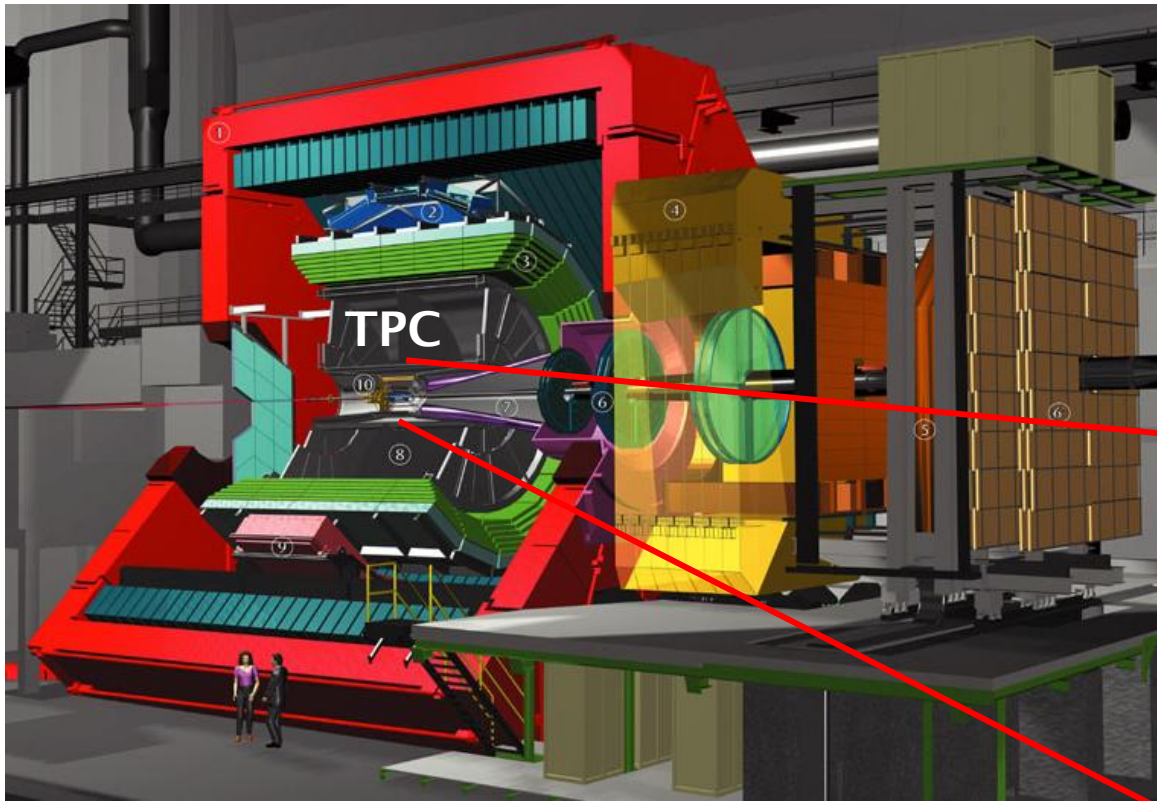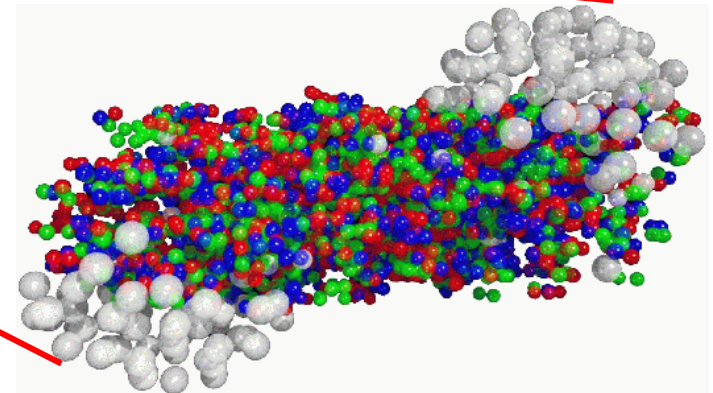# ALICE HLT

in the TPC Commissioning

IRTG Seminar

Heidelberg – January 2008

Jochen Thäder

Kirchhoff Institute of Physics

heavy-ion mode
- 5.5 ATeV pb-pb
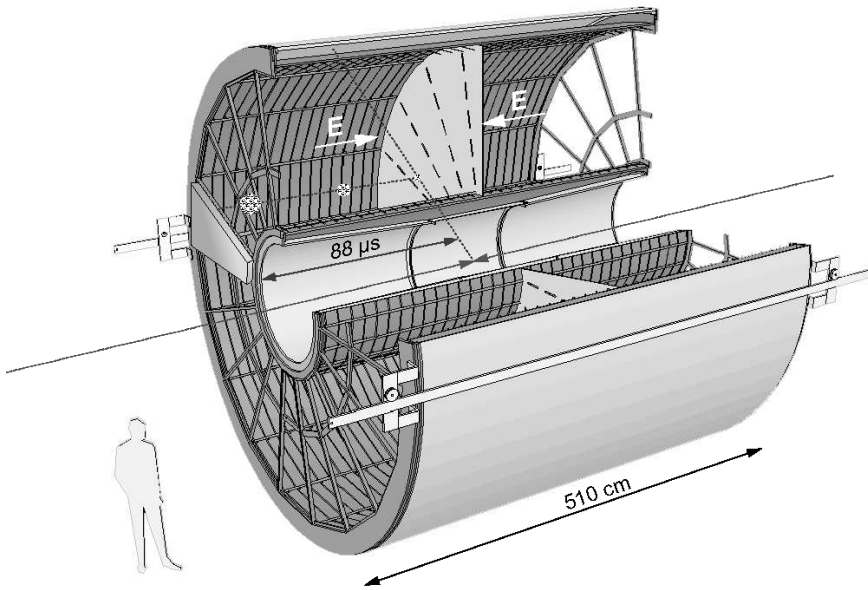- 10 MHz interaction rate

Aim :
Creation of the Quark-Gluon Plasma

a state of matter predicted to exist during the first few microseconds after the big bang
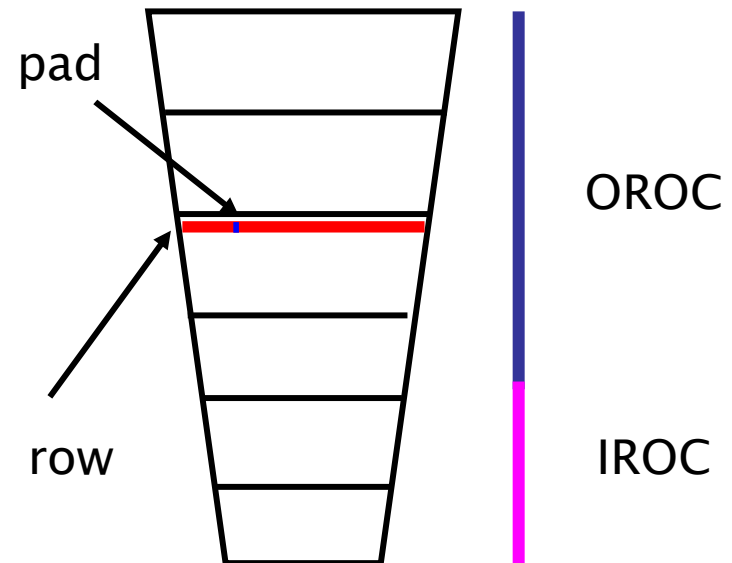
- **Large off–the–shelf PC cluster farm**
- **Several hundred nodes.**
- **Tasks:**
  - **Incoming data reduction**
    - ~ 22 GB/s (HI mode) ➔ 1.25 GB/s (to permanent storage)
  - **Trigger decisions**
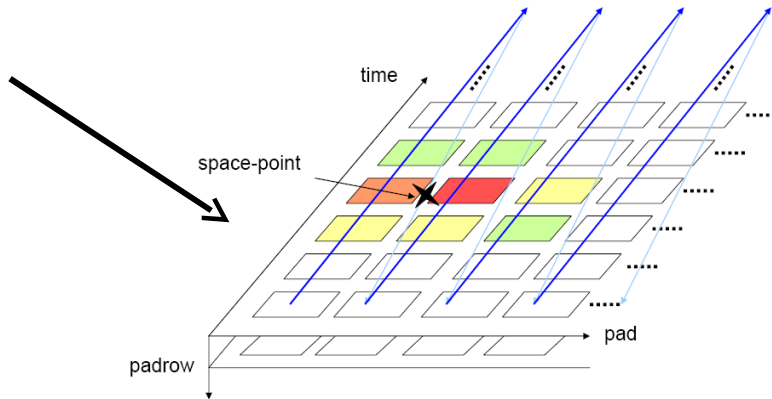   - Event rejection

⟶ **Online data reconstruction**

- **Drift chamber**
- **Inside the L3 solenoid** (homogeneous B–field)
- **Main tracking device**
- **Largest data producer**

- 36 sectors (on 2 sides)
- 216 readout partions (patch)
- ~ 26 rows per patch
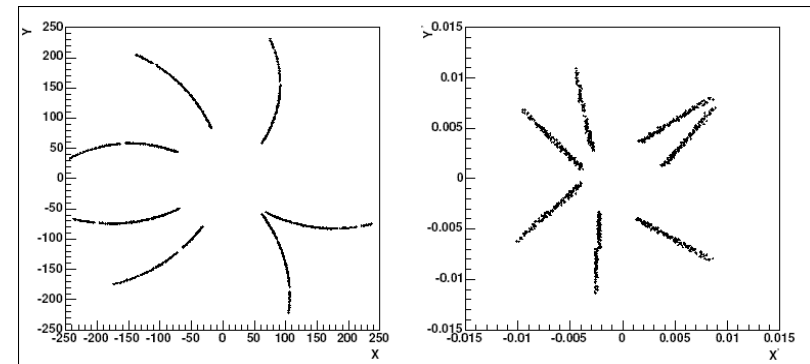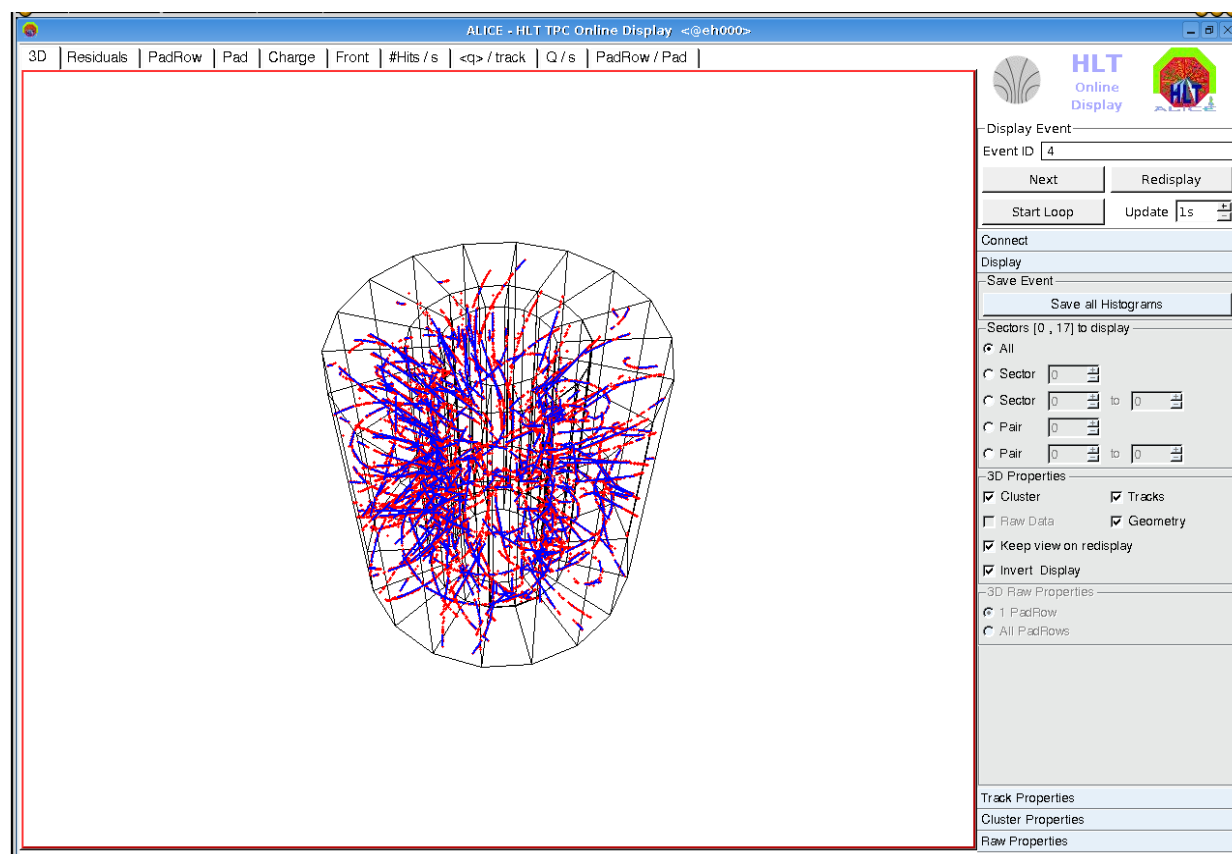- ~ 90 pads per row
- = 557,568 pads

pad

OROC

row

IROC

Raw Data
(Ordering , Zero Suppression)

– **Data amount**
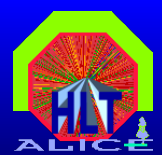+ **Computing amount**

Cluster Finding
(in readout partition)

Tracking
(Conformal-Mapping / Track Follower)

- **Reconstructed event visualisation in real time**
- **Supports HLT developers to finalize online reconstruction algorithms**
- **Supports detectors specialists to understand detector**

- Connects to every data source in HLT online analysis chain
- Displays:
  - Raw data
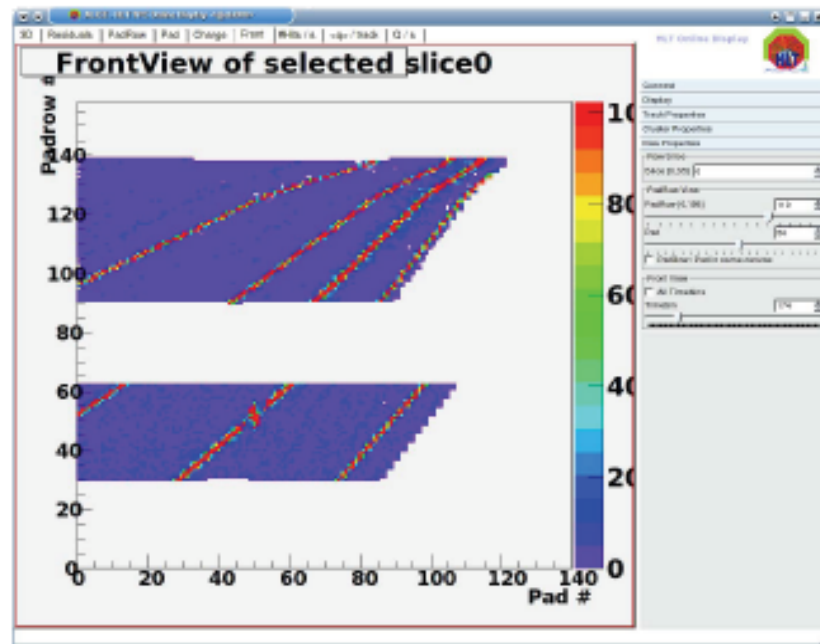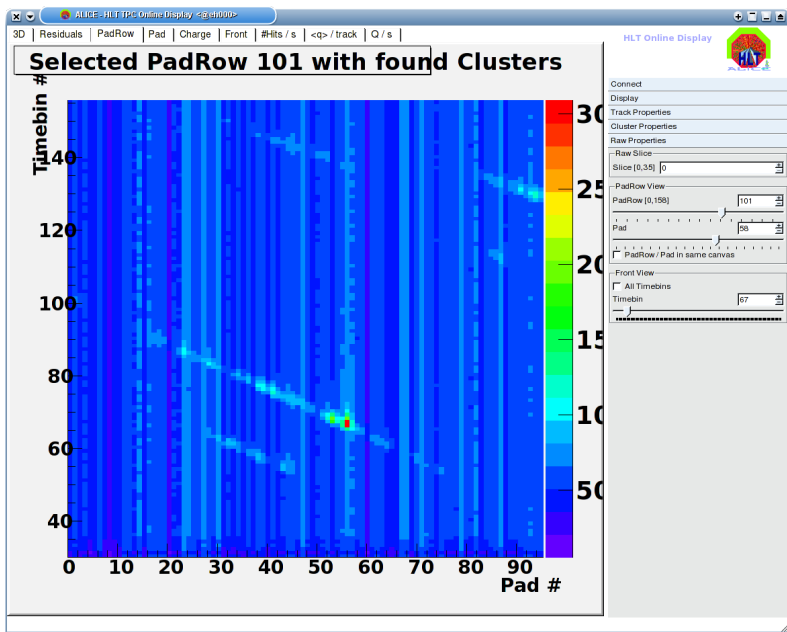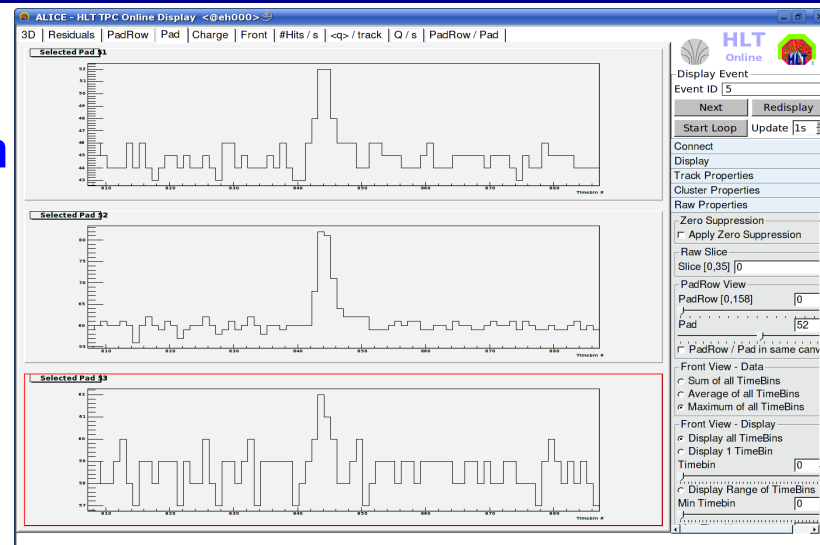 - Cluster data
  - Track data

- **Selection of single sectors, range of sectors, pair of sectors, all**
- **Event loop / single events**
- **Show track parameters**
- **Cuts on track parameters (nHits, p_t, charge,...)**
- **Used / unused cluster (in respect to tracking process)**
- **3D display / histograms**
- **Option of saving histograms**
- **Easy extendible for special needs**

- **Pad Display**
  - **Signal histograms for raw ADC data with neighbouring pad**
- **Padrow Display**
  - **Padrow histogram for raw ADC data**
- **Front Display**
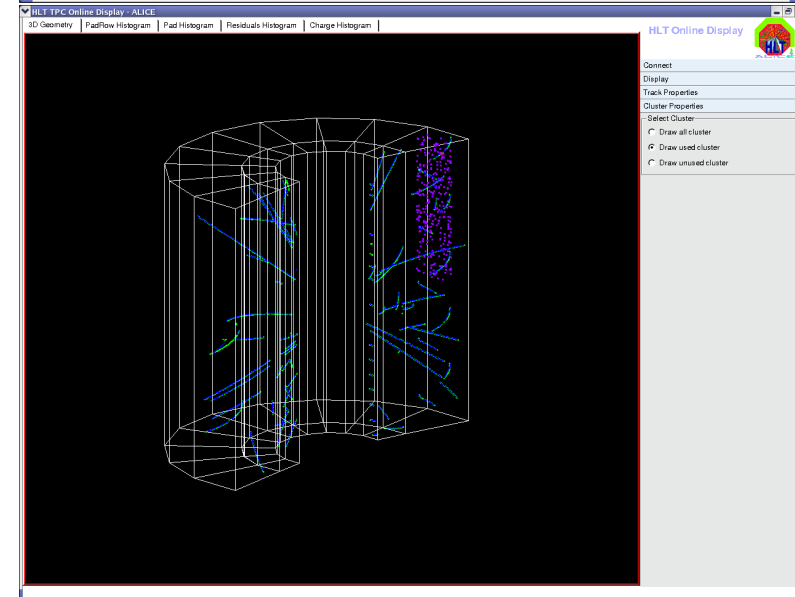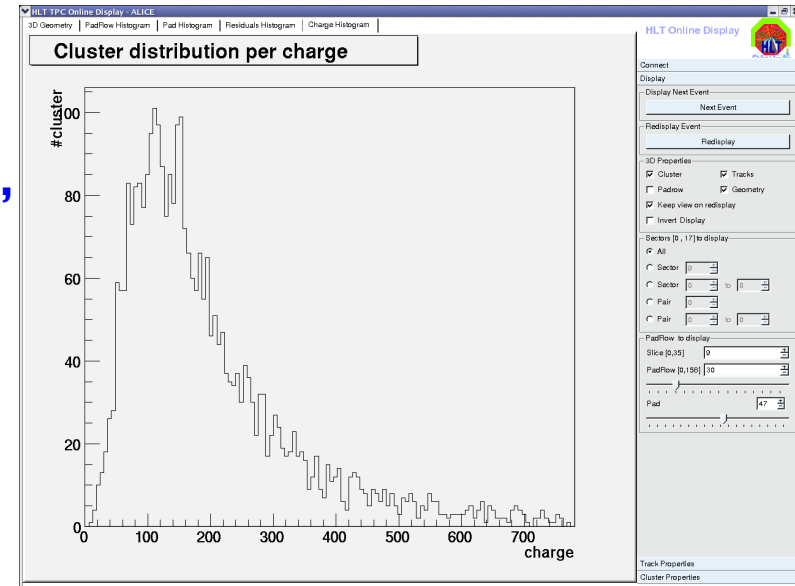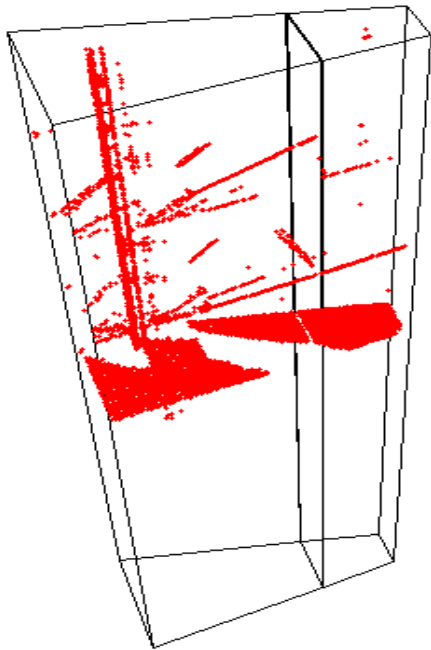 - **Endcap view TPC histogram**

- **3D Display**
  - Geometry, raw ADC data, cluster, tracks
  - Selection of single sectors, range of sectors, pair of sectors, all sectors
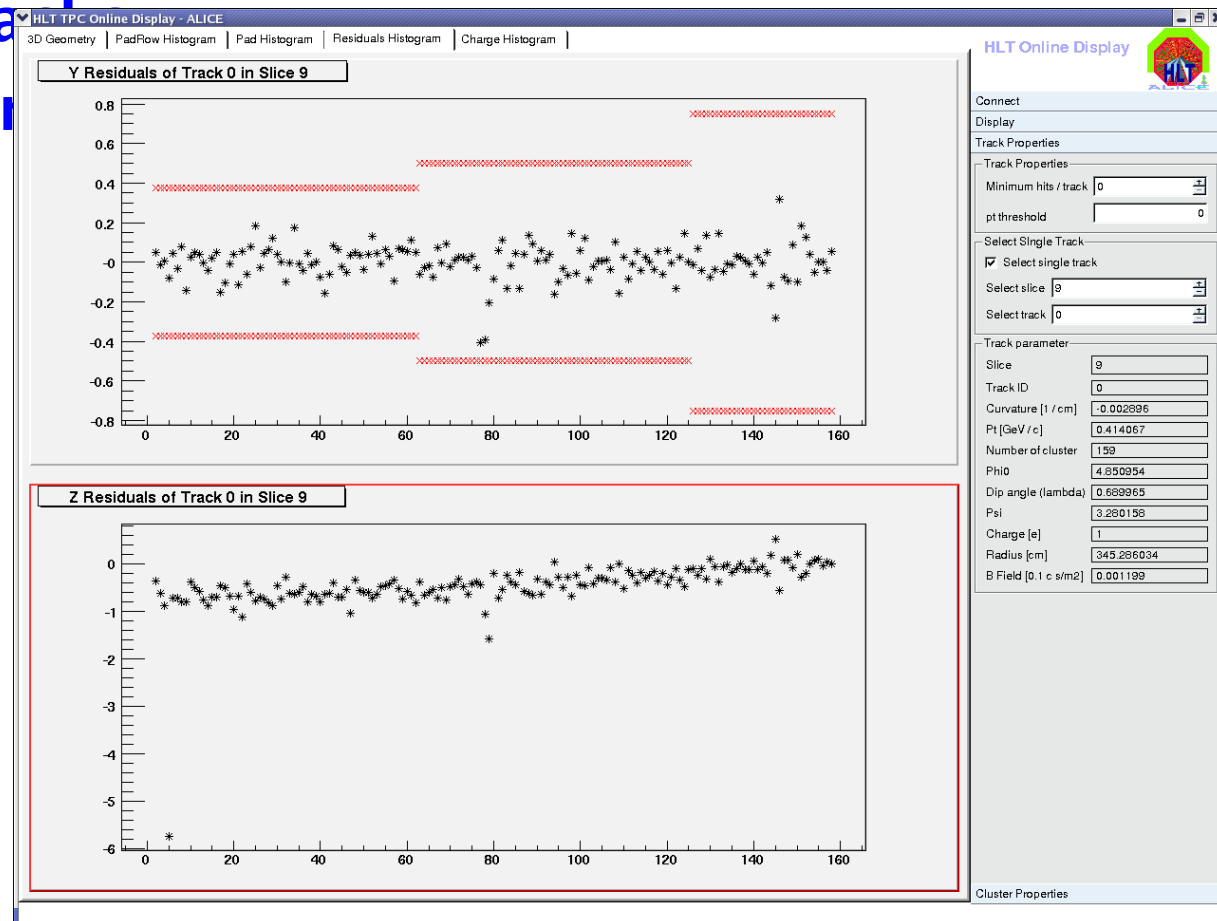
- **Charge Display**
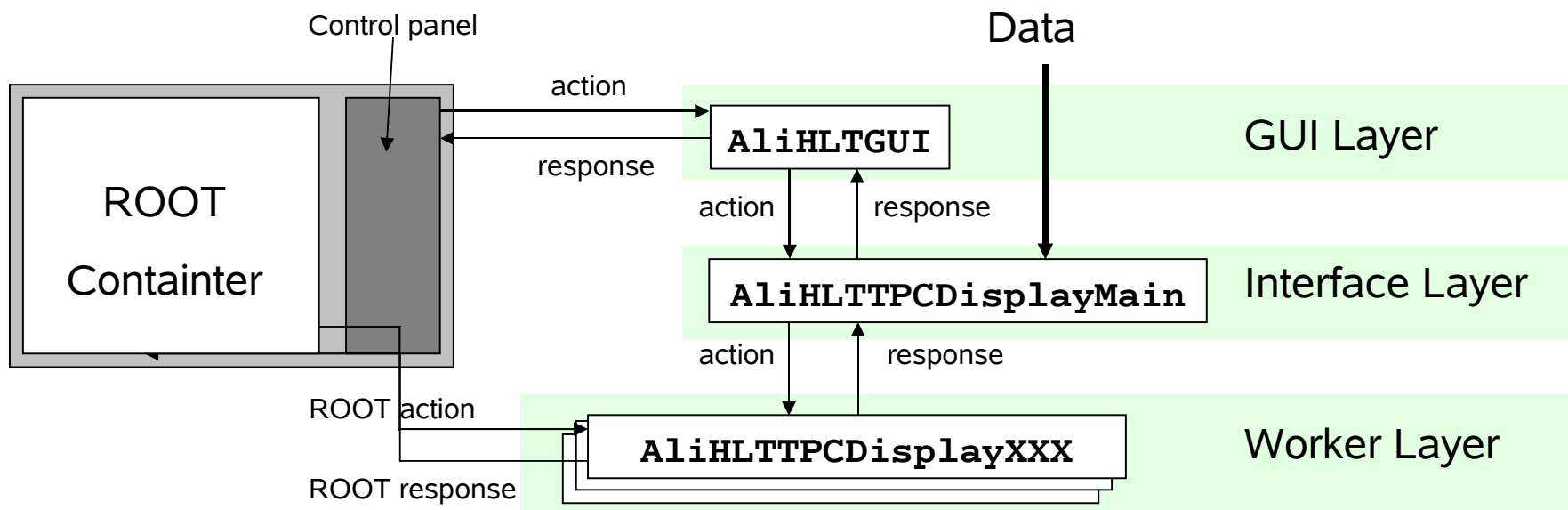 - Charge distribution of found Clusters

- **Residuals Display**
  - **Residual distribution of all tracks**
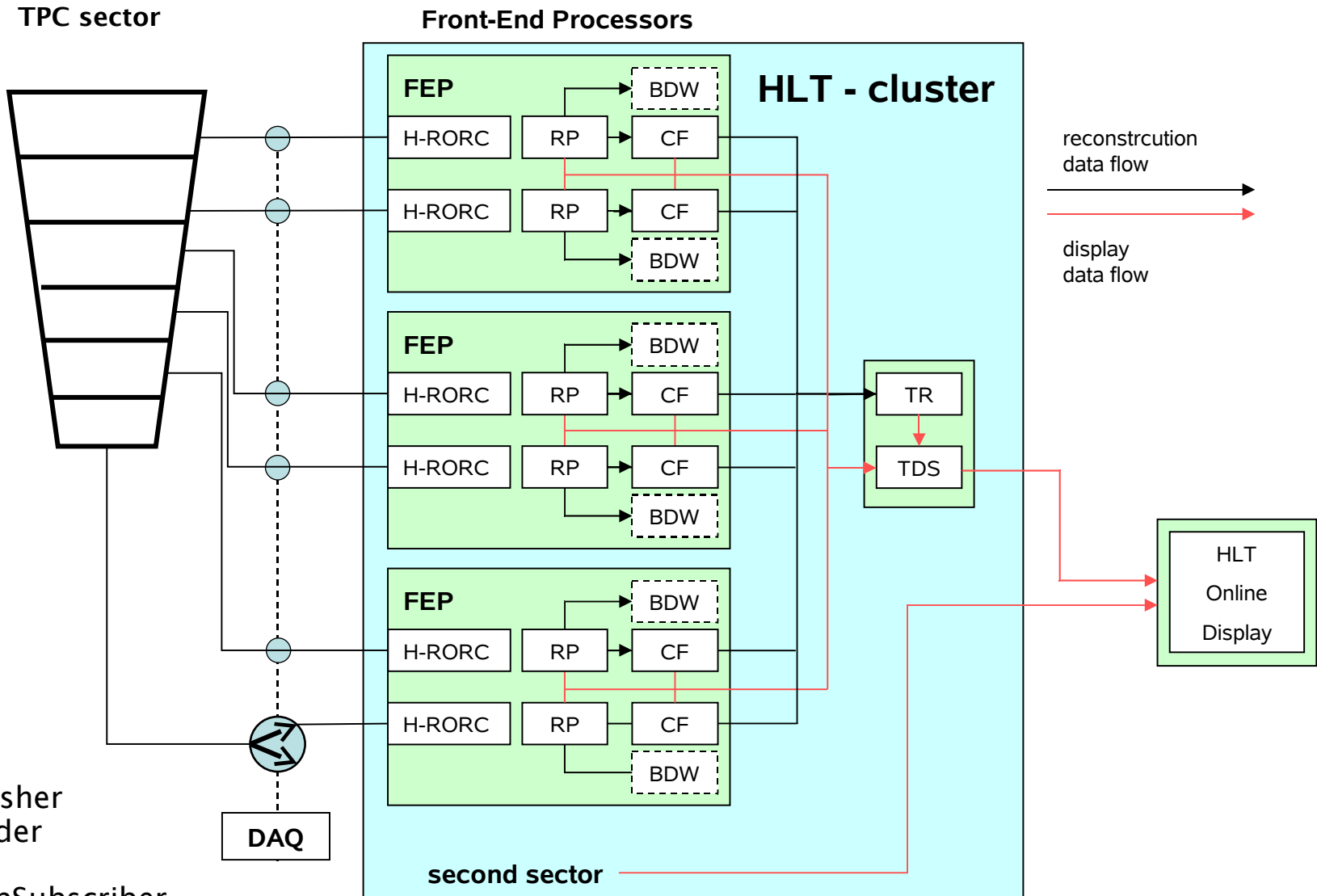 - **Residuals of single track**
  - **Track parameter of single tracks**

3 Layers

- – **Graphical User Interface (GUI) Layer**
  - Qt based
- – **Interface Layer**
  - Handles Qt <--> ROOT, data input from HLT chain
- – **Worker Layer**
  - ROOT based

- **7 Opteron PCs in CR2**
  - **connected to TPC via DDLs**
- **1 Opteron PC in TPC Cleanroom**
  - **running test setup for**
  - **TPC – DAQ – HLT interfaces**

- **All equipped with :**
  - – **HLT Data framework**
  - – **AliRoot offline framework**
  - – **modified TPC analysis components**
  - – **HLT TPC Online Display**

TPC sector

Front-End Processors

HLT - cluster

FEP
- H-RORC → RP → CF
- BDW
- BDW

FEP
- H-RORC → RP → CF
- H-RORC → RP → CF
- BDW
- BDW

FEP
- H-RORC → RP → CF
- H-RORC → RP → CF
- BDW
- BDW

TR → TDS

HLT Online Display

reconstrcution data flow

display data flow

second sector

DAQ

Components
RP :RORCPublisher
CF: ClusterFinder
TR: Tracker
TDS: TCPDumpSubscriber
BDW: BinaryDataWriter

- **Several issues not related to analysis components**
  - Hardware
  - Infrastructure
  - Hardware / Software Interface

➔ **Typical startup problems**

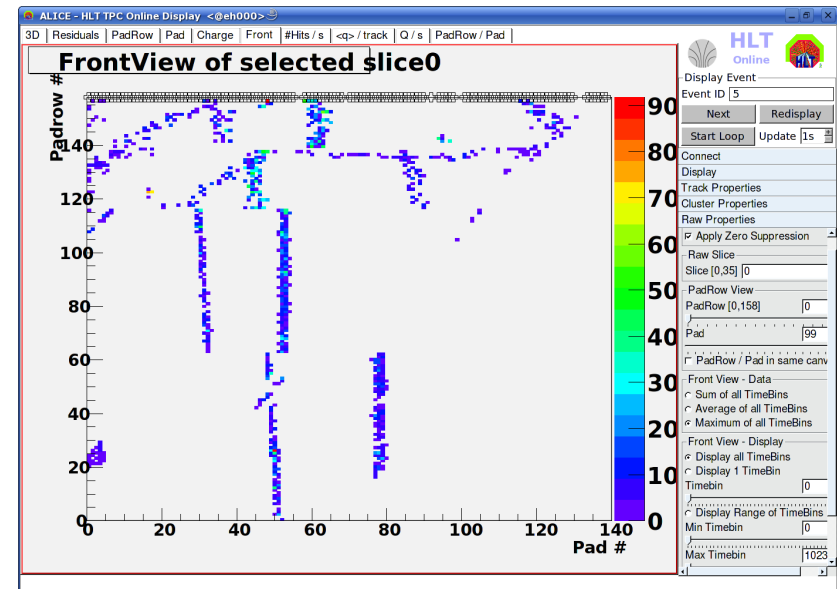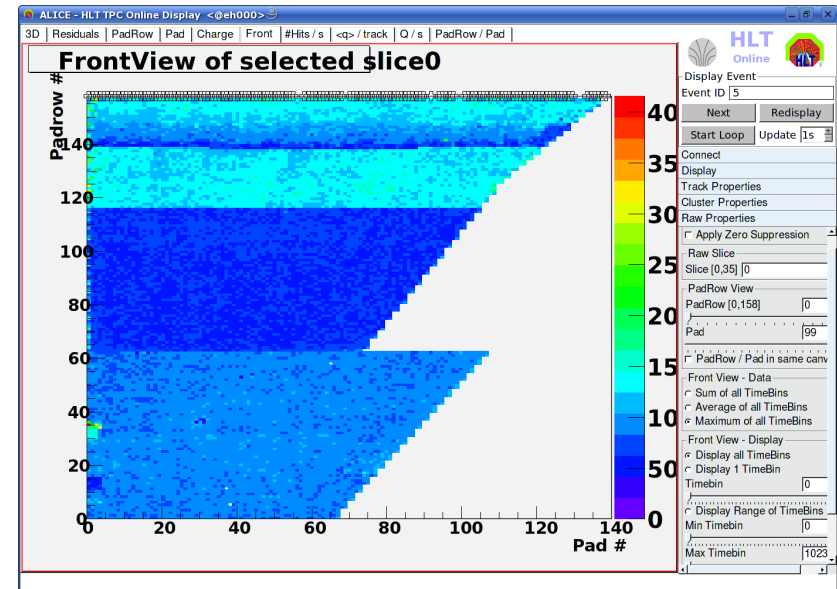➔ **All solved**

➔ **Not so much time for reconstruction tests**

- **Raw data from TPC not zero suppressed**

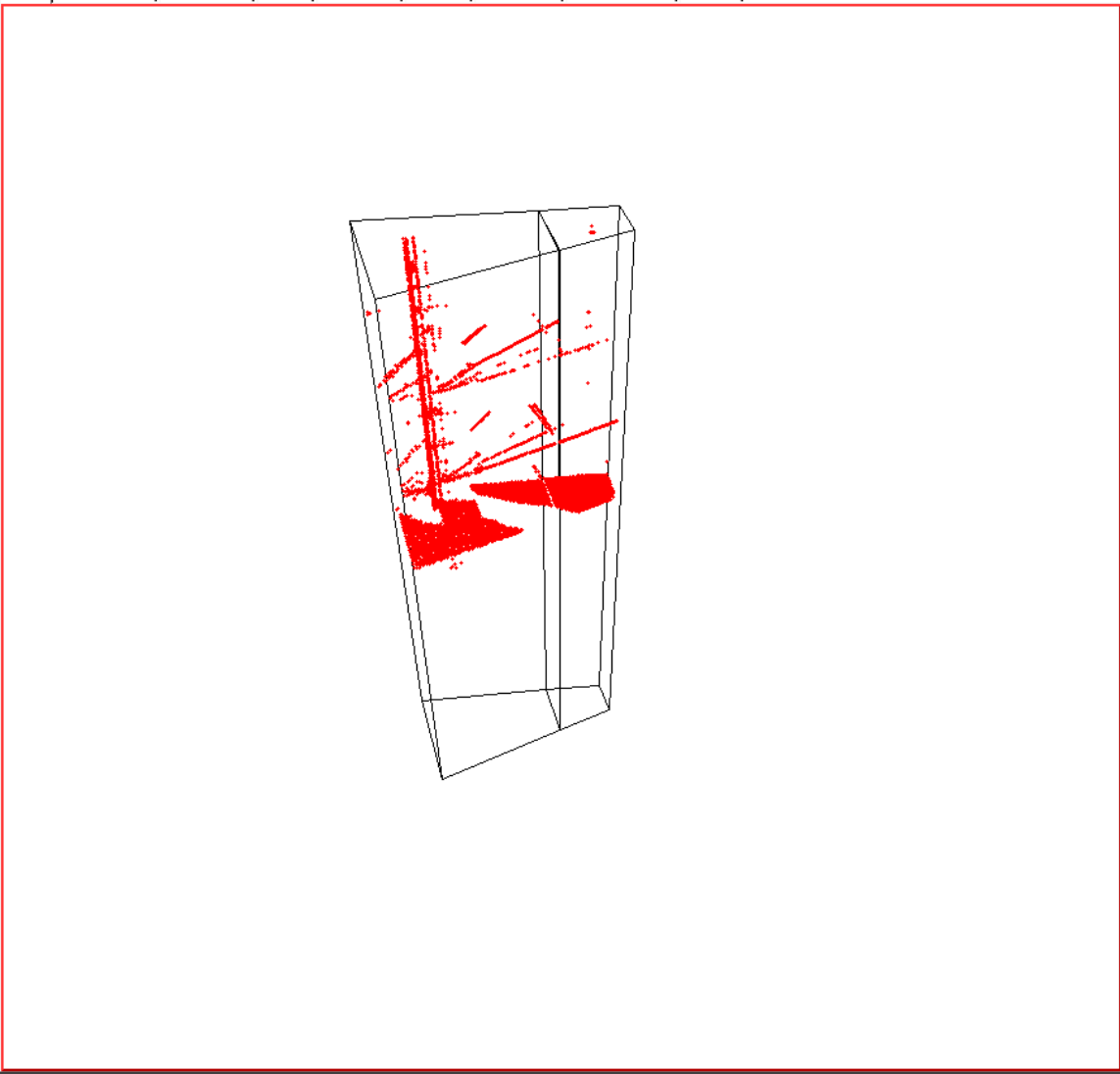➔ **Lots of noise**

➔ **Clusterfinding / Tracking impossible**

Solution:

➔ **Noise Reduction**
  - **Zero-Suppression added**
  - **Occupancy limit for single pads added**

Laser Event with Central Membrane

- **TPC not designed for tracks parallel (or small angle) to rows**

cosmic particle

- **Existing tracker not designed for tracks parallel (or small angle) to padrows**

→ New tracking approach

- Based on cellular automaton of Ivan Kisel

- First version finished and tested in last week of data taking

- Further tests necessary

- **Implementation of combined TPC–TRD Jet trigger for the HLT** (Not yet started)
  - Improvement of the TPC tracking algorithms
  - TRD tracks as seeds for jets
  - Continued with TPC tracks
- **Search for**
  - High pT jets in hadron–hadron collisions
  - Di–jets in pb–pb collisions

❖**Prepare the HLT for first year ALICE**