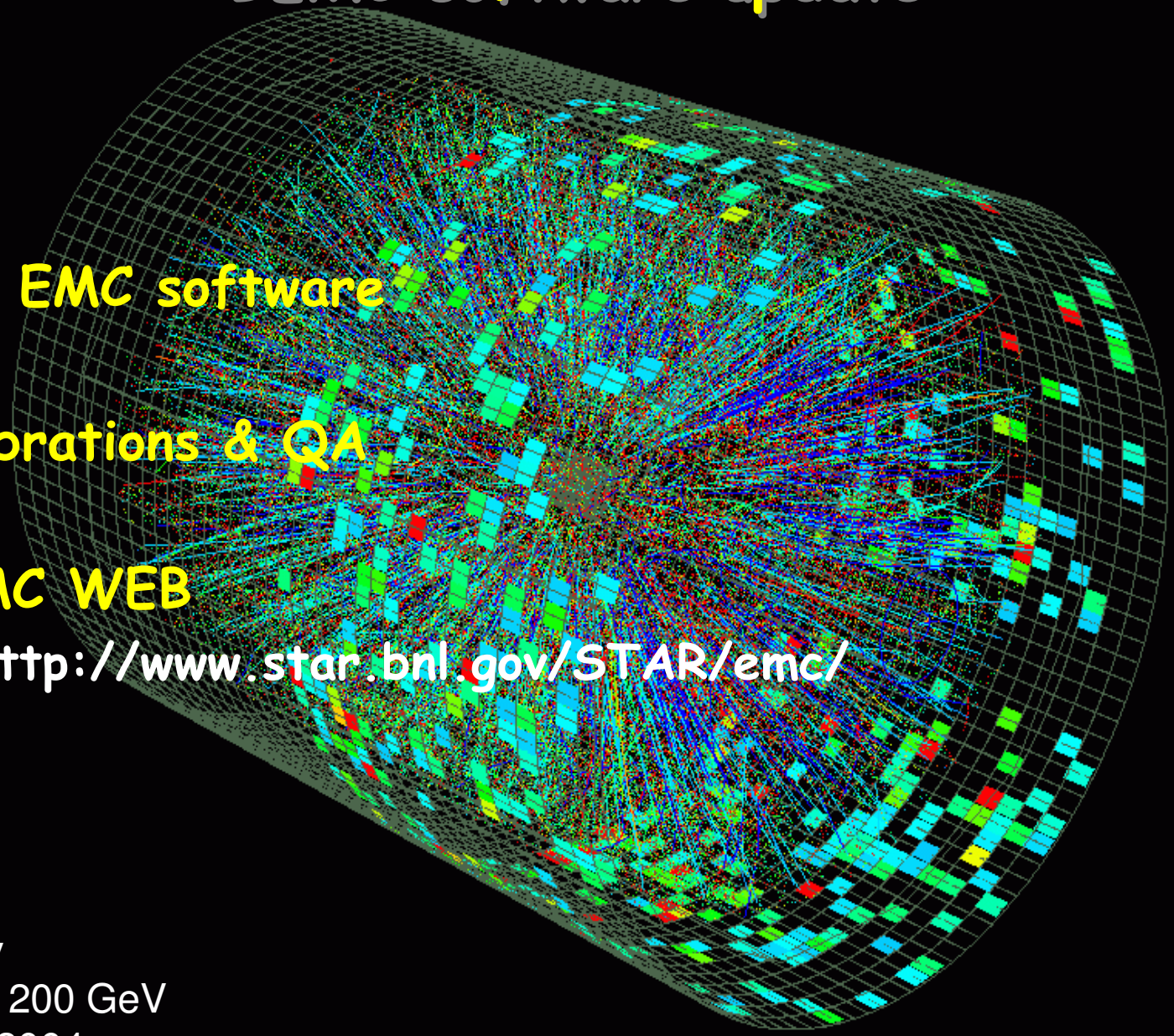
BEMC software update

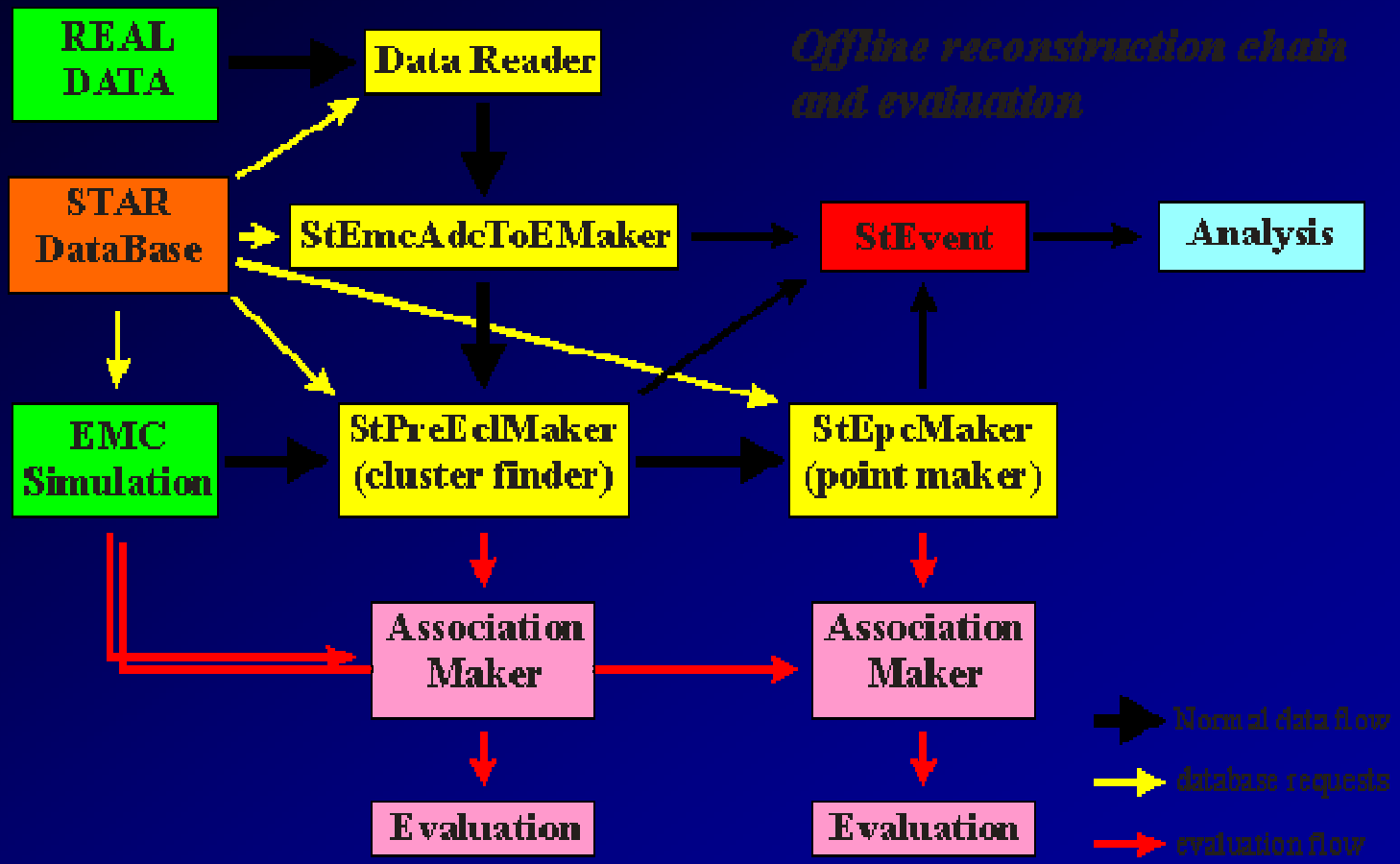
- The EMC software
- Calibrations & QA
- BEMC WEB
  - http://www.star.bnl.gov/STAR/emc/



L3 display
Au+Au @ 200 GeV
February 2004

EMC Software reconstruction and analysis chains

- Offline reconstruction chain is fully implemented



StEmcADCtoEMaker

- **Divided into two makers**
  - StEmcRawMaker – runs during reconstruction
    - Reads only RAW data format (DAQ or StEmcRawData)
    - Applies pedestal, calibration, copy daq structure to StEvent and Fill StEmcRawHits
    - Fills crate status in StEvent (and muDST)
      - This information is available for the user!
    - Also processes the Endcap data
  - StEmcADCtoEMaker
    - Runs only at analysis level
    - Does everything StEmcRawMaker does +
      - Reads StEmcRawHits from StEvent
      - Reads StMuEmcCollection (muDST)
      - Processes plain simulation files (need to set the correct flavor in database)

Cluster finder and matching

- Current cluster finder (StPreEclMaker) and point maker (StEpcMaker) are very naive
  - Cluster finder
    - Do not cluster over sub-modules and modules
    - Do not take status into account
      - Splitting if dead strip in between
    - Do not use other detector information as seed
      - TPC for electrons or SMD-eta for SMD-phi clustering over sub-module
  - Matching
    - Plain matching – split tower energy based on SMD energies
- Many improvements are necessary.
  - Include status information
  - Clustering over sub-modules
  - Use other detector as seed, etc…

BEMC database

- For each detector (BTOW, PRS, SMD-eta and phi)
  - Pedestal table
  - Calibration
  - Gain (time dependence of gain)
  - Status
- For the trigger
  - Trigger pedestals
  - Status (trigger masks)
    - Patch, high tower and single tower masks
  - LUT information
    - Do not save LUT (size) but save formula parameters
- StBemcTables (StEmcUtil)
  - Tool to interface with those tables in the database

What is already saved in the DB?

- **These tables can be accessed using StBemcTables**

dataset	BTOW	PRS	SMD-eta	SMD-phi
dAu200 ´03	S+C+P	NA	S+C+P	S+C+P
pp200 ´03	S+C+P	NA	S+C+P	S+C+P
AuAu200 ´04	C+P+T	P	C+P	C+P
AuAu62 ´04	C+P+T	P	C+P	C+P
pp200 ´04	C+P+T		C	C
CuCu200 ´05	C+P+T	P	C+P	C+P

- **Problem with bemcTriggerStatus. Solution found. Need to re-create old tables...**

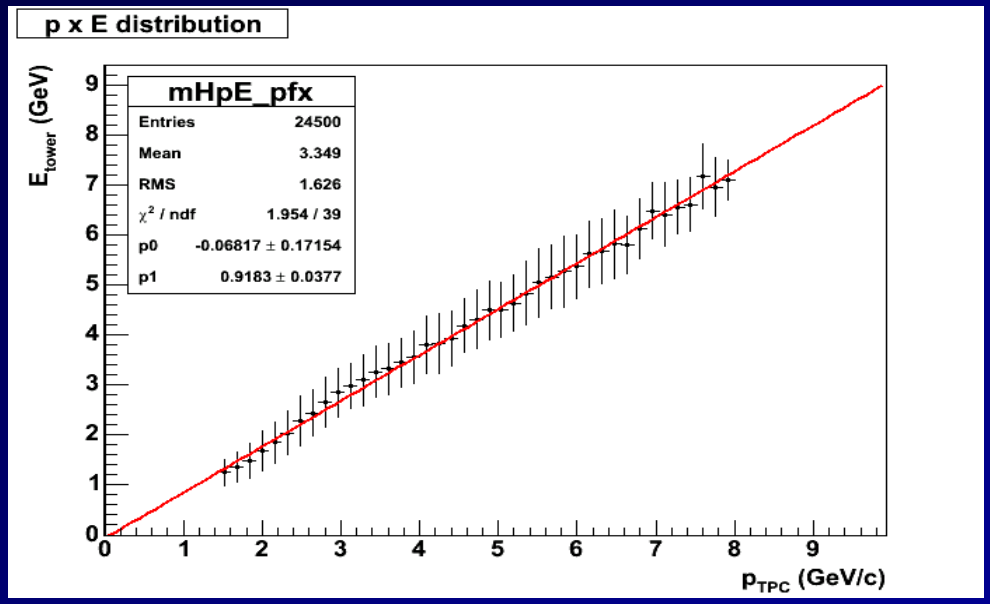
S = status table
C = calibration table
P = pedestal table
T = trigger tables (only BTOW)

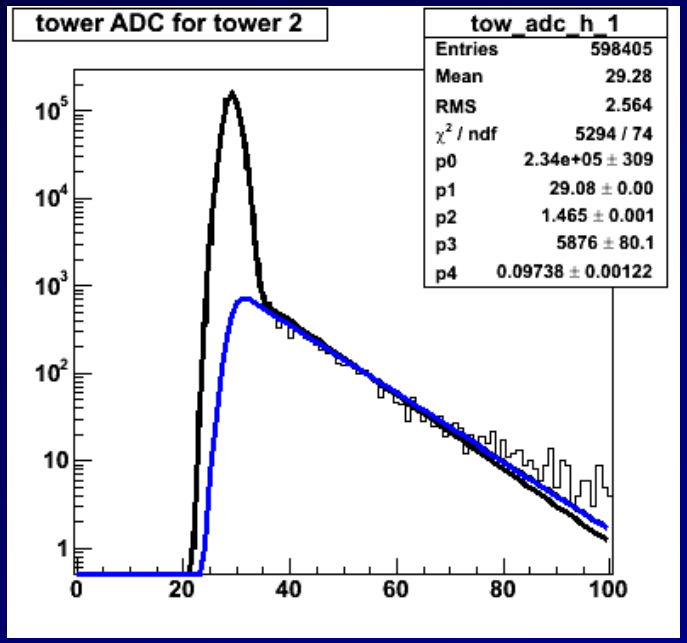
Calibration and status

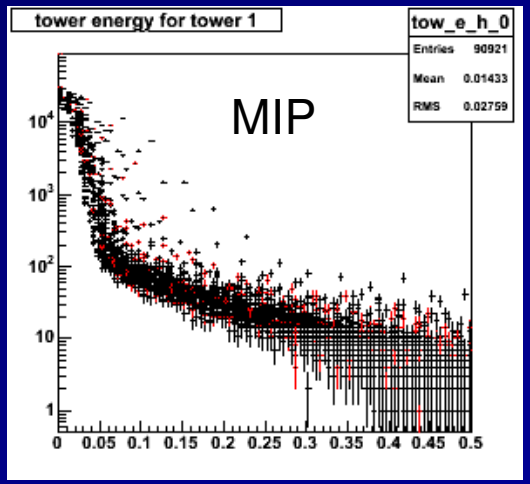
- Status of 2003, 2004 and 2005 runs
  - QA of the data
  - Calibrations
  - Status

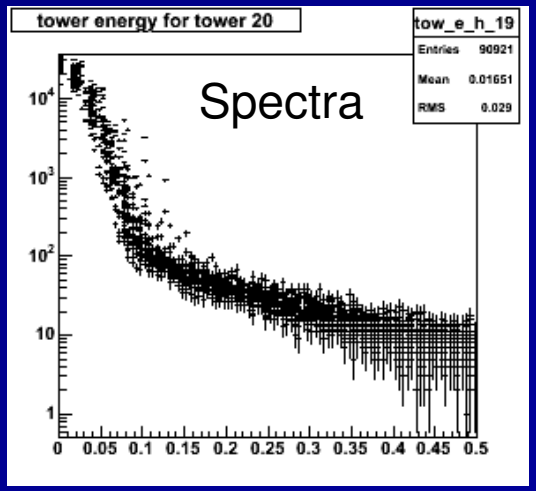
2003 dAu and pp data

- Single tower MIP spectrum
- Electron peak for absolute normalization
- Calibration still improving
  - Spectra shape (Marco van Leeuwen)



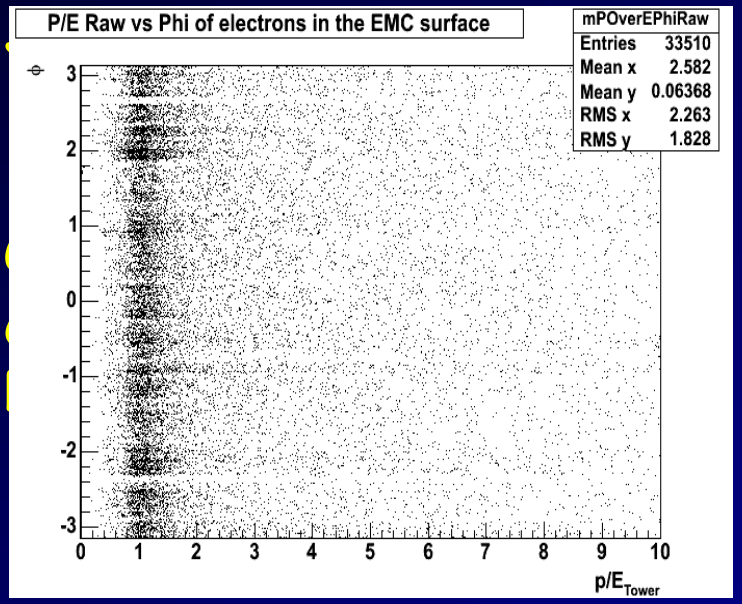


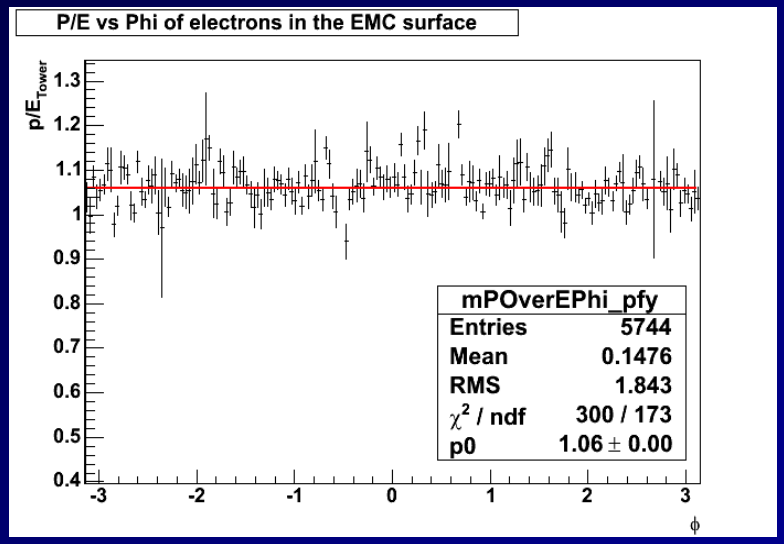


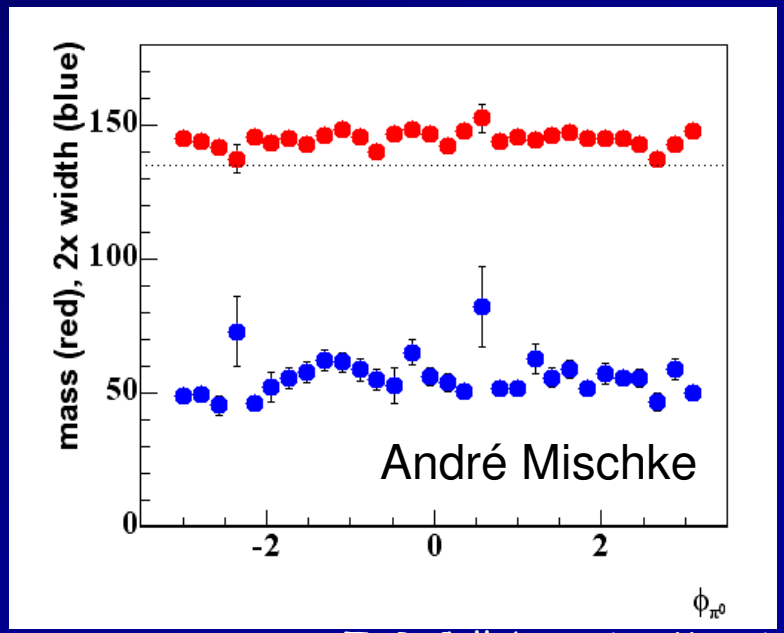


Single tower electron and π^0 calibrations

- Test detector uniformity
- Gain corrections
- Single tower electron
  - Peak position
-
-
-

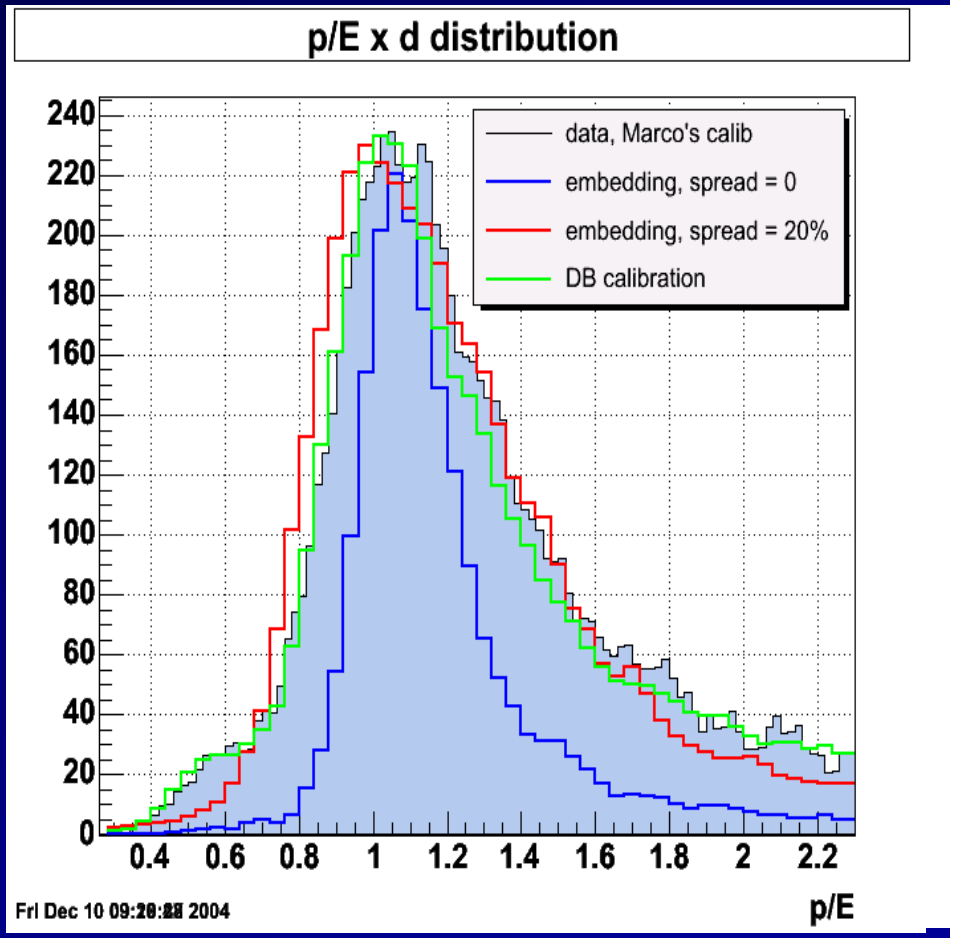






Single tower calibration "uncertainty" estimation

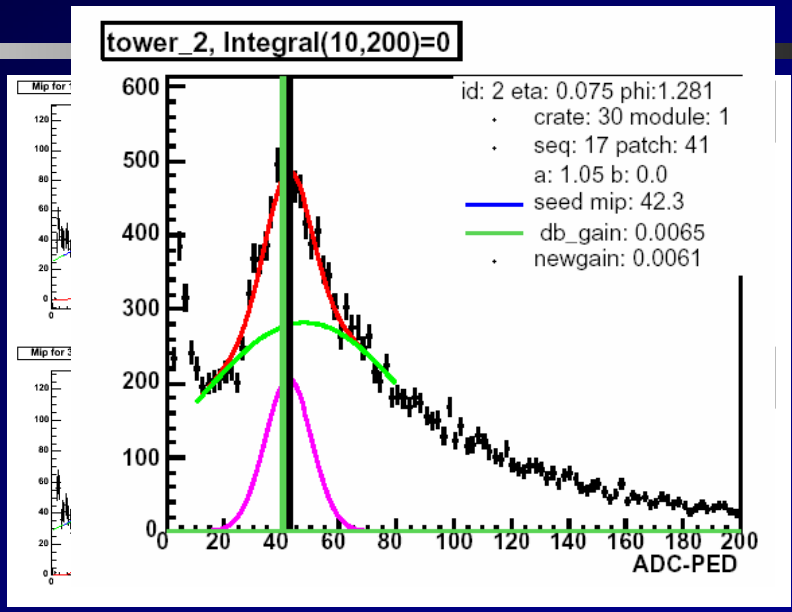
- Current calibration is MIP based
  - Electrons just shift overall gain
  - MIP calibration is at very low energy
    - 200-300 MeV
    - Large extrapolations to high-E
      - Large uncertainties
- StEmcSimulator was updated to account for calibration uncertainties
  - Systematic shift for all towers
  - Gaussian shaped gain error
    - Default is no shift and no error
  - The best settings to reproduce the electron data is
    - Shift = 1 (overall gain seems correct)
    - Single tower gain uncertainty = 15 %
- Comparing slopes and MIP method does not make improve the width of electron peak
  - Is this the maximum we can get with MIP and slopes?
    - Need to improve high-pT calibrations
  - Or do we have effects that are not being taken into account during simulations?

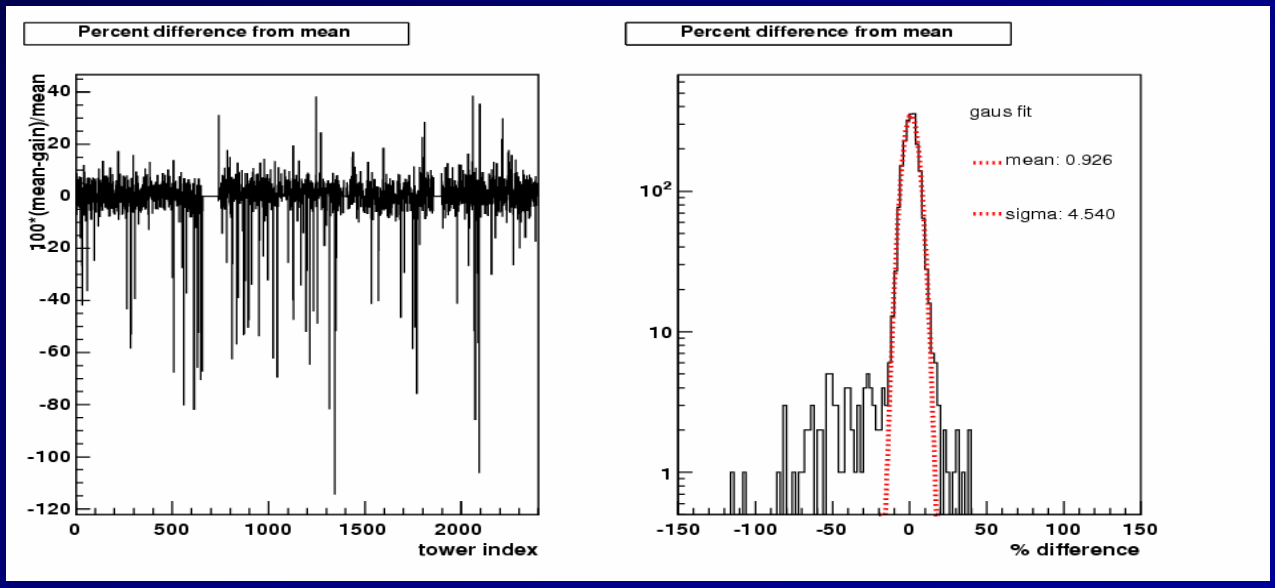


Calibration for Y2004 data

Mike Miller

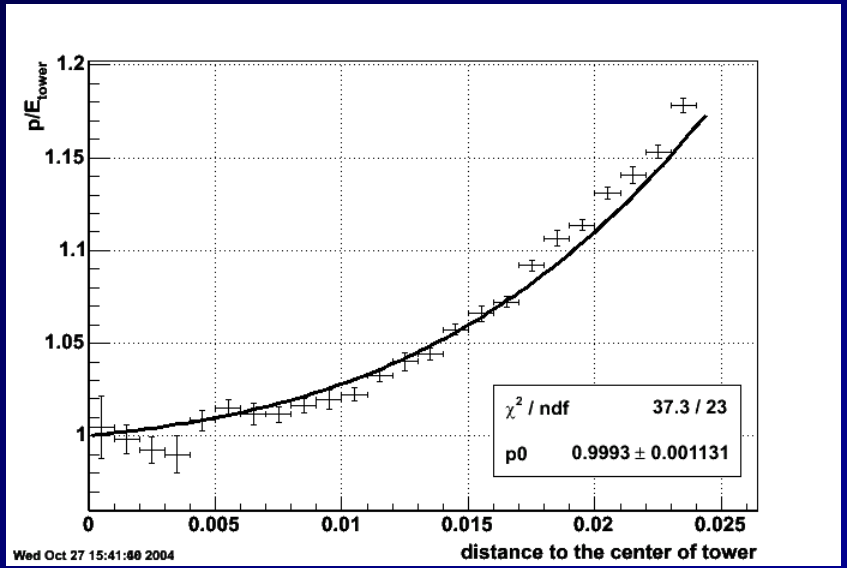
- Calibration in DB is based on a eta-bin MIP calibration
  - Statistically limited
  - In database
- Single tower MIP calibration
  - Needs a lot of statistics
  - Take care of some outliers

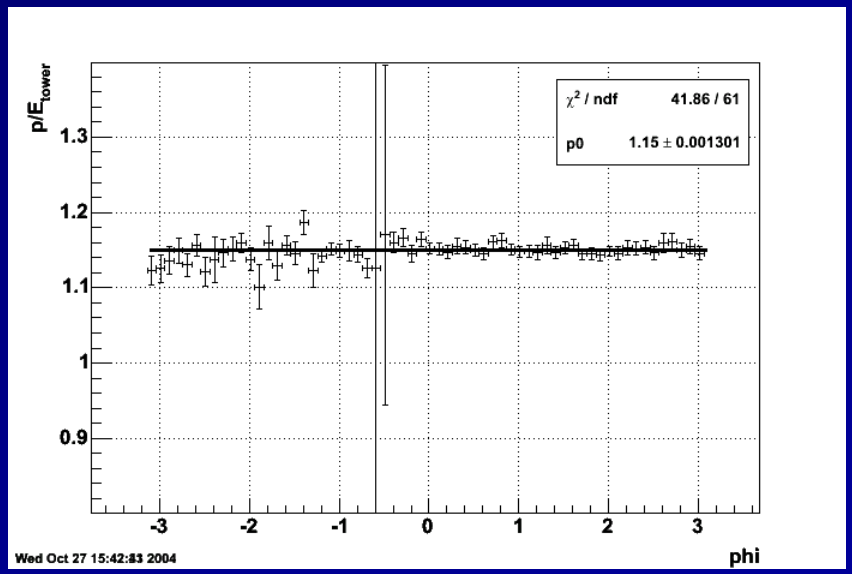




Electron calibration. Preliminary...

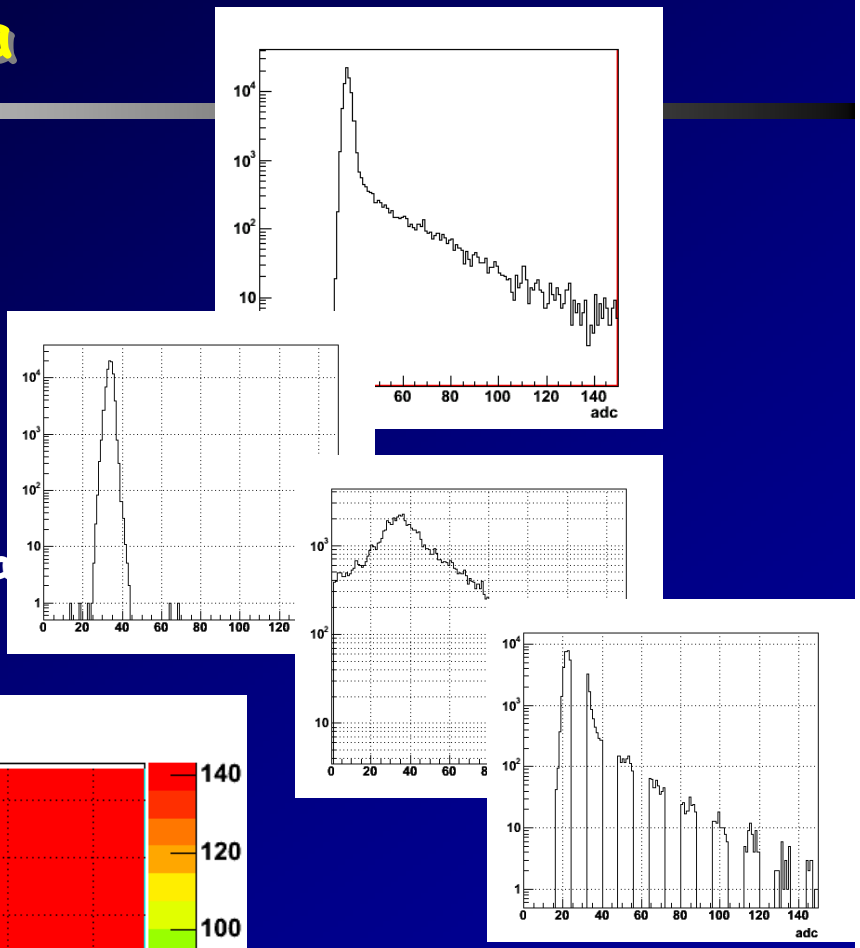
- Electron peak after MIP (eta bin) calibration
  - Offset of ~11%
  - Not uniform in ϕ direction
- Use electron peak to correct gain
  - Using DB calibration as start point
  - Not enough statistics to do it tower by tower
    - Do it in eta/phi bins
      - Overall peak position ok
      - Azimuthal uniformity ok
- Need to redo with TbyT MIP

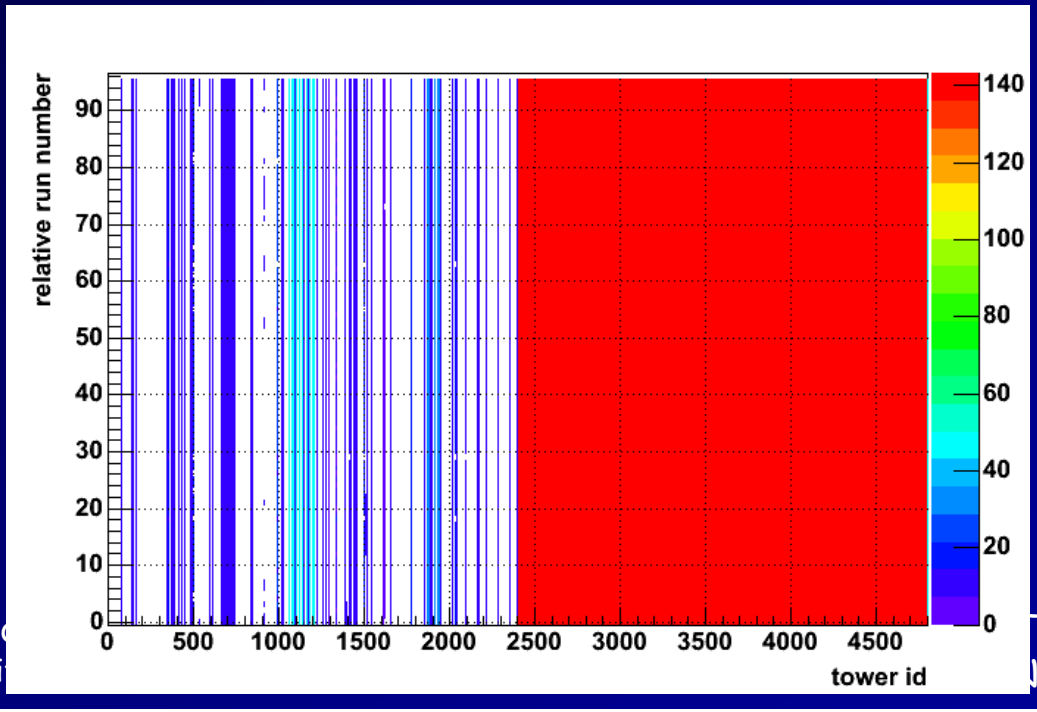




BTOW status for the 2004 data

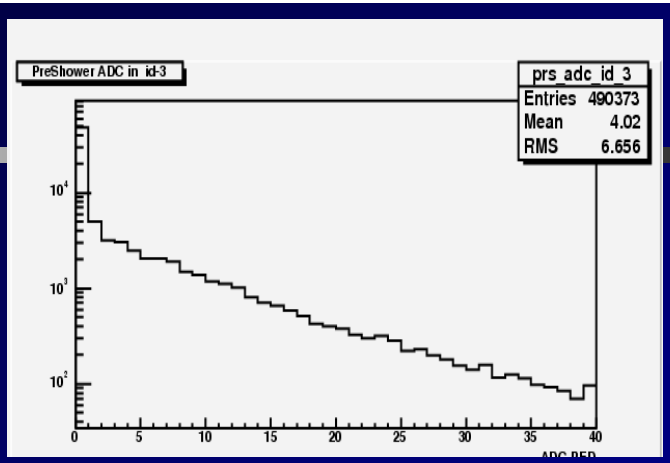
- 62 GeV AuAu (Thorsten)
  - Based on single tower spectra
  - Basically no changes during the run
  - Not yet saved to DB
  - 8.5% of bad towers
- pp (David)
  - Basically the same method
  - Need to generate the tables in DB forma
- Expect those tables to be saved after the CM.

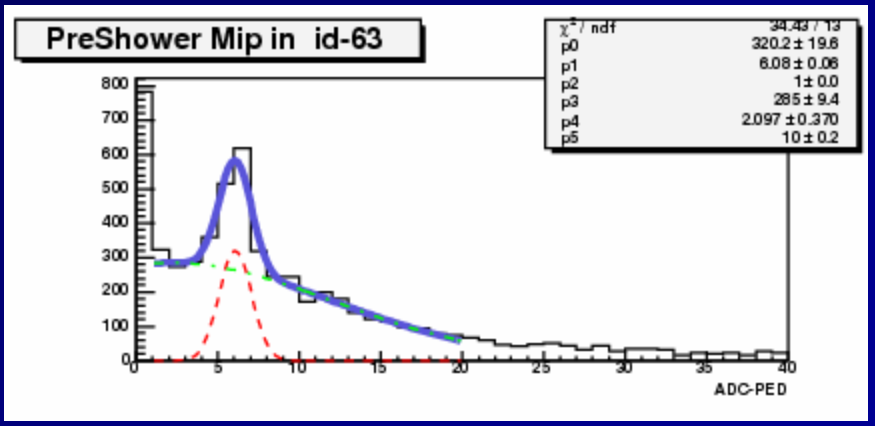


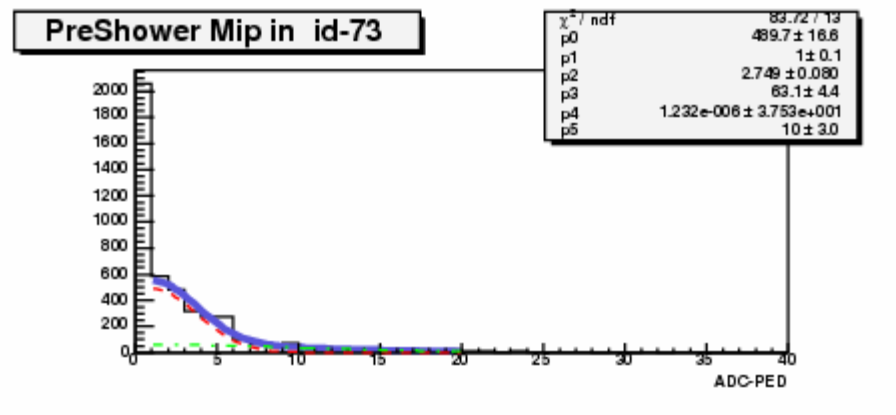


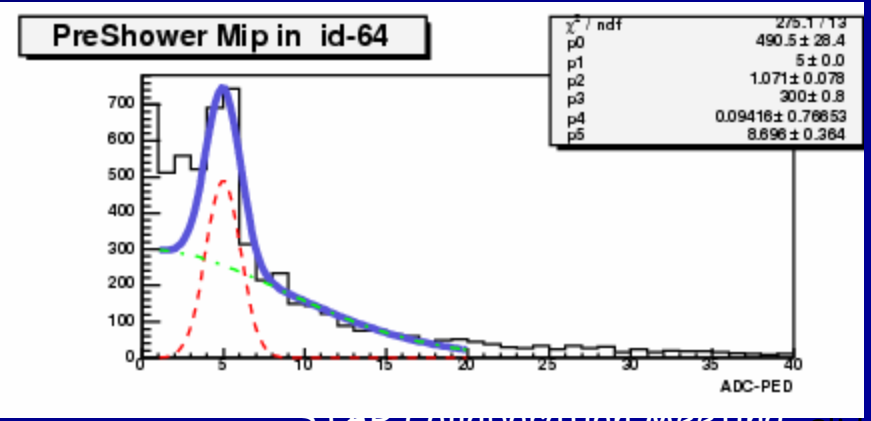
Pre-shower detector

- Problem with PSD map
  - Fixed after detailed review of documentation
- First look at calibration (Jaro)
  - MIP method (same as for towers)
  - Most of towers show a nice MIP peak
    - Some do not show
  - Hope to have first round available for tests soon



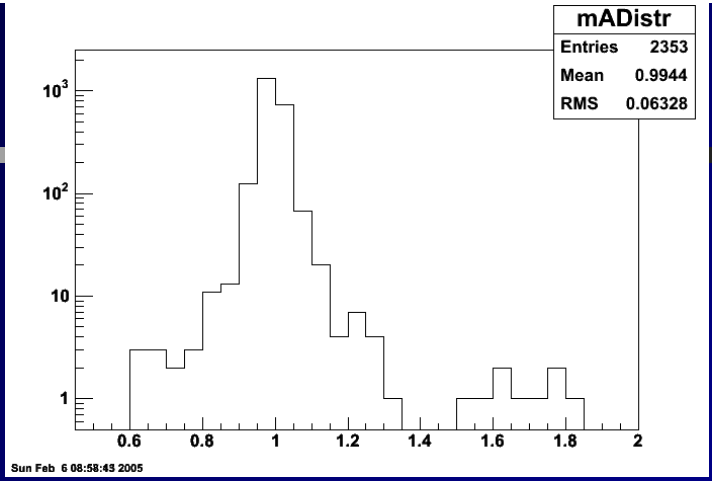


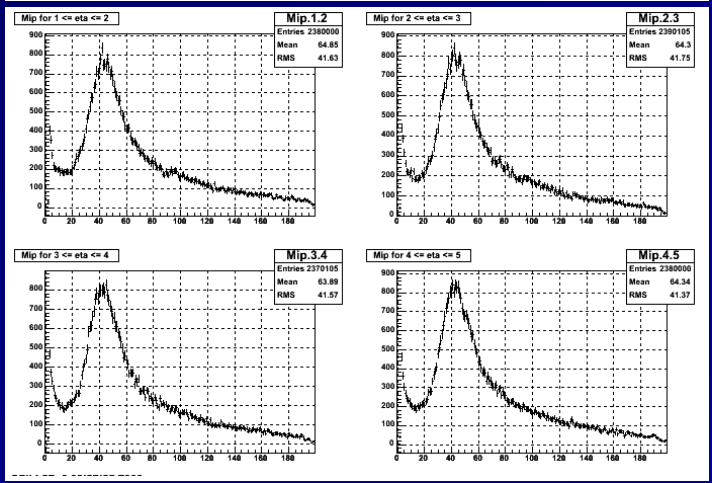


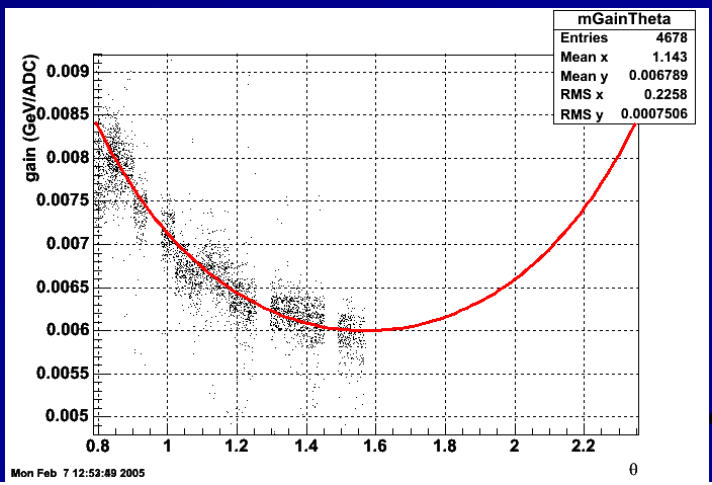


Y2005 - calibration

- **High voltage uniformity**
  - Calculated using the slopes method
    - Dynamic range ~ 21 GeV
    - West side only
      - Electronics in the east side are being installed
    - Uniformity (from slopes) ~ 7%
- **MIP calibration**
  - Fast offline production
  - ET ~ 0.006*(ADC-PED)







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To do list in the next few months

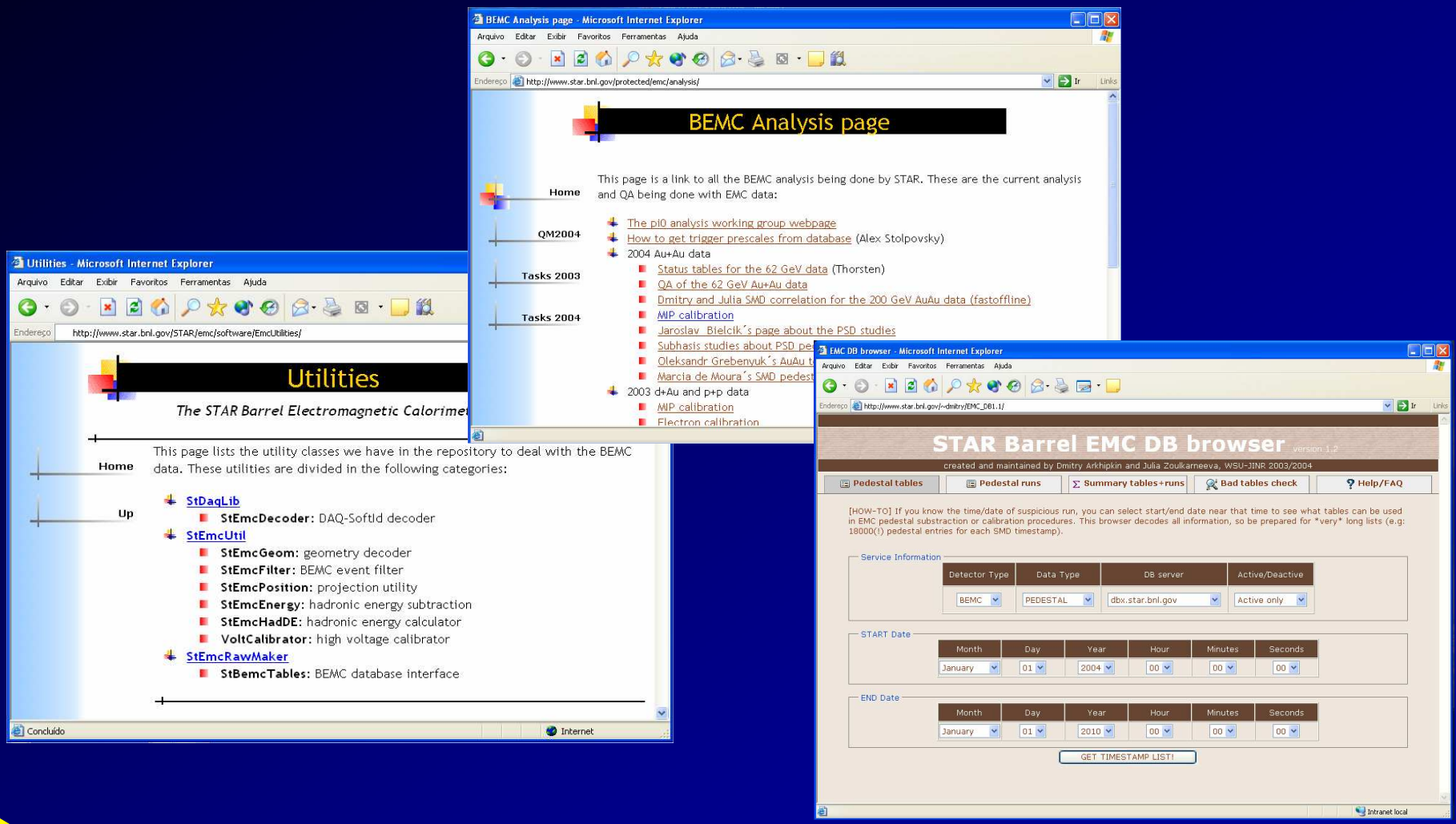
- Calibrations
  - Improve 2003 calibration
    - Need to consider other possibilities at high-pT
  - 2004 calibration
    - Mike is being working on that. He has a TbyT MIP calibration in the market
  - SMD calibration
    - Need person to work on it
  - PSD
    - Jaro is working on that. Hope to have test calibration ready soon
- Status tables and DB
  - Most of the work has been done for the towers
    - Need to do the same for the SMD
  - Need pedestal tables for 2004 SMD run
- Software development
  - Need development in cluster finding and matching
  - Implement muDST in analysis tools (StMuEmcUtil?)

Conclusion

- **Software was deeply modified**
  - New ADCtoEMaker
  - Many tools for analysis and DB
- **Calibrations**
  - 2003 calibration needs improvement (high-pT signals)
  - 2004 calibration is improving and will be available for tests soon (Mike´s single tower MIP)
  - 2005 pre-calibration in place – starting east side
- **QA of data**
  - All BEMC detectors are working as expected
    - MIP´s, electrons, pi0, etc.
  - PSD seems to be working fine after MAP was fixed
- **All BEMC software information in the BEMC web**
  - Page is still growing.

Where to look for information?

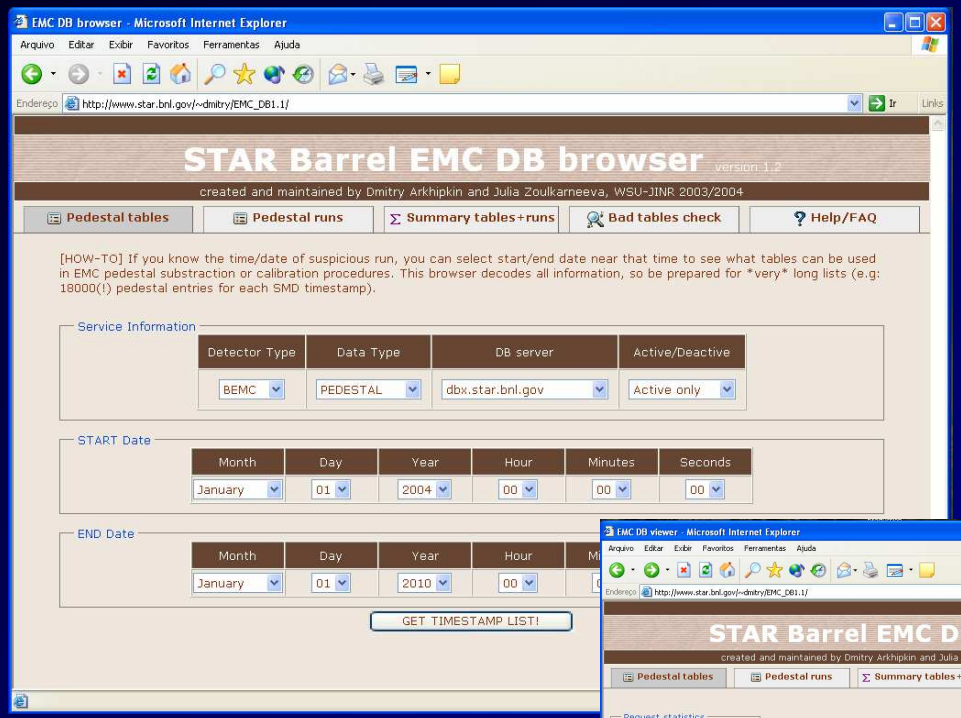
http://www.star.bnl.gov/STAR/emc

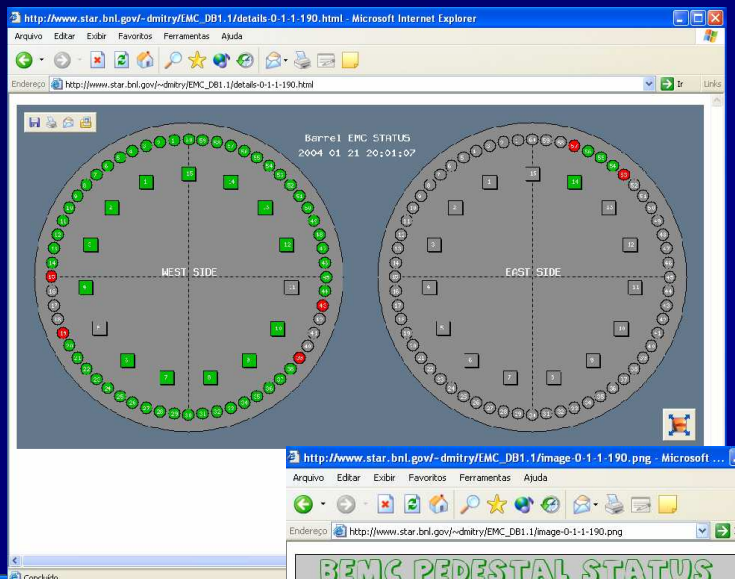


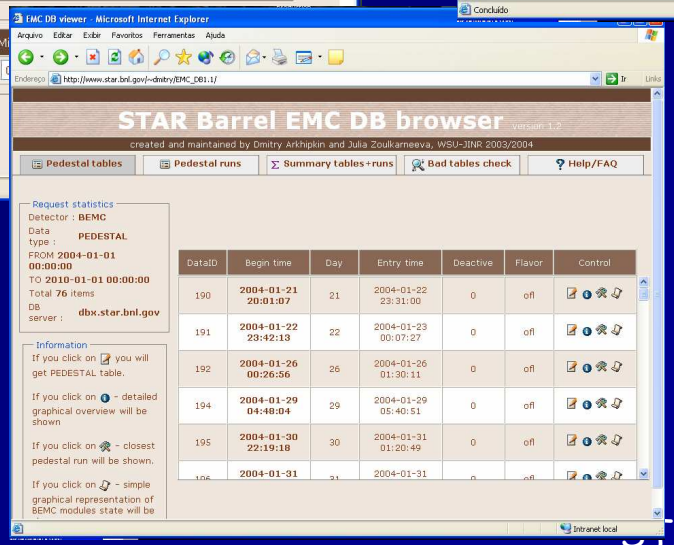
EMC Database Browser

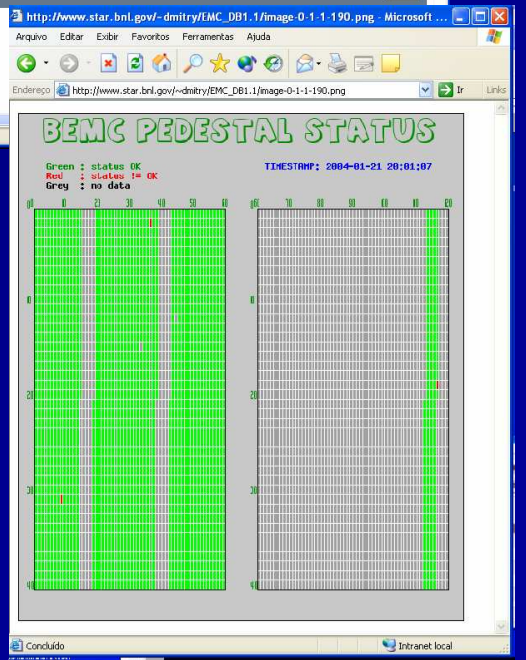
D. Arkhipkin, Y. Zoulkarneeva

http://www.star.bnl.gov/~dmitry/EMC_DB1.1/









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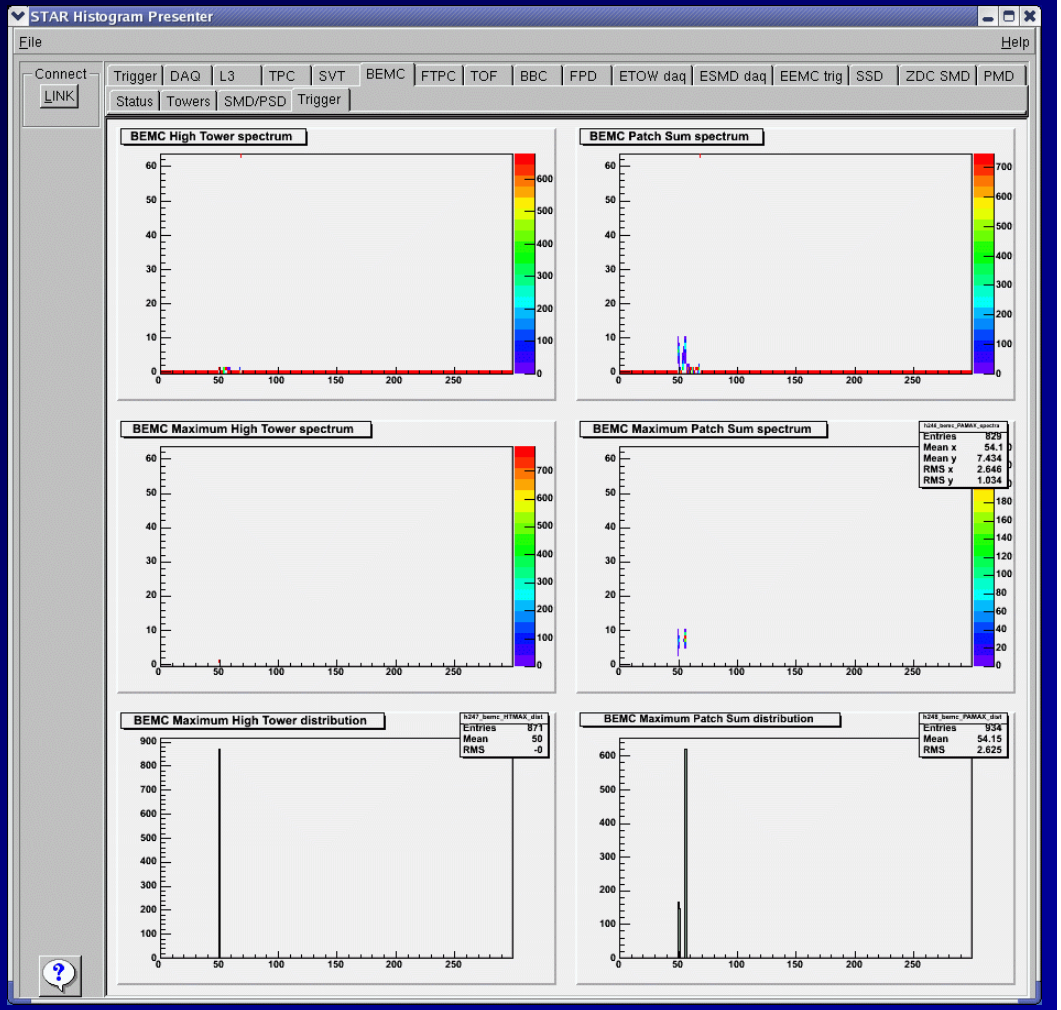
BEMC Online

- **Panitikin's plots**
  - Fast QA for the shift crew
    - This is the only tool the shift crew is trained to QA the data
    - Needs to be very simple and compact
    - Also Panitikin.LE in the emc01.starp and emc02.starp
      - Same interface with ONLY BEMC histograms
        - » Processes more events/second and much faster.
- **Expert QA (also runs offline)**
  - Event display
  - emcOnline
    - Hundreds of histograms for raw data and trigger QA
    - Option to run full BEMC reco (cluster finder, points, etc)
  - Online pedestal
    - Calculates pedestals every 24 hours and save them automatically to DB
    - With new offline status maker we will be able to check these pedestals values very fast

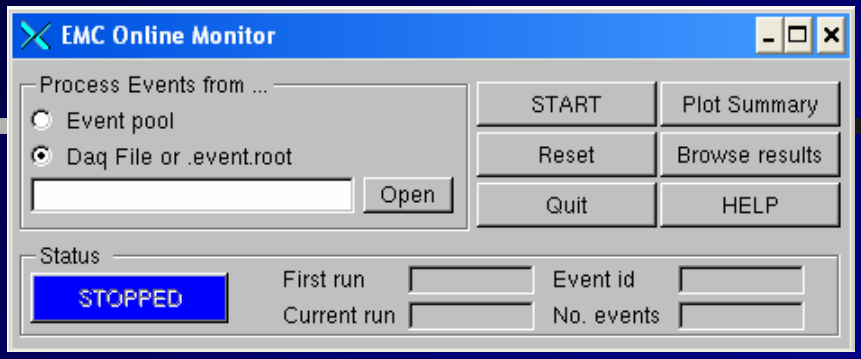
Panitikin's histograms (4 tabs)

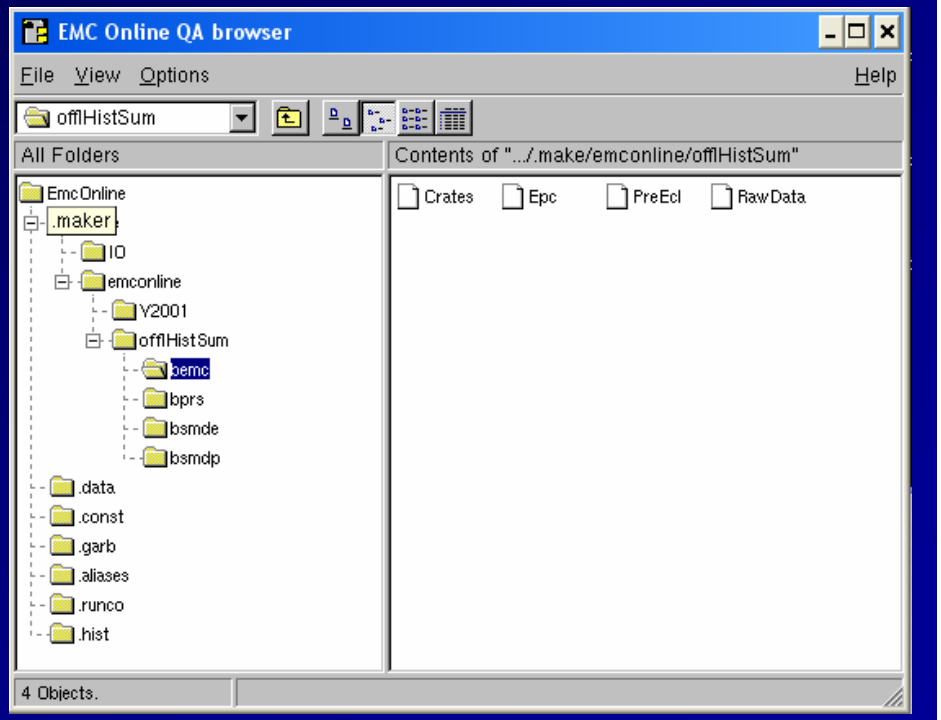
- **Status tab (3 histograms)**
  - Status of TDC event for each TDC channel (total, ok corrupted, not installed)
  - Global status of BTOW event (total, ok, corrupted)
  - Status of BSMD/BPRS data (fiber is present/not present)
- **Towers (3 histograms)**
  - Show 2D plot with spectra for each single tower. The plot is organized by TDC channel
- **BSMD/BPRS (6 histograms)**
  - Show ADC sum for each fiber and capacitor distribution
- **Trigger (6 histograms)**
  - High tower and Patch trigger information
    - 2D spectra for HT and PA
    - 2D highest HT and PA spectra (identify noisy towers)
    - 1D distribution of trigger tower id for HT and PA

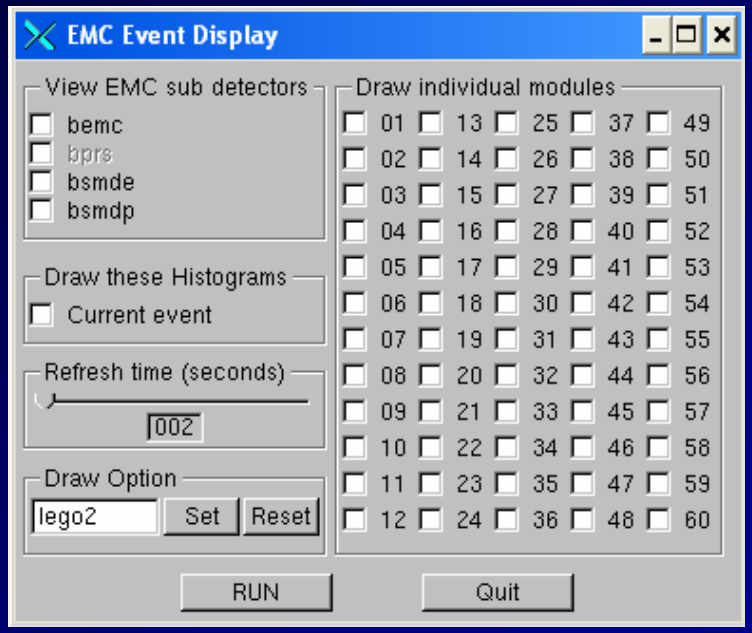


EMC event display and online monitor

- Display EMC events in real time
- Graphical user interface for easy operation
- QA of data in real time
  - Raw data
  - EMC trigger
- Possible to run offline







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