SW for European RPC DHCAL

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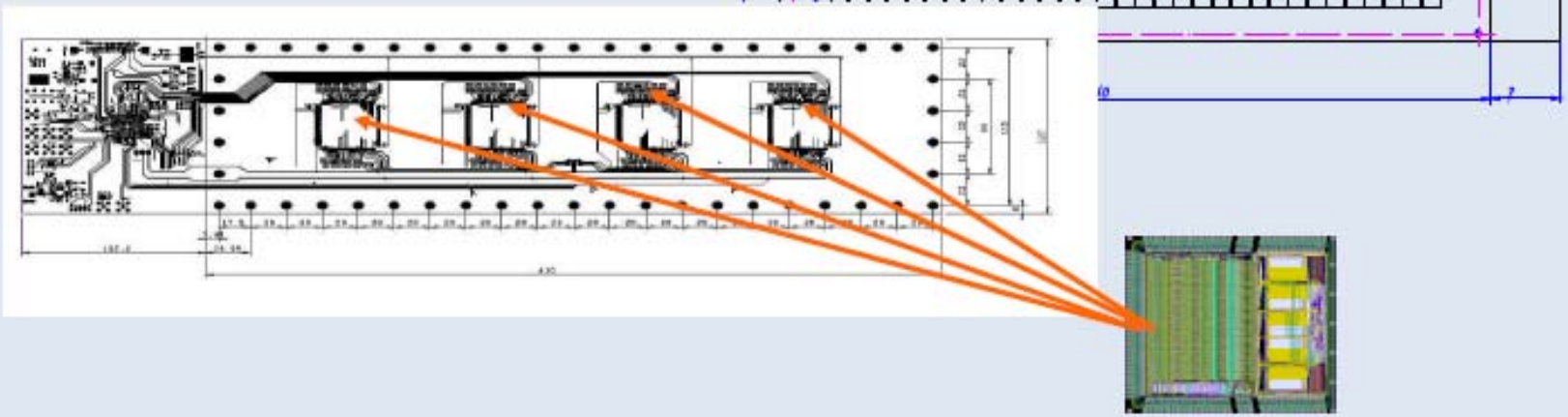
Outline

- Test Beam Experiment:
  - Electronics
  - Raw data & Plan for data format transition
- Simulation:
  - ILD SHcal04 with Mokka
  - Plan for Digitization process
- Analysis: PandoraPFA (see Imad's talk)

DHCAL1 board

- 8×32 pads detector (GRPC and µMEGAS)
  - 8-layer PCB
  - 4 HARDROC's (64 ch each)
- integrated DIF
  - Code being re-used for the DHCAL DIF's
- USB connector
  - libDHCAL developed
    → C driver, LabView interface



Upgrade : long slabs

DIF

Slab 1

Slab 2

PCBs conected with 0 ohms resistors

Information stored in raw data

Raw Train:

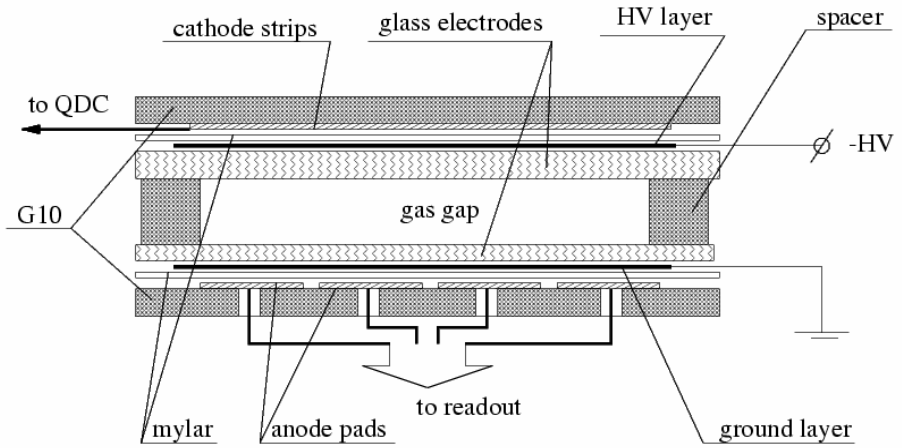
[[header] incl: train number
Trailer data DIF (data
Checking counters/CRC)
time difference between external
Trigger and RPC hit
 [DIF
  [ASIC
   [frames: ASIC ID,
BC ID + 64 * 2bits_thr]
   : x n_frames (<128)
   [frame]
  ]
  : × n_ASIC (<256)
  [ASIC]
 ]
 : × n_DIF (limit ?)
]

DHCAL Event:

[Header:
 - Event index in train
 - in beam/out of beam (~ noise)
 - Complete/Incomplete (All ASIC ready of not)
 - mean TimeStamp
]
[List of Hits: All hits with the same TimeStamp
 - TimeStamp wrt Spill_start or MeanTimeSTamp
 - Threshold (Energy in ECAL & AHCAL)
 - IJK
 - XYZ
 - Time_to_previous_Hit_in_same_cell
]

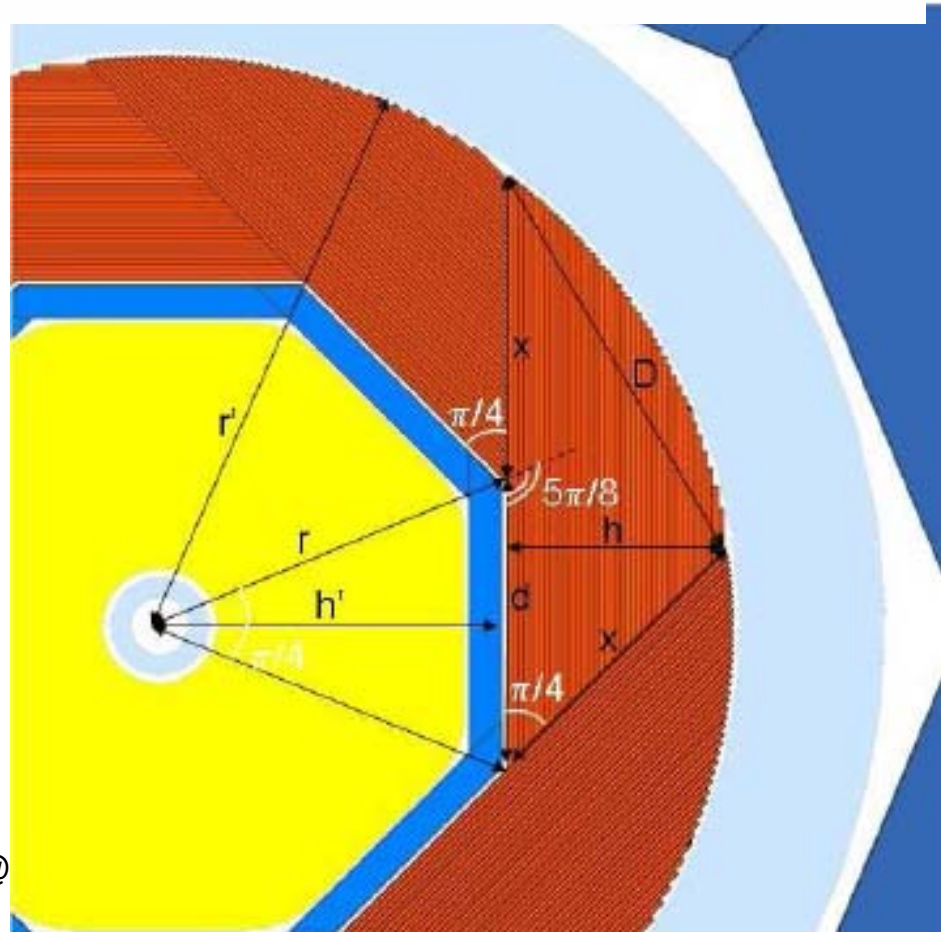
Plan: rewrite the information into the form similar to Calorimeter Hit

DHCAL Geometry



- Barrel region: 8 staves, 5 modules, 48 layers. 1920 DIFs
- Ring: 2×4 staves, 6 layers
- Endcap: 2×4 staves, 48 layers
- 1cm×1cm cell. Each asic is response for 8×8=64 cells.

➔ Studies on DHCAL Occupancy & Leakage have been done



SimCalorimeterHit & CalorimeterHit

---------- print out of SimCalorimeterHit collection ----------

…

[id] | cellId0 | cellId1 | energy | position (x,y,z) | nMCParticles

-> MC contribution: prim. PDG | energy | time | sec. PDG

---------- print out of CalorimeterHit collection ----------

…

[id] | cellId0 | cellId1 | energy | position (x,y,z) |

- SimCalorimeterHit → Digitization Process → CalorimeterHit → Analysis Module (PandoraPFA)
- Current Digitization Process: True energy deposition in RPC Gas layer × Sampling factor ➔ without considering the avalanche effect
- From the Test Beam: efficiency & energy deposition in the Gas by a mip is known ➔ New Digitization Process

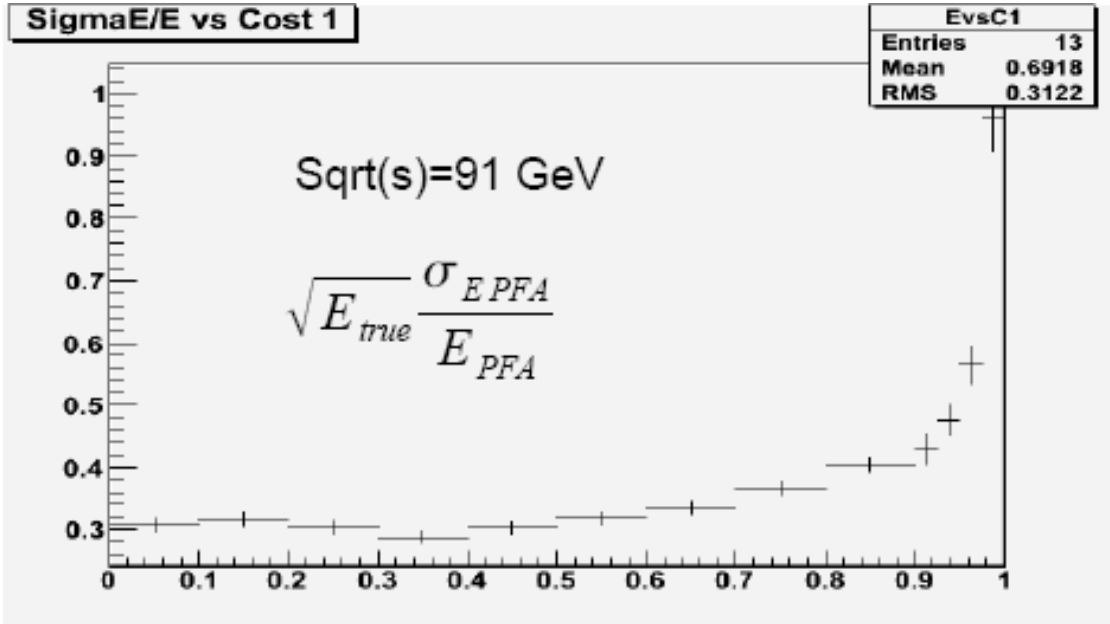
Back Up Slides

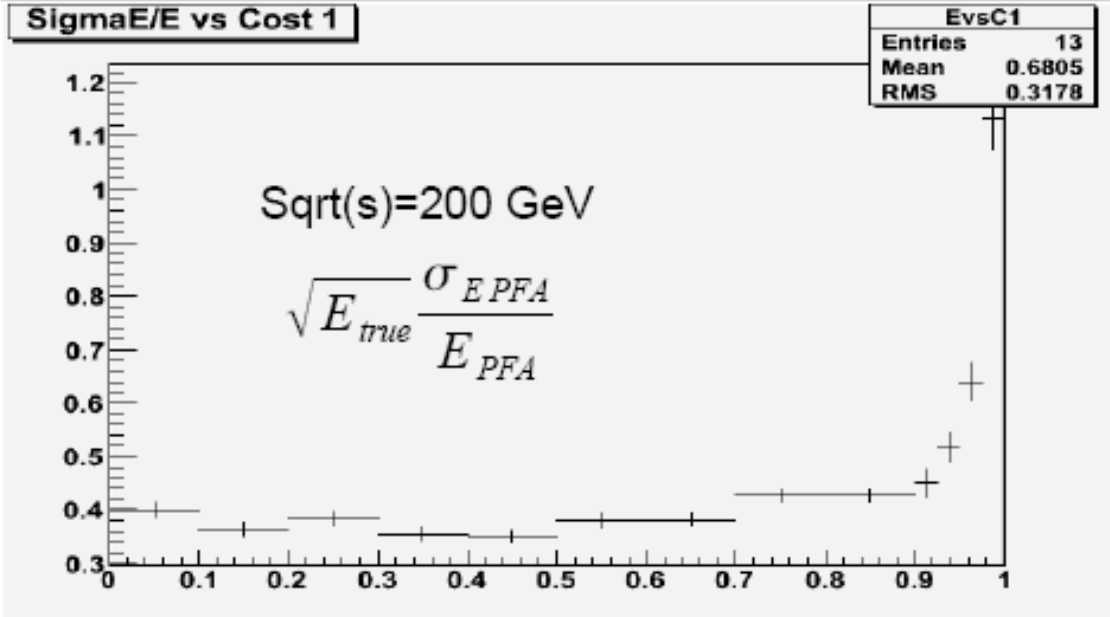
Pandora Analysis with SHcal04 Simulation

In barrel :
30.8 % ± 0.4 % at 91 GeV
Jet resolution = 4.6 %

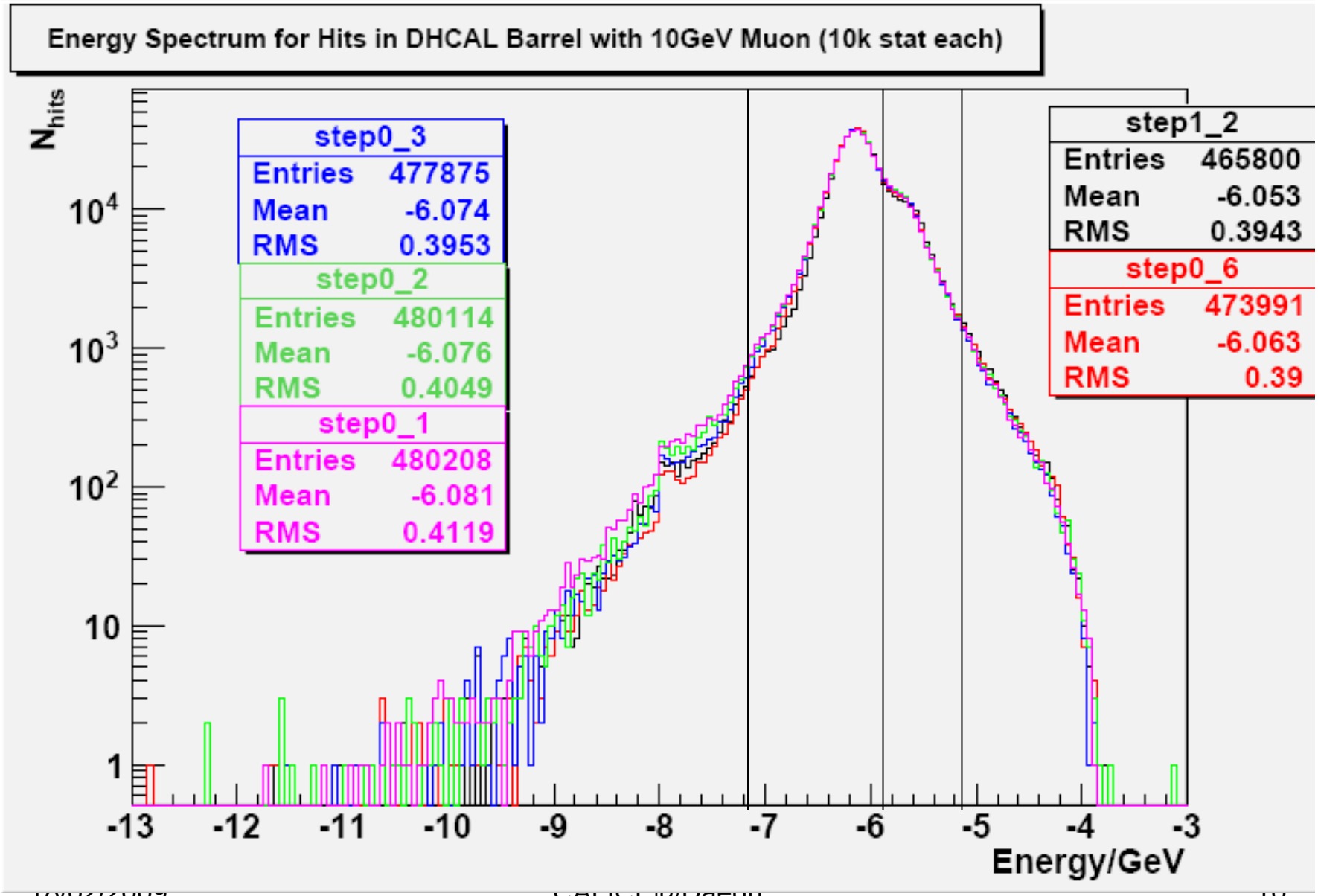
Using tools provided by
Mark Thomson

In barrel :
37.0 % ± 0.4 % at 200 GeV
Jet resolution = 3.7 %





Semi DHCAL: 3 Threshold at 0.1mip, 2mip & 10mip



Raw Event Data format