

Joint Energy Scan Hodoscope Recalibrations

Joe Osborn

UMich

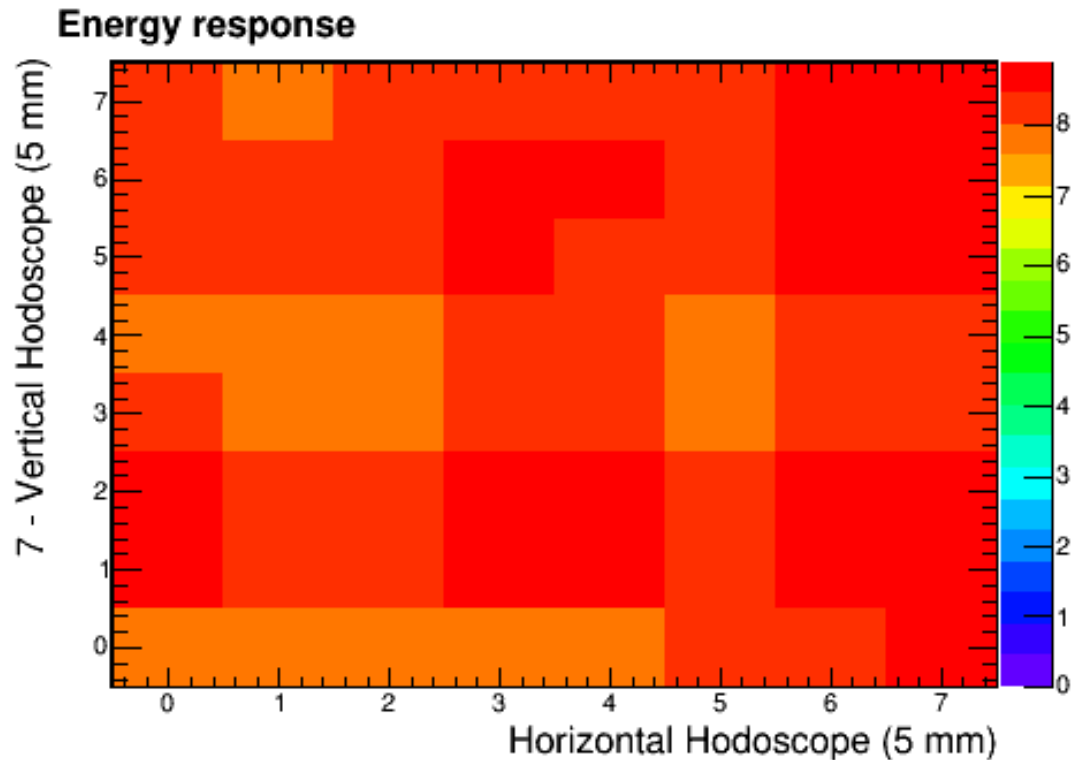
Reminder

- On Tuesday 2/21/17 I showed a position dependent hodoscope recalibration for the first joint energy scan
 - Improves EMCAL resolution quite well
- Also showed hodoscope recalibration for the third joint energy scan (which included block boundaries)
 - This did not improve the resolution of the EMCAL
- Today:
 - More investigation – hodoscope characterizations before and after recal revealed a small bug

Sanity Check on First Joint Scan - Revealed Bug

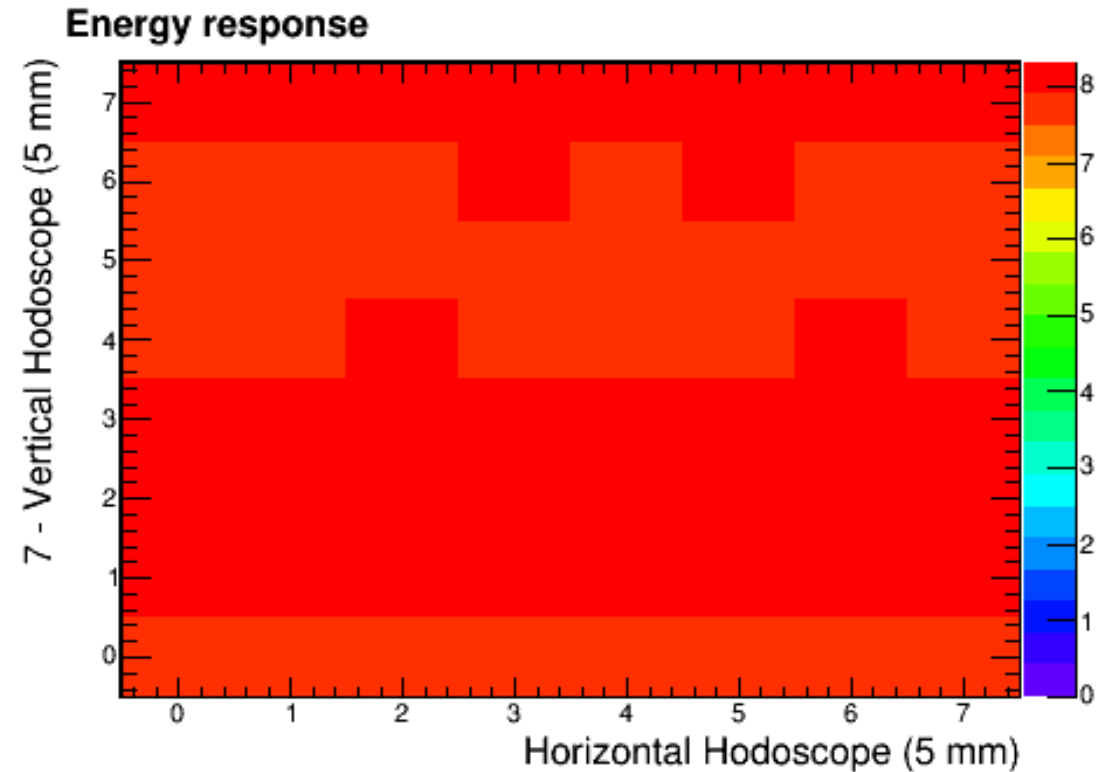
Originally I looked at this and decided it looked good – For an 8 GeV beam we expect that the recal centers all hodoscopes at 8 GeV

Before recal



Nonuniform

After recal

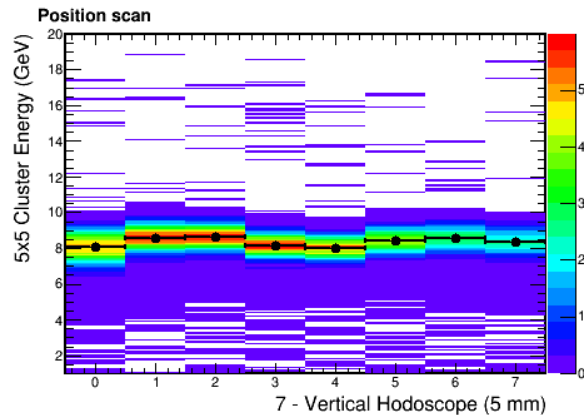
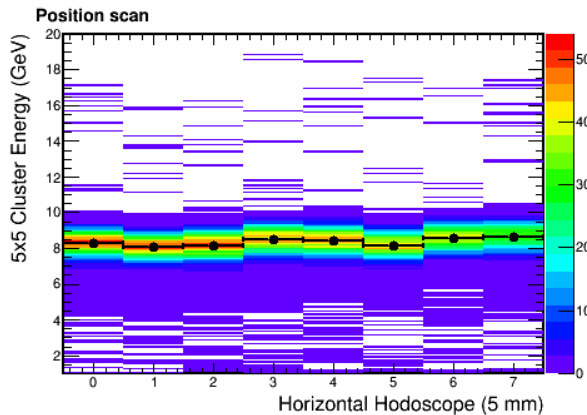
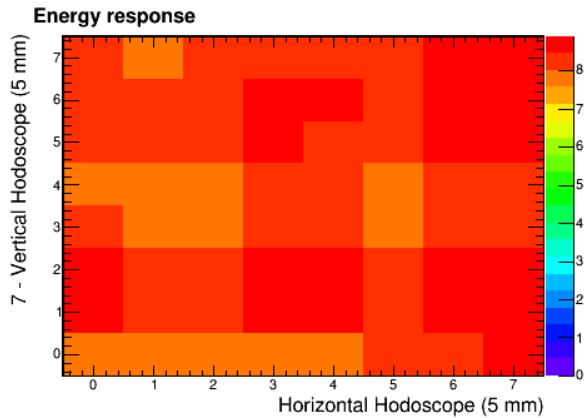


Uniform

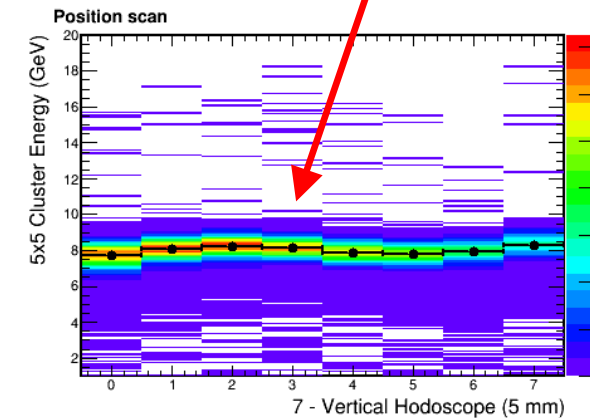
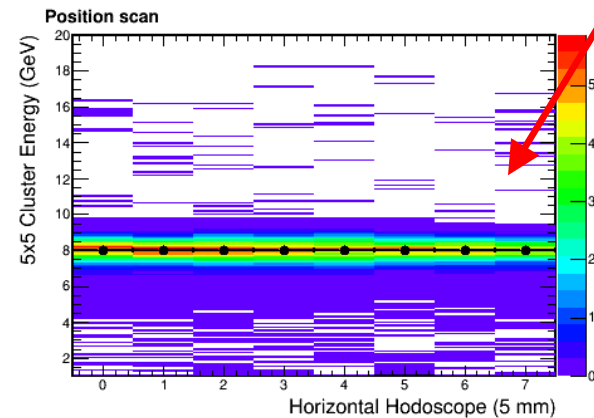
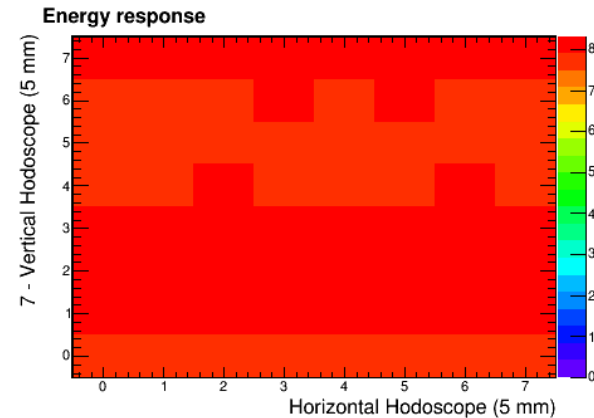
Sanity Check on First Joint Scan Revealed Bug

Expanding to look at the full picture showed something was wrong with the vertical hodoscope recalibration: not flat at 8 GeV

Before recal



After recal



Flat at 8 GeV

Not flat at 8 GeV

Bug Fix

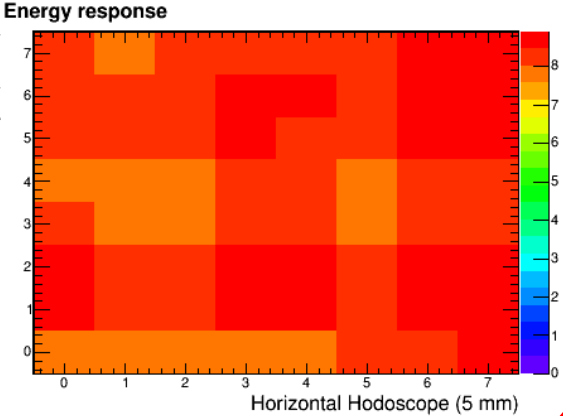
- I was applying the vertical hodoscope correction factors in the wrong order but the horizontal hodoscope correction factors in the correct order
- This slipped by in the first joint energy scan because the hodoscope response was already very good, so the difference was not noticeable
- In the third joint energy scan (with block boundaries) the response is so terrible that the error became more obvious

First Joint Energy Scan

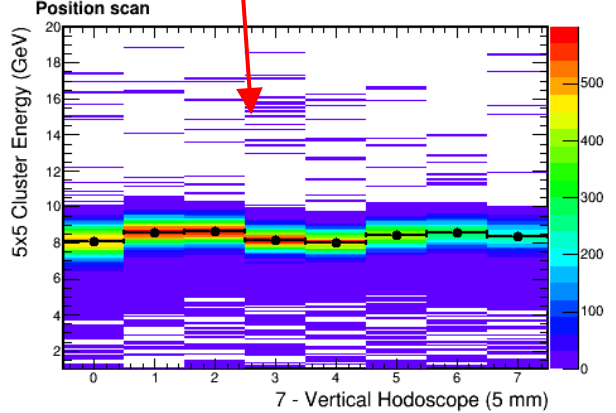
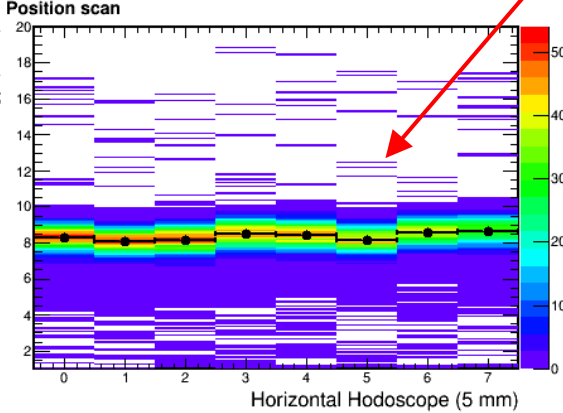
Runs 3736-3741 (No block boundary)

Fixed Recalibrated First Joint Energy Scan

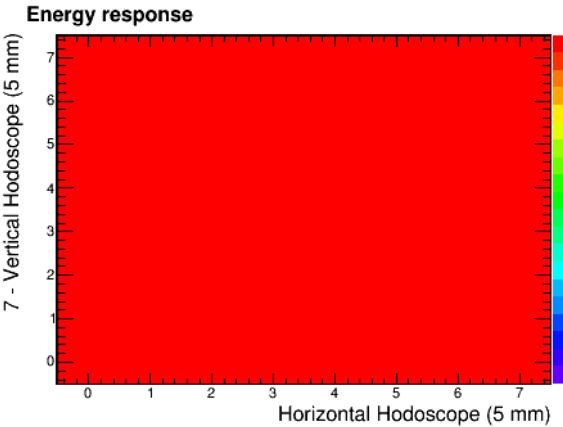
Before Hodo Recal



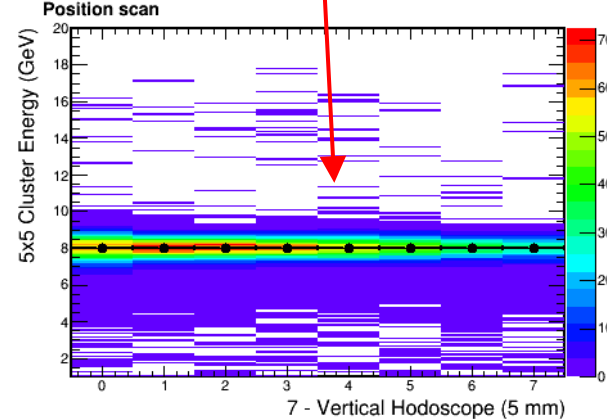
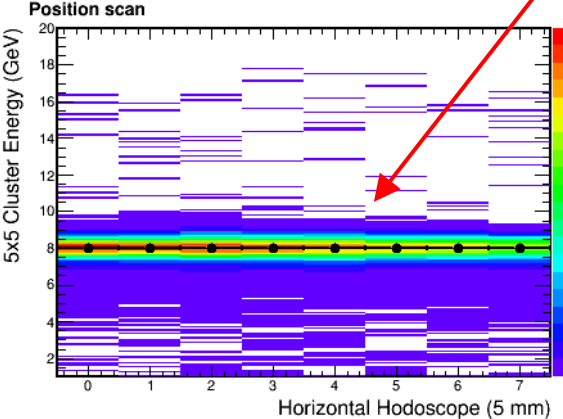
Nonuniformity indicates the difference in hodoscope finger response (8 GeV beam)



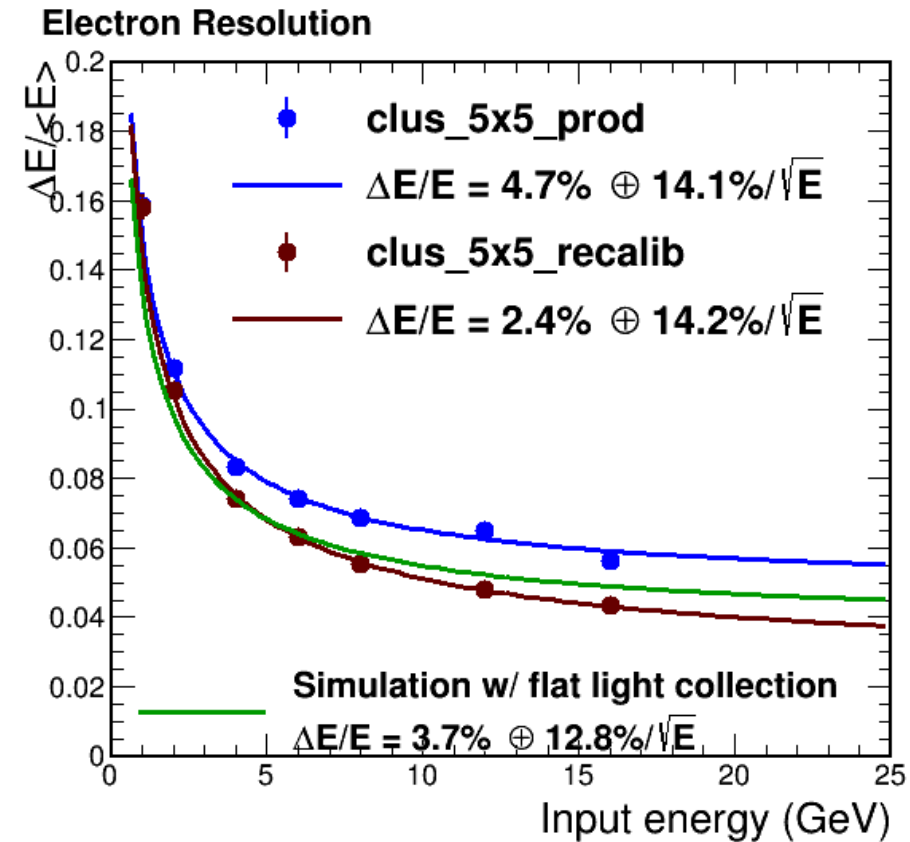
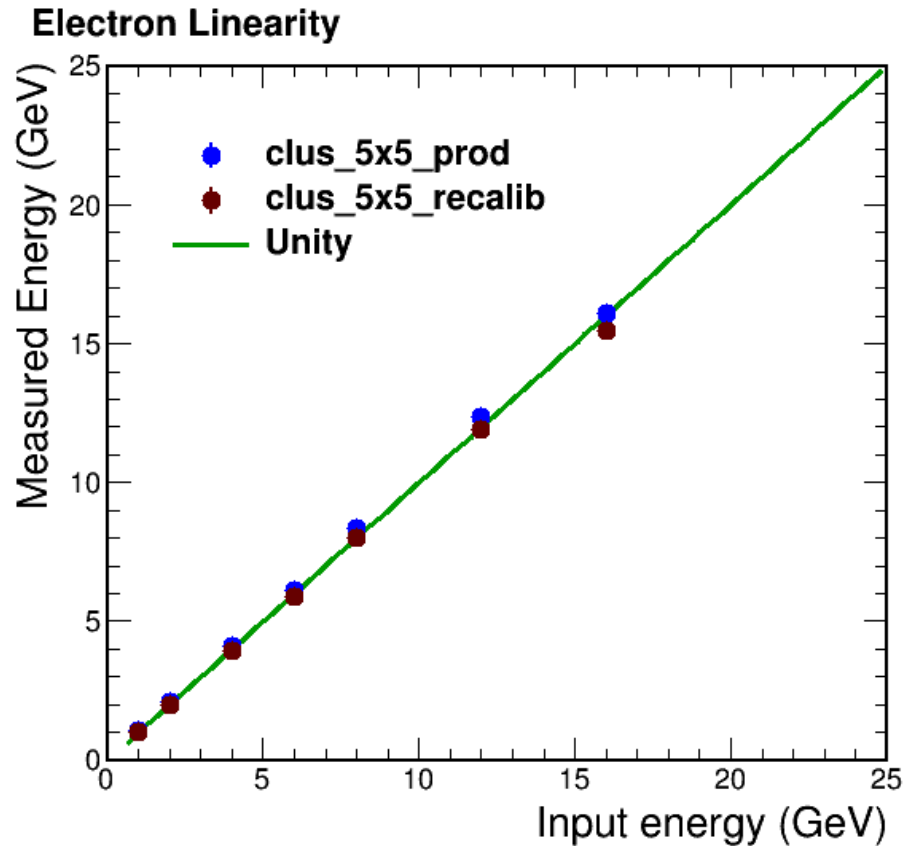
After Hodo Recal



- Now both are flat at 8 for 8 GeV beam
- 2d histo (left) is now entirely uniform



First Joint Energy Scan Resolution



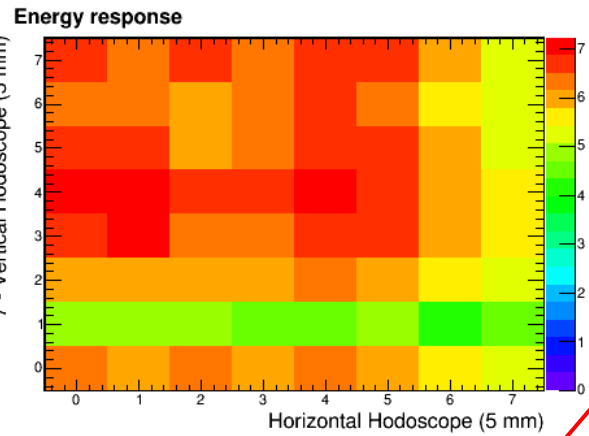
- No hodoscope cut applied here, i.e. using all 8x8 fingers.
- Constant term improved from what I showed on 2/21/17, but $1/\sqrt{E}$ term is basically the same

Third Joint Energy Scan

Runs 3997-4002 (with block boundary)

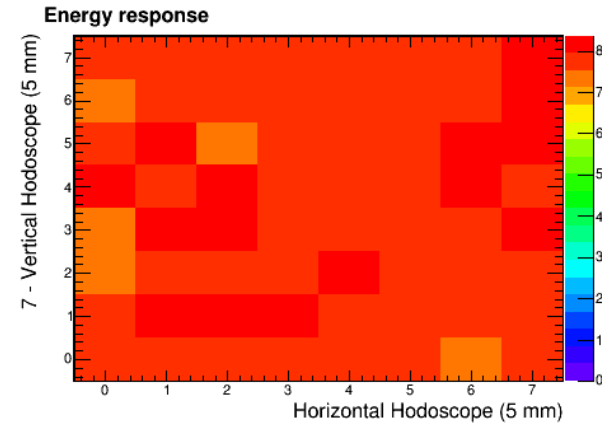
Third Joint Energy Scan (with block boundaries)

Before Hodo Recal

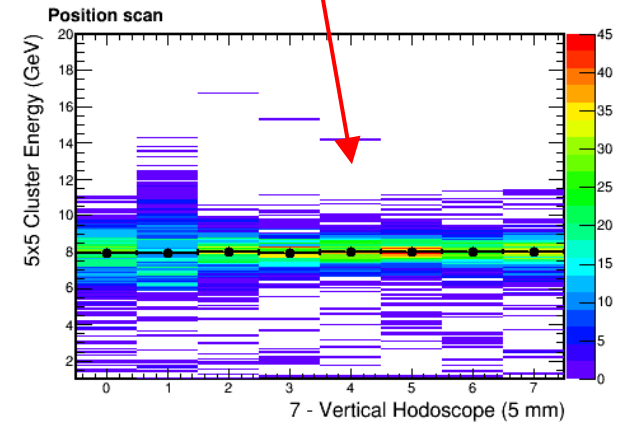
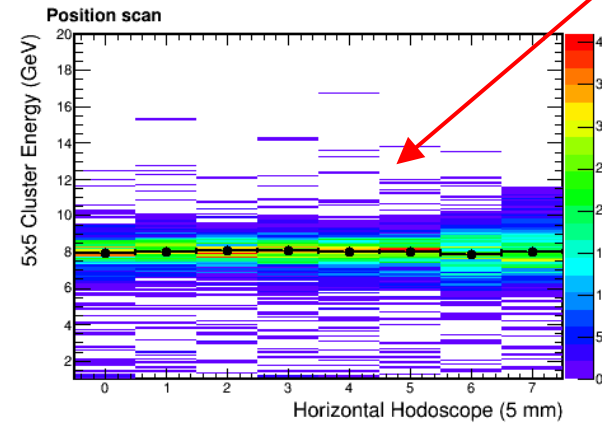
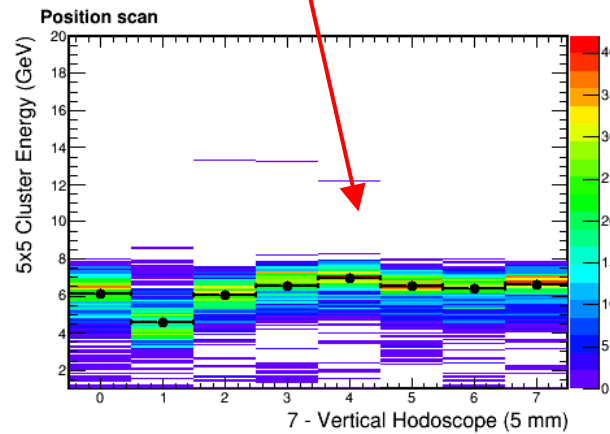
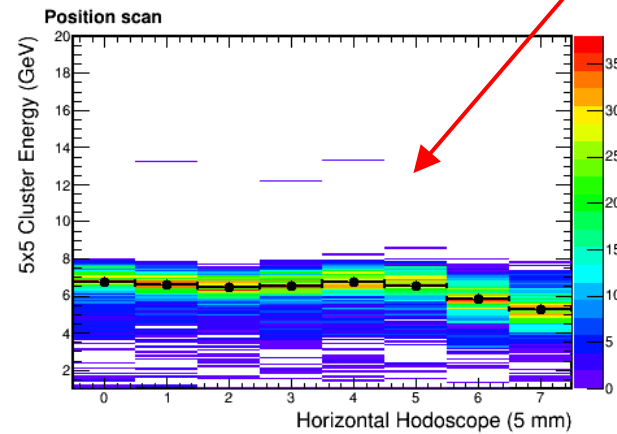


Nonuniformity indicates the difference in hodoscope finger response (8 GeV beam)

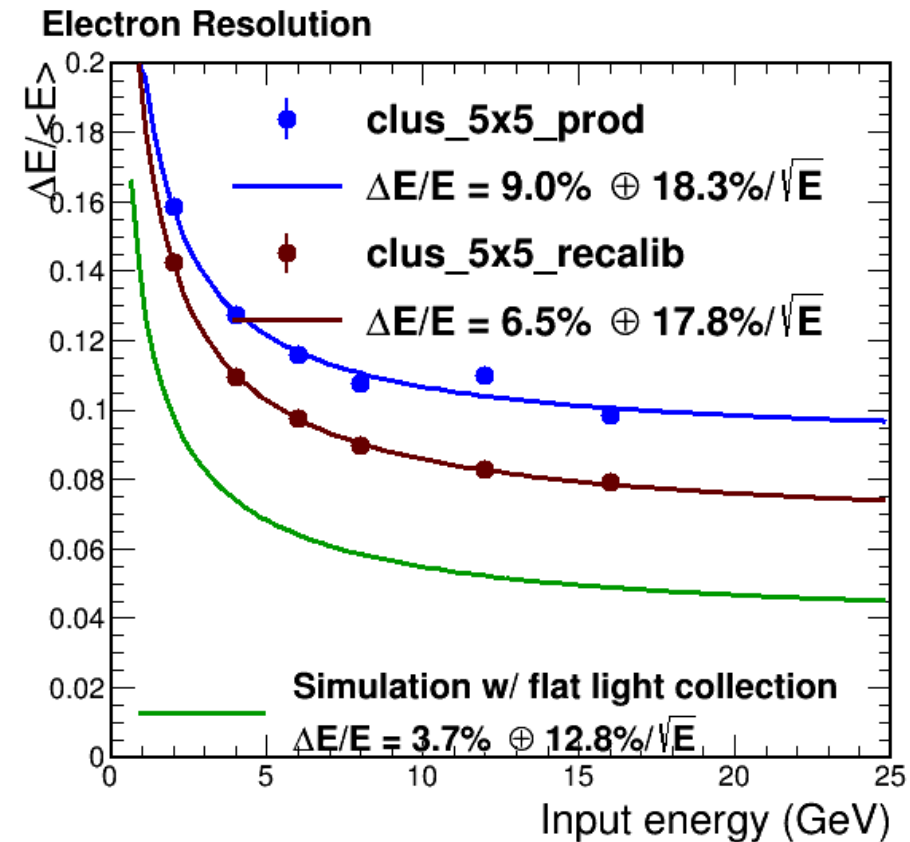
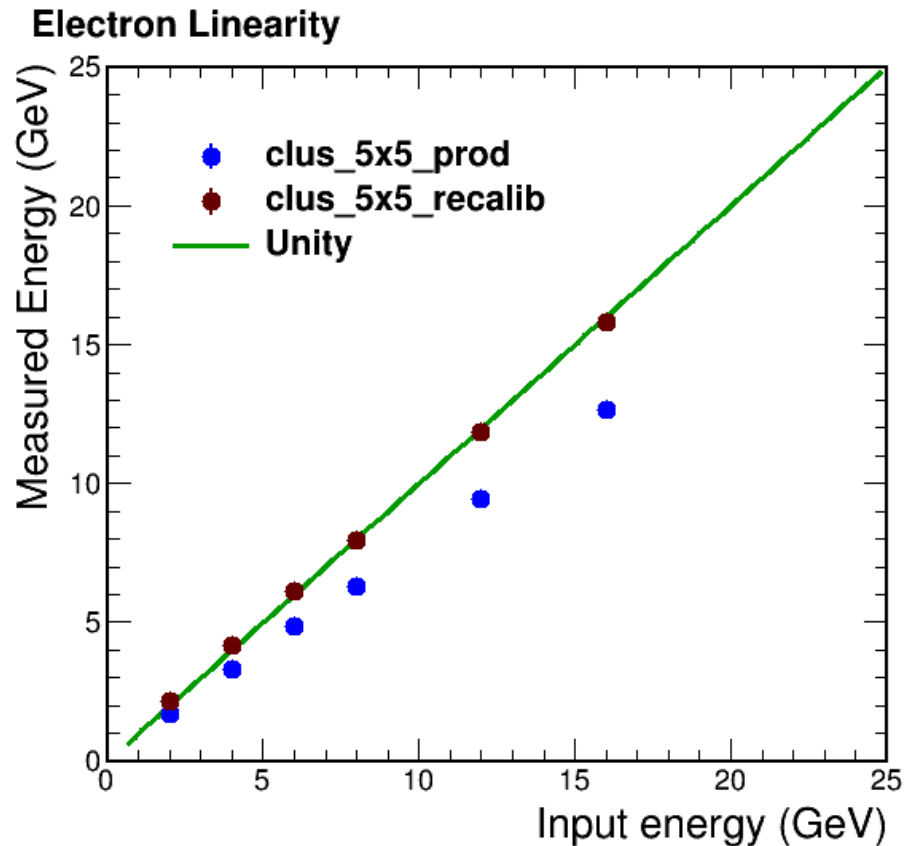
After Hodo Recal



Hodo recal centers at 8 GeV, but there is still some nonuniformity (orange bins in 2D plot to the left)



Third Joint Energy Scan Resolution

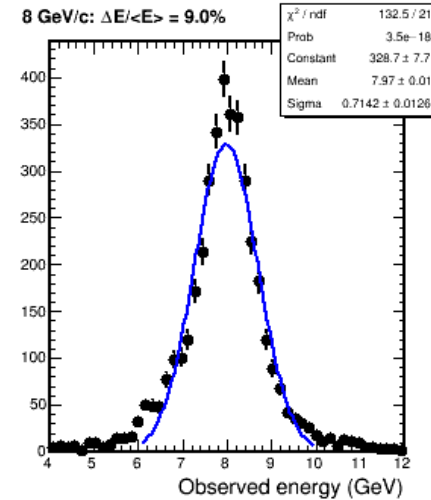
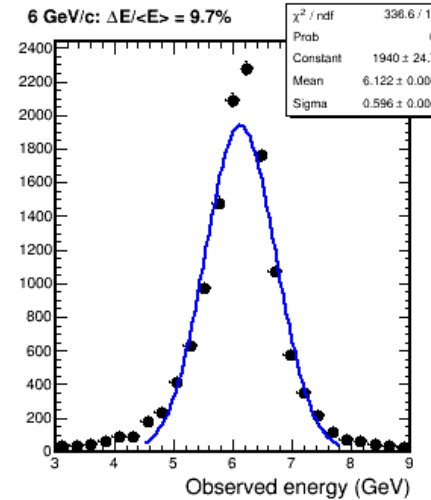
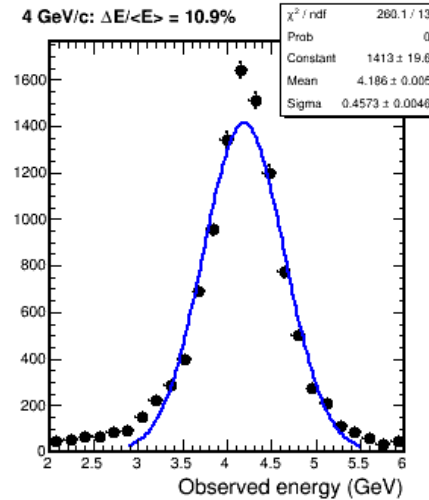
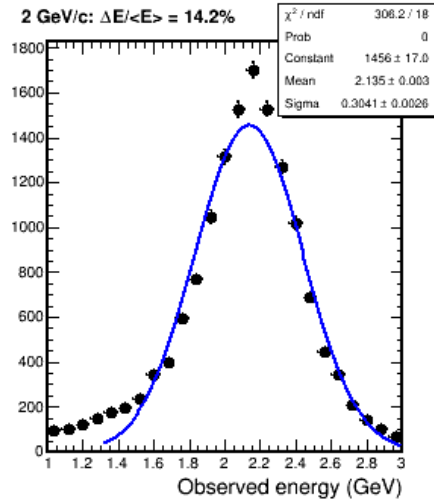


Resolution using all 8x8 hodoscope fingers

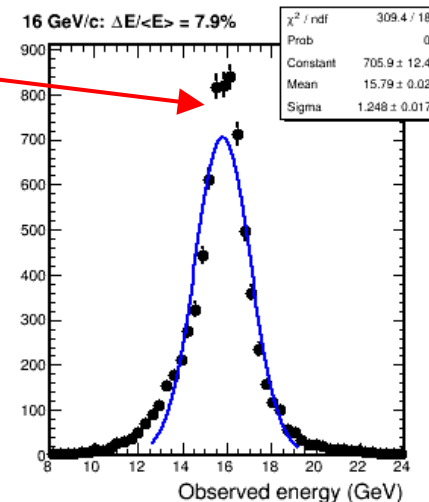
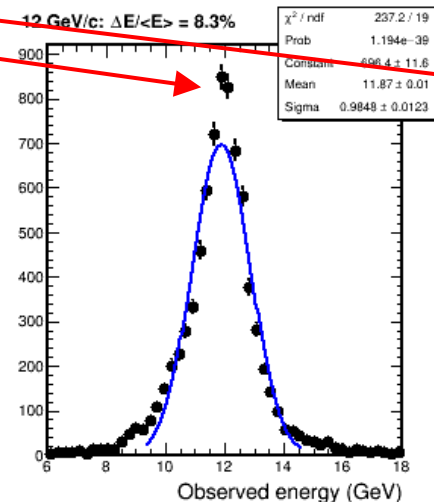
Hodoscope recalibration now improves the resolution, but it is still much worse than the first joint energy scan on page 8 (which didn't include block boundaries)

Energy Responses

- Still some tail from mis-measured energies
- Resolution could perhaps be improved by excluding the tails in the fits



- The fit doesn't properly account for the peaks in each energy bin



Conclusions

- Fixed bug in hodoscope recalibration code
- Recalibration improves resolution of the EMCal in both joint energy scans
- The block boundaries still introduce significant mis-measured energies that evidently the hodoscope recalibration can't fully correct for
 - These can be seen in the tails in the energy response on page 12
 - The resolution could be improved by narrowing the fit ranges on page 12, but the conclusion remains that there is still significant modification by the block boundaries (as one would expect)