

CLSN-2: The Universal Gauge Conversion Factor, D41 Representation Typing, and Source-Response Release in VERSF

A standalone successor to CLSN-1 (6 October 2026)

Keith Taylor | 9 October 2026 | Research-grade conditional continuation

Claim boundary. The paper classifies the interfaces at which a universal conversion can enter and gauge-symmetry-compatible linear auxiliary screenings, audits every known convention in the PCN-to-continuum chain, and specifies a two-ratio Stage-B test. It does not derive the absolute conversion factor, select a physical D41 reading, or fix a physical matching scale.

General Reader Summary

The Standard Model describes three fundamental forces with remarkable accuracy, but their measured strengths remain inputs rather than first-principles predictions. VERSF explores a different possibility: that the forces and their strengths arise from more basic processes of physical change, the movement of matter and the formation of lasting records of what has happened. CLSN-1 developed a conditional pattern of relative force strengths from those processes, but the physical conversion remained unresolved.

The largest unresolved issue is a conversion shared by all three forces. In the comparison explored here, the inverse force-strength coefficients calculated from the primitive VERSF framework need a common multiplier of roughly 0.52 to 0.53 to resemble the corresponding quantities in established physics at a high energy scale. That is a substantial difference, not a tiny correction. This paper examines whether it comes from how microscopic changes are counted and normalised, how the underlying process measures time, or an actual physical relationship between changes in space and time. It rules out several counting errors, including an extra factor of two from the usual energy formula. Neither the multiplier nor the comparison scale is independently derived.

The paper also clarifies a different, smaller question: how a common microscopic process might affect the three forces differently. Earlier VERSF calculations produced several screening percentages that appeared unrelated. Here they are shown to follow from one mathematical screening fraction combined with the participation of different particle classes. The inherited charge assignments have a nested structure: a class carrying strong or weak charge also carries hypercharge, while the class with no hypercharge carries neither. This is inherited from the representation framework, not an independent discovery of particle content.

There is an important complication. The same microscopic calculation can be read in three mathematically distinct ways: measuring one part while the others are held fixed, allowing the other parts to adjust, or describing the system through its combined mathematical modes. These give different answers; combined mathematical modes are not necessarily separately measurable forces. The physical question is how microscopic currents map to the three independently measured fields. A very close numerical match using one simplified comparison is not enough to answer that question, because more accurate calculations change the apparent ranking of the alternatives.

CLSN-2 does not yet derive the measured strengths. It unifies previously separate calculations, excludes misleading interpretations and identifies concrete tests for what remains: the common conversion, the response actually measured, and the link from microscopic time to physical energy. Deriving these without using measured strengths as inputs would move VERSF from a suggestive pattern towards an explanation.

Abstract

CLSN-1 fixed a conditional PCN-normalized gauge triple and a source-visible D41 history response, leaving physical conversion and representation-resolved screening unresolved. We identify the large remaining question as a possible universal primitive-to-continuum factor rather than small factor-dependent screening. Gauge invariance permits independent simple-factor coefficients; equality after conversion requires an additional common-source and common-grain theorem. We audit the trace, generator, orientation, edge/face, hypercharge and opportunity-grain interfaces, and give explicit falsifiers for a universal transfer.

We further distinguish curvature-linear auxiliary carriers from invariant-density carriers, proving the minimal representation requirement for simple-factor linear Schur screening. We replace one-loop ranking by a two-loop, two-ratio comparison curve that is Stage B only and cannot select the VERSF source. The lowest one-loop residual has no selection authority. The common conversion, physical D41 type and physical matching scale remain open source returns.

1. Relation to the published CLSN-1

The controlling antecedent is The Physical Changing Link Source Representation Resolved History Metric and Gauge Normalisation Closure Attempt in VERSF, CLSN-1, 6 October 2026, especially §§17.2–17.7 (D41 and portal), §17.81 (closed-loop work), §§17.82–17.85 (current/link and Fact-Lock), and §19 (physical release still open). This successor does not republish the proofs or claim their originality. It uses the later CLSN-1 working calculations solely as provenance for the PCN-normalised unscreened benchmark and the candidate projection.

The source-frozen unscreened primitive kinetic triple used here is $Z^{(0)}=(6,13/2,378)$, with $q=6Y$ and conventional hypercharge $Z_Y=Z_q/36$. Its primitive common action ruler is conditional on the explicitly declared Primitive Change Normalization premise (PCN). Independently fixing a physical source response and attaching the primitive scale to energy remain separate requirements.

2. Frozen source tensor and notation

CLSN-1 returns the conditional D41 history tensor on a real E_2 doublet, up to a common source gain g_{cyc} . In the fixed (C,W,Y) signature basis, define:

$$\begin{aligned} H &= (1/49) [[36,18,36],[18,26,26],[36,26,47]] \\ m &= (36,26,47)^T/49; \quad d = 0.0551296278772322; \quad \Delta = 0.004648154590676 \\ W_{D41} &= g_{cyc}^2 [dH - \Delta mm^T] \otimes I_2. \end{aligned}$$

All symbols and relative coefficients in this display are inherited from the published D41 construction. In particular, H is a statistical factor signature Gram and W_{D41} a conditional history covariance. Neither is defined to be the Yang–Mills action Hessian. The common gain cancels from all ratios below.

3. Proposition 1: gauge-equivariance obstruction

Statement. Let $\mathfrak{g}=\mathfrak{su}(3) \oplus \mathfrak{su}(2) \oplus \mathfrak{u}(1)$ and suppose a local quadratic gauge kinetic density is bilinear in field strengths and invariant under independent gauge transformations. It cannot contain a nonzero bilinear cross term between the $\mathfrak{su}(3)$ and $\mathfrak{su}(2)$ curvatures or between either simple-factor curvature and the $\mathfrak{u}(1)$ curvature. Furthermore, the invariant bilinear form on each simple factor is proportional to its canonical invariant form.

Proof. For independently varying adjoint transformations, a cross-factor bilinear is an invariant linear functional on one simple Lie algebra once the other field strength is fixed. Every adjoint-invariant linear functional on a simple algebra vanishes, since $[\mathfrak{g},\mathfrak{g}]=\mathfrak{g}$. Thus all simple-to-distinct-factor bilinears vanish. On each simple factor,

invariance restricts the symmetric bilinear form to a multiple of its Killing form (or the chosen generator-normalised equivalent). With only one abelian factor, no additional off-diagonal abelian mixing exists. ■

Application. H_{CW} , H_{CY} and H_{WY} are all nonzero, as are the corresponding entries after the D41 rank-one subtraction. Therefore directly promoting the full 3×3 D41 history matrix to the cross-factor gauge kinetic matrix fails this invariance test. This is a rigorous algebraic obstruction under the stated local quadratic action assumption. It does not show that all off-diagonal microscopic correlations vanish; they may contribute indirectly through auxiliary relaxation.

4. A conditional diagonal projection, not a source theorem

Define the dimensionless diagonal history fractions in the fixed D41 signature basis:

$$r_A = (dH_{AA} - \Delta m_A^2)/(dH_{AA}) = 1 - (\Delta/d)(m_A^2/H_{AA}), \quad A=C,W,Y.$$

Their values are source-fixed within D41. The additional hypothesis P_{D41} is that the fully reduced gauge-action coefficient in each factor equals its PCN-normalised unscreened coefficient multiplied by this history fraction:

$$P_{D41}: Z_A^{\text{candidate}} = r_A Z_A^{(0)}.$$

P_{D41} is not implied by the gauge-equivariance theorem. It requires a common primitive physical action, a derived history-to-action identification, a justified factorwise projection and complete treatment of every auxiliary Schur channel. We must not silently identify a history Fisher covariance with gauge work.

Gauge sector	Unscreened $Z^{(0)}$	D41 diagonal fraction	Conditional Z
SU(3)	6	0.93805562	5.62833371
SU(2)	13/2	0.95526239	6.20920554
U(1), $q=6Y$	378	0.91912817	347.43044756

For standard hypercharge, the conditional coefficient is $Z_Y = Z_q/36 \approx 9.65084577$. The three coefficients have not been adjusted independently to observations. That absence of sector fitting does not remove the post-comparator hypothesis-selection concern.

5. Theorem 2: why keeping only diagonals need not commute with Schur reduction

Take a positive quadratic parent on gauge variables a and auxiliaries η , $H_{\text{parent}} = [[A, B], [B^T, C]]$, with C positive. The physical retained Hessian is $K = A - BC^{-1}B^T$. Even when the direct A block is gauge-factor diagonal, the retained factor-diagonal entries obey $K_{AA} = A_{AA} - (BC^{-1}B^T)_{AA}$. They depend on all physical auxiliary couplings, including correlations of an auxiliary shared across source factors. The map “discard off-diagonal terms from a statistical history covariance” is not generally equal to “form the full same-source physical Schur complement and then read the invariant factor coefficients.”

Counterexample. With two gauge coordinates and a single auxiliary, take $A = \text{diag}(a_1, a_2)$, $C = (c)$, $B = (b_1, b_2)^T$, $c > 0$ and $a_1 a_2$ sufficiently large for positivity. The retained K has $K_{12} = -b_1 b_2 / c$ and $K_{ii} = a_i - b_i^2 / c$. Removing the cross-factor gauge term to restore symmetry still leaves diagonal corrections b_i^2 / c that cannot be inferred solely from a statistical factor covariance without independently identifying B and c . ■

Consequently P_{D41} is an additional physical claim with a clear source test, not a mathematical consequence of the Ward projection. A physical gauge-invariant parent may require cross-coupling cancellation or extra fields; those requirements must be demonstrated rather than assumed.

6. Post-freeze running comparison and its non-discriminating status

For reproducibility, the post-freeze one-loop calculation retains the CLSN-1 MS-bar inputs $\alpha_s(M_Z)=0.1180$, $\sin^2\theta_W(M_Z)=0.23122$ and $\alpha^{-1}(M_Z)=127.95$, with coefficients $(b_3, b_2, b_Y)=(-7, -19/6, 41/6)$, and conventional hypercharge $Z_Y=Z_q/36$. It supplies post-freeze diagnostic arithmetic only. A separate two-loop Standard Model gauge-running comparison incorporating the top Yukawa, with $y_t(M_Z)=0.94$, was supplied by independent review. The two-loop values are supplied by independent review; the script is listed in the reproducibility manifest.

$$s_A(L) = [g_A^{-2}(M_Z) - b_A L / (8\pi^2)] / Z_A,$$

$$\sigma(L) = [\max_A s_A(L) - \min_A s_A(L)] / \text{mean}_A s_A(L).$$

For one-loop running each s_A is affine in L , so pairwise intersections and scanned-domain endpoints determine the minimax result. The same analytic affine and determinant arguments do not apply to two-loop evolution. In particular, the low one-loop residual of the diagonal candidate is not a stable physical discriminator.

Candidate	One-loop spread	Two-loop spread	Best scale (two loop)
Unscreened PCN (6, 13/2, 378)	2.5049%	1.428%	5.7×10^{13} GeV
Eigenvalue triple (matrix invariant)	0.6300%	1.709%	3.9×10^{14} GeV
D41 diagonal (r_A)	0.0937%	1.165%	9.0×10^{13} GeV
Relaxed compliance (1, 1, 0.986636)	1.9914%	0.914%	7.72×10^{13} GeV

At one loop the diagonal-axis candidate has matched rescaling factors (0.56031, 0.55979, 0.56031), but the strong apparent advantage collapses at two loops. The two-loop spreads lie between 1.165% and 1.709%, and even their ordering differs from one loop. The independent review reports that varying $y_t(M_Z)$ over 0.90–0.98 does not change this conclusion. Additionally, $\alpha_s(M_Z) \pm 0.0009$ moves the diagonal candidate's one-loop spread between approximately 0.007% and 0.196%. The low one-loop residual is below the comparison's useful input and truncation resolution. No candidate is selected by these numbers.

7. Physical release calculation required for a theorem of gauge strengths

The sole route to promoting the conditional coefficients is a source-first computation on the 144-link faithful quotient. Let E_A denote the fixed, canonically generator-normalised gauge columns and let the full physical parent Hessian on links a and all same-order auxiliaries η have blocks $H_{aa}, H_{a\eta}, H_{\eta\eta}$. Compute

$$K_g = H_{aa} - H_{a\eta} H_{\eta\eta}^{-1} H_{\eta a}; \quad Z_A^{\text{phys}} \text{ from } E_A^\dagger K_g E_A.$$

The parent must be derived from one admitted physical source, with the same current, record, bath, completion and matter preparation, temporal event grain and quotient. Gauge-gradient nulls, Ward covariance, non-Abelian within-factor isotropy, positivity, symmetric reciprocity, and regulator transport must be checked before projecting to three sector coefficients. It is forbidden to set the response equal to the D41 fractions as an input or to use the one-loop comparator to choose any coefficient.

A source-only agreement with $r_A Z_A^{(0)}$ within preregistered numerical error would independently corroborate P_{D41} , but even then a physical scale/RG attachment is required before a measured-scale prediction. A disagreement is a valid rejection of P_{D41} without damaging the exact D41 history result or the underlying published CLSN-1.

8. Falsifiers and controls

ID	Criterion	Disposition
S1	Full D41 cross-factor history tensor inserted unchanged into local YM kinetic term	Reject: gauge-equivariance obstruction
S2	Projected diagonal numbers inferred without same-source action map	Conditional only; no physical promotion
S3	Complete 144-link reduced Hessian violates Ward/null, simple-factor isotropy or positivity	Reject proposed physical branch
S4	Source-derived factor coefficients disagree with $r_A Z_A^{(0)}$ beyond frozen tolerance	Reject P_D41
S5	Comparator scale/factor used to select source response	Invalid physical prediction claim
S6	Regulator response fails stable transport to a common quotient	No continuum promotion
S7	History covariance renamed energetic stiffness without derived bridge	Violates action/Fisher firewall

9. Theorem 3: exact single-parameter D41 diagonal law

Let $n=(36,26,47)$, so that $H_{AA}=n_A/49$ and $m_A=n_A/49$. Define $\kappa=\Delta/(49d)=0.001720677273210364$. The fractions of §4 simplify identically to $r_A=1-\kappa n_A$. Consequently every proposed diagonal response in P_D41 obeys the exact two independent constraints $(1-r_C)/36=(1-r_W)/26=(1-r_Y)/47=\kappa$. No sector-dependent coefficient can be selected without violating this particular fixed D41 law.

Proof. Direct substitution gives $m_A^2/H_{AA}=(n_A/49)^2/(n_A/49)=n_A/49$, hence $r_A=1-(\Delta/d)(n_A/49)$. All numerical values in the sector table follow from this single equality. ■

This is a genuinely more restrictive release test than asking whether three predicted couplings match experiment. The physical 144-link source must independently return a gauge-invariant response and then satisfy both source-side ratio constraints, to declared uncertainty, before comparison with any measured coupling. Agreement of one component does not imply agreement of the others.

10. Theorem 4: intrinsic portal spectrum versus factorwise diagonal reading

The D41 history metric itself determines a unique generalized screening spectrum relative to its direct Gram H . Since $H e_Y=m$, the matrix pair $(dH-\Delta m m^T, dH)$ has eigenvalues $(1,1,1-(\Delta/d)(47/49))=(1,1,0.919128168159)$ and the screened generalized direction is e_Y . Thus two independent relative directions are exactly protected. This statement is invariant under simultaneous nonsingular changes of the statistical factor coordinates.

Proof. $H^{-1}m=e_Y$ and $m^T H^{-1}m=m_Y=47/49$. The rank-one operator $I-(\Delta/d)H^{-1}m m^T$ has eigenvalue 1 on $\ker(m^T)$ and $1-(\Delta/d)m^T H^{-1}m$ on $H^{-1}m$. ■

Operational interpretation. The factor-axis reading r_A is a Rayleigh quotient of the screened quadratic form relative to dH , evaluated along a nominated pure-factor axis e_A . The intrinsic portal reading instead diagonalizes the generalized pair $(dH-\Delta m m^T, dH)$: its H -orthogonal eigendirections give two unit responses and one 0.919128168159 response, with e_Y as the nontrivial eigenvector. The eigen-reading is coordinate-free relative to the specified H metric; the axis reading relies on a physically selected embedding of each measured force into its pure-factor axis. Standard Model gauge labels alone do not establish that embedding from the D41 statistical carrier. The generalized eigenvalue triple is an intrinsic invariant of the statistical matrix, not a per-factor gauge-coupling assignment. The operational alternatives are the clamped-axis stiffness and the relaxed-compliance response; neither is selected as physical without the source-derived canonical-field map.

11. Proposition 5: a gauge-singlet mixing obstruction at the symmetric origin

At an invariant background, a gauge-invariant quadratic parent cannot have a nonzero mixed Hessian between a gauge-adjoint fluctuation for $SU(3)$ or $SU(2)$ and a gauge-singlet scalar auxiliary. Indeed the mixed linear map would be an invariant linear functional on a simple Lie algebra and must vanish. Consequently one shared gauge-singlet Gaussian bath mode cannot produce nonzero simple-factor gauge screening by ordinary linear Schur mixing at that origin. The same argument applies to simple-factor cross terms. This extends the obstruction of Theorem 1 from the final kinetic tensor to its simplest proposed parent mechanism.

Proof. Let a transform in the adjoint of a simple factor and η be gauge invariant. For the mixed quadratic term $a^T B \eta$ to be invariant under all group transformations, each column of B is a fixed vector of the dual adjoint representation. There are no nonzero fixed vectors on a simple Lie algebra, so $B=0$. Schur elimination of this singlet gives no contribution through that mixed block. ■

Scope. This does NOT prohibit gauge-covariant charged auxiliary representations, composite curvature-squared couplings, nonzero symmetry-breaking backgrounds, nonlinear or nonlocal loop contributions, or quantum threshold effects. It states precisely why borrowing a rank-one statistical bath as though it were one gauge-singlet scalar directly coupled to all three field strengths is not sufficient.

12. A source-first discriminatory test

The stronger successor test is now four-tiered, without additional measured inputs. First, derive the full physical parent on the faithful gauge quotient, including its transformation laws and auxiliary representations. Second, apply the actual gauge symmetry and all physically admissible Schur reductions; do not impose a factor-diagonal statistical projection. Third, determine whether the returned factor responses satisfy the D41 one-parameter law of Theorem 3 or instead retain the invariant portal structure of Theorem 4. Fourth, test reciprocity, Ward/null directions, within-factor isotropy, positivity and regulator stability on the same returned parent. Only after a frozen source result passes these tests should the one-loop comparator be opened.

Potential outcomes: (A) all three response deficits follow $\kappa(36,26,47)$ and independent source typing certifies their energetic meaning, giving a physical derivation of the factor pattern conditional on PCN and scale attachment; (B) the source instead yields only an Abelian portal, falsifying P_{D41} while preserving the inherited D41 statistical theorem; (C) the response is different or carries additional cross-sector structure, rejecting this candidate; or (D) the full parent is unavailable, leaving a clear unclosed source obligation. None can be decided from the 0.0937% comparator.

Pre-registration and provenance. The values κ , (36,26,47), the candidate triple, and the measured comparison have already been inspected in the current research sequence. The present work is therefore an explanatory and falsifiable source hypothesis, not a blind prediction. A future independent calculation must preserve the original source definition and be frozen before its comparison is evaluated.

13. Proposition 6: classification of invariant quadratic gauge responses

Assume unbroken $SU(3) \times SU(2) \times U(1)$, a local parity-even quadratic action built from field strengths, and no additional spurions that transform under the gauge group. On the real generator space $\mathfrak{g} = \mathfrak{su}(3) \oplus \mathfrak{su}(2) \oplus \mathfrak{u}(1)$, every invariant symmetric bilinear form is a direct sum of one coefficient times the invariant inner product on each simple ideal and one coefficient on the single Abelian ideal. In canonically normalised generator coordinates its matrix is $K_{\text{inv}} = \text{diag}(z_3 I_8, z_2 I_3, z_Y)$, with no independent cross-factor entries.

Proof. The off-block terms are invariant pairings between inequivalent representations; they vanish because the simple ideals have no invariant linear functionals and transform independently. On each simple ideal, the adjoint representation has a one-dimensional space of invariant symmetric bilinear forms, proportional to the Killing

form (or the fixed trace normalisation). A single one-dimensional Abelian ideal adds one scalar quadratic form. Positivity requires $z_3, z_2, z_Y > 0$. This classification is independent of the D41 candidate. ■

Consequences and scope. Gauge invariance fixes the allowable operator form and collapses a full generator-space matrix to three scalar coefficients, but it does NOT determine any of those three coefficients. For multiple $U(1)$ factors, kinetic mixing could be allowed; the present theorem relies on the Standard Model having just one. This theorem is about an invariant field-strength quadratic, not a claim that the C/W/Y statistical signature coordinates individually carry full adjoint transformation laws. A microscopic history-to-field-strength map is still needed before the theorem can be applied to D41.

14. Theorem 7: positive gauge-covariant parents realise a continuum of screenings

Let $D_A > 0$ be the fixed PCN-normalised direct kinetic coefficient for factor A, and choose any three fractions $0 < r_A \leq 1$. Introduce for each factor a separate real auxiliary in its own adjoint representation (one scalar auxiliary for $U(1)$), with fixed invariant inner product and quadratic form:

$$\Gamma_A(a_A, \eta_A) = \frac{1}{2} D_A \|a_A\|^2 + b_A \langle a_A, \eta_A \rangle + \frac{1}{2} c_A \|\eta_A\|^2, \quad c_A > 0, \quad b_A^2 = c_A D_A (1 - r_A).$$

All displayed terms are gauge invariant under the common adjoint action of factor A. Schur reduction of η_A gives $K_A = [D_A - b_A^2/c_A] I = r_A D_A I$. Each full quadratic block is strictly positive for $r_A > 0$, since its determinant per adjoint component equals $c_A D_A r_A > 0$. Different factors have no mixed terms. Thus every admissible positive triple (r_3, r_2, r_Y) has such a positive covariant parent. ■

This construction is a mathematical witness, not an admitted VERSF source or a physical mass mechanism. In particular, a fluctuation a_A in this quadratic model is assumed to transform homogeneously in an adjoint representation; an actual gauge potential A_μ transforms inhomogeneously, so the mixed term must NOT be read as a permitted gauge-potential mass/mixing term. A physically usable completion would require appropriately covariant field-strength variables, derivative operators, and the full momentum-dependent Ward identities. The witness proves that positivity, factor covariance and Schur algebra by themselves cannot select κ or the D41 fractions.

Additional discriminator. With deficits $\delta_A = 1 - r_A$, the D41 proposal predicts $\delta_C/\delta_W = 18/13$ and $\delta_Y/\delta_W = 47/26$, not merely a near-unification score. A successful source-derived reduction must meet both equalities after the same canonical generator normalisation, complete auxiliary elimination and regulator transport. Any independent three-coefficient result that violates either equality rejects the D41 identification, even if its measured-coupling comparator is numerically better.

15. Physical interpretation and source-first decision criterion

The strengthened result is a pair of boundaries. Proposition 6 shows exactly what gauge symmetry permits; Theorem 7 shows that those permitted, positive responses still form a continuum. The D41 single- κ law is therefore an additional source-selection hypothesis rather than a consequence of gauge invariance, positivity or Schur completion. This makes the decisive research question sharper: can the unmodified primitive VERSF source independently fix the factor-resolved energetic susceptibility and its κ , with the full gauge-invariant 144-link response and all Ward/null checks? The one-loop 0.0937% comparison must remain outside that source-selection step. The later Lemmas A and B sharpen the situation by deriving the indicator composition and the exact hypercharge-only compliance update, without assuming a physical gauge-field identification.

15A. Eigenvalue-triple separation from the operational readings

The factor Gram identity $H^{-1}m = e_Y$ makes the D41 generalized statistical spectrum (1,1,0.919128168159): two protected mixed directions and one hypercharge-aligned direction. This is a coordinate-invariant statement about a generalized eigenproblem, not an assignment of three physical gauge couplings. For comparison only, one may attach those three eigenvalues to named gauge factors, producing the eigenvalue-triple assignment

(1,1,0.919128168159). That additional labeling has no independent operational or source-derived authority. The physically pertinent alternative readings are the factor-axis stiffness and the relaxed-compliance residue, which must each pass the canonical-column and complete-Schur source test.

Theorem 8 (algebraic separation of the eigenvalue-triple assignment from the clamped-axis reading). If one artificially assigns the generalized eigenvalue triple to (C,W,Y), the resulting formal primitive triple is $Z_{\text{eig}}=(6,13/2,378 \times 0.919128168159)$. The clamped-axis reading instead gives $Z_{\text{clamp}}=(6r_C,(13/2)r_W,378r_Y)$, with $r_C=0.9380556$, $r_W=0.9552624$ and $r_Y=0.919128168159$. These formal assignments agree in Y and disagree in both simple-factor entries, so they cannot be related by one common positive rescaling. Neither formal assignment is established as physical by this theorem.

Proof. $H^{-1}m=e_Y$ gives the only nonunit generalized eigenvalue in the hypercharge-aligned direction. Labeling the two remaining unit eigenvalues C and W is a convention imposed on mixed protected directions, not a physical reading. The clamped-axis Rayleigh quotients instead satisfy $r_C < 1$ and $r_W < 1$ since their occupancies and Δ are positive. Because their Y entries agree, any common factor mapping the formal triples must equal one, after which their C and W entries disagree. ■

15B. Comparator robustness and loss of discriminating power

The fixed one-loop comparison gives superficially separated residuals that are not stable under two-loop gauge running. The two-loop comparison includes the top Yukawa with $y_t(M_Z)=0.94$ and introduces no new source-selection parameter. The displayed two-loop values and compliance result are supplied by independent review; the script is listed in the reproducibility manifest. The generalized eigenvalue assignment is included only as a matrix-based diagnostic, not a physical branch.

Frozen branch	One-loop spread	Two-loop spread	Two-loop scale
Unscreened	2.5049%	1.428%	5.7×10^{13} GeV
Eigenvalue triple (matrix invariant)	0.6300%	1.709%	3.9×10^{14} GeV
Diagonal fractions	0.0937%	1.165%	9.0×10^{13} GeV
Relaxed compliance (1, 1, 0.986636)	1.9914%	0.914%	7.72×10^{13} GeV

The apparent one-loop ranking changes at two loops, so numerical proximity does not establish a physical reading. In particular, the diagonal candidate's 0.0937% one-loop value has no selection authority. The operational clamped and relaxed-compliance responses must be assessed through their microscopic source and canonical-field map. The eigenvalue triple is displayed solely to explain earlier numerical comparisons; it is not a third independently measurable coupling prescription.

Theorem 9 (one-loop-only scale-and-common-factor elimination). Let A be the measured M_Z inverse-squared coupling triple, $c_A=-b_A/(8\pi^2)$ the fixed one-loop slope triple and Z a proposed bare kinetic triple in consistent conventional units. Exact agreement at one common scale μ and one common multiplicative factor s is possible only if $\det[Z,c,A]=0$; if Z and c are linearly independent, this condition is also sufficient algebraically, provided the resulting $\ln(\mu/M_Z)$ belongs to the admitted physical scale interval and $s>0$. Proof. Exact matching requires $A+cL=sZ$, so A is in $\text{span}\{Z,c\}$. Conversely a zero determinant implies such a linear combination when Z and c are linearly independent; the sign and interval requirements are separate. ■

The determinant removes two nuisance coordinates exactly only within the affine one-loop model. Because two-loop running is not affine in $\log \mu$, the determinant test has no comparable two-loop sufficiency or discriminating status. Its signed values are diagnostic one-loop algebra and cannot select between the three branches.

16. The large open quantity: a universal primitive-to-continuum conversion

In conventional hypercharge units the frozen unscreened PCN triple is $Z^{(0)}=(6, 13/2, 21/2)$. The measured running inverse-squared couplings have a similar relative pattern at high energy, but a common rescaling near $s \approx 0.52-0.53$ is required on the stated comparison branch. Its reciprocal, approximately 1.88–1.93, multiplies the squared couplings. This is the dominant magnitude discrepancy. The source must fix both its value and the physical interpretation of the comparison scale before an absolute coupling can be claimed.

Theorem 10 (universal-conversion factorization, conditional). Suppose (i) PCN supplies one primitive cost on the same six-cycle carrier, (ii) all factors pass through one factor-blind transfer of the primitive cost to the continuum kinetic action with scalar $s > 0$, and (iii) any factor-specific effects are contained in separately source-returned r_3, r_2, r_Y . Then $Z_A(\mu^*) = s r_A Z_A^{(0)}$ for $A=3, 2, Y$. In particular $1/g_A^2(\mu^*) = s r_A Z_A^{(0)}$, and a common s cancels from the two independent coupling ratios. Conversely, gauge invariance and PCN by themselves do not establish assumption (ii), and they do not fix s . Proof: the stated factor-blind linear transfer acts by scalar multiplication on all three canonical kinetic forms; factor-specific reductions act thereafter. Gauge invariance alone permits three independent coefficients, as Proposition 6 shows. ■

Theorem 10 is a decomposition and a falsifiable conditional implication, not a deduction of $s \approx 0.52$. The post-freeze comparison number cannot be substituted into the source action. Small D41 corrections (approximately 4–8% on the conditional diagonal reading) cannot explain the approximately 47–48% common reduction in inverse-squared couplings; they are different questions.

17. Blind audit of every possible common factor

Before opening any further Standard Model comparator, the following contracts must be checked on one physical event, one canonical field definition and one regulator. A fixed convention factor is distinct from an independently derived physical response. A factor near two can arise from mismatched conventions, but numerical proximity to two is no evidence for a particular origin.

Interface	Required blind check	Status in CLSN-1 / CLSN-2
Generator trace	Use $\text{Tr}(T^a T^b) = \frac{1}{2} \delta^{ab}$ on every factor; prove no multiplicity is counted twice.	Closed, no common factor: canonical generator Grams and trace multiplicities fixed.
Oriented / unoriented	Compare directed links, reverse conjugate links, real quadratures and quadratic $\frac{1}{2}$; price an undirected event exactly once.	Partly closed: the quadratic $\frac{1}{2}$ cancels identically against the Wilson weak-field $\frac{1}{2}$; orientation/reverse-link event counting remains open.
Edge / face	Track Z , $G=Z^T Z$, face-holonomy and canonical dual flux variables; do not insert an extra Gram.	Closed, no common factor: exact cycle/face conversion and $c_{\text{norm}}=1$; cannot supply an extra factor by convention.
Hypercharge $q=6Y$	Explicitly transform $Z_q \rightarrow Z_Y = Z_q/36$ and generator normalization at each step.	Closed, no common factor: $Z_Y = Z_q/36$ exact and factor-specific.
Fold / opportunity / loop grain	Match one D36 Fold, CLI opportunity, Wilson kinetic step and three-opportunity loop; compare what the action is pricing.	Open physical attachment: conditional step-grain identity exists, but equivalence of physical cost/event grain and clock is not yet source-proved.
Temporal electric / magnetic	Calculate one consistent compact transfer, spatial plaquette coefficient and temporal attachment; retain finite nonquadraticity.	Open physical attachment: spatial/temporal conversion can supply a factor-blind geometric-

		mean kinetic coefficient; equality of primitive costs and actual anisotropy require source selection.
Auxiliary and record/bath	Take the complete same-source Schur complement before comparing common factors; test whether any common renormalization is physical rather than convention.	Open physical reduction: full common-parent Schur response not returned; no arbitrary post-hoc common factor.
E_2 doublet / quadrature count	Test whether PCN and gauge factor Grams price one real quadrature or the whole E_2 doublet; do not count $\otimes I_2$ twice.	Statistical multiplicity explicit; no automatic factor 2. Physical grain mapping open; see §17A.

Temporal/spatial source test. On a standard anisotropic plaquette discretisation, after the lattice-spacing and field-coordinate factors are correctly transported, a relativistic continuum kinetic coefficient can be written $Z_{\text{eff}} = \sqrt{Z_t Z_s}$ (equivalently $1/g^2 = \sqrt{(\beta_t \beta_s)}$ only when β_t and β_s have already been placed in these matched canonical conventions). This geometric mean is common to the gauge factors if the temporal/spatial conversion is factor blind; it is a physical candidate origin for s , not a licence to insert one. Determine from the source clock whether PCN assigns equal temporal and spatial per-face physical costs. If not, return their ratio $\rho = Z_t/Z_s$ in the common primitive convention and infer $s = \sqrt{s_t s_s}$, with $s_t = Z_t/Z_{\text{PCN}}$ and $s_s = Z_s/Z_{\text{PCN}}$. A factor $s \approx 0.52$ cannot be inferred merely from choosing ρ ; both s_t and s_s must be independently fixed.

Audit partition and conditional no-go. Closed interfaces incapable of hiding a free universal factor are generator traces, edge-to-face conversion, and hypercharge $q=6Y$. The quadratic $\frac{1}{2}$ is closed as well: Gate E gives $-\log \varphi(1) = \frac{1}{2}$ and the Wilson expansion $\beta(1 - \cos \theta) = \frac{1}{2}\beta\theta^2 + O(\theta^4)$, hence $Z = \beta = 1/g^2$ at this matched interface without a residual factor of two. Open interfaces are orientation/reverse-link event counting, Fold/opportunity grain, temporal/spatial kinetic attachment and auxiliary Schur reduction. These four source choices must be computed before any post-freeze gauge comparator is used.

Decision F-U (universal conversion). Under Theorem 10, if one independent source return establishes equal temporal and spatial per-face PCN costs, unit orientation counting, a matched Fold/opportunity grain, and a factor-blind unit transfer with no additional common Schur renormalisation, then $s=1$. This conjunction cannot simultaneously reproduce the independently supplied post-freeze comparison requiring $s \approx 0.52$ – 0.53 at its fitted matching scale. Thus either a premise in the conjunction fails, the assumed scale identification fails, or the conditional VERSF branch is phenomenologically incompatible. The approximately 47–48% difference is a conditional mismatch, not a 48σ statistical exclusion; it cannot by itself identify which premise is false.

17A. E_2 doublet and common-factor counting gate

The D41 tensor is $W_{\text{factor}} \otimes I_2$ on two real E_2 quadratures. Its trace doubles the one-quadrature factor trace, but that does not itself multiply a canonically normalized quadratic coefficient. A factor of two appears only if primitive PCN cost and the canonical gauge lift price different physical grains (one quadrature versus the full doublet) without a compensating field normalization. The statistical operator does not justify a second factor of two. If a future source calculation halves the primitive unit-face triple, the effective common conversion relative to that redefined triple is $2s \approx 1.04$ – 1.06 ; that would not be explained by D41's positive screening deficits. If it does not, this particular counting route is closed and the surviving conversion is a physical source/clock problem.

Doublet test D2. Compare (i) the PCN cost on a unit E_2 vector, (ii) the cost on the full two-quadrature basis, and (iii) whether $Z^{(0)} = (6, 13/2, 378)$ is a per-generator one-quadrature Hessian or an E_2 trace. The published generator Grams and factor lift are per canonical generator, and W_{D41} carries I_2 explicitly, so no factor of two may be introduced by tracing the statistical doublet a second time. Full physical opportunity-to-gauge-action identification is still required. If it later fixes a factor of two, this audit must show the precise single occurrence in the source-to-continuum chain.

18. Theorem 11: minimal source representations for D41 screening

Let V_A denote the representation carried by the D41 input coordinate at the point of coupling, not merely the fact that its final statistical label is C, W or Y. The two cases below are physically inequivalent and should not be conflated.

Case I, curvature-linear reading. If V_A transforms as the curvature in the adjoint of $SU(3)$ or $SU(2)$, then a nonzero bilinear Schur term $F_A B_A \eta$ requires η to contain an adjoint component of the same simple factor (or an equivalent gauge-covariant source block). A gauge-singlet auxiliary cannot supply that linear term at an unbroken symmetric origin. For $U(1)$, F_Y itself is invariant, so a singlet auxiliary is allowed. This follows from the absence of an invariant linear functional on a simple adjoint and Schur's lemma on the matching representation. Hence a single singlet bath permits the portal-only response but does not justify non-Abelian diagonal screening. To obtain P_{D41} by such a linear mechanism one must exhibit adjoint-valued colour and weak auxiliaries with their physical susceptibilities and D41 deficit ratios $\delta_C/\delta_W=18/13$ and $\delta_Y/\delta_W=47/26$.

Case II, invariant-density reading. If the source coordinates are separately invariant quantities such as F_A^2 or source event counts, their cross terms are products of invariant densities and generally start at quartic order in gauge fields. They are not forbidden as cross-factor kinetic mixing, but neither do they shift a quadratic gauge coefficient at a zero-curvature symmetric origin without a nonzero background, condensation, or a source-derived linearization. Calling the diagonal statistical Rayleigh quotient a physical quadratic kinetic coefficient in this case requires that extra dynamical theorem. Thus coordinate type alone does not automatically establish P_{D41} in either case.

Decision gate. The D41 marked-rate scores are indicator-gated copies of one current on the declared reference branch (Lemma A below), not independently established curvature-linear adjoint fields. This closes the indicator typing on that statistical carrier but does not automatically identify those scores with gauge-invariant F_A^2 densities or canonical gauge fields. The physical decision requires differentiating the complete source parent in the canonical gauge coordinates and identifying whether other factor currents remain fixed or relax. The general representation obstruction in Theorem 11 remains valid.

18A. Two exact D41 lemmas and three operational readings

Theorem 12 (indicator-gated charge-class nesting on the inherited RCHS representation ledger). RCHS-1 defines the terminal factor scores by $s_{F,A}=2\chi_F(A)$ with $\chi_F(A)\in\{0,1\}$; the D41 factor Gram is $H_{AB}=\sum_r p_r \chi_A(r) \chi_B(r)$, with $p=(2,6,2,9,9,18,3)/49$. Thus binary signatures are a source-construction identity, not an extra boundedness assumption. The exact D41 identities $H_{AA}=m_A$ and $H_{YY}=m$ imply $\sum_r p_r \chi_A(r) [1-\chi_Y(r)]=0$ for $A=C,W$, hence $\text{supp } \chi_C \subseteq \text{supp } \chi_Y$ and $\text{supp } \chi_W \subseteq \text{supp } \chi_Y$. Every class carrying colour or weak charge also carries hypercharge, and the hypercharge-neutral class carries neither. This is an exact theorem on the inherited indicator ledger; it is not a derivation of the ledger's representation content from more primitive VERSF axioms.

The moments give $49m=(36,26,47)$ and $49H_{CW}=18$. Inclusion-exclusion fixes the five aggregate terminal-class weights: $C \cap W \cap Y:18$; $C \cap Y$ only:18; $W \cap Y$ only:8; Y only:3; no factor:2. One explicit realization places C on weights (9,9,18), W on (18,6,2), and Y on all except the other weight-2 sector. Equal-weight sector labels and some support arrangements remain ambiguous, but the five class totals do not. This reproduces the qualitative types of the inherited Standard Model charge-support ledger, including the fully neutral class; because the representation/indicator ledger was supplied upstream, it must not be presented as an independent prediction of Standard Model multiplet content or compared against measured multiplicities. Falsifier: any claimed same-branch physical terminal ledger violating the support inclusions is incompatible with these inherited D41 Gram identities.

Proposition 13 (single-scalar D41 screening identities). Put $f=\Delta/d=0.08431318638730783$ (cycle-current fraction, §17.2 of CLSN-1) and $m=(36,26,47)/49$. Then $W_{\text{red}}=d(H-fmm^T)$ and the clamped axis fractions satisfy $r_A=1-fm_A$ exactly. The relative factor-trace screening is $[\text{tr } W_0 - \text{tr } W_{\text{red}}]/\text{tr } W_0 = f(\sum_A m_A^2)/(\sum_A m_A) = 0.066001$ (approximately 6.6001%). The lone nontrivial generalized-eigenvalue screening is $f m_Y = 0.080871831841$ (approximately 8.0872%), because $H e_Y = m$ and $m^T H^{-1} m = m_Y$. Thus CLSN-1's cycle, trace

and portal screening percentages are not three separately chosen numbers: all follow from the single scalar f and the occupancy vector m . These remain statistical history responses, not physical gauge kinetic renormalisations.

Lemma B (exact rank-one compliance update). With $W_0=dH$, $W_{\text{red}}=dH-\Delta mm^T$, $H e_Y=m$ and $m_Y=47/49$, the Sherman–Morrison identity gives $W_{\text{red}}^{-1}-W_0^{-1}=c e_Y e_Y^T$, where $c=(\Delta/d^2)/[1-(\Delta/d)m_Y]\approx 1.6639273703$. Therefore in this factor-coordinate basis, integrating out the other statistical coordinates changes only the Y diagonal compliance. The associated normalized relaxed stiffness fractions, defined as $(W_0^{-1})_{AA}/(W_{\text{red}}^{-1})_{AA}$, are $(1,1,0.9866360)$. This is independent of an arbitrary overall history gain, although energetic interpretation still requires the history/action bridge.

Three mathematically distinct readings must not be interchanged:

Reading	(C, W, Y) screening fractions	Operational definition
Clamped axis stiffness	(0.938056, 0.955262, 0.919128)	$W_{\text{red},AA}/W_{0,AA}$; other factor coordinates fixed; matches the §7 column pullback only if E_A identifies these coordinates
Generalized eigenvalues	(1, 1, 0.919128)	Eigenvalues of (W_{red}, W_0) ; two protected directions are mixed H-orthogonal combinations, not identified with physical C and W
Relaxed compliance	(1, 1, 0.986636)	$(W_0^{-1})_{AA}/(W_{\text{red}}^{-1})_{AA}$; other statistical coordinates integrated out; a candidate propagator reading only with a derived source-to-field map

Operational release rule. A physical gauge coupling is defined by the pole/residue or canonically normalized inverse propagator of an independently source-derived gauge field, after permitted auxiliaries are integrated out. Whether that operation corresponds to clamping or relaxing these three D41 statistical coordinates is not settled by the D41 covariance alone. Because all three factor directions are gatings of one common cycle-current score, their independence as physical gauge fields cannot be assumed. The remaining source task is precisely the A-gated-current $\rightarrow$ canonical gauge-column map and the complete same-source Schur reduction. The generalized-eigenvalue triple is retained as a matrix invariant, not advertised as a physical coupling candidate.

19. Two-ratio Stage-B target and the limit of matching

Define the source screening ratios $R_W=r_W/r_C$ and $R_Y=r_Y/r_C$. Exact post-freeze matching at μ after cancelling a common s requires $R_W=[g_W^{-2}(\mu)/g_C^{-2}(\mu)]/[Z_W^{(0)}/Z_C^{(0)}]$ and $R_Y=[g_Y^{-2}(\mu)/g_C^{-2}(\mu)]/[Z_Y^{(0)}/Z_C^{(0)}]$. The independently reviewed two-loop data specify one curve in this two-dimensional ratio plane. It is an external Stage-B test, never a rule for selecting the Stage-A source. The numerical uncertainties summarized in §19A remain an indicative envelope, not a controlled full three-loop uncertainty estimate.

μ (GeV)	r_W/r_C required	r_Y/r_C required	$1/s$ indicative
4×10^{13}	1.021	1.016	1.95
5.7×10^{13}	1.014	1.000	1.93
9×10^{13}	1.007	0.980	1.90
1.3×10^{14}	1.001	0.965	1.88
3.9×10^{14}	0.983	0.919	1.83

Pre-registered operational decisions (Stage B only). Clamped source-to-field identification predicts screening ratios approximately (1.018,0.980), with the weak/colour ratio about 1.1% from the two-loop curve near 9×10^{13}

GeV. Relaxed compliance predicts (1,0.986636); the supplied two-loop minimax spread is 0.914% near 7.72×10^{13} GeV. The generalized eigenvalue triple is a matrix invariant rather than an operational assignment, although its artificial three-factor assignment can be retained as a comparison control. Neither physical reading is certified by a source-to-canonical-field map, and neither may be chosen from these residuals.

19A. Input-sensitivity audit of the Stage-B curve

The independently supplied sensitivity audit finds that $\alpha_s(M_Z)$ shifted by ± 0.0009 displaces each of the two required ratio coordinates by approximately $\pm 0.16\%$, largely in parallel rather than tangentially to the scale curve. The stated top-threshold treatment adds about $+0.04\%$ and $+0.05\%$, respectively. The proposed $\pm 0.2\%$ working band is therefore an approximate comparator envelope, not a proven truncation-error bound: the estimated three-loop contribution (of order 0.2% or less) still needs an explicit calculation and correlated uncertainty propagation before formal exclusion statements. Against that illustrative band, the 1.1% and 1.7% sector discrepancies are substantial, but are not formal σ -level exclusions or source-selection criteria.

20. Matching-scale and clock handoff

Conditional clock target (not a physical prediction). Neither CLSN-1 nor CLSN-2 derives an absolute primitive opportunity energy scale. If an independent clock theorem identifies the post-freeze comparison scale $\mu^* \approx 10^{14}$ GeV with $\hbar/a_t$, then $a_t \approx 6.58 \times 10^{-39}$ s. Without that independent identification, μ^* is a fitted comparator coordinate. Any independently fixed heavy-neutral scale would provide a subsequent, not an upstream, check.

Gate	Source-only condition	Known conditional consequence
D-U: universal s	Equal temporal and spatial PCN costs, unit orientation/grain, factor-blind unit transfer, no common Schur shift	$s=1$; compare against post-freeze $s \approx 0.52-0.53$; conjunction fails phenomenological test at selected scale
D-C: clamped	Canonical physical columns hold the other factor coordinates fixed	$(r_W/r_C, r_Y/r_C) \approx (1.018, 0.980)$; $\sim 1.1\%$ two-loop weak/colour residual
D-R: relaxed	Canonical propagator integrates out the other statistical coordinates	$(r_W/r_C, r_Y/r_C) = (1, 0.986636)$; supplied two-loop minimum spread 0.914% at 7.72×10^{13} GeV
D-T: time	Independently proved $\mu^* = \hbar/a_t$ at the physical opportunity scale	$a_t \approx 6.58 \times 10^{-39}$ s if $\mu^* \approx 10^{14}$ GeV

21. Release verdict and physical next calculation

The major quantitative frontier is the universal primitive-to-continuum factor s ; the D41 factor-dependent response is secondary. A valid closure would supply a source-only s together with a canonical event grain and physical matching scale; recover the physical factor coefficients by the complete Schur reduction; and freeze outputs before experimental comparison. Until these source objects exist, the paper supplies a sharper decision protocol and representation theorem, not an absolute Standard Model gauge-coupling prediction.

22. Conclusion and next decision

CLSN-2 establishes exact source-side algebra: a single- κ diagonal-quotient relation, an intrinsic rank-one portal eigenstructure, gauge-invariance constraints on physical kinetic operators, and the failure of simple symmetry and positivity requirements to determine unique physical screening. The operational reading of a gauge coupling remains open: the H-generalized eigenvalues characterise the coupled statistical form, but do not furnish gauge-factor couplings. Axis stiffness and relaxed compliance are different operational readings; identifying either with

physical gauge observables requires a source-derived current-to-canonical-field map. One-loop and two-loop comparisons do not discriminate among the proposed branches, and no physical gauge coupling is derived here.

The next worthwhile calculation is not another normalisation scan. It is the complete source-first representation-resolved Hessian with all physical auxiliaries, with the D41 candidate sealed until the resulting factor response is frozen. If the necessary parent data are unavailable, the correct research status is blocked on source inputs rather than to manufacture a fitted completion.

Standard-background note. Propositions 1, 5 and 6 record standard gauge-invariance or linear-algebra statements applied to the stated source; their proofs are included for clarity rather than claimed as new mathematical theorems.

Source-provenance note. The RCHS indicator rule $s_{F,A}=2\chi_F(A)$, $\chi_F(A)\in\{0,1\}$, is inherited from RCHS-1, not newly derived from the D41 moment matrix. The source-to-canonical-gauge-field map remains unresolved. The two-loop comparison figures are supplied by independent review; the script is listed in the reproducibility manifest.

23. Source notes and references

[1] K. Taylor, The Physical Changing Link Source Representation Resolved History Metric and Gauge Normalisation Closure Attempt in VERSF (CLSN-1), public manuscript dated 6 October 2026, §§17.2–17.7, 17.81–17.85, 19. Source PDF supplied by author.

[2] K. Taylor, CLSN-1 final working manuscript (version 12), §§17.88 and 17.106–17.109: PCN premise, frozen unscreened gauge triple and post-freeze one-loop diagnostic. The published 6 October source in [1] contains the D41 mathematics. No §17.110 or preliminary D41 projection section is attributed to version 12; the projected candidates are constructed and distinguished in the present CLSN-2.

[3] Standard Model one-loop coefficients and $\overline{MS}$ input values: comparator prescription recorded in the supplied CLSN-1 working manuscript. No new measured quantities enter the calculation.

Comparator-status note. Two-loop and input-sensitivity results are incorporated from the supplied independent review. They are used here to withdraw, not strengthen, any claim based on the lowest one-loop residual. No physical projection is inferred by numerical preference.

Research-status note. Theorems 3–5 are deductions from the D41 matrices and gauge-representation assumptions specified in this manuscript; they are not claimed as independent microscopic VERSF source returns. The conditional branch remains contingent on a physical action map.