# Data Quality -
# Tools and Results

CALICE Collaboration Meeting, Daegu, 19 - 20 February 2009

Nils Feege
Andrea Vargas
Serguei Morozov

presented by Niels Meyer

Calorimeter for ILC
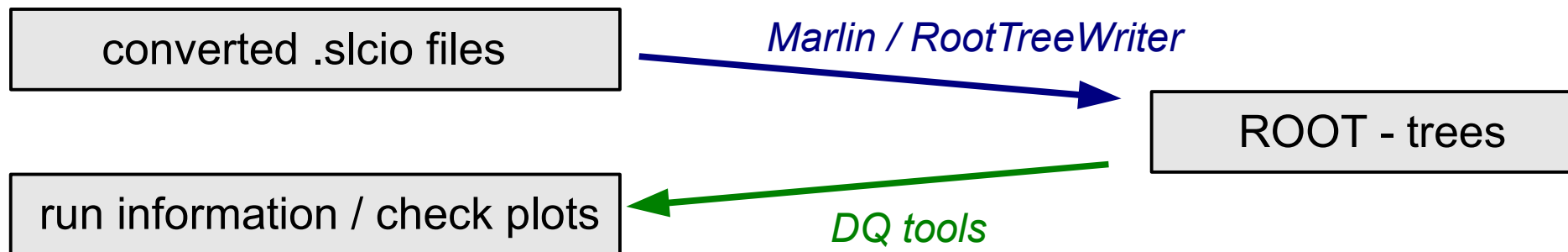
U H

Universität Hamburg

DESY

# 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:

| converted .slcio files | *Marlin / RootTreeWriter* → | ROOT - trees |
|---|---|---|

run information / check plots ← *DQ tools*

- 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
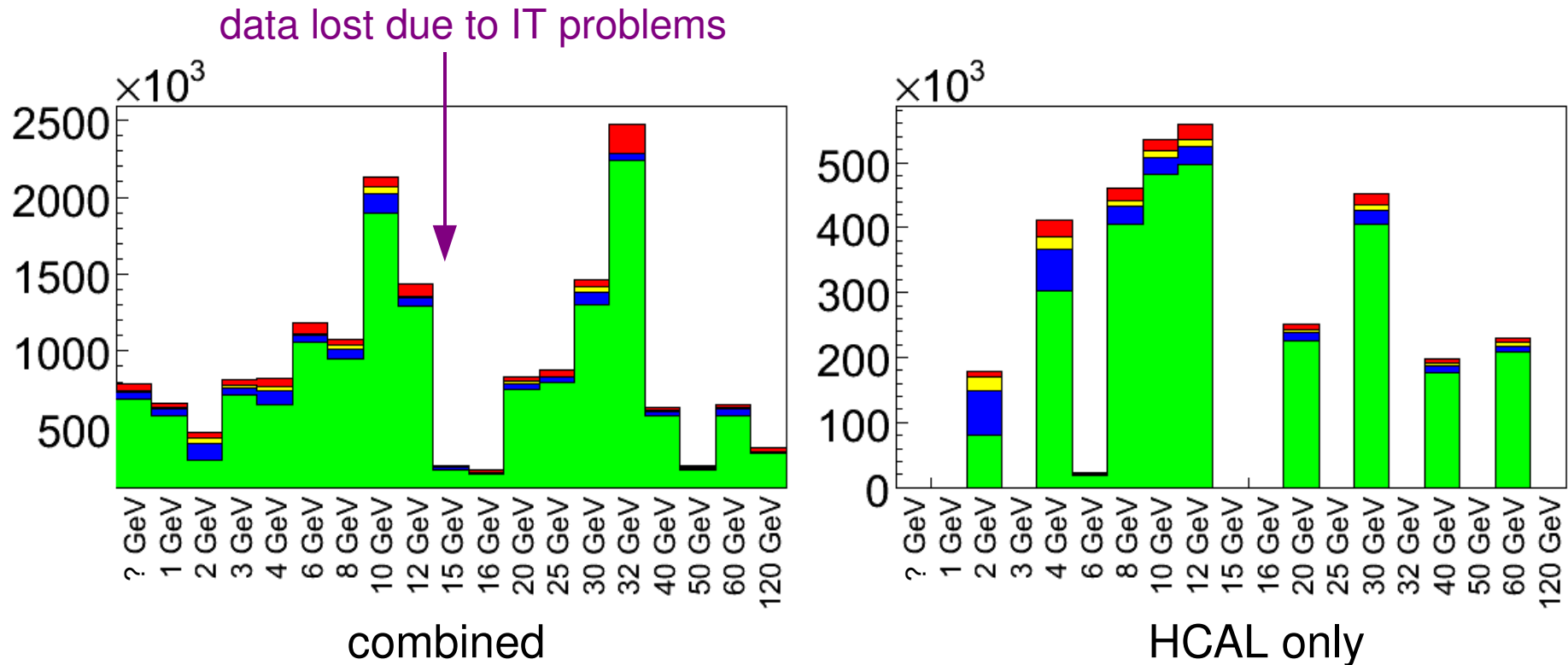
CERN (TBTrack)
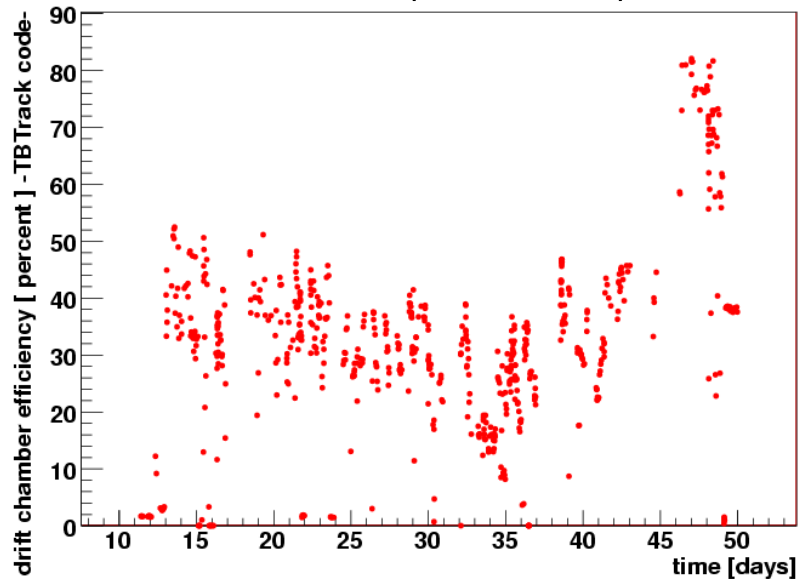
FNAL (DriftChamberToTrack_v01)
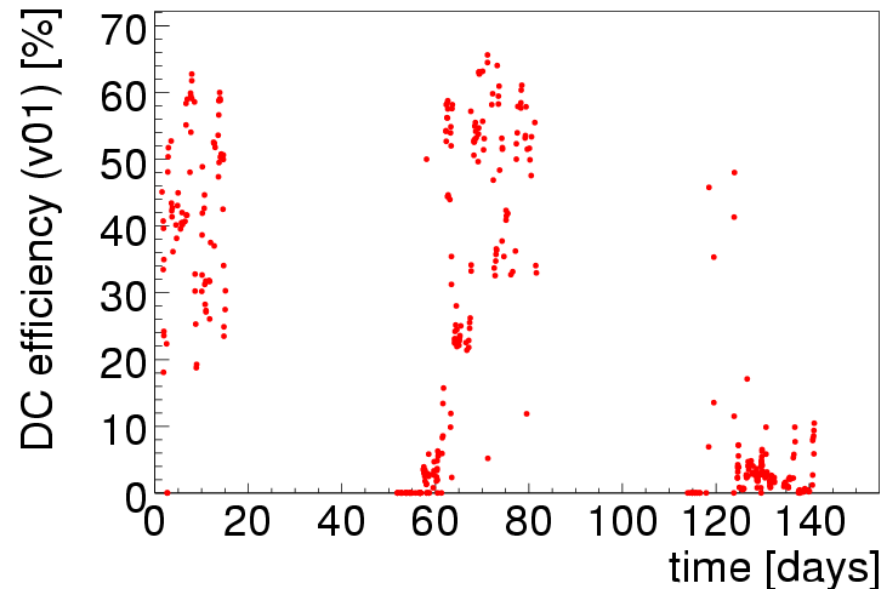


- Efficiency = $\dfrac{\text{events with reconstructed track}}{\text{all events}}$ (with 10x10 coincidence)

- Observed DC efficiency = efficiency (hardware) x efficiency (reconstruction)

- TBTrack not applicable for FNAL yet

# Run Composition for FNAL Data

data lost due to IT problems



combined

HCAL only

- 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
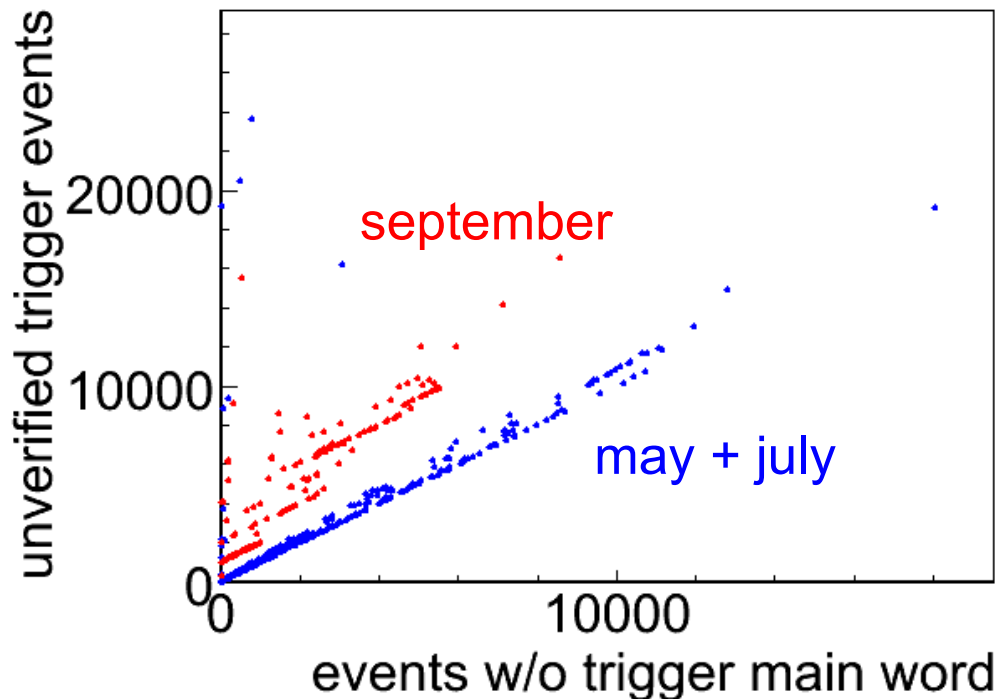


- Major contribution to unverified triggers: events without valid trigger main word

- 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
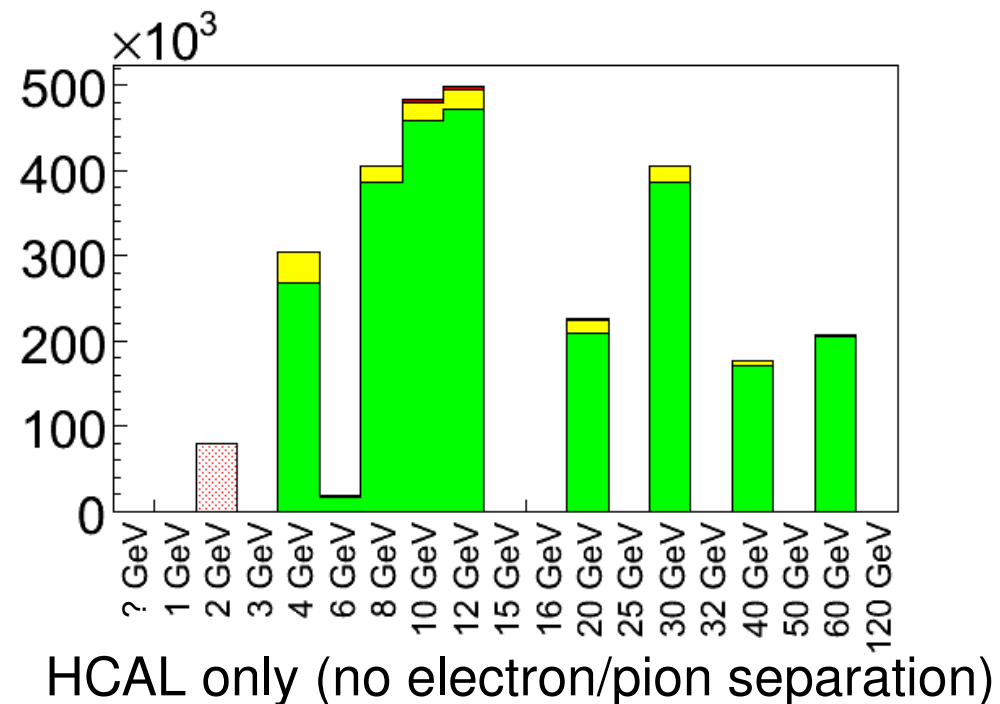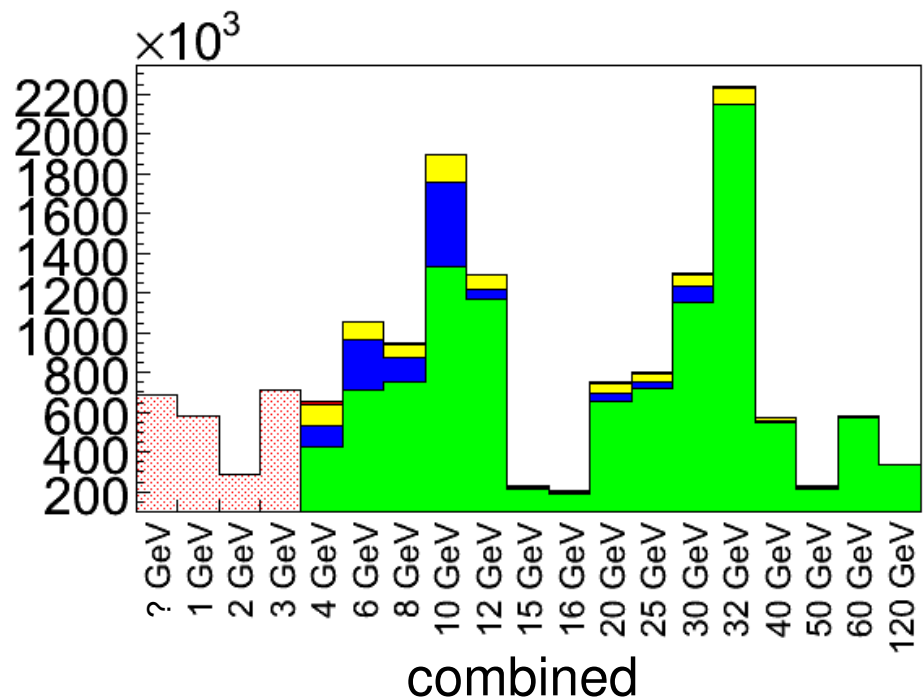
# Classification of Beam Events



FNAL combined run, 30 GeV
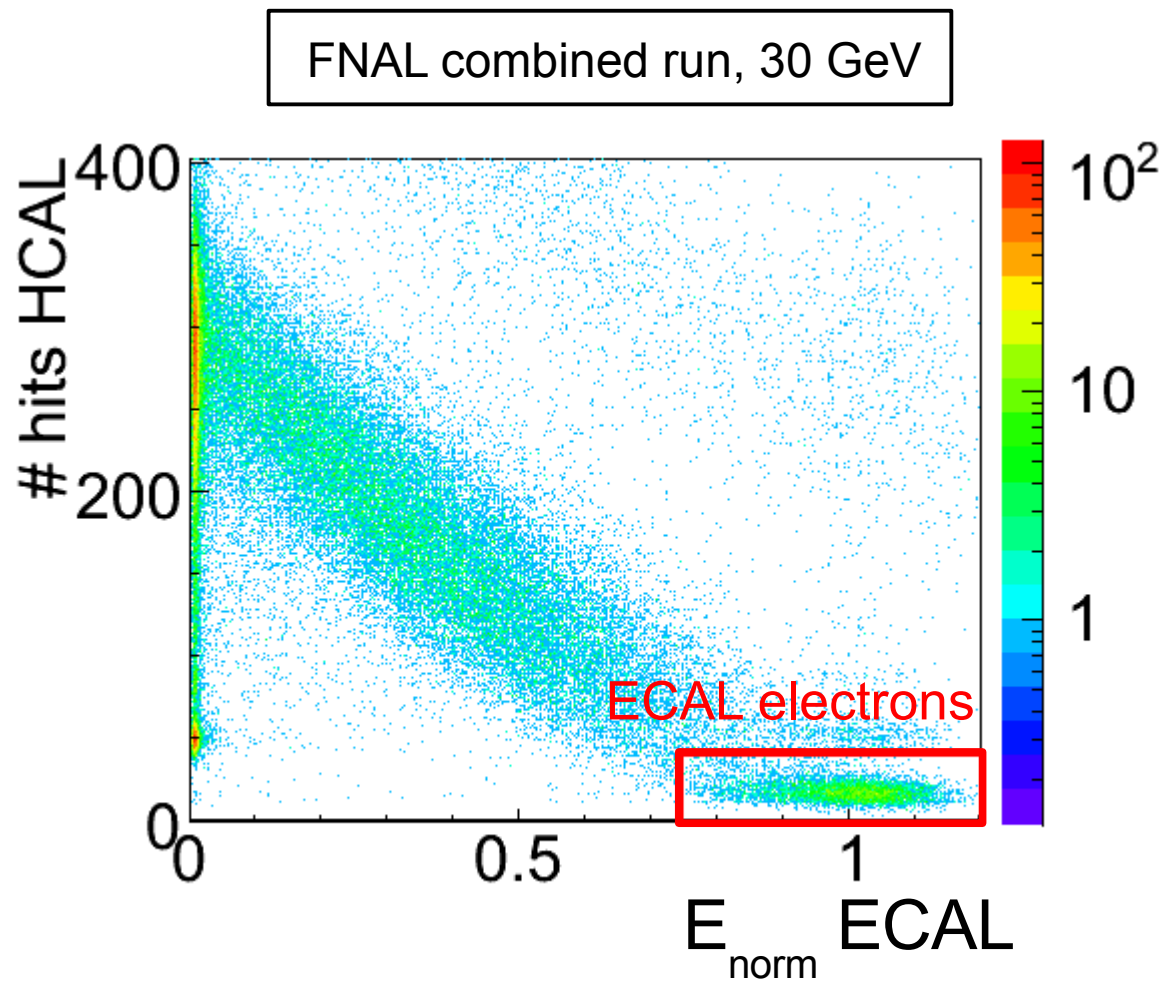
ECAL electrons

- First electron selection:
    - HCAL: # hits < 40
    - ECAL: $E_{norm} > 0.75$,
    
    $$E_{norm} = \frac{E_{ECAL}}{E_{RL} \cdot 135}$$

- $E_{RL}$ = energy from RunLog (graphical user interface for entering run information during data taking)

# Classification of Beam Events
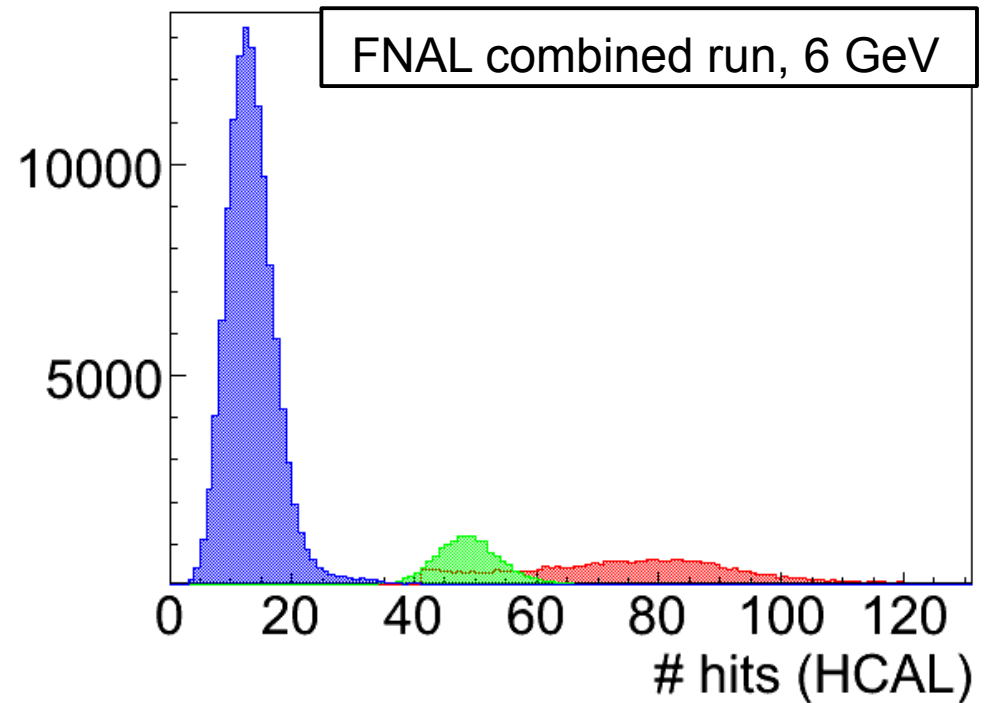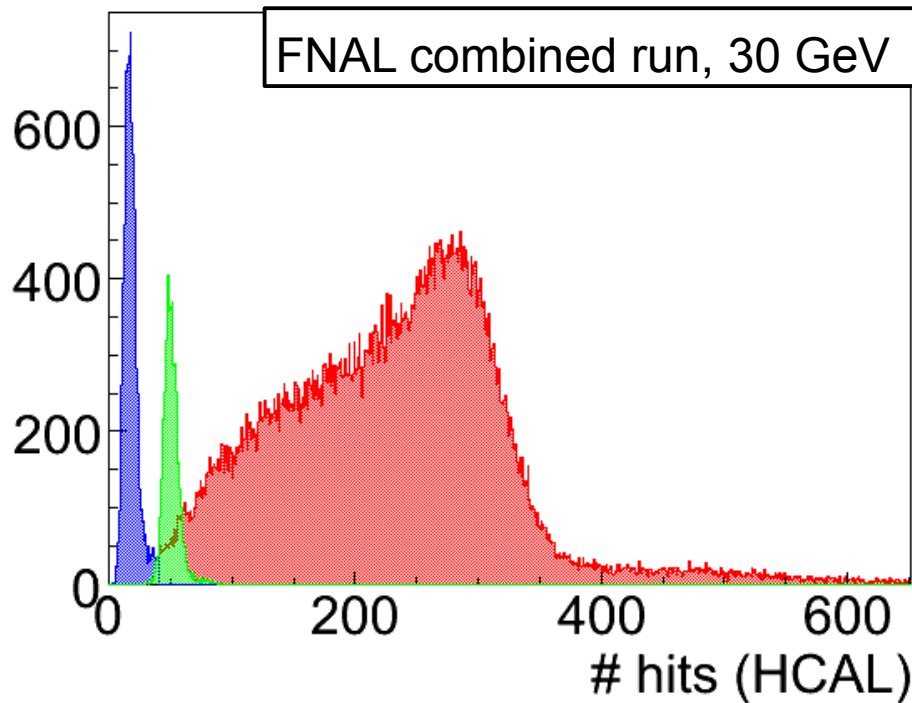


- **Electrons** (no veto)

- **Mip-like events** (25 layers with 0 < # hits < 4, energy sum < 100 mip, no veto)

- **Pion candidates** (not e, not mip, # hits > 40, no veto)

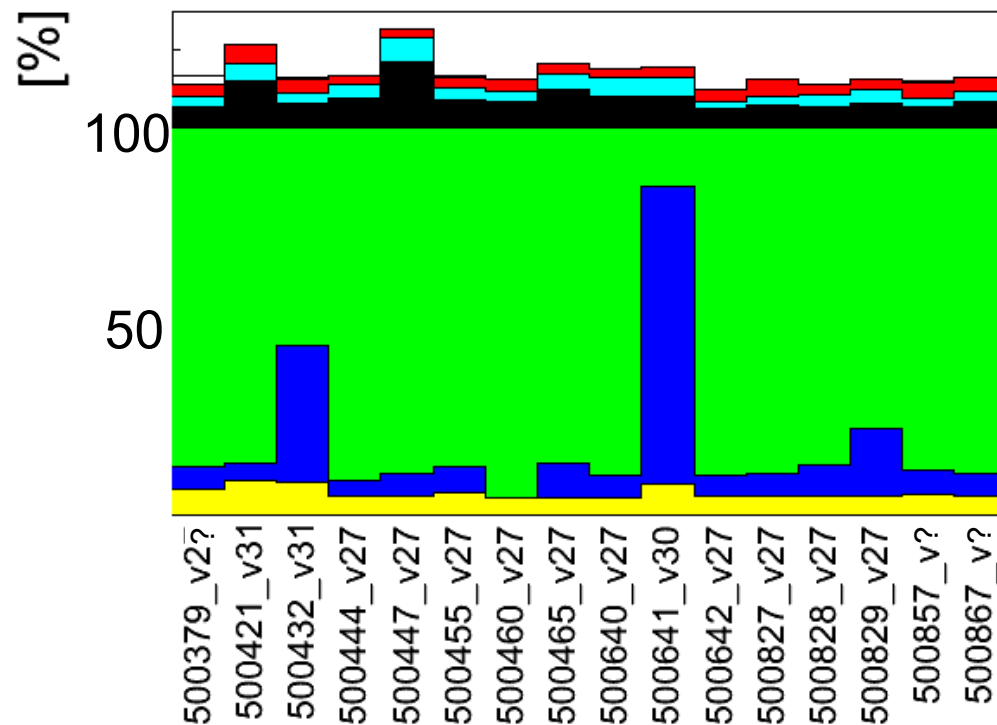combined          HCAL only (no electron/pion separation)

- 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
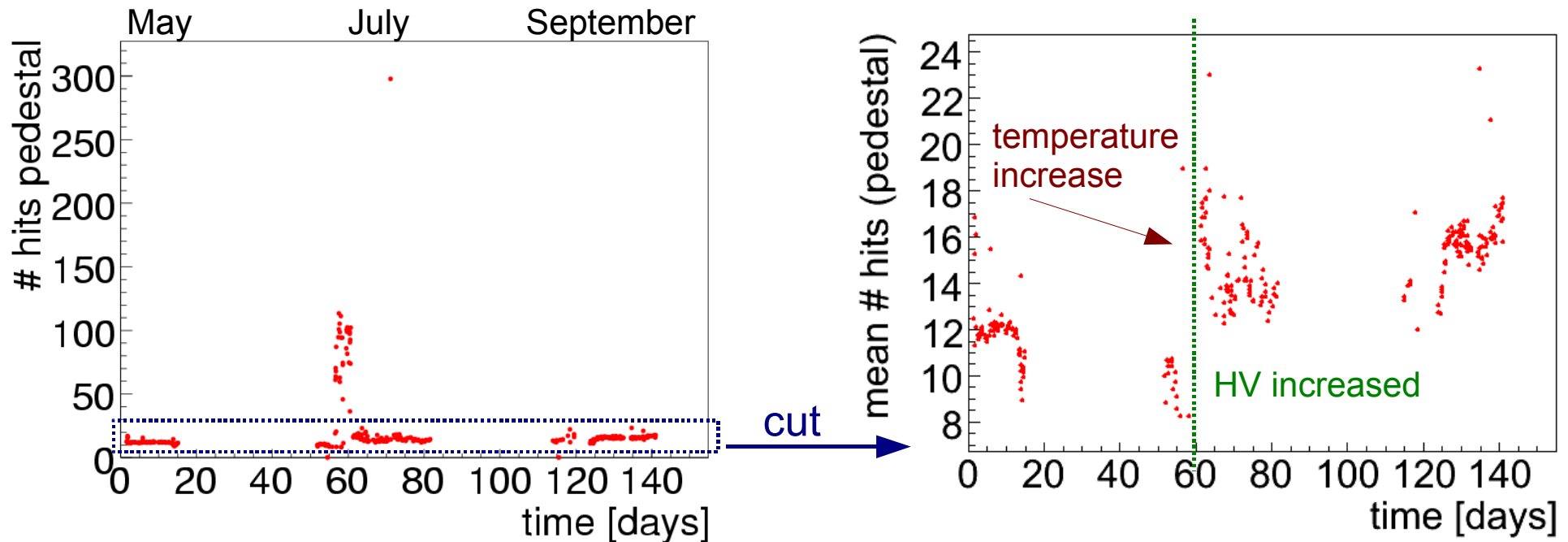
# Relative Beam Composition (FNAL)
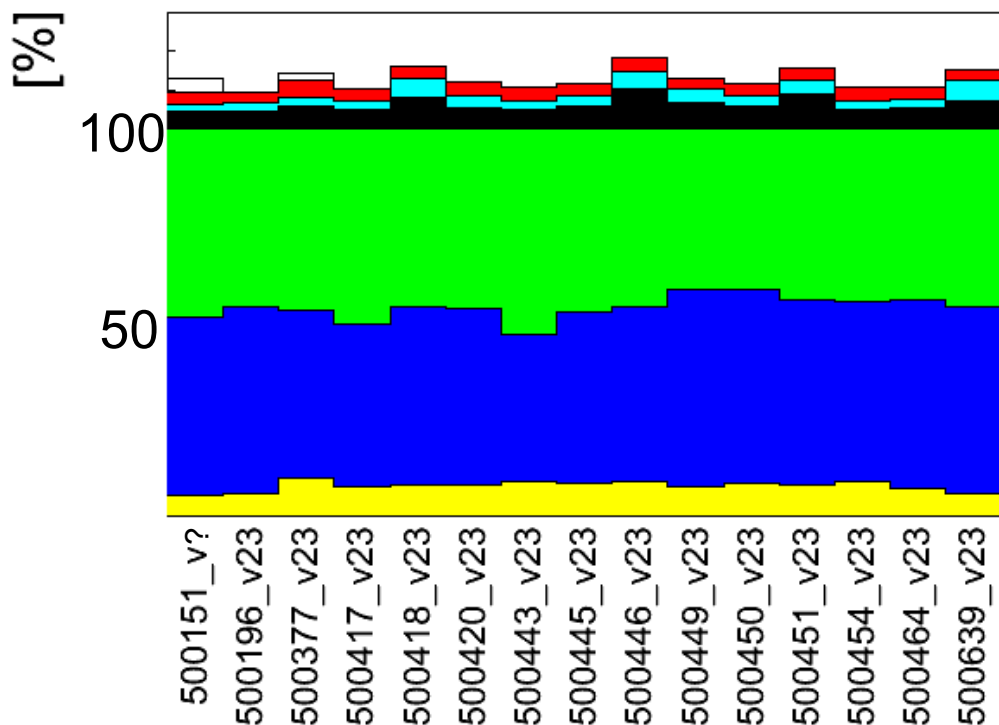


mixed beam

pion enhanced beam
(Cherenkov triggered)

- 10 GeV run, combined data taking

- Veto trigger (blank histogram)

- Unverified trigger

- Calibration events

- Pedestal events

- Hadron candidates

- Electrons

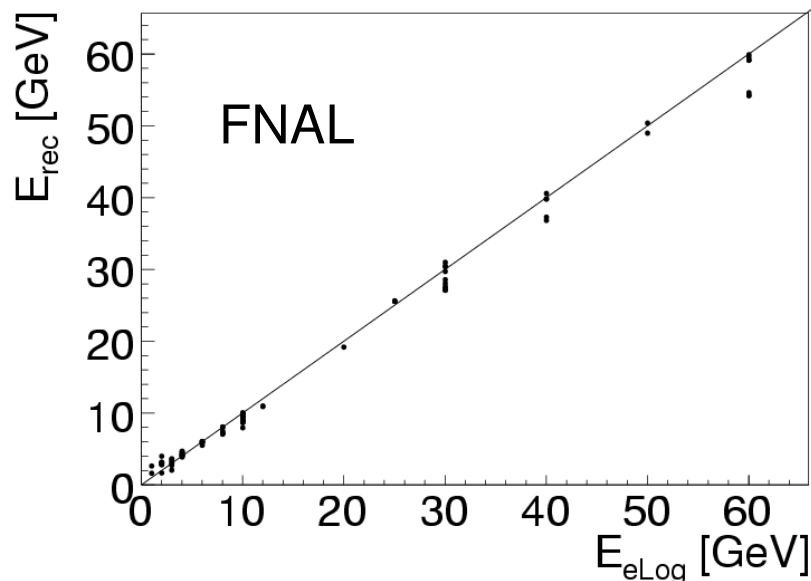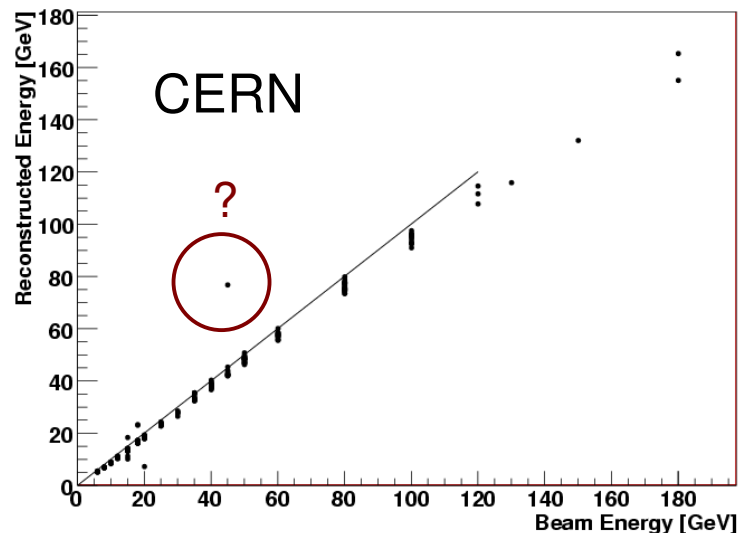- Mip like events

- 500460: ECAL off (no electron selection)

- 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)
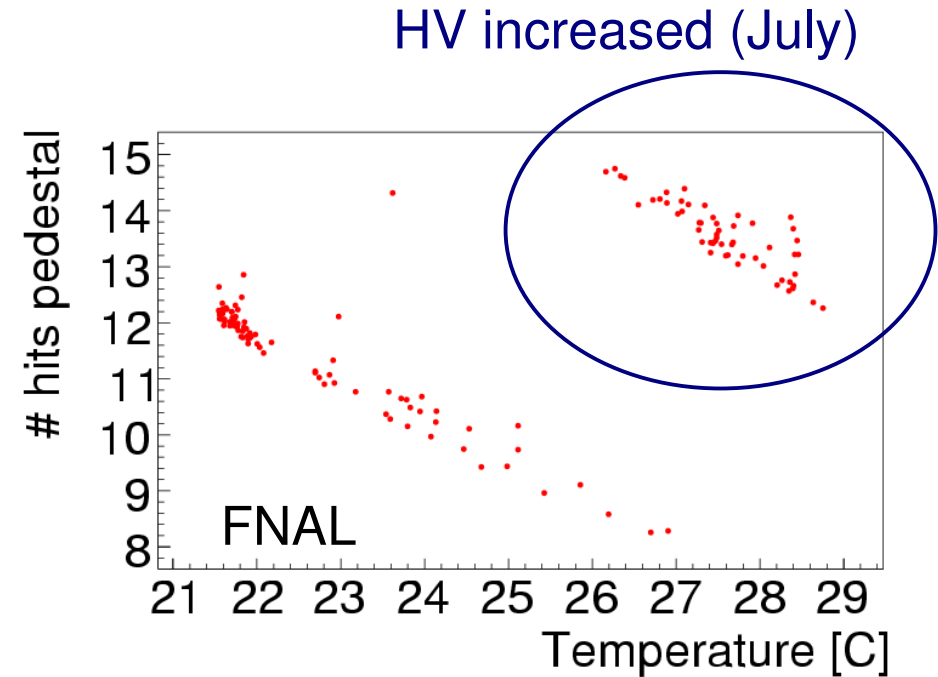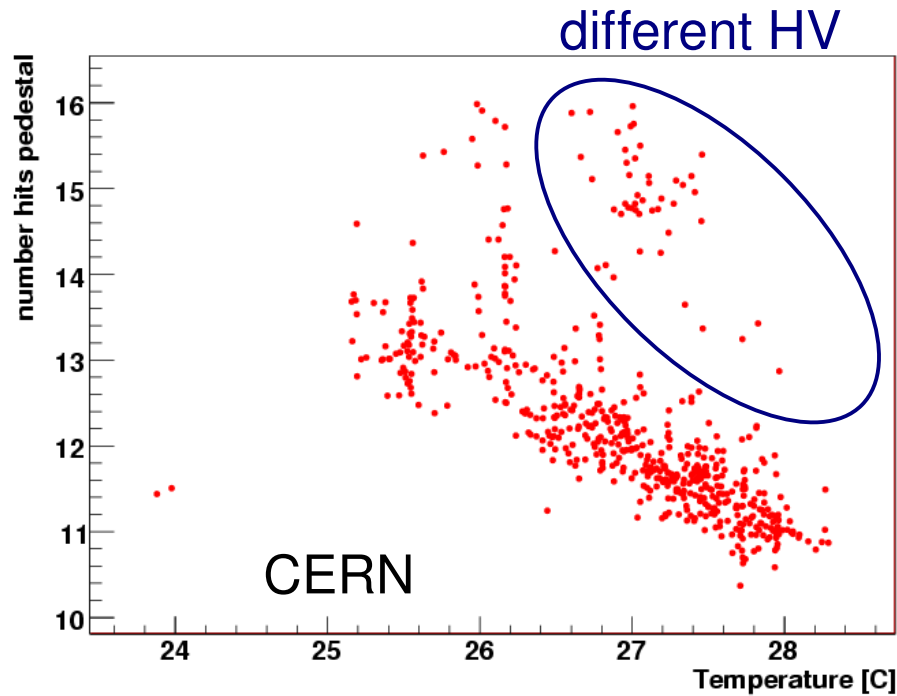


- Linear relation between # hits (pedestal) and temperature

- 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
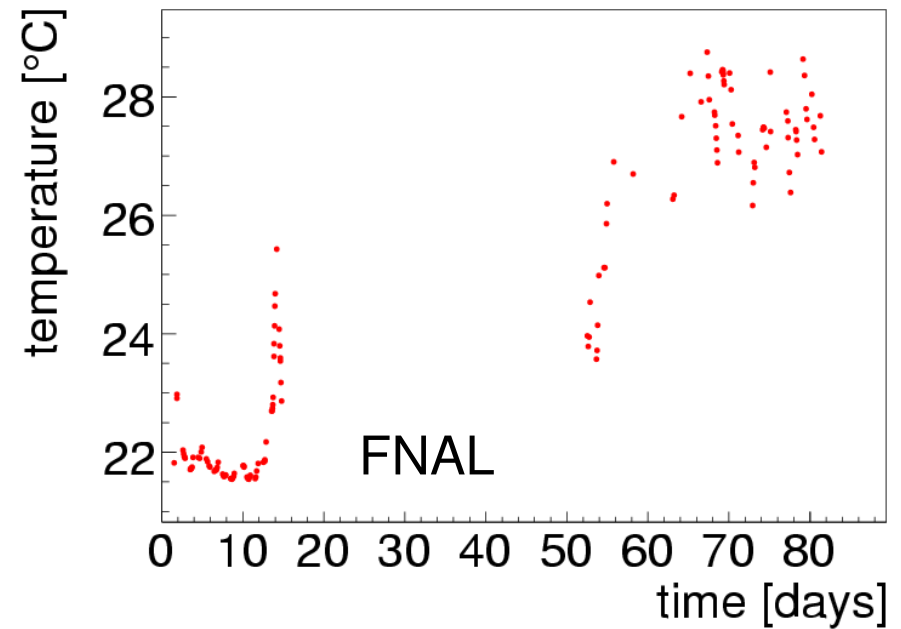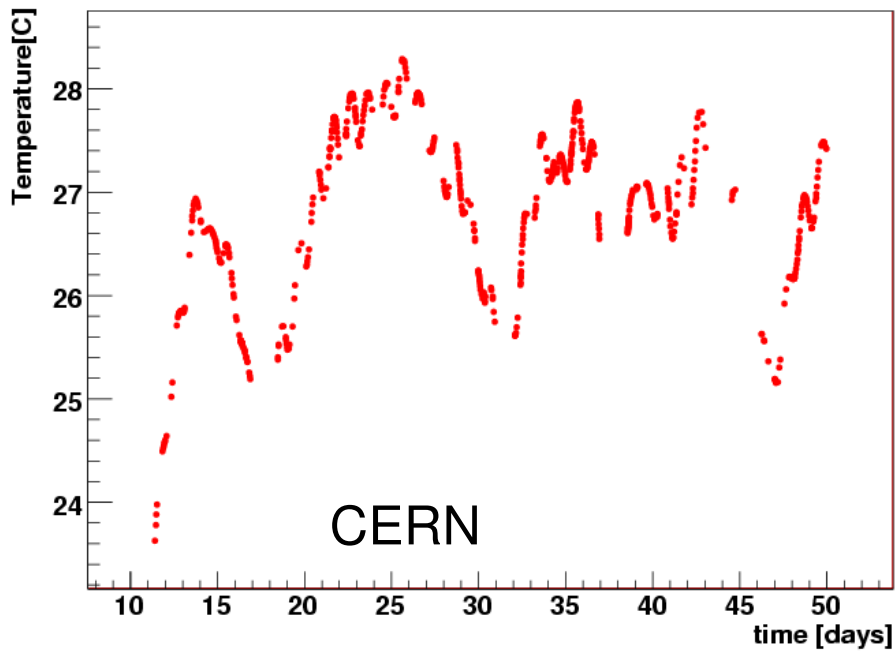
# Summary and Outlook

- 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

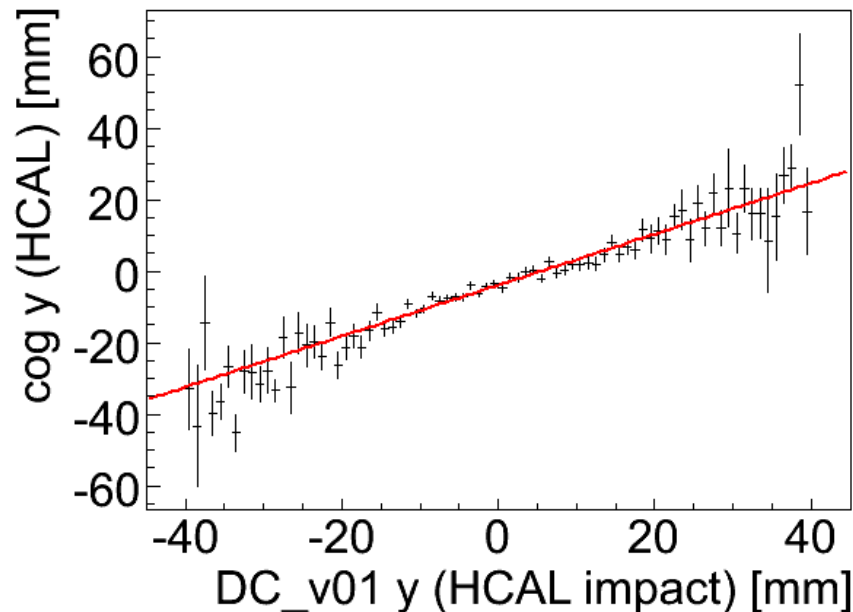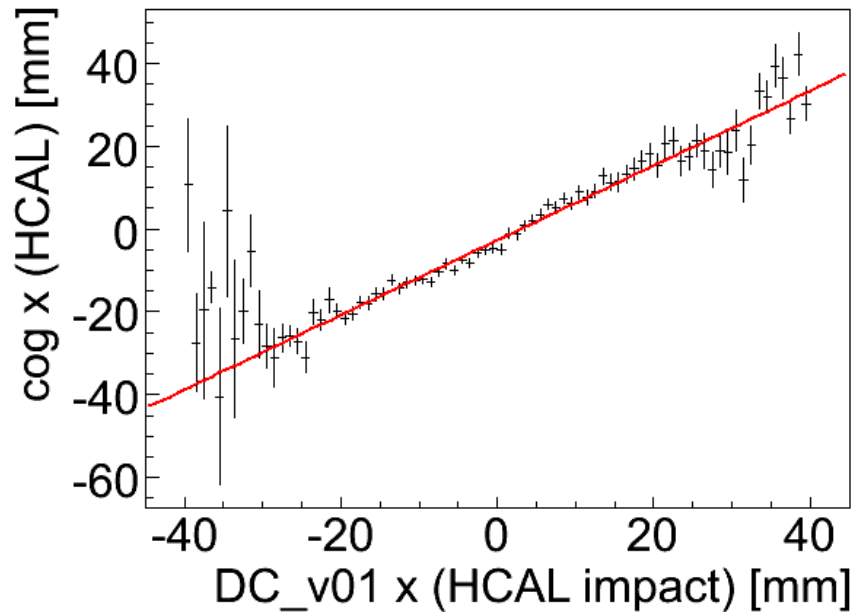- Still several open issues – any ideas / contributions are highly welcome

# *BACKUP SLIDES*

# Temperature Development (HCAL)



- Temperature range CERN: 4 K

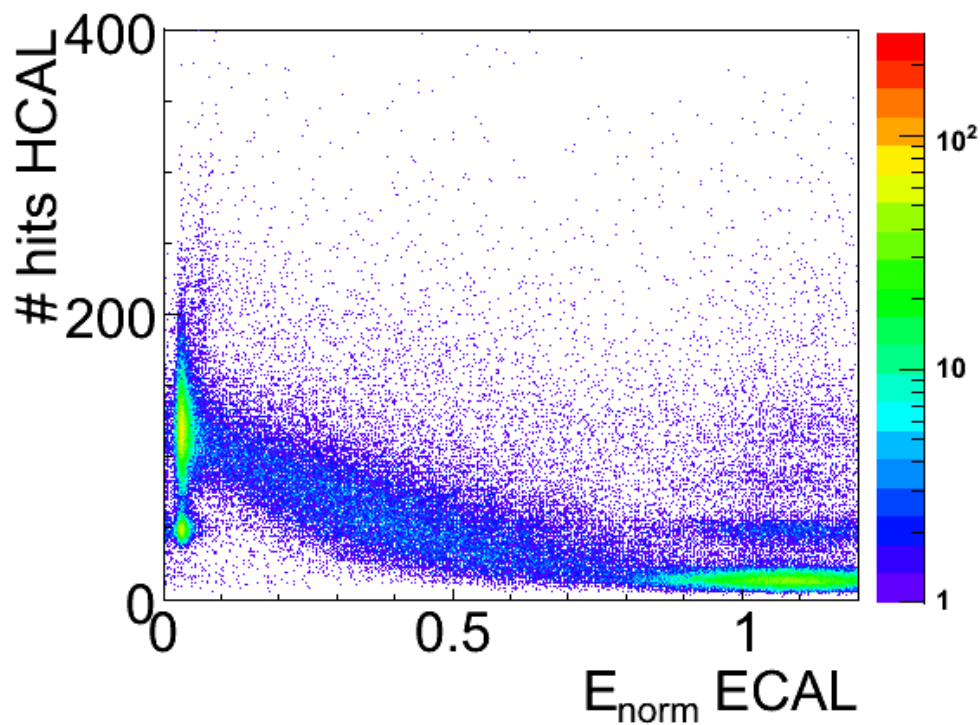- Temperature range FNAL: 5 K (May - July)

# 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