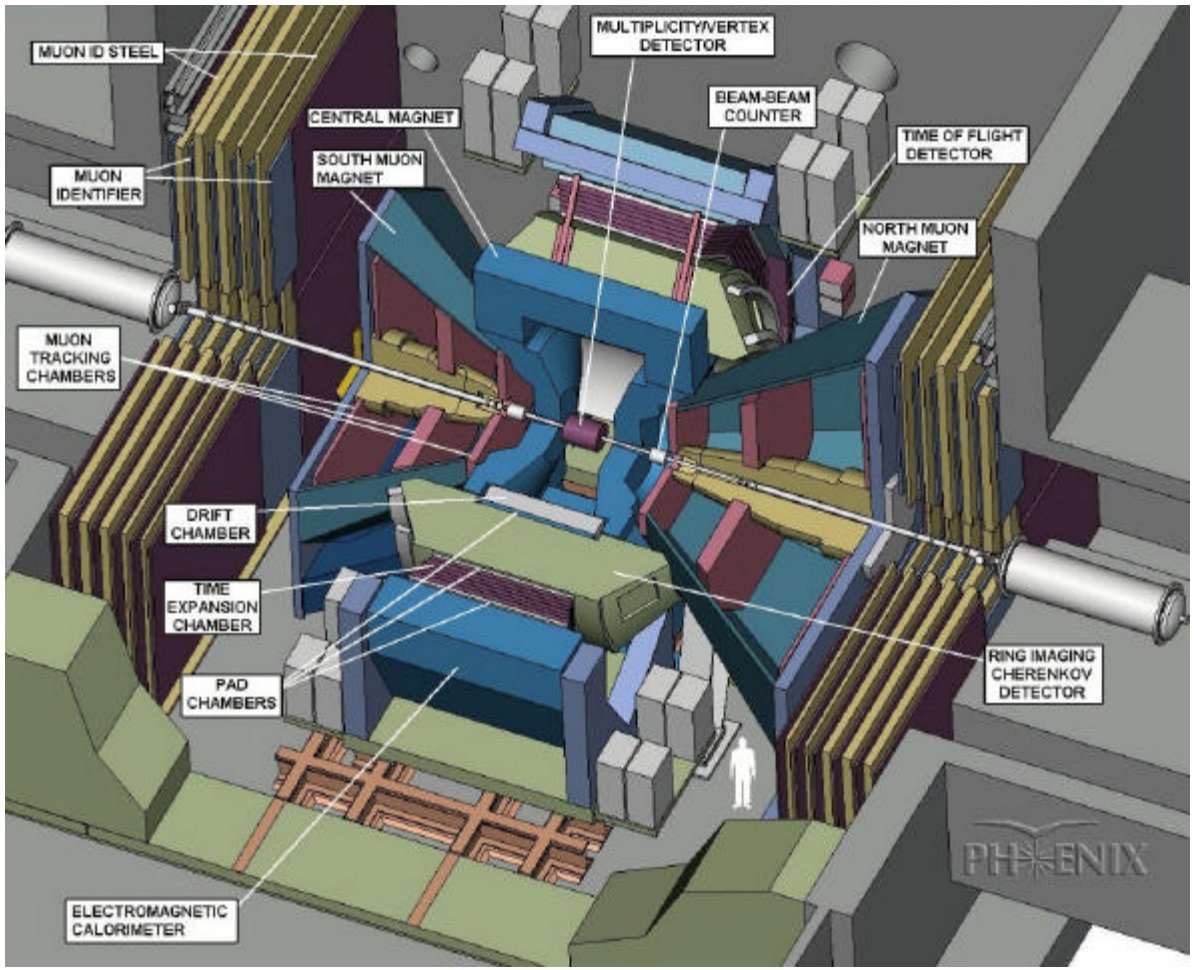
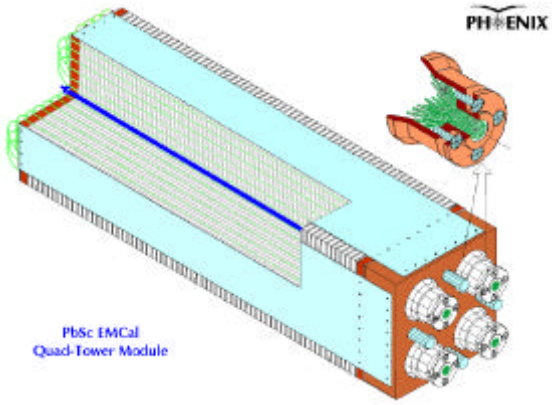
E.Kistenev for the PHENIX Collaboration

Performance of the PHENIX PbSc Electromagnetic Calorimeter
(first year running experience)



- Test beam summary
- Year-1 configuration
- Transporting the calibration
  $\pi 0$ reconstruction
- Electron identification
- Summary



Special thanks to: Y.Akiba, A.Bazilevsky, G.David, S.Mioduszewski, H.Torii

Overview

Item	PbSc	PbGl
η Coverage	± 0.35	± 0.35
ϕ Coverage	$3 \times 45°$	$45°$
Single wall active area	399×420 cm^2	394×426 cm^2
Cell Size (cm^3)	$5.25 \times 5.25 \times 37.0$	$4.0 \times 4.0 \times 40.0$ (TF1)
Channel count	18240	9984
Depth (radiation lengths)	$\approx 18X_\circ$	$16X_\circ$
Sampling Fraction	$\approx 20\%$	100%
Readout	PMT (FEU115M)	PMT (FEU84)

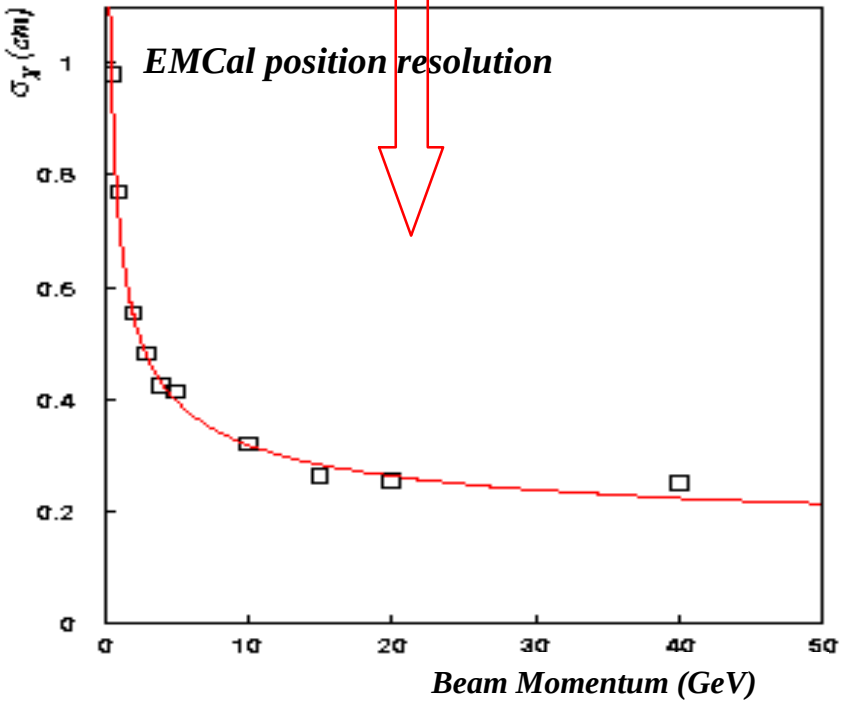
Characteristic	PbSc	PbGl
Energy Range (GeV)		
Au + Au collisions	0.1–50	0.1–50
p + p collisions	0.1–50	0.1–50
Least count (GeV)	0.002	0.002
Dynamic Range	15-bit (12+3)	15-bit (12+3)
Energy Resolution %	$8/\sqrt{E} \oplus 1.5$	$5.8/\sqrt{E} \oplus 1.$
Timing Resolution (ns)	$0.07 + 2.7/\sqrt{N_{pe} \cdot E_{Dep}}$	$0.075 + 3.75/\sqrt{N_{pe} \cdot E_{Dep}}$
Spatial Res., σ_x (mm)	$< 10./\sqrt{E(GeV)}$	$(5./\sqrt{E(GeV)} + 1.)$

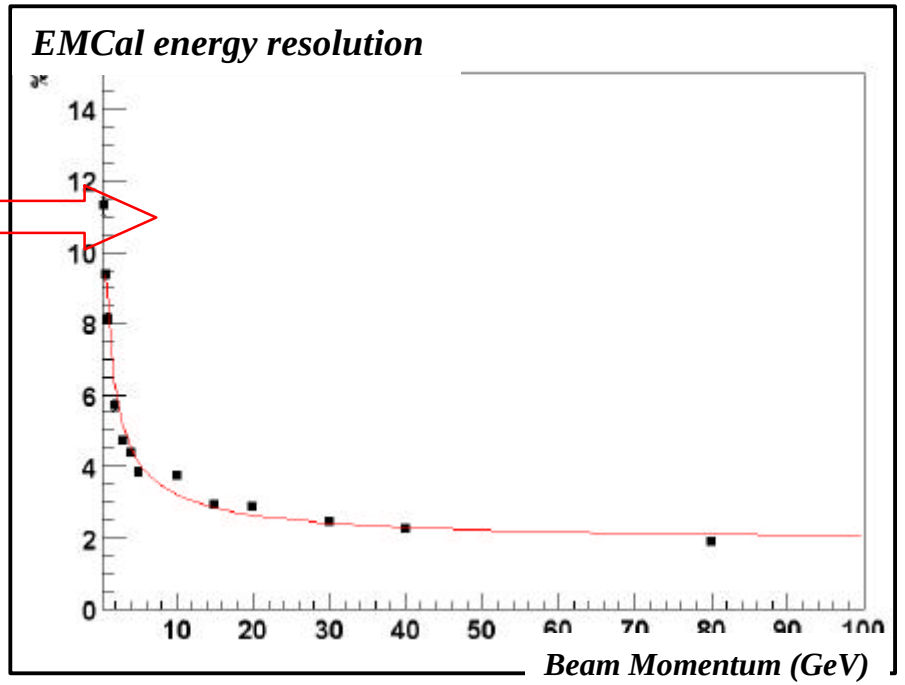
Energy and Position Resolution

AGS & SPS data

$\sigma(E)/E = 1.9\% \oplus 8.2\%/\sqrt{E}$

$\sigma(x) = 1.3 + 6.0/\sqrt{E}$ [mm]





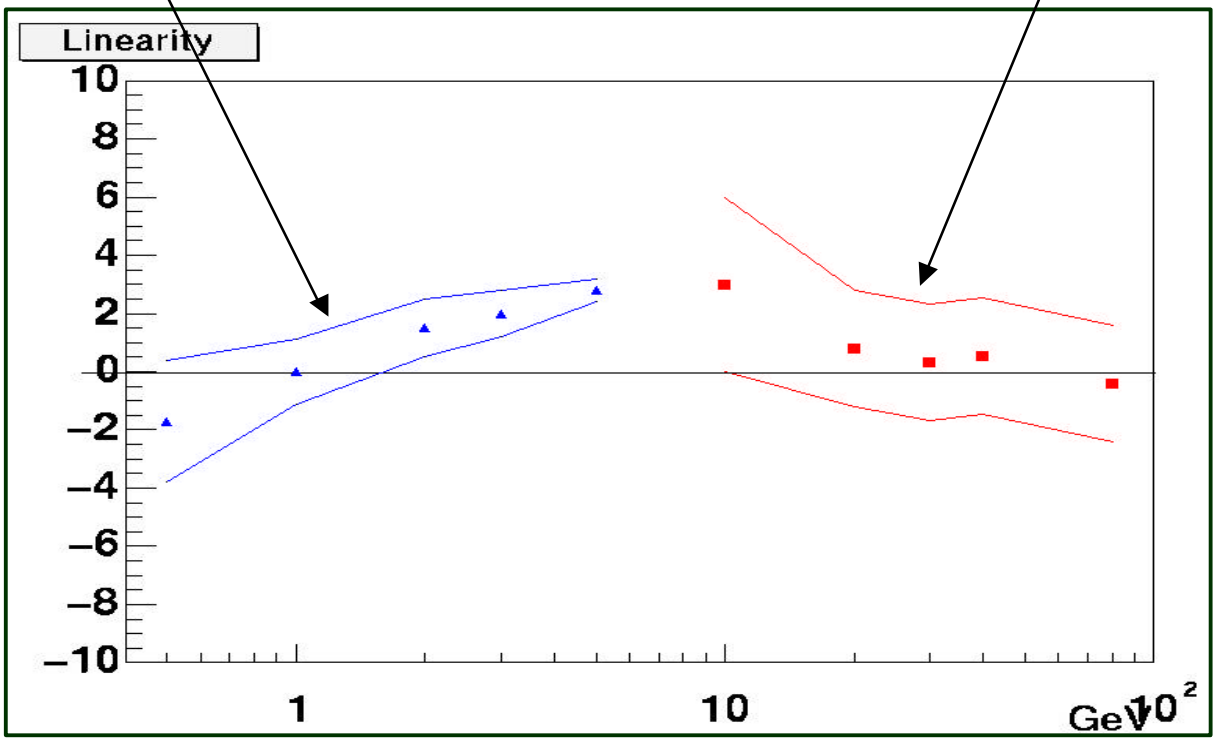
Linearity of the energy measurements

AGS:

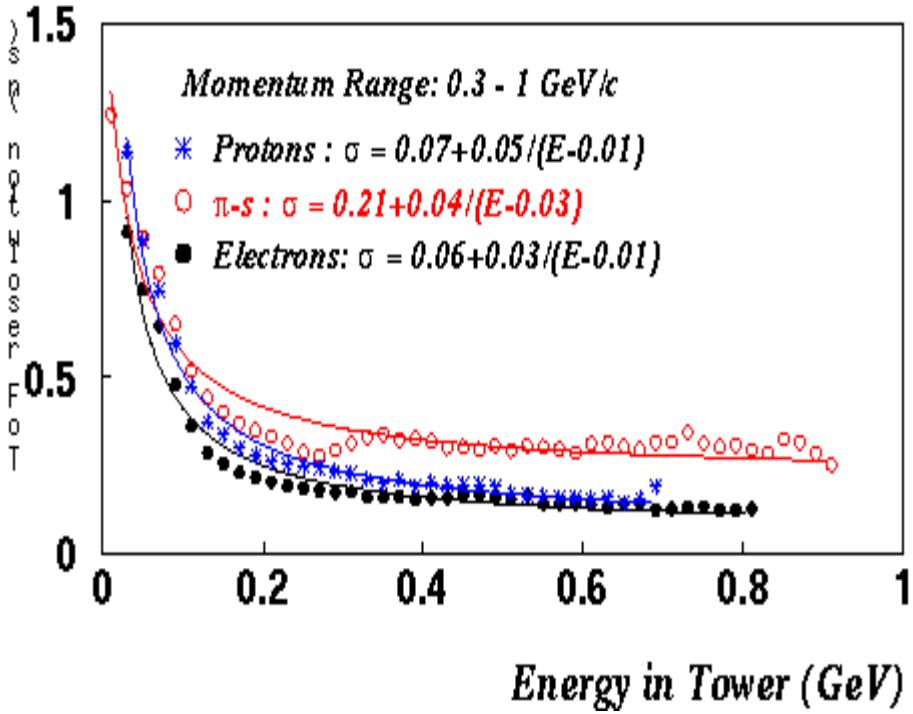
Dominant effect: light attenuation in the WS fibers (effective L_{att} ~ 100 cm)

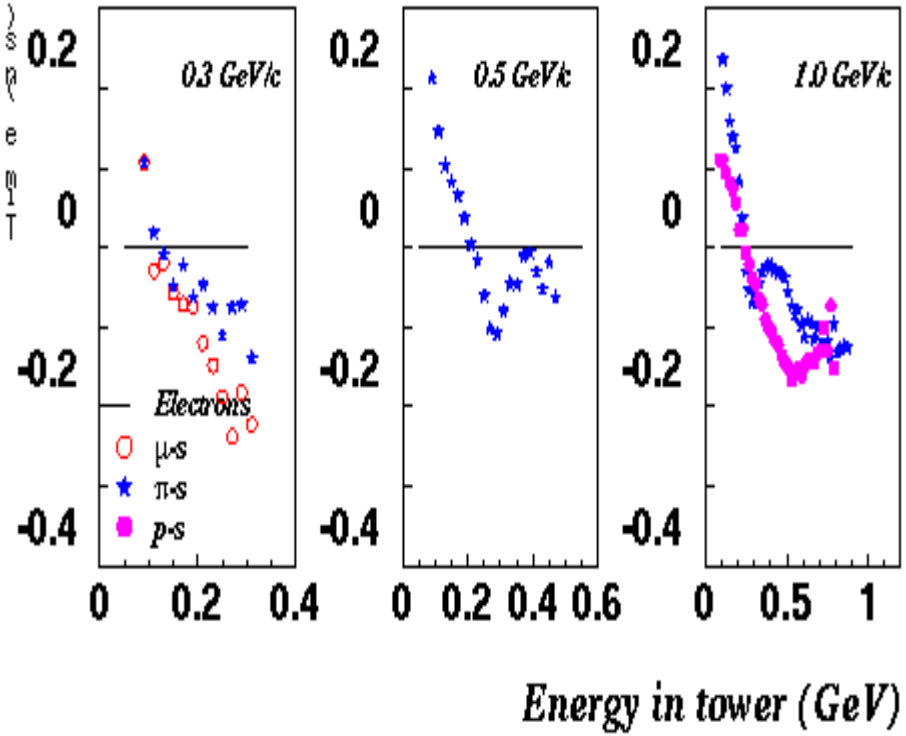
SPS:

Dominant effect: energy leakage

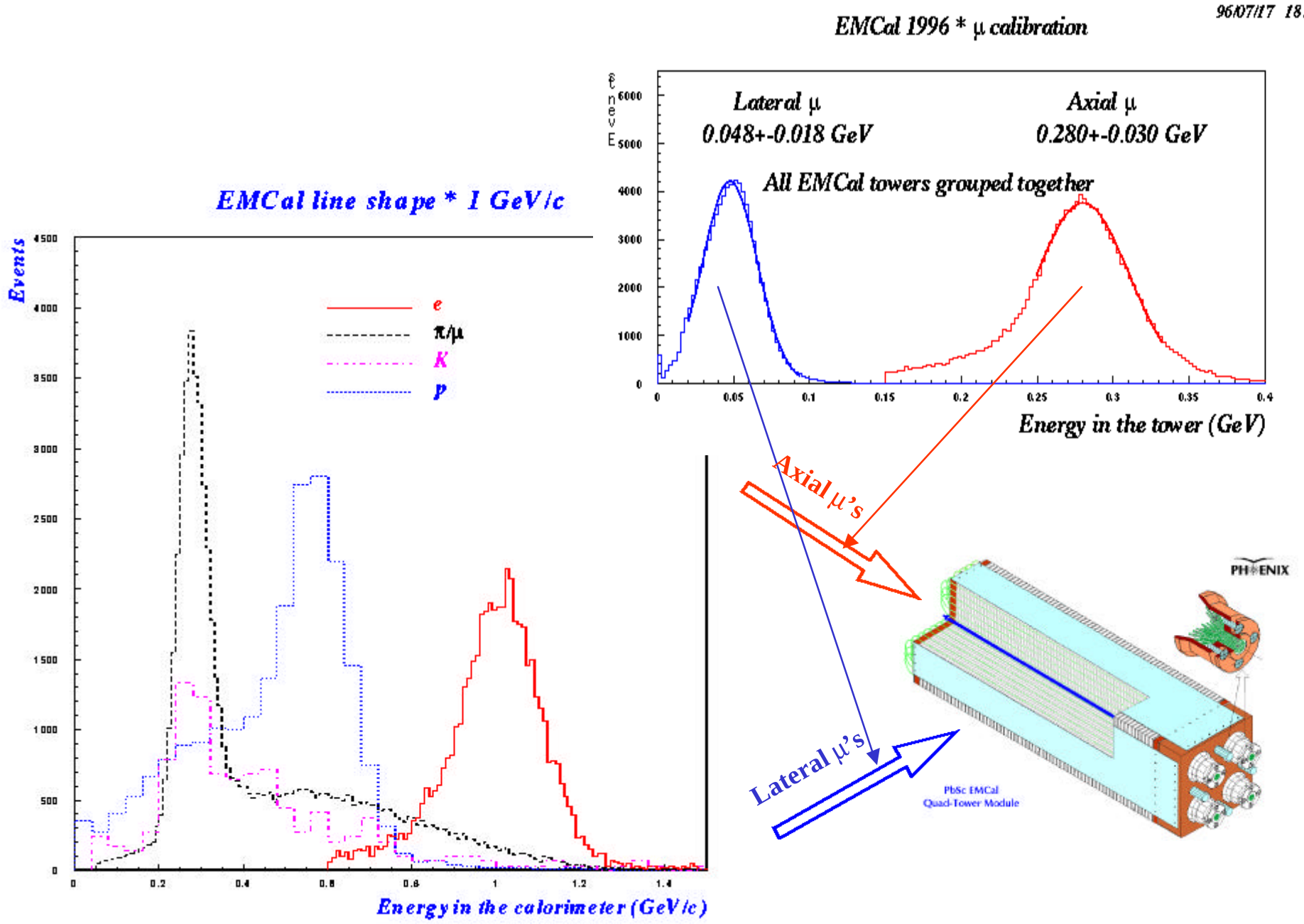


EMCal timing resolution

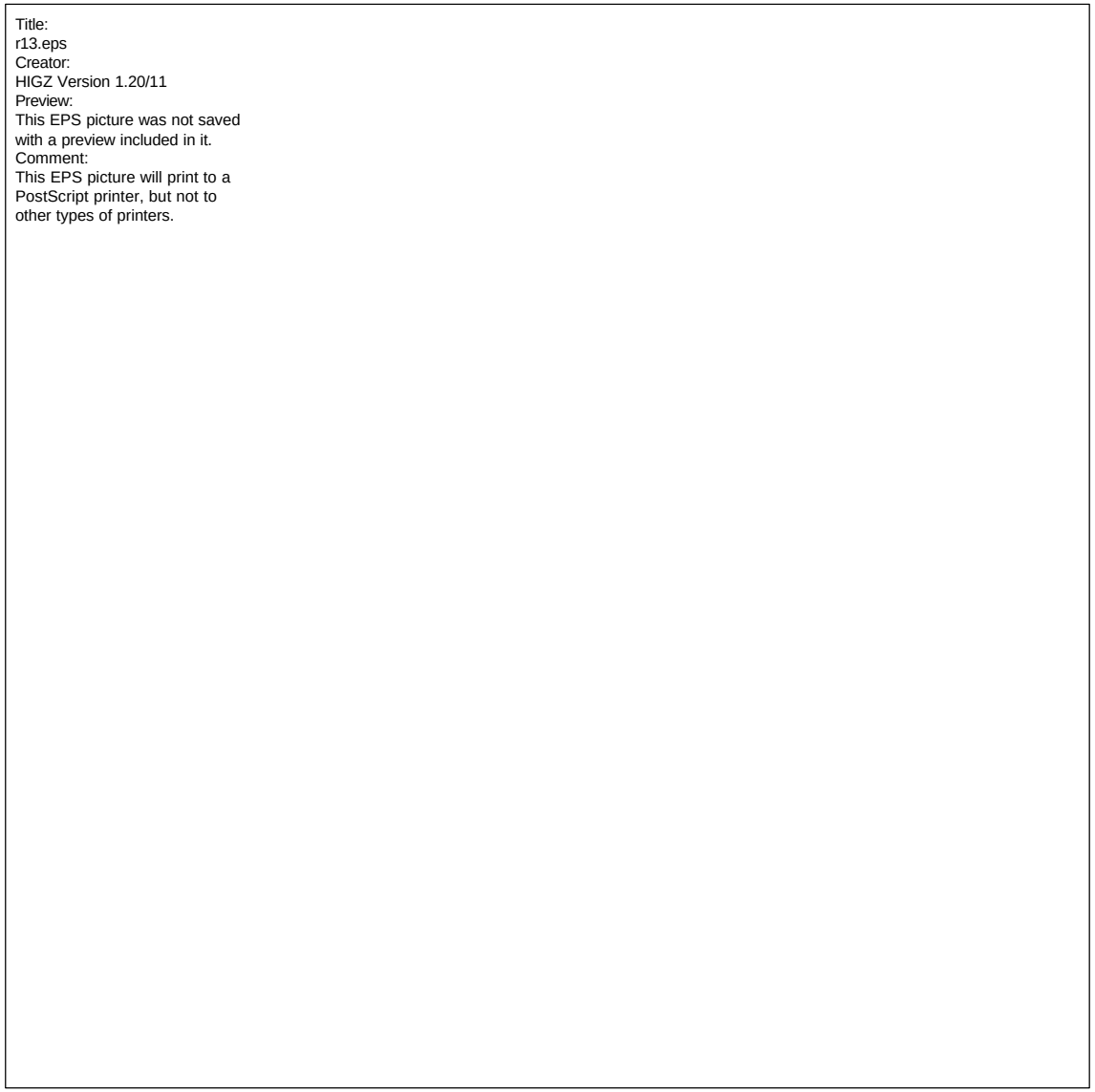




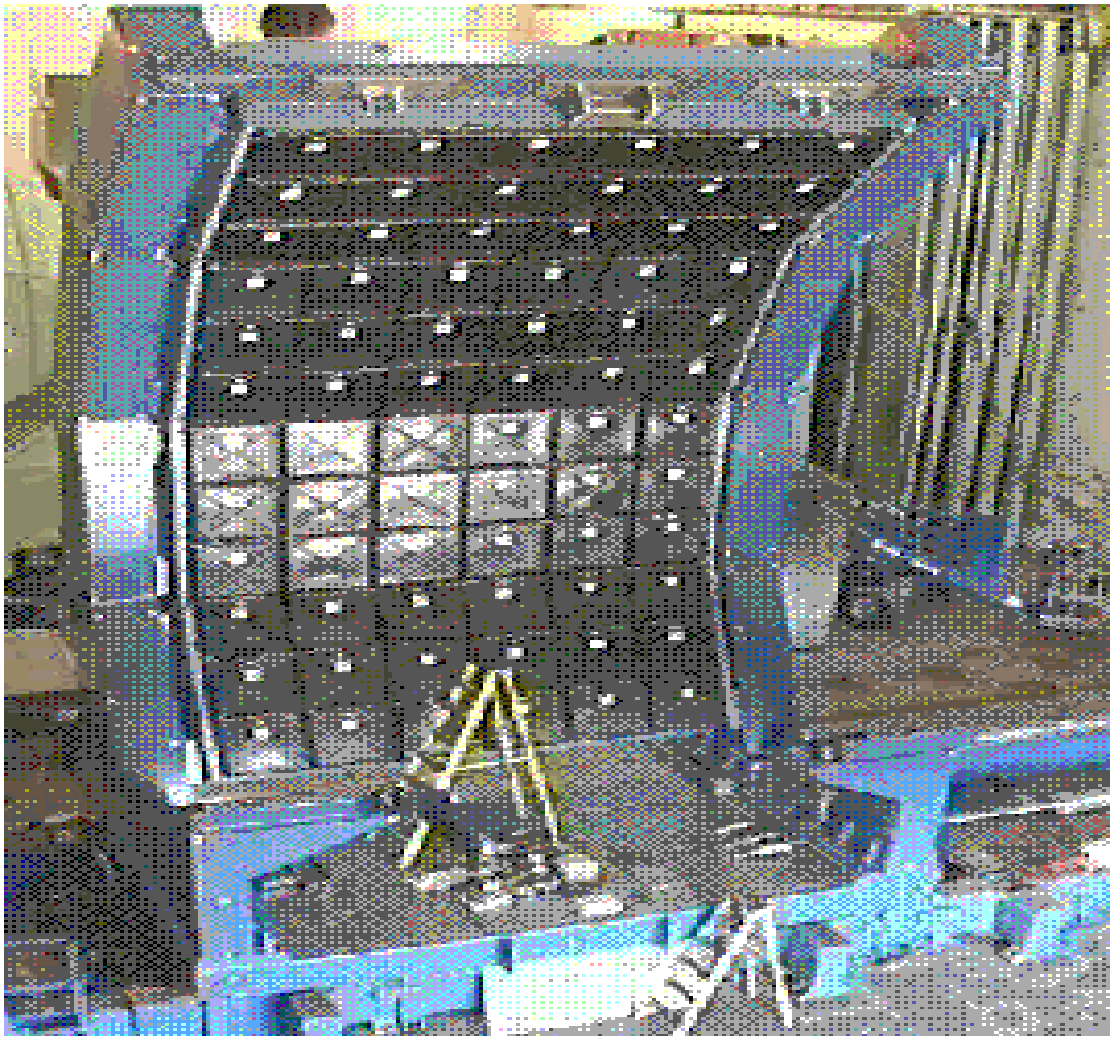
EMCal Energy Calibration

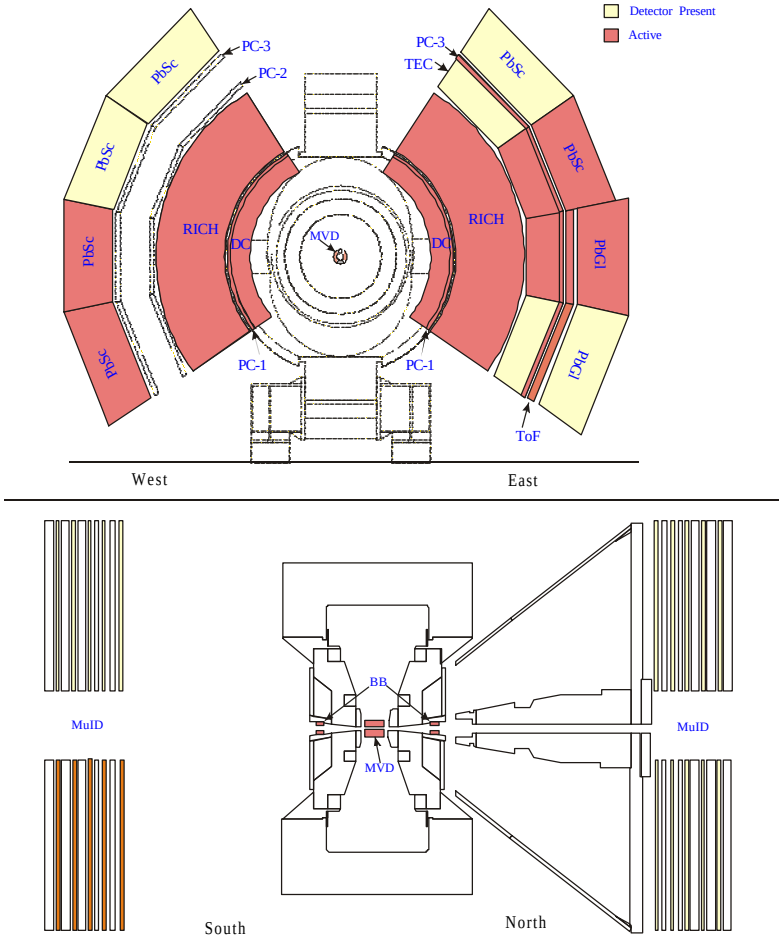


π^0-measurements at AGS

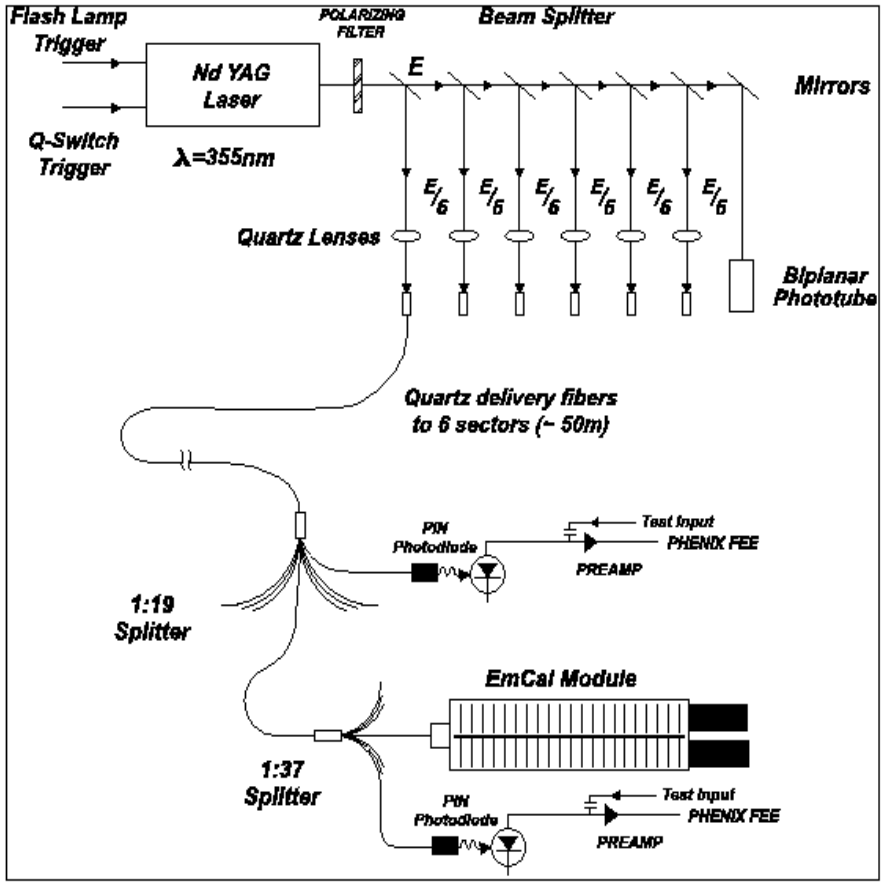


PHENIX Year-1 Configuration

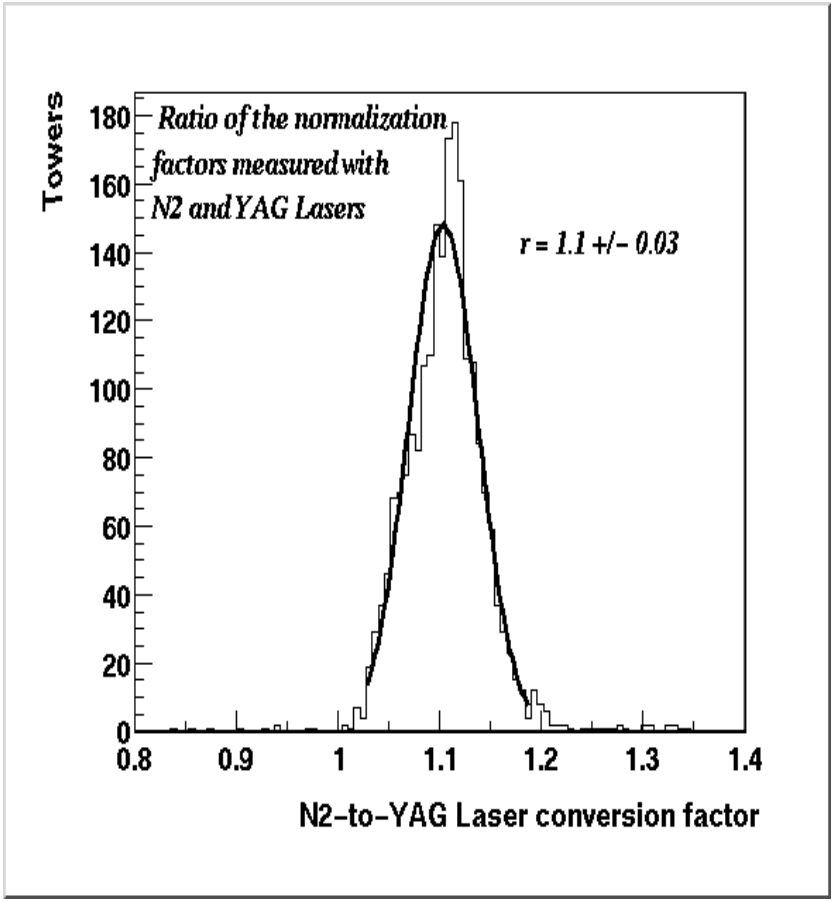




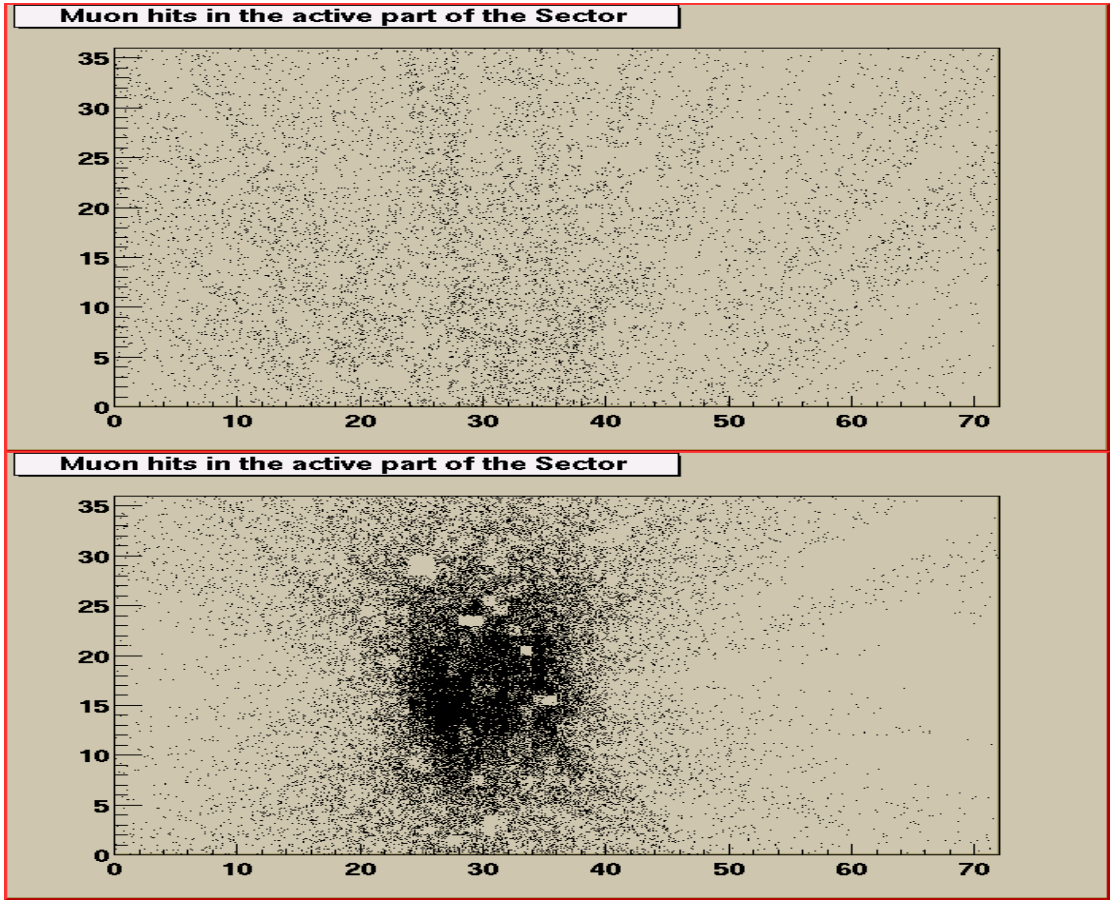
Transporting the calibration

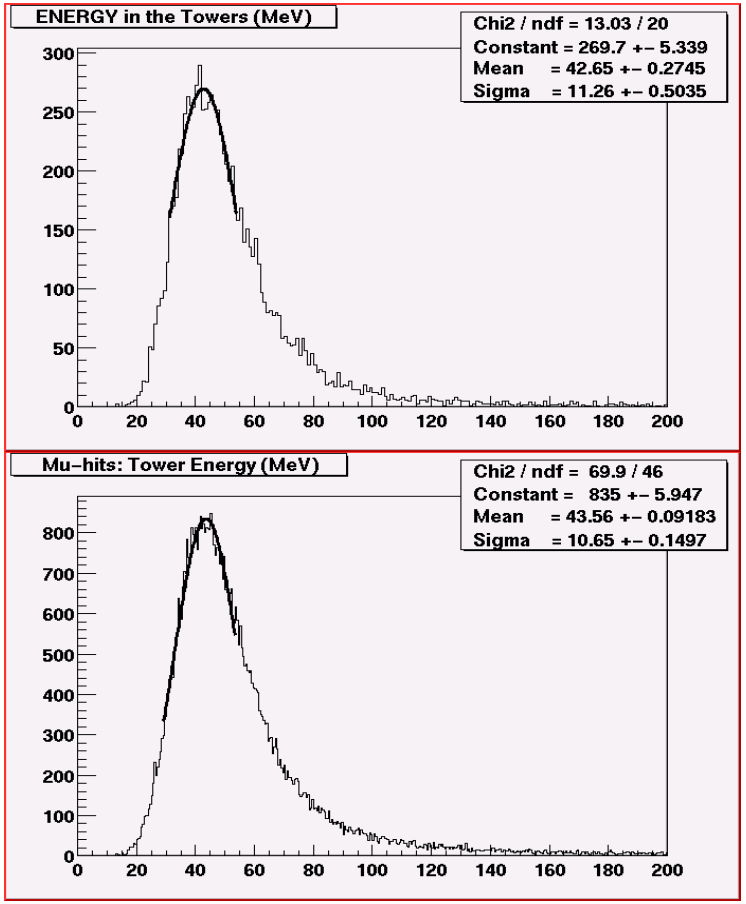


N2 Laser -> YAG Laser



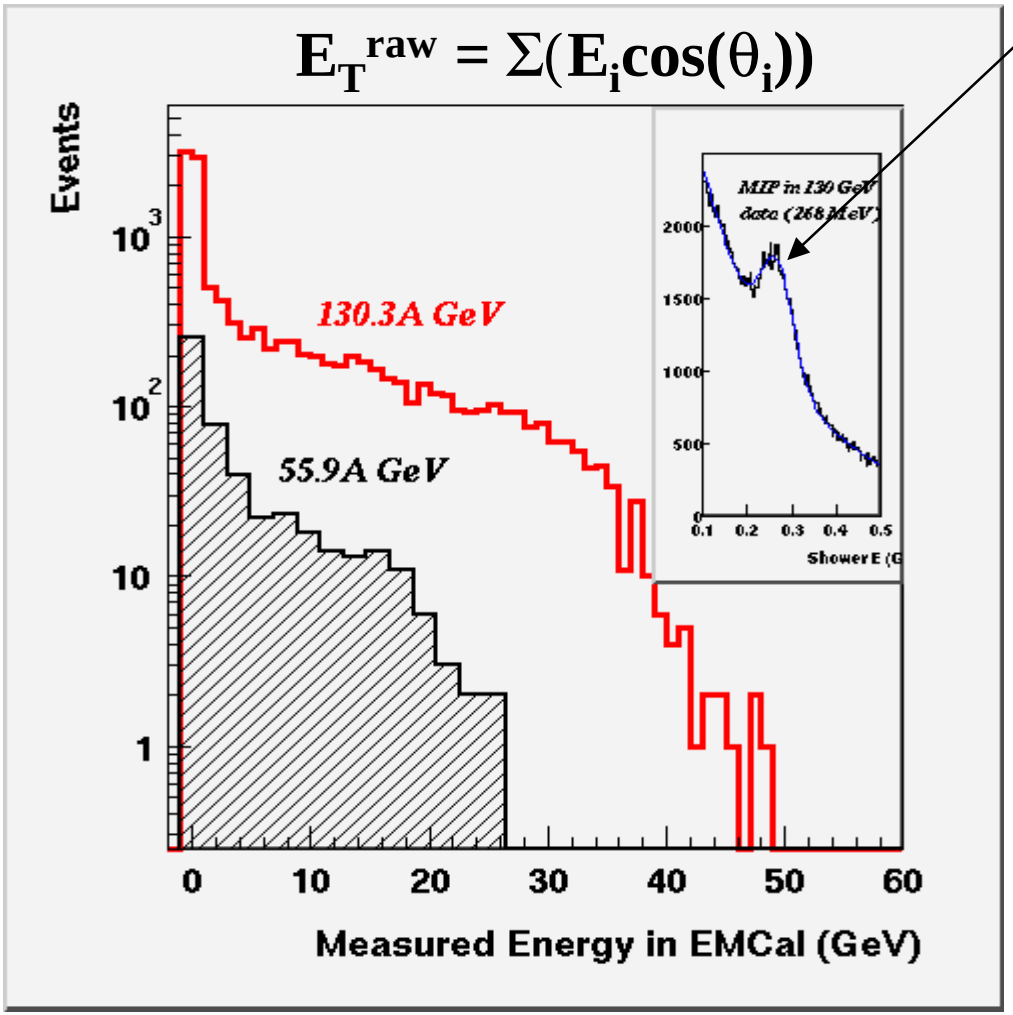
Testing Calibration with Lateral μ's



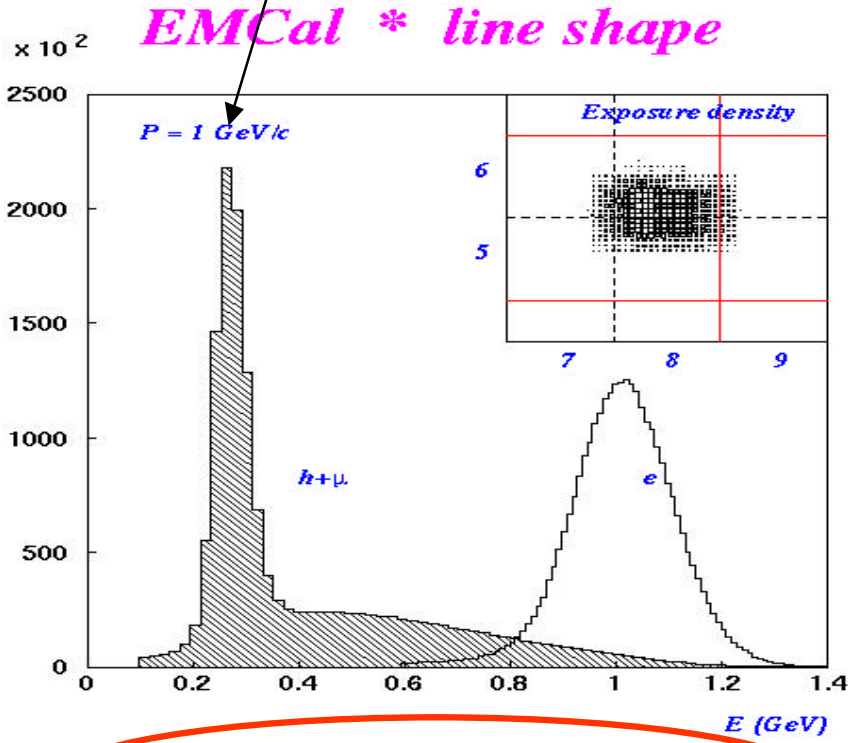


R = 0.048/0.043 = 1.11

Testing Calibration with MIP's

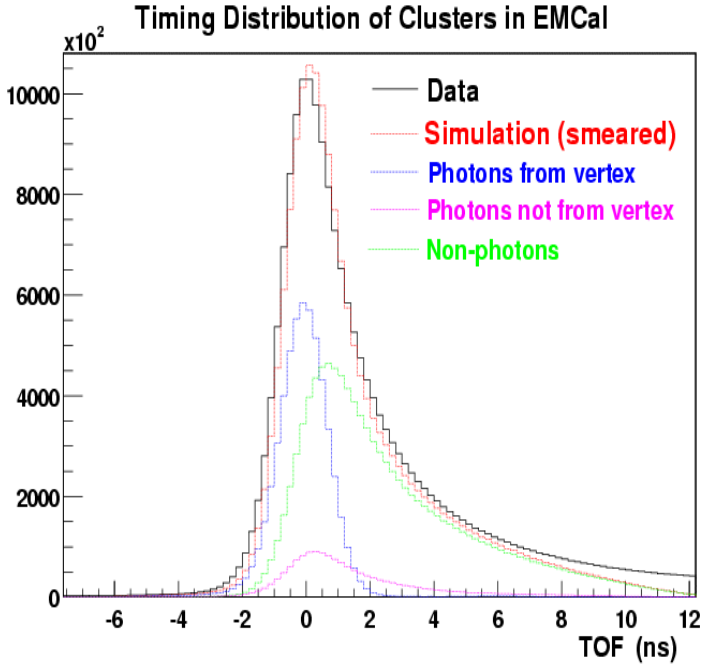


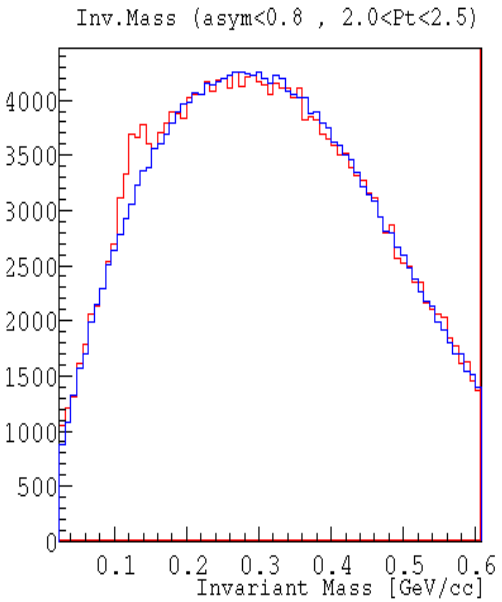
MIP at RHIC (~0.5GeV-2000) - 268 MeV
MIP at AGS (1GeV/c-1995) - 280 MeV

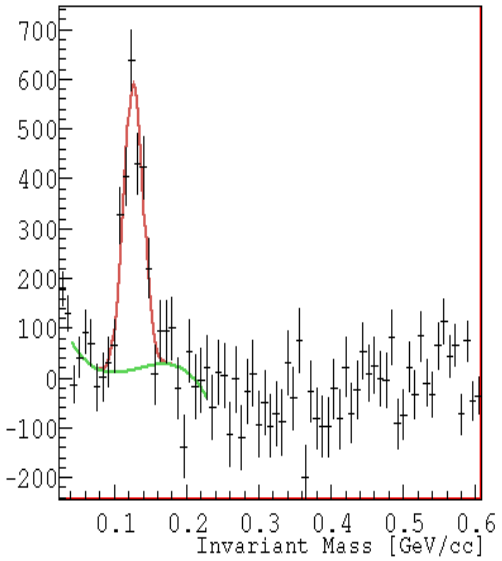


R = 0.28/0.268 = 1.05

Extracting π^0







- ***Main identification tool - timing* (*not yet perfect, σ(ToF)~600 ps after fine tuning using available data - SM*)**
- **Shower shape analysis add extra x2 rejection of hadron background;**
- **Two photon invariant mass spectrum analyzed as function of pair p_T**

Testing energy scale with π^0's

<Peak Position> ~124 MeV

But….

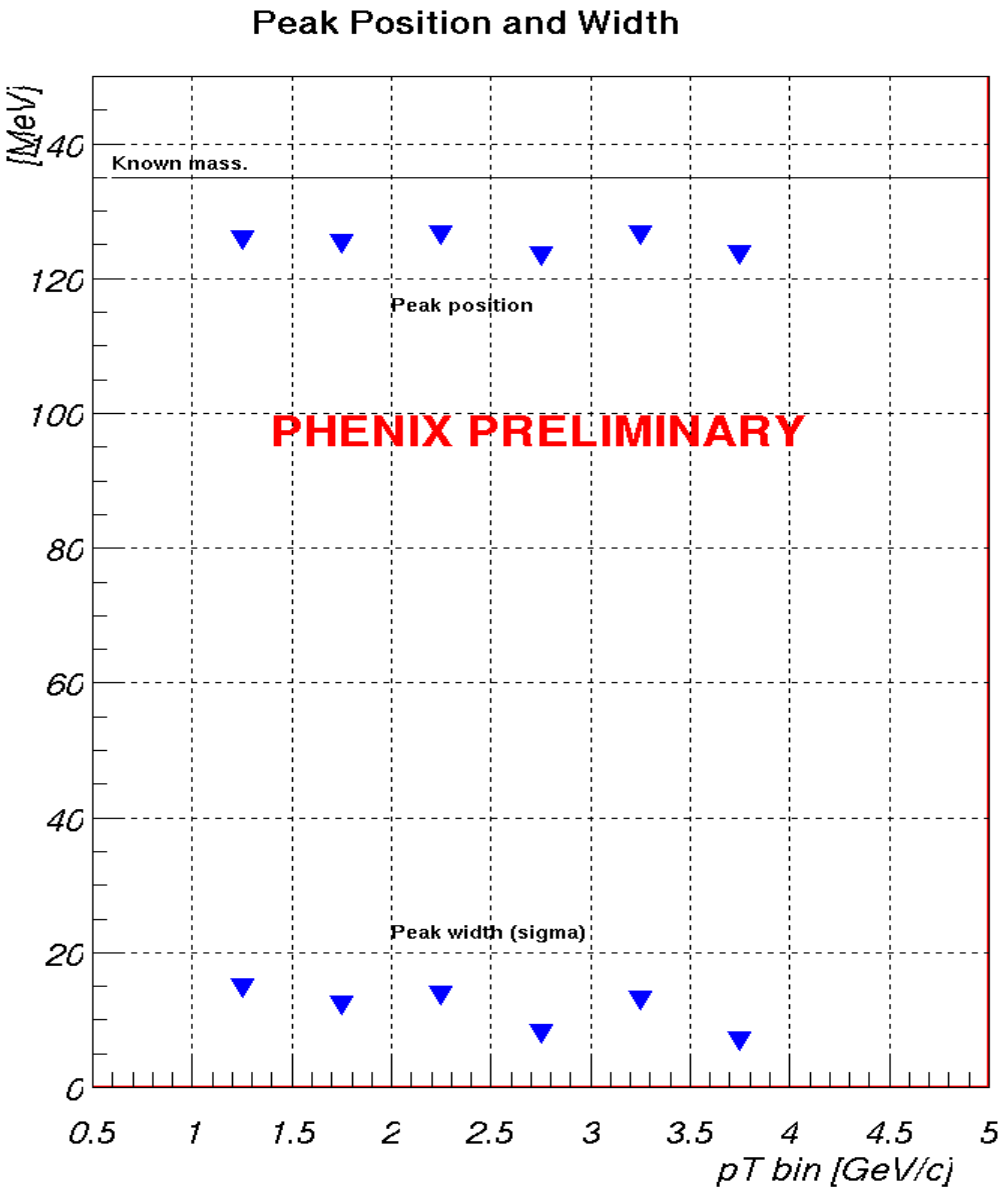
We used "restricted" shower energies (only towers with energies > 2% of the total shower energy) to construct m(γγ)

$m(\pi^0)_{expected}$ ~ 126 MeV

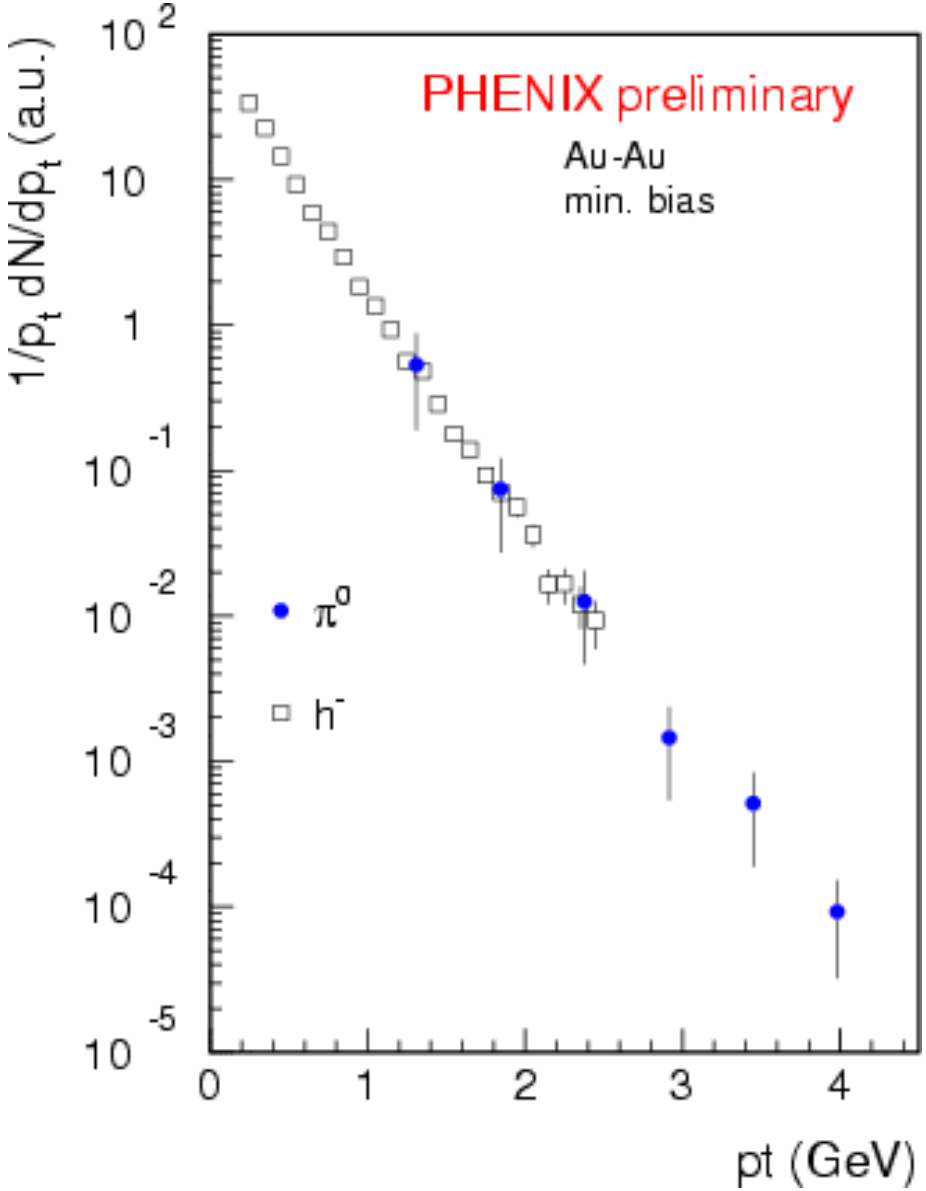
r= 126/124=1.02

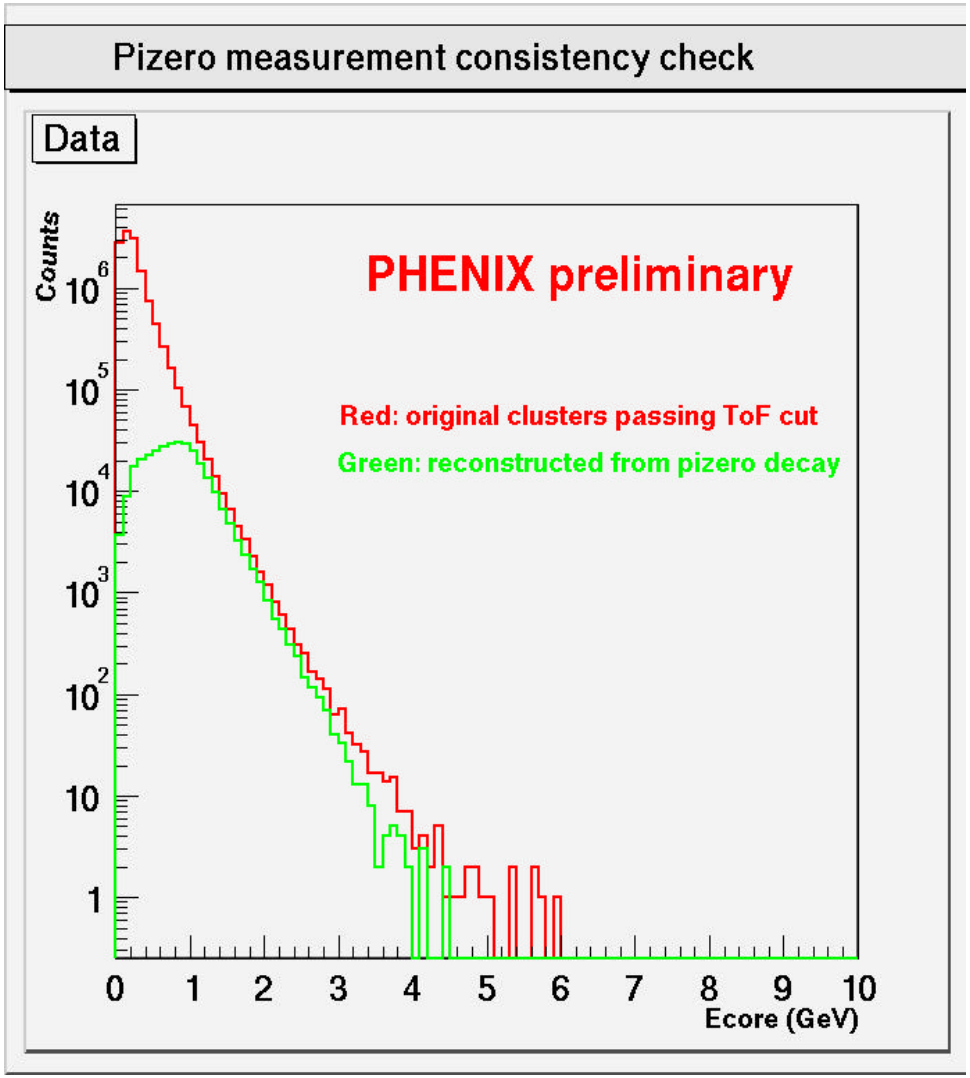
Conclusion

Absolute energy calibration transported to ~ 5%

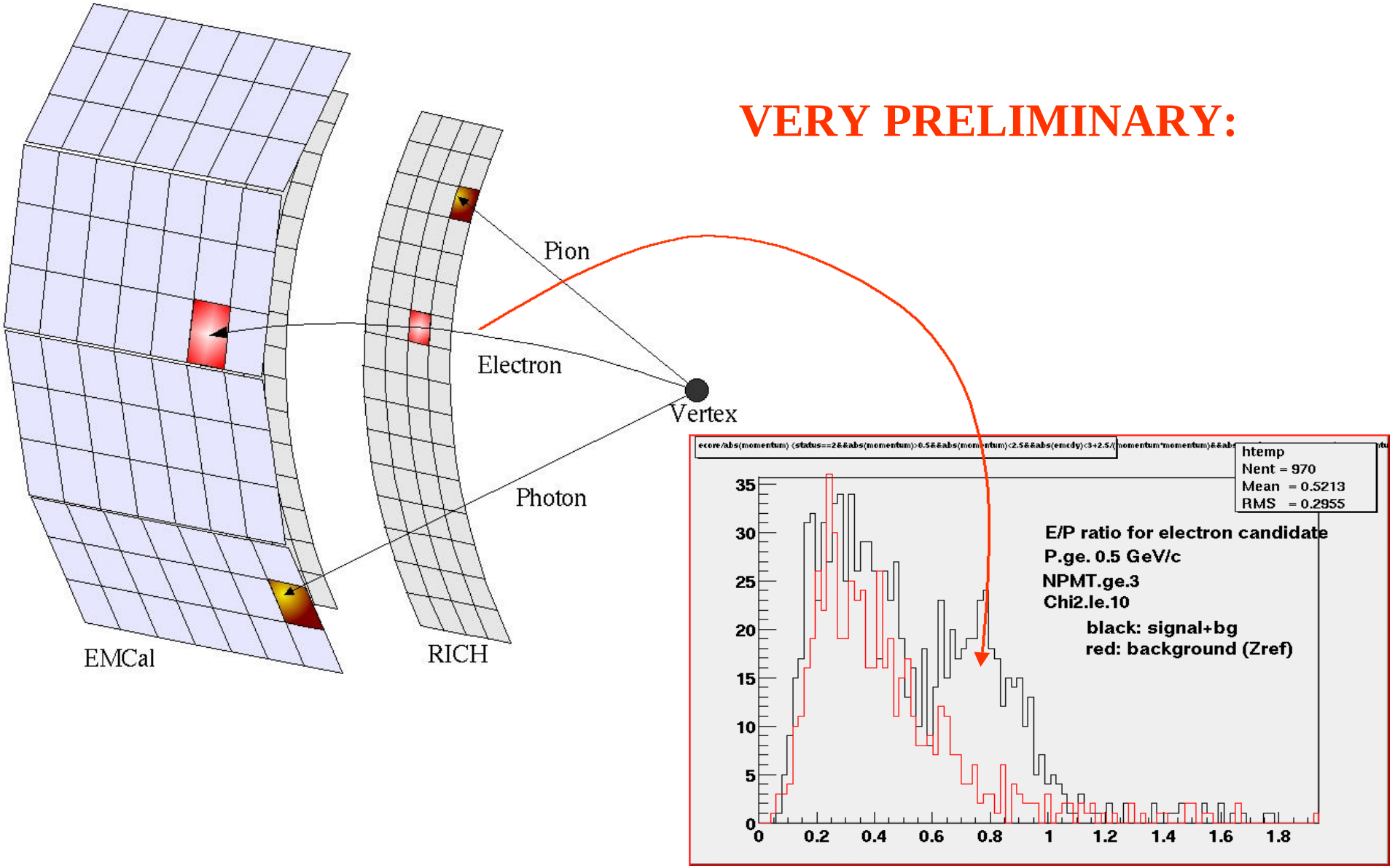


Sweet taste of the fist physics results……





Early example of electron identification (Ya. Akiba)



VERY PRELIMINARY:

Summary

PHENIX PbSc Calorimeter construction and commissioning successfully completed;

After two moths of running PHENIX accumulated ~5 106 events on tape. EMCal subsystem was one of the first to convert raw data into physics observables;

The energy calibration of the calorimeter was successfully built into construction phase. It was transported to the experiment environment to better then 5% precision;

$\pi 0$ p_T spectra were successfully reconstructed in the range $1.5<p_T<4$ GeV/c. Quality of $\pi 0$ data validates the EMCal specifications and choice of the technology.