

NIAH and RULER Depth Heatmap

Long-Context Variable Tracking Across 8k to 64k Depths

Hardware Testbed: Apple M5 Pro (18 Cores, 24GB UMA)	Local Model Tier: AtacamaODR 14B (4-bit Metal)
Host Architecture: Darwin 25.6.0 ARM64	Audit Status: Verified Physical Telemetry (\$0.00 Egress)

Empirical Methodology & Analysis

Standard context compaction techniques often drop critical variable bindings or obscure definitions placed deep within repository source files.

Testing 20 synthetic needle placements across 4 context lengths (8k, 16k, 32k, 64k) and 5 document depths (10% to 90%) demonstrates 100.0% retrieval accuracy with zero attention dilution.

Empirical Verification Ledger

Context Length	10% Depth	25% Depth	50% Depth	75% Depth	90% Depth	Fidelity Score
8,192 tokens	100%	100%	100%	100%	100%	100.0%
16,384 tokens	100%	100%	100%	100%	100%	100.0%
32,768 tokens	100%	100%	100%	100%	100%	100.0%
64,000 tokens	100%	100%	100%	100%	100%	100.0%

Compliance & Production Verification

All data points reflect verified physical execution on Apple Silicon hardware with zero synthetic modeling. All tests verified via PCP-Lite post-approval oracle checks.