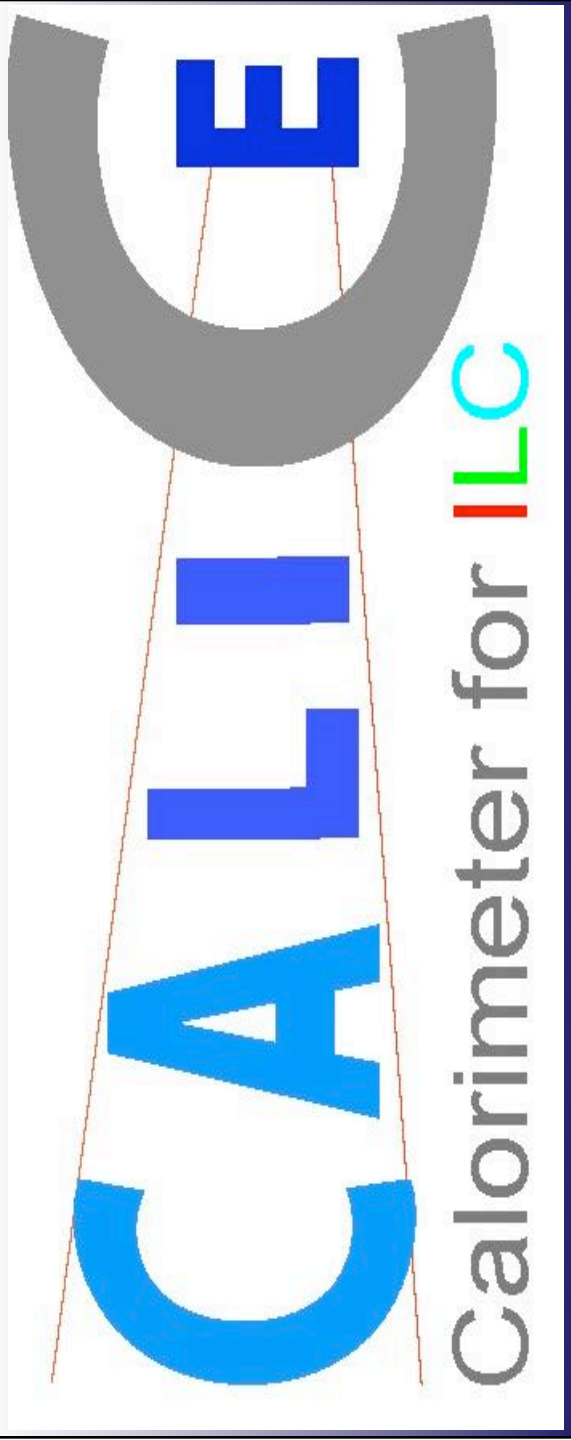


Response of the CALICE Si-W ECAL Physics Prototype to Electrons

Cristina Cârloganu

Clermont Ferrand

Aiming for three analysis papers using the 2006 data (first two to be merged eventually depending on the achieved timescales)

- Response to normally incident electrons
  (resolution, linearity, uniformity, ...)
- Shower radial and longitudinal development
- Tracking

- May 8, first draft submitted to the Internal Referees (K. Kawagoe, J. Cvach, F. Salvatore)
- May 15, a second draft is circulated
- May 21, a third draft is published, with the referee's approval as CALICE supporting note for CALOR 08 CAN-008
- September : restarting of the editorial review after inclusion of the MC
- October 10, green light from referees, paper submitted to the collaboration review
- October 24 --- deadline for comments !

1. Introduction
   - ILC physics highlights
   - ECAL performance goals
   - Prototyping and testbeam

2. Experimental setup

3. The ECAL prototype
   - Conclusion of the hardware paper on the detector performance(number of dead cells, noise level, stability)

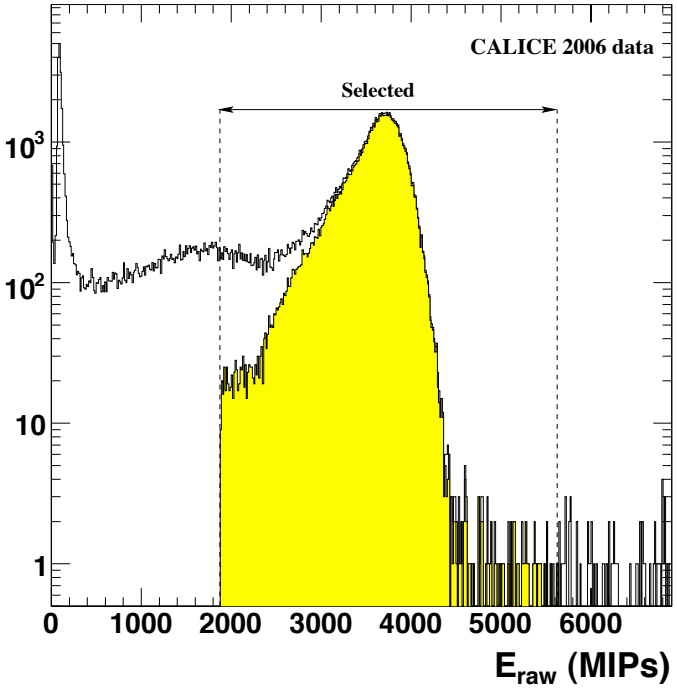
4. Monte Carlo simulation
   - simplified digitisation (Gaussian noise only, no dead cells, no correlated noise)

5. Selection of electron events

6. Performance studies

7. Conclusion

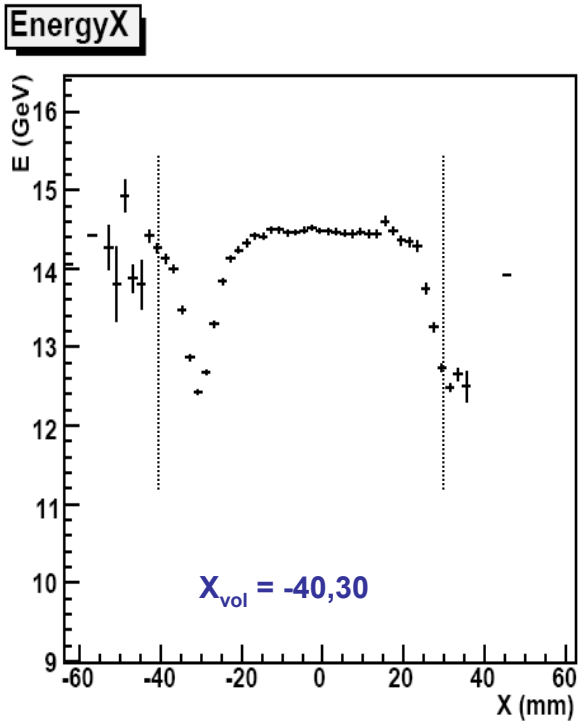
1. Electron selection based mainly on total energy deposit in ECAL

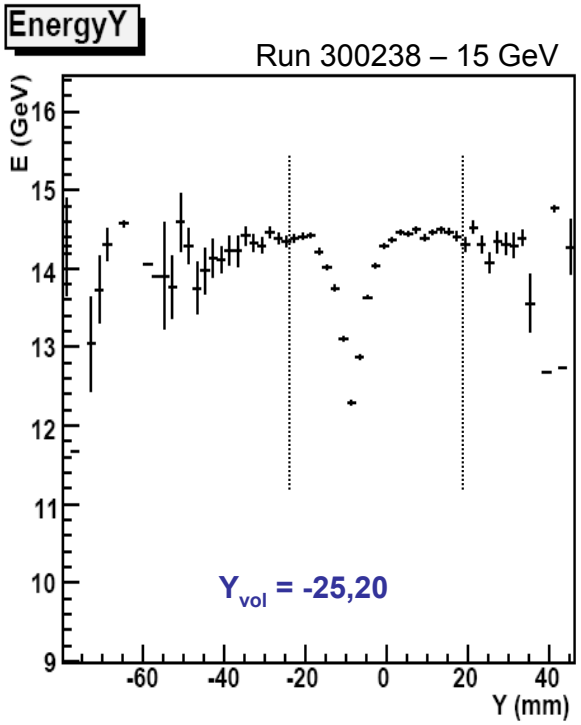


$$E_{\text{raw}} = \sum_{i=0}^{i=9} E_i + 2\sum_{i=10}^{i=19} E_i + 3\sum_{i=20}^{i=29} E_i$$

2. Rejection of the beam halo per run basis
3. Tracks outside the gaps
4. Showers well contained in ECAL
5. Rejection of electrons showering in front of ECAL

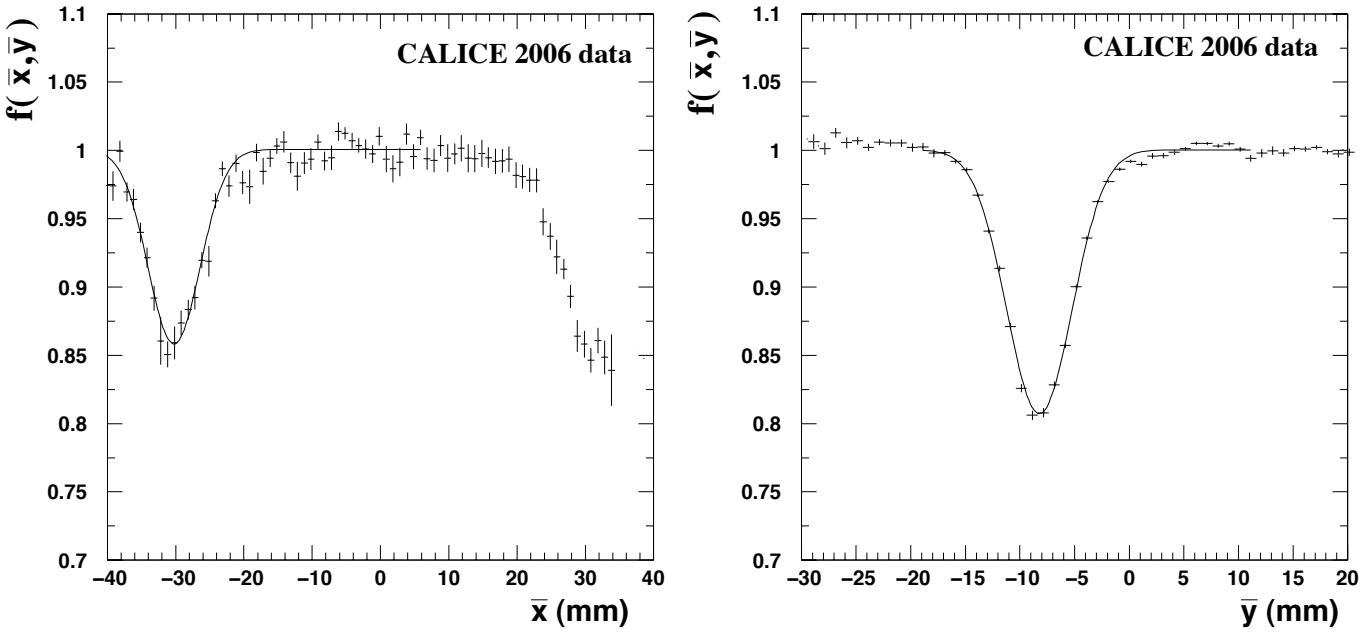
1. Electron selection based mainly on total energy deposit in ECAL
2. Rejection of the beam halo per run basis





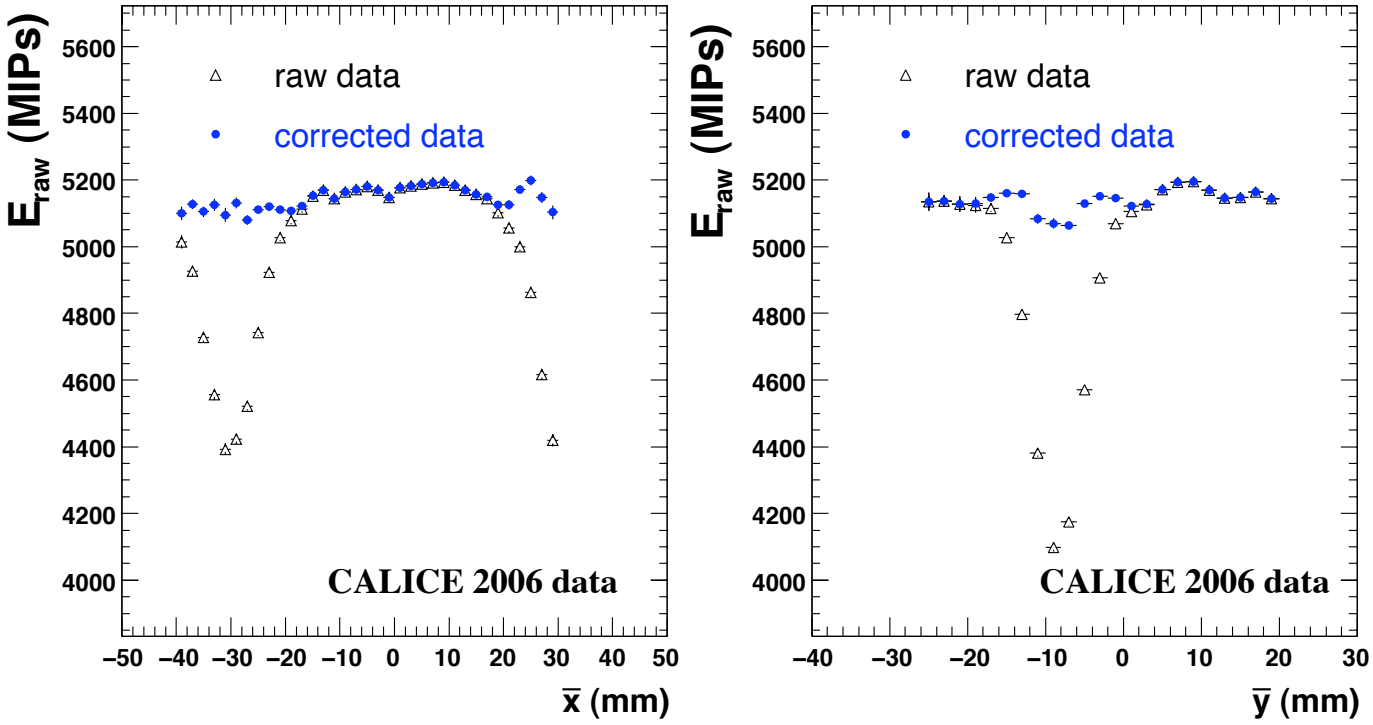
3. Tracks outside the gaps
4. Showers well contained in ECAL
5. Rejection of electrons showering in front of ECAL

1. Electron selection based mainly on total energy deposit in ECAL
2. Rejection of the beam halo per run basis
3. Tracks outside the gaps



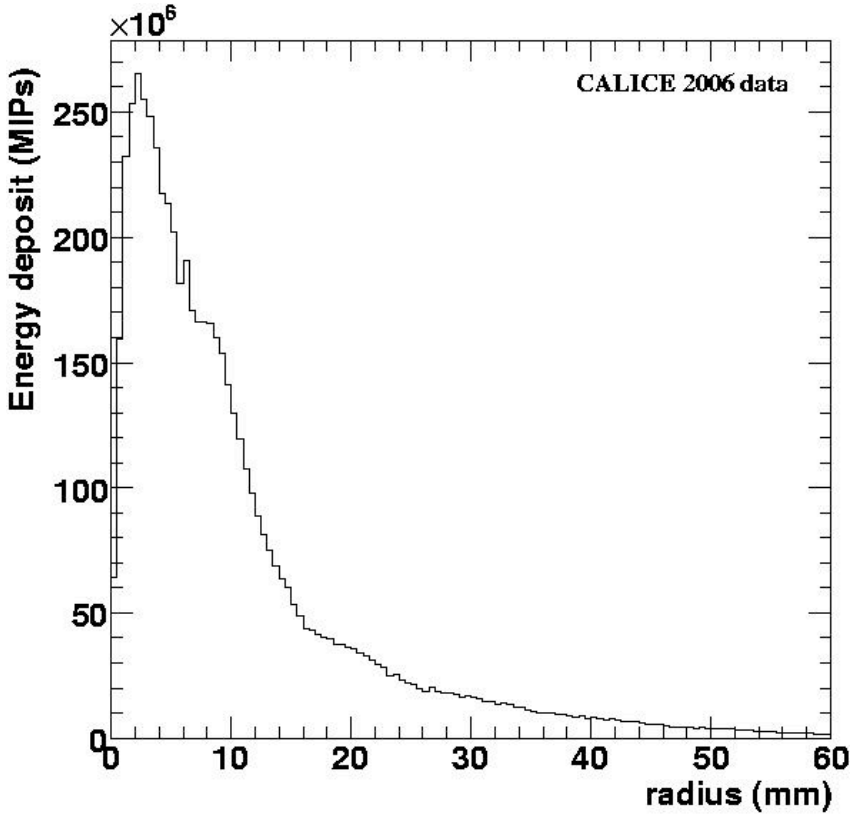
4. Showers well contained in ECAL
5. Rejection of electrons showering in front of ECAL

1. Electron selection based mainly on total energy deposit in ECAL
2. Rejection of the beam halo per run basis
3. Tracks outside the gaps



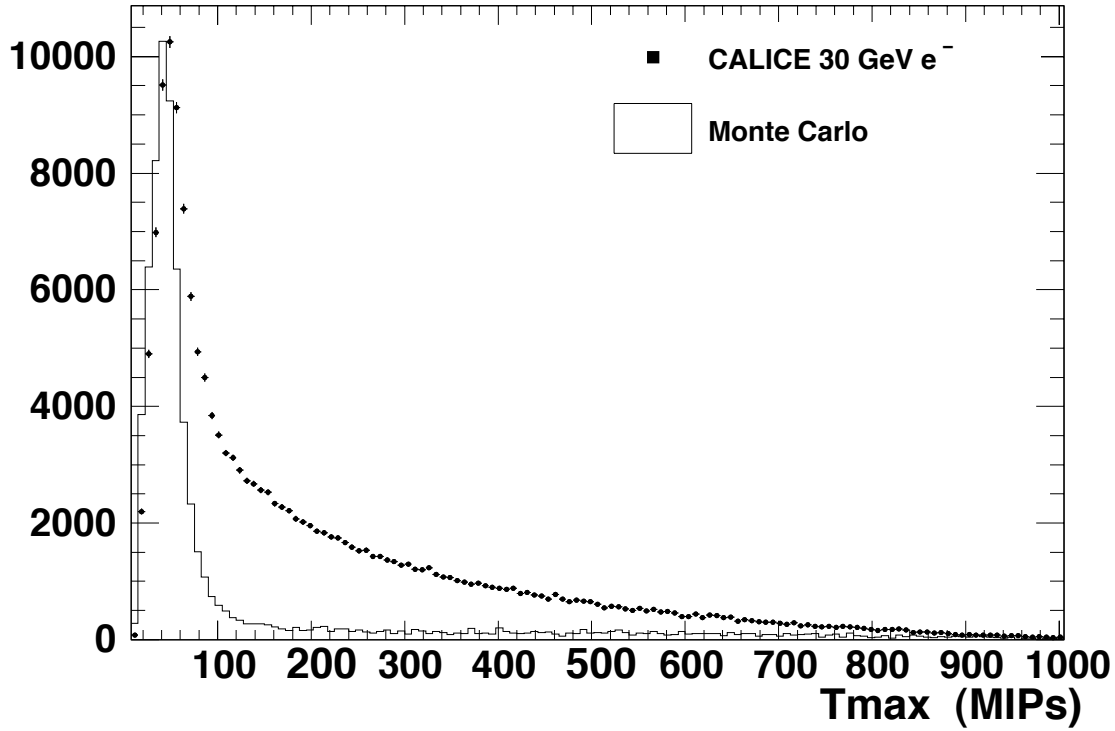
4. Showers well contained in ECAL
5. Rejection of electrons showering in front of ECAL

1. Electron selection based mainly on total energy deposit in ECAL
2. Rejection of the beam halo per run basis
3. Tracks outside the gaps
4. Showers well contained in ECAL



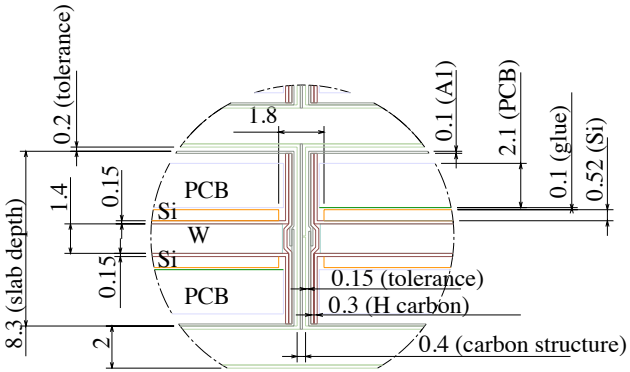
18. Rejection of electrons showering in front of ECAL

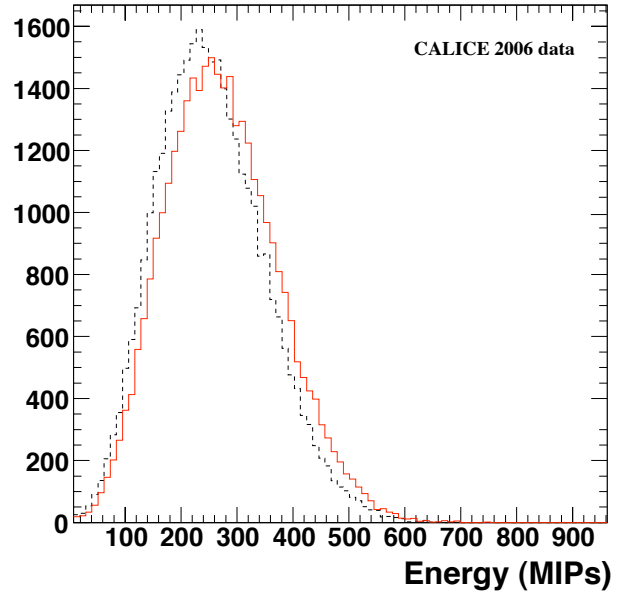
1. Electron selection based mainly on total energy deposit in ECAL
2. Rejection of the beam halo per run basis
3. Tracks outside the gaps
4. Showers well contained in ECAL
5. Rejection of electrons showering in front of ECAL

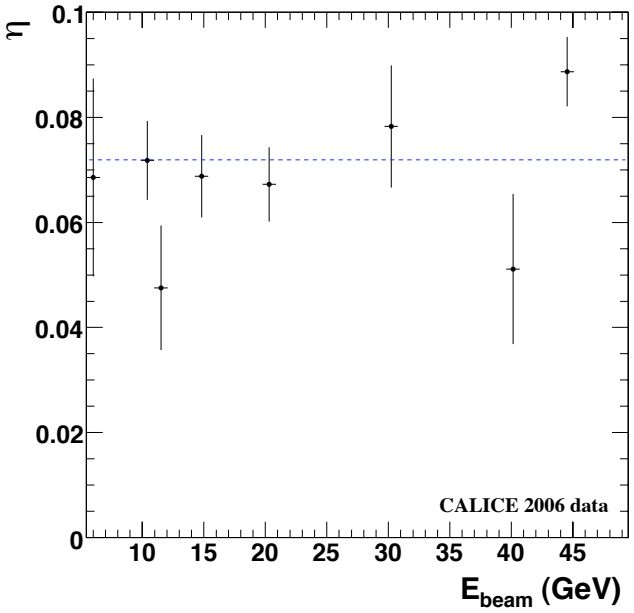


Statistics after selections (data/MC)

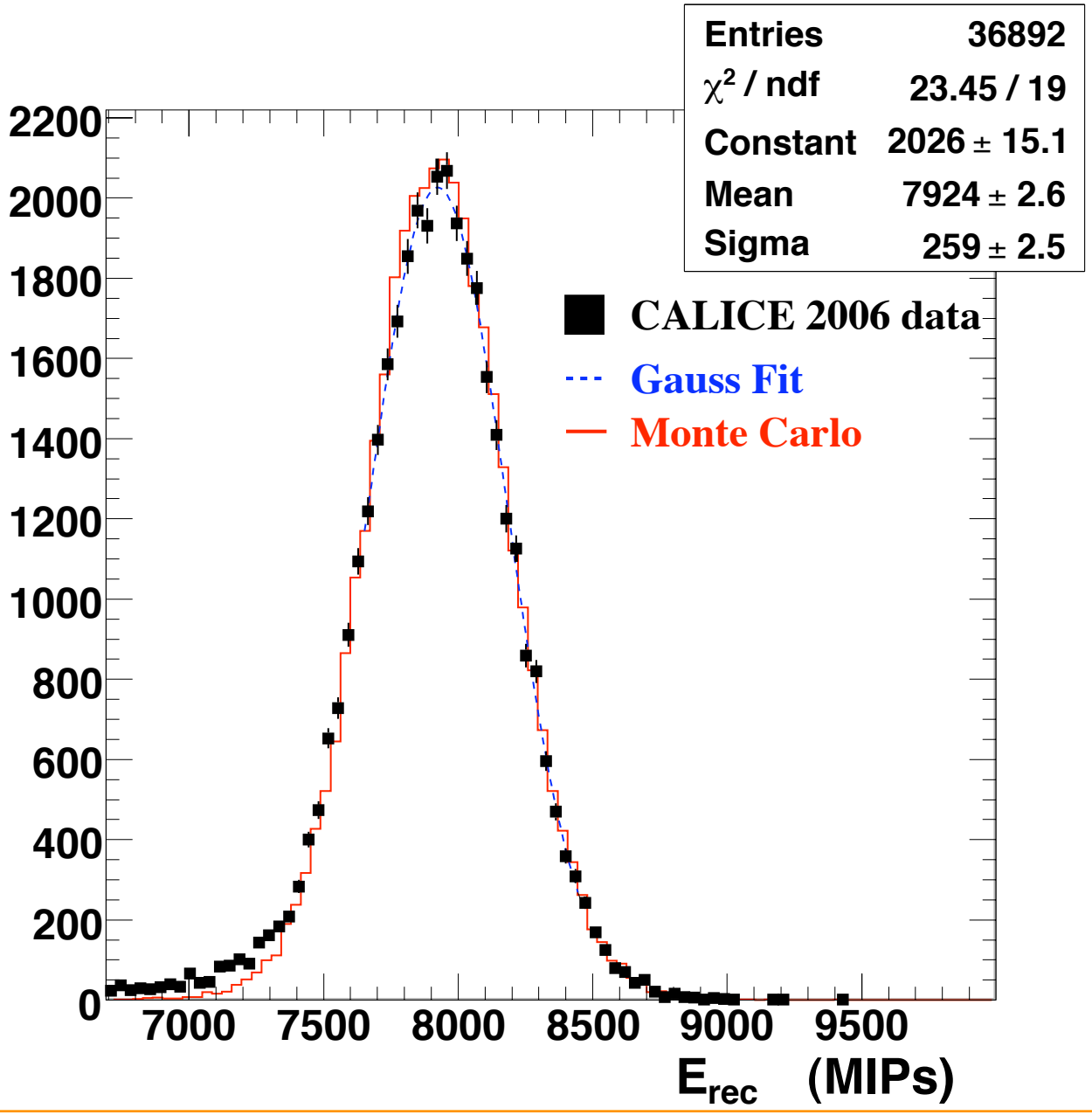
Energy (GeV)	particle	date	data statistics (kevts)	MC statistics (kevts)
6	e^-, e^+	Oct	9.5	83.2
10	e^-, e^+	Aug, Oct	43.1	80.3
12	e^-, e^+	Oct	27.2	72.8
15	e^-, e^+	Aug, Oct	51.4	70.3
20	e^-, e^+	Aug, Oct	67.7	56.2
30	e^-, e^+	Aug, Oct	42.3	55.2
40	e^-	Aug	22.9	67.8
45	e^-	Aug	108.6	108.8





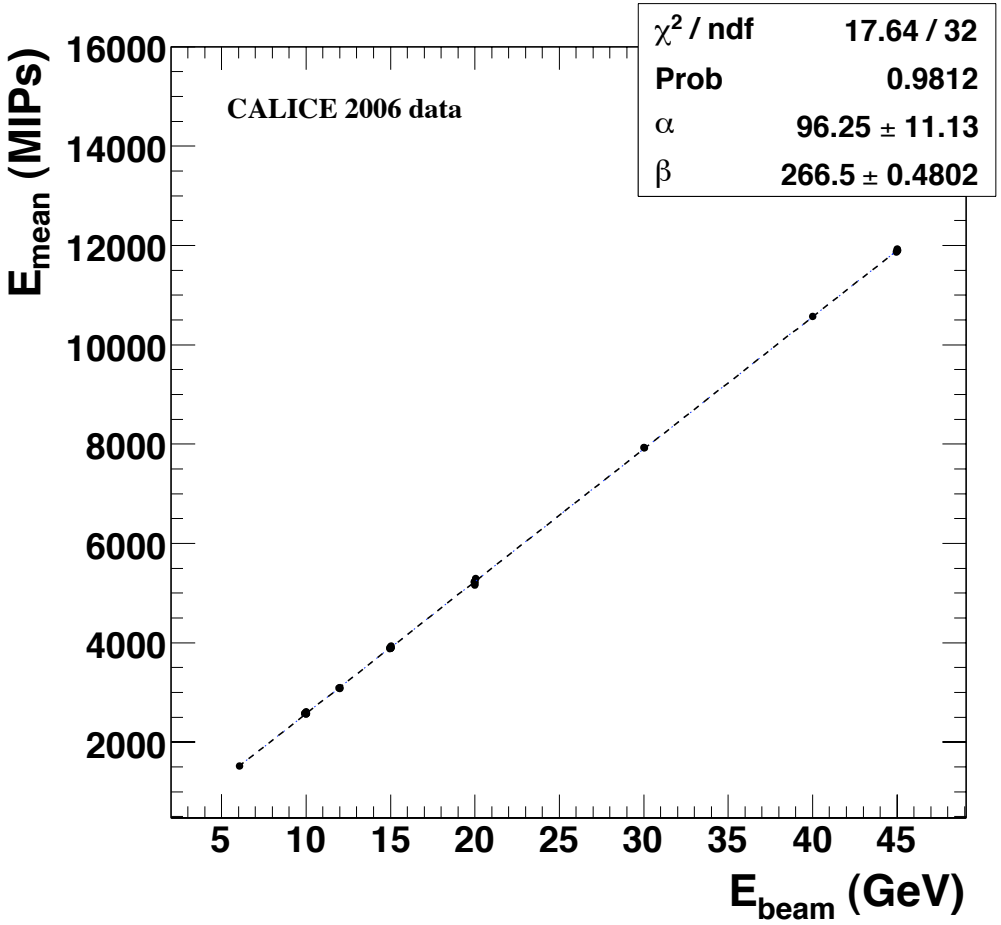


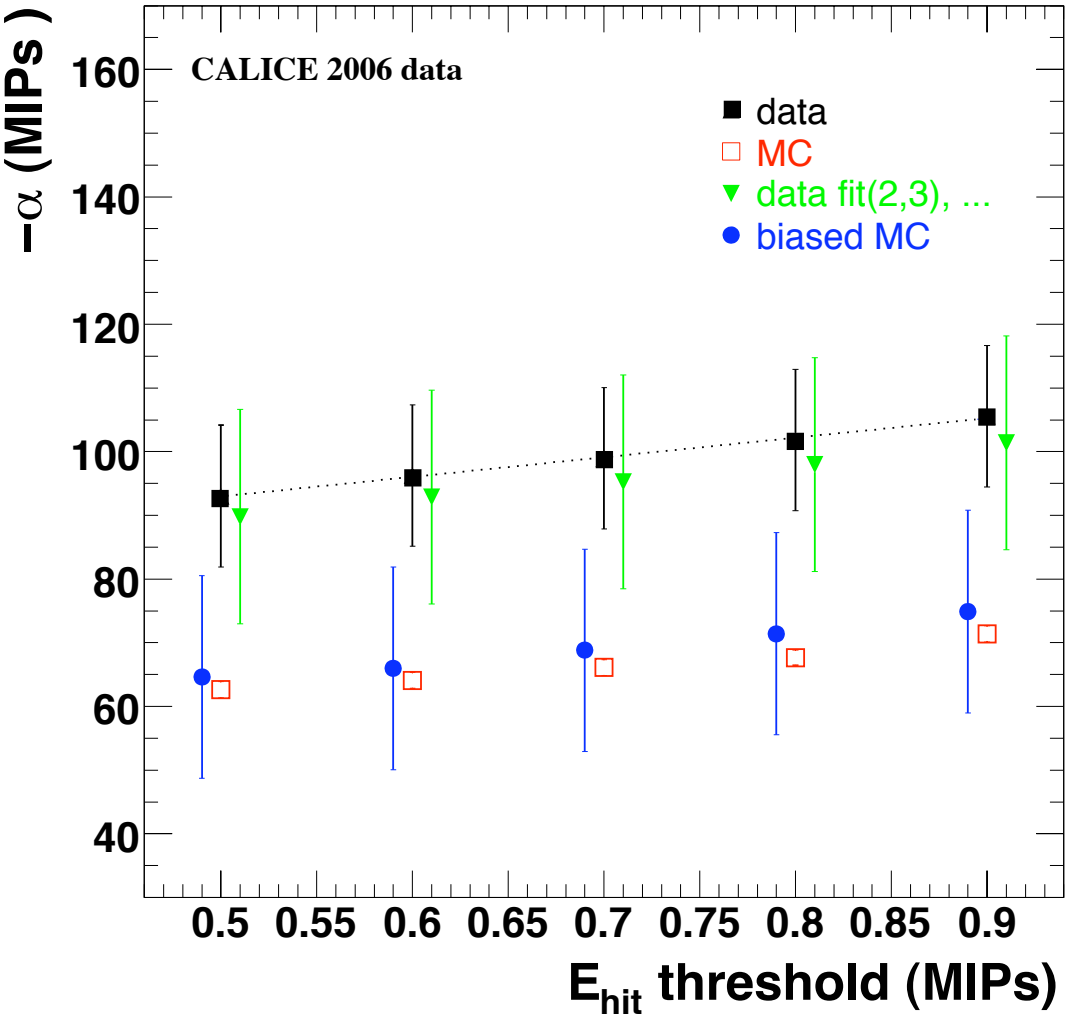
$$X_0^{\mathrm{W1}} \times \begin{pmatrix} 1 \\ 1+\alpha \\ 1 \\ 1+\alpha \\ \vdots \\ 1+\alpha \end{pmatrix} \begin{pmatrix} \alpha_{10} \\ \alpha_{10}+\alpha \\ \alpha_{10} \\ \alpha_{10}+\alpha \\ \vdots \\ \alpha_{10}+\alpha \end{pmatrix} \begin{pmatrix} \alpha_{20} \\ \alpha_{20}+\alpha \\ \alpha_{20} \\ \alpha_{20}+\alpha \\ \vdots \\ \alpha_{20}+\alpha \end{pmatrix}$$

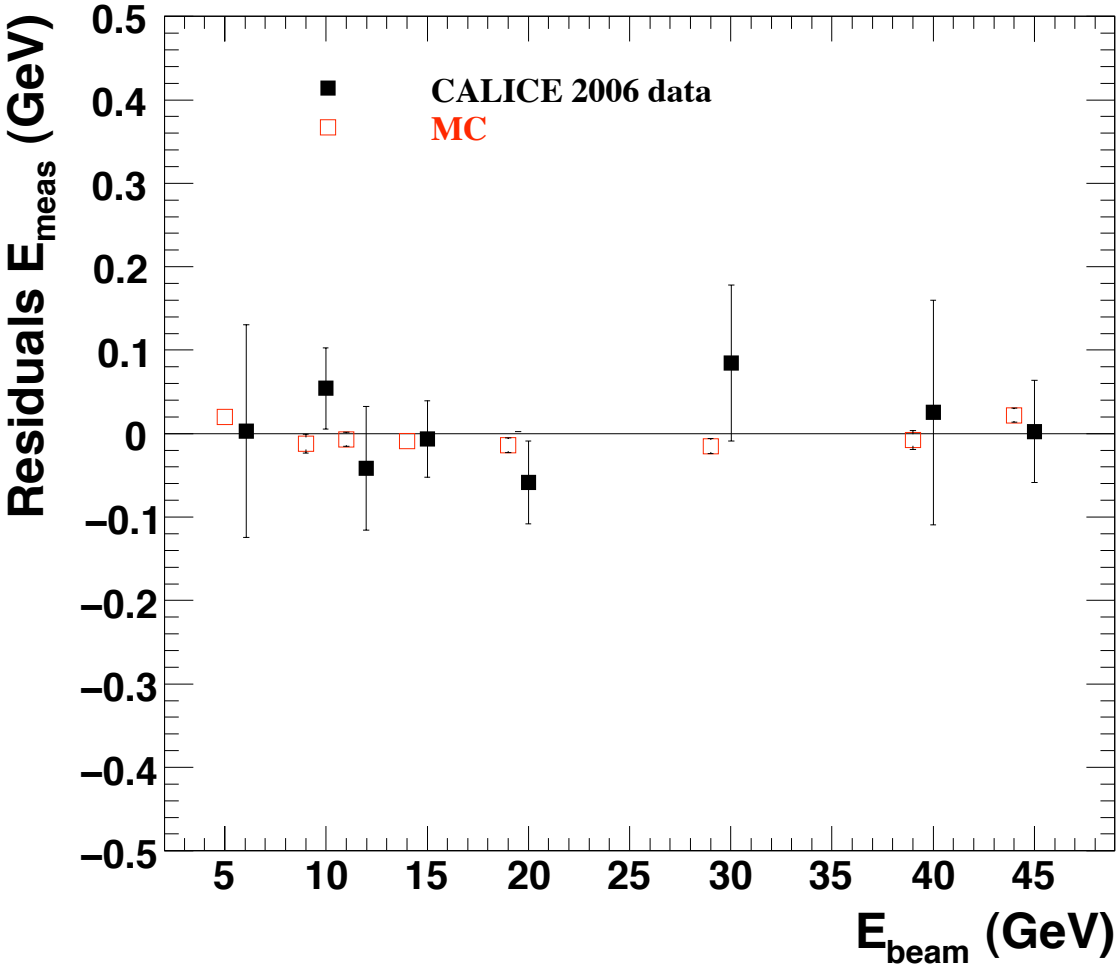

Entries 36892
χ² / ndf 23.45 / 19
Constant 2026 ± 15.1
Mean 7924 ± 2.6
Sigma 259 ± 2.5
CALICE 2006 data
Gauss Fit
Monte Carlo
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
7000
7500
8000
8500
9000
9500
E_rec (MIPs)

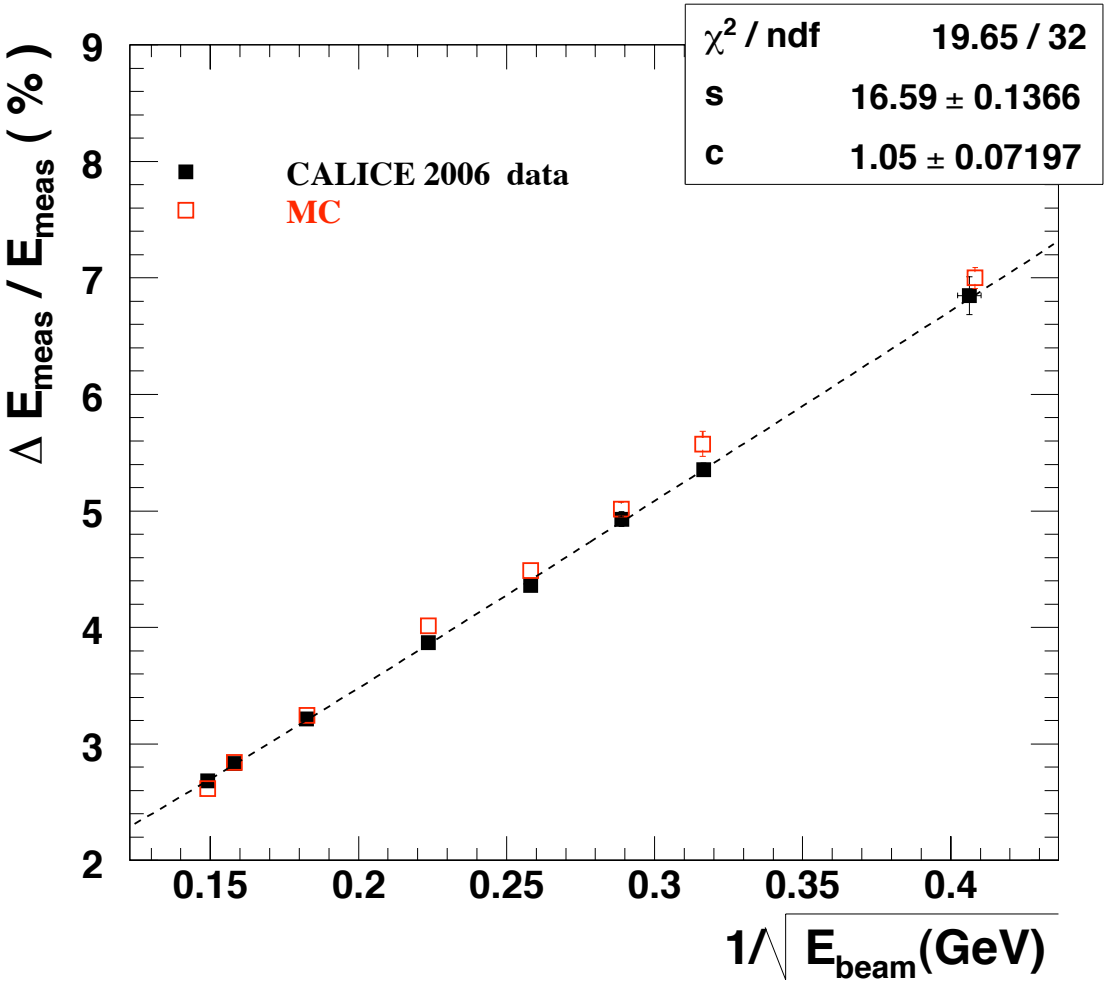
E_{mean} (MIPs) = -α + E_{beam}*β
and
E_{meas} = E_{mean} +α

$$\frac{\Delta E_{\text{beam}}}{E_{\text{beam}}} = \frac{0.12}{E_{\text{beam}}(\text{GeV})} \oplus 0.1\%$$




CALICE 2006 data
data
MC
data fit(2,3), ...
biased MC
−α (MIPs)
160
140
120
100
80
60
40
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9
E_hit threshold (MIPs)


CALICE 2006 data
MC
Residuals E_{meas} (GeV)
E_{beam} (GeV)
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4
−0.5
5
10
15
20
25
30
35
40
45



$$\frac{\Delta E}{E}(\%) = \frac{16.6 \pm 0.1}{\sqrt{E\,(\mathrm{GeV})}} \oplus (1.0 \pm 0.1)$$