Investigations Into the Time Dependence of STAR BEMC Gains

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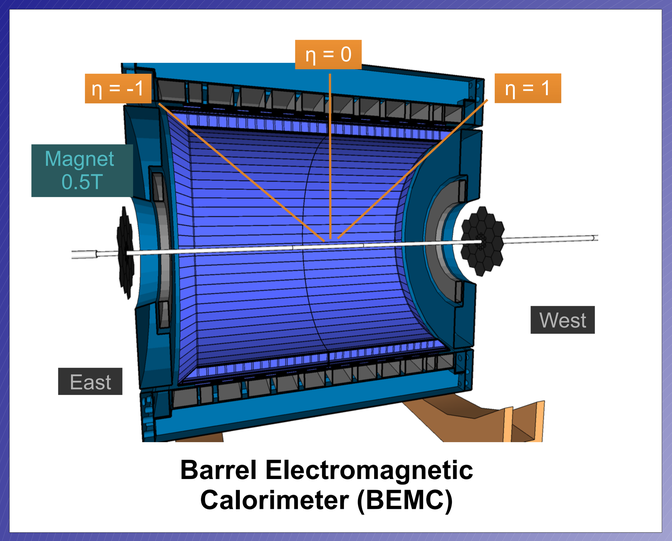
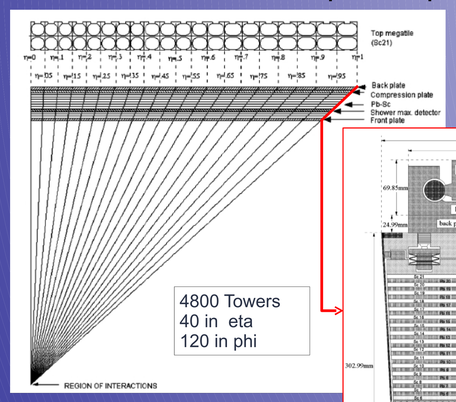
The STAR Detector

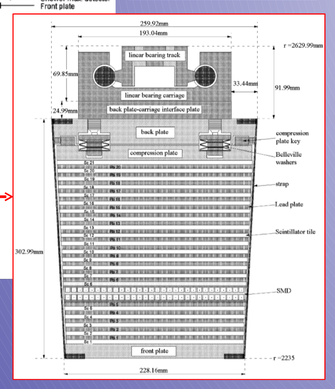


Barrel Electromagnetic Calorimeter (BEMC)

The STAR Barrel Electromagnetic Calorimeter (BEMC) is a sampling calorimeter composed of 21 plastic scintillator layers interleaved with 20 layers of lead resulting in 20 radiation lengths at η = 0. The BEMC is segmented into 4800 towers, each spanning a fiducial area of Δφ x Δη = 0.05 x 0.05. The entire detector covers Δφ = 2π and -1 ≤ η ≤ 1. The light collected by fibers in each of the tower's 21 scintillator layers is fed into a single photomultiplier tube (PMT). The response of the towers located in the same η bin will be identical due to the symmetry of the detector and kinematics of the proton-proton collisions.



BEMC Geometry



4800 Towers
40 in eta
120 in phi

Charged pions from STAR collisions that traverse straight through a tower will deposit 220-300 MeV.

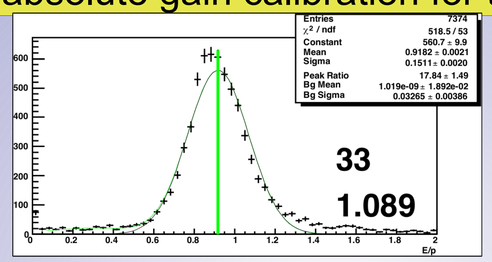
The Calibration Process

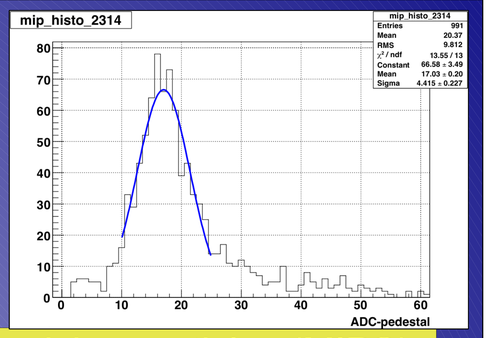
The BEMC towers are calibrated in situ.

Relative Calibration Within η Bin

Absolute Calibration

Electrons, with E_T < 60 GeV, that travel through the center of the tower will deposit all of their energy (E). The *e*- momentum (p) is independently determined by the Time Projection Chamber (TPC) located inside the BEMC. The E/p distribution is measured for each η bin. The offset from 1 indicates absolute gain calibration for that bin.





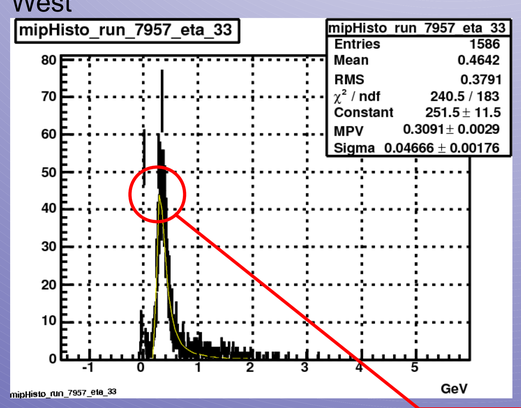
Minimum ionizing particles (MIPS) deposit 200-300 MeV in each tower. The mean of the MIP distribution is used to set the relative gain of towers within an η bin.

Per tower gains calculated from relative and absolute calibration data

The Investigation of Time Dependence

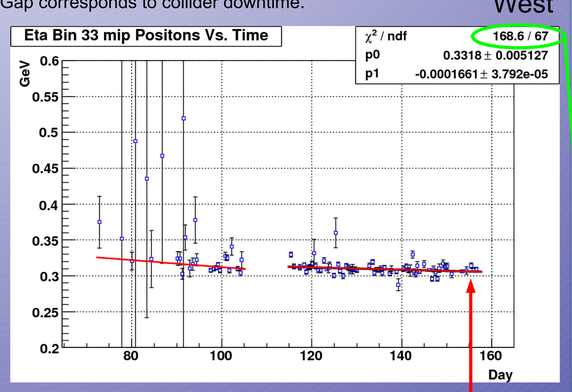
- Isolate MIP signals from all towers within a single η bin
- Characterize MIP distribution for each η bin with a Landau fit
- Plot most probable value of Landau fits as a function of time
- Characterize the time dependence with a linear fit
- The X^2 for the linear fit is smaller than for a constant fit
- The slopes are less than zero for all η bins which indicates that the gain is decreasing with time

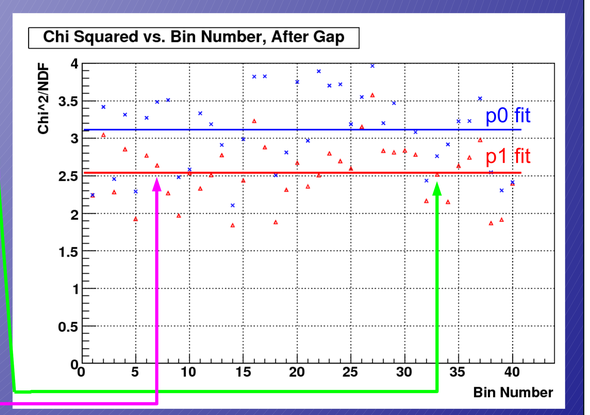
West

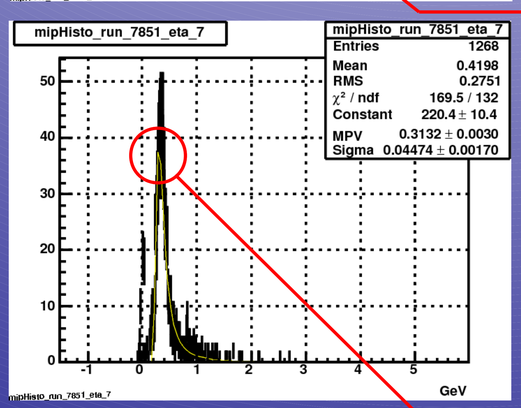


Gap corresponds to collider downtime.

West







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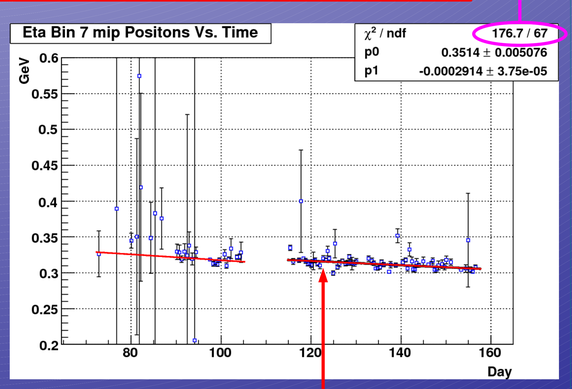

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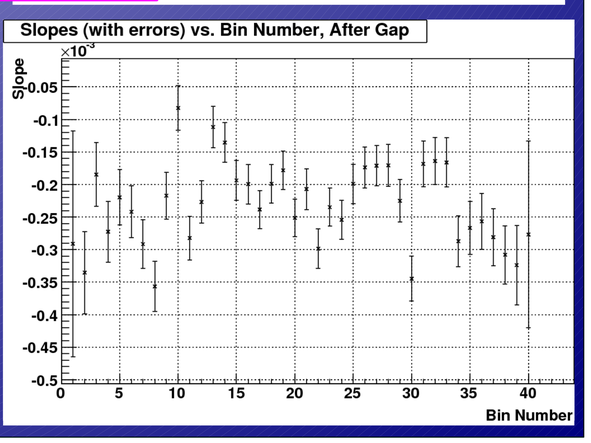

Conclusions and Future Investigations

The MIP position appears to shift by ~3% during the 2006 proton RHIC run.

The cause of this shift is currently undetermined. Various effects, such as localized tower failures, have been eliminated as causal candidates.

Due to increasing luminosity over the course of the 2006 run, the next area of investigation will be into detector effects correlated with luminosity.