Data Monitoring and Performance of the NOvA Detectors

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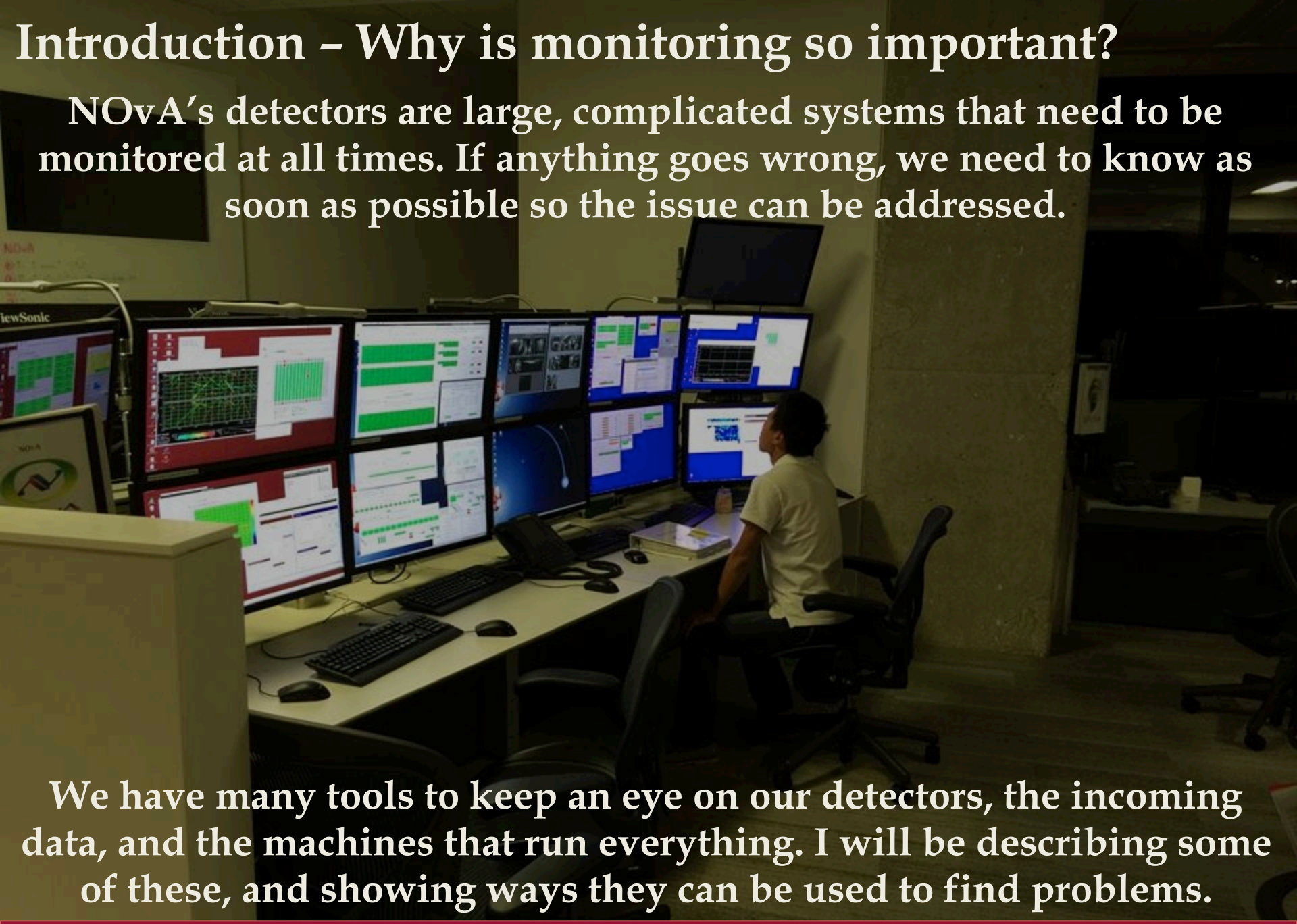
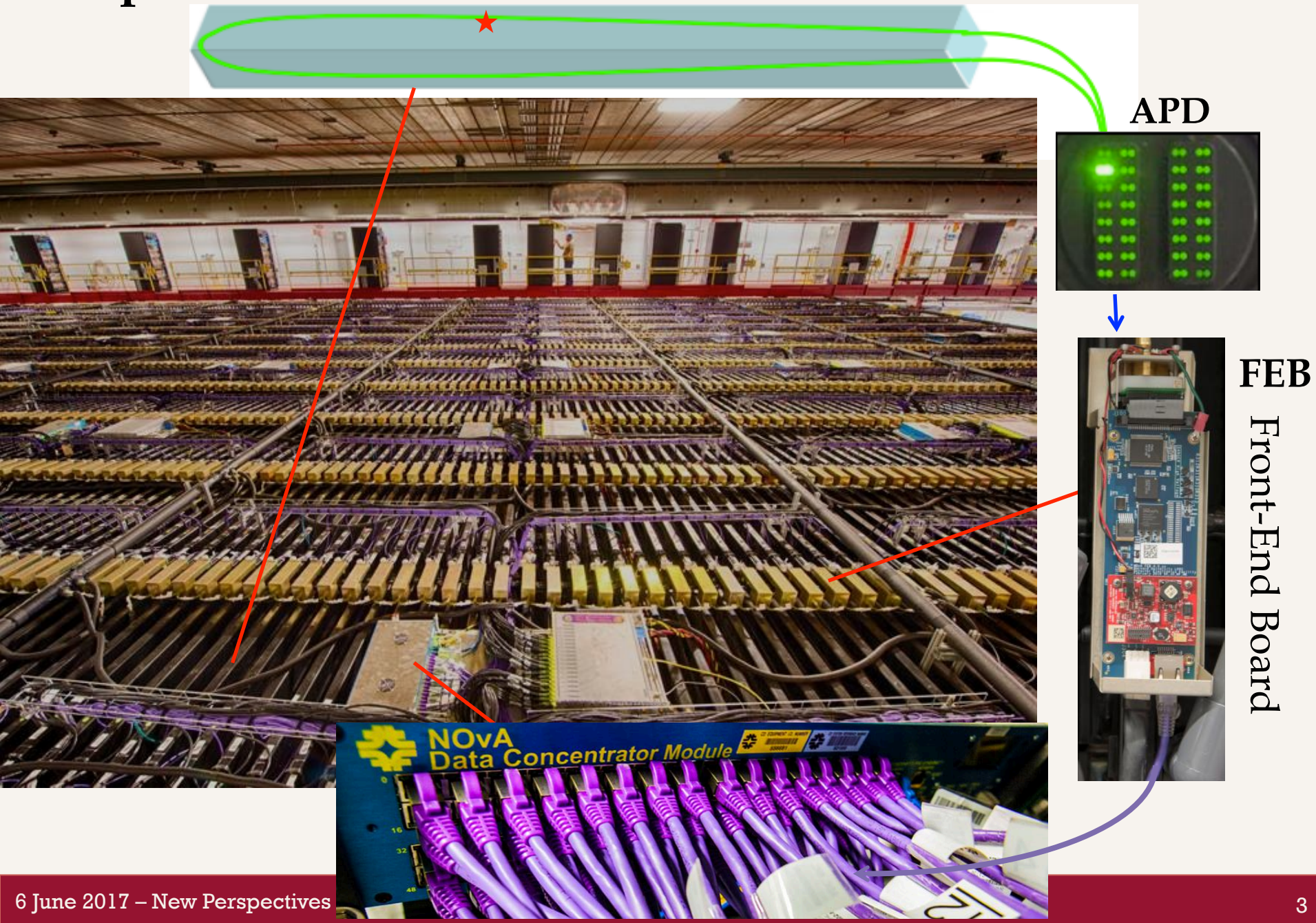
Introduction – Why is monitoring so important?

NOvA's detectors are large, complicated systems that need to be monitored at all times. If anything goes wrong, we need to know as soon as possible so the issue can be addressed.

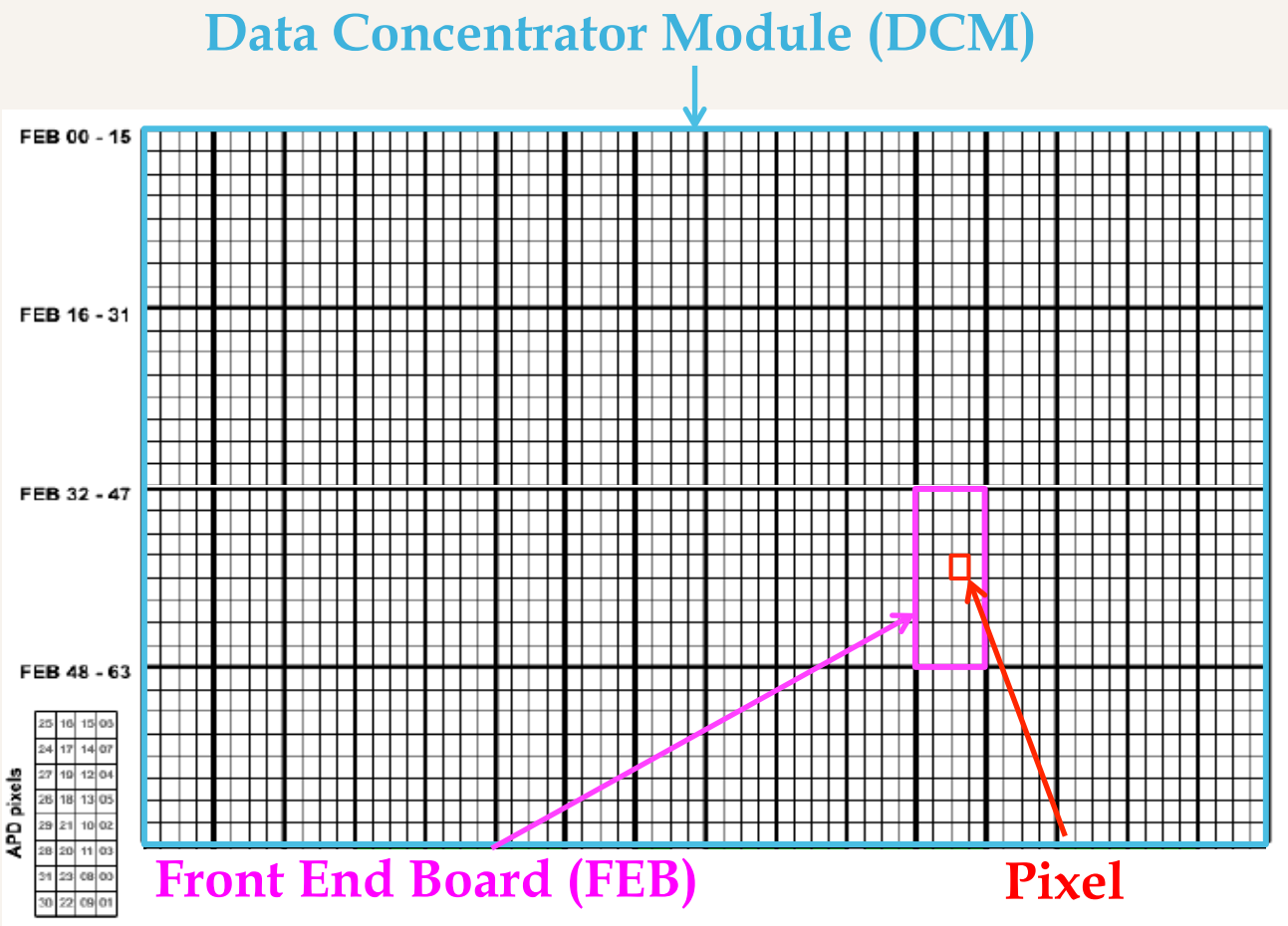


We have many tools to keep an eye on our detectors, the incoming data, and the machines that run everything. I will be describing some of these, and showing ways they can be used to find problems.

The path data takes:



Detector Breakdown



Far Detector

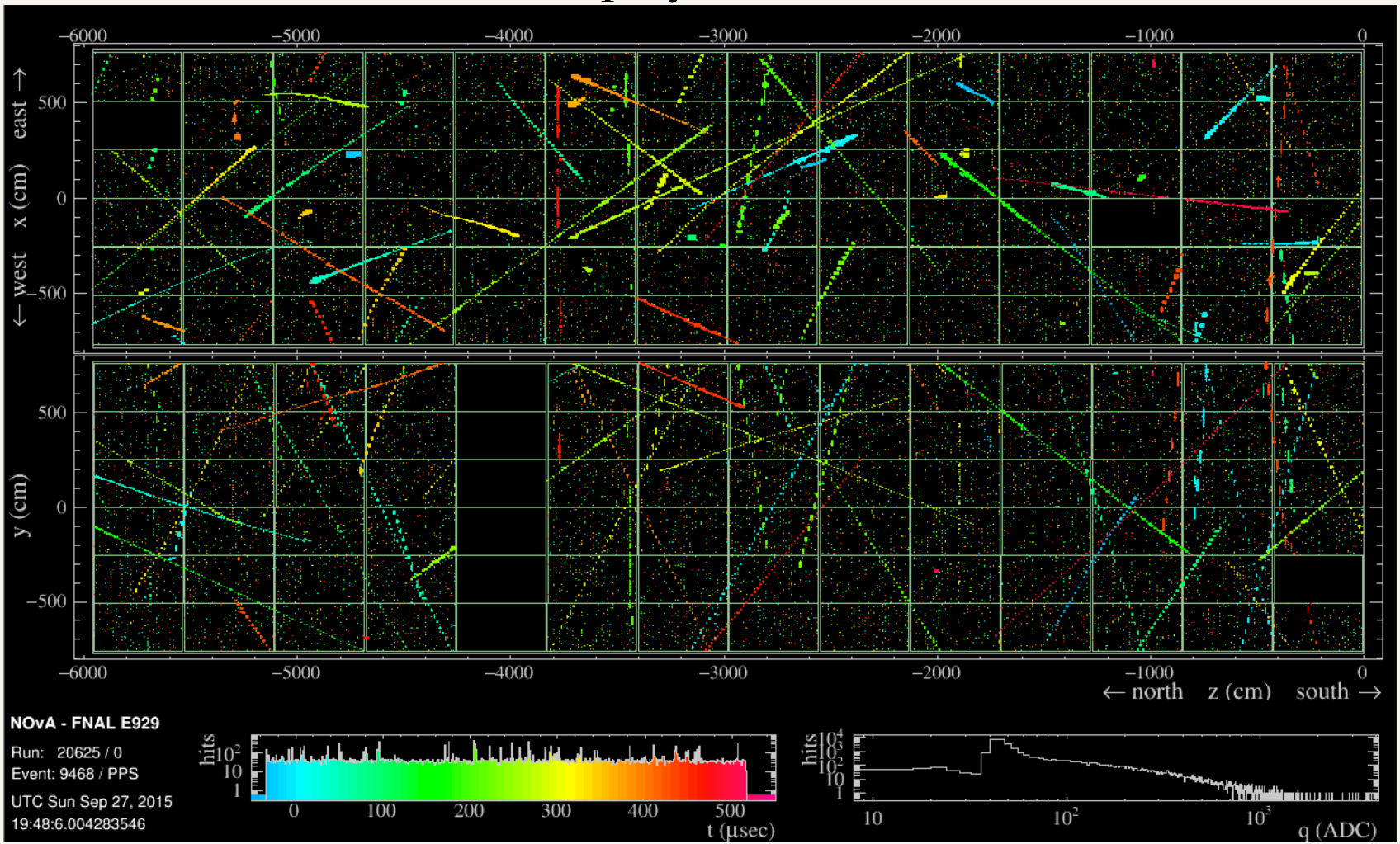
- 168 DCMs
- 10,749 FEBs
- 343,968 Pixels

Near Detector

- 14 DCMs
- 631 FEBs
- 20,192 Pixels

The Event Display

We can use the event display to look at events in real time.



If you look closely, you can see 9 sections of the detector that are completely blank

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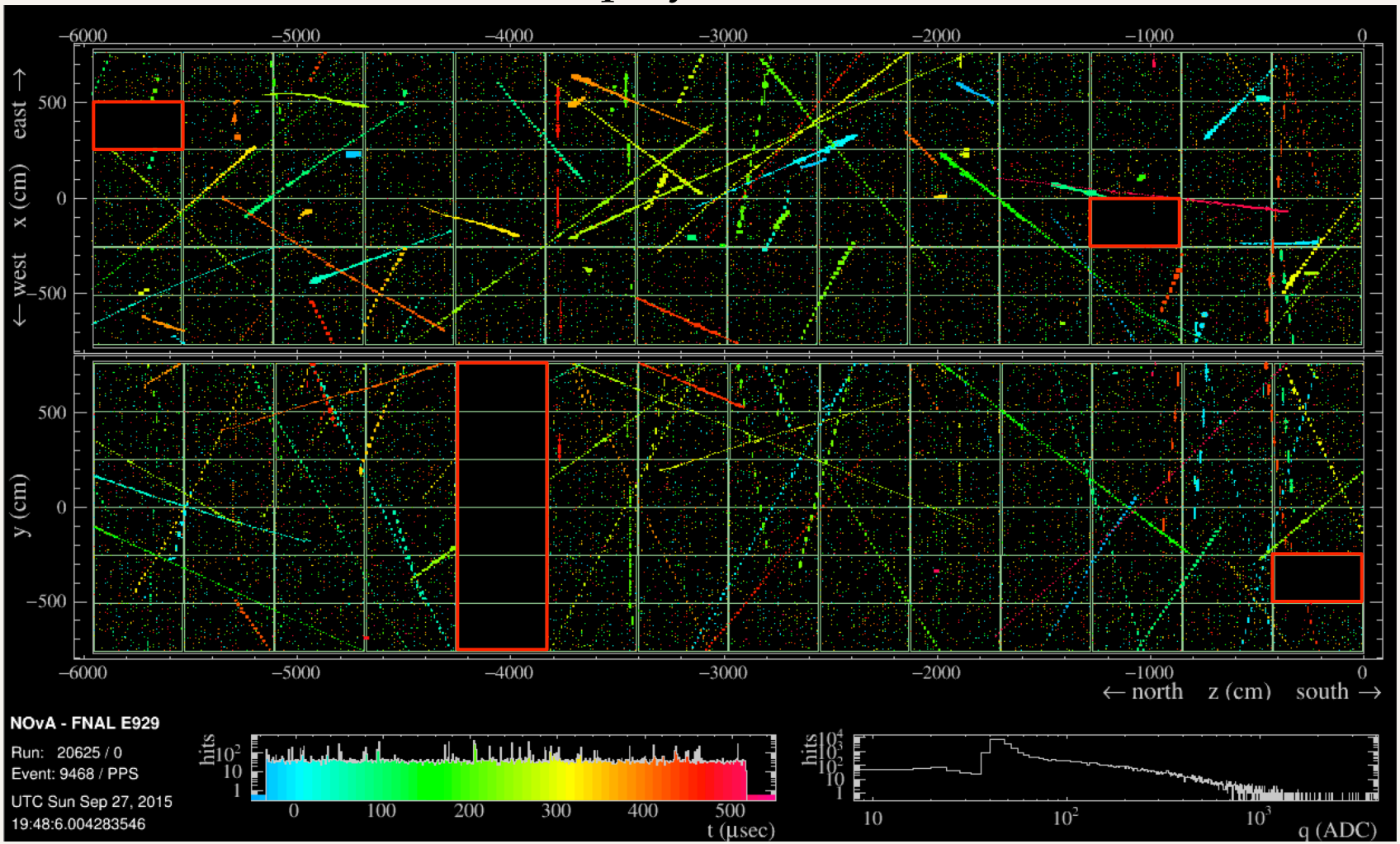

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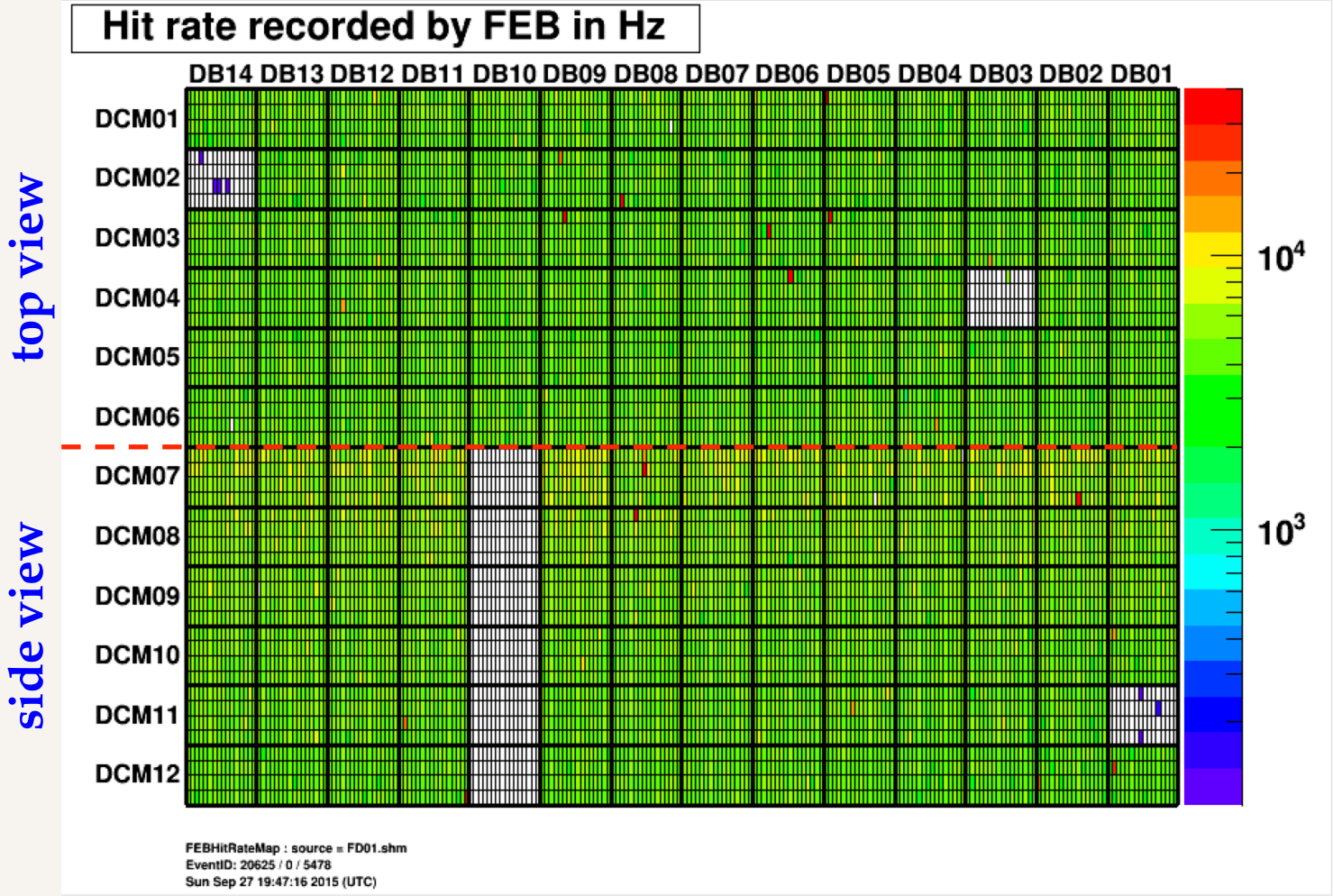
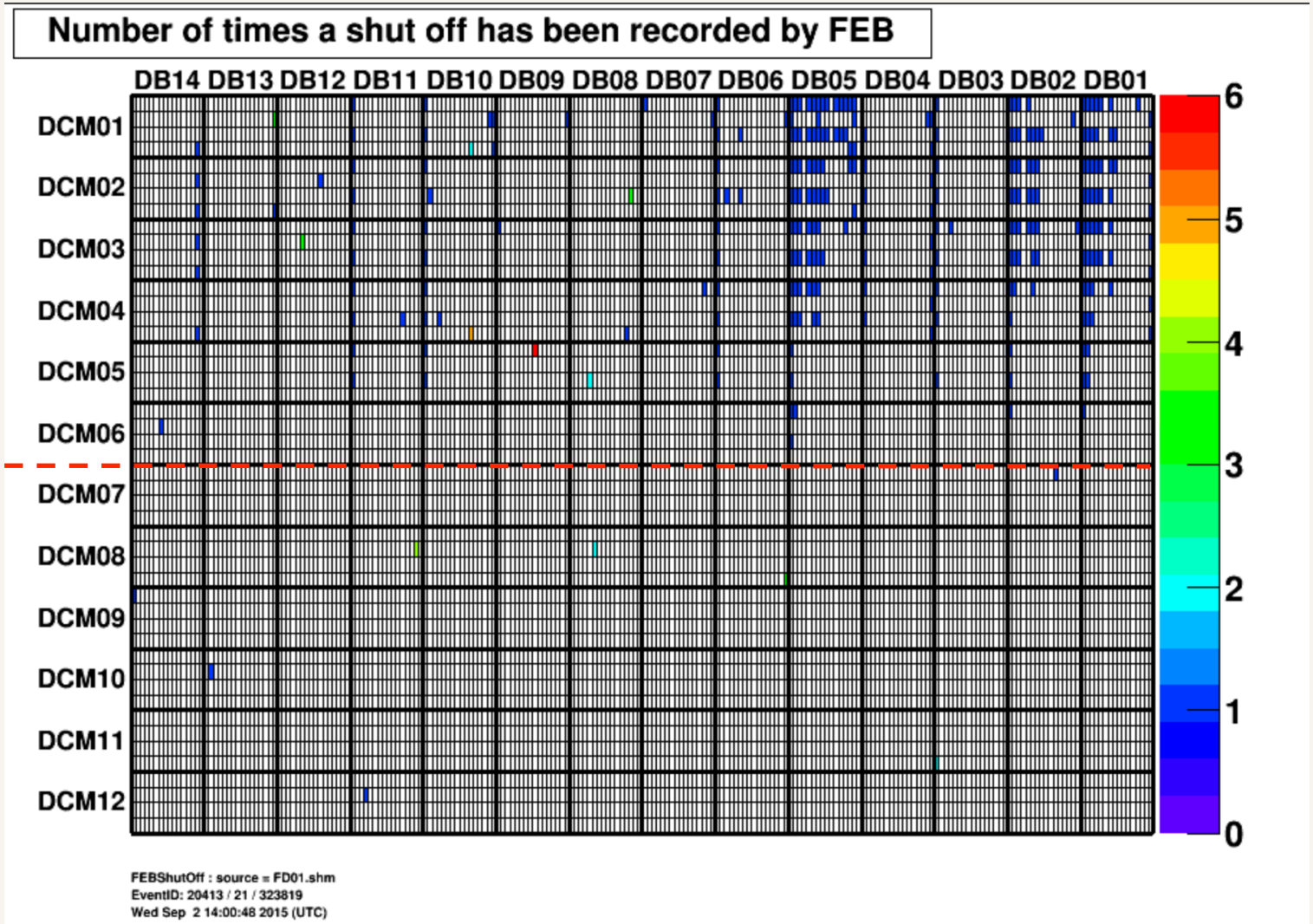
Online Monitoring

As the information comes in, plots are made from raw data. This plot in particular is almost always visible in our control room

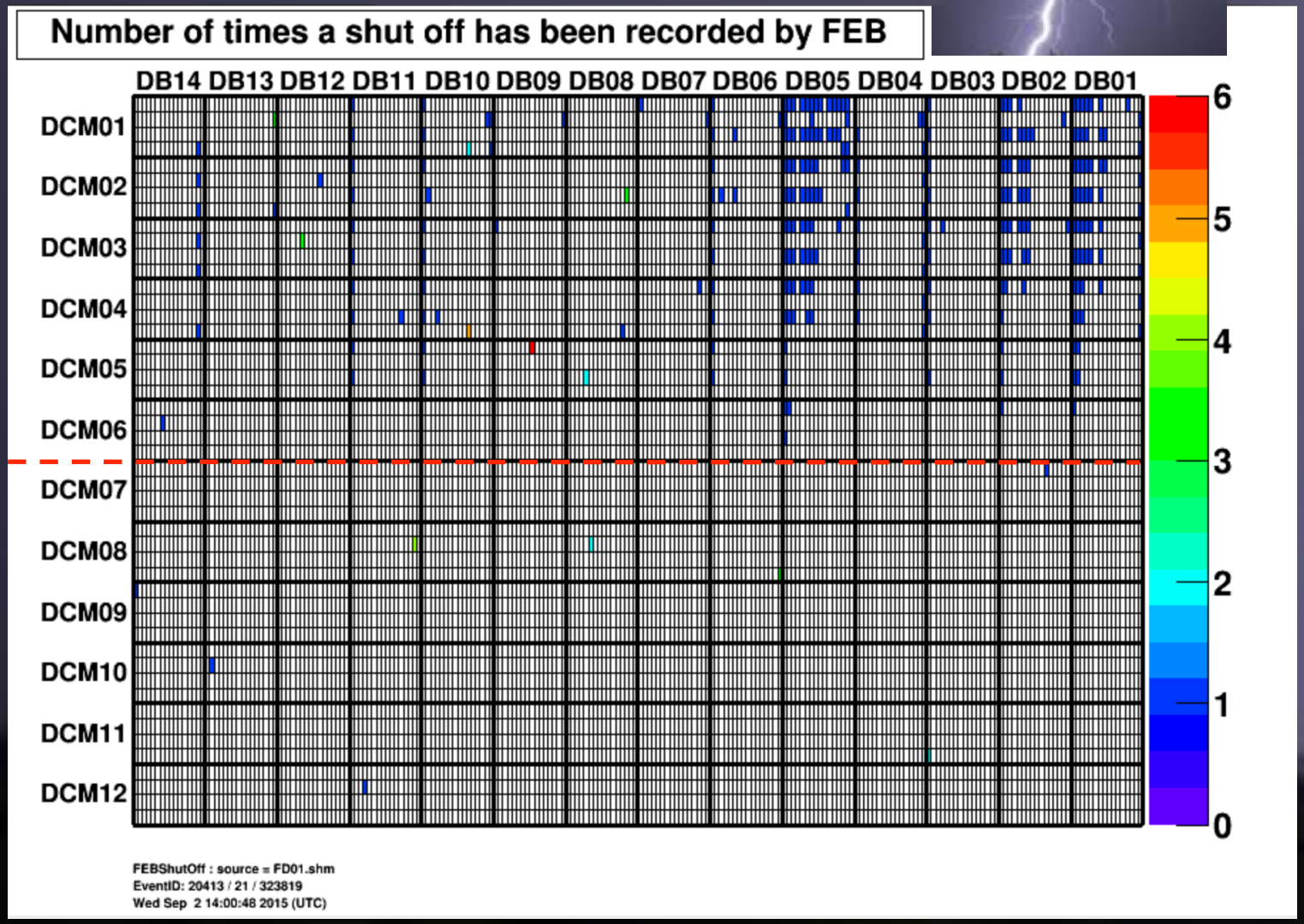


These same sections show up (mostly) blank on our hit rate plot.

Drop outs (non reporting parts of the detector)

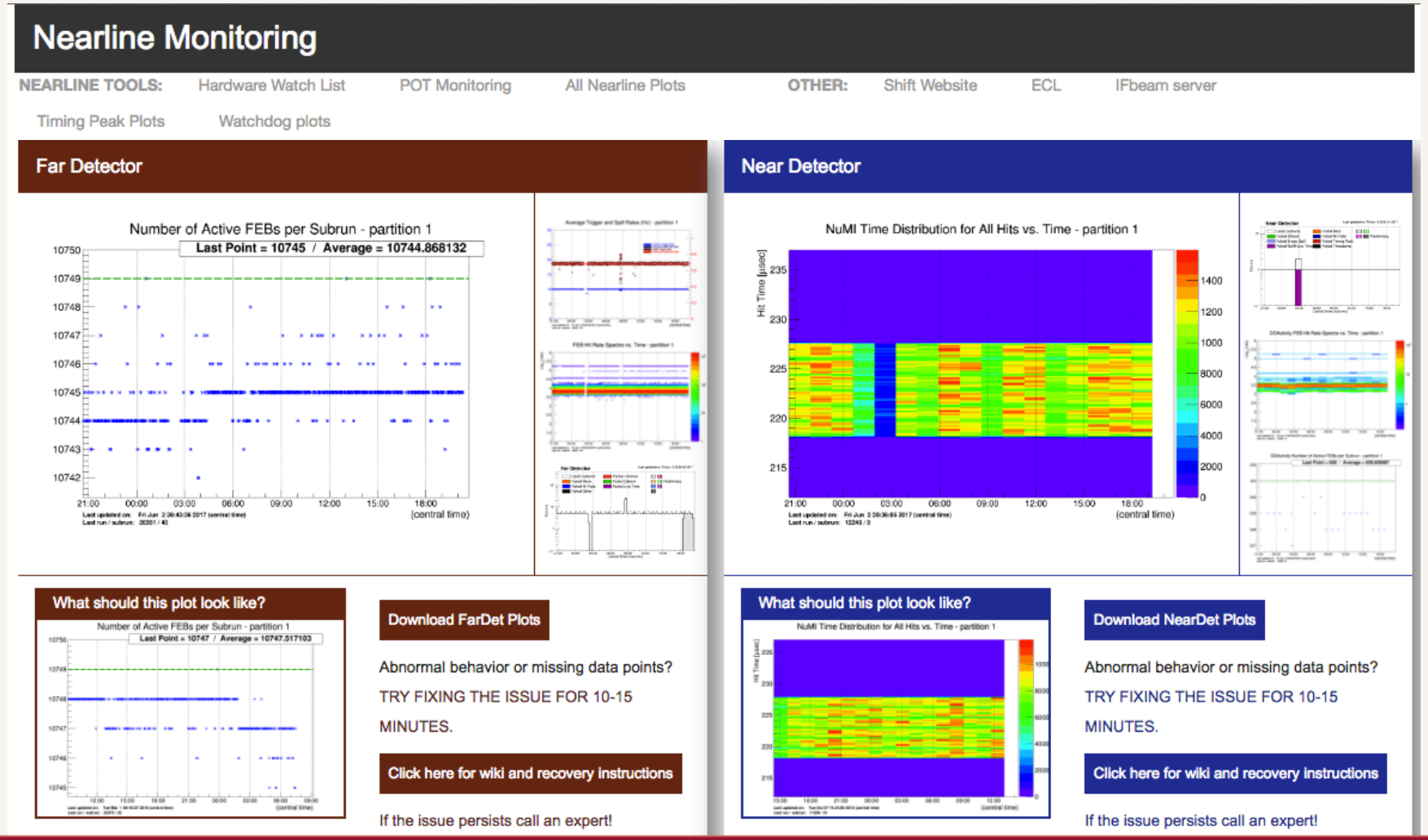


Thunderstorm

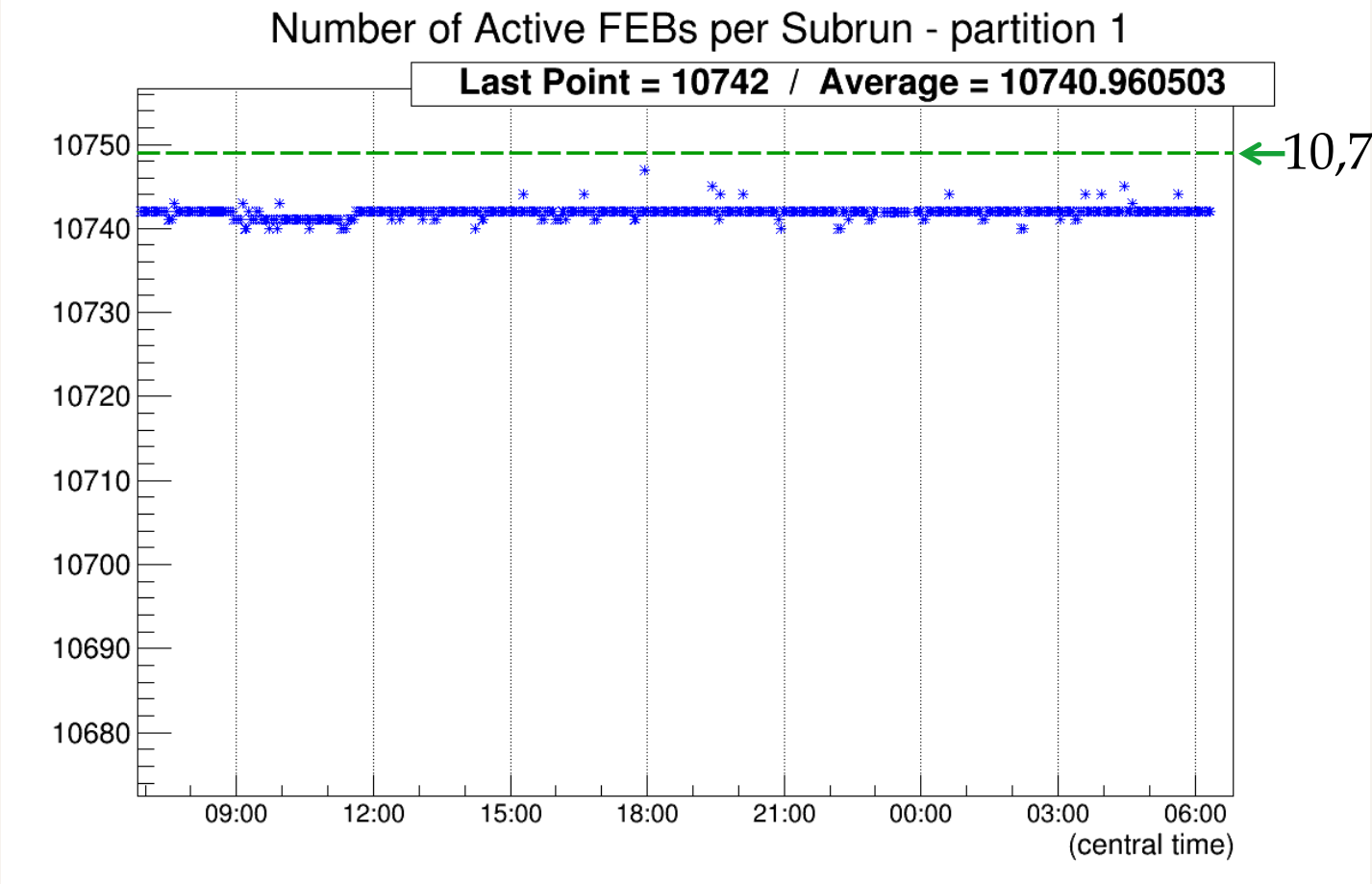


Nearline Plots

We have other plots that are made over a slightly longer timescale. They are placed on our Nearline website, and update every 10 minutes for the Far Detector, and every hour for the Near Detector.

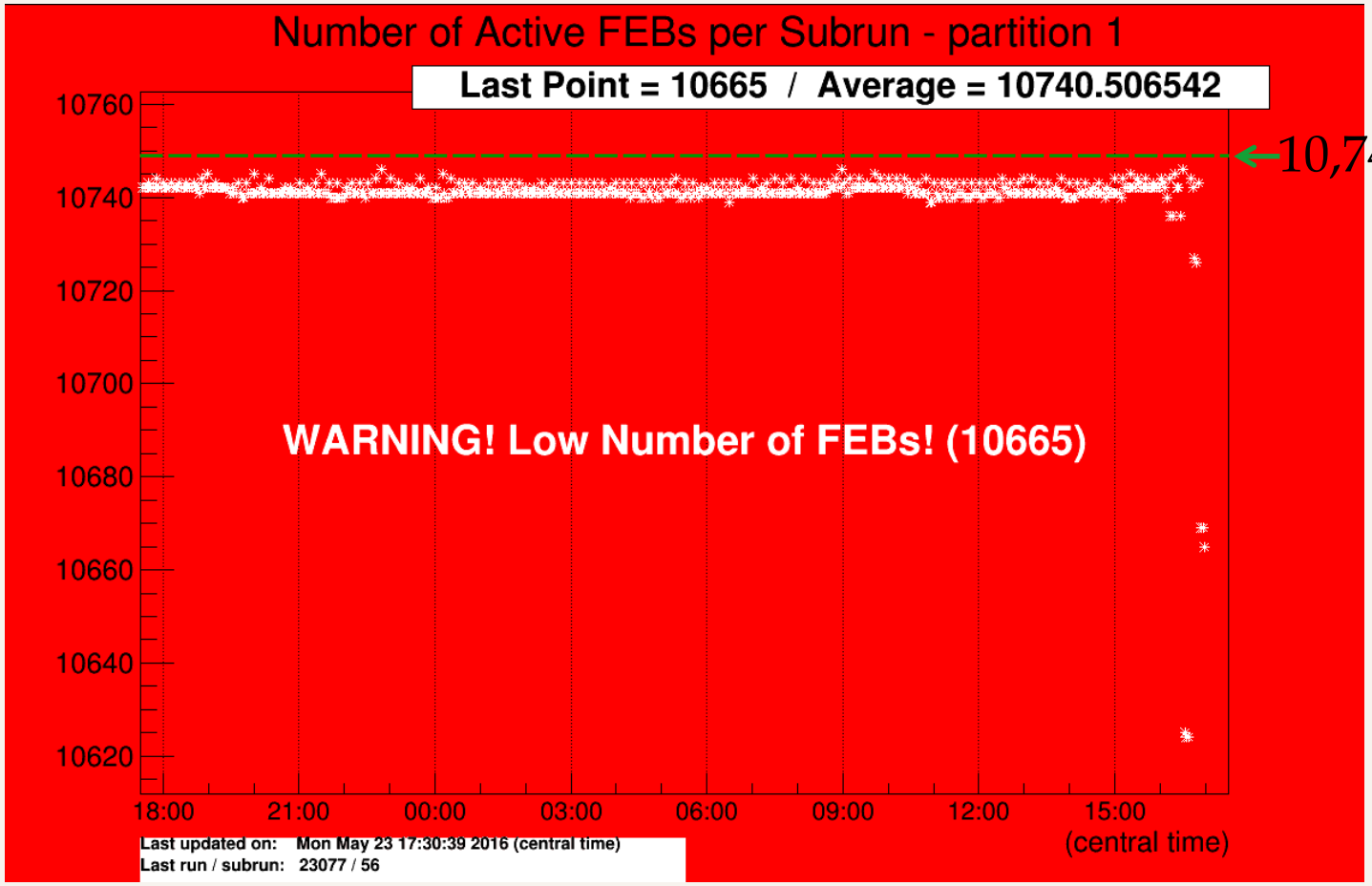


Nearline Plots



This plot shows how much of the detector is active at a given time. If too much is inactive, the plot will turn red.

Nearline Plots



←10,749 in total

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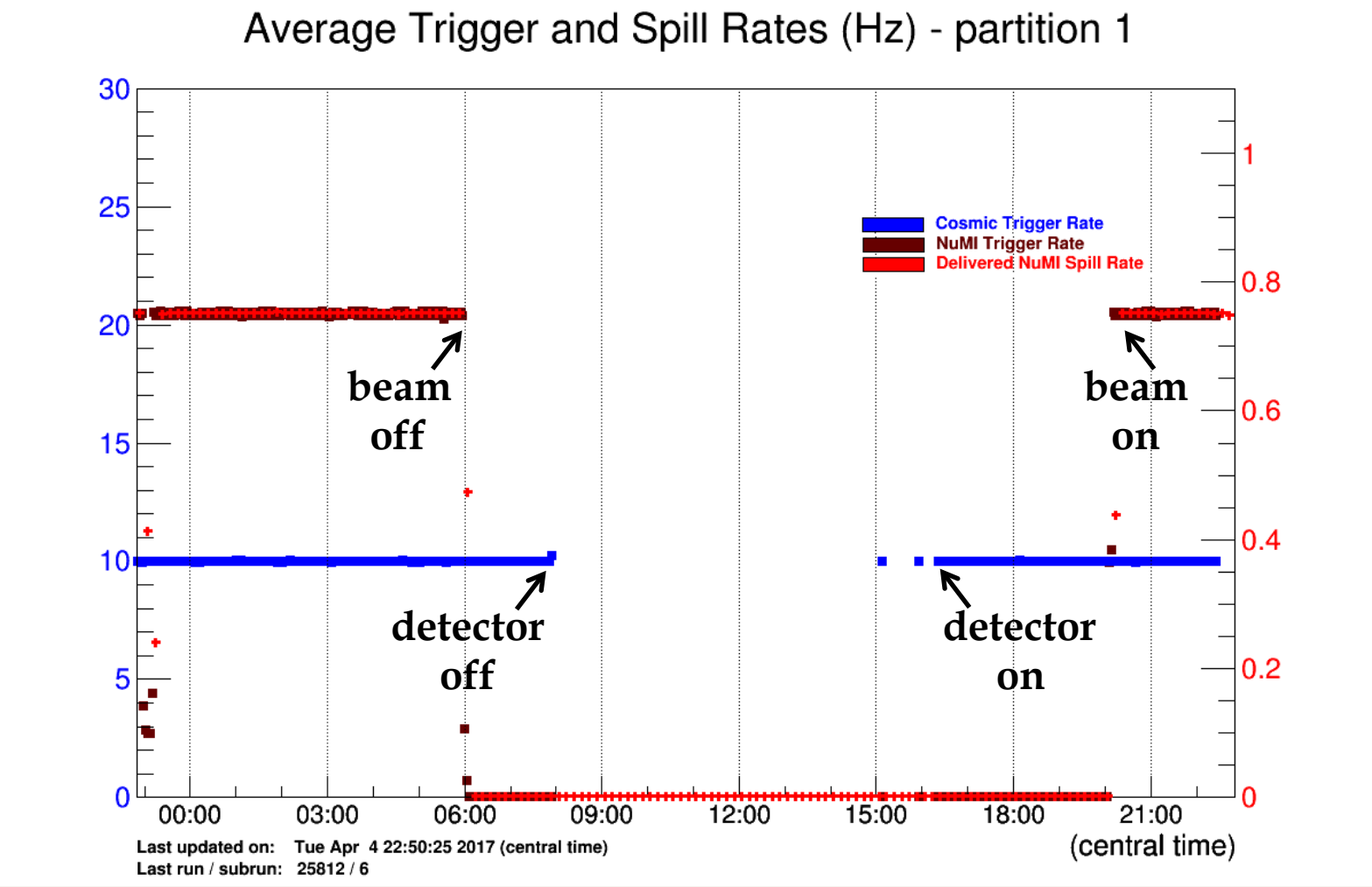
Maximizing beam data



We wait for beam downtimes to bring our detectors down for maintenance or software tests.

Hardware Watchlist

DB-DCM-FEB	BLK-PL-MOD-V	issue rate (score)	noisy rate	quiet rate	non-rep rate	lowADC rate	highADC rate	issue pixels	dropout rate	drops per subrun
06-10-26	11-20-05-02	100	100	0	0	100	0	32	0	0
02-06-46	02-29-11-01	100	11	2	86	6	11	32	5	0
08-10-27	15-22-05-02	79	0	0	73	5	0	32	1	0
08-07-22	15-12-11-02	74	0	2	71	0	0	32	5	0
13-03-18	25-05-04-01	33	1	0	0	33	0	32	0	0

The watchlist keeps track of various signs that hardware is failing. Once the issue rate becomes high enough (100 is the maximum) the component is placed on a maintenance list.

GoodRuns – Far Detector

We have algorithms that run on our data files to determine if data is 'good' based on a variety of metrics.

Good

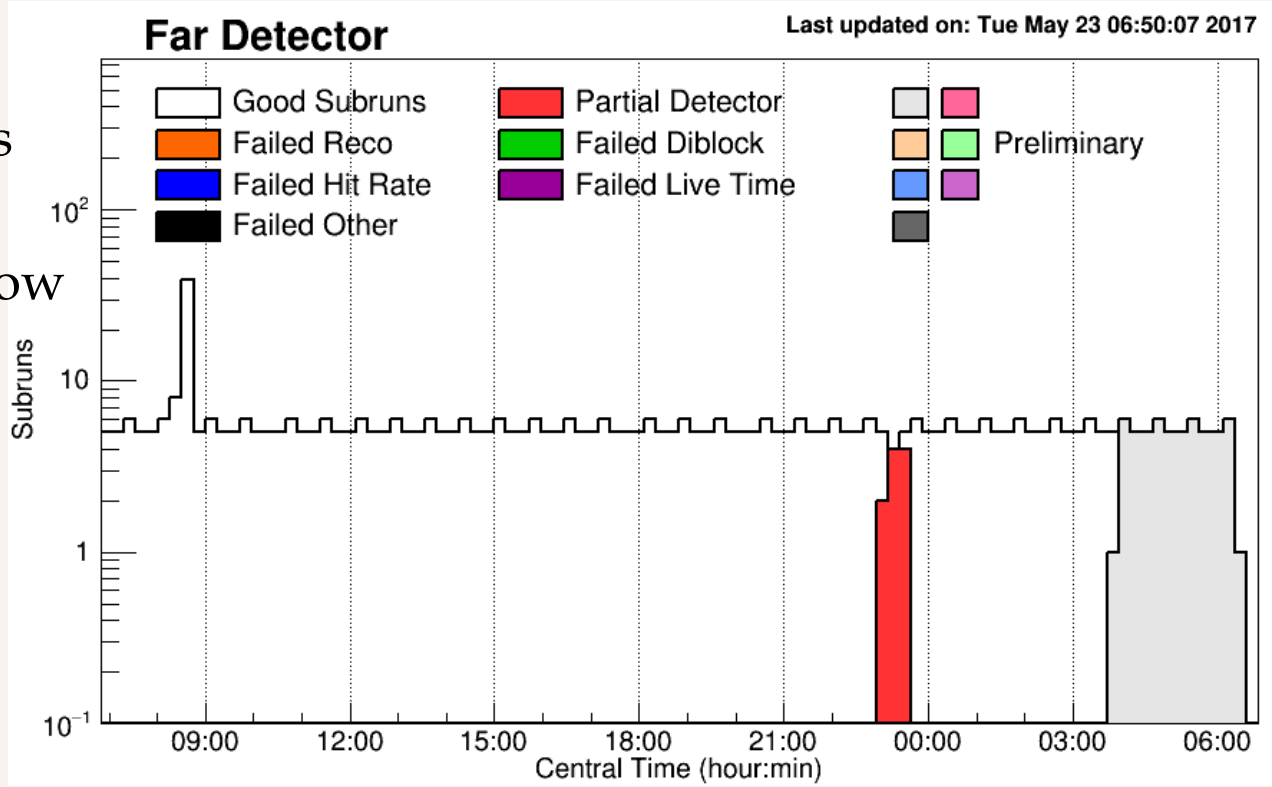
Too many or too few tracks

Median hit rate too high/low

Part of detector missing or has too high/low hit rate

Fewer than 1,000 triggers in run

No activity or incorrect timestamps



Summary of monitoring tools:

- Event Displays
- Online Monitoring plots of raw data in the control room
- Nearline Webpage with reconstruction variables plotted
- GoodRuns plots for determining quality of data
- Hardware watchlist so we know when maintenance is needed

Thank you.