Calibrations – Calorimeter and Drift Chamber

KLOE-2 Computing mini-Workshop
13-06-2015 LNF

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Overview

- Calorimeter calibration
  - MIP equalization
  - T0 global
  - Energy calibration
  - Time calibration
- Drift chamber
  - Calibration performance
  - Monitor histogram

Calorimeter calibration

Calorimeter calibration

$$E_i(MeV) = \frac{ADC_i - PED_i}{MIP_i} * Mip2MeV * K_{Ei}$$

$$t(ns) = \frac{t_A + t_B}{2} - \frac{t_{A0} + t_{B0}}{2} - L/2v - T0_{global}$$

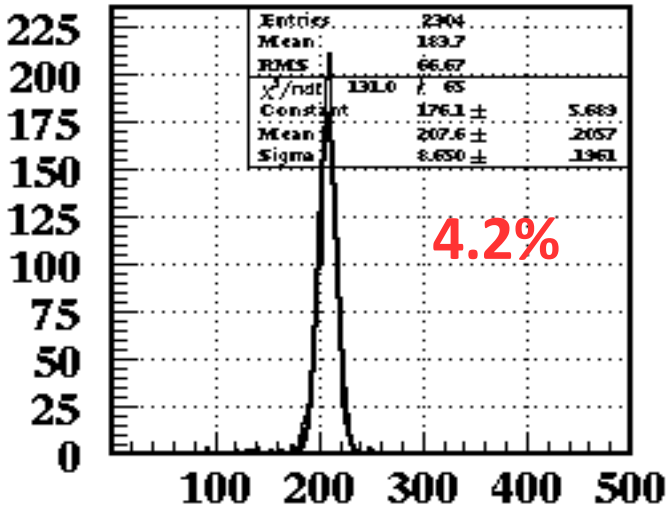
$$z(cm) = \frac{v}{2}(t_A - t_B - t_{A0} + t_{B0})$$

$$t_{A,B} = C_{A,B} * (TDC_{A,B} - Toffset_{A,B})$$

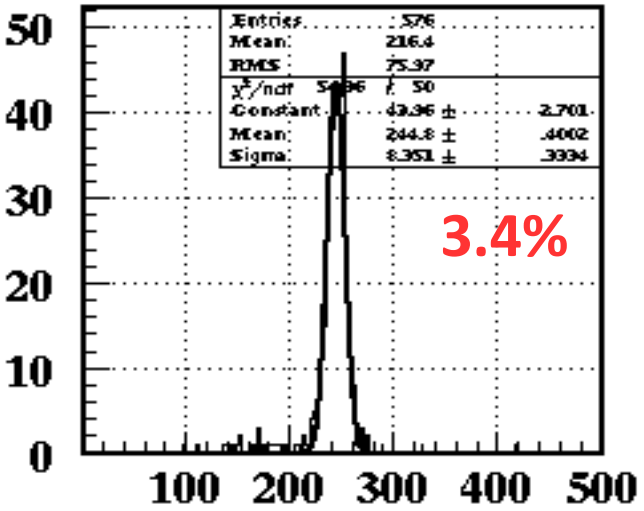
Processes and procedures for calibration will be described this afternoon

MIP run 73023-73030

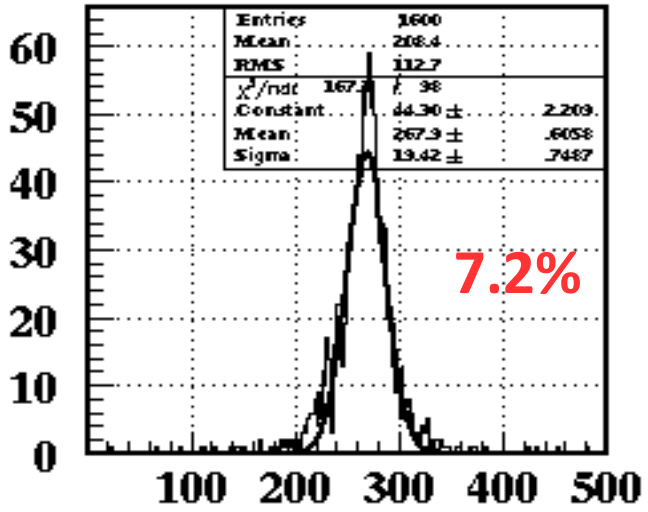
Excellent equalization reached



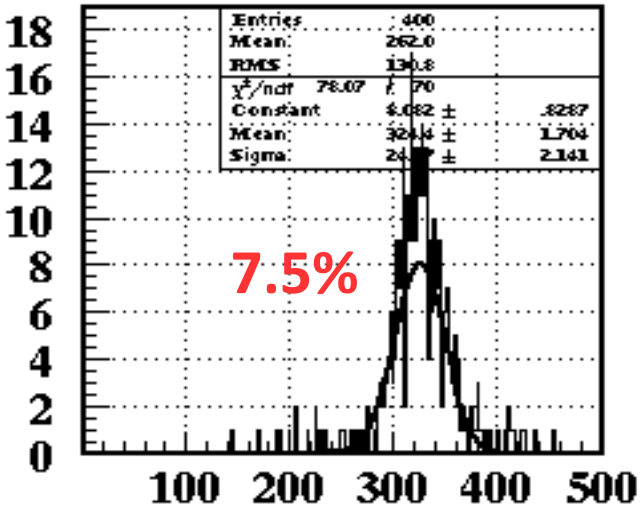
Barrel 1–4



Barrel 5



Endcap 1–4



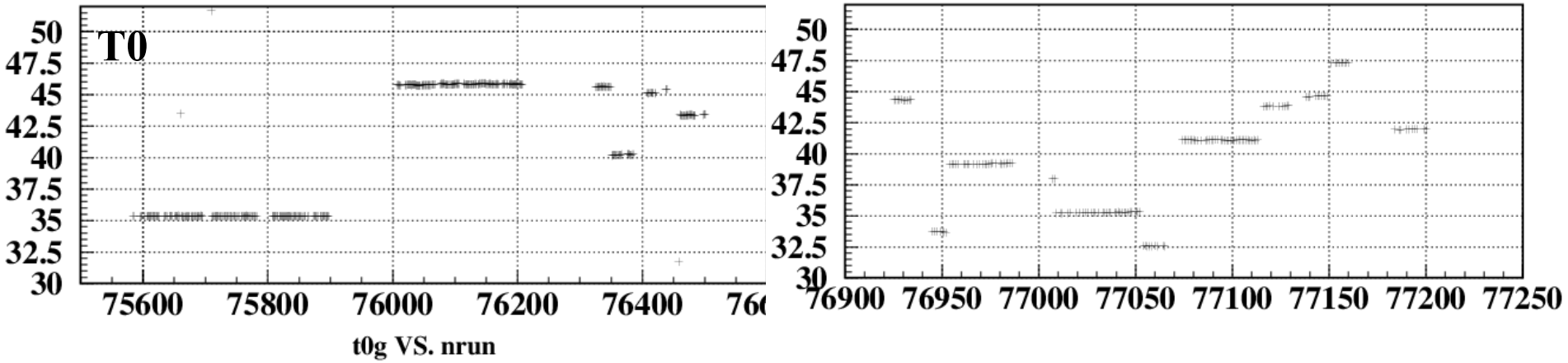
Endcap 5

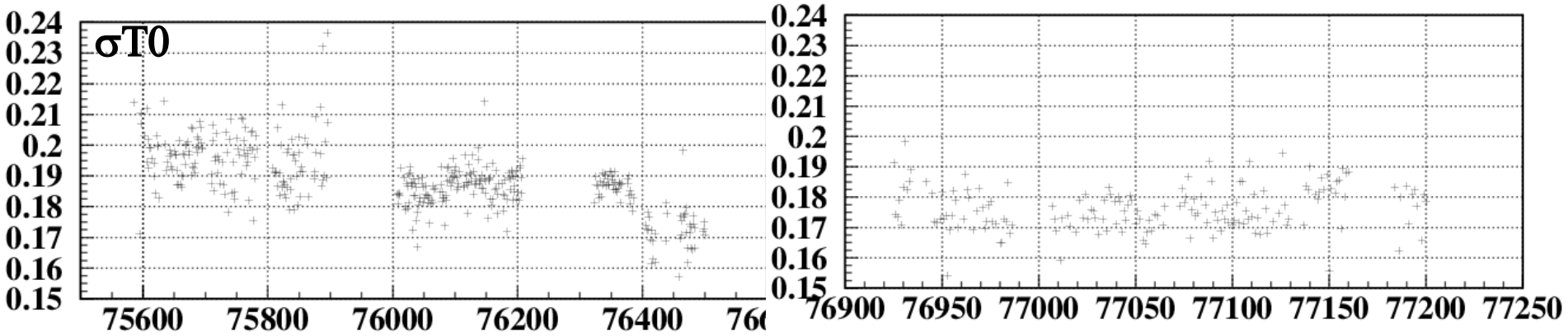
T0 Global

Calculated run by run from e+e-→γγ events, requiring T-R/c = 0.

Value it's very sensitive to Dafne working point.

T0 rms is stable at KLOE1 value.



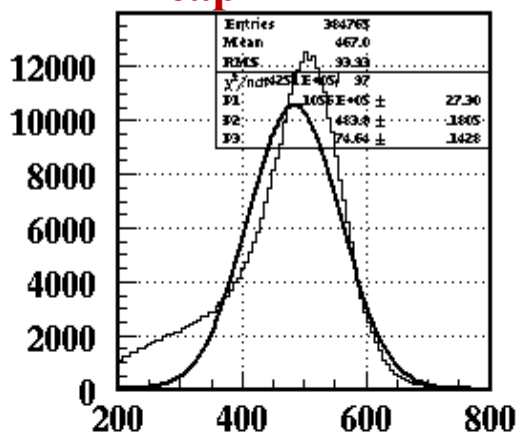


Fine Energy calibration:

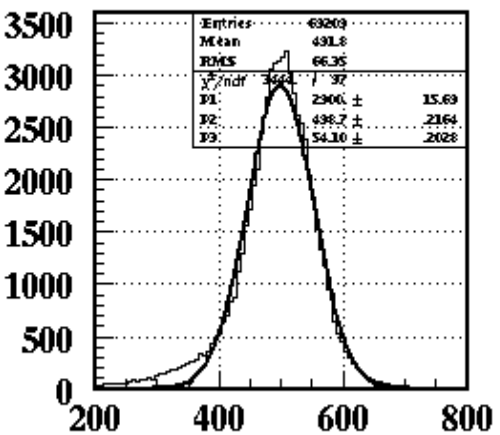
Evaluated every 800 nb^{-1} by fixing the $\gamma\gamma$ clusters peak to 510 MeV. Machine background required change of event selection. Long low energy queue still remaining (mainly on endcaps). Peak finding to be adjusted, but good stability reached.

Ecap1 | Barr | Ecap2

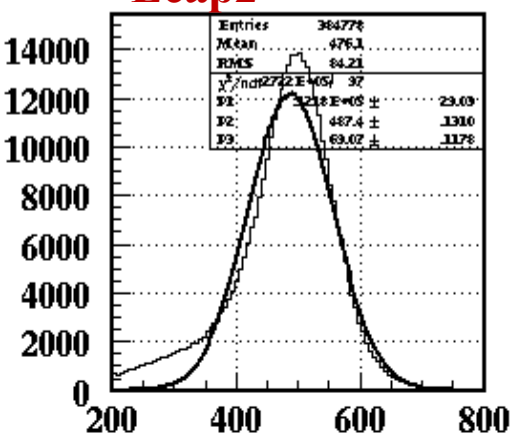
Bhabhas



ee scale d: 1

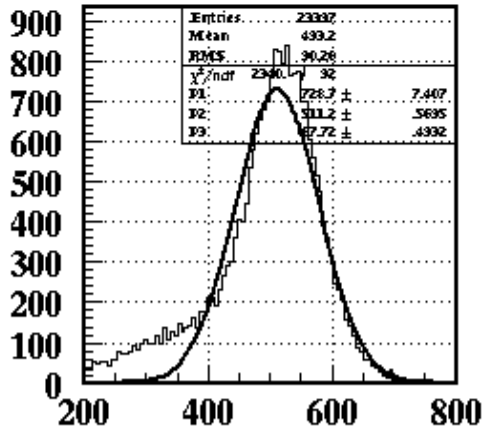


ee scale d: 2

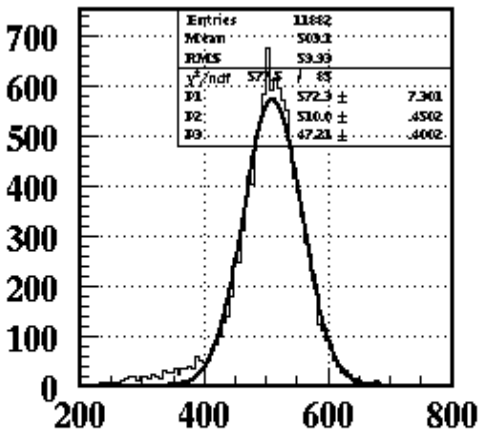


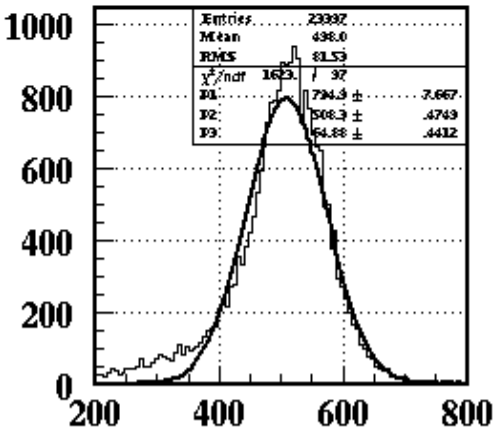
ee scale d: 3

$\gamma\gamma$



gg scale d: 1





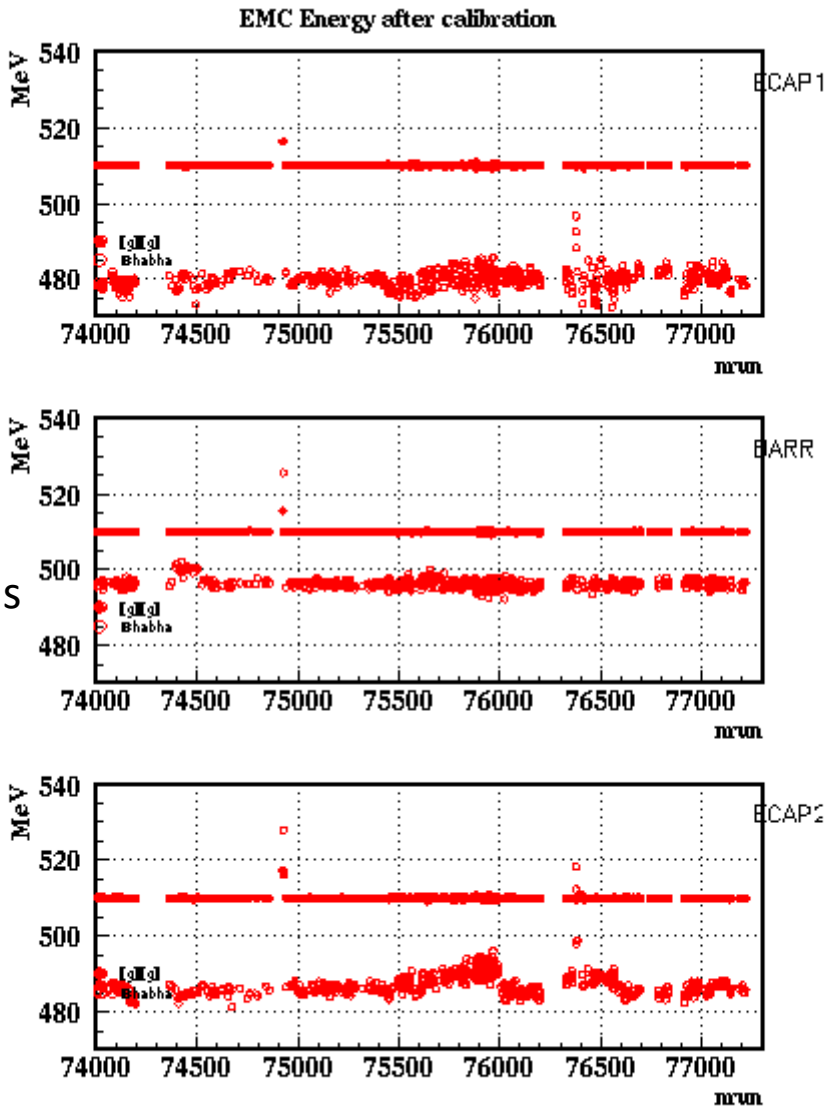
gg scale d: 3

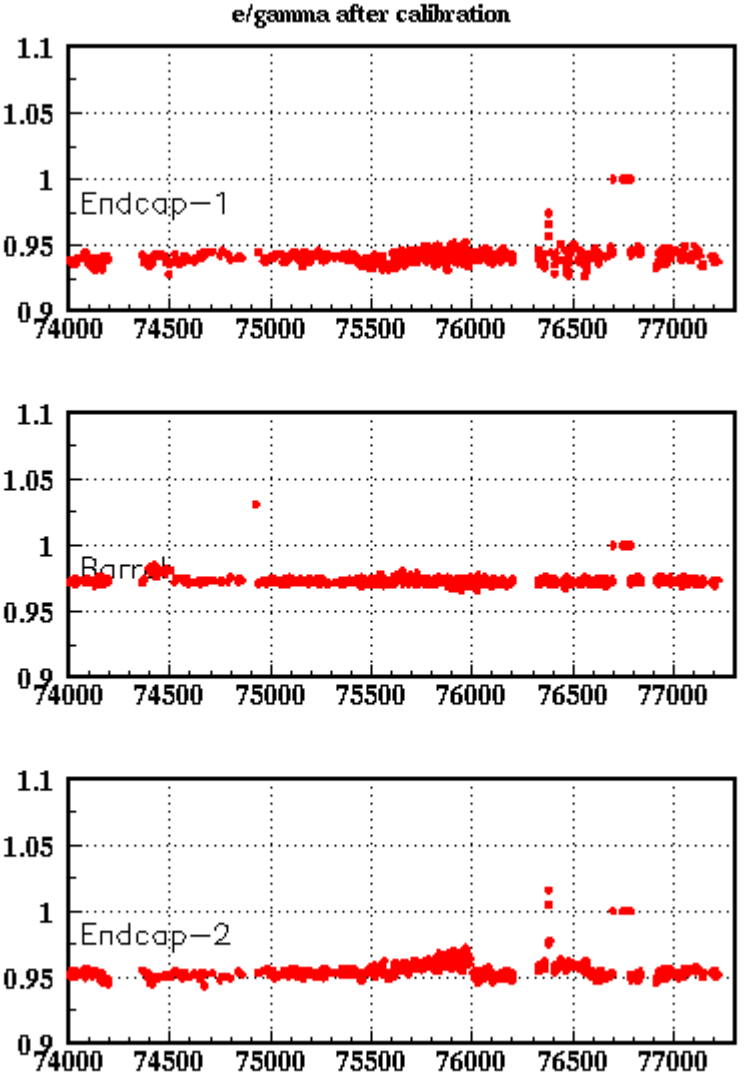
Energy calibration history from march

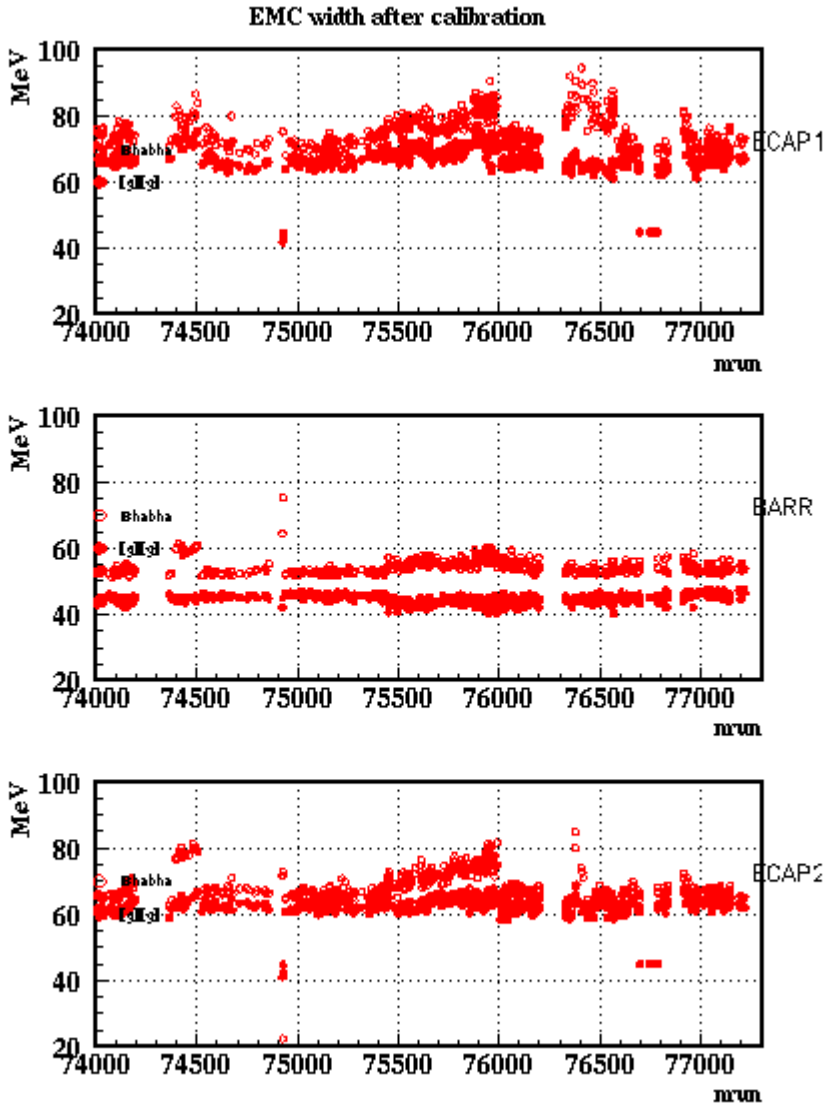
New detectors' material is seen differently on barrel and ecaps

γγ

Bhabhas



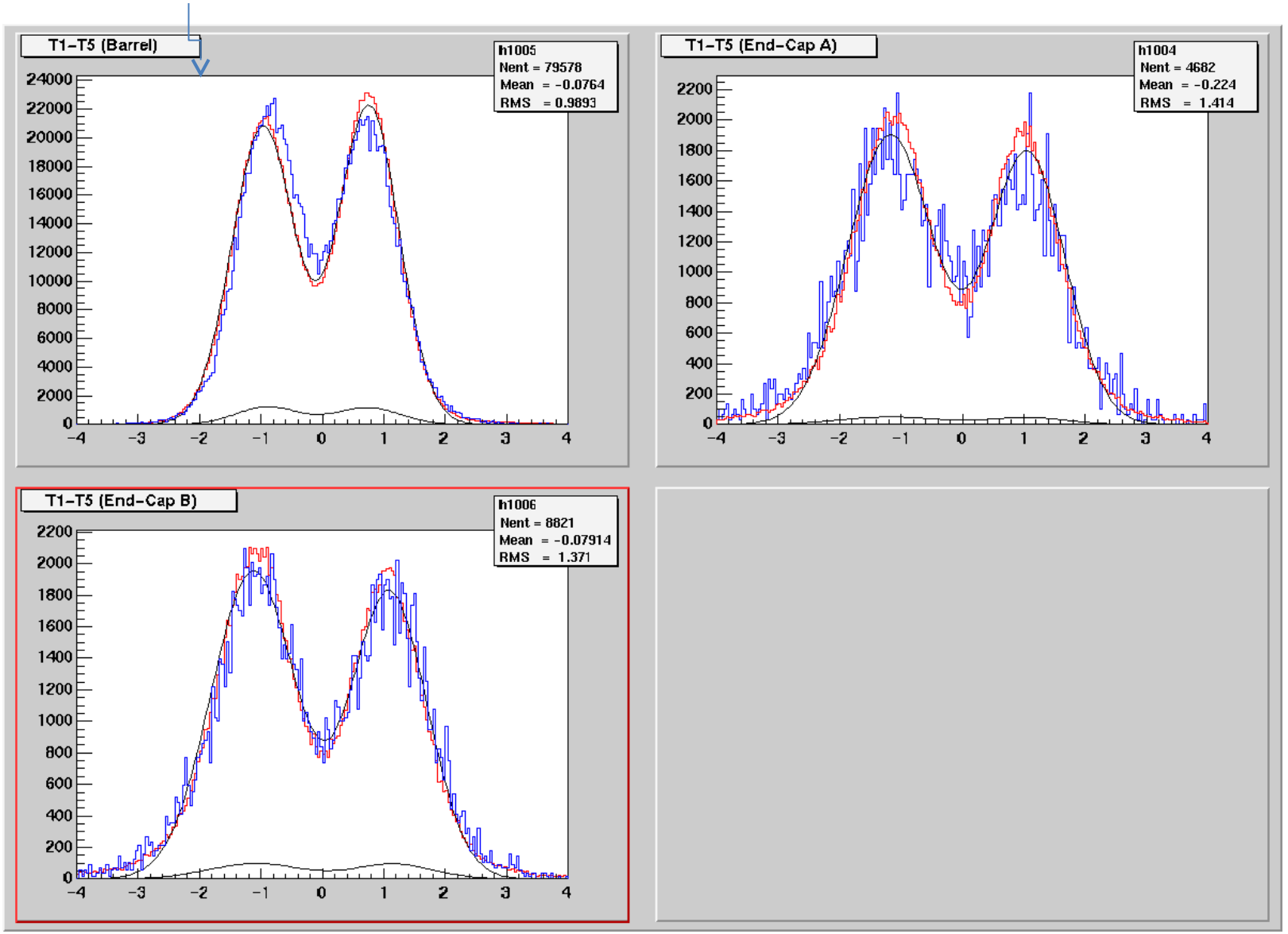




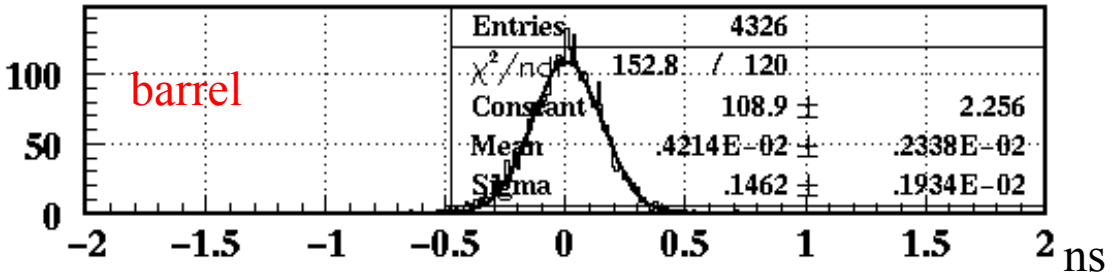
Sigma of energy peak:
barrel OK, ecap higher (but biased by bad peak finding)

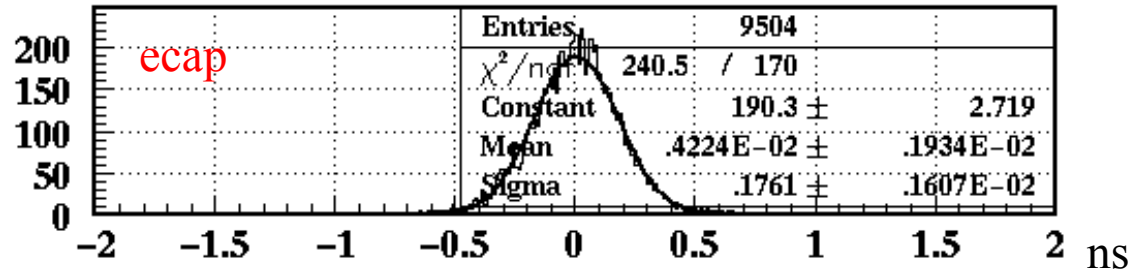
Time calibration with cosmics:

Separation between upward and downward muons assess the quality of the timing

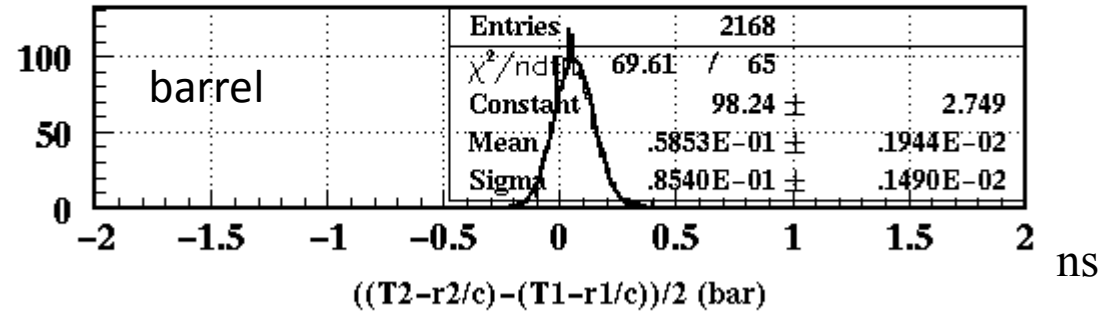


Fine time calibrations

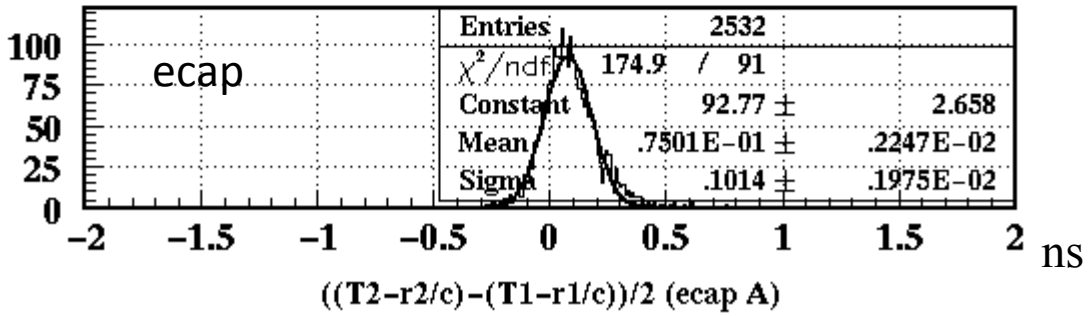




Evaluated every 800 nb^{-1} by fixing T-R/c=0 for $\gamma\gamma$ events.

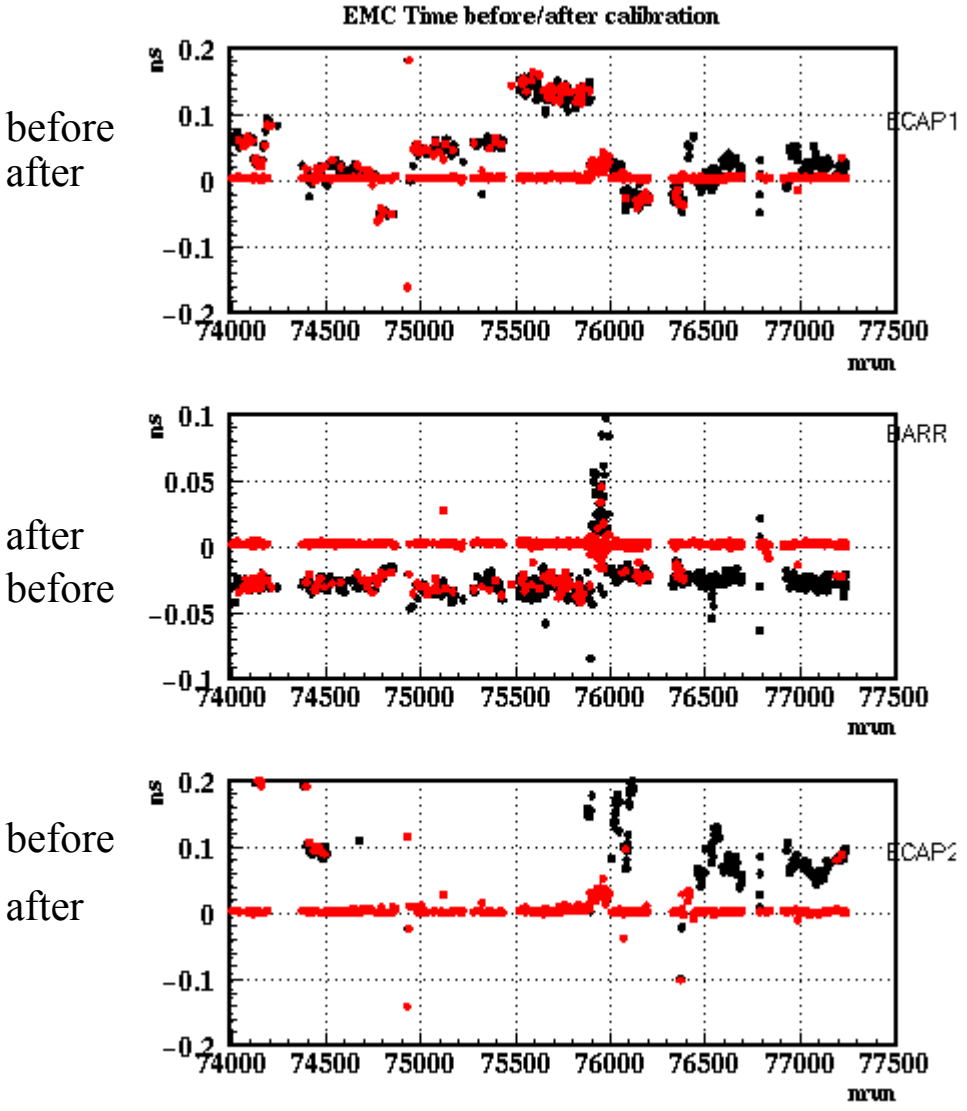


Δ(T-R/c) gives intrinsic time resolution*√2 : values aligned with KLOE1



Time calib history

T-R/c before and after calib:



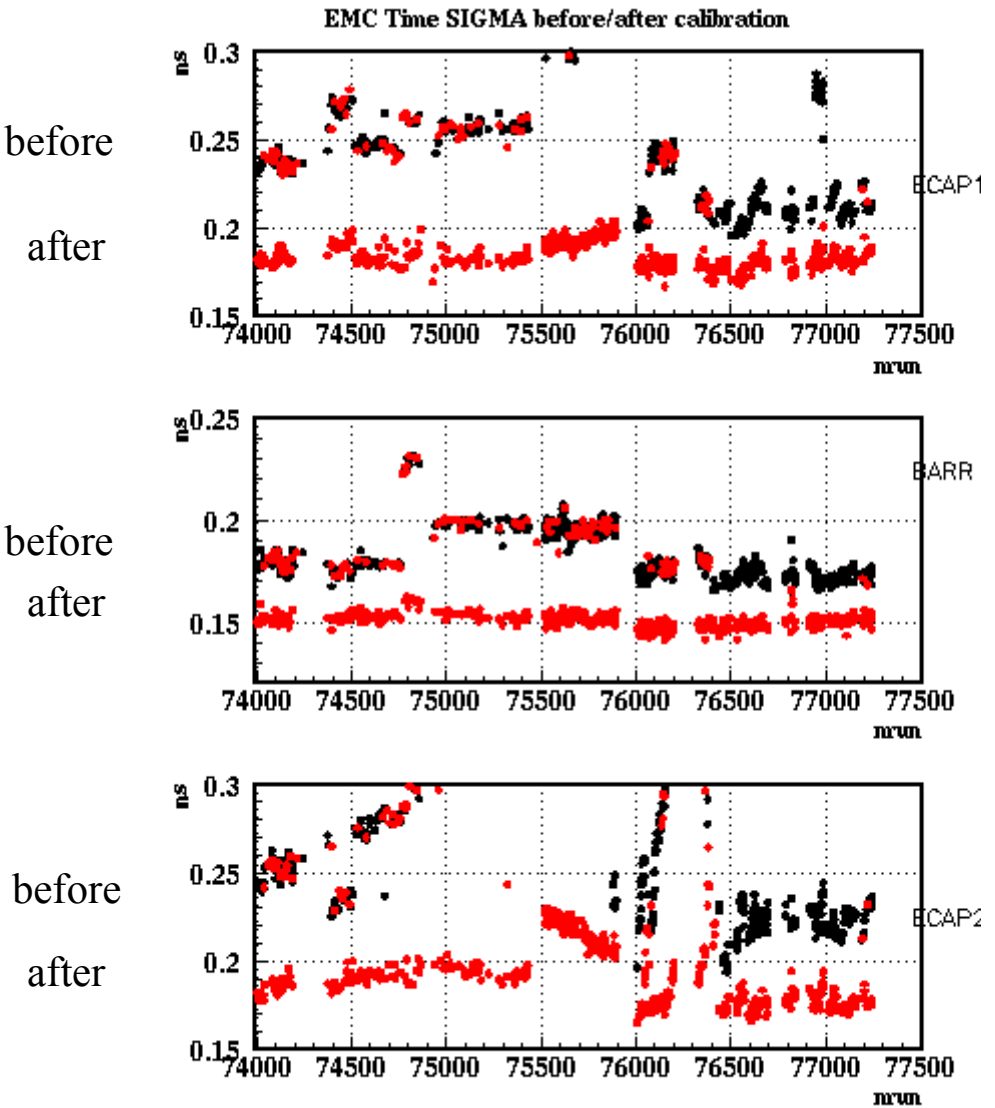
before
after

after
before

before
after

Time resolution σ(T-R/c)

OK. weird oscill before calib are getting better in recent runs.



before
after

before
after

before
after

Drift Chamber Calibration

- Calibration triplets
  - Dead/hot channels → identify and set to DB
- Time offsets of the sense wires → t0's
  - Once at the beginning of the run period or after electronic chains have been changed
- s-t relations
  - Run-wise online calibration

Description of the processes and procedures described this afternoon

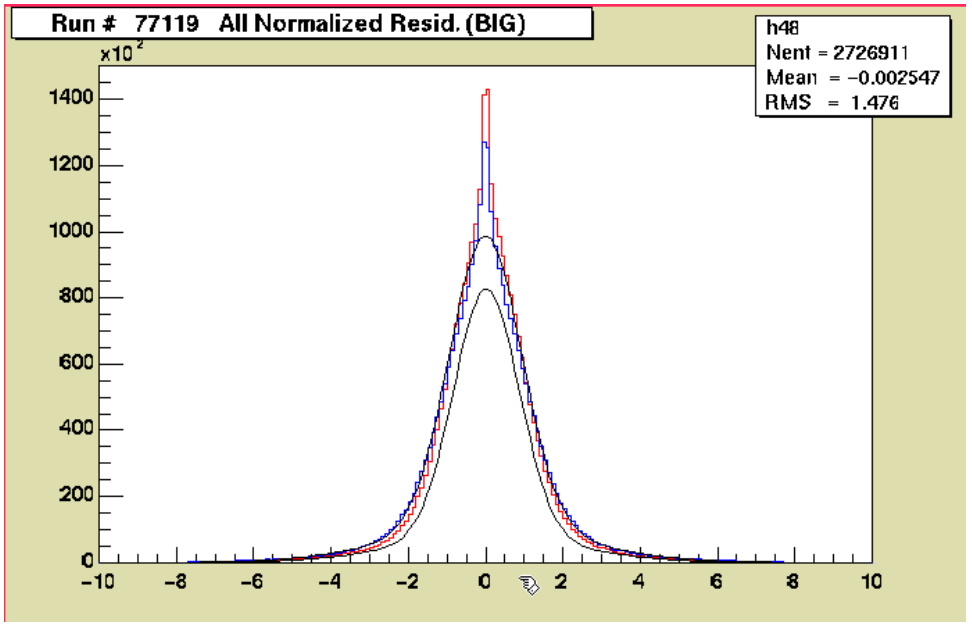
DC calibration

- At the 2005 level → residuals
- Currently calibration is done with a very small delay with respect to the data taking → improvement
- Suffers
  - New background rates
  - Stability of running conditions
- Profits of
  - New run size → 1.5 fb^{-1}

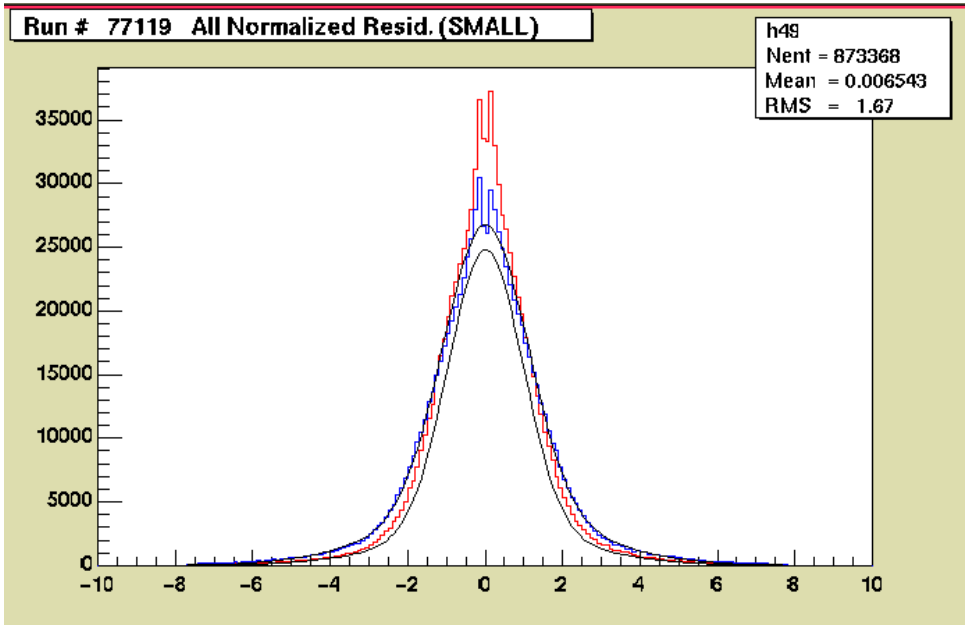
DC calibration

- Residuals compared to 2005

Run 77119
Run 37687



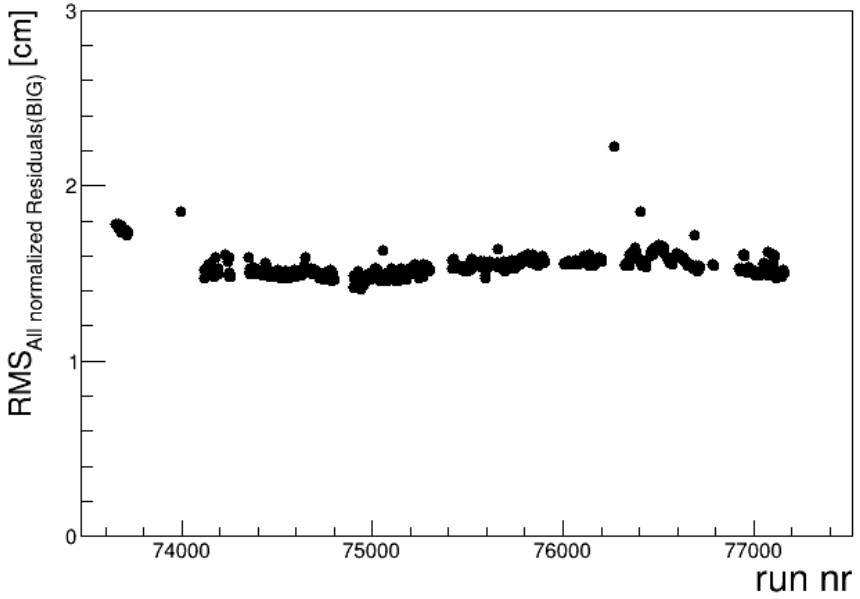
[cm]

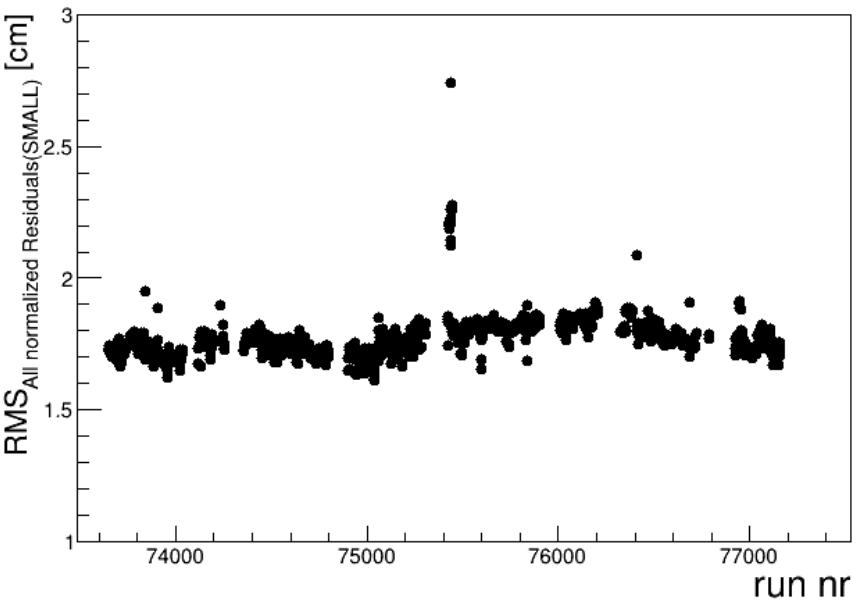


[cm]

DC calibration

- All normalized residuals RMS over run nr → stability

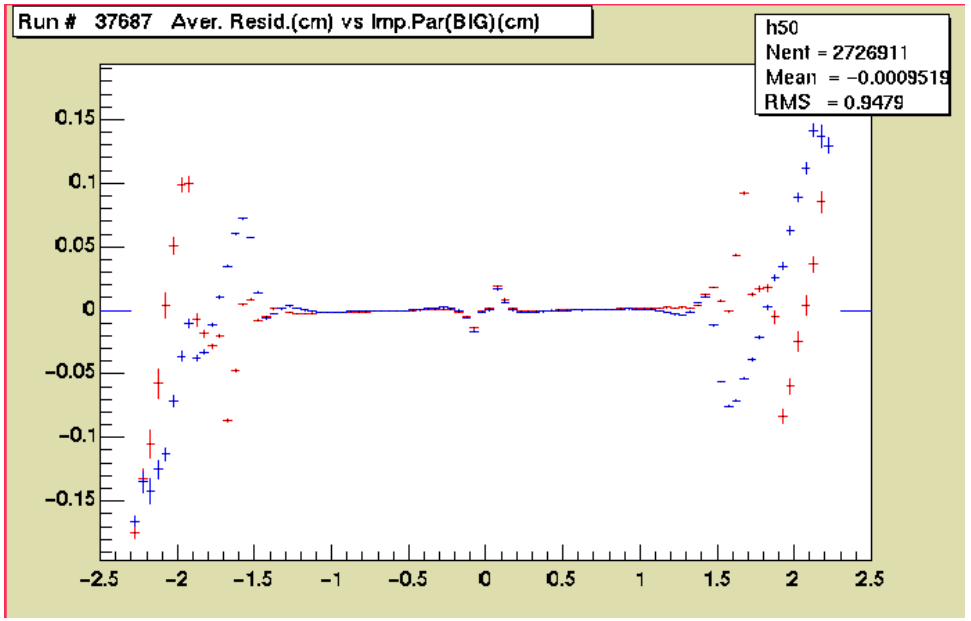


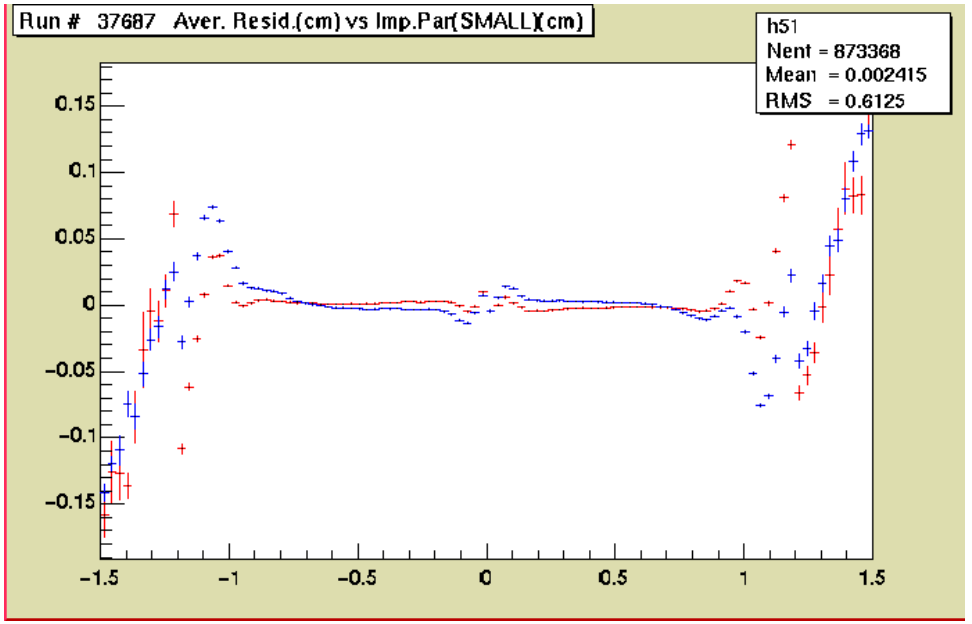


DC calibration

- Residuals compared to 2005

Run 77119
Run 37687

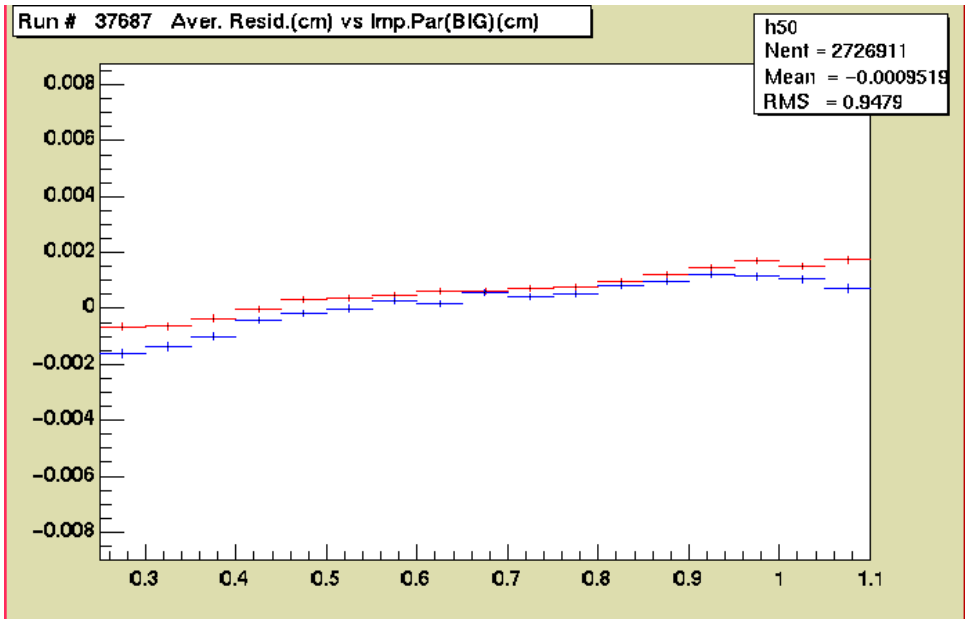


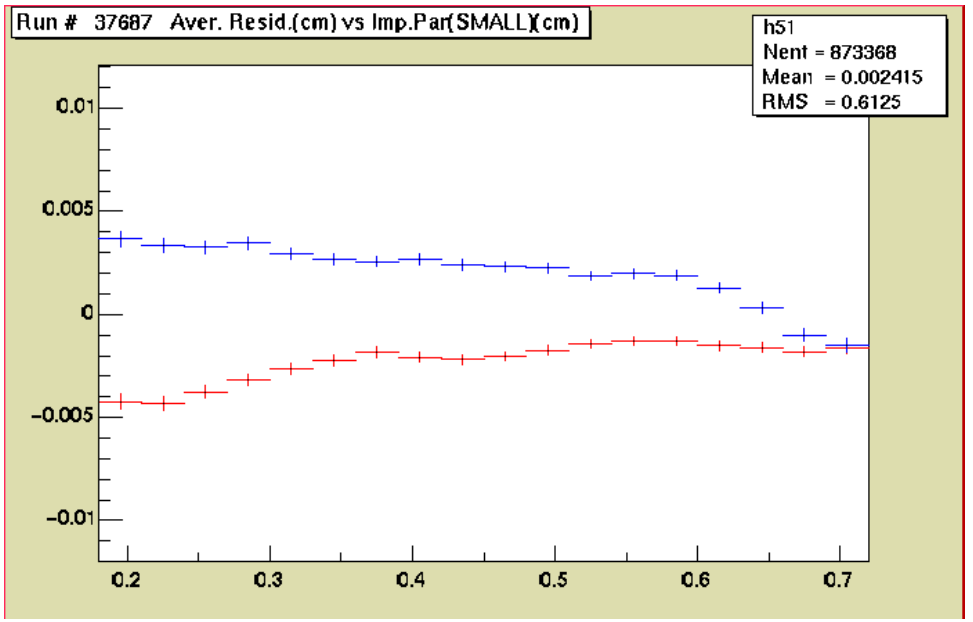


DC calibration

- Residuals compared to 2005

Run 77119
Run 37687





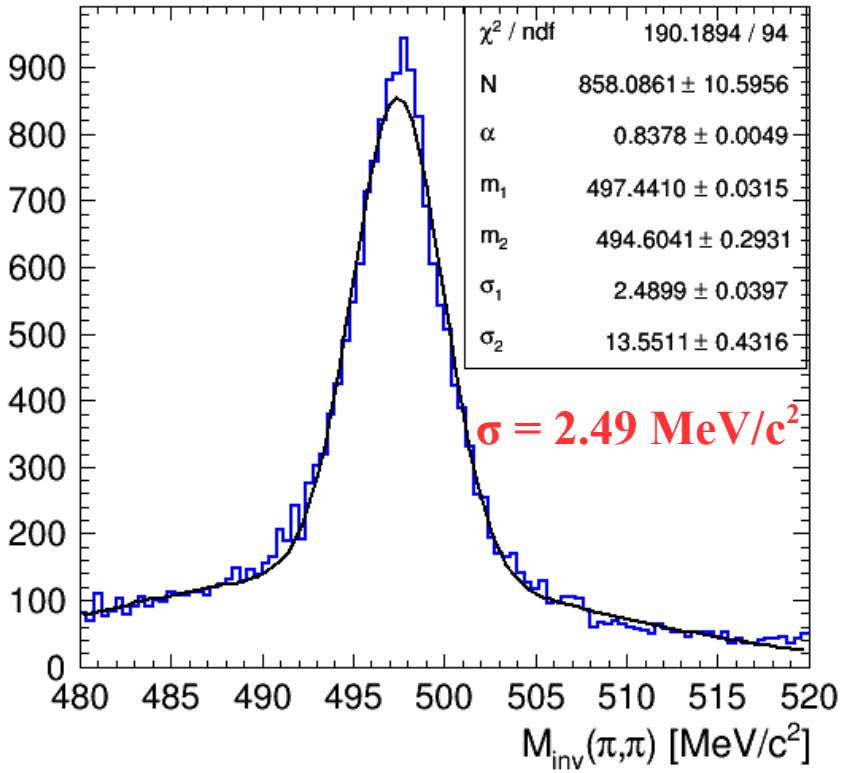
K_L inv. Mass from $K_L \to \pi^+\pi^-$

- **selection of $K_L \to \pi^+\pi^-$**

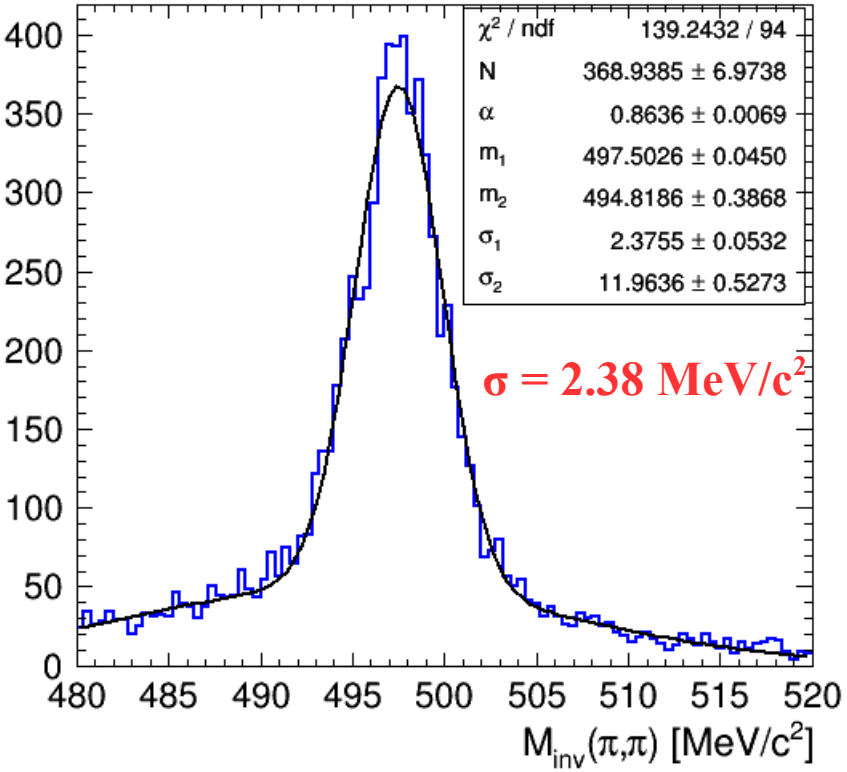
  For events from KSL stream with KLTAG at one vertex and:
  - Second vertex with two tracks of opposite curvature → **Decay within DC volume**
  - ρ > 30 cm for this vertex (K_L decay in the DC)
  - α_{CM} > 179.8° – cut on opening angle of 2 tracks in K_L CM frame
- A double gaussian fit to the K_L invariant mass peak gives comparable resolution for old and new data

$$f(x) = N \cdot \left(\alpha e^{\frac{(x-m_1)^2}{2\sigma_1^2}} + (1-\alpha) e^{\frac{(x-m_2)^2}{2\sigma_2^2}} \right)$$

Runs 30300 range



Runs 76000 range



Summary

- Calibration performance is as good as always
  - At the level of KLOE1
- Calibration procedures
  - Stable and small delay respect to data taking
  - Online calibration has improved along with the DAQ, run size and running conditions
- ToDo
  - Offline calibration
  - Calorimeter peak finding improvement for energy calibration