



Offline and Monitoring Software for the EMEC+HEC Combined Run



Combined Test Beam *and*
LArg Software and Performance
11 September 2002

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Overview



- ◆ **Previous testbeams:**
 - HEC: Fortran code **hec_adc**
 - EMEC: C code **emtb** (also athena version)
- ◆ **For 2002 combined EMEC/HEC run:**
 - Use HEC DAQ system for EMEC+HEC data
 - EMEC data: pack compressed mini-ROD data directly into (new) EPIO banks with no modification
 - Want single package handling HEC-ROD and EMEC-MINIROD data
 - **hec_adc**: do not want to develop legacy fortran code
 - **emtb**: annoying/difficult (impossible?) for use with HEC-EPIO data format (used also for new EMEC data)
 - Push directly to **athena**-based system which will use the offline analysis tools



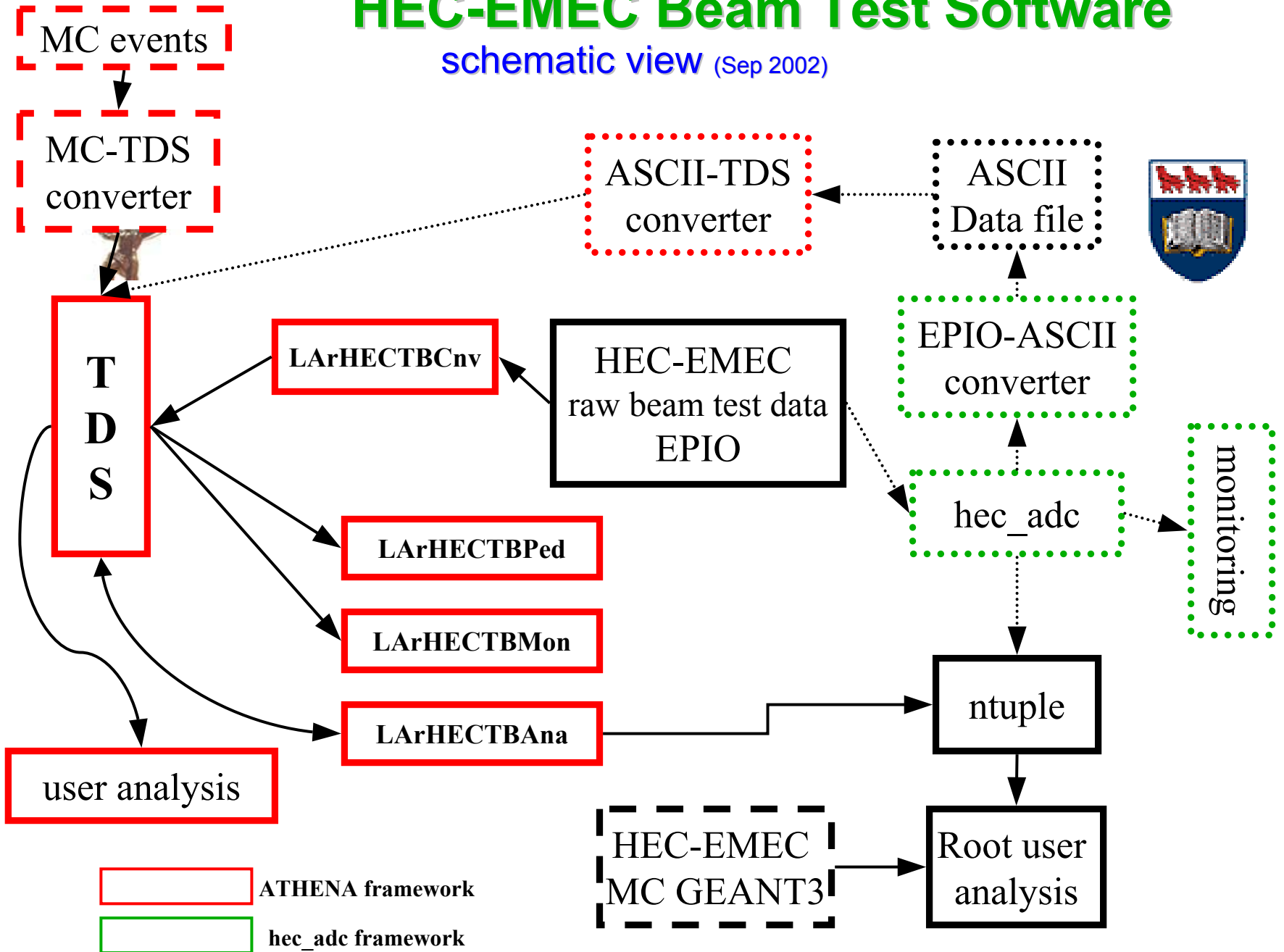
athena HEC+EMEC testbeam tools



- ◆ **LArHECTBCnv (Kanaya):** converts **EPIO** to **athena TDS**
 - This is the core routine for getting usable data
 - Not all information foreseen in **TDS** (yet)
- ◆ **LArHECTBPed (Kanaya):** calculates pedestals run-by-run
 - Currently done in “pass 1” by user
 - Plan to archive pedestals in database for general use
- ◆ **LArHECTBAna (Kanaya) :** offline analysis, produce standard ntuple
 - First priority is to understand calibrations and energy scales
- ◆ **LArHECTBMon (McPherson):** runs online to produce simple diagnostic histograms

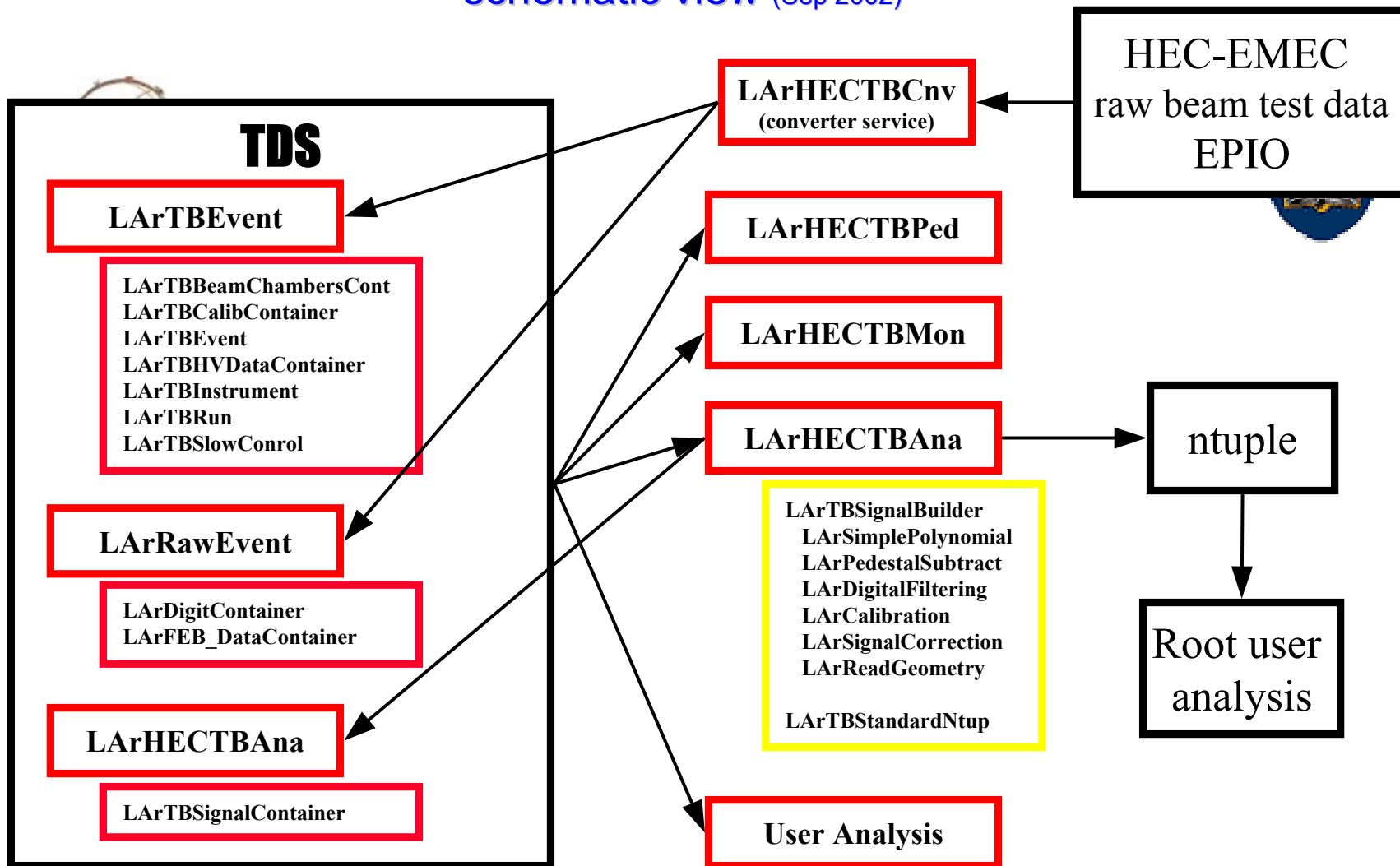
HEC-EMEC Beam Test Software

schematic view (Sep 2002)



HEC-EMEC Beam Test Software

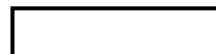
schematic view (Sep 2002)



Athena packages



Athena data classes



not in Athena



Athena (sub)Algorithms



Developments and Status (I) Converter



- ◆ **LArHECTBCnv with athena 4.0.0 (Kanaya et al.)**
 - **HEC ROD data in August 2002 run:**
 - Complications with byte swapping took **~ 1 day** to fix
 - **EMEC Mini-ROD data in August 2002 run:**
 - Uncompression routines: wrapped **EMTB C** code
 - Unpacking and mapping routines: Recoded from scratch
 - Many trials using pulser data for unmapping tests
 - ◆ **Pulser data → Guess Pattern → Test → Iterate**
 - Took about **~ 2 days** after start of data taking for valid data for EMEC timing adjustments
 - Plus another **~ 2 days** for full unpacking with final mapping
 - Still have problems with EMEC data from **corrupted** runs (usually results in EMEC **data compression problems**, not always noticed)



Developments and Status (II) TDS additions



- **LArTBInstrument**
 - 4 words containing trigger pattern bits
- **LArTBRun**
 - Particle type, Energy, Impact point (X,Y)
 - In principle: available in database, but we did not want to rely on real-time updating/reading for monitoring
- **LArTBChamber**
 - Wire number hit (raw data) – for expert diagnostics
- **LArTBSlowCont**
 - FEB Temperatures
- **LArTBEvent**
 - Need easier “raw” test beam geometry information
 - ◆ Atlas ↔ TestBeam index
 - ◆ TestBeam (η, ϕ, z), ATI connector, calibration line, ...
 - ◆ Request: include complete mapping files into TDS



Developments and Status (III) Monitoring

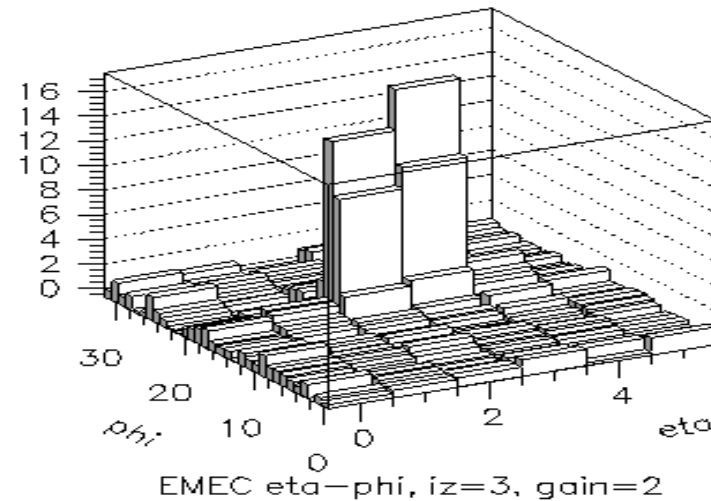
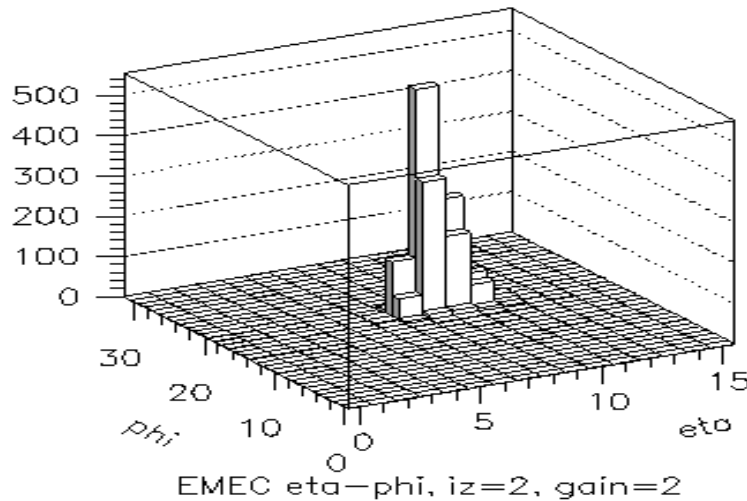
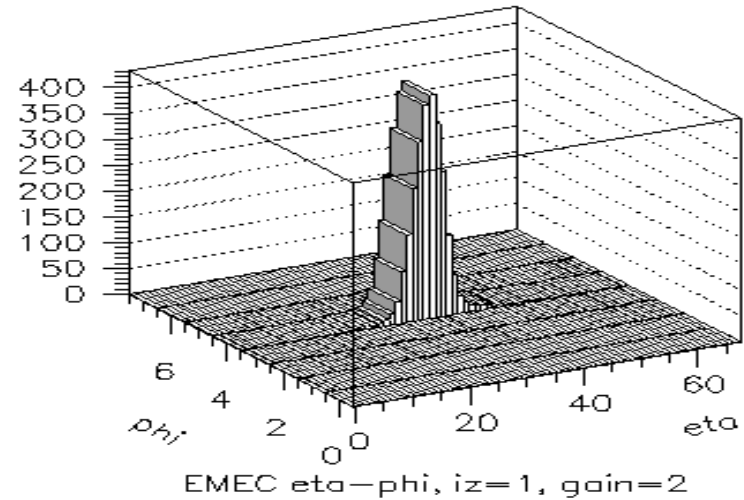
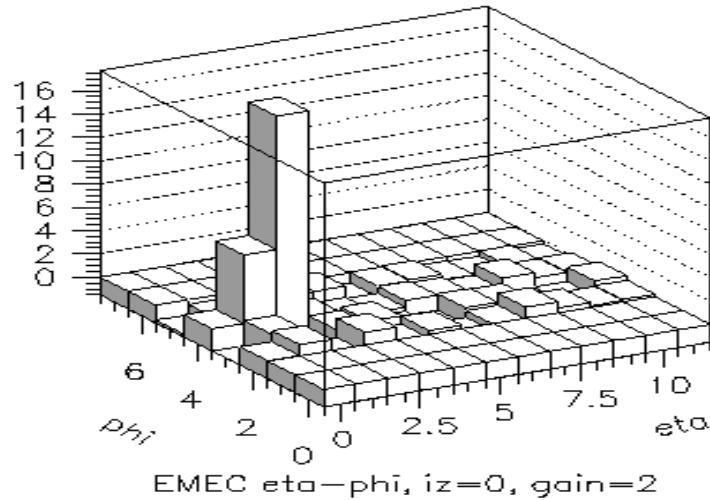


- ◆ **LArHECTBMon (McPherson, Fincke)**
 - **Accesses all HEC, EMEC, Header, Beam Chamber data**
 - **Basic set of monitoring histograms for shift crew**
 - **Runs online from atllinux1-h6**
 - **Accesses data via nfs mount to DAQ disk**
 - **Runs offline from lxplus**
 - **Accesses data from local copy or directly from castor**
- ◆ **Will maintain LArHECTBMon for offline quality control tests and code example**
- ◆ **See clear $e/\mu/\pi$ in EMEC and μ/π in HEC**

Eg: 40 GeV e in EMEC



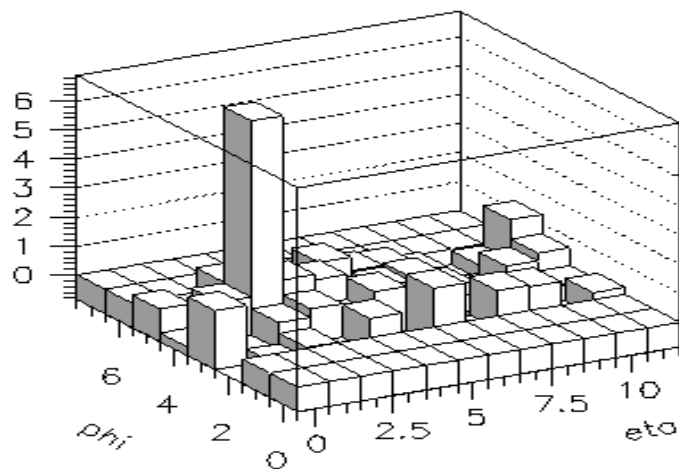
EMEC Eta vs Phi high gain



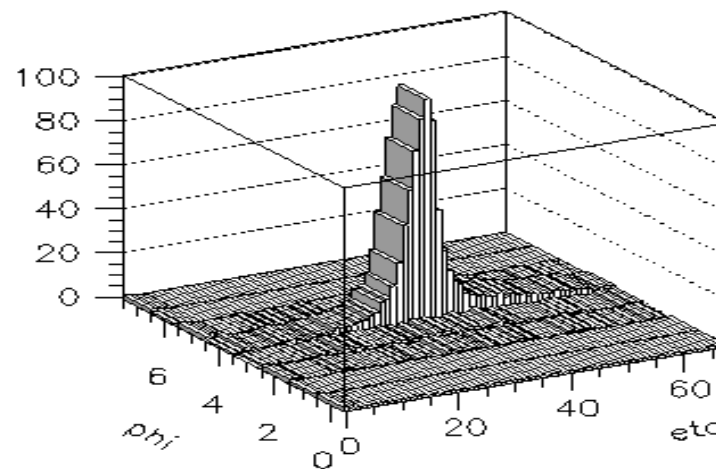
150 GeV π in EMEC



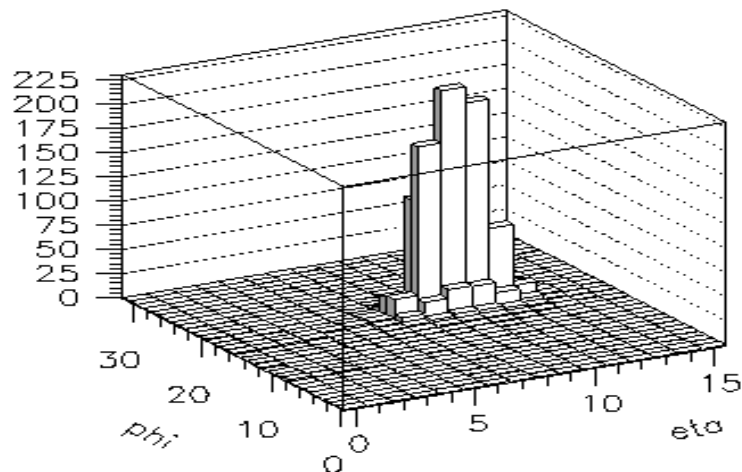
EMEC Eta vs Phi high gain



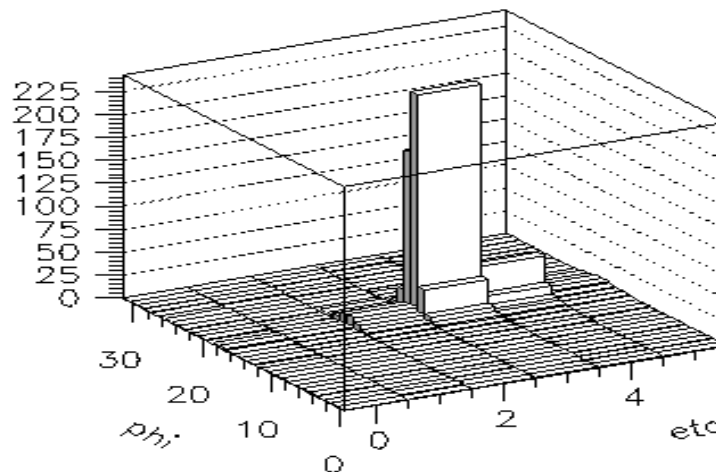
EMEC eta-phi, iz=0, gain=2



EMEC eta-phi, iz=1, gain=2



EMEC eta-phi, iz=2, gain=2

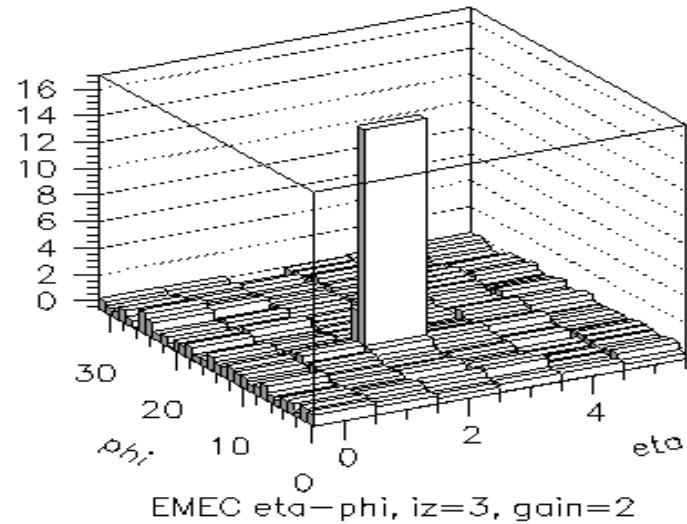
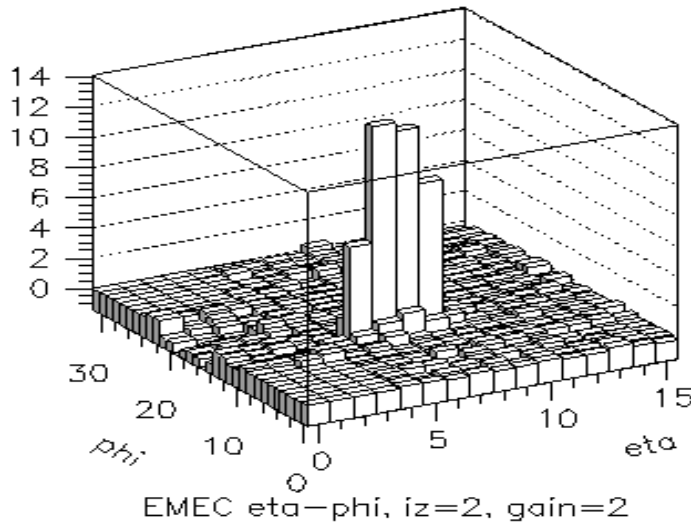
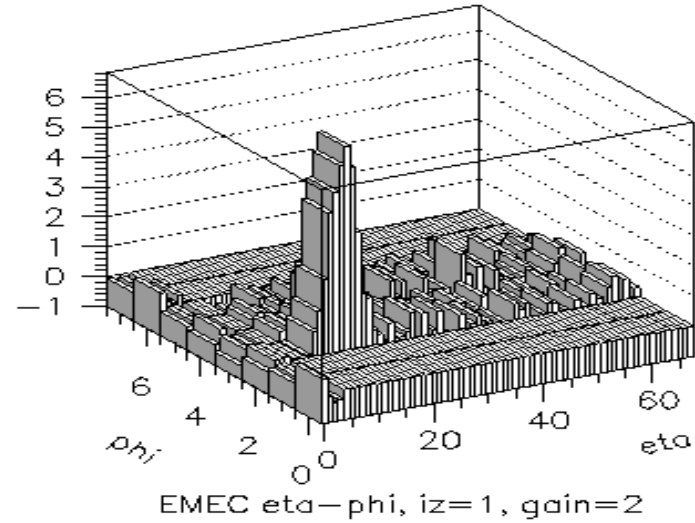
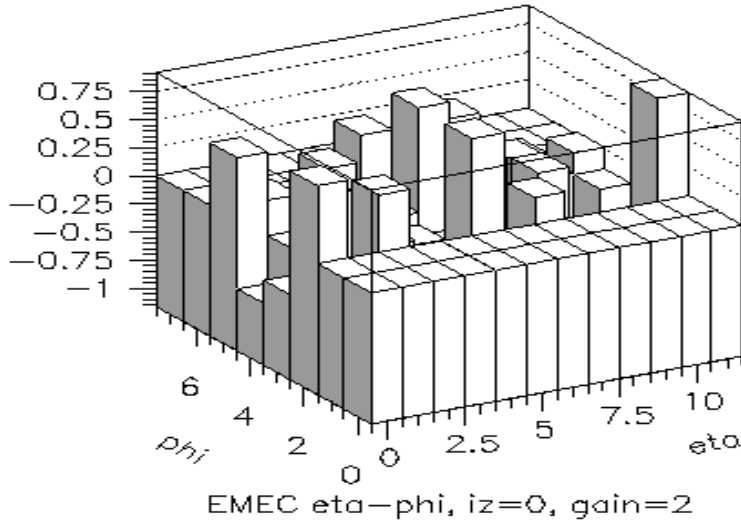


EMEC eta-phi, iz=3, gain=2

Eg: 150 GeV μ in EMEC

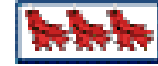


EMEC Eta vs Phi high gain

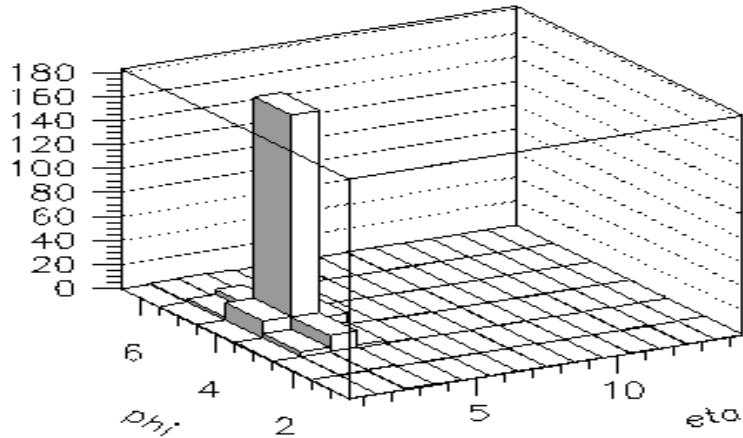




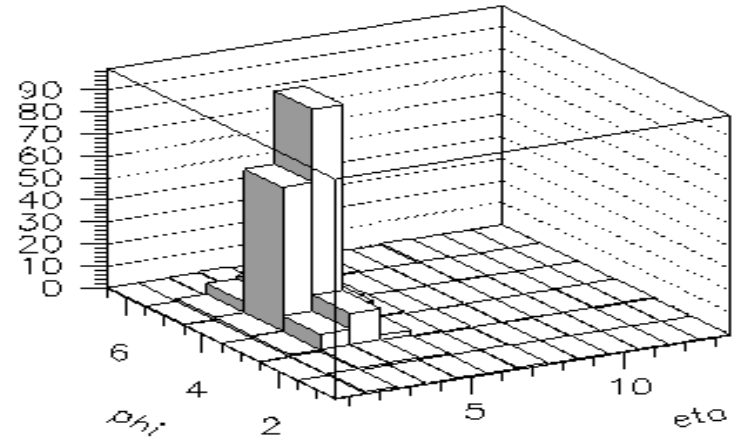
Eg: 150 GeV π in HEC



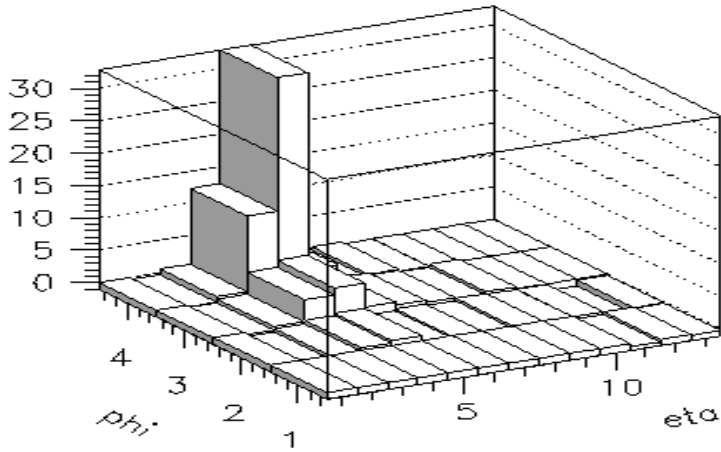
Eta vs Phi energy deposition



HEC eta-phi, iz=1



HEC eta-phi, iz=3



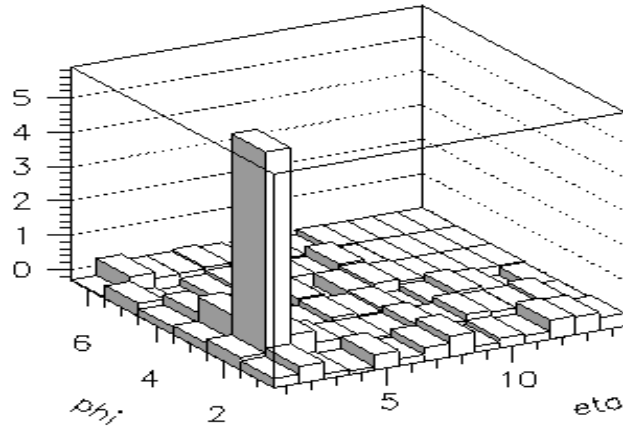
HEC eta-phi, iz=2



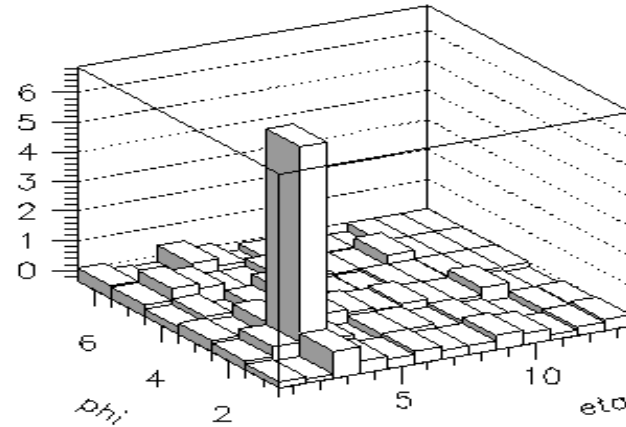
Eg: 150 GeV μ in HEC



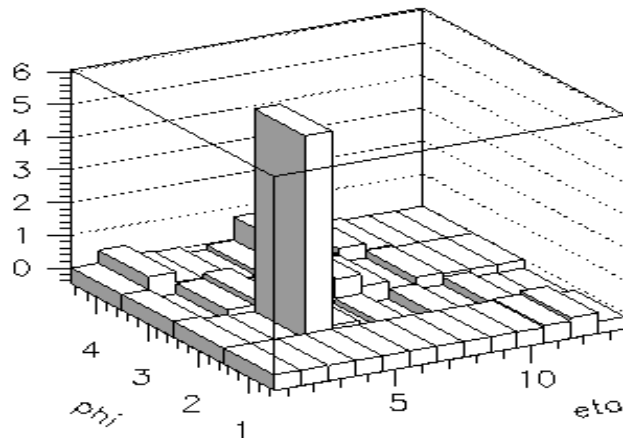
Eta vs Phi energy deposition



HEC eta-phi, iz=1



HEC eta-phi, iz=3



HEC eta-phi, iz=2



Developments and Status (IV): Analysis



- ◆ **LArHECTBAna with athena 4.0.0 (Kanaya, Lefebvre)**
 - Cubic “fit” for pulse height and time available (Lefebvre)
 - No digital filtering weights yet for EMEC
 - TDC wrap-around timing changes many times during run
 - Need to put in database
 - Also need cell-to-cell timing calibrations
 - Preliminary energy calibration now available
 - Calibration work in progress (Strizenec, Kanaya)
 - Investigations of timing have shown some problems with the TDC correction
 - Trigger: B1 instead of F1*F2 until run 12261 (different WAC)
 - Spikes in TDC distributions (also in Monitoring)
 - ⇒ seem to be able to correct offline (Lefebvre)

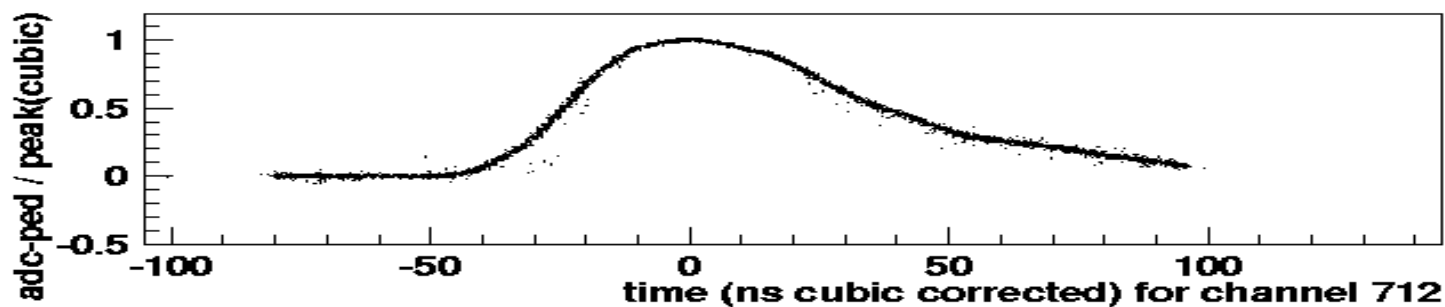
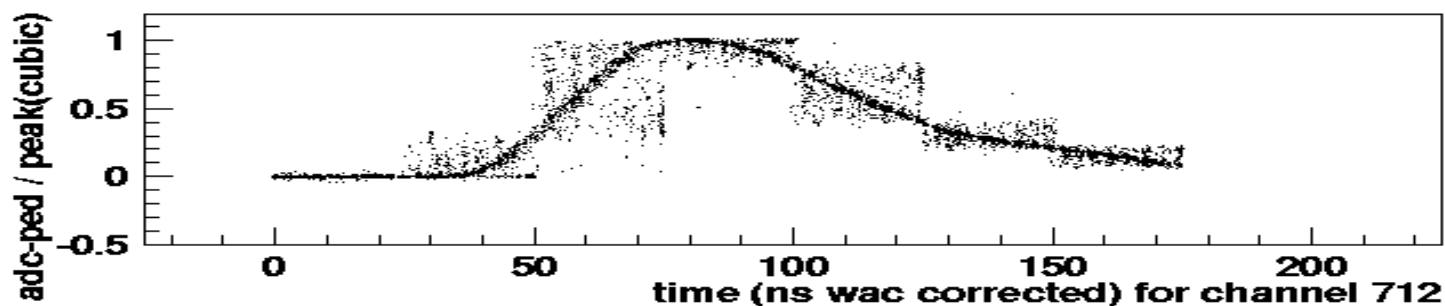
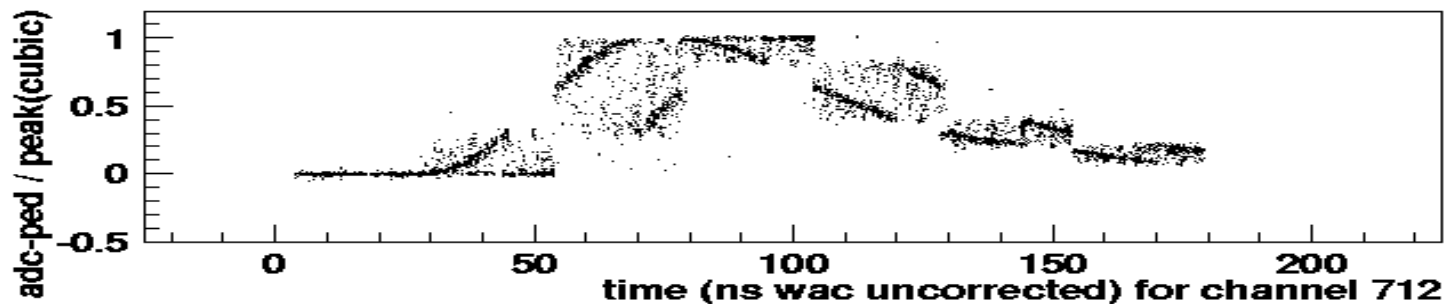


Pulse timing: good run



2002/08/29

12253 electrons 119 GeV EMEC HIGH gain



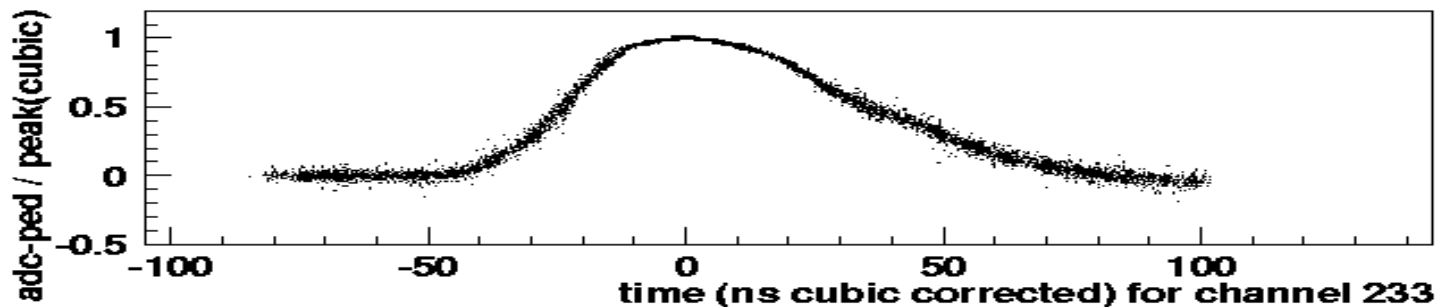
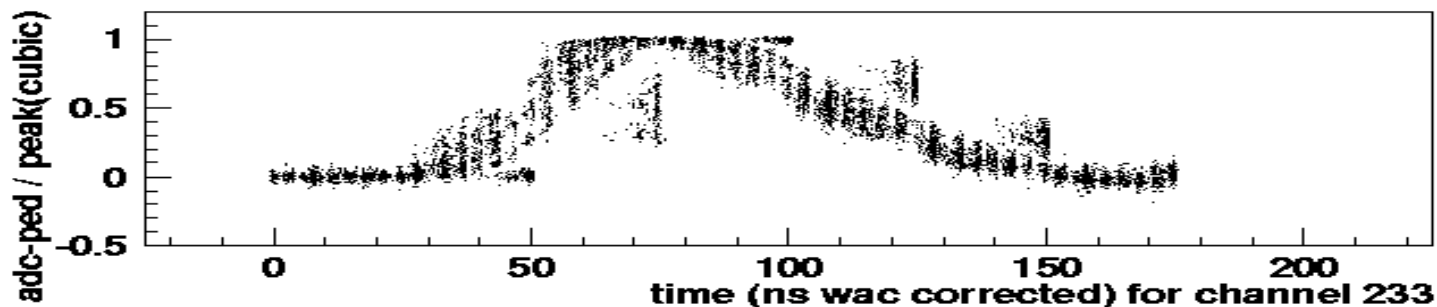
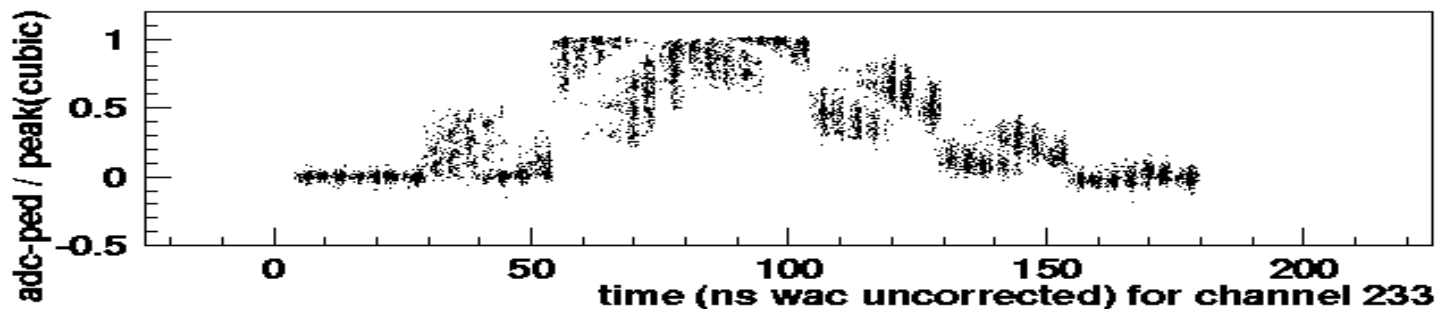


Pulse timing: problem run



2002/08/29

12563 electrons 40 GeV EMEC HIGH gain





TDC and Pulse timing ...

Good **Problem**

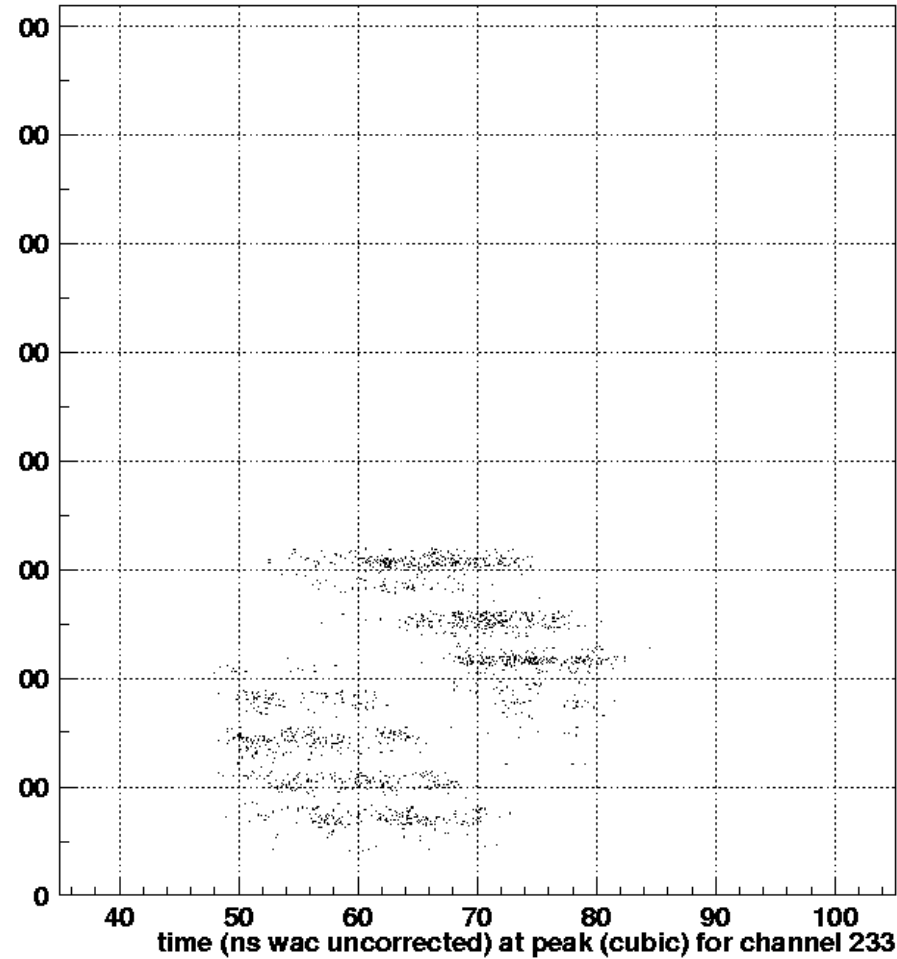
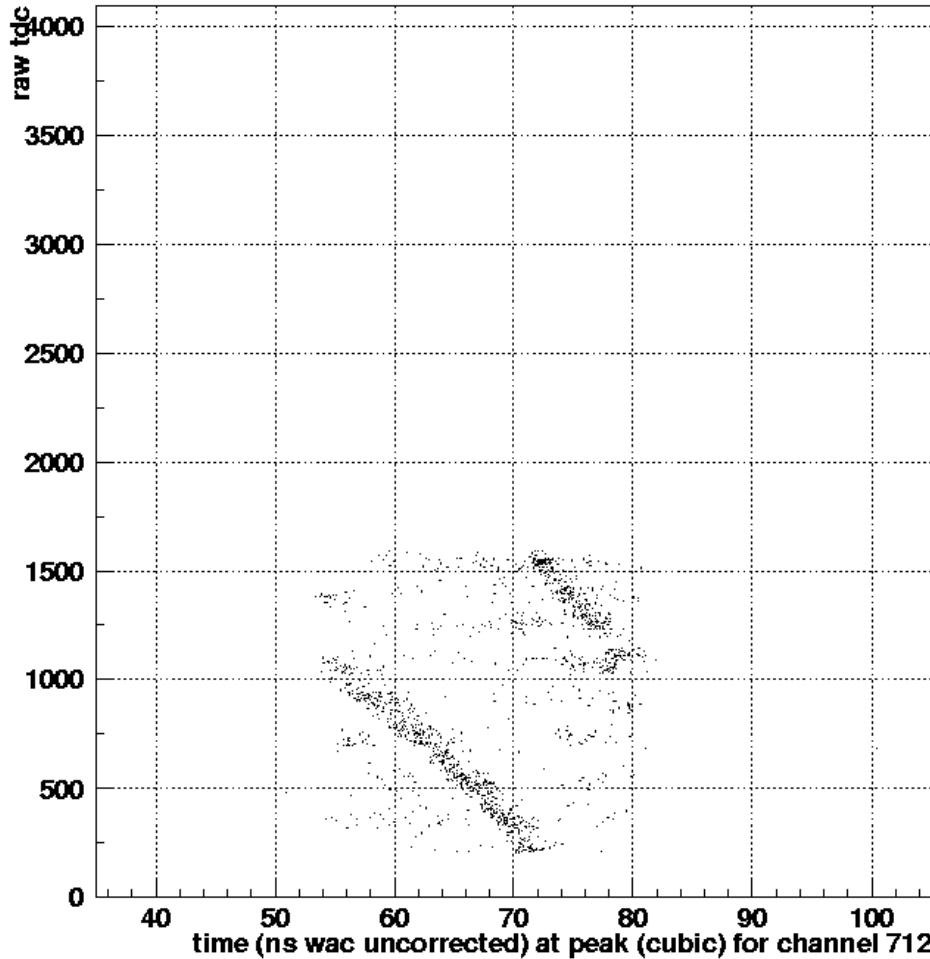


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2002/08/29

12253 electrons 119 GeV EMEC HIGH gain

12563 electrons 40 GeV EMEC HIGH gain



2002-09-10

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Plans and Schemes (I)



- ◆ **Started including all run information in database**
 - http://larbookkeeping.in2p3.fr/private_www/phpadmin/
 - → **database name : atlas_test_1**
 - ◆ → **table name : rawrun**
 - Run, data filename, particle type, energy, impact point, ...
 - Useful place for pedestal filename, calibration files, mapping files, ... ??
- ◆ **Access in **athena** via **LArBookkeepingSvc****
- ◆ **Some overlap with event header**
 - Will use database to indicate good runs, correct mistakes in event header



Plans and Schemes (II)



- ◆ **HEC Calibration:** done by Strizenec
 - Uses special runs *and* data format
- ◆ **EMEC Calibration:** the critical issue
 - Uses delay+ramp runs, but standard data format
 - **LArHECTBCnv:** decodes calibration board information
 - Under study (Strizenec, Kanaya)
 - Preliminary **ADC** → **nano-amps** available now (Strizenec)
 - Can use nominal **nano-amps** → **GeV** for EMEC
 - Need (much?) more work for digital filtering weights
 - One critical issue:
 - **Channel-by-channel differences in the correction between calibration and data pulses**
- ◆ **TDC (wrap-around) Calibration:**
 - Varies throughout run period
 - Maybe correct with pulses? (cubic fit)



Other issues



◆ Data access

- All data is in castor using paths like
 - `/castor/cern.ch/atlas/testbeam/hectestb/2002/aug/run_12972.dat`
 - Data is written in EPIO format, put into TDS with LArCnv
- Staging not always fast (≈ 5 min/file)
 - **Need to work on smart prestaging**
- Some institutes may want local data copies
- athena/gaudi histogramming services terrible ...
- Typical runs
 - 0.1 – 0.5 GBytes each
 - ≈ 1000 runs so far (many are junk)
 - Need ≈ 1 TByte $\pm 50\%$ for complete copy
- **athena** not brilliantly fast
 - ~ 1 hour / 20K events on fast Pentium for 2-pass analysis
 - About 3x – 10x slower than fortran hec_adc



Analyzers



- ◆ **Alberta: Cojocaru (PhD) + Vinciter**
- ◆ **Victoria: Starke (MSc), Ince(MSc) + Fincke,Kanaya,Lefebvre**
- ◆ **Others?**
- ◆ **⇒ should build up a complete list and coordinate effort**
 - **Especially: compare detector calibrations**

More info:

- ◆ **Started a web page**
 - **<http://cern.ch/EmecHecCombined/>**
- ◆ **And a mailing list**
 - **atlas-larg-hec-emec-testbeam@cern.ch**
- ◆ **Will keep updated with information and progress**