Summary of the 2011 SDHCAL TB data analysis

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Outline

- **Introduction :**
  - TB @ CERN

- **Aquisition & Data format**

- **Reconstruction**
  - **Event builder**
  - **Reconstruction**

- **Ongoing Analysis**
  - **Efficiency & multiplicity**
  - **Energy recontruction**

- **Summary**

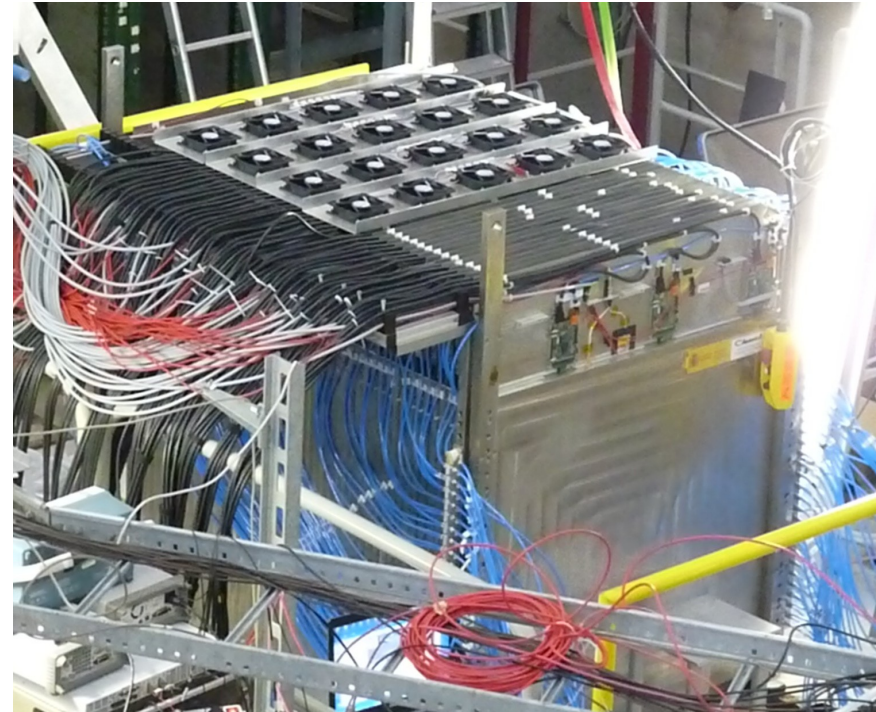# SDHCAL m3 Prototype setup

RPC Gasous detector
- GRPC
  - Simple robust rate ≤ 100 Hz/cm2
  - 1.2 mm gaz gap
  - 400 μm glass plate
 - Graphit/Licorn/Statguard resistive cover
  - Hv ~ 7.4 kV

One characteristic of SDHCAl is using the pad with 3 thresholds coded in 2 bits.

- The Value of thresolds :
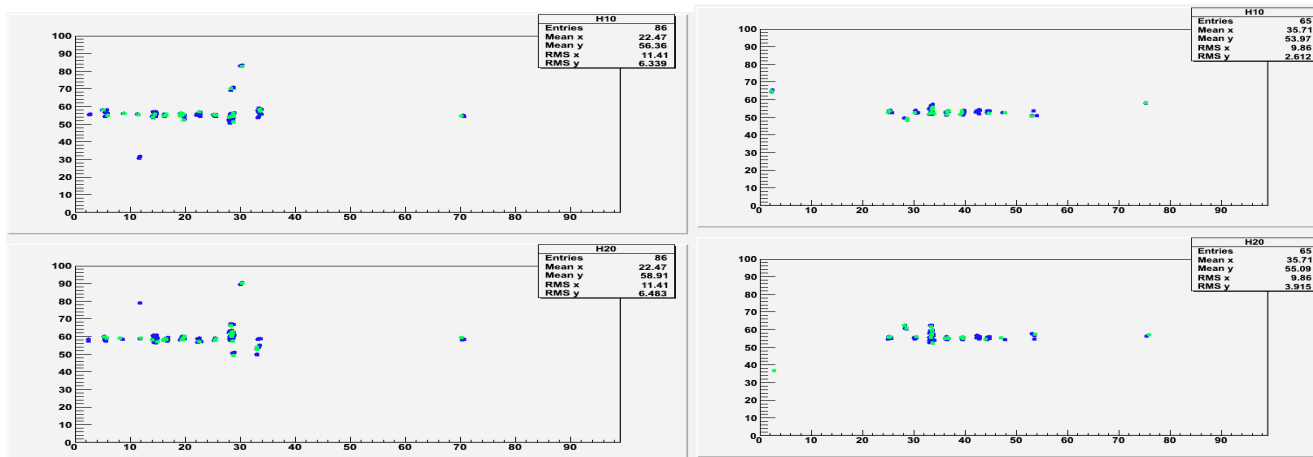 - Thr0 = 186   fC
  - Thr1 = 1585   fC
  - Thr2 = 7.5   pC

Aquisition system

- **2 readout system have been used,**
  - **DAQv2 readout**
  - **USB readout**

- **During the TB@SPS test, we find some problem with DAQ system ; Event information could be lost during the acquisition.**
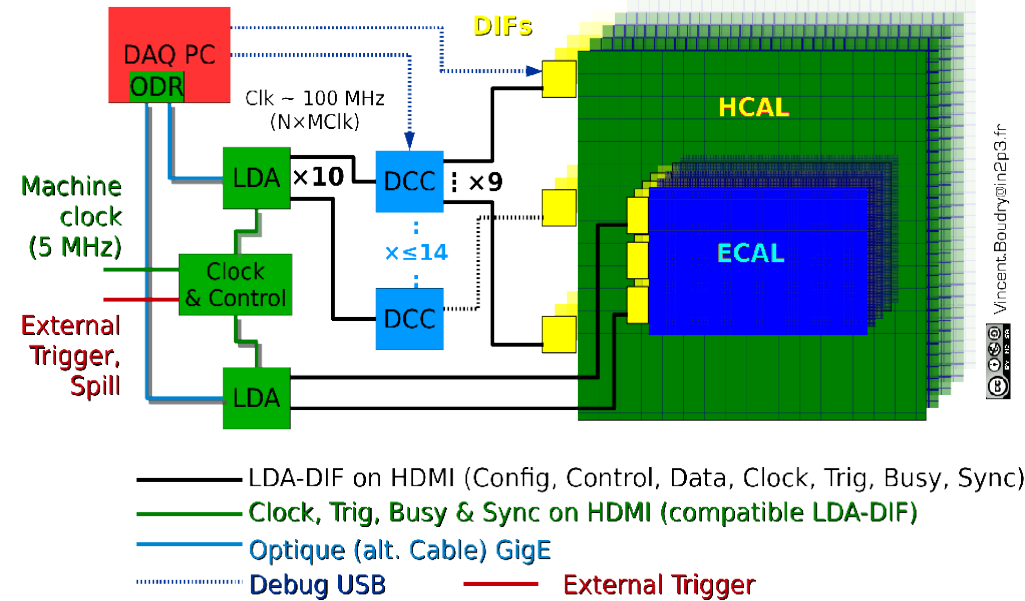
 **--> selection of events or work opn sub-event sample**

- **The hybrid solution between USB a DAQ are in study to solve this problem.**
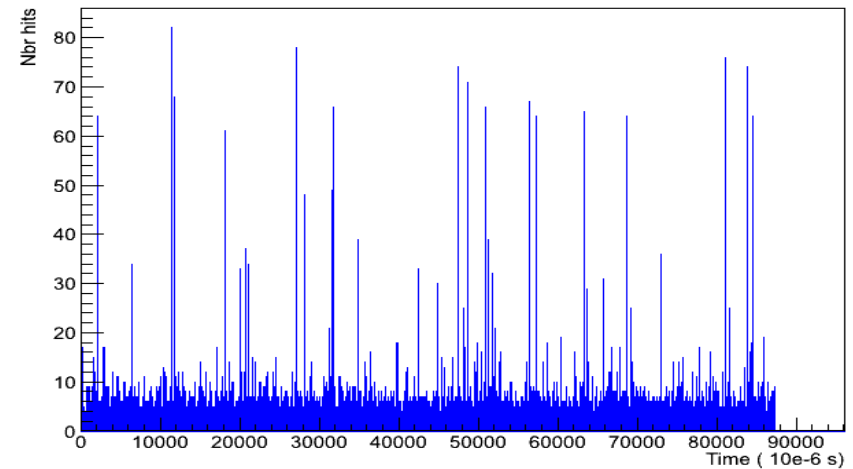
Lose data corresponding to 1 LDA

Data format

- When the acquisition is start, all collected information are saved during **one trigger (~10 ms). Two**
- The physical event are merged in this time window. The acquisition are stopped when the memory of one ASIC is full.
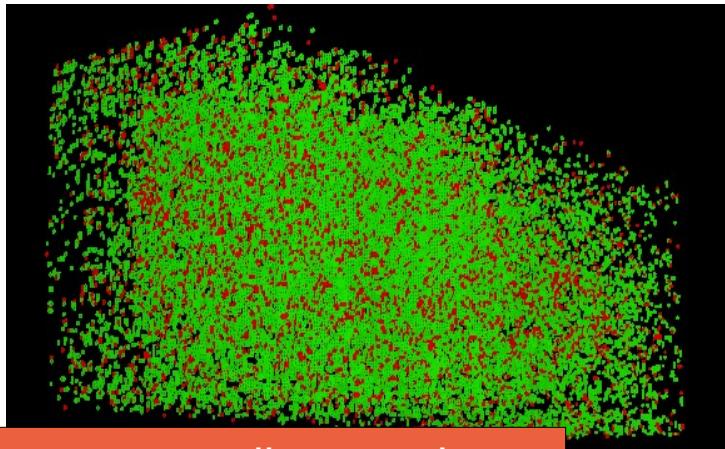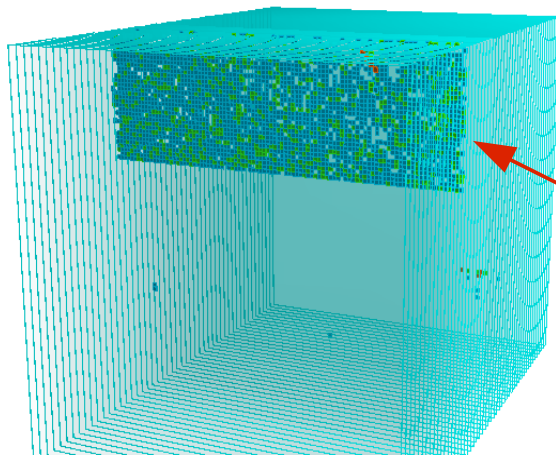

Hits correpondig to 1 trigger

DRUID, RunNum = 21509, EventNum = 5

Time spectrum of one trigger

Bad event -> Noisy DIF

To select the real event ;

- **Use time spectrum of one trigger to find the candidates events.**
- **Remove the events corresponding to noisy ASIC and DIF**

Event Builder « Trivent »

Trivent is a Marlin processor used to build and select the physical events in triggers. This tool is available @ **lyosvn.in2p3.fr/repository/ilc/Analyse/Trivent/**

- In fisrt step (Event builder): Trivent build the events by slecting the peaks in time spectrum of triggers (with Nhit > Noise_cut) with time window oppening -> save the correspondinghits (and other information) as condidate event.
- Second step : Select the condidate avec with good proprities (remove the noisy event ...) and save the correspondig anofmation in new LCIO file.

Time spectrum of one trigger
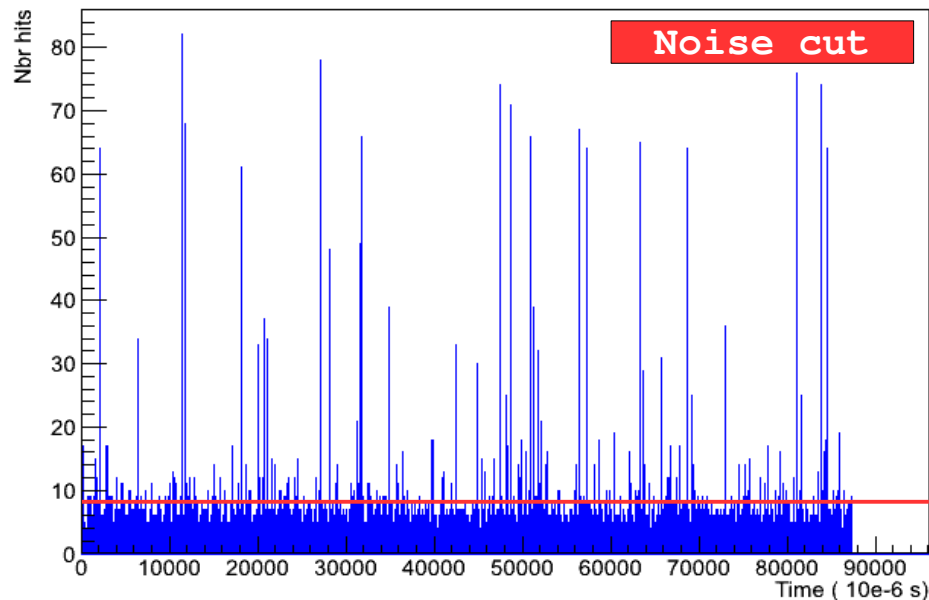
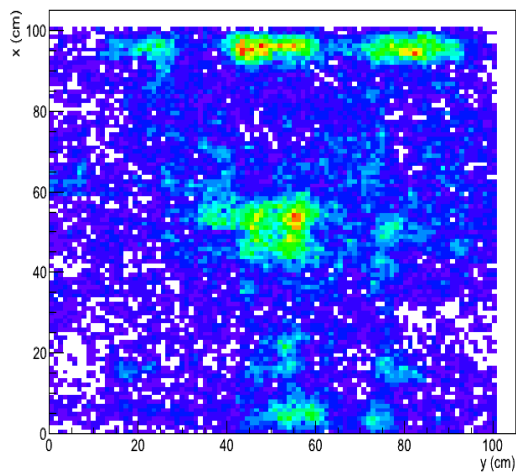**Find a peak with Nhit > Nhit_cut.**

fTime {fTime<100000}
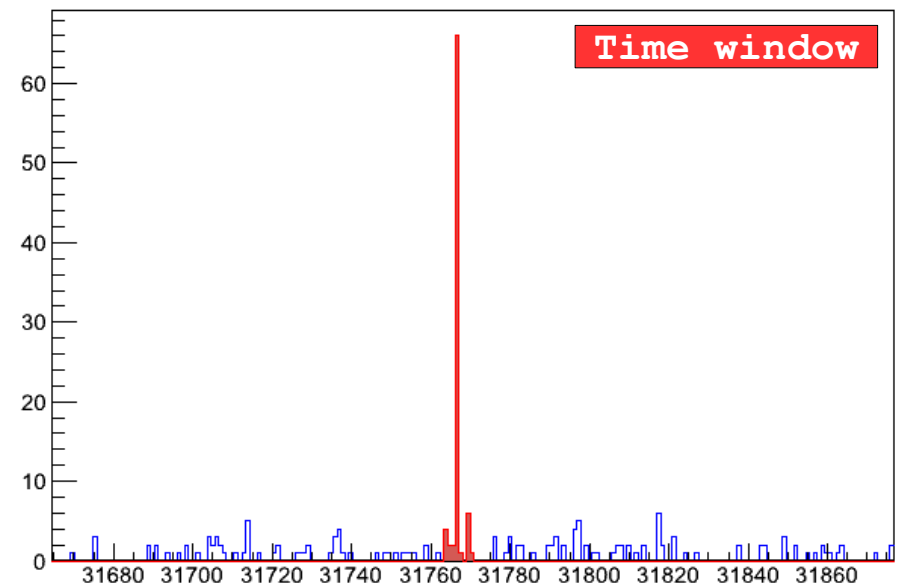
Get information of correspondig time peaks with an oppening window, and save it.
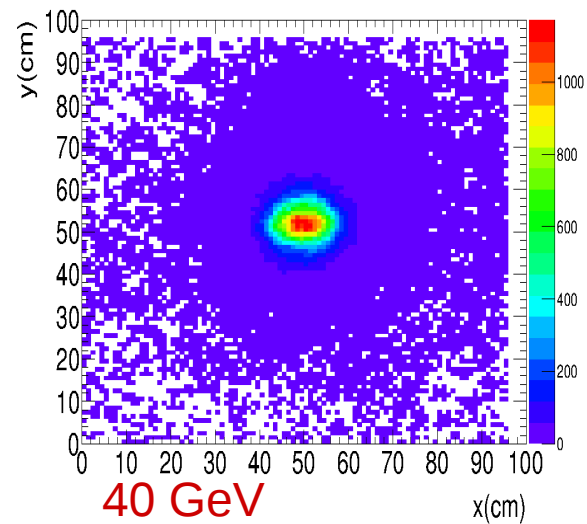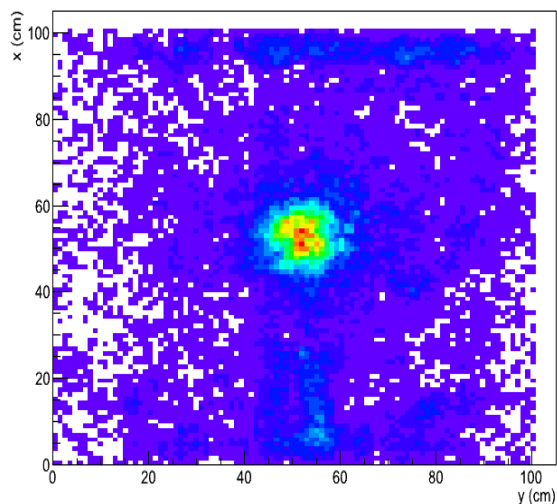
Event selection.

XY Map (40 GeV)

40 GeV

XY Beam profile

40 GeV
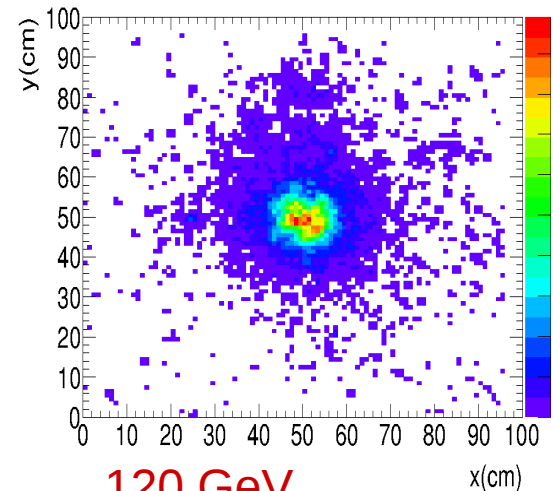
More than 10 layers must be hited

XY Map 120 GeV

120 GeV

- **This cut reduce significantly the noise due to the DIF.**
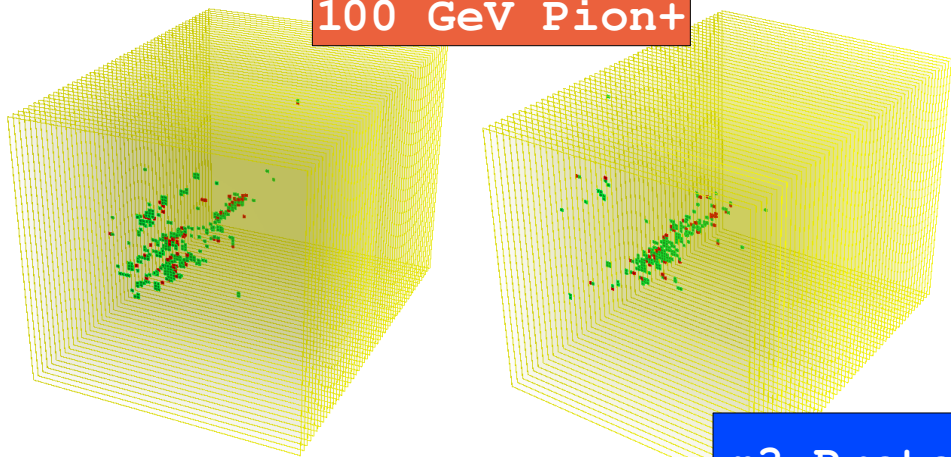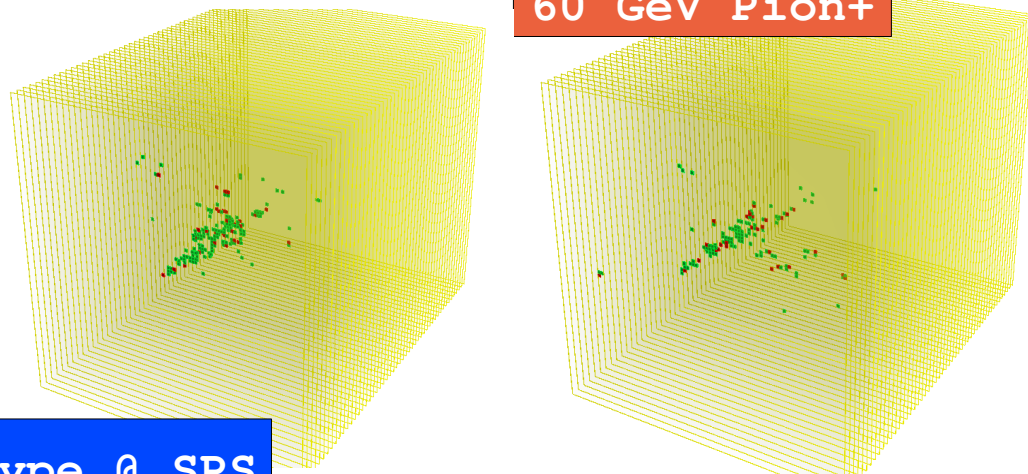

XY Beam profile

120 GeV

SDHCAL Event display

Druid is the soft used to display the event here. This tool is included in ILCSoft (For more information contact Manqi Ruan).
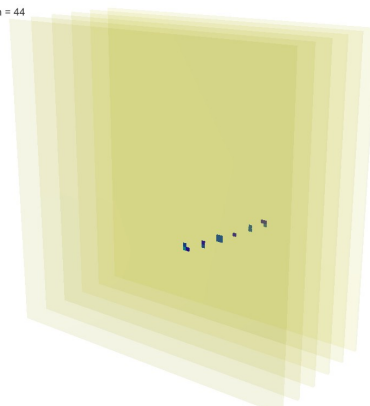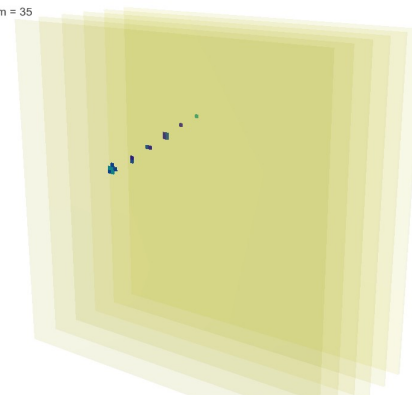

100 GeV Pion+

60 GeV Pion+

m3 Prototype @ SPS

- The color is correspondig to the different thresolds.

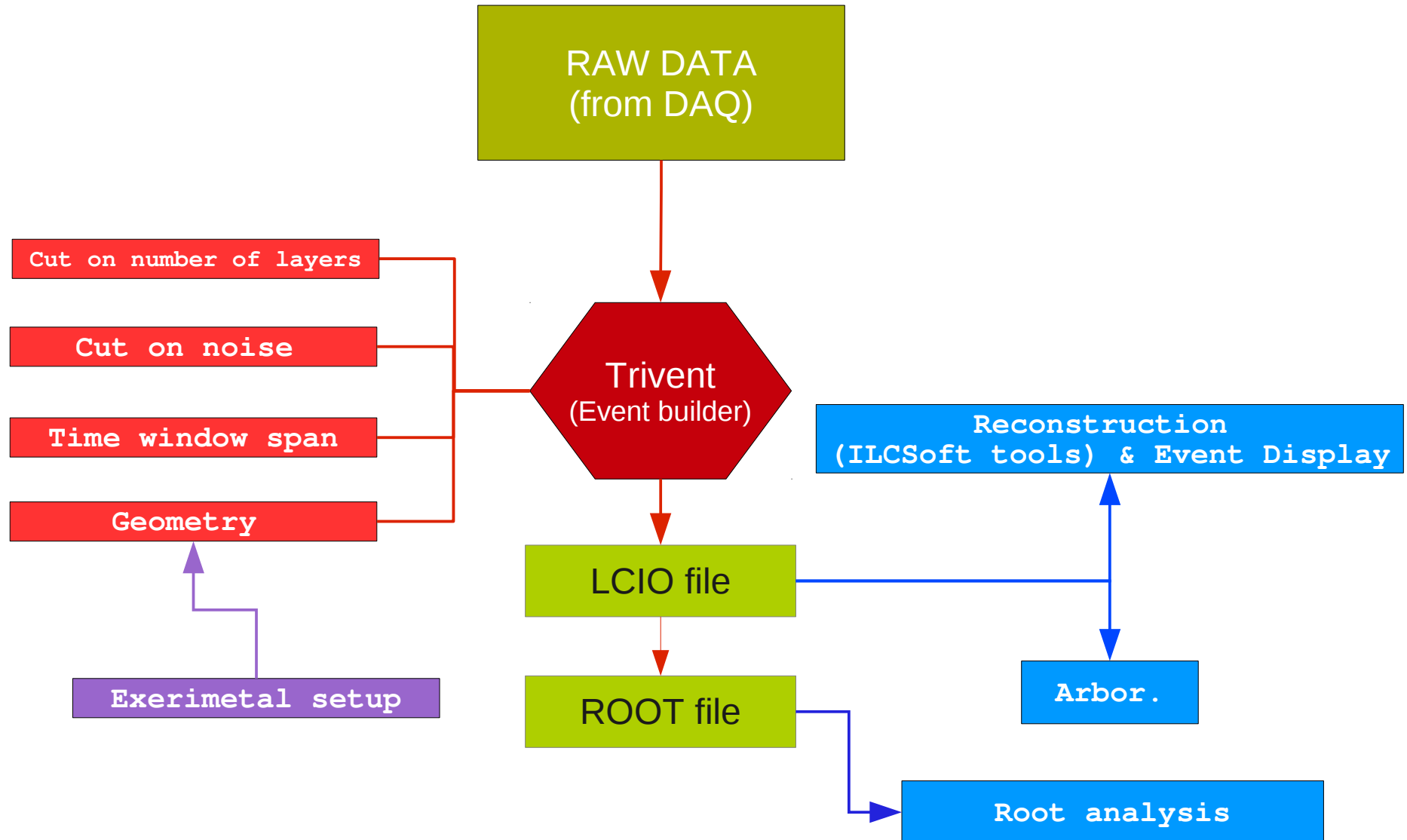- The colors is correspondig to the different thresolds.

EventNum = 44

EventNum = 35

8 GeV Pion+ @ PS
(Only the GRPC 6 chambers without absorber)

Diagram of event finder

Track reconstruction

- **The efficiency is the probability to one track hit in minimum one pad in one layer around 5cm.**

$$\varepsilon_{layer} = \frac{\sum\limits_{track} 1_{Nhit>0|layer}}{Nbr\ Tracks}$$

- **Multiplicity = number of fired cell in each layer.**
- **The tracks are reconstructed using linear fit.**

DRUID, RunNum = 22078, EventNum = 12

, RunNum = 22078, EventNum = 7

Fited track using TMinuit

PRELIMINARY

PRELIMINARY

Threshold scan

Energy resolution

Resolution

- χ² / ndf   0.3453 / 1
- p0   7490 ± 1.414
- p1   1046 ± 1.414
- p2   249.9 ± 1.414

- χ² / ndf   0.5822 / 1
- p0   7908 ± 1435
- p1   1248 ± 197.5
- p2   0.2173 ± 3.789e+004

- χ² / ndf   0.6412 / 1
- p0   7533 ± 2684
- p1   1469 ± 262.3
- p2   0.05263 ± 4.006e+004

Fit: $\frac{a\%}{E^{1/2}} \oplus b\% \oplus \frac{c\%}{E}$
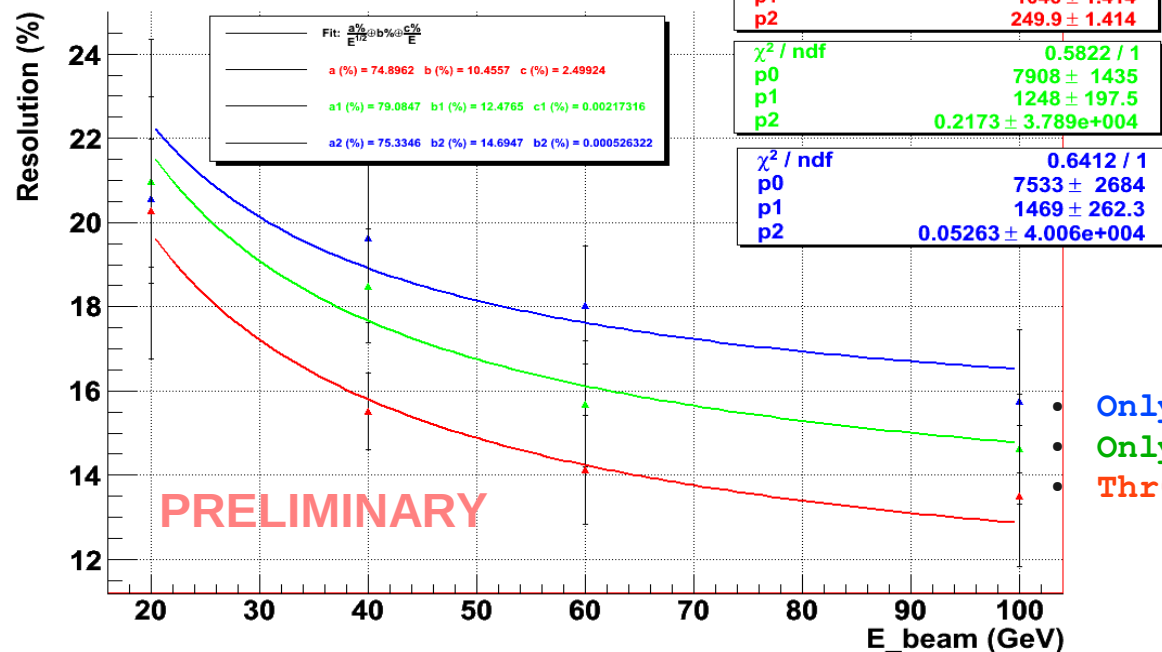
a (%) = 74.8962   b (%) = 10.4557   c (%) = 2.49924

a1 (%) = 79.0847   b1 (%) = 12.4765   c1 (%) = 0.00217316

a2 (%) = 75.3346   b2 (%) = 14.6947   b2 (%) = 0.000526322

PRELIMINARY

- Only Thr0
- Only Thr1
- Thr0 and Thr1

Source : Sameh Mennai

- Reconstructed energy is defined by,

$$E_{reco} = A\ N_{th1} + B\ N_{th2}$$

- The energy Resolution ;

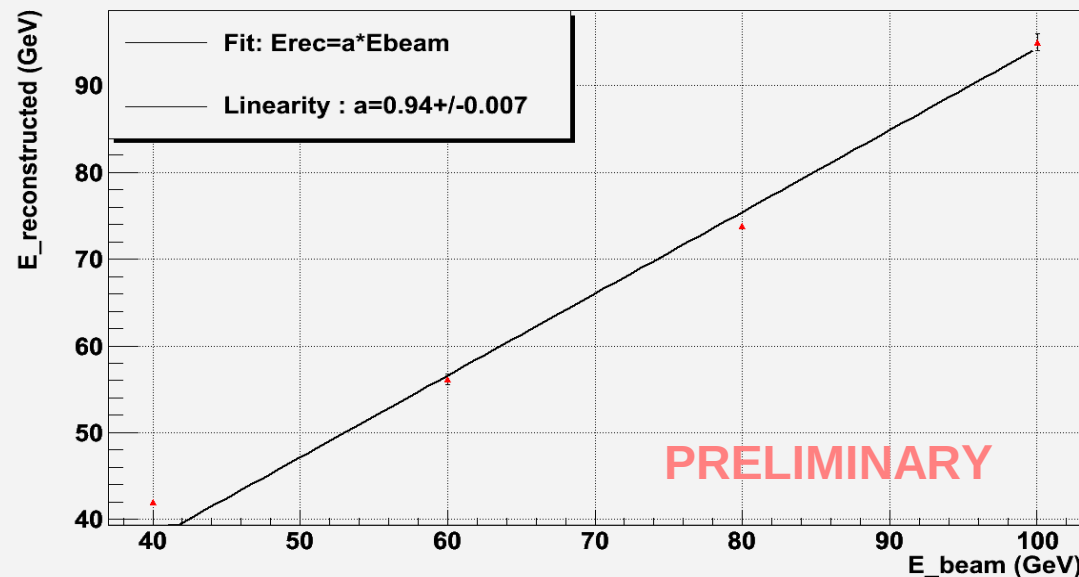$$R = \frac{\sigma(E)}{E} = \frac{a}{\sqrt{E}} \oplus \frac{b}{E} \oplus c$$

- The Value of thresolds :
  - Thr0 = 186   fC
  - Thr1 = 1585   fC
  - Thr2 = 7.5   pC

Linearity

Fit: Erec=a*Ebeam

Linearity : a=0.94+/-0.007

PRELIMINARY

Summary

- **Analysis of TB Data has begun.**
- **Preliminary results have been presented :**
    - Event selection & reconstruction
    - Efficiency and Multiplicity
    - Scan on threshold
    - Energy reconstruction & Energy resolution
- **The develloped are based in ILCsoft (LCIO, Marlin..)**

    -> can be adapted and tuned for other groups
- **The SDHCAL group are in tools develepement phase**

    -> Other studies coming soon.