TOF CALIBRATION DATABASE

OUTLINE

- Main Effects to Be Corrected for
- Calibration Algorithm
- Calibration DB structure
- Calibration DB Access Frequency
- Relationships with External DBs
- Calibration Infrastructure
- Summary, Conclusions, Plans

TYPES OF CALIBRATION

1. TIME DELAYS:

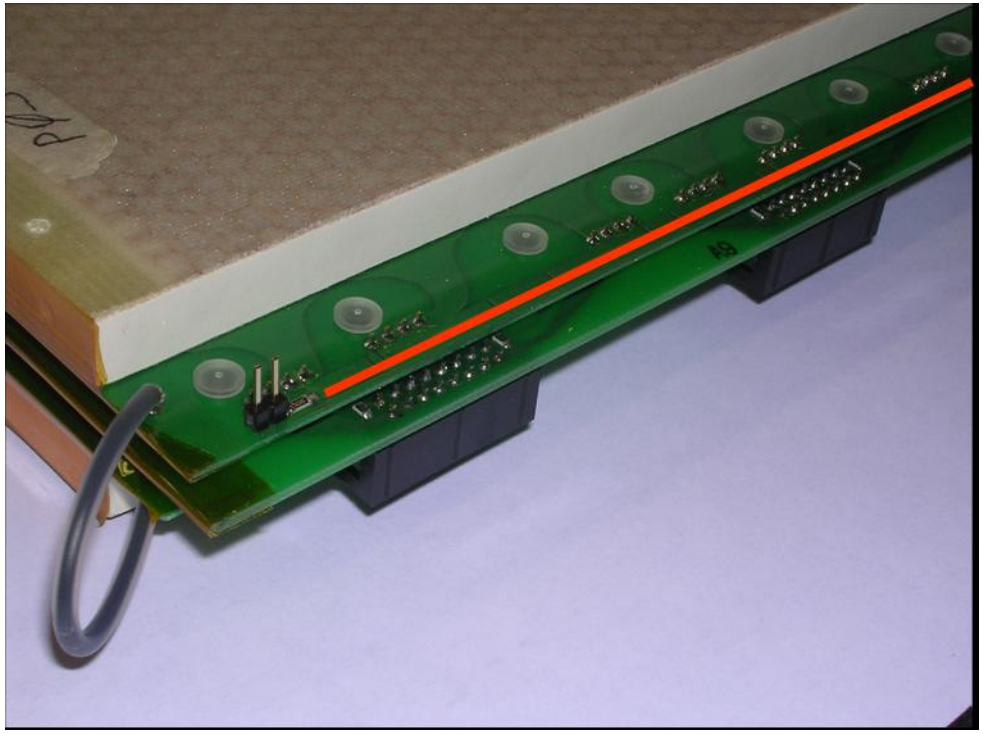
an equalization of the channels of the TDCs is necessary because of the delays introduced by the electronics (mainly cable lengths and pulse line lengths).

2. TIME SLEWING:

time slewing is caused by the finite amount of charge necessary to trigger the discriminator → charge fluctuations generate a time walk.

TIME DELAY - ROUGH CALIBRATION

A first rough calibration to equalize the channels will be done using the Pulser Line placed on the MRPC lower cathode PCBs, on the face opposite to the pads.



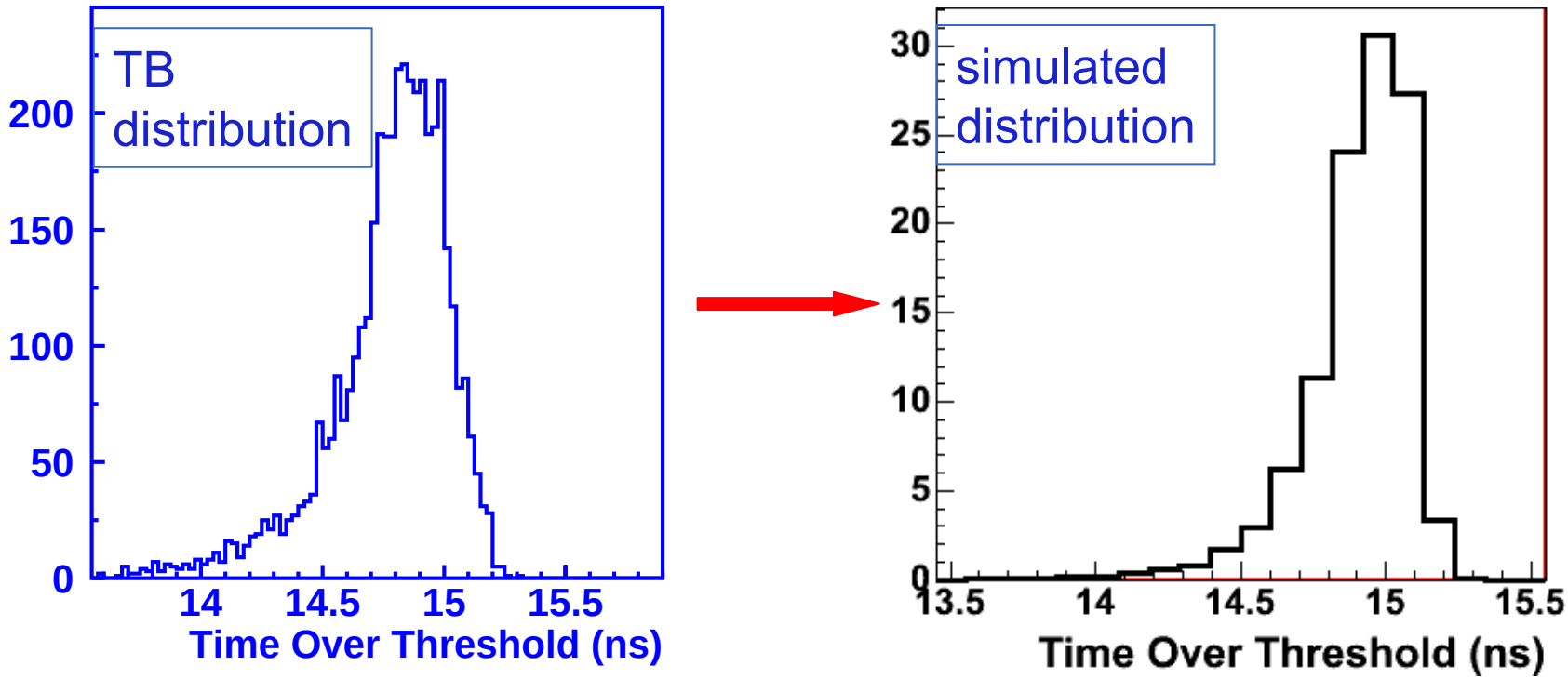
- Determine whether the pads work or not
  - ~ 160000 boolean consts
- Roughly (~ few ns) determine the time delays between the channels
  - ~ 160000 floating consts

CALIBRATION ALGO PHILOSOPHY

- A combinatorial algorithm with the aim to calibrate the measured times taking into account at the same time the time slewing effect and the delays introduced by electronic (refined calibration) is under development.
- To unfold the time spread due to the momentum spectra, to the particle types, and to the different track length, calibration can exploit the reconstructed tracks.
- The algorithm will be based on the comparison between the times of the *reconstructed* tracks (from track length and momentum measurements) and the *measured* times (t^{EXP}-t^{TOF}).

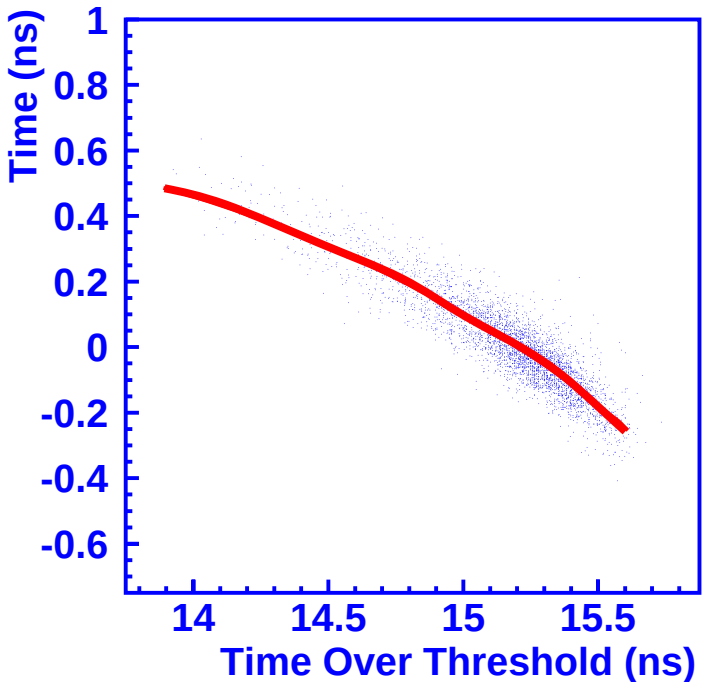
CALIBRATION ALGO - STATE of THE ART

- Since generated signals do not include either time slewing effects or time delays, these have to be appropriately simulated and added.
- Starting from a TOT spectrum obtained during Test Beam, a TOT distribution has been simulated.



CALIBRATION ALGO - state of the art cont'd

- To simulate the time slewing effect a Time vs TOT distribution from TB results has been used.



Just to start!

As a first approximation, a 1st order polynomial fit has been used:

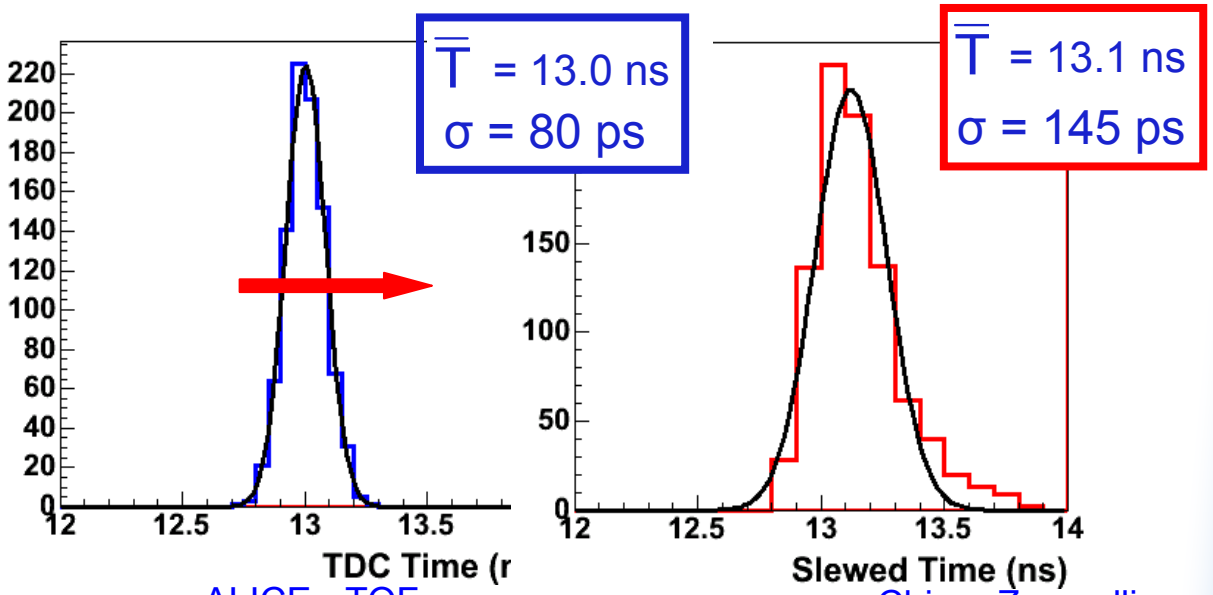
$$\begin{cases} \text{Time} = \text{par}[0] + \text{par}[1]\ \text{TOT}, \\ \text{par}[0] = 6.6,\ \text{par}[1] = -0.44 \end{cases}$$

Fits of higher order have now to be used to reproduce real data!

CALIBRATION ALGO - state of the art cont'd

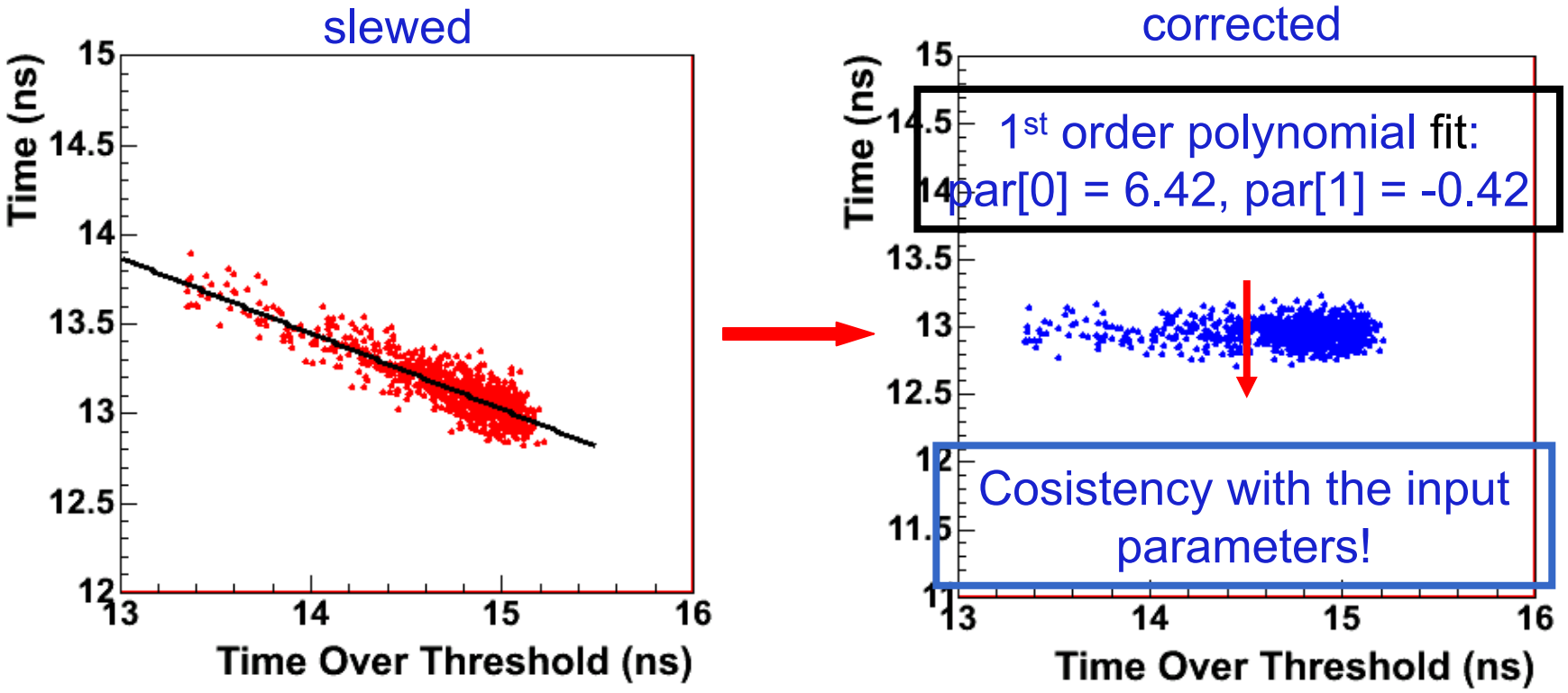
Just to start!

- A sample of 1000 tracks with a simulated time of 13 ns, smeared with a gaus distr. of σ = 80 ps (TOF resolution), has been generated, as if from the same particles (same type, same p, same L).
- For each track, a TOT value has been extracted form the simulated TOT distribution (hit or miss method) and the correspondent time slewing effect as calculated from the TB fit has then be added.



CALIBRATION ALGO - state of the art cont'd

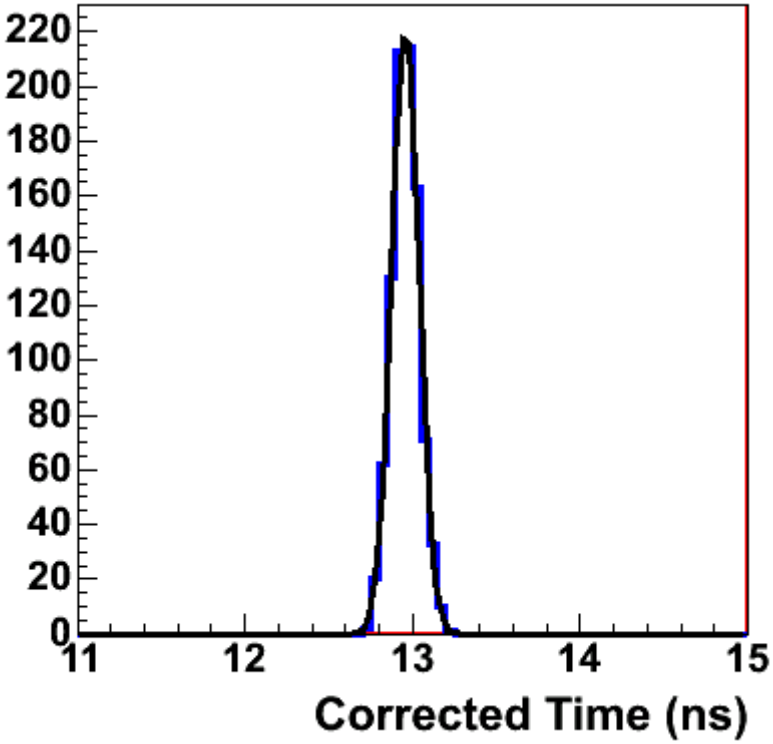
- The simulated time vs TOT distribution is then fitted in order to obtain correction for time slewing effect to be applied to the data.



To be noted that time delays would just shift the distributions upper or lower in the Time (y) direction

CALIBRATION ALGO - state of the art cont'd

➢The corrected time are then associated to the channels.

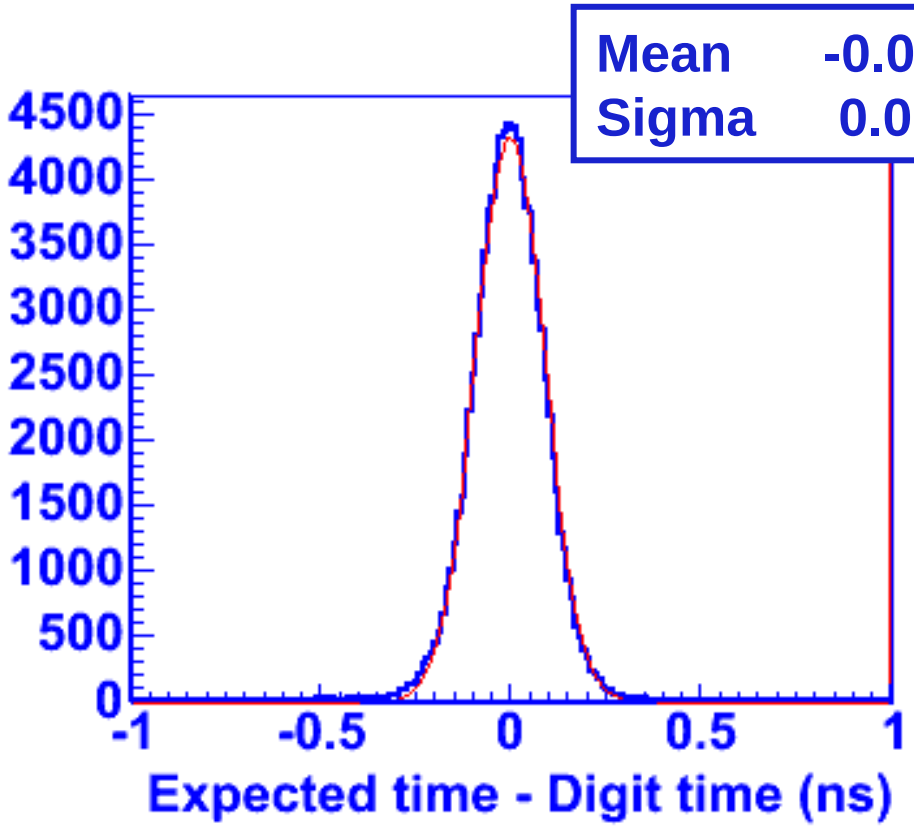


$\overline{T}$ = 13.0 ns
σ = 82 ps

What remains is just the simulated resolution!

CALIBRATION WITH $t^{EXP} - t^{TOF}$

- In a further step, time slewing effects will be corrected as described before, but using t^{EXP}-t^{TOF}, instead of just t^{TOF}.



- Moreover, in this way for each channel, the shift from the 0 value (corresponding to the case where no delays occur) will be the time delay due to the electronics.

Time slewing and time delay effects will be corrected at the same time!

CALIB ALGO – HOW MANY CONSTANTS?

- Time slewing:
  - As stated in February, the number of costants estimated for calibration for time slewing effects depends on the detailed shape of the signal in the HPTDC.
  - A reasonable number of parameters to be determined for each channel is 10.

O(10) per TDC channel → **O(10^6) floating consts**

- Time delays:

~160000 floating consts

CALIBRATION DB STRUCTURE

Reminder: in the TOF there are 18 sectors, 5 modules per sector, 19 strips (max) per module, 2 pad rows per strip, 48 pads per row

- So far, 4 calibration parameters types:
  - Operating status
  - Rough Channel Equalization
  - Time Slewing corretion
  - Refined Channel Equalization

- Possible types of calibration data storage (ROOT files):
  - Arrays of data (18 × 5 × 19 × 2 × 48)
  - ROOT Trees (sector, module, strip, pad branches)
    → more practicle and easier to deal with, but still to be implemented (some technical problems remain…  → any help will be very welcome!)

CALIBRATION DB UPDATE FREQUENCY

TYPE of CONSTANTS	NUMBER of CONSTANTS	UPDATE FREQUENCY
TDCs' channels operating status	~ 160000	once per month(✦)
rough TDCs' channels equalization	~ 160000	once per month(✦)
time slewing correction	O(10^6)	once per month(✦)
TDCs' channels equalization	~ 160000	once per month(✦)

(✦) at the start-up, the calibration updates will be likely to be more frequent, because of adjustment of parameters such as thresholds, operating voltages...

EXTERNAL DBs – PRELIMINARY IDEAS

- Detector Construction DataBase (DCDB):

  useful, for example, to know the lengths of the cables (which are responsible for time delays), to check the positions of the modules…

- Experiment Control System (ECS):

  useful especially during reconstruction

- Data Acquisition (DAQ):

  never accessed

- Trigger:

  ???

- Detector Control System (DCS):

  useful to know the status of the read-out electronics, and in particular to know if a re-calibration is necessary

- High Level Trigger (HLT):

  since calibration algos are based on reco tracks, it will be accessed to know the type of event recorded (central? peripheral?), if it has valid TPC data…

CALIBRATION INFRASTRUCTURE

- For the time being, I have not tested the calibration infrastructure, even if I have read the documents with lot of attention (sorry for the lack of feedback so far! ).
- Reading the docs, a bit of confusion remains for what concerns the GRID environment.
- It is not still very clear to me what the Default storage and the Drain storage are...

I'll try to use this ALICE Offline Week to (dis)solve my doubts!

SUMMARY, CONCLUSION, PLANS

- After a rough calibration with the pulser line, a dedicated algorithm should be used to obtain refined results.
- I am developing and modifying the algo, in order to better reproduce real data.
- The algo will use the reconstructed tracks to go around the obstacle of non-monocromatic spectra of different particles with different L.
- The structure of the Calibration DB ROOT files is still under study.
- I need to define in a more precise and clear way my idea of the relashionships with the External DBs → interaction with the people from Ext DBs during this Offline Week will be very important.
- I will test the Calibration Framework ASAP, especially making use of all the information gathered during the Tutorial sessions of this Offline Week.