# EPSCI

## Updates

Torri Jeske | CLAS Collaboration Meeting

# EPSCI group members

David Lawrence

Lead

Nathan Brei

JANA2, ePIC

Thomas Britton

Hydra, MCWrapper, ePIC

Michael Goodrich

EJFAT

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ERSAP, JIRIAF

Torri Jeske

Hydra, AIOP, ePIC

Carl Timmer

CODA, DAQ

Jeng-Yuan Tsai

JIRIAF

Raiqa Rasool

JANA2, Hydra

Jon Zarling

Online Calibrations

Armen Kasparian

Reinforcement Learning
Data Science

Nataliia Mastiuk

Hydra
Information + Records

“Cissie” Xinxin Mei

GPU, HPC Systems
HPDF

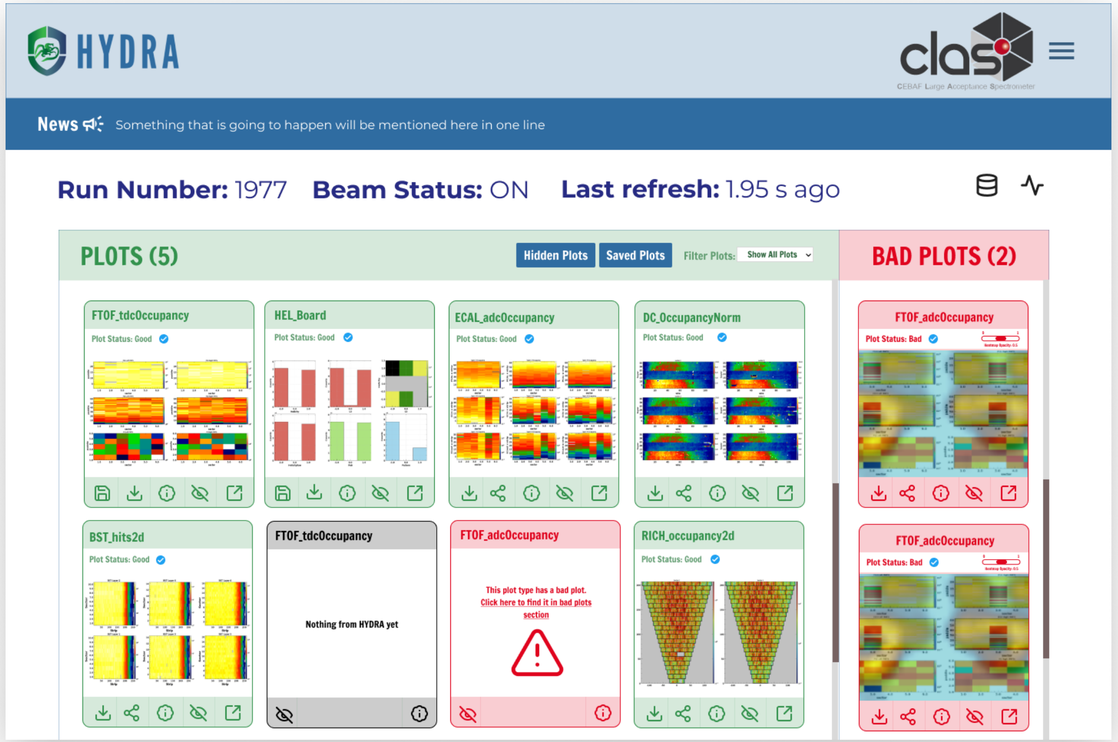
matrixed staff

# Mission

Identify, develop, implement, and maintain software and computing technologies in support of the Jefferson Lab Science Program.

# HYDRA

Web application for online data quality that utilizes computer vision. It continuously (~5min) provides classification of monitoring histograms, a task not well suited for humans.



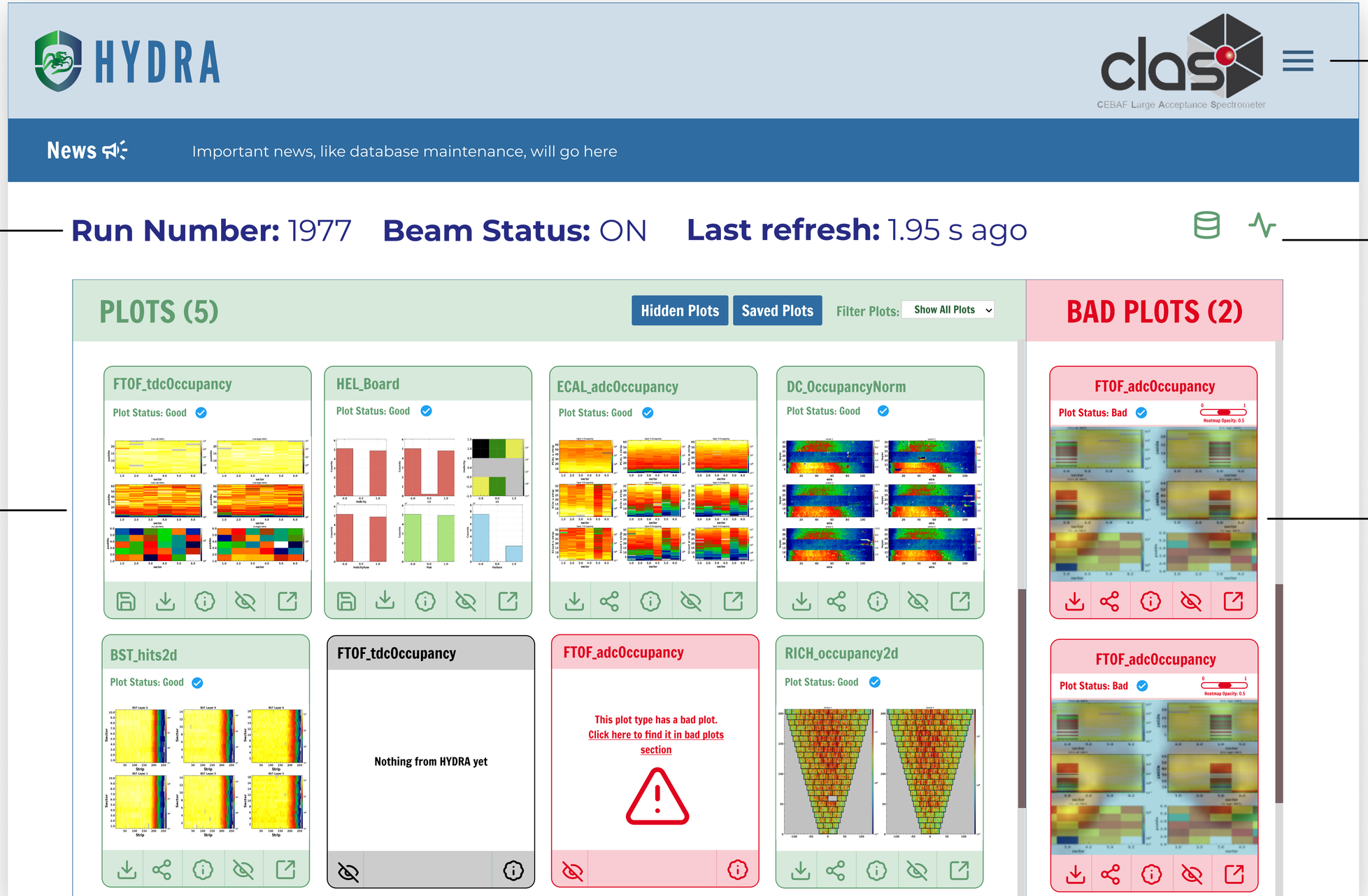
# Usage statistics

Hydra has 6 active deployments:

- Online monitoring: 4
- Offline monitoring:
  - GlueX calibrations
  - ePIC simulations + CI/CD pipelines

| | Hall D | Hall B | Hall A | Hall C | Hall D offline | ePIC |
|---|---|---|---|---|---|---|
| **Labeled Images** | 139,900 | 236,851 | 5,438 | 302 | 350,683 | - |
| **Trained Models** | 206 | 304 | - | - | - | - |
| **Plot Types** | 15 | 73 | 42 | 16 | 47 | 568 |
| **Batch / frequency** | 15 / min | 73 / 5 min | - | - | - | - |
| **Runs with 1 bad image** | **1,035** | **1,019** | - | - | - | - |
| **Total analyzed** | **1,101,160** | **1,199,771** | - | - | 437,607 | 131,335 |

# Run




Menu for all Hydra pages

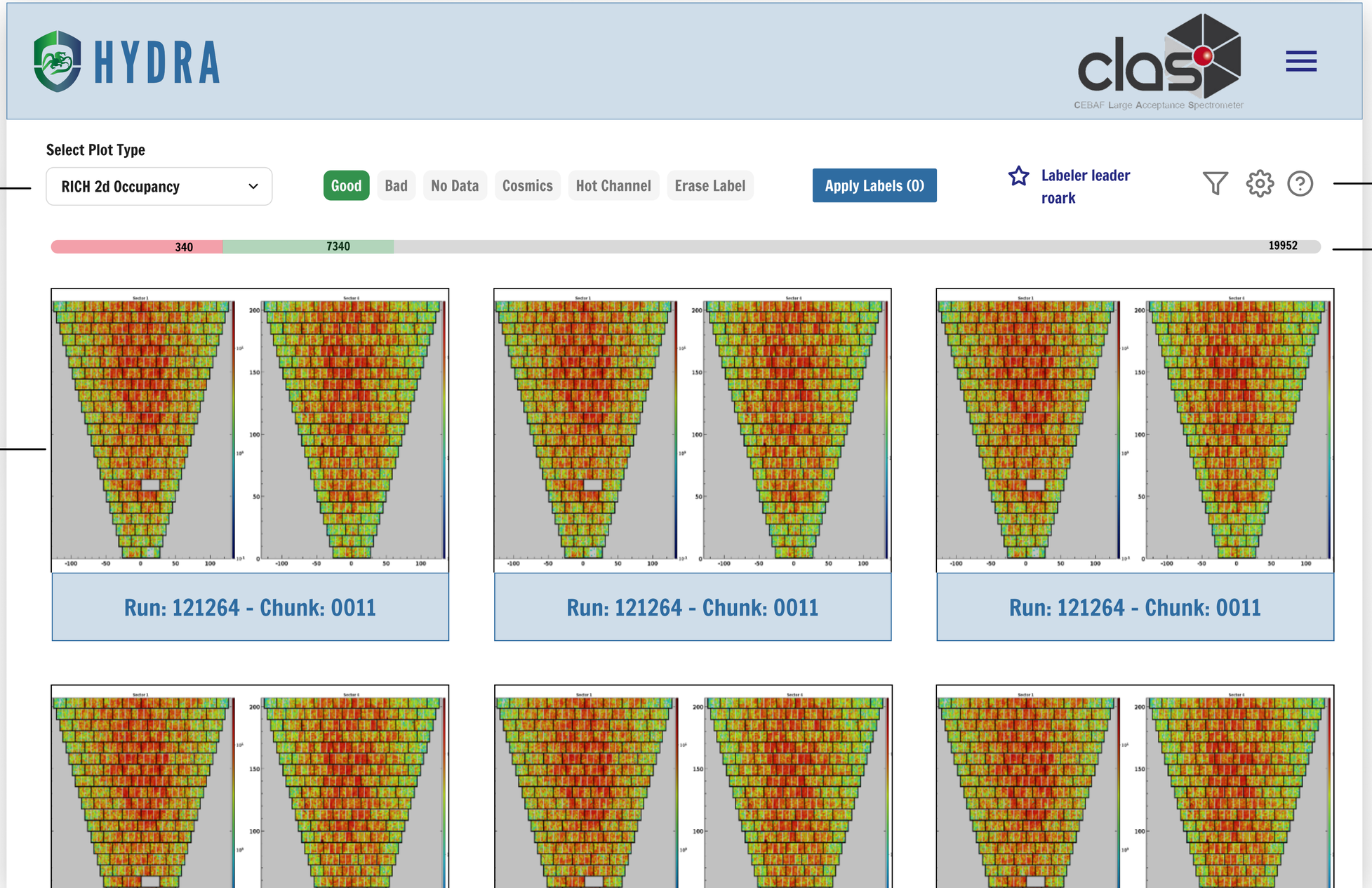
experiment status indicators

database and system status indicators

Main image gallery

reserved for Bad plots

# Image Labeler




Plot Type Selector

Images to label

filter, settings, and help

label count distribution

# Log

HYDRA

CEBAF Large Acceptance Spectrometer

News

Select Runs

19599
19600

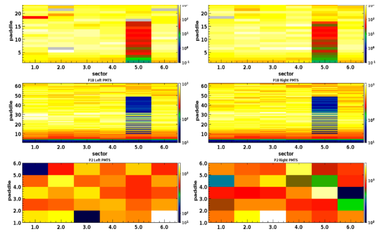
Select Detectors

FTOF
HEL

- [x] Bad
- [x] Unconfirmed
  Classification not above threshold

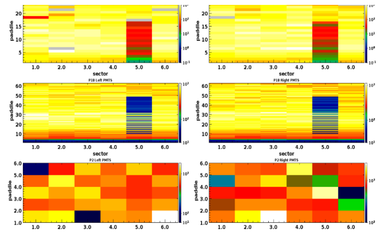
## FTOF TDC Occupancy

Contact: FTOF Expert



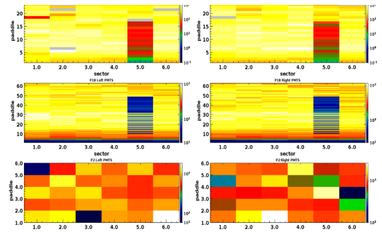
### Run: 19599.0

Date: 2024-02-06 20:04:49
Class: Bad @ 1



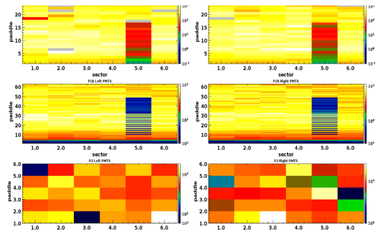
### Run: 19599.2

Date: 2024-02-06 20:09:55
Class: Bad @ 1



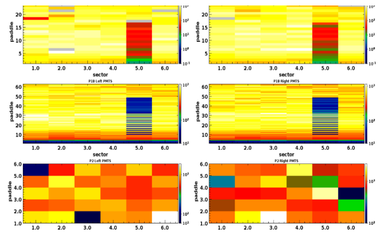
### Run: 19599.4

Date: 2024-02-06 20:13:59
Class: Bad @ 0.99



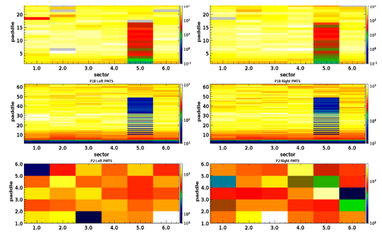
### Run: 19599.6

Date: 2024-02-06 20:17:03



### Run: 19599.8

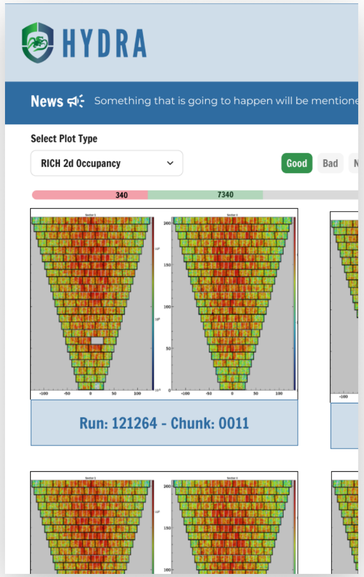
Date: 2024-02-06 20:20:48



### Run: 19599.10

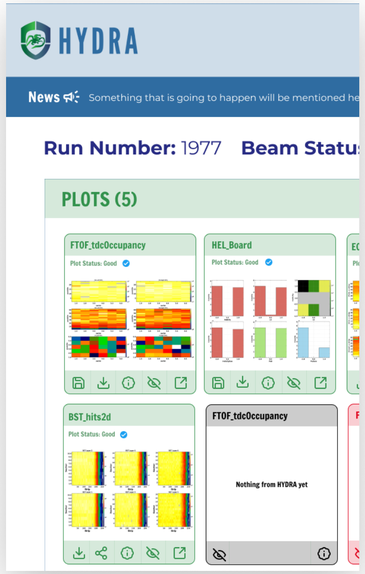
Date: 2024-02-06 20:24:11

# Front end updates




## Image Labeler

Efficiently label thousands of images used for training a model.

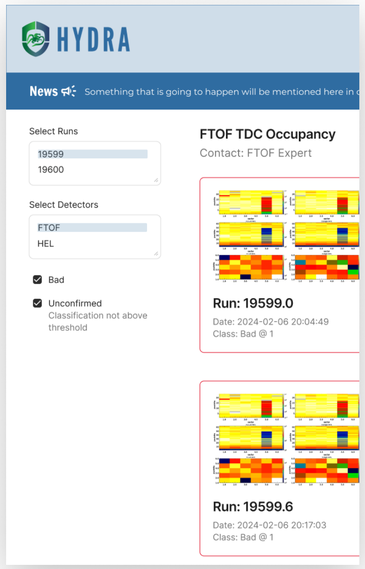



## Run

See predictions in near real-time. This page continuously updates with new images during an experiment.

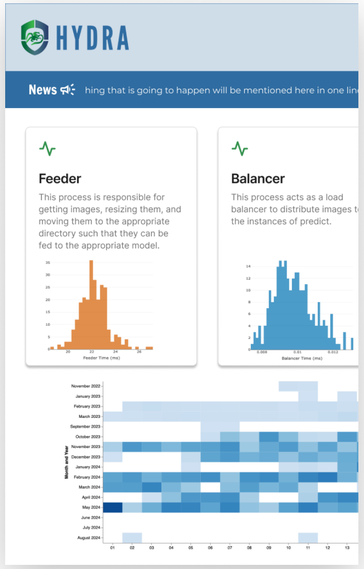

## Library

Contains information useful to evaluate a given model's training and performance.




## Log

Displays problematic and potentially problematic images from a trailing 24 hour window.




## Status

Primarily used by administrators to monitor system performance.


## Grafana

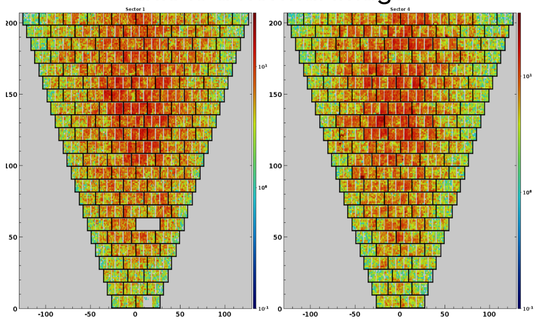
Displays all predictions over time. Trend analysis on predictions can indicate when it is time to retrain a model.

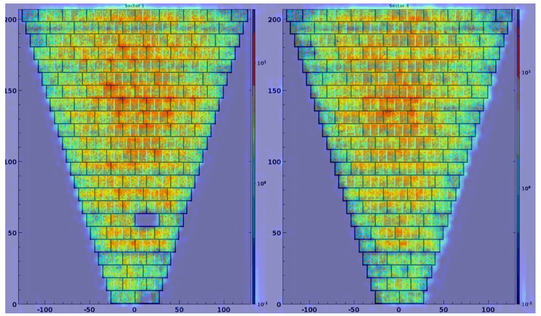
# Interpretability Updates

Gradient-weighted Class Activation Maps provide visual explanations for the model's classification by highlighting important regions of the image

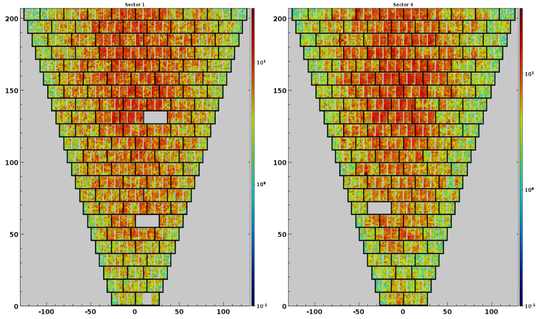
Convolutional Block Attention Modules were added to InceptionV3 to produce more localized heat maps

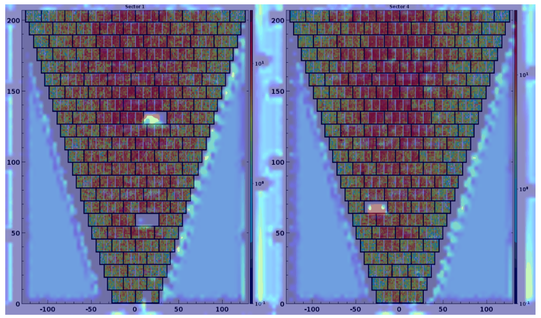
this is a normal image





this is a bad image



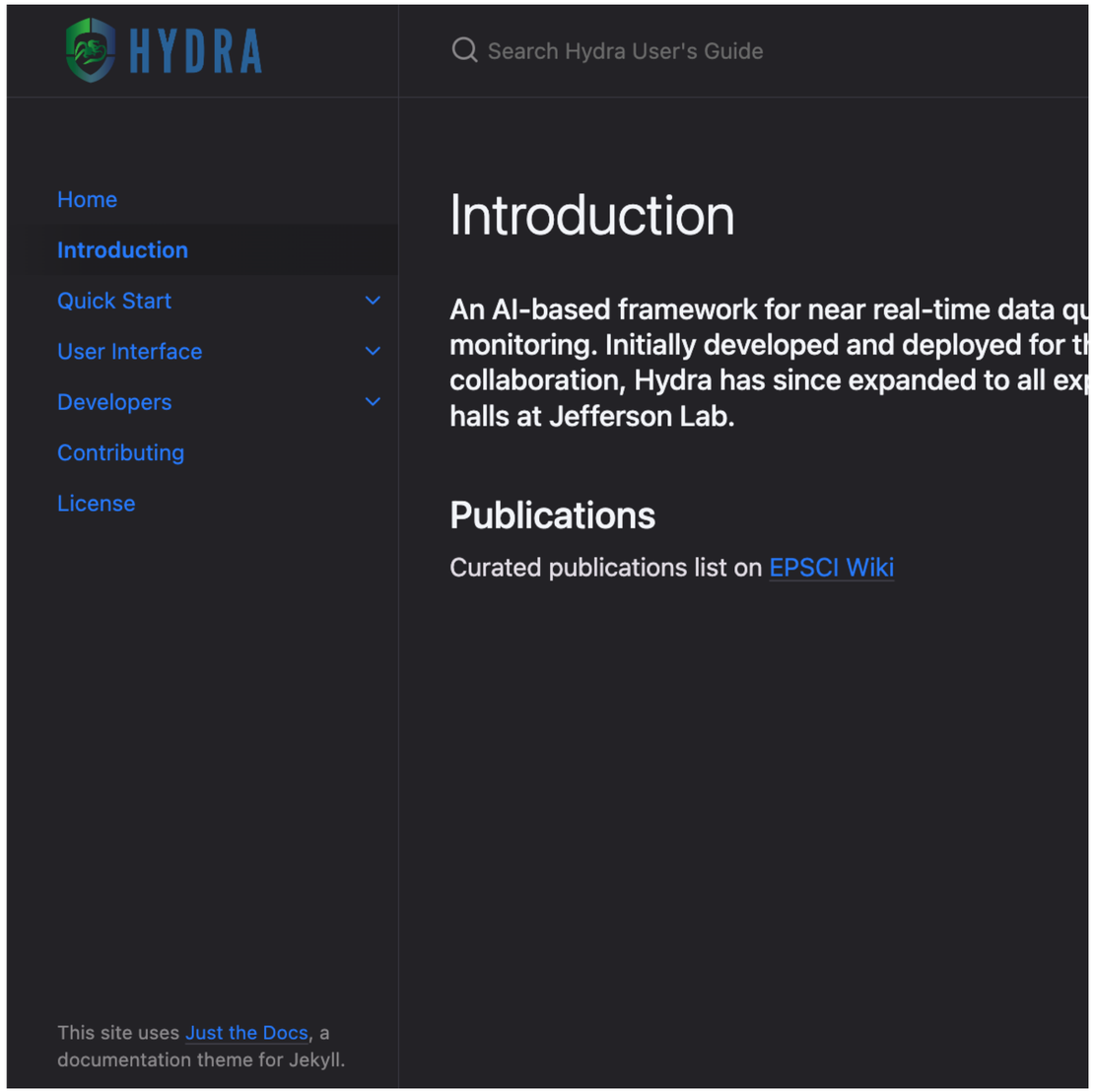


Heat maps are produced from mixed layers in InceptionV3+CBAM

# Documentation

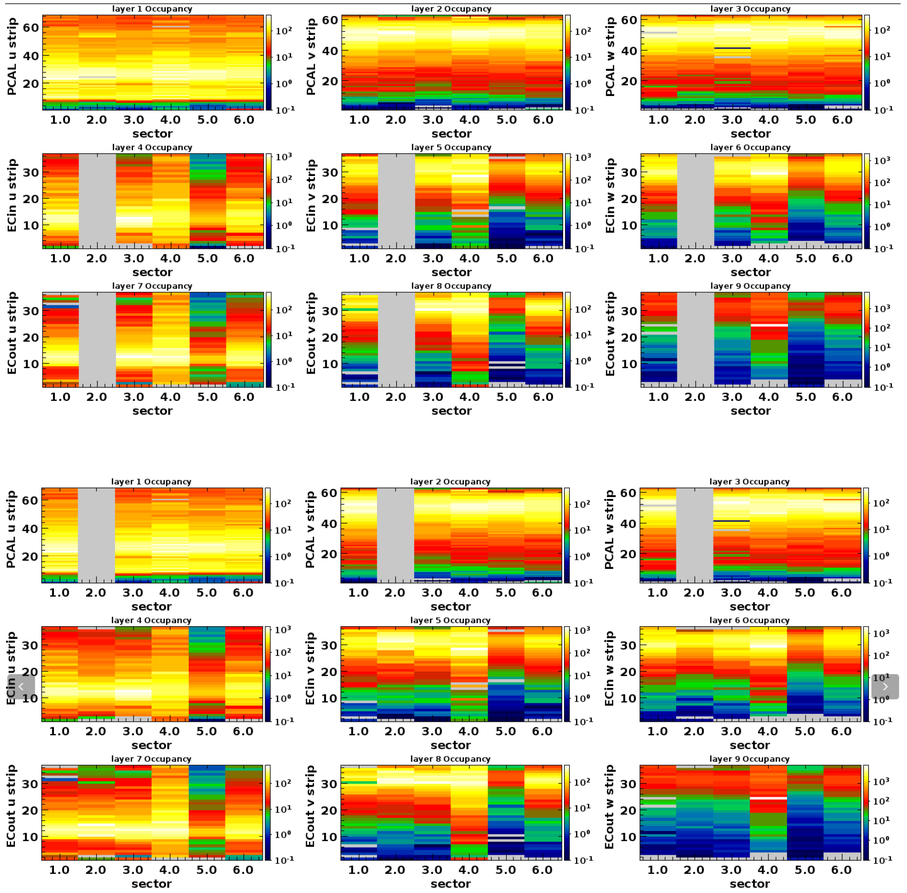
New documentation to incorporate new user interface, demo and development containers, and contributing to Hydra

https://jeffersonlab.github.io/HydraUsersGuide/



# Service work

Darren Upton and Nathan Baltzell are working on an automated system to generate “bad” plots for use in training



# “Hot Checkout”

## Update plots Hydra knows about

Check to ensure that Hydra is monitoring images it should be, remove ones that are no longer necessary

## Label images

Hydra uses supervised learning and requires labeled images

## Retrain models

We will re-train all models in production to incorporate new labels and CBAM architecture

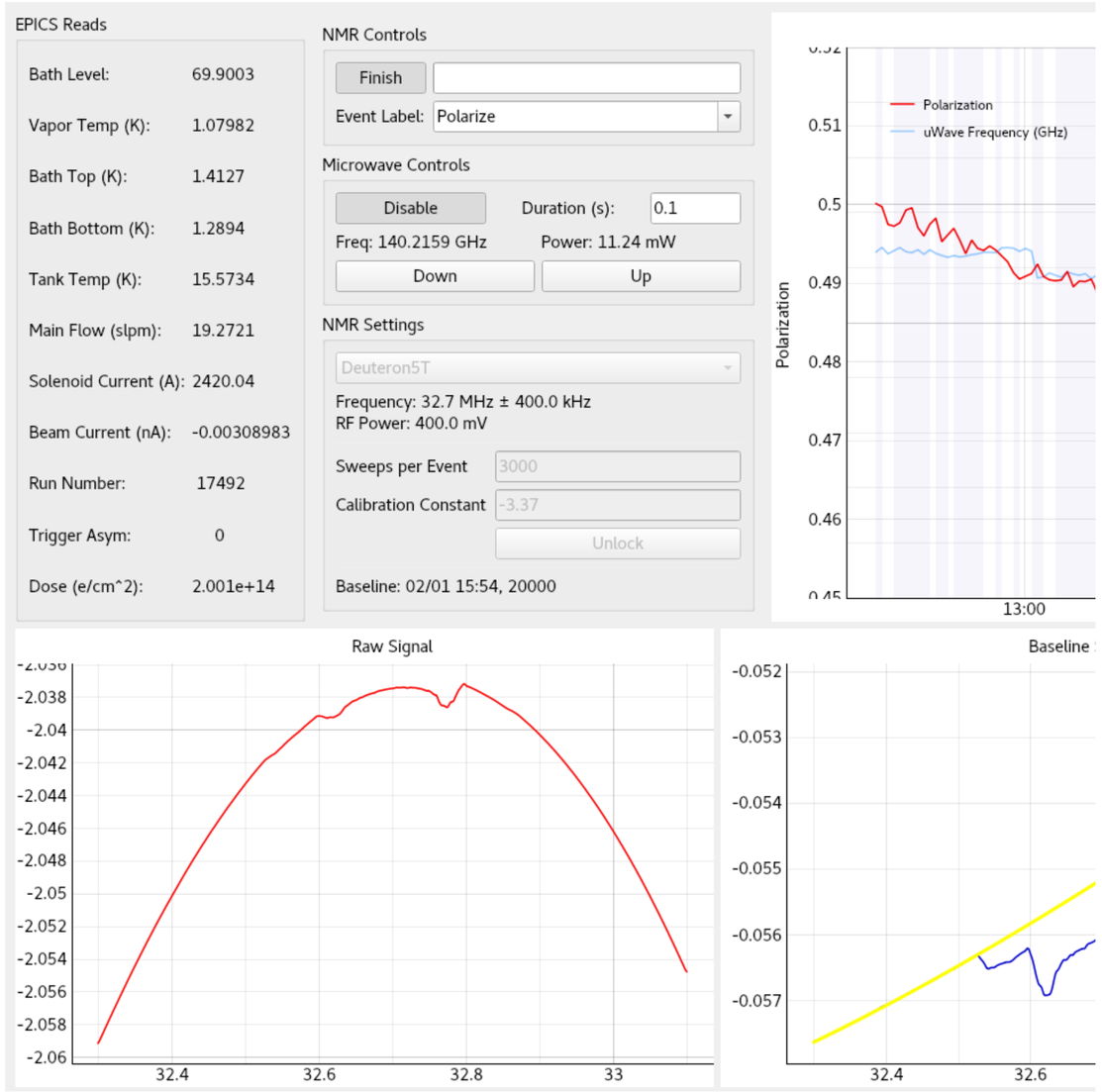
## UI/UX testing

We’d love to hear your feedback

# AI for Optimized Polarization

**Goal: Predict and optimize the polarization with machine learning**

DOE Funded proposal in collaboration with Target Group, William and Mary, and Carnegie Mellon Univeristy



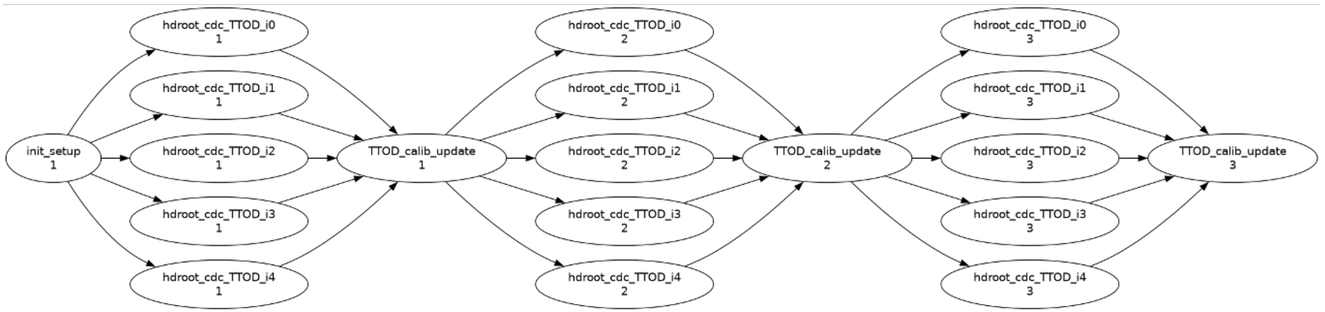
# Calibrations as dependency graphs

**Goal: Automate calibration workflows**

Testing using the cylc workflow engine for GlueX calibration workflows.

- workflow scheduler determines when jobs are ready to start
- can chain many calibration steps together

https://cylc.github.io/



# Summary

## Hydra

Web application for data quality monitoring that can utilize computer vision

## AI for Optimized Polarization

Predict and optimize the polarization of polarized cryotargets at Jefferson Lab

## Automated Calibrations

Utilizing Cylc workflow engine to automate calibration procedures

EPSCI

Identify, develop, implement, and maintain software and computing technologies in support of the Jefferson Lab Science Program.

# extras

# Labeling statistics