EMC Software

- **Offline Software**
  - Ready
  - Tested in full STAR reconstruction chain (MDC4)
- **Online Software**
  - Ready
  - Tested with simulated data (MDC4 and HIJING)
- **EMC integration to STAR database is done**
- **All software is ready for debug and analyse EMC data**
EMC offline software

- Offline reconstruction chain
  - Full tested and debugged during MDC4
MDC4 results (em $E_T$)

- Transverse electromagnetic energy
  - Use TPC tracks to subtract hadronic energy deposited on EMC
    - Distance from projected track to the center of the tower
    - Track momentum
    - Position ($\eta$) track hits EMC
  - Corrections for neutral tracks and TPC efficiency
MDC4 results ($\pi^0$)

- **$\pi^0$ reconstruction**
  - Match clusters for all EMC sub-detectors $\Rightarrow$ EMC point
  - Choose points with no TPC track projected
  - Calculate invariant mass for selected points
    - $\cos (\theta) > 0.9$
    - Energy asymmetry < 0.6
MDC4 results ($\pi^0$)

- **Background subtraction**
  - Mixed events method
  - Calculate invariant mass with pairs from different events

![Graphs showing MDC4 results and background subtraction](image)
EMC LO trigger

- EMC LO trigger as a high-$p_T$ $\pi^0$ trigger

High Tower Trigger AuAu minbias 20 GeV Jet

Threshold (GeV)

- False trigger
- 5 GeV $\pi^0$
- 9 GeV $\pi^0$
- 13 GeV $\pi^0$
MDC4 results (e/h discrimination)

- 6 parameters
  - $E_{\text{point}}/p_{\text{track}}$
  - $E_{\text{max}}/p_{\text{track}}$
  - Width of point ($\eta, \phi$)
  - Separation between point and projected track ($\eta, \phi$)
EMC Calibration

- **MIP calibration**
  - Minimum ionizing particles
    - High-$p_t$ hadrons
    - Energy deposited $\sim$ 300 MeV of electron equivalent energy
  - Method (two steps)
    - EMC Equalization
      - Find relative gain between towers in the same $\eta$
    - MIP accumulation
      - Project high-$p_t$ tracks ($> 1.2$ GeV) into EMC surface
      - Check if there is no other track on neighbor towers
MIP Peak

- Simulated events

MIP peak for real data soon...
EMC Online software - Event Display

Pedestal event

Triggered event
EMC Online software – Pedestal monitor
EMC Online software – Online Monitor

- **Fast QA histograms**
  - Tower spectra (mean and RMS)
    - Localize noisy/bad channels
  - ADC sums
    - Used to timing study (crate by crate)
  - Occupancy

![Graph](det_bmc_total_adc_distribution.png)

![Graph](timing_for_crate_18_latency_18.png)

(minimum bias Data)
EMC Online Software – Online Monitor II

- AVG and RMS Spectra (minimum bias Data)

EMC Online AVG for detector bemc

EMC Online RMS for detector bemc

Noisy channel

PMT BOX OFF

Need to look these channels (21/400 ~ 5%)
EMC Online software – Online Monitor III

- **Relative gain**
  - Central run
    - Width of ADC sum
      - ~ 2300
    - Mean value - pedestal
      - ~ 11000
    - Relative width
      - ~ 2300/11200 ~ 20%
  - Simulation
    - HIJING central events
    - Energy distribution mean value
      - 91.1 GeV
    - Relative width
      - 12.2/91.1 ~ 14 %
  - Tower gain
    - Mean tower gain
      - 8.2 MeV/ADC count
    - Mip peak ~ 32 ADC counts
    - Tower by tower fluctuation
      - $\sqrt{\sigma_{data}^2 - \sigma_{sim}^2} ~ 14\%$

Chi2 / ndf = 249.9 / 37
Constant = 7.689 ± 0.3174
Mean = 1.623e+04 ± 114.5
Sigma = 2351 ± 135.7

Chi2 / ndf = 24.89 / 7
Constant = 35.38 ± 0.9581
Mean = 39.03 ± 0.3276
Sigma = 32.8 ± 1.0362
Final comments

- **EMC Software**
  - Offline has been tested on MDC4
    - Reconstruction chain tested
    - Analysis tools tested
  - Online
    - Software developed and debugged
    - First events have been processed
  - Calibration
    - MIP peak method developed and tested
    - Doing calibration on real events
  - Much more fun with real data !!!!!!