

Near Detector Electronics Performance

- Previous Studies
- Preliminary Results from Caldet

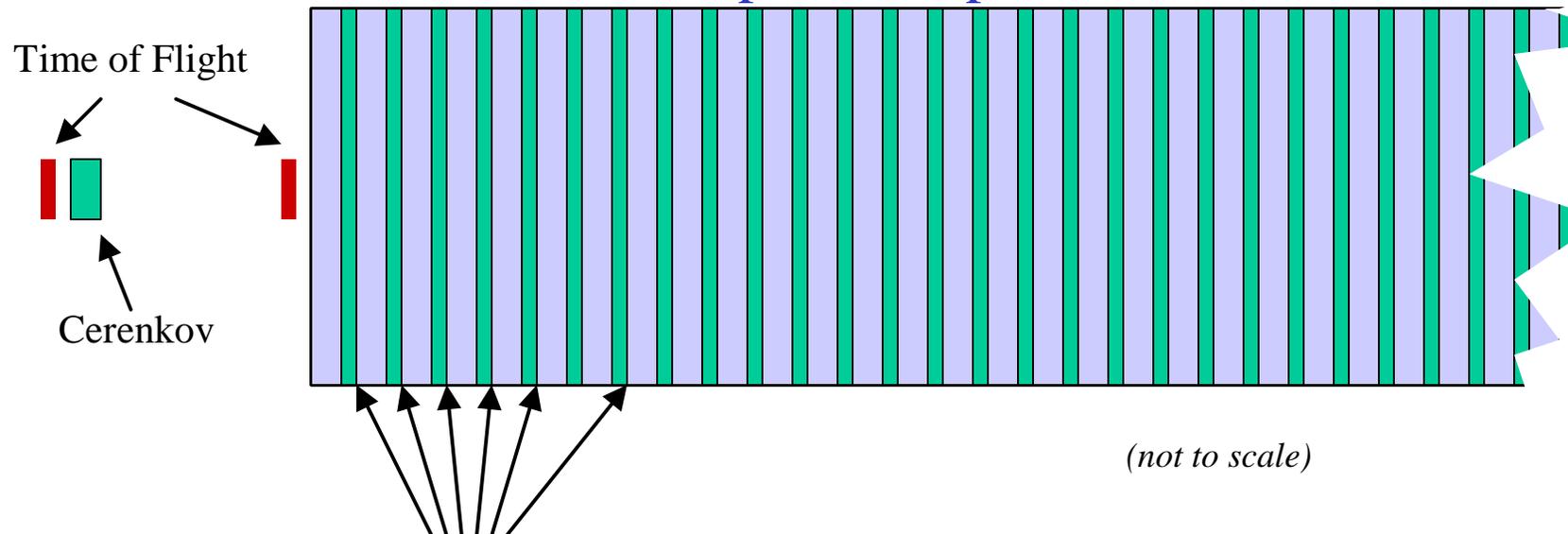
Previous Studies

- QIE Performance studies presented at April, 2002 review
 - Detailed studies of 2 QIEs with M64 PMT
 - http://home.fnal.gov/~shanahan/minos/ndfe_rev.pdf
- Argonne Teststands-
 - Development of system, performance studies, calibrations, preparation for Caldet

Caldet

150 Channels of Near Detector Electronics

- 6 planes out of 60 on one side
- T11 Beamline from Sept. 7 – Sept. 15, 2002

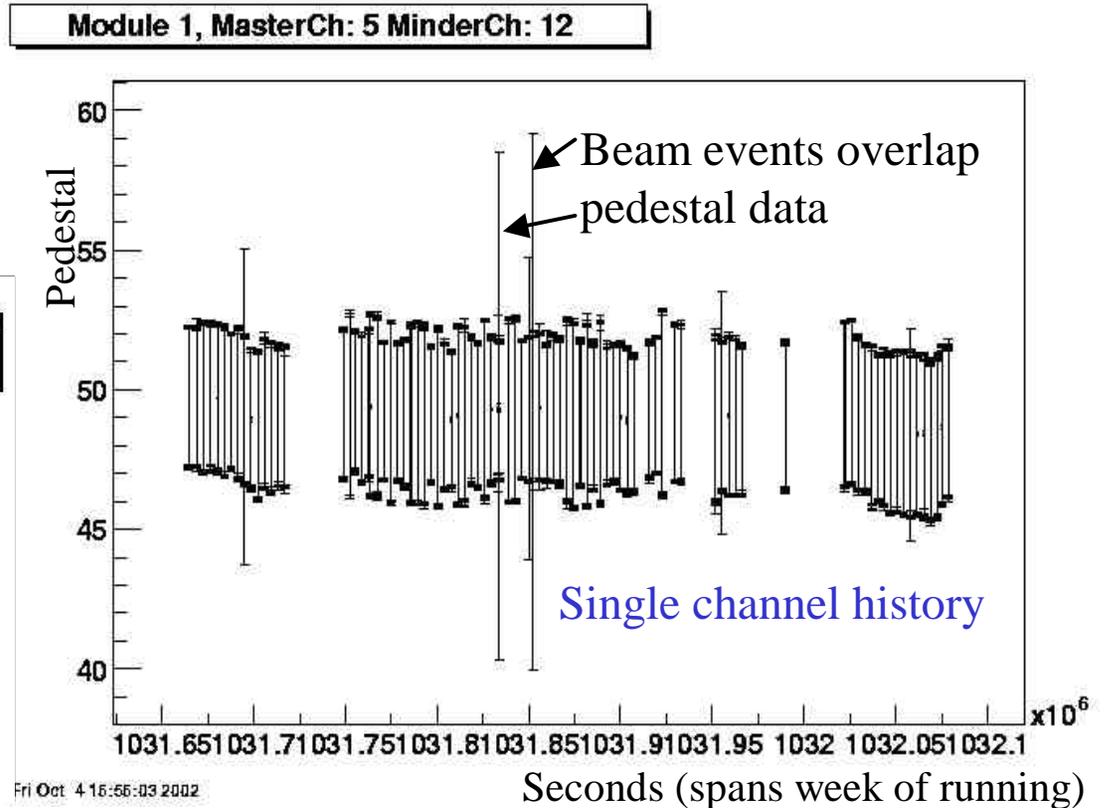
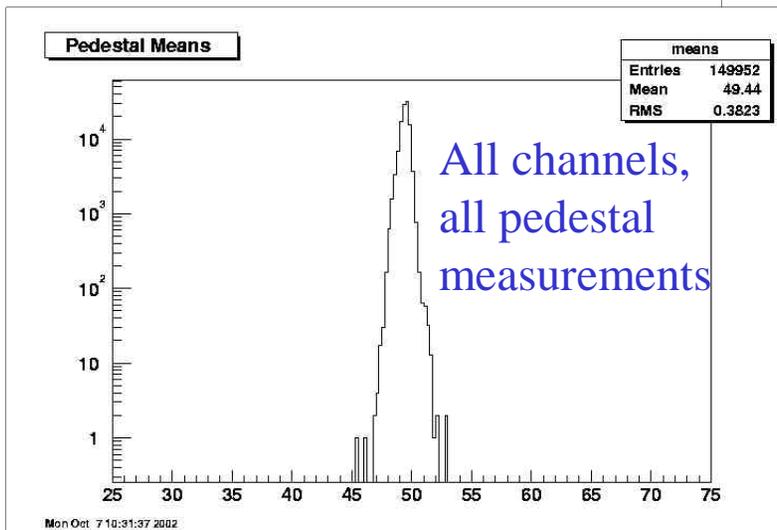


Caldet Run

- Several factors beyond scope of Nominal ND running
 - High rate dynode trigger running
 - External triggering
 - Timing issues between ND and FD electronics
- ND system performed extremely well
 - System of 150 channels ran smoothly for 1 week of production running with very few errors.

Stability Studies – Dave Reyna

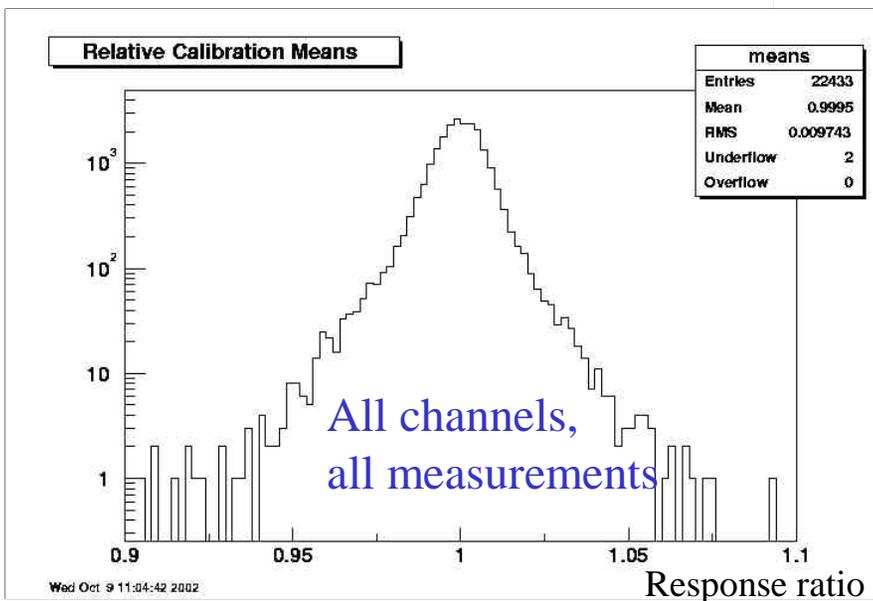
Pedestals stability throughout Caldet run



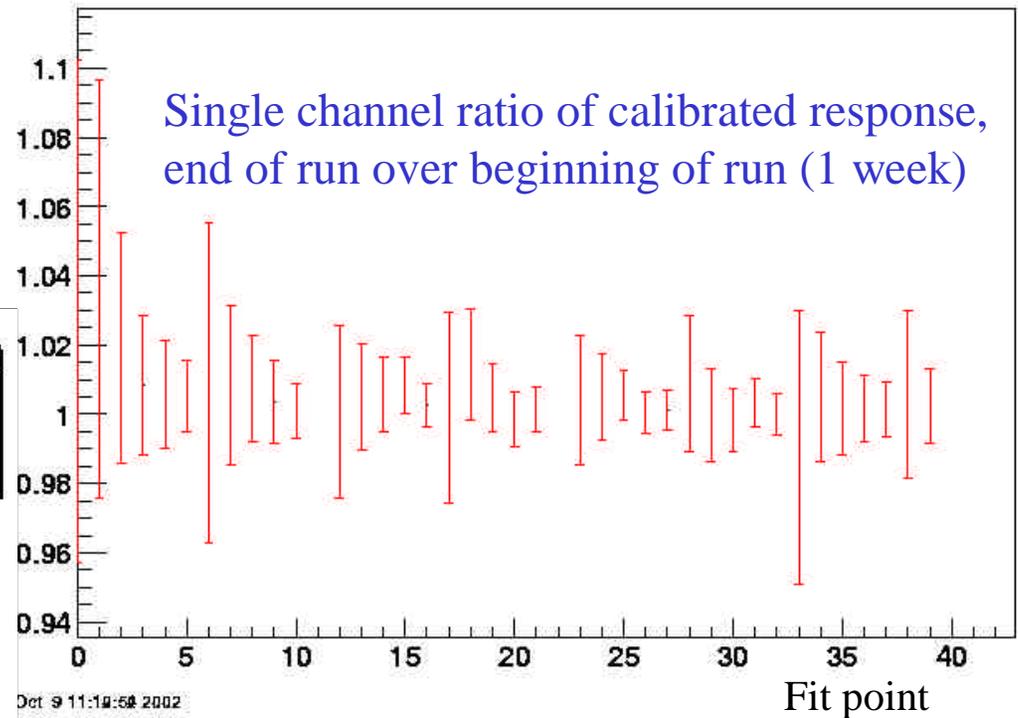
Some small pedestal drift with time (temperature?), but only on order of 1% of a PE

Stability Studies, cont.

- Calibration stability over run of 1 week:
 - Measure response with charge injection, relative to calibration



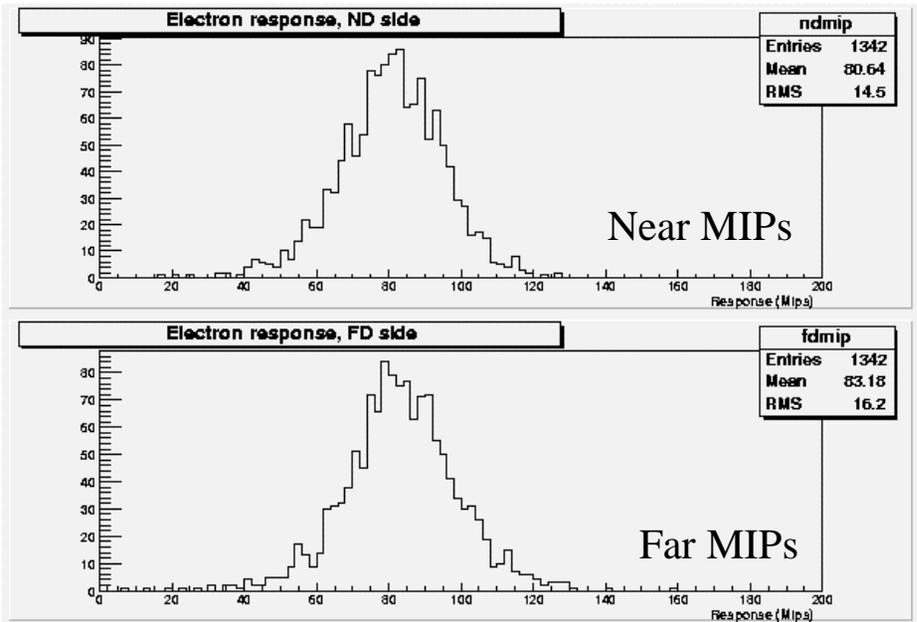
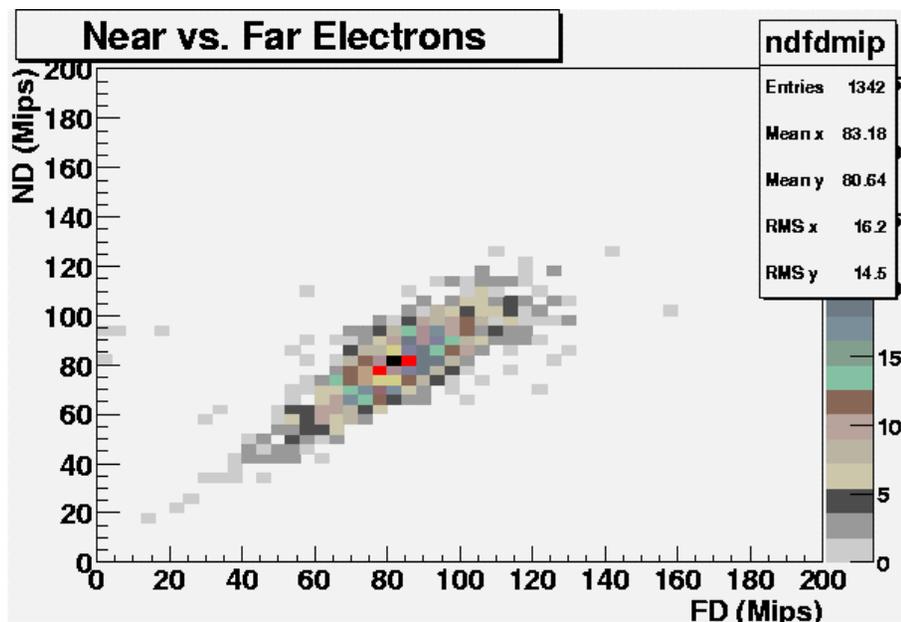
Module 0, MasterCh: 2 MinderCh: 3



Calibration is extremely stable:
0.05% mean, 1% rms

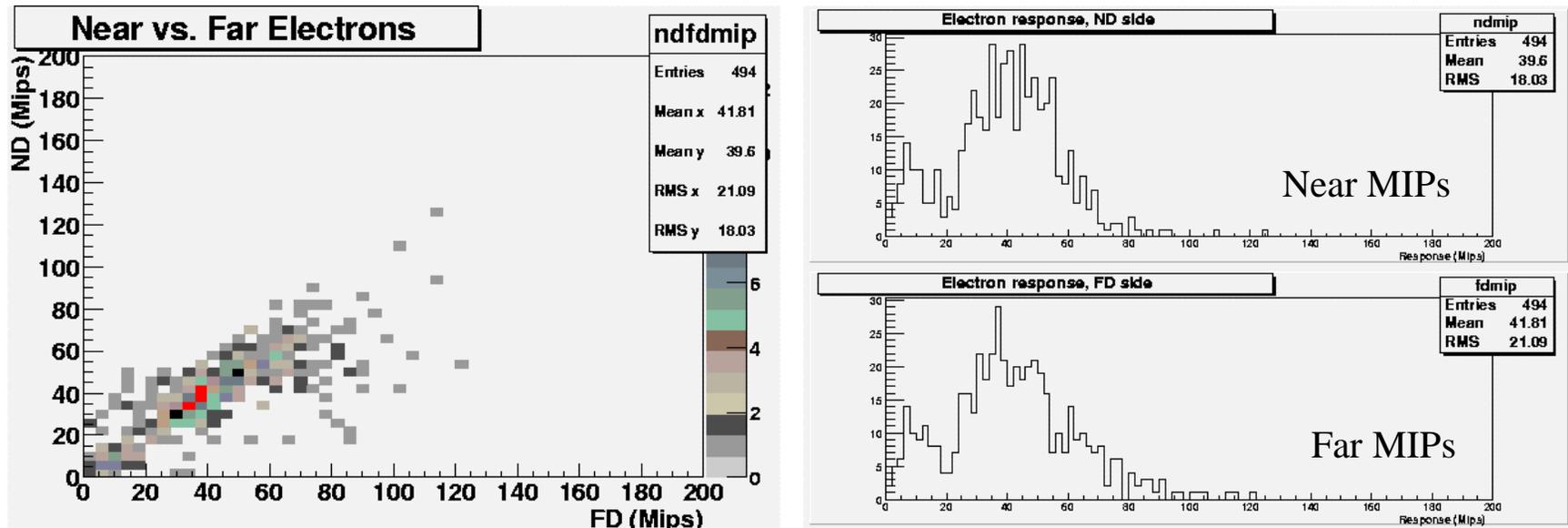
Preliminary Caldet Electron Analysis

- Electron cuts a la Trish:
 - Cerenkov ADC, TOF-Cerenkov timing, max energy near center of plane 1, etc.
 - 3 GeV/c electrons, run 31265



Caldet Electron Analysis, cont.

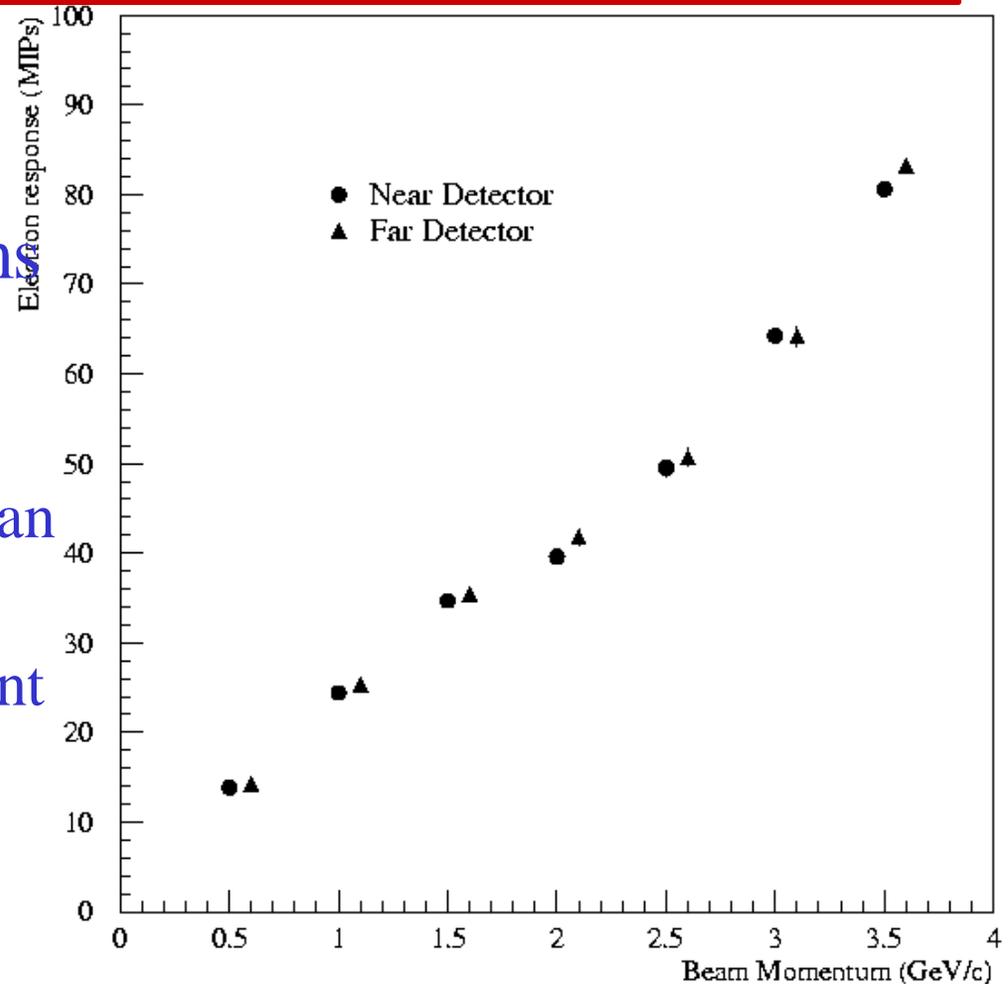
- Not all runs are as nice as 31265...
 - 2 GeV/c electrons in 31398....



- Low response events (below 20 MIPs) common to both sets of electronics

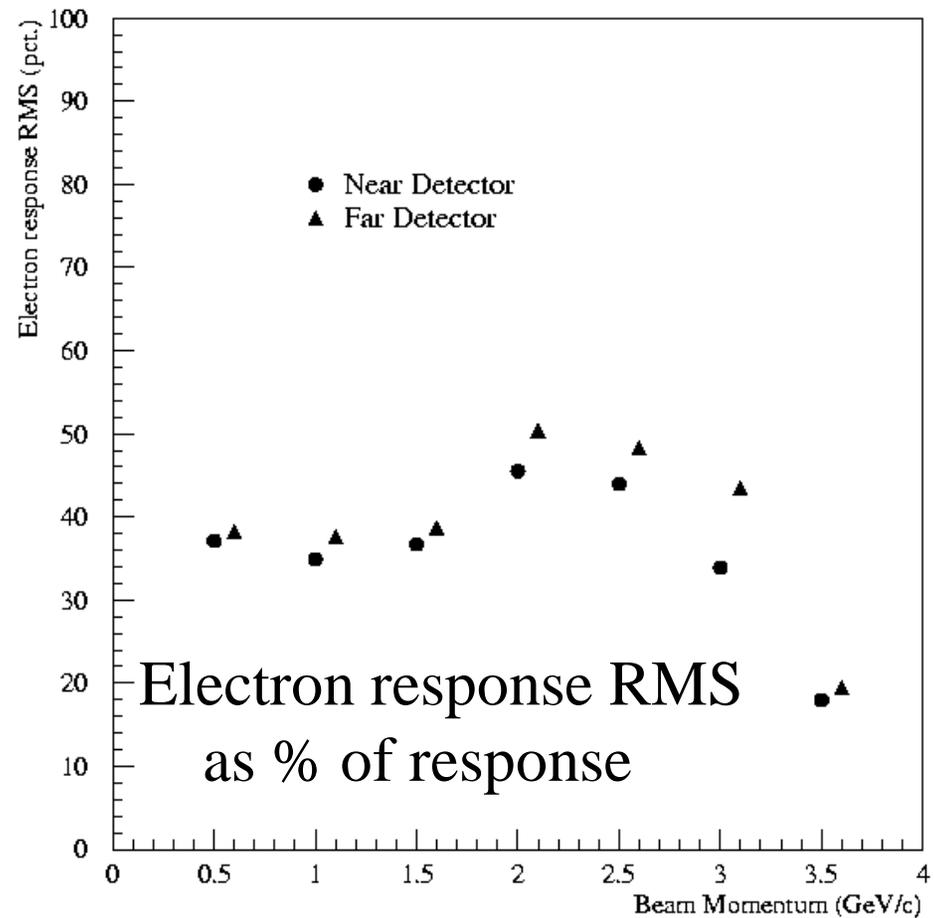
“Linearity”

- ND and FD responses track each other well, despite obvious problems with electron selection
 - Worst case: 5% disagreement, but less than 2σ effect
 - Typically 2-3% agreement



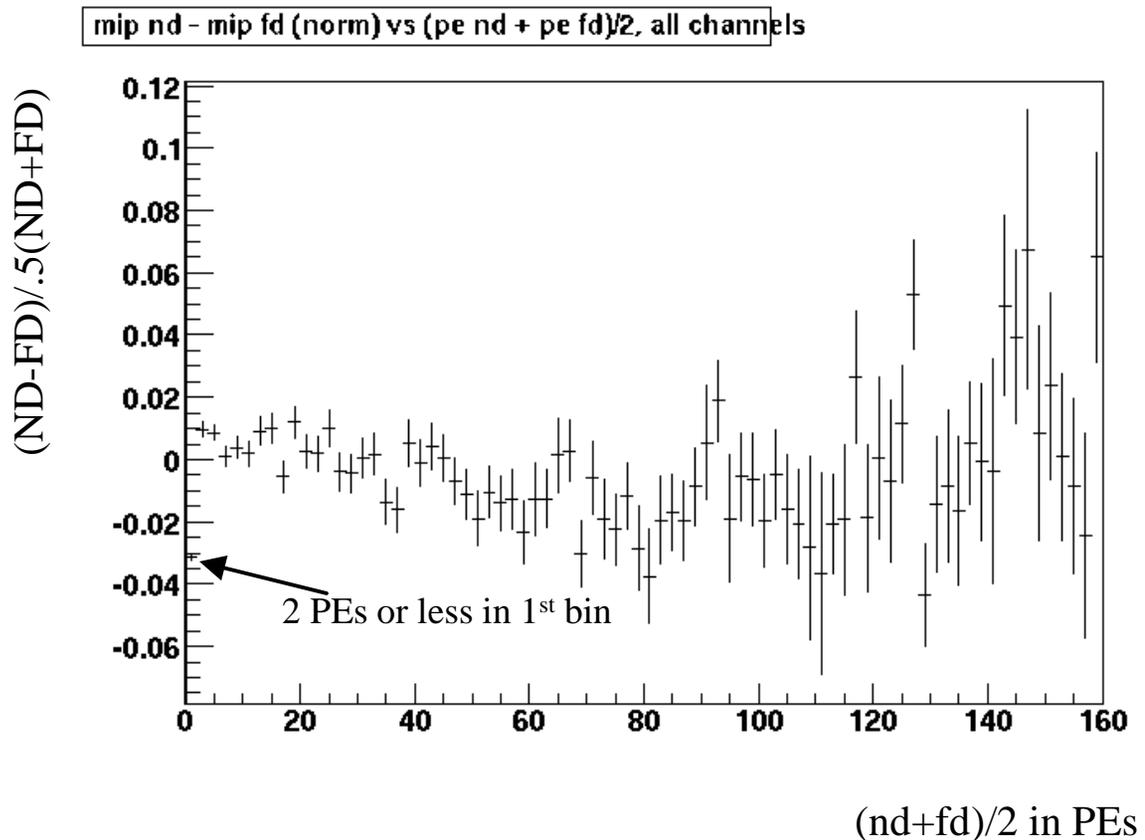
“Resolution”

- Less agreement than response plot
 - However, RMS is more susceptible to a handful of outliers
 - Effects of “missing” plane 6 as function of electron energy...
 - Not a source of concern at this time



Channel Correlation

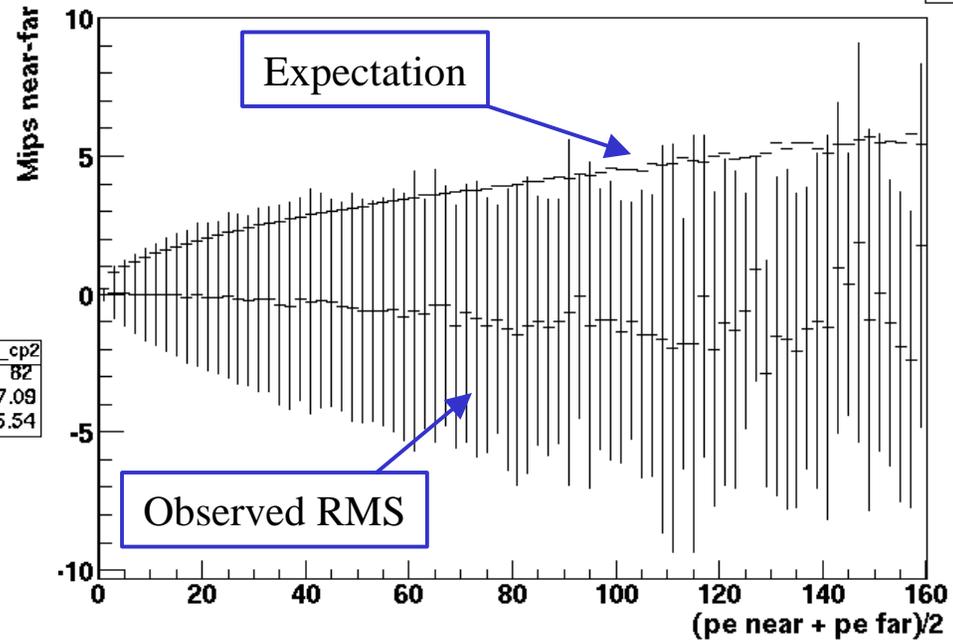
- Study individual strip Near-Far response in MIPs
 - Combine several strips for statistics
- Mostly within $\pm 2\%$
- There will be different threshold effects between the ND and FD in lowest bin



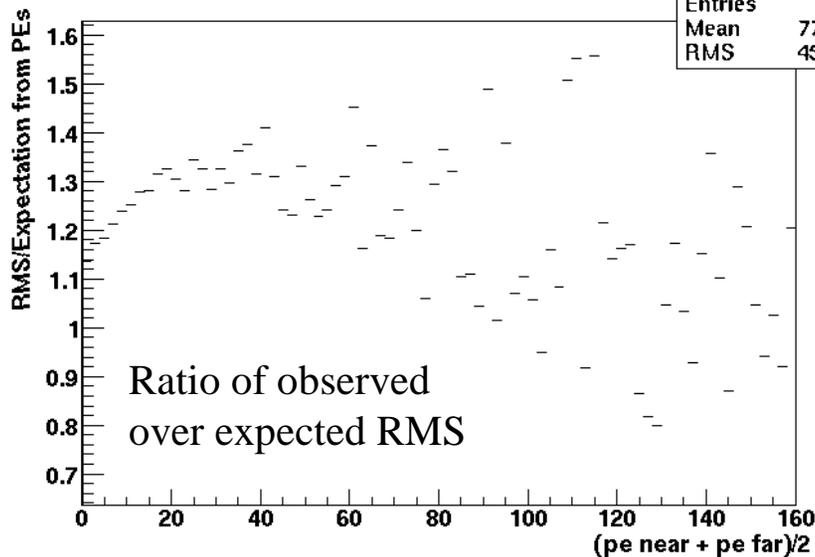
Channel Correlation, cont.

- Test: is $\sigma(\text{ND-FD})$ consistent with photostatistics?

mip nd - mip fd vs (pe nd + pe fd)/2, all channels



mip nd - mip fd vs (pe nd + pe fd)/2, all channels



~20% difference is to be expected due to secondary emission statistic
- comparison looks reasonable

To Do

- Some performance tests remaining at Argonne
 - E.g. dynode discriminator sensitivity
- Caldet Analysis
 - Look at more runs!
 - Improve electron analysis
 - Mip efficiency studies
 - Light injection data – Liz Buckley-Geer
- Production wouldn't be held up for each of these...

Summary

- Near Detector Front End Electronics prototypes have been thoroughly tested in several environments
 - Argonne and Fermilab teststands
 - Caldet
- 1 week of solid Caldet running showed system to be reliable and comparable to the FD in response
 - ... with more work needed on analysis.