

First Look at the Beam Test Data-MC

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Aim of the Study

- ▶ Compare data with the Stefano's MonteCarlo Production
- ▶ Try to understand where the disagreement in term of resolution come out
- ▶ Check how well we are simulating baseline oscillations

Sample

▶ Simulation:

- ▶ 2x2 cm² beam centered on the central crystal
- ▶ 0.7% spread on beam energy
- ▶ 1% error on intercalibration parameter
- ▶ Conversion parameter:
 - ▶ High Bias: 240 ADC = 194.3 MeV
 - ▶ Low Bias: 70 ADC = 194.3 MeV
- ▶ Baseline oscillations taken from frequency studies by M. Vignati

▶ Data:

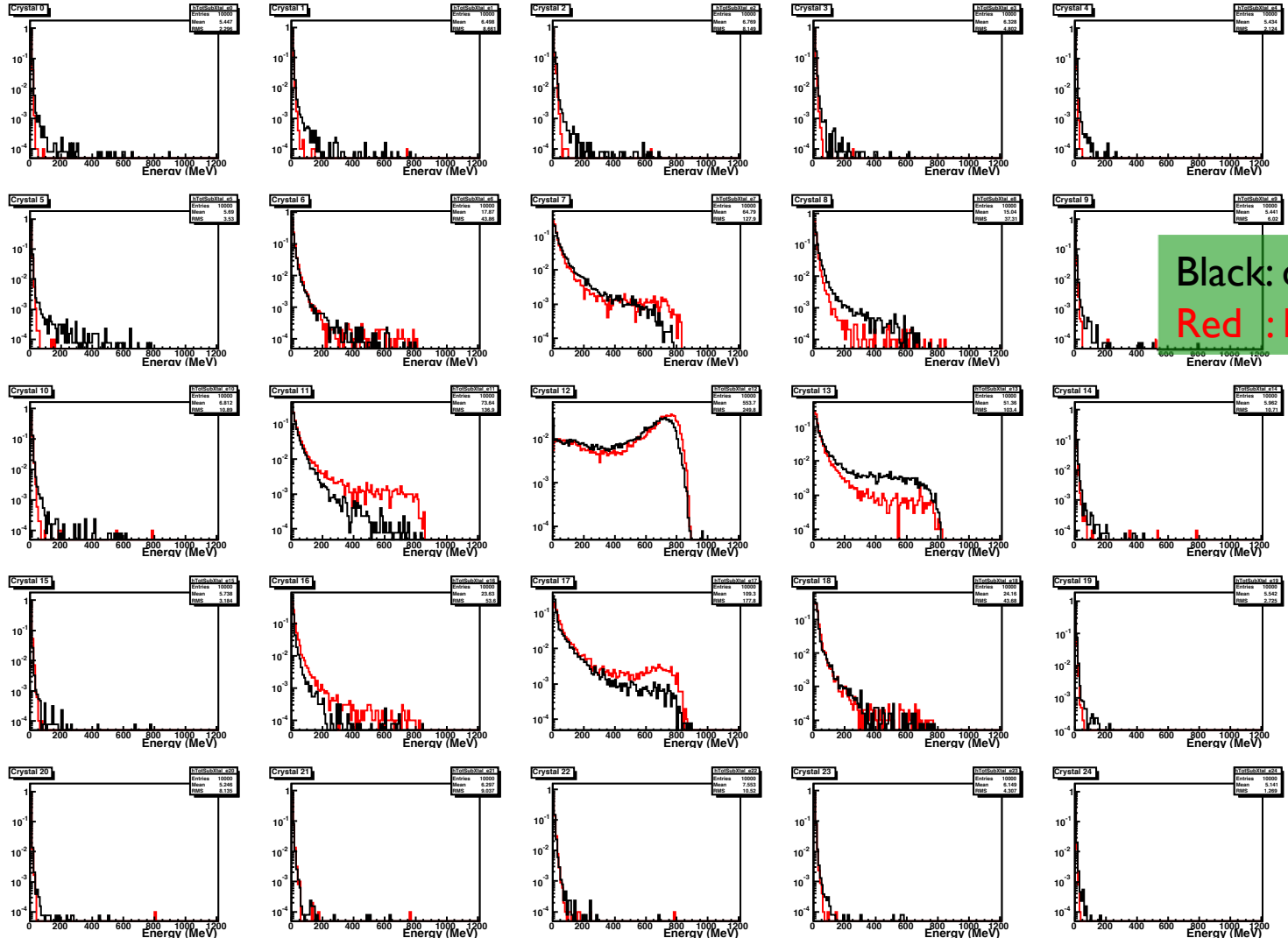
- ▶ Same conversion parameter of MC
- ▶ Intercalibration parameters calculated by Chih-hsiang

Selection

- ▶ Baseline calculated for each events using first 60 samples
- ▶ Look at Maximum Value in a windows of 25 samples (100ns)
 - ▶ Run < 328: 160-185
 - ▶ Run >328: 135-160
 - ▶ MC: 155-180
- ▶ Switch off crystal with $\text{MaxVal-Base} < 3 * \sigma_{\text{noise}}$
- ▶ Cherenkov requested

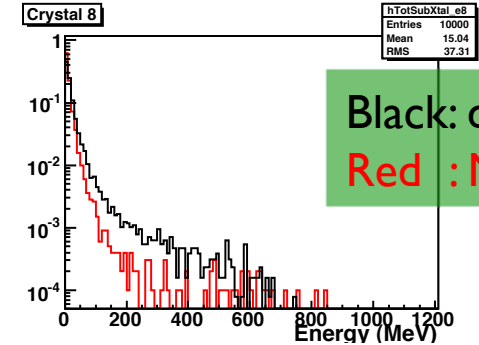
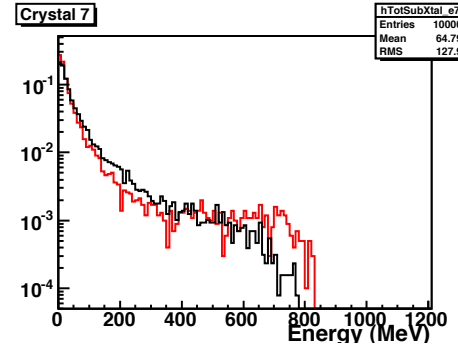
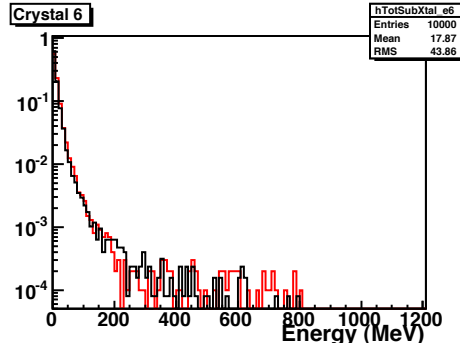
Crystal Energy Deposit

- ▶ 1 GeV
- ▶ HighBias
- ▶ Run350

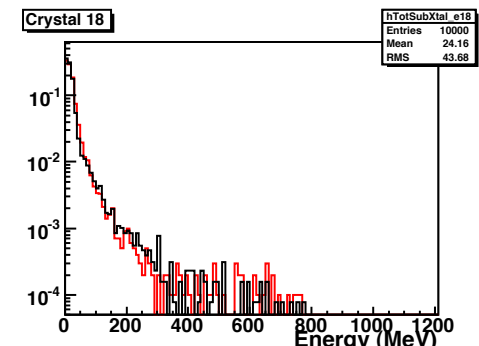
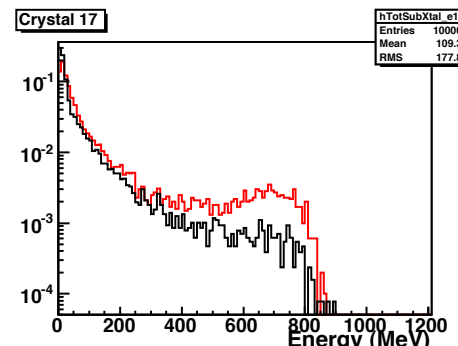
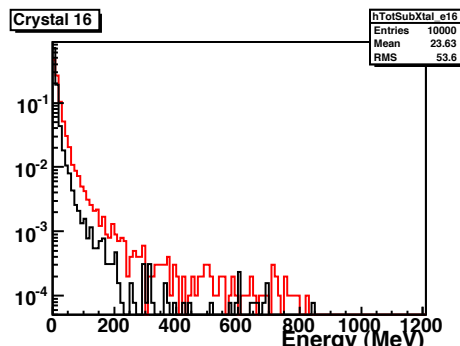
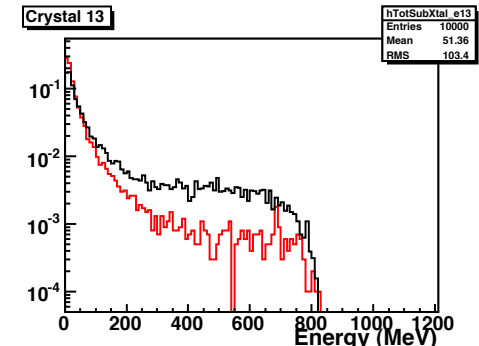
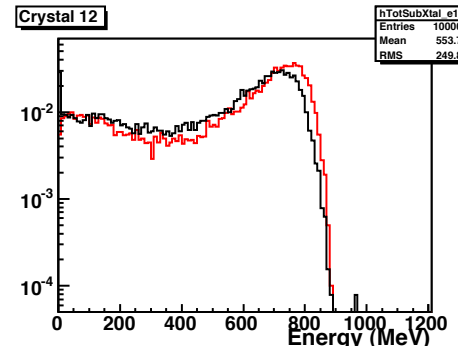
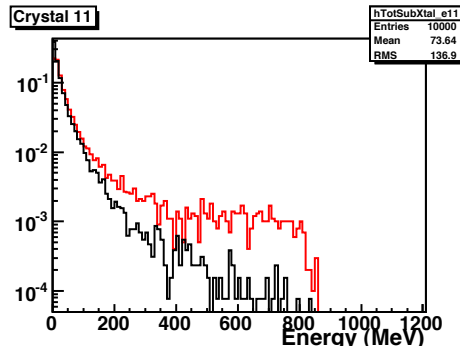


Crystal Energy Deposit

- ▶ 1 GeV
- ▶ HighBias
- ▶ Run350



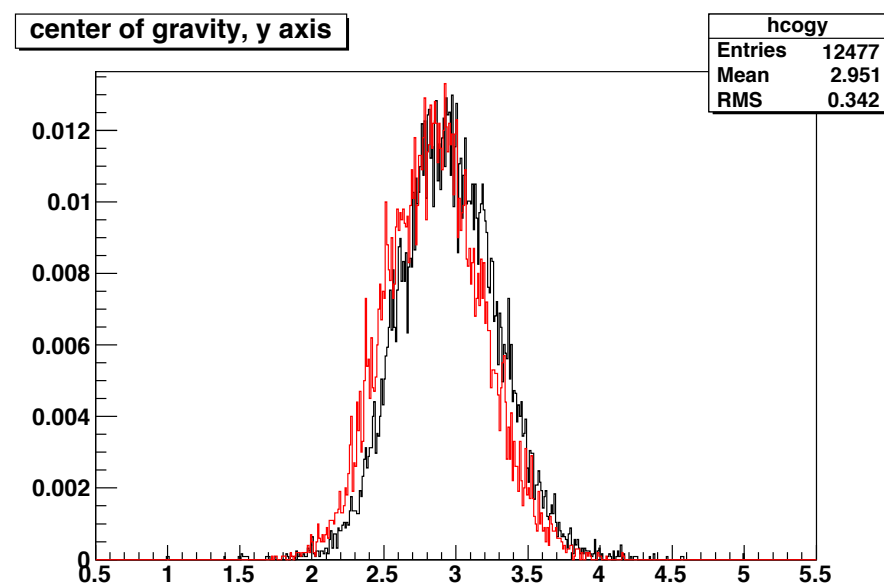
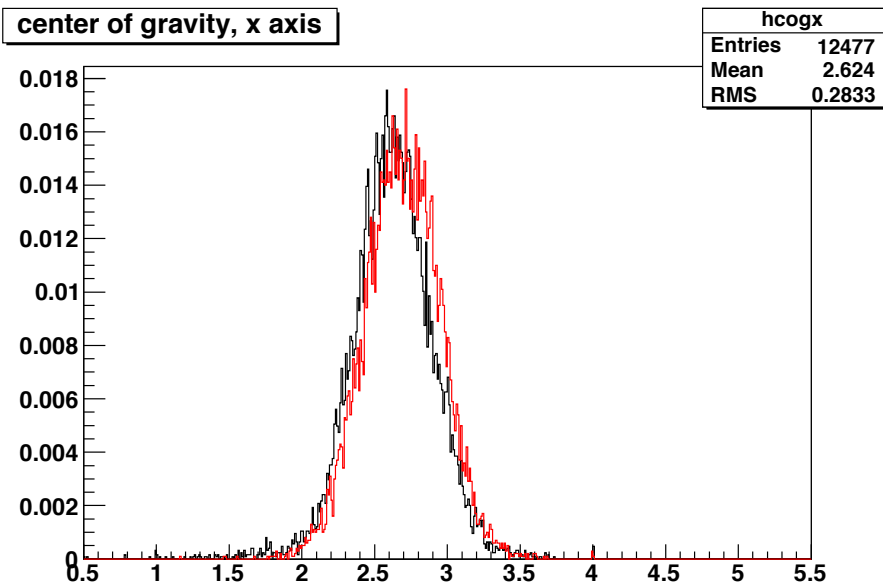
Black: data
Red : MC



Center of Gravity

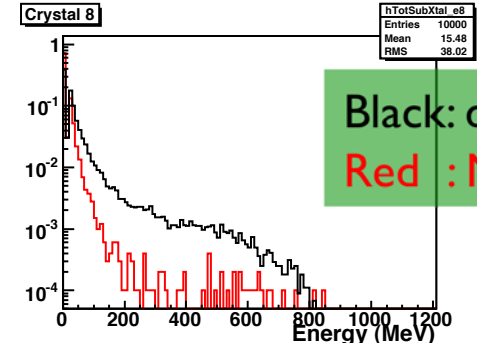
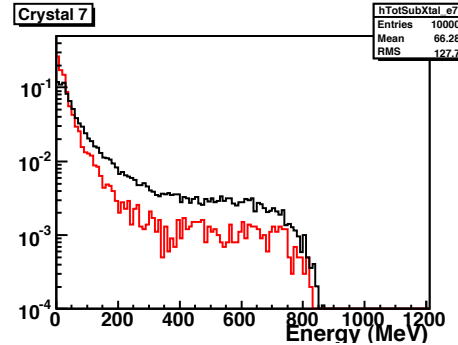
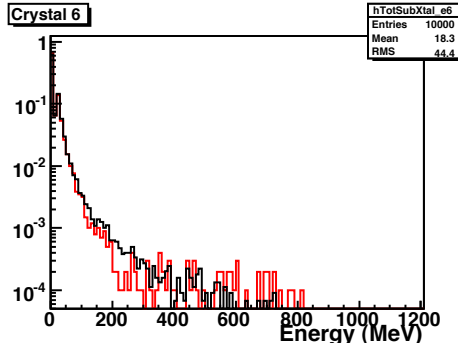
- ▶ Position (0,0) equal to the left bottom corner of the matrix

$$CoG_x = \frac{\sum_i crysIdx \cdot (4 + \log_{10}(\frac{E_i}{E_{tot}}))}{(4 + \log_{10}(\frac{E_i}{E_{tot}}))}$$

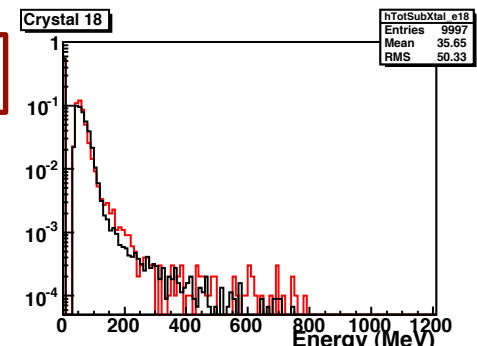
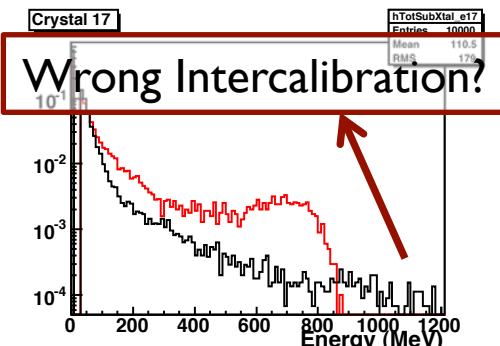
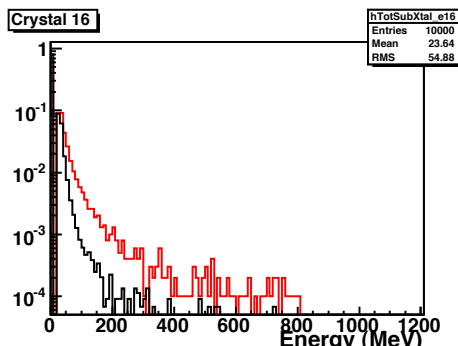
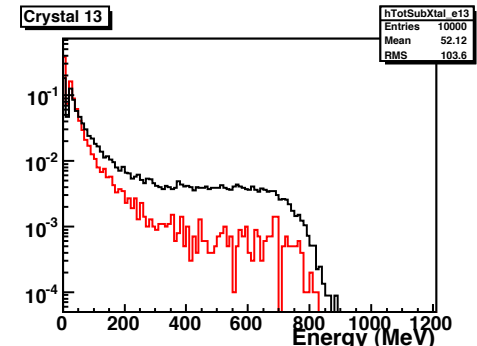
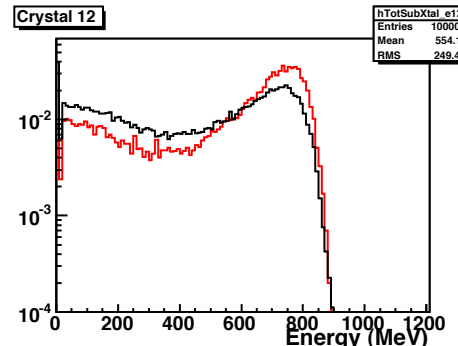
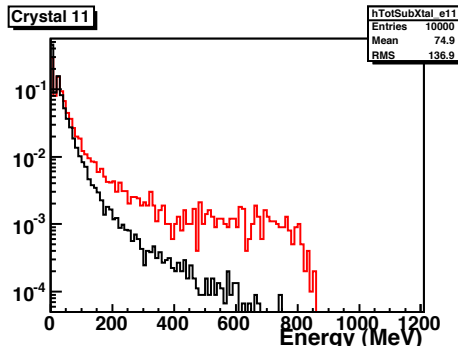


Crystal Energy Deposit

- ▶ 1 GeV
- ▶ LowBias
- ▶ Run279



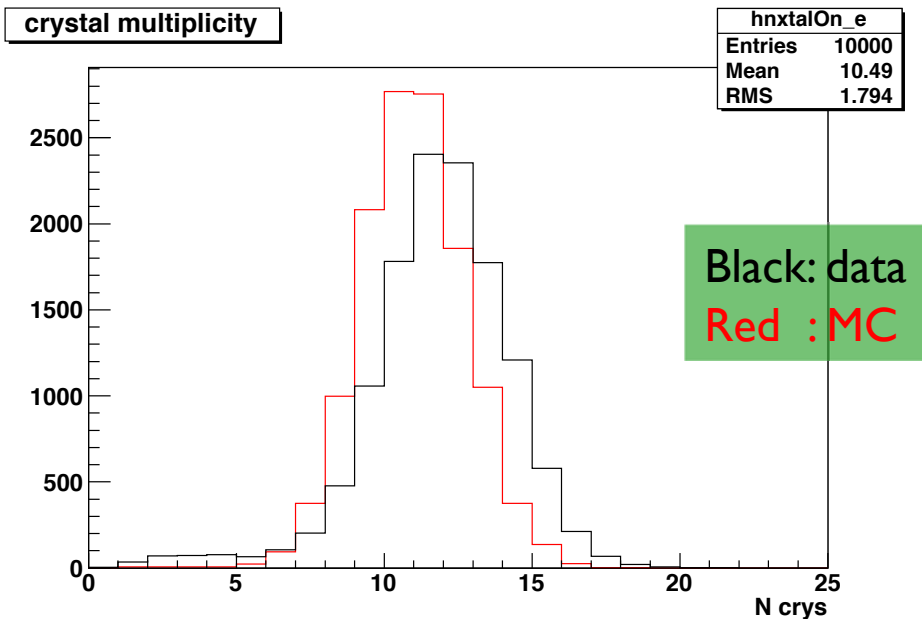
Black: data
Red : MC



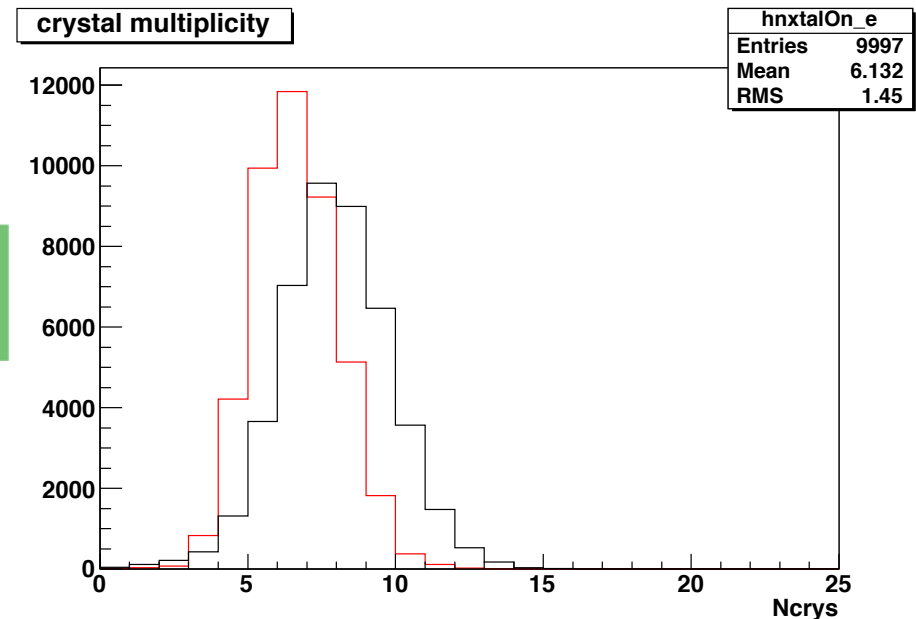
Crystals Multiplicity

- ▶ Number of crystal with a signal maximum value greater than 6 ADC counts ($3 \cdot \sigma_{\text{noise}}$)

- ▶ 1 GeV HighBias



- ▶ 1 GeV LowBias

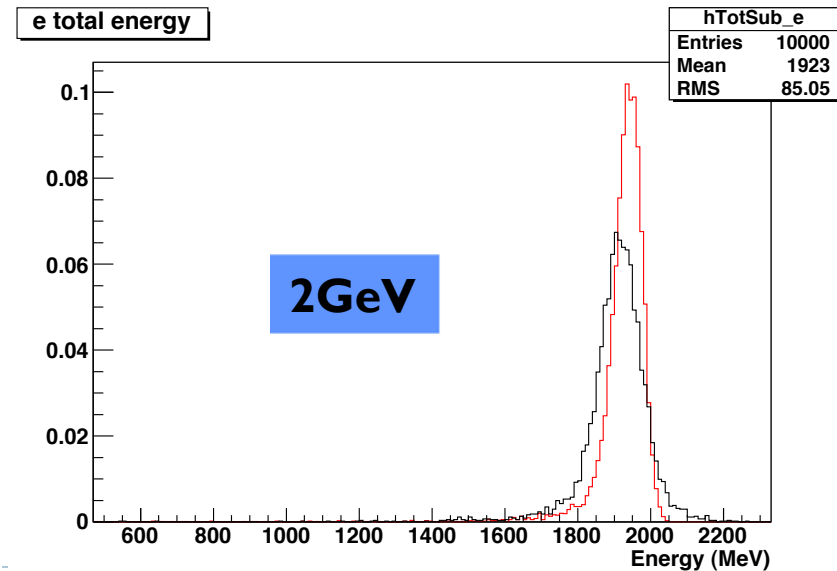
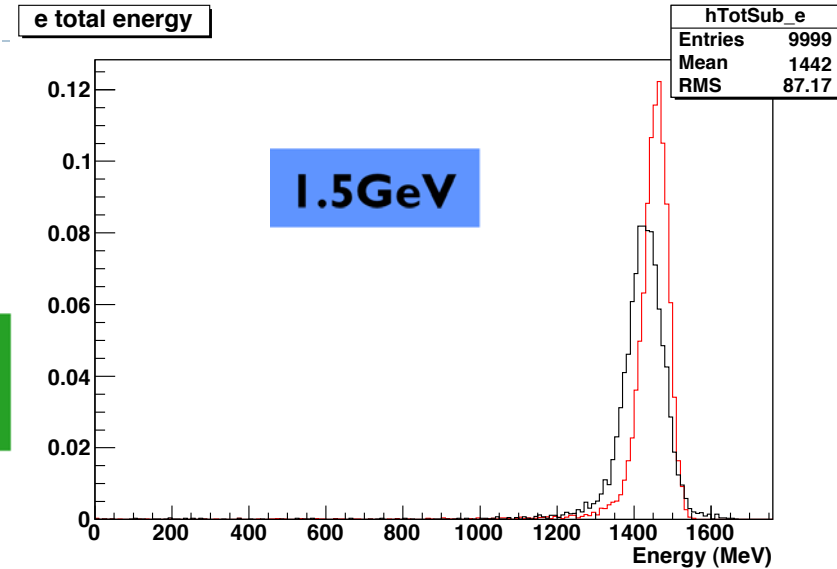
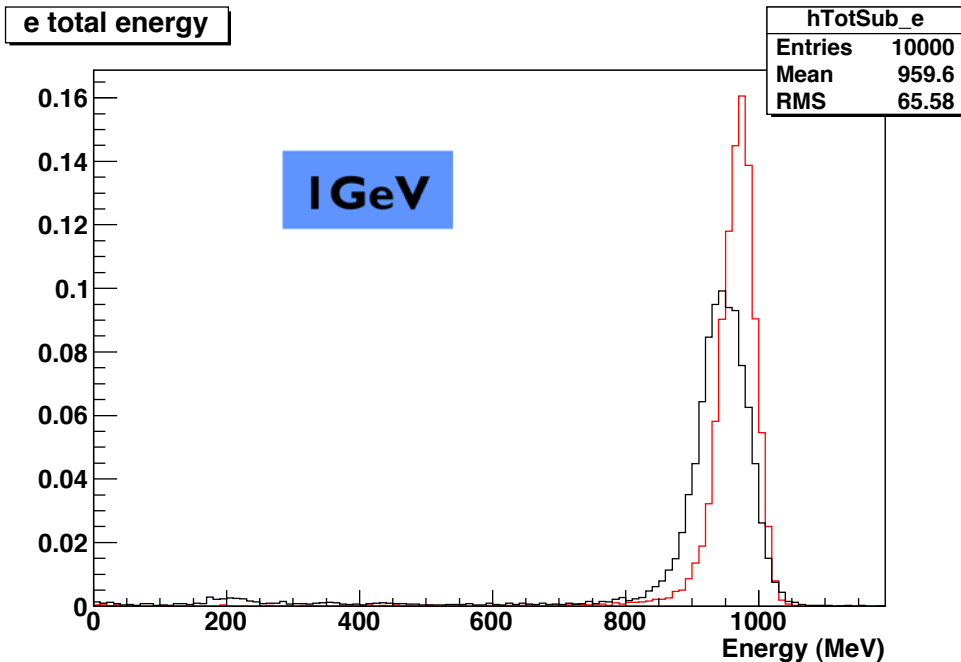


Total Energy (High Bias)

▶ Total Energy Deposit

- ▶ 1 GeV: Run350
- ▶ 1.5 GeV: Run437
- ▶ 2 GeV: Ru441

Black: data
Red : MC

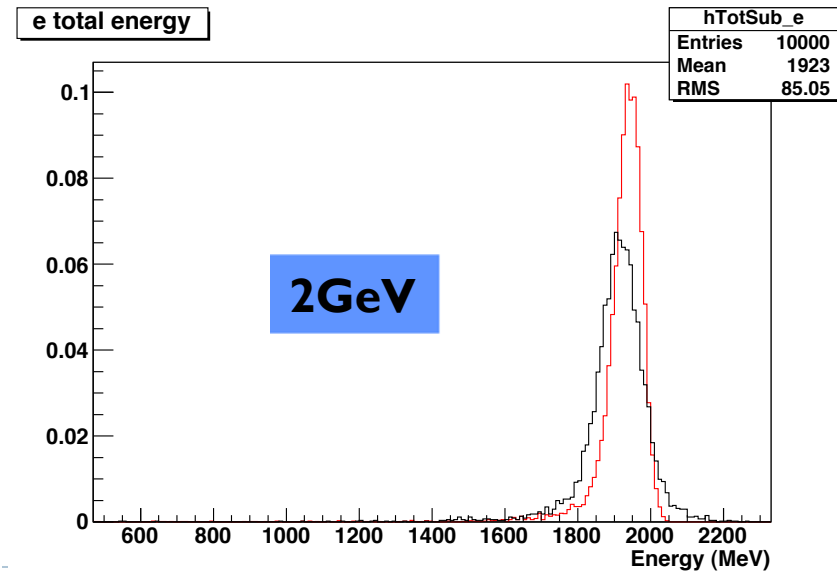
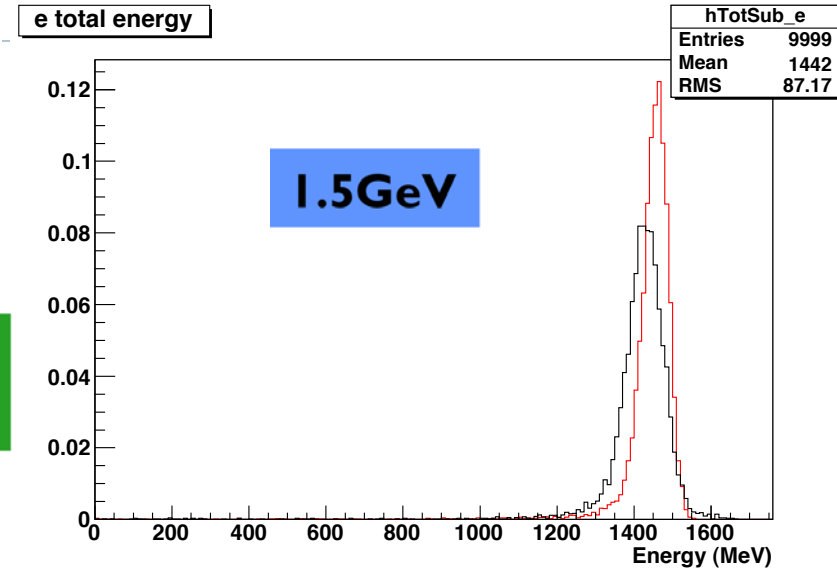
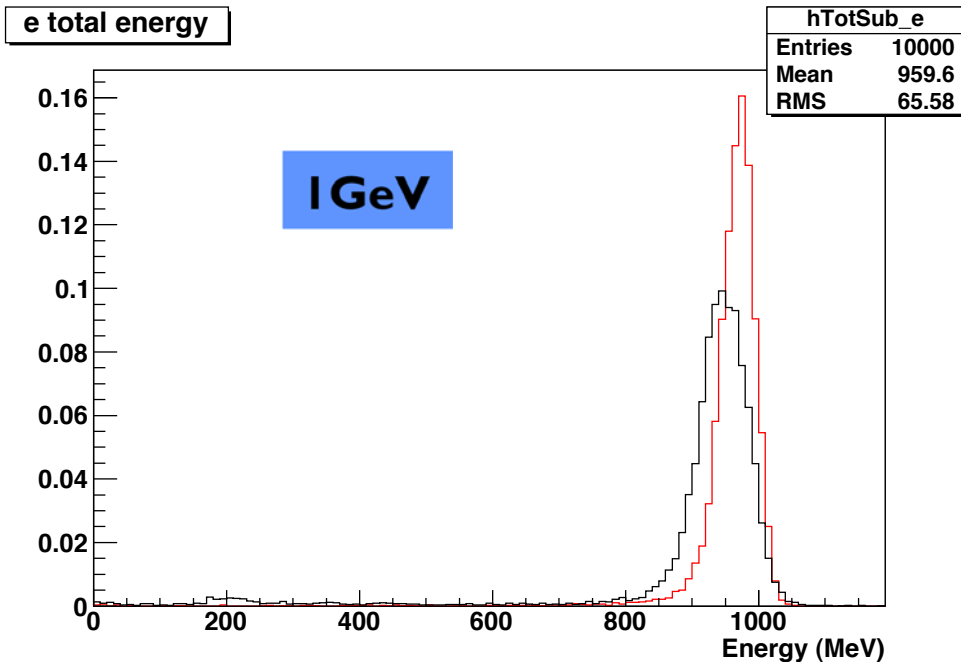


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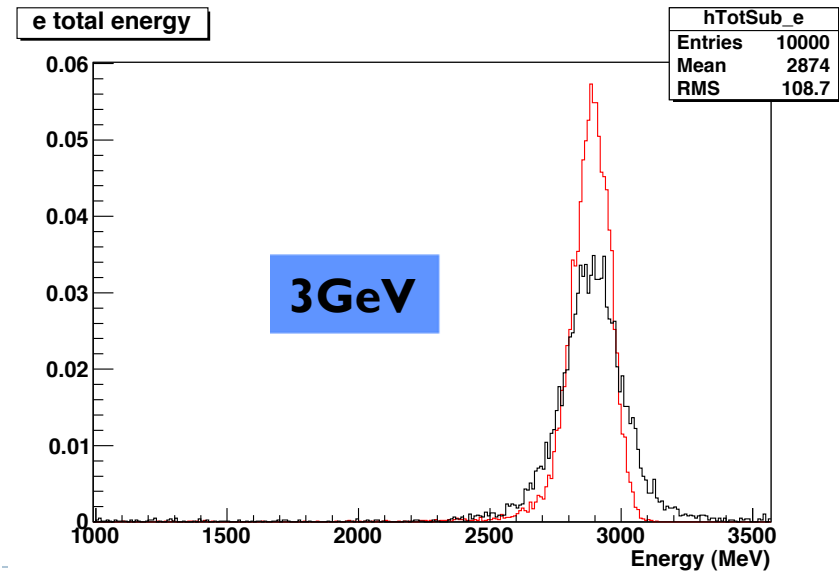
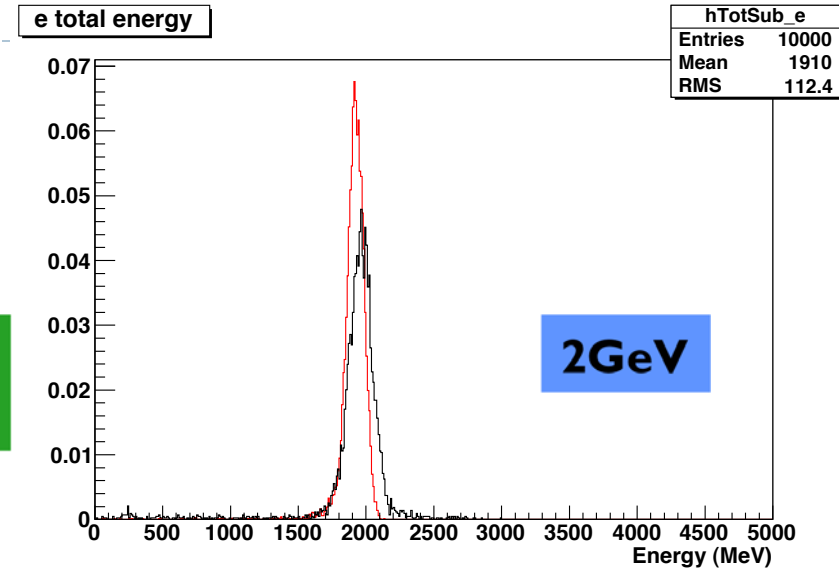
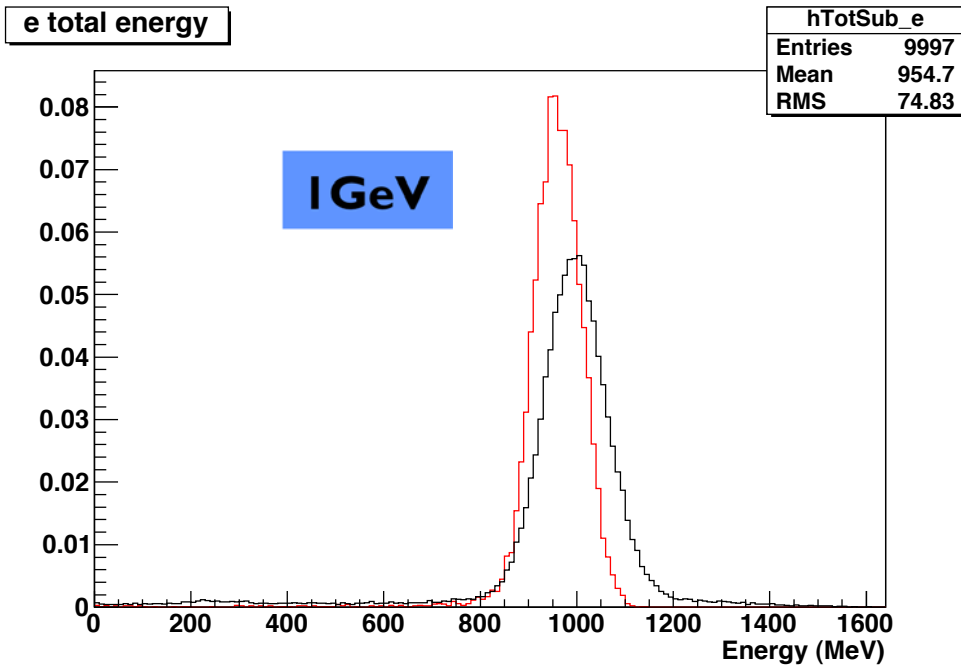


Total Energy (Low Bias)

▶ Total Energy Deposit

- ▶ 1 GeV: Run279
- ▶ 2 GeV: Run441
- ▶ 3 GeV: Ru333

Black: data
Red : MC



Temperature Studies

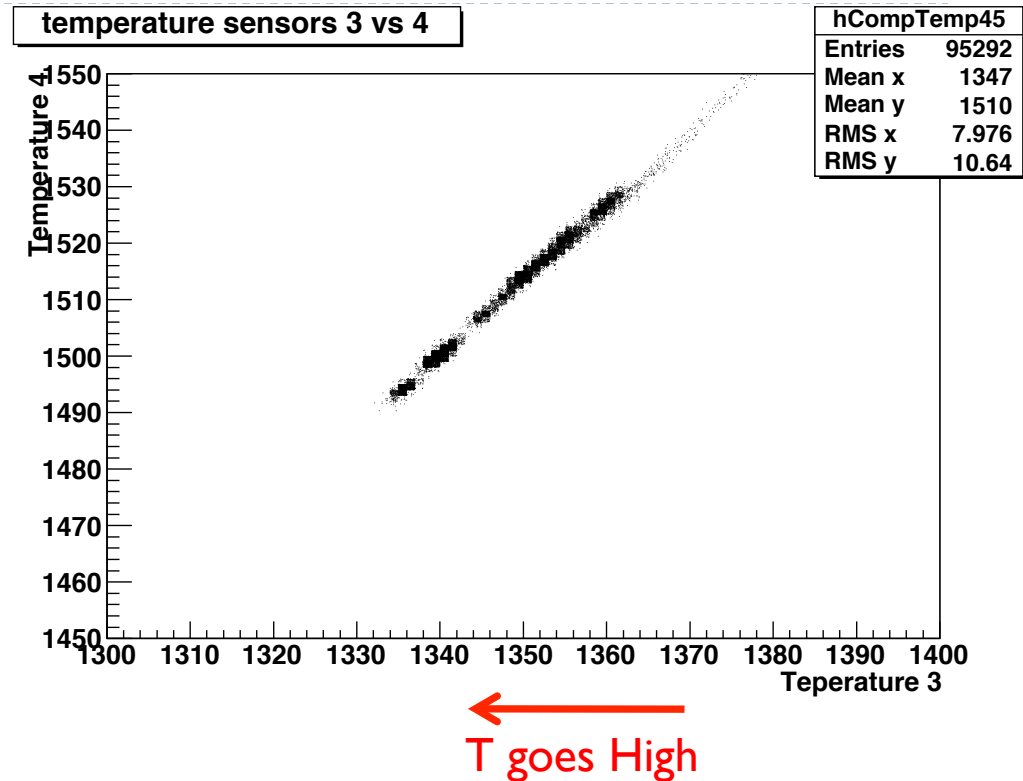
- ▶ 5 temperature sensors
- ▶ 2 works properly (0 and 1)
- ▶ The other 3 goes in the opposite direction
- ▶ This is not important because we are interested to DeltaT

	Ring 6	Ring 7	Ring 8	Ring 9	Ring 10
Shaper 0 PIN	Sipat 13	Sipat 7-4	Sipat 12	SG X	SG X
Shaper 1 APD	Sipat 14	Sipat 7-3	SG 005-3	SG X	SG X
Shaper 2 APD	Sipat 17	Sipat 18	Sipat 11	SG X	SG X
Shaper 3 APD	Sipat 15	Sipat 19	SG 005-4	SG X	SG X
Shaper 4 APD	Sipat 16	Sipat 7-5	Sipat L9	SG X	SG X

Sensor 0
Sensor 1
Sensor 2
Sensor 3
Sensor 4

Comparison between sensors

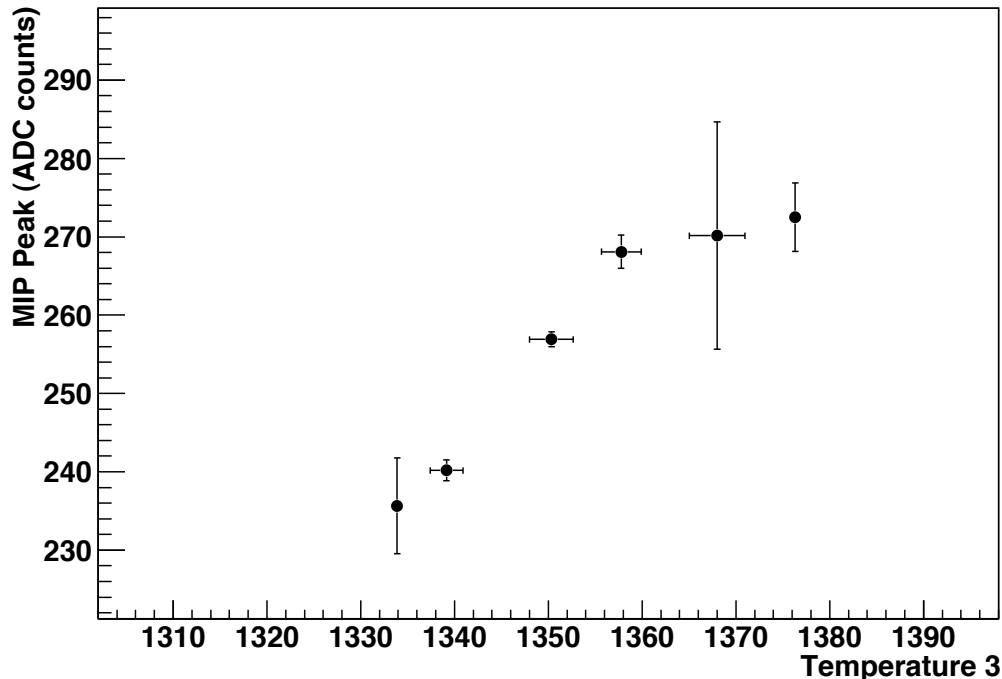
- ▶ For this studies we use the sensor 3 which is in the central position
- ▶ The other sensor are (as expected) in linear correlation with the sensor 3
- ▶ Sensor Response : $1^{\circ}\text{C}/10\text{mV}$
- ▶ ADC: $1\text{ADC}\sim 1\text{mV}$



APD Gain Vs temperature

- ▶ We use all the run at 1 GeV
- ▶ Data divided in temperature interval
- ▶ Temperature interval 10 ADC \sim 1°C

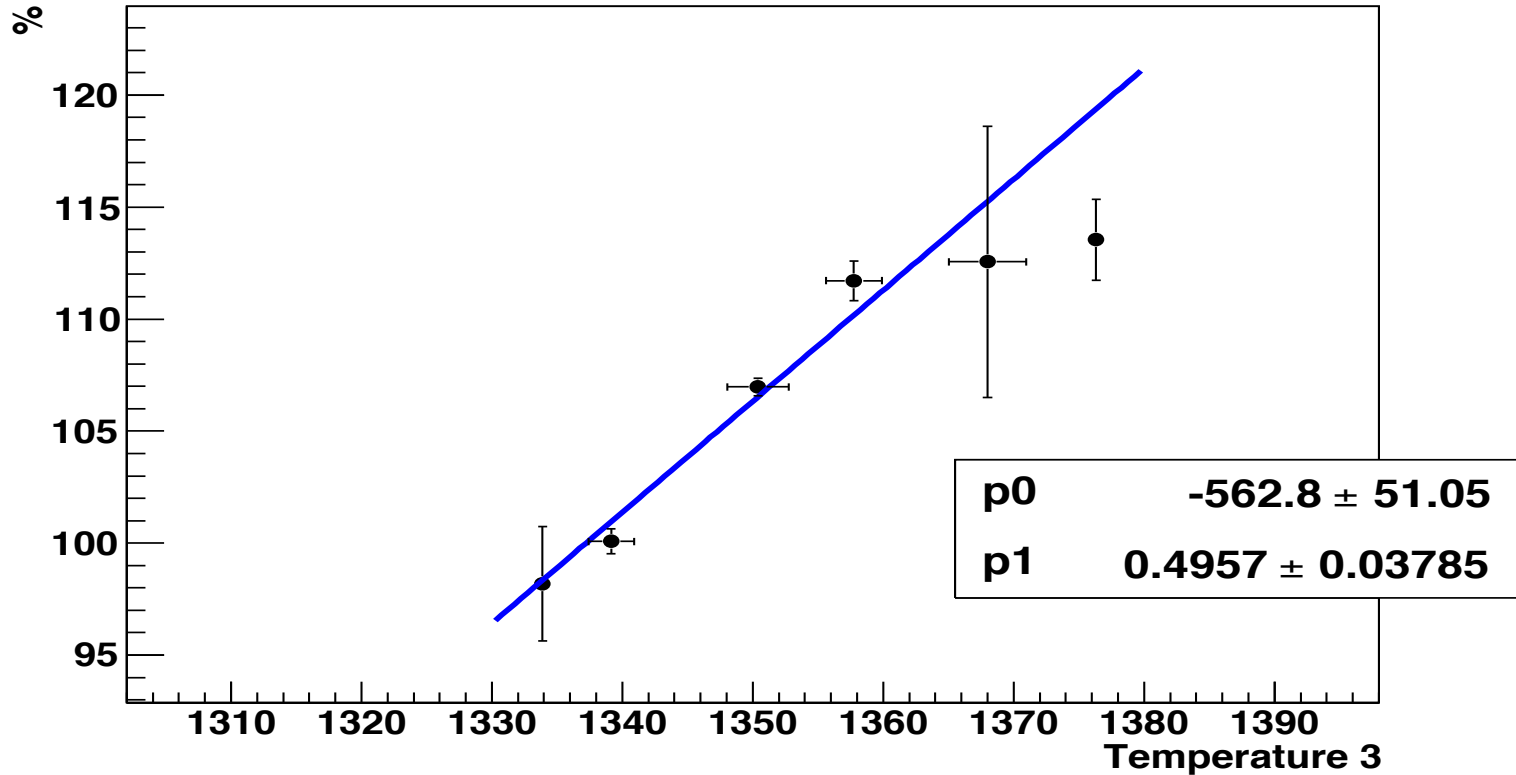
MIP Peak vs Temperature



- ▶ We choiche as normalization a value for the MIP peak of 240 ADC counts

APD Gain Vs temperature

APD Gain vs Temperature



▶ This correspond to: $\frac{1}{G} \frac{dG}{dT} \sim (-4.96 \pm 0.38)\%/^{\circ}C$

Conclusions

▶ Data/MC

- ▶ We are not far to find the correct simulation parameter
- ▶ But more work is needed to understand where the difference between data and MC come from
- ▶ For the Low Gain we have to try to improve the intercalibration

▶ APD Gain temperature dependency

- ▶ We find a value of $\sim -5\%/^{\circ}\text{C}$, higher than the -2% from literature
- ▶ Now we have to optimize intercalibration and resolution measurement with an event-by-event temperature correction