Analysis Progress

for the d_2^n analysis meeting

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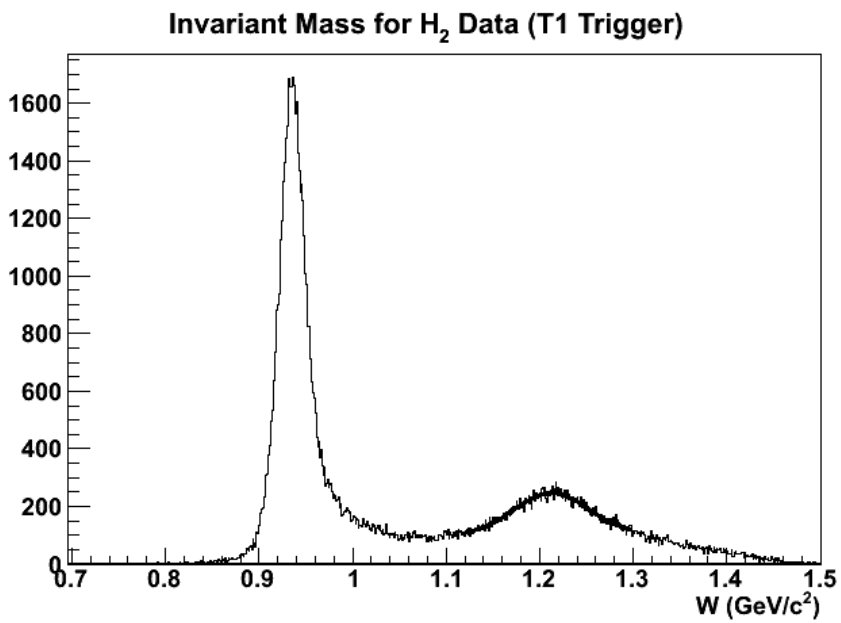
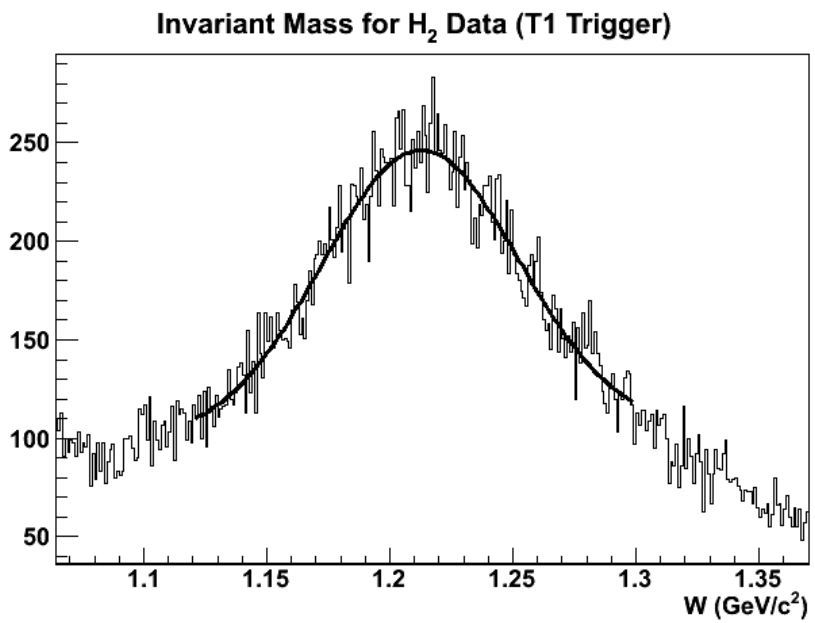
Δ Placement from Monte Carlo

- Gregg's simulation predicts a Δ with these characteristics:
  - Strength about $\times 1.5$ less than proton peak
  - Peak location around 1215 MeV/c^2
- Is the infamous low-momentum correction even necessary? Suppose we remove it from our T1 data...

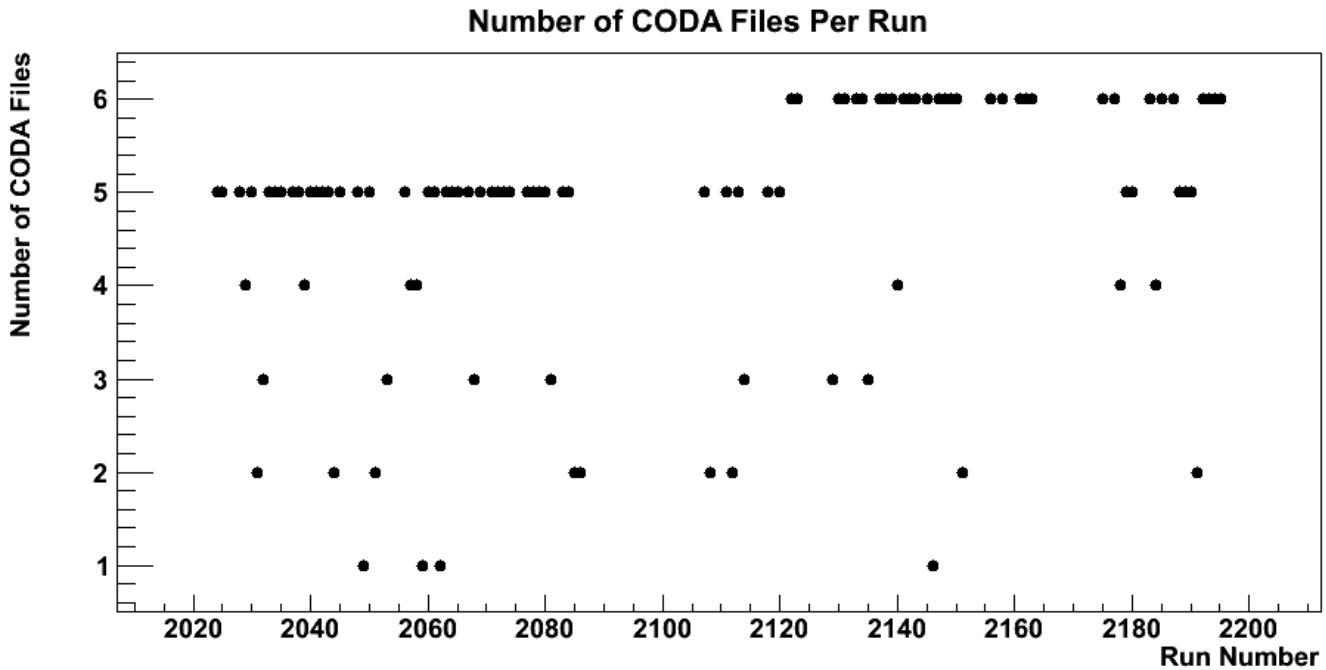




- Relative strength: $\times 2.5$
- Δ peak: 1212 ± 1 MeV/c^2

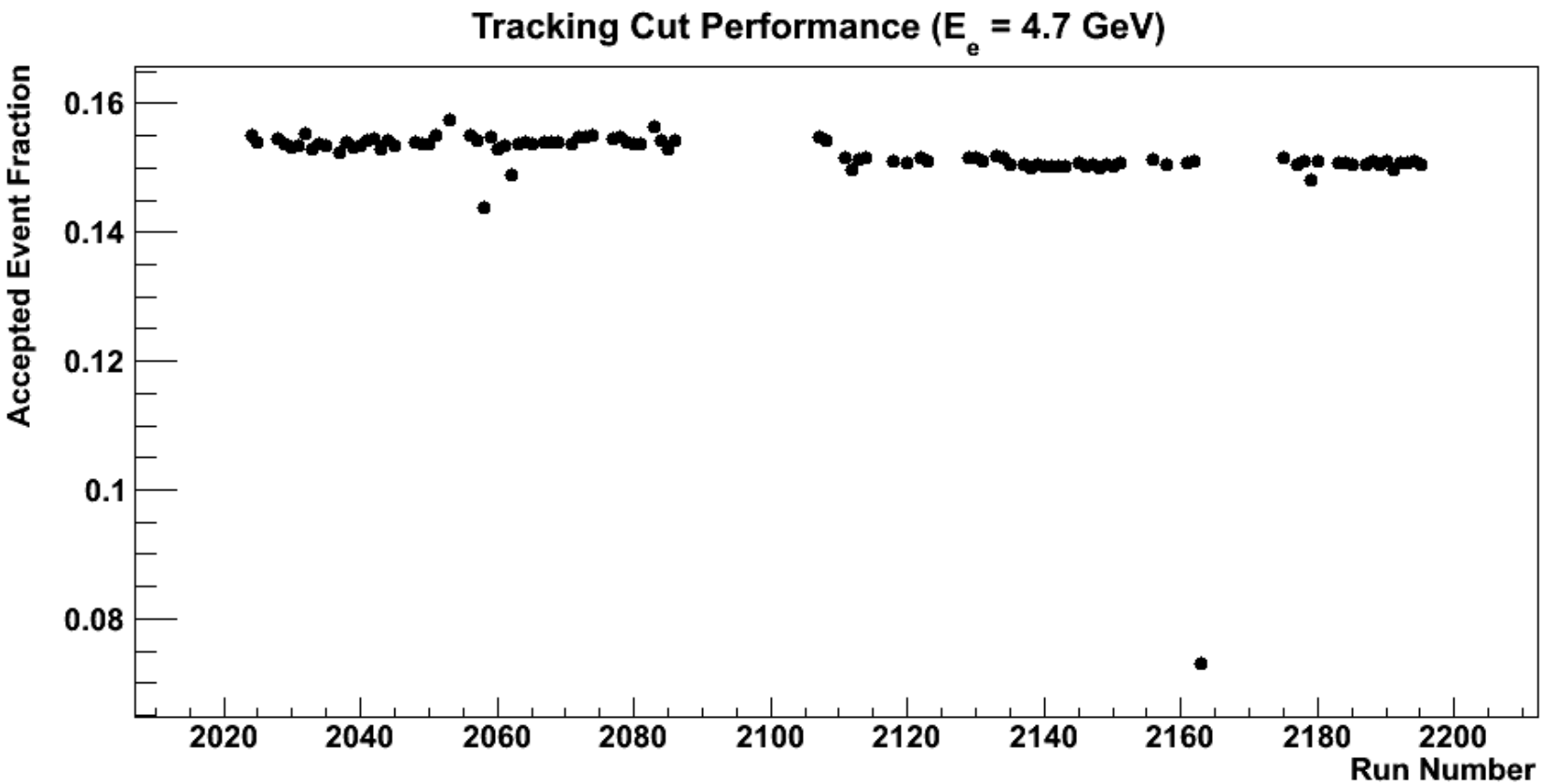
Four-Pass Production BigBite Replay Complete

- 102 runs
- 477 jobs
- 243.55 GB
- You can even see when the number of events per run was increased from 5M to 6.5M:



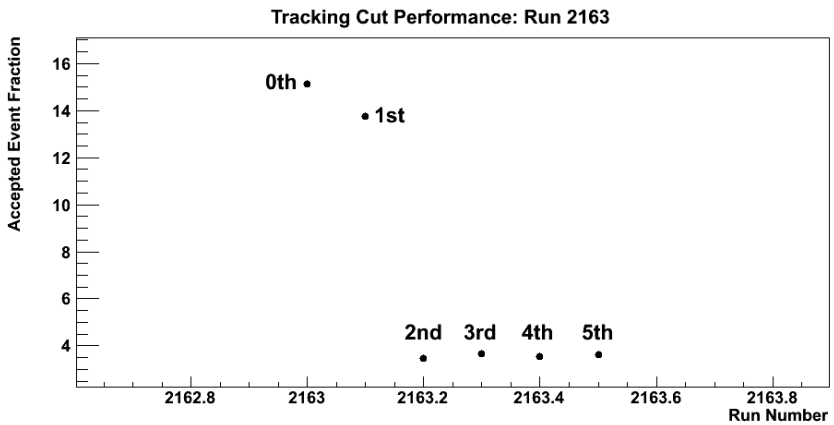
Tracking Cut Performance (i)

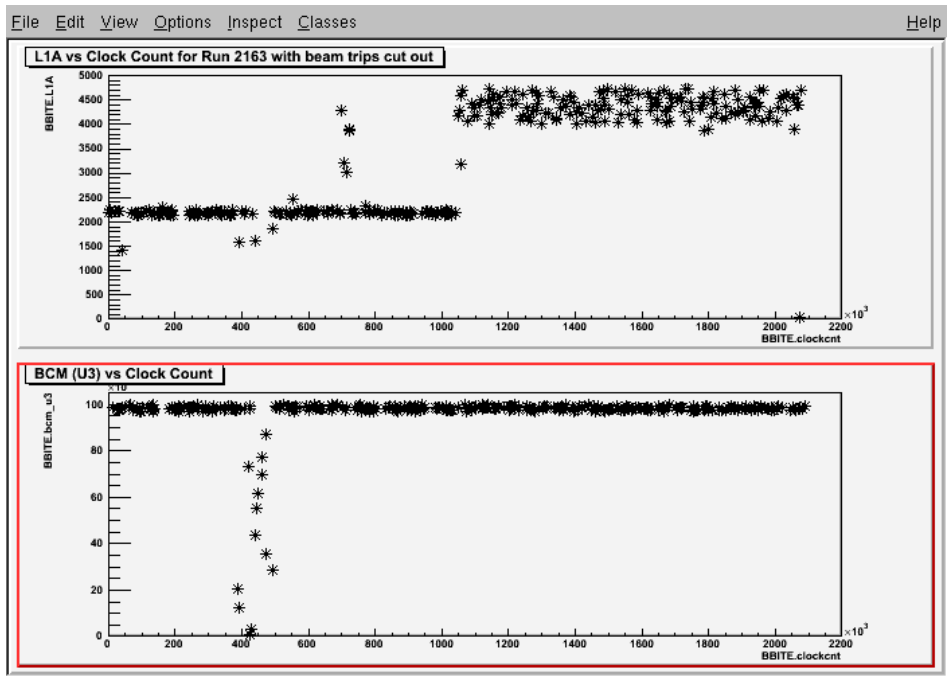
- To conserve space, we only wrote CODA events with `BB.tr.n`> 0
- Does this cut perform consistently across all runs?



Tracking Cut Performance (ii): Run 2163

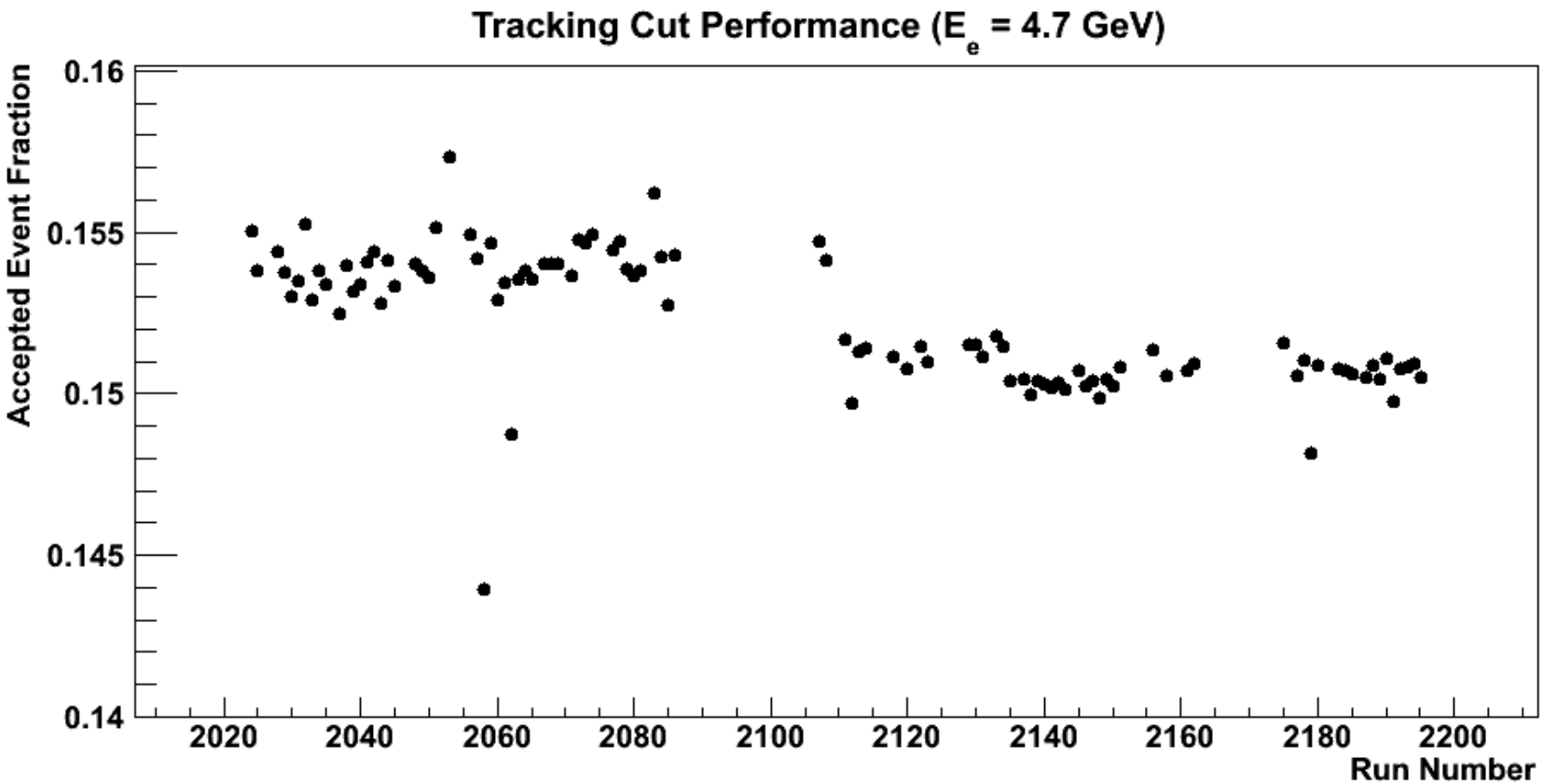
- Run 2163 is the only big outlier
- Problems began only partway through the run (left)
- HALOG entry shows onset of L1A double-pulsing (right)
- Problem was eventually fixed by re-seating T8 cable





Tracking Cut Performance (iii): Zoom

- We see a $\sim 2\%$ drop in accept ratio around Run 2110.
  - Run 2107 was the first production run after the long beam down in which several cryomodules were taken out of commission.
- Remaining outliers are low because of a single data file with a lower percentage of accepted events.

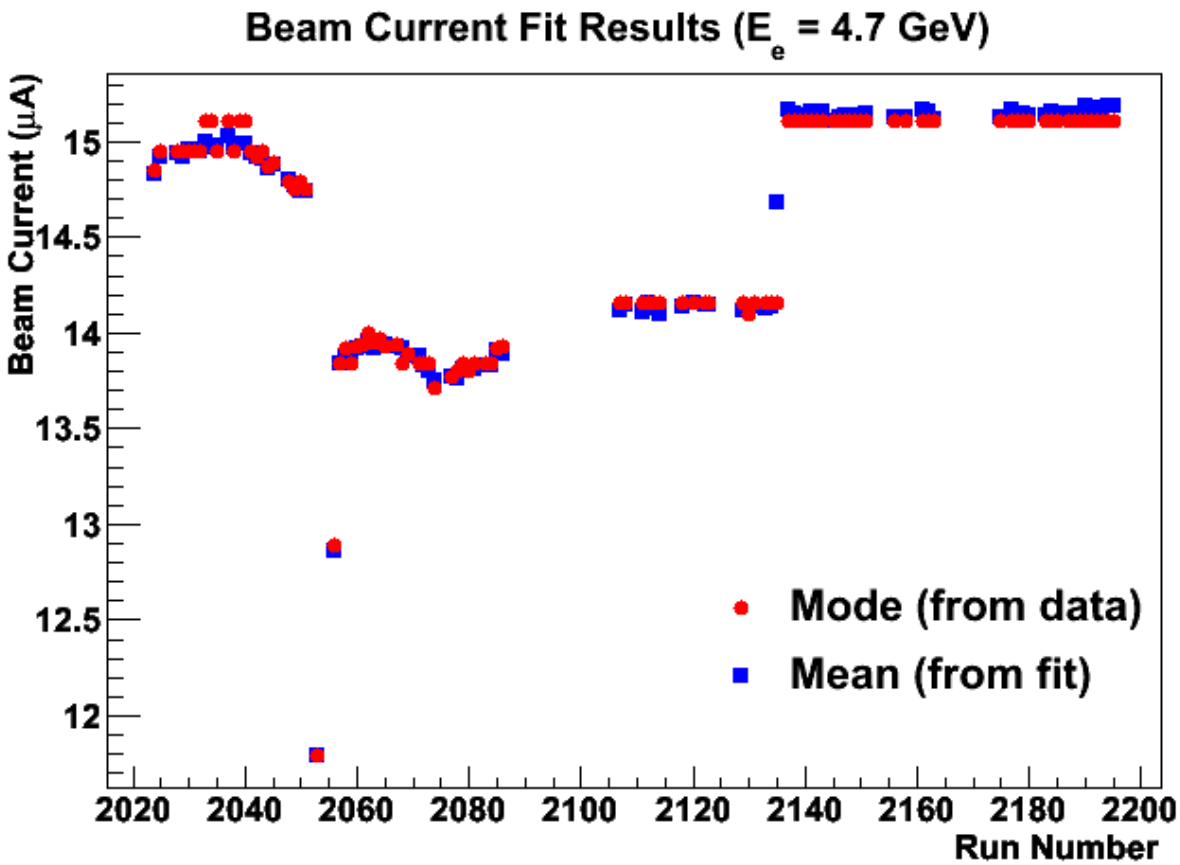


64-Bit Replay

- We'd like to have this available for future rounds of replay
- Brad learned the secret to compiling a 64-bit version of the analyzer on ifarml6
- My test replays on the 64-bit farm aren't working
  1. With 1GB allocated memory, the analyzer worked but ran out of memory
  2. With 2GB allocated memory, the analyzer crashed in 4/5 runs (but successfully completed the 5th)
- This is not a very high priority for me

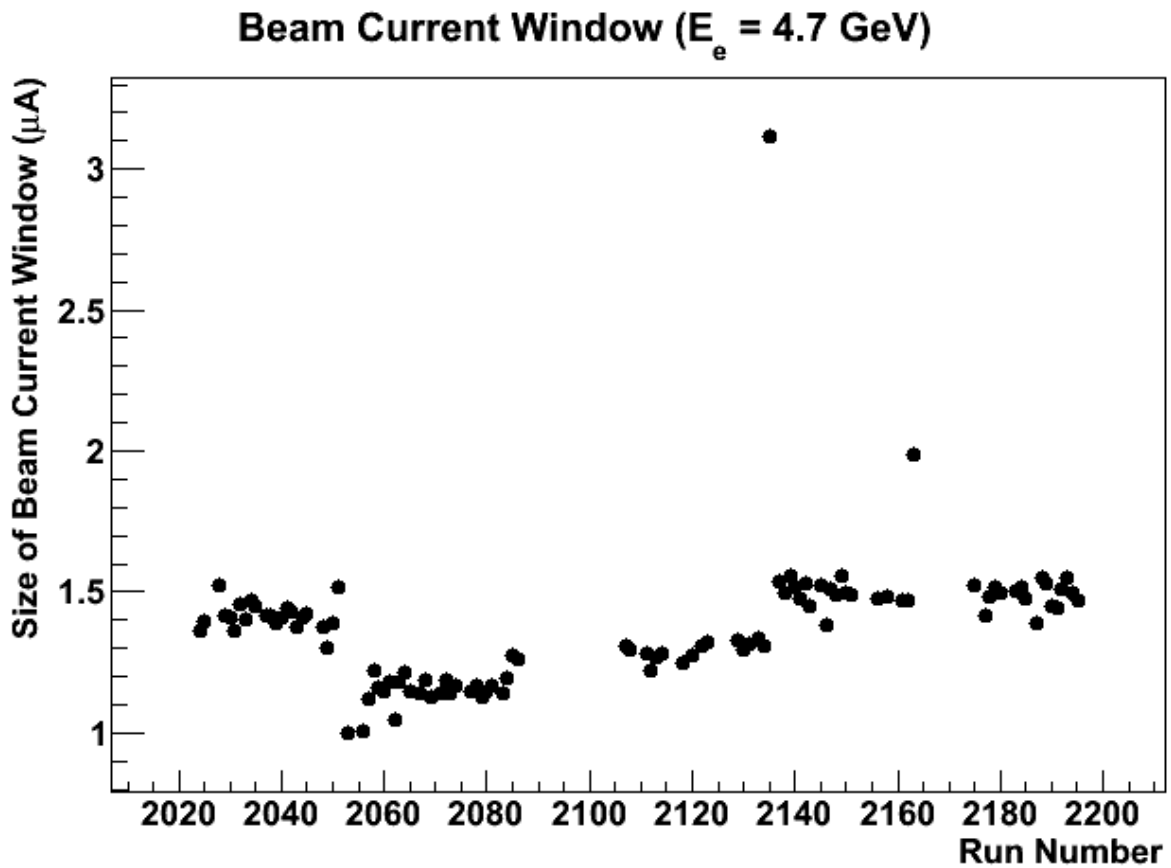
Beam Trips (i): Current Mean and Mode

- I ran beam-trip-finding code on the entire four-pass production dataset
- To check fit quality, I plotted results as a function of run number
- First up: mode (from data) and mean (from fit) of current distributions



Beam Trips (ii): Threshold Distance from Mean

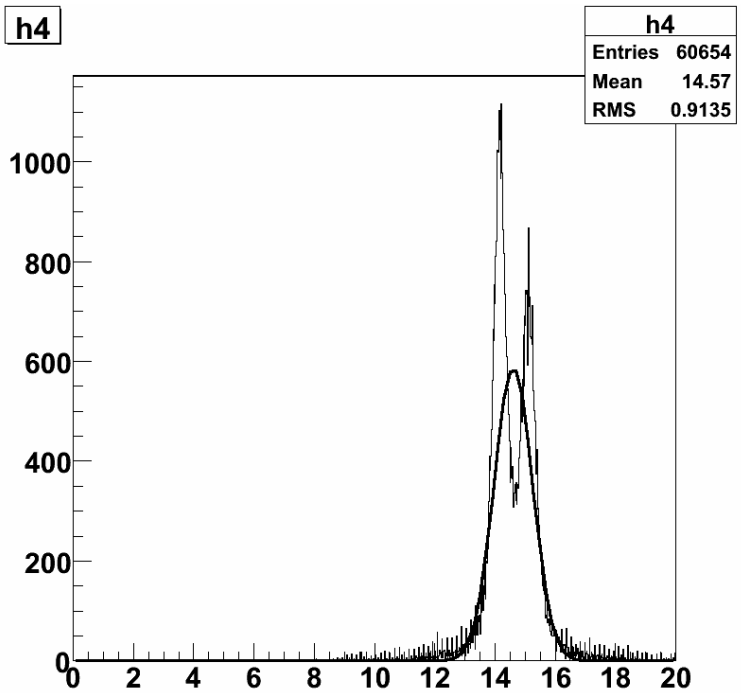
- The beam trip fit defines a window around the mean. Anything within the window is accepted.
- We measure window size by determining the distance of the threshold from the mean.



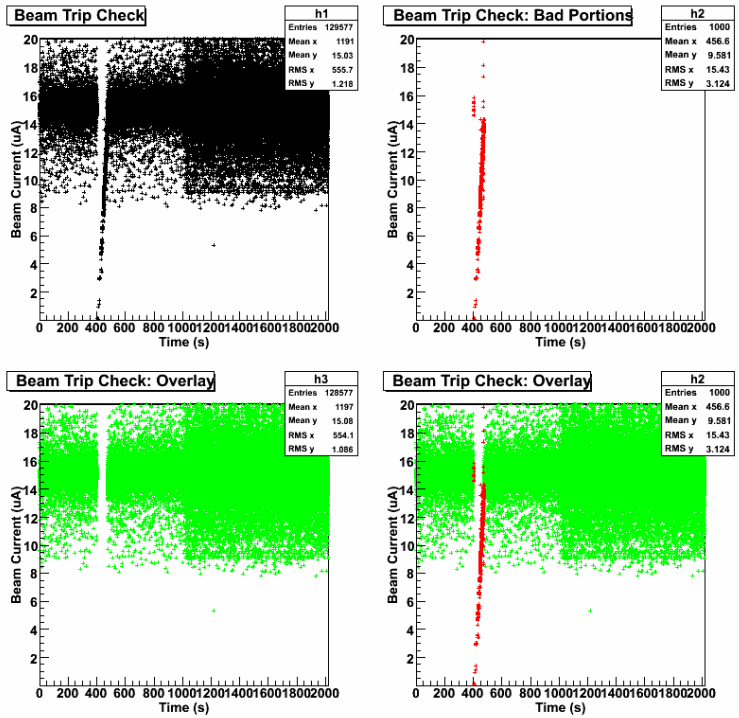
Beam Trips (iii): Outliers

- Two runs have significantly different window sizes from their neighbors
- Run 2135: Current setpoint changed midway through
- Run 2163: L1A double-pulsing problem

Run 2135



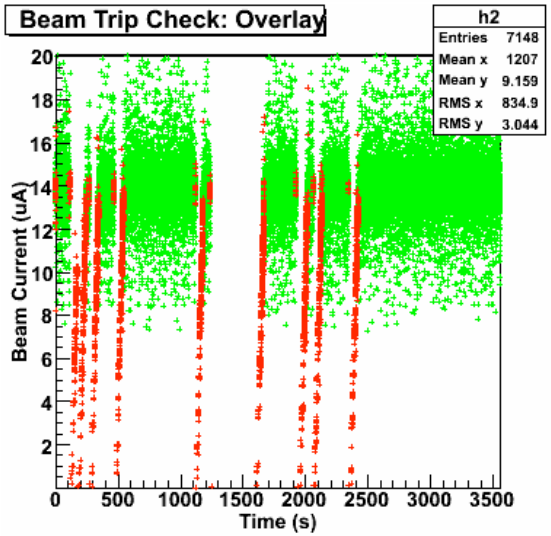
Run 2163

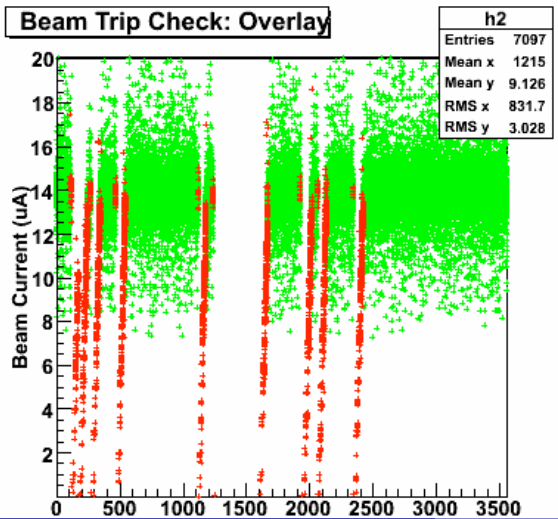


Beam Trips (iv): Glitches

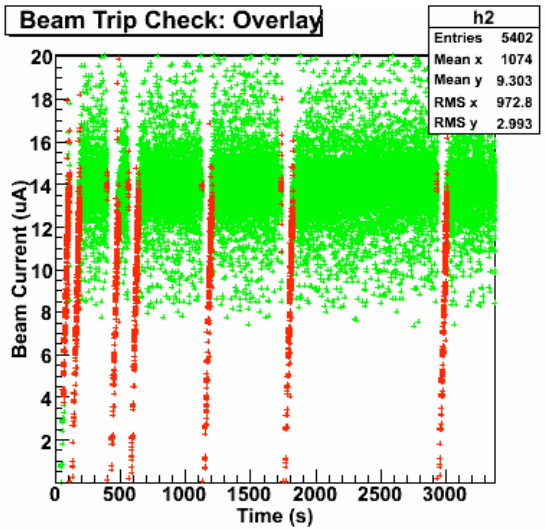
- I made corrections to the automatic cuts in about 70% of runs

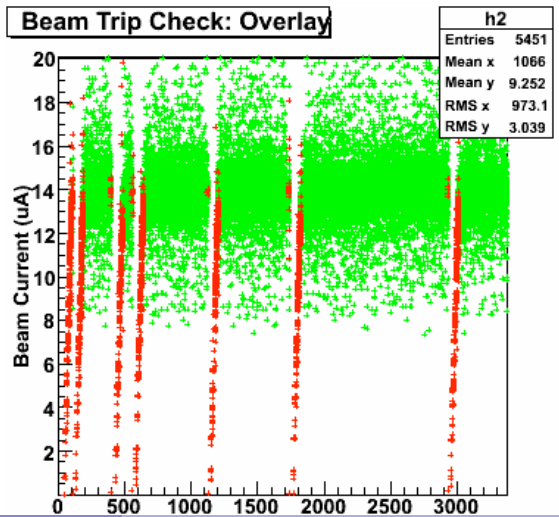
False Positives





False Negatives





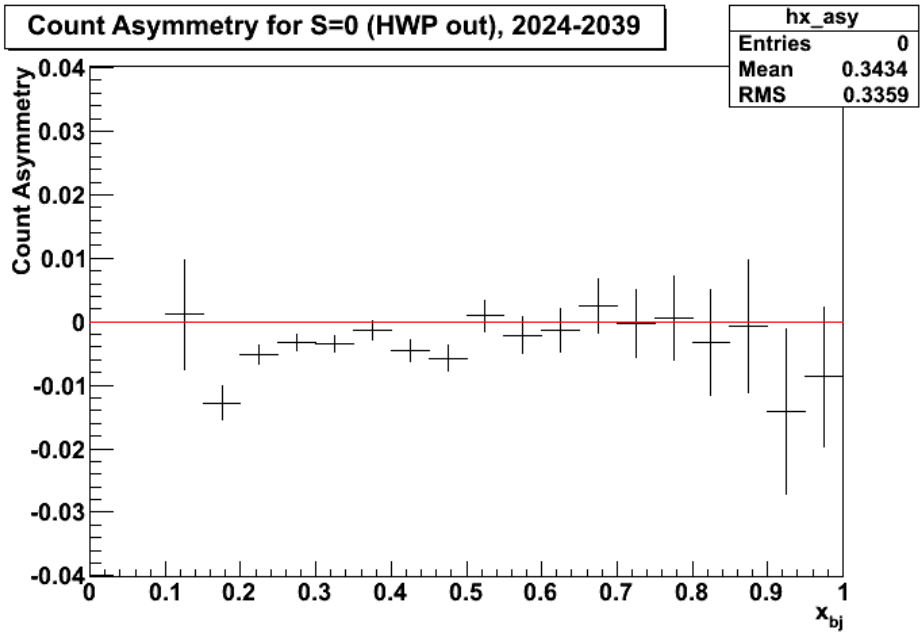
Kinematic Variables in BigBite

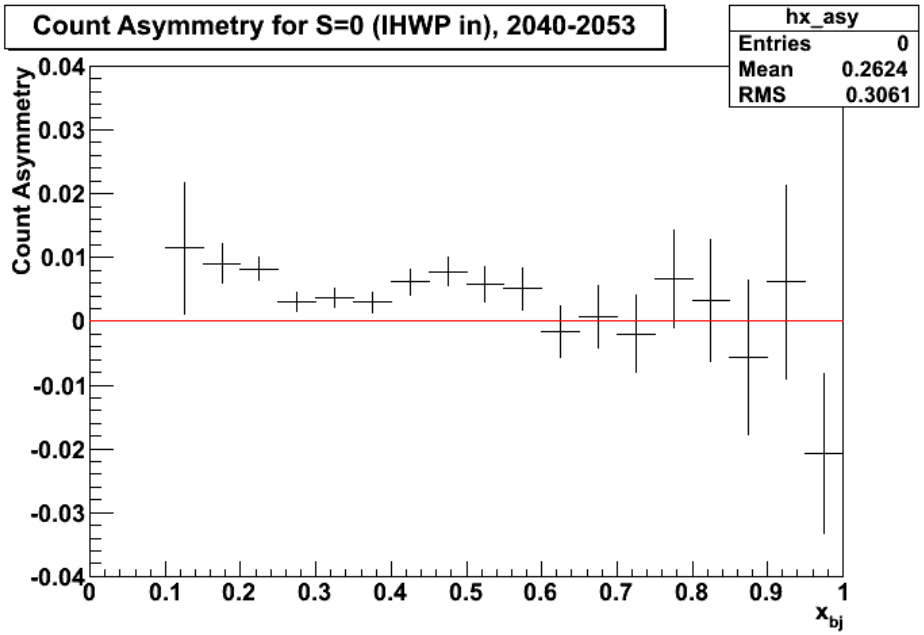
- We don't currently have a good package for computing kinematic variables in the replay
- `PriKineBB` uses `THaGoldenTrack`, which just selects the 0^{th} BigBite track
- To fix this, we introduce ν, Q^2, W and x during the skim process
- New variables: `skim.nu`, `skim.q2`, etc

Preliminary Asymmetries (i)

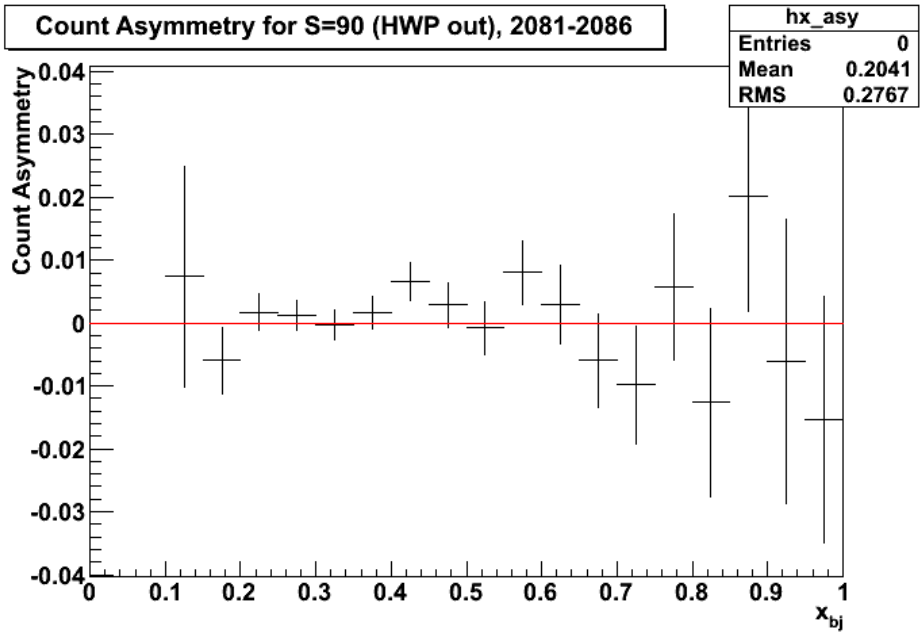
- I've written code to compute the preliminary asymmetries on a run-by-run basis
  1. Count the number of "good" tracks for each helicity, in each x bin
  2. Write them, bin by bin, to a text file for each run
  3. Later, read files to combine data for multiple runs
- It takes about three hours to do this for all 4-pass data
- I began with a set of very rudimentary cuts
  - Require track to pass through "good" part of magnet
  - Vertex-z within 17 cm of origin
  - Projected track within 15 cm of measured shower position
  - Trigger 2
  - Negative charge
  - χ^2/d.o.f. < 5

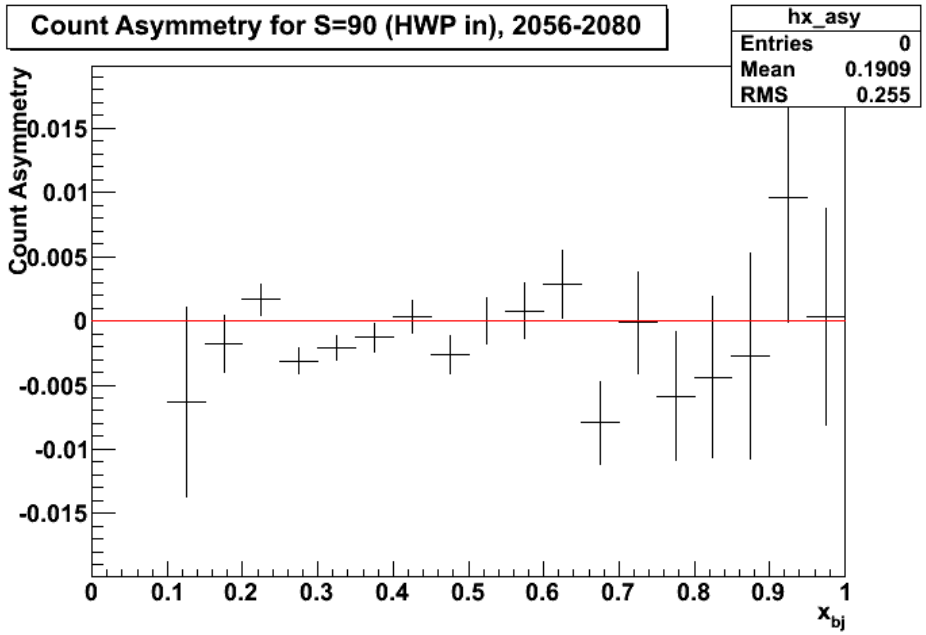
Preliminary Asymmetries (ii): 0° Target Spin



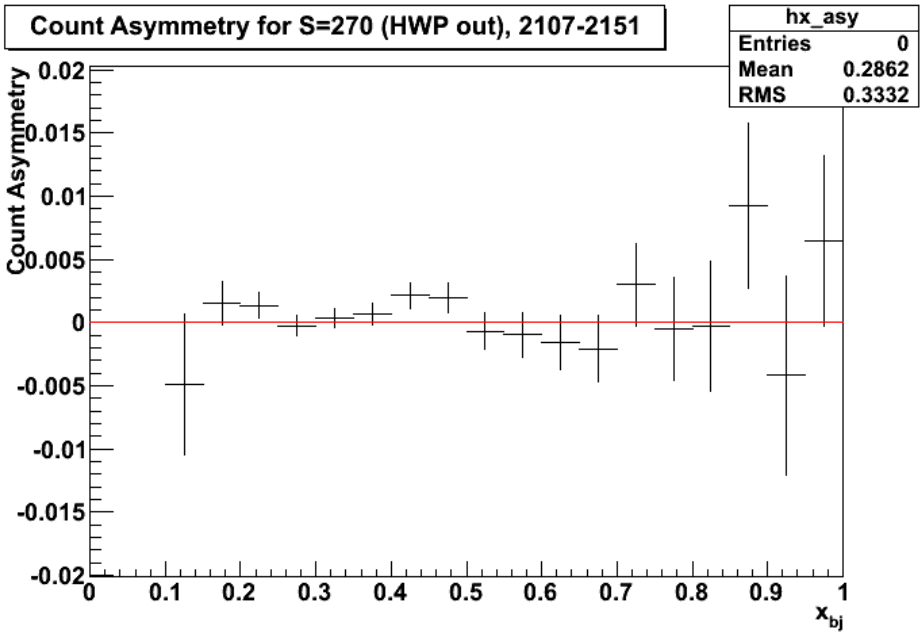


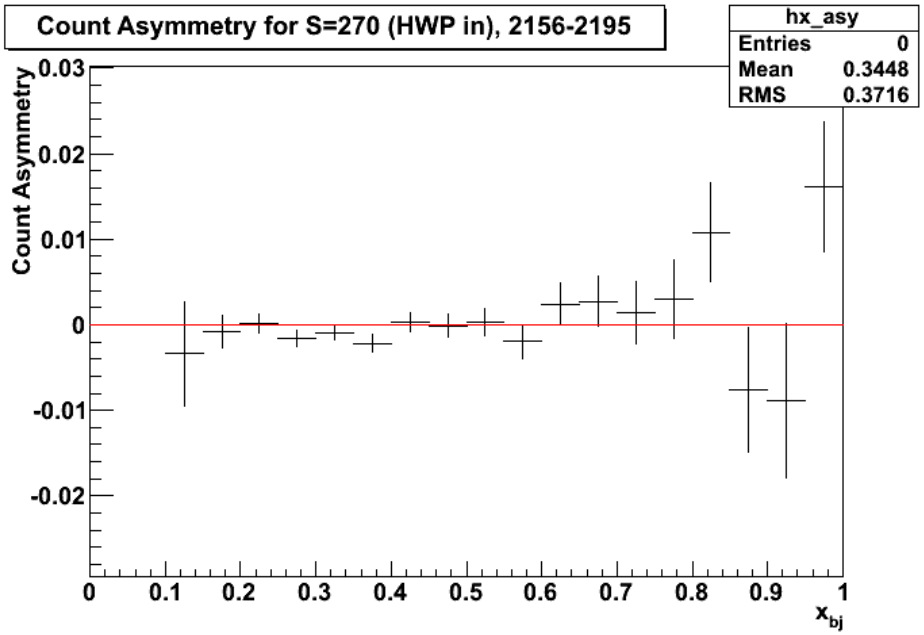
Preliminary Asymmetries (iii): 90° Target Spin



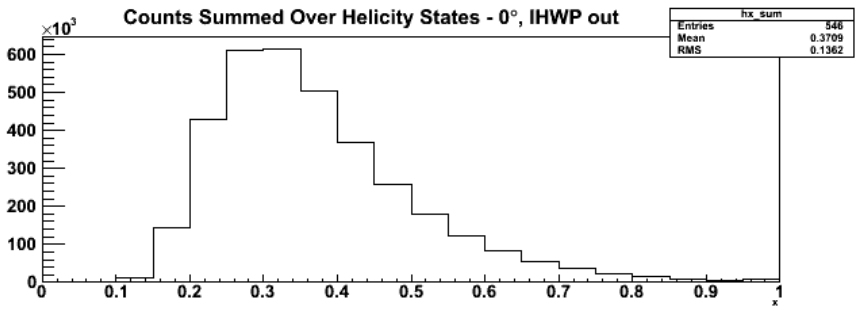


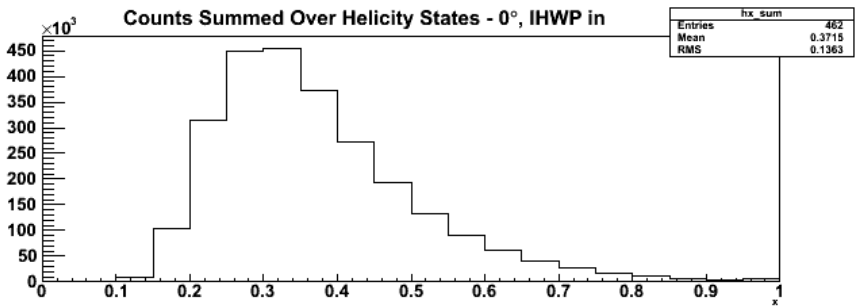
Preliminary Asymmetries (iv): 270° Target Spin

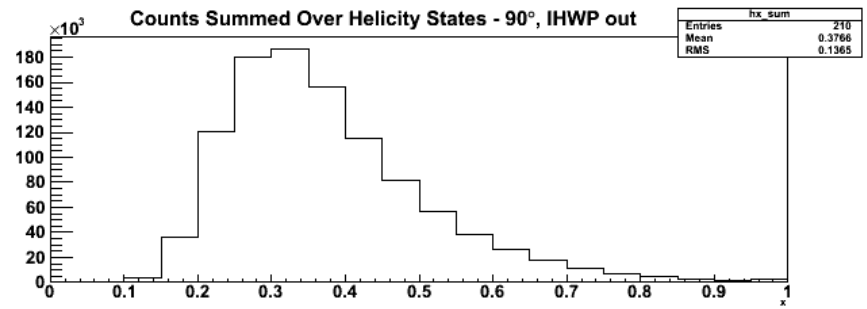


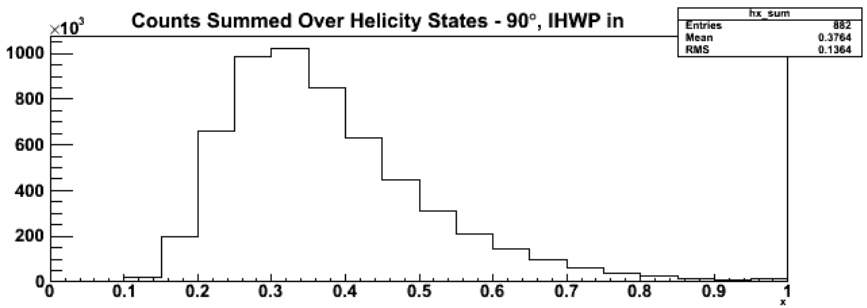


Preliminary Asymmetries (v): Statistics for 0° and 90°

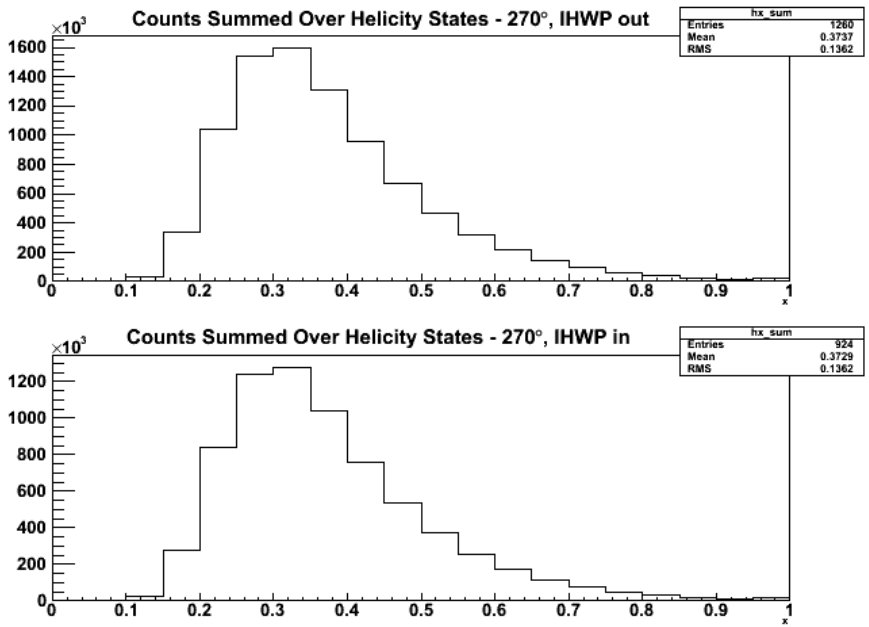






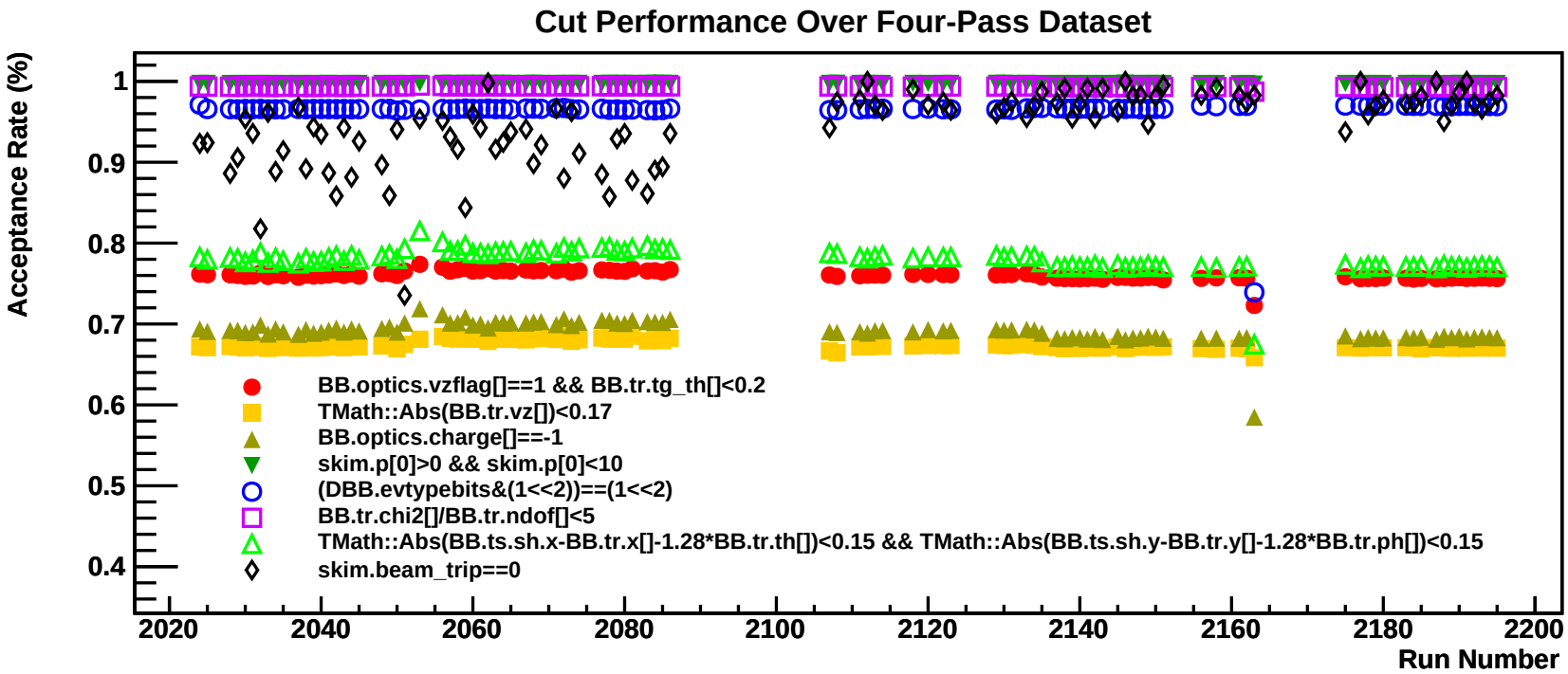


Preliminary Asymmetries (v): Statistics for 270°



Cuts

- We can do a quick-and-dirty cut determination based on a handful of sample runs
- The resulting cuts must be tested across the dataset
- I've built a testing framework and tested it on eight rudimentary cuts



Summary

- BB Optics: Low-p correction may not be necessary at all
- Farm Replays:
  - Four-pass production runs done on 32-bit farm
  - Cut performance shows degradation in track finding over time
  - 64-bit farm replays not quite working
- Skim Process:
  - Beam-trip finding is well-behaved
  - Kinematic variables can be added simultaneously
  - I have skimmed all four-pass production data using the farm
- Preliminary Asymmetries:
  - Rudimentary asymmetries in hand for whole data set
  - First set of cuts looks fairly stable
- ROOT File Locations:
  - Replayed ROOT files: `/w/halla/e06014/20101118/`
  - Skimmed ROOT files: `/w/halla/e06014/20101118/SkimROOTfiles/`

What's Next?

- Asymmetries
  - Finalize cuts
  - Study consistency of all cuts over time
  - Confirm times of HWP switches
- BigBite Optics
  - Explain width of `BB.tr.tg_ph` distribution in positive optics