Kinson VERNET

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Professional Summary

PhD physicist with 5+ years of experience in Monte Carlo simulation, high-energy physics computing, and scientific software development. Advanced skills in C++, Python, Rust, and Geant4. Creator of **ARCO** (Automated Computational Research), **qert** (quantum runtime telemetry), and **Procela** (epistemic governance framework). Co-developer of **Goupil** (backward Monte Carlo engine) and **Calzone** (Geant4 Python wrapper), published in *Computer Physics Communications* and *JOSS*. Experienced in HPC cluster deployment (Slurm/SGE). Seeking a research computing or simulation development role in a laboratory, research institute, or high-tech industry setting.

Technical Skills

Languages: C/C++, Python, Rust, Bash
Modeling & Simulation: Geant4, ROOT, Monte Carlo methods, backward transport, detector modelling
HPC: Slurm/SGE, cluster deployment, code optimization, parallelization
Software Engineering: CMake, Git, CI/CD (GitHub Actions), Docker, pytest, mypy, technical documentation

Professional Experience

Scientific Computing Engineer Jun 2023 – Feb 2024
Laboratoire de Physique de Clermont, France

- Developed high-energy physics simulation codes in C++ and Python using the Geant4 toolkit for gamma photon detector modelling.
- Optimized Monte Carlo simulation workflows, achieving significant reductions in execution time through algorithmic improvements.
- Led detector calibration, evolved the geometry model, authored documentation, and deployed pipelines on the lab's HPC cluster (Slurm).
- Co-developed **Calzone**, a Geant4 Python wrapper for outdoor particle detector simulation, published in *JOSS* (2025).

PhD Researcher in Particle Physics Oct 2019 – Dec 2022
Université Clermont-Auvergne, France

- Designed and implemented C++ algorithms for muon transmission radiography to reconstruct density distributions of volcanic substructures.
- Conducted advanced statistical analysis with ROOT and Python: systematic uncertainty quantification, background noise characterization.
- Co-developed **Goupil**, a backward Monte Carlo engine for low-energy gamma-ray transport, published in *Computer Physics Communications* (2025).

Research Intern (Master II) Apr – Sep 2019
Laboratoire de Physique de Clermont, France

- Developed Monte Carlo simulations for volcanic substructure radiography.
- Determined optimal detector placement via backward Monte Carlo techniques.

Research Intern (Master I) May – Dec 2018
IPNL (IP2I) & CERN, France & Switzerland

- Identified detection coincidences for the AEgIS antimatter experiment at CERN.
- Developed simulation and analysis tools using Geant4 and ROOT.

Key Projects

ARCO — Automated Research into Computational Ontologies 2026
Creator · github.com/kvernet/arco · Rust 1.96+ · Python (reference experiments)

- Designed and built a **computational science platform in Rust** for discovering the conditions under which computation, memory, and learning emerge in arbitrary information systems.

- Formalized *Information Universes* — 6-tuples of (state space, transformations, observations, resources, invariants, schedule) — and measured emergent computation via shuffle-corrected normalized mutual information calibrated against destructive null distributions.
- Published on **crates.io**.

QERT — Quantum Execution Runtime Telemetry 2026
Creator · github.com/kvernet/qert · C++17 · Eigen · PAPI · Python (orchestration)

- Designed and built an **instrumented statevector simulator** in C++ that treats quantum simulation as a scientific observatory — recording per-gate hardware performance counters (L3 cache misses, TLB misses via PAPI), execution timing, and half-chain entanglement entropy during circuit execution.
- **Core architecture**: modular C++17 library (statevector, gates, telemetry, entropy, circuit) with Eigen for linear algebra, PAPI instrumentation — all compile-time configurable via CMake.
- **Reproducibility-first design**: deterministic FNV-1a hashing for cross-platform experiment identification, RNG seeds embedded in metadata, self-describing output files, git commit and compiler info baked into build.
- **Null result**: no correlation between L3 cache miss patterns and entanglement growth ($R^2 < 0.2$ for all $N \geq 18$). Cache behavior dominated by circuit layer structure, not entanglement dynamics.
- **Methodological contribution**: demonstrated that quantum simulators can be designed as reproducible scientific instruments, establishing a baseline for the cache-contained regime and identifying the memory-pressure regime where entanglement-execution correlations may emerge.

Procela — Epistemic Governance in Mechanistic Simulations 2025 – 2026
Creator & Lead Developer | procela.org | PyPI

- Architected a Python framework enabling simulations to question their own structural assumptions at runtime — static models become adaptive, self-improving systems.
- Core abstractions: Epistemic Variables (hypothesis memory, cryptographic traceability), Causal Mechanisms (competing ontologies with confidence scores), Governance (system mutation via detect-hypothesize-experiment-evaluate-conclude lifecycle).
- Exemplary software quality: 100% test coverage, strict mypy typing, CI/CD (GitHub Actions).
- Validated on antimicrobial resistance case study: **20.4% error reduction**, **69% regret improvement** via epistemic governance strategies.
- Published on **PyPI** and under review.

Education

PhD in Particle Physics 2019 – 2022
Université Clermont-Auvergne, France | Thesis: 3D Volcano Imaging Using Transmission Muography

Master's in Fundamental Physics 2016 – 2018
Université d'État d'Haïti, Haiti

Bachelor's in Electromechanical Engineering 2005 – 2011
Université d'État d'Haïti, Haiti

Selected Publications

- V. Niess, **K. Vernet**, L. Terray. *Calzone: A Geant4 Python wrapper...* JOSS, 2025.
- V. Niess, **K. Vernet**, L. Terray. *Goupil: A Monte Carlo engine for backward transport...* CPC, 2025.
- **K. Vernet**. *3D Volcano Imaging Using Transmission Muography.* JRJC, 2022.
- **K. Vernet**. *Procela: Epistemic Governance in Mechanistic Simulations...* Under review, 2026.

Awards

Doctoral School of Fundamental Sciences Fellowship (France, 2019)

References

Available upon request.