Clustering of e-m showers in the SiW ECAL

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Overview

- Goal:
  cluster e-m showers and reconstruct particles from TB and simulation while imposing the same constraints as in full detector
  1.) Try to estimate and (hopefully) improve the „constrained“ energy resolution (wafer center, 0 degrees) - as done for 2006 – for data from CERN 2007 TB
  2.) Generalize energy resolution for non-zero impact angles and all impact positions (?)
  3.) Show capabilities to destinguish pi/e

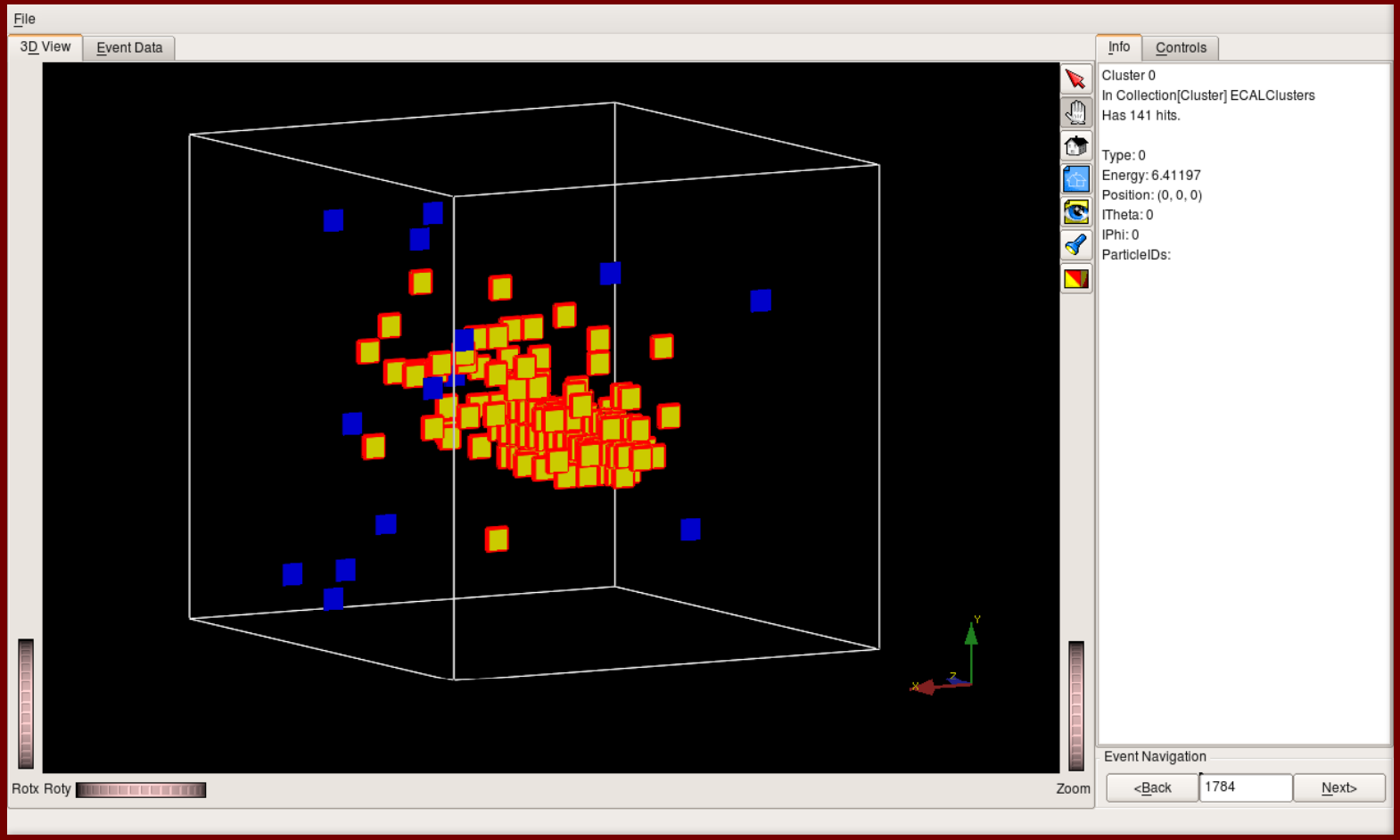
Overview

- First presented already at ILC software workshop (LAL, May'07)
- What happened since then?
  - Implementation proved not optimal for direct transfer to LDC models
  - Reimplementation for the LDC to use in $H \rightarrow \tau\tau$ studies
  - Transfer to prototype after achieving satisfactory results (almost 1:1 !)
  - First running version just finished last week:
    Very first impressions shown here

The GARLIC algorithm

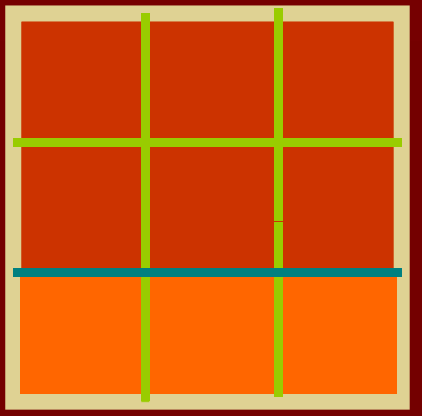
- Based on REPLIC
- Seed search via 2-dim energy projection in first $7X_0$
- Clustering based on neighbour criterion
- Several iterations from front to back
- Originally designed for pointing photons, works for all angles
- Rejection via simple criteria (#hits, minimum energy, seed criteria,...)
- + Computation of cluster variables (Eccentricity, width, direction, energy deposit in different regions,...)
- Correction for guard ring and module gaps

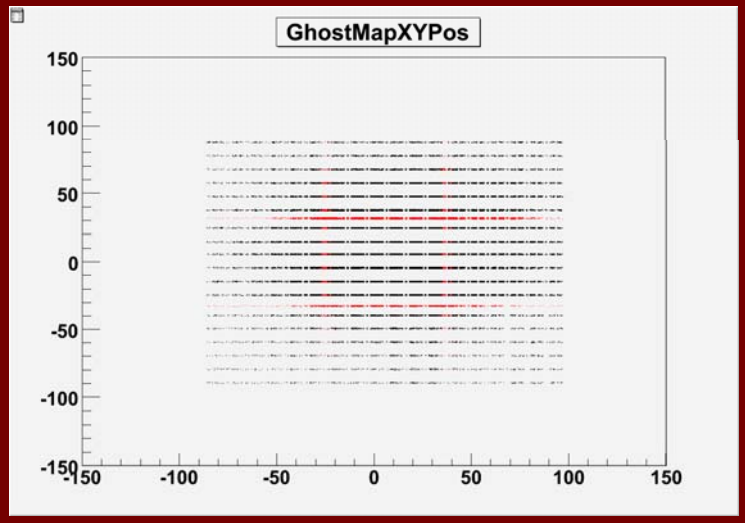
6 GeV e- shower

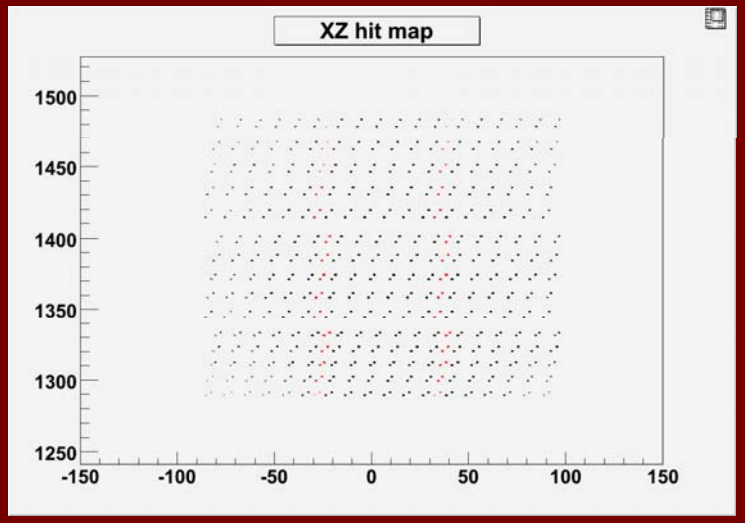


Gap correction

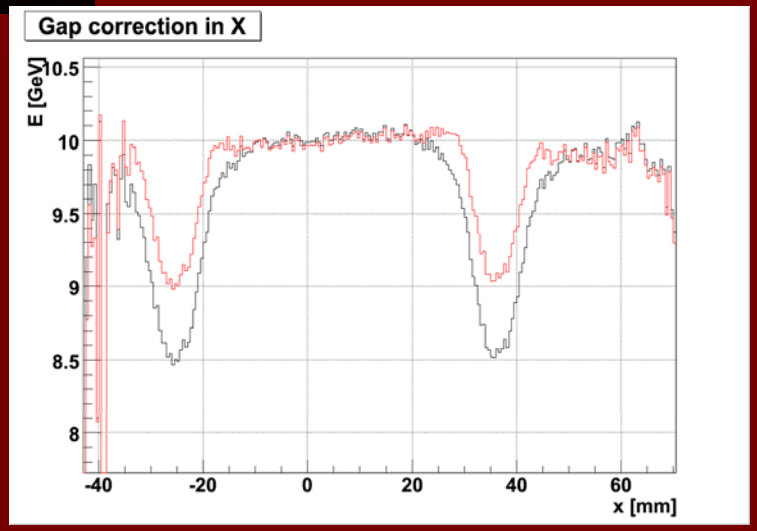
- Introducing „Ghost hits“ in a gap between to adjacent hits
- Linear energy interpolation
- angle independent
- Sensible to position in the shower
- Expecting reasonable improvement

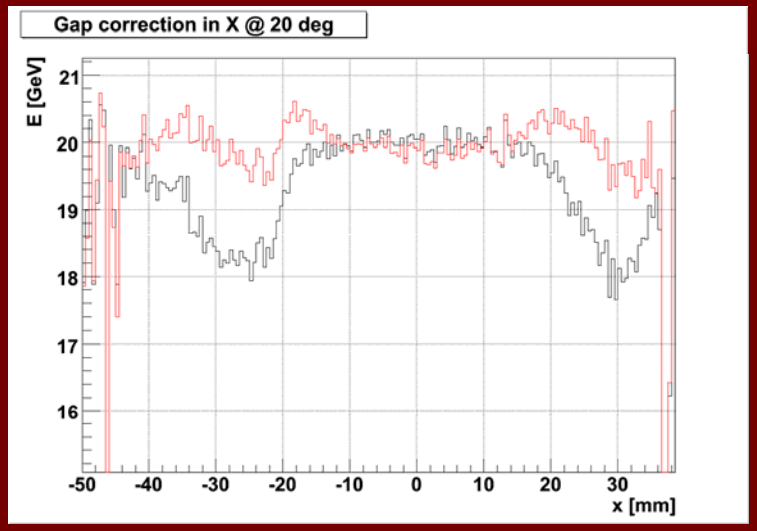


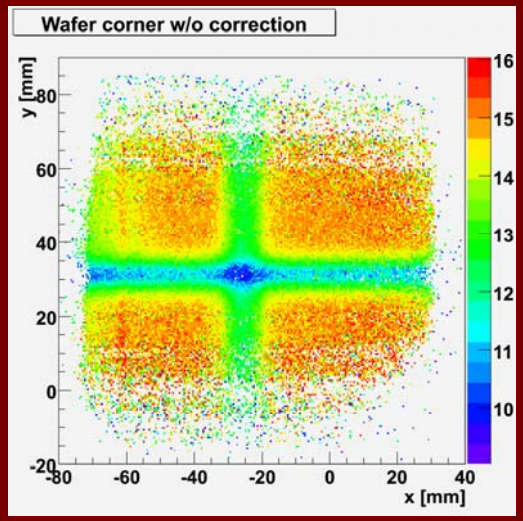


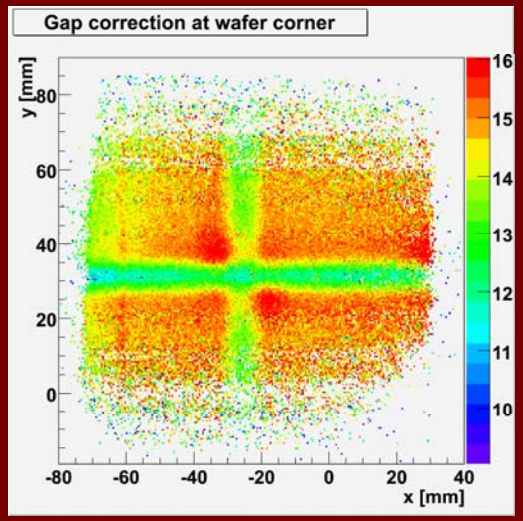


Gap correction: performance









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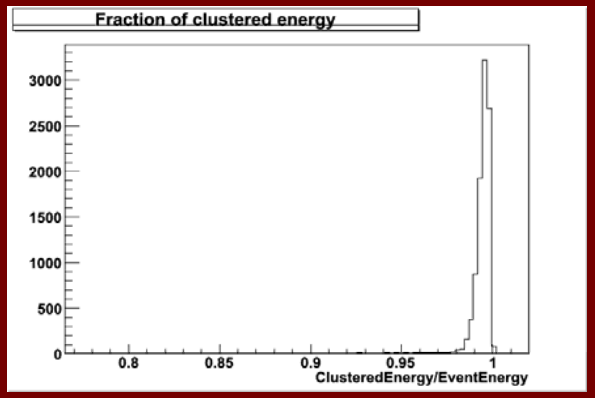
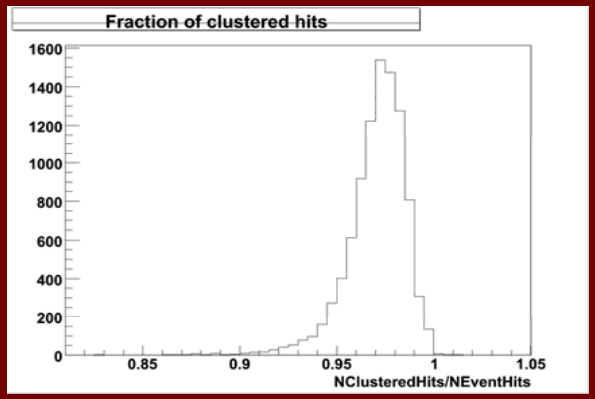
Clustering efficiency

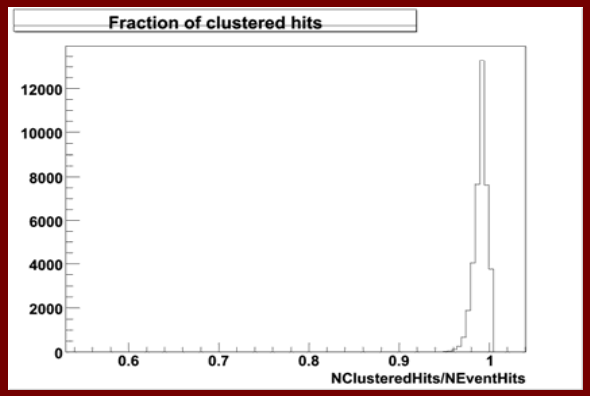
- „Ghost hits“ in fiber gap are counted
- Supression of noise hits
- Works well at angles != 0
- Further optimisation possible

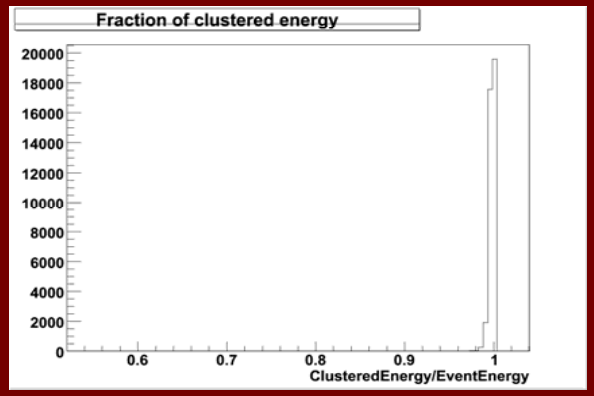
0 deg





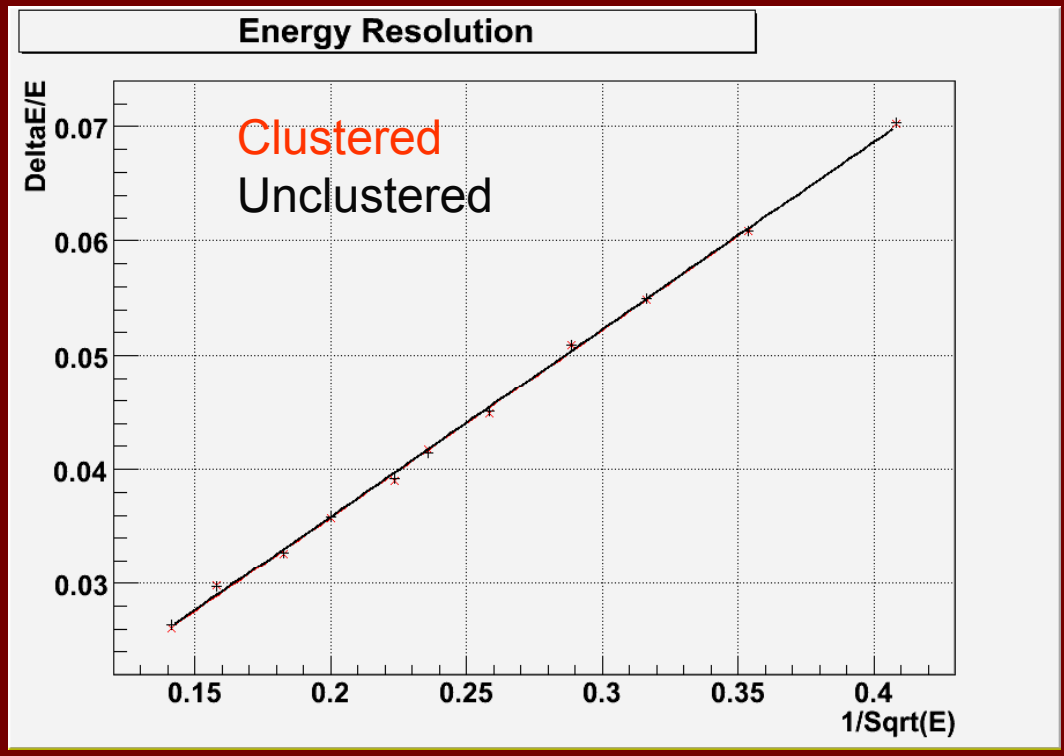
20 deg



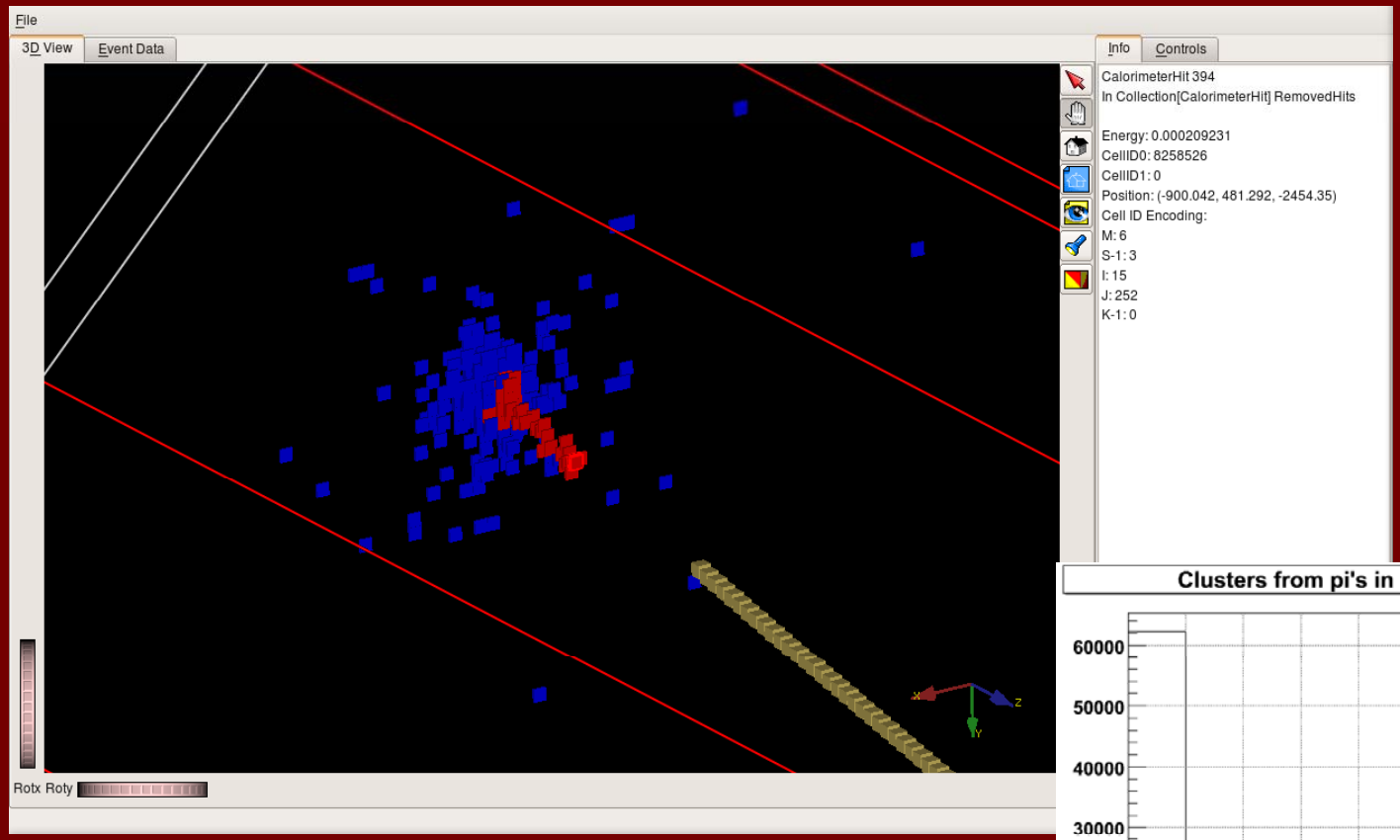


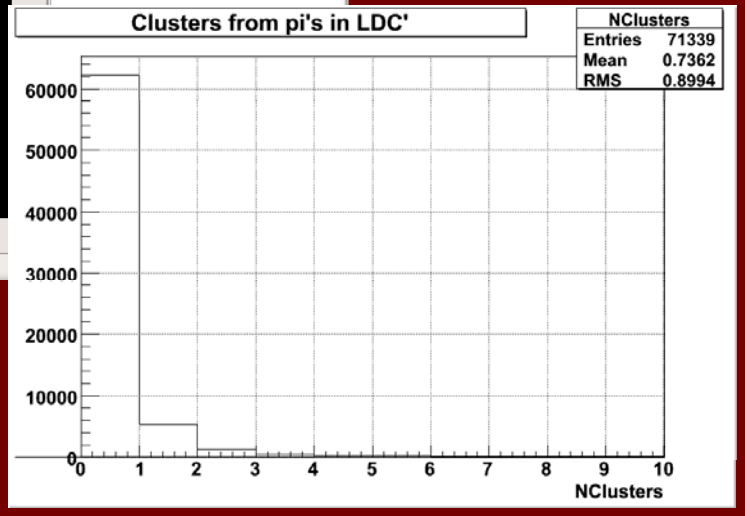
Energy Resolution

- Simple event selection on energy + Cherenkov
- COG in center of central wafer
- Gauss fit over entire energy range
- No loss in resolution
- But:
  - Without understanding the beam
  - No proper calibraiton
  - Far from sofisticated analysis

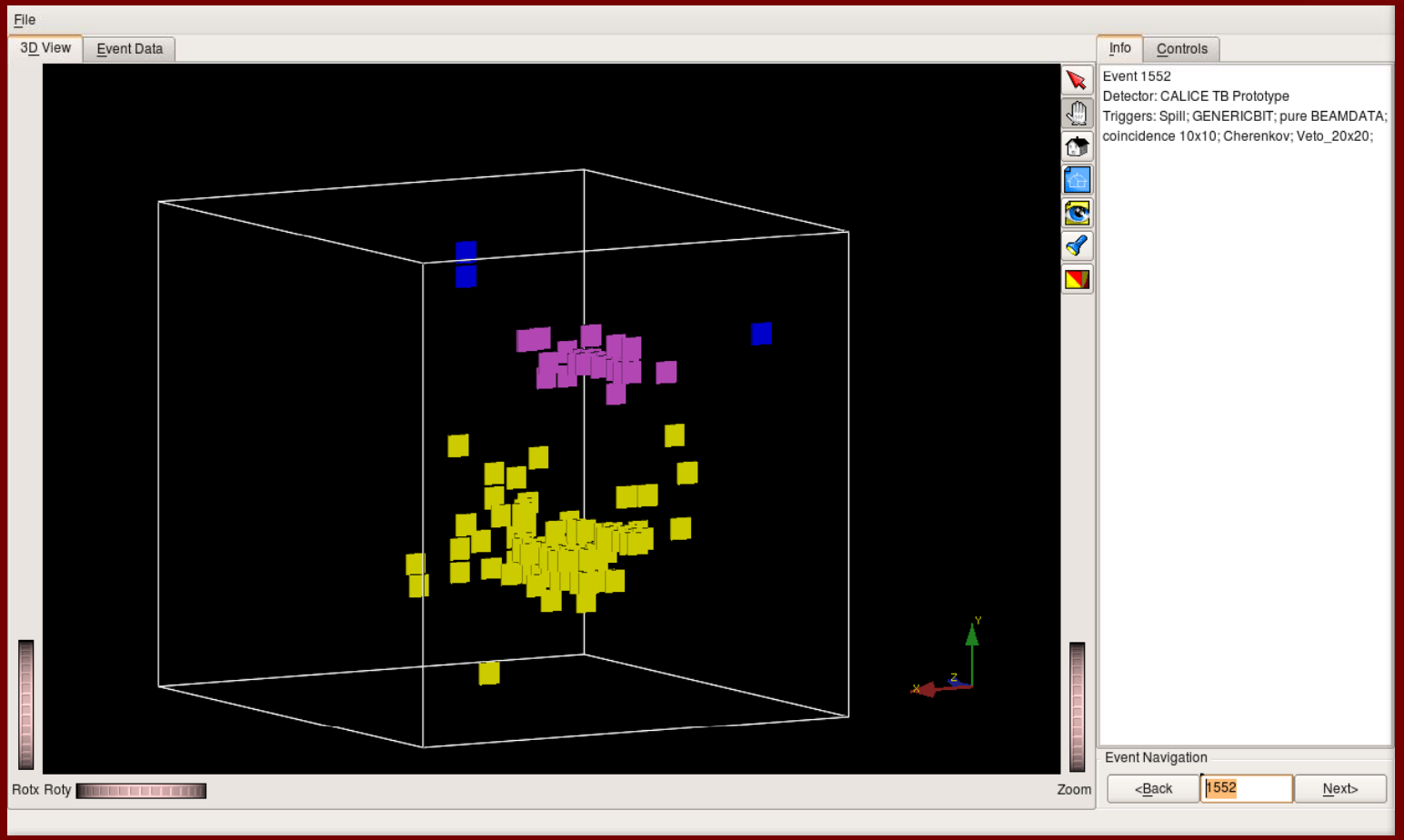


Pi rejection



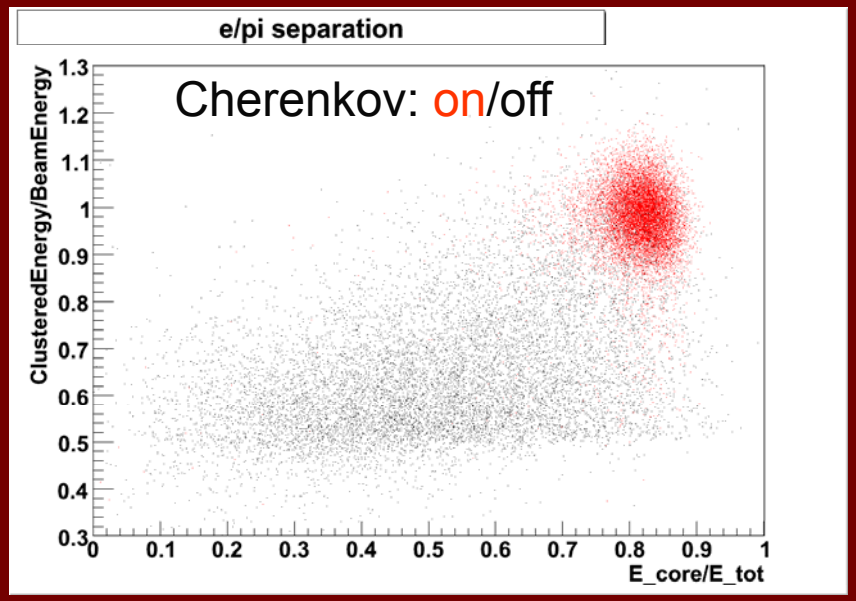


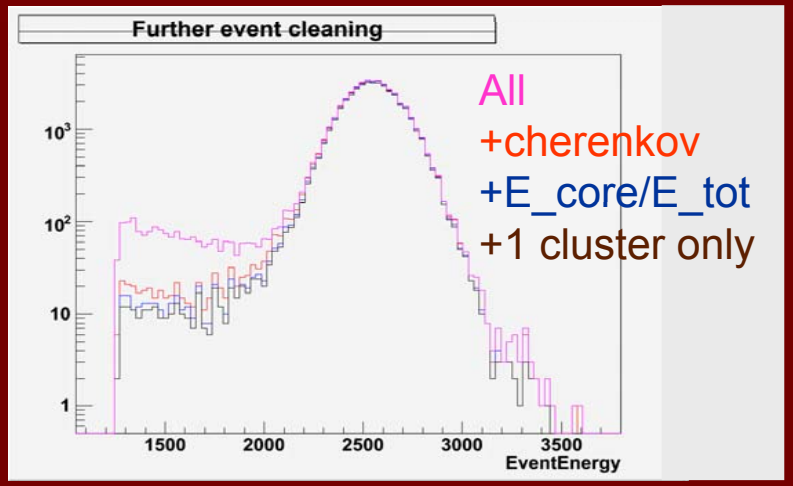
Dirty events

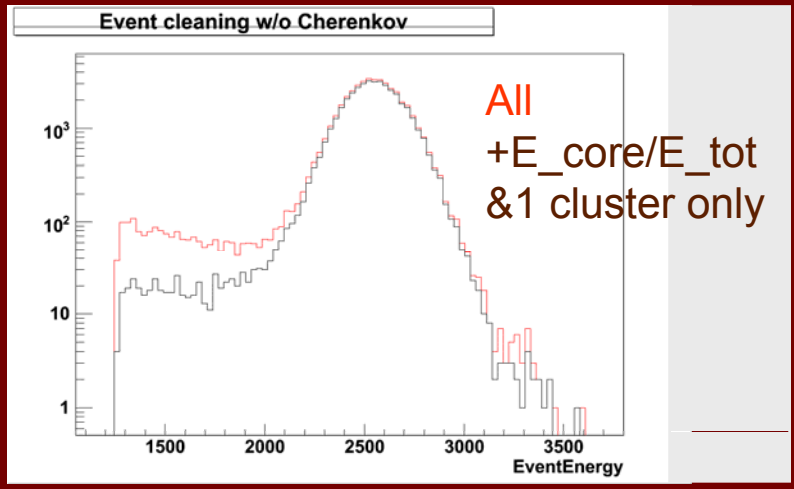


Additional Event cleaning

- Use energy deposit in shower core to reject pions
- Core = 2x2 pixel







Future plans

- Planned to work on Cern 2007 data (unresolved calibration issue...)
- Use track extrapolation for event cleaning
- Combined energy resolution at all angles
- ...and allow all impact points (?)
- Run on simulation, compare shower attributes
- Aim for LCWS‘08