

Data Quality - Tools and Results

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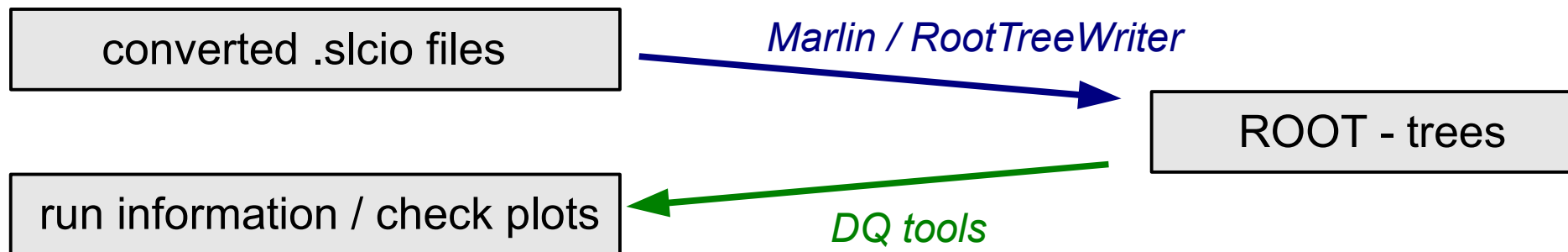


Outline

- The Data Quality Chain
- Drift Chamber Efficiency
- Beam Composition
- HCAL Operation Stability
- Open Issues
- Summary and Outlook

The Data Quality Chain

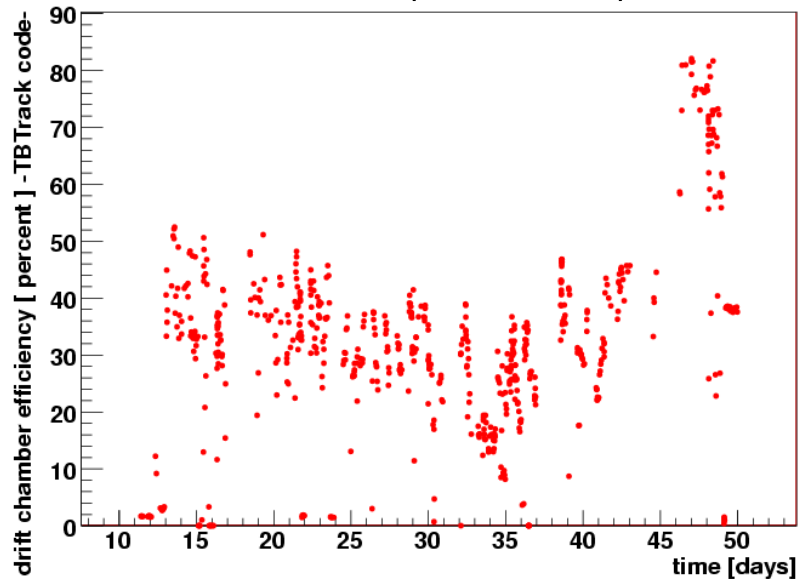
- Data quality chain established:



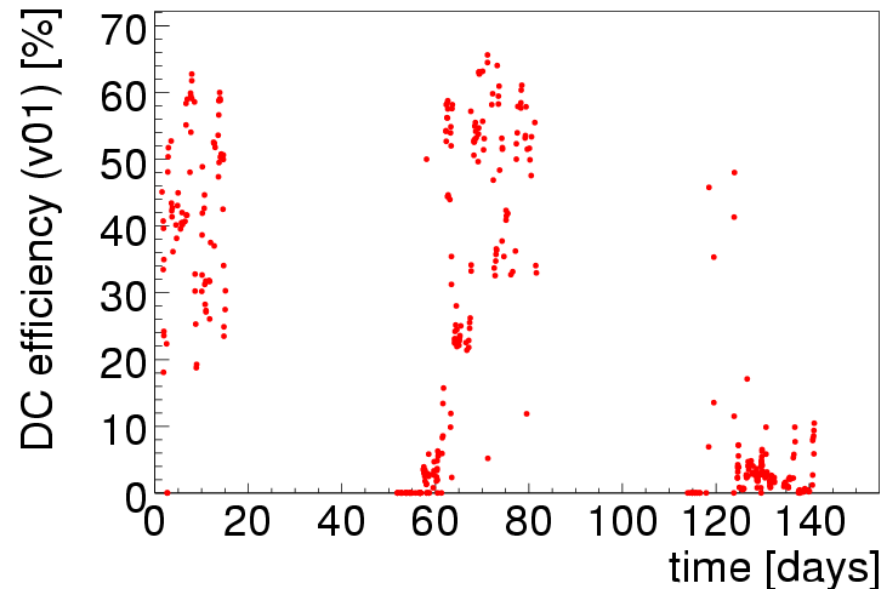
- First processing of all CERN 2007 and FNAL 2008 beam runs done
- Latest versions of the ROOT – trees:
 - include all events and information on trigger, drift chambers, ECAL, HCAL, TCMT and Slow Control
 - /grid/calice/tb-fnal(cern)/data_quality/prod_003/...
- Summary plots and control distributions for each run:
 - /grid/calice/tb-fnal(cern)/data_quality/check_003/...

Drift Chamber Efficiency

CERN (TBTrack)

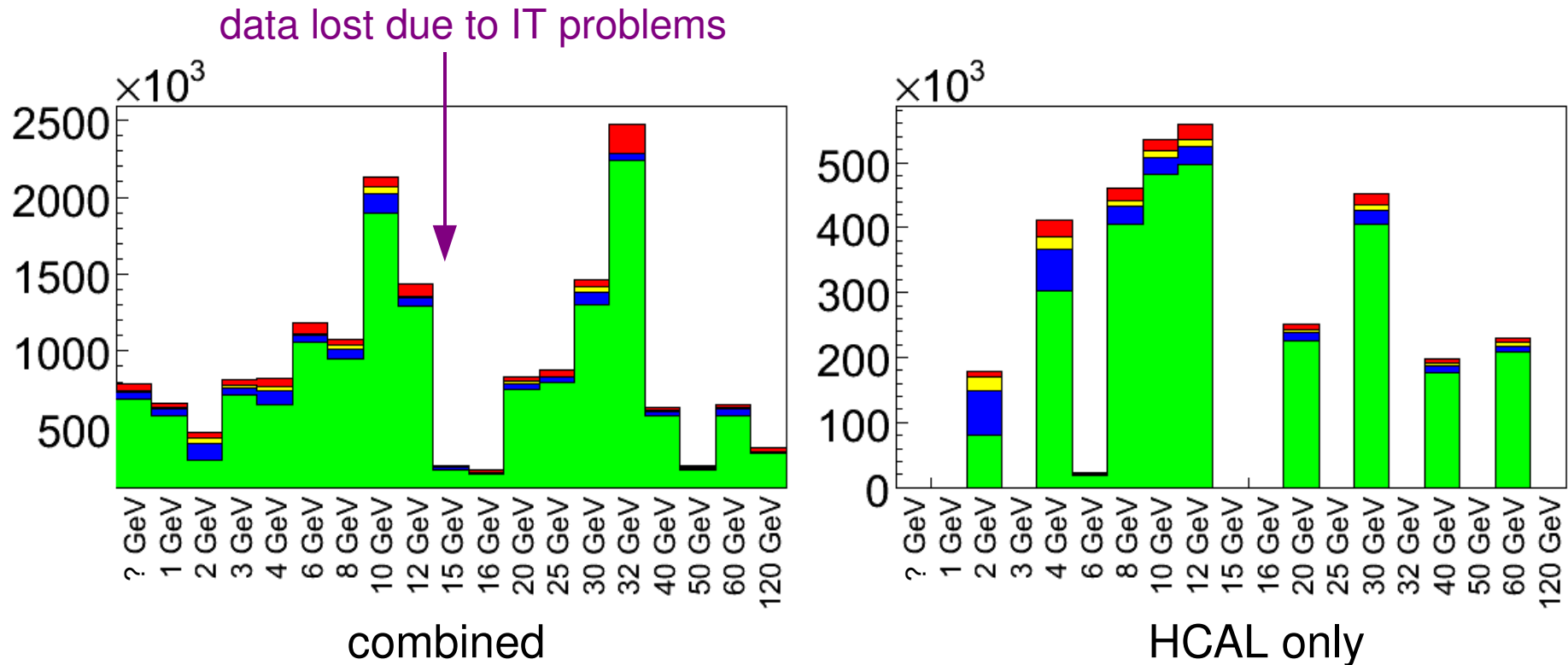


FNAL (DriftChamberToTrack_v01)



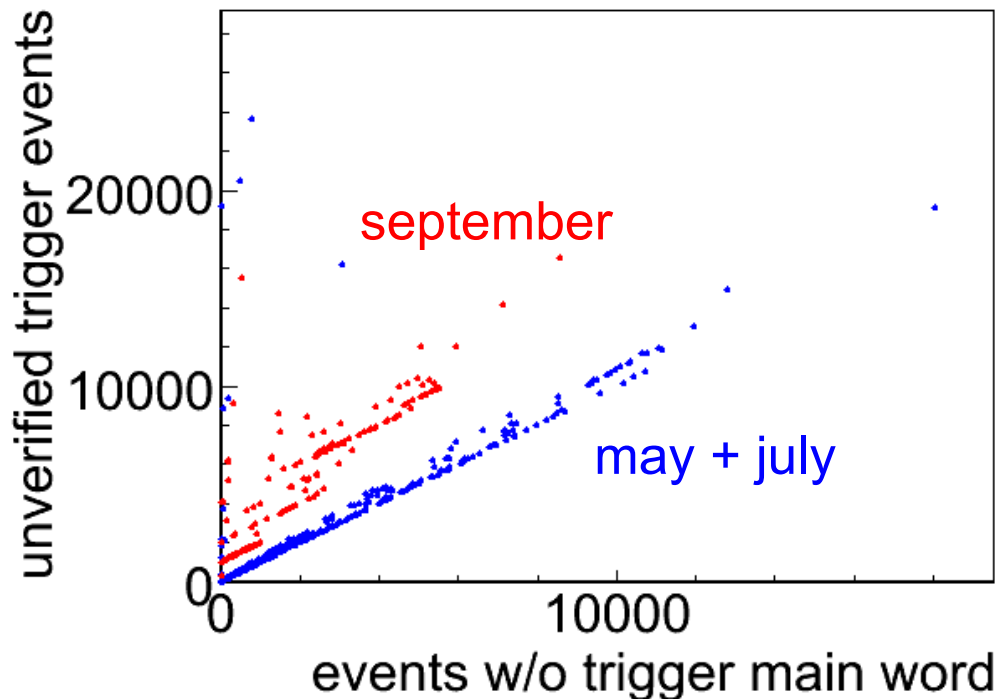
- Efficiency = $\frac{\text{events with reconstructed track}}{\text{all events}}$ (with 10x10 coincidence)
- Observed DC efficiency = efficiency (hardware) x efficiency (reconstruction)
- TBTrack not applicable for FNAL yet

Run Composition for FNAL Data



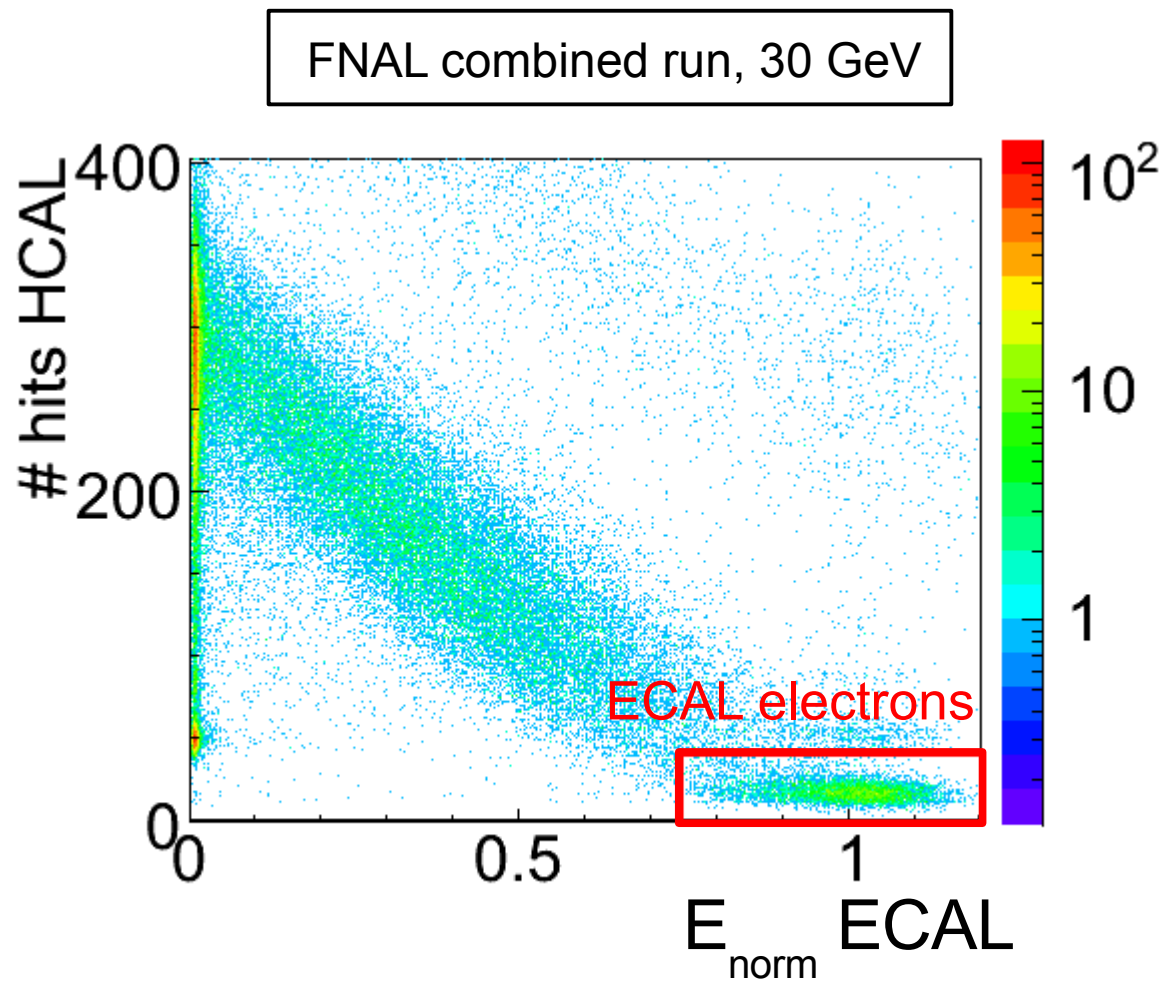
- No muon or electron runs, only runs with > 10k beam events
- Events with beam trigger
- Pedestal events
- LED calibration events (calibBit not set for converted September runs)
- Unverified triggers

Trigger Issues at FNAL



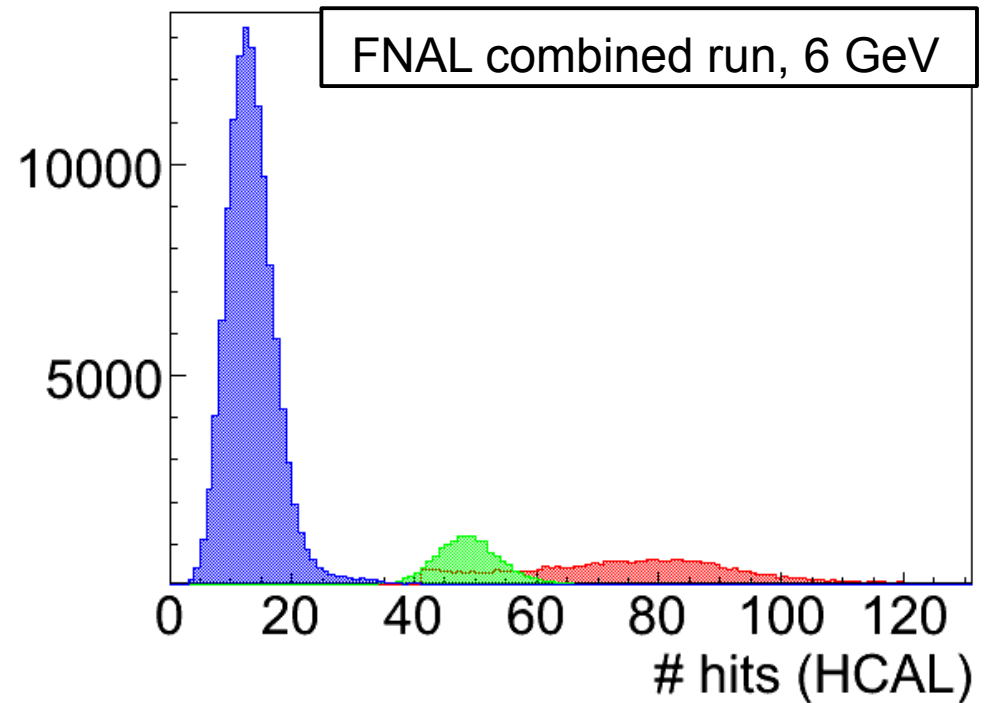
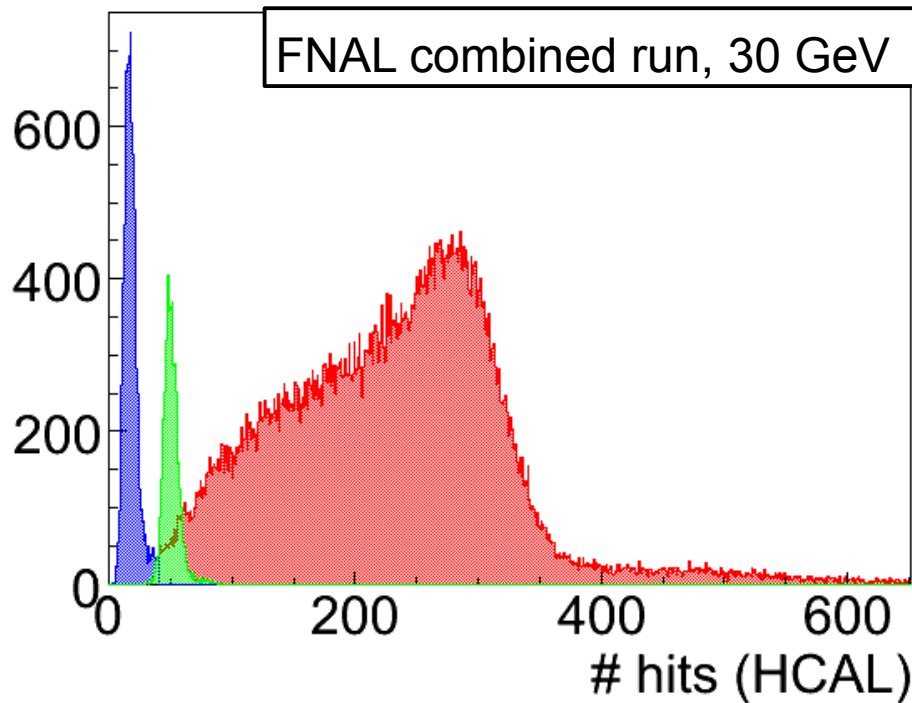
- Major contribution to unverified triggers: events without valid trigger main word
- September: LED calibration events contribute to unverified triggers (calibration bit not set)
- Observed discrepancies between veto trigger rates displayed in online monitor and extracted from TriggerProcessor / ROOT-trees

Classification of Beam Events



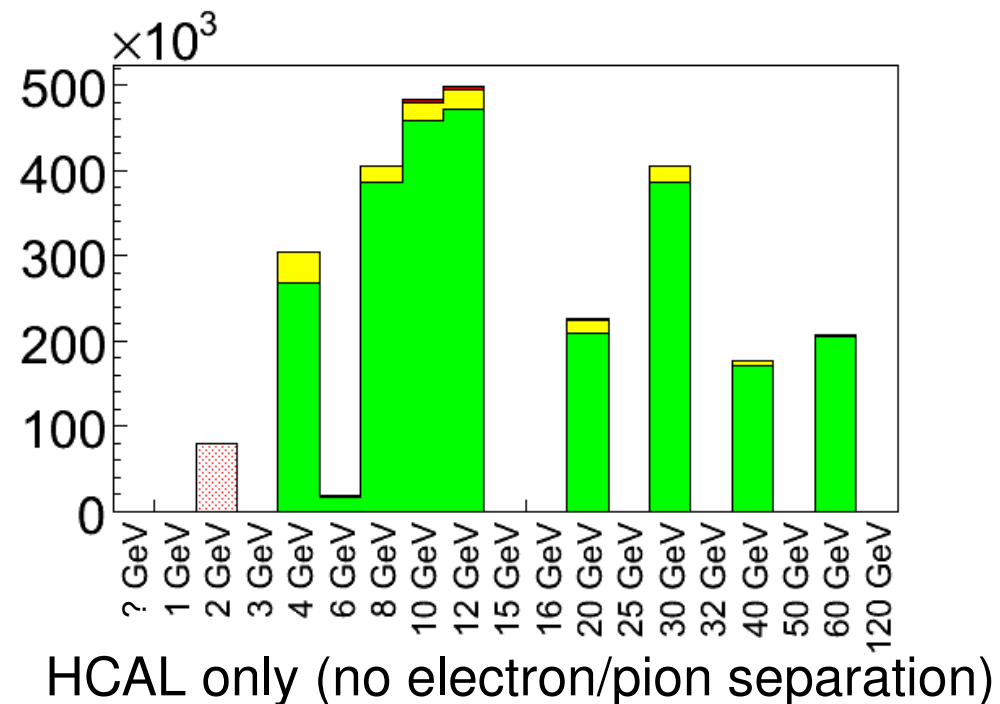
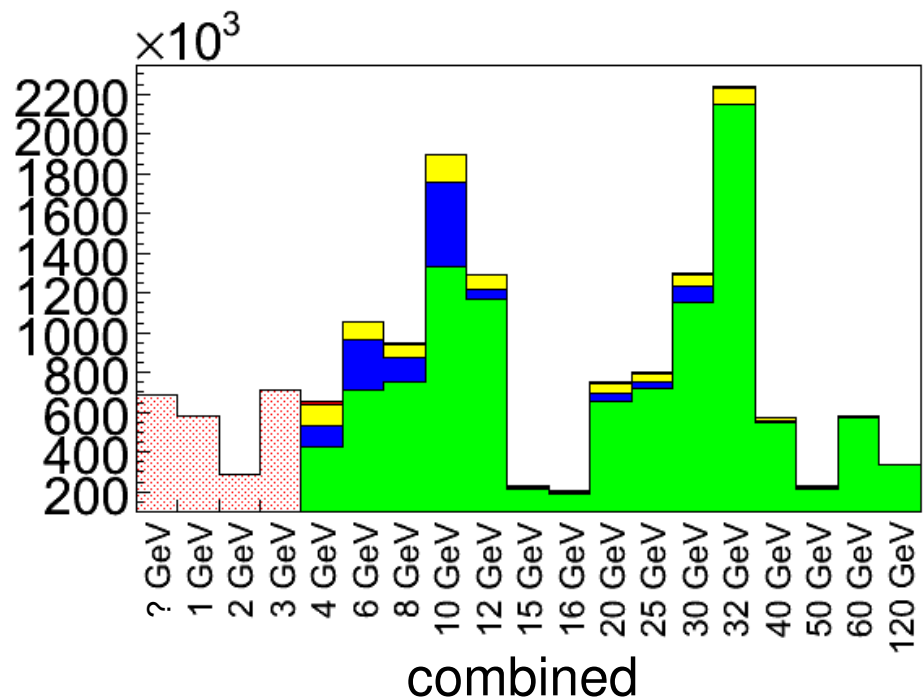
- First **electron** selection:
 - HCAL: # hits < 40
 - ECAL: $E_{\text{norm}} > 0.75$,
$$E_{\text{norm}} = \frac{E_{\text{ECAL}}}{E_{\text{RL}} \cdot 135}$$
 - E_{RL} = energy from RunLog (graphical user interface for entering run information during data taking)

Classification of Beam Events



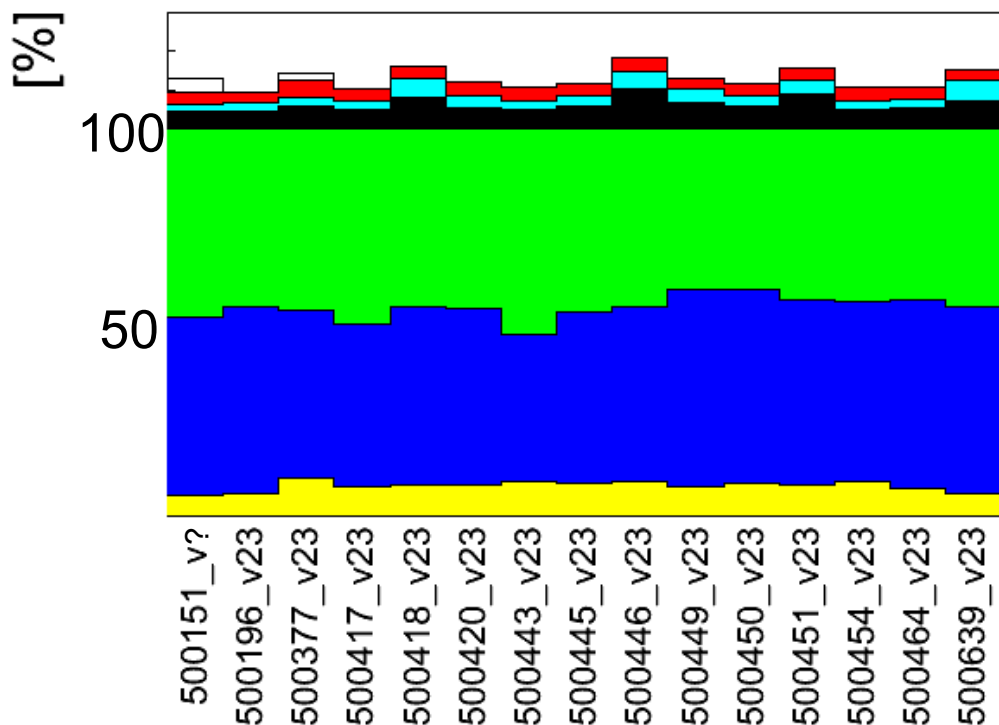
- **Electrons** (no veto)
- **Mip-like events** (25 layers with $0 < \# \text{ hits} < 4$, energy sum < 100 mip, no veto)
- **Pion candidates** (not e, not mip, $\# \text{ hits} > 40$, no veto)

Beam Events Collected at FNAL

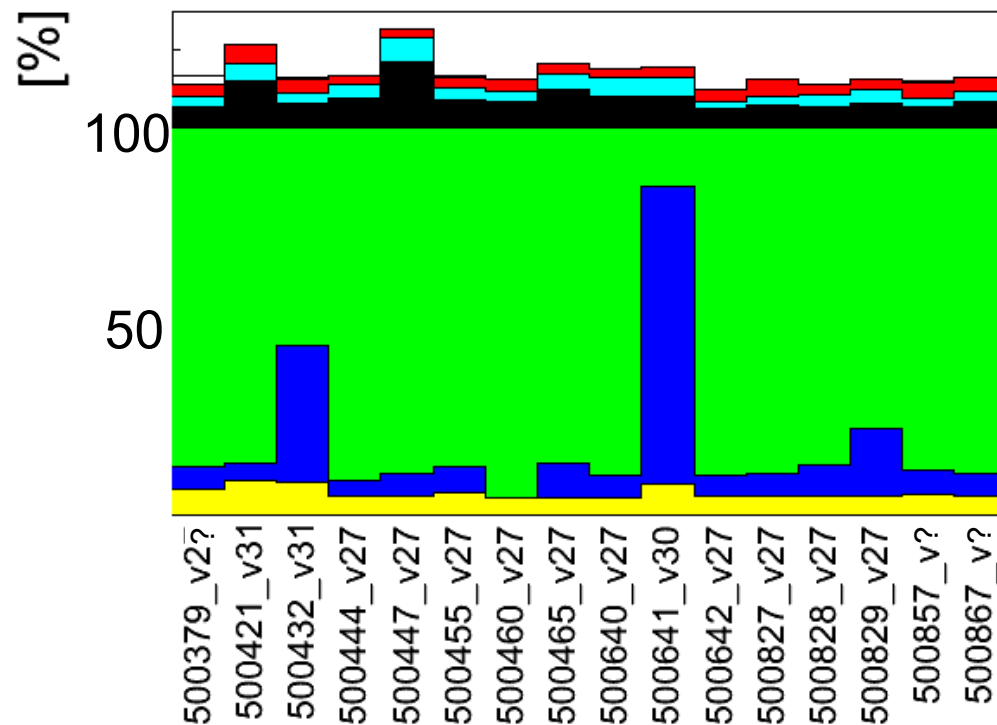


- No muon or electron runs, only runs with > 10k beam events
- Event classification (selection criteria not applicable < 4 GeV):
 - Pion candidates (no electron, no mip, no veto)
 - Electrons (electron in ECAL, no veto)
 - Mip-like particles (mip in HCAL, no veto)
 - Events with veto

Relative Beam Composition (FNAL)



mixed beam

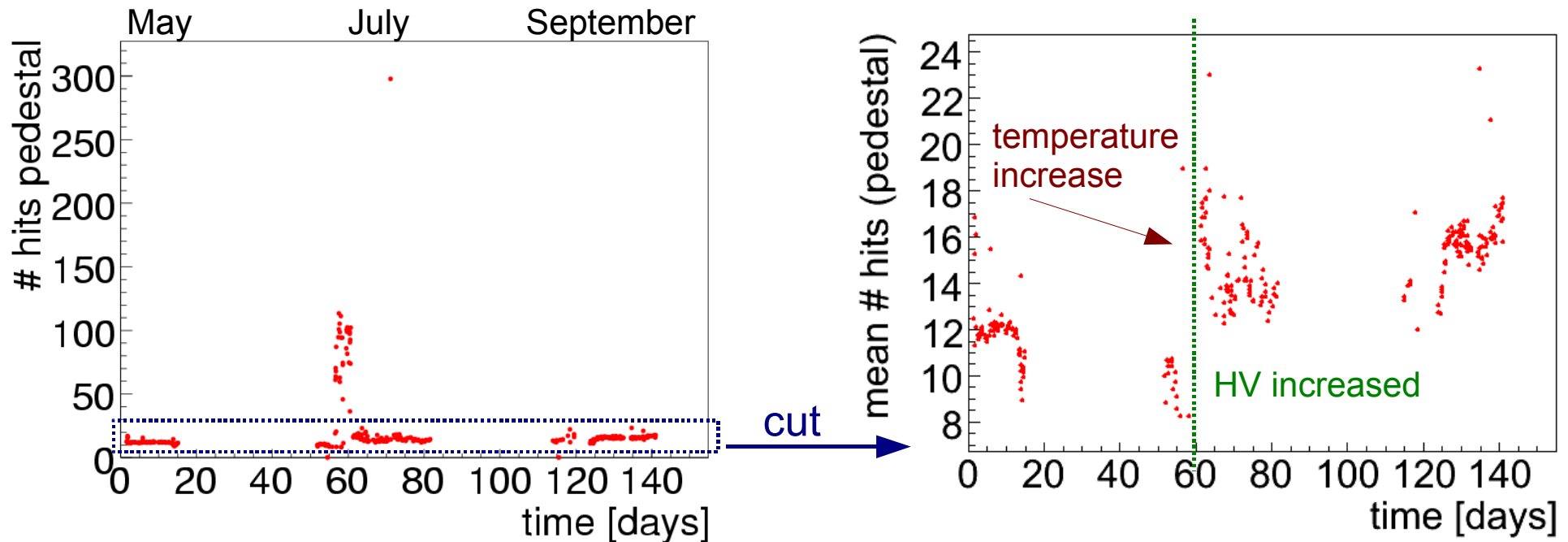


pion enhanced beam
(Cherenkov triggered)

- 10 GeV run, combined data taking
- Veto trigger (blank histogram)
- Unverified trigger
- Calibration events
- Pedestal events

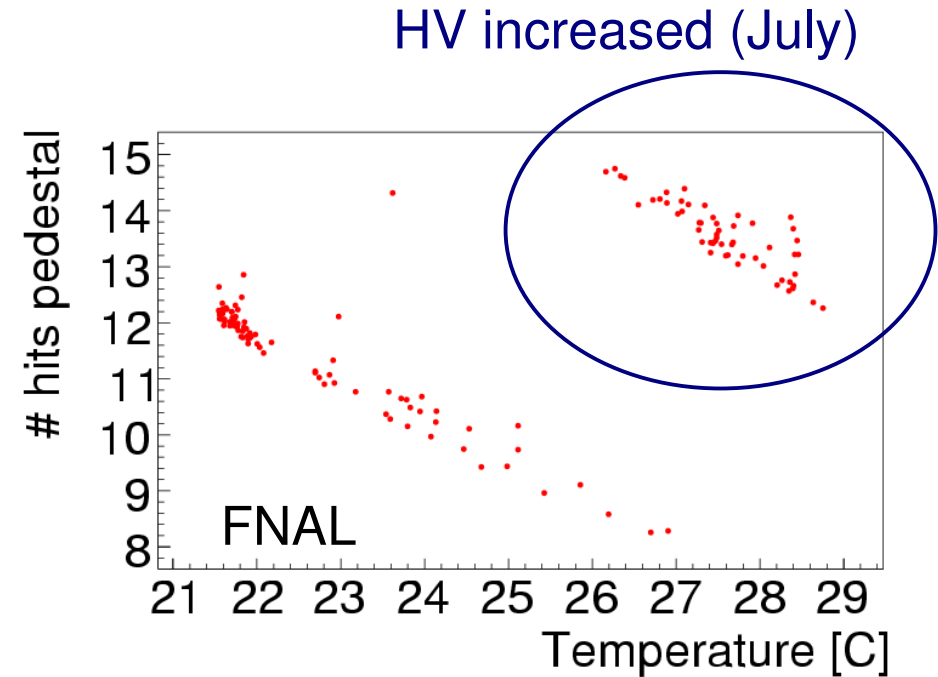
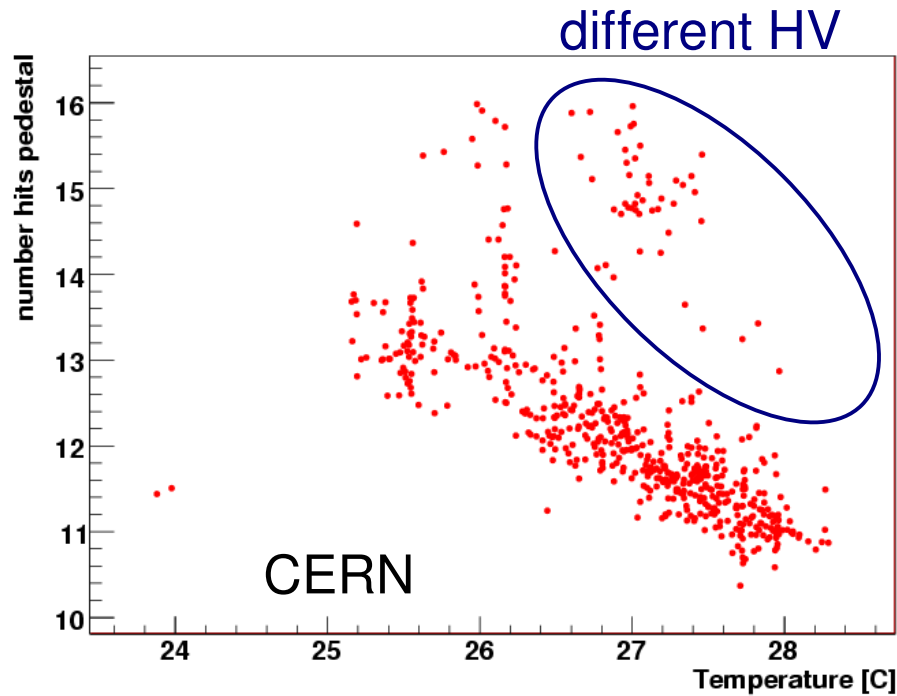
- Hadron candidates
- Electrons
- Mip like events
- 500460: ECAL off (no electron selection)

HCAL Pedestal Stability at FNAL



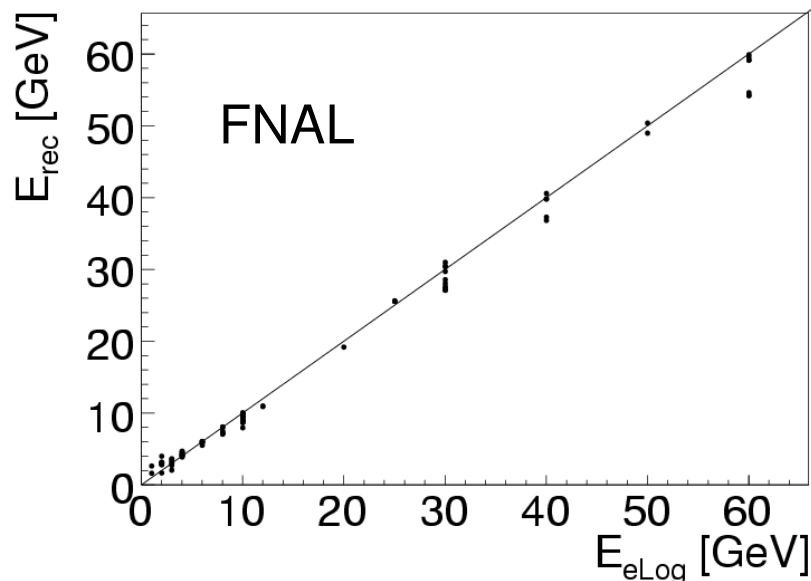
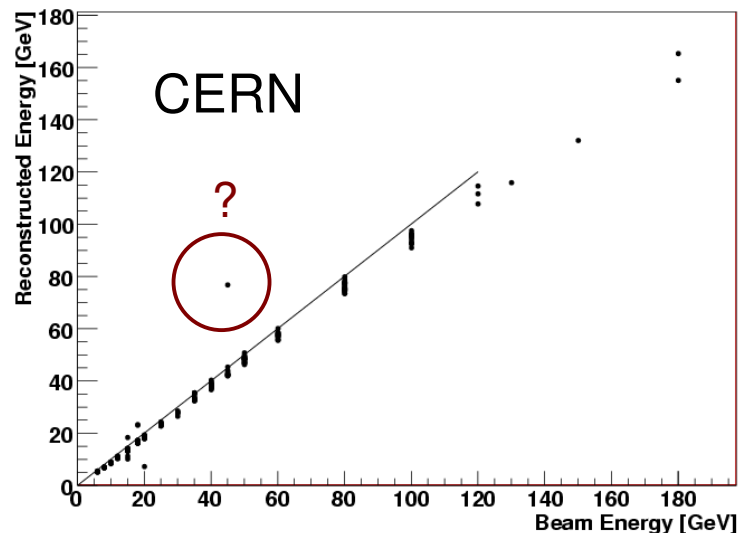
- high noise in some july runs
 - to be investigated in more detail, for now: **cut** on nHits ($5 < nHits < 30$)
- # noise hits depends on 0.5 mip threshold
 - Up to now: fixed mip calibration, no correction for **voltage adjustment** (july) and **temperature changes**
- CERN 2007: mean # hits pedestal = 12

Noise Hits vs Temperature (HCAL)



- Linear relation between # hits (pedestal) and temperature
- FNAL: only May and July runs included, temperature missing for September
- Temperature range CERN: 4 K, FNAL: 5 K (May - July)

Reconstructed Energy (HCAL)



- **Aim:** compare reconstructed energy and beam energy to find deviations larger than 10%
- **Sample:** mixed and pion runs
- **Event selection:** pions fully contained in HCAL (mip-like track in ECAL but not in HCAL, no leakage to TCMT)
- Beam Energy
 - CERN: calculated from magnet currents
 - FNAL: extracted from RunLog
- No temperature corrections applied
- Inappropriate mip calibration applied for FNAL (July and September)

Open Issues (FNAL)

- Stage position, rotation and beam line information: will be included as soon as they are available in the database (converter updated, but not tested yet)
- SlowControl data (e.g. Temperature) for September period: **missing**
- Cherenkov (particle identification): trigger bits are available, pressure will be available with beam line data, **but:**
 - **evaluation of these information is missing**
- Multiplicity counter (fraction of multi-particle events): **missing**, needs to be included and calibrated (available for CERN)
- Run version / DAQ settings (-v23, -v27, ...): **missing** (available from RunLog)
- Veto trigger: Discrepancies observed between online monitor and distributions coming from the TriggerProcessor / the ROOT-trees
- Drift chambers: TBTrack – Code not available for FNAL
- Information for ECAL and TCMT are included:
 - performance checks can be done, but need to be developed

Already Available Information

ROOT Object Browser

File View Options Help

bigtree

Contents of "/ROOT Files/fnal/prod_003/Reco500236_Evt1_Lvl2.root/bigtree"

DC_XChi2	DC_XEcallImpact	DC_XFoD	DC_XHcallImpact	DC_XOffset
DC_XSlope	DC_XdOffset	DC_XdSlope	DC_YChi2	DC_YEcallImpact
DC_YFoD	DC_YHcallImpact	DC_YOffset	DC_YSlope	DC_YdOffset
DC_YdSlope	TBTrack_DC_XChi2	TBTrack_DC_XHcallImpact	TBTrack_DC_YChi2	TBTrack_DC_YHcallImpact
a100x100Bit	a10x10Bit	a3x3Bit	ahc_cogI	ahc_cogIGeom
ahc_cogJPerLayer	ahc_cogIPerLayer	ahc_cogJ	ahc_cogJGeom	ahc_cogJGeomPerLayer
ahc_cogJPerLayer	ahc_cogX	ahc_cogX5Layer	ahc_cogXPerLayer	ahc_cogY
ahc_cogY5Layer	ahc_cogYPerLayer	ahc_cogZ	ahc_cogZ5Layer	ahc_energyDensity
ahc_energyPerLayer	ahc_energyPerLayer_err	ahc_energySum	ahc_energySum5Layer	ahc_iEvt
ahc_nHits	ahc_nHits5Layer	ahc_nHitsPerLayer	ahc_nLayers	ahc_radius
ahc_radiusEw	ahc_radiusEwPerLayer	ahc_radiusPerLayer	b100x100Bit	b10x10Bit
b3x3Bit	beamBit	calibBit	cherenkov2Bit	cherenkovBit
cmbTemp	cosmicsBit	emc_cogX	emc_cogX5Layer	emc_cogXPerLayer
emc_cogY	emc_cogY5Layer	emc_cogYPerLayer	emc_cogZ	emc_cogZ5Layer
emc_energyDensity	emc_energyPerLayer	emc_energyPerLayer_err	emc_energySum	emc_energySum5Layer
emc_iEvt	emc_nHits	emc_nHits5Layer	emc_nHitsPerLayer	emc_nLayers
emc_radius	emc_radiusEw	emc_radiusEwPerLayer	emc_radiusPerLayer	eventEnergyInMev
eventNumber	eventTime	hbabCurrent	hbabHV	hbabTemp
holdStart	holdWidth	modBlock	modTemp	module
multiADC	multiBit	pedestalBit	position	purePedBit
runNumber	spillBit	tcm_cogX	tcm_cogX5Layer	tcm_cogXPerLayer
tcm_cogY	tcm_cogY5Layer	tcm_cogYPerLayer	tcm_cogZ	tcm_cogZ5Layer
tcm_energyDensity	tcm_energyPerLayer	tcm_energyPerLayer_err	tcm_energySum	tcm_energySum5Layer
tcm_iEvt	tcm_nHits	tcm_nHits5Layer	tcm_nHitsPerLayer	tcm_nLayers
tcm_radius	tcm_radiusEw	tcm_radiusEwPerLayer	tcm_radiusPerLayer	vetoBit

125 Objects. ahc_radiusPerLayer

HCAL

ECAL

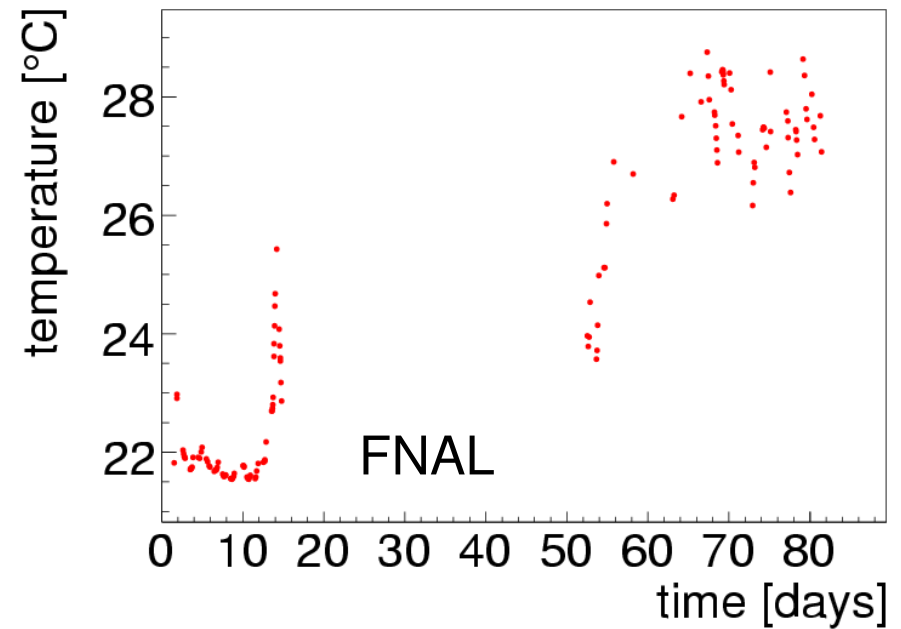
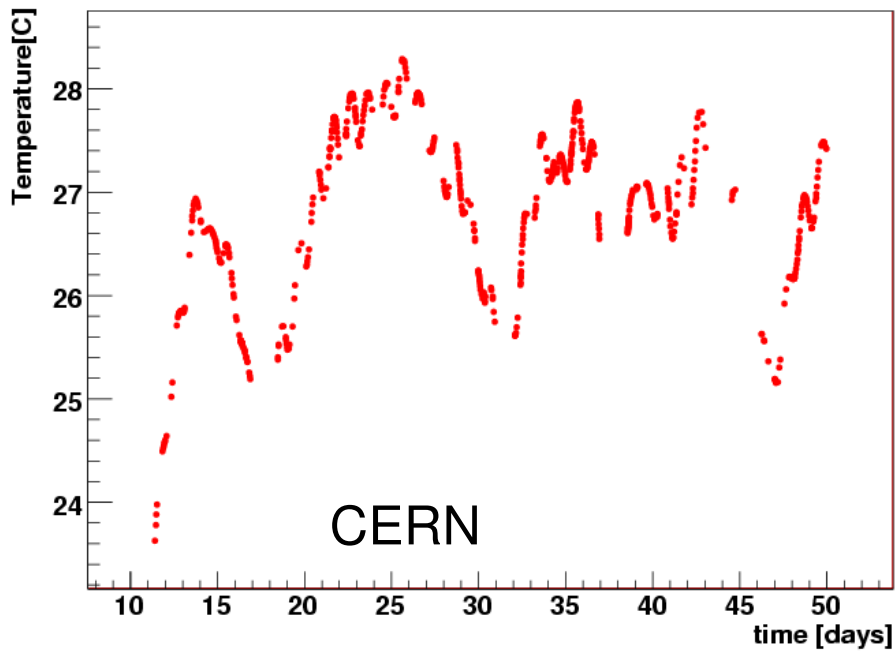
TCMT

Summary and Outlook

- Data quality chain established
- First survey of the **entire** data sets collected at CERN and FNAL performed
- Run and beam compositions studied
- Reconstructed energy checked (for HCAL)
- HCAL operation stability studied
- Still several open issues – any ideas / contributions are highly welcome

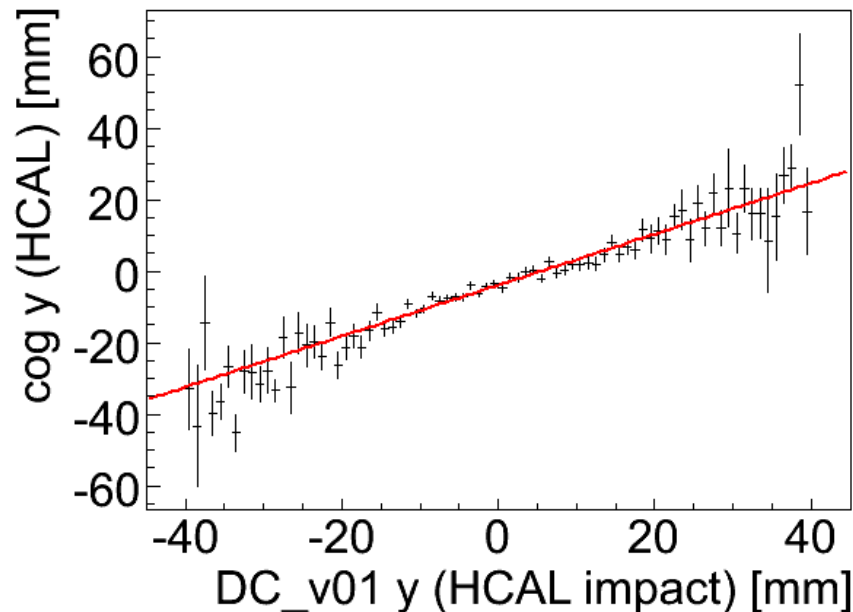
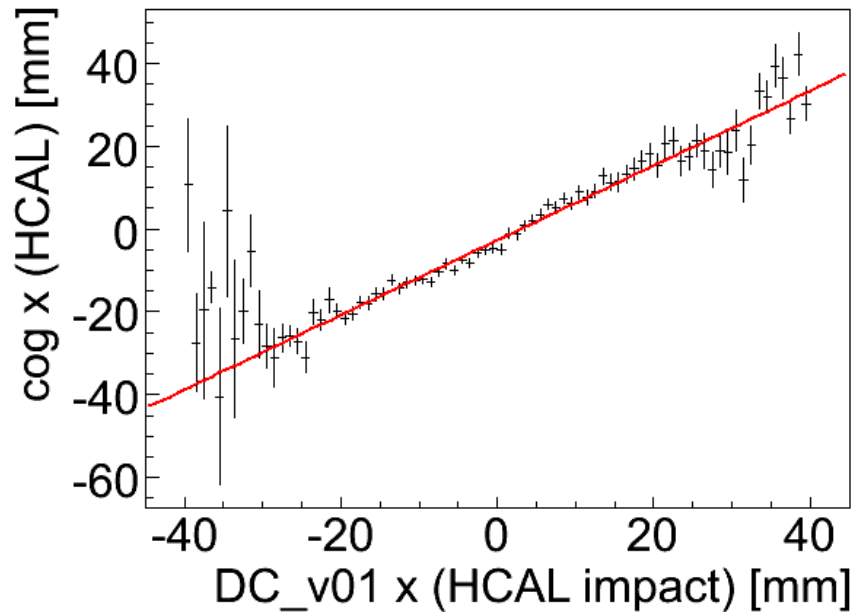
BACKUP SLIDES

Temperature Development (HCAL)



- Temperature range CERN: 4 K
- Temperature range FNAL: 5 K (May - July)

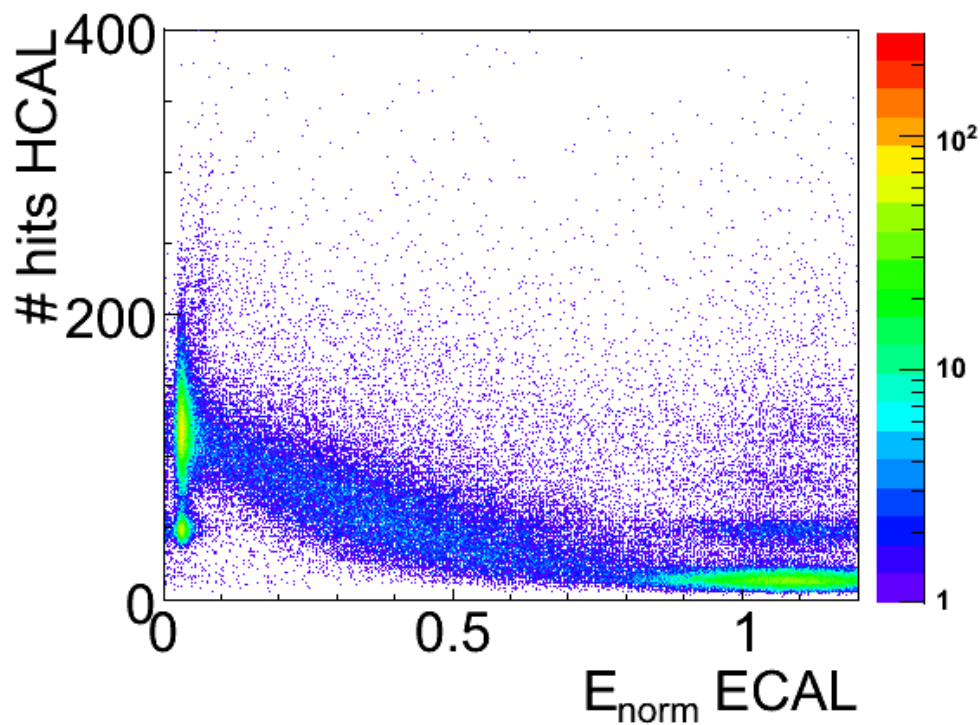
Alignment



- Run: FNAL, 30 GeV, combined
- Center of gravity (cog) averaged over first 5 HCAL layers
- Offset:
 - x: - 3 mm
 - y: - 4 mm
- Slope:
 - x: 0.9
 - Y: 0.7

More Electron Selection Plots

Run 500432



Run 500641

