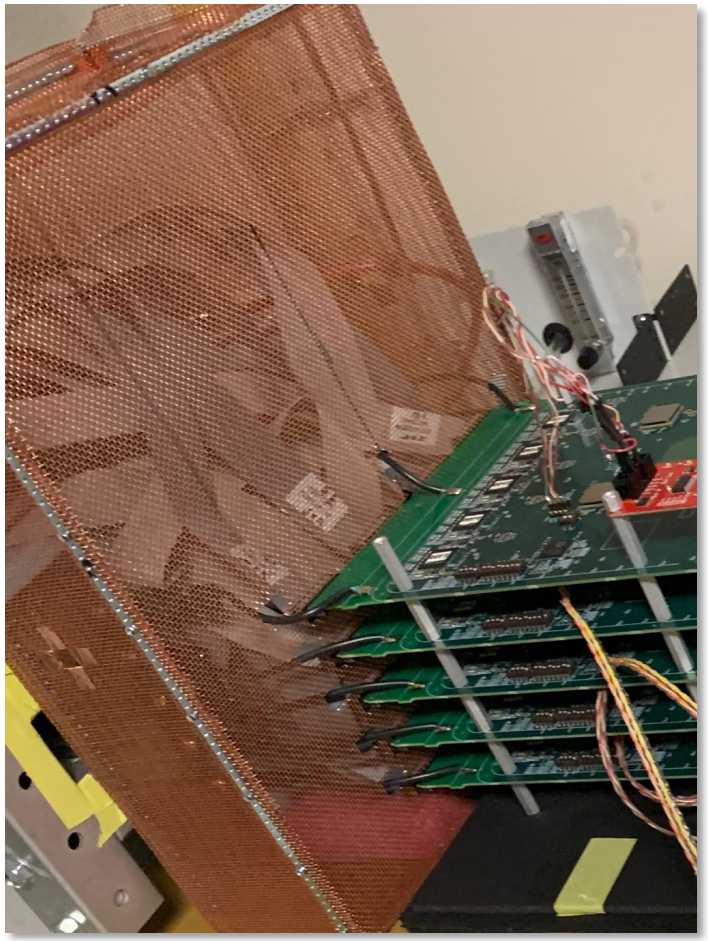
Address Challenges of Autonomous Control and Experimentation



INDRA-ASTRA

Develop a prototype for a fully automated, responsive detector system as a first step towards a fully automated, self-conscious experiment.

R&D integrated with streaming readout and AI/ML efforts at Jefferson Lab

Team

Jefferson Lab

- **ENP** M. Diefenthaler, E. Jastrzembski, H. Szumila-Vance
- **CST** D. Lawrence, V. Gyurjyan

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- **Applied Numerical Mathematics** R. Fang, A. Farhat, Y. Xu

Databricks

- S. Rajamohan

Automated Calibrations

Our Approach

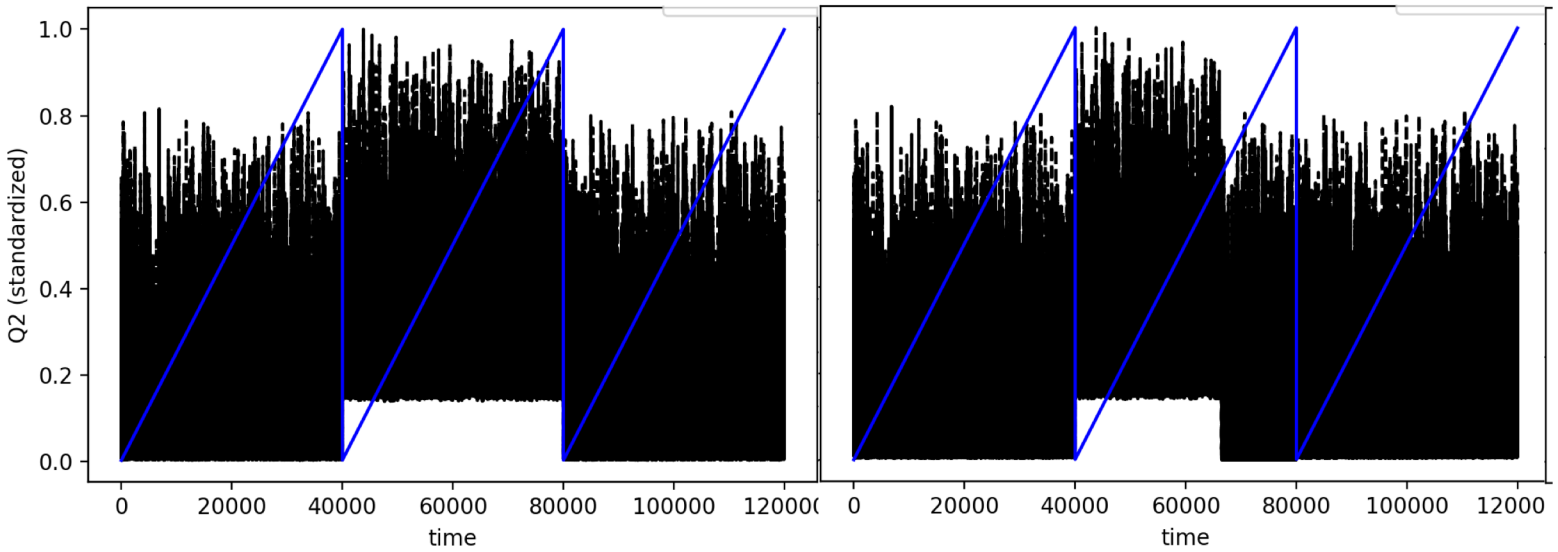
1. **Identify different data-taking periods** Use ML for a) online change detection and b) online data-quality monitoring
2. **Calibrate different data-taking periods to a baseline**

Learning how constant the data is within online adjustable thresholds

- Extended **ADWIN2** algorithm to higher dimensions
- Developed **Multi Scale Method**:
  - Represent data in multiscale basis: Increase of base coefficients → Change.
  - Transform to coefficient space: Outliers in the distribution → Change.
  - Detect Changes → Detect outliers using IQR.

Automatically identify changes in the underlying probability distribution

Re-calibrate in case of changes



Monitor pedestals and study cosmics