HSPR-1

The Refinement-Geometry Higgs Spatial-Propagation and Kinetic-Residue Reduction Theorem in VERSF

From the Canonical Neighbouring-Difference Injection through the Soldered Spatial Metric to Exact Defect-Silent Protection, the One-Scalar Physical Normalisation Gate, the Conditional Unit Operational-Fixed-Point Endpoint, and the Sequential-Spatial Metric Equality with the Physical-Time Attachment Constraint

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General Reader Summary

Earlier VERSF work found how a Higgs-like field moves through emergent space. A perfectly uniform swelling of the substrate turns out to be invisible to the substrate's own compatibility checks; what those checks respond to is a difference between neighbouring amplitudes. That neighbouring difference was constructed explicitly and behaves exactly like an ordinary propagating field, with no tuning knob inserted anywhere.

What stayed open was the strength of that propagation. In the internal bookkeeping of the earlier calculation a factor of two appeared, and it was rightly not called physical, because no physical ruler had yet been applied. The programme now has such a ruler, built from the substrate itself. Measured with it, the factor of two turns out to be nothing but the ordinary bookkeeping of comparing two points that sit two steps apart, and what remains is a geometric spatial propagation rule of exactly the standard strength. The paper also proves that the uniform Higgs direction is exactly invisible to an entire class of possible corrections: anything that reaches the field only through the substrate's compatibility defects misses it completely, so no amount of refining those murky sectors can ever change the answer.

That left one last number, the overall weight of the Higgs direction in the substrate's own accounting. Later work builds a notion of distance by counting how many genuinely distinguishable configurations separate two states. Turning such a counting distance into a full geometry normally runs into a known obstacle, but that obstacle only arises when many directions must be compared against each other. On the single Higgs line, any fixed measuring rule generates one and only one geometry, so the whole comparison between the framework's dynamical ruler and its counting ruler collapses to a single conversion factor between the two.

That factor is not yet derived, and the paper is explicit that a line can carry many different rulers; what the paper proves is that everything now hangs on that one number, and that once it is shown to equal one, the last normalisation is pinned to something concrete: how densely the distinguishable configurations are packed around the Higgs state.

If that conversion factor is one, and the substrate's refinement process really does even the packing out as the framework's assumed smoothing dynamics say it should, the propagation strength settles to exactly one. The paper is careful to keep two different limits strictly apart, sharpening the spatial grid and letting the refinement process run, and it supplies a single error budget: how far the propagation rule can be off is bounded by the sum of the operational-refinement error and the applicable finite-resolution error; on the sequential side that becomes a physical temporal-resolution error only once the time-attachment map is derived. Any leftover unevenness in the packing feeds into the framework's predicted Higgs mass only as a small correction with an explicit ceiling.

How does this cash out against experiment? The wider chain that this paper underpins produces the Higgs mass and the electroweak energy scale from first principles, with no measured particle data fed in. The predicted Higgs mass comes out at about 123.8 GeV against the measured 125.2 GeV, and the predicted electroweak scale at about 243.7 GeV against the measured 246.2 GeV: each within about one percent of experiment, while a purely structural ratio between the two lands within about a tenth of a percent. That is close, but it is not yet agreement: the measurements are far more precise than the remaining gap, and the framework has committed in advance to the specific outstanding corrections that must supply the difference, roughly one percent on the mass. If those corrections compute to the wrong size, the chain fails; if they compute correctly, the picture closes. Nothing anywhere in this paper adjusts anything to fit the measured numbers, and the paper's own contribution to that comparison is subtractive in the best sense: it proves a whole class of possible shifts exactly zero and reduces what could have been several hidden dials to one named conversion factor with a definite target.

The join between space and emergent time can now be sharpened, though not yet completed. The step-by-step evolution and the spatial construction act on exactly the same Higgs direction, and because that direction is invisible to the substrate's compatibility defects, both provably use one and the same underlying strength: no second dial hides on the time side. What has not yet been derived is the dictionary that says how one step of the evolution corresponds to a stretch of emergent duration. The paper instead proves that any such dictionary, whenever it is derived, has no freedom left in its normalisation: consistency with the geometry already in hand fixes the conversion factor completely. The paper also writes down, exactly and without needing the step size taken to zero, how the field's internal rest level follows from its stiffness divided by that shared strength, a relation that becomes a physical energy formula once the dictionary is supplied. No background clock is introduced and no number of seconds per step is implied. And this is still not a derivation of the Higgs mass: the smoothing behaviour remains an assumption awaiting proof, and the dictionary, calibration and loop work that separates the present result from a measured mass is named precisely. What the paper delivers is a clean split: the geometry is fixed, a whole class of corrections is exactly zero, the last normalisation is reduced to one named conversion factor plus a measurable property of the substrate, and the time side is constrained down to a single missing map.

Abstract

The VERSF Higgs-radial programme previously constructed, on the declared transitive $K = 7$ closure branch and within the declared EX2G attachment class, the canonical source-compatible neighbouring-difference injection

$$I_H^{can} = (I + S^{-1})/\sqrt{2},$$

whose composition with the source-native difference $d = S - I$ is

$$I_H^{can}\, d = (S - S^{-1})/\sqrt{2}.$$

The corresponding canonical whitened graph kernel is $2 \sin^2\theta$, full rank on the six-dimensional nonuniform carrier Q_6 and $O(k^2)$ at long wavelength, with no fitted gain. That result established the existence of a two-derivative Higgs spatial mechanism but correctly left its physical same-source normalisation open.

This paper imports the later VERSF refinement-transport and soldered-geometry results and closes the spatial geometric part of that normalisation. The refinement frame supplies the physical spatial ruler and tangent metric. Dividing the canonical graph numerator by the proper separation of its two endpoints converts it uniquely into the ordinary centred derivative,

$$\nabla_a^H = (S_a - S_a^{-1})/(2\ell_a),$$

so that

$$(\nabla_a^H)^\dagger\, \nabla_a^H = \sin^2(p_a\ell_a)/\ell_a^2 \to p_a^2.$$

On the declared $D = 3$ branch the summed principal symbol is the unit Laplace-Beltrami symbol. The spatial geometric residue is therefore exactly one, and the earlier coefficient 2 is identified as the dimensionless numerator of a centred difference before conversion by the physical spatial ruler, not a physical Higgs wavefunction factor.

A second theorem uses the exact physical common Higgs line $q_H = (1/2)(1, 1, 1, 1)$ and the inherited defect-silence relation $J_D\, q_H = 0$. For every operator M acting on the primitive defect carrier, $J_D^\dagger M J_D$ annihilates q_H two-sidedly. Hence all frequency-dependent defect metrics, defect-mediated history corrections, unresolved-bath Schur corrections, and the scalar commitment bath have zero projection on the common Higgs line, and none can mix that line with any other tangent direction at quadratic order. The physical spatial residue therefore reduces to one direct operational-metric scalar,

$$Z_H^{space}(\tau) = q_H^\dagger\, G_{op}^{direct}(\tau)\, q_H,$$

and this reduction is proved independent of the (non-unique) decomposition of the physical metric into direct and defect-mediated parts, because the restriction of the physical metric to $\ker J_D$ is decomposition-invariant. Positivity of Z_H^{space} is inherited from the admitted positivity of the full physical operational metric rather than separately assumed. For the canonically normalised physical radial field $\varphi = \sqrt{Z_H^{space}}\, h$, the spatial kinetic coefficient is exactly one.

A further theorem reduces the remaining spatial metric identity on the physical Higgs line to a single scalar, without claiming the corresponding result on the complete defect-silent tangent subspace. The finite-distinguishability reconstruction supplies a packing norm on the operational carrier; its global promotion to a Hilbert inner product carries an acknowledged multidimensional squaring obstruction. On the one-dimensional physical line $L_H = \mathrm{span}\{q_H\}$ that obstruction vanishes identically: absolute homogeneity of any norm gives $\|h\, q_H\|_{pack} = |h|\, \|q_H\|_{pack}$, so the parallelogram identity holds automatically and the restricted packing norm determines a unique positive quadratic metric; the same holds for the one-Fact norm. The comparison of the two rulers on L_H therefore reduces exactly, at each operational flow state, to one conversion scalar $\gamma_H(\tau) > 0$, with

$$q_H^\dagger G_{op}^{phys}(\tau)\, q_H = \gamma_H(\tau)^2 \left[\mathrm{Vol}_{op}(M)\, \rho_{op}(x_H, \tau)\right]^{2/d_{op}}.$$

One-dimensionality does not by itself force $\gamma_H(\tau) = 1$, nor make the scalar flow-independent: two distinct norms on the same line, $a|h|$ and $b|h|$ with $a \neq b$, are each perfectly quadratic, and both compared quantities are state dependent. The identity is therefore carried as an explicit distance-functional bridge premise (P8): the two local distance functionals coincide at every admissible Higgs-line operational state, equivalently their unit balls on L_H coincide after flat-reference recovery along the whole flow, forcing $\gamma_H(\tau) \equiv 1$. Deriving that state-wise bridge is the named next metric calculation. Under the bridge, exact defect silence gives $q_H^\dagger G_{op}^{direct}(\tau)\, q_H = q_H^\dagger G_{op}^{phys}(\tau)\, q_H$ and hence

$$Z_H^{space}(\tau) = \left[\mathrm{Vol}_{op}(M)\, \rho_{op}(x_H, \tau)\right]^{2/d_{op}} = (1 + \delta_H(\tau))^{2/d_{op}},$$

while unconditionally $Z_H^{space}(\tau) = \gamma_H(\tau)^2 (1 + \delta_H(\tau))^{2/d_{op}}$. This statement is restricted deliberately to L_H; it does not solve the global inner-product problem or determine the complete metric on the four-dimensional protected subspace $\ker J_D$.

Neither d_{op} nor the finite-flow δ_H is assigned numerically. The physical tangent dimension 187 is not substituted for d_{op}, and continuum refinement homogeneity is not used to set finite-flow $\delta_H = 0$.

The operational-curvature dynamics then supply a conditional operational-fixed-point evaluation. On the declared entropy-gradient/Fickian refinement branch, under the inherited S_{op}-concavity, regularity and flow hypotheses,

$$\rho_{op}(x, \tau) \to 1/\mathrm{Vol}_{op}(M),$$

so that $\zeta_H(\tau) \to 1$, $\delta_H(\tau) \to 0$, and

$Z_{(H,\infty)}^{space} = \lim_{(\tau\to\infty)} \gamma_H(\tau)^2$, assuming that limit exists, equal to one under the bridge premise.

The fixed-point value therefore carries exactly two conditions on the Higgs line: the distance-functional bridge $\gamma_H(\tau) \equiv 1$, and the physical selection or substrate derivation of the operational-flattening dynamics with their stated convergence hypotheses. The spatial regulator limit $\ell \to 0$ and the operational-flow limit $\tau \to \infty$ remain distinct operations and, under the distance-functional bridge P8, the quantitative companions are retained: $|Z_H^{space}(\tau) - 1| \leq (4/d_{op})|\delta_H(\tau)|$ on the Lemma 6.2 domain, and the joint two-error certificate $|K_{(H,grad)}^{space}(p;\, \ell, \tau)/p^2 - 1| \leq (4/d_{op})|\delta_H(\tau)| + (1/3)\max_a(p_a^2\ell_a^2)$. Through the invariant ratio $\mu_H^2 = K_H/Z_H^{space}$, the same envelope transfers to the leading mass of the completion chain as $|m_H(\tau)/m_H^{lead} - 1| \leq (2/d_{op})|\delta_H(\tau)|$ on the same domain, exact in logarithmic form for all $\delta_H > -1$. Prior to the bridge, Corollary 6.5.2 supplies the corresponding three-error certificate, including the term $|\gamma_H(\tau)^2 - 1|$.

The temporal side is sharpened to a single missing map. Let $g_H(\tau) = q_H^\dagger\, G_{op}^{phys}(\tau)\, q_H$ be the common-Higgs coefficient of the sequential one-Fact kernel $K_H^{fact}(\omega;\, \tau) = K_H + (4g_H(\tau)/a_t^2) \sin^2(\omega/2)$. Exact defect silence and decomposition independence give

$$g_H(\tau) = q_H^\dagger\, G_{op}^{phys}(\tau)\, q_H = q_H^\dagger\, G_{op}^{direct}(\tau)\, q_H = Z_H^{space}(\tau),$$

so the sequential and spatial kernels carry the same physical Higgs-line metric scalar and no second independent field-space normalisation is associated with sequential propagation. This equality is exact. What remains open, per the MFKR audit, is the identification of one sequential opportunity with a physical Lorentzian interval: the history-mark and closure-traversal structures are not one-to-one, so the sequential parameter remains an opportunity fraction until the physical-time attaching map is derived. The Lorentz-transport programme supplies the continuum target, a Lorentzian metric $ds^2 = -c_\star^2\, dt_{phys}^2 + g_{ij}\, dx^i\, dx^j$ with a unique timelike commitment direction, but not that map. HSPR-1 nevertheless constrains the missing map completely in its normalisation: if any admissible attachment identifies a physical angular frequency Ω with the sequential phase through $\omega = \Omega\, \Delta t_{phys}$, then matching the small-ω kernel to the Lorentzian temporal magnitude $Z_H^{space}\, \Omega^2/c_\star^2$, with $g_H = Z_H^{space} > 0$, forces uniquely

$$\Delta t_{phys} = a_t/c_\star, \quad \omega/a_t = \Omega/c_\star.$$

Conditional on that attaching map, and only then, $Z_H^{time}(\tau) = Z_H^{space}(\tau) \equiv Z_H(\tau)$, the local quadratic kernel takes the Lorentzian form $\Gamma_H^{(2)} = K_H + Z_H(\tau)[-\Omega^2/c_\star^2 + g^{ij} p_i p_j] + \ldots$, and on the declared operational-flattening branch $Z_{(H,\infty)}^{time} = Z_{(H,\infty)}^{space} = 1$. No background clock is introduced, no absolute seconds-per-Fact value is implied, and the exact finite-step pole relation is stated in the sequential spectral variable, its physical-energy form remaining conditional on the same attachment.

This is a conditional numerical operational-fixed-point return, not a finite-regulator or finite-flow identity. HSPR-1 closes the independent spatial geometric normalisation, reduces the remaining Higgs-line field-space normalisation to the single state-wise bridge scalar $\gamma_H(\tau)$, proves exact protection against all presently identified defect-mediated renormalisations, carries a conditional numerical operational-fixed-point endpoint $Z_{(H,\infty)}^{space} = 1$ on the declared operational-flattening branch, proves the sequential-spatial metric equality $g_H = Z_H^{space}$ exactly, and constrains any admissible physical-time attachment to $\Delta t_{phys} = a_t/c\star$. It does not claim a finite-regulator raw-field residue of one, a derived Higgs-line bridge $\gamma_H(\tau) \equiv 1$, a source-derived physical-time attaching map, exact all-orders finite-step Lorentz covariance, or an upgraded unconditional Higgs pole mass. The distance-functional bridge, the attaching map itself, the absolute fact-clock calibration, and the gauge/Yukawa loop, threshold and scheme-to-pole completion remain separately required.

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Central Result

The result of HSPR-1 is the following source-locked reduction.

On the declared transitive $K = 7$ Higgs-gradient branch, let

$d = S - I,$

and let the canonical source-compatible injection be

$I_H^{can} = (I + S^{-1})/\sqrt{2}.$

Then

$I_H^{can}\, d = (S - S^{-1})/\sqrt{2}.$

Let ℓ_a be the proper neighbouring-cell displacement measured along one orthonormal spacelike leg e_a of the source-derived refinement frame. The physical derivative associated with the same source numerator is

$\nabla_a^H = (1/(\sqrt{2}\ \ell_a))\, I_H^{can}\, d = (S_a - S_a^{-1})/(2\ell_a).$

For a refinement-frame Fourier mode with $S_a = \exp(i\, p_a \ell_a)$,

$(\nabla_a^H)^\dagger\, \nabla_a^H = \sin^2(p_a \ell_a)/\ell_a^2 = p_a^2 - (1/3)p_a^4 \ell_a^2 + O(p_a^6 \ell_a^4).$

Therefore, on the declared physical $D = 3$ branch,

$\sum_{a=1}^3 (\nabla_a^H)^\dagger\, \nabla_a^H \to -\Delta_g$

with principal symbol

$g^{ij}\, p_i p_j,$

which is $\sum_a p_a^2$ in the orthonormal refinement frame. Hence

$Z_{geom}^{space} = 1.$

The old whitened graph coefficient 2 is not a physical residue; it is removed by the source-derived spatial metric conversion and does not survive as an independent dimensionless Higgs coupling.

Now let

$q_H = (1/2)(1, 1, 1, 1),$

with the exact inherited result

$J_D\, q_H = 0.$

Then for every admissible operator M on the primitive defect carrier,

$J_D^\dagger M J_D q_H = 0,$

and, for every physical tangent vector v,

$q_H^\dagger J_D^\dagger M J_D v = 0.$

Thus every presently identified defect-mediated contribution to the Higgs common-mode kinetic metric vanishes, diagonally and in mixing:

$\Delta Z_H^{defect} = \Delta Z_H^{history} = \Delta Z_H^{bath} = \Delta Z_H^{commitment} = 0.$

Consequently the physical spatial residue is reduced to the direct physical operational geometry on the defect-silent line:

$Z_H^{space}(\tau) = q_H^\dagger G_{op}^{direct}(\tau) q_H.$

Equivalently, if

$G_{op}^{phys} = G_{op}^{direct} + J_D^\dagger M J_D$

for any decomposition in which the second term contains the known defect-mediated history/bath/Fisher corrections, then

$q_H^\dagger G_{op}^{phys} q_H = q_H^\dagger G_{op}^{direct} q_H,$

and this value is independent of which admissible decomposition is chosen: the restriction of G_{op}^{phys} to ker J_D is decomposition-invariant (Lemma 5.0). In particular $Z_H^{space} > 0$ is inherited directly from the admitted positivity of the full physical operational metric.

The same-source ruler question is reduced on the one-dimensional Higgs line itself: the packing norm and the one-Fact norm restricted to $L_H = \mathrm{span}\{q_H\}$ are each automatically quadratic by norm homogeneity (Lemma 6.6), so their comparison collapses exactly, at each operational flow state, to one conversion scalar $\gamma_H(\tau) > 0$ (Theorem 6.7), with

$Z_H^{space}(\tau) = q_H^\dagger G_{op}^{direct}(\tau) q_H = \gamma_H(\tau)^2 \zeta_H(\tau)^{(2/d_{op})}$, $\zeta_H(\tau) = \mathrm{Vol}_{op}(M) \rho_{op}(x_H, \tau) = 1 + \delta_H(\tau).$

One-dimensionality alone does not force $\gamma_H(\tau) = 1$, nor a flow-independent scalar; the identity is the distance-functional bridge premise P8 (the two local distance functionals coincide at every admissible operational state, with flat-reference recovery fixing the common convention, forcing $\gamma_H(\tau) \equiv 1$), and deriving it is the named next metric calculation. Under the bridge,

$Z_H^{space}(\tau) = (1 + \delta_H(\tau))^{(2/d_{op})}.$

The complete metric on the four-dimensional protected subspace remains open and is not required for this scalar. At finite flow time no numerical δ_H or d_{op} is inserted.

The Operational Curvature refinement dynamics supply an asymptotic evaluation on their declared entropy-gradient/Fickian branch. Under the S_{op}-concavity hypothesis and the other assumptions of that flow,

$$\rho_{op}(x, \tau) \to 1/\mathrm{Vol}_{op}(M)$$

as $\tau \to \infty$. Therefore

$$\zeta_H(\infty) = 1, \ \delta_H(\infty) = 0,$$

and

$Z_{(H,\infty)}^{space} = \lim_{(\tau\to\infty)} \gamma_H(\tau)^2$, assuming that limit exists, equal to one under the bridge premise P8.

This value is independent of d_{op}. It is a **CONDITIONAL NUMERICAL OPERATIONAL-FIXED-POINT RETURN**, not a finite-regulator or finite-flow identity. The two limits involved are distinct operations and are solved separately:

$\ell \to 0$ (spatial regulator/continuum limit) $\Longrightarrow Z_{geom}^{space} = 1$ exactly,

$\tau \to \infty$ (operational refinement-flow fixed point) $\Longrightarrow \delta_H(\tau) \to 0$ and hence $q_H^\dagger G_{op}^{direct} q_H \to \lim_{(\tau\to\infty)} \gamma_H(\tau)^2$ conditionally, assuming that limit exists,

and separately

P8: $\gamma_H(\tau) \equiv 1 \Longrightarrow Z_{(H,\infty)}^{space} = 1$,

so that the two pieces of conditionality stay visible and the headline statement is the iterated limit

$\lim_{(\tau\to\infty)} [\lim_{(\ell\to 0)} Z_H^{space}(\ell, \tau)] = \lim_{(\tau\to\infty)} \gamma_H(\tau)^2$, equal to one under the bridge premise,

on the declared packing-metric/entropy-gradient branch. It does not identify the finite-flow Higgs point with the operational entropy maximum and remains conditional on the physical selection/derivation of the operational flattening dynamics; the Higgs-line ruler reduction is supplied by Theorem 6.7, with $\gamma_H(\tau) \equiv 1$ carried as P8. A quantitative rate-transfer bound accompanies it: for $d_{op} \geq 1$ and $|\delta_H(\tau)| \leq 1/2$,

$$|Z_H^{space}(\tau) - 1| \leq (4/d_{op})\, |\delta_H(\tau)|,$$

so the operational dimension cancels from the endpoint but governs the finite-flow approach, with larger d_{op} tightening the deviation at fixed packing contrast. The two error sources combine into a single certificate: with the gradient kernel

$$K_{(H,grad)}^{space}(p; \ell, \tau) = Z_H^{space}(\tau) \sum_a \sin^2(p_a \ell_a)/\ell_a^2,$$

$p^2 = \sum_a p_a^2$ and $|p_a \ell_a| \leq 1$ for every a,

$$|K_{(H,grad)}^{space}(p; \ell, \tau)/p^2 - 1| \leq |Z_H^{space}(\tau) - 1| + (1/3)\max_a(p_a^2\ell_a^2) \leq (4/d_{op})|\delta_H(\tau)| + (1/3)\max_a(p_a^2\ell_a^2),$$

the second inequality on the Lemma 6.2 domain. In words: Higgs propagation error ≤ operational-normalisation error + finite-spatial-resolution error, with the pre-bridge form adding the term $|\gamma_H(\tau)^2 - 1|$ (Corollary 6.5.2). The metric-identification question is reduced on the Higgs line to a single state-wise scalar: Lemma 6.6 removes the multidimensional squaring obstruction on L_H, and Theorem 6.7 compresses the one-Fact/packing comparison into $\gamma_H(\tau)$ alone, with $\gamma_H(\tau) \equiv 1$ the explicit bridge premise P8 whose derivation is the next metric calculation (Corollary 6.7.1). Beyond that one scalar, only the complete four-dimensional protected-subspace metric remains open, and it is not load-bearing for the Higgs scalar.

Finally, with the physical radial coordinate

$$\varphi = \sqrt{Z_H^{space}}\, h,$$

the spatial kinetic term is canonically normalised:

$$\Gamma_{H,space}^{(2)} = (1/2) \int \sqrt{-g}\, g^{ij}\, \partial_i\varphi\, \partial_j\varphi.$$

This is not a whitening claim masquerading as a prediction. The nontrivial return is that the spatial source architecture contributes no additional coefficient beyond the direct physical norm of the Higgs line itself, and the declared operational-flattening branch fixes that remaining norm to $\lim_{(\tau\to\infty)} \gamma_H(\tau)^2$ at the operational fixed point, unity under the bridge premise.

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1. Problem Statement

The earlier Higgs-radial bridge had already answered the mechanism question at the canonical structural level:

common local scalar → nonuniform closure carrier

is symmetry-forbidden on the declared transitive cell branch, while

neighbouring Higgs difference → nonuniform closure carrier

is allowed and can be constructed explicitly.

The resulting injection is source-compatible, full rank on Q_6, and produces the required $O(k^2)$ long-wavelength kernel. But the previous paper stopped at the correct point: its coefficient was calculated in a whitened graph norm and therefore could not be promoted to a physical wavefunction residue.

The precise open question was:

What is the physical spatial Higgs kinetic residue when the canonical source injection is measured in the physical ruler and field metric generated by the same VERSF source?

A second question sits beside it:

Which of the unresolved history, bath and operational-metric corrections can actually renormalise that residue on the physical common Higgs line?

Those two questions are now calculable because the source corpus has changed since the earlier bridge paper. VERSF now contains a substrate-derived refinement transport, a continuum refinement frame, a soldered spatial metric, and a sharper physical common-mode metric audit.

The objective of this paper is not to fit a Higgs mass, choose $Z_H = 1$ by convention, or turn the canonical graph coefficient 2 into a prediction. It is to propagate the same source construction through the new geometry and determine what remains physically free.

2. Source-Locked Inputs and Typing Firewalls

2.1 The physical common Higgs line

The full-faithful source assembly identifies the physical common Higgs/completion direction

$q_H = (1/2)(1, 1, 1, 1)$

on the carrier (φ_H, X_{H0}, X_{H1}, X_{H2}). It has unit reference norm,

$q_H^\dagger q_H = 1$,

and is full-action visible but defect-silent:

$J_D q_H = 0$.

This is not the statement that the Higgs is absent from the action. The local potential/completion sector is nonzero on the common line. The statement is that the six compatibility defects do not respond to a uniform displacement along that line at first order.

2.2 The canonical spatial injection

On the declared transitive Z_7 closure carrier, let S be the cyclic neighbour shift and define

$d = S - I.$

The prior Higgs bridge constructs, within the declared endpoint-local EX2G attachment class,

$I_H^{can} = (I + S^{-1})/\sqrt{2}.$

The composition is the centred first-difference numerator

$I_H^{can}\, d = (S - S^{-1})/\sqrt{2}.$

The PSAC map W from the closure six-plane Q_6 to the physical Φ-field carrier is an exact isometry, so it introduces no further gain. On the six nonuniform Fourier modes the injection has singular values

$s_k = \sqrt{2}\,|\cos(\pi k/7)|$, $k = 1, \ldots, 6$,

all nonzero. Thus no nonuniform direction is lost.

This paper inherits the grade of that construction: exact within the declared attachment class and transitive source branch; primitive selection of that attachment class among wider weighted or nonlocal classes remains an upstream premise.

2.3 The source-derived refinement geometry

The later refinement-transport programme constructs genuine oriented edge/path transport and a refinement-Cauchy continuum limit. The successor transport-group paper derives a refinement-stable invariant bilinear form η_{ab} of Lorentzian signature (1, D), suppression of anisotropic transport under refinement, and the continuum refinement frame $e^a{}_\mu$. The continuum metric is soldered from the substrate transport geometry:

$g_{\mu\nu} = e^a{}_\mu\, e^b{}_\nu\, \eta_{ab},$

with

$\nabla_\mu e^a{}_\nu = 0.$

The bilinear form is unique up to one common overall scale. That scale is a common ruler scale; it does not provide independent directional coefficients. The transport fixed point is proper and orientation preserving.

For the spatial calculation below the paper works on the declared physical D = 3 branch. HSPR-1 does not claim to re-derive why the global continuum has D = 3.

2.4 The operational metric and the one-Fact proposal

The continuous one-Fact proposal acts on the complete physical tangent, including defect-silent directions. Its quadratic increment cost is governed by a positive operational metric G_{op}. Along the Higgs common line,

$$\Delta S_{kin} = [q_H^\dagger G_{op} q_H/(2a_t)] (\delta h)^2.$$

The canonical execution $G_{op} = I$ gives $g_H^{can} = 1$, but the provenance audit correctly forbids promoting that identity coefficient to a physical residue until the physical metric is selected independently.

A separate finite-distinguishability reconstruction supplies an important additional fact. Operational packing first reconstructs a distance and norm from counts of physically distinguishable states, with local metric

$$g_{op}(x) = Vol_{op}(M)^{(2/d_{op})} \rho_{op}(x)^{(2/d_{op})} \langle\cdot,\cdot\rangle_{op}$$

and ρ_{op} a smooth local packing density of admissible operational sectors. The complete multidimensional carrier still possesses an acknowledged inner-product or squaring obstruction: a general norm need not be quadratic. That obstruction is irrelevant on the one-dimensional Higgs line $L_H = \mathrm{span}\{q_H\}$, because every norm restricted to a one-dimensional real vector space is necessarily of the form $c|h|$ and therefore determines a unique positive quadratic form c^2h^2. Since both norms are automatically quadratic on L_H, their comparison there reduces, state by state, to a single conversion scalar $\gamma_H(\tau)$; the one-Fact G_{op} is typed by the master-history construction as the inherited operational tangent metric whose norm measures operational distinguishability, which motivates, but does not yet prove, the bridge $\gamma_H(\tau) \equiv 1$. Section 8.7 makes the reduction and the remaining bridge premise precise. The corresponding full-metric identification on all four directions of ker J_D remains open and is not required for the scalar Higgs projection.

2.5 Temporal attachment and absolute-clock firewall

The spatial metric and the sequential one-Fact description remain differently constructed objects, but they are not allowed independent Higgs-line kinetic coefficients.

The one-Fact construction gives

$$g_H = q_H^\dagger G_{op}^{phys} q_H,$$

while the spatial calculation gives

$$Z_H^{space} = q_H^\dagger G_{op}^{direct} q_H.$$

Because

$J_D q_H = 0$,

Theorem 4 and Lemma 5.0 imply

$g_H = Z_H^{space}$.

Thus the field-space part of the sequential/spatial attachment is already exact.

What remains to be attached is the sequential phase variable ω/a_t to physical Lorentzian frequency. The continuum transport programme has independently supplied a Lorentzian metric. Let its emergent proper-time coordinate be t_{phys}, with

$$ds^2 = -c_\star^2 \, dt_{phys}^2 + g_{ij} \, dx^i \, dx^j.$$

If a physical mode of angular frequency Ω accumulates one-Fact phase

$$\omega = \Omega \, \Delta t_{phys},$$

coefficient matching between the small-ω one-Fact kernel and the Lorentzian temporal principal symbol fixes the magnitude of the conversion, and the inherited future-directed time orientation selects its sign, forcing

$$\Delta t_{phys} = a_t/c_\star$$

on any admissible attachment. The attaching map itself is not yet source-derived: the MFKR audit records that the history-mark and closure-traversal structures are not one-to-one, so a sequential opportunity cannot yet be read directly as a physical duration. The constraint is a normalisation requirement on the missing map, not the introduction of primitive background time, and it does not determine an absolute laboratory value of seconds per Fact: such a number is necessarily a calibration between the primitive fact clock and a chosen composite reference clock.

HSPR-1 therefore proves the sequential-spatial metric equality exactly and constrains the physical-time attachment completely in its normalisation (Section 9.2), while retaining the attaching map itself and the absolute fact-clock calibration as separate open quantities.

3. The Canonical Higgs Gradient Injection

Theorem 1: Canonical neighbouring-difference injection

Grade: inherited exact within the declared attachment class and transitive source branch.

Let $h = (h_0, \dots, h_6)$ be the common Higgs radial profile on the transitive Z_7 carrier and let

$$g = d\,h = (S - I)\,h.$$

The source-compatible reversal-even scalar incidence attachment gives

$I\_H^{can} = (I + S^{-1})/\sqrt{2}$,

and therefore

$I\_H^{can}\, d = (S - S^{-1})/\sqrt{2}$.

For a Fourier mode $h\_j = h \exp(i\, j\, \theta)$,

$I\_H^{can}\, d\, h = i \sqrt{2} \sin(\theta)\, h$.

Thus the canonical whitened graph kernel is

$K\_H^{grad}(\theta) = 2 \sin^2\theta = 2\theta^2 - (2/3)\theta^4 + O(\theta^6)$.

The kernel is $O(k^2)$, not $O(k^4)$, and its only zero mode is the uniform common mode.

Proposition 1.1: Full rank on Q_6

On $k = 1, \ldots, 6$,

$s\_k(I\_H^{can}|Q_6) = \sqrt{2}\, |\cos(\pi k/7)| > 0$.

Hence I_H^can has rank six on the nonuniform carrier. The composed map therefore reaches every nonuniform closure direction without an inserted scalar gain.

Remark 1.2: What the coefficient 2 did and did not mean

The quantity 2 multiplying θ^2 was never a physical Higgs residue. It was the norm of a dimensionless graph numerator in the canonical whitened carrier. A physical derivative requires a physical distance. The previous paper explicitly left that conversion open.

4. Refinement Geometry and the Physical Centred Derivative

The new source input is the refinement frame. Let e_a, $a = 1, 2, 3$, be the three orthonormal spacelike legs of the declared $D = 3$ refinement frame at a continuum point, and let ℓ_a denote the proper neighbour displacement along e_a for a given regulator level.

The source numerator from Theorem 1 compares the values one cell forward and one cell backward. These endpoints are separated by proper distance $2\ell_a$. Therefore the physical first derivative associated with the same numerator is not obtained by attaching a new coupling. It is the metric conversion

$$\nabla_a\text{^}H = (1/(\sqrt{2}\ \ell_a))\ I\_H\text{^}can\ d = (S_a - S_a^{-1})/(2\ell_a).$$

This is the ordinary centred difference in the physical proper-distance coordinate selected by the refinement geometry.

One provenance point deserves emphasis. The factor $1/\sqrt{2}$ removed by this conversion is the canonical whitened-carrier normalisation carried by I_H^can within the declared attachment class of the source construction (Internal Source 1), not a physical amplitude gain: the source paper fixes the attachment uniquely up to sign and a declared unit-norm convention in the whitened carrier (its canonical-rigidity theorem), introduces the $1/\sqrt{2}$ as exactly that convention, and separately bars promotion of the resulting whitened coefficient to a physical residue in its own falsifier ledger. The refinement geometry contributes only the proper endpoint separation $2\ell_a$. The conversion therefore undoes a declared chart normalisation; it does not select a coefficient to make the answer one.

Proposition 2: Exact finite-regulator spatial symbol

For a refinement-frame momentum p_a with

$$S_a = \exp(i\ p_a\ell_a),$$

we have

$$\nabla_a\text{^}H(p_a) = i\ \sin(p_a\ell_a)/\ell_a,$$

and hence

$$(\nabla_a\text{^}H)^\dagger\ \nabla_a\text{^}H = \sin^2(p_a\ell_a)/\ell_a^2.$$

The expansion is

$$\sin^2(p_a\ell_a)/\ell_a^2 = p_a^2 - (1/3)p_a^4\ell_a^2 + (2/45)p_a^6\ell_a^4 + O(\ell_a^6 p_a^8).$$

No free coefficient appears.

Corollary 2.1: Refinement limit

As $\ell_a \to 0$ at fixed physical p_a,

$$(\nabla_a\text{^}H)^\dagger\ \nabla_a\text{^}H \to p_a^2.$$

Summing over the orthonormal spatial refinement frame,

$\sum_a (\nabla_a{}^H)^\dagger \nabla_a{}^H \to g^{ij} p_i p_j$,

which becomes $\sum_a p_a^2$ in that frame.

5. The Spatial Geometric-Residue Theorem

Theorem 3: Source-derived unit spatial geometric residue

Grade: source-derived refinement-geometry pass on the declared D = 3 canonical-injection branch.

The physical spatial operator generated by the canonical Higgs injection and measured using the soldered refinement metric has unit Laplace-Beltrami principal symbol. Therefore the source-derived *geometric* Higgs residue is

$$Z_{geom}^{space} = 1.$$

Proof

The source construction gives the dimensionless centred numerator

$$(S_a - S_a^{-1})/\sqrt{2}.$$

The physical refinement geometry supplies the proper separation $2\ell_a$ of the two endpoint samples. Converting the source numerator to a derivative gives

$$(S_a - S_a^{-1})/(2\ell_a).$$

Its squared symbol is $\sin^2(p_a\ell_a)/\ell_a^2$ and converges to p_a^2. The spatial refinement frame is orthonormal with respect to the soldered metric, so summing the three directions yields the unit Laplace-Beltrami principal symbol. No dimensionless coefficient remains to be selected. QED.

Corollary 3.1: Resolution of the old factor 2

The canonical graph result

$$K_H^{grad}(\theta) = 2 \sin^2\theta$$

and the physical result

$$K_{H,geom}^{space}(p) = \sin^2(p\ell)/\ell^2$$

are the same operator written before and after conversion from the dimensionless graph numerator to the physical centred derivative:

$K_{H,geom}^{space} = [1/(2\ell^2)] K_H^{grad}$.

Because $\theta = p\ell$, the long-wavelength coefficient of p^2 is one. Thus the number 2 is not a physical wavefunction factor and must not be propagated into the Higgs mass calculation as $Z_H = 2$.

Corollary 3.2: Overall ruler-scale firewall

The refinement bilinear form is unique up to one common overall scale. Rescaling the common ruler changes ℓ and the numerical components of p inversely; it does not create a dimensionless coefficient multiplying $g^{ij} p_i p_j$. The unresolved absolute bilinear-form scale is therefore an absolute length/energy conversion problem, not an independent spatial Higgs residue.

6. Exact Defect-Silent Protection of the Higgs Common Line

The spatial geometry removes the unknown propagation coefficient. We now ask whether unresolved history and bath structures can renormalise the remaining field-space norm.

Theorem 4: Defect-mediated Higgs protection

Grade: exact on the inherited full-faithful common-mode and defect-differential structure.

Let q_H satisfy

$J_D q_H = 0$.

For any linear operator M on the primitive defect carrier,

$J_D^\dagger M J_D q_H = 0$,

and for every physical tangent v,

$q_H^\dagger J_D^\dagger M J_D v = 0$.

Proof

$J_D q_H = 0$. Therefore $M J_D q_H = 0$ for every M, and applying $J_D^\dagger$ gives the first identity. Taking the adjoint scalar product with q_H, or using $q_H^\dagger J_D^\dagger = (J_D q_H)^\dagger = 0$, gives the second. QED.

Corollary 4.1: Unresolved history/bath Schur correction vanishes

The unresolved-bath construction has

$$W\_prim = W\_core - C^\dagger A\_Q^+ C.$$

Its configuration-space correction factors through J_D:

$$\Delta G\_bath = J\_D^\dagger C^\dagger A\_Q^+ C J\_D.$$

Therefore

$$\delta g\_H\text{^}bath = q\_H^\dagger \Delta G\_bath\ q\_H = 0$$

for every admissible A_Q and C, provided the correction continues to factor through the primitive defect differential.

Corollary 4.2: Frequency-dependent defect/history dressing vanishes

For any frequency-dependent defect-carrier metric $M(\omega)$,

$$q\_H^\dagger J\_D^\dagger M(\omega) J\_D\ q\_H = 0.$$

Thus no frequency-dependent correction built exclusively through the six-defect image can generate the common Higgs propagation coefficient.

Corollary 4.3: Scalar commitment bath vanishes on q_H

Grade: exact given the source factorisation $u\_\kappa = J\_D^\dagger w\_\kappa$.

The later scalar commitment correction is carried by a vector u_κ that the source construction supplies in factorised form through the defect adjoint,

$$u\_\kappa = J\_D^\dagger w\_\kappa,$$

for a defect-carrier vector w_κ. Then

$$q\_H^\dagger u\_\kappa = q\_H^\dagger J\_D^\dagger w\_\kappa = (J\_D\ q\_H)^\dagger w\_\kappa = 0,$$

so any rank-one correction proportional to $u\_\kappa u\_\kappa^\dagger$ has zero common-Higgs projection. If a future source presents a commitment vector not of this factorised form, Corollary 4.3 does not apply to it; such a term belongs to G_op^direct and falls under F-HSPR4.

Corollary 4.4: Four-dimensional protected tangent subspace

The physical tangent has dimension 187 while the realised primitive defect image has rank 183. Hence

$$\dim \ker J_D = 4.$$

Every direction in this four-dimensional defect-silent subspace is protected against corrections of the form $J_D^\dagger M J_D$. The common Higgs line is one member of this protected subspace.

Corollary 4.5: No defect-mediated mixing

Theorem 4 is a two-sided annihilation, not merely a vanishing diagonal entry. For every physical tangent direction v and every defect-carrier operator M,

$$q_H^\dagger J_D^\dagger M J_D v = 0 \text{ and } v^\dagger J_D^\dagger M J_D q_H = 0.$$

Hence no defect-mediated correction can mix q_H with any other physical tangent direction at quadratic order. The Higgs row and column of every pullback metric $J_D^\dagger M J_D$ vanish identically, so protection covers off-diagonal dressing as well as the diagonal residue. The same statement holds verbatim for every direction of the four-dimensional protected subspace of Corollary 4.4.

7. Reduction of the Physical Spatial Higgs Residue

Theorems 3 and 4 combine cleanly. Let the physical one-Fact/operational metric on the physical tangent be decomposed schematically as

$$G_{op}^{phys} = G_{op}^{direct} + J_D^\dagger M J_D,$$

where G_{op}^{direct} collects the part acting directly on the physical tangent and M may contain the presently identified defect Fisher, history, bath and commitment-mediated structures. This decomposition need not be unique. The Higgs projection is nevertheless unique, and the following lemma makes that precise.

Lemma 5.0: Decomposition independence on the protected subspace

Grade: exact.

Let

$$G_{op}^{phys} = G_{op}^{direct} + J_D^\dagger M J_D = \tilde{G}_{op}^{direct} + J_D^\dagger \tilde{M} J_D$$

be any two admissible decompositions. Then the restrictions of G_{op}^{direct} and $\tilde{G}_{op}^{direct}$ to $\ker J_D$ coincide, and both equal the restriction of G_{op}^{phys} itself. In particular

$$q_H^\dagger G_{op}^{direct} q_H = q_H^\dagger \tilde{G}_{op}^{direct} q_H = q_H^\dagger G_{op}^{phys} q_H,$$

so Z_H^{space} is well defined independently of the chosen decomposition.

Proof

Subtracting the two decompositions gives

$$G_{op}^{direct} - \tilde{G}_{op}^{direct} = J_D^\dagger (\tilde{M} - M) J_D,$$

which by Theorem 4 annihilates $\ker J_D$ two-sidedly. Hence the two direct parts have identical matrix elements between any vectors of $\ker J_D$. Evaluating G_{op}^{phys} on $q_H \in \ker J_D$, the defect-mediated term contributes $q_H^\dagger J_D^\dagger M J_D q_H = 0$, so the full-metric value coincides with the direct-part value. QED.

Theorem 5: Direct-metric reduction of the spatial Higgs residue

Grade: exact reduction, conditional only on the physical metric existing as a positive direct-plus-defect-mediated operator on the declared common-mode carrier.

The raw-field physical spatial kinetic term has the leading form

$$\Gamma_{H,space}^{(2)} = (1/2) \int d^4x \sqrt{(-g)} [q_H^\dagger G_{op}^{phys} q_H] g^{ij} \partial_i h \partial_j h.$$

By Theorem 4 and Lemma 5.0,

$$q_H^\dagger G_{op}^{phys} q_H = q_H^\dagger G_{op}^{direct} q_H.$$

Hence

$$Z_H^{space} = q_H^\dagger G_{op}^{direct} q_H.$$

There is no independent spatial-gradient factor and no defect-mediated Schur correction.

Corollary 5.1: Exact zero ledger for known correction classes

On the common Higgs line,

$$\Delta Z_H^{defect} = 0,\ \Delta Z_H^{history} = 0,\ \Delta Z_H^{bath} = 0,\ \Delta Z_H^{commitment} = 0,$$

for every member of those classes that factors through J_D, in both diagonal and mixing entries (Corollary 4.5).

Corollary 5.2: Canonically normalised physical radial field

Define

$$\varphi = \sqrt{Z_H^{space}}\, h,$$

with $Z_H^{space} > 0$ supplied by Corollary 5.3 below. Then

$$\Gamma_{H,space}^{(2)} = (1/2) \int d^4x \sqrt{-g}\, g^{ij}\, \partial_i\varphi\, \partial_j\varphi.$$

Thus

$$Z_{(H,\varphi)}^{space} = 1.$$

This is not itself a prediction that the raw coordinate h has unit norm. The prediction is that the spatial source architecture supplies no second multiplicative residue once the physical Higgs-line norm is used.

Corollary 5.3: Inherited positivity

Since $q_H^\dagger G_{op}^{direct} q_H = q_H^\dagger G_{op}^{phys} q_H$ by Lemma 5.0, positivity of Z_H^{space} follows directly from the admitted positivity of the full physical operational metric on the physical tangent and requires no separate positivity assumption on the direct part alone. The former premise "positive direct metric" is thereby reduced to the already-admitted positivity of G_{op}^{phys} (see P7).

8. The Operational-Packing Representation and Operational-Fixed-Point Evaluation

The current corpus contains one explicit source-side candidate for G_{op}^{direct}: the operational distinguishability metric derived from the local packing of admissible operational sectors.

At coarse-graining scale ε, let

$$\eta_\varepsilon(x) = |\Sigma(M) \cap B_{op}(x, \varepsilon)| / [\omega_{(d_{op})}\, \varepsilon^{(d_{op})}],$$

and let ρ_{op} be its normalised smooth mollification,

$$\int_{(M_{op})} \rho_{op}\, dH_{op}^{(d_{op})} = 1.$$

The distinguishability-counting metric is

$$g_{op}(x) = \mathrm{Vol}_{op}(M)^{(2/d_{op})} \rho_{op}(x)^{(2/d_{op})} \langle\cdot,\cdot\rangle_{op}.$$

For the Higgs point x_H define

$$\zeta_H(\tau) = \mathrm{Vol}_{op}(M) \rho_{op}(x_H, \tau).$$

With q_H of unit norm in the flat reference operational metric, Theorem 6.7 below reduces the distinguishability-counting/one-Fact comparison on the Higgs line, at each operational state, to a single conversion scalar $\gamma_H(\tau)$, and on the bridge premise P8 ($\gamma_H(\tau) \equiv 1$):

Proposition 6: Higgs-line packing formula

Grade: exact on the physical Higgs line conditional on the distance-functional bridge premise P8 ($\gamma_H(\tau) \equiv 1$) through the reduction of Theorem 6.7 below; unconditionally $Z_H^{space}(\tau) = \gamma_H(\tau)^2 \zeta_H(\tau)^{(2/d_{op})}$, and every formula below evaluates on the P8 branch, the general form being recovered by the substitution $Z_H^{space} \to Z_H^{space}/\gamma_H(\tau)^2$.

$$Z_H^{space}(\tau) = \zeta_H(\tau)^{(2/d_{op})}.$$

Writing

$$\zeta_H(\tau) = 1 + \delta_H(\tau)$$

gives

$$Z_H^{space}(\tau) = (1 + \delta_H(\tau))^{(2/d_{op})}.$$

On the bridge branch no free phenomenological or source-independent multiplicative gain remains on the physical Higgs line; without the bridge the single state-wise scalar $\gamma_H(\tau)$ is that gain (Theorem 6.7). The finite-flow unknowns are therefore $\gamma_H(\tau)$ (pending Route A) and the operational packing observable $\delta_H(\tau)$, together with d_{op} where a finite-flow numerical correction is required.

8.1 Why finite-flow δ_H cannot be set to zero from continuum homogeneity

The refinement metric lives on the emergent continuum tangent bundle. ρ_{op} lives on the continuous operational image of admissible source sectors. These are differently typed spaces. Uniformity of the geometric refinement fixed point does not imply uniform packing of admissible operational sectors at the broken Higgs point at finite operational flow time.

Therefore

$\delta\_H(\tau) = 0$

at finite τ is not a consequence of continuum refinement isotropy or Lorentz transport.

8.2 Why d_op cannot yet be replaced by 187

The continuous one-Fact proposal acts on a 187-dimensional physical tangent. The operational-packing theorem, however, defines d_op as the dimension of the continuous operational image carrying its Hausdorff/packing measure. The corpus has not published a theorem identifying these dimensions. Hence

$d\_op = 187$

may not be substituted merely because the tangent carrier has dimension 187.

The K = 7 spectral architecture also does not by itself imply d_op = 7: the operational geometry allows nontrivial per-channel multiplicity in Im(Ω_max). A numerical operational dimension must be returned from the actual projected admissible subspace if finite-flow corrections are to be evaluated.

8.3 Corollary 6.1: Conditional operational-fixed-point Higgs residue

Grade: CONDITIONAL NUMERICAL OPERATIONAL-FIXED-POINT RETURN. Theorem 6.7 reduces the Higgs-line metric identity to the bridge scalar; the conditionality is that bridge, the operational-refinement dynamics, and the evaluation-point/convergence hypotheses below.

Let τ denote the operational refinement-flow parameter of the Operational Curvature programme. Assume all of the following on the branch being used:

1. the distance-functional bridge premise P8 holds, $\gamma\_H(\tau) \equiv 1$;
2. the physical operational refinement follows the entropy-gradient/Fickian branch of the operational-curvature dynamics;
3. the S_op-concavity and regularity/coverage hypotheses required by that refinement theorem hold;
4. either the Higgs operational point is stationary under the flow, $x\_H(\tau) = x\_H$, or the flattening of hypothesis 2 holds uniformly on M_op, $\sup\_x |\rho\_op(x, \tau) - 1/Vol\_op(M)| \to 0$. The inherited source wording states pointwise approach; pointwise approach suffices for a flow-stationary x_H, while uniform approach yields the same conclusion for any flow-dependent $x\_H(\tau)$ that remains in the physical operational image.

The inherited refinement-dynamics result is

$\rho\_op(x, \tau) \to 1/Vol\_op(M)$

as $\tau \to \infty$. Therefore, under hypotheses 1 and 4, for the Higgs operational point,

$\zeta\_H(\tau) = \mathrm{Vol\_op}(M)\ \rho\_op(x\_H, \tau) \to 1$.

Hence

$\delta\_H(\tau) = \zeta\_H(\tau) - 1 \to 0$,

and Proposition 6 gives

$Z\_H\text{^}space(\tau) = \zeta\_H(\tau)\text{^}(2/d\_op) \to 1\text{^}(2/d\_op) = 1$.

Thus

$\lim\_(\tau\to\infty)\ Z\_H\text{^}space(\tau) = Z\_(H,\infty)\text{^}space = 1$.

The numerical value is independent of d_op. The operational dimension can remain unevaluated and the fixed-point residue is still determined.

Lemma 6.2: Rate transfer

Grade: exact bound, conditional on the packing representation of Proposition 6 and on $d\_op \geq 1$.

Set $\alpha = 2/d\_op$, so $\alpha \in (0, 2]$. For every τ with $|\delta\_H(\tau)| \leq 1/2$,

$|Z\_H\text{^}space(\tau) - 1| \leq 2\alpha\ |\delta\_H(\tau)| = (4/d\_op)\ |\delta\_H(\tau)|$,

and exactly,

$\log Z\_H\text{^}space(\tau) = (2/d\_op) \log(1 + \delta\_H(\tau))$.

Proof

By the mean value theorem, $(1 + \delta)\text{^}\alpha - 1 = \alpha(1 + \xi)\text{^}(\alpha-1)\ \delta$ for some ξ between 0 and δ, so with $|\delta| \leq 1/2$ the point $1 + \xi$ lies in $[1/2, 3/2]$. If $\alpha \geq 1$ then $(1 + \xi)\text{^}(\alpha-1) \leq (3/2)\text{^}(\alpha-1) \leq 3/2 < 2$; if $\alpha < 1$ then $(1 + \xi)\text{^}(\alpha-1) \leq (1/2)\text{^}(\alpha-1) = 2\text{^}(1-\alpha) \leq 2$. In both cases the prefactor is at most 2α. The logarithmic identity is immediate from Proposition 6. QED.

Remark 6.3

The exponent 2/d_op therefore cancels from the operational-fixed-point endpoint but controls the finite-flow approach: at fixed packing contrast δ_H, a larger operational dimension tightens the deviation of Z_H^space from unity. This converts the future finite-flow execution (Route C of Section 12) into a two-parameter convergence test in $(\delta\_H(\tau), d\_op)$ with an explicit a priori envelope, without assigning either number here.

8.4 Why the fixed-point result does not violate the finite-flow firewall

The earlier provenance firewall remains correct: the broken Higgs background has not been proved to coincide, at finite flow time, with the operational entropy maximum. HSPR-1 does not make that identification.

The fixed-point calculation uses a different statement. On the declared entropy-gradient/Fickian branch, the entire operational density relaxes toward the uniform equilibrium. Therefore every surviving point has the same asymptotic density, including the point representing the broken Higgs background. No special identification

$x_H = x_{(op,eq)}$

is required.

At finite τ,

$Z_H^{space}(\tau) = (1 + \delta_H(\tau))^{(2/d_{op})}$

may differ from one, and $\delta_H(\tau)$ remains a genuine source observable bounded through Lemma 6.2. Only the operational refinement fixed point is fixed to unity on this branch.

The grade must therefore remain conditional. The operational-curvature paper itself records the substrate derivation of S_{op} concavity as open. With the Higgs-line ruler reduction supplied by Theorem 6.7, the bridge premise and the flow premises are the load-bearing conditions: removing either removes the physical promotion of the unit fixed-point return.

8.5 Separation of the spatial regulator limit and the operational flow limit

The spatial continuum limit of Sections 4 and 5 and the fixed-point limit of Section 8.3 are two distinct operations and must not be identified:

$\ell \to 0$: the spatial regulator/continuum limit, taken at fixed physical momentum;

$\tau \to \infty$: the operational refinement-flow fixed point of the Operational Curvature dynamics.

The source Operational Curvature paper describes τ as an operational evolution/refinement parameter and its density-flow result as an asymptotic operational equilibrium, not as the $\ell \to 0$ spatial limit. To keep the typing explicit, define the two-index object

$Z_H^{space}(\ell, \tau)$ = coefficient of $g^{ij} p_i p_j$ in the physical spatial Higgs kernel at spatial regulator ℓ and operational flow time τ.

For each fixed τ the inner limit exists by Theorem 3 and equals $q_H^\dagger G_{op}^{direct}(\tau) q_H$; indeed the p^2 coefficient is ℓ-independent, the regulator entering only through the $O(p^4\ell^2)$ lattice corrections to the symbol. The outer limit is then Corollary 6.1. The clean headline statement of this paper is therefore the iterated limit

$\lim_{\tau\to\infty} [\lim_{\ell\to 0} Z_H^{space}(\ell, \tau)] = \lim_{\tau\to\infty} \gamma_H(\tau)^2$, equal to one under the bridge premise,

on the declared packing-metric/entropy-gradient branch, decomposing as

$\ell \to 0 \Longrightarrow Z_{geom}^{space} = 1$ exactly,

$\tau \to \infty \Longrightarrow \delta_H(\tau) \to 0$, hence $q_H^\dagger G_{op}^{direct} q_H \to \lim_{\tau\to\infty} \gamma_H(\tau)^2$ conditionally (assuming that limit exists), with P8: $\gamma_H(\tau) \equiv 1 \Longrightarrow Z_{(H,\infty)}^{space} = 1$.

Equivalently, at the kernel level:

$\ell \to 0$: $K_{(H,grad)}^{space}/Z_H^{space} \to p^2$, EXACT;

$\tau \to \infty$: $Z_H^{space} \to \lim_{\tau\to\infty} \gamma_H(\tau)^2$ (if it exists), CONDITIONAL; = 1 under P8.

No correspondence between a regulator level and a value of τ is currently proved. Executions must therefore report regulator convergence and operational-flow convergence separately and must not substitute one parameter for the other.

8.6 The joint two-error propagation certificate

The two limits of Section 8.5 are distinct, but their errors compose. The following certificate bounds the total deviation of the physical Higgs propagation kernel by the sum of the two named errors.

Lemma 6.4: Discretisation envelope

Grade: exact.

For every real x with $|x| \le 1$,

$0 \le 1 - \sin^2 x/x^2 \le x^2/3$.

Proof

The upper bound of $\sin^2 x/x^2$ by 1 follows from $|\sin x| \le |x|$. For the lower bound, $\sin x \ge x - x^3/6$ on $[0, 1]$, so

$\sin^2 x \ge (x - x^3/6)^2 = x^2 - x^4/3 + x^6/36 \ge x^2 - x^4/3$, hence $\sin^2 x/x^2 \geq 1 - x^2/3$; the statement for negative x follows by evenness. QED.

Theorem 6.5: Joint two-error propagation certificate

Grade: exact envelope given Theorems 3 and 5; the substituted second form uses the Higgs-line packing representation (Proposition 6, Theorem 6.7) on the Lemma 6.2 domain (P8, P10); the general pre-bridge form is Corollary 6.5.2.

Define the gradient part of the physical spatial Higgs kernel at spatial regulator ℓ and operational flow time τ,

$$K_{(H,grad)}^{space}(p; \ell, \tau) = Z_H^{space}(\tau) \sum_a \sin^2(p_a \ell_a)/\ell_a^2.$$

For refinement-frame momenta with $|p_a \ell_a| \leq 1$ for every a, set

$$p^2 = \sum_a p_a^2, \quad \varepsilon_\ell = (1/3) \max_a (p_a^2 \ell_a^2).$$

Then

$$|K_{(H,grad)}^{space}(p; \ell, \tau)/p^2 - 1| \leq |Z_H^{space}(\tau) - 1| + \varepsilon_\ell.$$

If in addition the packing representation of Proposition 6 holds with $|\delta_H(\tau)| \leq 1/2$ and $d_{op} \geq 1$, then

$$|K_{(H,grad)}^{space}(p; \ell, \tau)/p^2 - 1| \leq (4/d_{op})|\delta_H(\tau)| + (1/3) \max_a (p_a^2 \ell_a^2).$$

Proof

Write $\sigma = \sum_a \sin^2(p_a \ell_a)/\ell_a^2 = \sum_a p_a^2 \cdot [\sin^2(p_a \ell_a)/(p_a \ell_a)^2]$. By Lemma 6.4 each bracketed ratio lies in $[1 - \varepsilon_\ell, 1]$, and σ/p^2 is their convex combination with weights p_a^2/p^2, so $\sigma/p^2 \in [1 - \varepsilon_\ell, 1]$. Then

$$K_{(H,grad)}^{space}/p^2 - 1 = (Z_H^{space} - 1)(\sigma/p^2) + (\sigma/p^2 - 1),$$

and the triangle inequality with $0 \leq \sigma/p^2 \leq 1$ gives the first bound. The second follows by substituting Lemma 6.2 on its domain. QED.

Corollary 6.5.1: Two-error decomposition and joint limit

On the declared packing-metric/entropy-gradient branch,

Higgs propagation error ≤ operational-normalisation error + finite-spatial-resolution error,

with the two terms separately named, separately typed, and separately executable. In particular, under the bridge premise,

$\ell \to 0, \tau \to \infty \Longrightarrow K\_(H,grad)\^{}space(p) \to p^2$,

and the certificate quantifies every intermediate stage: neither limit need be completed for the kernel error to be controlled, and no cross-term between the spatial regulator and the operational flow appears at this order.

Corollary 6.5.2: General pre-bridge three-error certificate

Grade: exact on the Lemma 6.2 domain; collapses to Theorem 6.5 under the bridge premise P8.

Prior to the bridge, the unconditional Higgs-line representation is

$Z\_H\^{}space(\tau) = \gamma\_H(\tau)^2 (1 + \delta\_H(\tau))\^{}(2/d\_op)$.

On the Lemma 6.2 domain ($d\_op \geq 1$, $|\delta\_H(\tau)| \leq 1/2$),

$|Z\_H\^{}space(\tau) - \gamma\_H(\tau)^2| \leq \gamma\_H(\tau)^2 (4/d\_op) |\delta\_H(\tau)|$,

hence

$|Z\_H\^{}space(\tau) - 1| \leq |\gamma\_H(\tau)^2 - 1| + \gamma\_H(\tau)^2 (4/d\_op) |\delta\_H(\tau)|$,

and, with ε_ℓ as in Theorem 6.5,

$|K\_(H,grad)\^{}space(p; \ell, \tau)/p^2 - 1| \leq |\gamma\_H(\tau)^2 - 1| + \gamma\_H(\tau)^2 (4/d\_op) |\delta\_H(\tau)| + (1/3) \max_a (p_a^2 \ell_a^2)$.

The first bound is Lemma 6.2 applied to $Z/\gamma\_H(\tau)^2$; the second is the triangle inequality on $Z - 1 = (\gamma\_H(\tau)^2 - 1) + (Z - \gamma\_H(\tau)^2)$; the kernel bound follows exactly as in Theorem 6.5 with $0 \leq \sigma/p^2 \leq 1$. Under P8, $\gamma\_H(\tau) \equiv 1$ and every display collapses to the two-error certificate. The pre-Route-A uncertainty is thereby fully explicit: a bridge error, an operational-flow error and a finite-resolution error, with exactly the first term disappearing when Route A passes.

8.7 One-dimensional closure of the same-source operational-ruler identity

A full-subspace route reduces the metric-identification problem to the construction of a typed map from ker J_D into the operational tangent together with locality, Z_7-equivariance, channel uniformity, distinguishability counting and flat-reference recovery. That remains a useful route to the complete metric on the four-dimensional protected subspace, but it is stronger than is required for the Higgs residue.

HSPR-1 needs only the restriction to the single physical line

$L\_H = span\{q\_H\}$.

On this line the global inner-product obstruction of the finite-packing reconstruction disappears.

Lemma 6.6: Automatic quadraticity of the packing norm on the Higgs line

Grade: exact mathematical consequence of the inherited packing norm.

Let $\|\cdot\|_{pack}$ be the operational packing norm restricted to

$L_H = \{h\, q_H : h \in \mathbb{R}\}$.

Then this norm is generated by a unique positive quadratic form.

Proof

Absolute homogeneity of a norm gives

$\|h\, q_H\|_{pack} = |h|\, \|q_H\|_{pack}$.

For arbitrary $a, b \in \mathbb{R}$,

$\|(a + b)q_H\|_{pack}^2 + \|(a - b)q_H\|_{pack}^2 = [(a + b)^2 + (a - b)^2]\, \|q_H\|_{pack}^2 = 2(a^2 + b^2)\, \|q_H\|_{pack}^2 = 2\|a\, q_H\|_{pack}^2 + 2\|b\, q_H\|_{pack}^2$.

Thus the parallelogram identity is automatic on L_H. Polarisation therefore supplies the unique inner product

$\langle a\, q_H, b\, q_H\rangle_{(H,pack)} = ab\, \|q_H\|_{pack}^2$.

No multidimensional squaring assumption is required. QED.

Remark 6.6.1: Exact scope

This lemma does not solve the global operational inner-product problem. In dimensions greater than one, different norms can have identical unary scaling while differing in their binary geometry, and the finite-packing programme correctly retains that obstruction. The present result works because L_H has dimension one. It therefore cannot be promoted to the whole four-dimensional protected subspace without further work.

Theorem 6.7: Higgs-line ruler reduction and the conditional same-source identity

Grade: the reduction to one state-wise scalar is exact; the identity $\gamma_H(\tau) \equiv 1$ is conditional on the state-wise distance-functional bridge premise P8.

The physical common Higgs line is

$q_H = (1/2)(1, 1, 1, 1)$, $L_H = \mathrm{span}\{q_H\}$, with q_H the independently normalised common character of the four-route completion carrier.

The finite-distinguishability construction defines physical operational distance by counting the local distinguishability quanta separating operational configurations. Its local metric at x_H gives, for the flat-reference unit common direction,

$$g_{pack}(x_H)(q_H, q_H) = [Vol_{op}(M)\, \rho_{op}(x_H)]^{2/d_{op}}.$$

Independently, the physical one-Fact construction declares G_{op} to be the inherited operational tangent metric; its minimum-norm lift selects the displacement of least operational distinguishability, and the continuous one-Fact proposal has covariance $a_t G_{op}^{-1}$.

By Lemma 6.6, each of these norms restricted to L_H has exactly one quadratic representative. Two quadratic forms on a one-dimensional line differ by a single positive scalar. Both compared quantities are state dependent, so the reduction is state-wise: at each operational flow state τ there exists a unique $\gamma_H(\tau) > 0$ with

$$q_H^\dagger G_{op}^{phys}(\tau)\, q_H = \gamma_H(\tau)^2 [Vol_{op}(M)\, \rho_{op}(x_H, \tau)]^{2/d_{op}},$$

and, by exact defect silence (Theorem 4 and Lemma 5.0),

$$q_H^\dagger G_{op}^{direct}(\tau)\, q_H = \gamma_H(\tau)^2 [Vol_{op}(M)\, \rho_{op}(x_H, \tau)]^{2/d_{op}}.$$

One-dimensionality yields one scalar at each operational state; it does not by itself make that scalar flow-independent. If the evaluation point itself flows (P11), $\gamma_H(\tau)$ abbreviates $\gamma_H(x_H(\tau), \tau)$.

This reduction is exact: the entire Higgs-line metric-identification question is compressed into the one state-wise conversion scalar $\gamma_H(\tau)$. One-dimensionality does not by itself force $\gamma_H(\tau) = 1$, since two distinct norms $a|h|$ and $b|h|$ on the same line are each quadratic. The identity

$$\gamma_H(\tau) \equiv 1$$

along the flow holds if and only if the distance-functional bridge premise P8 holds: the two local distance functionals coincide at every admissible Higgs-line operational state, equivalently their unit balls on L_H coincide after flat-reference recovery at every such state. Under P8,

$$Z_H^{space}(\tau) = (1 + \delta_H(\tau))^{2/d_{op}}.$$ QED.

Corollary 6.7.1: $\gamma_H(\tau)$ is the sole remaining Higgs-line normalisation freedom

The scalar $\gamma_H(\tau)$ is convention-independent once flat-reference recovery fixes both rulers' overall conventions, so it is a genuine physical target rather than a chart artefact. Deriving $\gamma_H(\tau) \equiv 1$, by proving the state-wise coincidence of the two local distance functionals (equality of the two unit balls on L_H, or both norms as the second-order local form of one distinguishability functional, at every admissible operational state), is the named next metric calculation (Route A of Section 12). A derived value $\gamma_H(\tau) \neq 1$ at any admissible state would retype the one-Fact metric as physically distinct from the distinguishability-counting metric on the Higgs line and would propagate through every formula below via $Z_H^{space} \to \gamma_H(\tau)^2 Z_H^{space}|_{(P8)}$.

This is not the rejected whitening argument in either direction. The reduction does not infer physical unit norm from $G_{op} = I$ in a convenient chart; the reference vector q_H is fixed independently as the normalised common completion character, the nontrivial physical norm is supplied by the distinguishability density, and the surviving freedom is exactly the one scalar the bridge must fix.

Corollary 6.7.2: Restricted reduction of the metric-identification debt

The identification debt D-HSPR3 is reduced for the scalar Higgs projection to the single bridge scalar:

$$G_{op}^{direct}|_{(L_H)} = \gamma_H(\tau)^2 g_{pack}|_{(L_H)}, \quad \gamma_H(\tau) \equiv 1 \Leftrightarrow \text{P8}.$$

A typed full-subspace map

$$\iota : \ker J_D \to T_{(x_H)} M_{op}$$

remains useful if the programme wishes to derive the complete four-dimensional protected metric, but it is not a prerequisite for Z_H^{space}; the Higgs-line prerequisite is the bridge alone.

Remark 6.7.3: What remains conditional

The Higgs-line ruler comparison is now one state-wise scalar, but that scalar is not yet derived: $\gamma_H(\tau) \equiv 1$ is premise P8. Neither $\delta_H(\tau)$ nor d_{op} is numerically evaluated at finite flow time. The numerical endpoint

$$Z_{(H,\infty)}^{space} = 1$$

requires both the bridge and the physical selection or substrate derivation of an operational refinement whose density converges to the uniform fixed point; without the bridge the endpoint is $\lim_{(\tau\to\infty)} \gamma_H(\tau)^2$, assuming that limit exists. The inherited entropy-gradient/Fickian result continues to depend on its declared S_{op}-concavity, regularity and convergence hypotheses.

9. Canonical Field Coordinates and Coordinate-Rescaling Invariants

Proposition 7: Coordinate-rescaling covariance

Under a one-dimensional radial coordinate change

$h' = c\,h$,

the raw spatial kinetic coefficient transforms as

$Z'_H^{space} = Z_H^{space} / c^2$.

A local quadratic potential curvature K_H transforms in the same way,

$K'_H = K_H / c^2$.

Therefore the ratio

$\mu_H^2 = K_H / Z_H^{space}$

is invariant under radial coordinate rescaling.

This is useful but must be graded correctly. The canonical values K_H^{can} and Z_H^{can} do not automatically equal their physical values simply because the ratio is coordinate invariant; the physical action still has to identify the correct underlying field metric and potential curvature on the same source branch.

9.1 Spatial and sequential kinetic coefficients

The one-Fact audit gives a sequential/fact kernel

$K_H^{fact}(\omega) = K_H + (4g_H/a_t^2) \sin^2(\omega/2)$.

The spatial result of this paper gives

$K_H^{space}(p) = K_H + Z_H^{space} g^{ij} p_i p_j + O(p^4)$.

Both involve the same physical common Higgs line, but the spatial momentum p is measured in the refinement metric while ω/a_t remains a sequential opportunity variable until the physical-time attaching map is derived. This paper does not identify the two coefficients as one Lorentz-covariant Z_H by notation alone; Section 9.2 proves the field-space part of the identification exactly and constrains the remaining phase attachment.

9.2 Sequential-spatial Higgs metric equality and the physical-time attachment constraint

Theorem 8: Common-Higgs sequential/spatial metric equality

Grade: EXACT ON THE COMMON HIGGS LINE.

The sequential one-Fact Higgs kernel is

$$K\_H^{fact}(\omega; \tau) = K\_H + (4g\_H(\tau)/a\_t^2) \sin^2(\omega/2),$$

where

$$g\_H(\tau) = q\_H^\dagger G\_op^{phys}(\tau) q\_H.$$

The spatial Higgs residue is

$$Z\_H^{space}(\tau) = q\_H^\dagger G\_op^{direct}(\tau) q\_H.$$

Exact defect silence gives

$$q\_H^\dagger G\_op^{phys} q\_H = q\_H^\dagger G\_op^{direct} q\_H.$$

Therefore

$$g\_H(\tau) = Z\_H^{space}(\tau).$$

Thus the sequential one-Fact kernel and the spatial Higgs kernel carry the same physical Higgs-line metric scalar. There is no second independent common-Higgs field-space normalisation associated with sequential propagation.

This statement does not yet identify the sequential opportunity parameter with a physical duration. QED.

Corollary 8.1: Constraint on the physical-time attaching map

Grade: DERIVED NECESSARY CONSTRAINT; the attaching map itself remains open.

The continuum refinement programme independently supplies a Lorentzian metric with a unique timelike commitment direction at each continuum point. The sequential one-Fact construction supplies an ordered opportunity variable ω. The existing source stack does not yet derive the map from one sequential opportunity to displacement along that continuum timelike direction: the MFKR audit records that the history-mark and closure-traversal structures are not one-to-one.

Suppose a future source-derived attaching map assigns to each physical angular frequency Ω a sequential phase

$$\omega = f(\Omega),\ f(0) = 0,$$

with f smooth at the origin; the linear identification $\omega = \Omega\, \Delta t\_phys$ is the special case $f(\Omega) = \Omega\, \Delta t\_phys$, and in general $\Delta t\_phys \equiv f'(0)$ is the local conversion slope. The small-ω sequential kernel is

$$K\_H + g\_H\, \omega^2/a\_t^2 + O(\omega^4),$$

while a Lorentzian scalar principal symbol with the already-derived spatial coefficient has temporal magnitude

$Z\_H^{space}\, \Omega^2/c\star^2$.

Since $g\_H = Z\_H^{space} > 0$, matching at quadratic order constrains exactly the slope magnitude:

$g\_H\, f'(0)^2/a\_t^2 = Z\_H^{space}/c\star^2$,

so coefficient matching determines $|f'(0)| = a\_t/c\star$; the inherited future-directed time orientation selects the positive branch. Hence

$d\omega/d\Omega\, |\_(\Omega=0) = \Delta t\_phys = a\_t/c\star$,

equivalently $\omega/a\_t = \Omega/c\star$ at leading order. Higher-order terms of f are not constrained at principal-symbol order; they enter alongside the ω^4 kernel corrections and are fenced by F-HSPR26. Dimensionally, a_t is the sequential scale appearing in the one-Fact kernel and c⋆ carries length per emergent proper time; the attachment condition identifies a_t/c⋆ as the corresponding local physical-time conversion once the map exists, with ω dimensionless throughout.

This is a necessary local normalisation condition on any admissible sequential-opportunity-to-physical-time attaching map. It fixes the map's linearisation without deriving the map.

Corollary 8.2: Conditional local Lorentzian Higgs principal symbol

Grade: CONDITIONAL CONSEQUENCE of the physical-time attachment; the underlying metric equality of Theorem 8 is exact.

If the source-selected physical-time attaching map satisfies the identification of Corollary 8.1, then

$Z\_H^{time}(\tau) = Z\_H^{space}(\tau) \equiv Z\_H(\tau)$,

with Z_H(τ) carrying its Section 8 grade (conditional on the bridge premise P8 for the packing form),

and the local continuum quadratic kernel becomes

$\Gamma\_H^{(2)} = K\_H + Z\_H(\tau)\, [-\Omega^2/c\star^2 + g^{ij} p_i p_j] + O(\Omega^4 a\_t^2/c\star^4, p^4\ell^2)$.

Thus the complete temporal-spatial equality is a conditional consequence of the physical-time attachment, while the equality of the underlying Higgs-line metric scalar $g\_H = Z\_H^{space}$ is already exact, so no additional temporal field-space gain is available under any admissible attachment. On the declared operational-flattening branch $Z\_H(\tau) \to 1$, so, conditional additionally on the physical-time attaching map,

$Z_{(H,\infty)}^{time} = Z_{(H,\infty)}^{space} = 1.$

Corollary 8.3: Sequential and spatial discretisation certificate

Grade: exact envelopes; the physical temporal reading of the sequential envelope is conditional on the attachment of Corollary 8.1; the substituted form is conditional on the Higgs-line packing representation and the Lemma 6.2 domain.

For every real x with $|x| \le 1$,

$$0 \le 1 - 4 \sin^2(x/2)/x^2 \le x^2/12,$$

since $|\sin(x/2)| \le |x/2|$ gives the upper bound of the ratio by one, while $\sin(x/2) \ge x/2 - x^3/48$ on $[0, 1]$ gives $4 \sin^2(x/2) \ge x^2 - x^4/12$, and both sides are even. Consequently, with

$$\varepsilon_{seq} = (1/12)\, \omega^2,\quad \varepsilon_\ell = (1/3) \max_a (p_a^2 \ell_a^2),$$

and for $|\omega| \le 1$, $|p_a \ell_a| \le 1$, $d_{op} \ge 1$ and $|\delta_H(\tau)| \le 1/2$, the sequential coefficient (normalised to its ω^2 target) and the spatial coefficient block (normalised to its p^2 target) deviate from one by at most

$$(4/d_{op})|\delta_H(\tau)| + \varepsilon_{seq} \text{ and } (4/d_{op})|\delta_H(\tau)| + \varepsilon_\ell$$

respectively, by the same convex-combination argument as Theorem 6.5. The sequential envelope is four times tighter than the spatial one at equal phase, reflecting the half-step form of the sequential kernel against the full centred spatial difference. Under an attaching map satisfying Corollary 8.1, and only then, ε_{seq} reads as the physical temporal-resolution error $(1/12)\Omega^2 a_t^2/c_\star^2$.

9.3 Finite sequential spectral relation

The exact one-Fact kernel can be analytically continued before any physical-time calibration. Introduce the sequential spectral parameter ε by

$$\omega = i\, \varepsilon\, a_t.$$

The rest-sector inverse kernel is then

$$\Gamma_{(H,rest)}^{(2)}(\varepsilon) = K_H - (4Z_H/a_t^2) \sinh^2(\varepsilon\, a_t/2).$$

Its exact sequential pole is

$$\varepsilon_H = (2/a_t)\, \mathrm{arsinh}[(a_t/2) \sqrt{(K_H/Z_H)}].$$

In the local sequential continuum limit,

$\varepsilon_H \to \sqrt{(K_H/Z_H)}$.

Only after the physical-time attaching map is derived may this sequential spectral parameter be promoted through

$$E = \hbar c^\star \varepsilon$$

to the physical-energy relation

$$E_H(a_t) = (2\hbar c^\star/a_t) \operatorname{arsinh}[(a_t/2) \sqrt{(K_H/Z_H)}],$$

with local continuum limit $E_H \to \hbar c^\star \sqrt{(K_H/Z_H)}$ and, in natural units, $m_H^2 = K_H/Z_H$. The latter is therefore a conditional physical-energy formula, not yet an unconditional physical pole relation. The internal choice $a_t = 1$ or any diagnostic phase must not be promoted into a physical calibration.

10. What This Paper Does Not Yet Prove

10.1 It does not return a finite-regulator or finite-flow raw-field Z_H^{space}

The exact finite-flow reduction remains

$$Z_H^{space}(\tau) = q_H^\dagger G_{op}^{direct}(\tau) q_H.$$

The packing representation, now reduced on the Higgs line to the single bridge scalar, has the operational-fixed-point return $Z_{(H,\infty)}^{space} = 1$ under the bridge premise, but this does not make every finite-regulator or finite-flow value equal to one. The finite-flow contrast $\delta_H(\tau)$, or an equivalent direct metric evaluation, remains a physical source output; Lemma 6.2 bounds its transfer into Z_H^{space} but does not evaluate it.

10.2 It does not derive the complete metric on the four-dimensional protected subspace

The open same-source metric identity has been reduced on the physical one-dimensional Higgs line, by Lemma 6.6 and Theorem 6.7, to the single state-wise conversion scalar $\gamma_H(\tau)$. Consequently

$$Z_H^{space}(\tau) = (1 + \delta_H(\tau))^{(2/d_{op})}$$

requires exactly one Higgs-line metric premise, the distance-functional bridge $\gamma_H(\tau) \equiv 1$ (P8), whose derivation is Route A of Section 12.

This should not be overextended. The physical defect-silent subspace has dimension four,

$$\dim \ker J_D = 4,$$

and the global finite-packing reconstruction still carries its multidimensional inner-product obstruction. HSPR-1 therefore does not claim

$$G_{op}^{direct}|_{(\ker J_D)} = g_{pack}|_{(\ker J_D)}$$

as a complete matrix identity.

The new result is narrower and sufficient for the present purpose:

$$G_{op}^{direct}|_{(L_H)} = \gamma_H(\tau)^2\, g_{pack}|_{(L_H)}, \text{ with } \gamma_H(\tau) \equiv 1 \text{ under P8.}$$

A future full-subspace source map and metric reconstruction would strengthen the wider VERSF operational geometry, but it is no longer load-bearing for the Higgs spatial residue.

10.3 It does not set finite-flow $\delta_H = 0$

The broken Higgs vacuum has not been proved to coincide with the finite-flow uniform operational-density equilibrium. Continuum refinement homogeneity does not close this differently typed operational question.

What is now available is narrower and stronger: on the declared entropy-gradient/Fickian operational-refinement branch, the inherited flattening theorem gives

$$\delta_H(\tau) \to 0$$

as $\tau \to \infty$. Thus finite-flow δ_H remains open while its conditional operational-fixed-point limit is fixed.

10.4 It does not set $d_{op} = 187$

The operational dimension remains an independently typed source quantity. The conditional fixed-point number does not require it because

$$1^{(2/d_{op})} = 1$$

for every finite positive d_{op}. The operational dimension re-enters only through the finite-flow rate (Lemma 6.2), where it must be returned from the projected admissible subspace, not substituted from the tangent dimension.

10.5 It does not source-derive the entropy-gradient refinement hypotheses

The Operational Curvature flattening result rests on the S_{op}-concavity hypothesis and on the declared entropy-gradient/Fickian operational-flow structure. The operational-curvature paper itself records substrate derivation of S_{op} concavity as open. HSPR-1 therefore grades

$$Z_{(H,\infty)}^{space} = 1$$

as a conditional numerical operational-fixed-point return, not an unconditional source theorem. In particular, an earlier operational-curvature draft argued S_{op} concavity from partition counting; the later authoritative Operational Curvature and Unified Refinement papers deliberately retreat from that argument and retain S_{op} concavity as an explicit hypothesis and open substrate problem. HSPR-1 respects the later correction and does not resurrect the superseded derivation (F-HSPR19).

10.6 It does not primitive-select the EX2G attachment class

I_H^{can} is unique within the declared endpoint-local, nonnegative integer one-arrival/one-departure class. A deeper source theorem must still prove that this is the attachment class selected by the primitive substrate, or replace it with the class actually selected.

10.7 The sequential-opportunity-to-physical-time attaching map remains open

HSPR-1 proves that the sequential and spatial constructions use the same common-Higgs field-space metric scalar,

$$g_H = Z_H^{space},$$

and the Lorentz-transport programme independently derives a unique timelike commitment direction in the continuum. What remains unreturned is the physical map identifying a sequential one-Fact opportunity with displacement along that timelike continuum direction. The prior MFKR audit localises this gap precisely: the history-mark and closure-traversal structures are not one-to-one, so an opportunity fraction cannot yet be read directly as a physical duration.

HSPR-1 nevertheless places a sharp constraint on the missing map. If

$$\omega = \Omega \, \Delta t_{phys},$$

then local Lorentzian principal-symbol consistency requires

$$\Delta t_{phys} = a_t/c\star.$$

Thus the temporal normalisation is no longer free, but the physical attachment itself remains to be source-derived. No number of laboratory seconds per Fact is implied.

10.8 It does not by itself promote the Higgs pole mass

HSPR-1 supplies a substantial part of the pole architecture. The field-space ambiguity between the sequential and spatial kernels is removed exactly ($g_H = Z_H^{space}$), the local Lorentzian form

$$K_H + Z_H [-\Omega^2/c_\star^2 + g^{ij} p_i p_j]$$

is fixed conditionally on the physical-time attachment, and the exact sequential finite-step pole equation is

$$K_H - (4Z_H/a_t^2) \sinh^2(\varepsilon a_t/2) = 0.$$

A physical numerical pole mass nevertheless still requires:

1. the source-derived sequential-opportunity-to-physical-time attaching map, whose normalisation is already forced by Corollary 8.1;
2. physical promotion of the operational-flow branch or a finite-flow evaluation of Z_H;
3. the absolute energy/reference-clock calibration;
4. the complete same-scale gauge contribution;
5. the physical top-Yukawa contribution;
6. the declared renormalisation, threshold and scheme-to-pole bridge.

Accordingly, HSPR-1 strengthens the pole chain substantially but does not promote the existing numerical Higgs value to unconditional status. The gauge part of these requirements is sharpened by a parallel same-mark audit recorded in Appendix E: the presently executed first-order record/completion mark architecture supplies no D41 subtraction, so the missing gauge contribution must come from a source-derived nonfactorising same-mark law or its correctly graded higher-order continuation.

11. Consequence for the Existing Higgs-Potential and Mass Chain

The existing Higgs completion programme has conditional numerical returns including

$$v_{cl} \approx 243.723 \text{ GeV}, \lambda = 512/3969, m_H \approx 123.796 \text{ GeV},$$

on its declared source stack. HSPR-1 does not alter those numbers.

For orientation only, and never as inputs (F-HSPR11): those conditional returns lie within about one percent of the corresponding measured quantities, with the structural ratio $m_H/v = 32/63$

within about 0.11 percent of the measured ratio, so the discrepancy is dominated by a common absolute-scale offset rather than by the closure geometry; the declared outstanding gauge, top, Goldstone and threshold corrections are the pre-committed channels that must account for the remaining difference, of order one percent on the mass. If they compute to a materially different size, the chain fails.

What it alters is the provenance ledger beneath them.

Before HSPR-1, the spatial Higgs mechanism had the grade:

canonical $O(k^2)$ gradient mechanism: structural pass; physical spatial normalisation: open.

After HSPR-1, the spatial side becomes:

canonical $O(k^2)$ gradient mechanism: inherited structural pass; physical spatial ruler and Laplace-Beltrami coefficient: source-derived pass; known defect/history/bath corrections on q_H: exactly zero, diagonally and in mixing; finite-flow raw-field spatial residue: one direct operational scalar, decomposition-independent and positive by inheritance; Higgs-line ruler comparison reduced exactly to the single state-wise bridge scalar $\gamma_H(\tau)$, with $\gamma_H(\tau) \equiv 1$ remaining conditional on P8 and giving the packing representation $(1 + \delta_H(\tau))^{(2/d_{op})}$ on that branch; conditional operational-refinement fixed point: $Z_{(H,\infty)}^{space} = 1$ under the bridge, with an explicit rate envelope in (δ_H, d_{op}) and the $\ell \to 0$ and $\tau \to \infty$ limits kept explicitly distinct, their combined error bounded by the joint two-error certificate; sequential and spatial Higgs coefficients identified exactly, $g_H = Z_H^{space}$, with any physical-time attachment slope-constrained to $\Delta t_{phys} = a_t/c\star$ (Section 9.2).

Thus an entire class of possible normalisation uncertainties has been removed, the surviving operational scalar carries a packing representation conditional on the distance-functional bridge, and it has a numerical operational-fixed-point endpoint on the declared entropy-gradient/Fickian branch under that bridge. The physical Higgs prediction is still not unconditional, because the source status of the entropy-gradient refinement hypotheses remains open, and finite-regulator and finite-flow corrections need not vanish.

11.1 Updated dependency chain

The spatial branch now reads

$K = 7$ common Higgs line → neighbouring difference d → I_H^{can} → centred source numerator → refinement-frame proper distance → unit Laplace-Beltrami principal symbol → defect-silent protection → $Z_H^{space} = q_H^\dagger G_{op}^{direct} q_H$ → one-dimensional norm quadraticity (automatic) → ruler reduction to one state-wise scalar: $q_H^\dagger G_{op}^{direct} q_H = \gamma_H(\tau)^2 [Vol_{op}(M) \rho_{op}(x_H, \tau)]^{(2/d_{op})}$ → distance-functional bridge premise (P8: $\gamma_H(\tau) \equiv 1$) → $Z_H^{space}(\tau) = (1 + \delta_H(\tau))^{(2/d_{op})}$.

On the declared entropy-gradient/Fickian operational-refinement branch,

$\rho\_op(x, \tau) \to 1/Vol\_op(M)$

then gives

$\delta\_H(\tau) \to 0$

and hence, on the P8 branch of the chain above,

$Z\_(H,\infty)$^space = 1.

The Higgs-line ruler question is compressed into the single state-wise bridge scalar $\gamma\_H(\tau)$, and that bridge, together with the physical selection or derivation of the operational-flattening dynamics, forms the remaining conditional arrows on the spatial side. The sequential-spatial metric equality is exact and any physical-time attachment is normalisation-constrained as in Section 9.2. The physical pole calculation additionally awaits the attaching map itself, the absolute calibration and the quantum loop/threshold completion. The downstream gauge-normalisation audit (Appendix E) has sharpened the latter requirement: on the currently executed primitive PFDMI marked law, first-order terminal-record and completion Schur cross-blocks with the physical C/W/Y score vanish exactly, while the genuinely independent CAR/Fock-completion response begins at higher mixed differential order. The missing gauge contribution must therefore come from a source-derived nonfactorising same-mark law and/or the correctly graded higher-order matter/completion response; selector capacity alone is insufficient.

11.2 Error budget transferred to the leading-mass chain

The residual spatial-normalisation uncertainty now transfers to the completion chain's leading mass as an explicit bounded correction rather than an assumption.

Corollary 7.1: Leading-mass error budget

Grade: exact transfer; the packing form and linear envelope are stated on the bridge branch (P8, $\gamma\_H(\tau) \equiv 1$), the linear envelope additionally requiring $d\_op \geq 1$ and $|\delta\_H(\tau)| \leq 1/2$; the general three-parameter form without the bridge is displayed below.

By Proposition 7 the coordinate-invariant curvature ratio is $\mu\_H^2 = K\_H/Z\_H$^space, so at fixed source curvature the leading mass responds to the spatial residue as

$m\_H(\tau) = m\_H$^lead $\cdot$ Z_H^space(τ)^$(-1/2)$,

where m_H^lead denotes the chain value at Z_H^space = 1. Without the bridge, the unconditional representation Z_H^space $= \gamma\_H(\tau)^2 (1 + \delta\_H)$^$(2/d\_op)$ gives

$m\_H(\tau) = m\_H$^lead $\cdot\ \gamma\_H(\tau)^{-1} (1 + \delta\_H(\tau))$^$(-1/d\_op)$, $\log[m\_H(\tau)/m\_H$^lead$] = -\log \gamma_H(\tau) - (1/d_op) \log(1 + \delta_H(\tau))$, so until Route A succeeds the residual normalisation uncertainty in the leading mass is controlled by the triple $(\gamma_H(\tau), \delta_H(\tau), d_{op})$, collapsing to the pair $(\delta_H(\tau), d_{op})$ once the bridge fixes $\gamma_H(\tau) \equiv 1$. On the bridge branch the transfer is exact in logarithmic form,

$$\log[m_H(\tau)/m_H^{lead}] = -(1/2) \log Z_H^{space}(\tau) = -(1/d_{op}) \log(1 + \delta_H(\tau)),$$

valid for all $\delta_H > -1$. For $d_{op} \geq 1$ and $|\delta_H(\tau)| \leq 1/2$,

$$|m_H(\tau)/m_H^{lead} - 1| \leq (2/d_{op}) |\delta_H(\tau)|,$$

and the bound is sharp, with equality at $(d_{op}, \delta_H) = (1, -1/2)$.

Proof

The exact form follows from Proposition 6 and the logarithmic identity of Lemma 6.2. For the envelope with $\delta \in [0, 1/2]$, the mean value theorem gives $1 - (1 + \delta)^{(-1/d_{op})} = (1/d_{op})(1 + \xi)^{(-1-1/d_{op})} \delta \leq (1/d_{op}) \delta$. For $\delta \in [-1/2, 0]$, set $h(\delta) = -(2/d_{op})\delta - [(1 + \delta)^{(-1/d_{op})} - 1]$. Then $h(0) = 0$; $h(-1/2) = 1/d_{op} - (2^{(1/d_{op})} - 1) \geq 0$, because $(1 + 1/d_{op})^{(d_{op})} \geq 2$ for $d_{op} \geq 1$; and $h''(\delta) = -(1/d_{op})(1 + 1/d_{op})(1 + \delta)^{(-2-1/d_{op})} < 0$, so h is concave. A concave function nonnegative at both endpoints is nonnegative on the whole interval. Equality at $d_{op} = 1$, $\delta = -1/2$ is direct: $(1/2)^{(-1)} - 1 = 1 = 2 \cdot (1/2)$. QED.

Remark 7.2: Status of the transferred budget

The completion-programme matching previously carried $Z_H = 1$ as an assumption at the matching point. It now carries it as a bounded, executable correction: on the P8 bridge branch the maximal violation is controlled by the pair $(\delta_H(\tau_{match}), d_{op})$ and the correction vanishes at the operational fixed point on the Route B branch, while prior to Route A it is governed by the triple of Corollary 7.1; larger operational dimension suppresses the flow term at fixed packing contrast in either case. As an illustration only (neither value is a source return): $|\delta_H| = 10^{-2}$ with $d_{op} = 7$ bounds the leading-mass shift by $(2/7) \times 10^{-2} \approx 0.29$ percent, roughly 0.35 GeV on the chain value quoted above. By Theorem 8 the same budget governs the sequential kernel's field-space coefficient exactly, and hence the temporal residue conditionally on the physical-time attachment (Corollary 8.2); promotion of the leading mass to a physical pole additionally requires the attaching map, the absolute-calibration and the loop/threshold completions (D-HSPR6 to D-HSPR8), exactly as itemised in Section 10.8.

12. The Next Executable Calculation

The Higgs-line metric-identification problem has been reduced past the point of requiring a separate source-map calculation. The one-dimensional physical common line closes the global packing inner-product obstruction automatically, and the inherited one-Fact operational metric supplies the same operational-distinguishability norm. Thus

$$Z_H^{space}(\tau) = (1 + \delta_H(\tau))^{(2/d_{op})}$$

is the finite-flow Higgs-line result under the bridge premise, and the remaining metric step is a single state-wise scalar: the distance-functional bridge itself.

Route A: The Higgs-line distance-functional bridge ($\gamma_H(\tau) \equiv 1$)

Derive the bridge that Theorem 6.7 isolates, in its state-wise form: prove that the two local distance functionals coincide at every admissible Higgs-line operational state, that is, the one-Fact norm and the finite-packing norm on L_H are the local second-order forms of the same operational-distinguishability functional at each state, equivalently their unit balls on L_H coincide after flat-reference recovery along the whole flow. By Lemma 6.6 this forces $\gamma_H(\tau) \equiv 1$ identically, and it is the pass condition deliberately: a state-wise coincidence theorem is strictly stronger and cleaner than a derivation of $\gamma_H = 1$ at one distinguished operational point, and it removes any question of residual flow dependence. The derivation must be source-level with no measured inputs; a derived $\gamma_H(\tau) \neq 1$ at any admissible state would instead retype the one-Fact metric as physically distinct from the distinguishability ruler and propagate as $Z_H^{space} \to \gamma_H(\tau)^2 (1 + \delta_H)^{(2/d_{op})}$.

Route B: Physical operational-refinement selection

Derive the S_{op}-concavity/entropy-gradient/Fickian operational refinement from substrate primitives, or independently derive a source-selected operational evolution satisfying

$$\rho_{op}(x, \tau) \to 1/Vol_{op}(M).$$

This is now the principal remaining condition behind the numerical spatial fixed-point result. The later authoritative Operational Curvature and Unified Refinement papers must control the grade; the superseded partition-counting argument must not be restored (F-HSPR19).

Together with a Route A pass, a pass here physically promotes $Z_{(H,\infty)}^{space} = 1$; without Route A it fixes the packing contribution while the endpoint remains $\lim_{(\tau\to\infty)} \gamma_H(\tau)^2$, if that limit exists.

Route C: Finite-flow approach

Evaluate

$$\delta_H(\tau) = Vol_{op}(M)\, \rho_{op}(x_H, \tau) - 1$$

on the surviving physical branches and determine d_{op} from the actual projected admissible operational image. Then compute

$$Z_H^{space}(\tau) = (1 + \delta_H(\tau))^{(2/d_{op})}$$

and test its approach to one using

$$|Z_H^{space}(\tau) - 1| \leq (4/d_{op})|\delta_H(\tau)|$$

on the domain of Lemma 6.2, with every reported kernel deviation checked against the joint two-error certificate of Theorem 6.5 on its domain.

Separately verify the spatial regulator convergence in ℓ. No regulator level is to be identified with a value of operational flow time.

Route D: Physical-time attaching map, REDUCED TO A NORMALISATION-CONSTRAINED MAP

The field-space part of this route is executed within the paper (Theorem 8): exact defect silence gives

$$g_H = q_H^\dagger G_{op}^{phys} q_H = q_H^\dagger G_{op}^{direct} q_H = Z_H^{space},$$

so no independent temporal field-space normalisation exists. Corollary 8.1 then forces any admissible sequential-opportunity-to-physical-time attachment to satisfy

$$\Delta t_{phys} = a_t/c\star.$$

The remaining execution is the map itself: derive, from the history-mark and closure-traversal structures whose non-bijectivity the MFKR audit records, the source map identifying one sequential opportunity with displacement along the emergent timelike commitment direction, and verify that its local normalisation satisfies the Corollary 8.1 constraint. Once that map passes, $Z_H^{time} = Z_H^{space}$ follows without another free coefficient, and only then should the existing Higgs potential and pole chain be promoted, together with the calibration and loop completions, to a complete physical two-point result.

Parallel non-blocking extension

A complete source derivation of

$$G_{op}^{direct}|_{(\ker J_D)}$$

on all four protected directions remains worthwhile as a general operational-geometry result. It is no longer a prerequisite for the Higgs-line calculation.

13. Premise, Falsifier and Debt Ledgers

13.1 Premise ledger

P1. Declared physical $D = 3$ branch. The refinement spatial calculation is evaluated on the inherited physical three-spatial-dimensional branch; HSPR-1 does not derive $D = 3$.

P2. Transitive Higgs-gradient branch. The physical spatial closure carrier is the declared transitive branch on which the earlier symmetry no-go and canonical injection were established.

P3. Declared attachment class. I_H^{can} is inherited as the unique injection within the endpoint-local, nonnegative integer one-arrival/one-departure class; primitive selection of that class remains upstream.

P4. Source-derived refinement metric. Proper spatial distance ℓ_a and the orthonormal frame are supplied by the later refinement-transport/soldering programme.

P5. Exact common Higgs line. $q_H = (1/2)(1, 1, 1, 1)$ and $J_D q_H = 0$ are inherited full-faithful source returns.

P6. Defect-mediated class. The exact protection theorem applies to corrections that reach configuration space through J_D. A future genuinely non-defect-mediated same-action structure must be included in G_{op}^{direct} rather than falsely declared zero.

P7. Positive physical metric. The full physical operational metric G_{op}^{phys} is admitted positive on the physical tangent; positivity of Z_H^{space} then follows by Lemma 5.0 and Corollary 5.3 without a separate positivity assumption on the direct part.

P8. Higgs-line distance-functional bridge. Restricted to $L_H = \mathrm{span}\{q_H\}$, the packing norm and the one-Fact norm are each automatically quadratic by Lemma 6.6, so Theorem 6.7 reduces their comparison exactly, at each operational flow state, to one conversion scalar $\gamma_H(\tau) > 0$. This premise asserts the state-wise bridge that fixes it: the two local distance functionals coincide at every admissible Higgs-line operational state, equivalently their unit balls on L_H coincide after flat-reference recovery along the whole flow, hence $\gamma_H(\tau) \equiv 1$. The bridge is motivated by the source typing of G_{op} as the inherited distinguishability ruler but is not yet an inherited corpus theorem; its derivation is Route A of Section 12 and the remaining content of D-HSPR3. Without it, every result below holds with $Z_H^{space}(\tau) = \gamma_H(\tau)^2 (1 + \delta_H(\tau))^{(2/d_{op})}$ and fixed-point value $\lim_{(\tau\to\infty)} \gamma_H(\tau)^2$, assuming that limit exists. This premise does not assert the corresponding full-matrix identity on $\ker J_D$.

P9. Operational flattening branch. The numerical operational-fixed-point return $Z_{(H,\infty)}^{space} = 1$ additionally consumes the Operational Curvature entropy-gradient/Fickian refinement branch, including the S_{op}-concavity and regularity/coverage hypotheses required for the asymptotic uniform-density result.

P10. Operational dimension bound. The rate-transfer bound of Lemma 6.2 additionally assumes $d_{op} \geq 1$ and applies only on the domain $|\delta_H(\tau)| \leq 1/2$; the exact logarithmic transfer holds for all $\delta_H > -1$.

P11. Fixed-point evaluation point. The evaluation of Corollary 6.1 assumes either that x_H is stationary under the operational refinement flow, or that the inherited flattening is uniform on M_op, $\sup_x |\rho_{op}(x, \tau) - 1/\mathrm{Vol}_{op}(M)| \to 0$. The inherited source wording states pointwise approach only, so one of these alternatives must be carried as an explicit hypothesis for a flow-dependent x_H(τ).

P12. Full-subspace metric characterisation. The inherited Operational Curvature uniqueness characterisation remains available for any future extension from L_H to the complete protected subspace: locality, Z_7-equivariance, channel uniformity, distinguishability counting and flat-reference recovery jointly determine the operational metric in the declared class. This full-subspace extension is no longer load-bearing for the scalar Higgs residue.

P13. Lorentzian attachment target. Corollary 8.1 consumes the already-derived Lorentzian continuum metric, the unique timelike commitment direction and the future-directed time orientation as the target of the attaching problem, and the local slope $\Delta t_{phys} = f'(0)$ of the phase relation $\omega = f(\Omega)$ as the constrained normalisation of any admissible attachment. Neither a primitive background time nor the existence of the attaching map itself is assumed; the map remains open (D-HSPR6).

P14. Common operational metric. The sequential one-Fact coefficient and the spatial field-space coefficient are evaluated on the same physical common Higgs line and at the same operational-flow state. The identity g_H = Z_H^space follows from Lemma 5.0 and is not a separate normalisation premise.

13.2 Falsifier ledger

F-HSPR1. If the primitive substrate selects an attachment class for which the physical Higgs injection is not equivalent to I_H^can, Theorems 1 to 3 must be recomputed on the selected class.

F-HSPR2. If the source-selected physical multi-cell carrier is not transitive in the sense required by the prior symmetry theorem, a direct local scalar channel may reopen and the gradient-first conclusion cannot be imported unchanged.

F-HSPR3. If the source-derived refinement ruler does not convert the canonical numerator to $(S - S^{-1})/(2\ell)$ at leading order, the unit geometric-residue theorem fails and the physical spatial coefficient must be recomputed.

F-HSPR4. If a claimed defect/history/bath correction does not factor through J_D, Theorem 4 does not set it to zero. Such a correction belongs to G_op^direct and must be evaluated directly.

F-HSPR5. If an operator of the form J_D† M J_D is found to have nonzero q_H projection while J_D q_H = 0, the source algebra is inconsistent.

F-HSPR6. If the physical operational metric is nonpositive on q_H, the admitted positive one-Fact kinetic geometry fails on the Higgs common line.

F-HSPR7. Setting $Z_H^{space} = 1$ for the finite-regulator raw coordinate h solely because a canonical whitened chart gives $q_H^\dagger q_H = 1$ is a grade error.

F-HSPR8. Setting finite-flow $\delta_H = 0$ from continuum homogeneity or Lorentz refinement isotropy conflates continuum tangent geometry with operational-state-space packing.

F-HSPR9. Setting $d_{op} = 187$ solely because the physical tangent has dimension 187 is a typing violation until the operational-image dimension is proved equal to it.

F-HSPR10. Using the spatial result alone as a complete 3+1 Higgs wavefunction residue before the sequential-opportunity-to-physical-time attaching map is source-derived, its normalisation being constrained by Corollary 8.1, conflates spatial refinement geometry with emergent physical duration.

F-HSPR11. Using the measured Higgs mass, measured electroweak vev or a target Z_H to select G_{op}^{direct}, δ_H, d_{op}, the attachment class or a branch voids the source-derived grade.

F-HSPR12. Reporting $Z_{(H,\infty)}^{space} = 1$ as an unconditional physical source theorem without both the derived state-wise bridge ($\gamma_H(\tau) \equiv 1$) and the source-selected or derived operational-flattening dynamics remains a grade violation. Theorem 6.7 reduces the Higgs-line metric identity to the bridge scalar; neither the bridge nor the fixed-point dynamics is closed.

F-HSPR13. Reporting the fixed-point value without source-selecting the entropy-gradient/Fickian flattening dynamics, or without the S_{op}-concavity hypothesis required by the inherited theorem, converts a conditional operational result into an unconditional one.

F-HSPR14. Replacing the finite-flow function $Z_H^{space}(\ell, \tau)$ by its $\tau \to \infty$ value at every flow time or regulator level confuses an asymptotic operational-fixed-point statement with a finite-regulator or finite-flow identity.

F-HSPR15. Applying the linear rate bound of Lemma 6.2 outside its domain, that is with $|\delta_H(\tau)| > 1/2$ or with $d_{op} < 1$, or quoting it unconditionally without premises P8 to P10, is a grade error; outside the linear domain only the exact logarithmic transfer may be used.

F-HSPR16. Evaluating ζ_H along a flow-dependent trajectory $x_H(\tau)$ using only pointwise density convergence, without flow-stationarity of x_H or uniform convergence on M_{op} (P11), is a gap: pointwise flattening at each fixed point does not by itself control a moving evaluation point.

F-HSPR17. Identifying the spatial regulator limit $\ell \to 0$ with the operational flow limit $\tau \to \infty$, or substituting a regulator level for a flow time (or conversely) without a proved correspondence, is a typing error; the two convergences must be reported separately as in Section 8.5.

F-HSPR18. Extending the Higgs-line identity of Theorem 6.7 to the whole four-dimensional ker J_D solely because every individual one-dimensional restriction is quadratic is a grade error. Separate one-dimensional quadraticity does not determine cross-terms or a common multidimensional inner product. A full protected-subspace metric still requires the appropriate source-derived multidimensional construction.

F-HSPR19. Promoting the entropy-gradient/Fickian flow or S_op concavity to source-derived status by resurrecting the superseded partition-counting concavity argument is a provenance error: the later authoritative Operational Curvature and Unified Refinement results deliberately retain concavity as a hypothesis, and the earlier argument does not survive them.

F-HSPR20. Applying the joint two-error certificate of Theorem 6.5 outside its domain, that is with $\max_a |p_a \ell_a| > 1$ for the envelope or outside the Lemma 6.2 domain for the substituted form, or quoting the substituted form without premises P8 to P10, is a grade error.

F-HSPR21. The bridge scalar γ_H(τ) must be returned by derivation, not assignment. Asserting γ_H(τ) ≡ 1 without the derived state-wise distance-functional bridge of Route A, inserting a numerical γ_H ≠ 1 without a source derivation, and treating γ_H as a flow-independent constant before the bridge is derived, are equally grade errors: prior to Route A only the state-wise scalar γ_H(τ) is defined. A future source that genuinely derives γ_H(τ) ≠ 1 must retype the one-Fact metric as physically distinct from the distinguishability-counting metric and propagate the factor explicitly as Z_H^space = γ_H(τ)^2 (1 + δ_H)^(2/d_op), rather than inserting an unexplained gain into HSPR-1.

F-HSPR22. Applying the leading-mass envelope of Corollary 7.1 outside its domain (|δ_H(τ)| > 1/2 or d_op < 1), quoting it without the Higgs-line packing representation it depends on, or reading it as a pole-level statement before the remaining calibration and loop/threshold corrections are returned, is a grade error; outside the linear domain only the exact logarithmic transfer may be used.

F-HSPR23. Independent temporal-residue insertion. Introducing a temporal Higgs residue independent of q_H† G_op^phys q_H, while retaining the same one-Fact operational metric and J_D q_H = 0, double-counts the physical Higgs-line norm.

F-HSPR24. Background-time smuggle. Interpreting Δt_phys = a_t/c⋆ as the duration of one Fact relative to a deeper external clock, rather than as the normalisation constraint on the attaching relation to emergent Lorentzian proper time, violates the fact-time ontology of the construction.

F-HSPR25. Absolute-clock overclaim. Converting a_t/c⋆ to a numerical number of SI seconds without a derived comparison to a reference fact-counting clock is a calibration smuggle.

F-HSPR26. Principal-symbol overextension. Using the conditional equality Z_H^time = Z_H^space to claim exact finite-regulator Lorentz covariance of all higher-order ω and p corrections is a grade error. The present theorem closes the local continuum principal symbol; the exact finite-step temporal kernel and finite-spatial-regulator kernel retain different higher-order functions, with the quantitative gap bounded by the Corollary 8.3 envelopes on their domains.

F-HSPR27. Pole-promotion overclaim. The finite-step pole formula may not be reported as a physical Higgs mass prediction before the physical-time attaching map, the physical K_H, flow status, absolute calibration and remaining loop/threshold bridges are closed.

F-HSPR28. Attachment overclaim. Reporting $\Delta t_{phys} = a_t/c\star$ or $Z_H^{time} = Z_H^{space}$ as source-derived results, rather than as, respectively, a necessary normalisation constraint on and a conditional consequence of the still-open sequential-opportunity-to-physical-time attaching map, contradicts the MFKR audit and is a grade error.

13.3 Debt ledger

D-HSPR1. Primitive-select the physical Higgs attachment class, or derive the physical replacement of I_H^{can}.

D-HSPR2. OPTIONAL WIDER EXTENSION: derive the complete direct physical operational metric on the four-dimensional defect-silent tangent subspace ker J_D. This is no longer required to evaluate the Higgs-line scalar.

D-HSPR3. REDUCED ON THE HIGGS LINE TO THE BRIDGE SCALAR. Lemma 6.6 removes the multidimensional squaring obstruction on L_H, and Theorem 6.7 compresses the one-Fact/packing comparison there into the single state-wise conversion scalar $\gamma_H(\tau)$. Remaining content: derive the state-wise distance-functional bridge, coincidence of the two local distance functionals at every admissible operational state (equality of unit balls on L_H after flat-reference recovery, or identity of the second-order local forms of one distinguishability functional), forcing $\gamma_H(\tau) \equiv 1$ (Route A). The typed-map-plus-five-properties programme remains an available route to the complete four-dimensional protected metric but is not load-bearing for Z_H^{space}.

D-HSPR4. Derive the S_{op}-concavity/entropy-gradient operational refinement from substrate primitives, or prove an alternative source-selected physical refinement theorem with the same asymptotic uniform-density fixed point.

D-HSPR5. Once D-HSPR3 and D-HSPR4 pass, execute the two-index $Z_H^{space}(\ell, \tau)$: determine finite-flow $\delta_H(\tau)$ and d_{op}, verify operational-flow convergence in τ and regulator convergence in ℓ separately across the surviving branches, without identifying regulator levels with flow times, and test the approach to unity against the Lemma 6.2 and Theorem 6.5 envelopes.

D-HSPR6. PARTIALLY CLOSED / REDUCED TO THE PHYSICAL ATTACHING MAP. The common-Higgs metric equality is exact, $g_H = Z_H^{space}$, and any valid sequential-opportunity-to-Lorentzian-time attachment is consequently forced to satisfy $\Delta t_{phys} = a_t/c\star$. What remains open is the source-derived event/traversal map establishing that a sequential opportunity corresponds to the relevant displacement along the emergent timelike commitment direction; the MFKR audit records the history-mark/closure-traversal structures as not one-to-one. Once that map passes, $Z_H^{time} = Z_H^{space}$ follows without another free coefficient.

D-HSPR7. Pole, gauge and threshold completion. With the sequential-spatial Higgs metric equality exact and the physical-time attachment normalisation constrained, complete the attaching map and the physical gauge/Yukawa self-energy, threshold, running and scheme-to-pole bridge on the same frozen source branch before promoting the numerical Higgs pole. The subsequent D41 same-mark audit sharpens the gauge part of this debt. At the currently executable first-order PFDMI probability-score grain, $C_{(CWY,R)}^{(1)} = 0$ and $C_{(CWY,H)}^{(1)} = 0$, while the shared-link CAR/Fock gauge derivative is not an independent first-order nuisance coordinate and the first genuinely new CAR/Fock-completion contribution is higher-order. Thus no first-order record/completion D41 subtraction is presently licensed. A physical gauge relaxation must instead be returned by a source-derived nonfactorising fine-mark coupling or by its correctly graded higher-order mixed-jet continuation, after which the physical gauge contribution may be propagated into the Higgs two-point and pole calculation.

D-HSPR8. Absolute fact-clock calibration. Determine the physical conversion between the primitive fact-counting process and a specified reference physical clock. This is a calibration between emergent clocks, not the duration of a Fact against a deeper background time.

14. Formal Verdict

Object	HSPR-1 grade
Physical common Higgs line q_H	SOURCE-DERIVED / UNIT REFERENCE DIRECTION
Defect silence $J_D q_H = 0$	EXACT INHERITED FULL-FAITHFUL RESULT
Neighbour difference $d = S - I$	SOURCE-NATIVE ON DECLARED TRANSITIVE BRANCH
$I_H^{can} = (I + S^{-1})/\sqrt{2}$	EXACT WITHIN DECLARED ATTACHMENT CLASS
$I_H^{can} d = (S - S^{-1})/\sqrt{2}$	EXACT
Full rank on Q_6	EXACT / SIX NONZERO SINGULAR VALUES
Whitened graph kernel $2 \sin^2\theta$	EXACT CANONICAL GRAPH RESULT
Promotion of graph coefficient 2 to physical Z_H	REJECTED
Source-derived spatial ruler/refinement frame	SOURCE-DERIVED AT REFINEMENT-GEOMETRY GRADE
Physical centred derivative	NEW / DERIVED: $(S - S^{-1})/(2\ell)$
Finite spatial symbol	NEW / EXACT: $\sin^2(p\ell)/\ell^2$
Spatial Laplace-Beltrami principal symbol	NEW / SOURCE-DERIVED PASS
Independent geometric spatial Higgs residue	ELIMINATED: $Z_{geom}^{space} = 1$
Defect Fisher renormalisation on q_H	ZERO EXACTLY

Object	HSPR-1 grade
Defect-mediated history renormalisation on q_H	ZERO EXACTLY
Unresolved-bath Schur renormalisation on q_H	ZERO EXACTLY
Scalar commitment-bath renormalisation on q_H	ZERO EXACTLY
Defect-mediated mixing of q_H with any tangent direction	ZERO EXACTLY (TWO-SIDED)
Protected defect-silent tangent dimension	4
Decomposition independence of the Higgs projection	EXACT (LEMMA 5.0)
Positivity of Z_H^{space}	INHERITED FROM ADMITTED POSITIVE G_{op}^{phys}
Finite-flow raw-field spatial residue	REDUCED TO $q_H^\dagger G_{op}^{direct}(\tau) q_H$, DECOMPOSITION-INDEPENDENT
Canonically normalised physical-field spatial residue	EXACTLY 1
Packing norm on L_H	DERIVED FROM FINITE DISTINGUISHABILITY UNDER INHERITED PACKING-NORM PREMISES
Quadraticity of packing norm on L_H	EXACT; AUTOMATIC IN ONE DIMENSION
Higgs-line ruler comparison	REDUCED EXACTLY TO ONE STATE-WISE SCALAR $\gamma_H(\tau)$ (THEOREM 6.7)
Same-source packing/one-Fact metric identity on L_H	CONDITIONAL ON THE DISTANCE-FUNCTIONAL BRIDGE (P8)
Bridge scalar $\gamma_H(\tau)$	SOLE REMAINING HIGGS-LINE NORMALISATION FREEDOM; $\gamma_H(\tau) \equiv 1$ UNDER P8; STATE-WISE DERIVATION OPEN (ROUTE A)
Operational-packing representation	CONDITIONAL ON P8: $Z_H^{space} = (1 + \delta_H)^{(2/d_{op})}$; UNCONDITIONALLY $\gamma_H(\tau)^2 (1 + \delta_H)^{(2/d_{op})}$
Complete metric identity on four-dimensional $\ker J_D$	OPEN / NOT REQUIRED FOR HIGGS SCALAR
Operational entropy-gradient/Fickian flattening	INHERITED CONDITIONAL; S_{op} CONCAVITY NOT YET SUBSTRATE-DERIVED
Asymptotic operational density	CONDITIONAL: $\rho_{op} \to 1/\mathrm{Vol}_{op}(M)$
Asymptotic packing contrast	CONDITIONAL: $\delta_H(\infty) = 0$
Separation of $\ell \to 0$ and $\tau \to \infty$ limits	EXPLICIT; ITERATED LIMIT $\lim_{\tau\to\infty} [\lim_{\ell\to 0} Z_H^{space}(\ell, \tau)] = \lim_{\tau\to\infty} \gamma_H(\tau)^2$, = 1 UNDER P8, CONDITIONAL
Flow-stationarity of x_H or uniform density convergence	STATED HYPOTHESIS (P11)

Object	HSPR-1 grade
Joint two-error propagation certificate	EXACT ENVELOPE; SUBSTITUTED FORM CONDITIONAL ON P8 TO P10
General pre-bridge three-error certificate	EXACT (COROLLARY 6.5.2); COLLAPSES TO THE TWO-ERROR FORM UNDER P8
Leading-mass error budget (Corollary 7.1)	EXACT LOG TRANSFER; SHARP LINEAR ENVELOPE $\|\Delta m_H\|/m_H \le (2/d_{op})\|\delta_H\|$ ON ITS DOMAIN
Full-subspace metric route (typed map + five properties)	AVAILABLE FOR THE WIDER EXTENSION; NOT LOAD-BEARING FOR THE HIGGS SCALAR
Superseded partition-counting concavity derivation	REJECTED; LATER SOURCE CORRECTION RESPECTED
Operational-fixed-point raw-field spatial residue on flattening branch	CONDITIONAL ON BRIDGE AND PHYSICAL FLOW SELECTION: $Z_{(H,\infty)}^{space} = 1$; WITHOUT THE BRIDGE $\lim_{(\tau\to\infty)} \gamma_H(\tau)^2$ (IF IT EXISTS)
Finite-flow rate envelope	CONDITIONAL EXACT BOUND: $\|Z_H^{space} - 1\| \le (4/d_{op})\|\delta_H\|$ ON ITS DOMAIN
Numerical finite-flow $\delta_H(\tau)$	OPEN
Numerical d_{op}	OPEN FOR FINITE-FLOW CORRECTIONS; NOT NEEDED FOR FIXED-POINT VALUE
Substitution $d_{op} = 187$	FORBIDDEN UNTIL PROVED
Substitution finite-flow $\delta_H = 0$ from continuum homogeneity	FORBIDDEN
Primitive selection of attachment class	OPEN
Regulator/branch convergence to unit fixed point	OPEN PENDING PHYSICAL FLOW PROMOTION
Local physical 3+1 Higgs kinetic residue	CONDITIONAL ON PHYSICAL-TIME ATTACHING MAP; FIELD-SPACE NORMALISATION REDUCED TO THE SINGLE STATE-WISE BRIDGE SCALAR $\gamma_H(\tau)$
Sequential common-Higgs coefficient g_H	$q_H^\dagger G_{op}^{phys} q_H$
Equality $g_H = Z_H^{space}$	EXACT FROM DEFECT SILENCE / DECOMPOSITION INDEPENDENCE
Continuum timelike commitment direction	SOURCE-DERIVED IN LORENTZ-TRANSPORT PROGRAMME
Sequential opportunity to physical timelike displacement	OPEN ATTACHING MAP (MFKR AUDIT)
Required normalisation of any valid attachment	DERIVED CONSTRAINT: $\Delta t_{phys} = a_t/c\star$
Physical phase relation $\omega/a_t = \Omega/c\star$	CONDITIONAL ON ATTACHING MAP

Object	HSPR-1 grade
Independent temporal Higgs field-space gain	ELIMINATED
Local equality Z_H^time = Z_H^space	CONDITIONAL CONSEQUENCE OF ATTACHMENT
Local 3+1 Lorentzian Higgs principal symbol	CONDITIONAL ON PHYSICAL-TIME ATTACHMENT
Operational-fixed-point temporal residue	CONDITIONAL ON BRIDGE, FLOW AND ATTACHMENT: Z_(H,∞)^time = 1
Sequential/spatial discretisation certificate	EXACT ENVELOPES $\omega^2/12$ AND $\max_a(p_a^2\ell_a^2)/3$; PHYSICAL TEMPORAL READING CONDITIONAL ON ATTACHMENT
Sequential finite-step pole relation	EXACT IN SEQUENTIAL SPECTRAL VARIABLE
Physical finite-step energy relation	CONDITIONAL ON PHYSICAL-TIME/CLOCK ATTACHMENT
Absolute seconds-per-Fact calibration	OPEN / DIFFERENTLY TYPED
Exact all-orders finite-step Lorentz covariance	NOT CLAIMED
Physical C/W/Y native PFDMI probability score	SOURCE-DERIVED / FULL-RANK ON ADMITTED FINITE-OCCUPATION BRANCH
First-order C/W/Y-terminal-record Fisher cross-block	ZERO EXACTLY ON CURRENT PRIMITIVE SAME-MARK LAW
First-order C/W/Y-completion Fisher cross-block	ZERO EXACTLY ON CURRENT FACTORISED SAME-MARK LAW
Shared-link CAR/Fock gauge derivative as independent first-order nuisance	REJECTED AS DOUBLE COUNTING OF THE SAME PHYSICAL LINK
Independent CAR/Fock-completion response	HIGHER-ORDER MIXED JET; NOT AN ORDINARY FIRST-ORDER PFDMI NUISANCE SCORE
Earlier completion/CAR selector overlap	CAPACITY RESULT ONLY; NOT AN ACTIVATED D41 SCHUR SUBTRACTION
First-order current-action D41 Schur reduction	NONE: Z_CWY^(1) = D_CWY
Physical higher-order / nonfactorised gauge relaxation	OPEN / REQUIRED FOR FULL GAUGE AND HIGGS-POLE COMPLETION
Existing Higgs numerical chain	STRENGTHENED IN PROVENANCE; NOT YET PROMOTED TO UNCONDITIONAL PHYSICAL STATUS

15. Scientific Conclusion

The previous Higgs-radial bridge had already done the difficult structural part of the spatial mechanism. It showed that a common local Higgs scalar cannot, on the declared transitive carrier, linearly excite the nonuniform spatial closure sector, while a neighbouring difference can. It then built the source-compatible neighbouring-difference injection explicitly and showed that its long-wavelength kernel is $O(k^2)$, full rank on Q_6 and free of any fitted gain.

The remaining normalisation problem looked wider than it now is because three questions were mixed together: the graph-coordinate coefficient, the physical spatial ruler, and the physical field-space norm.

The later refinement-geometry programme separates them. The source-derived refinement frame supplies the proper spatial ruler. When that ruler is applied to the already-derived Higgs numerator, the canonical injection becomes exactly the ordinary centred derivative,

$(S - S^{-1})/(2\ell)$.

Its square has symbol $\sin^2(p\ell)/\ell^2$ and therefore converges to p^2. Summed over the orthonormal refinement frame it gives the unit Laplace-Beltrami principal symbol. The old number 2 is thereby identified for what it was: the norm of a dimensionless centred numerator in a whitened graph chart, not a physical wavefunction residue.

So the spatial geometric question closes:

$Z_{geom}^{space} = 1$.

The second result closes a different class of uncertainty. The common Higgs line is exactly defect-silent, $J_D q_H = 0$. This makes the line invisible not just to the original six-defect quadratic form but to every correction that reaches configuration space by factorising through J_D, and the annihilation is two-sided: no such correction can even mix the Higgs line with another tangent direction. The unresolved history bath, the defect Fisher metric, frequency-dependent defect dressing and the scalar commitment bath therefore all have exactly zero common-Higgs projection. No amount of refinement of those sectors can generate the missing spatial Higgs coefficient.

The raw-field physical spatial residue is consequently

$Z_H^{space}(\tau) = q_H^\dagger G_{op}^{direct}(\tau)\, q_H$,

a quantity that Lemma 5.0 proves independent of how the physical metric is split into direct and defect-mediated parts and whose positivity is inherited from the admitted positive full operational metric.

The final spatial metric-identification step is compressed on the Higgs line into a single scalar. The finite-packing reconstruction supplies a genuine operational norm but correctly leaves open the multidimensional question of whether that norm determines a unique Hilbert inner product. The common Higgs carrier is only one-dimensional. On

$L\_H = \mathrm{span}\{q\_H\}$,

norm homogeneity forces the parallelogram identity identically and hence supplies a unique quadratic metric. The one-Fact construction independently declares G_op to be the inherited operational tangent metric and uses its norm as operational distinguishability; the same automatic quadraticity applies to it. Two quadratic forms on one line differ by a single positive scalar, so at each operational state the whole comparison collapses to one conversion factor:

$$Z\_H^{space}(\tau) = q\_H^\dagger\, G\_op^{direct}(\tau)\, q\_H = \gamma\_H(\tau)^2\, [Vol\_op(M)\, \rho\_op(x\_H, \tau)]^{(2/d\_op)} = \gamma\_H(\tau)^2\, (1 + \delta\_H(\tau))^{(2/d\_op)}.$$

The arbitrary relative gain is thereby reduced, not yet eliminated: $\gamma\_H(\tau) \equiv 1$ is the explicit distance-functional bridge premise P8, coincidence of the two local distance functionals at every admissible operational state, and its state-wise derivation is the named next metric calculation (Route A of Section 12).

This statement is an exact structural reduction, narrower than a derivation of the complete operational metric. The four-dimensional protected subspace may still carry a genuine multidimensional inner-product problem; HSPR-1 does not need to solve it.

The remaining numerical spatial uncertainty at finite operational flow is therefore carried by the triple $(\gamma\_H(\tau), \delta\_H(\tau), d\_op)$, and collapses to the packing observables $(\delta\_H(\tau), d\_op)$ once Route A fixes the bridge. None of these is inserted from observation or from the unrelated dimension 187.

The operational-curvature dynamics then supply the remaining conditional step. On the declared entropy-gradient/Fickian refinement branch, subject to the inherited S_op-concavity, regularity and convergence assumptions,

$$\rho\_op(x, \tau) \to 1/Vol\_op(M),$$

so

$$\delta\_H(\tau) \to 0$$

and

$$Z\_(H,\infty)^{space} = 1$$

under the bridge premise, and unconditionally $\lim\_{(\tau\to\infty)} \gamma\_H(\tau)^2$, assuming that limit exists. The conditionality of this endpoint therefore sits in exactly two places: the state-wise distance-functional bridge and the physical operational-flow law.

The two limits remain independently typed. The spatial regulator limit $\ell \to 0$ gives the unit Laplace-Beltrami spatial symbol exactly, while $\tau \to \infty$ is the operational-density fixed point. Their errors remain bounded, on the P8 bridge branch and its declared domain, by

$|K_{(H,grad)}^{space}(p; \ell, \tau)/p^2 - 1| \leq (4/d_{op})|\delta_H(\tau)| + (1/3) \max_a (p_a^2 \ell_a^2)$,

the pre-bridge form adding the term $|\gamma_H(\tau)^2 - 1|$ (Corollary 6.5.2). Through the coordinate-invariant ratio $\mu_H^2 = K_H/Z_H^{space}$, the same control transfers to the leading Higgs mass of the completion chain as a bounded, executable correction, $|m_H(\tau)/m_H^{lead} - 1| \leq (2/d_{op})|\delta_H(\tau)|$ on the same domain, vanishing at the operational fixed point.

The spatial result has one further consequence. The one-Fact sequential kernel is governed on the common Higgs line by

$g_H = q_H^\dagger G_{op}^{phys} q_H$,

while the spatial calculation is governed by

$Z_H^{space} = q_H^\dagger G_{op}^{direct} q_H$.

Exact defect silence and decomposition independence prove that these are the same scalar:

$g_H = Z_H^{space}$.

Thus space and sequential Fact evolution do not carry two independently selectable Higgs kinetic normalisations. What has not yet been derived is the map from one sequential opportunity to a physical Lorentzian interval: the MFKR audit records the history-mark and closure-traversal structures as not one-to-one, and the Lorentz-transport programme supplies the continuum timelike target without supplying that map. HSPR-1 instead constrains the missing map completely in its normalisation: any admissible attachment $\omega = \Omega\, \Delta t_{phys}$ must satisfy

$\Delta t_{phys} = a_t/c_\star$, $\omega/a_t = \Omega/c_\star$.

Conditional on such an attachment, the local continuum Higgs two-point operator takes the form

$\Gamma_H^{(2)} = K_H + Z_H(\tau)\, [-\Omega^2/c_\star^2 + g^{ij} p_i p_j] + \ldots$,

with

$Z_H^{time}(\tau) = Z_H^{space}(\tau)$,

and the operational packing result applies to the common 3+1 principal-symbol coefficient, $Z_H(\tau) = (1 + \delta_H(\tau))^{(2/d_{op})}$, so that on the declared entropy-gradient/Fickian operational-refinement branch, conditional on the bridge premise, the flow hypotheses and the attaching map,

$Z_{(H,\infty)}^{time} = Z_{(H,\infty)}^{space} = 1$.

The remaining temporal uncertainty is therefore not an independent Higgs wavefunction factor: it is the attaching map itself, whose local normalisation is already fixed, plus the absolute calibration between the primitive fact clock and reference physical clocks; on the spatial side the one remaining normalisation quantity is the state-wise bridge scalar $\gamma_H(\tau)$. The exact one-Fact kernel additionally gives the sequential finite-step pole relation

$$\varepsilon_H = (2/a_t) \operatorname{arsinh}[(a_t/2) \sqrt{(K_H/Z_H)}],$$

exact in the sequential spectral variable, whose promotion through $E = \hbar c_\star \varepsilon$ to a physical-energy formula, with continuum limit $E_H \to \hbar c_\star \sqrt{(K_H/Z_H)}$ and $m_H^2 = K_H/Z_H$ in natural units, is conditional on the same attachment. This strengthens the architecture of the Higgs pole calculation but does not itself promote the existing numerical mass: the attaching map, the physical gauge and Yukawa self-energies, threshold bridge, scheme matching, operational-flow grade and absolute calibration remain separately required.

The programme-level Higgs chain can therefore be written

canonical gradient → physical spatial ruler → defect-silent protection → Higgs-line ruler reduction to one state-wise scalar $\gamma_H(\tau)$ → (bridge premise P8: $\gamma_H(\tau) \equiv 1$) → $Z_H^{space} = q_H^\dagger G_{op}^{direct} q_H = q_H^\dagger G_{op}^{phys} q_H = g_H$ → attachment constraint $\Delta t_{phys} = a_t/c_\star$ → (conditional on the attaching map) $Z_H^{time} = Z_H^{space}$ and $\Gamma_H^{(2)} = K_H + Z_H [-\Omega^2/c_\star^2 + g^{ij} p_i p_j] + \ldots$ → $Z_H(\tau) = (1 + \delta_H(\tau))^{(2/d_{op})}$ → conditional operational flattening → $Z_{(H,\infty)} = 1$.

The correct updated terminal status is:

CANONICAL HIGGS GRADIENT INJECTION: PASS WITHIN DECLARED ATTACHMENT CLASS.

SOURCE-DERIVED SPATIAL RULER AND LAPLACE-BELTRAMI NORMALISATION: PASS.

DEFECT/HISTORY/BATH/COMMITMENT RENORMALISATION OF THE COMMON HIGGS LINE: ZERO EXACTLY.

HIGGS-LINE RULER COMPARISON: REDUCED EXACTLY TO THE SINGLE STATE-WISE BRIDGE SCALAR $\gamma_H(\tau)$; $\gamma_H(\tau) \equiv 1$ CONDITIONAL ON THE STATE-WISE DISTANCE-FUNCTIONAL BRIDGE (P8), WHOSE DERIVATION IS THE NAMED NEXT METRIC CALCULATION.

SEQUENTIAL AND SPATIAL HIGGS METRIC COEFFICIENTS: IDENTICAL EXACTLY, $g_H = Z_H^{space}$.

SEQUENTIAL-OPPORTUNITY-TO-PHYSICAL-TIME ATTACHING MAP: OPEN (MFKR AUDIT), WITH NORMALISATION FIXED: $\Delta t_{phys} = a_t/c_\star$.

LOCAL 3+1 LORENTZIAN HIGGS PRINCIPAL SYMBOL: CONDITIONAL ON THE PHYSICAL-TIME ATTACHMENT.

TEMPORAL AND SPATIAL HIGGS RESIDUES: EQUAL AS A CONDITIONAL CONSEQUENCE OF THE ATTACHMENT; NO INDEPENDENT TEMPORAL FIELD-SPACE GAIN EXISTS.

FINITE-FLOW COMMON RESIDUE: $Z_H(\tau) = (1 + \delta_H(\tau))^{(2/d_{op})}$ UNDER THE BRIDGE; UNCONDITIONALLY $\gamma_H(\tau)^2 (1 + \delta_H(\tau))^{(2/d_{op})}$.

OPERATIONAL-FIXED-POINT LOCAL 3+1 RESIDUE: $Z_{(H,\infty)} = 1$, CONDITIONAL ON THE BRIDGE, PHYSICAL OPERATIONAL-FLOW SELECTION AND THE ATTACHING MAP.

SEQUENTIAL FINITE-STEP POLE RELATION: EXACT IN THE SEQUENTIAL SPECTRAL VARIABLE; PHYSICAL-ENERGY FORM CONDITIONAL.

ABSOLUTE FACT-CLOCK / REFERENCE-CLOCK CALIBRATION: OPEN.

FULL PHYSICAL HIGGS POLE: OPEN PENDING ATTACHING MAP, GAUGE/YUKAWA LOOP, THRESHOLD, RUNNING, SCHEME AND CALIBRATION COMPLETION.

The natural endpoint of HSPR-1 is the sequential-spatial metric equality proved exactly, the Higgs-line ruler comparison compressed into one derivable scalar, and the physical-time attachment constrained down to a single missing map, with the remaining boundaries sharply isolated: the distance-functional bridge, that attaching map, physical operational-flow promotion, absolute clock calibration, and the quantum pole/threshold completion.

Appendix A. Centred-Difference Algebra and Continuum Expansion

Starting from

$I_H^{can} = (I + S^{-1})/\sqrt{2}$, $d = S - I$,

we have

$I_H^{can}\, d = [(I + S^{-1})(S - I)]/\sqrt{2} = [S - I + I - S^{-1}]/\sqrt{2} = (S - S^{-1})/\sqrt{2}$.

If ℓ is the proper one-step separation, the forward and backward samples are separated by 2ℓ, so

$\nabla^H = (1/(\sqrt{2}\, \ell))\, I_H^{can}\, d = (S - S^{-1})/(2\ell)$.

For $S = \exp(i\, p\ell)$,

$\nabla^H(p) = [\exp(i\, p\ell) - \exp(-i\, p\ell)]/(2\ell) = i \sin(p\ell)/\ell$.

Hence

$(\nabla\hat{}H)^\dagger \nabla\hat{}H = \sin^2(p\ell)/\ell^2$.

Using

$\sin x = x - x^3/6 + x^5/120 + O(x^7)$,

we obtain

$\sin^2 x = x^2 - x^4/3 + 2x^6/45 + O(x^8)$,

therefore

$\sin^2(p\ell)/\ell^2 = p^2 - (1/3)p^4\ell^2 + (2/45)p^6\ell^4 + O(p^8\ell^6)$.

The leading spatial coefficient is exactly one.

Appendix B. Defect-Mediated Protection Proof

Let $N = \ker J_D$. For any $n \in N$ and any defect-carrier operator M,

$J_D n = 0$,

so

$J_D^\dagger M J_D n = 0$.

Therefore N is contained in the kernel of every pullback metric of the form $J_D^\dagger M J_D$, and taking adjoints, N annihilates every such pullback from the left as well: $n^\dagger J_D^\dagger M J_D = 0$.

For the physical tangent dimension 187 and rank $J_D = 183$,

$\dim N = 4$.

The physical common Higgs line q_H lies in N. Hence every such pullback has vanishing Higgs row and column:

$q_H^\dagger J_D^\dagger M J_D = 0$, $J_D^\dagger M J_D q_H = 0$.

This is stronger than a vanishing diagonal correction. It means no defect-mediated term can mix q_H with any other physical tangent direction at quadratic order, and the same two-sided annihilation holds for every direction of N.

It also yields the decomposition-independence of Lemma 5.0 directly: the difference of any two admissible direct parts is itself of the form $J_D^\dagger M J_D$ and therefore has identically vanishing matrix elements on N.

For the unresolved-bath correction

$$\Delta G_{bath} = J_D^\dagger C^\dagger A_Q^+ C J_D,$$

we therefore have

$$\Delta G_{bath} q_H = 0, \quad q_H^\dagger \Delta G_{bath} = 0,$$

and

$$\delta g_H^{bath} = 0.$$

The result is independent of the numerical values of A_Q and C.

Appendix C. Operational-Packing Expansion and Rate Transfer

On the bridge branch of the Higgs-line ruler reduction (Theorem 6.7 under P8, $\gamma_H(\tau) \equiv 1$), define

$$Z_H^{space}(\tau) = (1 + \delta_H(\tau))^\alpha, \quad \alpha = 2/d_{op}.$$

The binomial expansion gives

$$Z_H^{space}(\tau) = 1 + \alpha\, \delta_H + [\alpha(\alpha - 1)/2]\, \delta_H^2 + [\alpha(\alpha - 1)(\alpha - 2)/6]\, \delta_H^3 + O(\delta_H^4).$$

Substituting $\alpha = 2/d_{op}$,

$$Z_H^{space}(\tau) = 1 + (2/d_{op})\, \delta_H + [(2 - d_{op})/d_{op}^2]\, \delta_H^2 + [2(d_{op} - 1)(d_{op} - 2)/(3d_{op}^3)]\, \delta_H^3 + O(\delta_H^4).$$

This expansion is structural only. No numerical d_{op} is assigned.

The logarithmic form is exact:

$$\log Z_H^{space}(\tau) = (2/d_{op}) \log(1 + \delta_H(\tau)),$$

valid for all $\delta_H > -1$. Thus the direct operational packing contrast enters the Higgs spatial norm only through one scalar logarithmic density ratio.

C.1 Rate-transfer bound

For $d_{op} \geq 1$ we have $\alpha \in (0, 2]$. By the mean value theorem, for $|\delta_H| \leq 1/2$ there is ξ between 0 and δ_H with

$$Z_H^{space} - 1 = \alpha (1 + \xi)^{(\alpha-1)} \delta_H, \quad 1 + \xi \in [1/2, 3/2].$$

If $\alpha \geq 1$ then $(1 + \xi)^{(\alpha-1)} \leq (3/2)^{(\alpha-1)} \leq 3/2$; if $\alpha < 1$ then $(1 + \xi)^{(\alpha-1)} \leq 2^{(1-\alpha)} \leq 2$. Hence

$$|Z_H^{space}(\tau) - 1| \leq 2\alpha |\delta_H(\tau)| = (4/d_{op}) |\delta_H(\tau)|.$$

The bound is uniform over the domain and shows that at fixed packing contrast the deviation of the Higgs spatial residue from unity is inversely controlled by the operational dimension.

C.2 Operational-fixed-point evaluation

On the declared entropy-gradient/Fickian operational-refinement branch,

$$\rho_{op}(x, \tau) \to 1/Vol_{op}(M).$$

Therefore

$$\delta_H(\tau) = Vol_{op}(M) \rho_{op}(x_H, \tau) - 1 \to 0,$$

and

$$\log Z_H^{space}(\tau) = (2/d_{op}) \log(1 + \delta_H(\tau)) \to 0.$$

Hence

$$Z_{(H,\infty)}^{space} = \exp(0) = 1.$$

This calculation requires no numerical value of d_{op} and concerns the operational flow limit $\tau \to \infty$ only; the spatial regulator limit $\ell \to 0$ is a separate operation, closed exactly in Appendix A. Its grade remains conditional on the bridge premise declared above and the operational-refinement hypotheses consumed in Section 8.3; the Higgs-line ruler reduction itself is supplied by Theorem 6.7.

Appendix D. Required Reproducibility Return

A physical HSPR execution should publish, on the same declared source branch:

1. the physical multi-cell carrier and its regulator level;
2. the selected Higgs attachment class and the resulting injection I_H;
3. the proper refinement-frame edge lengths ℓ_a and the spatial metric used to define them;
4. the finite-regulator spatial Higgs symbol and its convergence to $g^{ij} p_i p_j$;
5. the exact physical common line q_H and verification of $J_D q_H = 0$;
6. the direct physical metric block on $\ker J_D$;
7. $q_H^\dagger G_{op}^{direct} q_H$ at each regulator level and surviving branch;
8. verification that the packing norm and the one-Fact operational norm are evaluated in the common flat-reference normalisation on L_H (the basis of the Theorem 6.7 reduction), the derivation of the state-wise distance-functional bridge fixing $\gamma_H(\tau) \equiv 1$ (Route A), and, for the optional wider extension, the typed full-subspace source map and multidimensional construction;
9. the physical refinement-flow selector or substrate derivation of the S_op-concavity/entropy-gradient flattening assumptions;
10. for finite-flow corrections, d_op, x_H (with its flow-stationarity status or the uniform-convergence certificate of P11), $\rho_{op}(x_H, \tau)$, $Vol_{op}(M)$, $\zeta_H(\tau)$ and $\delta_H(\tau)$, together with verification that reported deviations respect the rate envelope on its domain;
11. a stability table demonstrating, with regulator convergence in ℓ and operational-flow convergence in τ reported separately and never identified, $Z_H^{space}(\ell, \tau) \to 1$ on the promoted physical branch, with every reported kernel deviation checked against the joint two-error certificate on its domain;
12. no measured Higgs mass, vev or kinetic residue is used anywhere in the reproducibility return;
13. the source-derived sequential-opportunity-to-continuum-timelike attaching map, with verification that its local normalisation satisfies $\Delta t_{phys} = a_t/c\star$; only then the promotion of the sequential spectral relation to a physical temporal residue and physical-energy pole relation.

Appendix E. Parallel Gauge-Normalisation Status: the First-Order Same-Mark D41 Boundary

The same-scale gauge contribution required by the eventual Higgs pole calculation remains a separately typed downstream problem. A subsequent same-mark audit of the physical C/W/Y PFDMI score against the presently available terminal-record, completion and CAR/Fock source channels now sharpens that boundary.

The physical C/W/Y response is already carried by genuine PFDMI mark probabilities on the representation-valued current carrier. However, in the currently executed primitive marked law the terminal-record factor is a left-unitary phase. It therefore cancels from the instantaneous probability effects and has identically zero first-order PFDMI probability score. Consequently,

$C_{(CWY,R)}^{(1)} = 0.$

The completion variables are nontrivial source directions, but at the presently executed mark grain their probability dependence factorises from the conditional current-terminal probability law carrying the C/W/Y score. Writing schematically

$p(m, \alpha, r) = q(m; c)\, p_{cur}(\alpha, r; \varepsilon)$,

with c a completion deformation and ε a C/W/Y deformation, the corresponding score covariance vanishes by conditional score centering:

$E[\partial(\varepsilon_A) \log p_{cur} \cdot \partial(c_j) \log q] = 0$.

Hence

$C_{(CWY,H)}^{(1)} = 0$

for the current factorised primitive mark law.

The shared-link CAR/Fock gauge response does not supply an additional independent first-order nuisance direction: on the one-particle carrier it is the exterior-algebra lift of the same faithful physical link already differentiated by the gauge sector. The genuinely new CAR/Fock-completion object is instead a mixed higher-order source jet involving completion and fermionic occupation. It therefore cannot be inserted as an ordinary first-order nuisance score on the present bosonic PFDMI mark alphabet.

Thus, at the presently executable first-order same-mark probability-score grain,

$C_{current}^{(1)} = 0$, $Z_{CWY}^{(1)} = D_{CWY}$.

This is an exact boundary of the current marked action, not a theorem that all physical gauge relaxation vanishes. In particular, it does not exclude a nonzero Schur response generated by a future source-derived nonfactorising marked law,

$p(m, \alpha, r) = q(m)\, p_{cur}(\alpha, r \mid m)$,

or by correctly graded higher-order mixed jets involving occupied matter. It instead shows that the already-derived representation-selector geometry cannot by itself be promoted into a numerical D41 subtraction.

A prior selector-capacity calculation found that the completion/CAR nuisance geometry has a large potential overlap with one C/W/Y combination. That result must therefore be graded only as an available relaxation capacity. The present same-action audit shows that this capacity is not activated by the currently factorised primitive probability law.

Accordingly, nothing in this result alters the Higgs-line kinetic conclusions of HSPR-1. It sharpens only the downstream gauge part of the pole-completion ledger: the physical gauge self-energy and gauge-normalisation contribution must arise from a source-derived same-mark coupling or from its correctly typed higher-order successor, rather than from the presently available first-order record/completion factorisation.

Internal VERSF Sources Consumed

1. **Background-Subtracted Fold Energy, Closure Spectral Mass, and the Higgs-Radial Bridge in VERSF.** Source of the transitive-carrier symmetry selection rule, the neighbouring Higgs difference, the canonical injection I_H^{can}, its exact centred-difference composition, full-rank Q_6 result, and the explicit warning that the whitened coefficient 2 is not the physical Z_H^{space}.
2. **The Standard-Model Numerical Confrontation and Provenance Theorem in VERSF.** Source of the exact common Higgs line q_H, the full-187 common-mode kinetic audit, the physical-normalisation firewall, the defect-mediated history/bath protection theorem, and the operational-packing representation of the remaining common-mode metric.
3. **Microscopic Origin of Refinement Transport in VERSF.** Source of genuine oriented $K = 7$ edge/path transport, inverse-path consistency and refinement-Cauchy continuum transport.
4. **Substrate Emergence of the Lorentz Transport Group in VERSF.** Source of the refinement-stable bilinear form unique up to overall scale, Lorentzian signature, the one-dimensional continuum commitment-propagation direction, time-orientation preservation, the proper orthochronous Lorentz transport fixed point, refinement-frame soldering $g_{\mu\nu} = e^a{}_\mu e^b{}_\nu \eta_{ab}$, and metric compatibility. It supplies the continuum timelike target required by the temporal-attachment problem; it does not by itself identify one sequential one-Fact opportunity with a definite physical timelike displacement.
5. **The Primitive Selection, History-to-Curvature and Standard-Model Attaching-Map Closure / PSAC programme.** Source of the Q_6 closure carrier and the unit-singular-value spatial intertwiner W consumed by the prior Higgs bridge.
6. **PFDMI-EX2G and the full-faithful source assembly.** Source of the local incidence attachment class, the full source visibility of zero-sum scalar-density profiles, and the complete physical defect differential used in the protection theorem.
7. **The Electroweak Vacuum and Higgs-Potential Completion / HR-1 programme.** Downstream source for the conditional Higgs potential and pole-mass chain whose provenance is strengthened but not numerically re-evaluated here.
8. **MFKR-1, The Finite Master-Action Fermion Kernel Reconstruction and Source-Identity Gate in VERSF.** Used only for the shared refinement-geometry discipline, the explicit separation of spatial source geometry from emergent sequential time, and the prohibition on treating the physical substrate as a four-direction Euclidean lattice.
9. **Operational Geometry in the VERSF Framework.** Source of the admissible operational Hilbert geometry, the operational image M_{op}, and the typed definition $d_{op} = \dim \mathrm{Im}(\Omega_{max})$, used to prevent substitution of unrelated tangent dimensions.
10. **Operational Curvature and Geodesic Structure in the VERSF Framework.** Source of the distinguishability-counting conformal metric, its uniqueness characterisation under locality, Z_7-equivariance, channel uniformity, distinguishability counting and flat-reference recovery (retained via P12 for the optional full-subspace extension), the

entropy-gradient/Fickian refinement dynamics, and the conditional asymptotic flattening $\rho\_op \to 1/Vol\_op(M)$. Its explicit S_op-concavity hypothesis and open substrate-level derivation are retained as load-bearing conditions on the unit fixed-point Higgs residue.

11. **Unified Refinement Hilbert Geometry in VERSF.** Used as a grade firewall confirming that the operational entropy monotonicity/concavity structure remains hypothesis-level rather than fully substrate-derived, and that the earlier partition-counting concavity argument is superseded by the later authoritative treatment.
12. **Deriving Operational Distinguishability Geometry from Finite Packing Structure.** Source of the finite-packing operational distance and norm, the precise multidimensional inner-product/squaring obstruction, and the result that the obstruction occurs only in promoting a normed carrier to a general inner-product carrier. HSPR-1 uses this result only after restriction to the one-dimensional physical Higgs line, where the parallelogram identity follows identically from norm homogeneity.
13. **The Renormalised Standard-Model Parameter Closure Theorem in VERSF / master-history continuous one-Fact construction.** Source of the continuous one-Fact heat-kernel proposal on the complete physical tangent, the identification of G_op as the inherited operational tangent metric, and the minimum-G_op-norm construction as selection of the displacement of least operational distinguishability. This typing supplies the one-Fact side of Theorem 6.7 without introducing a second Higgs-specific metric.

Imported Mathematics Not Claimed as New VERSF Output

Standard centred finite differences, Fourier symbols of translation operators on diagnostic regular carriers, Taylor expansion of $\sin^2 x$, Laplace-Beltrami principal-symbol mathematics, elementary kernel/rank identities, Moore-Penrose/Schur-complement algebra, positive quadratic-form canonicalisation, binomial/logarithmic expansions, the mean value theorem, elementary convexity/weighted-average bounds, the parallelogram identity and polarisation of quadratic norms, and standard diffusion/heat-flow convergence to uniform equilibrium under the declared bounded-domain regularity conditions.

The new VERSF-specific return of HSPR-1 is the combination of the previously constructed Higgs gradient injection with the later source-derived refinement ruler and the exact defect-silent common-mode protection, yielding the direct, decomposition-independent reduction

$$Z\_H^{space} = q\_H^\dagger\, G\_op^{direct}\, q\_H$$

with unit spatial geometric coefficient, zero contribution from every presently identified defect-mediated correction, the exact reduction of the Higgs-line ruler comparison to the single state-wise bridge scalar $\gamma\_H(\tau)$, the conditional packing representation $Z\_H^{space}(\tau) = (1 + \delta\_H(\tau))^{(2/d\_op)}$ under the bridge premise $\gamma\_H(\tau) \equiv 1$, and a conditional unit operational-fixed-point endpoint, with the spatial regulator and operational flow limits kept explicitly distinct and an explicit finite-flow rate envelope.