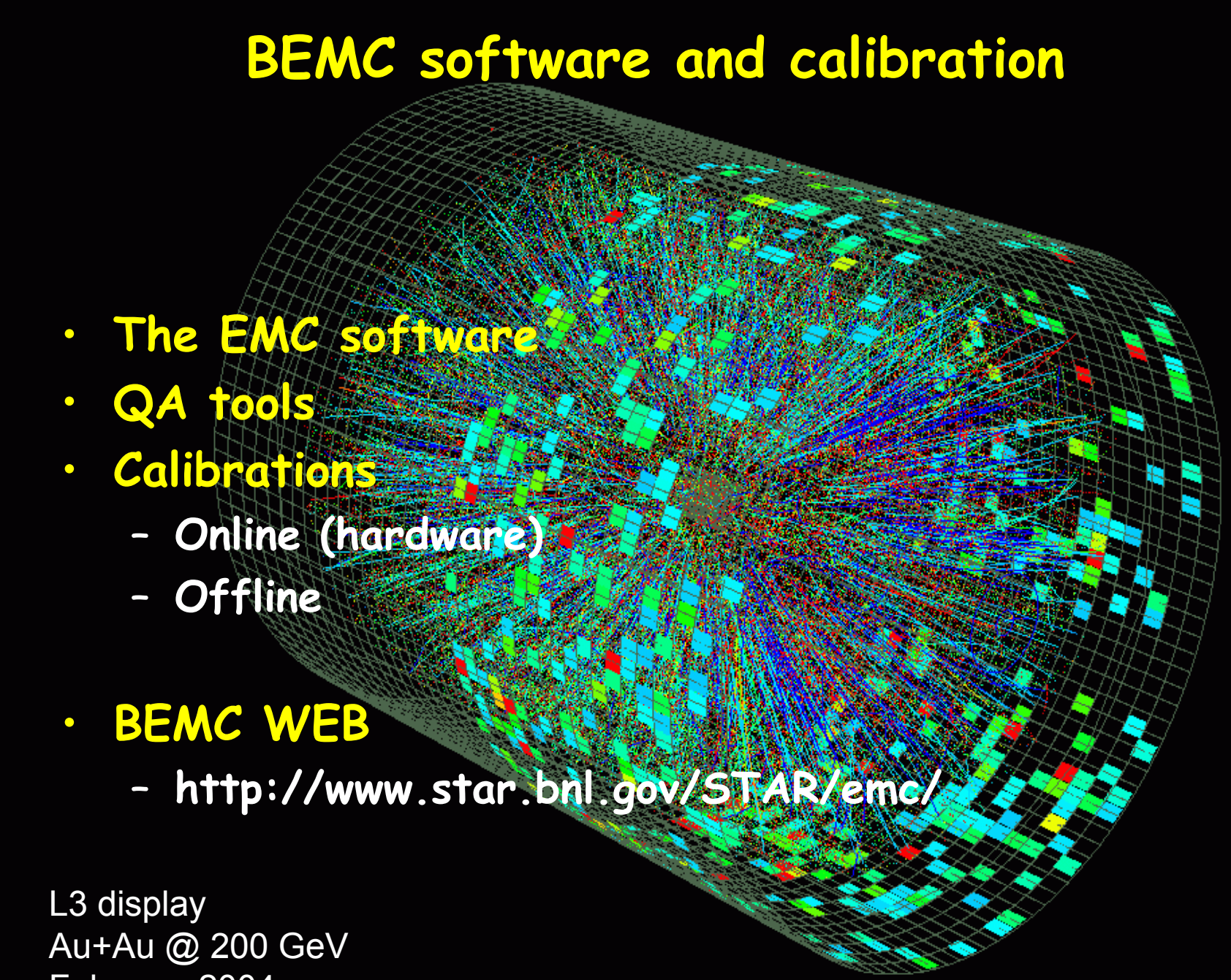
BEMC software and calibration



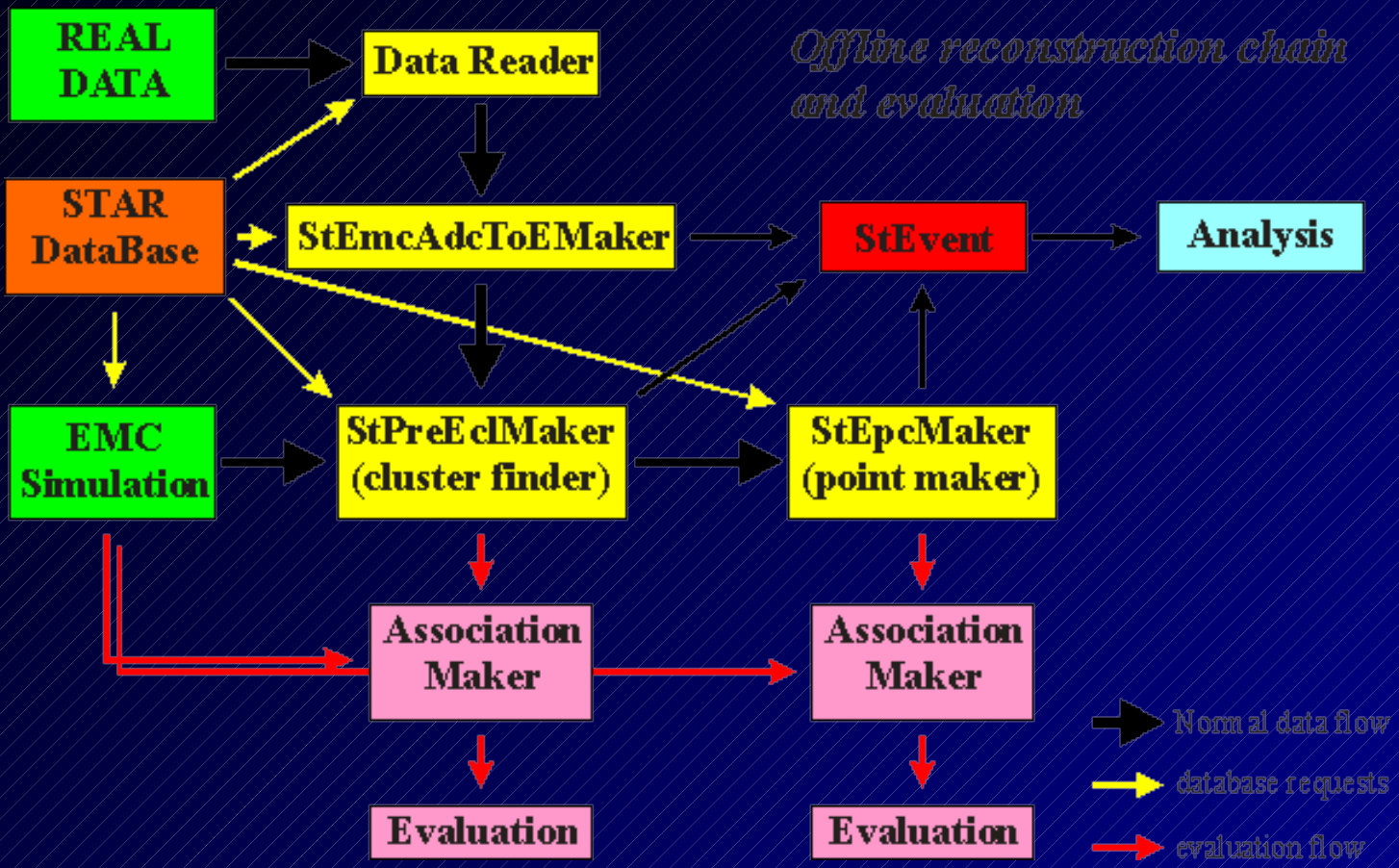
- The EMC software
- QA tools
- Calibrations
  - Online (hardware)
  - Offline

- BEMC WEB
  - http://www.star.bnl.gov/STAR/emc/

L3 display
Au+Au @ 200 GeV
February 2004

EMC Software reconstruction and analysis chains

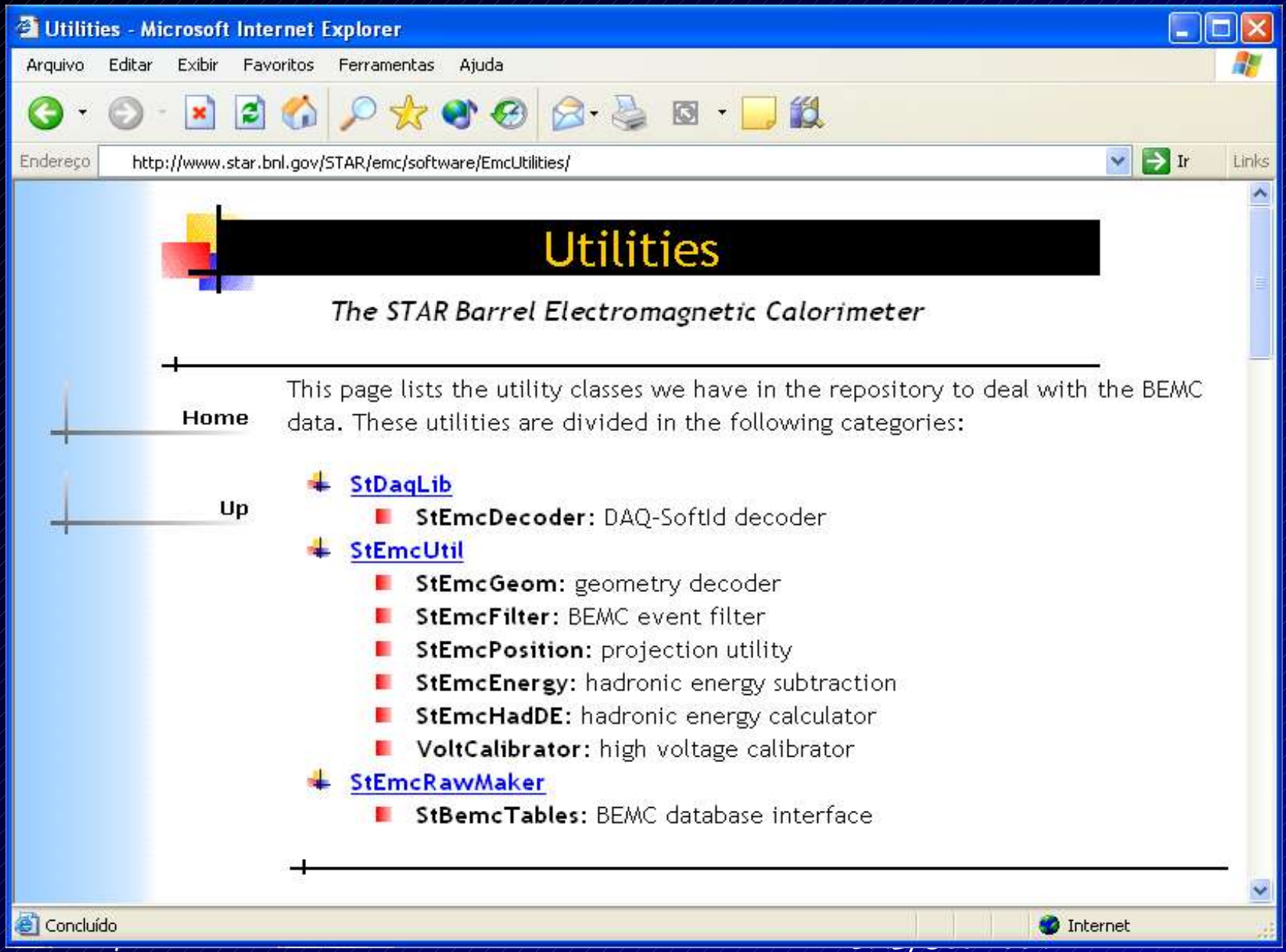
- Offline reconstruction chain is fully implemented



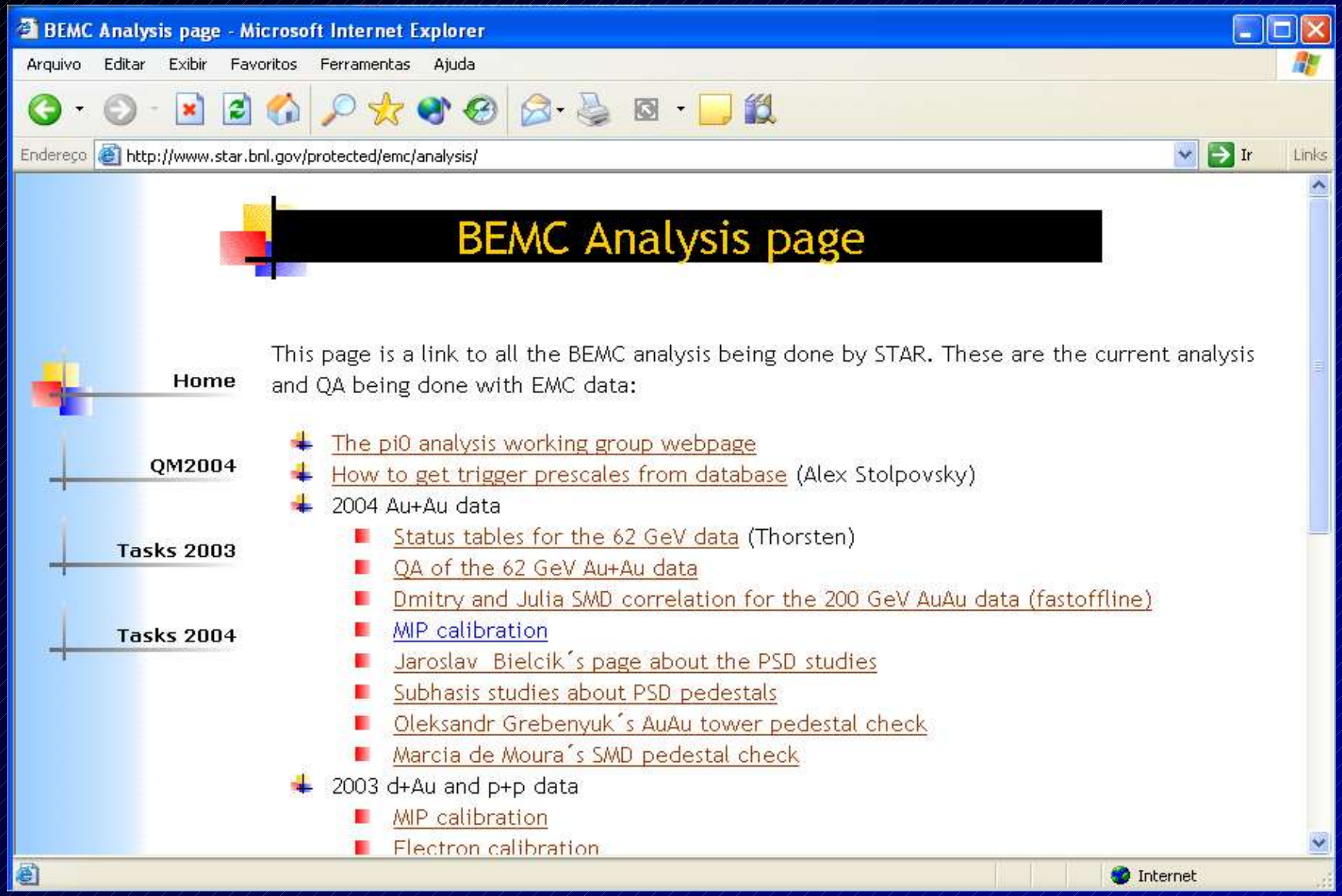
StEmcADCtoEMaker

- **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)

Offline tools for analysis



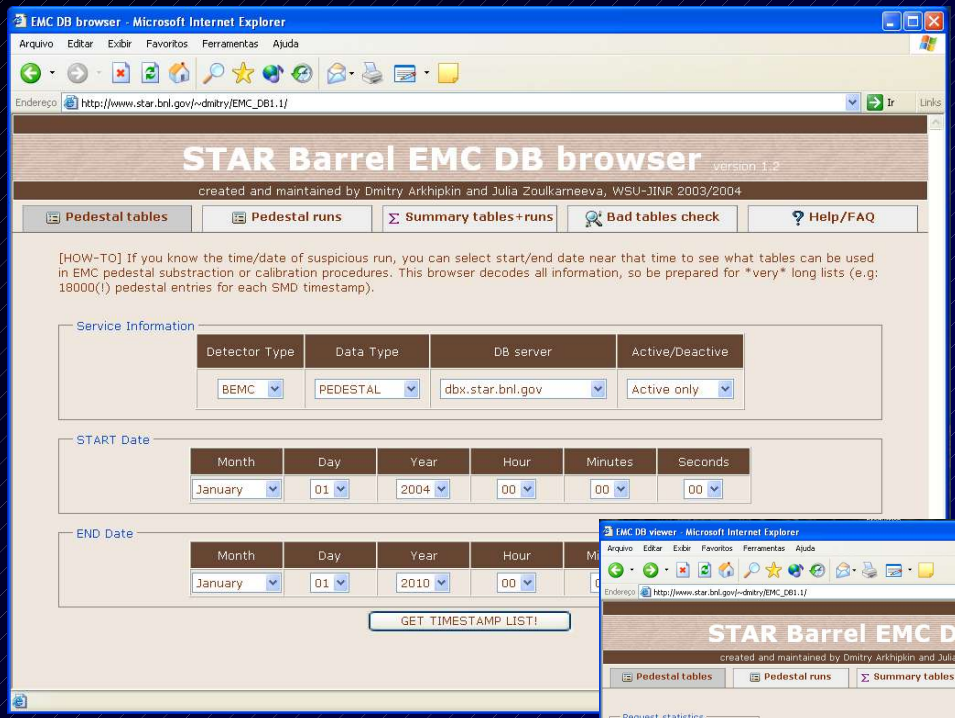
EMC Analysis pages collection

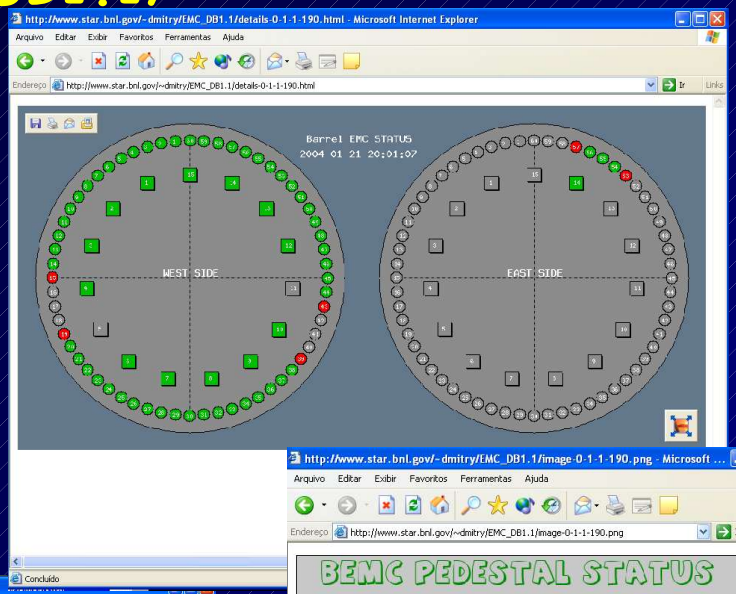


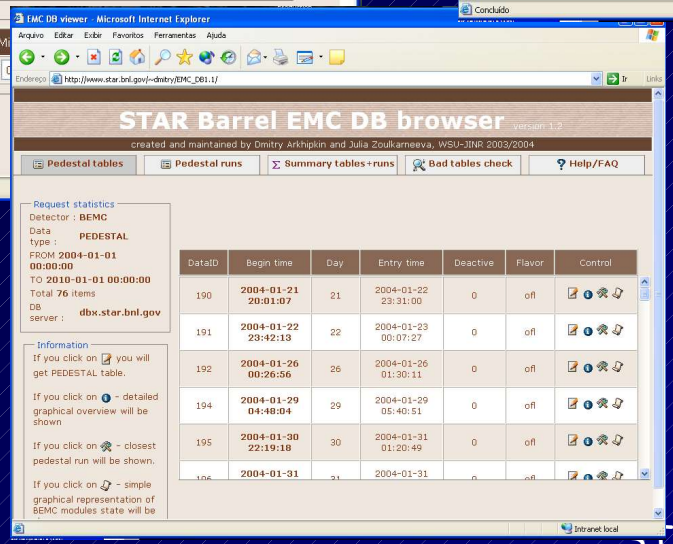
EMC Database Browser

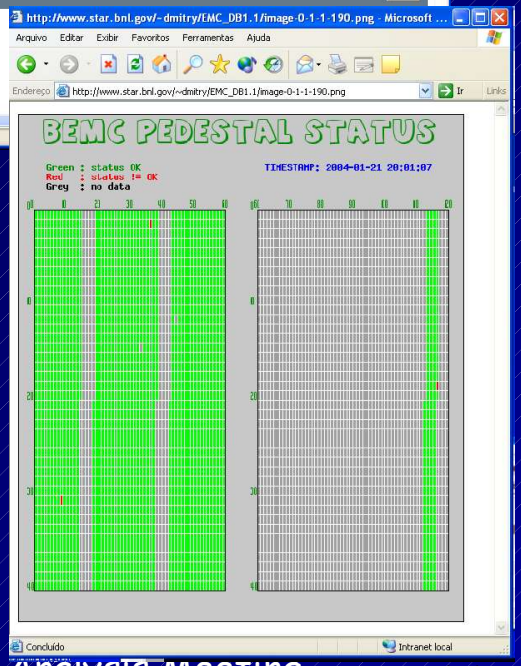
D. Arkhipkin, Y. Zoulkarneeva

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







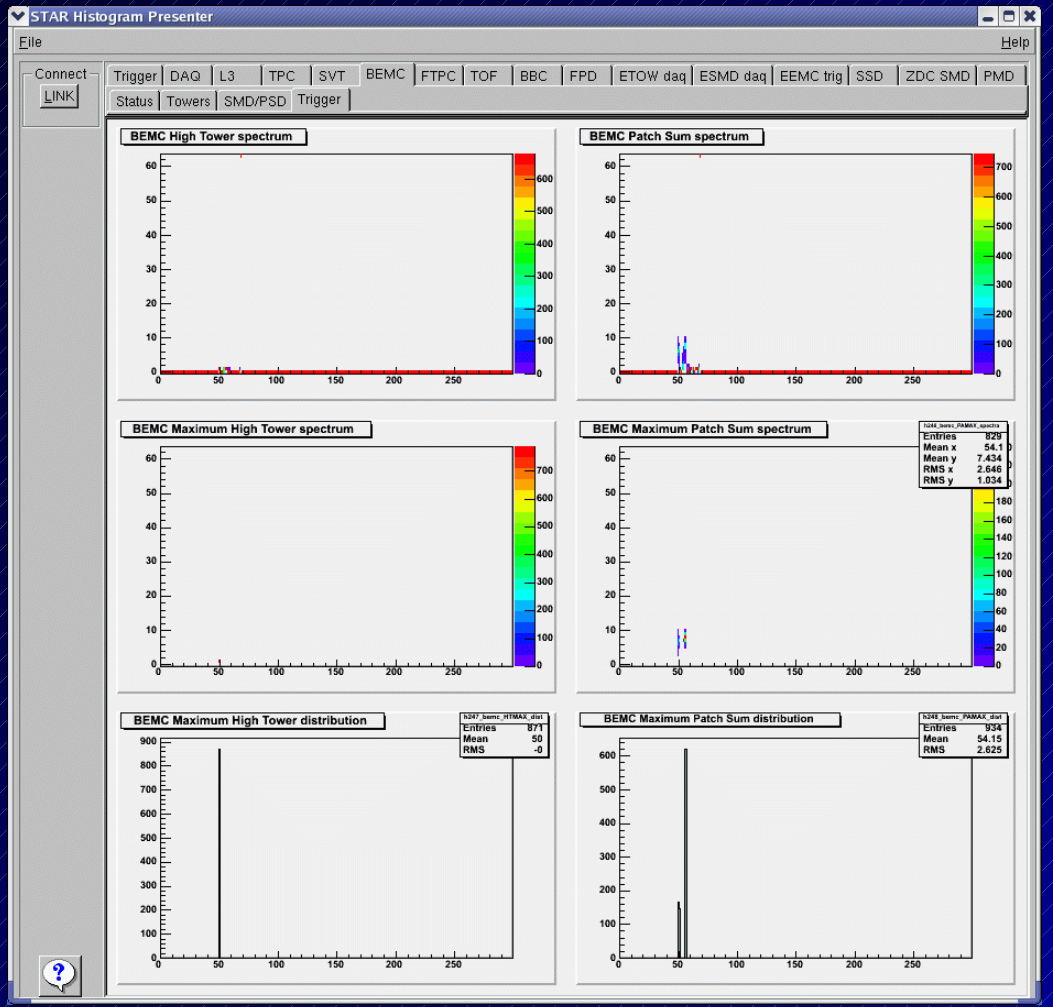


BEMC Online

- 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

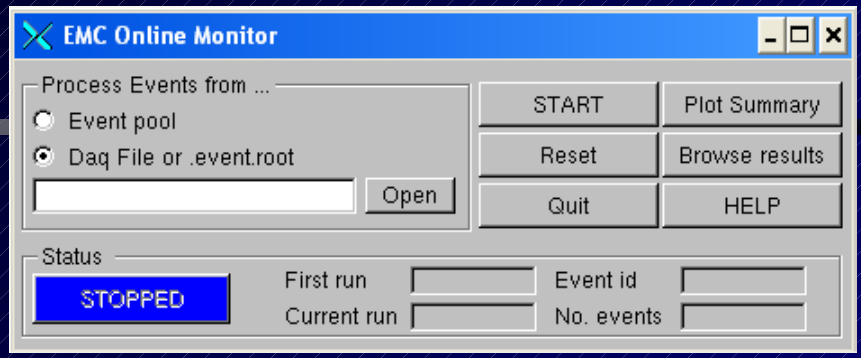
Panitikin's histograms (4 tabs)

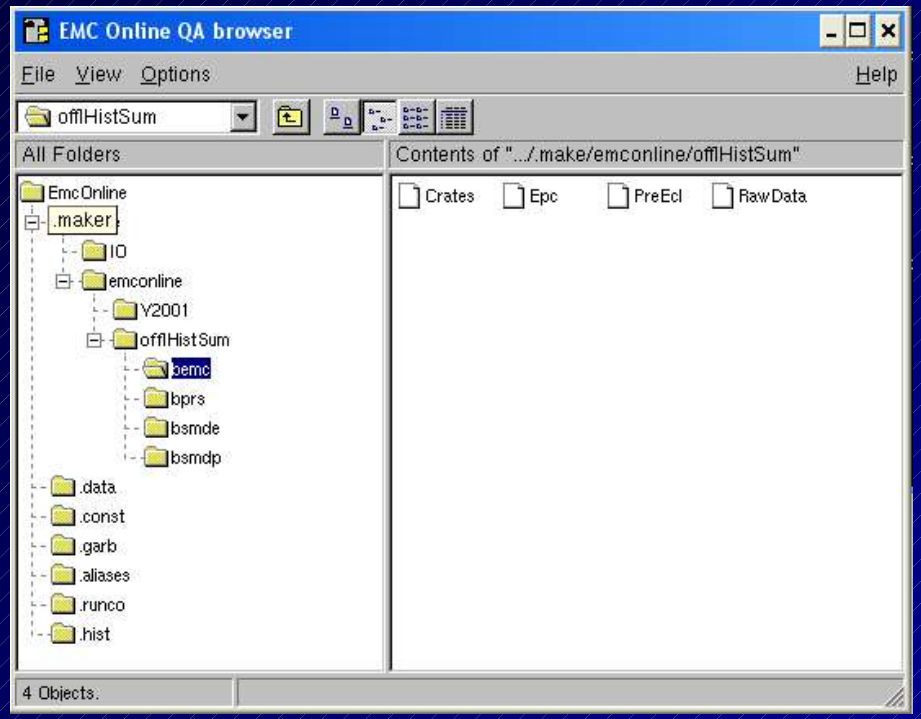
- **Status tab (3 histograms)**
  - Status of TDC event for each TDC channel (total, ok corrupted, not installed)
  - Global status of BTOW event (total, ok, corrupted)
  - Status of BSMD/BPRS data (fiber is present/not present)
- **Towers (3 histograms)**
  - Show 2D plot with spectra for each single 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

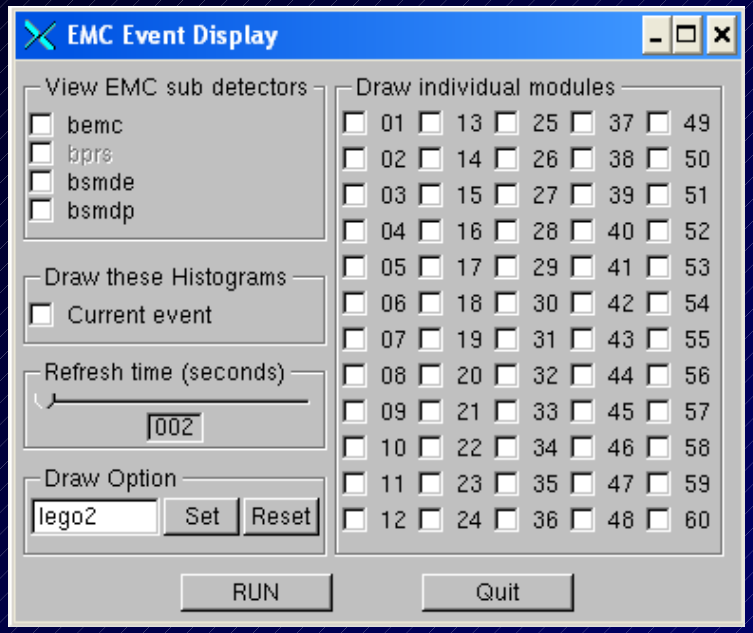


EMC event display and online monitor

- 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





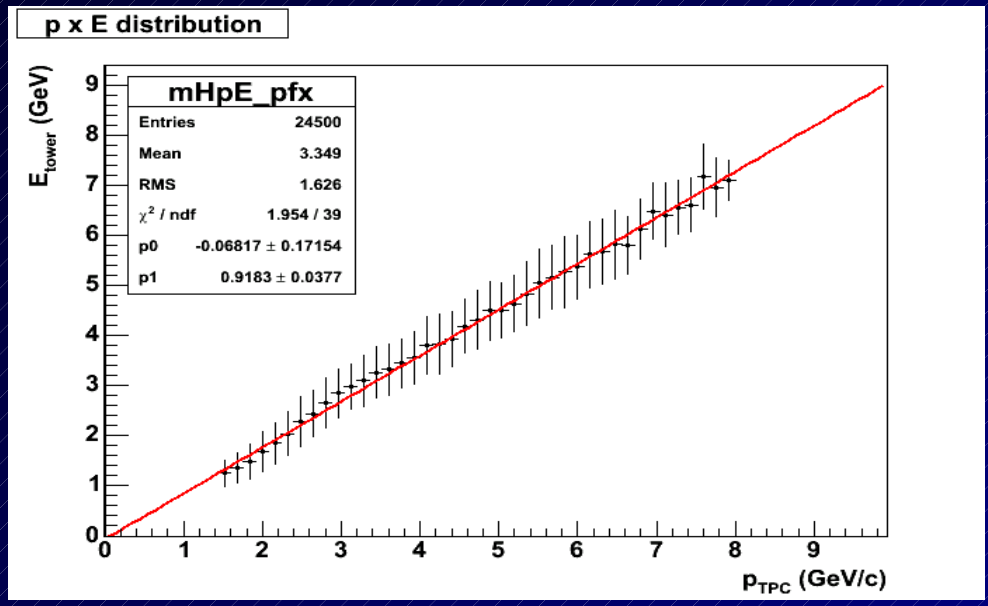


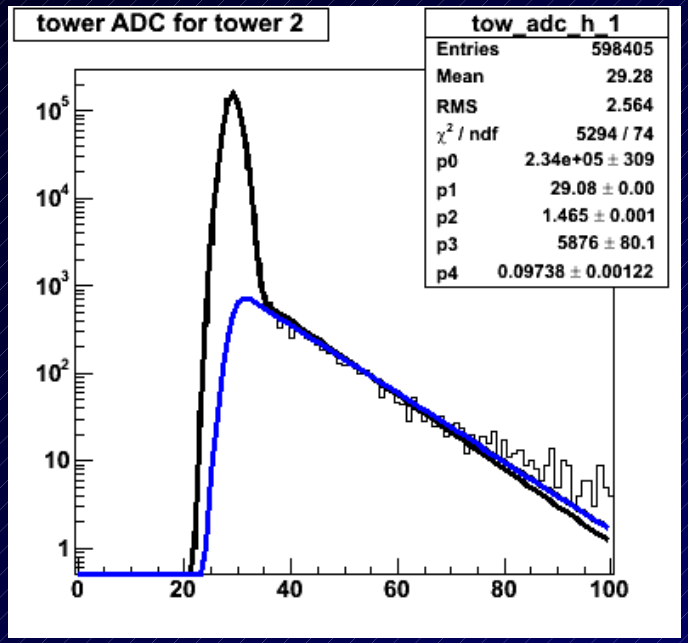
Calibration

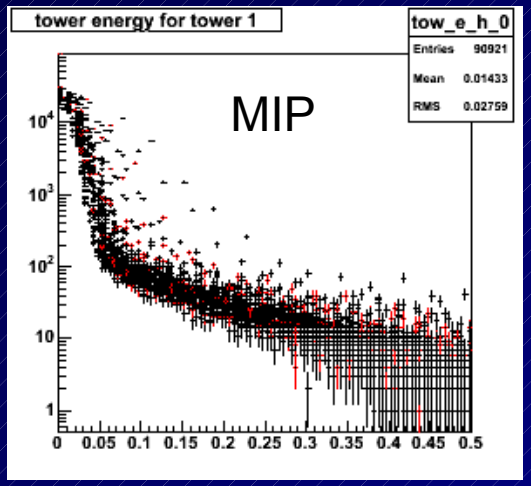
- Status of 2003 and 2004 runs
- Calibration for upcoming run
  - Hardware calibration
  - Offline

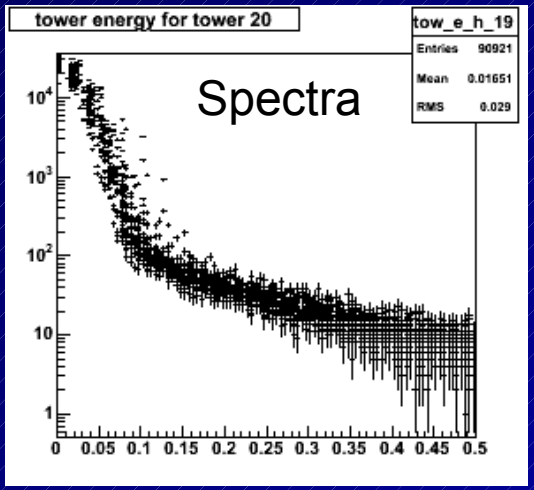
2003 dAu and pp data

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



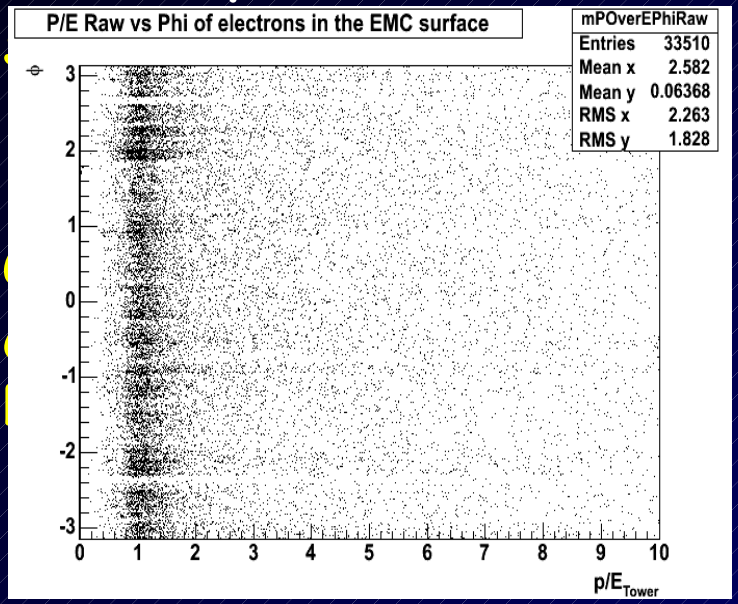


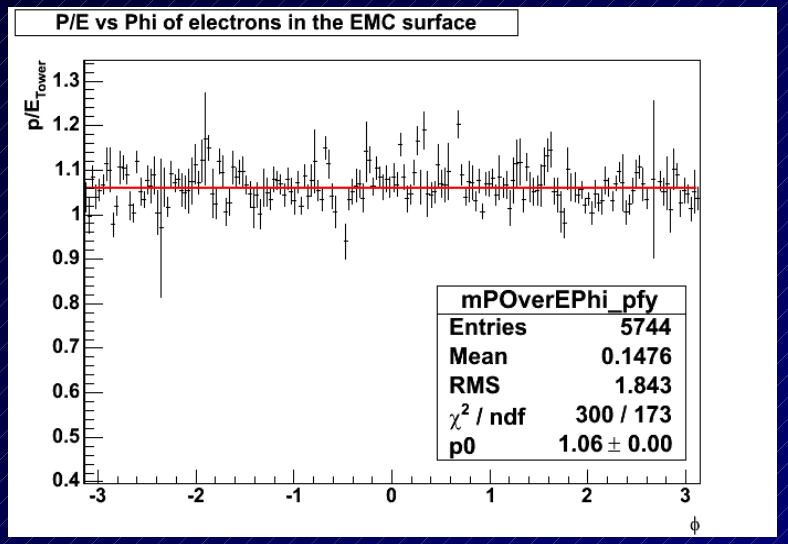


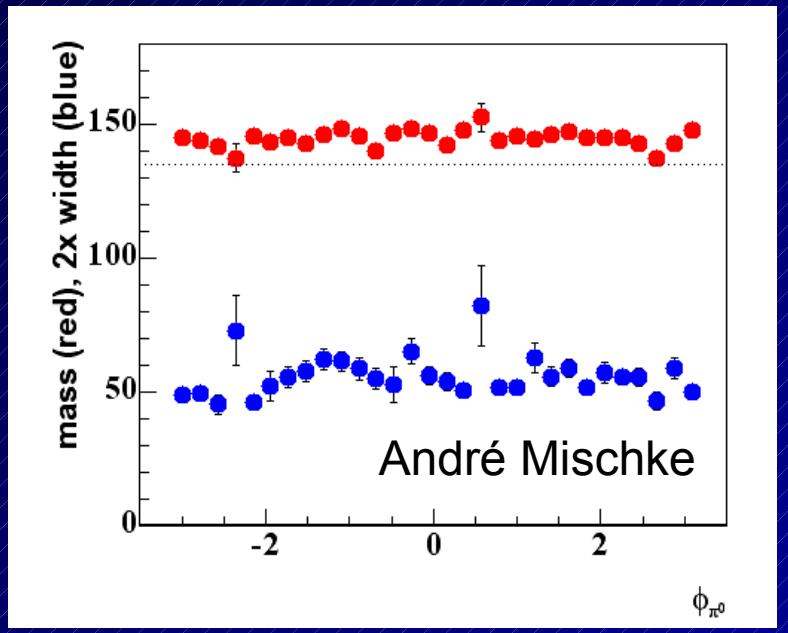


Single tower electron and π^0 calibrations

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

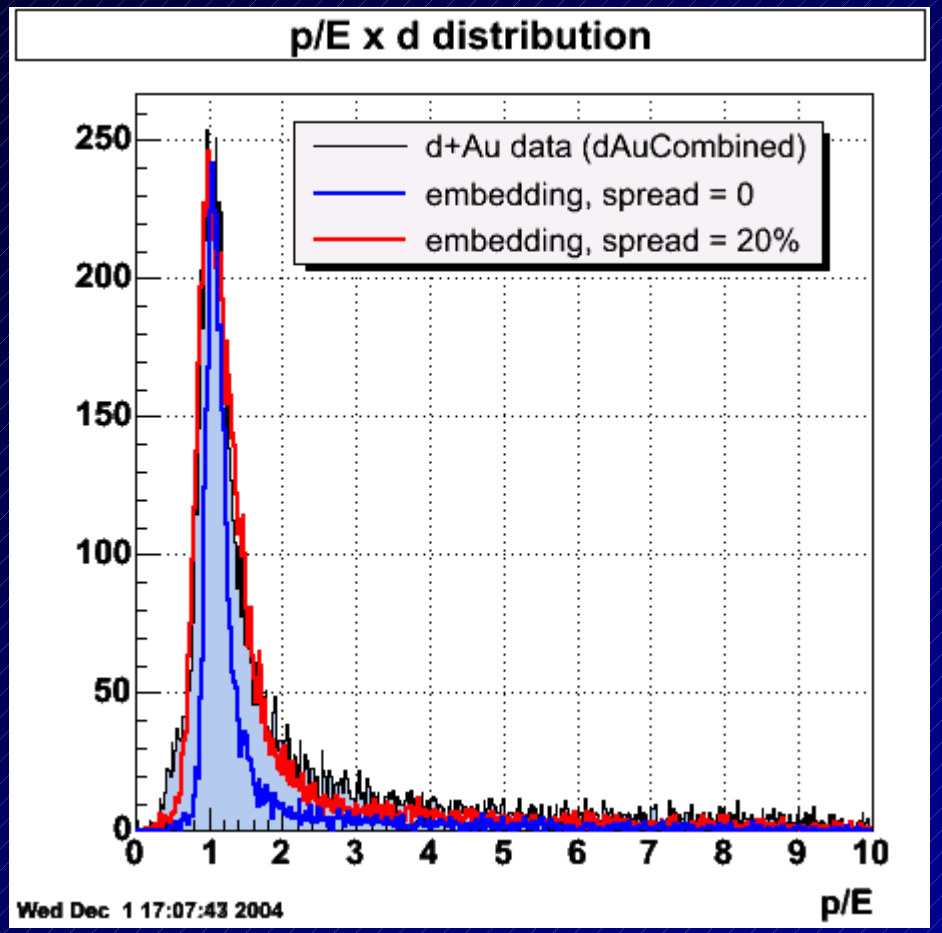






Single tower calibration "uncertainty" estimation

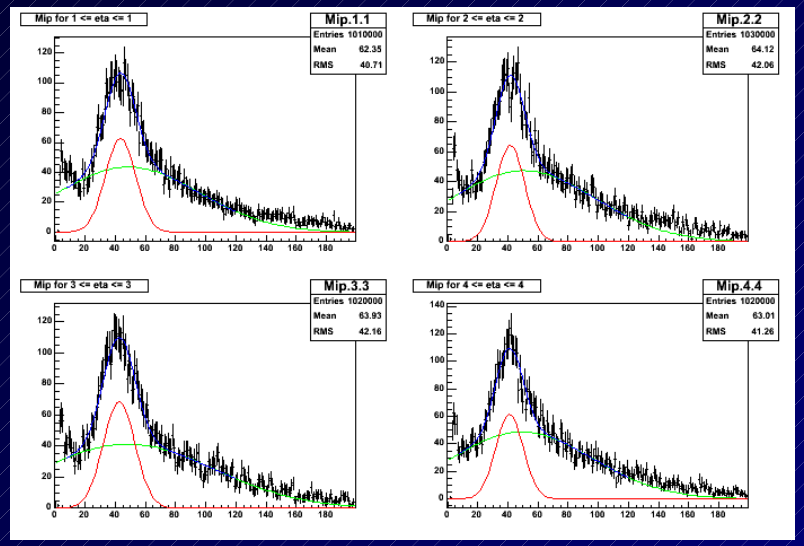
- **Current calibration is MIP based**
  - Electrons just shift overall gain
  - MIP calibration is at very low energy
    - 200-300 MeV
    - Large extrapolations to high-E
      - Large uncertainties
- **StEmcSimulator was updated to account for calibration uncertainties**
  - Systematic shift for 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 = 20 %

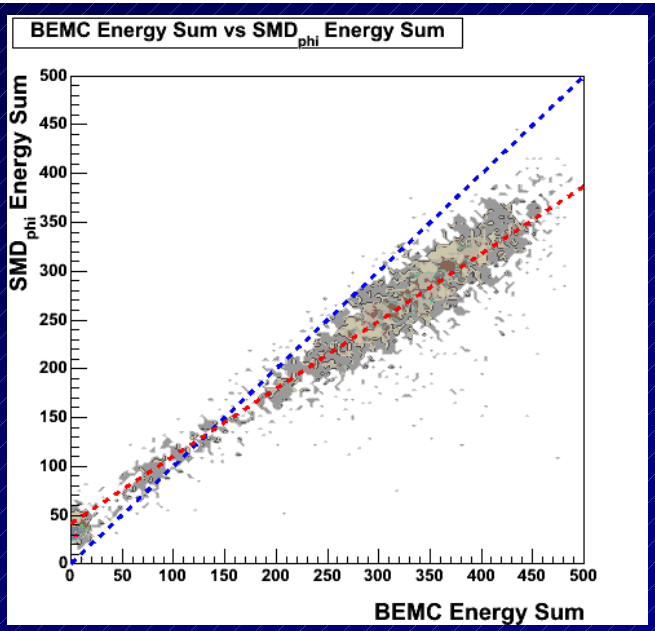


Calibration for Y2004 data

Alex Suaide, D. Arkhipkin, Y. Zoulkarneeva

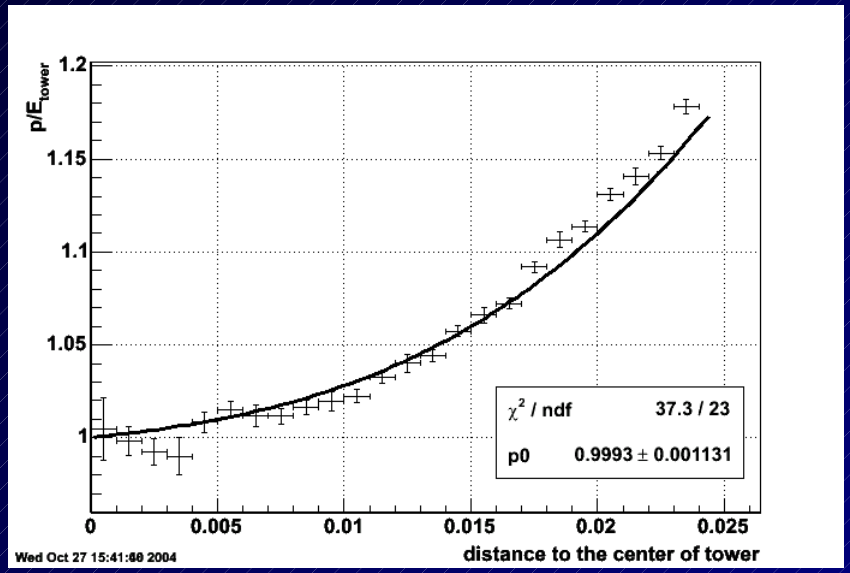
- Hardware calibration
  - Online spectra slope method
    - Adjust high voltages to get better uniformity
    - Special runs during data taking
    - Very important for trigger uniformity
- MIP Calibration
  - Absolute calibration
- SMD calibration
  - Global gain correction with respect to towers

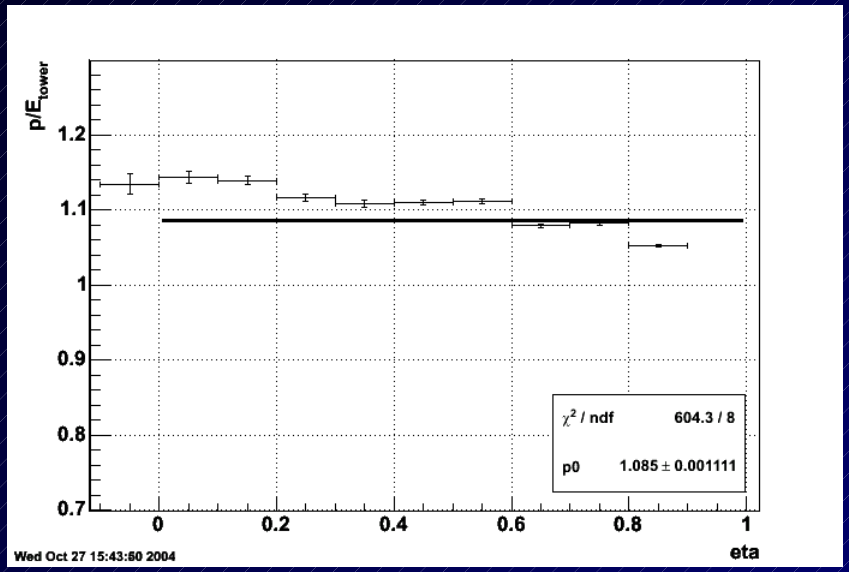


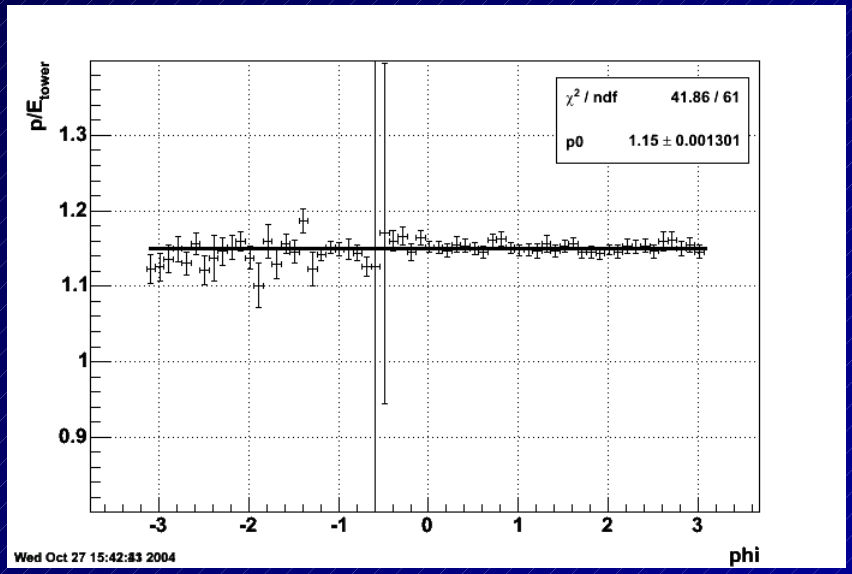


Electron calibration. Preliminary...

- Electron peak fitted to MIP
- Use track momentum to correct gain calibration
  - Not enough statistics to do it tower by tower
  - Do it in eta/phi bins
  - Not uniform in ϕ direction
    - Overall peak position ok
    - Azimuthal uniformity ok
    - η dependence
      - Still investigating
        - » Towers are large at η=1
        - » Less leakage, small p/E???





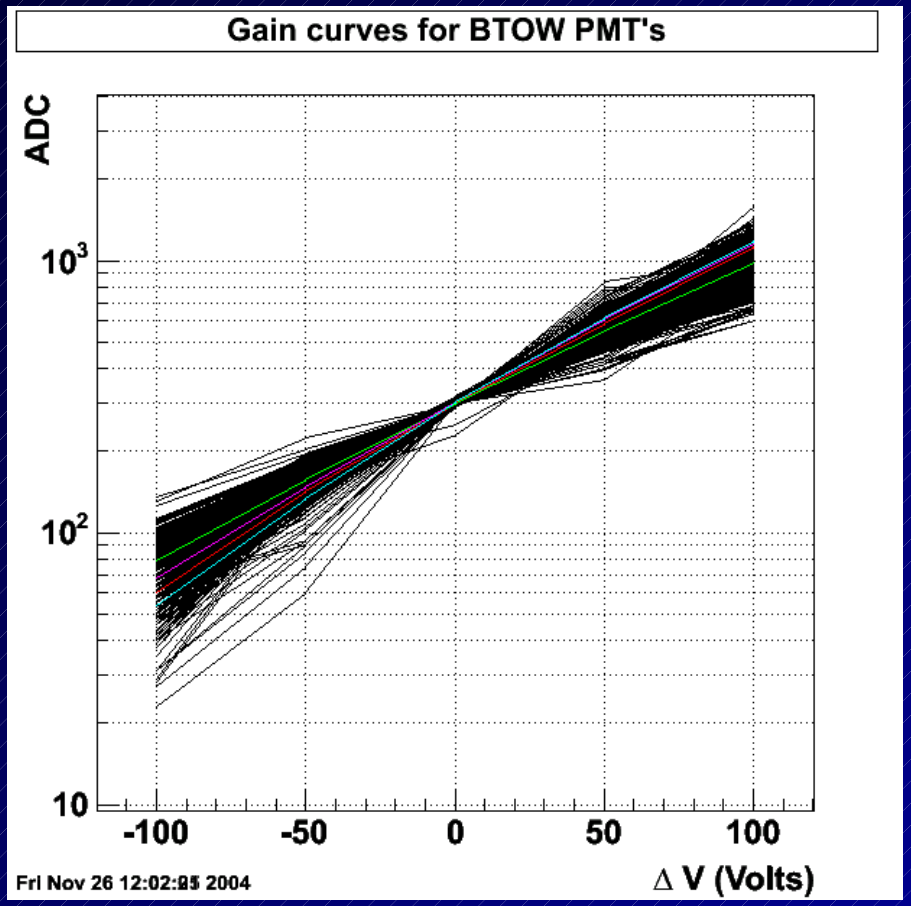


Calibration task list

- 2003 dataset
  - What is in DB?
    - Single tower MIP + electron gain correction
    - Ideal SMD calibration
  - Need to compare calibration fro π^0 and electrons better.
  - Need better single tower absolute calibration!
    - Very important for π^0
  - Need SMD calibration (global gain correction?)
- 2004 dataset
  - What is in DB?
    - Eta-bin MIPS
    - Ideal SMD calibration
  - Need to finish eta/phi electron calibration
    - Available as root file for private DB after analysis meeting.
  - Need π^0 calibration
  - Need PSD and SMD calibration
    - PSD has other issues (Subhasis, Jaro, Marcia and Ahmed)

Calibration task list (cont.)

- Redo High Voltages settings
  - 2004 data has gain twice the designed one
  - Make BEMC only runs (about 500 k minimum bias event per run)
  - Calculate single tower spectrum slope (fit)
  - Calculate gain correction
    - Compare to gain x voltage curves for every PMT
  - Redo this process about 3-4 times until converge
- Make 500k minimum bias run with BEMC+TPC (L3 would be great)
  - Do MIP calibration.



Conclusion

- **Software was deeply modified**
  - New ADCtoEMaker
  - New web page
  - Many tools for analysis
- **QA of data is reshaped**
  - Hope that shift crew can identify problems easly
  - Expert QA also available
- **Calibrations**
  - 2003 calibration needs improvement
  - 2004 calibration is improving and will be available for tests soon
  - 2005 scheme in place. Turn around time is a few days after start taking data
- **All BEMC software information in the BEMC web**
  - Page is still growing.