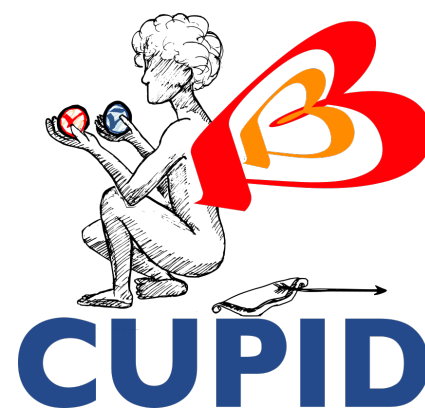


Causally Grounded World Models for Autonomous Rare-Event Scientific Instruments

17 June 2026 BUQ Meeting

Brian Fujikawa

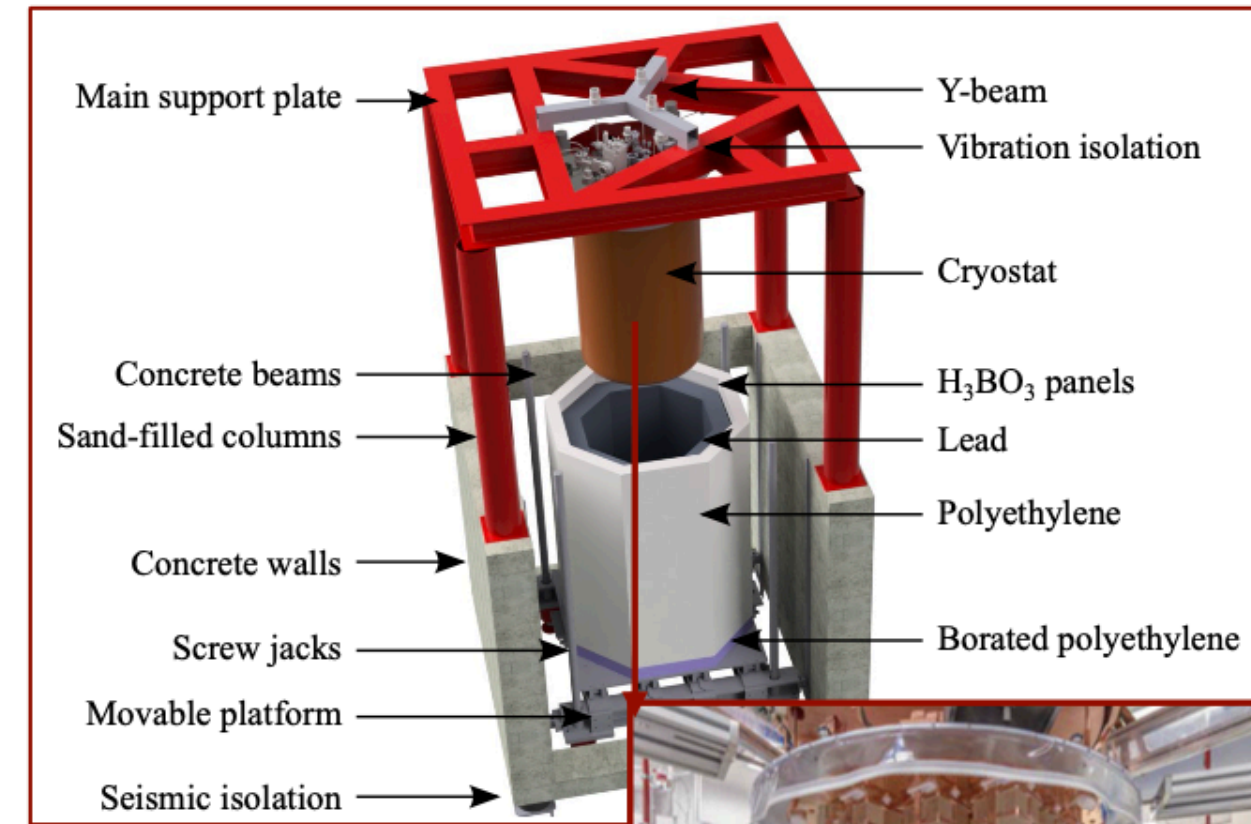




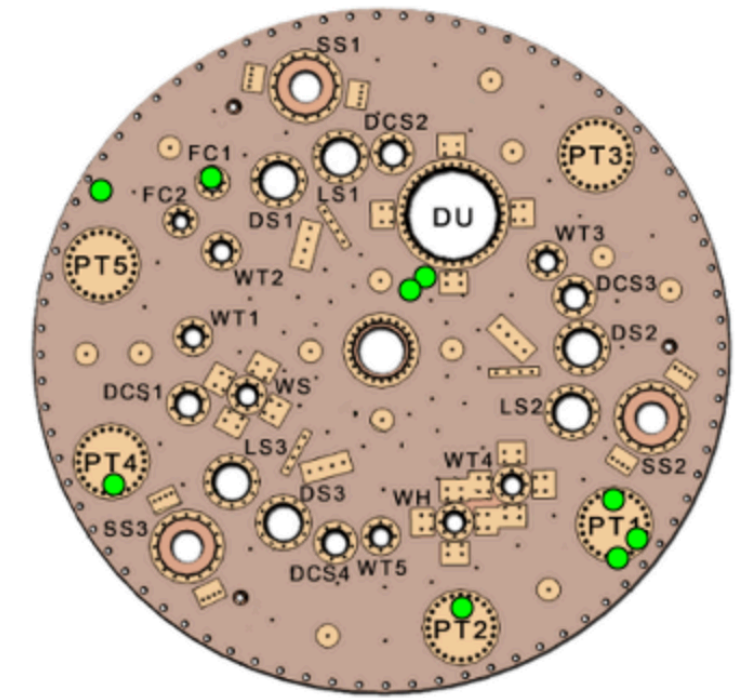
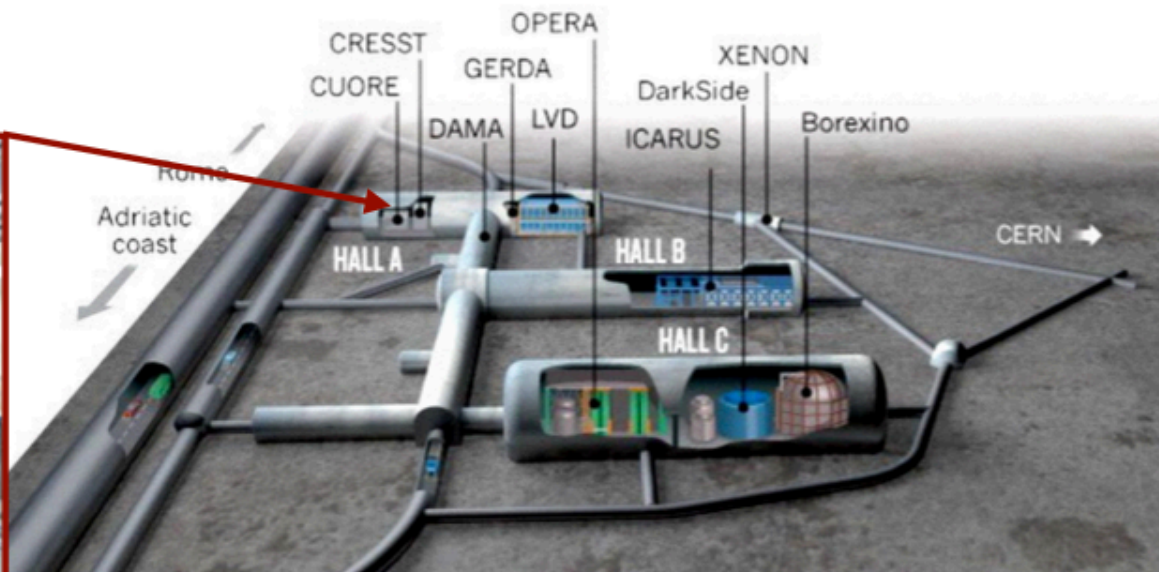
Proposal Summary

- Primary Challenge and Focus Area:
 - Topic 11 – Achieving AI-Driven Autonomous Laboratories
 - Focus Area 11C – AI-Accelerated Science: Correlation to Understanding
- Key Personnel:
 - Chris Grant (Boston University, lead PI)
 - Brian Fujikawa (Berkeley Lab)
 - Tommy O'Donnell (Virginia Tech)
 - Danielle Speller (Johns Hopkins University)
 - Pranava Teja Surukuchi (University of Pittsburgh)

CUPID: CUORE Upgrade with Particle ID

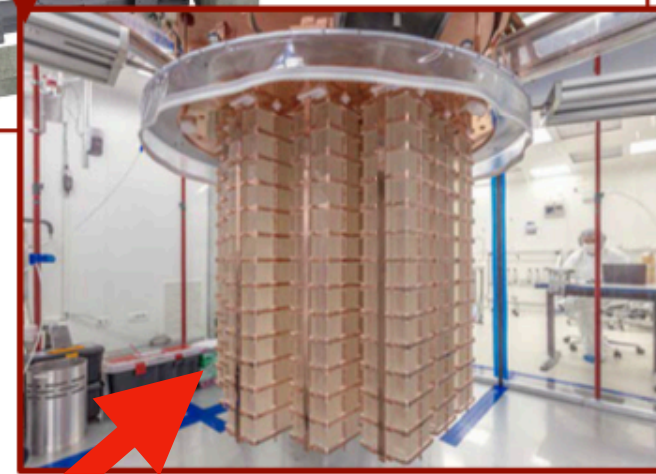


LNGS: Laboratori Nazionali del Gran Sasso

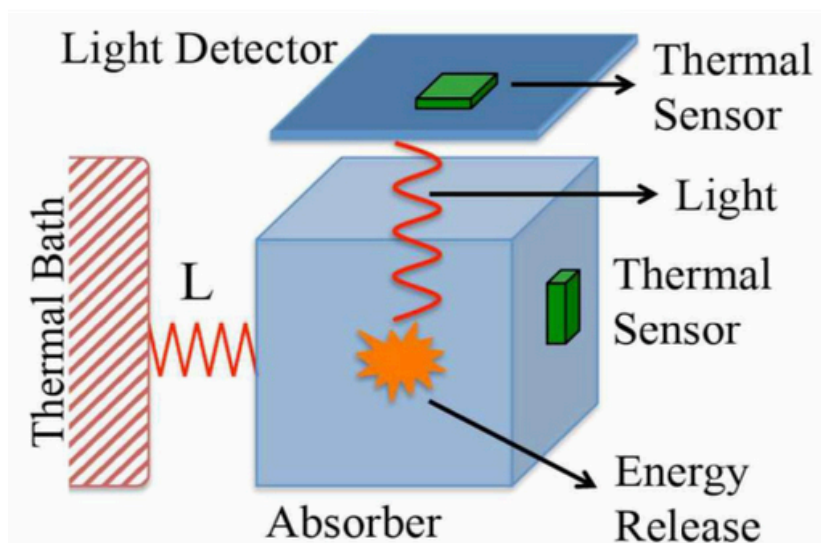


>100 temperatures, pressures, flow rates & other slow-control parameters

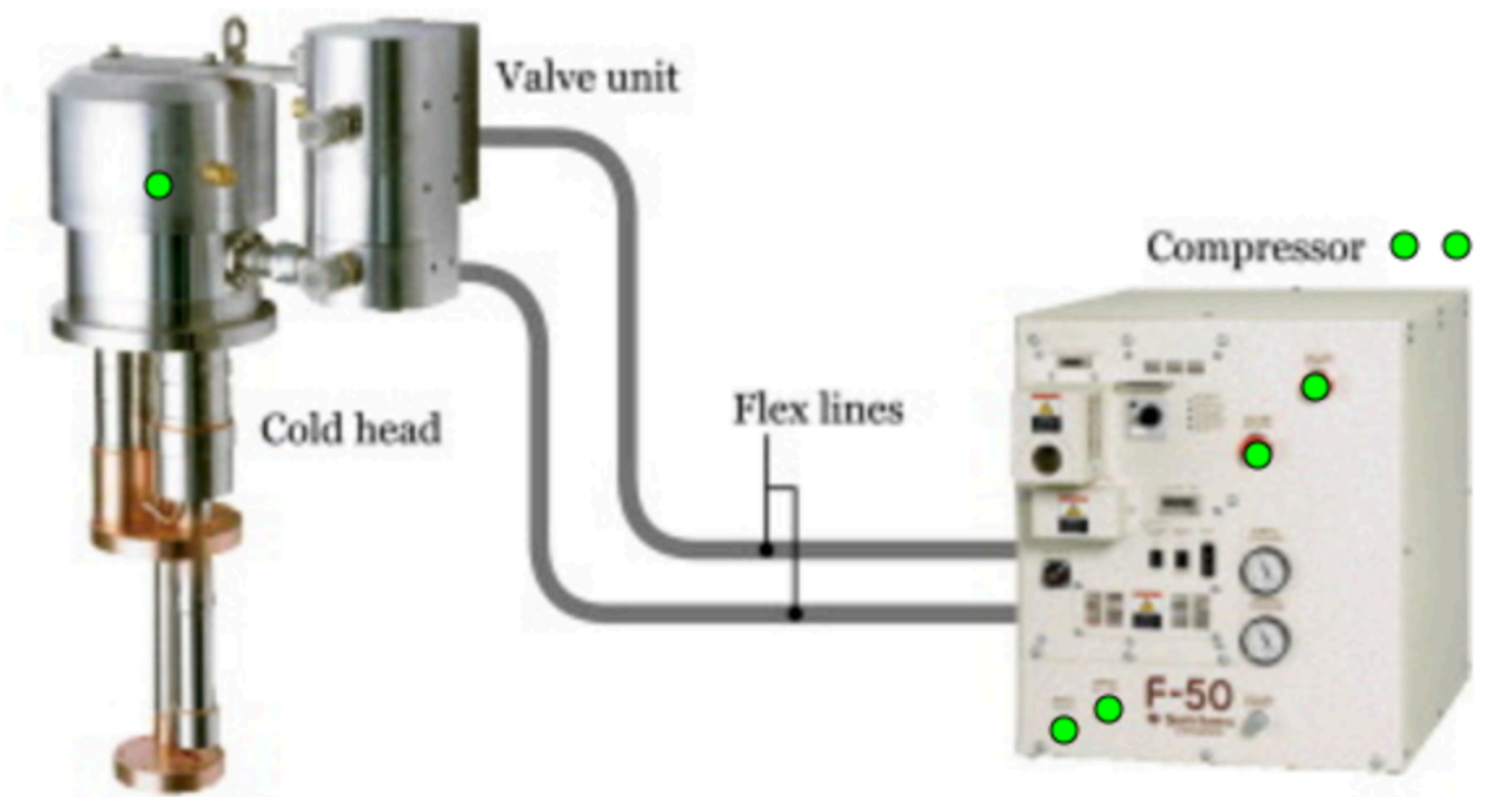
CUORE/CUPID



Scintillating Bolometer



Search for ¹³⁰Te (CUORE) & ¹⁰⁰Mo (CUPID) Neutrinoless Double Beta Decay and other Rare Events



CORC: CUORE Online Run Control

24-7 Human Remote Shifter Monitoring and Intervention



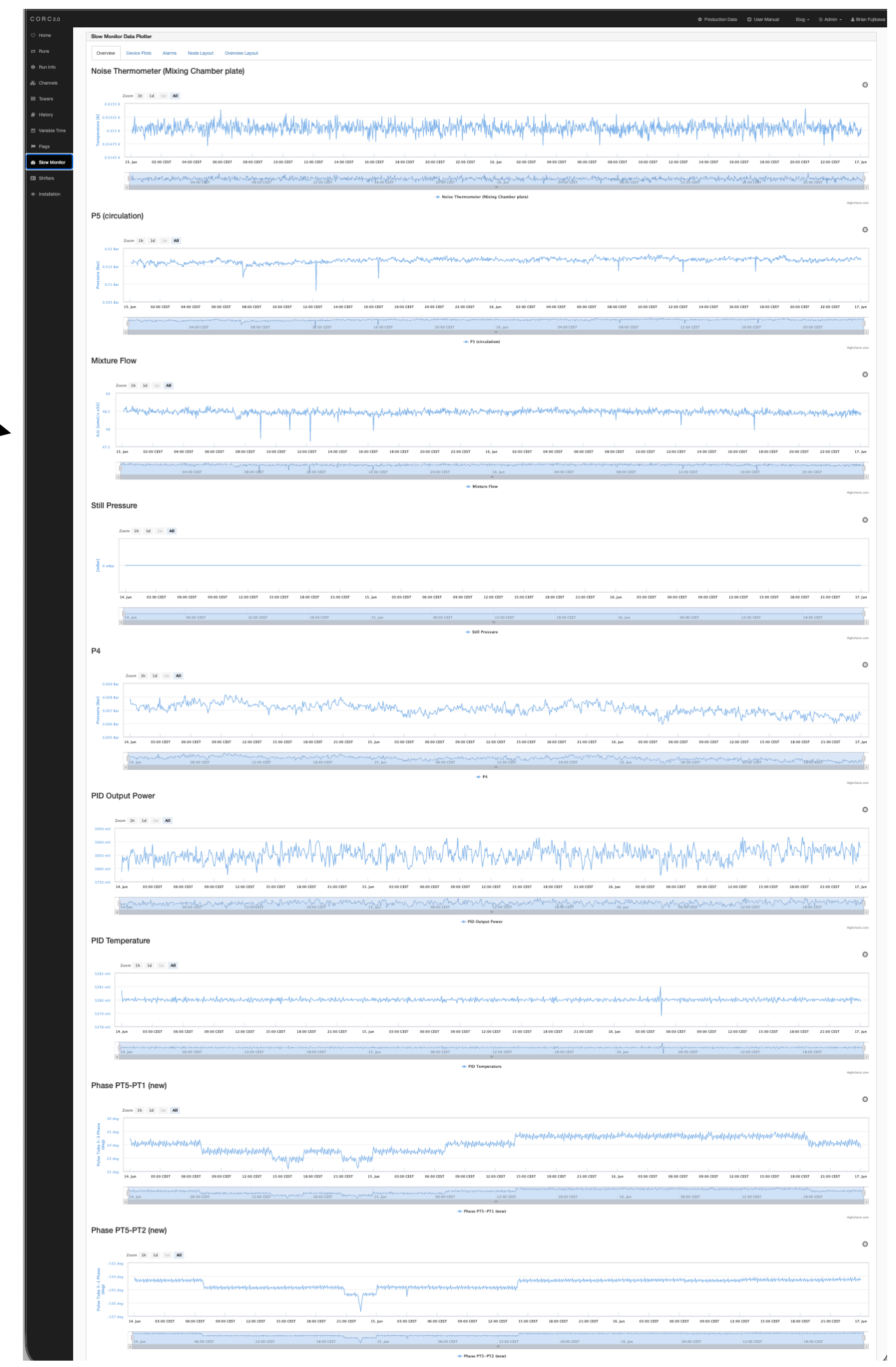
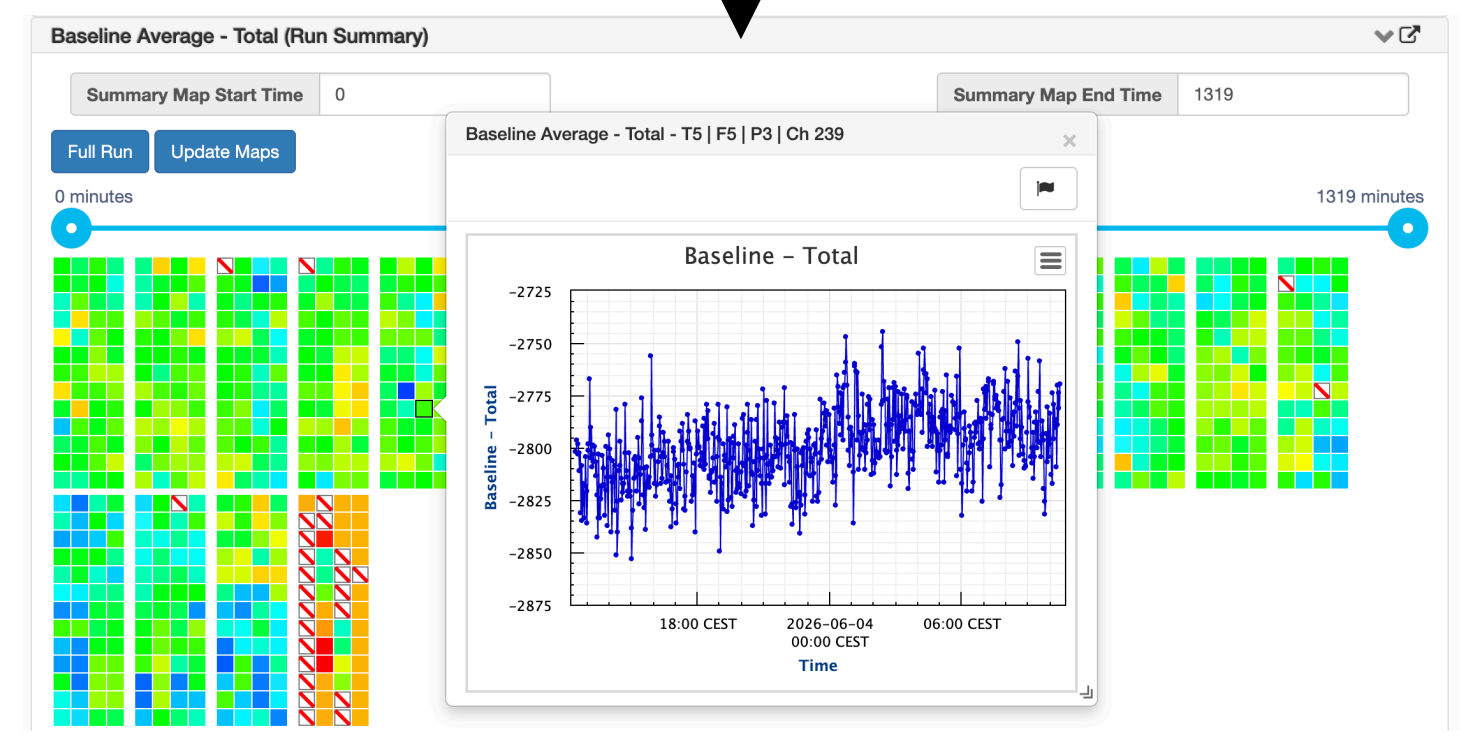
DAQ Builder
26 Pulse Parameters



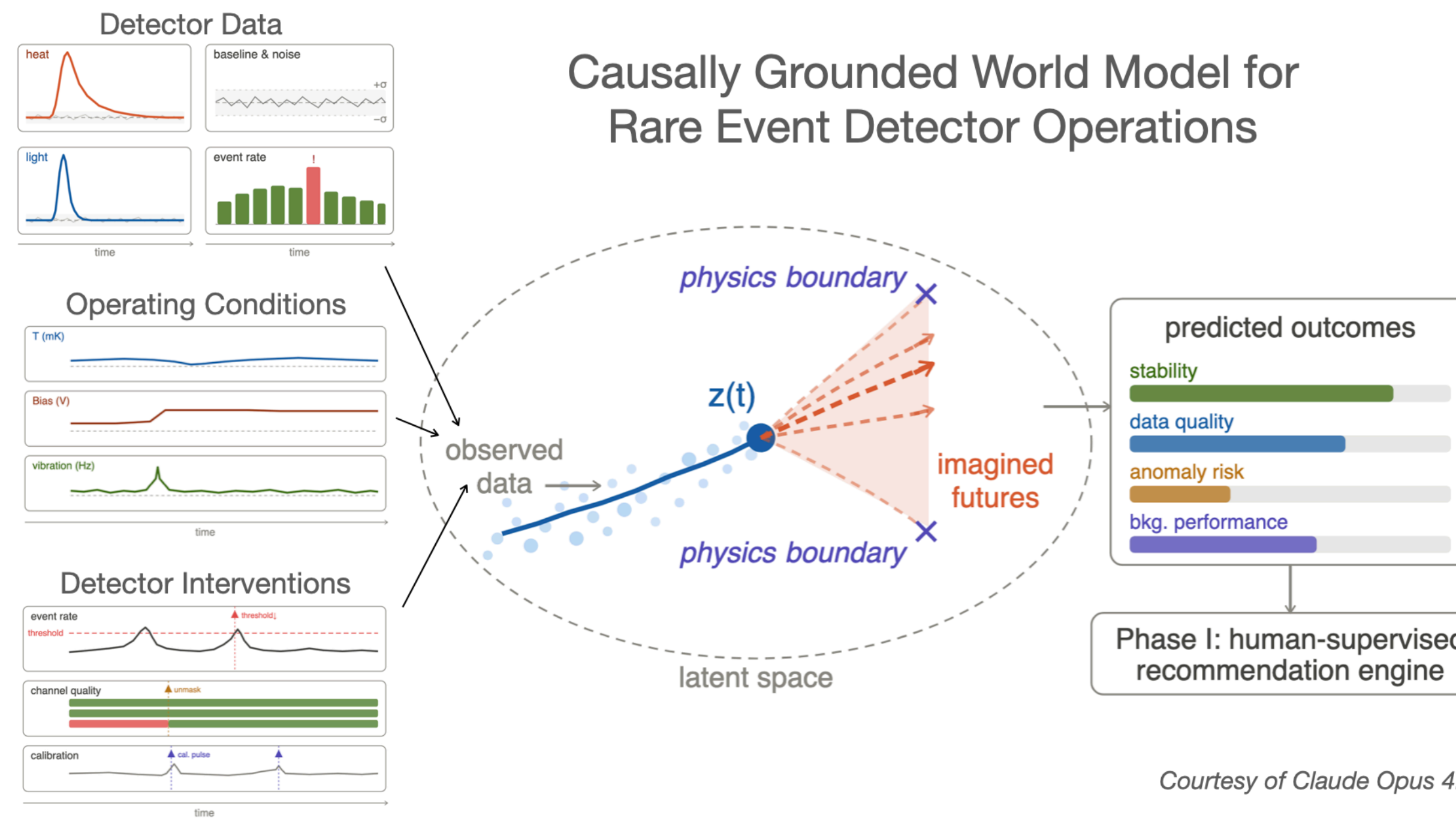
>100 temperatures,
pressures, flow rates, & other
slow-control parameters



mongo DB



World Model Objectives



1. Build and validate a detector world model using CUORE operations data.
2. Develop a planning and recommendation layer based on imagined detector futures.
3. Probe portability across CUPID-family prototype platforms.

End