DATA-MC energy comparison at TOFWALL
and
TOFWALL-VTX track matching studies

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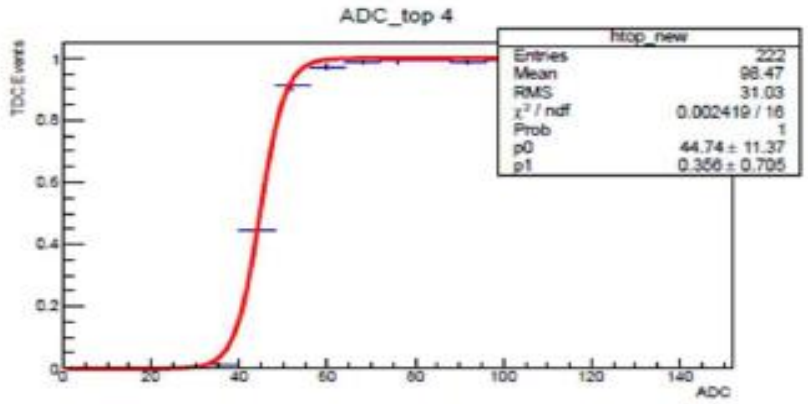
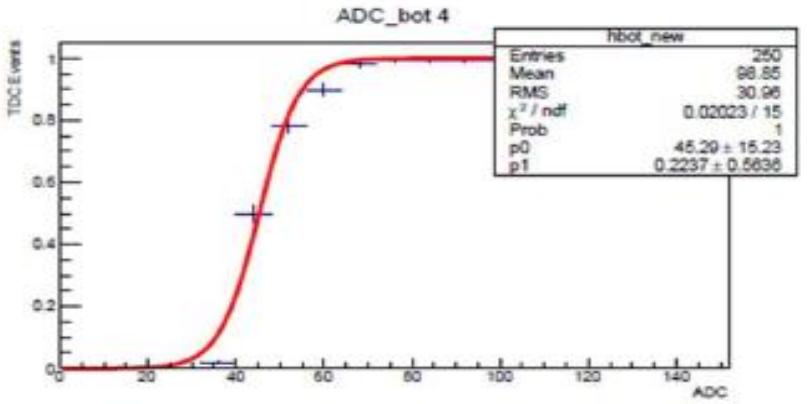
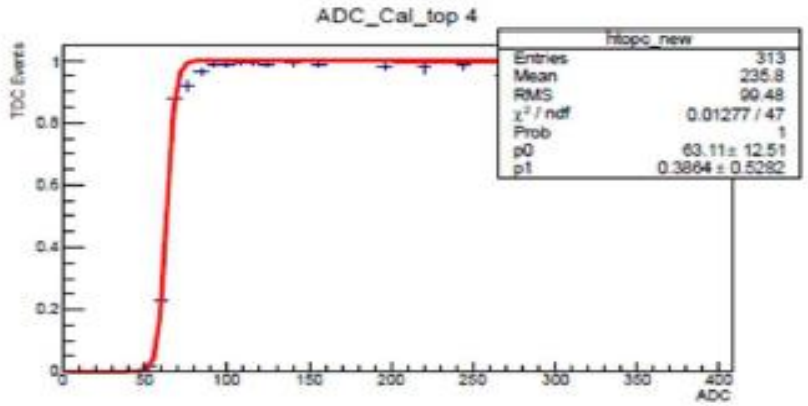
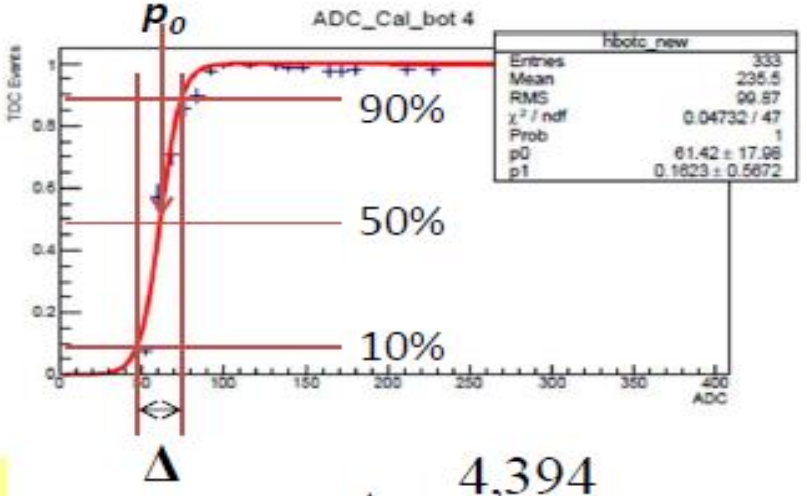
Study on minimum energy detection on TOFWALL

Probability to have a TDC hit as a function of the counts of the corresponding ADC (ADC raw counts with pedestals subtracted)







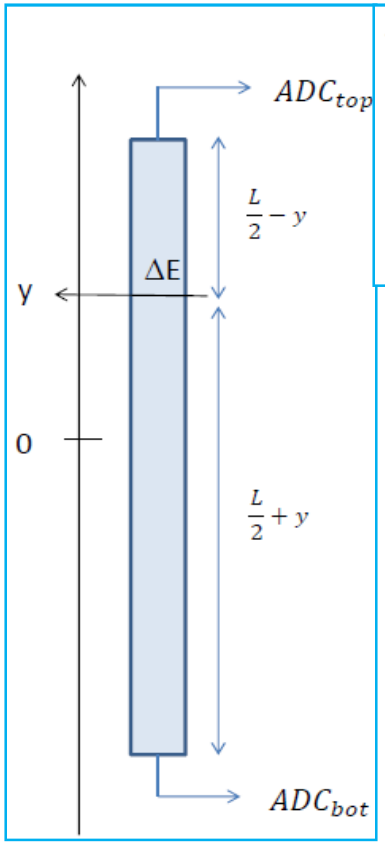


Fitted with: $$\varepsilon = \frac{1}{1+\exp(-p_1 \cdot (ADC_{counts} - p_0))}$$

$$\Delta = \frac{4{,}394}{p_1}$$

Estimated from data and implemented in montecarlo

Minimum energy detection (needed to trigger TDC hit)



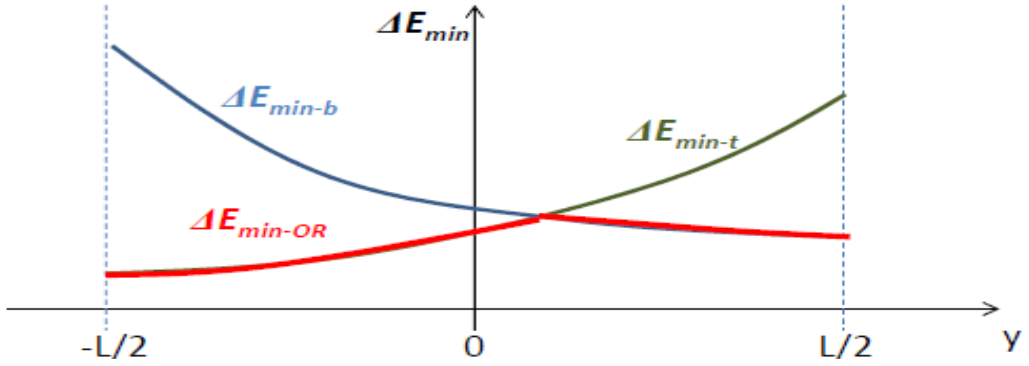
The minimum energy to be released by a particle in the TOF to have a TDC hit are:

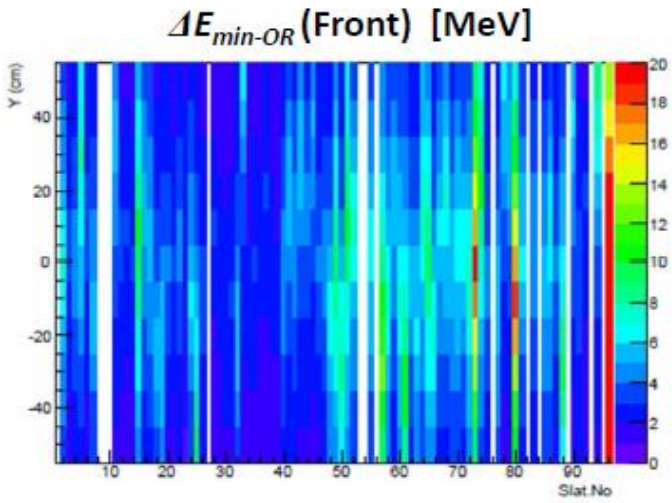
$$\Delta E_{min-t}(y) = k_t \cdot \min(ADC_{top}) \cdot e^{-\lambda y} \qquad \text{for the TDC-top}$$

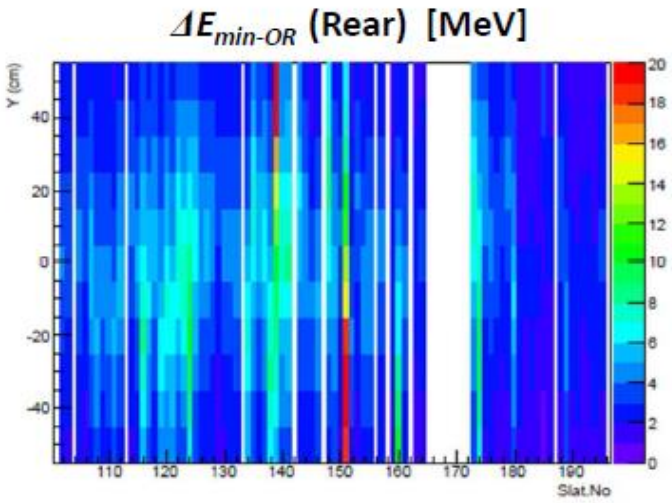
$$\Delta E_{min-b}(y) = k_b \cdot \min(ADC_{bot}) \cdot e^{\lambda y} \qquad \text{for the TDC-bottom}$$

$$\Delta E_{min-OR} = \min(\Delta E_{min-t}, \Delta E_{min-b})$$

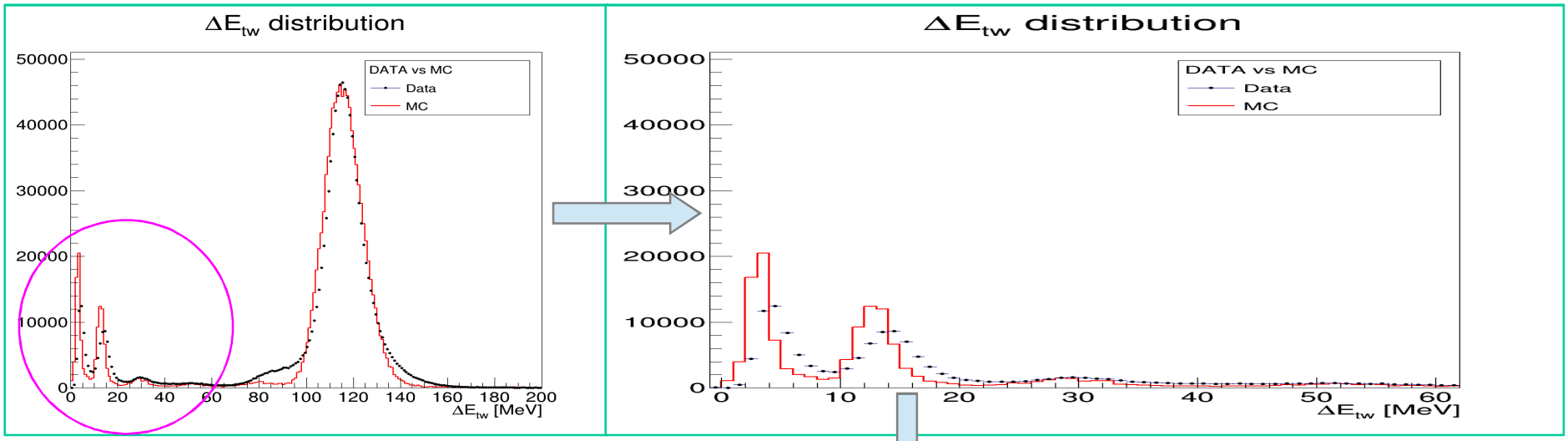
With single channel calibration only one TDC can be used to measure the TOF and y, complimented from the two ADCs



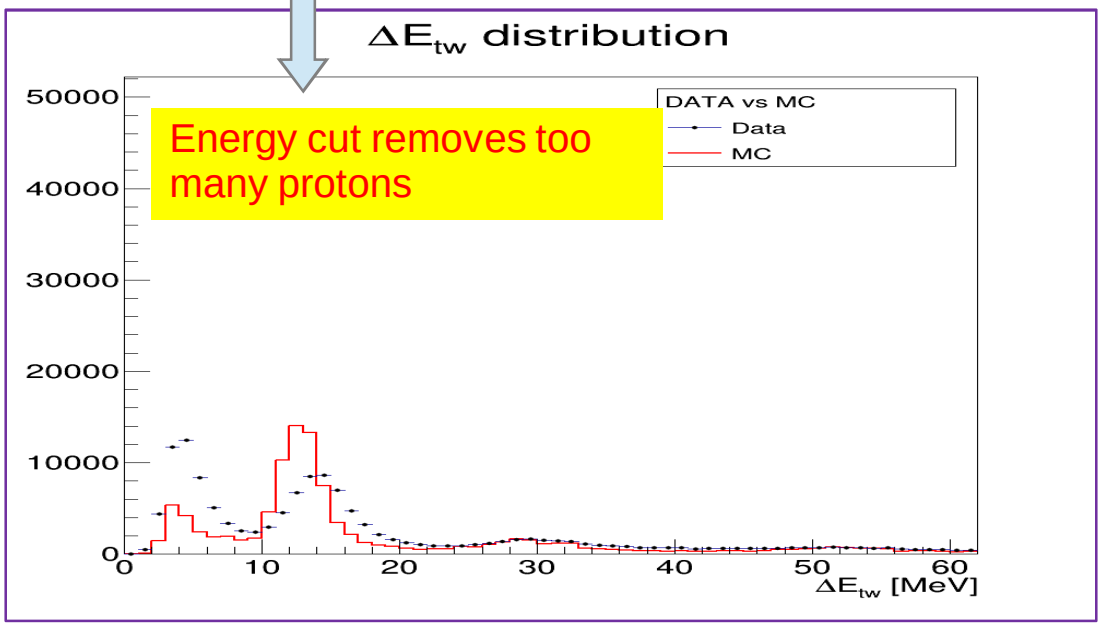




TOF WALL energy distribution: DATA vs MC



	DATA	MC	Diff
Proton	4.673	3.218	1.455
Helium	14.26	12.87	1.39
Lithium	30.01	29.02	0.99
Beryllium	51.95	51.38	0.57
Boron	88.03	83.19	4.84
Carbon	116.1	115.9	0.2

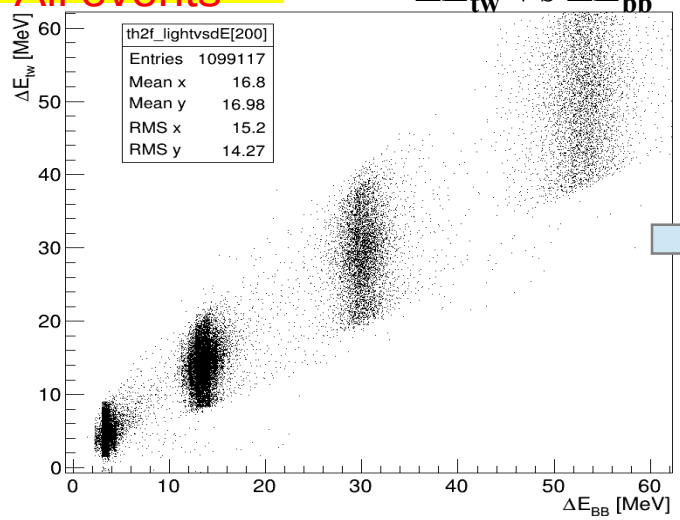


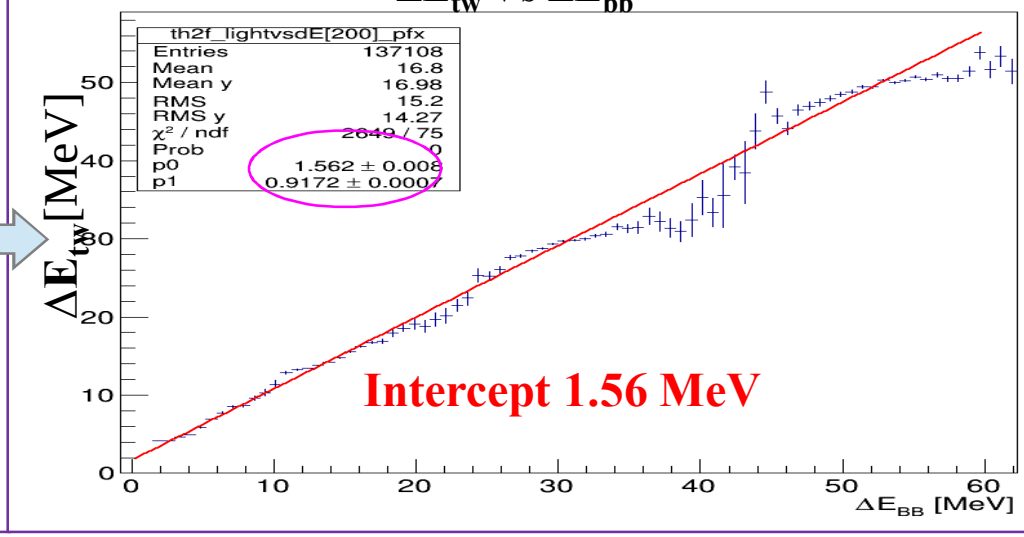
- Mismatch between data and MC at low energy
- Minimum energy cut(estimated as shown in previous slide), removes too many protons

ΔE_{tw} Vs ΔE_{bb} : (Low z regions zoomed)

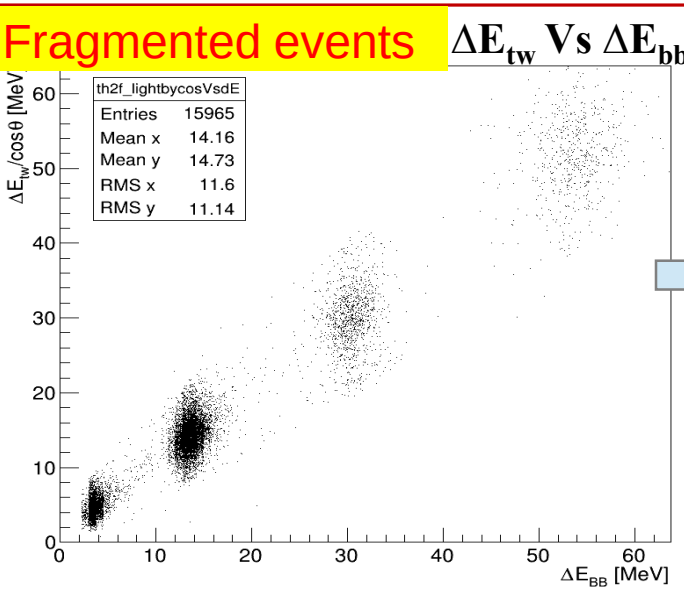
- æE_{tw}:- Energy collected at TOFWALL (Corrected for non-linearity)
- æE_{bb}:- Estimated from reconstruction variable and Bethe Bloch prediction

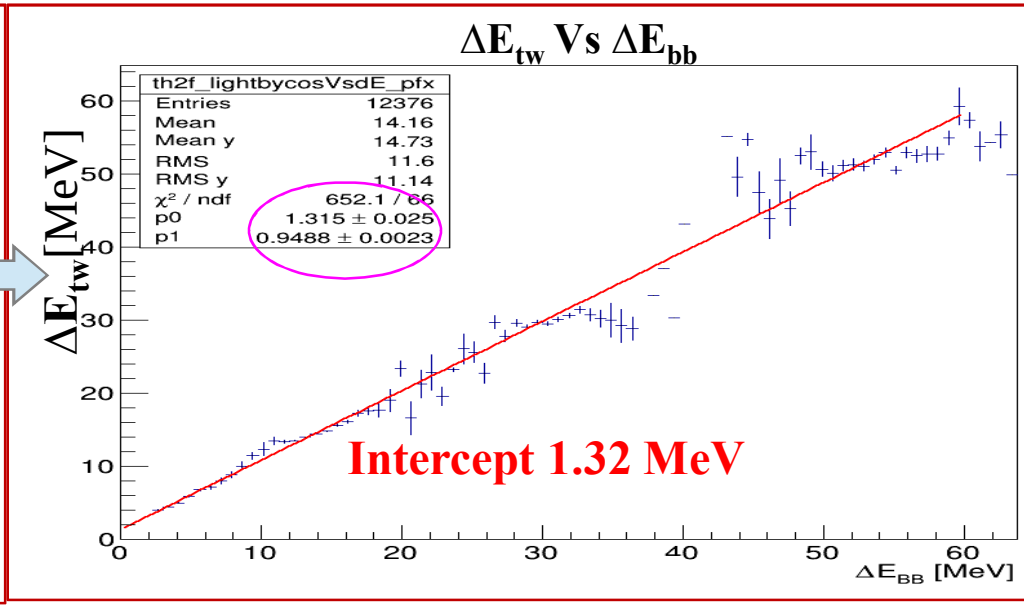
All events



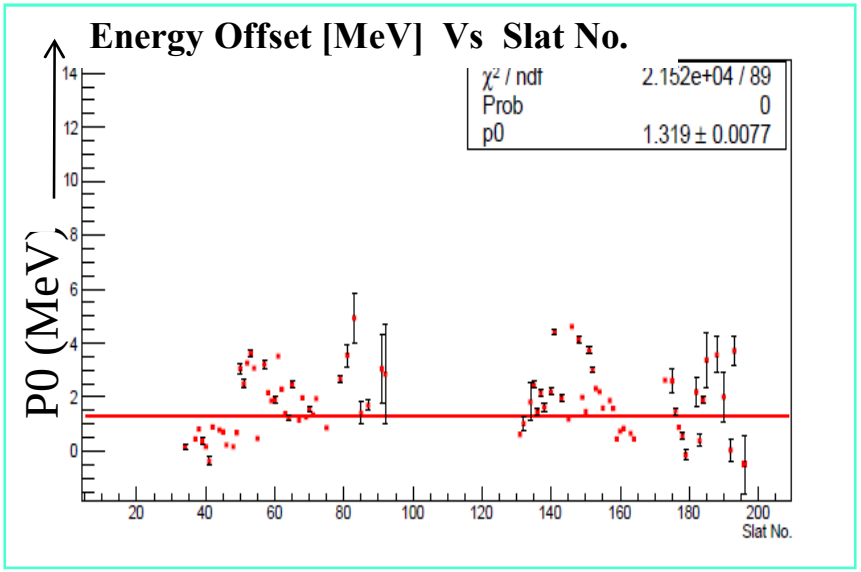


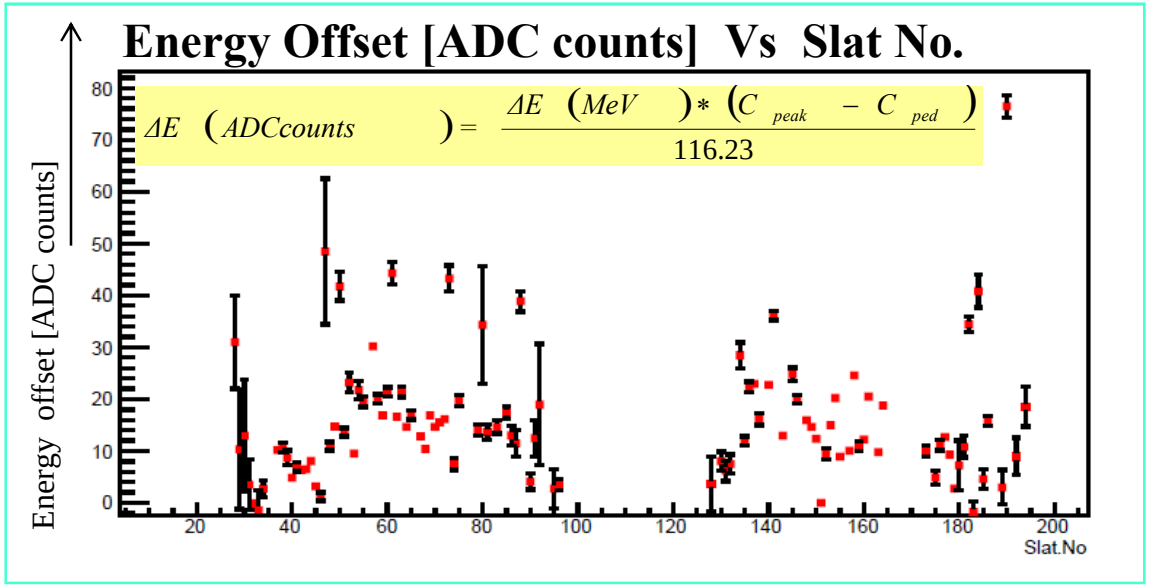
Fragmented events

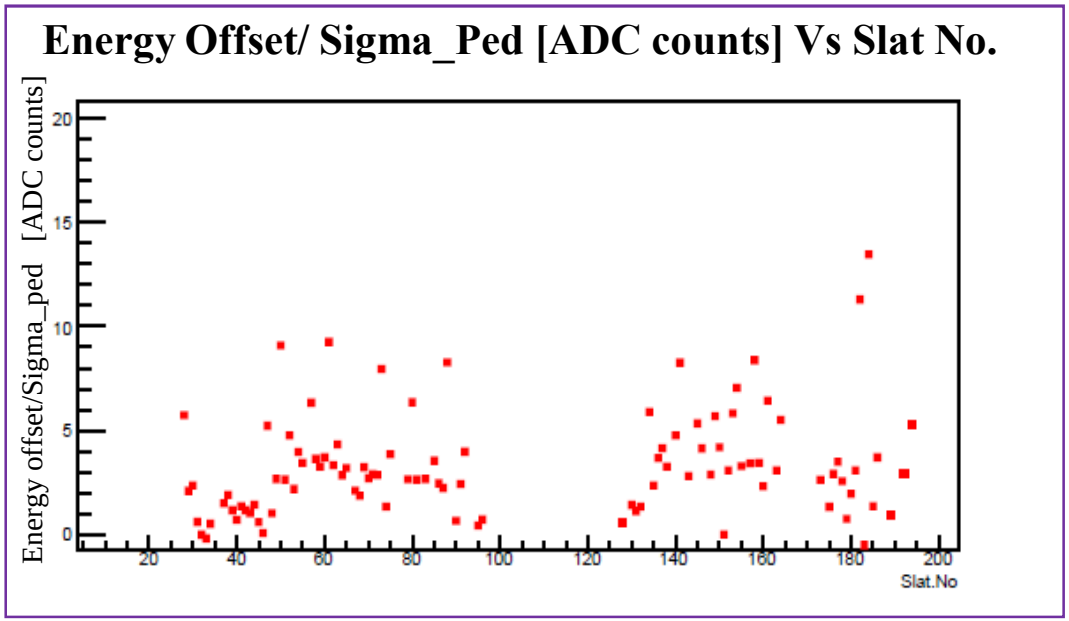


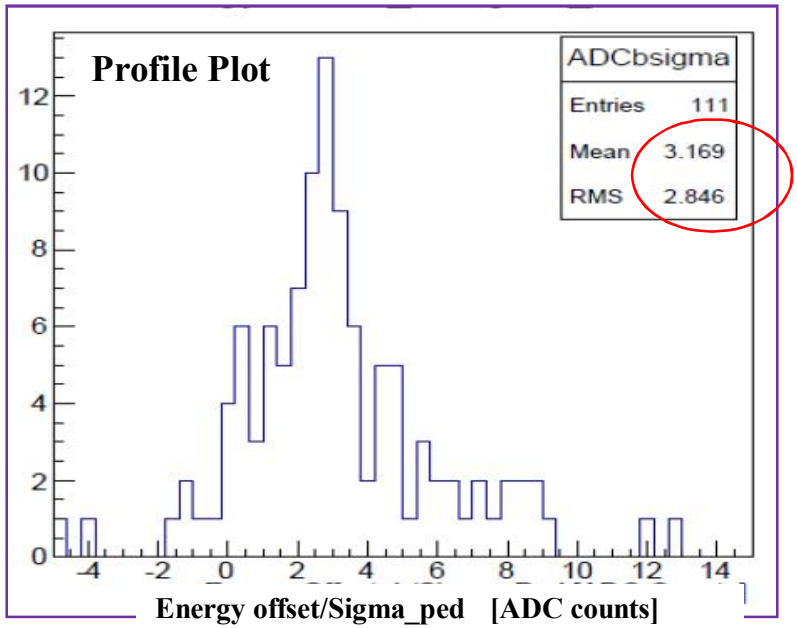


Slat by slat study of ΔE_{tw} Vs ΔE_{bb} offset





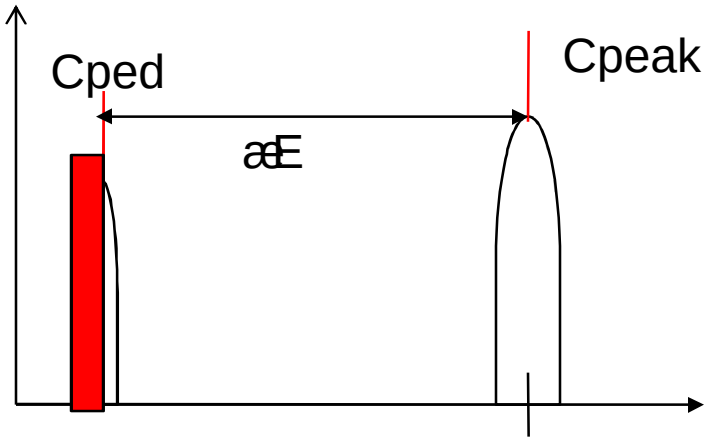


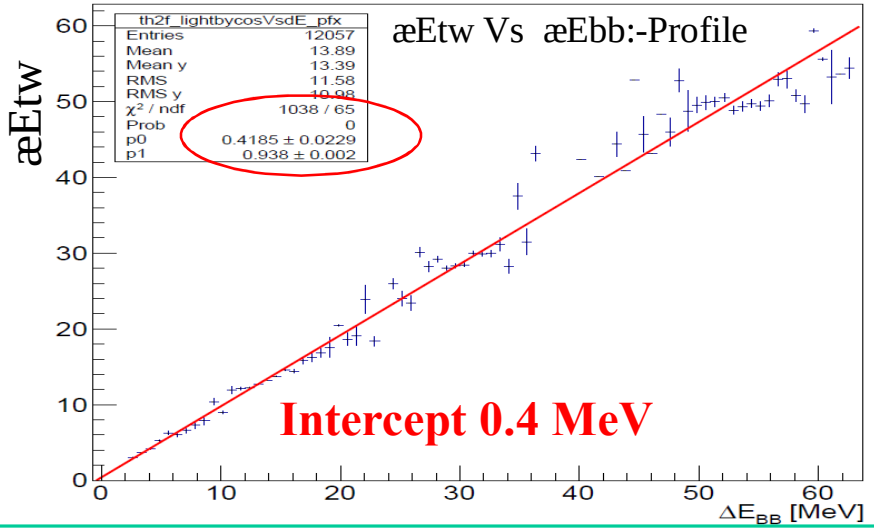


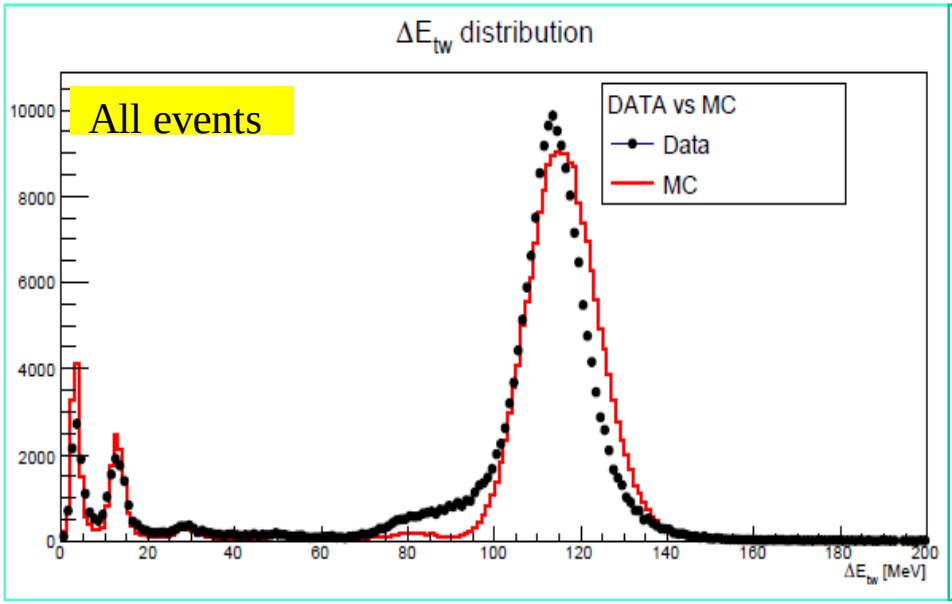
➢The offset is compatible with a 2 or 3 sigma error in the pedestal definition

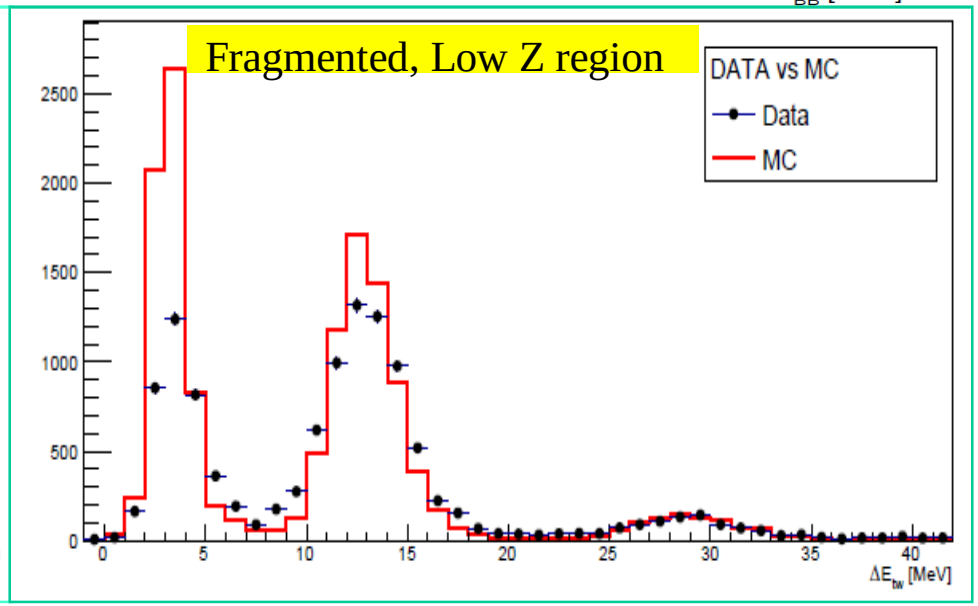
New pedestal subtraction and Low Z DATA -MC matching studies

- Pedestal values has been reviewed by the Politecnico group on above observation









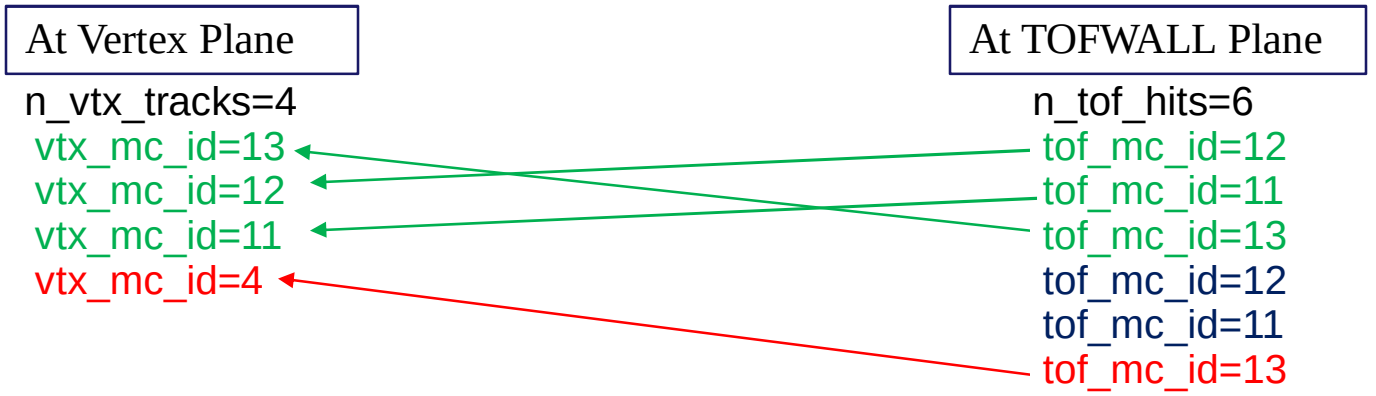
- Offset is reduced from 1.3 MeV to 0.4 MeV.

TOFWALL-VTX track matching studies

TOFWALL hits -VTX track matching studies

Each TOF tracks (two planes are considered as independent) matching with VTX tracks to suite best momentum, then sort with comparable ñYò (position in y-plane).

For example:-



- mcid (Montecarlo particle id) of the particle chain is given on both planes.
- Each colored line represent the mcid correlations as implemented currently in FIRST reconstruction code.
- Below table represent the navigated tracks mcid (Navigating each TOF hits to its mother and identify the right MC id in the MC chain at the VTX).

Navigated tracks mcid at VERTEX	mcid at TOFWALL
12	12
11	11
13	13
12	12
11	11
13	13

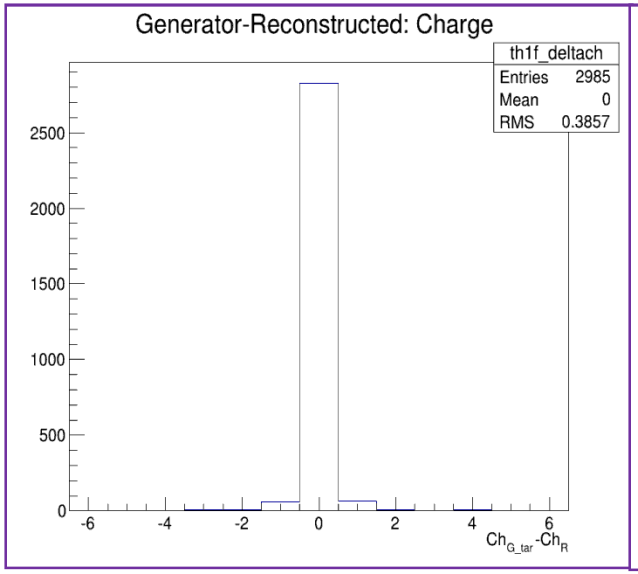
Above examples, shows
Global tracks assigned correctly 3
Global tracks assigned wrongly 1
Not assigned tracks 2

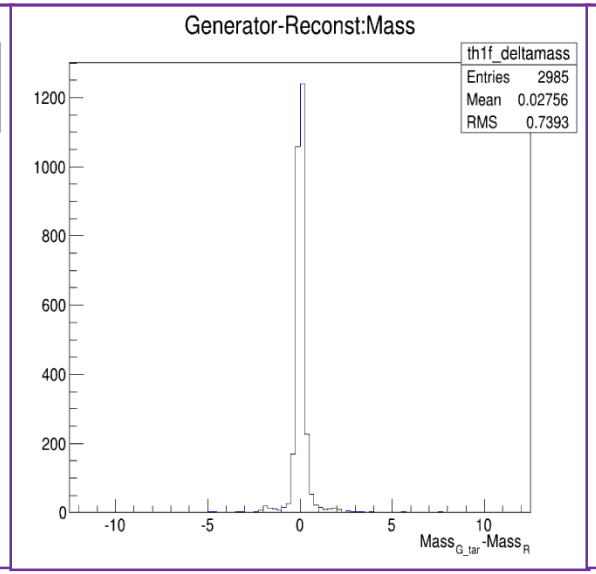
- **~14% of tracks (of Global tracks) are wrongly assigned.**
- **~19% of events contribute for wrong track assignment**

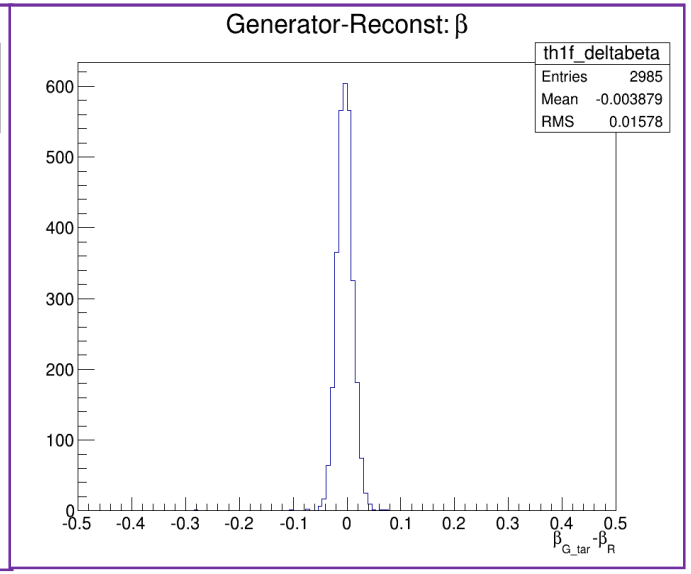
Different quantities for true/wrong track assignments

- The comparison is between reconstructed variables and MC generator variables at VTX

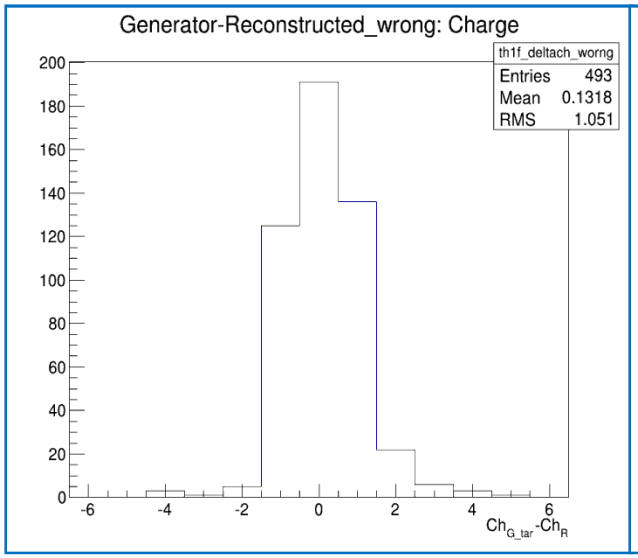
True assignment

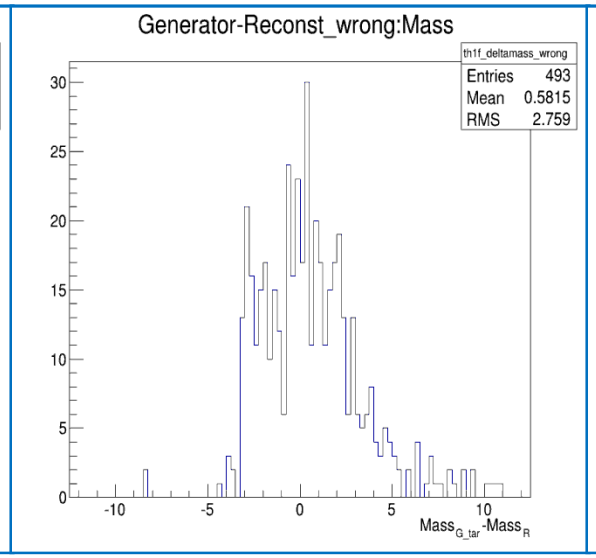


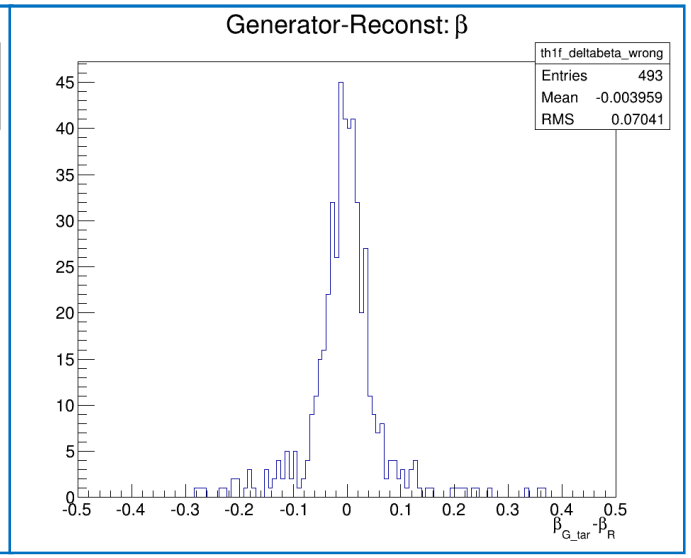




Wrong assignment







Conclusion:

- DATA and MC agreement at low energy is improved. Now we can enable single TDC cuts in MC.

- Fraction of tracks/events with wrong assignments is not negligible .

- We are trying to match two TOF plane (clustering of the two TOF planes).

  (work in progress)

- The VTX-TOF matching can be improved by considering the charge from the VTX.

Thanks for your attention