



# 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



Vardan Gyurjyan

ERSAP, JIRIAF



Torri Jeske

Hydra, AIOP, ePIC



Carl Timmer

CODA, DAQ



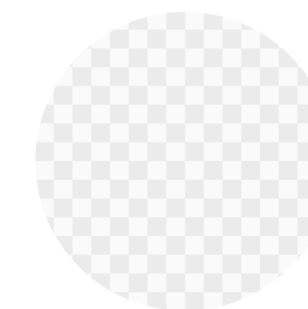
Jeng-Yuan Tsai

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

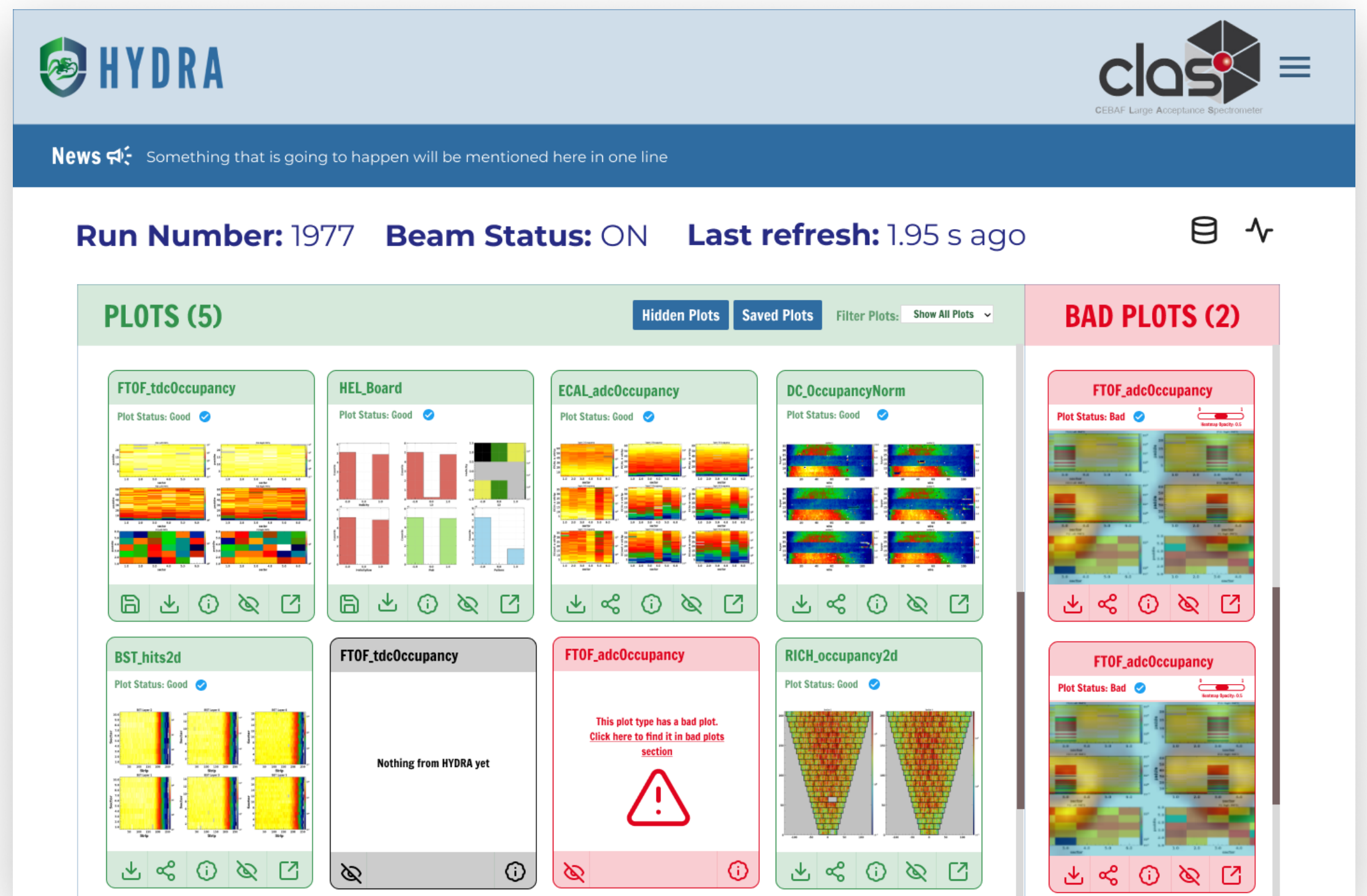
matrixed staff

# **Mission**

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



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
<b>Labeled Images</b>	139,900	236,851	5,438	302	350,683	-
<b>Trained Models</b>	206	304	-	-	-	-
<b>Plot Types</b>	15	73	42	16	47	568
<b>Batch / frequency</b>	15 / min	73 / 5 min	-	-	-	-
<b>Runs with 1 bad image</b>	<b>1,035</b>	<b>1,019</b>	-	-	-	-
<b>Total analyzed</b>	<b>1,101,160</b>	<b>1,199,771</b>	-	-	437,607	131,335

Run



Menu for all Hydra pages

News

Important news, like database maintenance, will go here

experiment status indicators

Run Number: 1977 Beam Status: ON Last refresh: 1.95 s ago



database and system status indicators

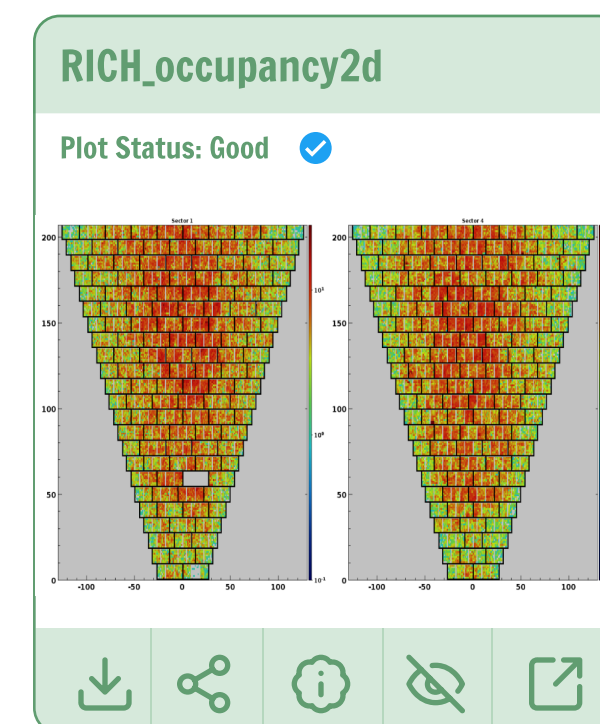
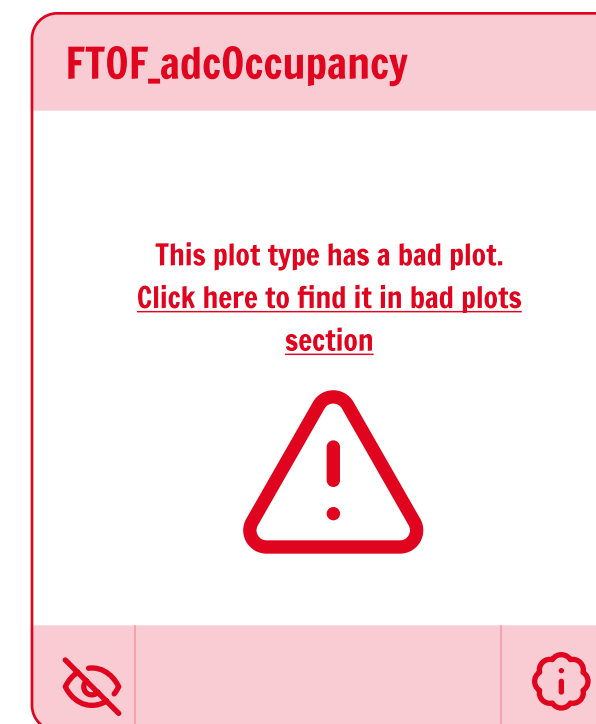
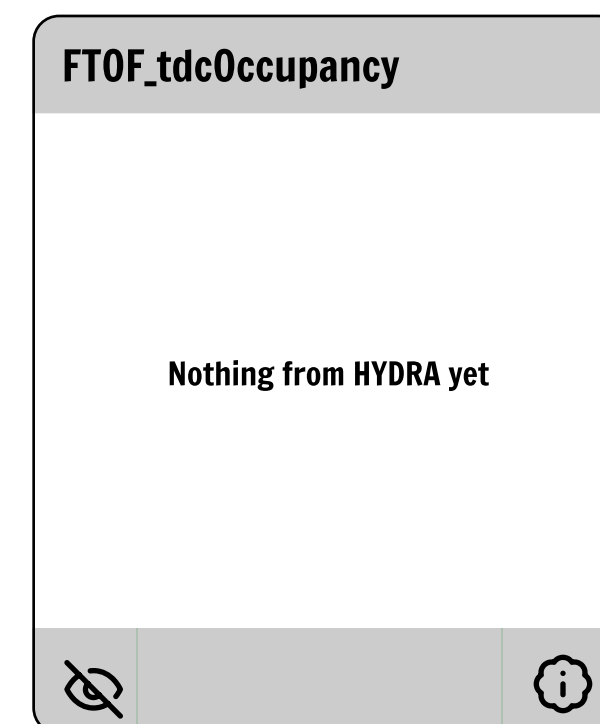
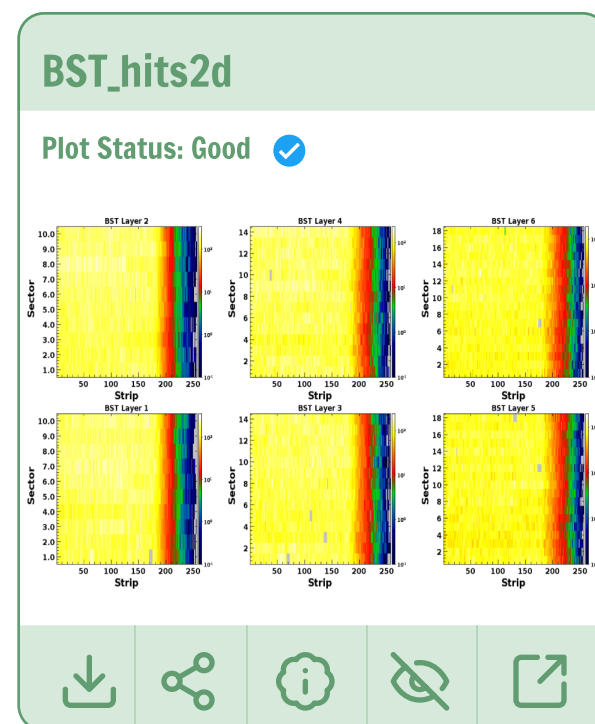
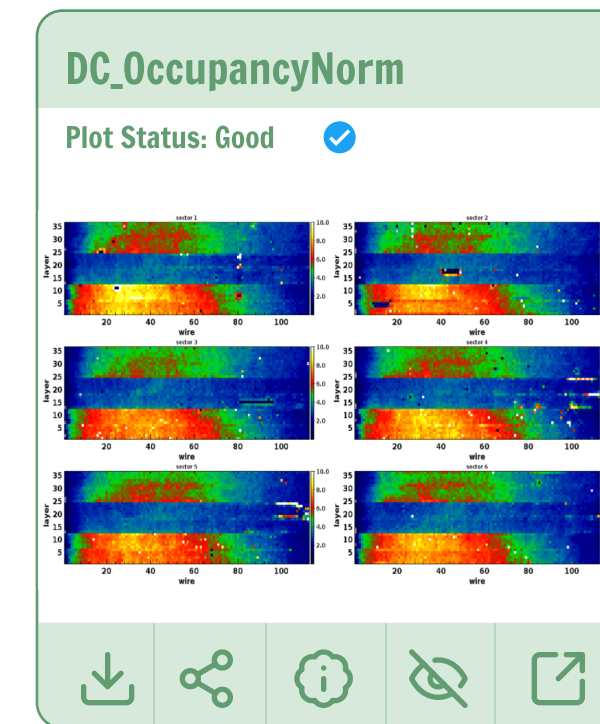
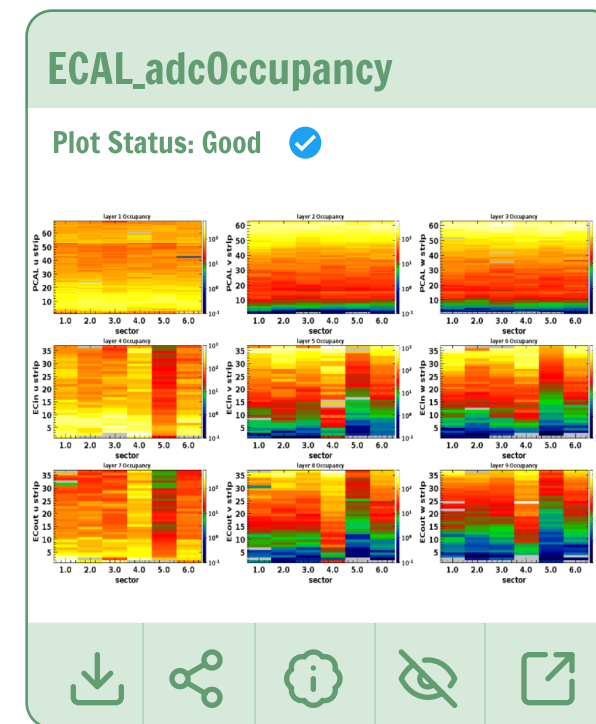
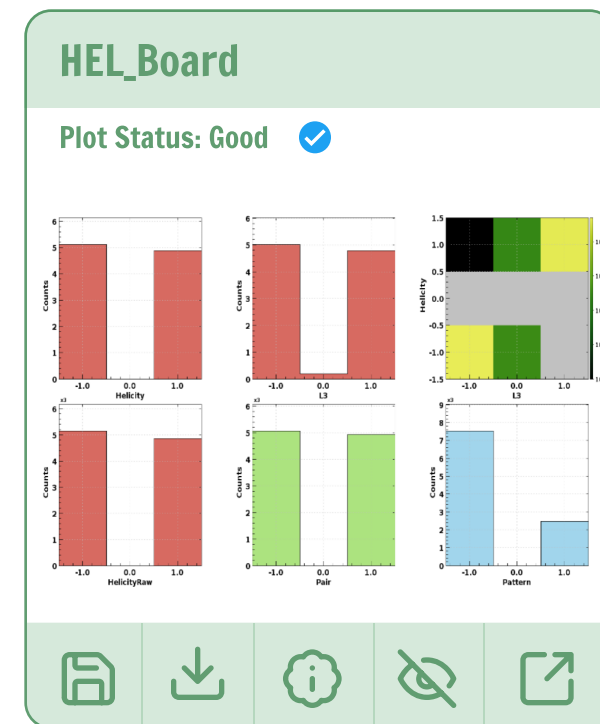
PLOTS (5)

Hidden Plots

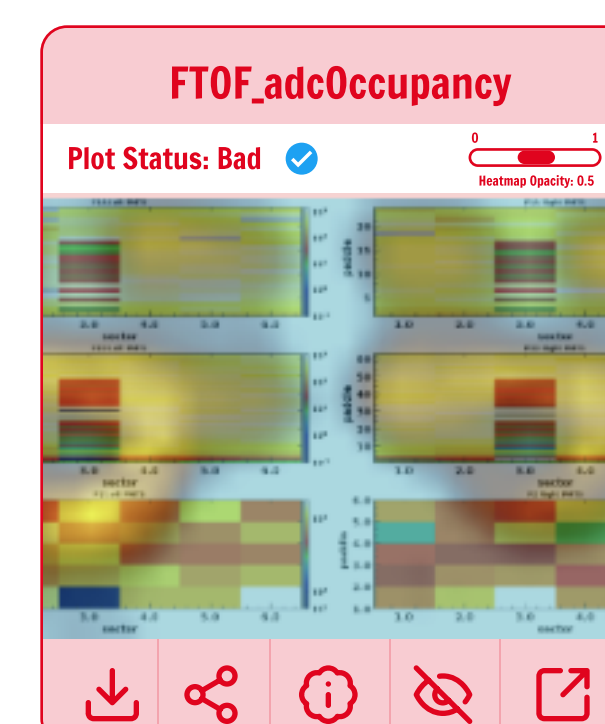
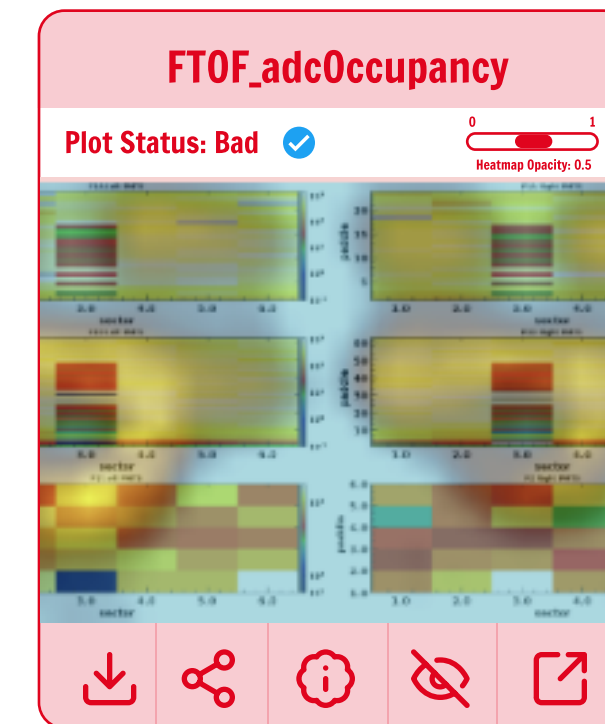
Saved Plots

Filter Plots: Show All Plots

Main image gallery



BAD PLOTS (2)



reserved for Bad plots

# Image Labeler



Select Plot Type

RICH 2d Occupancy

Good

Bad

No Data

Cosmics

Hot Channel

Erase Label

Apply Labels (0)

☆ Labeler leader roark



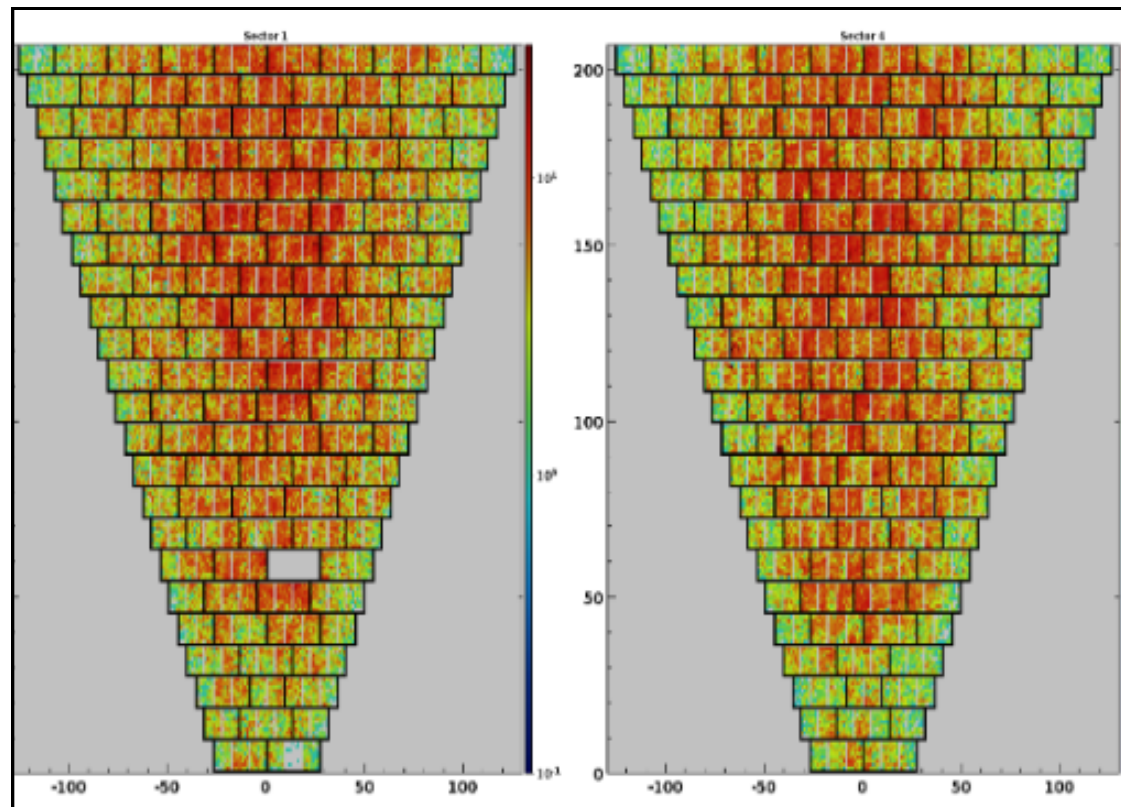
filter, settings, and help

label count distribution

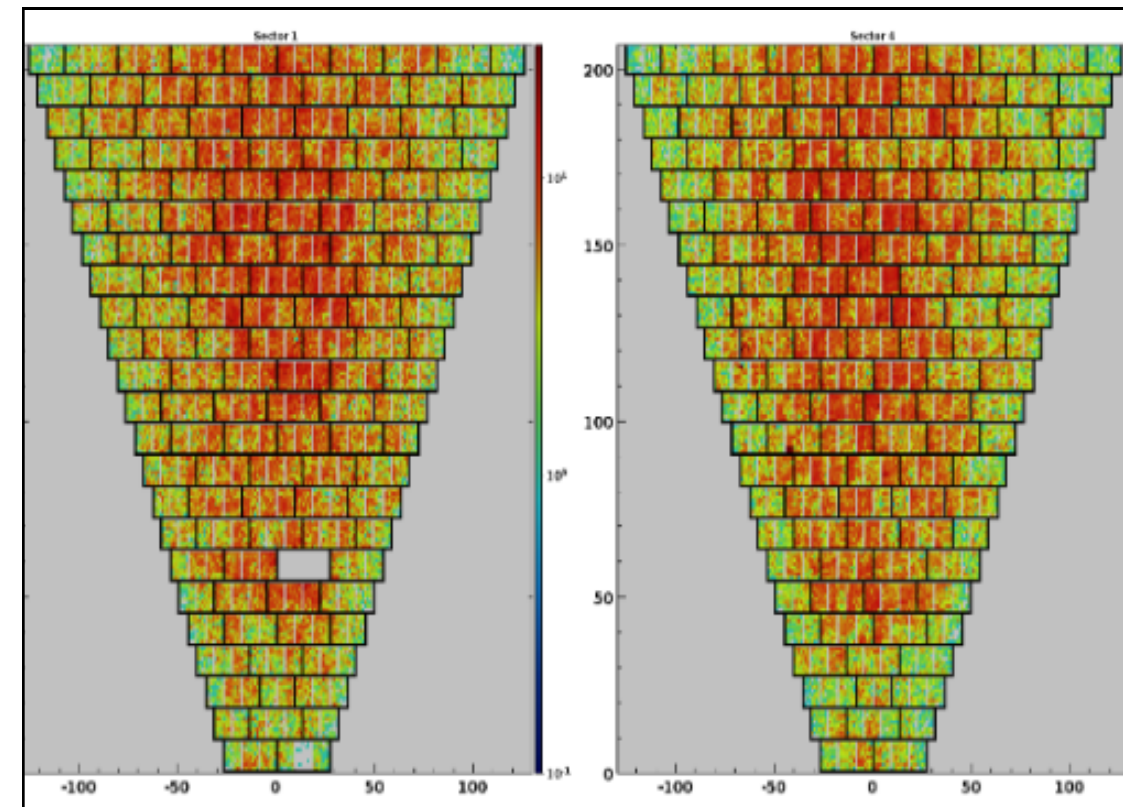
340

7340

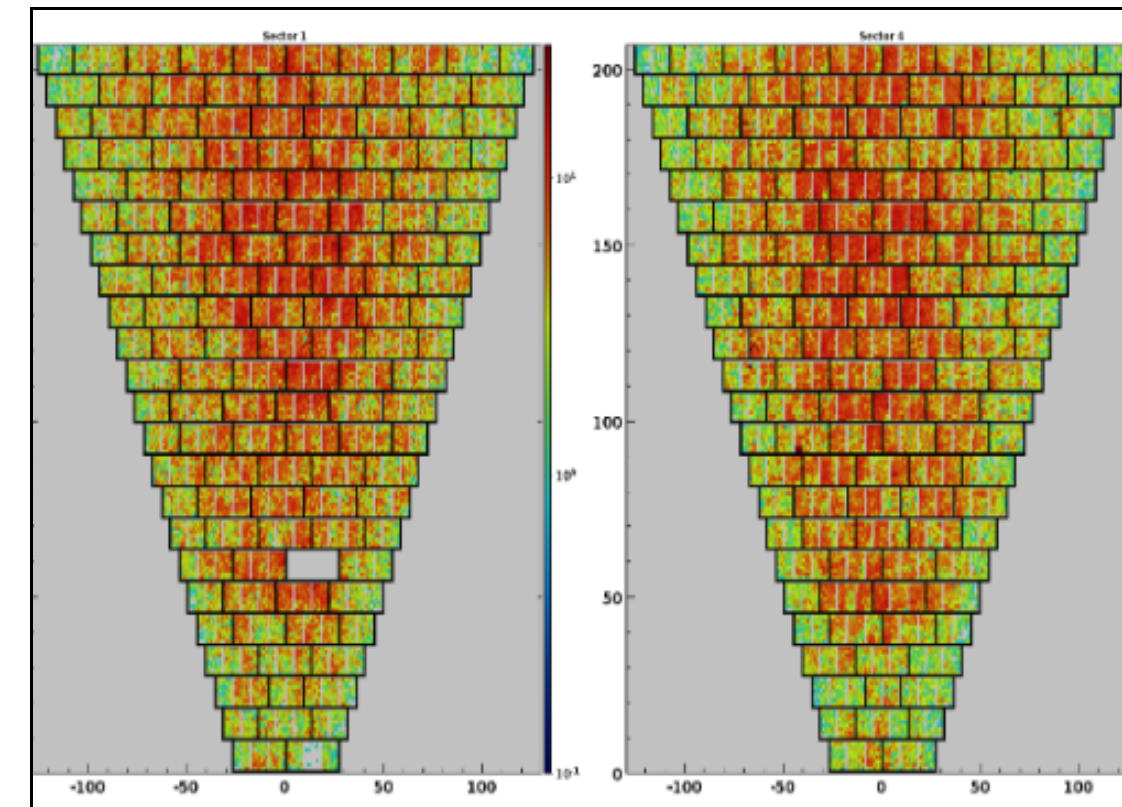
19952



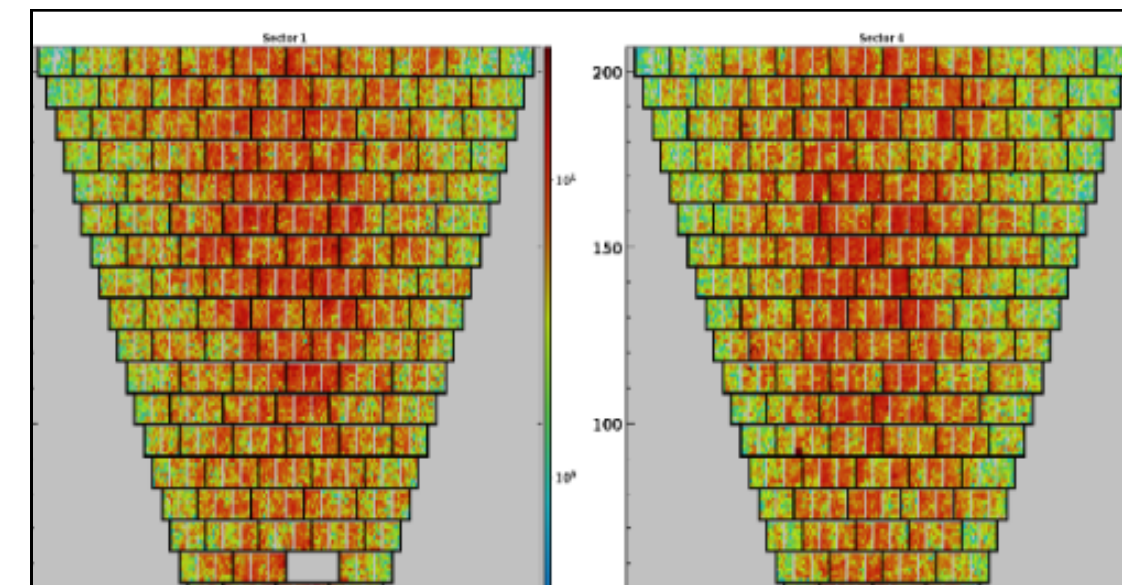
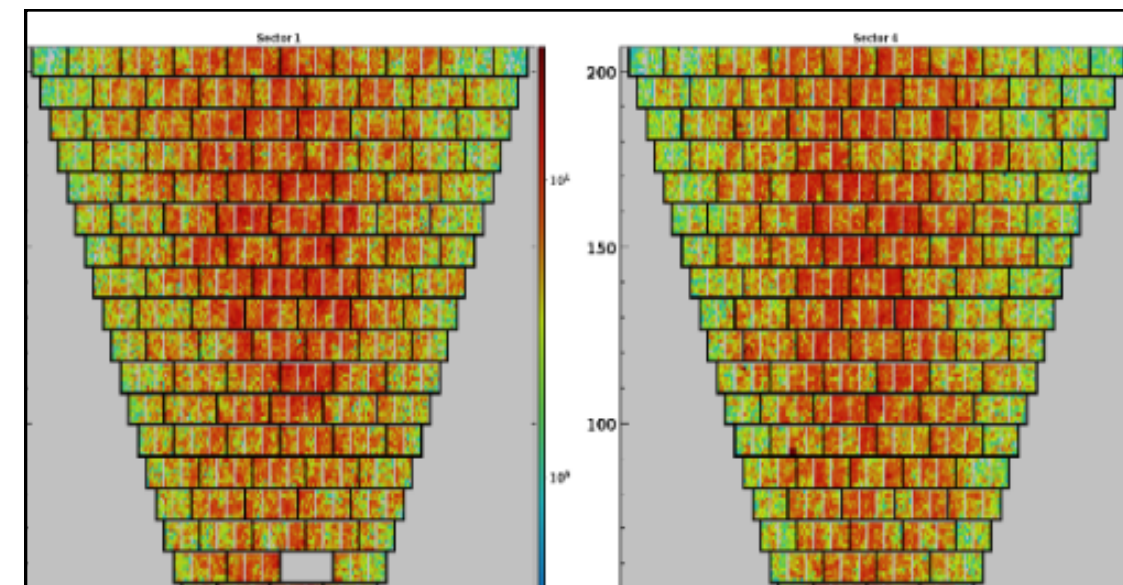
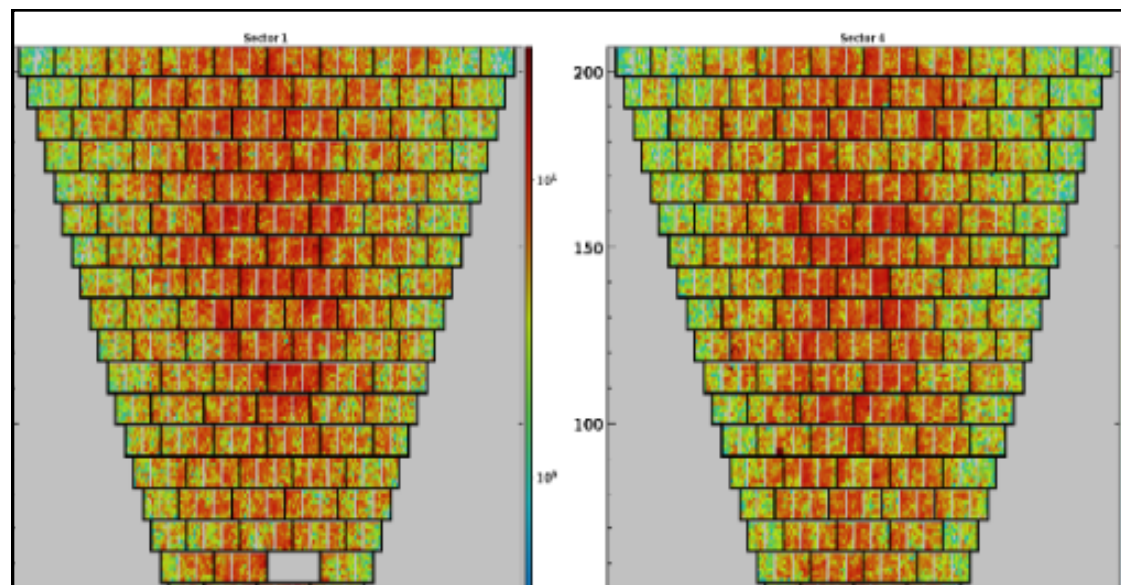
Run: 121264 - Chunk: 0011



Run: 121264 - Chunk: 0011



Run: 121264 - Chunk: 0011



Plot Type Selector

Images to label



## News

Select Runs

19599

19600

Select Detectors

FTOF

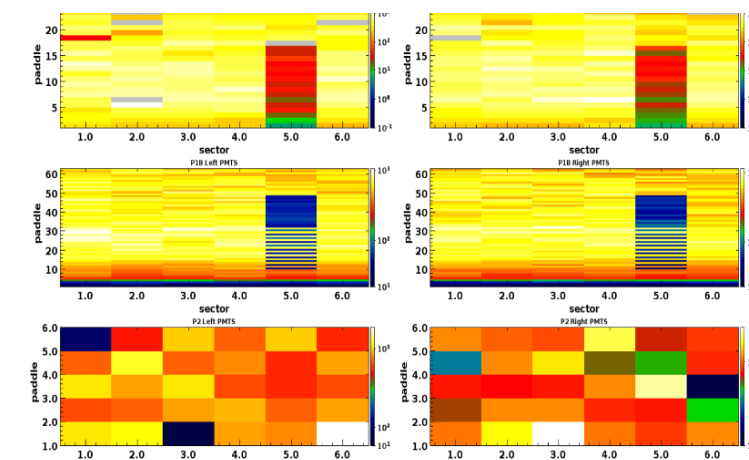
HEL

Bad

Unconfirmed  
Classification not above  
threshold

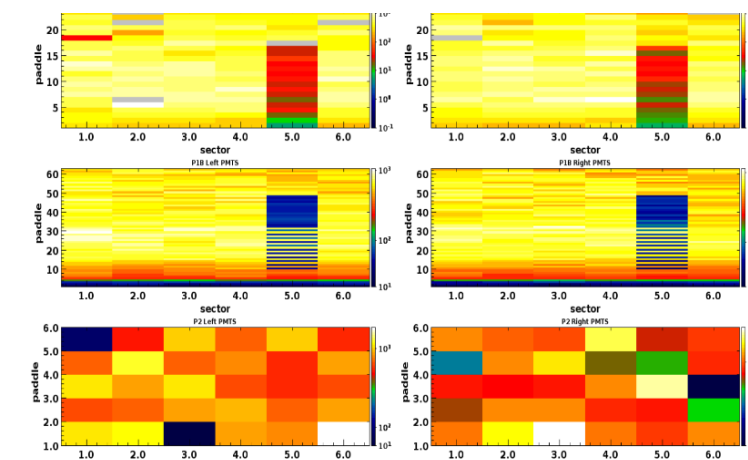
## FTOF TDC Occupancy

Contact: FTOF Expert



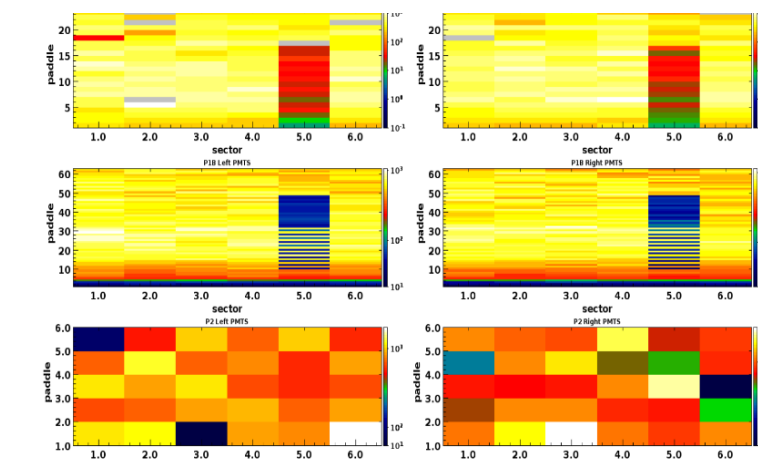
**Run: 19599.0**

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



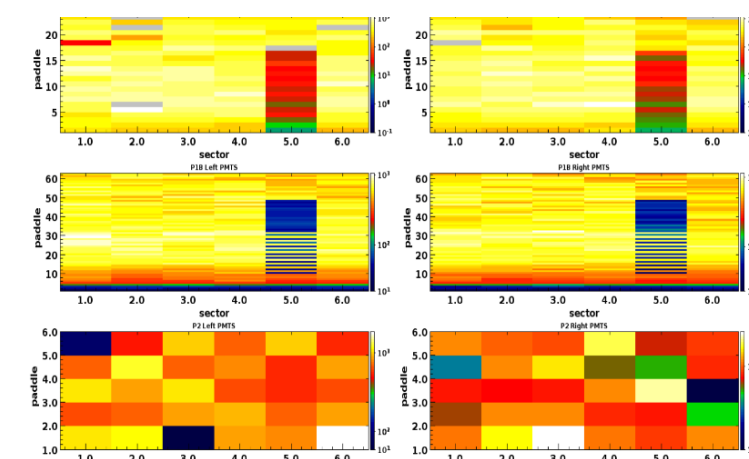
**Run: 19599.2**

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



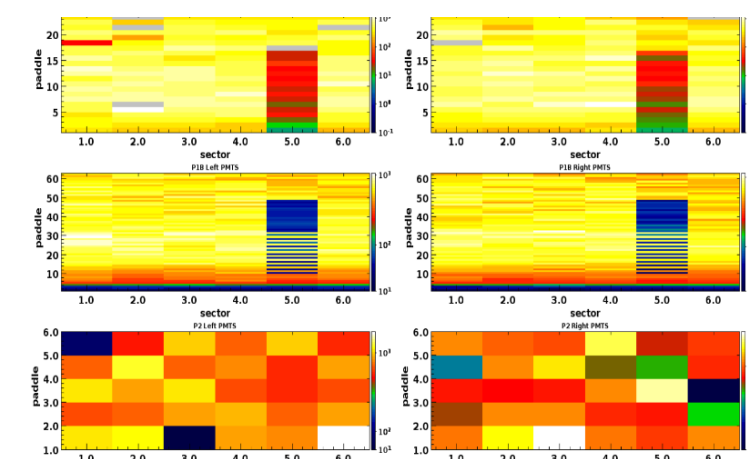
**Run: 19599.4**

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



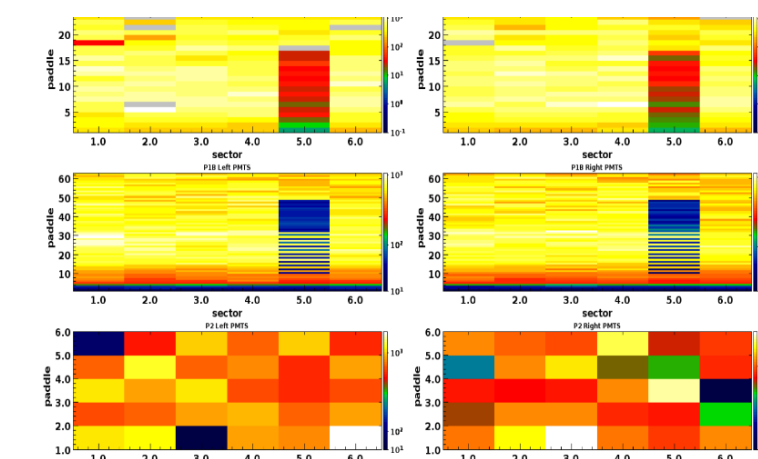
**Run: 19599.6**

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



**Run: 19599.8**

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

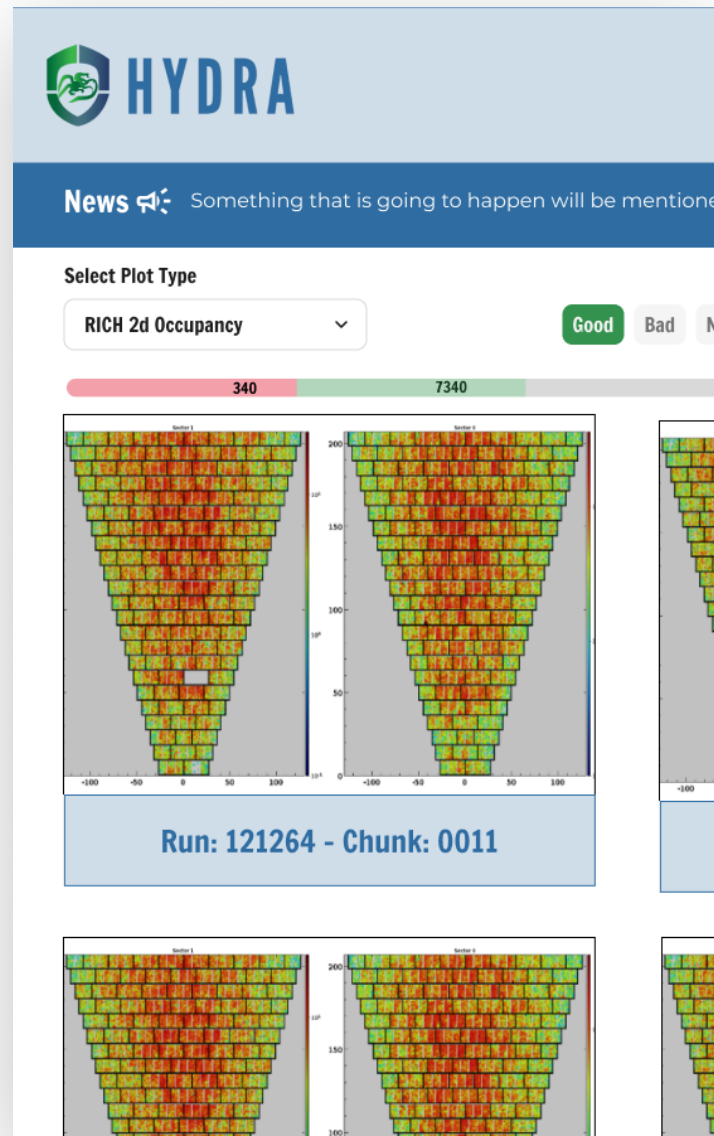


**Run: 19599.10**

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

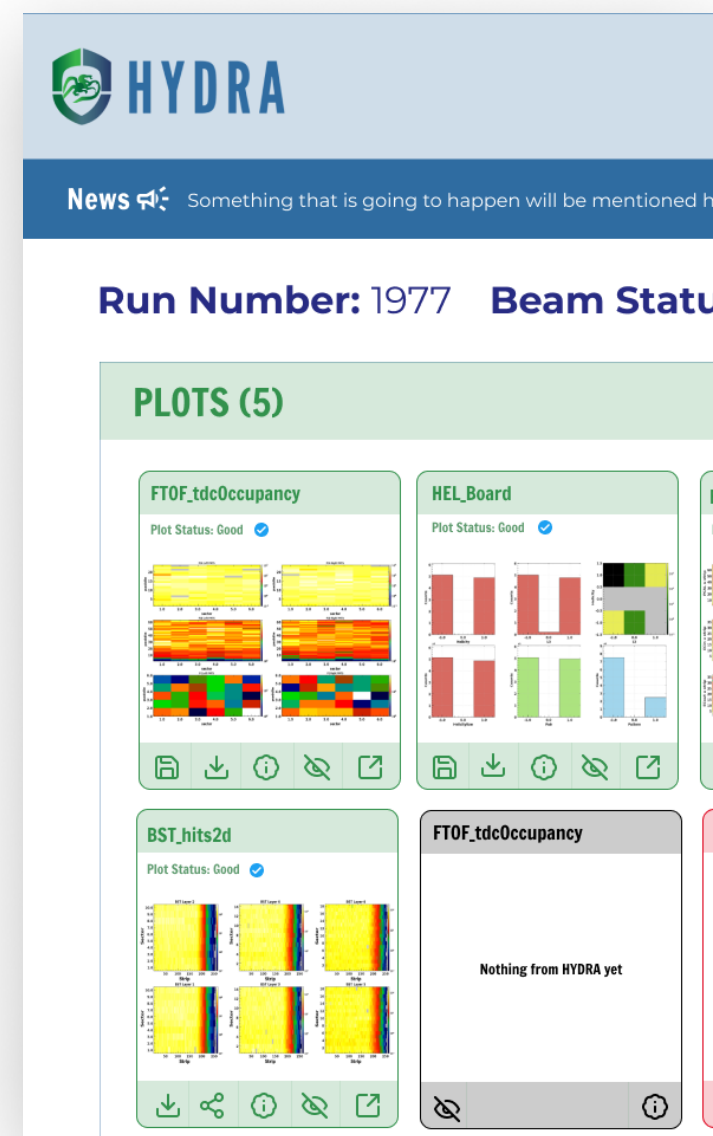


# Front end updates



## Image Labeler

Efficiently label thousands of images used for training a model.



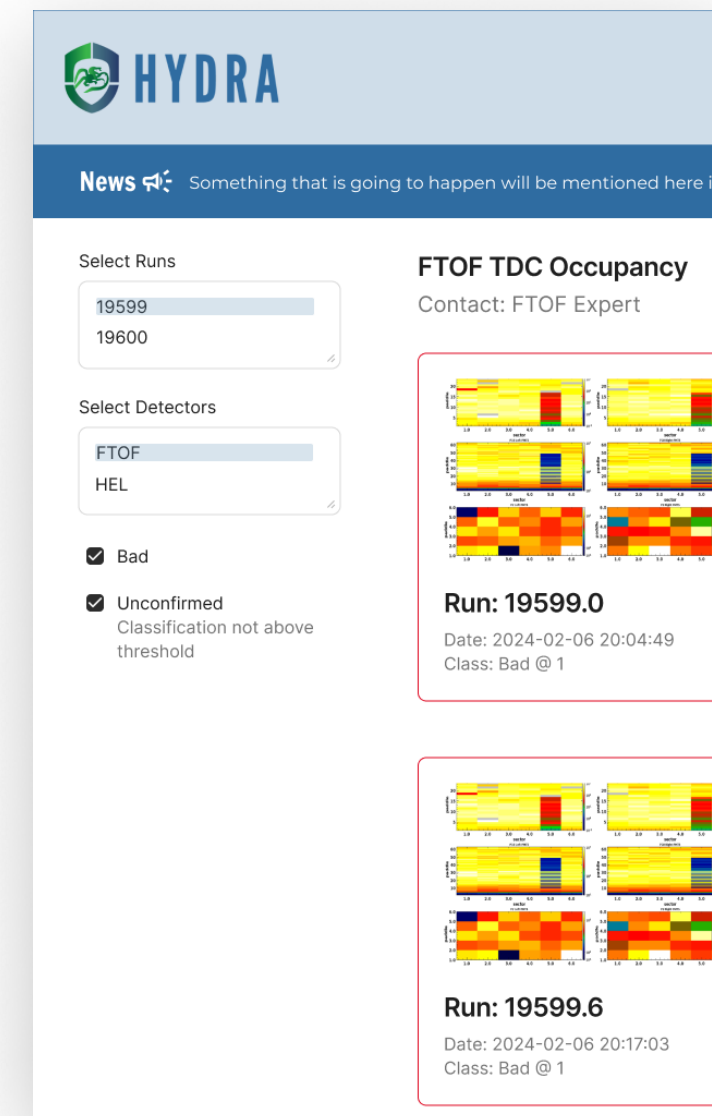
## Run

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



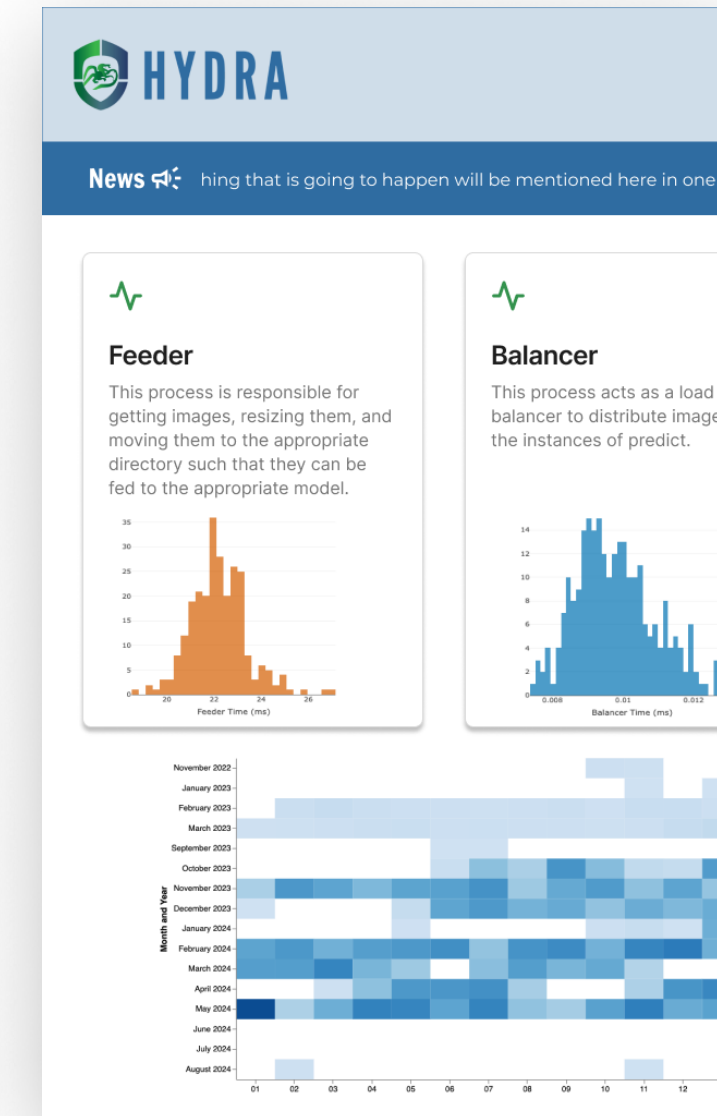
## Library

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.

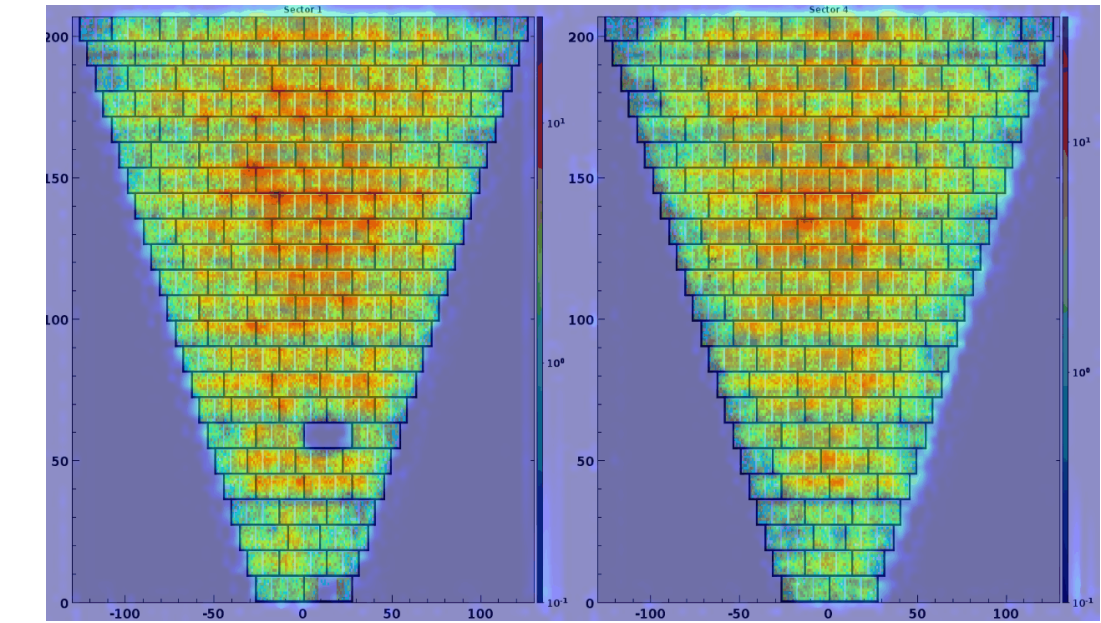
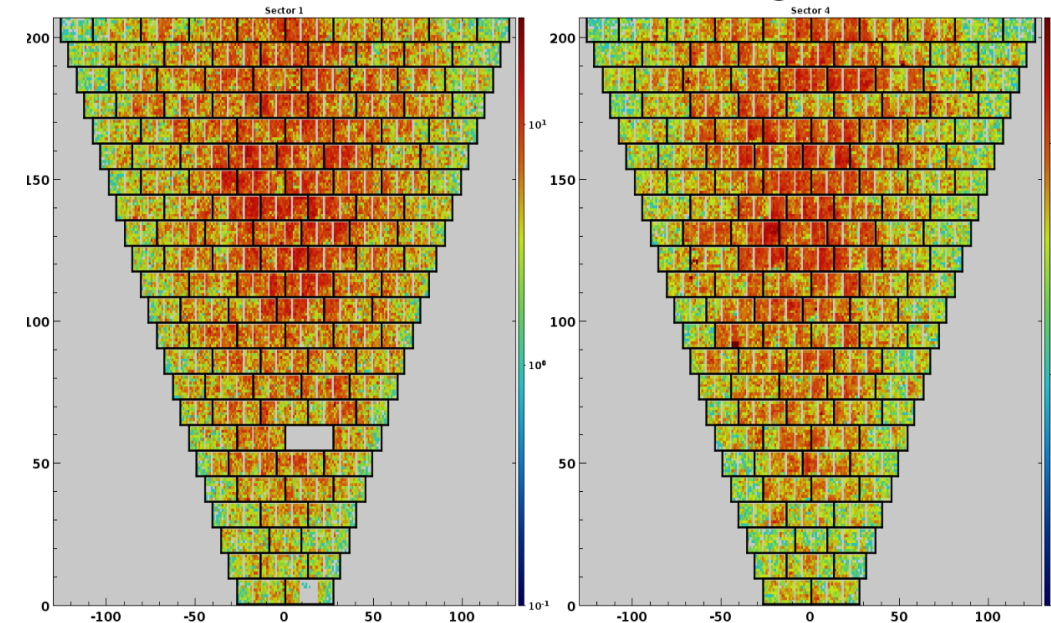
# Interpretability Updates



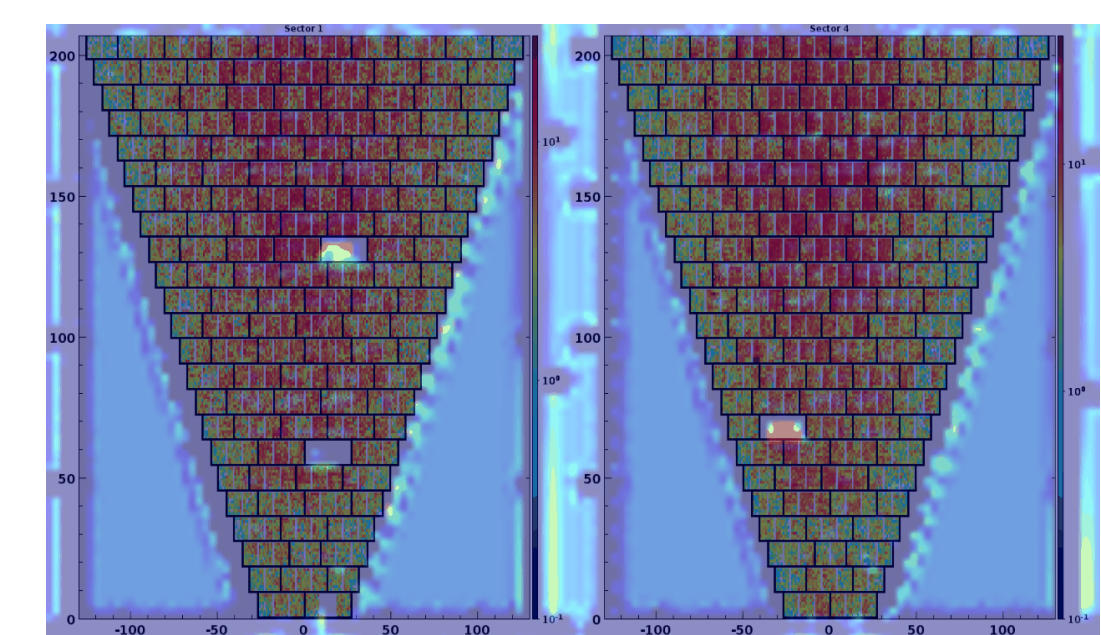
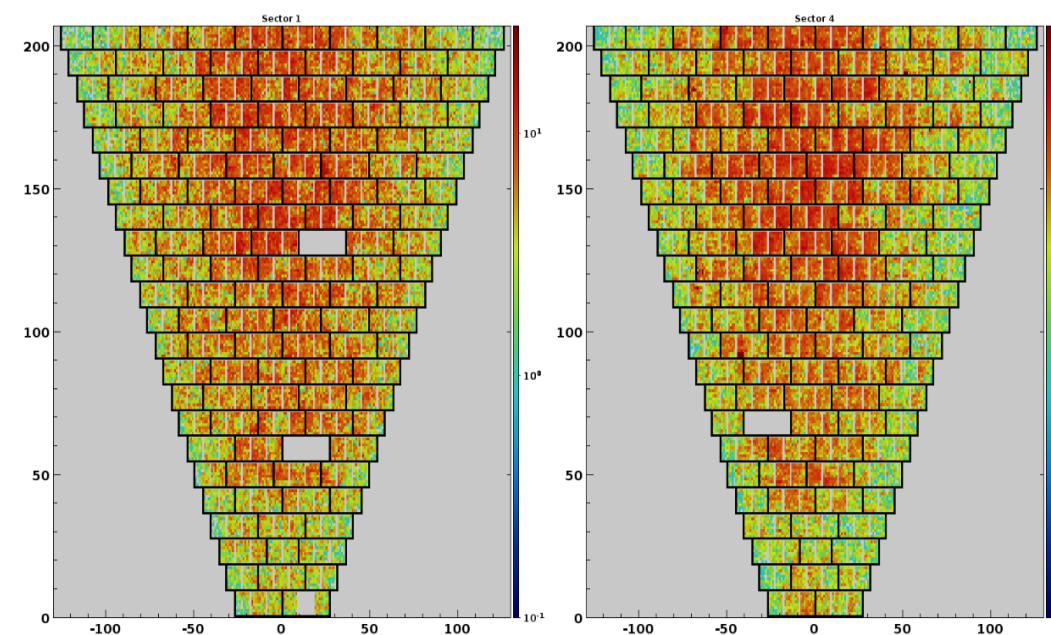
Gradient-weighted Class Activation Maps provide visual explanations for the model's classification by highlighting important regions of the image

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

this is a normal image



this is a bad image

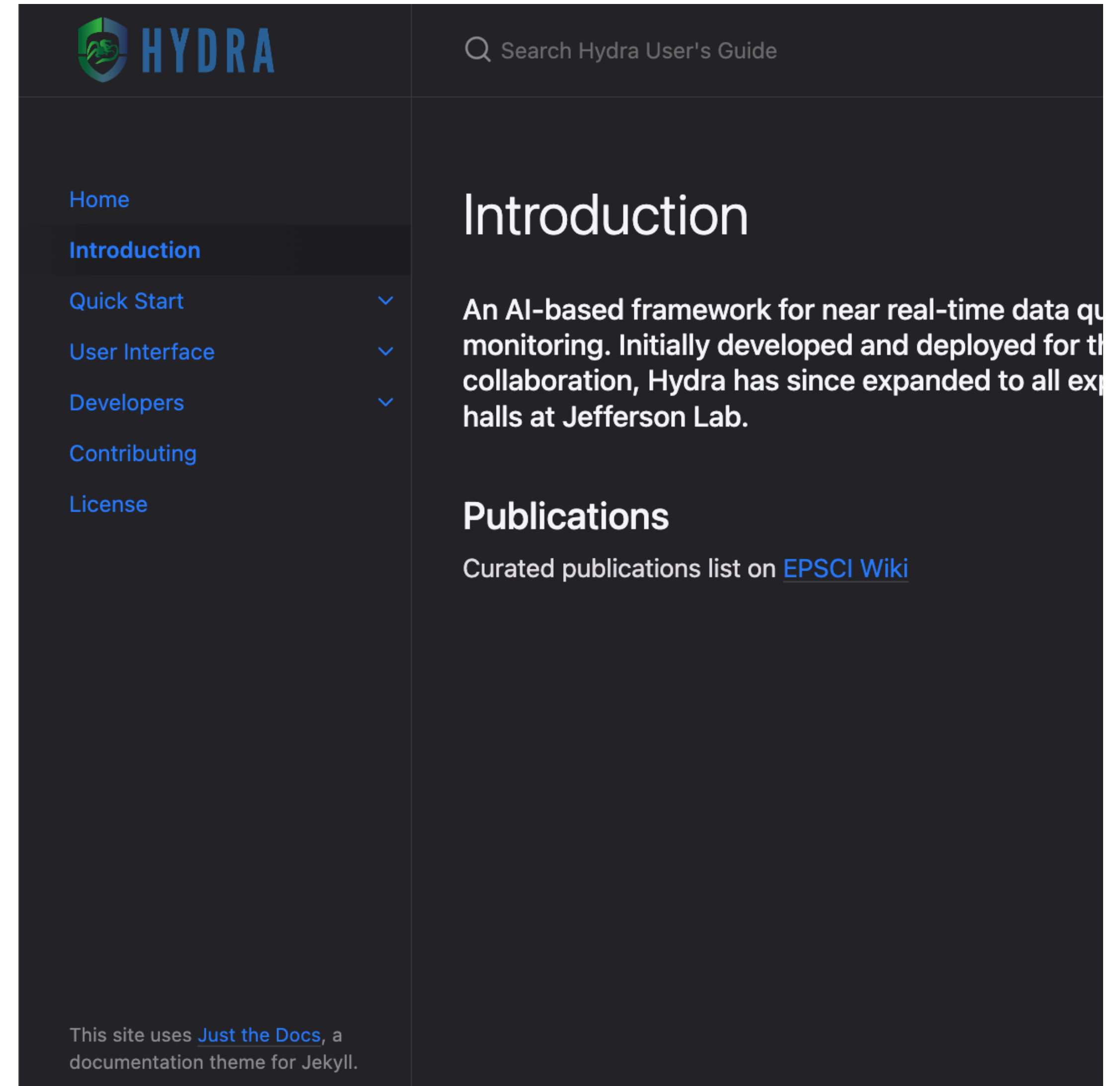


Heat maps are produced from mixed layers in InceptionV3+CBAM

# Documentation

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

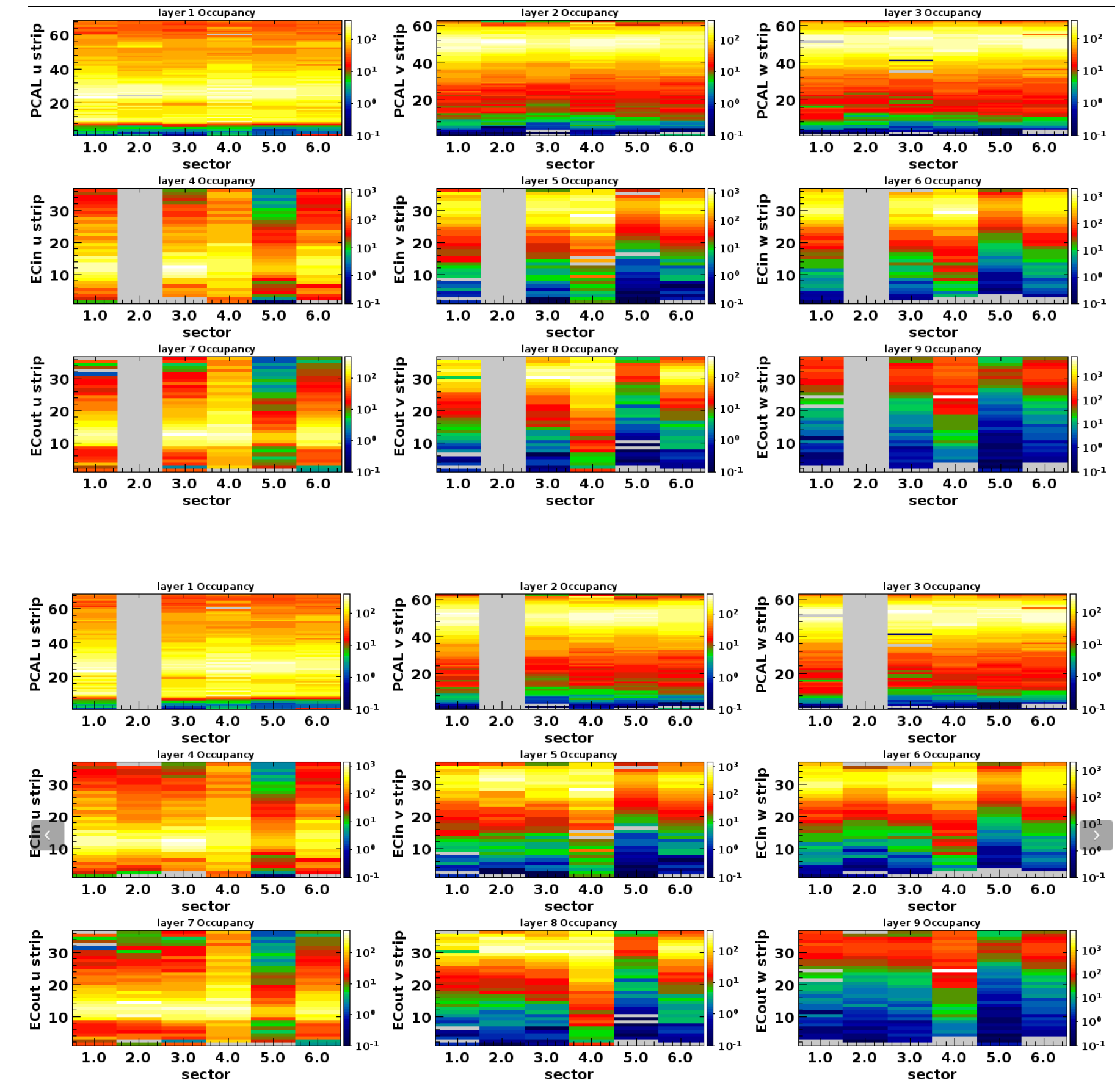
<https://jeffersonlab.github.io/HydraUsersGuide/>



The screenshot shows the Hydra User's Guide documentation page. The page has a dark theme with a light blue and green logo for 'HYDRA' in the top left. A search bar in the top right contains the text 'Search Hydra User's Guide'. The left sidebar contains a navigation menu with the following items: 'Home', 'Introduction' (highlighted in blue), 'Quick Start' (with a dropdown arrow), 'User Interface' (with a dropdown arrow), 'Developers' (with a dropdown arrow), 'Contributing', and 'License'. The main content area features the title 'Introduction' in large white text, followed by a paragraph: 'An AI-based framework for near real-time data qu monitoring. Initially developed and deployed for th collaboration, Hydra has since expanded to all exp halls at Jefferson Lab.' Below this is a section titled 'Publications' with the text 'Curated publications list on [EPSCI Wiki](#)'. At the bottom of the page, a footer note states: 'This site uses [Just the Docs](#), a documentation theme for Jekyll.'

# 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

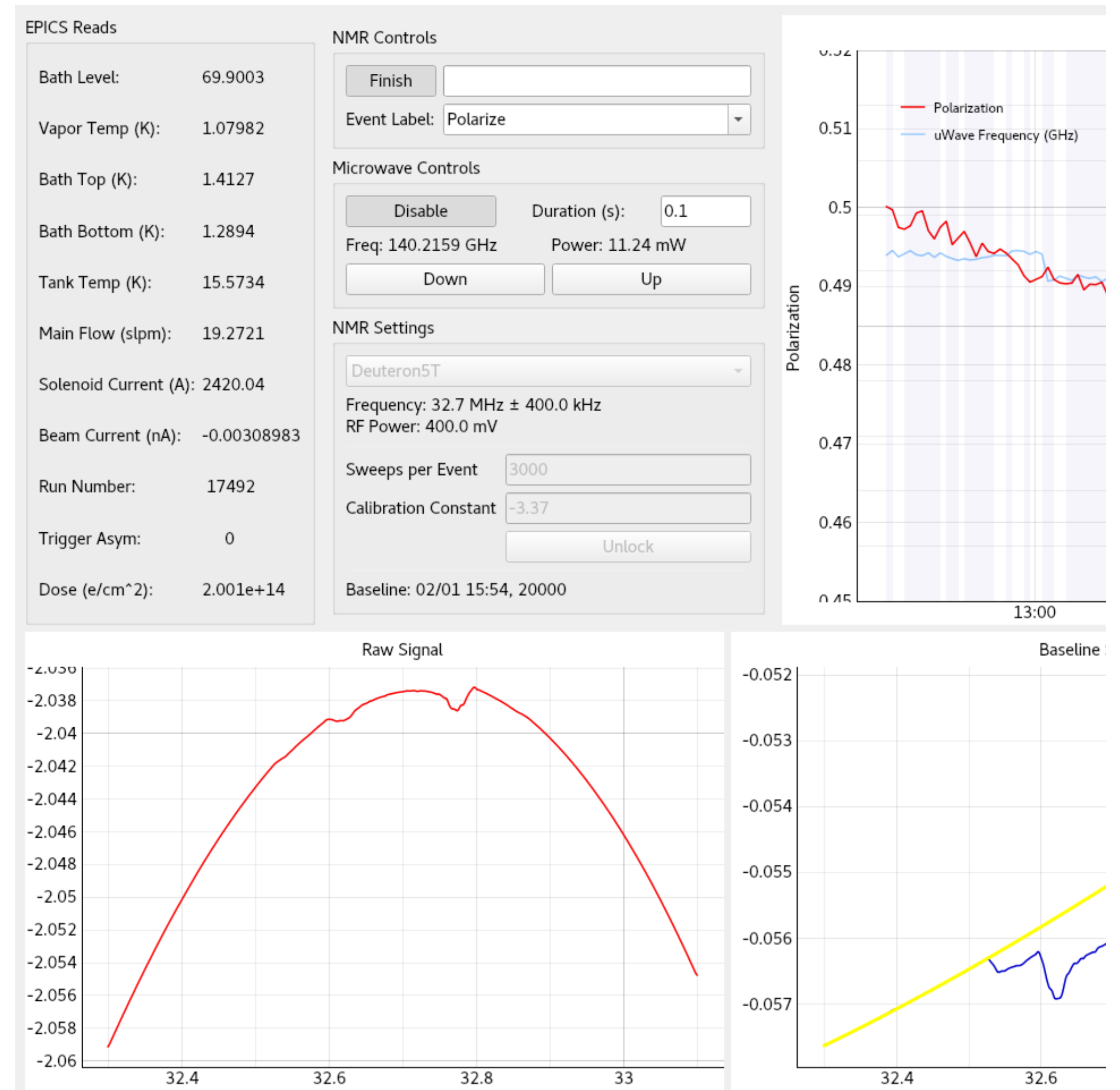
## UI/UX testing

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 University



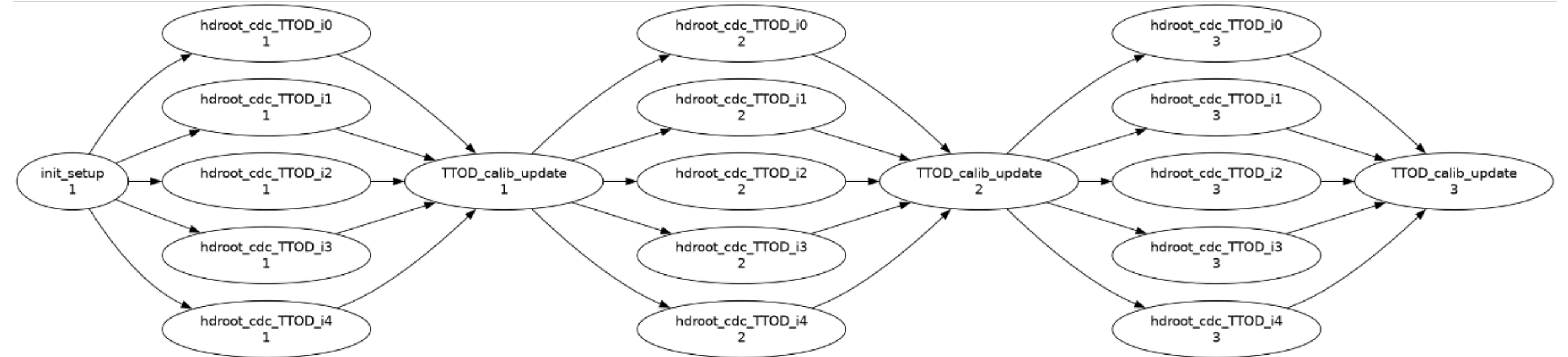
# Calibrations as dependency graphs

**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

