# ZEUS X-Trust

Authentication with no stored key. The valid secret exists only while the system runs — nothing to extract, nothing to attack offline.

**GeoFold AI — a deep-tech venture by Trauth Research LLC**

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A POST-QUANTUM CANDIDATE · LIVE-STATE AUTHENTICATION

# ZEUS X-Trust

The secret is never stored. It exists only while the system runs — so there is nothing to extract and nothing to attack offline. Security is carried by the live state, not by the length of the password.

**A 6-character password carries what 20+ characters carry today**


*Campaign summary — 3,500 controlled test executions across four adversarial campaigns; all scheduled positive controls accepted, all unauthorized inputs denied.*

**3,476/3,476**
ATTACKS DENIED

**0**
BREACHES

**22**
ATTACK PROFILES

**$2^{256}$ effective work factor** · no stored static key · no offline verification object · no known brute-force path to date

# Nothing to brute-force, nothing to steal

## No stored key

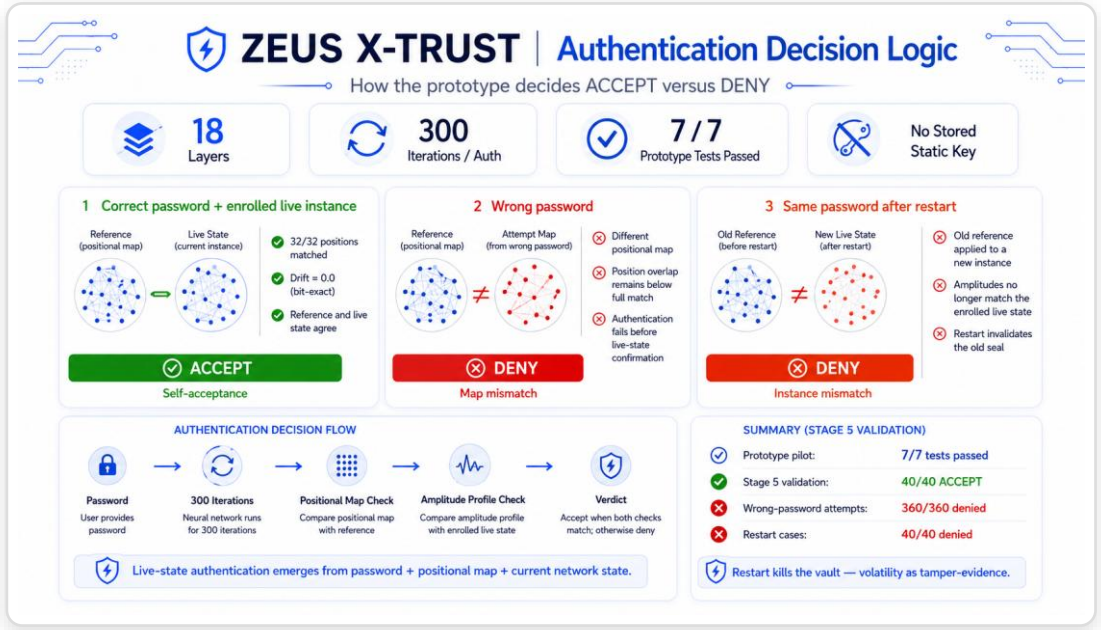
Access = a password-controlled positional map × the live amplitude profile × the enrolled neural instance. There is no hash and no static key to lift.

## Live-state binding

The valid state exists only inside the running instance. Reproducing it means reproducing the whole substrate — not guessing a string.

## Fail-closed

Any restart or tamper destroys the seal. The volatility of the live state is itself the tamper-evidence.




*Authentication decision logic — ACCEPT only when the positional map and the live amplitude profile both match the enrolled instance.*

| 3,476/3,476 | 0 | 22 | $2^{256}$ |
|---|---|---|---|
| DENY | BREACH | PROFILES | TARGET* |

**6-char password, effective security modelled at $2^{256}$ class — now backed by 4,005 measured distances.*

**ROADMAP**

**Independent watchdog** (continuous integrity + graduated response) → **System-level adversarial testing** → **External black-box validation**

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REINITIALISATION DISTANCE MEASUREMENT · 100 RUNS × 1,000 ITERATIONS · 4,005 PAIRWISE COMPARISONS

# The distance is measured, not assumed

The same instance reproduces its state exactly. No foreign instance ever enters the acceptance window.

### Deterministic reference

Ten runs, each a fully rebuilt network, no weights ever saved or loaded: bit-identical amplitude vectors. Pairwise distance exactly 0.0 — the reference carries no measurement noise.

### Foreign instances stay far out

Ninety independent re-initialisations, 4,005 pair comparisons. At the authentication-relevant positions the closest pair still sits $2.8 \times 10^{11}$ acceptance windows apart. Zero collisions.

### Structure, not scale

Normalised to |max| = 1, the median structural distance is 0.52 on a scale whose maximum is 2. The separation survives any global rescaling by an attacker.

| 0.0 | 0 / 4,005 | $2.8 \times 10^{11}$ | $2^{256}$ |
|---|---|---|---|
| SAME-INSTANCE DISTANCE | COLLISIONS | × ACCEPTANCE WINDOW | EFFECTIVE WORK FACTOR |

**The password is not the security boundary.** A 6-character secret addresses twelve coupled position–amplitude relations that must all be reproduced on the enrolled live instance — effective work factor modelled in the $2^{256}$ class, the order of the 256-bit security level of SHA-512.

*Appendix C — DOI 10.5281/zenodo.21744755 · Measurement 2026-08-01: 100 runs × 1,000 iterations, 4.8 h, no NaN/Inf, weights never stored or reloaded. Collision experiment for a formal false-accept rate in progress.*

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