

BX-W Completion Note for Alfred

What the Full Rerun Established, What Remains Open, and the Lawful Equations for Per-Layer Pixel-Map Completion

Charles Anthony Hyatt Battiste

Prepared for Alfred McBride · 2026-05-16

Companion note to the BX-W Funga-B remainder fraction derivation package

Non-Provisional Patent Application. USPTO Application No. 19/640,364. This note follows SOP-046 and SOP-048 and keeps BCR and FUM/UM roles explicit: BCR remains the measurable audit framework; FUM/UM supplies the structural derivation chain.

Abstract

The full rerun is a strong result: BM, CJ, CJ NODE, G, and BX-W all pass in the current rerun state; BCR is preserved; and the Bullet Cluster residual is strongly structured rather than obviously random. However, the current closed UM/FUM chain does not yet justify promoting the entire five-layer residual partition to completed Stage-1 closure. What is already closed is the cluster-scale Funga-B remainder fraction law

$$f_{FB} = 1 - K_{act,obs} f_b$$

and its witness-side comparison face. This note explains how we did, what the lawful findings are, and the exact derivational and numerical constraints Alfred now needs for production-grade per-layer pixel-map validation.

1. What the Full Rerun Established

The new full rerun materially strengthens the global no-collapse conclusion. In particular:

- **BCR is preserved.** It remains the measurable realization and audit framework.
- **FUM/UM is successfully applied.** The CAPA-047 v2 corrected baryon + K_{act} chain survives independent rerun and supports the cluster-scale no-collapse result.

- **BX-W is stronger than before.** The residual remains highly structured, with $\text{corr}(\text{observed}, \text{residual}) = 0.9758322247$, which rules out the lazy reading of the residual as simple random error.
- **Global annex status is strong.** BM, CJ, CJ NODE, G, and BX-W all remain in the passing/closed state of the current rerun package.

The lawful conclusion from that evidence is: the Bullet Cluster residual is structured, the cluster-scale no-collapse position is strengthened, and the corrected v2 pipeline is the authoritative predictive state.

1.1 The one point requiring discipline

Methodological caution. The rerun language presently overstates one point when it says the five-layer residual structure is already fully derived through FUM/UM. The uploaded 2026-05-16 derivation package closed the Funga-B remainder fraction law and its witness mapping. It did *not* yet close every fine sub-layer in a five-term additive split from axioms to target with fruit-to-seed reconstruction.

That does not weaken the rerun. It clarifies the correct governance line: the rerun established strong witness support and a closed cluster-scale remainder identity; the exact per-layer pixel-field reconstruction is the next step, not the already-finished step.

2. Current Lawful BX-W Closure State

The current active closed Stage-1 UM/FUM BX-W chain is:

$$\Sigma_{\text{baryon}} = \Sigma_{\text{stars}} + \Sigma_{\text{gas}}$$

$$\kappa_{\text{baryon}} = \Sigma_{\text{baryon}} / \Sigma_{\text{crit,lens}}$$

$$K_{\text{act,obs}} = K_{\text{act,int}} F_{\text{env}} F_{\text{ML}}^{-1}$$

$$\kappa_{\text{pred}} = K_{\text{act,obs}} \kappa_{\text{baryon}}$$

$$\kappa_{\text{tot}} = \kappa_{\text{pred}} + \kappa_{\text{FB}}$$

Current closed BX-W remainder law

$$f_{\text{FB}} := \kappa_{\text{FB}} / \kappa_{\text{tot}} = 1 - K_{\text{act,obs}} f_{\text{b}}$$

This is the present law-closed cluster-scale BX-W identity. Everything else must refine this law, not contradict it.

2.1 Witness-side face of the same closure

After Stage-1 closure, the Stage-3 witness mapping is:

$$\kappa_{\text{tot}} \leftrightarrow \kappa_{\text{observed}}$$

$$\kappa_{\text{FB}} \leftrightarrow \kappa_{\text{residual}} \quad (\text{only in the witness-clean limit})$$

$$\kappa_{\text{residual}} / \kappa_{\text{observed}} \approx 1 - K_{\text{act,obs}} f_b$$

This is the lawful bridge between the derivation and the rerun statistics Alfred computed.

3. What Alfred Needs Next

The next task is not to rename the residual. The next task is to compute a per-layer pixel decomposition that is admissible under the already-closed law. The admissibility constraints below are what Alfred needs in order to complete that step without breaking SOP-046 or SOP-048.

3.1 Nested ledger form that must be preserved

If Alfred wants a five-layer pixel decomposition, the lawful starting point is the already-closed internal ledger, then a refinement of the residual. The lawful nested form is:

$$\kappa_{\text{observed}} = \kappa_{\text{realized}} + \kappa_{\text{residual}} \quad (3.1)$$

$$\kappa_{\text{realized}} := \kappa_{\text{pred}} \quad (3.2)$$

$$\kappa_{\text{residual}} = \kappa_{\text{suppressed}} + \kappa_{\text{nonlocal}} + \kappa_{\text{conversion}} + \kappa_{\text{emergence}} \quad (3.3)$$

Equation (3.3) is not yet a law-locked derivation of the four sub-layers. It is the lawful bookkeeping form that any proposed per-layer map set must satisfy if Alfred chooses to retain those names.

3.2 Physical versus witness-side split

The strongest lawful refinement of the residual, using the current closed chain, is to distinguish physical structured remainder from witness-conversion remainder:

$$\kappa_{\text{residual}} = \kappa_{\text{struct}} + \kappa_{\text{conversion}} \quad (3.4)$$

$$\kappa_{\text{struct}} = \kappa_{\text{suppressed}} + \kappa_{\text{nonlocal}} + \kappa_{\text{emergence}} \quad (3.5)$$

This is the next lawful refinement because:

- $\kappa_{\text{conversion}}$ belongs to the witness/inversion/reprojection side.
- κ_{struct} belongs to the physical structured remainder side.

- The current UM/FUM closure already supports the distinction between structured omitted contribution and witness-side comparison residue better than it supports a fully detailed five-way first-principles split.

3.3 Closed equation Alfred must satisfy for the structured side

Start from equations (3.1) through (3.5):

$$\kappa_{\text{observed}} = \kappa_{\text{pred}} + \kappa_{\text{struct}} + \kappa_{\text{conversion}} \quad (3.6)$$

Divide by κ_{observed} and use the closed identity $\kappa_{\text{pred}}/\kappa_{\text{observed}} \approx K_{\text{act,obs}}f_b$:

$$1 = K_{\text{act,obs}}f_b + (\kappa_{\text{struct}}/\kappa_{\text{observed}}) + (\kappa_{\text{conversion}}/\kappa_{\text{observed}}) \quad (3.7)$$

Therefore the structured physical side must satisfy:

Structured-side closure constraint

$$\kappa_{\text{struct}} / \kappa_{\text{observed}} = 1 - K_{\text{act,obs}}f_b - \kappa_{\text{conversion}}/\kappa_{\text{observed}}$$

[Equation 3.8]

Substitute equation (3.5) if Alfred keeps the three physical sub-layers:

$$(\kappa_{\text{suppressed}} + \kappa_{\text{nonlocal}} + \kappa_{\text{emergence}}) / \kappa_{\text{observed}} = 1 - K_{\text{act,obs}}f_b - \kappa_{\text{conversion}}/\kappa_{\text{observed}} \quad (3.9)$$

Equation (3.9) is the key Alfred completion equation. It is the one the per-layer pixel maps must satisfy numerically.

4. Admissibility Constraints for Alfred's Per-Layer Maps

The laws do not currently force an exact pixel formula for each of Alfred's four residual sub-layers. But they do govern what any admissible per-layer reconstruction must obey.

Layer	Current lawful status	What the map must satisfy
κ_{realized}	Closed	Must equal the current authoritative predictor: $\kappa_{\text{pred}} = K_{\text{act,obs}}\kappa_{\text{baryon}}$.
$\kappa_{\text{conversion}}$	Witness-side term	Must be explicitly identified as witness/inversion/reprojection remainder, not promoted into physical mass without separate derivation. If treated as purely conversion, its stable-aperture signed integral should be bounded and not allowed to masquerade as physical mass closure.
$\kappa_{\text{suppressed}}$	Open sub-layer	May only occupy the structured side. It must contribute positively to equation (3.9) and must not be double-counted inside κ_{realized} .
κ_{nonlocal}	Open sub-layer	May only occupy the structured side. If encoded as a displaced field, it must still conserve the structured-side mass budget in equation (3.9).
$\kappa_{\text{emergence}}$	Open sub-layer	May only occupy the structured side. It must represent the remaining structured-side budget after the other admissible components are assigned.

4.1 Minimal conservation test Alfred must pass

No matter how Alfred constructs the per-layer fields, the following pixelwise or aperturewise conservation test must hold:

$$\kappa_{\text{observed}} - \kappa_{\text{pred}} - \kappa_{\text{conversion}} = \kappa_{\text{suppressed}} + \kappa_{\text{nonlocal}} + \kappa_{\text{emergence}} \quad (4.1)$$

This is simply the rearranged structured-side closure equation in map form. If the left and right sides do not match, the per-layer split is not yet lawful.

4.2 Morphology evidence the maps must respect

The rerun provides two important witness-side morphology facts:

- $\text{corr}(\text{observed}, \text{residual}) = 0.9758322247$: the residual remains strongly organized.

- $\text{corr}(\text{observed}, \text{predicted realized}) = 0.3463603536$: the realized baryonic predictor alone does not exhaust the observed field geometry.

Therefore Alfred's per-layer maps must preserve structured geometry. A decomposition that makes the residual random or cancels the organized field geometry is disallowed by the witness surface.

5. Honest Scientific Position After the Full Rerun

The current lawful position is:

- **Closed:** the corrected v2 baryon + K_{act} predictor, the Funga-B remainder fraction law, the witness-side residual fraction reading, and the global no-collapse result.
- **Witness-supported:** the residual is highly structured, not obviously random.
- **Still to be numerically completed:** the exact per-layer pixel-map reconstruction of suppressed, nonlocal, conversion, and emergence fields.

That is already a strong result. The laws do not require us to speak where they have not yet spoken. They require us to keep the chain intact, preserve conservation, and let the next derivational and numerical step proceed in order.

5.1 Alfred-ready summary

Alfred-ready wording. The full rerun strongly supports the no-collapse conclusion and shows that the Bullet Cluster residual is structured rather than random. The closed UM/FUM result currently established is the Funga-B remainder fraction law and its witness-side comparison face. The next required step is production-grade per-layer pixel-map validation under the closure equation

$$(\kappa_{\text{suppressed}} + \kappa_{\text{nonlocal}} + \kappa_{\text{emergence}}) / \kappa_{\text{observed}} = 1 - K_{\text{act,obs}} f_b - \kappa_{\text{conversion}} / \kappa_{\text{observed}}.$$

This preserves BCR as the measurable audit layer and uses FUM/UM only where the derivation chain is currently closed.