Calorimeter energy calibration with π^0

Malek MAZOUZ
Faculté des sciences de Monastir

With the collaboration of
Meriem BENALI
FS Monastir- LPC Clermont

- The calibration method

- Results for kinematics 2 (low)

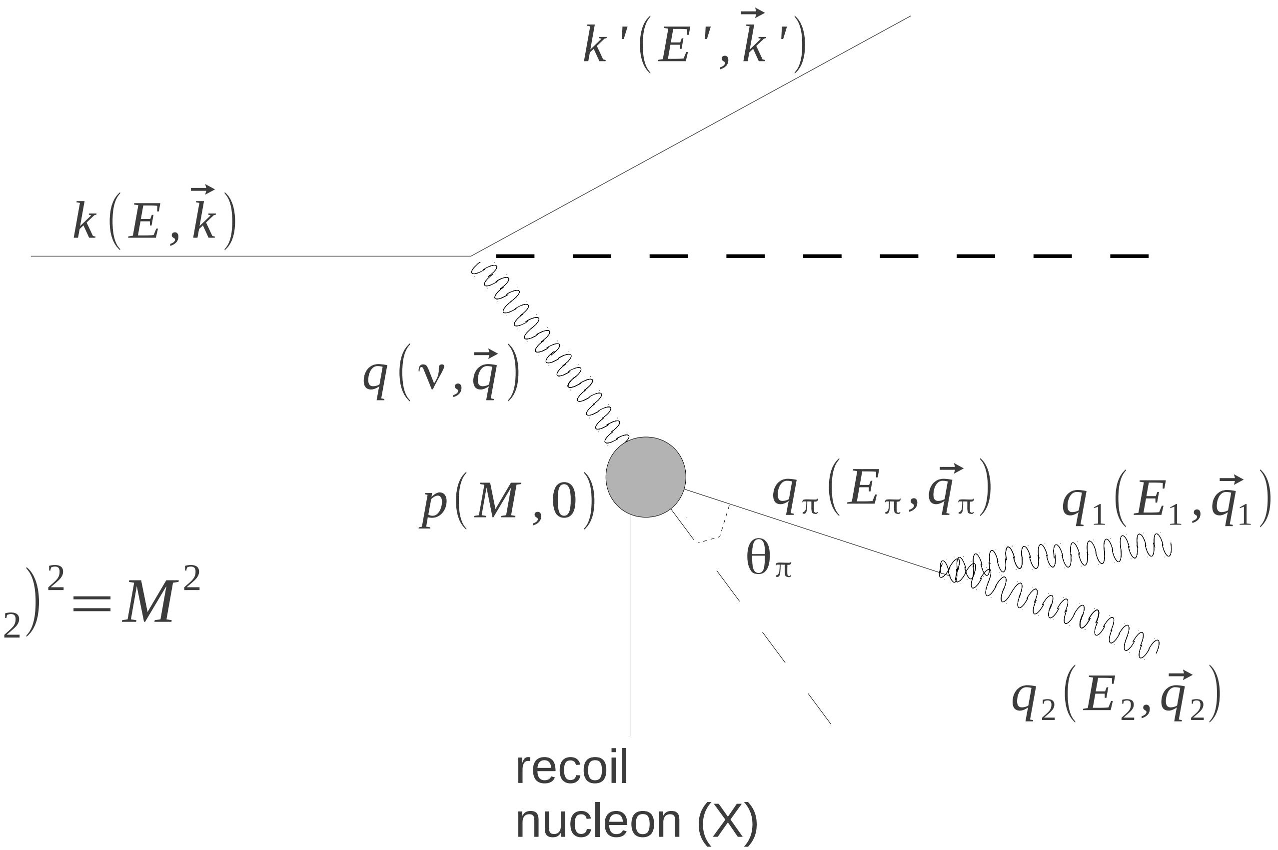
- Conclusions

DVCS collaboration meeting

Orsay, Nov 12th 2012

Presentation of the calibration method

The calibration is performed using N(e,e'π^0)N events :



$$\begin{cases} M_X^2 = (p + k - k' - q_1 - q_2)^2 = M^2 \\ (q_1 + q_2)^2 = M_\pi^2 \end{cases}$$

$$\rightarrow \quad a E_\pi^2 + b E_\pi + c = 0$$

$$E_\pi = E_1 + E_2 = \frac{-b + \sqrt{(b^2 - 4ac)}}{2a}$$

$$\begin{cases} a = 4(\nu + M)^2 - 4\vec{q}^{\,2} cos^2 \theta_\pi \\ b = 4(\nu + M)[M^2 - (q + p)^2 - M_\pi^2] \\ c = 4 M_\pi^2 \vec{q}^{\,2} cos^2 \theta_\pi + [M^2 - (q + p)^2 - M_\pi^2]^2 \end{cases}$$

Presentation of the method

A minimization procedure is done based on the comparison between the calculated energy E_π and the measured energy $E_{\exp} = \sum_i E_i$

$$\chi^2 = \sum_j \left(E_\pi^j - \sum_i C_i E_i^j \right)^2$$

- $\sum_j$: Sum over the number of events
- $\sum_i$: Sum over the number of hit blocks in event j
- C_i: Calibration coefficient of block i
- E_i^j: Energy measured in block i using elastic coefficients

$$\frac{\partial \chi^2}{\partial C_i} = 0 \longrightarrow [C_i] = [M_{ik}]^{-1} [B_k]$$

Where :

$$\begin{cases} M_{ik} = \sum_j E_i^j E_k^j \\ B_k = \sum_j E_\pi^j E_k^j \end{cases}$$

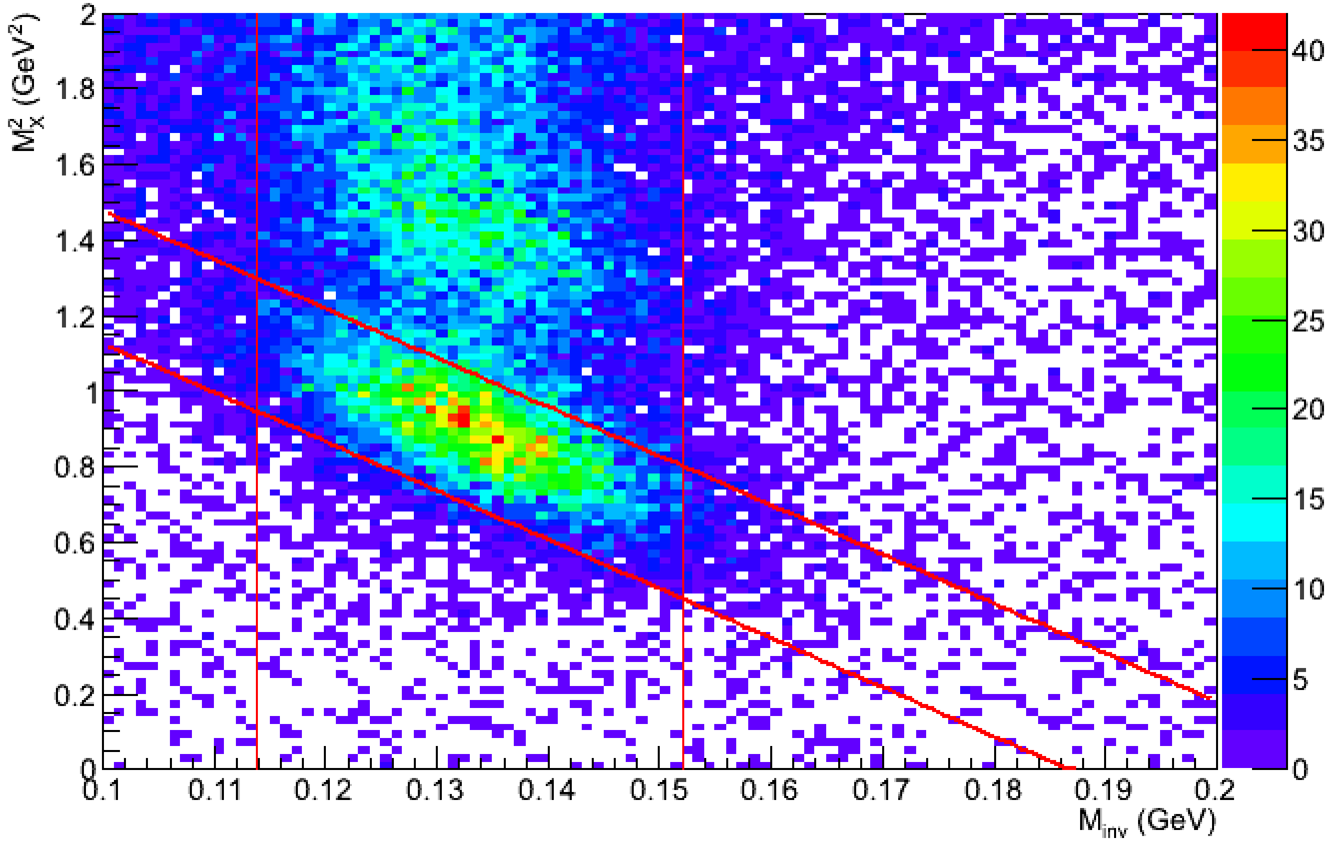
$$\delta C_i = \sqrt{[M_{ii}]^{-1}}$$

by taking 0.1 GeV as an error on E_i (for all blocks and all events)

Selection of good events

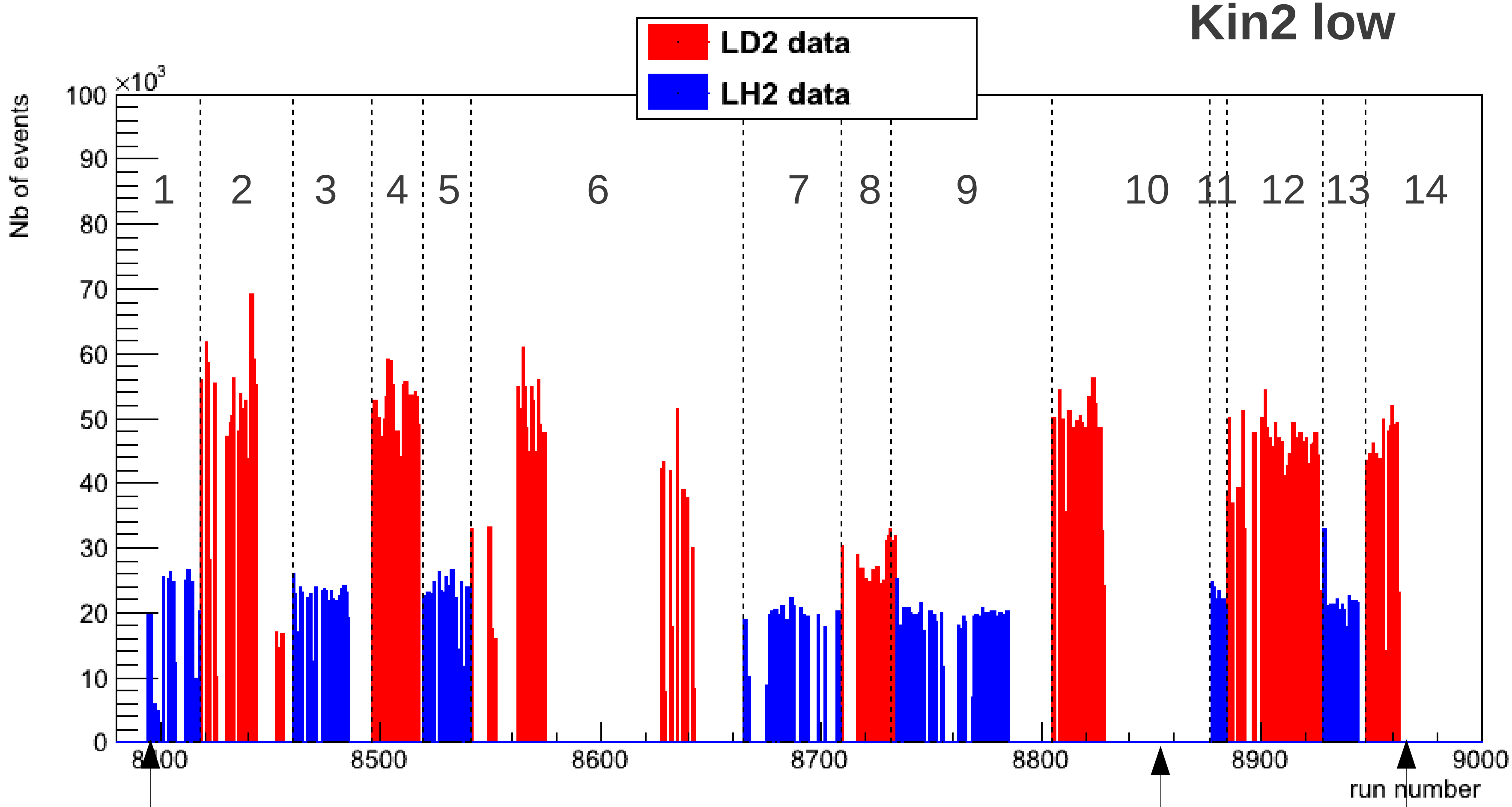
HRS cuts :
- only 1 track
- standard acceptance cuts
- electron selection with Cerenkov

Calorimeter cuts :
- energy of each cluster > 0.2 GeV
- edge blocks removed (but not in the minimization procedure)



Selection of **N(e,e'π⁰)N** events with a bidimensional **cut** applied to **N(e,e'γγ)X** events.

Kinematics 2 partition



Nov 05th

Nov 17th

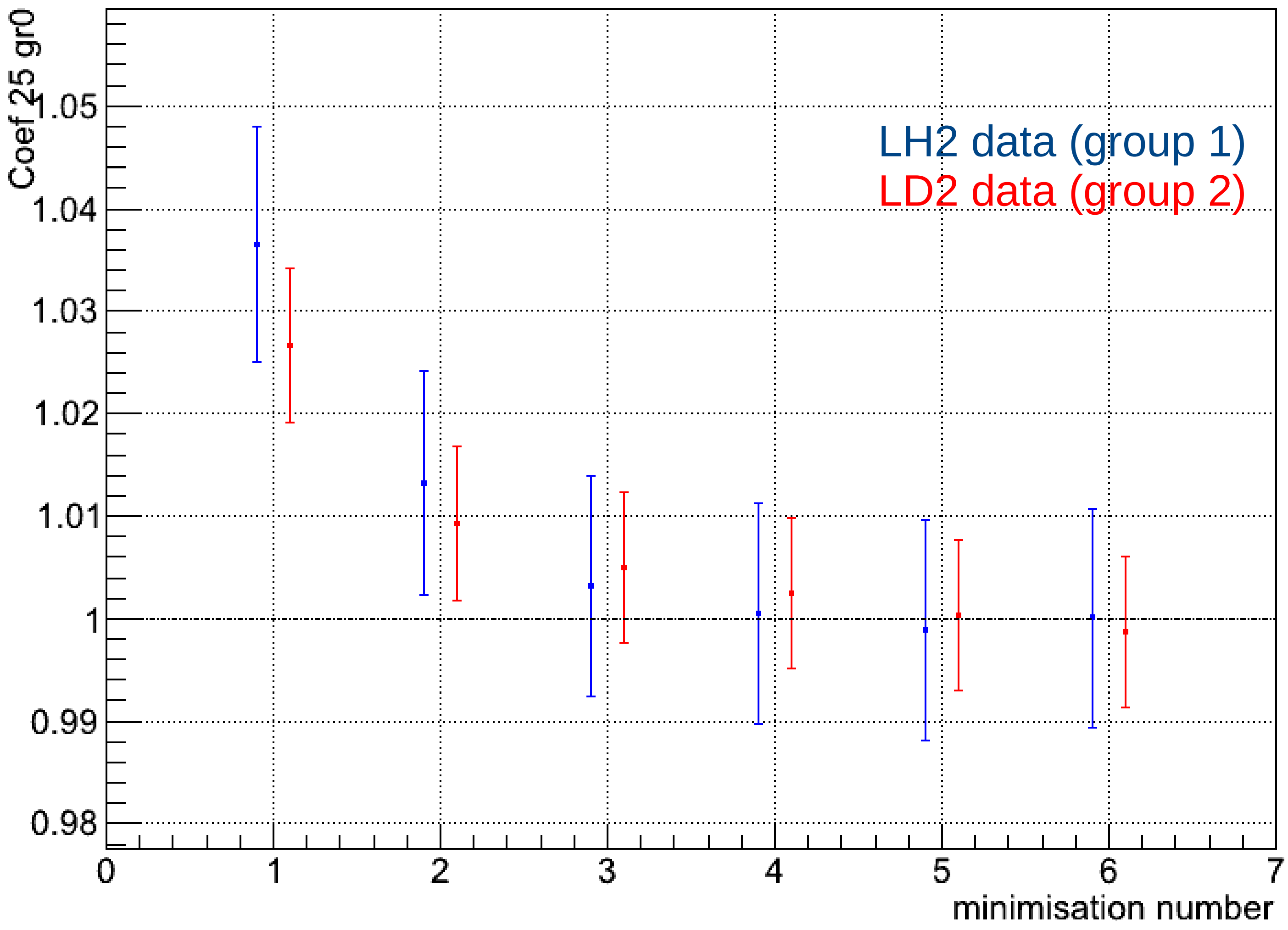
elastic calibration + HV change)

Nov 22nd

Oct 26th (elastic calibration)

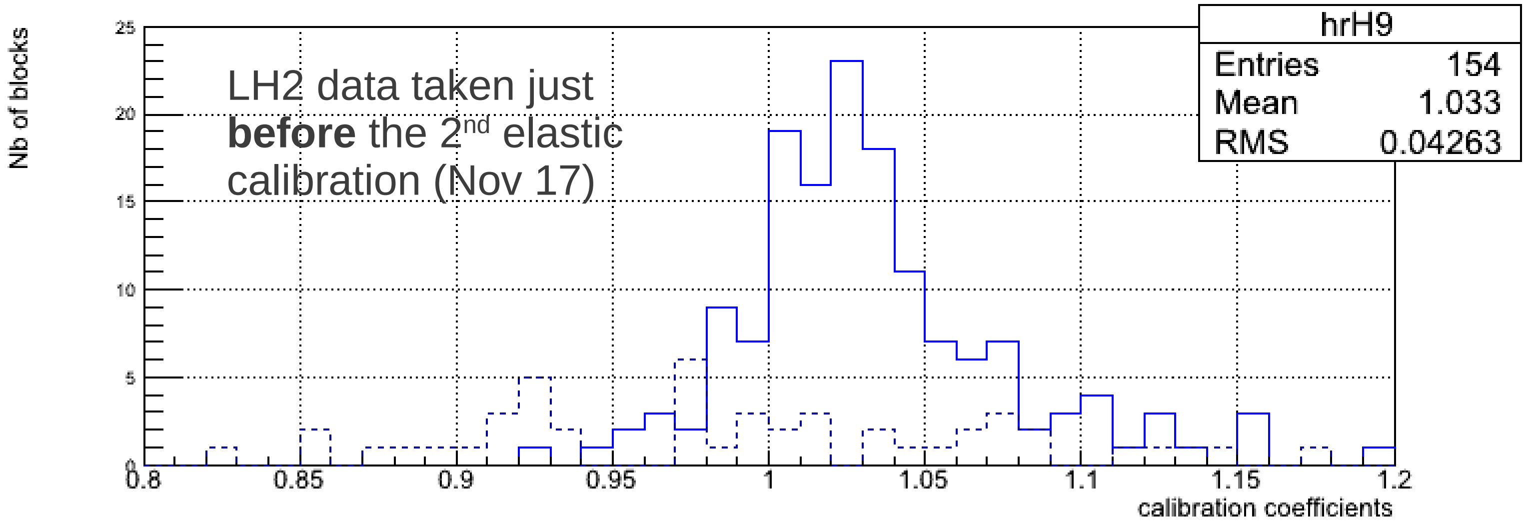
Results : number of iterations

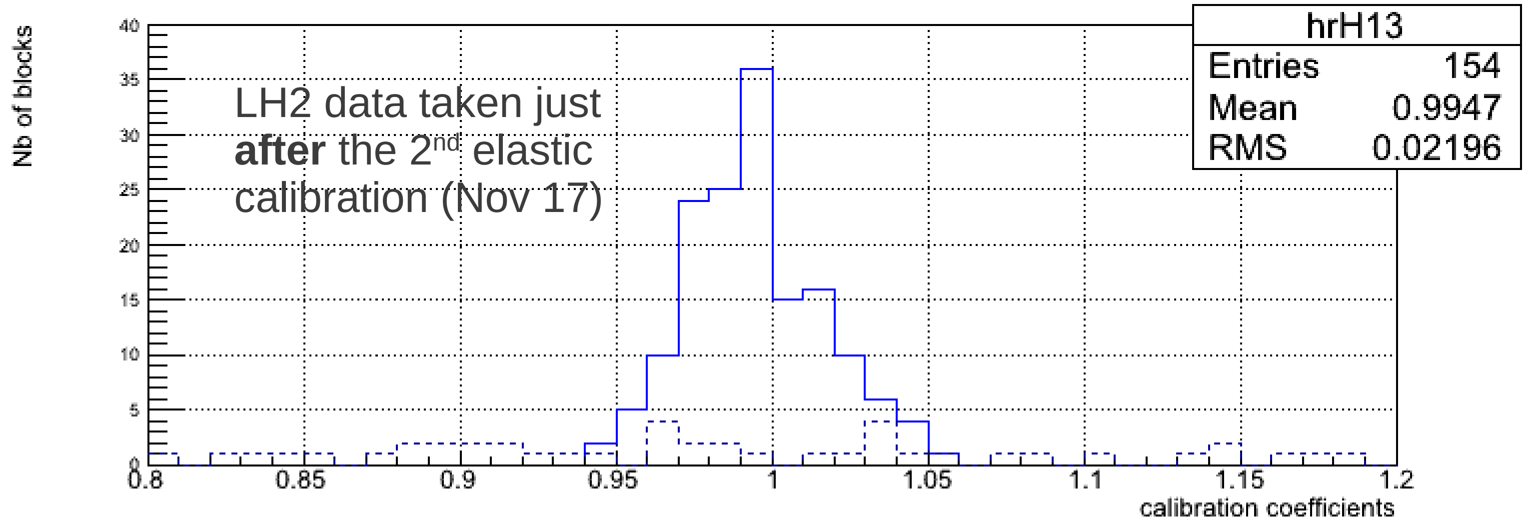
Example of block # 25



$$C_i^{final} = C_i^{iter1} \times C_i^{iter2} \times \ldots \times C_i^{iter6}$$

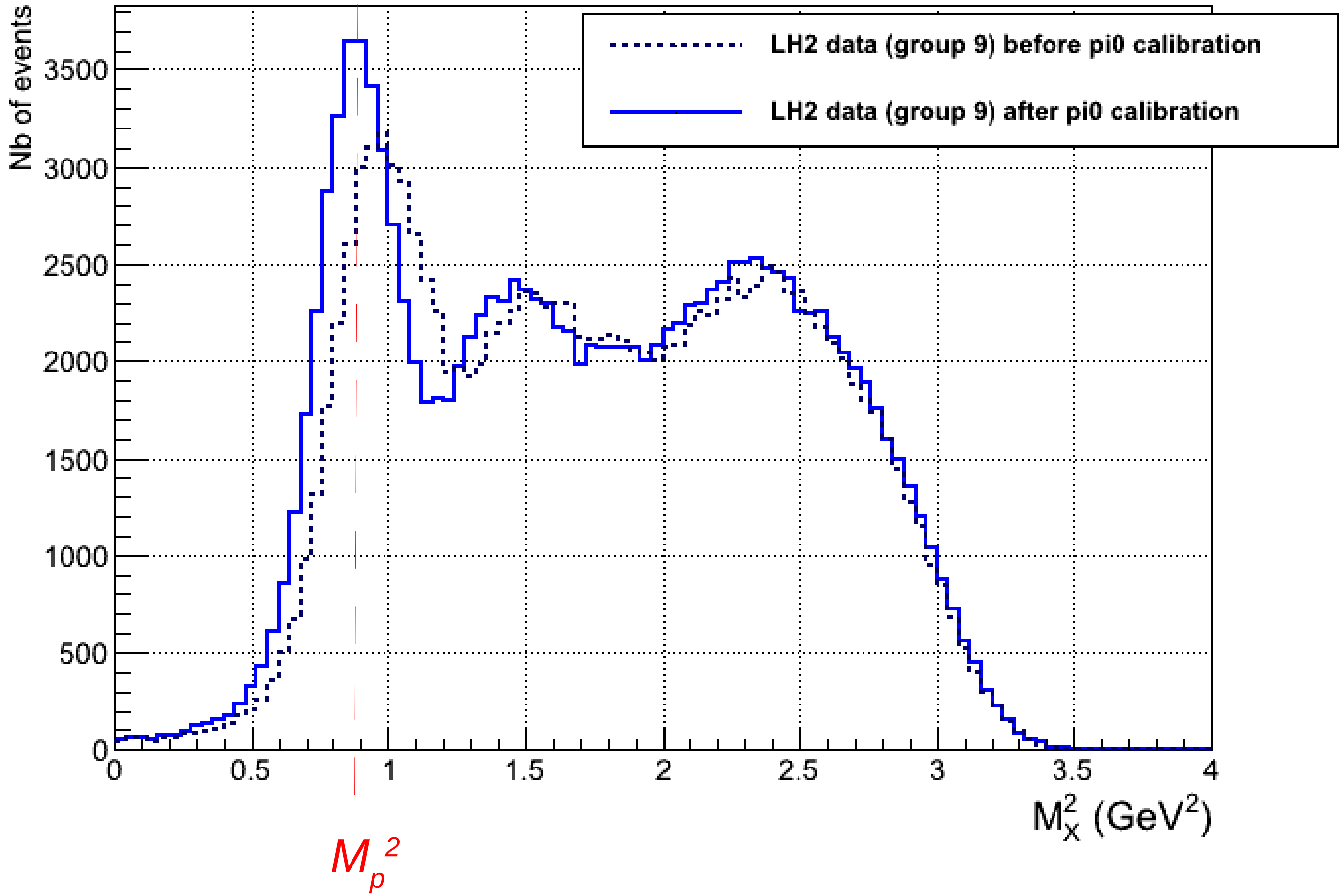
Results : calibration coefficients



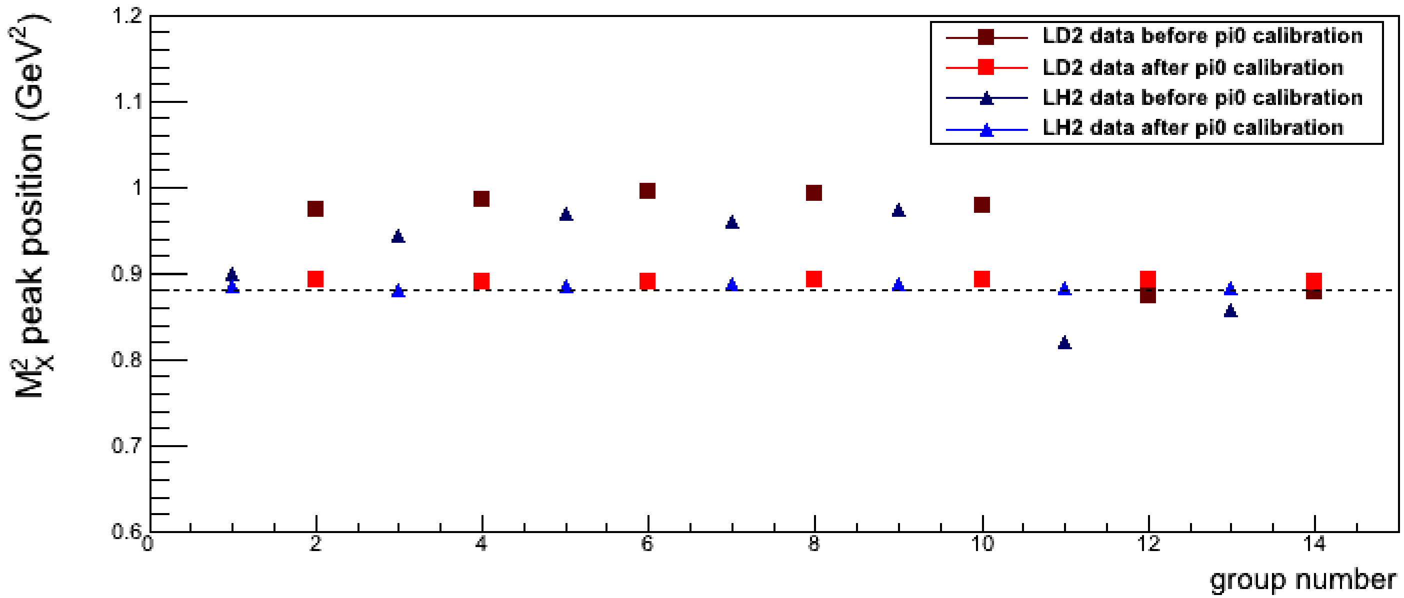


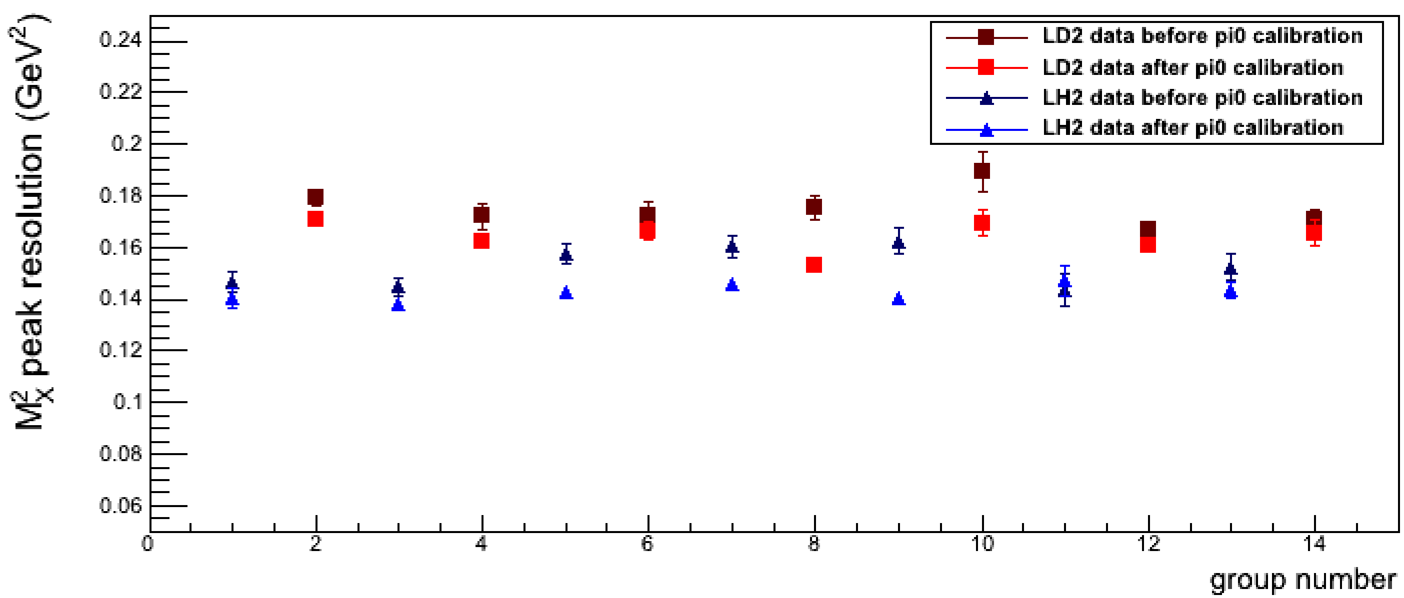
Results : improvement of M_X^2

$$H(e,e'\gamma\gamma)X$$



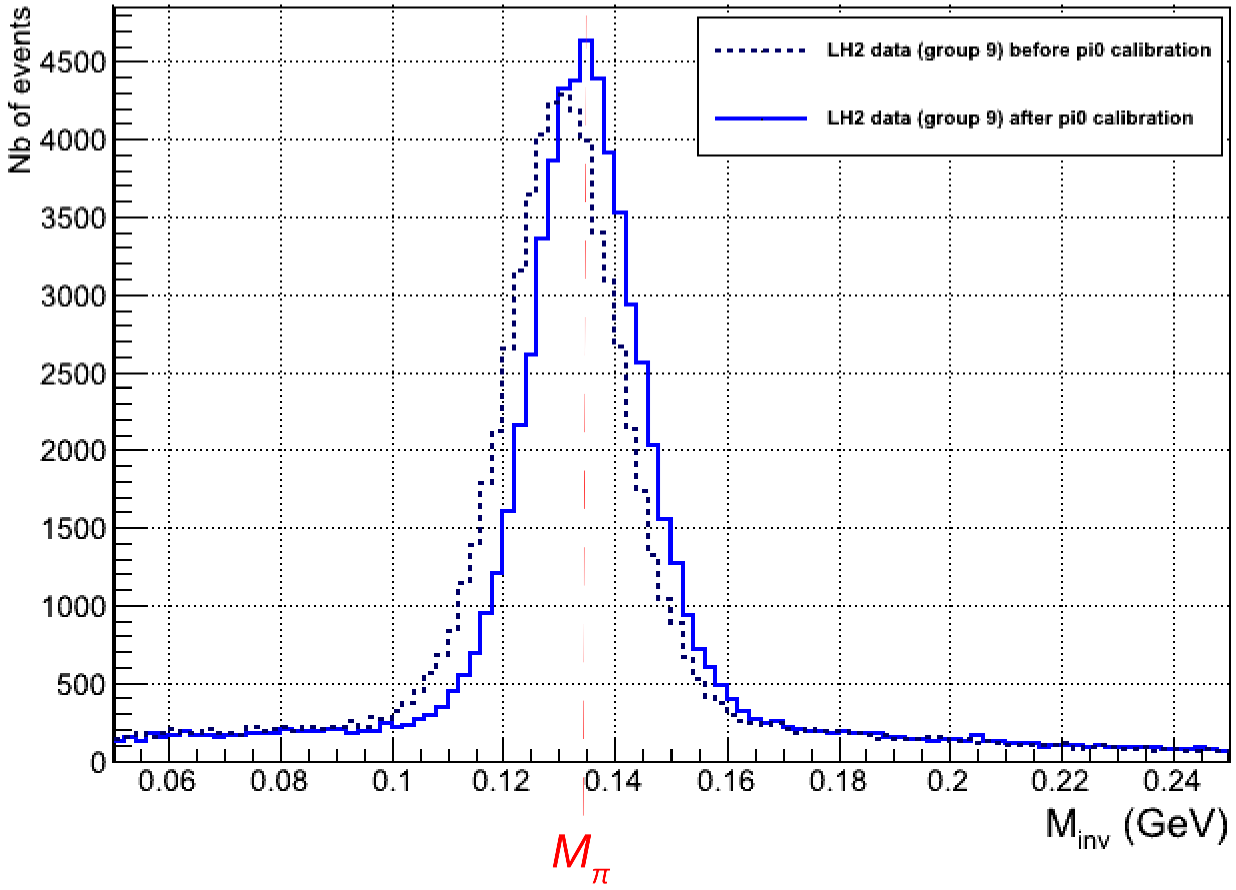
Results : improvement of M_X^2



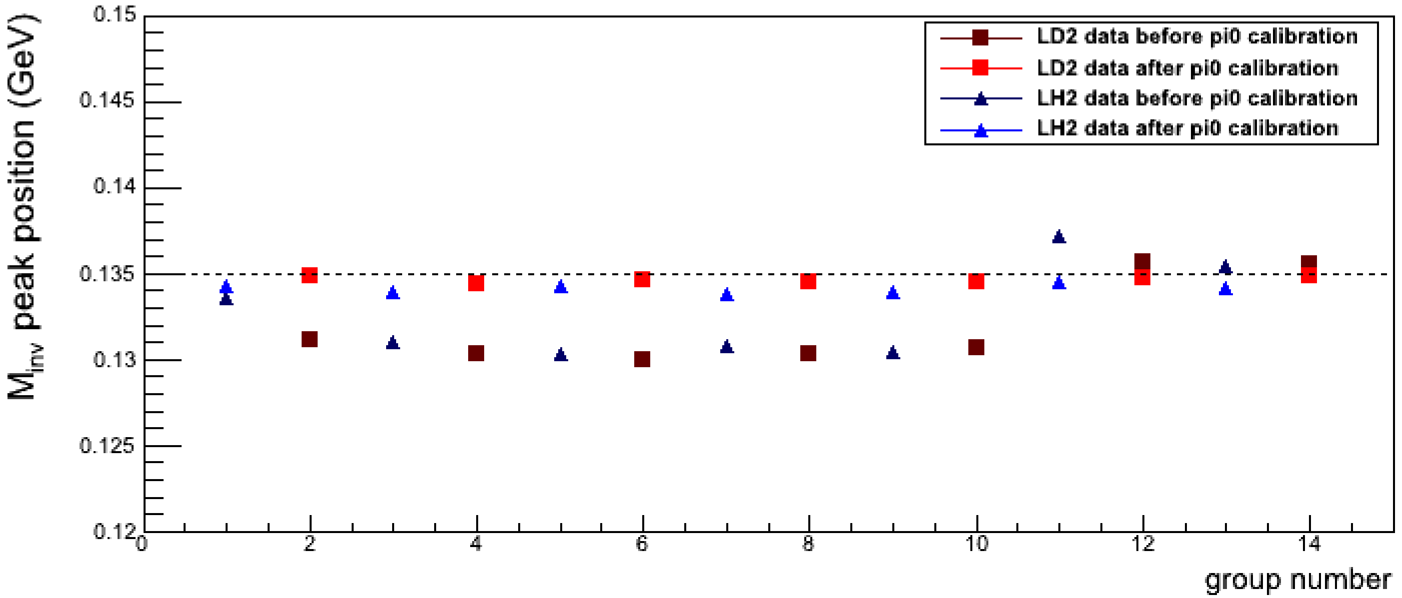


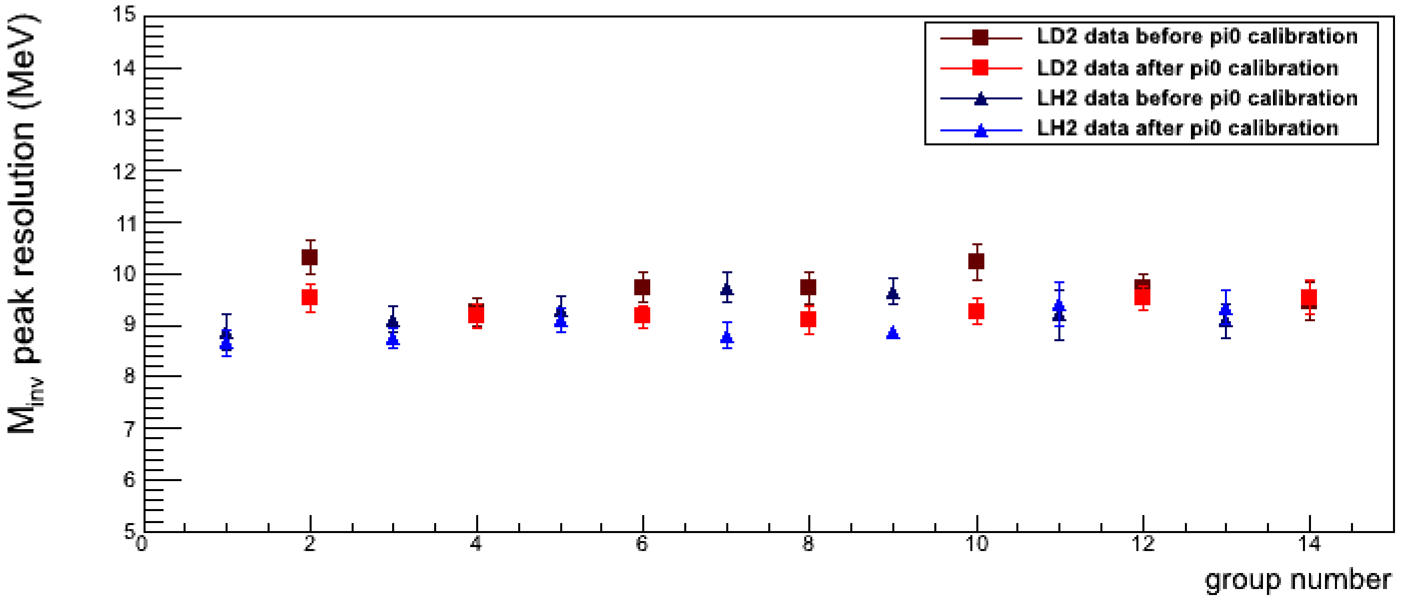
Results : improvement of M_{inv}

$$H(e, e'\gamma\gamma)X$$



Results : improvement of M_{inv}





Conclusions

- This method can provide the calibration coefficients for each day of data taking with 1-2% accuracy.

- These coefficients are compatible with the elastic coefficients (within 2%)

- The obtained coefficients give the same data quality (M_X^2 and M_{inv}) than the elastic coefficients.

- The mean gain variation of the blocks between the 1st and the 2nd elastic calibration is about 3%

- Subtract accidentals when performing the minimization procedure could give better results.

- Still to calibrate kin1, kin2 (high) and kin3.