HYDRA

Computer Vision for Data Quality Monitoring

Thomas Britton, Torri Jeske
David Lawrence
Kishansingh Rajput

Introducing Hydra

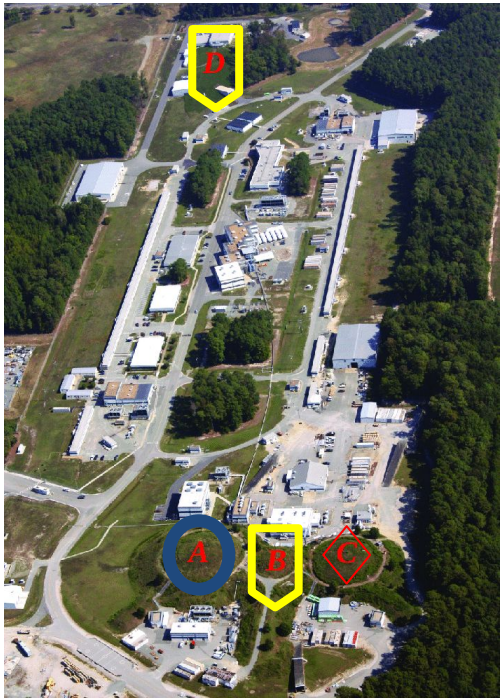
- Hydra aims to be an extensible framework for training and managing A.I. for near real time monitoring
  - If you need it to tell a dog from cat I can have hydra do that, without system modification, now

Koboldpress.com

- Most importantly, Hydra allows me to embrace my inner sloth:

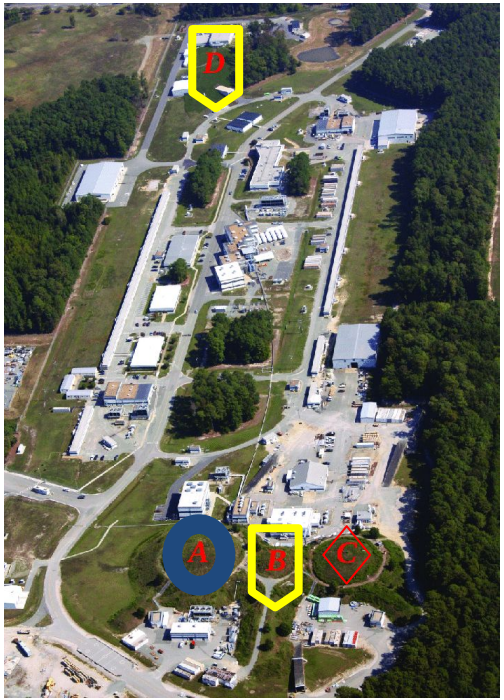
Deployed site wide

- Instance of Hydra deployed in <u>all halls</u>
  - Fully in B and D
  - In A but not being fully utilized
  - Technically in Hall-C
    - Working to make its adoption more green-field



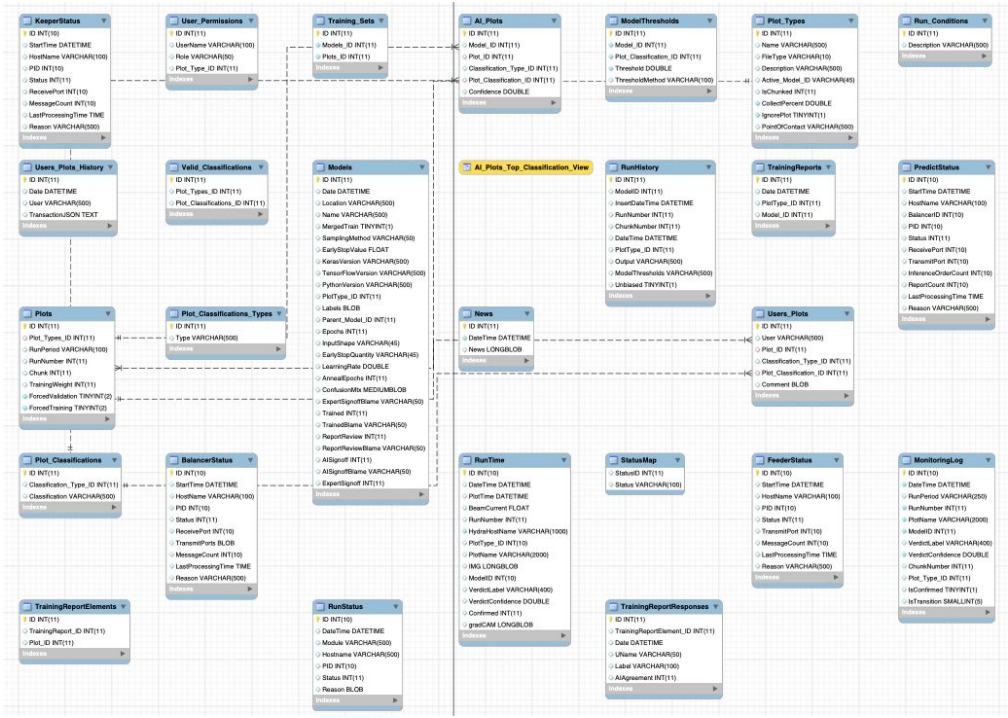
Challenges

- **Differing protocols**
  - Not everyone is set up to provide images, or in the granularity required
- **Differences in scale**
  - GlueX has about a dozen plots. CLAS has 81
- **Requires some degree of buy-in from disparate groups**



Back End

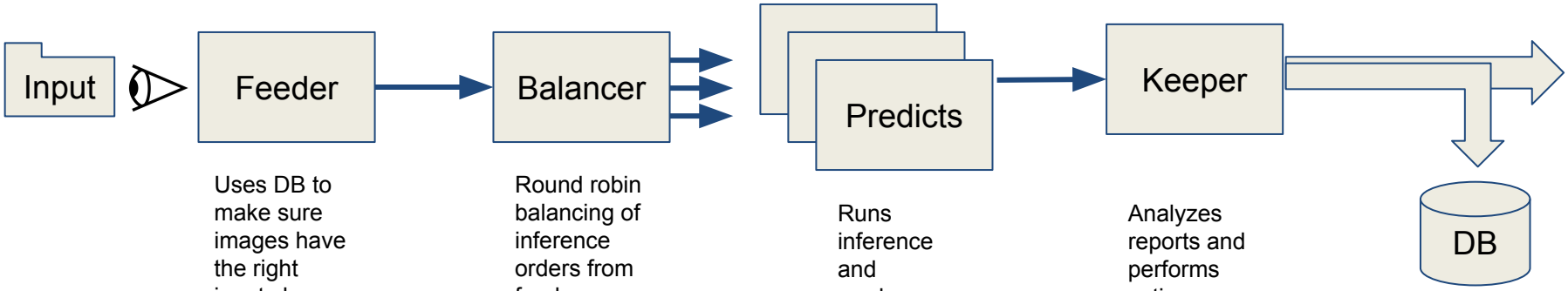
- Hydra is supported by a MySQL database which holds both training data and operational data
- Model configurations are also stored/read from the database
- Saves a snapshot of every inference and training
  - A whole host of data to analyze and utilize



Hydra System

- Parasitic to normal operations
  - Meant to aid not replace!
- Feed images into the input directory and Hydra handles the rest

→ Messages passed via 0MQ allowing for more distributed deployment



Self-sustaining

- The goal is to provide a system which is more or less self-sustaining
  - Further Education
    - Unbiased, configurable, sampling
    - Unconfirmed, Bad examples
  - How is a model performing?
    - If labeling is up-to-date we can leverage the unbiased selection to compute a trailing accuracy

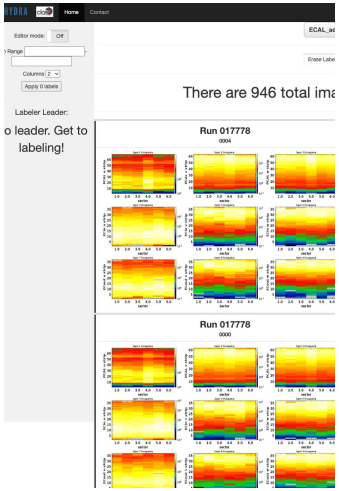
Self-sustaining cont.

- Possible to trigger retrainings based on changes in the running accuracy
  - Other conditions?

- Developing methods to enable better administration of the Hydra system
  - Monitoring Hydra

HYDRA: Front End

Web based for user convenience.

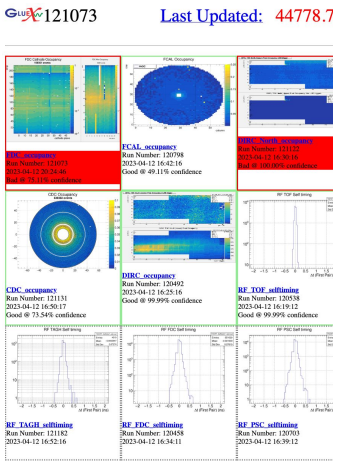


Data Labeler

Efficiently label hundreds (thousands) of images

Library

Contains enhanced confusion matrix, thresholds, active model designations

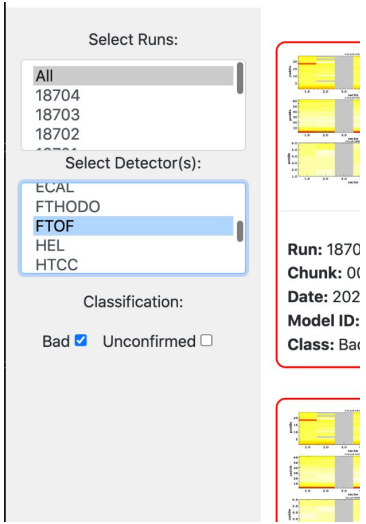


Run

See near real time predictions

Grafana

Dashboard displays all predictions over time



Log

Display concerning plots sorted by detector from previous day

HYDRA: Data Labeler

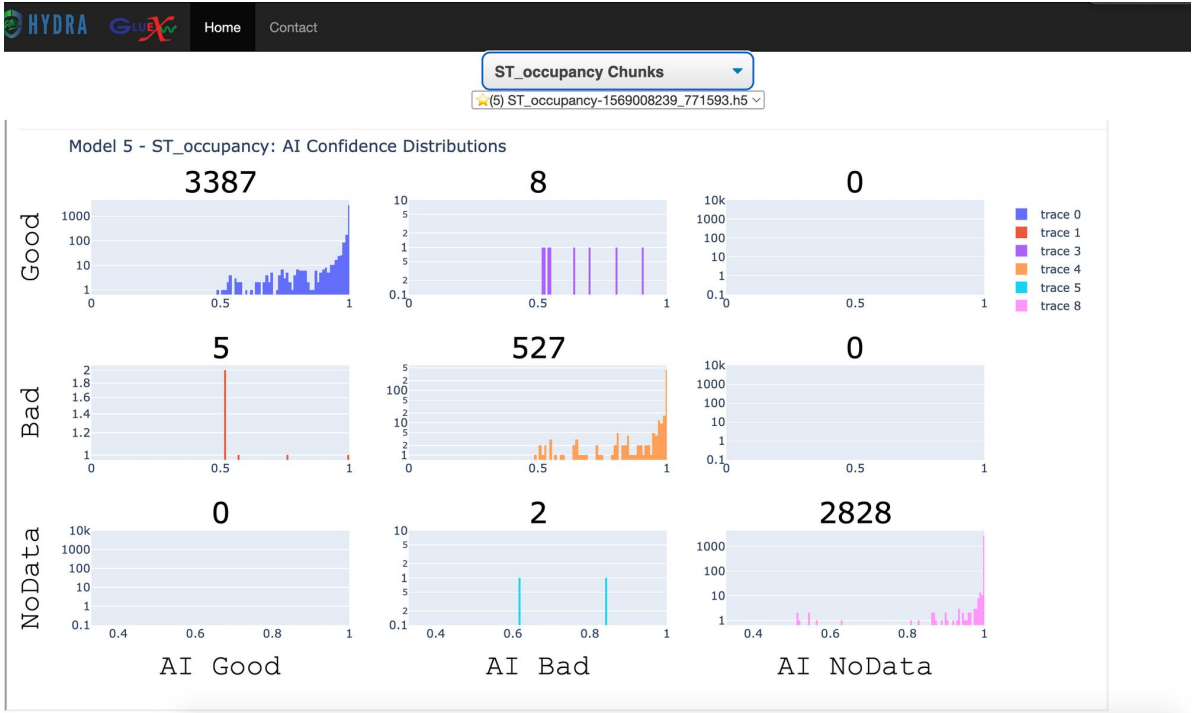
Efficiently label multiple monitoring plots. Labels and images are automatically uploaded to database.

HYDRA: Library

Visualize model performance, thresholds, active models, etc.

Enhanced confusion matrix

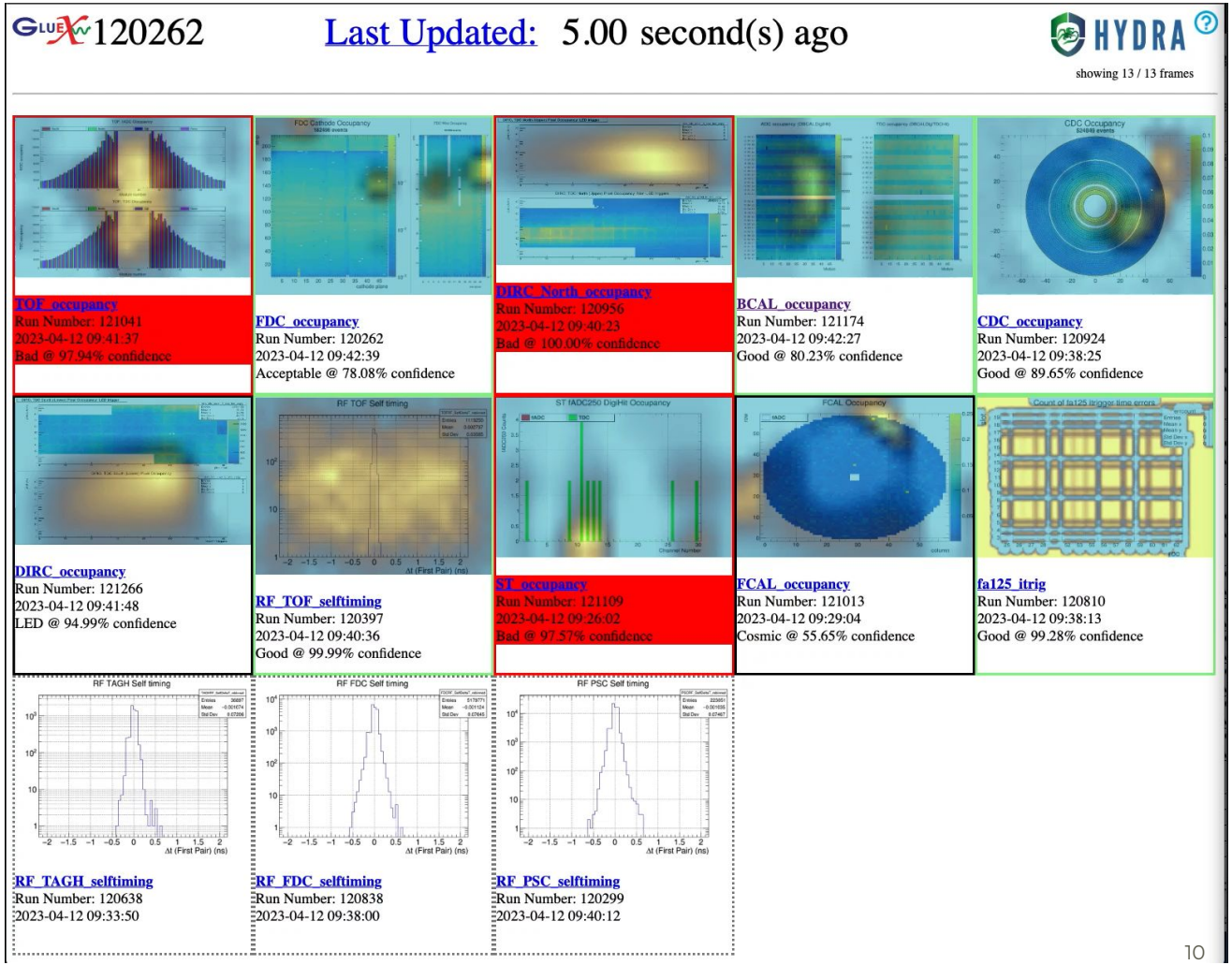
Each cell contains AI confidence distribution and total counts



HYDRA: Run

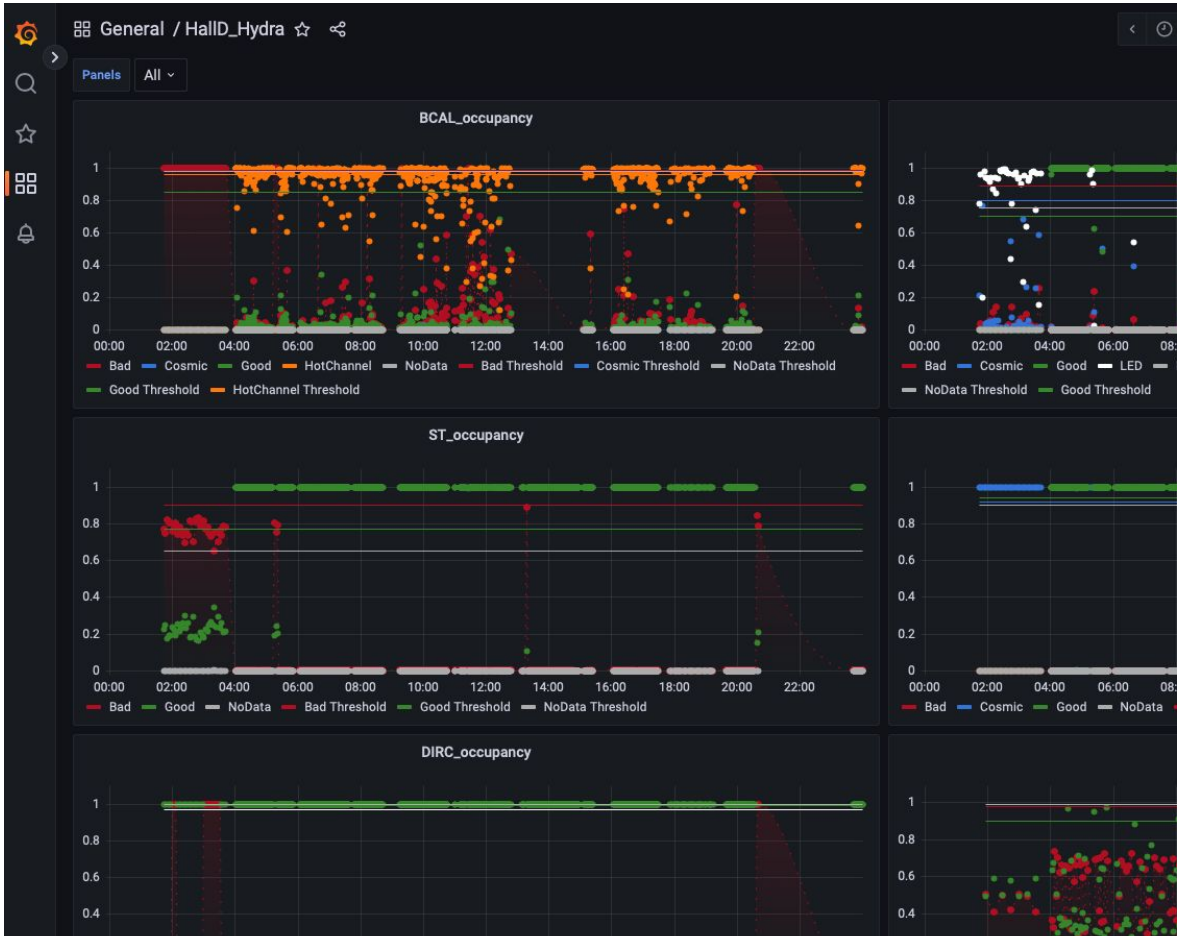
Watch predictions in real time from anywhere

GradCAM visualizations are optional



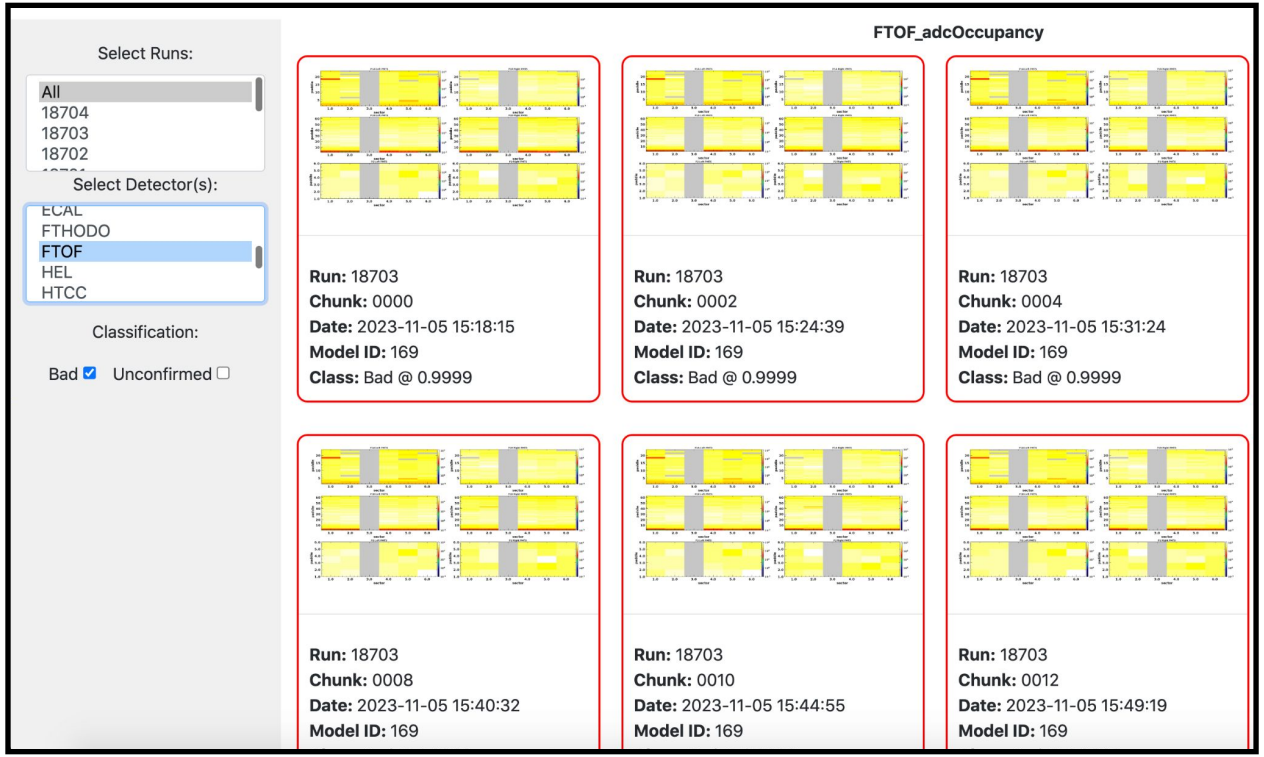
HYDRA: Grafana Dashboard

Look at any prediction over time.



HYDRA: Log

See 'Bad' or 'Unconfirmed' images from previous runs, separated by detector. Easily identify when a particular problem started



Other Future Hydra developments

- Siamese model(s)
  - Two step processing
    - First a generic anomaly approach
    - Second is a diagnostic step in the face of anomalies
- Masking
  - Ability to ignore parts of an image in inference
    - known/accepted problems aren't considered
- Kubernetization
  - Use Kubernetes for easier maintenance/deployment
- AI human interface improvements
  - Enable non AI experts to maintain/manage the hydra system

Chang Woo Lee

Hydra alarmed on the FA125 itrig errors. Indeed, during run 101072 after about 8.8 M events, the error occurred. We immediately ended the run and restarted R 101073. The error had cleared.
Kudos to Thomas, Naomi and Hydra!
p.s. We plan to change the SD board within the next hour.

HydraRun also saw the FDC problem, which I probably would have missed inspecting it by eye.

Hydra alarm on fa125_itrig during Run 101076

Questions?