Calorimeter calibration procedure

Calorimeter data quality

- 3 main steps can issue quality status:

    – On line monitoring

    – E-flow calibration

    – Electron and photon caracteristic

- Final calibration

1. On line monitoring

- From calibration farm for ECAL/HCAL/PS/SPD

    - Detect dead & noisy channels
        - Non working detector part

    - Follow the gain variation with the LED system
        - Analyse the rate of variation
    - Eventually change the database
        - Criteria have to be defined

- In link with Calo piquet .

Olivier-Serguey

For ECAL

   From gain calculation cell intercalibrated at 10%

HCAL (3%) Cs source

PS 10% (MIP)

Smoothing E-Flow response method on each channel -> 4-5%
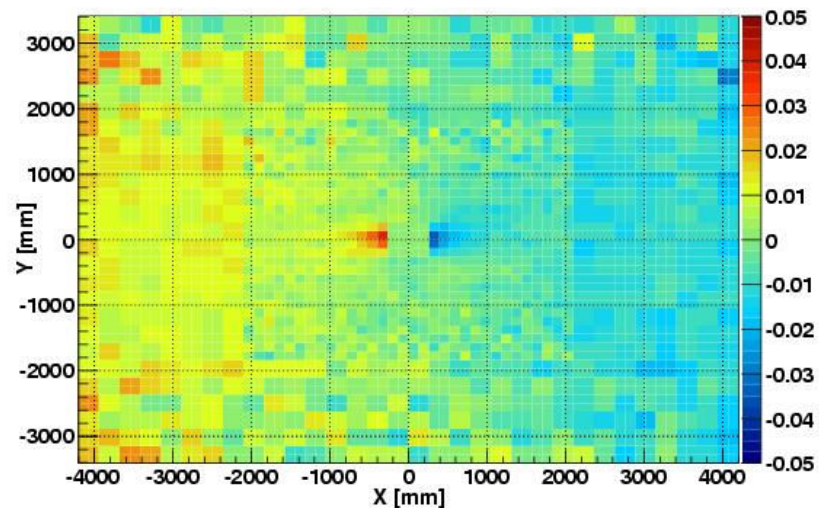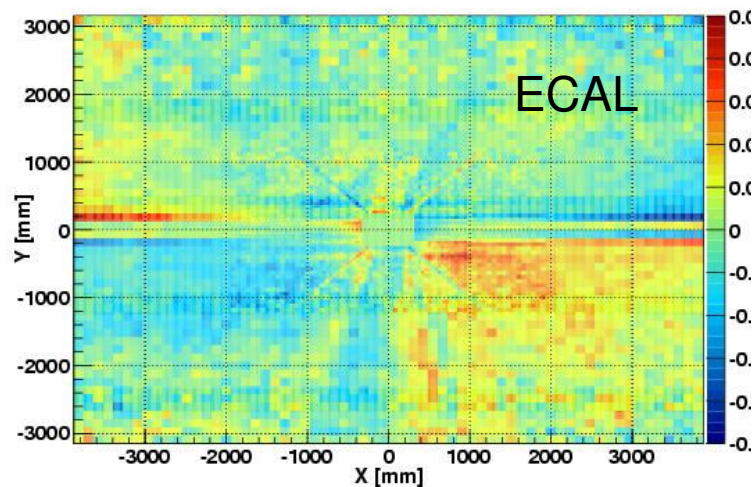
   Use neighboour average
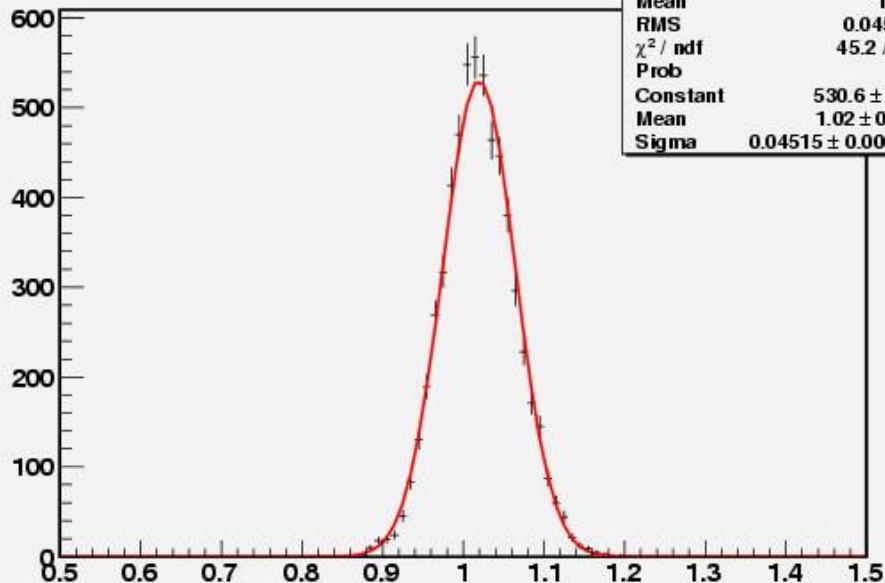
   Use detector symetries

   For ECAL/HCAL/PS

Aurélien -Frédéric

HCAL

ECAL

M.N Minard

Calorimeter Calibration scheme

LHCb
Calorimeters

LHCb

2. ECAL inter cell calibration to 5% (2)

EcalRatio	
Entries	6016
Mean	1.02
RMS	0.04502
χ^2 / ndf	45.2 / 97
Prob	1
Constant	530.6 ± 8.4
Mean	1.02 ± 0.00
Sigma	0.04515 ± 0.00041

Dead channels
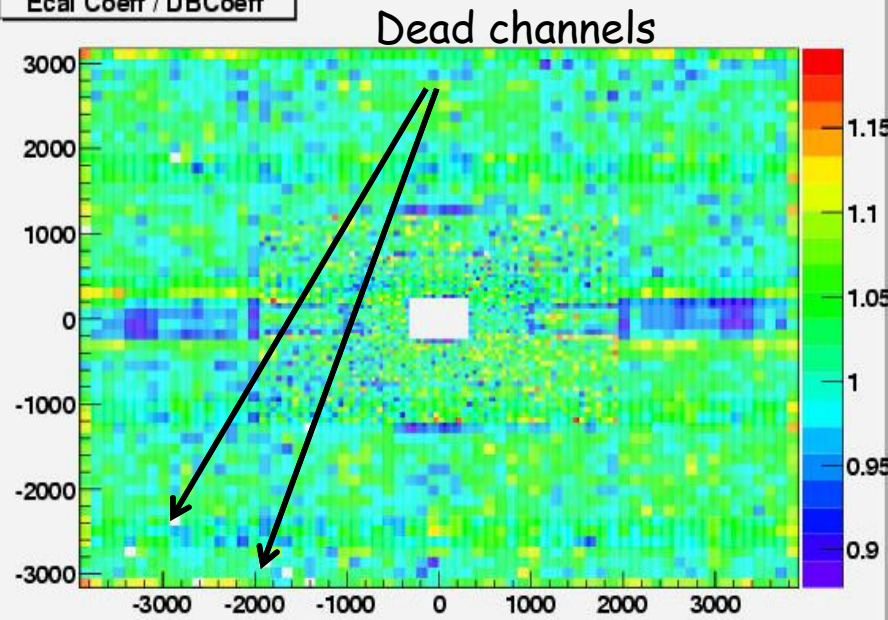
Region	Bias	Sigma	χ^2/Ndof
Inner	+2.2%	5.0%	28/97
Middle	+2.3%	4.8%	31/97
Outer	+1.7%	3.9%	49/97
All	+2.0%	4.5%	45/97

Calibration exercise 10M evts
10% Miscalibration cell to cell
Dead channels

Cell to cell calibration at 5% level

Calorimeter Calibration scheme

LHCb

2. ECAL inter cell calibration to 5%

- Statistics needed 10millions events

- For each cell ECAL/HCAL/PS
    - Calibration factor is issued

- Will take few day(s) when the required statistic is available

- Will need ressource for this step

2'. Calibration with $\pi 0$ mass

- When updated database , use reconstructed $\pi 0$ using the cell calibration (off-line)
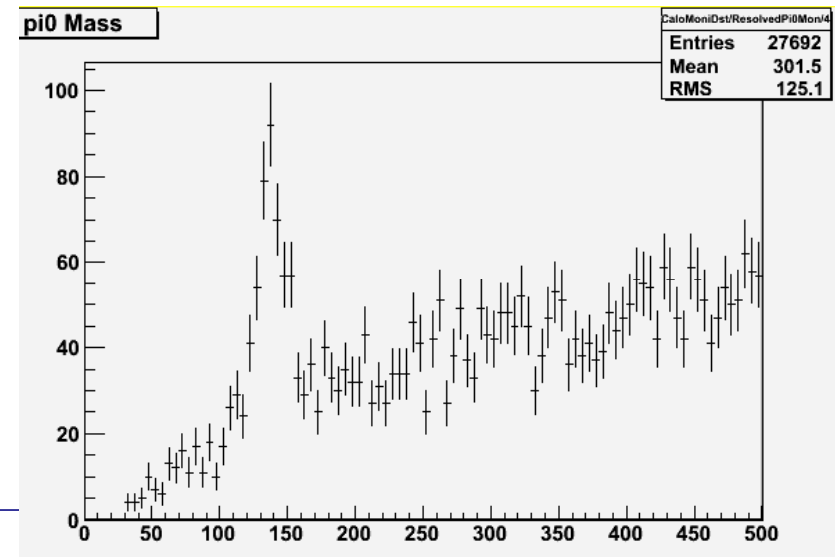
The $\pi 0$ mass peak will be fitted :

Ecal energy scale ~ 1-2%

Inter cell calibration ~ 5%

pi0 Mass

CaloMoniDst/ResolvedPi0Mon/4	
Entries	27692
Mean	301.5
RMS	125.1

Update of the database for
  - Cells coefficients
  - Calibration factor
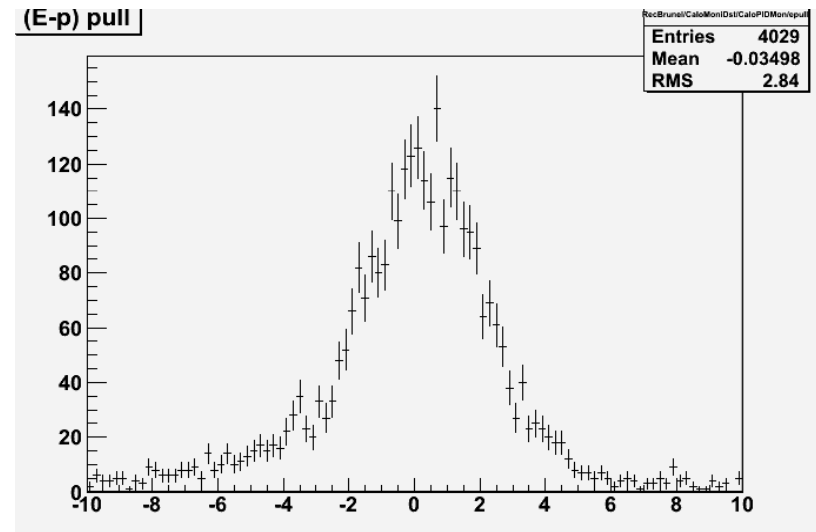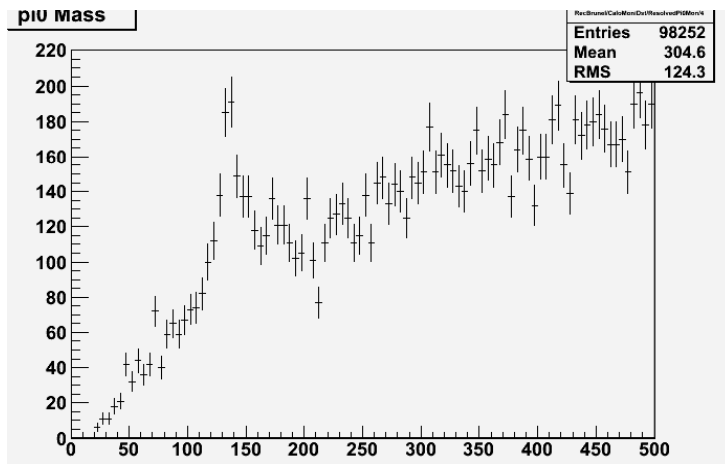HV settings can be changed instead of database update

Olivier

This is the precalibration phase – Data can be processed with this calibration

Build quality reference

- Most of the variable used in electron or photon identification can be accessed in fully reconstructed events

But also Et ditribution , multiplicity etc ..;
PID estimator

Olivier-Dmitri-Victor

Calibration to 1% for ECAL(1%)

- Methods developped for calibration using :

  □ $\pi 0$: Albert Puig - Vanya
  - 2 photons combination
  - Background
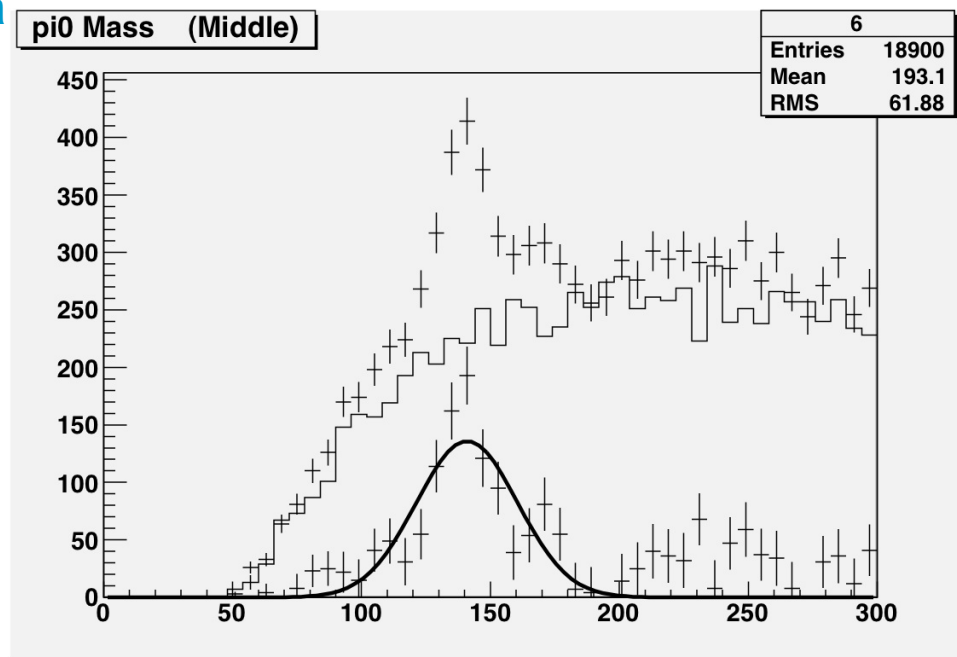   - From photon –x,-y
- 6000 cells
  - Iterative method
  - Fit method
  - 80 to 200 Millions
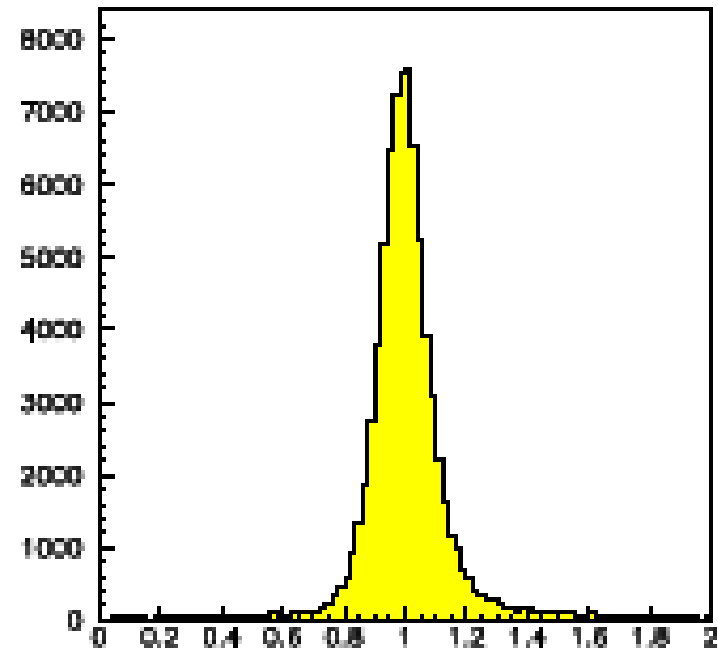- Methods experienced on Decaibrated data 200Mevts

Calibration ECAL to 1%

- With electrons :
  - Using RICH PID (Oleg)
  - Electron from conversion (S.T'J)
  - Electron from J/psi (Ricci)

Fits will statistics

30- 100 millions of events

$$\chi^2 = \sum_n \left[\left(\frac{\alpha \cdot E_{prs} + \sum_j k_j E_j^n}{p^n} - 1 \right)^2 \times \frac{1}{\sum_j k_j E_j^n} \right]$$

FemtoDST

- For calibration with $\pi 0$
  - Iterative procedure or fit on a very large number of event
- Calibrationwith ellectron
  - Fit with a very large number of events

- Vanya design a tool able to reduce data flow
  - for iterativee procedure
  - Kali-Calo
  - Running on DST

- Procedure will be redone regurlarly ..

Data Flow for `Kali-`π^0 (I)
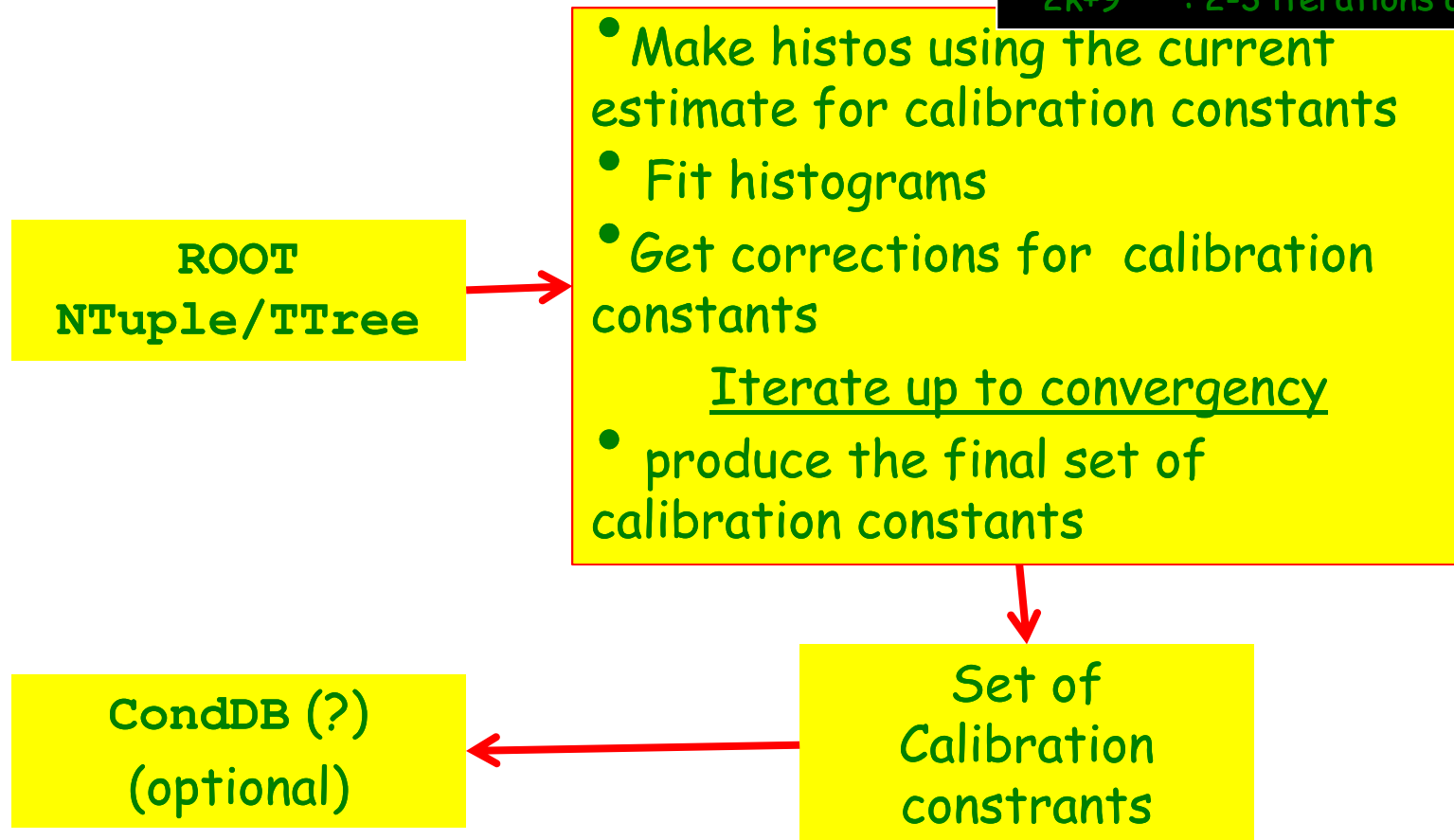
DST or DAQ

ROOT
NTuple/TTree

Kali-π^0 Job

fmDST

Vanya

LHCb
Calorimeters

Data Flow for `Kali-`π^0 (II)

- 2k+(4-5): 3-5 iterations are OK
- 2k+9   : 2-3 iterations are OK

ROOT NTuple/TTree

- Make histos using the current estimate for calibration constants
- Fit histograms
- Get corrections for calibration constants

  Iterate up to convergency

- produce the final set of calibration constants

Set of Calibration constrants

CondDB (?) (optional)

LHCb Calorimeters

Plans

- Produce selections tools for the different photon and electron approach

- Produced from 200Milions decalibrated ->femto DST

- Apply the calibration procedures ;

- Timescale 6 weeks;

- Given theprocedure to reach 1% :
  - When reached >100Millions events
  - Calibration will update the database ~few weeks after

To be discussed the procedure to produce the FemtoDST