

JOE CROWLEY

EXPERIMENTAL SYSTEMS & APPLIED AI ENGINEER

Petaluma, California · joe-crowley.com
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PROFILE

Experimental physicist and applied-AI engineer who builds reliable paths from bench hardware and noisy measurements to software people can use. Developed and installed CERN detector data acquisition with FPGA firmware, C++ software, and Python hardware interfaces; built RF calibration signals and automated detector-validation workflows; deployed production identity-resolution software; and now develops agentic workflows with retrieval, provenance, evaluation, and human review. Experienced teaching electronics, FPGA, and scientific computing and presenting technical work across international collaborations.

CORE CAPABILITIES

Measurement systems: Data acquisition, oscilloscopes, optical detector and PMT calibration, high-voltage electronics, digitizer testing, RF calibration and test-signal generation, FPGA/Verilog, experimental design, signal processing, failure isolation

AI and software: Python, C++, PyTorch, supervised and unsupervised learning, anomaly detection, clustering, boosted decision trees, autoencoders, embeddings, LLM agents, tool integration, retrieval/RAG, evaluation, provenance, PostgreSQL/pgvector

Automation and computing: Hardware interfaces, Linux, Git, Docker, CI/CD, HTCondor, Singularity, high-performance and parallel computing, test and validation automation

Technical communication: Technical presentations, electronics and computing instruction, documentation, healthcare IT deployment, and cross-functional and international collaboration

EXPERIENCE

Founder & Applied AI Engineer | Fat Tailed Solutions

Petaluma, California · January 2024 to present

- Architected agentic AI workflows that turn expert technical procedures into reusable tools with retrieval, typed actions, durable state, provenance, evaluations, approval controls, and human-review surfaces.
- Built Python and PostgreSQL/pgvector systems for source-grounded retrieval, workflow state, evidence tracking, repeatable evaluation, and claim-level confidence and provenance across multi-step technical work.

Graduate Researcher | UC Santa Barbara / CMS & MilliQan, CERN

Santa Barbara, California and Geneva, Switzerland · September 2020 to December 2023

- Engineered and installed a 164-channel data-acquisition system for the MilliQan experiment at CERN, developing Verilog trigger firmware plus C++ and Python interfaces for detector hardware and performing functional tests of CAEN digitizers.
- Built automated CMS detector-validation workflows on HTCondor and Singularity, including stage verification and failed-job resubmission across high-performance computing campaigns.
- Analyzed petabyte-scale LHC datasets in Python and C++, applying statistical analysis, anomaly detection, supervised and unsupervised learning, boosted decision trees, and simulation methods in rare-signal searches.
- Presented designs, validation results, and technical findings in recurring meetings with international, multidisciplinary collaborators.

Founding Software Engineer & Technical Lead (1099 Contractor) | Avant Sciences, LLC

Remote · May 2021 to December 2023

- Led the startup's software effort, managing software contributors and owning core algorithms, full-stack development, production deployment, and maintenance.
- Designed a deterministic-plus-embedding identity-resolution and search system that processed approximately 10 million records in aggregate across more than four healthcare deployments, combining Python/C++, multiprocessing, memory-mapped data, feature ranking, and interpretable matching.
- Containerized and deployed data applications into healthcare IT environments, partnering with product, engineering, and inpatient-facility IT teams on integration, documentation, reliability, support, profiling, CI/CD, and adversarial-input testing.

Student Researcher | Cal Poly / ALICE at CERN / ANITA & SLAC

San Luis Obispo, California and Geneva, Switzerland · September 2018 to June 2020

- Assembled, calibrated, and tested PMT-based electronics for CERN's ALICE FIT T0+ detector, including optical calibration, high-voltage boards, test-bench work, and background simulation for a system targeting order-of-10-picosecond timing resolution.
- Developed RF calibration and test signals for the NASA/DOE ANITA and SLAC T-576 test-beam program by implementing FPGA waveform-generation logic and the output bitstream used to drive a 10 kV pulser; wrote C++ particle-propagation simulations to estimate detector acceptance.
- Presented research at the 2019 American Physical Society Far West Section meeting and delivered weekly technical reports to interdisciplinary teams.

TEACHING AND TECHNICAL LEADERSHIP

Teaching Assistant, UC Santa Barbara Physics: Taught analog electronics; digital electronics and FPGA/Verilog; scientific computing in Python, Bash, and parallel methods; and advanced experimental physics laboratories. Coordinated UCSB Physics Circus outreach in 2023.

EDUCATION

M.A., Physics, University of California, Santa Barbara, December 2023

Graduate research in experimental high-energy physics, detector systems, and scientific computing

B.S., Physics, California Polytechnic State University, San Luis Obispo, June 2020 · GPA 3.7