Analysis Progress

for the d_2^n analysis meeting

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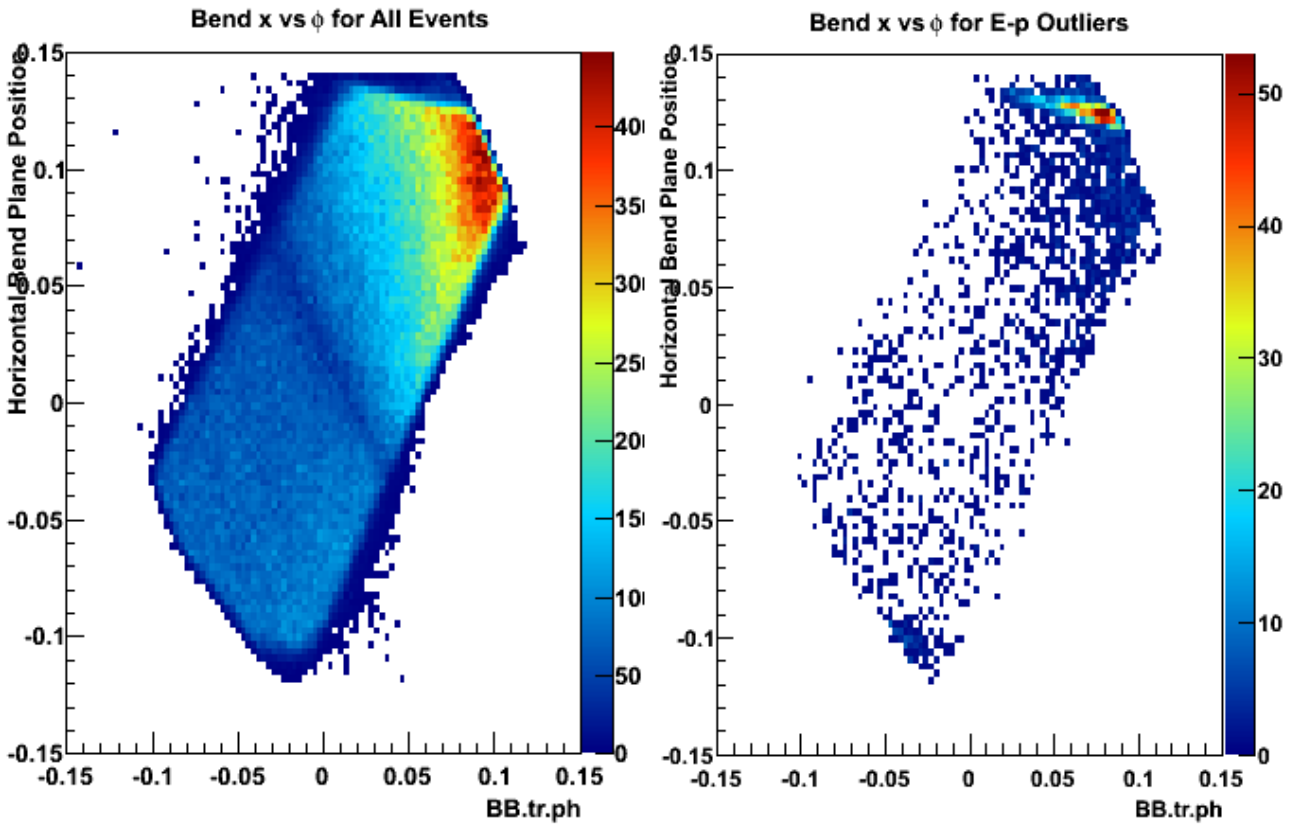
Helicity Sign

- We want to be sure of our helicity sign when computing asymmetries
- Two approaches
  - Measure known asymmetry (e.g. ^{3}He elastic scattering)
  - Check with other experiments of same configuration
- We had two DAQs
- I checked their relative helicity signs during coincidence running
- LHRS and BB have the same sign

Rescattered Particles (i): Setting a Cut

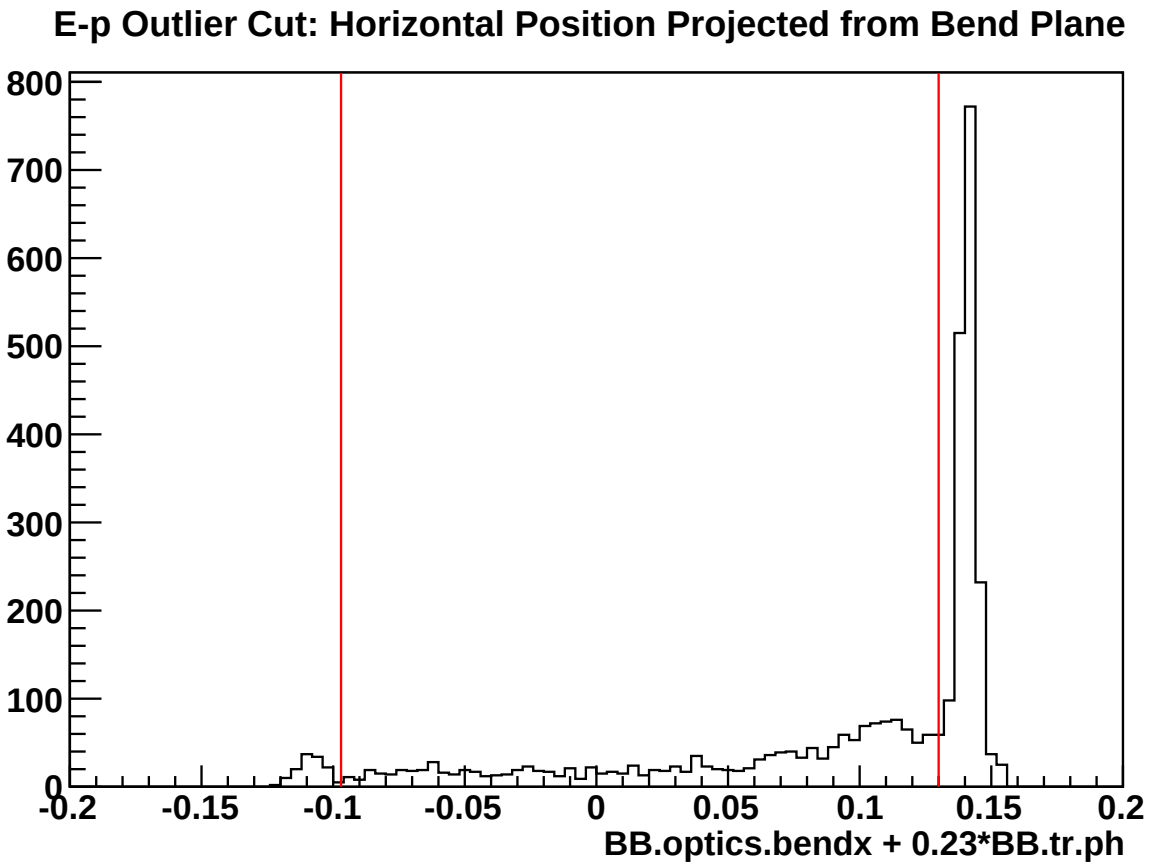
- We can remove many rescattered particles by placing a cut on horizontal bend plane position
- If we project to the plane where the scattering starts, can we define a cleaner cut?
- What plane should we use?



Rescattered Particles (ii): Setting a Cut

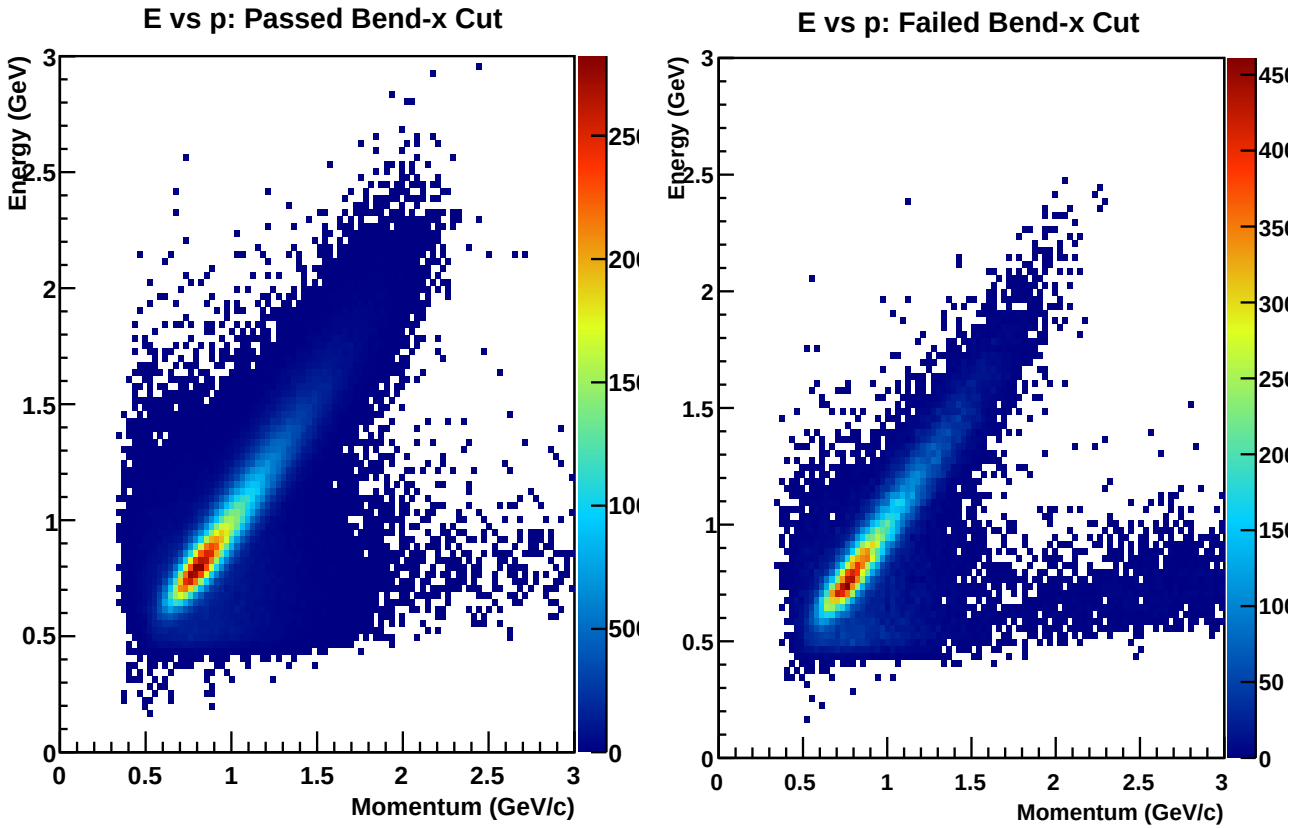
- Choose a plane 0.23 m downstream from bend plane
- A plot of projected E-p outlier positions lets us choose a cut:

```
(BB.optics.bendx + 0.23*BB.tr.ph)>-0.097 &&
(BB.optics.bendx + 0.23*BB.tr.ph)<0.13
```

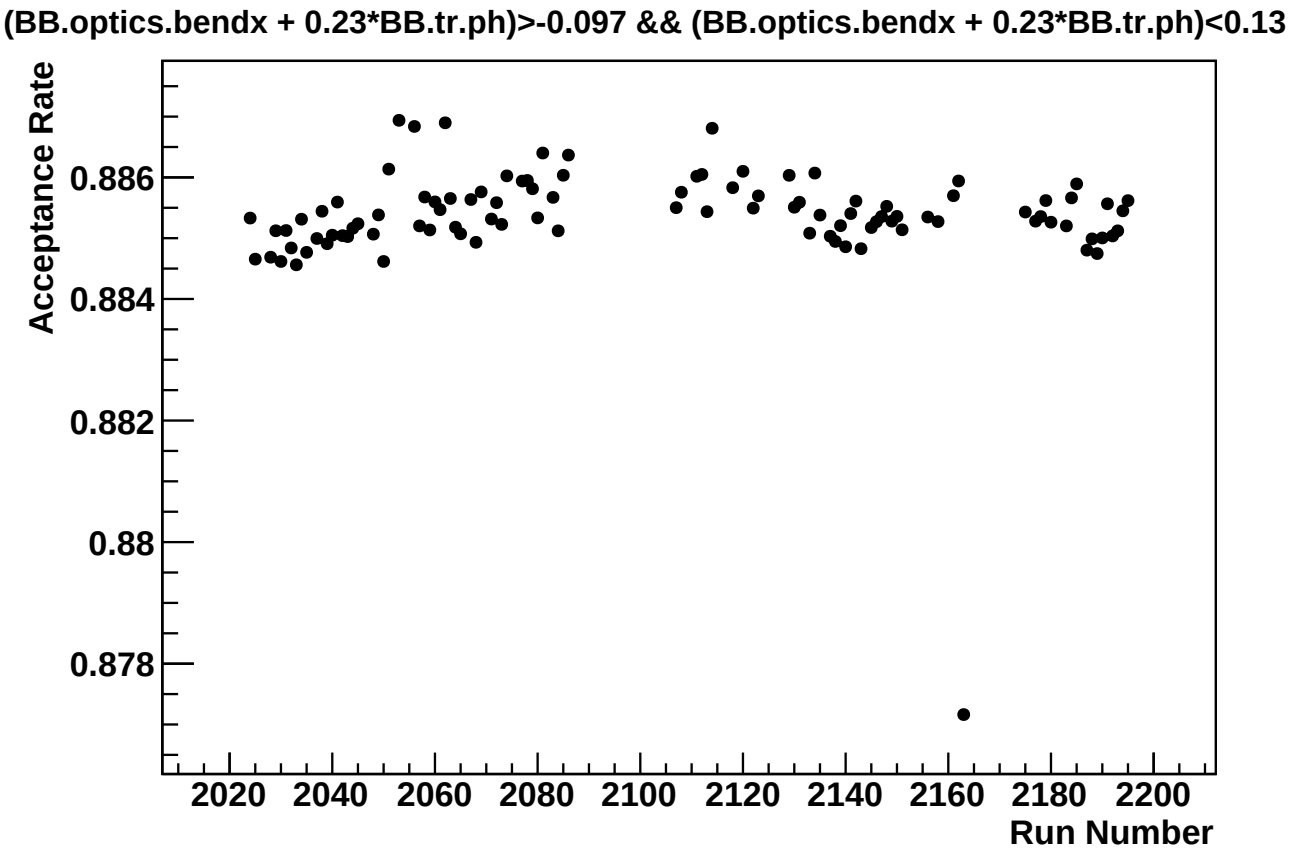


Rescattered Particles (iii): Evaluating the Cut

- The projected-position cut rejects 9.1% of tracks with a reasonable E/p
- This compares favorably to original bend-x cut (12.6%)

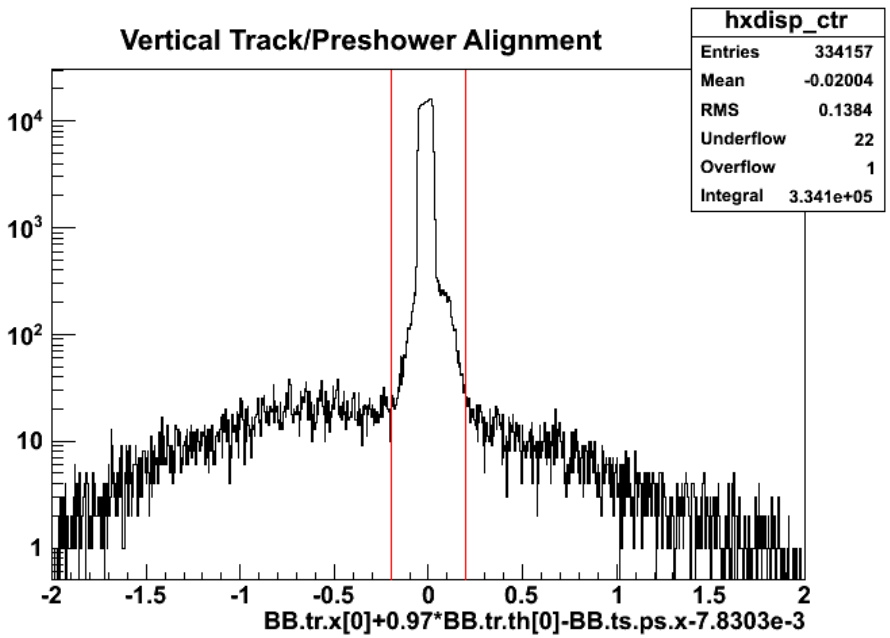


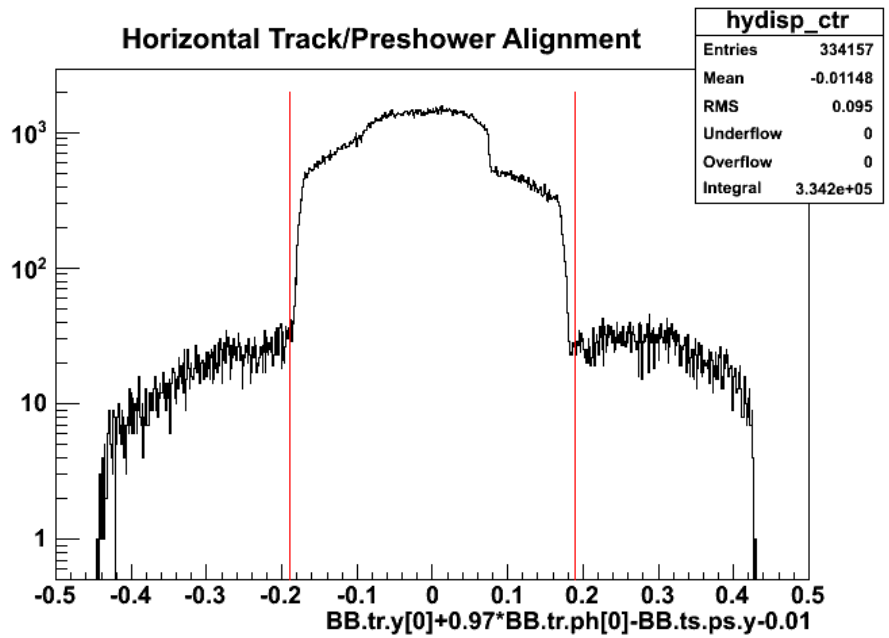
Rescattered Particles (iv): Evaluating the Cut



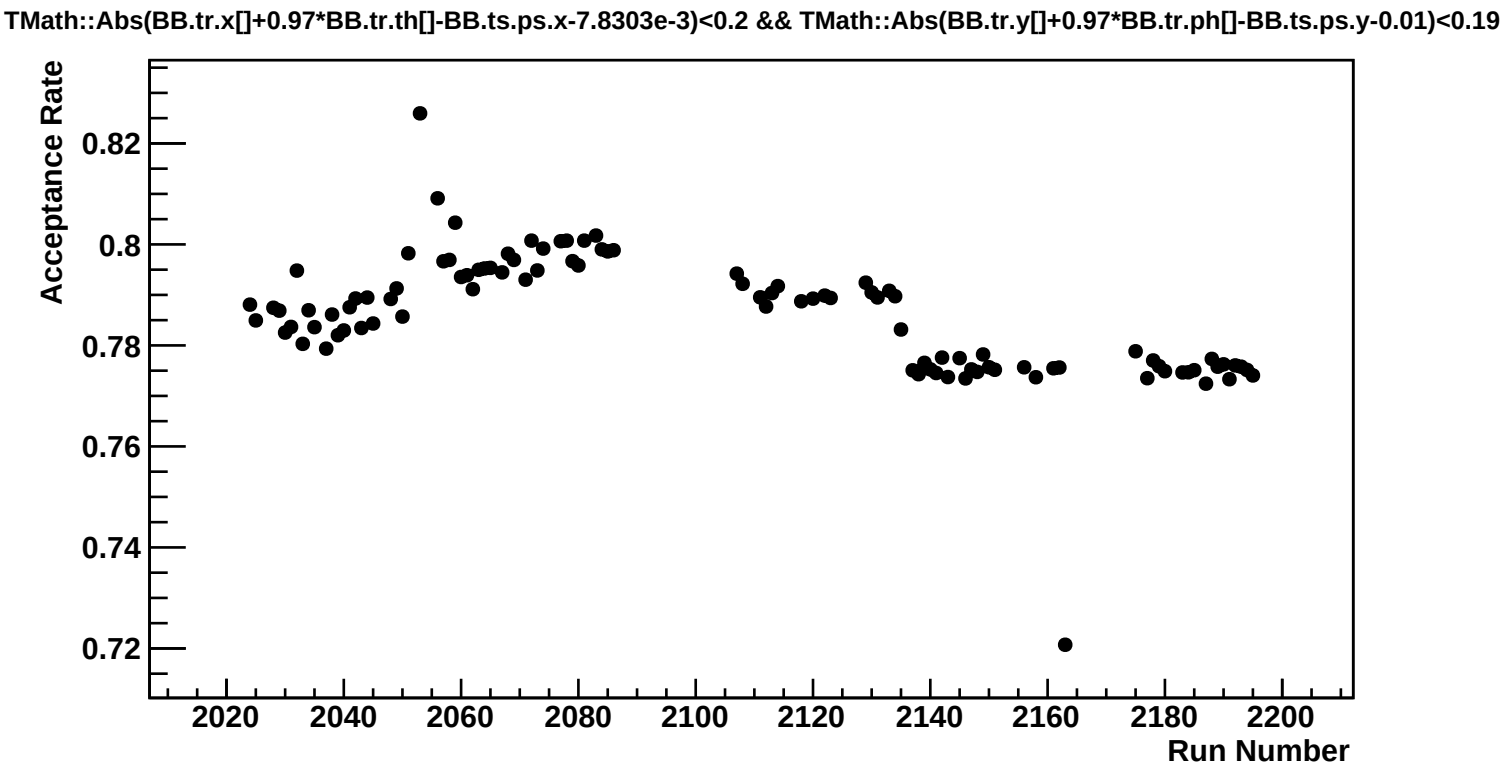
Preshower-Track Alignment (ii)

- Matt did the hard work of extracting the preshower position (in detector coordinates) a while back
- Here's where I've set my alignment cuts for the following study:
  - `TMath::Abs(BB.tr.x[]+0.97*BB.tr.th[]-BB.ts.ps.x-0.0078)<0.2`
  - `TMath::Abs(BB.tr.y[]+0.97*BB.tr.ph[]-BB.ts.ps.y-0.01)<0.19`



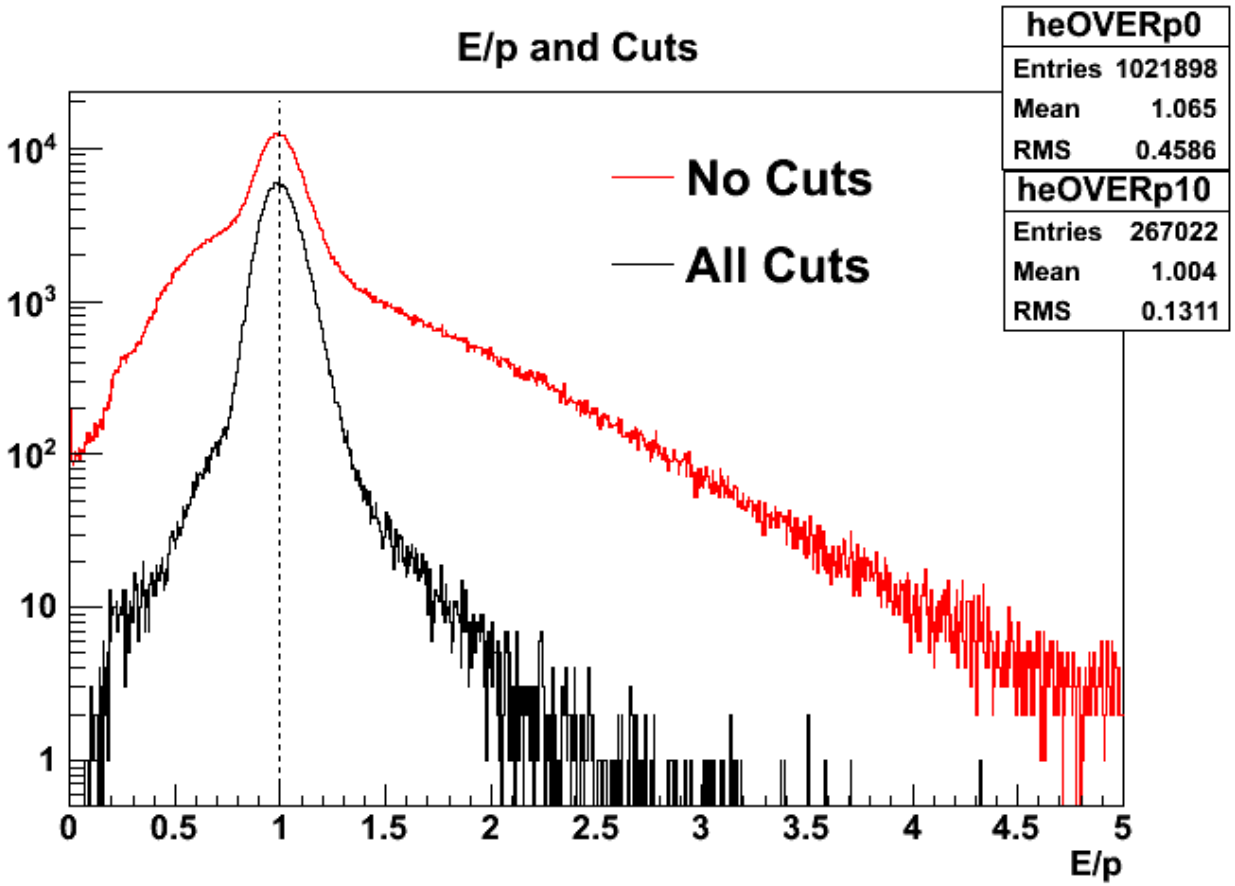


Preshower-Track Alignment (i)



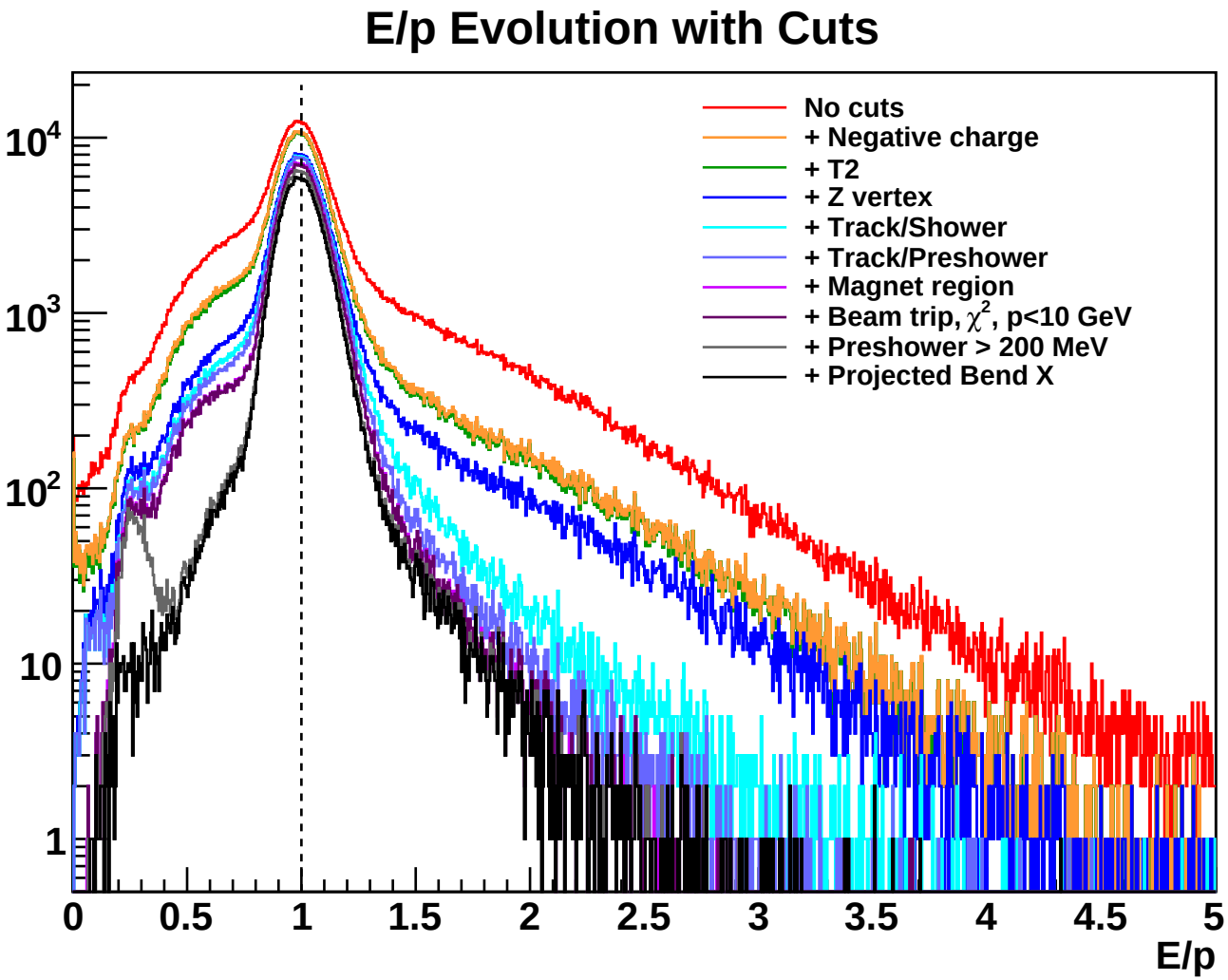
Good Electrons Without Čerenkov (i)

- What does our sample look like with all our non-Čerenkov cuts?
- Let's plot E/p for a sample run
- 26.1% of tracks survive full set of cuts



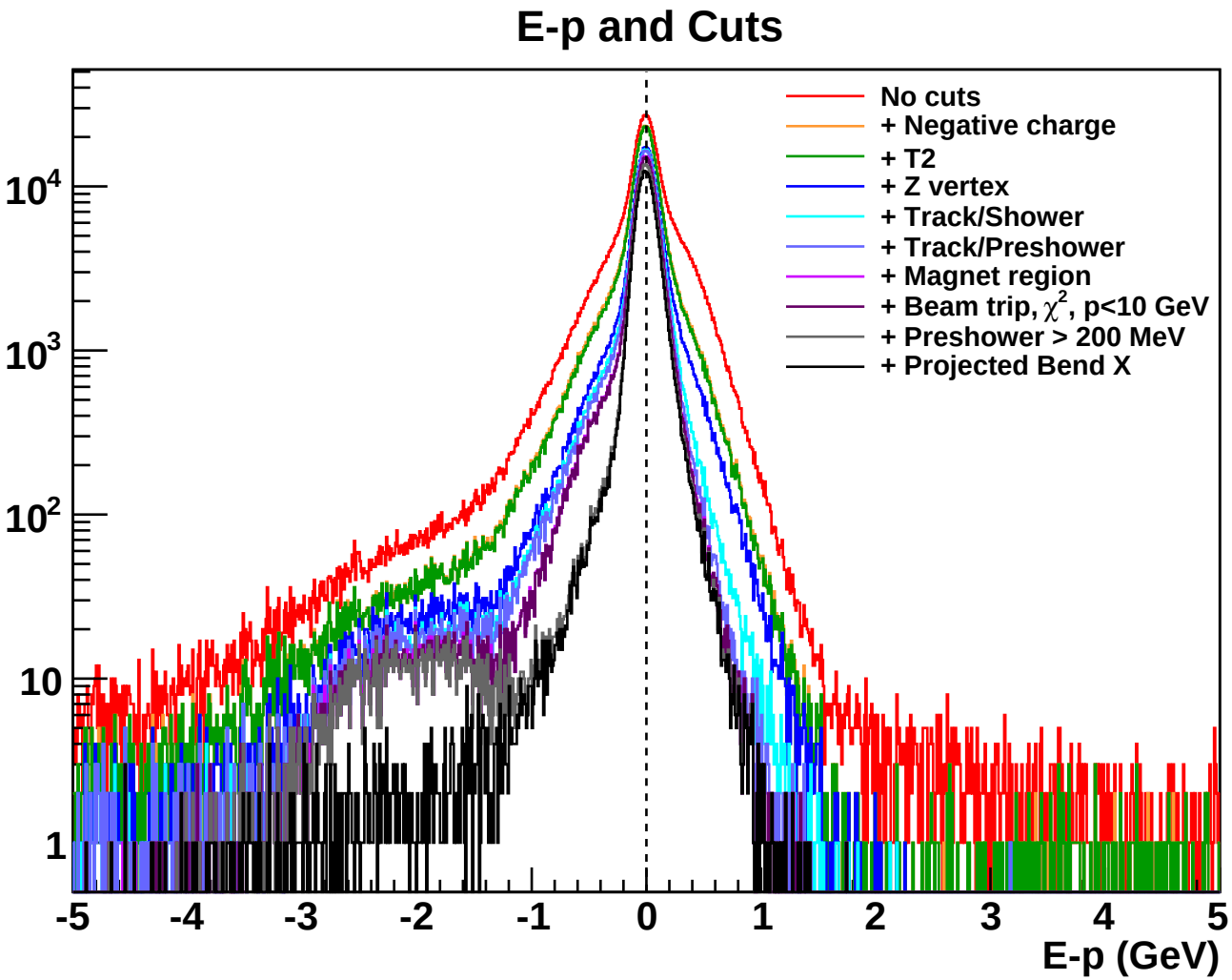
Good Electrons Without Čerenkov (ii)

- We can also look at the change in E/p from turning on one cut at a time:



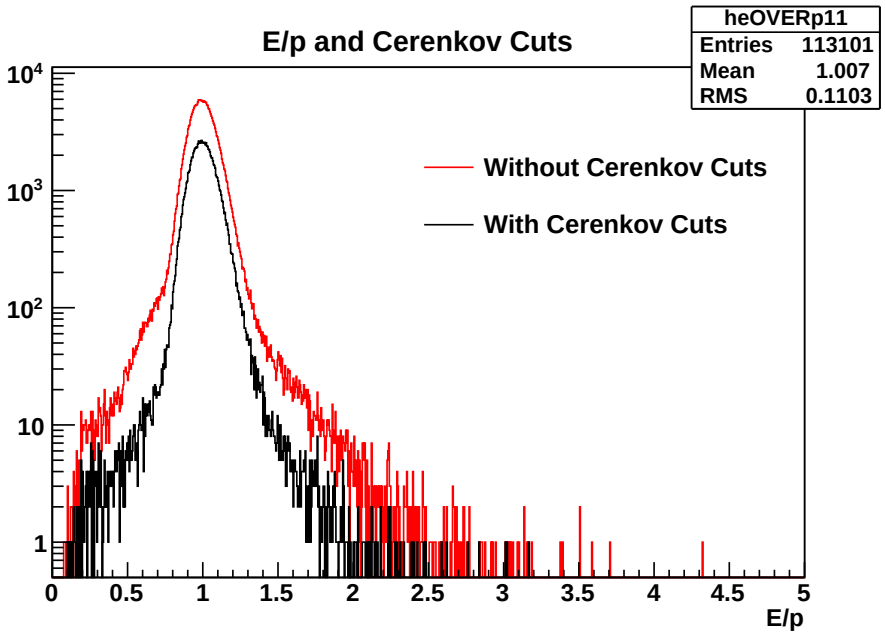
Good Electrons Without Čerenkov (iii)

- $E - p$ plots show that the cuts look the same from a slightly different perspective:



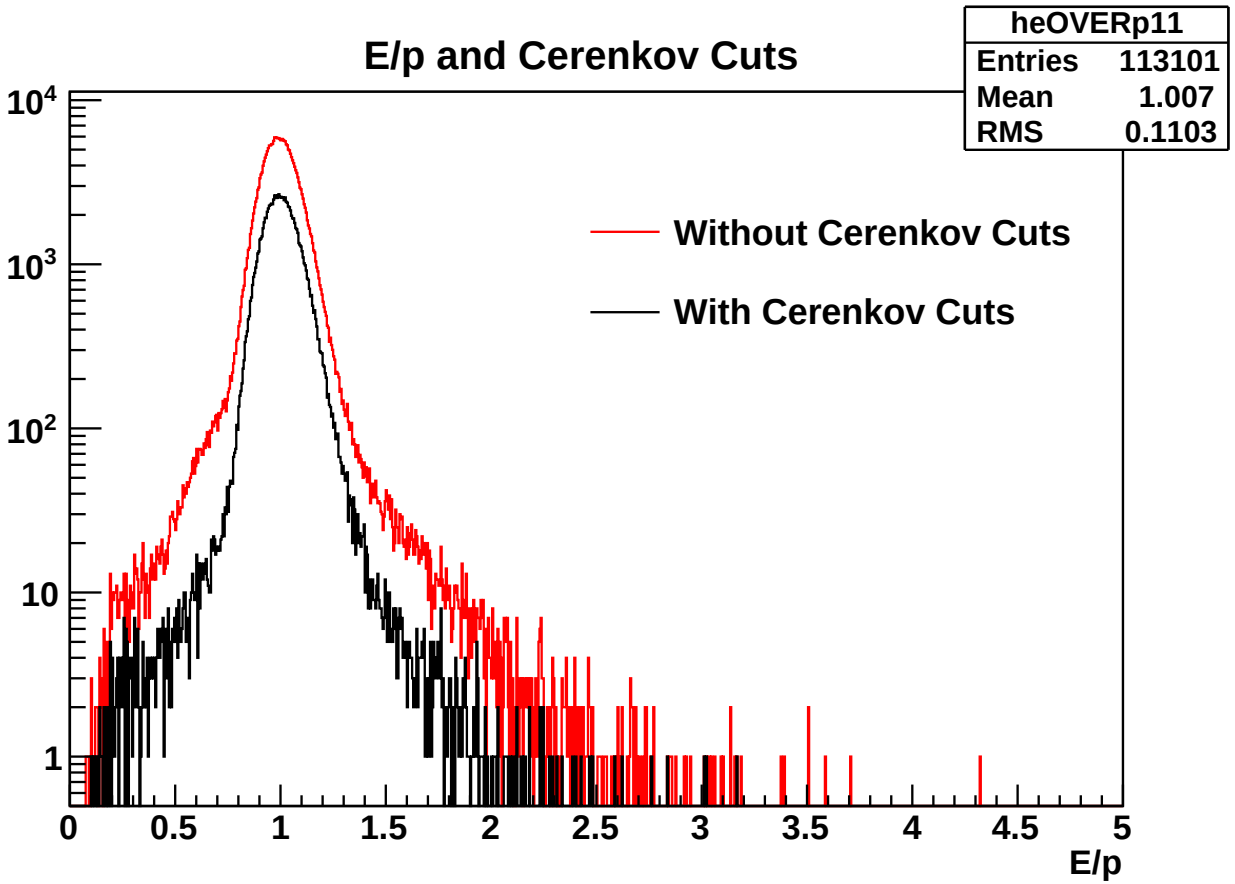
Production Čerenkov Cuts (i)

- The Čerenkov cut for each PMT has four elements
  1. Did the TDC record any hits?
  2. **AND** If so, were they within the right timing window?
  3. **AND** Was the ADC level high enough for an electron signal?
  4. **AND** Did the track intersect with the right mirror?
- The total Çerenkov cut is formed **OR**ing all PMT cuts together
- Matt's Čerenkov cuts are very tight
- 42.4% of tracks from pre-Čerenkov cut survive Čerenkov cut



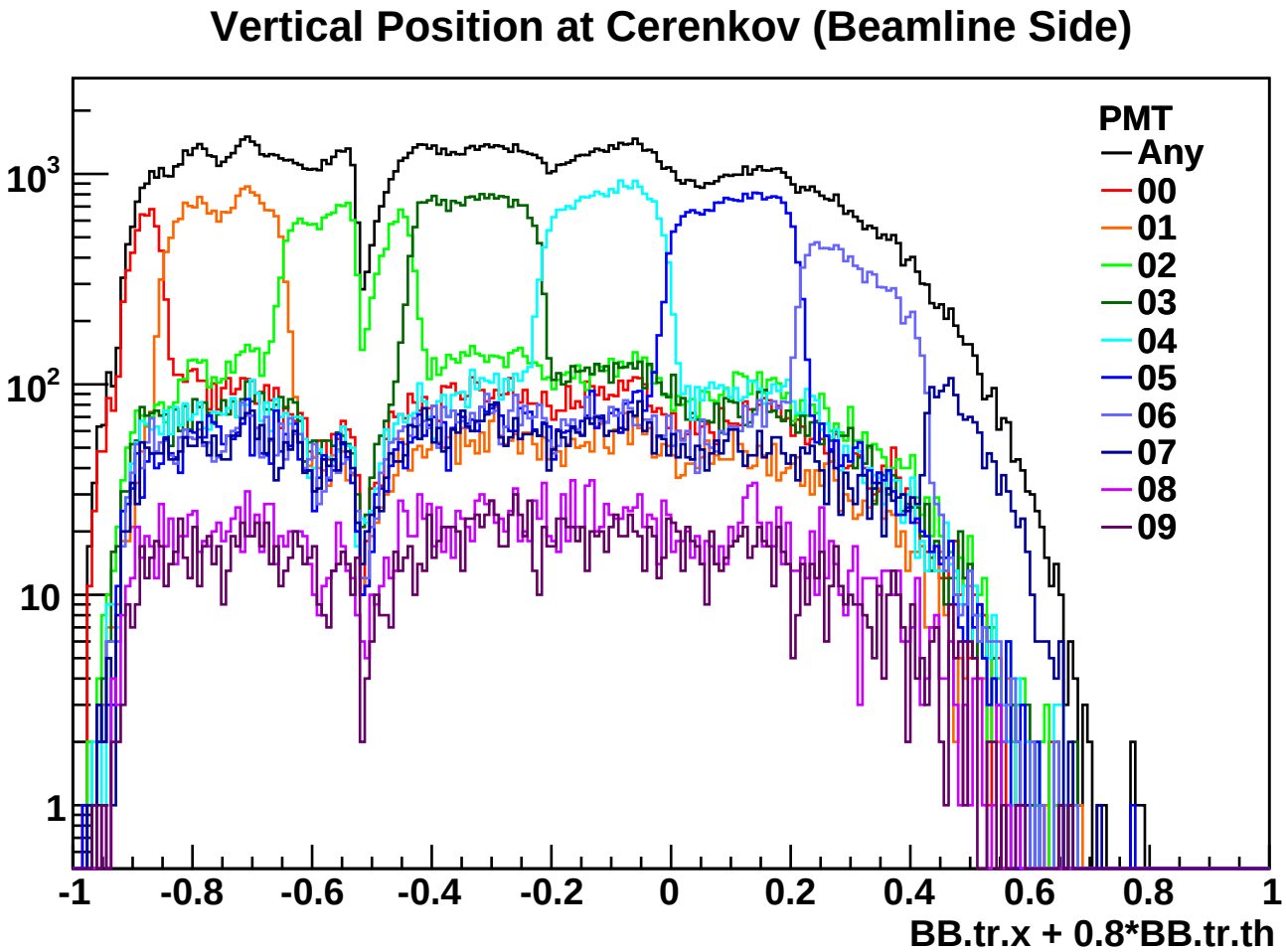
Production Čerenkov Cuts (ii)

- We're throwing out too many statistics for production analysis
- Most of this is due to the track-mirror alignment cut



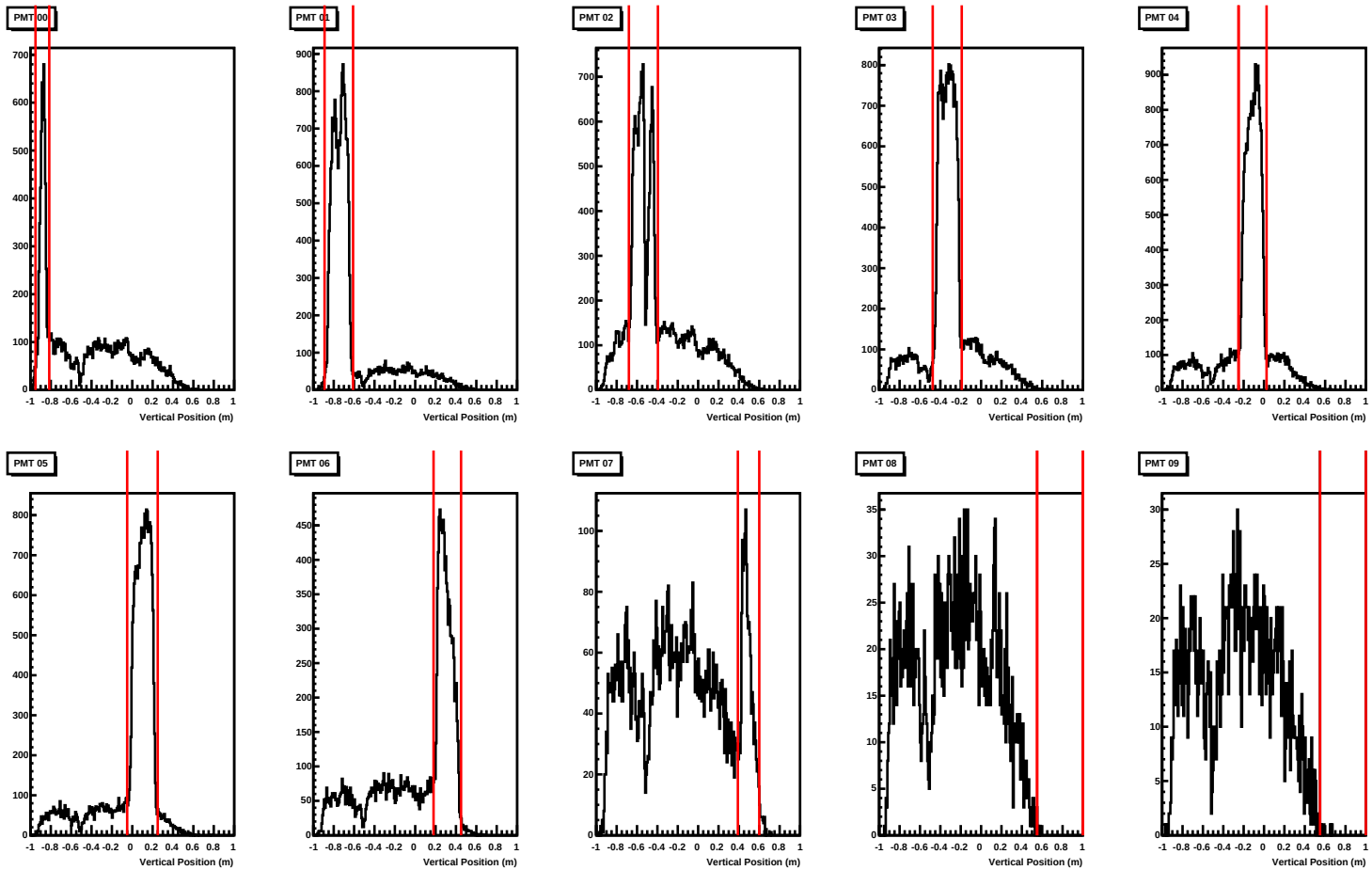
Production Čerenkov Cuts (ii)

- Let's redo the mirror cuts with the TDC information Matt has recently finalized
- When a particular PMT fires, what's the track x position?



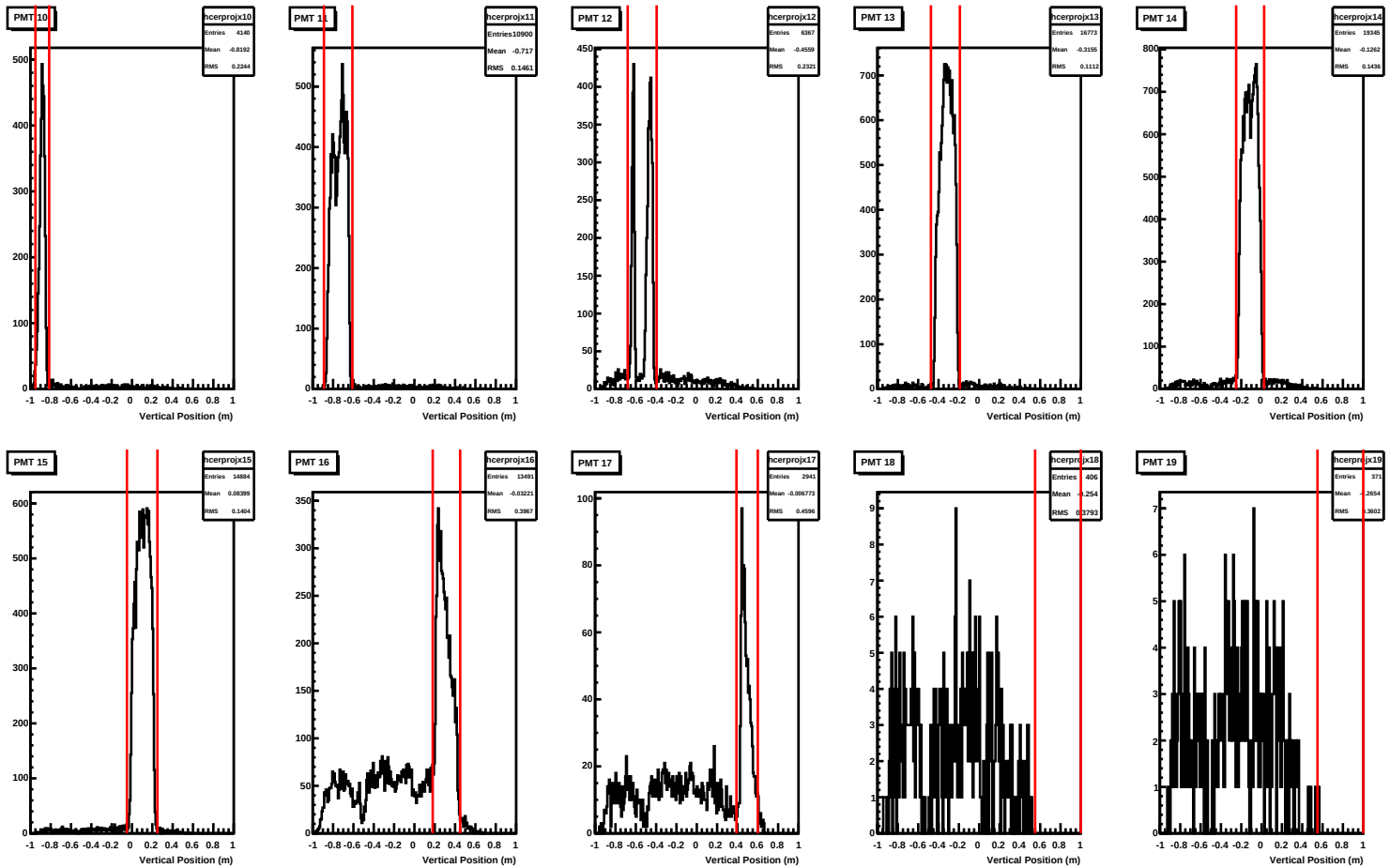
Production Čerenkov Cuts (iii)

- Place a loose cut around the x peak for each PMT



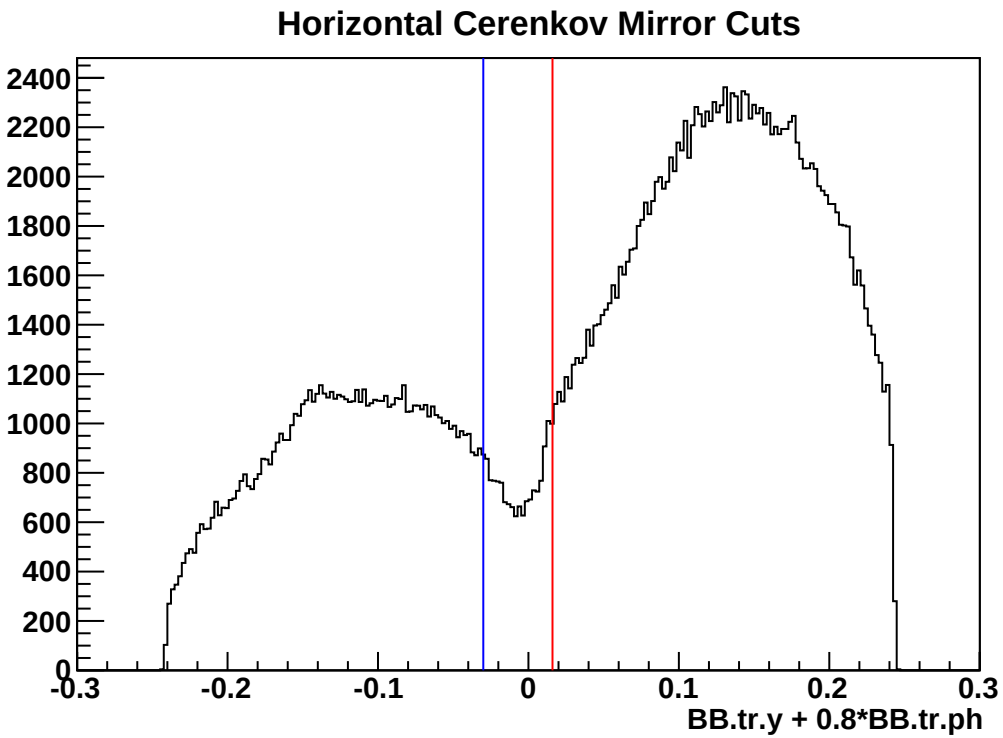
Production Čerenkov Cuts (iv)

- The same cuts also work for the RHRS side



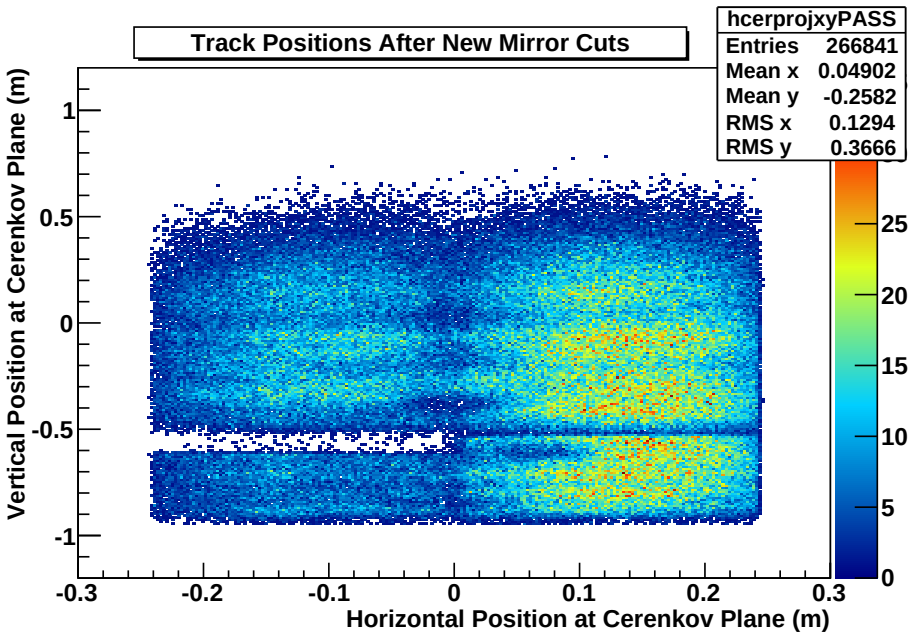
Production Čerenkov Cuts (v)

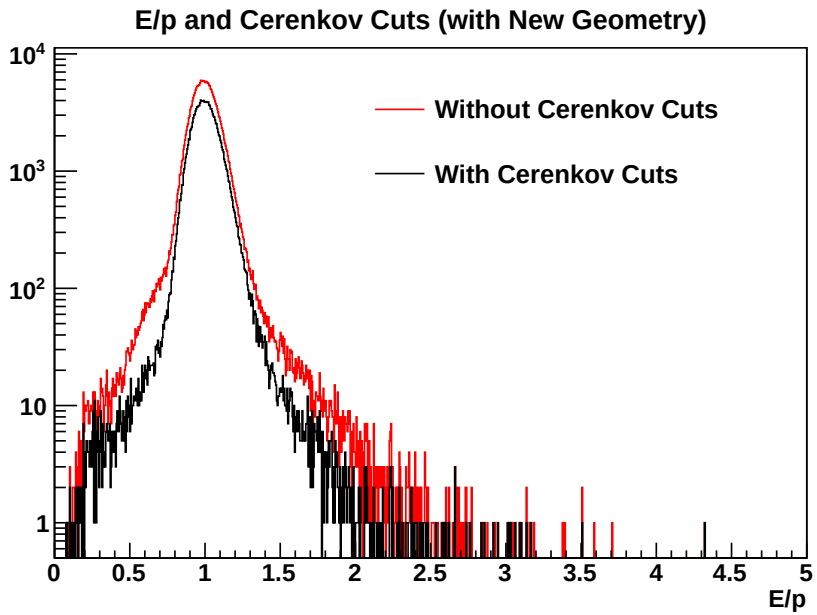
- On the horizontal side, we have much less resolution
- We need to allow overlap between the two columns



Production Čerenkov Cuts (vi)

- The new track/mirror alignment cut has a much larger acceptance (left)
- Now, 65.9% of previously accepted tracks survive Čerenkov (right)
- How much of each distribution passes a loose E/p cut?
  - Pre-Čerenkov cut: 95.8%
  - Post-Čerenkov cut: 97.2%





Summary

- LHRS and BB have same helicity sign
- Best to cut out E-p outliers via a projected-bendx cut
- Preshower/track alignment cleans up our sample
- No nasty surprises are apparent in E/p spectrum
- (Indeed, not much background is apparent there, either)
- I have loosened geometrical Čerenkov cuts and some mirror overlap is allowed

What's Next?

- Cuts
  - Loosen Čerenkov ADC cuts?
  - Čerenkov cut consistency
  - Confirm times of HWP switches
- Asymmetries
  - Elastic ^{3}He asymmetry to check sign
  - Asymmetry on particles that scattered from pole piece
  - Asymmetry on new good electron sample
- Compton
  - Continue quantifying systematic errors, especially on P_γ
  - Produce single P_e for each run period
- Dissertation