ECal hit rates

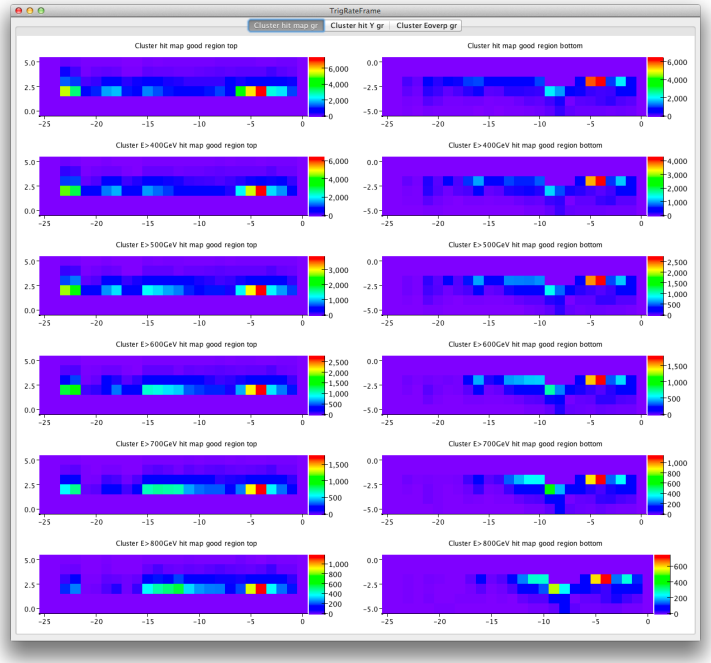
Pelle/Sho

This crazy thing we did for the PAC

- ECal-only measurement of absolute rate of scattered particles
- Checking estimates of ECal gain
- Comparison with Monte Carlo rates

Counting clusters

- Select a relatively good region of ECal: left (x<0) half, top and bottom
  - Bottom has an HV group with high gain and some crystals that were dropped as being “bad”
- Reject clusters with seed (highest E) crystal in Y=$\pm$1
- Count clusters with energy above a given threshold — use a threshold high enough to guarantee a trigger
- Normalize (to 90 nC, a k a “Hz at 90 nA”) by dividing by the integrated current for each run; subtract the empty run to remove background

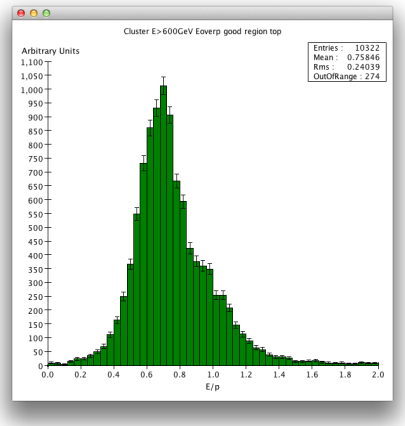


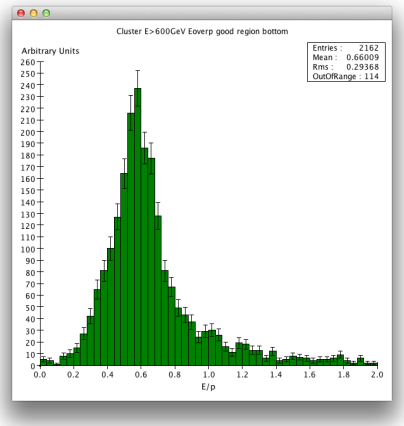
Simulation

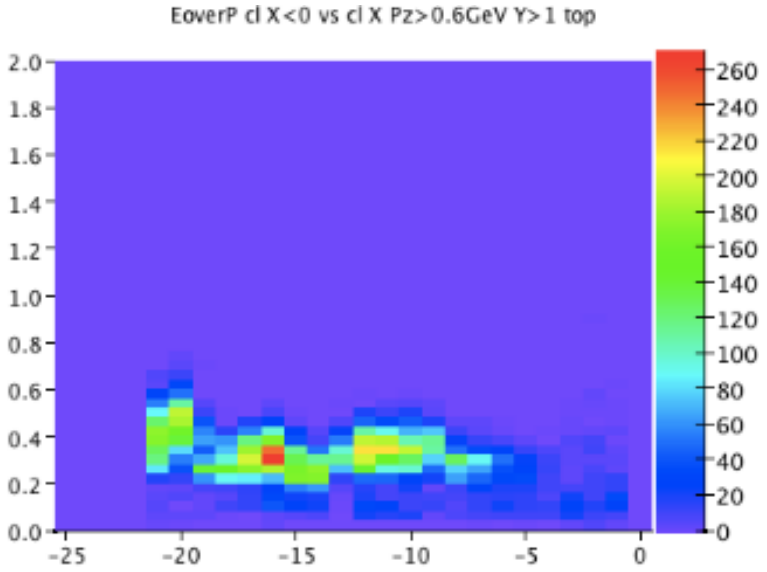
- Use Geant4/EGS5 samples coming out of the converter; run them in SLIC, get hits in ECal crystals
- Ignore time evolution, readout and triggering, but do apply the crystal readout threshold
- Use same ECal region, clustering, position cuts, energy thresholds as for the real data

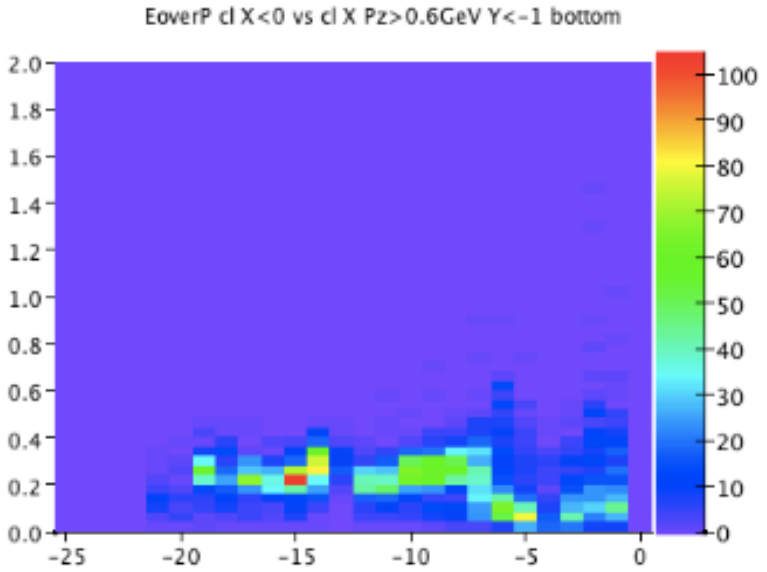
ECal gain

- Data and simulation will only match if the ECal gain used for the data is correct
- We used Stepan's value for ECal gain (constant across crystals)
- Check cluster energy against track momentum, get E/p of 0.7 in top, 0.6 in bottom (figure on right was made with gain incorrect by a factor of 2)



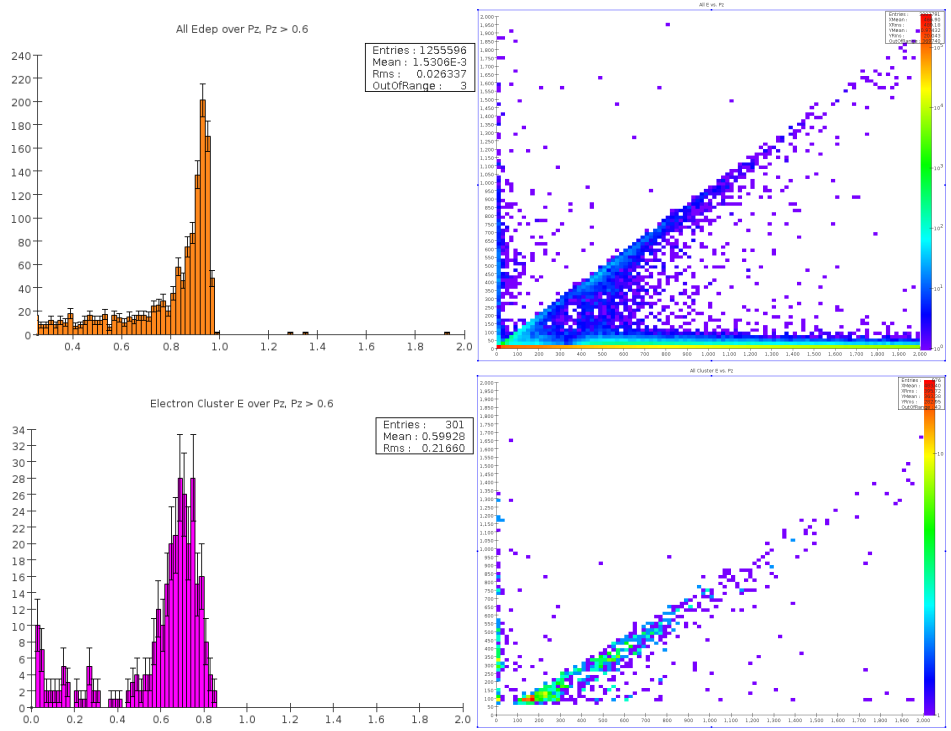






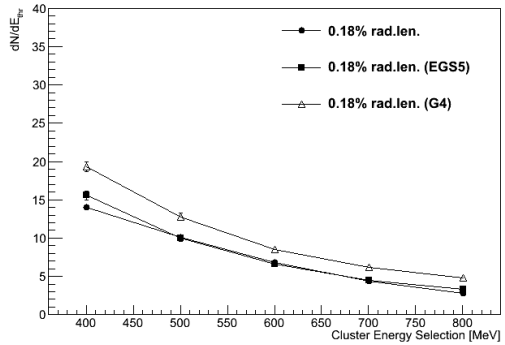
E/p in simulation

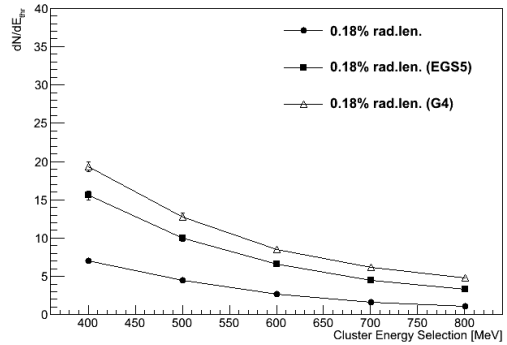
- The E we measure is the sum of energy deposition in ECal crystals; the p we measure should be the true scattered particle momentum
  - Some energy isn't deposited in crystals (sampling fraction)
  - Some energy deposition doesn't make it into the data (readout threshold)
- Simulation shows E/p around 0.7 if we use the same cuts as we do with data

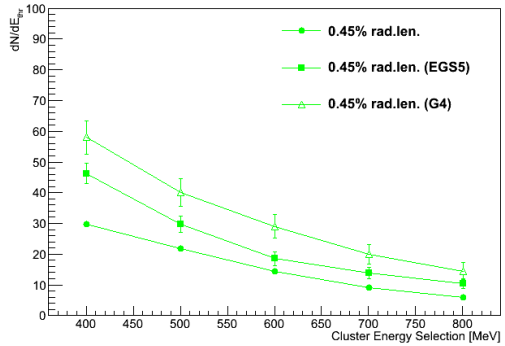


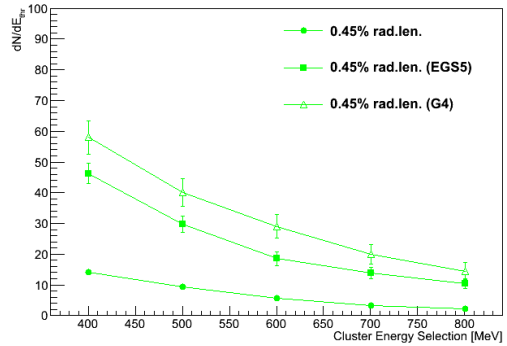
Results

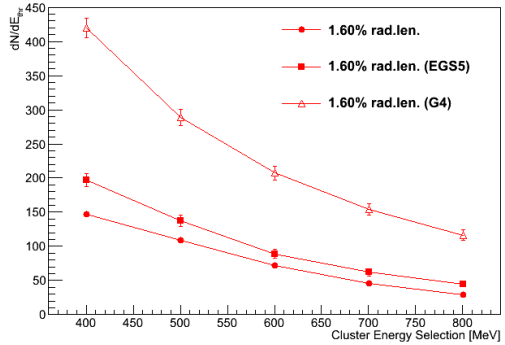
- This is what was presented to PAC (ECal top half on left, bottom on right)

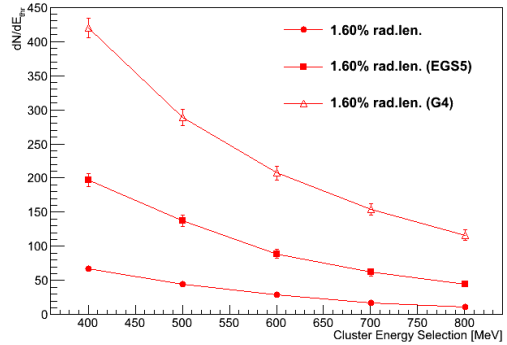












Next steps

- Do a real ECal gain calibration by comparing to MC
  - Maybe start by setting gains for HV groups to iron out the worst of the irregularities; crystal-by-crystal calibration is much more involved
  - It looks like overall gain is somewhat lower (10% in top, 20% in bottom) than what we used
  - Some work needed before we trust our E/p measurement enough to calibrate based on it
- "Angular distribution" (rates vs. crystal Y index): in progress (top half shown)