Paper 024 / Application 001

NIDUS Lab: A Falsification-First Operating System for Frontier Physics Experiments

A JMP0X1B application architecture for protocols, ledgers, instruments, and review gates

JMP0X1B Research Group

Working paper draft / June 13, 2026

Abstract

NIDUS Lab is proposed as a laboratory operating system for research programs where negative results are valuable and premature claims are dangerous. It binds protocol state machines, instrument telemetry, stress-energy ledgers, null-result likelihoods, sample recipes, and publication artifacts into a signed, replayable workflow. The target domains are electrostatic projection tests, coated-wire replication, microwave cavity audits, and cryogenic subsystem qualification.

Status. Draft manuscript for review and revision. This paper is not an empirical claim of new physics or field-ready technology. It is a structured proposal, theory note, protocol, or application architecture intended to be auditable, falsifiable, and publishable with source.

Contents

1 Problem

Frontier laboratories often separate experiment control, data logging, analysis notebooks, provenance, and publication. That separation makes it difficult to audit whether a result followed its declared protocol. NIDUS Lab treats the experiment as an evidence-producing distributed system. The problem is to coordinate instruments, researchers, analysis locks, and release gates without turning science into bureaucracy.

2 Model

NIDUS Lab uses actors for instruments and review roles, typed effects for high-voltage, cryogenic, telemetry, statistics, and publication operations, and immutable artifact digests for every stage. A protocol graph controls which transitions are allowed. Nulls, positives, errata, and replications all share the same release machinery.

$$\text{Run} = (P, A, T, D, R),$$

where P is the protocol, A the apparatus manifest, T the telemetry stream, D the data artifacts, and R the review state.

$$\Box(\text{Publish} \Rightarrow \text{ProtocolComplete} \wedge \text{ArtifactsSigned} \wedge \text{ReviewClosed}).$$

3 Claims

1. **Claim 1.** A laboratory OS should make null publication as natural as positive-result publication.
2. **Claim 2.** Typed effects are useful because high-voltage, cryogenic, telemetry, and analysis operations have different failure modes.
3. **Claim 3.** Protocol gates reduce overclaiming by making missing controls visible before release.
4. **Claim 4.** The same platform can serve speculative physics, materials replication, and space-grade subsystem qualification.

4 Evidence Plan

A prototype should replay one synthetic capacitor null, one coated-wire materials run, and one cavity closure audit. The acceptance benchmark is not throughput; it is whether an independent reviewer can reconstruct the run sequence, verify artifacts, and identify every claim gate from the PDF and source bundle.

5 JMP0X1B Implementation Surface

The application should be implemented in JMP0X1B when the toolchain is ready. Early prototypes can preserve the target semantics by keeping typed contracts, actor boundaries, and effect declarations explicit.

Illustrative JMP0X1B-style contract

```
actor Instrument<Telemetry> {
    fn arm(plan: RunPlan) -> Gate effects{Safety, Audit}
    fn stream() -> TelemetryFrame effects{Telemetry}
}
actor ReviewGate {
    fn evaluate(run: RunBundle) -> Decision effects{Provenance, Statistics, HumanReview}
}
```

6 Release And Review Plan

Release a reference architecture, protocol schemas, actor contracts, sample run bundles, and a paper-to-artifact mapping for research.jmp0x1b.com publication pages.

7 Open Questions

- Which laboratory instruments need native actors first?
- How can offline labs synchronize without weakening provenance?
- What review gates should be mandatory for every frontier-physics paper?
- How can human notes be preserved without turning them into unverifiable data?

8 Conclusion

NIDUS Lab converts the norms of falsification-first research into a concrete software architecture. It is a practical spinout from speculative papers regardless of whether any anomaly survives.

References

References

[1] JMP0X1B Research Group. *Ultra-High-Vacuum Null Tests of Electrostatic Projection Couplings with Symmetry-Matched Capacitors*. Working paper, 2026. https://research.jmp0x1b.com/papers/uhv-electrostatic-null-tests.html

[2] JMP0X1B Research Group. *Replication and Falsification of Piezoelectric Strain-Driven Superconductivity in Composite Coated Wires*. Working paper, 2026. https://research.jmp0x1b.com/papers/piezoelectric-superconductivity-replication.html

[3] JMP0X1B Research Group. *Energy-Momentum Closure for Microwave Cavity Inertia Claims and Electromagnetic-to-Gravitational Conversion Architectures*. Working paper, 2026. https://research.jmp0x1b.com/papers/energy-momentum-cavity-hfgw.html

[4] JMP0X1B Research Group. *Identifiability of Fifth-Sector Electromagnetic Operators Under Null Experimental Controls*. Working paper draft, 2026. https://research.jmp0x1b.com/papers/

identifiability-of-fifth-sector-electromagnetic-operators-under-null-experimenta.html

[5] JMP0X1B Research Group. *A Bayesian Null Ledger for Electrostatic Projection Experiments*. Working paper draft, 2026. https://research.jmp0x1b.com/papers/a-bayesian-null-ledger-for-electrostatic-projection-experiments.html

[6] JMP0X1B Research Group. *Formal Verification of Falsification Protocols for Frontier Physics Experiments*. Working paper draft, 2026. https://research.jmp0x1b.com/papers/formal-verification-of-falsification-protocols-for-frontier-physics-experiments.html

[7] JMP0X1B. *Technology for Earth, designed with space as the operating condition*. https://jmp0x1b.com/

[8] JMP0X1B. *jmp0x1b Documentation Portal*. https://lang.jmp0x1b.com/latest/site/index.html

[9] JMP0X1B. *jmp0x1b_lang_spec package*. https://libs.jmp0x1b.com/packages/jmp0x1b_lang_spec

[10] JMP0X1B. *jmp0x1b_provenance package*. https://libs.jmp0x1b.com/packages/jmp0x1b_provenance

[11] L. Lamport. *Specifying Systems: The TLA+ Language and Tools for Hardware and Software Engineers*. Addison-Wesley, 2002.

[12] C. Hewitt, P. Bishop, and R. Steiger. A universal modular actor formalism for artificial intelligence. *Proceedings of IJCAI*, 1973.