QA Monitor Readiness for Pass1 of RGA Outbending Data

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First Experiment Meeting
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QA Monitoring Timelines

Timelines Link
https://clas12mon.jlab.org/rga/pass1/qa/tlsummary/

subsystem (dataset)	variables	link
INBENDING1	• beam_spin_asymmetry • defined_helicity_fraction • electron_FT_yield_normalized_values • electron_trigger_yield_normalized_values • faraday_cup_charge • live_time • pim_kinematics_means • pim_kinematics_stddevs • pip_kinematics_means • pip_kinematics_stddevs • q2_W_x_y_means • q2_W_x_y_stddevs • relative_luminosity	timelines
INBENDING1_QA	• SectorLoss • Any_Defect • TerminalOutlier • LiveTimeGT1 • MarginalOutlier • TotalOutlier • Misc	timelines
INBENDING1_SUPPLEMENTAL	• electron_FT_yield_QA_Automatic_Result • electron_trigger_yield_QA_Automatic_Result • electron_FT_yield_QA_epoch_view • electron_FT_yield_stddev • electron_FT_yield_values • electron_trigger_yield_QA_epoch_view • electron_trigger_yield_stddev • electron_trigger_yield_values • faraday_cup_stddev • helicity_sinPhi	timelines

Monitoring timelines
- these are used to perform QA

QA timelines
- lists files with “defect bits”
- this is the QA result

Supplemental timelines
- extra / expert QA timelines

QA Monitoring Timelines

Timelines Link
https://clas12mon.jlab.org/rga/pass1/qa/tlsummary/

Listed data sets:

- Inbending1: runs 5032 – 5262
- Inbending2: runs 5300 – 5419

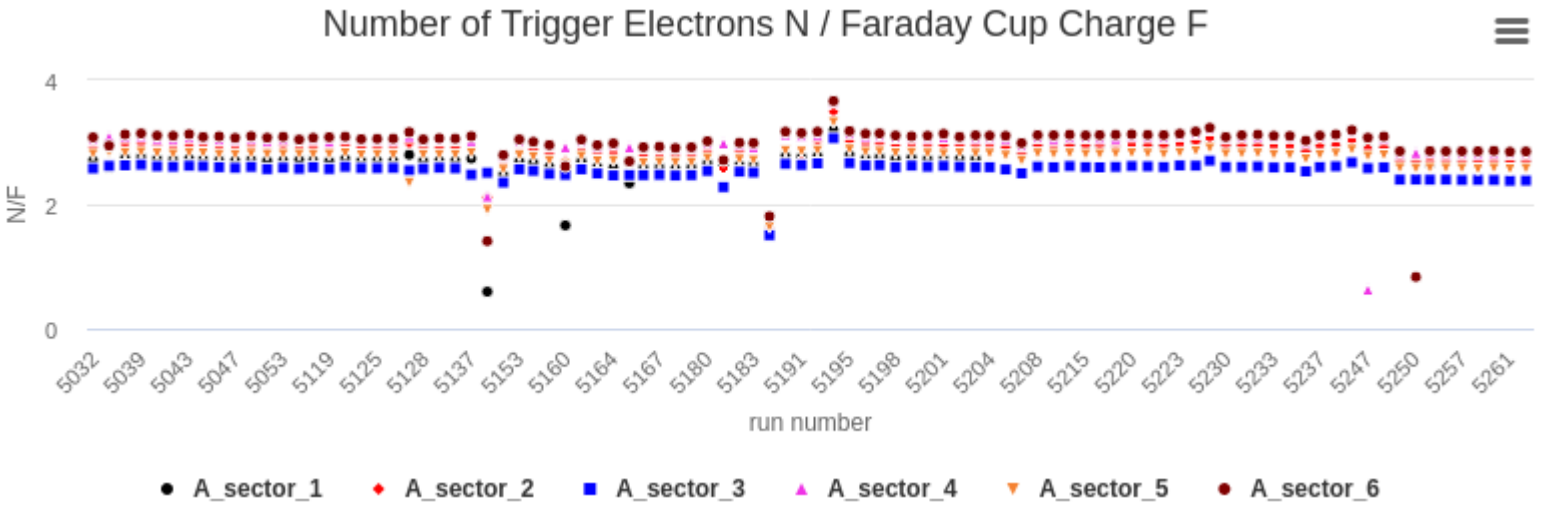
} to be merged into one set “inbending”

- Outbending data: need DST files before QA can start

To showcase the features of the QA monitor, these slides will focus on the **Inbending1** dataset

The QA is divided into two parts:
– automatic QA: based on electron yield and FCup charge
– manual QA: based on automatic QA result, and inspection of additional timelines

Normalized Electron Trigger Yield



- Number of electron triggers (N) normalized by Faraday Cup charge (F)
- Outliers are automatically identified by IQR method; IQR is calculated in regions of relatively constant N/F called “epochs” (see backup)
- The livetime is also monitored as part of the automatic QA

Defect Bits

- Various criteria are checked, and *defect bits* are assigned to a file if any anomalies are found
- Different analyses have different levels of quality criteria, so the idea is to identify defects, and let the analyzer decide which runs are sufficient for their analysis

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Defect Bit List:
0   TotalOutlier:    outlier N/F, but not terminal, marginal, or sector loss
1   TerminalOutlier: outlier N/F of first or last file of run, not marginal
2   MarginalOutlier: marginal outlier N/F, within one stddev of cut line
3   SectorLoss:      N/F diminished within a sector for several consecutive files
4   LiveTimeGT1:     live time > 1
5   Misc:            miscellaneous defect, documented as comment
```

For bits 0-3, only 1 can be assigned to a file

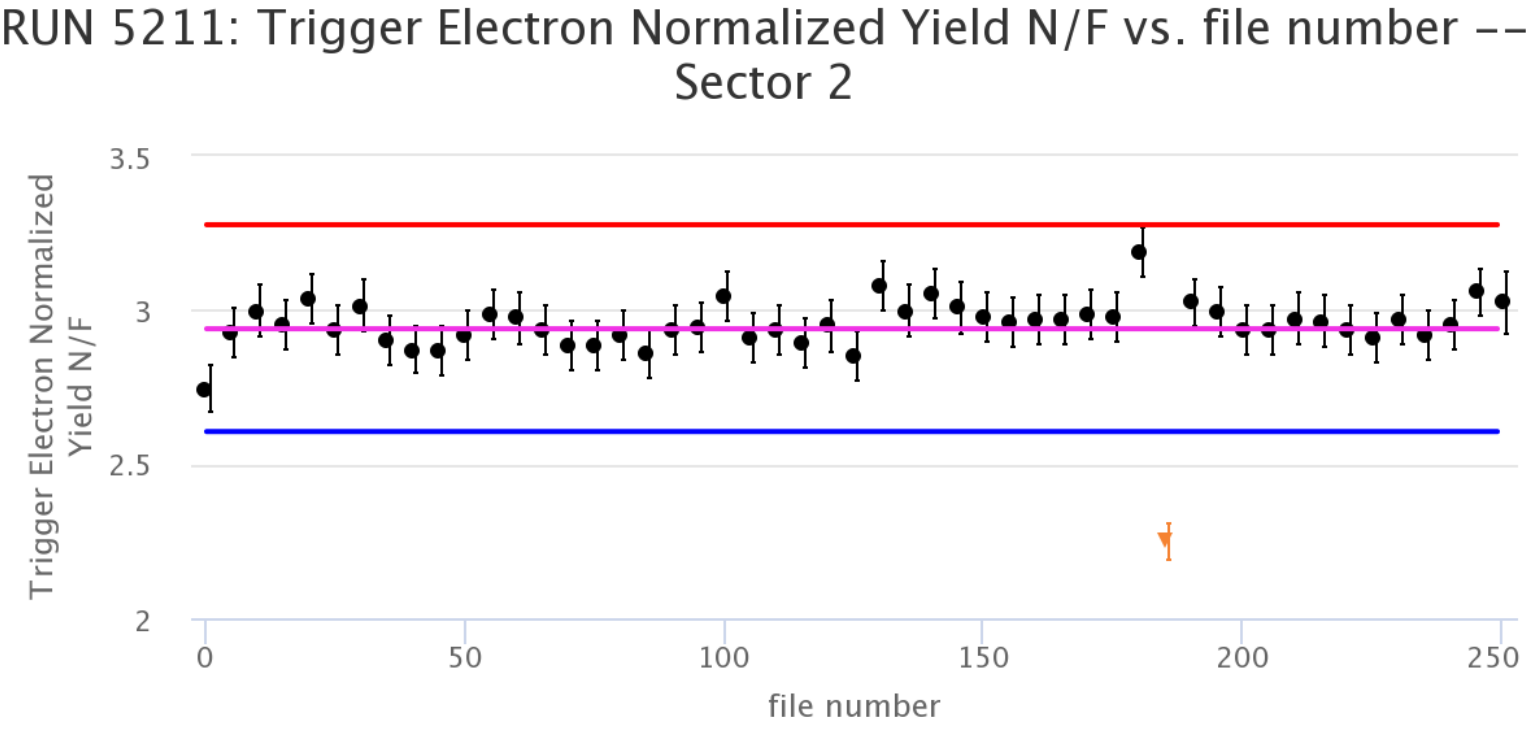
The next few slides show examples of each of these

→ plots of N/F vs. file number, for a particular run and sector

→ files with the defect are drawn as red points

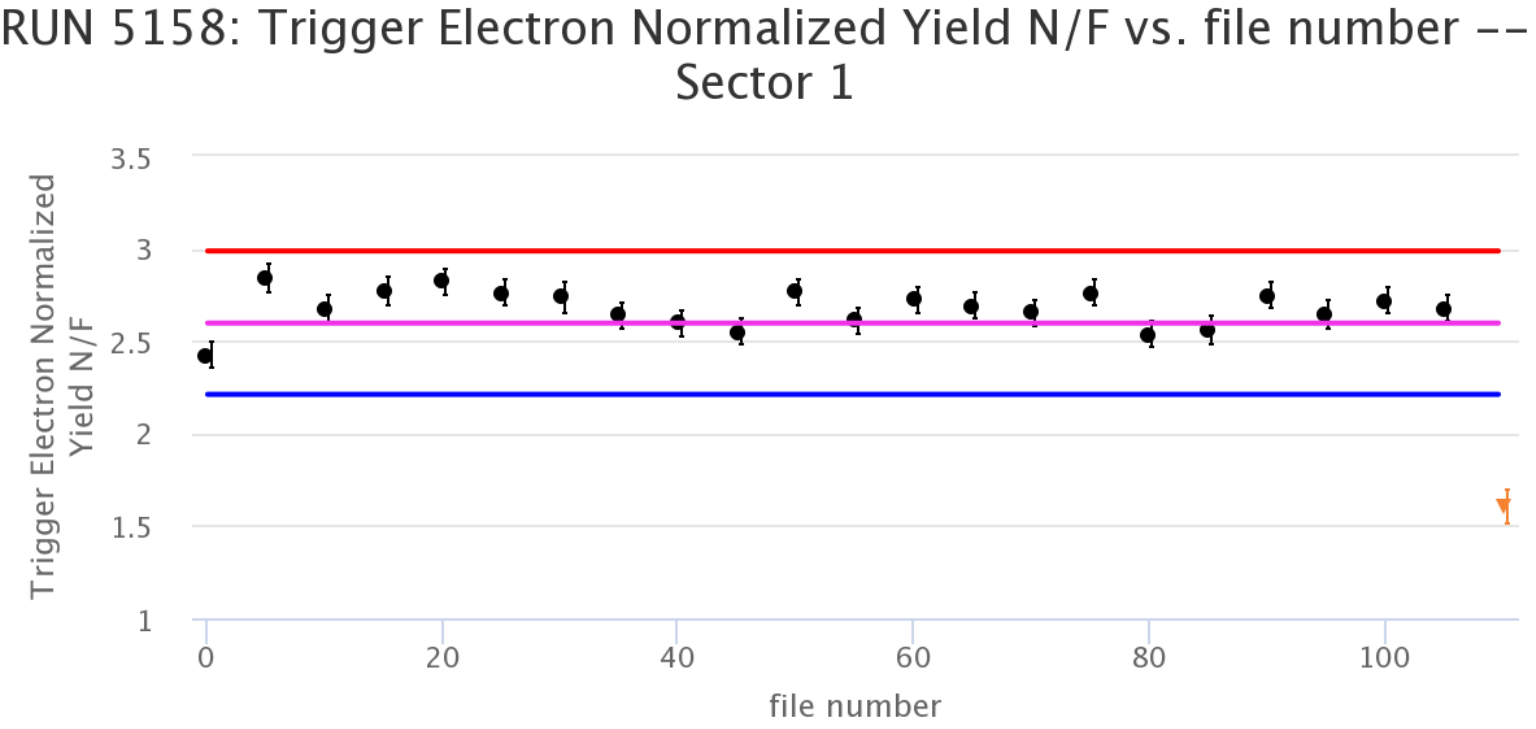
→ cut lines, as well as the epoch's median, are drawn as well

Bit 0: TotalOutlier



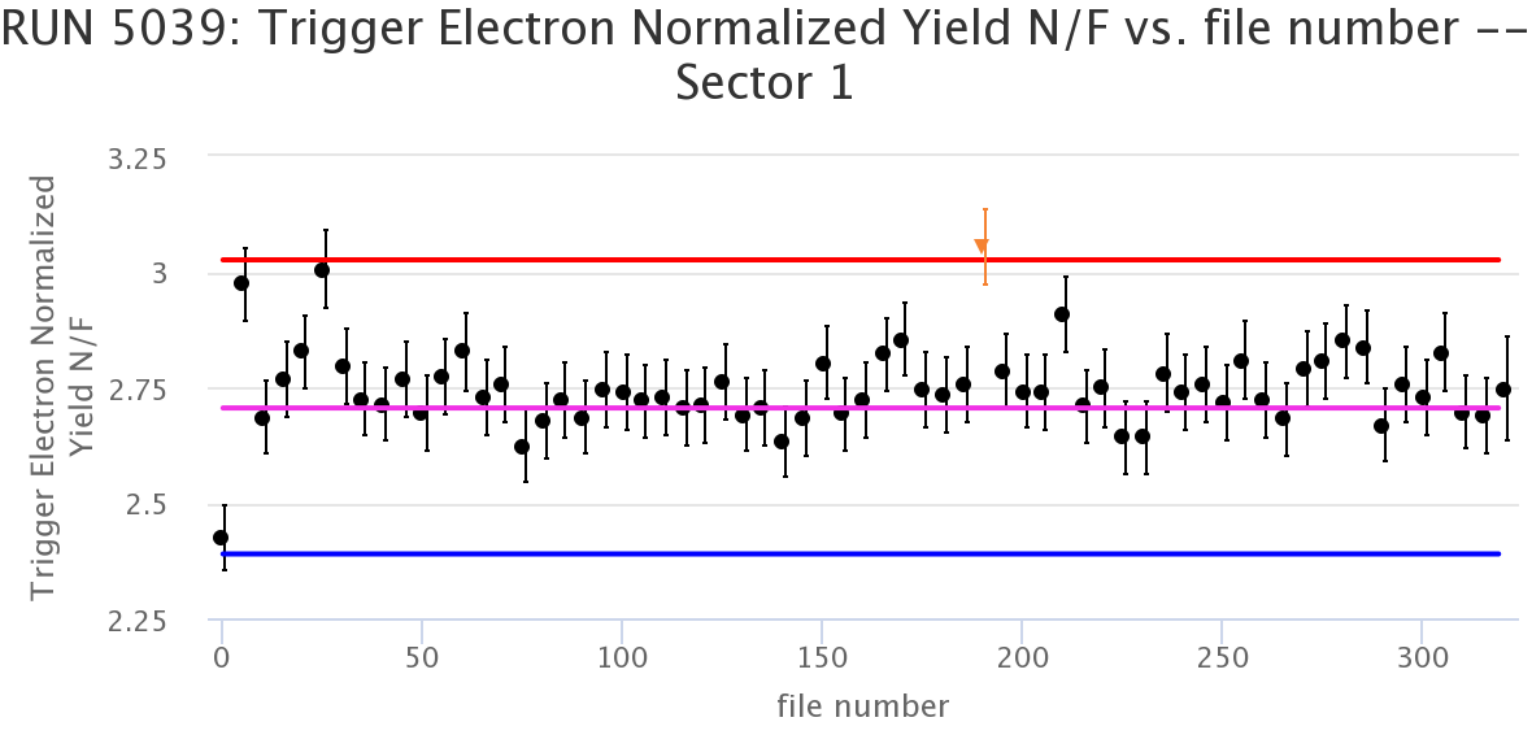
Identified by Automatic QA

Bit 1: TerminalOutlier



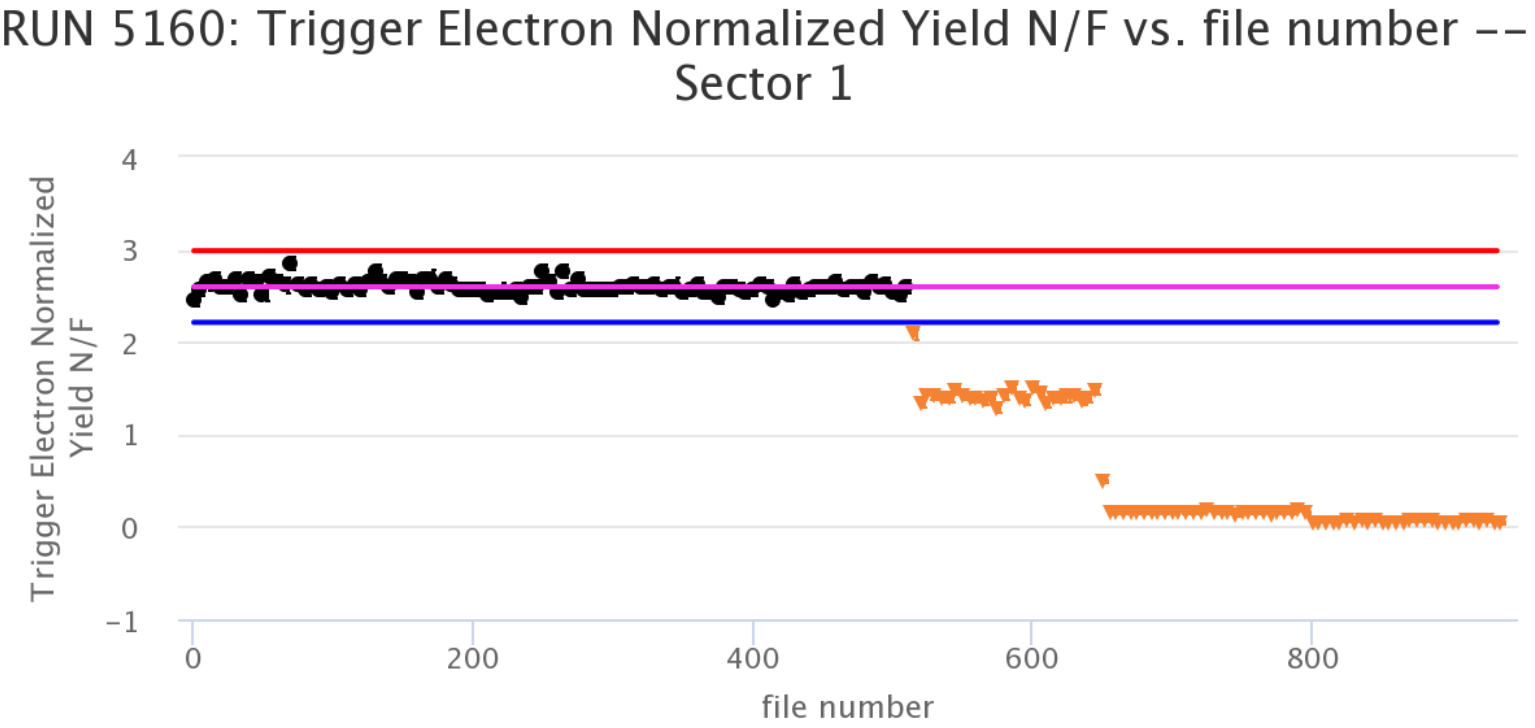
Identified by Automatic QA

Bit 2: MarginalOutlier



Identified by Automatic QA

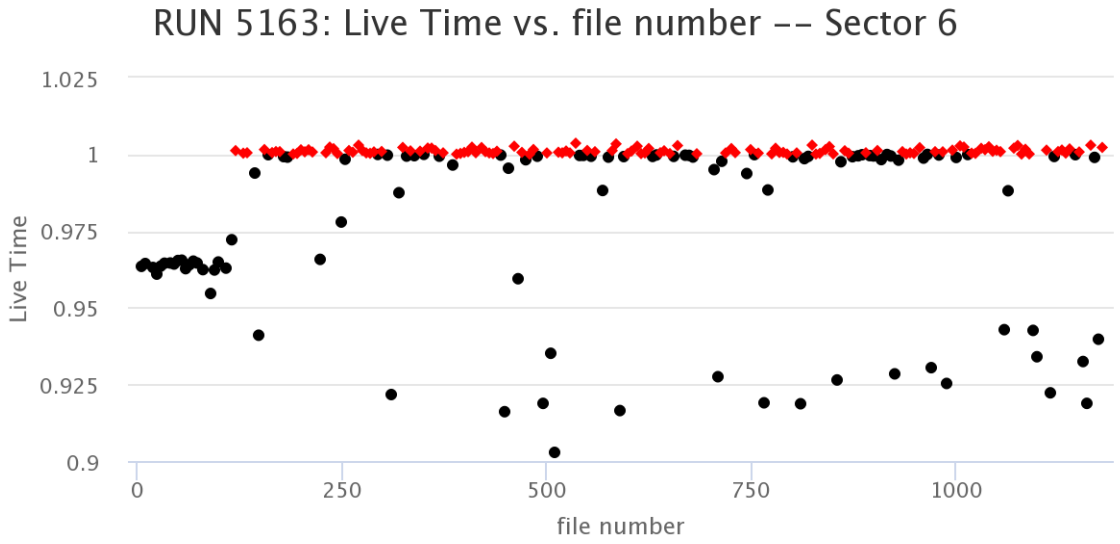
Bit 3: SectorLoss



Identified as Outliers in Automatic QA

Manual QA is used to change the bit to SectorLoss

Bit 4: LiveTimeGT1

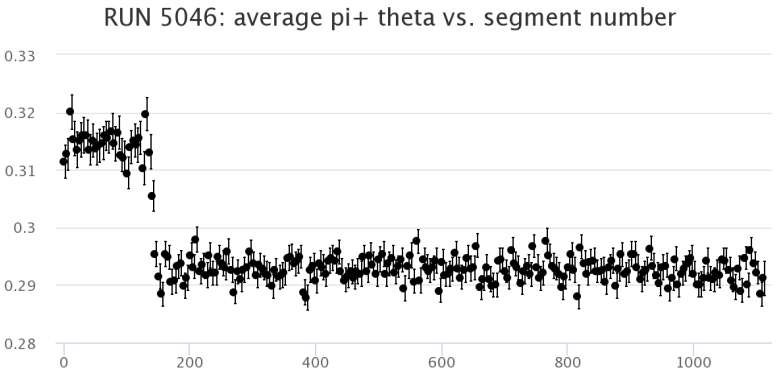


Identified by Automatic QA

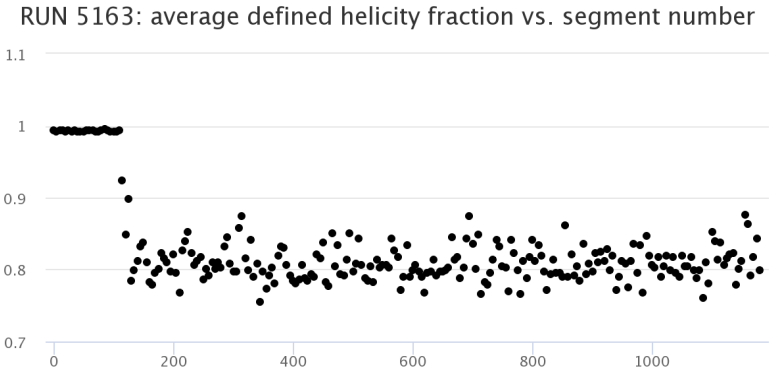
Note: this livetime calculation might not be correct!
– based on ratio of gated to ungated FC charge
– ungated FC charge has some issues in inbending2
– low-lumi runs' livetime is inconsistent
Need to crosscheck with other livetime tables

Bit 5: Misc

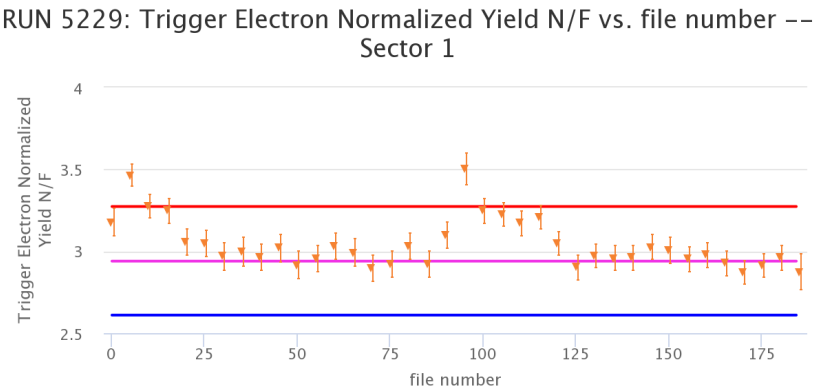
Jump in pion θ



Low fraction of events with defined helicity



Unstable beam



- Plots show some examples
- A comment is stored in the QA database* if this bit is used

* currently just a JSON file

Identified in Manual QA

Overall Quality

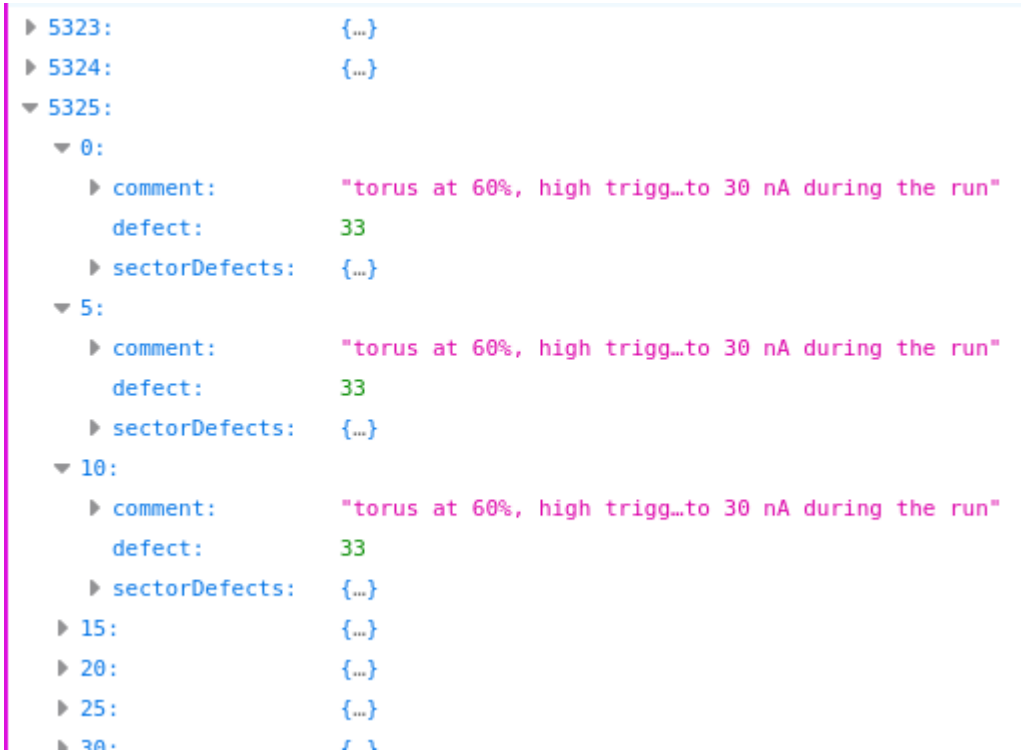
- **Inbending1: runs 5032 – 5262**
  - Files with no defects: **76%**
  - Files with defect = Misc: **23%**
  - Files with livetime>1: **6%**
- **Inbending2: runs 5300 – 5419**
  - Files with no defects: **87%**
  - Files with defect = Misc: **12%**
  - Files with livetime>1: **0.4%**

Caveats:

- Files with defect=Misc are not necessarily “bad”, but this flag should serve as a warning to the analyzer
- The livetime calculation may not be accurate

The QA “Database”

- QA results are currently stored in a JSON file
  - Accessors and modifiers are implemented, but could certainly be improved
  - Access file number via mapping event number to file number
- Software meeting discussion: include defect bit in the trains
  - Does not allow for access to QA comment
  - Not easy to update
- Still under discussion, but JSON file is a start

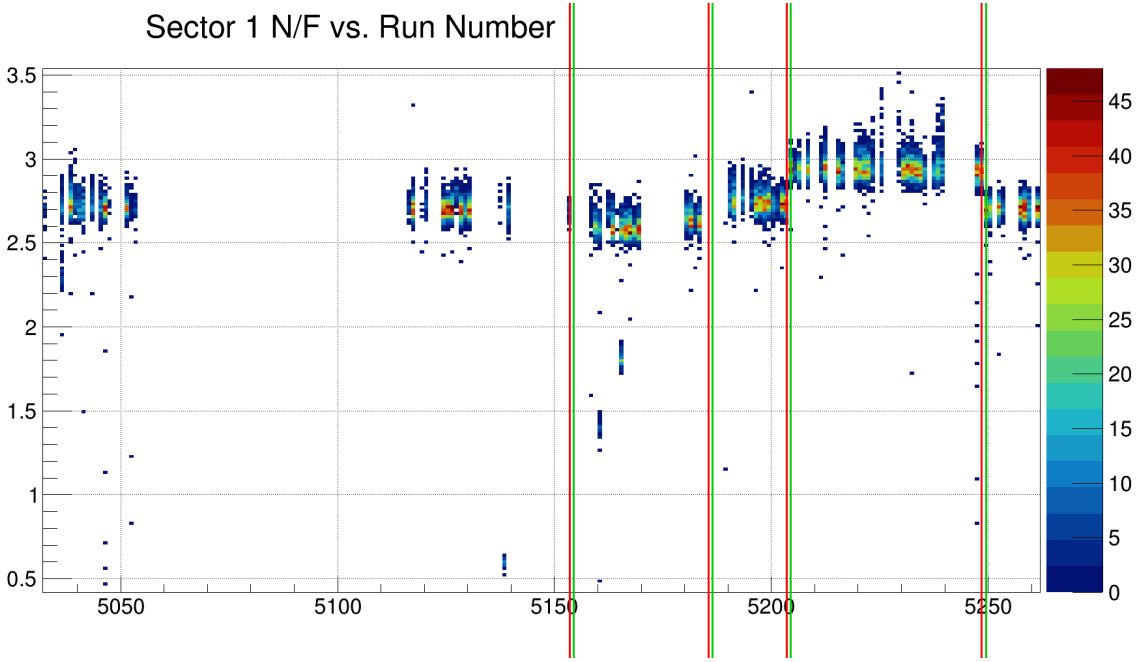


Plans

- Add event number ranges to QA JSON file
- Decide how the QA information can be accessed by all analyzers
- Silvia is applying this software to RGB, and helping spot bugs in the code and in the documentation
- The software is ready to run on outbending data

BACKUP

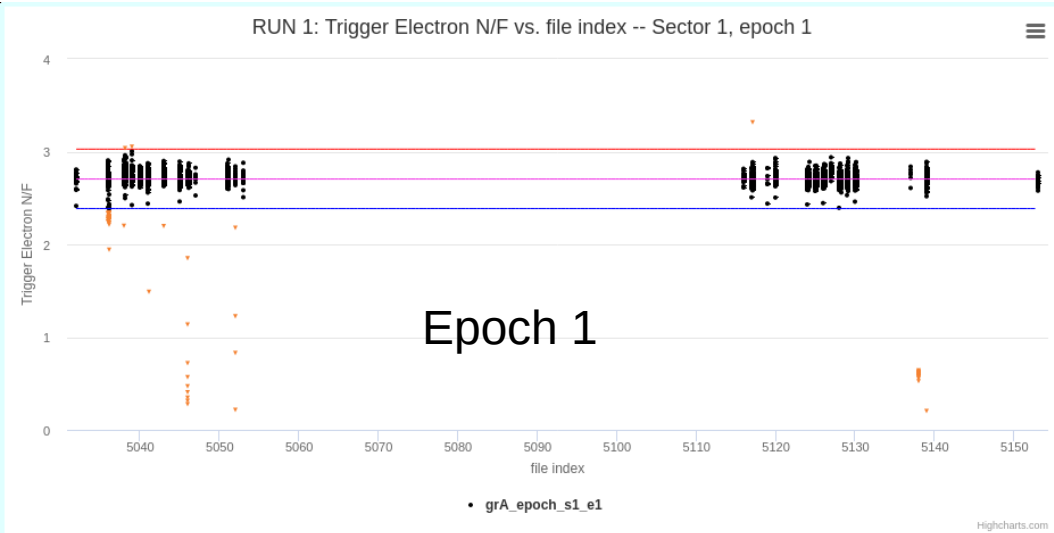
Epoch boundaries

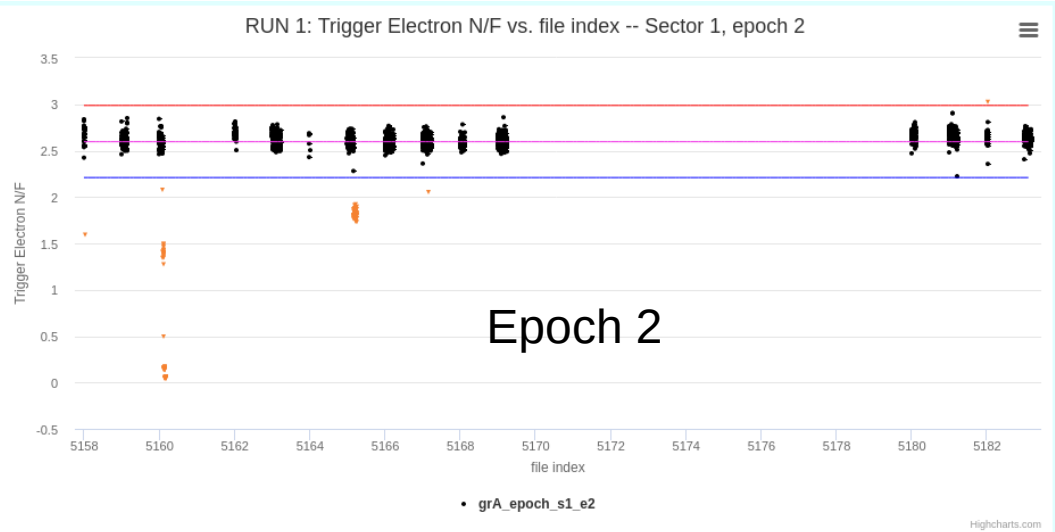


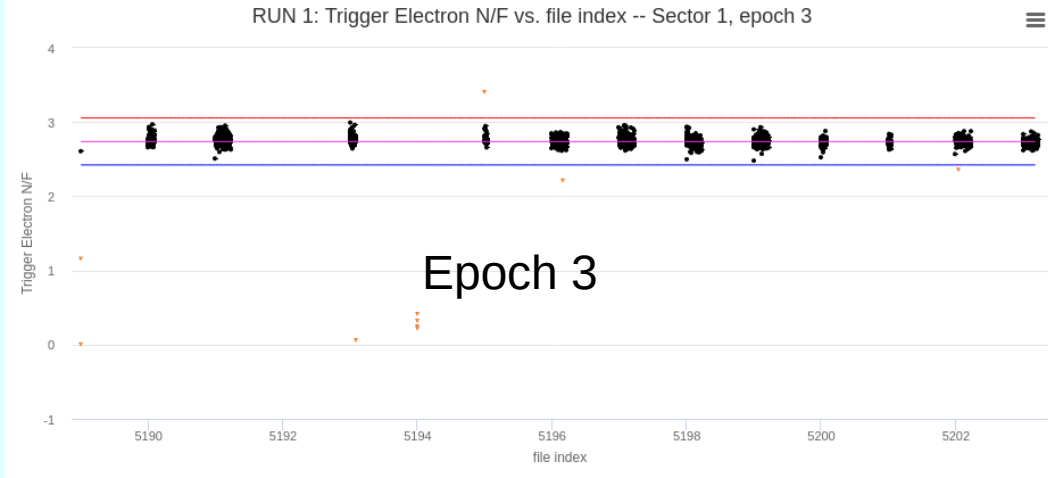
- Plot of Charge-normalized electron trigger yield “N/F” vs. Run Number
- QA cut lines are set with 4*IQR method, determined separately within each epoch
- Vertical lines represent epoch boundaries

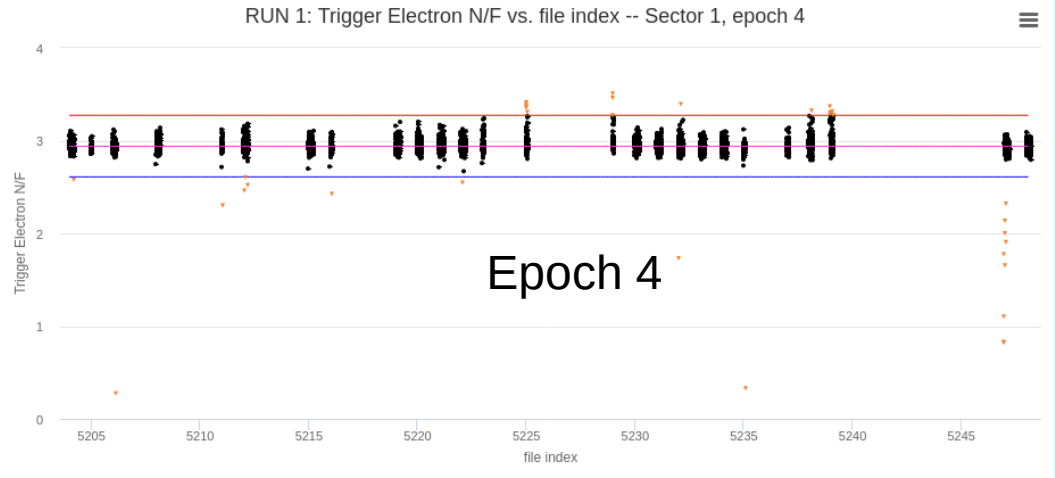
Epoch boundaries

- N/F vs. Run Number, for Sector 1, Epochs 1-4
- These plots are used to tune epoch boundaries and width of cut lines

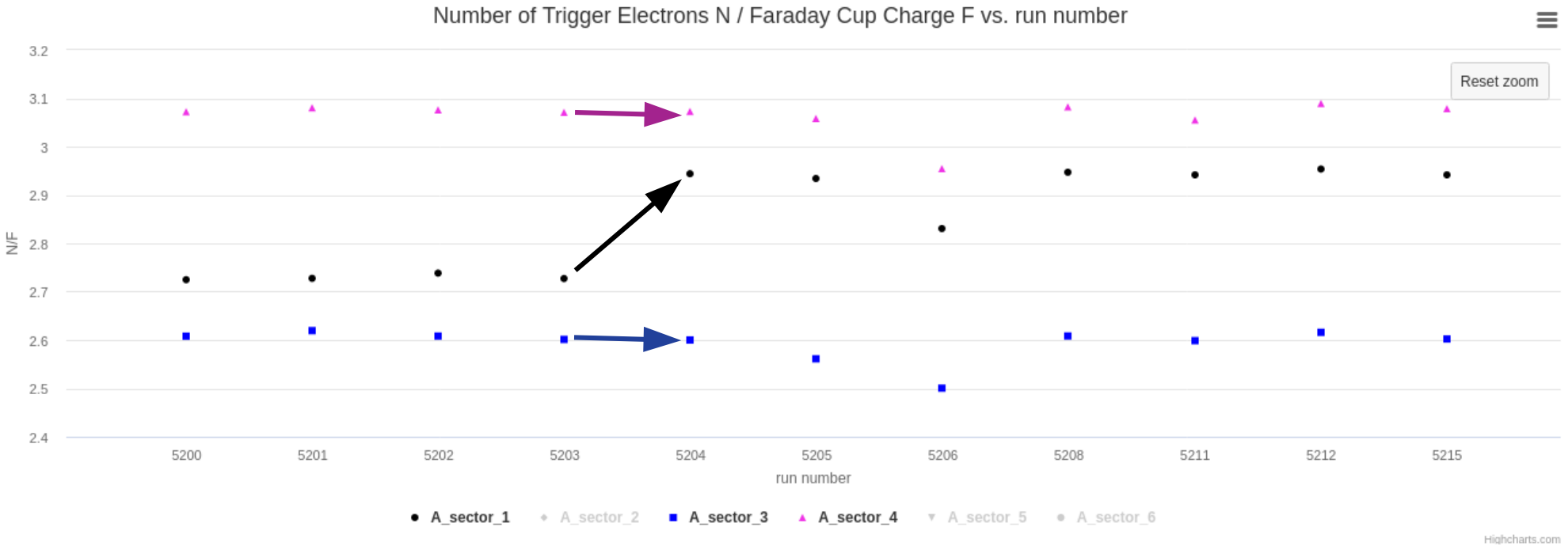








Epoch boundaries



- Sector 1 has a step between runs 5204 and 5205, relative to all other sectors
- An epoch boundary for the QA is drawn here, even though it is only needed for sector 1