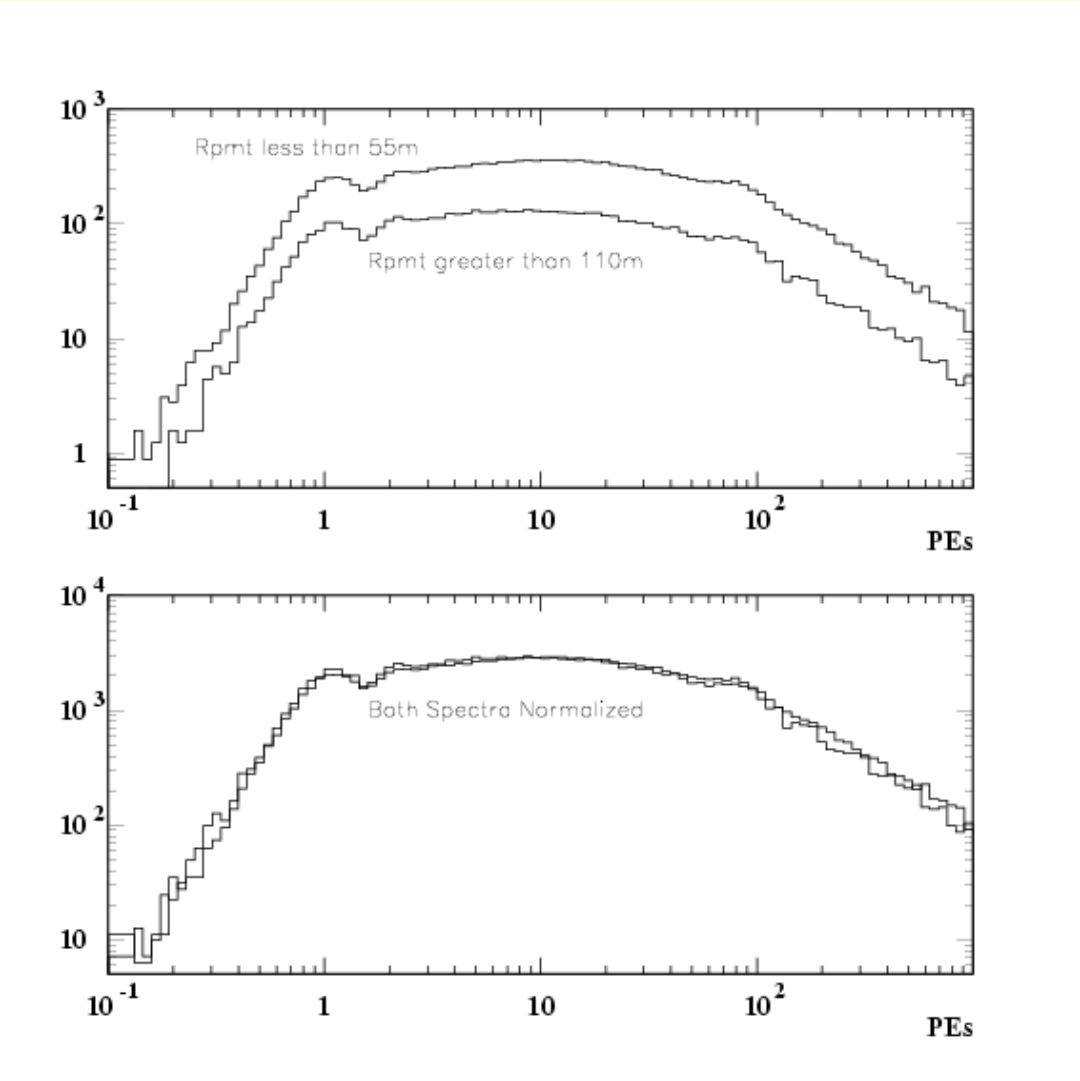
Outrigger PE Calibration

Andrew Smith, UMD

Outrigger PE Spectra from MC

The outrigger calibrations are based on a single model outrigger spectrum:

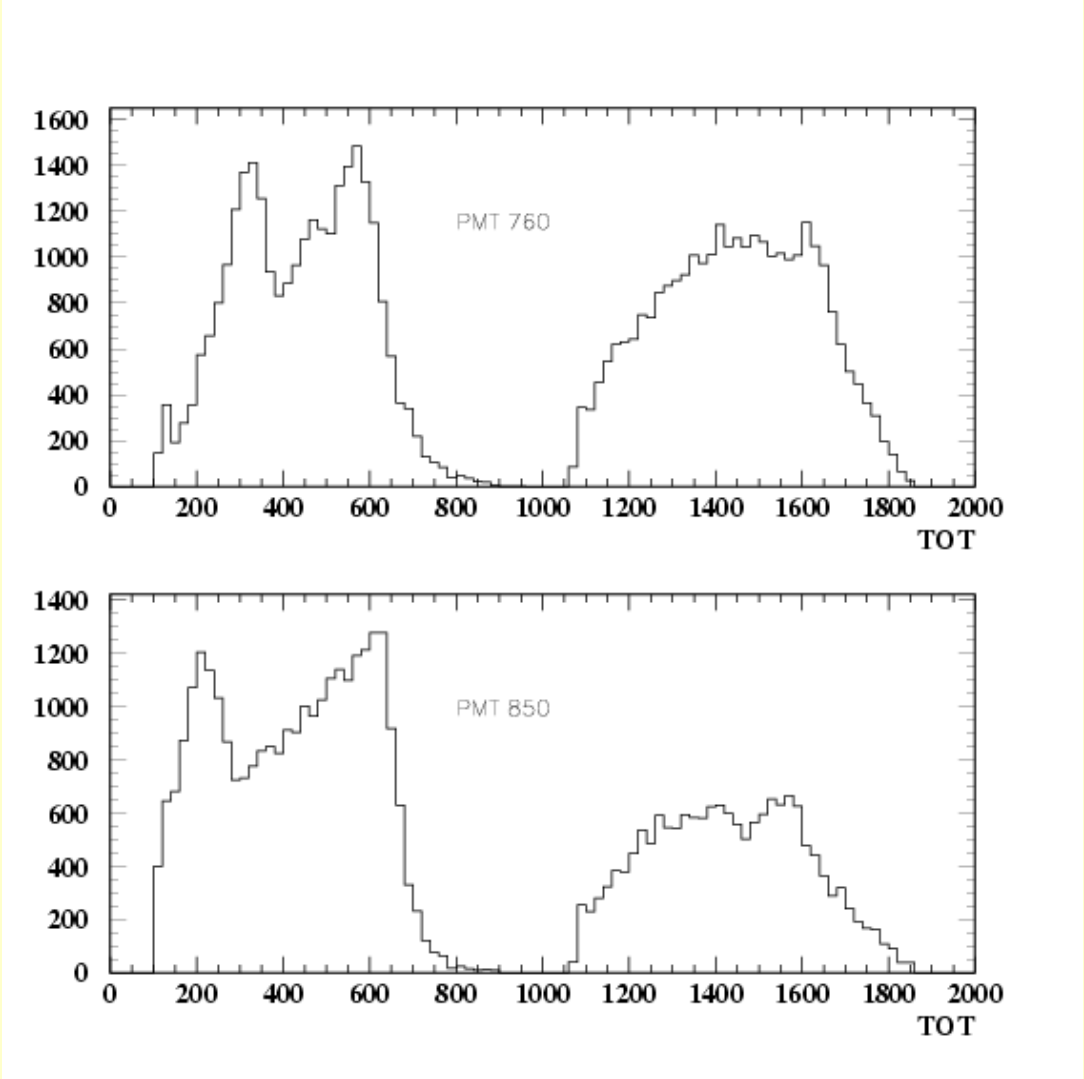
Although the outrigger hit occupancy seems to change with radius (inner counters hit more), both inner and outer counters seem to have nearly identical spectra.



TOT Spectrum from Data

Selected data taken at night to avoid the light leaks.

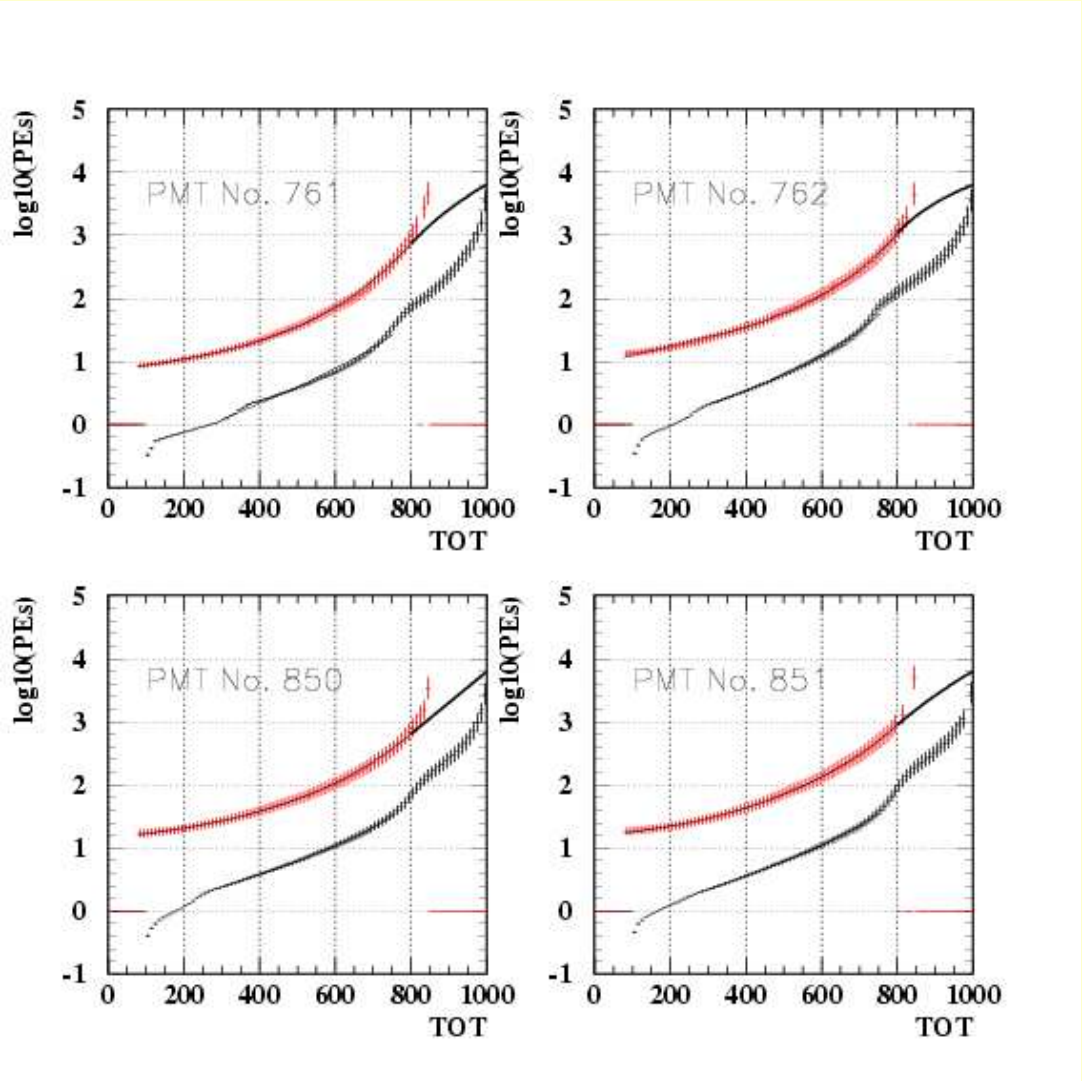
TOT distributions from 2 outrigger. The long cables and short cables produce qualitatively different TOT distributions.



Calibration Fits

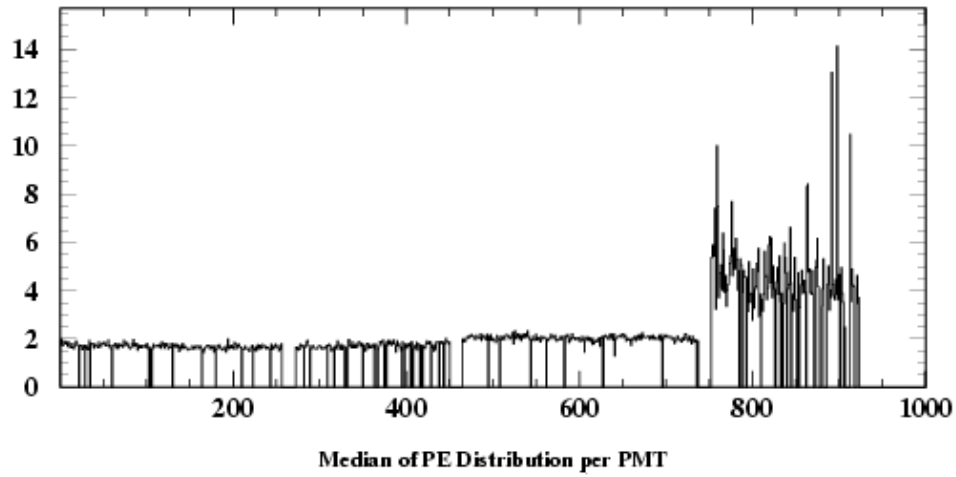
The TOT and MC PE spectra were connected and the the data were binned in log10(PEs) vs TOT.

The binned data were fit to the standard calibration functional form. The range of the fits was expanded from hiTOT=700 to hiTOT=800.

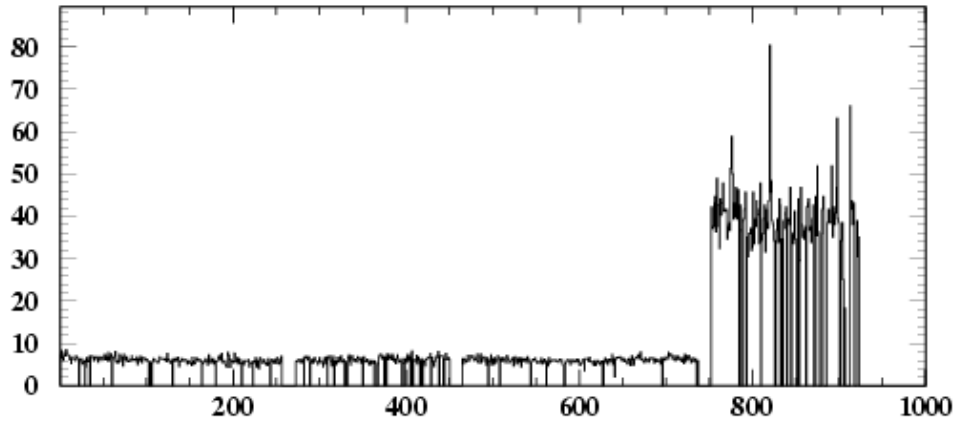


How these Calibrations Look in Data

From the online monitor program:



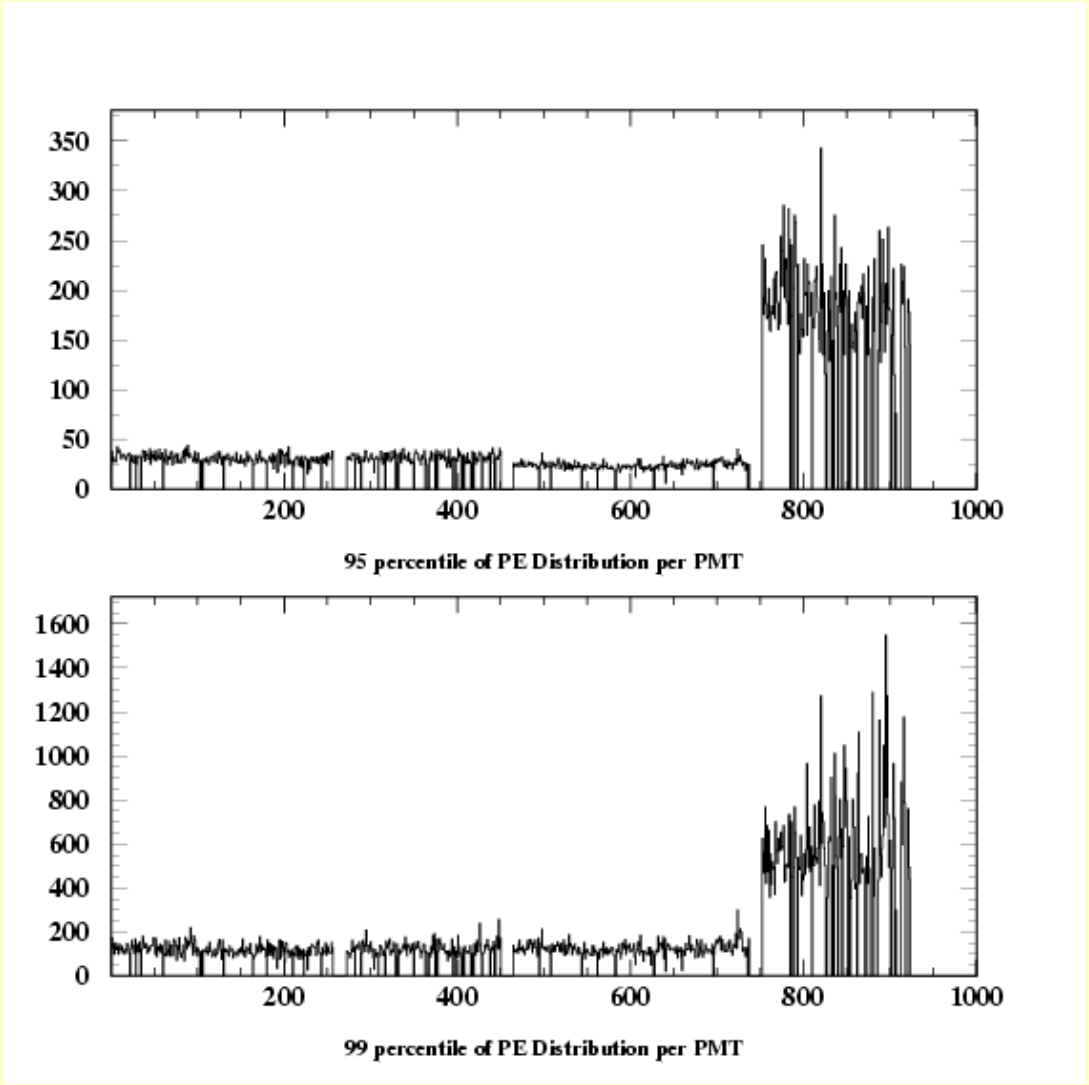
Median of PE Distribution per PMT



80 percentile of PE Distribution per PMT

How these Calibrations Look in Data

From the online monitor program:



Outrigger Reconstruction Software

What we need to accomplish:

- For the first 3 years of running (No outriggers) we observed ~4σ/year on the crab.
- Claimed 2+ years ago in our outrigger construction proposal that $Q_{outrigger} \cong 2.1$. (~1.3x from Angular Res., ~1.6x from γ/hadron separation?)
- Currently have ~.7 years of crab full outrigger array crab data on disk. This should be sufficient to confirm our resolution claims.
- All the tools are in place accept software/calibration to achieve and confirm our sensitivity improvements.

Outrigger Calibration

Current outrigger calibration status:

PE Calibration:

- Using spectrum calibration. Match spectrum to MC spectrum. (Previous talk)
- Software in place to do calibration in ~1-2 days if with clean data.

Timing Calibration:

- Slewing based on a single outrigger that received good light. Same slewing curve used on all outrigger. Maybe OK approximation for short cables, but certainly bad for long cables.
- Pedestals not online. No way to get Tpeds from laser, because we can't measure “cable length”.

Outrigger Software

Current reconstruction software status:

Ty's ORCOM fitter is online now: (Add dates here)
Uses outriggers OR pond detectors to identify core position. Determines off vs on based on number of pond and outrigger hits.

Tony's Gaussian fitter (NOT?) in software CVS library.

Outrigger angle fitting software NOT in software CVS library.

Cuts NOT optimized for γ/hadron separation with outriggers.

Stuff to Do – Calibration

We should do this.

Stuff to Do – Software

Ty's Core fitter is online, and should be yielding ~10%-20% improvement based on improved curvature correction.

Need to add outriggers to angle fitting (~10%-20% improvement?)

Need to optimize γ/hadron cuts to account for the improved knowledge of the core. (The bulk of the unrealized improvement)

- Devising cuts, X_2, Core Radius, MARs?
- Improve MC to account for calibration,TOT,saturation effects.
  Analyze data with by with event weighting, PSF and S/N
- Need to find someone to reconstruct the data and look at it.