# **Overview of FRIB's Diagnostics Controls System**

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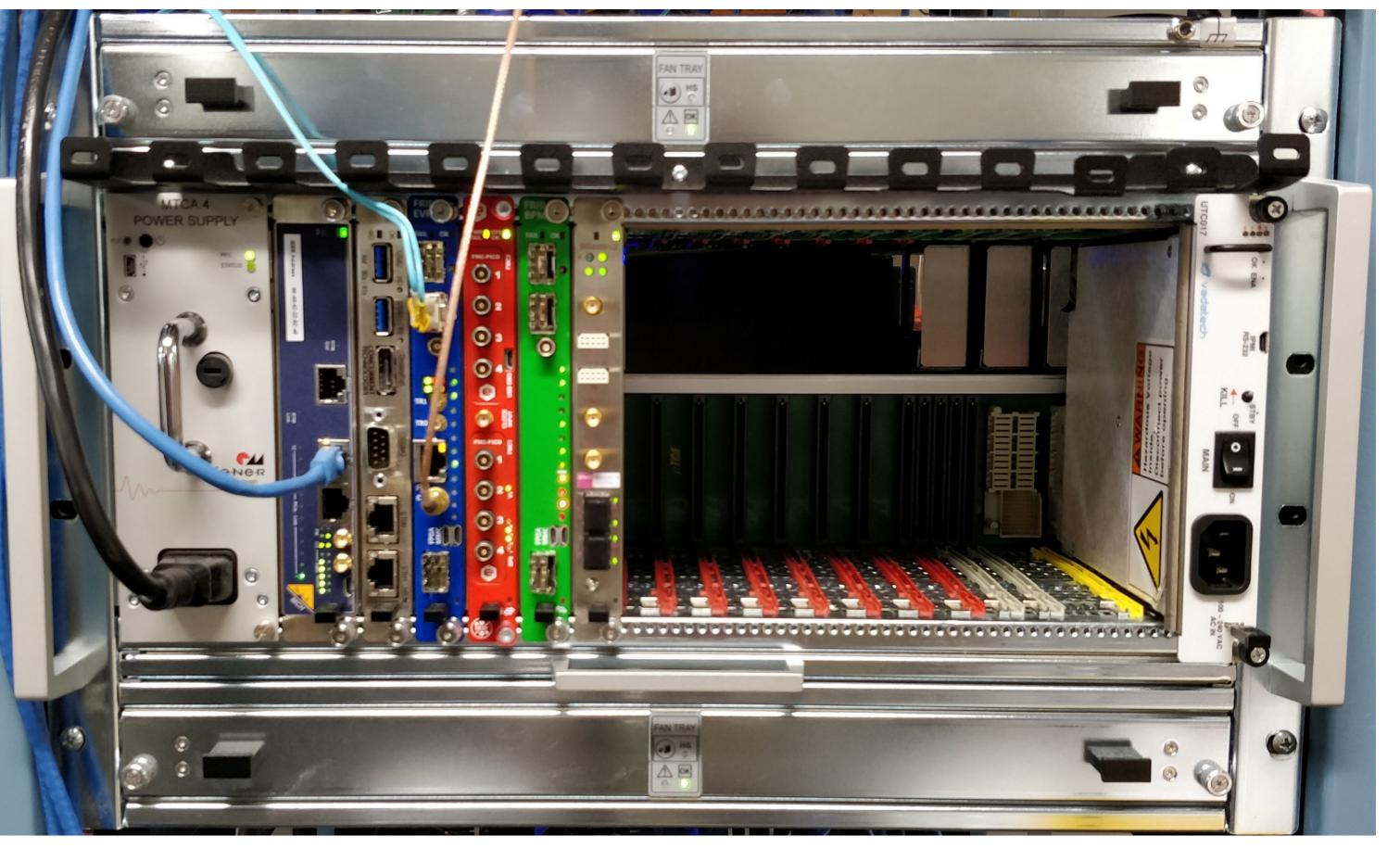
Facility for Rare Isotope Beams (FRIB), Michigan State University, East Lansing, MI 48824 USA

### Background

- The Diagnostics controls system is composed of several kinds of devices:
  - Fast µTCA digitizer cards: picoammeter, Beam Position Monitor, Beam Current Monitor.
  - Devices that generate a lot of network traffic, such as Gigabit Cameras.
  - Other devices such as fast thermometers, motor controllers and A/D and D/A converters.

• Also, there are several "soft" IOCs for monitoring and data processing.

 The large amount of different software pieces require a great degree of automation to be maintainable



In total, there are currently 28 different types of Diagnostics IOCs with 157 individual instances deployed.

## Figure 1: A µTCA crate with MCH, CPU, Event Receiver, Pico8, BPM and BCM cards.

## Monitoring and data processing IOCs

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Facility for Rare Isotope Beams U.S. Department of Energy Office of Science Michigan State University Profile Monitor D0824 L2 (12 in)		
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- Most of the Diagnostics IOCs are, in fact, "soft" IOCs, which are used for:
  - Status monitoring of certain systems
  - Data processing
  - Combining different physical devices into a higher level abstract device.
- Most of these "soft" IOCs have their logic

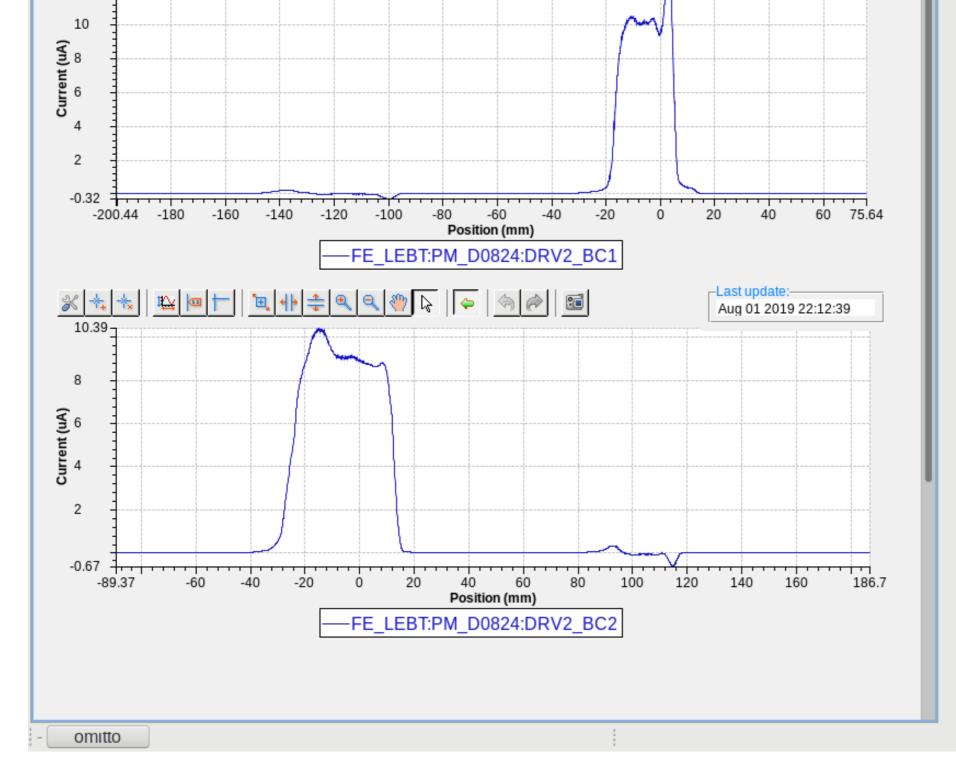


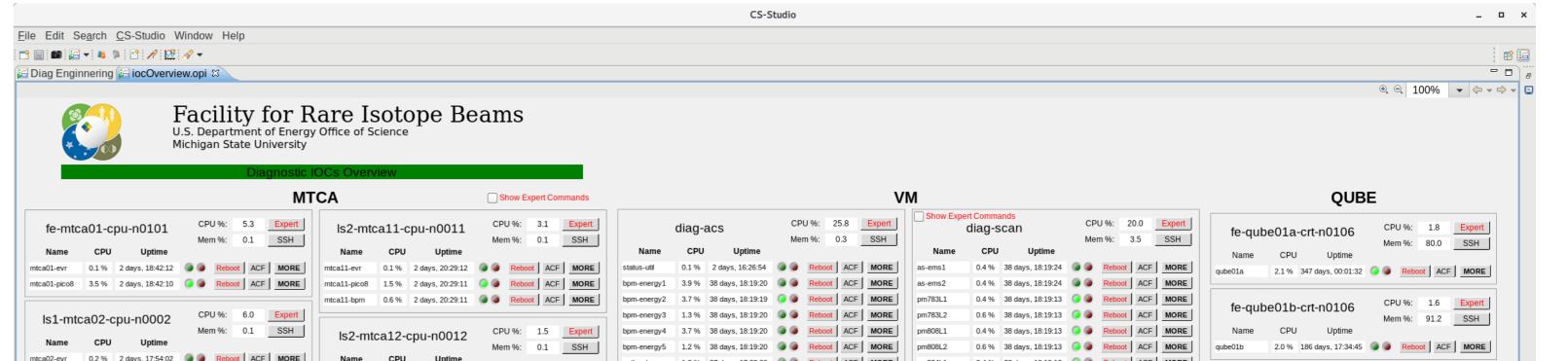
Figure 2: Profile Monitor "soft" IOC

implemented in Python, by using pyDevSup, so they can have access to powerful Python libraries such as numpy and scipy.

 A good example of such "soft" IOC is the Profile Monitor IOC, which combines PVs from Motor Controllers, PLC Interlocks, A/D converters and picoammeters to provide a cohesive set of PVs for scanning the beam profile and returning the collected wire position vs current reading data correlated in time.

# Standardization and Continuous Deployment / Delivery

• All Diagnostics IOCs and their hosts are managed centrally. The IOCs have a common set of



modules included and configured automatically by using a special, in-house developed EPICS module called *fribdiagstd*.

• For example, all IOCs automatically include the iocStats module, which makes it easy to develop overview screens such as the one seen in Figure 3.

 Supporting software, such as EPICS base and modules (asyn, autosave, etc) are built and deployed as Debian packages by a Continuous Deployment / Delivery pipeline built with Jenkins, Aptly and Puppet.

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#### Figure 3: Overview of the status of all IOCs



#### Facility for Rare Isotope Beams

U.S. Department of Energy Office of Science Michigan State University This material is based upon work supported by the U.S. Department of Energy Office of Science under Cooperative Agreement DE-SC0000661. Michigan State University designs and establishes FRIB as a DOE Office of Science National User Facility in support of the mission of the Office of Nuclear Physics.