	$\sqrt{2}/4$	19/3	152/79
2	I_4	$\sqrt{2}/4$	38/3	304/79

This is not a rescaling of the whole action: the original potential and protected metric are fixed. The full calculation retains 18 current and 18 link coordinates in the 187-dimensional quotient and eliminates all 151 remaining coordinates. Its Schur matrices agree with the cycle formulas, and their inverses agree with the retained susceptibility computed from the inverse full Hessian. The stricter fixed-conversion family passes all 24 of its numerical checks.

17.53 Verification scope and the remaining physical selection

The calculation archive [63] verifies seven consumed input files against the original EPMD-1 SHA-256 manifest and reproduces the native Jacobians. In total, 108 named numerical checks and 20 exact rational mode-parameter checks pass. Across the s family, the protected-metric error is below 2.5×10^{-15} , the core-Hessian identity error below 3.6×10^{-13} , and the full matrix reciprocity error below 5.1×10^{-16} , all in Frobenius norm. A directional check of the original nonlinear source with fixed W at $s = 1$ has error 1.36×10^{-9} and the expected second-order step convergence.

The scope remains finite and conditional. The source has only 36 scalar link tangents, compared with 144 for a faithful $SU(3) \times SU(2) \times U(1)$ connection on its twelve-edge graph; its deficit of 108 is inherited from

EPMD-1. The constructed metrics are not independently admitted physical returns. A physical bath, locality, refinement or a globally derived operational geometry could restrict them, and those requirements are not certified here.

The established result is that the granted protected-sector anchor, the conditional Gaussian core identities and current-link reciprocity do not suffice to fix the response on this carrier. General common-scale freedom was already known [4,5]; the additional test shows that imposing the whole protected metric does not remove it. The next physical return must select the metric on defect-producing current and gauge directions. No physical coupling, completed-Fact scale or neutrino renormalisation is issued from this supporting result. Section 17.54 records the admission test; Sections 17.56–17.60 address a separate, explicitly identified candidate bath.

17.54 What the protected-scale family changes upstream

The admission test [71] uses the archived EPMD matrices rather than a replacement fixture. Its quotient defect Jacobian A has shape 243×187 , rank 183 and a four-dimensional kernel. At the fixed CGN shape parameter $s = 1$, write $P = A^+A$ and $P_0 = I - P$. The diagnostic metric and covariance are

$$M = P + A^T A, \quad G(c) = P_0 + cM, \quad D(c) = G(c)^{-1} = P_0 + c^{-1}M^+, \quad c > 0.$$

Relative to $c = 1$, the generalized metric eigenvalues are 1 with multiplicity four and c with multiplicity 183; the covariance eigenvalues are 1 and $1/c$ with the same multiplicities. They are invariant under a simultaneous change of coordinates. A common clock rescaling would require $D(c) = \alpha D(1)$. The protected directions force $\alpha = 1$, after which the visible directions force $c = 1$. The displayed family therefore changes relative diffusion, not just the clock.

In its constant-coefficient Gaussian realization, the positive generator is $-\frac{1}{2}D(c)^{ij}\partial_i\partial_j$. Changing c changes its principal symbol at fixed physical coordinates; adding a lower-order drift or potential cannot undo that change. This is a statement about the declared Gaussian realization, not every possible microscopic origin of the metric. Forty-one numerical checks reproduce the source matrices, earlier relaxed responses, inverse and generalized spectra [71].

Once a complete physical kernel family and its normalized physical source perturbation are fixed, the score and covariance are fixed. Multiplying the resulting metric downstream is not a second realization of that unchanged source. Conversely, this elementary fixed-source fact does not derive the source, select the diagnostic member $c = 1$, or prove physical uniqueness. The family still lacks full physical admission and the faithful connection carrier described in Section 17.53.

The full-carrier refinement residual proposed in [71] was not evaluated. The corrected reason is the absence of matched physical inputs for that particular carrier and deformation in the recovered package, not the absence of refinement maps throughout the corpus [64]. The NFDMA construction examined next is a distinct candidate and does not supply that unperformed CGN admission test.

17.55 A native-work attachment tested by its curl

The independent work pairing in Section 7 cannot be supplied by naming a momentum kick a force. The native source reproduction [70] retains edge 9, oriented $0 \rightarrow 4$, the archived 50-dimensional prime-chirp endpoints, maximal-current complement and fixed incoming preparation. Its hypercharge second moment is 0.11474015448901476. For a declared kinetic energy $kp^2/2$, the local second-moment contribution to work is 0.05737007724450738κ. The source does not determine κ or the full matter-record-bath work budget.

To test a direct mean-kick identification, use the commuting chart $U(x,y) = \exp[i(xT_3 + yY)]$ and stack the native Kraus outputs into the normalized vector $\Psi(x,y)$. Its mean-kick one-form is $a_i = -i\Psi^\dagger\partial_i\Psi$. A conservative static scalar work gradient on this fixed chart must have zero curl. Direct differentiation instead gives

$$F_{xy} = \partial_x a_y - \partial_y a_x = 2\text{Im}[(\partial_x \Psi)^\dagger \partial_y \Psi] \simeq 0.0005265814976614051.$$

Independent finite-field derivatives and overlap phases around small closed squares converge to this nonzero value with second-order errors. Forty checks pass [70]; these are floating-point reproducibility checks, not interval certificates. A common smooth phase changes a by an exact differential and leaves its curl unchanged. A nonzero constant gain or subtraction of a constant background cannot remove the obstruction. Freezing the current-dependent compensator gives zero curl for these commuting generators, as a control.

Thus the mean recording kick cannot be directly promoted to a conservative static work gradient in a neighbourhood of the tested fixed preparation. This circulation is not identified with physical work around a realized cycle. Geometric terms, memory, momentum dependence and a different source-selected full force law remain possible. The independently normalized response route is still open; this test does not derive a coupling or obstruct that route in general.

17.56 The recovered candidate and its failed coarse-bath match

The calculation uses the NFDMA-2 executable and source premises [68,72]. Its seven-vertex K_7 bath is refined by inserting 21 edge midpoints with the archived interactions. The resulting 28-variable bath is not a tensor-factorized duplicate. The candidate assumes equal sharing of one source across seven facts, yielding its coefficient $1/7$; that rule is declared constitutive content. The calculation asks whether exact reduction holds and whether it selects that coefficient.

Notation in Sections 17.56–17.60 is local to this bath. A is its positive bath matrix, C the three-channel source coupling, and U the 7×3 matrix of orthonormal zero-sum vertex source modes selected by the executable. These are dimensionless candidate units. The resolvent variable z is spectral; identifying it with physical frequency squared or assigning a physical clock requires a separate kinetic attachment.

$$H = \begin{pmatrix} K_0 & C \\ C^\top & A \end{pmatrix}, \quad K_0 = \text{diag}(1, 13/8, 189), \quad A = L + I/7.$$

$$C_c = \frac{1}{7} D U^\top, \quad D = \text{diag}(\sqrt{3}, \sqrt{2}, 1).$$

Let B be the 7×21 unoriented incidence matrix of K_7 . Then $BB^\top = 5I + 11^\top$, where 1 is the seven-component all-ones vector, and the midpoint line-graph Laplacian is $12I - B^\top B$. The independently reconstructed fine Laplacian and archived interpolation are

$$L_f = \begin{pmatrix} 12I & -2B \\ -2B^\top & 4I + (12I - B^\top B)/294 \end{pmatrix}, \quad P = \begin{pmatrix} I \\ B^\top/2 \end{pmatrix}.$$

Define $V = P(P^\top P)^{-1/2}$. The fine source is $C_f = D U^\top V^\top / 7$. On each normalized zero-sum source u , $Vu = [2u/3; B^\top u/3]$. For this actual interpolation the relative Frobenius residual is

$$\frac{\|A_f V - V A_c\|_F}{\|V A_c\|_F} = 0.727940088410.$$

This stronger operator identity fails even though the earlier two-level final-output comparison passed its declared tolerances. There is also a map-independent obstruction at the frozen units: A_c has eigenvalue $1/7$ once and $50/7$ six times, while the fine spectrum is

$$\text{spec}(A_f) = \{(1/7)^{[1]}, (113/7)^{[1]}, (205/49)^{[14]}, \lambda_-^{[6]}, \lambda_+^{[6]}\}.$$

$$\lambda_\pm^2 - \frac{685}{42} \lambda_\pm + \frac{1285}{42} = 0.$$

The bracketed superscripts denote multiplicities. None of these fine eigenvalues equals $50/7$. Hence any exact intertwiner from this coarse bath to this fine bath annihilates the six-dimensional nonconstant coarse

eigenspace and cannot be injective. This rules out exact matching for this frozen pair, not VERSF refinement generally.

17.57 The exact two-pole response

For each source u , the fine bath preserves the plane spanned by $[u;0]$ and $[0;B^T u/\sqrt{5}]$. The restricted bath and source vector are

$$A_{\text{std}} = \begin{pmatrix} 85/7 & -2\sqrt{5} \\ -2\sqrt{5} & 25/6 \end{pmatrix}, \quad v = \frac{1}{3} \begin{pmatrix} 2 \\ \sqrt{5} \end{pmatrix}.$$

$$r_f(z) = v^T (A_{\text{std}} + zI)^{-1} v = \frac{z + 2465/189}{z^2 + (685/42)z + 1285/42}.$$

$$r_c(z) = \frac{1}{z + 50/7}, \quad \Sigma_f(z) = \frac{D^2}{49} r_f(z).$$

The two bath eigenvalues are 2.162691842745 and 14.146831966779, with positive source weights 0.907836197423 and 0.092163802577. The resolvent poles occur at their negatives and neither cancels. At zero, $r_f = 986/2313$ and $r_c = 7/50$, so the bath-response ratio is 3.044901488481. A small change in a final coefficient can therefore conceal a larger change in its smaller bath subtraction.

Rescaling the fine source amplitude by 0.573077525208 matches the static subtraction alone. It cannot match the full spectral response. More generally, writing $r(z) = r_0 - r_1 z + r_2 z^2 + \dots$ gives the exact invariant

$$\frac{r_0 r_2}{r_1^2} - 1 = \frac{463327053}{41798656712} = 0.0110847354783 \dots > 0.$$

Every single-pole response has zero value of this invariant. Multiplying the response or rescaling z leaves it unchanged. Thus neither a source-amplitude adjustment nor a common spectral-scale adjustment repairs the archived single-pole description.

17.58 An exact minimal six-mode realization

Use the orthonormal basis v and $w = (-\sqrt{5}, 2)^T/3$ in each invariant plane. For the three source channels together define

$$A_* = \begin{pmatrix} aI_3 & bI_3 \\ bI_3 & dI_3 \end{pmatrix}, \quad C_* = \begin{pmatrix} D/7 & 0 \end{pmatrix}.$$

$$a = \frac{1235}{378}, \quad b = -\frac{293\sqrt{5}}{189}, \quad d = \frac{2465}{189}.$$

$$V_* = \begin{pmatrix} (2/3)U & -(\sqrt{5}/3)U \\ (1/3)B^T U & (2/(3\sqrt{5}))B^T U \end{pmatrix}.$$

Direct substitution gives the complete bath and source matching identities

$$V_*^T V_* = I_6, \quad A_f V_* = V_* A_*, \quad C_f V_* = C_*,$$

$$C_f (I - V_* V_*^T) = 0.$$

Because A_f is self-adjoint, the orthogonal complement of the embedded invariant space is invariant too. Consequently, for every z off the bath poles,

$$C_f (A_f + zI)^{-1} C_f^T = C_* (A_* + zI)^{-1} C_*^T.$$

The full coupled quadratic parent also intertwines under $\text{diag}(I_3, V_*)$, and so does its matrix exponential by functional calculus. Minimality follows because each of the two distinct poles has a rank-three residue: a finite self-adjoint realization needs at least three states at each pole. Equivalently, the reachable matrix $[C_f^T$,

$AfC_f^T]$ has rank six. The remaining 22 fine modes are dark only to these three fixed channels; no claim is made about their response to other fields, records or backgrounds.

This is exact source-response compression of the supplied fine candidate. V^* is a spectral/source embedding, distinct from the seven-to-28-node geometric interpolation that failed in Section 17.56. It does not establish a new geometric regulator sequence, physical source admission or the full HMGBC refinement requirement HP3.

17.59 Elimination of the actual midpoint variables

The geometric vertex/midpoint split can also be retained. Partition A_f into vv , vm , mv and mm blocks and $C_f = [C_v, C_m]$. Eliminating the actual 21 midpoint variables at $z \geq 0$ returns three linked changes from the same fine parent:

$$A_{\text{eff}}(z) = A_{vv} + zI - A_{vm}(A_{mm} + zI)^{-1}A_{mv},$$

$$C_{\text{eff}}(z) = C_v - C_m(A_{mm} + zI)^{-1}A_{mv},$$

$$K_{\text{eff}}(z) = K_0 - C_m(A_{mm} + zI)^{-1}C_m^T.$$

$$K_{\text{eff}} - C_{\text{eff}}A_{\text{eff}}^{-1}C_{\text{eff}}^T = K_0 - C_f(A_f + zI)^{-1}C_f^T.$$

The left-hand blocks are all evaluated at the same z . Their spectral dependence is essential. At $z = 0$, the source-relevant expressions simplify to

$$A_{\text{eff}}U = \frac{257}{35}U, \quad C_{\text{eff}} = \frac{22}{105}DU^T, \quad K_{\text{eff}} = K_0 - \frac{2}{735}D^2.$$

The constant vertex direction has eigenvalue 113/203; the full effective bath is positive. Subsequent elimination of its seven variables reproduces the fine reduced gauge metric. Leaving K_0 unchanged while using the other two effective blocks omits diagonal corrections (0.00816326530612, 0.00544217687075, 0.00272108843538) and gives Frobenius error 0.0101813806443. Thus matching only the bath and coupling is insufficient: the direct gauge term must be transformed too.

17.60 Exact matching leaves the source strength unselected

Set $C_\gamma = \gamma C$, with $\gamma = 1$ denoting the archived 1/7 source rule. Both the six-mode identities and actual midpoint elimination hold for every γ : the effective source scales by γ and the direct-term correction by γ^2 , while bath matrices and embeddings remain fixed. The fine parent is strictly positive throughout

$$|\gamma| < \sqrt{\frac{37779}{986}} = 6.189944734931 \dots$$

The colour Schur-complement entry supplies the limiting inequality. Three positive members give the following reduced entries in the candidate's frozen source coordinates; these are not physical Standard-Model couplings.

Source multiplier γ	Colour entry	Weak entry	Integer-U(1) entry
0.5	0.993475211096	1.620650140731	188.997825070365
1	0.973900844384	1.607600562923	188.991300281462
2	0.895603377538	1.555402251692	188.965201125846

Exact matching and positive quadratic stiffness therefore do not uniquely select $\gamma = 1$. This is a sufficiency failure of those tests within the candidate family. Members with $\gamma \neq 1$ deliberately relax its named equal-sharing premise; they are not asserted to satisfy every physical VERSF condition or to describe alternative

admitted universes. Positive quadratic stiffness also does not certify entrywise or cone positivity of a full history transfer.

The executable [72] passes 52 checks: independent graph reconstruction and reproduction of both archived gauge outputs, invariant-subspace identities, seven resolvent arguments from zero through 100, midpoint elimination, three source multipliers and full-parent matrix-exponential intertwining. The maximum numerical residual is 4.9763×10^{-13} . Rational identities, non-cancellation and the single-pole obstruction are also checked in exact Fraction arithmetic. The package preserves the original source files and hashes and returns the computed matrices and results.

The closed result is the exact minimal source-visible bath reduction and complete midpoint block transformation for an existing candidate. Physical derivation of its source strength, full carrier and source law, physical kinetic/time attachment, other coupled sectors and regulator-uniform continuum convergence remain open. This result neither supplies physical gauge couplings nor proves that they cannot be derived in VERSF.

The same-source normalization test in Sections 17.61–17.64 prices the bath and interaction together. It distinguishes an assumed event-cost unit from equal-sharing arithmetic and resolves whether a common coefficient can repair the archived refinement mismatch. It does not establish physical admission of the deformed candidates.

17.61 The source premise and a common quadratic cost

The normalization question depends on explicit source premises. NFDMA-2 states equal sharing over seven facts as new constitutive content, and its Section 2.2 explicitly withholds a physical coupling derivation [68]. Its current traces give the printed core metric only after a trace-per-seat prescription and a colour-unit choice. NFDMA-1 likewise calls its unit event variance and bath-strength choices a proposed canonical unit prescription, not a descent from nonlinear commitment dynamics [67, Section 3]. The spectral-density source leaves the relevant event statistics to that dynamics [74, Section 4.5]. These primary-source reads refine the earlier corpus audit; they are not a new proof-level audit of every paper.

Let E have the three orthonormal source columns of the archived regulator, let $D = \text{diag}(\sqrt{3}, \sqrt{2}, 1)$, and write the bath variable as b to avoid confusion with integer hypercharge. The original gauge–bath quadratic form has the following exact decomposition [73].

$$S_1(x, b) = \frac{1}{2} x^T K_b x + \frac{1}{2} b^T L b + \frac{1}{14} \| b + E D x \|^2.$$

$$K_b = K_{\text{core}} - \frac{1}{7} D^2 = \text{diag}\left(\frac{4}{7}, \frac{75}{56}, \frac{1322}{7}\right) > 0.$$

Expanding the square returns the original bath mass $1/7$, interaction $D E^T / 7$ and direct gauge block K_{core} . This is an algebraic rewriting of the candidate, not a unique decomposition or a derivation of primitive physical work. At the seven-variable level, its final term equals the expected cost $(b_i + (E D x)_i)^2 / 2$ for a uniformly chosen label i . Uniform averaging supplies a factor $1/7$ once that event-cost model and its unit price are assumed; it does not establish either assumption. At the 28-variable level the archived factor remains $1/7$, not the probability $1/28$ for a new uniform label. A physical refinement measure must be derived separately.

17.62 Varying one cost changes all three blocks

Introduce a dimensionless relative cost η while keeping the source coordinates, graph stiffness and positive remainder K_b fixed. This is a declared deformation of the candidate premise, not a family of physically admitted sources.

$$S_\eta(x, b) = \frac{1}{2} x^T K_b x + \frac{1}{2} b^T L b + \frac{\eta}{14} \| b + E D x \|^2, \quad s = \frac{\eta}{7} > 0.$$

$$K_\eta = K_b + sD^2, \quad A_\eta = L + sI, \quad C_\eta = sDE^T.$$

All three terms come from one shared cost. The full quadratic form is strictly positive for every $\eta > 0$: if x is nonzero, the K_b term is positive; if x is zero and b is nonzero, the last term is positive. This proves positive stiffness, not physical transfer or reflection positivity. The six-mode invariant subspace from Section 17.58 is unchanged by adding sI , and the transformed source remains entirely within it. Consequently exact parent compression, the full source resolvent and complete midpoint elimination survive at every positive η . The bounded γ interval in Section 17.60 does not apply to this different family, which changes the diagonal blocks too.

Eliminating the bath gives the static force $f = G_\eta x$ in the fixed source coordinates. Both archived regulators have the form

$$G_\eta = K_b + k(s)D^2, \quad k(s) = s - s^2 r(s).$$

$$k_c(s) = \frac{7s}{7+s}, \quad k_f(s) = \frac{s[(1181/378)s + 198/7]}{s^2 + (673/42)s + 198/7}.$$

Here c and f denote the original seven-variable and 28-variable graphs. The fine source resolvent is $r(s) = (s + 2438/189)/(s^2 + (673/42)s + 198/7)$, obtained by subtracting $I/7$ from the exact two-mode block in Section 17.58. Its two Laplacian eigenvalues and source weights are positive. Thus k is a positive weighted sum of terms $s\lambda/(\lambda+s)$, and is strictly increasing for $s > 0$. The exact reduced work also satisfies

$$W_\eta(x) = \min_b S_\eta(x, b) = \frac{1}{2} x^T G_\eta x, \quad \frac{\partial W_\eta}{\partial \eta} = \frac{1}{14} \|b_\eta^* + EDx\|^2 > 0 \quad (x \neq 0).$$

The following fine-regulator entries use the inherited source coordinates. They are response coefficients of the candidate, not measured or derived physical gauge couplings.

Cost η	Colour entry	Weak entry	Integer U(1) entry
0.5	0.778969537896	1.477646358597	188.926323179299
1.0	0.973900844384	1.607600562923	188.991300281461
2.0	1.330560553769	1.845373702513	189.110186851256

Even the colour-to-weak entry ratio changes, from approximately 0.52717 at $\eta = 1/2$ to 0.72102 at $\eta = 2$. A bath-coordinate change leaves the Schur response invariant and cannot remove this dependence. Pricing the bath and interaction together therefore does not select the unit cost.

17.63 A strict refinement obstruction for a common coefficient

A stronger statement is available than a finite numerical scan. Direct subtraction gives the exact identity

$$k_f(s) - k_c(s) = -\frac{1465}{378} \frac{s^2(s+16)}{(s+7)[s^2 + (673/42)s + 198/7]} < 0 \quad (s > 0).$$

Therefore no common positive η makes the static gauge responses of the two archived regulator forms coincide, when K_b , D , the source maps and their coordinate identification are held fixed. Equality occurs only in the zero-cost limit, where the interaction vanishes. This closes a specific attempted repair: changing the common source-work coefficient cannot cure that refinement mismatch. It does not obstruct the exact six-mode reduction, which has a different effective bath, or the complete midpoint transformation, which changes all effective blocks. It is not a no-go theorem for a renormalized action or for VERSF.

Allowing the coefficient itself to run instead produces a matching relation. If $u = kc(sc)$, a finite positive fine coefficient exists uniquely when $0 < u < 1181/378$ and solves

$$\left(\frac{1181}{378} - u\right)s_f^2 + \left(\frac{198}{7} - \frac{673}{42}u\right)s_f - \frac{198}{7}u = 0.$$

For coarse $\eta_c = 1$, this gives $\eta_f = 1.0464904707647422$. This example matches only the static three-channel response. It does not match the one-pole and two-pole resolvents at all spectral arguments, and it does not select the initial coefficient or establish physical admission. Running a coefficient supplies a relation between levels, not the missing absolute source law.

17.64 What this calculation closes

The source trace and common-cost calculation locate the missing normalization more precisely. Equal-sharing arithmetic, positive stiffness and exact bath elimination do not derive a physical price for a unit deformation. The original current-core normalization remains an additional candidate prescription. The new exact negative result is narrower: a common coefficient cannot make the two frozen regulator forms agree even at zero spectral argument. The core identities and positive family remain conditional on the supplied source carrier and quadratic action.

The reproducibility archive [73] includes the original Laplacians, published gauge outputs, premise manifest and source texts, with hashes. Its calculation independently reconstructs both graphs, reproduces the original outputs at $\eta = 1$, checks the common-cost Hessian, minimized work and force, the work derivative, bath-coordinate invariance, minimal resolvents and all midpoint blocks. It passes 160 numerical assertions with maximum normalized residual 4.515×10^{-16} ; the rational coefficients, midpoint identity and strict refinement-gap factorization are also verified with exact Fraction arithmetic. The proof of the strict sign covers all positive η and does not rely on the sampled values.

The continuations in Sections 17.65–17.80 pursue this requirement. They derive the native endpoint primitive and conditional update-cost transformations, but still do not return a selected full joint operation or independently calibrated complete force law. The gauge, bath and mixed blocks must follow from one admitted source in the same units. A direct force route remains available for quadratic response; history and completed-Fact claims retain their additional event-law requirements. Further scans of a freely chosen coefficient would not advance physical coupling closure.

17.65 Native transport cost and exact edge subdivision

The endpoint equations supply a conditional transport-cost primitive, rather than the complete joint action [75]. With the inherited covariant difference, conductance matrix and vertex weight, their gradient interpretation gives

$$j = K \Delta_U \psi, \quad M_v \dot{\psi} = -\Delta_U^\dagger j, \quad F_{\text{tr}} = \sum_e k_e \|\psi_t - U_e \psi_s\|^2.$$

The native wheel uses conductance $1/31$ on each edge. At fixed links, the cost decreases at the rate twice the negative squared velocity in the vertex metric. Integration of the endpoint equations still permits a function of the independent links and other fields; it does not derive their dynamics or price. The transport primitive is not automatically the squared-defect MASD action or physical heat.

For unitary half-links with ordered product equal to the coarse link, exact midpoint minimisation gives

$$\psi_m^* = \frac{k_1 U_1 \psi_s + k_2 U_2^\dagger \psi_t}{k_1 + k_2}, \quad k_{\text{eff}}^{-1} = k_1^{-1} + k_2^{-1}.$$

Thus matched binary subdivision uses conductance $2/31$ on each half. This identity needs no commutativity. On the 50-component native endpoint carrier, subdivision of all twelve edges produces 19 vertices and 24 half-edges. The coarse and minimised fine costs are 0.7526556344563870 and

0.7526556344563867. Under the declared flat complex midpoint measure, the Gaussian determinant is field independent; that particular elimination adds only a constant to the static action.

Positive midpoint relaxation weights introduce a separate dynamical correction. Writing the refined endpoint Laplacian in boundary and interior blocks gives the exact retained inverse response

$$Q(z) = zM_b + A - B(D + zM_i)^{-1}B^\dagger.$$

Its small-frequency expansion changes the effective vertex metric, and its full denominator carries memory and an initial-interior-state term. Static series matching therefore does not establish finite-duration dynamical matching. The midpoint weights, clock and physical refinement remain source inputs.

17.66 Native loop influence and the recording refinement rule

A three-hop non-Abelian loop was executed with the unchanged native current instrument, carried matter and all 343 ordered terminal outcomes [76]. At the declared two-angle background, let the normalised output purification be the vector v , its mean impulse one-form be a , and its real projective derivative metric be g . The local two-configuration influence has the expansion

$$\log D(x + \delta/2, x - \delta/2) = i a \cdot \delta - 1/2 \delta^T g \delta + O(\|\delta\|^3).$$

Consequently the corresponding dimensionless influence action has a positive imaginary quadratic term. This is a conditional record-induced loss of coherence, not a derived static energetic potential. The impulse curl is -0.004653328690301338 , and its circulation around the stated rectangle is $-9.305810950654915 \times 10^{-6}$. Independent surface integration agrees. Thus the mean impulse cannot be identified with a conservative static work gradient on that preparation.

Refinement preserves the whole conditional operation if it preserves the original recording opportunities and inserts pure transport between them. Applying a fresh full-strength native record on every half-edge instead changes the final internal state by trace distance 0.07473746622883948 and the final terminal distribution by total variation 0.017981958062558433 . Static cost matching does not select the record-event refinement rule. The 44-check execution does not supply a complete field Hamiltonian, completed-Fact rate or interacting continuum limit.

17.67 Fixed source inputs exclude the extra gauge potential

The endpoint and record tests leave some gauge-only additions invisible to those restricted observations. That invisibility does not admit them as changes to a fixed complete source. The fixed-input MASD/HMGBC test establishes this distinction [77]. Hold the measure, clock, kinetic operator, reference potential and common defect metric fixed, and let T be the resulting positive definite finite transfer. For a real diagonal added potential W ,

$$T_\lambda = D_\lambda T D_\lambda, \quad D_\lambda = \exp(-a\lambda W/2), \quad \frac{(T_\lambda)_{ii}}{T_{ii}} = e^{-a\lambda W_i}.$$

Equality of the transfers forces the addition to vanish; equality up to one global transfer multiplier permits only a constant potential. The tested Wilson addition is nonconstant. Its flat-background Hessian on the native 144-link coordinates has rank 72 and changes every curvature direction of that fixture. It also changes the closure block of the common MASD metric. It is therefore excluded under the fixed inputs, not a gauge-null freedom or a pair of fully admitted VERSF theories.

Conservation provides another useful selection equation once the off-diagonal rates are supplied. In a symmetric representation with reference vector equal to the square root of the measure, the kinetic operator must annihilate that vector. Testing ordinary row sums in a different measure is incorrect.

Conservation fixes the diagonal from the off-diagonal rates; neither conservation nor cone positivity derives those rates. All 38 named checks pass. The complete continuous-amplitude law remains an upstream requirement.

17.68 Why metric self consistency does not select the proposal

The conditional continuous proposal already exists in RPC Section 64.4.1 [61]. It uses the supplied operational metric G , defect differential J and minimum-norm lift E . In a frozen chart its covariance is proportional to the inverse of G . Its returned core obeys

$$E = G^{-1}J^T(JG^{-1}J^T)^+, \quad J^TW_{\text{core}}J = G^{1/2}\Pi_G G^{1/2},$$

where the projector selects the row space of the whitened defect differential. The returned Hessian therefore reproduces its input metric on defect-visible directions; it is not an independent measurement of that metric [78].

The additional ansatz identifying G with the substrate-potential Hessian plus the reduced defect Hessian was tested on the archived 226-variable bosonic fixture. After its 39 kinematic null directions are removed, J has rank 183 on 187 coordinates, while the potential Hessian has rank 22. The no-bath ansatz would equate that rank-22 matrix to a rank-four remainder and is impossible. An algebraically constructed bath permits a classified family of solutions. Two members have the same clock, Gaussian normalisation and drift lift but different covariances and curvatures. The 46-check result rejects this ansatz as a sufficient selector; it is not full-premise physical nonuniqueness.

This carrier must not be promoted to the full faithful MASD carrier. The later HM4 assembly replaces the old fixture's restricted link directions by 144 faithful directions and uses 334 variables [82]. Neither its carrier nor the native single-edge carrier below can be substituted into the 187-coordinate arrays without an explicit map. The local statistical tilt also does not become a restoring dynamics merely by identifying its source parameter with the current defect.

17.69 What the native operation itself distinguishes

An independent process-geometry calculation avoids choosing a Gaussian covariance [79]. It evaluates a formal terminal-labelled Choi/Bures geometry directly from the native operation. On a chart containing twelve link coordinates and 98 current-ray coordinates, the complete derivative has rank 109. Its one null is exact: a simultaneous target hypercharge rotation of current and link multiplies each recorded Kraus branch by a scalar phase, leaving every terminal-labelled completely positive map unchanged.

On the original fixed-endpoint family, where the current varies with the link, all twelve link directions remain locally distinguishable. Profiling an independently variable current instead leaves rank eleven. These are different restrictions, not contradictory measurements. The 48-check calculation establishes conditional operation geometry; it does not establish that its tomography protocol, fixed frames or Bures distance realise the physical operational metric. Radial information also remains absent from the normalised-current family. No gauge coupling or physical missing-mode count follows from these ranks.

17.70 Joint composition fixes a covariance compatibility equation

The joint-law selection test uses the inherited link/current composition on a unitary representation and its real current carrier [81]. Write a joint element as g and a tangent as an anti-Hermitian generator X together with a current vector v . Then

$$(U_2, j_2)(U_1, j_1) = (U_2 U_1, j_2 + U_2 j_1),$$

$$\text{Ad}_{(U, j)}(X, v) = (UXU^{-1}, Uv - UXU^{-1}j).$$

These are composition and comparison identities. They are not a selected temporal probability law. For a fixed factorisation and left increments on its two factors, exact multiplication and first-order differentiation give

$$h_c = h_2(g_2 h_1 g_2^{-1}), \quad \xi_c = \xi_2 + A \xi_1, \quad A = \text{Ad}_{g_2}.$$

With centred tangent covariances and cross covariance C_{12} , the necessary joint compatibility equation is

$$\Sigma_c = A \Sigma_1 A^T + \Sigma_2 + A C_{12} + C_{12}^T A^T.$$

This is exact for the linearised variables and gives the leading covariance of a small-noise finite update. It needs no Gaussian assumption. Higher moments and nonlinear finite-step terms require the full law. The transported-current term in the adjoint cannot be discarded while retaining the inherited composition.

17.71 An exact obstruction to homogeneous independent updates

The tested extra prescription uses the same state-independent left-increment covariance at both fine factors, makes their fluctuations conditionally independent, and requires one coarse covariance across every compatible factorisation in a local open family. It also asks for gauge variance in directions acting nontrivially on the current. These are additional test assumptions, not VERSF axioms.

For a current translation by t times a fixed vector a , define the real linear map that sends X to Xa . The adjoint and a general symmetric covariance have block forms

$$A_t = \begin{pmatrix} I & 0 \\ -tR_a & I \end{pmatrix}, \quad S = \begin{pmatrix} P & B \\ B^T & D \end{pmatrix}.$$

The current block of the transported covariance is

$$D - t(R_a B + B^T R_a^T) + t^2 R_a P R_a^T.$$

Adding the second factor's fixed covariance does not change its dependence on t . Constancy on any open interval therefore requires

$$R_a P R_a^T = 0.$$

For positive semidefinite gauge covariance P , this says that its support must annihilate a . If P is positive definite, the gauge action on a must vanish; if the map R_a has full column rank, P itself must vanish. Thus a nonzero charged gauge variance is incompatible with the tested homogeneous independent exact-descent prescription. Existing cross covariance B cannot cancel the quadratic coefficient. A drift does not repair this covariance identity.

The argument needs only an interval of nonzero currents. It never evaluates the native normalised-ray operation at zero current. In metric language, a nontrivial unipotent shear cannot preserve a positive inner product. This is a standard invariant-metric obstruction applied to the joint carrier; the compact-link refinement theorem does not automatically extend to current translations.

An even stronger proposed shortcut, a probability law invariant under conjugation by every current translation, also fails to carry a nontrivial faithful gauge increment. Conjugation shifts the current increment by $(I-U)a$. Conditional on any nontrivial U , invariance would demand a finite probability measure invariant under a nonzero translation, which is impossible. Full joint conjugation invariance is stronger than ordinary compact gauge covariance and is not a VERSF requirement.

17.72 Positive compatible lifts leave their amplitudes unselected

The obstruction has constructive repairs. Supply any positive coarse covariance C and positive vertical covariance V , and take independent centred variables y and ζ with those covariances. Define

$$\xi_1 = A^{-1}(y/2 + \zeta), \quad \xi_2 = y/2 - \zeta.$$

Their block covariance is

$$\Sigma_f = \begin{pmatrix} A^{-1}(C/4 + V)A^{-T} & A^{-1}(C/4 - V) \\ (C/4 - V)A^{-T} & C/4 + V \end{pmatrix}.$$

It is positive because the defining change of variables is invertible, and the blocked variable is exactly y . Choosing $V=C/4$ removes the cross covariance while leaving state dependence in the first fine covariance. Other choices generally correlate the factors. Correlation is therefore not the only repair. Neither C nor V is selected by compatibility; any claim that vertical choices are physically irrelevant needs the complete observable algebra.

An exact finite group lift also exists. Given a supplied coarse increment h and any vertical increment κ , choose

$$h_1 = \kappa, \quad h_2 = h g_2 \kappa^{-1} g_2^{-1}.$$

The resulting fine product is exactly the requested coarse update. This parametrises lifts of supplied laws. It does not derive those laws or certify that two fine quantum instruments compose to the coarse one. Evaluating the native operation at the identical coarse output checks consistency only.

17.73 The conditional quadratic cost under refinement

For a positive Gaussian covariance and linear blocking map L , constrained minimisation gives

$$\min_{Lx_f=x_c} \frac{1}{2} x_f^T \Sigma_f^{-1} x_f = \frac{1}{2} x_c^T (L \Sigma_f L^T)^{-1} x_c.$$

With L formed from the blocks A and I , the preceding lifts return the same coarse precision for every positive V . This derives how the supplied quadratic update cost descends, not its physical coefficient. State-dependent measures and determinant terms must be retained outside the frozen chart.

A local left-increment covariance proportional to the block diagonal matrix with positive blocks P and D gives a related transport cross term. If the ambient current change is the independent current increment plus the infinitesimal link transport, its quadratic negative log density is

$$Q = \frac{1}{2a_t} \left[\theta^T P^{-1} \theta + (\delta j - R_j \theta)^T D^{-1} (\delta j - R_j \theta) \right].$$

The mixed precision is fixed by this coordinate transformation. Holding the current fixed adds a positive transported-current term to the link precision; minimising over the current returns the input link precision. This is a conditional proposal cost. Its identification with the energetic action, its covariance strengths and its physical clock remain unproved.

17.74 Native verification and the approximate refinement boundary

The implementation uses the unchanged 50-dimensional representation with twelve generators, one non-Abelian link and its endpoint-defined current [81]. The current norm is 1.4484250721266234. The angular-to-current map has rank twelve and smallest singular value 0.3632127348262991. The single-edge tangent has 112 real coordinates before any physical quotient; it is not the complete MASD state.

Two nonzero-current factorizations of the same coarse state are

$$(I, j/2)(U, j/2), \quad (I, 3j/2)(U, -j/2).$$

Both satisfy the endpoint/current residual relation with their corresponding midpoint vectors, but their midpoint amplitudes differ. They are not asserted to be a common physical branch or a gauge redundancy. Under the diagnostic homogeneous independent covariance, the target-frame invariant scalar probe has leading variances 2.0008404508516335 and 2.0075640576647005. This verifies factorisation dependence under the tested rule, not different predictions of two fully admitted theories.

All 54 checks pass and a clean extraction reproduces the JSON certificate exactly. The product-differential error falls to 1.01×10^{-11} , and repaired covariance residuals are at most 2.43×10^{-15} . Exact polynomial and rational arguments prove the stated obstruction; numerical checks verify its implementation and inherited conventions.

Approximate physical refinement is not excluded. With block-diagonal diagnostic covariance and fine current of order h , the induced mixed and current-current corrections are of orders h and h^2 at fixed noise normalisation. If the covariance also scales as h , their absolute orders are h^2 and h^3 . These shrinking local terms prove neither convergence nor failure of the accumulated continuum error. A source-selected support restricting the allowed factorisations could also change the exact test. Full simplicial refinement, BCB/TPB admission, matter attachment and quantum consistency remain separate.

17.75 The remaining full action selection problem

The enlarged corpus audit [80] and these continuations locate the unresolved input more precisely: the primitive law must select the magnitude and coupled allocation of configuration changes, with its reference measure, retained memory, physical preparation and matter/record attachment. Existing conditional proposals, action reconstruction and refinement constructions should consume that return. A covariance chosen to satisfy the new identity would still be an input.

There are three distinct possible outcomes. A derivation may select a unique physical law, or prove all admitted alternatives equivalent for the claimed observables. Two laws satisfying the same complete premises but giving different invariant responses would instead prove underdetermination. If the admitted class or a required attachment remains unspecified, the result remains unresolved. The families in this paper establish narrower sufficiency failures and do not yet provide the second outcome for the full theory.

An independently work-normalised force response could close a leading quadratic gauge milestone without first solving every history question. It would not alone determine nonlinear vertices, the fermionic phase and global consistency, or the full physical action. Conversely, a numerical SI action unit is not a prerequisite for a dimensionless prediction: an overall convention must be separated from relative source strengths and any still-needed physical ruler. No Standard Model parameter is selected by the present tests, and the conditional neutrino ratios remain unchanged.

17.76 Graph-Wilson roughness and holonomy curvature are different operators

The direct holonomy-Wilson comparison closes a typing issue that had remained implicit in earlier normalisation discussions. The closure-stiffness Wilson operator inherited from the graph Dirac construction has edge block $BB^\dagger$. The physical integrated closure direction is instead an oriented circulation ωC . On that cycle, incidence conservation gives $B^\dagger \omega C = 0$ and therefore $BB^\dagger \omega C = 0$. The graph-Wilson edge roughness thus assigns zero cost to the very circulation that carries plaquette holonomy. This is an operator-level distinction, not a numerical mismatch, and it rules out identifying the existing fermionic/graph Wilson coefficient with the gauge holonomy stiffness by name alone [8,86].

$$B\dagger\omega C = 0, \quad BB\dagger\omega C = 0.$$

The appropriate gauge object lives one cochain level higher. On the physical gauge-orthogonal edge carrier, the face differential supplies the curvature and the full one-form Hodge operator contains $d1\dagger d1$. The exact face/edge attachment gives $d1\dagger d1 = 5I$ and $||d1A||^2 = 5||A||^2$ on the declared physical simplex carrier [8]. Consequently the geometry converts connection perturbations into face curvature with a fixed factor; it does not leave a hidden geometric scalar that can be used to tune the gauge action.

$$d1\dagger d1 = 5I, \quad ||d1A||^2 = 5||A||^2 \text{ on the physical gauge slice.}$$

17.77 Master-action descent and the same-r test

The common master action places closure, current, transport, record, bond and completion defects in one operational metric, $\Gamma_{bos} = \Gamma V + 1/2 \langle D, W_{prim} D \rangle$. At a common defect zero its quadratic Hessian is exactly $G^* = GV + DD^*\dagger W_{prim} DD^*$. After the gauge/null quotient and complete same-order auxiliary relaxation, the physical gauge operator is the Schur complement $K_g = H_{aa} - H_{a\eta} H_{\eta\eta}^{-1} H_{\eta a}$ [87]. This is the operator that must be compared with any holonomy quadratic; a bare curvature block or graph roughness coefficient is not the physical response.

$$K_g = H_{aa} - H_{a\eta} H_{\eta\eta}^{-1} H_{\eta a}.$$

Let $G_{hol} = d1\dagger W2 d1$ denote the independently typed holonomy-curvature quadratic on the supported physical carrier. The proposed identification $C_{hol} = r$ would require the generalized response operator $G_{hol}^{-1}/2 K_g G_{hol}^{-1}/2$ to equal rI on every physical curvature mode. The present source stack does not prove that equality. GRCE retains a universal C_{hol} precisely because the action conversion remains open, while the later configuration-response audit explicitly distinguishes native roughness spectra from physical gauge stiffness [3,88].

$$C_{hol} = r \text{ iff } G_{hol}^{-1}/2 K_g G_{hol}^{-1}/2 = rI.$$

This negative result is useful: face-Hodge geometry is closed, but the absolute physical coefficient belongs to the source-selected operational/work response. The old Wilson coefficient cannot be promoted into that role without a new same-source theorem.

17.78 Changing-link score, current attachment and the amplitude-scaling obstruction

The compatible joint Gaussian update of Section 17.73 makes the source-attachment issue calculable. Write the link increment as θ , the independent current increment as δj , the transported-current map as R_j , and positive covariances P and D . For the declared fixed-covariance proposal,

$$Q(\theta, \delta j) = (1/2a_t)[\theta^T P^{-1} \theta + (\delta j - R_j \theta)^T D^{-1} (\delta j - R_j \theta)].$$

Now let a physical source amplitude ε move the mean link by εv and the mean current by εMv . Direct differentiation gives the score and Fisher curvature

$$S_v = (1/a_t)[v^T P^{-1} \theta + ((M - R_j)v)^T D^{-1} (\delta j - R_j \theta)],$$

$$W_v = (1/a_t)v^T [P^{-1} + (M - R_j)^T D^{-1} (M - R_j)] v.$$

If the current co-moves exactly with the changing link, $M = R_j$, the transported-current term cancels and the curvature information is set by the link covariance alone. If the current is artificially held fixed, $M = 0$, an additional positive term is added. Thus the physical same-event current/link attachment changes the inferred curvature metric; freezing current during a link perturbation is not an innocent simplification.

The more general Perron/Doob result is even sharper. The normalized score is linear in the raw source derivative $Tdot_h$. Hence $Tdot_h \rightarrow c Tdot_h$ implies $S_h \rightarrow c S_h$ and $W_h \rightarrow c^2 W_h$. PJCK-1 proves

independently that the D36/PFDMI discrete skeleton admits radial rescalings that leave its history and attaching certificates unchanged while changing physical first and second field-update moments [89]. Therefore the absolute changing-link history metric cannot be extracted from the discrete skeleton alone.

$$Tdot_h \rightarrow c Tdot_h \quad \Rightarrow \quad S_h \rightarrow c S_h \quad \Rightarrow \quad W_h \rightarrow c^2 W_h.$$

17.79 Primitive semidirect kernel, exact linear cut and the BCTR-6 handoff

PJCK-1 now supplies the strongest source architecture available without inventing the missing amplitude law. For a semidirect increment $h=(V,\eta)$, the primitive positive event measure Λ_n is pushed through $(U,j) \rightarrow (VU,\eta+Vj)$ to a raw off-diagonal transfer, and only then Perron/Doob-normalised. The chain $\Lambda_n \rightarrow T_n \rightarrow K_n \rightarrow \text{scores} \rightarrow W_{\text{prim}}$ is therefore explicit. What remains unselected is the continuous increment component of Λ_n itself [89].

$$(U,j) \rightarrow (VU, \eta + Vj), \quad \Lambda_n \rightarrow T_n \rightarrow K_n \rightarrow \text{score} \rightarrow W_{\text{prim}}.$$

The same continuation closes one tempting bridge negatively. The direct endpoint/gradient-E2 to cycle/history-E2 linear map is exactly zero by the gradient/cycle Hodge separation. The first allowed response is background-contracted and quadratic in current. A nonlinear EPMD/CFB1 source does return a nonzero current-squared E2 third jet with coefficient $2/(2809\sqrt{3})$, but its carrier is record stretch rather than the physical self/fact history-eligibility coordinate; the executed graph contains no current-to-eligibility path. BCTR-6 independently reaches the same physical boundary: its exact current-to-record-phase block is nonzero, but capacity and binary eligibility do not carry the missing strength [89,90].

$$H_{\text{eff}}(J_{\text{cyc}}, y) = -(\sqrt{2}/11) I_6, \quad \text{current} \rightarrow \text{binary eligibility: not returned.}$$

The binary first-record route is therefore frozen on the present architecture. The higher-leverage target is the absolute continuum gauge-kinetic/current-field normalisation, which does not require the gauge strength to be encoded in the probability that a primitive Fact occurs.

17.80 Priority K: compact-link normalisation and exact event-work inversion

The continuum attack begins with a result that is stronger than the older continuum-current convention. The same compact link $U = \exp(i\theta)$ appears in matter transport and gauge curvature. A charge- n transport along a signed path γ shifts the conjugate electric flux exactly by $\Delta p = n\gamma$ while preserving the Gauss constraint [91]. Within the common-carrier premise, a faithful orientation-preserving $U(1) \rightarrow U(1)$ embedding has integer degree $+1$, so no continuous link-angle gain remains. Separately, exact expansion of the declared Wilson plaquette action with $U_p = \exp(i\oint pF)$ fixes the interface-to-continuum multiplier to $c_{\text{norm}} = 1$ in that convention [92].

$$\Delta p = n \gamma, \quad \text{faithful common-carrier embedding gain} = 1, \quad c_{\text{norm}} = 1.$$

This does not make the older continuum term $-J \cdot A$ an absolute anchor: in the matter-coupling theorem its coefficient c_1 was explicitly absorbed into the definition of J , so $c_1 = -1$ is a convention rather than a source-derived strength [93]. The physical scale must instead be read from the energetic response of the already normalised compact flux coordinate.

Let the retained electric Hamiltonian be $H_E(p) = 1/2 p^T Q p$ and let z_a be divergence-free cycle-flux preparations. For a known charge impulse $q e_j$, compare two otherwise identical source events whose incoming flux differs by z_a . All flux-independent matter/record costs cancel in the difference, giving [94]

$$\Delta W_{aj} = W(p + z_a; q e_j) - W(p; q e_j) = q z_a^T Q e_j.$$

If C collects the independent cycle columns and $G_{aj} = \Delta W_{aj}/q$, the retained kinetic matrix follows algebraically:

$$G = C^T Q, \quad Q_{\text{cycle}} = G C = C^T Q C, \quad M_{\text{cycle}} = Q_{\text{cycle}}^{-1}.$$

In continuum canonical variables, the compact momentum is the discretised electric displacement rather than the electric field itself. For the continuum quadratic form $-(1/4) Z_{ab} F^a \cdot F^b$, the electric Hamiltonian is the inverse kinetic form; after the frozen geometric and temporal conversion, Q_{cycle} therefore supplies the retained discretisation of Z^{-1} . On an isotropic one-coefficient branch, one nonzero independently derived work difference is sufficient to fix the surviving common kinetic scale.

The present corpus does not yet supply that physical work difference. Existing native-work calculations derive the work operator only after a kinetic coefficient has been declared, so using those outputs to reconstruct the same coefficient would be circular. Priority K therefore ends at a very narrow source target: return the energy transferred by the same charge-changing event for neighbouring loop-flux preparations, together with the energy-resolved amplitudes needed to preserve the operation on superpositions. Once that source return is available, the leading electric kinetic matrix can be reconstructed before any measured gauge coupling is opened. The Lorentz four-current/time attachment and full non-Abelian/matter/global completion remain separate gates.

17.81 Closed-loop work spectroscopy and direct cycle-kinetic reconstruction

Priority K can be sharpened by replacing an open edge impulse with a source-derived closed charged loop. CLI-1 already supplies the required carrier on its declared coherent-worldline branch [95]. For the six oriented triangular cycles $z_i = s_i + r_i - s_{i+1}$, collect $Z = (z_1, \dots, z_6)$. The same particle returns to its starting site, Gauss preservation holds after every partial hop, and a completed loop leaves a divergence-free edge impulse $J_\gamma = Z \ell_\gamma$. The six triangle cycles are independent: their Gram matrix is

$$Z^T Z = \text{circ}(3, -1, 0, 0, 0, -1), \quad \det(Z^T Z) = 320 \neq 0.$$

Thus the six loops form a complete probe of the K7 cycle carrier. This is a carrier-completeness theorem, not yet an energetic selection theorem.

Closed-Loop Work Reconstruction Theorem. Let the retained electric energy on the edge-flux carrier be $H_E(p) = 1/2 p^T Q p$ with $Q = Q^T$, and let closed loop b apply the known charge- q impulse $p \rightarrow p + q z_b$. Compare the same source branch and the same non-gauge preparation with incoming cycle fluxes p and $p + z_a$. If every non-gauge contribution to the work is independent of that incoming cycle displacement, or is separately returned and subtracted by the same source law, then

$$D_{ab}(p) := [W_b(p + z_a) - W_b(p)]/q = z_a^T Q z_b = (Q_{\text{cycle}})_{ab}.$$

Hence the ordered 6×6 loop-work response matrix is the retained cycle kinetic matrix itself:

$$D = Q_{\text{cycle}} = Z^T Q Z.$$

No matrix inversion and no extra cycle-Gram factor are required. The result is the cycle-space analogue of Appendix A.5 and uses the already-fixed compact charge/flux coordinate. Thirty-six ordered response coefficients should be returned first; symmetry must then be tested rather than imposed. If a real quadratic energetic parent is complete, reciprocity requires $D_{ab} = D_{ba}$, giving fifteen off-diagonal consistency checks before compression to the twenty-one independent entries.

Centered source protocol and quadraticity falsifier. To suppress flux-independent offsets and expose contamination, use paired preparations $p \pm z_a$ and define

$$D_{ab}^{(c)}(p) := [W_b(p+z_a) - W_b(p-z_a)] / (2q).$$

For a purely quadratic electric kinetic response, $D_{ab}^{(c)} = z_a^T Q z_b$ and is independent of the baseline p . The same paired calculation supplies the null test

$$R_{ab}^{(2)}(p) := W_b(p+z_a) + W_b(p-z_a) - 2W_b(p) = 0.$$

A nonzero $R_{ab}^{(2)}$, baseline dependence of $D_{ab}^{(c)}$, or failure of reciprocity means that higher-order field terms, bath/record/matter cross-work, memory, or incomplete source subtraction is present at the tested event grain; the result may not be called Q_{cycle} without resolving that contribution.

Nested source tests. Reconstruct the full ordered matrix before using symmetry. If the returned response is D6-equivariant, it must reduce to the symmetric circulant form $Q_{\text{cycle}} = \text{circ}(a, b, c, d, c, b)$. Its four distinct eigenvalues are

$$\lambda_0 = a + 2b + 2c + d; \quad \lambda_{1,5} = a + b - c - d; \quad \lambda_{2,4} = a - b - c + d; \quad \lambda_3 = a - 2b + 2c - d.$$

Physical positivity requires all four to be positive on the retained support. A stronger edge-local two-orbit law with one spoke coefficient q_s and one rim coefficient q_r predicts $c = d = 0$, $q_s = -b$ and $q_r = a + 2b$. The still stronger uniform-edge branch predicts

$$Q_{\text{cycle}} = q Z^T Z, \quad a = 3q, \quad b = -q, \quad c = d = 0, \quad a = -3b.$$

These reductions are therefore post-reconstruction tests, not assumptions used to obtain the matrix. A physical source may fail locality or uniformity while still returning a valid positive D6-equivariant kinetic matrix.

Exact method verification. Applying the closed-loop schedule to the deliberately chosen positive 12-edge kinetic matrix used in the earlier event-energy inversion [94] reproduces exactly the same retained matrix as the 72 edge-response calculation. The ordered response is exactly symmetric, and the reconstructed matrix is positive with eigenvalues approximately 8.46893690679, 11.2149502336, 12.8592265792, 17.6516683862, 21.7601734844 and 267.045044410. Appendix A.6 gives the exact matrix and proof. This verifies the reconstruction method only; the synthetic Q was supplied deliberately and is not a physical VERSF return.

Physical source boundary. Returning the matter particle to its starting site removes the endpoint-displacement problem but does not by itself prove that record, bath, interaction, transient matter or completion work is independent of incoming loop flux. The joint energetic audit already shows that cross-energy can belong to the full parent [3]. A physical Priority-K release must therefore return either the total same-source work for the paired loop preparations together with a source-justified separation of the non-gauge flux-dependent terms, or an independently work-normalised conjugate response on the same cycle carrier. No Standard-Model coupling may enter that release.

Pre-registered release gate. Before any gauge comparator is opened, freeze the branch, charge convention, loop orientations, baseline preparations, record/bath state, clock/temporal attachment and regulator maps. Require: (i) centered quadraticity residuals within the declared tolerance; (ii) background independence of $D^{(c)}$; (iii) reciprocity; (iv) positive Q_{cycle} ; (v) D6 covariance tested rather than imposed; (vi) any locality or uniform-edge reduction tested only after reconstruction; and (vii) agreement across regulator levels after transport to the common cycle carrier. Where an independently source-derived susceptibility or reduced Master-action kinetic operator exists, require route agreement with the same frozen Q_{cycle} .

17.82 Nonfactorising loop/current compatibility and the record-lock resolvent

Sections 17.52 and 17.81 expose a same-source test between the CLI closed-loop curvature and the RCHS current response. HX1 denotes the K7 record/completion phase tangent of $\text{Pol}(\Phi)$ identified in the post-commitment master-action audit [96]. The CLI link price grows linearly with the cycle eigenvalue, whereas the fully relaxed unit RCHS link response contains an additional mode-dependent record-screening term. The question is not merely whether a positive parent can be written, but whether the specific mode function demanded by the two returns coincides with a native response on the same carrier.

Closed-loop link operator.

Let $G=Z^T Z$ on the six triangle-loop coordinates. Its eigenvalues are $\ell=(1,2,2,4,4,5)$. CLI-1 gives $a_3=0.0646879369753897$ and the unit-charge curvature per face per opportunity

$$t := a_3/3 = 0.0215626456584632.$$

For a normalized cycle eigenvector f with $Gf=\ell f$, the normalized edge-cycle coordinate $c=Zf/\sqrt{\ell}$ therefore has CLI link stiffness

$$K\theta, \text{CLI}(\ell) = t \ell.$$

Generic positive-parent lemma and specific mode-function test.

For simultaneously diagonal positive $K\theta$ and a unit bare current metric, any target current spectrum with eigenvalues strictly between zero and one admits a positive parent of this Schur form: mode by mode $\kappa^2=2K\theta(KJ^{-1}-1)>0$, and the complementary Schur block is positive. Positive-parent existence is therefore generic and is not a selection theorem. For the unit diagnostic RCHS branch specifically, define $K_R(\ell)=\ell(\ell+2)/(\ell+1)$ and $KJ,R(\ell)=K_R(\ell)/(K_R(\ell)+1/2)$. Retaining $W_J=I$ only as the declared diagnostic normalisation and setting the link Schur return to tG gives the particular mixed mode function

$$\kappa_{\text{target}}^2(\ell) = 2 t \ell [1/KJ,R(\ell)-1] = t (\ell+1)/(\ell+2).$$

Equivalently, on the six-cycle operator,

$$\kappa_{\text{target}}^2 = t (G+I)(G+2I)^{-1} = t [I-(G+2I)^{-1}].$$

The dimensionless eigenvalues $\kappa_{\text{target}}^2/t$ are $(2/3, 3/4, 3/4, 5/6, 5/6, 6/7)$. Let κ_{target} be the positive square root and define the twelve-dimensional current-link parent

$$H_* = [[I, -\kappa_{\text{target}}/\sqrt{2}], [-\kappa_{\text{target}}/\sqrt{2}, tG + \kappa_{\text{target}}^2/2]].$$

Schur-eliminating the current returns exactly tG , and eliminating the link returns the RCHS unit-branch current spectrum. Positivity follows from the positive current block and complementary Schur block $tG>0$. This construction verifies compatibility for the specific CLI/RCHS inputs, but the existence of such a parent is generic; the substantive test is the mode-function identity below.

Native record-lock identity.

Section 17.52 already contains the native four-variable invariant block $H4(\ell)$ on current p , conjugate current q , matched link θ and record phase y . Rotate the two current coordinates to

$$u=(p+q)/\sqrt{2}, \quad v=(q-p)/\sqrt{2}.$$

The u direction decouples and the remaining native block is

$$H(v, \theta, y)(\ell) = [[1, 1, 0], [1, \ell+2, -1], [0, -1, \ell+1]].$$

If the record-phase direction y is held fixed and only θ is relaxed, the exact retained v stiffness is

$$K_{v,lock}(\ell) = 1 - 1/(\ell+2) = (\ell+1)/(\ell+2).$$

Under $W_J=1$ and the unit H4 current normalisation, the specific mixed mode function required by the CLI/RCHS pair coincides exactly with the native record-locked v response:

$$\kappa_{target}^2 = t K_{v,lock}(G).$$

This is an exact coincidence of mode functions in the unit diagnostic convention. Its physical meaning depends on identifying the same carrier, record coordinate and operational metric; it is not source selection and does not turn the generic positive-parent lemma into a uniqueness theorem. The fully relaxed control is different. If y is also eliminated,

$$K_{v,relaxed}(\ell) = \ell(\ell+2)/(\ell^2+3\ell+1),$$

and

$$K_{v,lock}(\ell) - K_{v,relaxed}(\ell) = 1/[(\ell+2)(\ell^2+3\ell+1)] > 0.$$

The distinction is therefore exactly the availability or removal of the record-phase relaxation direction, not a numerical fitting freedom.

Commitment gate and source typing.

The post-commitment audit shows that removing an old record-phase relaxation direction stiffens the link response, while the explicit FCHI/PFDMI/MASD constraints inspected there do not dynamically remove the selected HX1 phase tangent [96,97]. Those source constructions therefore do not generate a force-like or Hessian-level backreaction that removes y . Fact-Lock addresses a different question: once a source/record theorem identifies y as the event-local degree of freedom carrying an irreversible Fact, y is excluded from the admissible post-commitment tangent by definition of the committed record. Until that carrier identification is established, the locked response remains conditional.

The exact NFDMA-2 bath reduction [72] does not supply that theorem. Its source-visible fine response is a two-pole function of a bath/frequency spectral variable z . The cycle label ℓ used above is a spatial face-incidence eigenvalue. No source theorem identified $z=\ell$, and that substitution is forbidden. The NFDMA bath remains a useful exact auxiliary reduction but is not used as the origin of the record-lock spatial resolvent.

Release gate.

Before this branch can be called physical, the source must establish all of the following without Standard-Model input: (i) the CLI coherent closed-loop weight belongs to the admitted amplitude/action law; (ii) the source/record map identifies the relevant y tangent as the physical degree of freedom carrying the committed Fact, at which point the Fact-Lock Principle removes it from the admissible post-commitment tangent; (iii) the resulting nonfactorising mixed map descends from the physical W_{prim} rather than from inverse reconstruction; and (iv) the action-side kinetic operator agrees with closed-loop work spectroscopy or an independently work-normalised conjugate response when that second route is available. Failure of any item returns the result to compatibility grade only. The Fact-Lock Principle supplies the post-commitment admissibility constraint; it does not supply the carrier identification or the energetic normalisation.

17.83 One-dimensional antipodal-odd commitment bottleneck and same-branch lock correction

The fully relaxed RCHS current target and the native record-locked v response belong to different constraint regimes. If the same y constraint is imposed on the current response itself, the diagnostic locked-current eigenvalue becomes

$$KJ, \text{lock}(\ell) = (2\ell + 2)/(2\ell + 3).$$

Exact reciprocity with $K\theta = t\ell$ would then require

$$\kappa_{\text{coherent-lock}^2}(\ell) = t\ell/(\ell+1), \quad \kappa_{\text{coherent-lock}^2} = tG(G+I)^{-1}.$$

This differs from the relaxed-target operator $t(G+I)(G+2I)^{-1}$ of Section 17.82. Section 17.84 gives the coherent same-parent locked-current/link reconstruction and proves positivity. Branch existence and branch admissibility remain distinct: the open physical question is whether the relevant alternating $m=3$ HX1 direction is the event-local record of the committed Fact. If it is, Fact-Lock selects the constrained tangent.

EX2G cycle-incidence restriction.

Let $\Delta_i = (h \rightarrow b_i \rightarrow b_{i+1} \rightarrow h)$ be the six oriented wheel triangles and let f in R^6 be their coefficients. The source-derived EX2G attaching rule $A(x \rightarrow y) = C_y^+ + C_x^-$ [8] induces on the closed triangle carrier

$$A_{\text{cyc}} f = (Rf, Rf), \quad (Rf)_h = \sum_i f_i, \quad (Rf)_{(b_j)} = f_{(j-1)} + f_j.$$

Direct multiplication gives $R^T R = \text{circ}(3, 2, 1, 1, 1, 2)$, with Fourier spectrum $(10, 3, 3, 1, 1, 0)$. Hence

$$\text{rank } A_{\text{cyc}} = 5, \quad \ker A_{\text{cyc}} = \text{span}\{f_{\text{alt}}\}, \quad f_{\text{alt}} = (1, -1, 1, -1, 1, -1)^T.$$

Thus the primitive incidence attachment resolves five independent cycle combinations and misses exactly one alternating $m=3$ direction, where $m=3$ is the D6 Fourier label of the one-dimensional character that changes sign under a one-step 60-degree boundary rotation.

Canonical K7 history comparison.

For the constructed algebraic cycle-to-wheel lift $J_T f = (-(4/7) 1^T f; f)$, the alternating vector has zero hub component,

$$u_{\text{alt}} = J_T f_{\text{alt}} = (0; 1, -1, 1, -1, 1, -1)^T.$$

The canonical source wheel kernel T_0 of HMGB [7] then gives $T_0 u_{\text{alt}} = -(1/4)u_{\text{alt}}$ exactly. With stationary measure $\pi = (1/31)(7, 4, 4, 4, 4, 4)$,

$$\|u_{\text{alt}}\|_{\pi}^2 = 24/31, \quad \langle u_{\text{alt}}, (I - T_0)u_{\text{alt}} \rangle_{\pi} = 30/31,$$

so the normalized Dirichlet stiffness is $5/4$.

This proves that the missing representation is not a null direction of the canonical K7 history dynamics inside the constructed lift. It does not promote J_T to the physical cycle-to-history attachment: HMGB itself warns that the six-dimensional nonpersistent carrier still requires the correctly typed physical identification [7].

Antipodal terminal-quotient obstruction.

HMGB [7] derives the unique D6-equivariant equal-layer terminal quotient $b_i \sim b_{i+3}$, giving $A = \{b_0, b_3\}$, $B = \{b_1, b_4\}$, $C = \{b_2, b_5\}$. The alternating mode is odd under every antipodal pair, so

$$q_* u_{alt} = (1-1, -1+1, 1-1) = 0.$$

The standard terminal generation/completion quotient therefore removes exactly the one direction left unresolved by A_{cyc} . It cannot supply the sixth record constraint.

R4 does not supply the missing mode.

The Fold/R4 audit identifies the R4 population split as rotation-even and reflection-odd [8]. By contrast the alternating cycle character obeys $S f_{alt} = -f_{alt}$ under a one-step 60-degree boundary rotation. The two are inequivalent one-dimensional D6 representations, so a linear D6-equivariant identification of the $m=3$ cycle with R4 is forbidden. Independently, the present candidate master action returns the exact Fold-to-R4 gain $g_{MA1}=0$ [8]. The differently typed Gate-2 spoke alternating zero mode is likewise not a substitute for the HX1 cycle direction.

One-dimensional release theorem.

Let L_{phys} be any additional source-derived marked terminal-record functional acting on the six-cycle carrier. Since $\ker A_{cyc}$ is one-dimensional,

$$\text{rank}[A_{cyc}; L_{phys}] = 6 \quad \text{iff} \quad L_{phys} f_{alt} \neq 0.$$

A convenient diagnostic representative of the required symmetry channel is the normalized $m=3$ projection

$$\zeta(f) = (1/\sqrt{6}) \sum_{j=0}^5 (-1)^j f_j, \quad \zeta(f_{alt}) = \sqrt{6}.$$

This ζ is not inserted as a physical law. It states the exact minimal requirement: the source must return some correctly typed marked-record channel with nonzero action on f_{alt} , or prove that f_{alt} is physically redundant. The PMS audit still lists the directional half of DA_Ω , the marked completion-rate coordinates, record-tensor vertex and direction typing as open [9]. If such a channel is returned, the carrier rank closes; only after the same-parent locked-current response and post-commitment tangent are recomputed may one test $Q_{post}|Cyc_6=0$ and $s=0$.

Claim grade. The rank-five EX2G restriction, its one-dimensional alternating kernel, the canonical-wheel -1/4 eigenvalue under the constructed lift, the 5/4 normalised Dirichlet cost, antipodal-quotient annihilation, R4 representation mismatch and rank-six release criterion are exact finite statements. Section 17.84 proves the downstream no-recovery theorem, uniqueness up to one scalar gain of the linear D6-covariant $m=3$ marked extension, and the coherent locked-parent Schur algebra. Section 17.85 states the Fact-Lock Principle as a declared foundational premise with an append-only repeated-commitment architecture. Physical promotion remains open at the cycle-to-history/record typing, source identification and activation of the $m=3$ mark as the Fact-bearing record, any required directional DA_Ω map, and the kinetic/work normalisation.

17.84 Minimal marked $m=3$ extension and coherent locked-parent completion

Downstream quotient no-recovery theorem.

Let $q: R^6 \rightarrow R^3$ be the ordinary HMGBC antipodal terminal quotient, $q(f) = (f_0+f_3, f_1+f_4, f_2+f_5)$. Since $q(f_{alt})=0$, for every f and every scalar α ,

$$q(f + \alpha f_{alt}) = q(f).$$

Therefore every downstream map $\Phi \circ q$, linear or nonlinear, takes the same value on f and $f + \alpha f_{alt}$. The missing alternating information cannot be reconstructed after the ordinary antipodal quotient has been

applied. Any physical sixth record channel must therefore be written before, or as an extension of, that quotient rather than manufactured downstream.

Unique linear D6-covariant marked extension.

Let S be the one-step boundary rotation and F the standard reflection $j \rightarrow -j$. The missing vector satisfies $S f_{\text{alt}} = -f_{\text{alt}}$ and $F f_{\text{alt}} = f_{\text{alt}}$. Consider a scalar linear record $L(f) = \sum_j a_j f_j$ required to carry the same D6 character: $L(Sf) = -L(f)$ and $L(Ff) = L(f)$. The covariance equations force $a_{(j+1)} = -a_j$ and $a_{(-j)} = a_j$, hence

$$L_3(f) = g_3 \zeta_3(f), \quad \zeta_3(f) = (1/\sqrt{6}) \sum_{j=0}^5 (-1)^j f_j.$$

The $m=3$ scalar channel is therefore unique up to the real gain g_3 within the linear D6-covariant class. Because $\ker A_{\text{cyc}} = \text{span}\{f_{\text{alt}}\}$ and $\zeta_3(f_{\text{alt}}) = \sqrt{6}$,

$$\text{rank}[A_{\text{cyc}}; g_3 \zeta_3] = 6 \quad \text{iff} \quad g_3 \neq 0.$$

Thus the shape of the minimal marked repair is fixed. Source physics must still decide whether this channel is physically present, how it is normalised, and whether it is the record direction that carries the committed distinction. This is a representation theorem, not a source-selection theorem. In particular g_3 may not be chosen from a Standard-Model target or inserted merely to complete the rank. If a nonzero L_3 is established as the Fact-bearing record, the Fact-Lock Principle of Section 17.85 supplies the hard post-commitment constraint without an additional fitted stiffness.

Coherent locked-parent theorem.

Impose the same record-phase lock on the current response as on the native record-locked link response. With $K\theta = tG$ and exact reciprocity, the required mixed operator is

$$\kappa_{\text{lock}}^2 = t G(G+I)^{-1}.$$

Let $B_{\text{lock}} = \kappa_{\text{lock}}/\sqrt{2}$ and define the twelve-dimensional current-link parent

$$H_{\text{lock}} = [[I, -B_{\text{lock}}], [-B_{\text{lock}}, tG + B_{\text{lock}}^2]].$$

Schur elimination of the current block returns exactly $K\theta = tG$. Schur elimination of the link block gives

$$KJ_{\text{lock}} = [I + B_{\text{lock}}(tG)^{-1} B_{\text{lock}}]^{-1} = 2(G+I)(2G+3I)^{-1}.$$

For $\ell = (1, 2, 2, 4, 4, 5)$, this is

$$KJ_{\text{lock}} = (4/5, 6/7, 6/7, 10/11, 10/11, 12/13),$$

while $\kappa_{\text{lock}}^2/t = (1/2, 2/3, 2/3, 4/5, 4/5, 5/6)$. Positivity is exact because $I > 0$ and the complementary Schur block $tG > 0$. Hence a positive coherent locked parent reproduces the locked current and CLI link responses on the same branch. Its physical application is conditional on identifying the constrained coordinate as the event-local Fact-bearing record; Fact-Lock supplies the constraint rather than an additional restoring interaction.

Relaxed-versus-locked difference.

The fully relaxed compatibility witness remains distinct. Since

$$\kappa_{\text{relaxed}}^2 - \kappa_{\text{lock}}^2 = t(G+I)^{-1}(G+2I)^{-1} > 0,$$

the coherent locked branch uses a strictly smaller mixed current-link coupling in every cycle mode. The same-parent locked-current calculation is therefore an exact finite construction. Physical release still requires a source-derived nonzero marked record on the correct carrier and a proof that this marked

direction is the degree of freedom carrying the committed Fact. Once that identification is established, Fact-Lock imposes the constraint. The independently normalised kinetic/work scale remains separately required.

Claim grade.

The downstream no-recovery statement, uniqueness of L_3 within the linear D6-covariant scalar class, the rank-six criterion for $g_3 \neq 0$, the H_{lock} construction, its Schur returns and positivity, and the relaxed-minus-locked operator difference are exact finite-dimensional results. No claim is made that g_3 is physically nonzero or that the primitive post-commitment operation is linear. Fact-Lock is a declared foundational admissibility rule. H_{lock} becomes the physical local commitment block only conditional on a source/record theorem identifying the corresponding event-local $m=3/HX1$ coordinate as the physical record of the committed Fact.

17.85 Fact-Lock Principle and post-commitment branch selection

Foundational statement.

The Fact-Commitment Axiom is taken to mean: when an admissible primitive closure reaches completion, one allowed alternative resolves into a persistent Fact. Fact-Lock adds one narrow admissibility rule. For commitment event n , let $x_3^{(n)}$ denote the event-local active coordinate and let R_n map the pre-commitment state to the physical record $r_3^{(n)}$ of the realised distinction. Once the Fact is committed, the record value is fixed and ordinary post-commitment variations must lie in the kernel of dR_n .

$$R_n(X_n)=r_3^{(n)}, \quad T_{\text{post}}(F_n)=\ker dR_n|_{\{X_n\}}.$$

Repeated commitment is append-only, not cumulative freezing of one finite six-cycle carrier. The committed record $r_3^{(n)}$ is retired into the persistent ledger, while renewal prepares a fresh event-local active coordinate $x_3^{(n+1)}$ for the next event. The previous Fact is not unlocked; the working machinery is re-prepared around a new coordinate.

$$\mathcal{L}_N=(r_3^{(1)}, r_3^{(2)}, \dots, r_3^{(N)}), \quad x_3^{(N+1)} \text{ fresh on the renewed active carrier.}$$

This architecture prevents finite-carrier exhaustion. Fact-Lock fixes the already written record of each event, not every future degree of freedom that shares the same local representation. H_{lock} is therefore interpreted as the local commitment-event constrained block, not as a claim that one global $HX1$ coordinate is frozen for all later events.

On this branch, the retained response is read after commitment and before renewal: W_{prim} is the stationary covariance of those event-indexed reads, each with the $m=3$ tangent locked, so H_{lock} applies. It is not a duty-cycle average over the renewed-free interval; such a time-weighted observable would require a separate timing law.

Constraint versus infinite stiffness.

At quadratic algebra level an exact constraint and the limit of an increasingly stiff soft tether produce the same constrained Schur matrix. In particular, $K_v, \text{constrained}(\ell) = \lim_{h_3 \rightarrow \infty} \{K_v(\ell, h_3) = K_v, \text{lock}(\ell)\}$ when the soft tether is defined on the same record coordinate. The distinction is provenance, not the reduced matrix: Fact-Lock treats the lock as an admissibility condition and does not assert an infinite physical energy penalty.

Compatibility with persistence and zero backreaction.

The post-commitment source audits remain valid. The current factorised ledger/work architecture retains the Fact while returning zero ledger-to-future mixed derivative, and the frozen EPMD density source contains no r_3/x_3 dependence [8,9]. These results show that the tested actions do not generate the lock as an ordinary force-like interaction. They do not refute an admissibility constraint on a degree of freedom independently identified as the physical record.

Application to the unique $m=3$ record channel.

If the source/record derivation establishes $r_3^{(n)} = g_3 x_3^{(n)}$ on the unique linear D6-covariant $m=3$ channel, with $g_3 \neq 0$, then Fact-Lock gives $\delta r_3^{(n)} = 0$ and therefore $\delta x_3^{(n)} = 0$ for that completed event. The next event uses $x_3^{(n+1)}$ rather than reopening $x_3^{(n)}$.

$$0 = \delta r_3^{(n)} = g_3 \delta x_3^{(n)} \Rightarrow \delta x_3^{(n)} = 0.$$

The hard local lock then follows from admissibility. The derivational obligation is the physical record identification itself: the theory must show that the nonzero $m=3$ channel carries the committed distinction rather than inserting that identification merely to complete rank. Kinetic/work normalisation remains independent.

Claim category and falsifiability. Fact-Lock is a declared foundational premise, not a theorem derived from MA1, EPMD, FCHI, PFDMI or MASD. It is nevertheless falsifiable within VERSF: if a source-derived physical record coordinate is shown to relax under an ordinary admissible post-commitment evolution while the same Fact persists, with no new commitment, record transfer or erasure event, Fact-Lock fails. Section 18 states this falsifier explicitly.

18 Status ledger, falsifiers and stopping rules

Object	Grade	Consequence
Dual-route retained-curvature identity	EXACT mathematics	Must hold if full-kernel and work routes describe one source.
Full-configuration inverse within split class	INHERITED EXACT / CONDITIONAL PHYSICAL	Physical K,Q,a_t package not returned.
Work-normalized susceptibility route	EXACT local response theorem	Physical conjugate source not returned.
Perron/Doob score descent	EXACT	Physical Th not returned.
Current-link Schur reciprocity	INHERITED EXACT within source block	Constrains physical source; does not equal W_{prim} .
Protected metric as an absolute gauge anchor	INSUFFICIENT IN THE TESTED QUADRATIC CLASS	Whole four-dimensional protected metric and effective current-link conversion fixed, but both stiffnesses vary. Sections 17.51–17.53; physical metric selection remains open.
Source-action $\rightarrow$ history/Fisher identity	INADMISSIBLE IDENTIFICATION / PHYSICAL MAP OPEN	PCRS typing forbids direct identification without a derived map. The SFNMR numerical discrepancy is a post-freeze illustration, not a rejection ground. Sections 11–12.

Object	Grade	Consequence
Physical W_{prim}	OPEN	Central release object.
Gauge Z_3, Z_2, Z_q	OPEN DOWNSTREAM	Requires physical parent and canonical field normalization.
SFNMR physical R_v	OPEN DOWNSTREAM	Conditional response is near-linear in source amplitude; matching benchmarks and approximate residuals are given in Section 12. Physical amplitude remains unselected.
UFG typed addresses/current bridges	OPEN DOWNSTREAM	Minimal isometric realization falsified.
D41 Abelian portal alignment	EXACT on conditional history branch	Portal strength 0.0879875458532; physical auxiliary identity and absolute gain not selected.
Sequential native triangle instrument	EXECUTED at supplied currents	All 343 terminal words; stationary family dimension at least 45, so no unique preparation selected.
Joint matter and flux coordinates	EXACT in neutralized one-particle $U(1)$ sector	Particle position plus six integer loop fluxes; shared-link transport preserves Gauss's law.
Spatial infrared Dirac normalization	INHERITED at declared refinement grade	Normalized principal symbol retained; finite physical edge manifest remains distinct.
Two-state exchange ratio	EXACT for a positive invariant pair	Clock cancels; temporal coefficient remains. The primitive wheel pair leaks into other states.
Auxiliary elimination without fermion sewing	SCOPED CONTROL	Zero cross-interface bilinear diagnoses an incomplete action, not a VERSF obstruction.
Gauged sequential operator and vertices	EXECUTED CONDITIONAL CONSTRUCTION	Ten finite checks pass; covariance and both local Ward identities verified.
Static and dynamic gauge response	EXECUTED ON DECLARED REGULATORS	Closed HT Dirac loop and actual overlap Weyl response; physical global phase remains separate.
Transfer-derived chiral matrix	CONSTRUCTED AND FINITELY CHECKED	Actual projected Weyl matrix; 19 checks. Changes the raw HT determinant.
Free spectrum and local comparison	ANALYTIC ON CANONICAL FAMILY	One Weyl branch, unit residue, free gap ≥ 1 ; stated gauge neighbourhood gap ≥ 0.7575974459 .
Free reflection positivity and transfer	ANALYTIC ON THE CANONICAL FREE FAMILY	Nonnegative pole and continuum weights for all momenta and λ in $[0,1]$; Dirac and stated physical Weyl sectors. Independent Fourier error $\leq 1.42 \times 10^{-13}$.
Static link reflection positivity	ANALYTIC FOR THE GAPPED CANONICAL FAMILY	Time-independent non-Abelian spatial links, $U_0 = I$; Dirac Gaussian and stated physical Weyl observables. Sections 17.39–17.41.

Object	Grade	Consequence
Nonnegative one-step static transfer	DISPROVED IN GENERAL AT $\lambda = 1$	Explicit SU(2) field at arbitrarily small nonzero amplitude; negative covariance cut persists within the 10^{-4} neighbourhood.
Negative static sector under refinement	CONDITIONAL DECOUPLING THEOREM	All negative covariance spectral values obey $ r \leq 0.2583709137$ in the certified neighbourhood. Bounded-norm amplitudes vanish at fixed positive time as $a_t \rightarrow 0$.
Time-dependent and dynamical gauge positivity	OPEN	Requires an explicitly stated reflection-compatible background class, then the selected gauge action, chiral measure and integration.
Relative electric and magnetic matching	NUMERICALLY EVALUATED	$C_E \approx 3.9 \times 10^{-4}$, $C_M \approx -1.0 \times 10^{-3}$; conservative precision a few percent.
Dynamic test of static matching	EXECUTED FOR TWO COMPONENTS	At $\omega = p = 0.025$ the response-pair residual is 0.6–1.1%; no dynamic refit.
Chiral phase and physical source identity	SEPARATE REQUIREMENTS	Free and static results do not select the global chiral phase, microscopic transfer, physical time calibration or absolute force strengths.
Occurrence curvature and score	EXACT LOCAL DISTINCTION	At the regular symmetric origin, a quadratic contrast has nonzero hazard Hessian but zero first-order occurrence Fisher.
Finite-opportunity D41 identification	REJECTED ON FROZEN BASELINE	$b/a = 0.795060078455$ differs from $d_{\text{red}}/d = 0.915686813613$.
Native nonzero-current history	EXECUTED CONDITIONAL	Rank-three relative response across 151 histories; common radial response exactly zero.
Native saturated scalar gain	EXACT RESTRICTED LIMIT	A smooth two-sided gain at $c = 1$ has zero derivative; other instrument families are not excluded.
Raw-current first-event operation	CONSTRUCTED AND VERIFIED	Completely positive, affine and magnitude sensitive; physical intensity, interval and Fact attachment remain open.
Dark activation by native recording	EXECUTED AT FIXED CURRENT	Persistent occupied dark dimension $36 \rightarrow 11$; second-hop native excitation 0.0291840211483 from ρD .
Common gauge dark kernel	EVALUATED OPERATOR ALGEBRA	Five occupied directions survive all supplied gauge generators; no selected trajectory or renewal law follows.
Absolute Fact rate and neutrino update	OPEN	The continuations do not fix a physical occurrence scale or replace the conditional neutrino amplitude.
Protected-scale admission test	EXECUTED DIAGNOSTIC / PHYSICAL ADMISSION OPEN	Relative diffusion changes; not a common clock. Forty-one checks; no two admitted physical sources. Section 17.54.
Native mean-kick work attachment	REJECTED ON THE FIXED PREPARATION	Nonzero commuting-chart curl 0.0005265814976614051 ; forty checks. Full physical work route remains open. Section 17.55.

Object	Grade	Consequence
Archived NFDMA coarse bath	EXACT MATCHING FAILS AT FROZEN UNITS	Spectral obstruction excludes an injective bath intertwiner; earlier output-tolerance result has weaker scope. Section 17.56.
Minimal six-mode bath and midpoint reduction	EXACT WITHIN THE DECLARED CANDIDATE	Full three-channel resolvent and all effective blocks returned; 52 checks below 5×10^{-13} . Sections 17.57–17.59.
Source gain from exact matching and stiffness positivity	INSUFFICIENT WITHIN THE CANDIDATE FAMILY	γ remains free within a positive interval. Varying it relaxes the equal-sharing premise; physical couplings remain unissued. Section 17.60.
Common source cost and refinement repair	EXACT SCOPED OBSTRUCTION / PHYSICAL UNIT OPEN	A positive same-action family survives reduction. No positive common coefficient equates the two archived static responses. Sections 17.61–17.64.
Native transport and recording refinement	EXACT CONDITIONAL REDUCTION / RECORD RULE OPEN	Series-conductance matching and dynamic memory derived. Fresh full-strength records on each half-edge change the declared operation. Sections 17.65–17.66.
Extra gauge potential with fixed complete inputs	EXCLUDED UNDER FIXED SOURCE CONTRACT	The tested addition changes a rank-72 curvature Hessian. Conditional-record invisibility does not admit it. Section 17.67.
Operational metric from action self consistency	INSUFFICIENT ADDITIONAL ANSATZ	No-bath rank obstruction; bath-compatible family remains. Forty-six checks on the old fixture; no full-premise nonuniqueness. Section 17.68.
Native process geometry	EXECUTED CONDITIONAL DIAGNOSTIC	Rank 109 on the 110-coordinate chart; exact joint hypercharge null. Original endpoint-defined link family has rank 12. Physical operational metric unreturned. Section 17.69.
Joint covariance descent	EXACT TANGENT IDENTITY AND SCOPED OBSTRUCTION	Homogeneous independent exact descent fails with charged gauge variance on the stated open factorisation family. These extra assumptions are not VERSF axioms. Sections 17.70–17.71.
Positive joint lifts and update cost	CONSTRUCTED FOR SUPPLIED LAWS	State-dependent or correlated repairs and Gaussian cost descent verified; 54 checks and identical clean JSON rerun. Physical covariance and action identity unselected. Sections 17.72–17.74.
Closed-loop K7 cycle probe	EXACT CARRIER / SOURCE-GRADE PREMISE	Six triangular loops span the complete six-dimensional cycle carrier; closed-loop matter transport returns the particle to its starting site and leaves a divergence-free gauge impulse on the declared CLI-1 coherent-worldline branch. Section 17.81.
Closed-loop work reconstruction	EXACT ALGEBRA / SYNTHETIC VERIFICATION	Thirty-six ordered loop-work responses reconstruct Q_{cycle} directly; reciprocity, quadraticity, D6 equivariance, locality and uniform-edge reduction are source tests. Exact synthetic equivalence to the earlier edge-probe inversion; physical work remains unreturned. Section 17.81.
Physical loop-work release	OPEN SOURCE RETURN	Return paired same-branch loop-event work or equivalent work-normalised response with flux-dependent matter/record/bath/cross contributions included or separately source-subtracted; then freeze Q_{cycle} before any measured coupling is

Object	Grade	Consequence
		opened.
CLI/RCHS positive-parent compatibility	GENERIC POSITIVE-PARENT LEMMA / SPECIFIC INPUTS	For simultaneously diagonal positive $K\theta$ and $0 < KJ < 1$, positive-parent existence is generic. The specific CLI/RCHS construction is a compatibility witness, not selection. Section 17.82.
Native locked-mode function	EXACT UNIT-CONVENTION MODE-FUNCTION IDENTITY / CARRIER IDENTIFICATION OPEN	Under $W_J = I$ and the unit H4 current normalisation, $\kappa_{\text{target}}^2/t$ equals the native locked-v mode function. Physical meaning depends on common carrier and operational-metric identification. Section 17.82.
Fact-Lock Principle	DECLARED FOUNDATIONAL PREMISE / EXPLICIT FALSIFIER	Each commitment fixes its Fact-bearing record while renewal prepares a fresh event-local coordinate. H_{lock} is the post-commitment/pre-renewal event read used in the stationary response, not a duty-cycle average. This is an admissibility rule, not a restoring force. F28 states the falsifier. Section 17.85.
Fact-bearing $m=3$ /HX1 carrier identification	OPEN SOURCE/RECORD IDENTIFICATION	The tested sources do not dynamically remove HX1, and that zero does not refute Fact-Lock. The source must identify a correctly typed nonzero $m=3$ record channel as the event-local carrier of the committed distinction, or prove it redundant.
NFDMA bath $\rightarrow$ spatial record-lock identification	NOT ESTABLISHED / TYPING FIREWALL	The exact NFDMA response is a two-pole function of bath/frequency z ; ℓ is a spatial cycle eigenvalue. No source bridge permits $z=\ell$.
Minimal antipodal-odd marked extension	EXACT REPRESENTATION THEOREM / SOURCE GAIN AND CARRIER IDENTIFICATION OPEN	Any downstream function of the ordinary antipodal quotient is blind to f_{alt} . Within the linear D6-covariant scalar class the only detecting channel is $L_3 = g_3 \zeta_3$. Full six-cycle rank iff $g_3 \neq 0$. Physical use still requires Fact-bearing carrier identification. Section 17.84.
Coherent same-parent locked current/link parent	EXACT LOCAL COMMITMENT-BLOCK ALGEBRA / CARRIER IDENTIFICATION OPEN	H_{lock} is positive and returns $K\theta = tG$ and the coherent locked current spectrum on one constrained parent. Fact-Lock supplies the constraint once the event-local Fact-bearing coordinate is identified; no restoring-force selection is required. Section 17.84.
Physical $m=3$ Fact-record identification	OPEN SOURCE RETURN	The primitive operation must write the antipodal-odd mark before or at the terminal quotient with source-derived nonzero g_3 , identify it as the event-local carrier of the committed distinction, or prove the direction redundant. The gain may not be fitted from rank closure or Standard-Model data.
Complete physical action	OPEN SOURCE SELECTION AND IDENTIFICATION	Return the admitted joint amplitude law and matter/bath attachment, or prove all admitted choices physically equivalent. A quadratic gauge response is a narrower milestone. Section 17.75.

Falsifier F0: Factorised-history attachment

Any claimed D41 history coupling obtained solely by multiplying the frozen history law by a separately normalized conditional mark law is invalid: its exact cross block is zero. A nonzero physical D41 return

must change the raw history/event law, retain a genuinely joint source, or arise through another source-derived nonfactorising mechanism.

Falsifier F1: Dual-route mismatch

If independently source-derived full-kernel and work-normalized routes disagree on Hret beyond the declared regulator/numerical tolerance, they do not represent one physical source or the retained/auxiliary typing is incomplete.

Falsifier F2: Doob-score inconsistency

If the derivative of the normalized history law is not reproduced by the Perron/Doob differentiation of the returned raw transfer, the history normalization is not source consistent.

Falsifier F3: Source-action substitution

Any derivation that sets W_{prim} equal to a source-action Hessian solely because their shapes or carriers coincide fails the action/Fisher firewall unless the transfer/mark bridge is independently derived.

Falsifier F4: Target access

If a measured gauge coupling, mass, CKM/PMNS entry, neutrino splitting or Higgs quantity is used to select the source branch or normalization before Stage A freezes, the physical prediction claim is void.

Falsifier F5: Centered-score substitution

A conditional/projective mark Fisher matrix may not be promoted to the magnitude-bearing event-rate metric by scalar rescaling alone. The exact source identity requires the rank-one occurrence-rate term $4\mu\mu^T$ in addition to the centered block. Omitting it conditions away precisely the radial information whose physical scale is under test.

Falsifier F6: Stopped-instrument field motion

A Fact-stopped construction built only from configuration-diagonal elementary operations cannot be claimed to generate physical changing-link/current dynamics. Within that class the stopped configuration kernel is δ_z , independent of the stopping rule. A physical release requires an off-diagonal field/current update or an equivalent source-derived work response.

Falsifier F7: Quantum mixture inconsistency

With physical controls fixed, a proposed quantum event operation must be linear and its probabilities affine in the incoming density. The scalar law $\exp[-\text{tr}(G\rho)]$ fails that requirement for the non-scalar native G . Treating ρ as an extra classical control changes the premise and must be declared.

Falsifier F8: Event and renewal identification

A current-pointer excitation, a terminal record, a raw first event and a completed Fact cannot be identified solely because each has a normalized probability. Likewise, native recorded-hop limits and a survival process with added terminal records cannot be promoted to a selected physical renewal law or used to set its clock.

Falsifier F9: Static positivity and its permitted scope

Link-reflection positivity must not be promoted to nonnegative one-step transfer: the admissible static $SU(2)$ counterexample rules out that claim for the unchanged $\lambda = 1$ completion. The fixed-static proof

cannot be promoted to time-dependent or dynamical gauge positivity using the gap or locality alone. Such a claim must supply the appropriate reflection construction and, for dynamical fields, the selected gauge action and chiral measure.

Falsifier F10: Decoupling and microscopic time

The bound on negative covariance support proves disappearance only under the stated physical-time refinement and normalization assumptions. It cannot be used to assert nonnegative transfer at a finite primitive tick, select the time attaching map, remove contact terms, or establish the positive-sector continuum limit. Replacing signed K by $|K|$ or declaring two steps to be the primitive duration changes the physical construction and requires independent source justification.

Falsifier F11: Protected metric substitution

A protected Higgs-line or protected-sector normalisation, together with the minimum-norm Gaussian identities and reciprocity, cannot be promoted to an absolute gauge coefficient without a source rule selecting the operational metric on defect-producing directions. The family in Section 17.52 is an explicit witness. Conversely, it cannot be called a counterexample to the full physical theory without establishing that its members satisfy the complete primitive admissibility conditions.

Falsifier F12: Mean-kick work substitution

A proposed conservative static work gradient must be closed on the relevant fixed-preparation chart. The native one-form in Section 17.55 fails this test. Its curl cannot be removed by a common phase or nonzero constant gain; a different physical force law must be derived, not silently substituted.

Falsifier F13: Incomplete bath matching or normalization promotion

Output-tolerance agreement must not be promoted to exact operator intertwining. Exact elimination must transform the bath, source and direct gauge block together. Conversely, the exact six-mode response identities and positive quadratic stiffness do not select $\gamma = 1$ or certify physical history-cone positivity. A physical selection claim must discharge the source premise and carrier requirements in addition to the identities already verified. The common-cost family and strict gap in Sections 17.62–17.63 also prevent promoting a shared normalization choice into exact agreement of the archived regulator forms.

Falsifier F14: Fixed input and full admission

Terminal invisibility does not admit an extra potential at fixed MASD/HMGB inputs. Neither the potential tests nor the Gaussian fixed-point families are two fully admitted VERSF theories. A full nonuniqueness claim must hold every governing premise fixed and demonstrate two admitted sources with different invariant responses.

Falsifier F15: Operational geometry substitution

A formal Choi/Bures metric or a covariance-defined distance may not be renamed the physical operational metric without the source-selected realisation, probe, measure, quotient and action/clock attachment. The 110-coordinate native chart, the old 187-coordinate fixture quotient and later faithful assemblies require explicit maps before comparison or combination.

Falsifier F16: Exact joint refinement and its scope

Under the homogeneous independent assumptions of Section 17.71, nonzero charged gauge variance violates exact covariance descent across the specified open factorisation family. A compatible lift must relax those assumptions or justify restricted support. State dependence, correlations and approximate refinement remain possible. A positive covariance repair or equality of the native operation at an identical coarse output does not certify a physically admitted fine quantum instrument.

Falsifier F17: Graph-Wilson/holonomy conflation

A graph-Dirac/Wilson edge roughness operator may not be promoted to the gauge holonomy action merely because both descend from the K7 carrier. On the physical oriented closure circulation $B\uparrow\omega C=0$ and $BB\uparrow\omega C=0$. A physical gauge action must price the face-curvature sector or an explicitly source-derived equivalent.

Falsifier F18: Event-work reconstruction circularity

Computing event work from an assumed electric kinetic matrix and then applying the work-difference inversion to recover that same matrix is an identity check, not a derivation. A physical Priority-K claim requires the work difference or equivalent conjugate response to be returned independently by the primitive source.

Falsifier F19: Continuum-current convention as an absolute anchor

A unit coefficient in $-J\cdot A$ cannot fix the physical gauge scale if that coefficient was obtained by absorbing a constant into the definition of J . The absolute continuum normalisation must be tied to the already fixed compact charge/flux coordinate by a source-derived kinetic/work response, not by a current naming convention.

Falsifier F20: Closed-loop matter-return overpromotion

Returning the transported particle to its starting site and producing a divergence-free cycle impulse do not prove that record, bath, completion, interaction or transient matter work is independent of the incoming cycle-flux preparation. A closed-loop work matrix may be promoted to Q_{cycle} only after the source proves that cancellation or returns and subtracts the same-source flux-dependent cross-work.

Falsifier F21: Symmetry, locality or uniformity inserted before reconstruction

D6 covariance, edge locality, one spoke/rim pair, or a uniform edge coefficient may not be imposed to reduce the number of source responses before the full ordered cycle-work matrix has been reconstructed. They are post-reconstruction tests. A result obtained by assuming $Q_{\text{cycle}}=q Z^T Z$ is not a derivation of q .

Falsifier F22: Closed-loop quadraticity or reciprocity failure

If the centered loop-work response depends on the baseline cycle flux, if $W_b(p+z_a)+W_b(p-z_a)-2W_b(p)$ is nonzero beyond tolerance, or if $D_{ab}\neq D_{ba}$ after all declared same-source subtractions, the tested branch does not return a single real symmetric quadratic electric kinetic matrix on that carrier. The discrepancy must be retained as nonlinear, memory or cross-sector physics rather than averaged away.

Falsifier F23: Fact-Lock carrier overpromotion

The equality $\kappa_{\text{target}}^2/t=(G+I)(G+2I)^{-1}$ may not be promoted to a physical current-link map merely because the same mode function is obtained by holding the native record phase y fixed. The explicit commitment constraints audited so far do not dynamically remove the selected HX1 phase tangent. Fact-Lock is a foundational admissibility premise and applies only after the physical record-bearing direction has been identified. Declaring y to be that direction by fiat is therefore still an overpromotion. If the $m=3/\text{HX1}$ direction is source-derived as the event-local Fact-bearing record, the current response must use the coherent same-parent locked response of Section 17.84; combining a fully relaxed RCHS current target with a locked native v response remains only a compatibility witness.

Falsifier F24: Bath-frequency/cycle-mode conflation

The NFDMA bath resolvent variable z and the face-incidence cycle eigenvalue ℓ are differently typed. A calculation that substitutes $z=\ell$, or otherwise uses the exact NFDMA two-pole bath as the spatial record-

lock resolvent without a derived carrier map, fails the source-typing protocol even if numerical values appear close.

Falsifier F25: Antipodal-odd channel insertion

The missing $m=3$ record direction may not be inserted solely because it raises the EX2G restriction from rank five to rank six. The standard HMGBC antipodal terminal quotient annihilates that direction, the R4 binary record carries a different D6 character, and the present MA1 Fold-to-R4 gain is zero. The Gate-2 spoke alternating mode is differently typed. Fact-Lock does not repair this provenance problem: it constrains whichever degree of freedom actually carries the Fact, but it does not identify that carrier. A physical sixth channel must therefore be source-derived on the correct cycle/record carrier; once it is identified as Fact-bearing, the coherent same-parent H_{lock} calculation supplies the constrained response.

Falsifier F26: Downstream $m=3$ recovery or gain insertion

Once the ordinary antipodal HMGBC quotient has been applied, no downstream function of that quotient may be claimed to recover the missing $m=3$ cycle information, because $q(f+\alpha f_{\text{alt}})=q(f)$ identically. Within a linear D6-covariant scalar extension the missing channel is unique up to g_3 ; choosing g_3 by phenomenological fit, by rank completion alone, or by identifying it with an inequivalent R4/Gate-2 carrier is not a source derivation. The Fact-Lock Principle constrains a derived physical record; it cannot be used to manufacture the record map that the quotient has erased.

Falsifier F27: Backreaction/Fact-Lock conflation

The exact zero ledger-to-future mixed derivative of the current factorised post-commitment action, and the absence of r_3/x_3 dependence in the frozen EPMD density source, may not be quoted as falsifying Fact-Lock: they show that those actions do not generate the lock as a force-like interaction. Conversely, Fact-Lock may not be used to infer a nonzero mixed Hessian, memory-force coefficient, event work or energetic stiffness. It is a restriction of the admissible post-commitment tangent and becomes applicable to HX1 only after the physical Fact-bearing carrier has been independently identified.

Falsifier F28: Fact-Lock failure

Fact-Lock is falsified if VERSF derives a physical record coordinate that distinguishes a committed Fact and then admits an ordinary post-commitment evolution for which that record coordinate changes while the same Fact persists, with no new commitment, no transfer to an equivalent immutable record, and no erasure event. Such a result would show that irreversibility does not require the committed record to remain fixed and would remove Fact-Lock as a foundational premise.

Stopping rule.

If the primitive source does not return either (a) an independently work-normalized susceptibility/event-work matrix on the closed-loop carrier, or (b) a same-source action route that identifies the physical Fact-bearing record channel, supplies the admitted CLI/current-link parent and connects it to the kinetic/time normalization, the physical gauge couplings are not issued. Under route (b), the post-commitment record-phase constraint is supplied by the declared Fact-Lock Principle once the carrier identification is established; it is not required to reappear as a force-like mixed-source derivative. Conditional source-action, Fisher/history, coherent-worldline and record-identification quantities remain separately graded.

19 Conclusion

CLSN-1 establishes an executable conditional history response and precise requirements for its physical interpretation. The factorised history $\times$ mark construction and the directly audited post-commitment source

have zero ordinary cross response. Those zeros show that the tested sources do not generate record retention as a force-like backreaction; they do not determine the admissible tangent of an independently identified irreversible record. The nonfactorised current-cycle branch has a nonzero D41 response, reproducible bath reduction and a positive rank-six colour/weak/hypercharge tensor. Current-link reciprocity constrains a common parent, while the PCRS type distinction prevents substituting action stiffness for the history metric without a derived physical map.

The declared dynamical constructions preserve Gauss's constraint and retain the spatial fermion principal symbol. A transfer-derived chiral completion has a unit pole, one free Weyl branch, a local gap certificate and finite static and dynamic gauge-response checks. Free transfer positivity and fixed-static link-reflection positivity hold in their stated sectors. An explicit $SU(2)$ field prevents universally nonnegative one-step transfer; a uniform spectral bound proves conditional decoupling of the alternating sector at fixed positive time separation. Time-dependent and dynamical gauge positivity, the positive-sector continuum limit and global chiral consistency remain separate obligations.

The native record operation detects relative current changes while losing their common magnitude. A quantum-consistent raw-current first-event candidate restores magnitude sensitivity at a declared conditional grade. Recording reduces the persistent occupied dark dimension from 36 to 11, with five common gauge-dark directions. These results do not supply a completed-Fact rate or a physical renewal law. The configuration-diagonal marked instrument also cannot generate independent field motion through a stopping rule alone.

Exact candidate reductions resolve specific refinement questions. The 28-mode NFDMA-2 bath has a minimal six-mode realisation for its three fixed gauge channels, with the full two-pole response preserved. Midpoint elimination returns bath, source and direct gauge corrections together. A positive common-cost family preserves this reduction, but no positive common coefficient equates the original coarse and fine static responses. Native endpoint dynamics determine a transport primitive and its series refinement; dynamical elimination introduces memory, and record refinement needs its own rule. These identities do not select the physical source strength.

The source-selection tests exclude several sufficient-selector claims within their stated classes. A fixed protected sector and current-link conversion leave stiffness freedom; the varied Gaussian sources are not thereby fully admitted physical models. The native mean-kick curl prevents its direct identification with conservative static work on the tested preparation. Fixed complete MASD/HMGBc inputs exclude the tested extra Wilson potential. Neither metric/action self-consistency nor the evaluated process geometry supplies an independently selected operational metric. Joint link/current composition imposes an exact tangent covariance identity. Homogeneous independent exact descent fails under the additional assumptions tested, while state-dependent or correlated lifts exist for supplied laws. Their statistical cost is not thereby identified with the full physical action.

Section 12 gives the unresolved source conversion a quantitative neutrino consequence. On the declared projected-source chain, the spacing ratio is approximately proportional to the amplitude at the tested points. Matching the NuFIT 6.0 and 6.1 comparator centres corresponds to amplitudes roughly 5.6–6.3% above the archived value. The archived output has approximate residuals of -2.0σ and -3.9σ under the stated zero-covariance calculation; these are not formal exclusions. The direct action/Fisher identification is inadmissible on typing grounds alone, and its factors of 2.83 and 2.85 below the archived amplitude and ratio are post-freeze illustrations. The physical amplitude must be independently derived, frozen and tested without retuning the archived prediction.

Full action closure requires a primitive joint amplitude law and allocation on the admitted carrier, together with its physical matter, bath and record attachment, or a proof that every admitted alternative gives the same relevant physical action. Two fully admitted inequivalent laws would establish insufficiency of the stated premises; the conditional families here do not establish that outcome. An independently work-normalised response can close a leading quadratic gauge milestone, but does not determine all nonlinear, matter, phase and global content. No physical gauge coupling or replacement neutrino normalisation is issued.

The new operator audit removes a misleading shortcut. The graph-Wilson edge Laplacian is blind to the physical closure circulation, whereas the face-Hodge map and exact closure injection fix the geometry of curvature without fixing its energetic coefficient. The master action therefore remains the correct place to read the physical gauge Hessian, after the complete quotient and Schur relaxation; the existing roughness coefficient cannot be promoted to C_{hol} or to a gauge coupling without a same-source equality theorem.

At the same time, Priority K eliminates two apparent continuum convention freedoms. The common compact link fixes the continuous charge/field coordinate, and the declared Wilson plaquette map fixes $c_{norm}=1$. The remaining leading scale is therefore operationally meaningful: it is the energy cost of a known quantized flux impulse. Source-derived work differences across neighbouring loop-flux preparations reconstruct $Q_{cycle} = C^T Q C$ exactly and hence the inverse retained gauge stiffness after the frozen continuum conversion. The present source does not yet return those work differences; calculations that assume the kinetic coefficient first are verification only. The derivation frontier is consequently narrower than before: derive the primitive event-work or equivalent calibrated response, freeze it, reconstruct the kinetic matrix, and only then expose the physical gauge couplings to experiment.

The closed-loop continuation sharpens Priority K again. Six source-supported triangle loops span the complete K7 cycle carrier, and a same-loop work comparison across neighbouring cycle-flux preparations reconstructs the retained electric kinetic matrix directly: $D=Q_{cycle}$. A centered implementation provides quadraticity and background-independence null tests, while the unreduced ordered matrix supplies reciprocity, positivity and D6 covariance tests before any locality or uniform-edge hypothesis is admitted. The theorem has been checked exactly against the existing synthetic kinetic inversion and returns the same positive 6×6 matrix entry-for-entry.

The remaining physical release is therefore finite and pre-registerable rather than qualitative: return the paired closed-loop work matrix, or an independently calibrated conjugate response on the same carrier, with all flux-dependent non-gauge contributions accounted for; verify reciprocity, positivity, symmetry and regulator stability; compare against any independently reduced Master-action kinetic operator; freeze the result; and only then canonically normalise the continuum fields and expose the resulting gauge couplings to experiment.

For the CLI/RCHS pair, positive nonfactorising-parent existence is not itself a selective result: within the simultaneously diagonal unit-current setting it is generic for positive $K\theta$ and current eigenvalues between zero and one. The specific content is the exact unit-convention coincidence between the mixed mode function demanded by the CLI/RCHS pair and the native record-locked v response. That identity remains conditional on common carrier and operational-metric identification.

The commitment-side structure is one-dimensional. The EX2G cycle-incidence attachment has rank five and misses one alternating D6 Fourier mode. Under the constructed canonical lift that mode is non-null in K7 history dynamics, while the standard antipodal terminal quotient annihilates it. No downstream processing of that quotient can recover the lost mode, and within the linear D6-covariant scalar class the only possible

marked extension is $L_3 = g_3 \zeta_3$ up to one gain. Fact-Lock treats an irreversible Fact as an append-only record: event n fixes its own record coordinate, renewal prepares a fresh event-local coordinate for event $n+1$, and the finite working carrier is not progressively exhausted.

The release frontier is dual. The work route can return the paired closed-loop work matrix or an independently calibrated conjugate response and thereby reconstruct the retained kinetic matrix. The action route has a positive coherent local commitment block that returns the locked current and link responses on one constrained parent. The open commitment-side task is to derive a correctly typed nonzero $m=3$ mark and establish that it is the event-local physical record of the committed Fact. Fact-Lock then supplies the constraint, while the physical kinetic/time normalisation remains independently required.

The commitment-side bottleneck is therefore one-dimensional and one-gain rather than qualitative. The record shape is fixed, the local constrained parent is explicit, and irreversibility is represented as an append-only admissibility condition rather than a required infinite restoring force. What remains unestablished is the physical Fact-bearing carrier identification and the independent work/kinetic normalisation. Accordingly CLSN-1 does not issue a physical gauge coupling.

The clear successor is a dedicated Fact-record identification paper. Its sole task is to derive or refute the source map that makes the unique alternating $m=3$ channel the event-local physical carrier of the committed distinction, while preserving the append-only renewal architecture. A positive identification makes the coherent local locked parent applicable; a no-go closes the HX1-lock route and leaves closed-loop work normalisation as the independent gauge-kinetic path.

Appendix A: Algebraic derivations

A.1 Schur reduction and conjugate susceptibility

For $x = (\theta, a)$, consider the quadratic action $\frac{1}{2}x^T H x - f^T \theta$. The auxiliary stationarity equation is $H a a + H a \theta \theta = 0$, so $a^* = -H a a^+ H a \theta \theta$ on the supported quotient. Substitution gives the effective action $\frac{1}{2}\theta^T H_{\text{ret}} \theta - f^T \theta$ with $H_{\text{ret}} = H \theta \theta - H \theta a H a a^+ H a \theta$. Stationarity in θ gives $H_{\text{ret}} \theta = f$. Therefore $\chi \theta = \partial \theta / \partial f = H_{\text{ret}}^{-1}$. This proves Theorem 1 when the full-kernel reconstruction supplies the same H .

A.2 Perron/Doob differentiation

Differentiate $T \epsilon \epsilon = \lambda \epsilon \epsilon$ at $\epsilon = 0$ and impose $\ell_0 \dagger r h = 0$. The Perron eigenvalue derivative is $\lambda h = \ell_0 \dagger T h r_0$. The reduced resolvent fixes $r h$ on the complement of the Perron ray. Logarithmic differentiation of $P \epsilon(i, j) = T \epsilon(i, j) r \epsilon(j) / (\lambda \epsilon \epsilon(i))$ gives the score printed in Section 10. Its stationary mean vanishes automatically for a normalized differentiable Markov family. The score covariance is therefore uniquely determined by $T h$.

A.3 Why an action offset cannot fix an event scale

If Γ is replaced by $\Gamma + C$, all local derivatives, Hessians and stationary points are unchanged. Any direct rule assigning an absolute event rate proportional to $\exp(-\Gamma)$ changes by $\exp(-C)$. Hence a derivative-level source action does not select an absolute stochastic baseline unless the primitive transfer/mark construction itself fixes the mapping. This is the local form of the action/Fisher firewall used in Section 11.

A.4 Changing-link Gaussian score and attachment dependence

For the conditional fixed-covariance joint proposal $Q = (2a_t)^{-1} [\theta^T P^{-1} \theta + (\delta j - R j \theta)^T D^{-1} (\delta j - R j \theta)]$, let a source parameter ϵ shift the means by $d\langle \theta \rangle / d\epsilon = v$ and $d\langle \delta j \rangle / d\epsilon = M v$. Differentiating the log density at $\epsilon=0$ gives

$$S_v = (1/a_t) [v^T P^{-1} \theta + ((M - R j) v)^T D^{-1} (\delta j - R j \theta)].$$

Taking the covariance at the reference law gives

$$W_v = (1/a_t) v^T [P^{-1} + (M-R_j)^T D^{-1} (M-R_j)] v.$$

Thus $M=R_j$ removes the transported-current contribution, while $M=0$ adds the positive term $v^T R_j^T D^{-1} R_j v / a_t$. This is an exact statement inside the declared Gaussian source family and demonstrates why the current/link attachment must be source selected.

A.5 Event-work inversion of the retained electric kinetic matrix

Let $H_E(p) = 1/2 p^T Q p$ and let a charge- q event shift p by $q e_j$. For a divergence-free cycle displacement z_a ,

$$W(p+z_a; q e_j) - W(p; q e_j) = q z_a^T Q e_j.$$

Defining $G_{aj} = [W(p+z_a; q e_j) - W(p; q e_j)]/q$ and collecting the cycle columns in C gives

$$G = C^T Q, \quad Q_{\text{cycle}} = G C = C^T Q C.$$

The identity is independent of any cycle Gram correction because $p = C\pi$ and $x = C^T\theta$ are dual canonical coordinates: $p \cdot d\theta = \pi \cdot dx$. It becomes a physical normalisation theorem only when the work differences are returned independently by the primitive source rather than evaluated from an assumed Q .

A.6 Closed-loop work reconstruction, cycle completeness and synthetic verification

For the K7 wheel order the twelve edges as six spokes followed by six rims, and define $z_i = s_i + r_{i-s_i+1}$. With $Z = (z_1, \dots, z_6)$, direct multiplication gives

$$Z^T Z = \begin{bmatrix} 3 & -1 & 0 & 0 & 0 & -1 \\ -1 & 3 & -1 & 0 & 0 & 0 \\ 0 & -1 & 3 & -1 & 0 & 0 \\ 0 & 0 & -1 & 3 & -1 & 0 \\ 0 & 0 & 0 & -1 & 3 & -1 \\ -1 & 0 & 0 & 0 & -1 & 3 \end{bmatrix},$$

$\det(Z^T Z) = 320$, so the six triangular cycles are independent and span the six-dimensional cycle space.

Let $H_E(p) = 1/2 p^T Q p$ and let loop b shift p by $q z_b$. Up to a branch-dependent but incoming-cycle-independent contribution c_b ,

$$W_b(p) = q p^T Q z_b + (q^2/2) z_b^T Q z_b + c_b.$$

Therefore

$$[W_b(p+z_a) - W_b(p)]/q = z_a^T Q z_b.$$

Collecting the ordered responses gives $D = Z^T Q Z = Q_{\text{cycle}}$. The centered formula $[W_b(p+z_a) - W_b(p-z_a)]/(2q)$ gives the same result and eliminates all cycle-independent offsets. The second centered difference vanishes identically for this quadratic law.

Synthetic verification. Use the deliberately chosen exact positive edge matrix $Q = \text{diag}(1, 2, \dots, 12) + vv^T$ with $v = (1, -1, 2, -2, 3, -3, 1, -1, 2, -2, 3, -3)^T$ from [94]. The closed-loop response reconstructs exactly

$$Q_{\text{cycle}} = \begin{bmatrix} 19 & -14 & 18 & -21 & 27 & -22 \\ -14 & 29 & -27 & 28 & -36 & 28 \\ 18 & -27 & 52 & -46 & 54 & -42 \\ -21 & 28 & -46 & 68 & -68 & 49 \\ 27 & -36 & 54 & -68 & 103 & -69 \\ -22 & 28 & -42 & 49 & -69 & 68 \end{bmatrix}.$$

This is entry-for-entry identical to the earlier edge-probe reconstruction. $D - D^T = 0$ exactly. Its numerical eigenvalues are approximately 8.46893690679, 11.2149502336, 12.8592265792, 17.6516683862, 21.7601734844 and 267.045044410, confirming positivity. Because Q was supplied synthetically, this verifies only the reconstruction theorem and implementation.

If a physical returned matrix is D_6 -equivariant, symmetry forces $Q_{\text{cycle}} = \text{circ}(a, b, c, d, c, b)$. Its eigenvalues are $\lambda_0 = a + 2b + 2c + d$, $\lambda_{1,5} = a + b - c - d$, $\lambda_{2,4} = a - b - c + d$ and $\lambda_3 = a - 2b + 2c - d$. For an edge-local diagonal energy with spoke coefficient q_s and rim coefficient q_r , $c = d = 0$, $q_s = -b$ and $q_r = a + 2b$. Uniform edge stiffness adds

$q_s=q_r=q$ and therefore $Q_{\text{cycle}}=qZ^T Z$, equivalently $a=3q$ and $b=-q$. These are post-reconstruction source tests.

A.7 Nonfactorising compatibility and the native record-lock Schur identity

Let $G=Z^T Z$ on the six loop coordinates, $Gf=\ell f$ and $t=a_3/3$. The CLI unit-charge edge Hessian tZZ^T gives normalised cycle stiffness $t\ell$. For any simultaneously diagonal $K\theta>0$ and $0<KJ<1$ with $W_J=I$, reciprocity gives $\kappa^2=2K\theta(KJ^{-1}-1)>0$, so a positive parent exists generically. For the specific RCHS unit branch, $K_R(\ell)=\ell(\ell+2)/(\ell+1)$ and $KJ,R=K_R/(K_R+1/2)$, giving

$$\kappa^2(\ell)=2 t \ell [1/KJ,R(\ell)-1]=t(\ell+1)/(\ell+2).$$

Functional calculus on G gives

$$\kappa^2=t(G+I)(G+2I)^{-1}=t[I-(G+2I)^{-1}].$$

With $B=\kappa/\sqrt{2}$, the parent $H_*=[[I,-B],[-B,tG+B^2]]$ has current Schur complement tG and link Schur complement $[I+B(tG)^{-1}B]^{-1}$, whose eigenvalues are exactly KJ,R . Positivity follows from $I>0$ and the positive complementary Schur block tG .

For the native $H_4(\ell)$, define $u=(p+q)/\sqrt{2}$, $v=(q-p)/\sqrt{2}$. The u mode decouples and the (v,θ,y) block is $[[1,1,0],[1,\ell+2,-1],[0,-1,\ell+1]]$. Holding y fixed and eliminating θ gives

$$K_{v,\text{lock}}=1-1/(\ell+2)=(\ell+1)/(\ell+2)=\kappa^2(\ell)/t.$$

Eliminating y as well gives $K_{v,\text{relaxed}}=\ell(\ell+2)/(\ell^2+3\ell+1)$, and direct subtraction yields

$$K_{v,\text{lock}}-K_{v,\text{relaxed}}=1/[(\ell+2)(\ell^2+3\ell+1)]>0.$$

The specific CLI/RCHS mode function therefore coincides exactly with the record-locked native Schur response in the unit diagnostic convention. This appendix proves a mode-function identity, not physical selection. Promotion additionally requires common carrier and metric identification, the CLI coherent loop action and the same-parent kinetic attachment.

A.8 Rank-five EX2G attachment and the antipodal-odd release criterion

For triangle coefficients f on $\Delta_i=(h\rightarrow b_i\rightarrow b_{i+1}\rightarrow h)$, EX2G gives $A_{\text{cyc}} f=(Rf,Rf)$ with $(Rf)_h=\sum_i f_i$ and $(Rf)_{(b_j)}=f_{(j-1)}+f_j$. Hence

$$R^T R = \text{circ}(3,2,1,1,1,2), \quad \text{spec}(R^T R)=(10,3,3,1,1,0).$$

The null vector is $f_{\text{alt}}=(1,-1,1,-1,1,-1)^T$. For the constructed lift $J_{-T} f=(-(4/7)1^T f;f)$, $u_{\text{alt}}=J_{-T} f_{\text{alt}}$ has zero hub entry and alternating boundary entries. The canonical K_7 kernel gives

$$T_0 u_{\text{alt}} = -(1/4)u_{\text{alt}}.$$

With $\pi=(1/31)(7,4,4,4,4,4)$, $\|u_{\text{alt}}\|_{\pi}^2=24/31$ and $\langle u_{\text{alt}},(I-T_0)u_{\text{alt}} \rangle_{\pi}=30/31$, so the normalized Dirichlet stiffness is $5/4$. The antipodal terminal quotient $q_{-}^*(b_i)=q_{-}^*(b_{i+3})$ annihilates u_{alt} exactly. Thus for any additional functional L ,

$$\text{rank}[A_{\text{cyc}}; L] = 6 \quad \text{iff} \quad L f_{\text{alt}} \neq 0.$$

The normalized Fourier functional $\zeta(f)=1/\sqrt{6} \sum_j (-1)^j f_j$ is a diagnostic representative of the required $m=3$ channel, not a source-selected physical record law.

A.9 Coherent same-parent locked-current/link reconstruction

Section 17.82 fixes $K\theta=t\ell$ and uses the fully relaxed RCHS unit-current response to obtain $\kappa_{\text{relaxed}}^2=t(\ell+1)/(\ell+2)$. If the same y lock is imposed on the current response itself, the locked-current eigenvalue is $KJ_{\text{lock}}(\ell)=(2\ell+2)/(2\ell+3)$, so reciprocity requires $\kappa_{\text{lock}}^2(\ell)=t\ell/(\ell+1)$. Functional calculus gives $\kappa_{\text{lock}}^2=tG(G+I)^{-1}$.

$$B_{\text{lock}}=\kappa_{\text{lock}}/\sqrt{2}, \quad H_{\text{lock}}=[[I,-B_{\text{lock}}],[-B_{\text{lock}},tG+B_{\text{lock}}^2]].$$

The current Schur complement is tG . The link Schur complement is $[I+B_{\text{lock}}(tG)^{-1}B_{\text{lock}}]^{-1}=2(G+I)(2G+3I)^{-1}$, with mode values $(4/5, 6/7, 6/7, 10/11, 10/11, 12/13)$. Since $I>0$ and $tG>0$, H_{lock} is positive definite on the six-cycle quotient.

$$\kappa_{\text{relaxed}}^2-\kappa_{\text{lock}}^2=t(G+I)^{-1}(G+2I)^{-1}>0.$$

This completes the same-parent locked-current/link algebra. Under Fact-Lock the matrix is the local constrained commitment block if, and only if, the source/record derivation identifies the relevant event-local $m=3/\text{HX1}$ coordinate as the degree of freedom carrying the committed Fact. Source activation and typing of the marked record and the common kinetic/work normalisation remain separate release conditions.

A.10 Minimal D6-covariant $m=3$ marked extension and quotient no-go

Write the antipodal quotient $q(f)=(f_0+f_3, f_1+f_4, f_2+f_5)$. Since $f_{\text{alt}}=(1,-1,1,-1,1,-1)^T$ lies in $\ker q$, $q(f+\alpha f_{\text{alt}})=q(f)$ for every f and α . Therefore no function $\Phi(q(f))$ can distinguish points differing only by f_{alt} ; the lost component cannot be reconstructed downstream.

Let S be the cyclic shift and F the reflection $j \rightarrow -j$. A scalar linear channel $L(f)=a^T f$ with $L(Sf)=-L(f)$ and $L(Ff)=L(f)$ has coefficients $a_{(j+1)}=-a_j$ and $a_{(-j)}=a_j$. Hence a is proportional to $(1,-1,1,-1,1,-1)$, and

$$L_3(f)=g_3 \zeta_3(f), \quad \zeta_3(f)=1/\sqrt{6} \sum_j (-1)^j f_j.$$

The $m=3$ one-dimensional representation occurs with multiplicity one in the six-boundary permutation carrier. Consequently every linear D6-covariant scalar repair is the same channel up to g_3 . Since $\ker A_{\text{cyc}}=\text{span}\{f_{\text{alt}}\}$, $\text{rank}[A_{\text{cyc}}; g_3 \zeta_3]=6$ iff $g_3 \neq 0$. This fixes the form of the minimal extension but not its physical activation or its identification as the carrier of the committed Fact.

A.11 Fact-Lock tangent restriction

For commitment event n , let R_n be the physical record map and $x_3^{(n)}$ the event-local active coordinate. Fact-Lock declares the ordinary post-commitment tangent to be the kernel of the differential of R_n at the committed state, while renewal prepares a fresh $x_3^{(n+1)}$ for the next event:

$$T_{\text{post}}(F_n)=\ker dR_n, \quad \mathcal{L}_N=(r_3^{(1)}, \dots, r_3^{(N)}).$$

If the physical $m=3$ record is $r_3^{(n)}=g_3 x_3^{(n)}$ with $g_3 \neq 0$, then an ordinary post-commitment variation obeys $0=\delta r_3^{(n)}=g_3 \delta x_3^{(n)}$, so $\delta x_3^{(n)}=0$. The next event uses $x_3^{(n+1)}$ rather than reopening the previous record coordinate. Algebraically the exact constrained Schur result equals the $h_3 \rightarrow \infty$ limit of a soft tether on the same coordinate; the distinction is provenance, not the reduced matrix. Fact-Lock posits an admissibility constraint rather than an infinite physical stiffness.

The exact zero mixed derivatives of the current factorised post-commitment action and the differently typed EPMD density source are compatible with Fact-Lock. They exclude those tested sources as force-like origins of the lock. Fact-Lock itself would fail if a source-derived Fact-bearing record were shown to relax

under ordinary post-commitment evolution while the same Fact persisted without transfer, erasure or recommitment.

Appendix B: Source manifest for the next execution

Manifest item	Required return
Branch identifier	One physical finite-regulator branch; hashes frozen before Stage B.
Regulator sequence	Actual maps and coupled block matching at declared levels, plus a uniform convergence bound or controlled error argument for any continuum claim. Two-level tolerance agreement alone is insufficient.
Physical changing-link coordinate	CRTF/RCHS physical radial/transverse tangent, not the retired fixed gradient proxy.
Full configuration state	Links plus every same-order source-coupled current, record, completion, support, matter and unresolved coordinate.
Reference measure / kinetic law	Source-derived Q or equivalent moment/generator data and event grain.
Clock	Source-derived a_t / physical opportunity grain; no post-output rescaling.
Release route A	Complete physical configuration kernel K with full-kernel compatibility certificate.
Release route B	Independently work-normalized conjugate force and measured/source-computed susceptibility $\chi\theta$.
Dual-route check	$H_{ret}(\text{kernel})$ versus $\chi\theta^{-1}$ where both routes are available.
Raw history derivative	$\text{Th on } E_2 \otimes (C, W, Y)$, including graded/background-contracted source jets.
Doob/Perron outputs	λh , $r h$, normalized score $S h$ and residual checks.
History metric	Physical score covariance and declared bath/defect Schur reduction to W_{prim} .
Universal completion	Terminal conductances, $\Delta\Omega$, WH and $R\Omega^{\text{or}}$.
Frozen Stage-A package	Matrices, source hashes, code, tolerances, units and provenance before any SM comparator is loaded.
Source coefficient	Derive the physical sharing/work normalization; explain what fixes or excludes the γ family of Section 17.60 without using observed couplings.
Matched bath and direct block	Return bath, source and direct gauge blocks from one physical parent. Preserve the direct correction under actual coarse elimination.
Carrier and route attachment	Identify the faithful carrier and the kinetic/time or independent work attachment. Candidate compression does not by itself discharge physical HP3.

Manifest item	Required return
Joint amplitude and fine allocation	Source-selected magnitude measure, allowed factorisation support, cross-factor covariance or retained memory; tangent and finite-operation refinement checks at their declared grades.
Full action identification	One admitted source for probability, energetic response, bath, matter and nonlinear/global content; no identification of proposal cost and action by convention alone.
Closed-loop work spectroscopy	For each ordered cycle pair (a,b), return the paired same-branch work $W_b(p \pm z_a)$ or an equivalent conjugate response with charge convention, loop orientation, baseline preparation, record/bath state and all flux-dependent cross-sector work fixed or separately source-resolved. Reconstruct the full ordered Q_{cycle} before symmetry reduction; report quadraticity, background-independence, reciprocity, positivity, D6 covariance, locality/uniformity tests and regulator transport residuals.
Fact-bearing record identification	On the same physical closed-loop/current branch, identify the event-local physical record of the committed distinction. For the six-cycle route, return the unique $m=3$ channel with source-derived $g_3 \neq 0$ before or at the antipodal quotient, or prove it redundant. Once identified, Fact-Lock supplies the post-commitment constraint; do not demand a separate restoring force and do not identify the NFDMA bath variable z with the spatial cycle eigenvalue ℓ without a source-derived bridge.
Repeated-commitment renewal	Show how the completed event-local record is appended to the persistent ledger while renewal prepares a fresh active record coordinate for the next commitment. The construction must preserve earlier Facts without progressively removing all directions of a fixed finite working carrier.

The next source-derivation stage must return the following manifest. No Standard-Model or neutrino target may select its inputs. Fact-Lock is held fixed as a declared premise; the source obligation is the physical record identification and the kinetic/work normalisation.

- Primitive field/current state: independent physical link and current variables on the faithful quotient, with substrate amplitudes, incident links, record/completion, bath and matter coordinates required by the source. Keep the native 50-component representation, its 49-complex-dimensional projective tangent, the single-edge process chart and the later faithful HM4 assembly explicitly typed; none is the full carrier merely by dimension counting.
- Primitive marked instrument: EX2A/EX2E current/terminal source with its 72-dimensional Wilson quotient, regulator-stable recurrent score covariance and centered factor matrix C_{Haar} .
- History/record state: the declared pre-Fact D36 branch and its explicit record grain; first persistent record and first closed cover are kept distinct unless a source theorem identifies them.
- History/dynamical route operation, when claimed: a physically selected joint one-Fold transition or Kraus family with genuinely off-diagonal support in (U, j) . Existing conditional constructions must be attached to that source; stopping a configuration-controlled instrument does not create the missing motion.

- Same-parent action test: return W_J^{phys} , $K_{\text{theta}}^{\text{phys}}$ and the constitutive current-link map from one source branch and require the current-link duality residual to vanish within the declared numerical/regulator tolerance.
- Operational metric selection: derive the metric on defect-producing tangent directions, including current-link cross terms and the physical bath reduction; demonstrate what selects or excludes the protected-anchor-preserving family of Section 17.52. Match the physical bath, source and direct blocks and derive the normalization that the candidate test in Section 17.60 leaves free. Derive this geometry independently of a Gaussian that already assumes it; the fixed-point test in Section 17.68 and conditional process geometry in Section 17.69 do not close that selection.
- Magnitude-bearing history release, when that route or observable is claimed: return the first normalized occurrence score at a selected current background, with the physical exposure unit, coordinate map and absolute scale. Restore the rank-one $\mu\mu^T$ information at the appropriate observation grade; a hazard Hessian alone is insufficient. This is separate from the direct action/force normalisation route.
- Quantum operation and renewal: select the jump/no-event generators or their equivalent, verify complete positivity and mixture affinity, specify any terminal recording on survival, and derive the attachment of current excitation to completed Facts and subsequent renewal.
- Dynamical carrier test: identify the current evolution on the admitted matter-field carrier and evaluate its action on the persistent dark subspace. Existing record activation and gauge-algebra ranks are comparison results, not a physical propagation or preparation selector.
- Joint update and refinement: derive the coarse amplitude measure and the conditional fine allocation, including state dependence, cross-factor correlation or retained memory when required. Check the covariance identity of Section 17.70 at its proper tangent grade and the full operation for any finite-step claim. Restrict the factorisation support only by a source-derived rule.
- Full action identity: show that the same source supplies energetic cost, bath reduction, matter amplitudes and nonlinear interactions. Separate a leading quadratic gauge milestone from global chiral, topological and continuum closure; preserve moving weights, supports and embeddings at nonzero backgrounds.
- Antipodal-odd Fact-record identification: return a source-derived physical channel on the six-cycle/record carrier in the unique linear D6-covariant $m=3$ class $L_3=g_3\zeta_3$ with $g_3\neq 0$, or prove that this direction is physically redundant. The channel must be written before or at the ordinary antipodal terminal quotient; no downstream function of that quotient can reconstruct it. Establish whether this channel is the event-local physical carrier of the committed distinction. If it is, Fact-Lock fixes that event record while renewal prepares a fresh active coordinate for the next event, and the exact coherent H_{lock} parent is the corresponding local constrained response. Do not introduce an additional retention force merely to reproduce the lock.
- No-target manifest: measured gauge couplings, fermion masses, CKM/PMNS entries, neutrino splittings, Higgs quantities and cosmological bounds are excluded from source selection and normalization.
- Continuum event-work release: on one frozen charge preparation, return the physical energy transferred by a specified charge-changing event for a sufficient set of neighbouring divergence-free loop-flux preparations. Return the corresponding energy-resolved amplitudes or reservoir overlaps so the operation is fixed on superpositions, separate every flux-dependent matter/record/bath contribution under the same source law, and reconstruct Q_{cycle} from the work differences before any measured gauge coupling is loaded.

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