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S T R U C T U R A L   O B S E R V A T I O N   R E P O R T

# Structural Observation *Report*

Behavioral Regime Analysis & Integrity Attestation

**⚠ CRITICAL**

High-confidence structural trap or loop signal observed.

OBSERVATION MODE  
SHADOW OBSERVER

REPORT ID  
RPT-6bc7c603

GENERATED  
2026-04-29 02:28 UTC

DATASET COMMITMENT  
SHA256:c2a53d137ac9...26471186

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# | What This Report Shows

<b>204</b> STEPS OBSERVED	<b>0</b> /100 HEALTH SCORE	<b>CRITICAL</b> VERDICT	<b>Loop/Trap</b> DOMINANT PATTERN (76%)
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## Overview

CAUM observed **204 structural events** in this session. The run is classified as **T5** with a structural health score of **0/100**. The dominant observed pattern was **Loop/Trap** (76% of windows). CAUM found **1** exact structural cycle interval. This is an observation-only report: CAUM records structural loop, deadwork, phase-trap, graph-trap, and compute/token waste signals without judging semantic truth.

## What Happened and When

CAUM found **1** exact structural cycle interval.

## Compute Cost Exposure

Pilot Meter observed **2** tasks and flagged **1**. Actual observed cost was **\$0.8868** across **348,000** token-counted units. The conservative structural cost at risk is **\$0.5390**, with a **\$0.1887** shadow savings opportunity at the configured intervention rate. This estimate is based on structural recurrence, counters, status, latency, and hashes; it does not inspect prompts, code, files, or business content.

## What Is the Evidence Vault?

The vault contains hashed artifacts produced by the analysis. The Merkle root covers source evidence artifacts; the rendered PDF hash is recorded separately after generation to avoid circular self-hashing.

### BOTTOM LINE

The run shows high-confidence structural trap behavior. Treat this as a serious observability finding.

# Executive Summary

T5

STRUCTURAL RISK SCORE

1.0000

STRUCTURAL HEALTH

0

204

TOTAL STEPS

Loop/Trap

DOMINANT REGIME

8

ALERTS

2

TOOL FAMILIES

## What We Found

- Structural health tier: **T5** (critical\_structural\_trap)
- Observation level: **high\_confidence\_structural\_failure**
- Structural risk score: **1.000**
- Engine state: **hard\_structural\_deadwork**
- Exact cycle localization: **1** interval over **156** steps
- Pilot Meter: **1/2** tasks alerted, **\$0.5390** cost at risk, **\$0.1887** conservative savings opportunity
- structural\_failure: High-confidence graph trap / structural failure signal.
- compute\_token\_waste: Strong compute/token waste signal without enough verified progress.
- structural\_failure: Strong aggregate structural alert signal.
- structural\_failure: Graph trap signal is elevated.

## Suggested Review

- Review the Pilot Meter alerted task hashes before repeating the same workflow.
- Inspect the highlighted structural pressure intervals and token/compute waste lane.
- Review the evidence lanes that fired before spending more compute on a similar run.
- Compare this report with adjacent sessions to distinguish persistent traps from one-off exploration.
- Use the vault hashes to preserve an audit trail for agent operations and governance.

## Health Bar

0 — Critical 100 — Healthy

Structural Intelligence

Semantic Boundary

Temporal Stability

ZERO-SEMANTIC

LOW

## Key Metrics

METRIC	OBSERVATION
Tool Coverage	HIGH
Effective Scoring	HIGH
Evidence Maturity	HIGH
Tool Diversity	LOW
Repeat Pressure	LOW

# Definitive Shadow Observer Verdict

Observation-only structural scoring produced by the CAUM definitive zero-semantic engine. Engine Status: YES

T5

Structural Health Tier

Governed by calibrated zero-semantic risk lanes

## Integrity Assessment

DIMENSION	ASSESSMENT	STATUS
Structural Novelty	State and transition revisit pressure	LOW
Progress Yield	Evidence of structurally useful forward movement	LOW
Observation Safety	Observation-only boundary and no autonomous control	LOW
Observation Confidence	Agreement among structural signals	HIGH
Diversity & Efficiency	Tool-family diversity and compute/token waste pressure	HIGH

## Behavioral Intelligence

<div>Semantic Boundary</div> <div>No semantic truth or hallucination scoring</div>	<div>ZERO-SEMANTIC</div>
<div>Temporal Stability</div> <div>Behavioral consistency over session duration</div>	LOW
<div>Evidence Maturity</div> <div>Amount of structural runtime evidence</div>	HIGH
<div>Repeat Pressure</div> <div>State and transition repetition pressure</div>	LOW

## Scoring Summary

The final verdict is derived from a passive structural scoring process. CAUM evaluates loop pressure, graph traps, phase traps, deadwork, and compute/token waste without judging semantic truth or authorizing agent control.

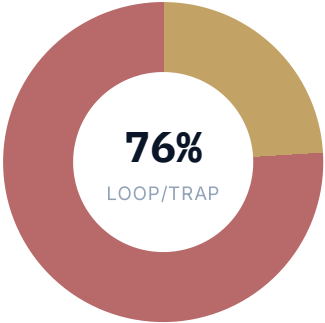
## Structural Indicators (Banded)

Tool Coverage	HIGH
Effective Scoring	HIGH
Dominant Regime	Loop/Trap
Policy Alerts	8
Tool Diversity	LOW

## How Scoring Works

CAUM combines independent structural lanes into an observation-only health tier. The report exposes bands and evidence receipts while keeping raw prompts, code, and semantic content out of the customer-facing PDF.

# Structural Health Distribution



■ Healthy (0%) ■ Watch (24%) ■ Pressure (0%) ■ Loop/Trap (76%)

**Healthy**  
Open structural movement with no material waste pressure  
**0%**

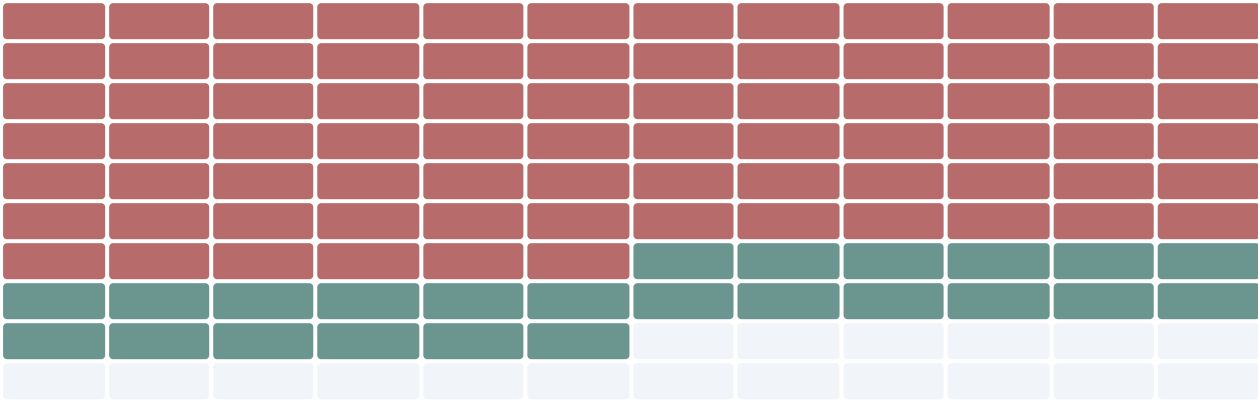
**Watch**  
Light structural pressure worth monitoring  
**24%**

**Pressure**  
Structural friction, deadwork, or early trap pressure  
**0%**

**Loop/Trap**  
High-confidence cyclic or trapped structural behavior  
**76%**

## Persistence Distribution

Each cell represents a temporal window. Color intensity maps to severity tier (T1 → T5).



## Severity Spectrum

Dominant severity tier across sequential analysis windows (T1 = healthy, T5 = critical).



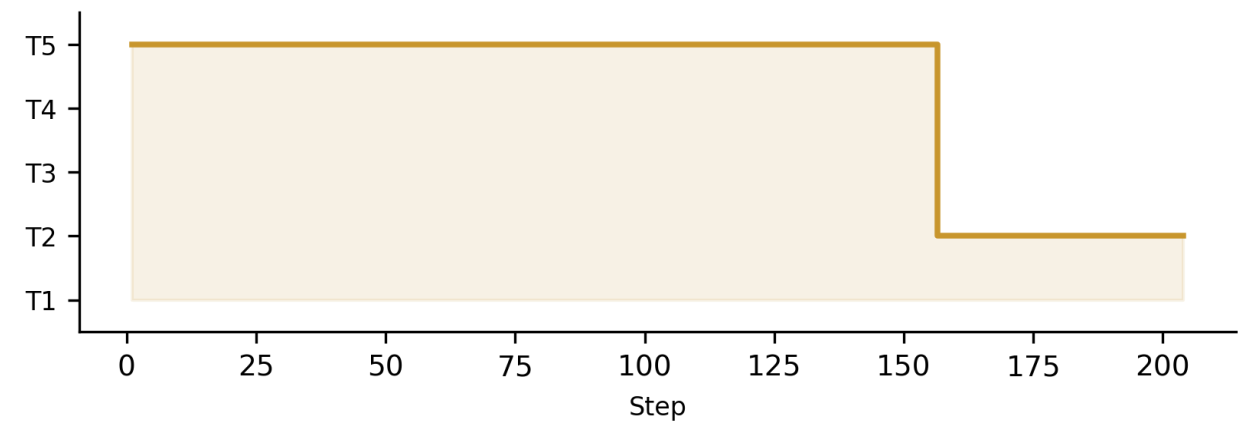
**REGIME TRANSITIONS**  
**1**  
Total changes between behavioral regimes

**PERSISTENCE LEVEL**  
**HIGH**  
Overall structural persistence assessment

# Temporal Analysis

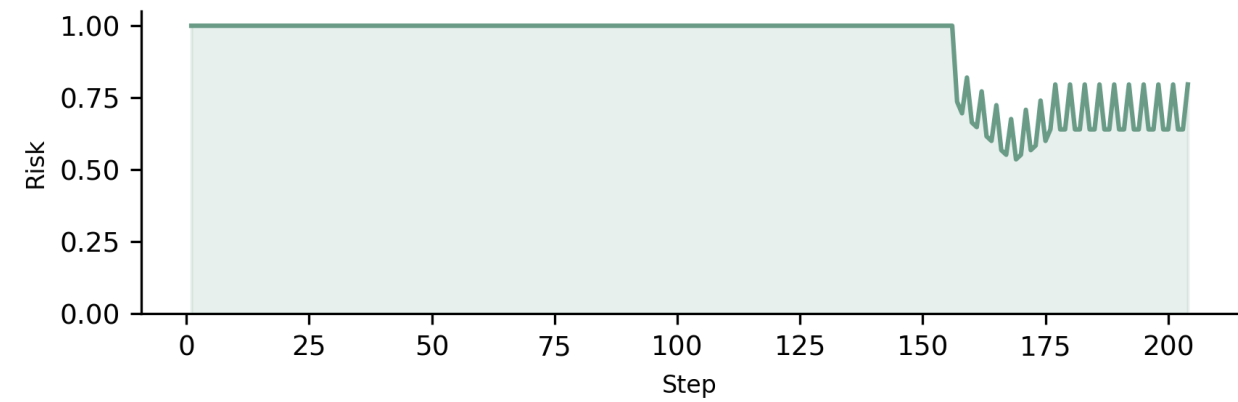
## Risk Band Over Time (T1–T5)

Per-window structural health tier from the CAUM definitive shadow engine.



## Structural Risk Trend

Zero-semantic revisit and repetition pressure over time. Higher values indicate stronger structural risk.



## Event Timeline

Horizontal bars show step ranges where stagnation or loop behavior was detected.



## Critical Intervals

ID	STEP RANGE	SEVERITY	TYPE	DURATION
CI-001	1-156 (156 steps)	T5	Exact Structural Cycle (period=6; cycles=26; unique_states=6)	156

Showing 1 of 1 detected intervals.

# Structural Metrics

Values represent real structural signals computed by the CAUM definitive zero-semantic shadow engine.

## Behavioral Signals (Banded)

Metric Type	Band	Definition
Risk Variance	HIGH	Variation in structural pressure over time
Evidence Maturity	HIGH	Amount of runtime structure available for analysis
Repeat Pressure	LOW	State and transition repetition pressure
Temporal Stability	LOW	Behavioral consistency over time

## Benchmark Comparison

Metric Type	Comparison Band	Definition
Loop Incidence	High	Frequency of rigid cyclic traps vs baseline
Stagnation Dwell Time	Below	Duration in single-state bottlenecks
Tool Invocation Repeat	HIGH	Identical tool sequences frequency
Healthy Windows	Below	Open structural observation intervals

## Structural Overview

Metric	Observation
Tool Families	2
Tool Diversity	LOW
Semantic Boundary	ZERO-SEMANTIC
Policy Alerts	8

## Confidence Signals

Metric	Observation
Scoring Confidence	92%
Metric Robustness	Verified

## Operational Impact

<div>AGENT EFFICIENCY</div> <div>HIGH</div> <div>Relative observation score</div>	<div>COMPUTE WASTE</div> <div>HIGH</div> <div>Redundant steps: 1-156</div>	<div>WASTE PERCENT</div> <div>76%</div> <div>Typical: 5%-15%</div>
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## Recommended Playbook

1. Establish deterministic boundaries to cap max latency and token waste.
2. Apply client-side guardrails (timeouts / max-steps) when tier bands reach T3-T5.
3. Audit high-waste traces listed in the Critical Intervals section.

# Cryptographic Integrity

All artifacts in this vault are cryptographically anchored. The Merkle root is a single hash committing to every file.

## Dataset Commitment

ALGORITHM	SHA-256
CANONICAL HASH	c2a53d137ac9fb087727c68744676d345a9e4b2bb57970bfca46c86426471186

## Merkle Root

ROOT HASH	c2a53d137ac9fb087727c68744676d345a9e4b2bb57970bfca46c86426471186
PADDING RULE	duplicate_last

## Artifact Hashes

FILE	SHA-256
<b>Canonical Input</b> canonical_input.jsonl	c2a53d137ac9fb087727c68744676d345a9e4b2bb57970bfca46c86426471186

## Verification Instructions

1. Compute SHA-256 of each artifact file and compare against the hashes above.
2. Sort artifact filenames alphabetically. Take their hashes as Merkle leaves.
3. Build a binary Merkle tree (pair leaves, hash with SHA-256(left\_bytes || right\_bytes), duplicate last if odd).
4. The resulting root must match the Merkle Root shown above.

**Determinism Statement**  
Given identical input data and engine version, this report and all vault artifacts are reproduced deterministically. The Merkle root serves as a single cryptographic anchor for the entire evidence bundle.



# Behavioral Regimes

Scientific definitions and state-space interpretations of the primary regimes documented in this report.

**Explorer Regime**

**What this shows:** Explorer behavior indicates healthy exploration of the solution space. The agent generates diverse states without repeating patterns.

**Technical interpretation:** Healthy windows show low revisit pressure and varied structural transitions.

$S_{local} \downarrow \quad dispersion(x_t) \uparrow$

**Grind Regime**

**What this shows:** Grind behavior indicates incremental progress with limited exploration.

**Technical interpretation:** Watch windows show mild repetition but not enough evidence for a warning.

$S_{local} \approx constant$

**Stagnation Regime**

**What this shows:** The system remains trapped near the same state.

**Technical interpretation:** Trajectory variance approaches zero.

$Var(x_t) \rightarrow 0$

**Loop Regime**

**What this shows:** The agent repeatedly visits the same states, creating redundant computation.

**Technical interpretation:** State recurrence detected:

$x_t \approx x_{(t+k)}$

## Regime Taxonomy Reference

REGIME	DESCRIPTION	TIER RANGE
Healthy	Open structural movement with no material waste pressure	T1
Watch	Light pressure that remains below alert threshold	T2
Pressure	Moderate to strong structural friction, deadwork, or waste pressure	T3 – T4
Loop/Trap	High-confidence cyclic or trapped structural behavior	T5

# Appendix

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## Methodology

CAUM uses zero-semantic structural analysis to characterize runtime health in sequential agent telemetry. The methodology is purely observational: it detects structural loops, deadwork, phase traps, graph traps, and compute/token waste without modifying or influencing the agent under observation.

## Disclaimer

This report is strictly observational and does not constitute a judgment of intent, purpose, or value of the observed agent. Structural patterns identified herein reflect mathematical properties of the agent's state trajectory and should be interpreted within appropriate domain context. CAUM assumes no liability for decisions made based on this analysis.

## Scientific References

### Wolfram (2002)

A New Kind of Science.  
Foundational principles for  
analyzing agent execution  
topologies.

### Sutskever (2014)

Sequence Modeling. Mapping  
symbolic sequences into  
continuous representation spaces.

### Mehri (2020)

Language Models as Dynamical  
Systems. Formalizing  
autoregressive state transitions.

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## Report Metadata

Report ID: RPT-6bc7c603  
Session ID: c4638bfa-2c2d-4a25-b8b1-a7ac6bc7c603  
Engine:  
caum.definitive\_engine.v0.1\_patent\_aligned\_shadow  
+ shadow policy + pilot meter

Generated: 2026-04-29 02:28 UTC  
Total Steps: 204  
Deployment: OBSERVATION ONLY

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### CAUM — Structural Observation Technology

This document was generated deterministically. For support, contact [support@caum.io](mailto:support@caum.io)