Frozen prospective protocol for a blinded 3-D reconstruction of Khufu's sarcophagus original envelope

Version 1.0 | Frozen 5 August 2026 | Unchanged numerical rules, packaged with Version 7.5

Prospectively fixed before inspection of any new 3-D scan or morphometric reconstruction

1. Purpose and scope

This protocol adjudicates one claim: whether a morphometric reconstruction based solely on the damaged sarcophagus supports the original external longitudinal envelope predicted by the King's Chamber–exterior construction. It does not test symbolic intention, authorship, date or the arithmetic correctness of calculations made from Petrie's published central values.

2. Frozen endpoint and numerical bands

Primary endpoint: the maximum original external longitudinal envelope Lmorph, reconstructed from the sarcophagus point cloud and damage morphology without using chamber or exterior-pyramid dimensions.

Item	Frozen value
Angle-route central prediction	90.59647664 in
Petrie B/100 route	90.688 in
Compatibility core	90.404–90.789 in
Broad conservative envelope	89.750–91.412 in

3. Eligible data

- A metrically calibrated 3-D point cloud or surface mesh covering both damaged ends, both preserved long faces, the external top and enough internal surface to identify orientation.
- Raw and processed data archived with scale calibration, scanner specification, registration report and all transformations.
- Coverage sufficient to define the longitudinal axis and estimate both missing end envelopes; omission of either damaged end makes the primary endpoint ineligible.
- No reconstruction previously fitted with chamber dimensions, exterior-pyramid dimensions, B/100 or the 90.60-in target is eligible as the primary analysis.

4. Blinding

A data curator provides calibrated geometry and the physical endpoint definition. Until analysis lock, the morphometric team is not provided W, H, h, θface, Lθ, B/100, Petrie's approximate original length or the decision bands. Before unblinding, the team deposits a timestamped report, executable code, all exclusions and masks, model-specific and combined estimates, uncertainty intervals and SHA-256 hashes.

5. Coordinate system and estimator

The longitudinal axis is estimated from a joint robust fit to the preserved external long-face surfaces. Damage masks are defined before missing-surface reconstruction. The external envelope is reconstructed at both ends; the primary endpoint is the maximum distance between reconstructed original end envelopes along the frozen longitudinal axis.

At least three predeclared reconstruction families are reported: a low-order polynomial surface, a regularised spline and a Gaussian-process or equivalently uncertainty-bearing smooth surface. The primary point estimate is the median of eligible model-specific envelope estimates. The primary 95% uncertainty interval is the union of model-specific bootstrap or posterior 95% intervals. No family is discarded because its result is distant from the prediction.

6. Quality-control gates

Gate	Pass rule	Failure consequence
Registration	Global registration RMSE ≤1.0 mm	Re-register or reacquire before endpoint opening
Held-out reconstruction	Median absolute error ≤2.0 mm	Primary classification invalid
Held-out tail error	95th-percentile absolute error ≤5.0 mm	Primary classification invalid
End coverage	Both damaged ends and long-face curvature represented	Endpoint ineligible
Locked analysis	Report, code, exclusions and hashes deposited before unblinding	Result exploratory only

7. Frozen primary decision rule

Classification	Rule
Compatible	Point estimate in 90.404–90.789 in AND 95% interval wholly in 89.750–91.412 in.
Incompatible	95% interval wholly below 89.750 in OR wholly above 91.412 in.
Indeterminate	Every other outcome, including intervals that cross a boundary or fail to resolve the core.

The bands were frozen before the Version 7.5 positional audit and are not recalculated after new morphology is observed. The compatibility core is the angle-only inverse range; the broad envelope combines the conservative historical bounds on angle, chamber width, chamber height and sarcophagus height.

Post-freeze interpretive note added in Version 7.5; thresholds and decision rules are unchanged. On the measured-face scale, the core excludes the reduced H/W, h/W angular branch at 91.181 in but includes the reduced centesimal branch at 90.658 in. This is partial directional discrimination only: the protocol was not frozen as a full-model comparison, and the broad envelope includes both branches.

8. Secondary tests

Branch asymmetry: independent northwest and southwest reconstructions are compatible only when each branch's 95% slope interval overlaps 1.269982–1.275462 and the two branch intervals overlap one another. If either interval lies wholly outside the band, the symmetric-X extension is incompatible; otherwise it is indeterminate.

Original-position reconstruction is governed by a separate frozen protocol. It cannot rescue an incompatible envelope endpoint and is not included in the primary longitudinal decision.

9. Exclusions and deviations

- No chamber dimension, pyramid dimension, B/100 value or historical 90.60-in target may enter surface fitting.
- All predeclared model families and model-specific outputs are retained; selective reporting is prohibited.
- Surface masks, smoothing parameters, coordinate transformations and outlier rules are frozen before unblinding.
- Protocol deviations are timestamped before unblinding and do not alter the frozen decision bands.
- An analysis failing quality-control or blinding is labelled exploratory and cannot produce a confirmatory classification.

10. Interpretation and impact rule

A compatible result strengthens the claim that the chamber–exterior operator recovers the damaged original envelope, but does not prove symbolic intention. An incompatible result retires that recovery claim and any argument depending on it. It does not alter the direct arithmetic fact that Petrie's printed central measurements generate the reported X angle. An indeterminate result produces no directional evidential update.

11. Freeze record

Machine-readable thresholds accompany this protocol in data/frozen_prospective_thresholds_v7_5.csv and data/frozen_prospective_protocol_v7_5.json. The protocol, data files and code are included in the Version 7.5 SHA-256 manifest.