Updated 5g+1g analysis

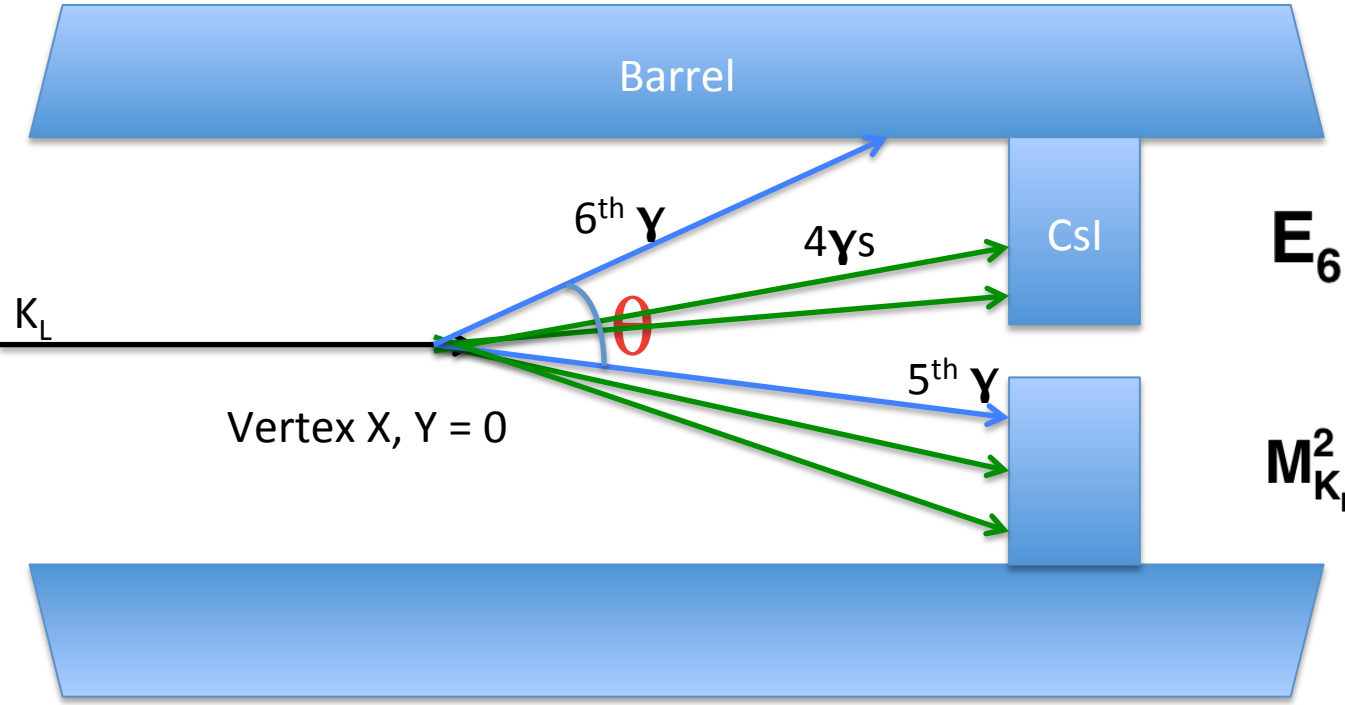
JunLee, Kim

Korea Univ.

Contents

- 1) Kaon reconstruction with C.O.E.
- 2) Updated Timing Resolution of IB
- 3) New energy calibration

$K_L \to \pi^0\pi^0\pi^0$ Reconstruction Using 5γ on CsI and 1γ on Barrel



$$E_6 = \frac{M_\pi^2}{2E_5(1-\cos\theta)}$$

$$M_{K_L}^2 = \left(\sum_{i=1}^{6} E_i\right)^2 - \left(\sum_{i=1}^{6} \vec{p}_i\right)^2$$

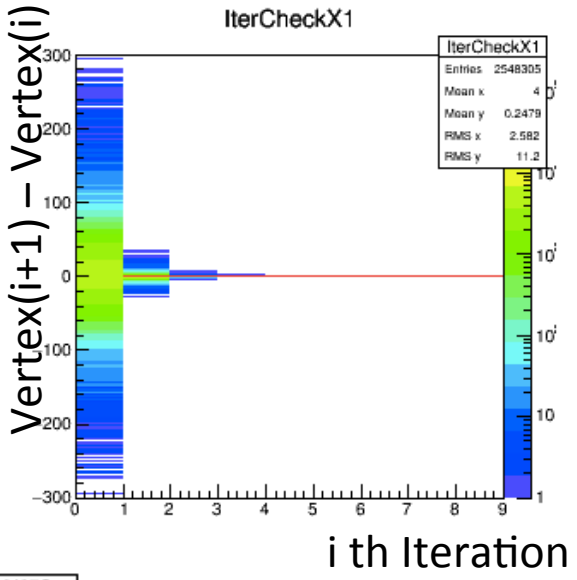
- $K_L \to \pi^0\pi^0\pi^0$ decay samples with 5γs on CsI and 1γ on Barrel
- Reconstruction of $2\pi^0$ from 4γs on CsI
- 1γ Reconstruction from hit information of Barrel (timing and Module ID)
- Reconstruction of the last π^0 from 1γ on CsI and 1γ on Barrel

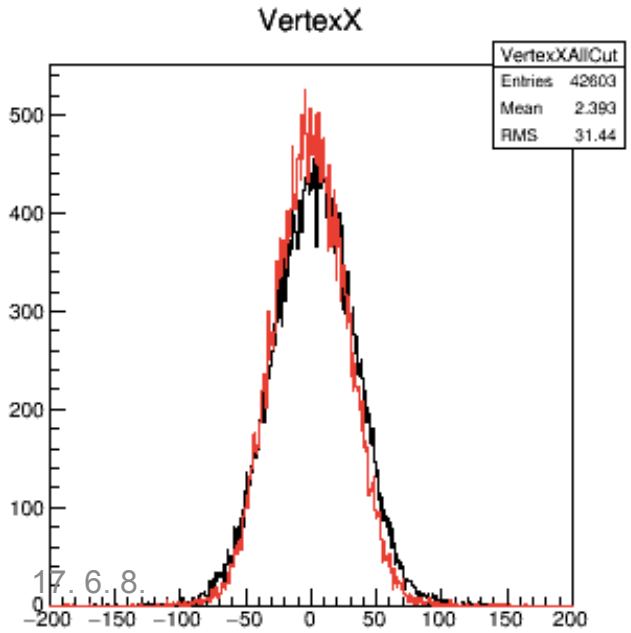
Reconstruction of Vertex X, Y

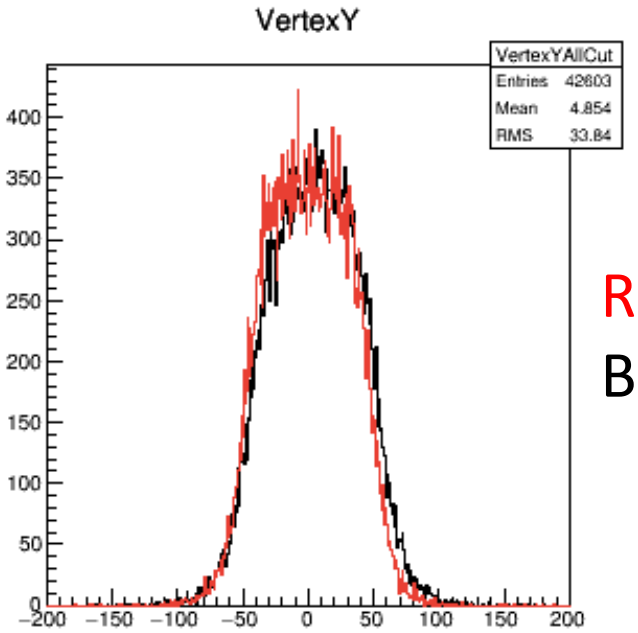
Vertex X,Y from C.O.E.

Reconstruction of Energy of incident gamma

Iteration (10 times)





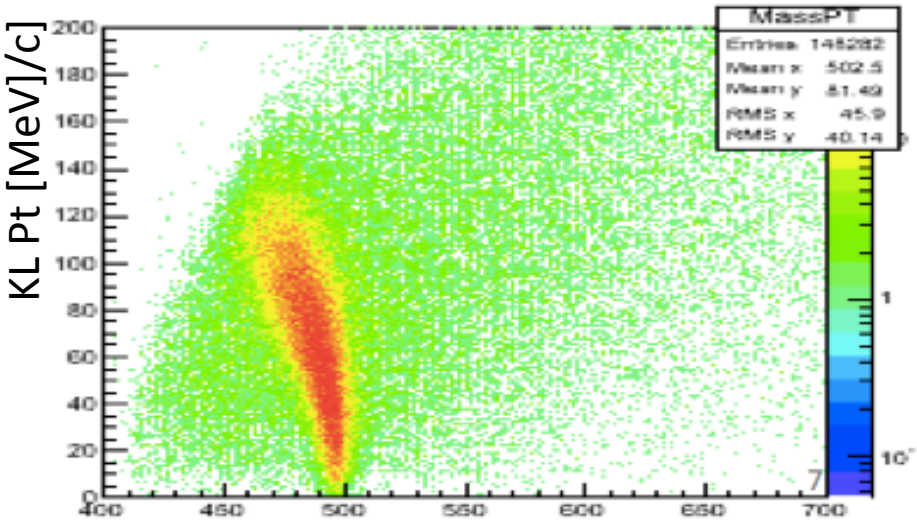


Red : M.C.

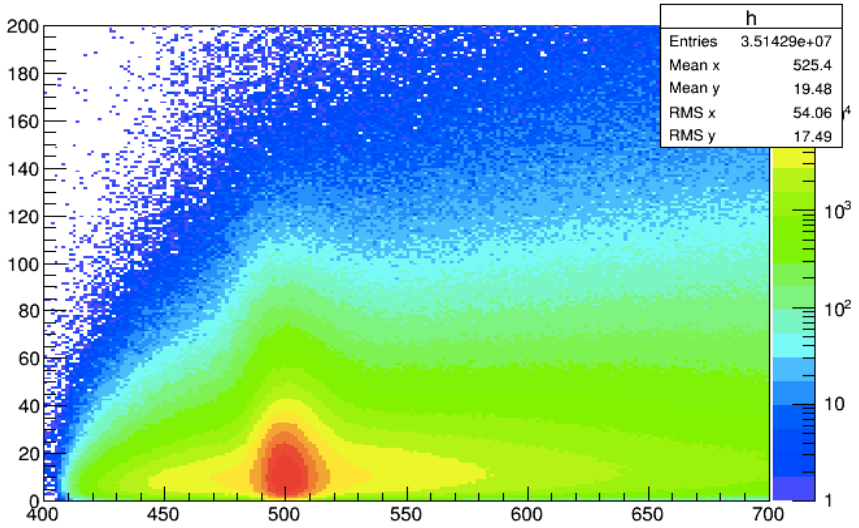
Black : Data(Run62)

KL Pt Reconstruction

Vertex X, Y = 0 (Old Version)

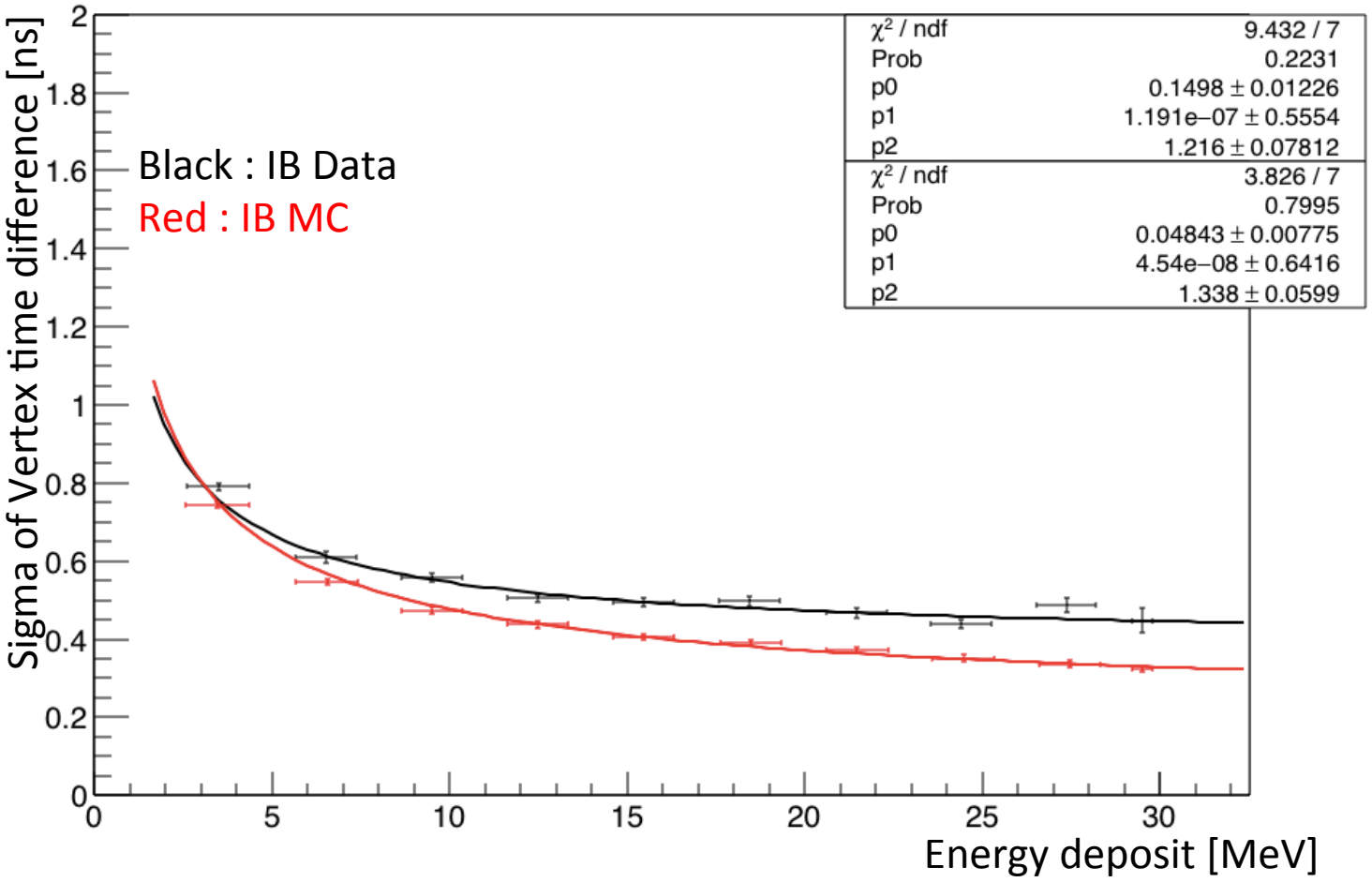


With Reconstructed Vertex X, Y

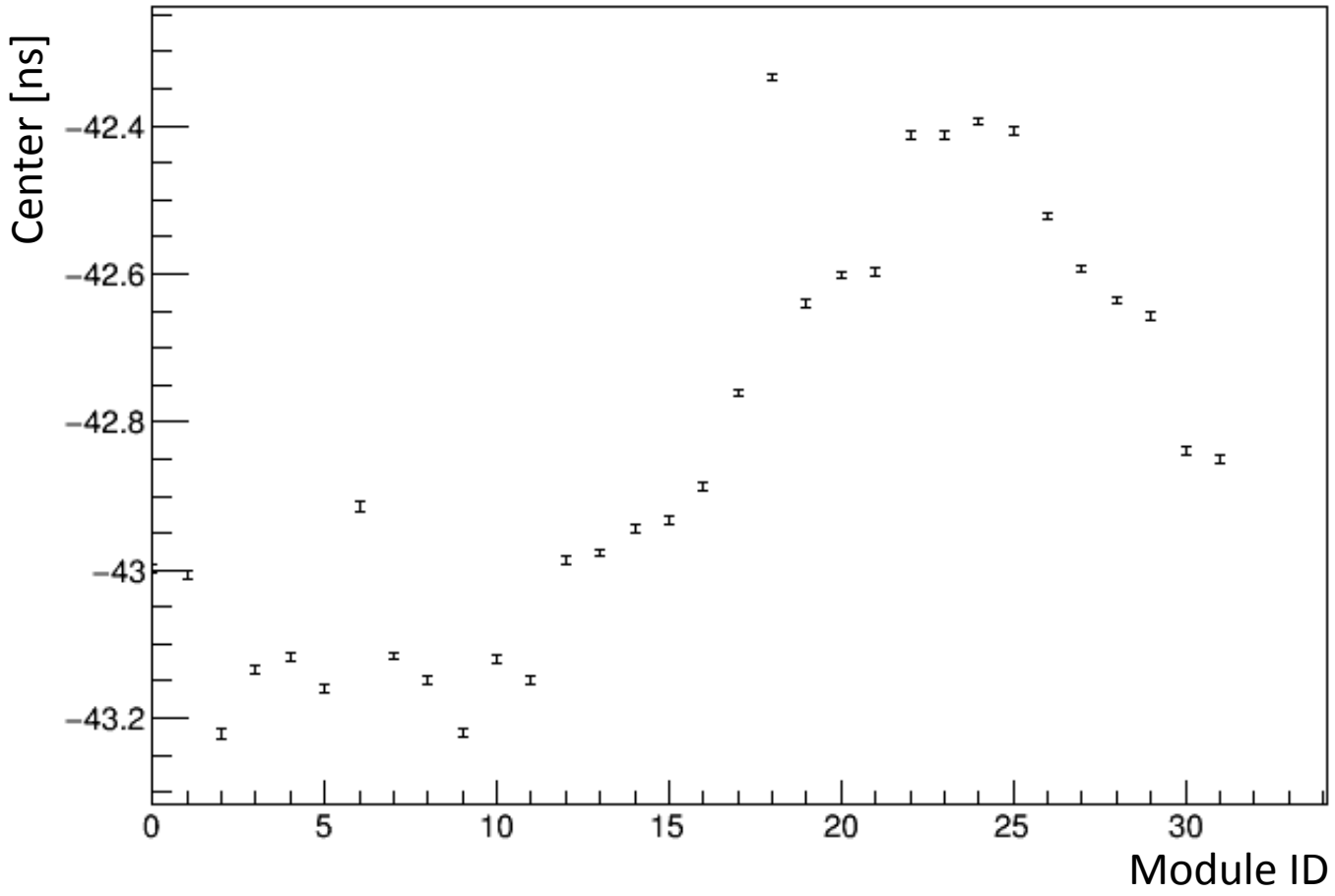


2) Updated Timing Resolution of IB

Discrepancy btw M.C. and data

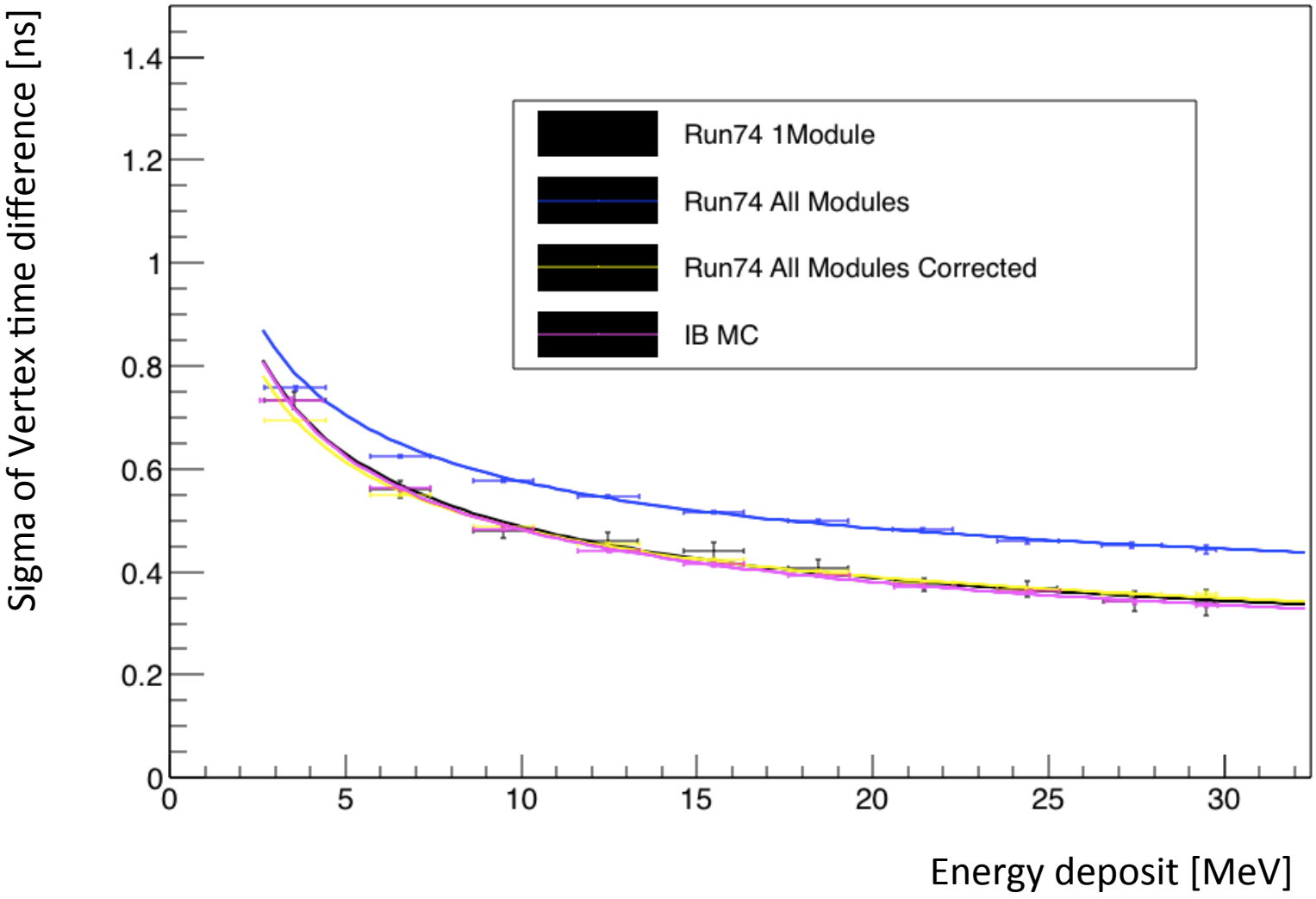


Fine Module Correction



- Fine module Correction can be done by 5g+1g analysis

Updated Timing Resolution of IB



3) New Energy Calibration

Energy Deposit on Barrel

- With clear gamma selection, signal from gamma interaction can be obtained
- As a basic signal, deposited energy is measured
- Using reconstructed incident gamma energy, Sampling fraction(Visible Ratio) can be obtained with requirement of only one hit

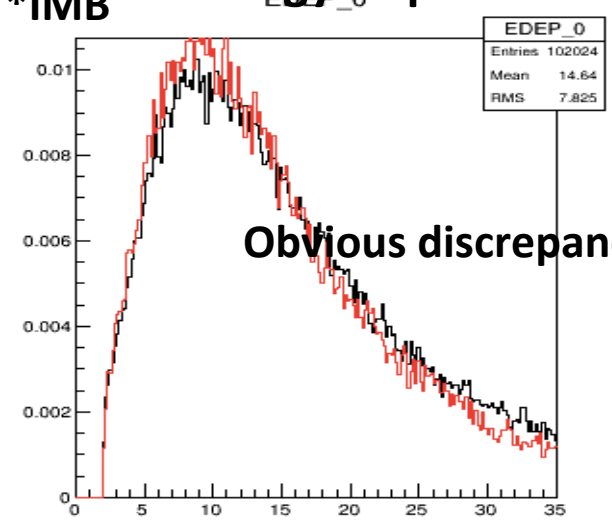
Data : Run65 Min. bias trigger (Black)

M.C. : KL3pi0 with Run65 Acc. (Red)

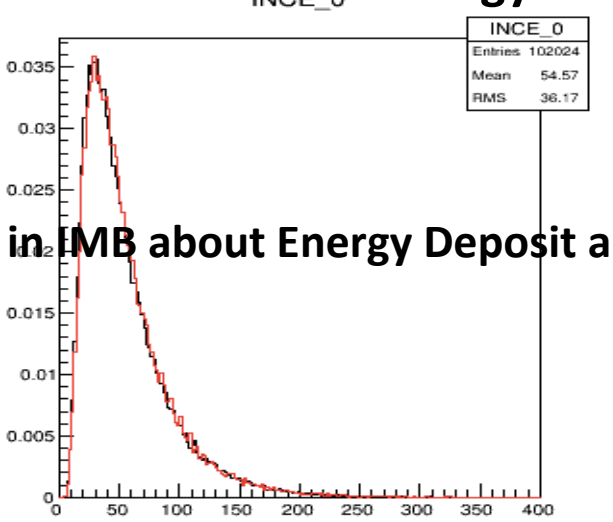
Deposited energy, Incident energy

***IMB**

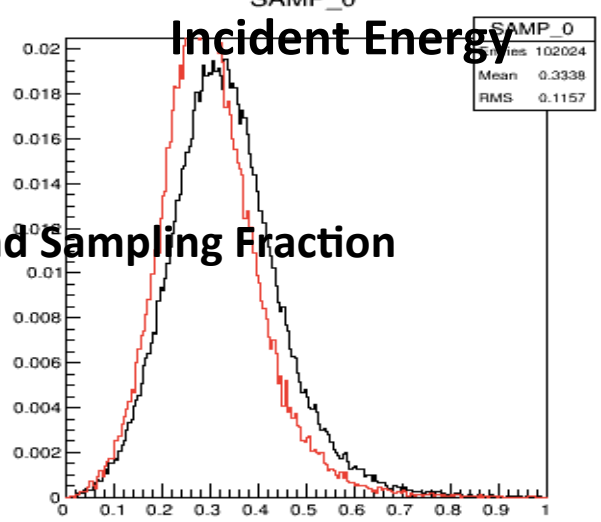
Energy Deposit



Incident Energy



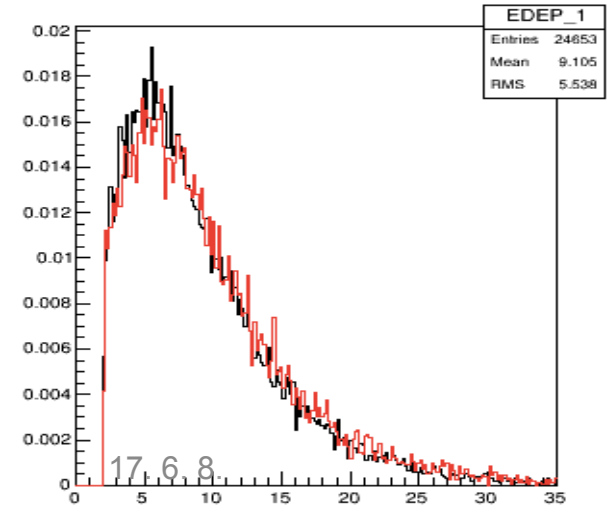
Energy Deposit / Incident Energy



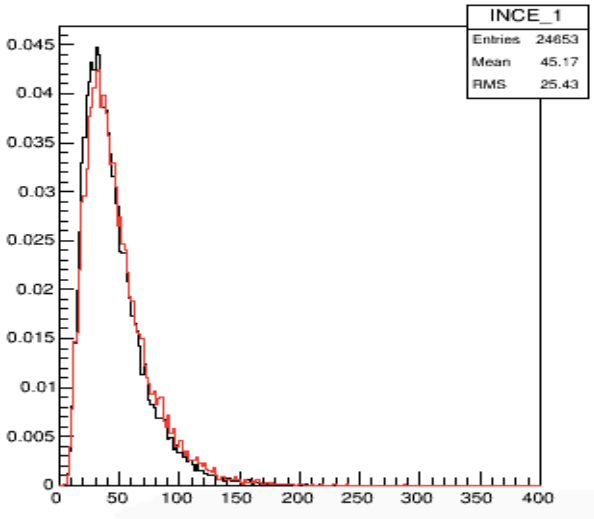
Obvious discrepancy in IMB about Energy Deposit and Sampling Fraction

***OMB**

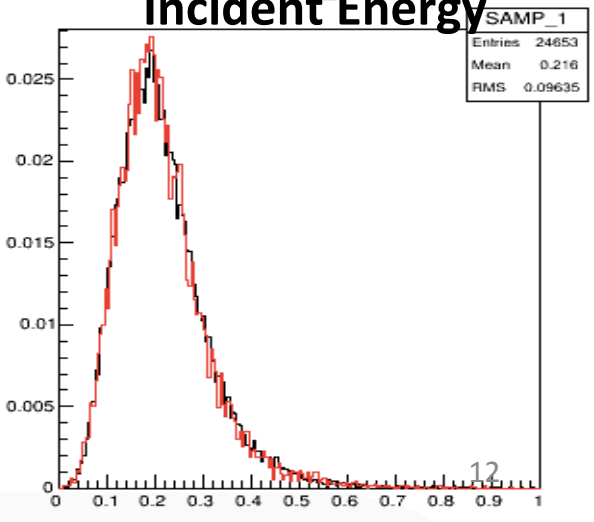
Energy Deposit



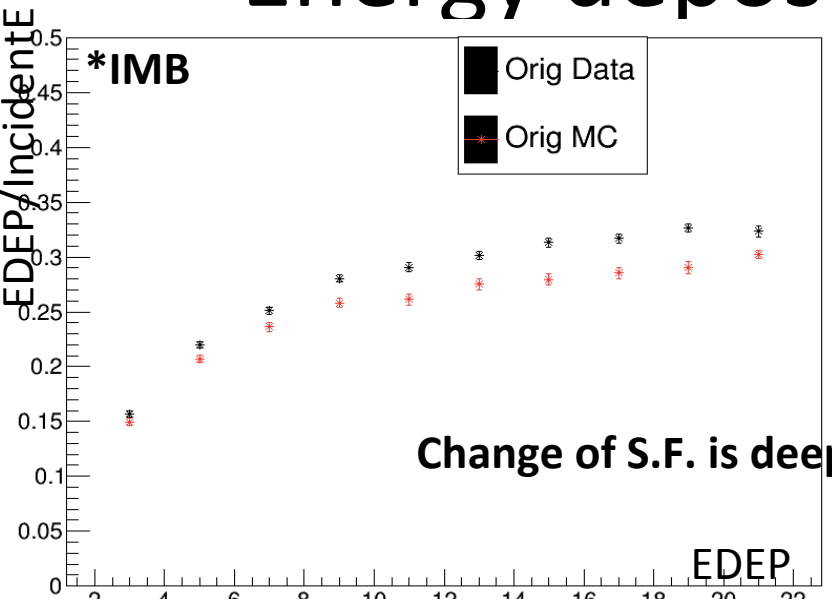
Incident Energy

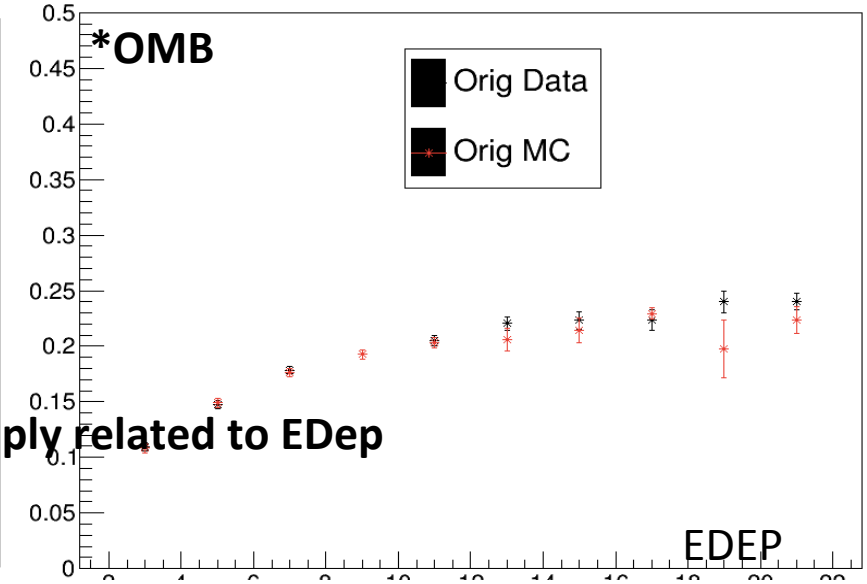


Energy Deposit / Incident Energy

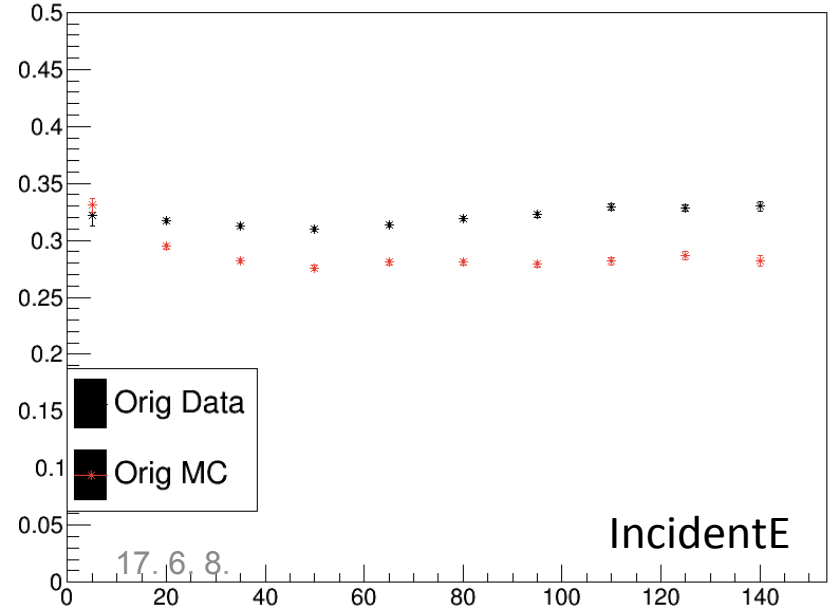


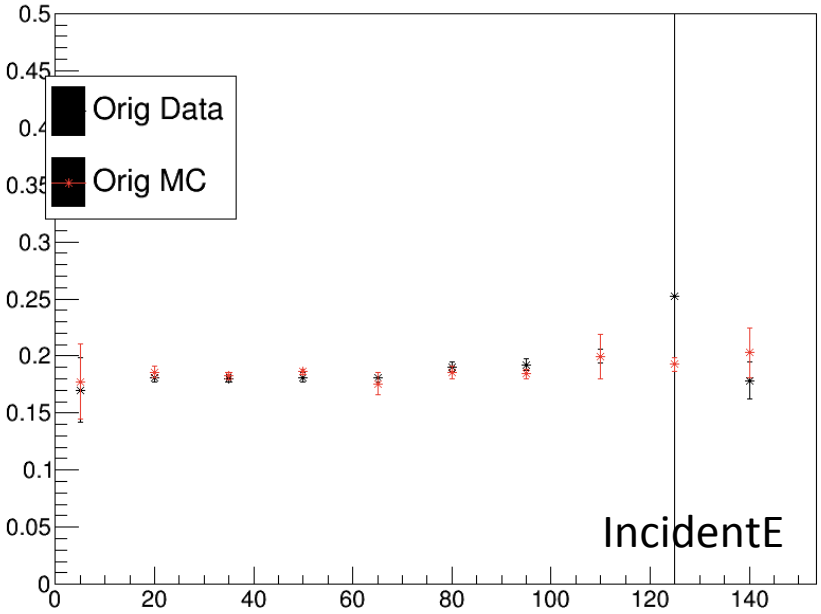
Sampling Fraction with regard to Energy deposit & Incident energy





Change of S.F. is deeply related to EDep



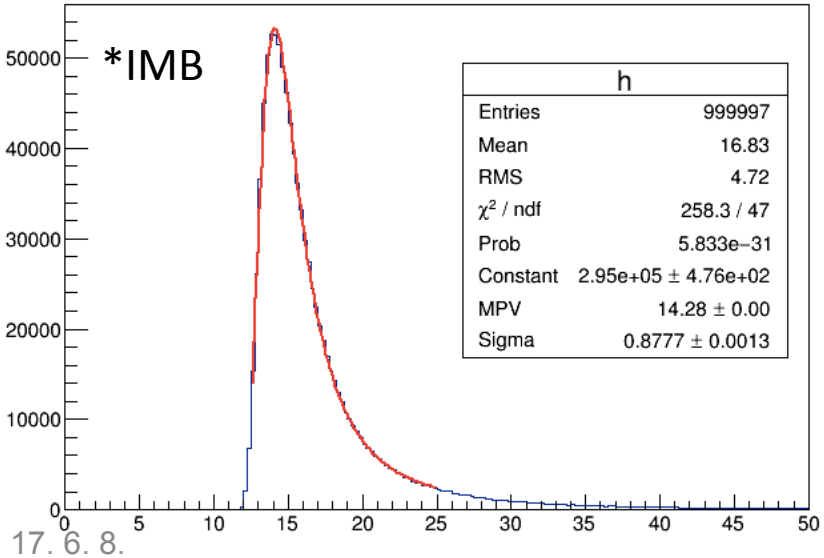


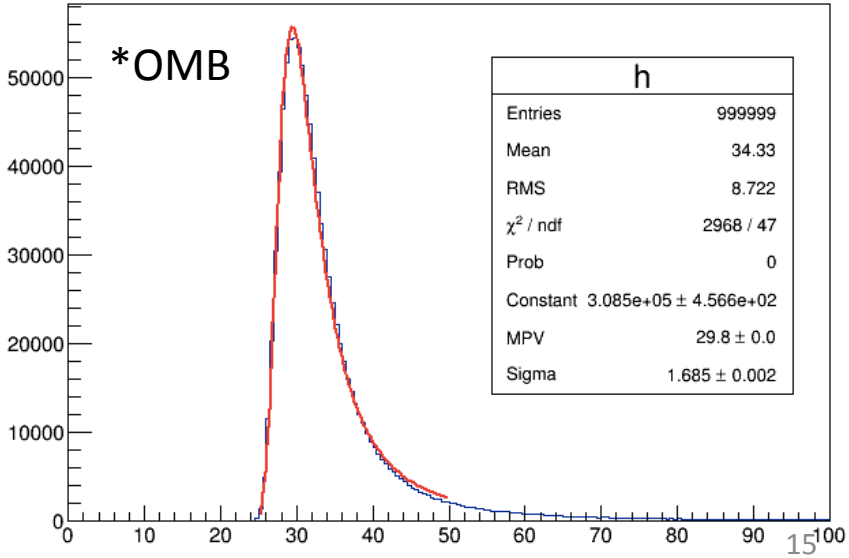
Check of MIP of Cosmic-Ray

- With 2 kinds of versions
  - 1st version : Muon-Ray with mono-momentum
  - 2nd version : Muon-Ray with momentum distribution & Position distribution
    - Distributions from CosmicSpectrum function in e14lib
- General Process of M.C.
  - Gsim
  - Gsim2dst (attenuation & pulse shaping included)
  - CosmicAna
    - Code for calibration
    - Get the MIP @ Center of detectors
    - Also True energy deposited can be seen (in ver1)

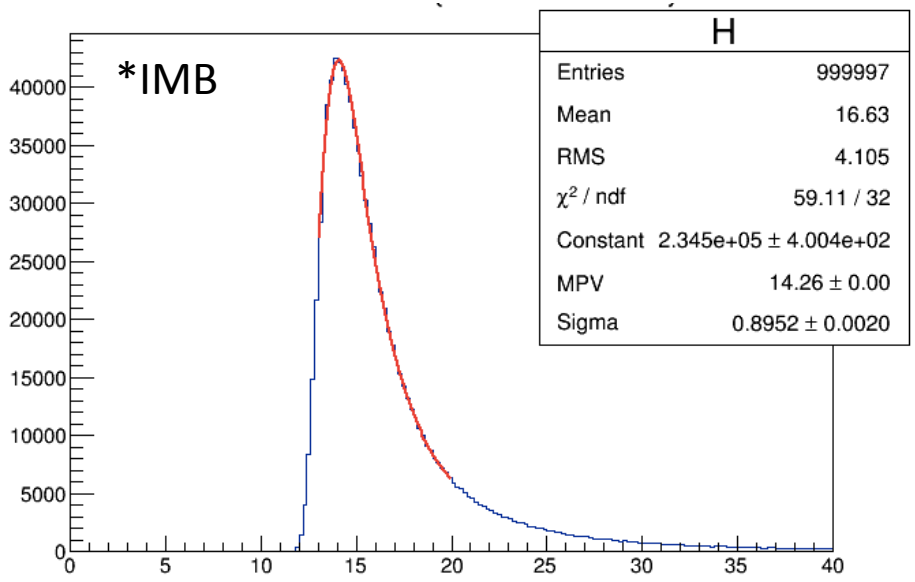
M.C. version 1

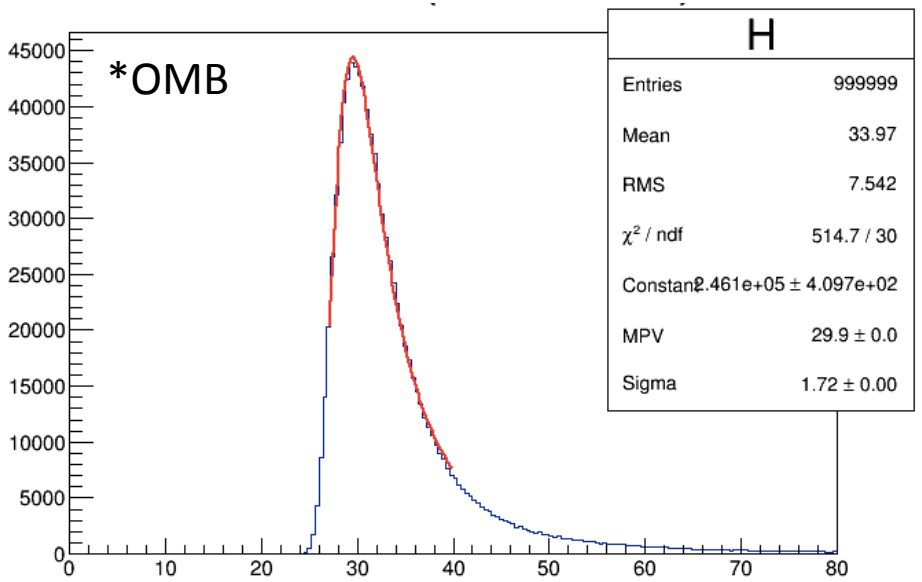
- Shoot Muon
  - Generation Position : 0, 2m, 4.073m
    - Center of MB
  - Momentum Direction : 0, -1, 0



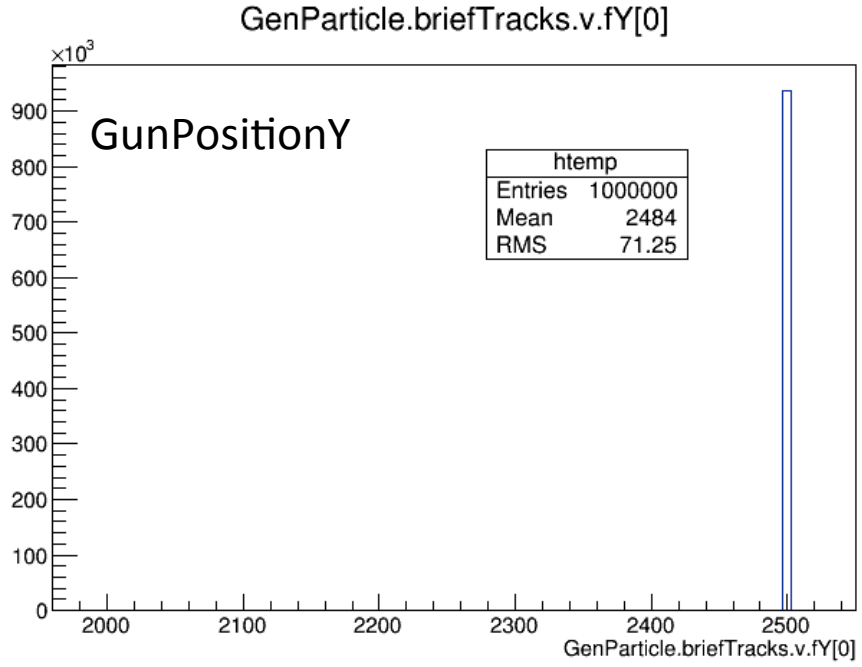


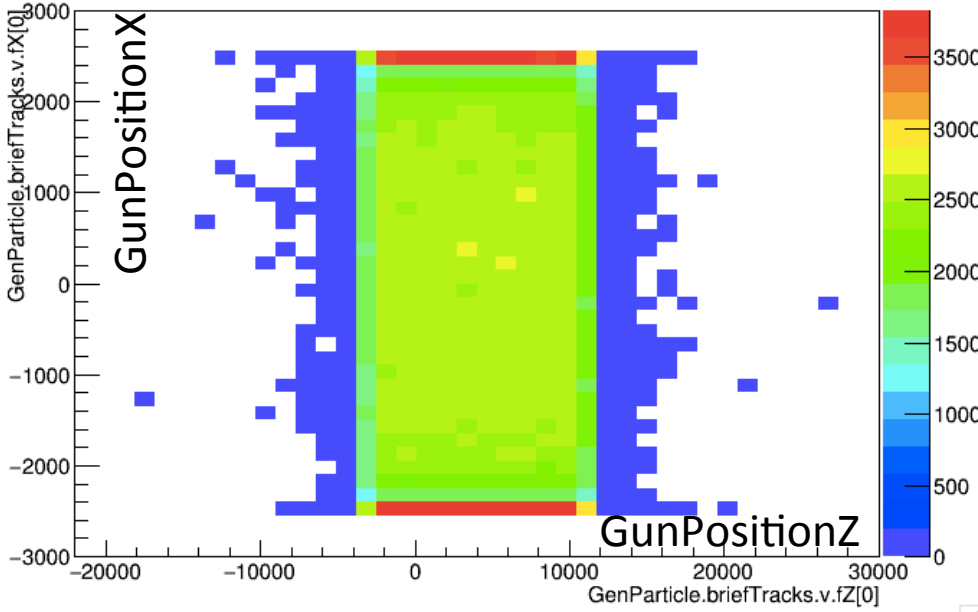
True energy deposit

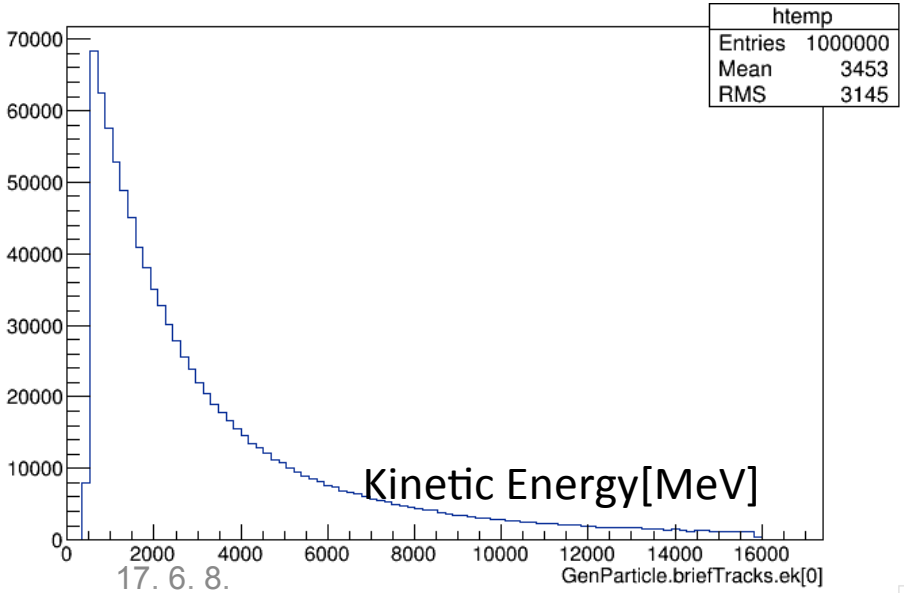


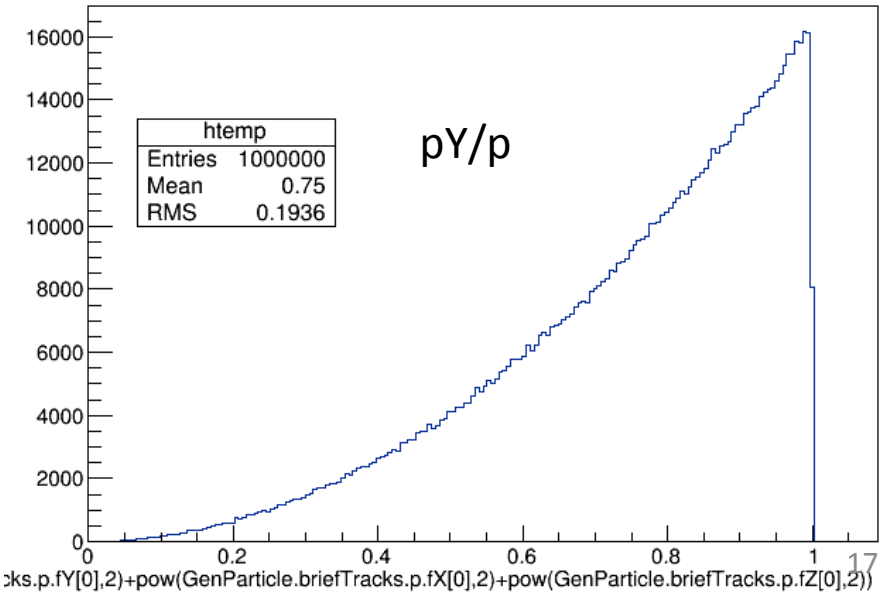


M.C. version 2 (Generation Info.)



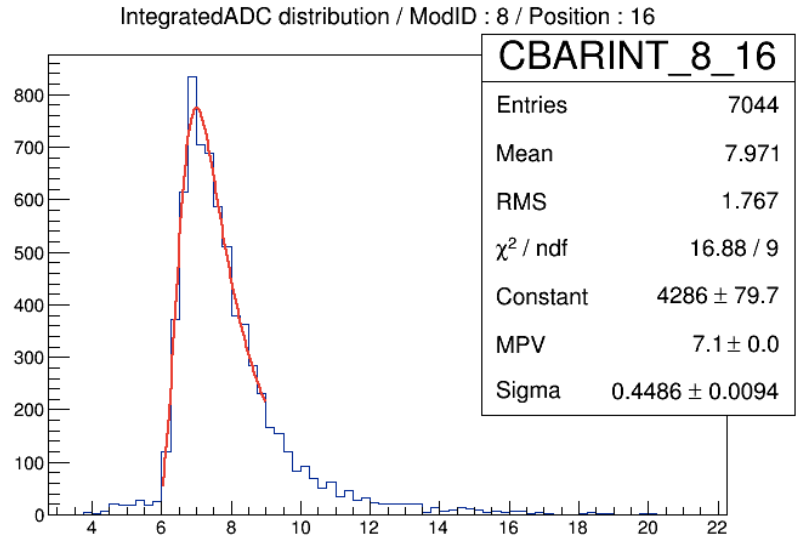


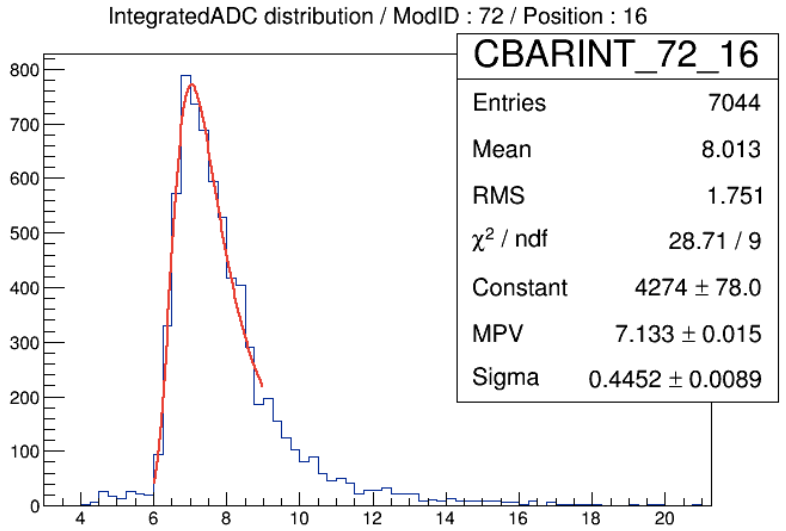




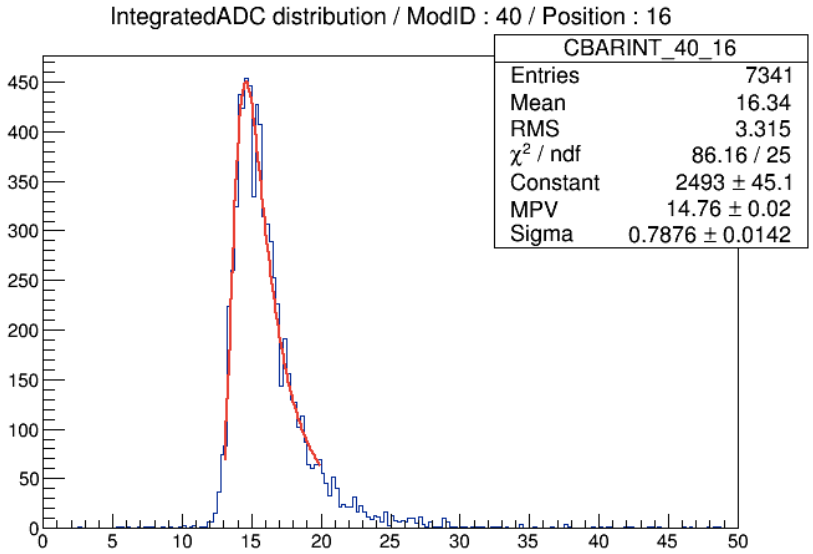
MIP Peak (Center) from Ver2

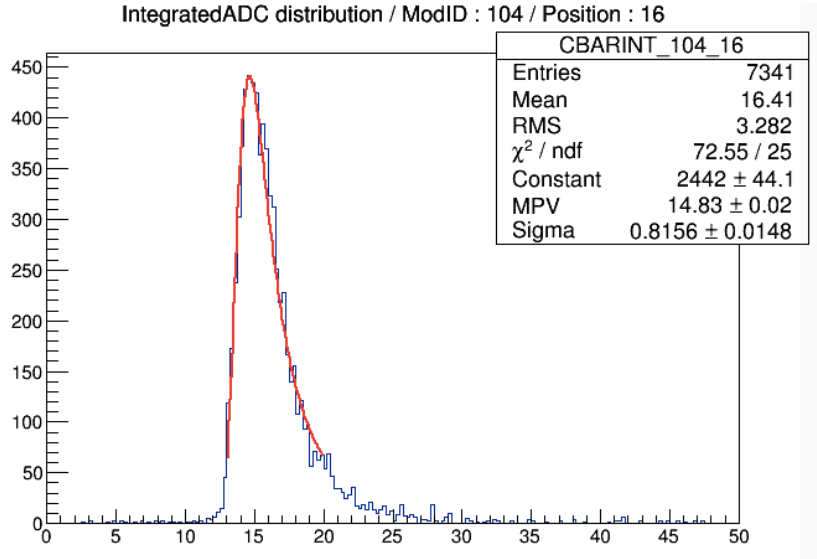
0.95



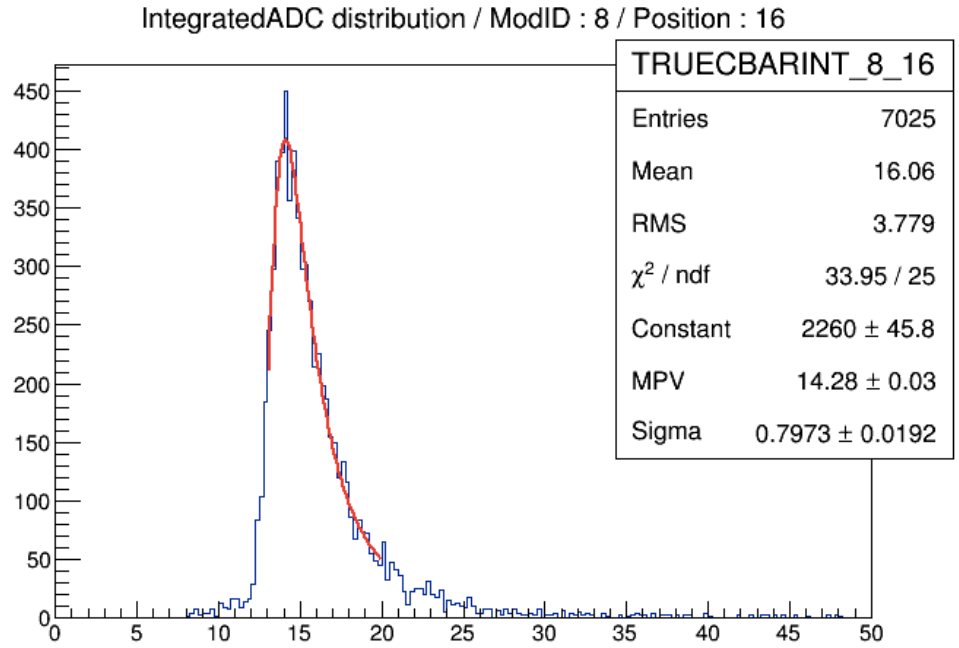


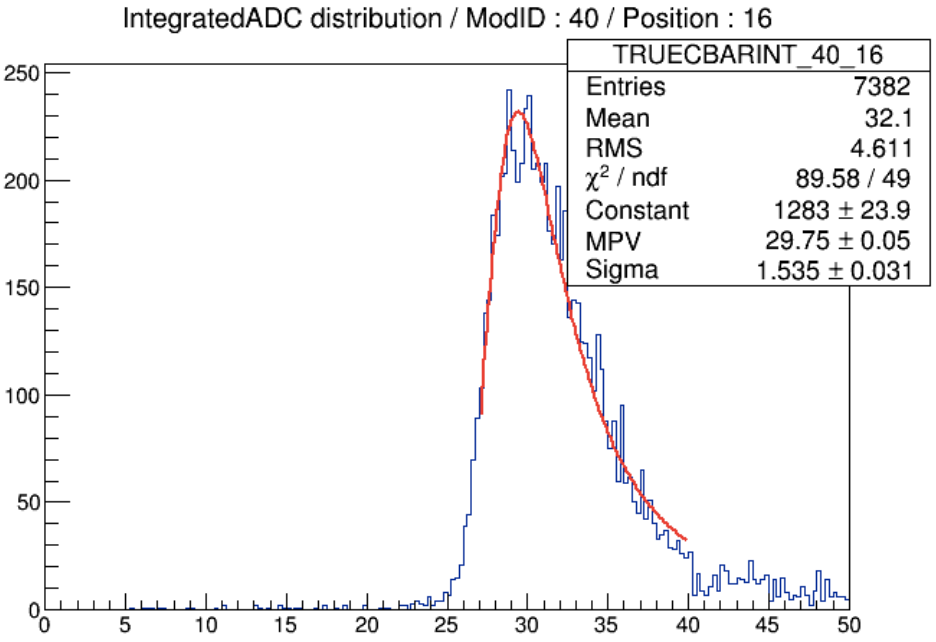
0.99



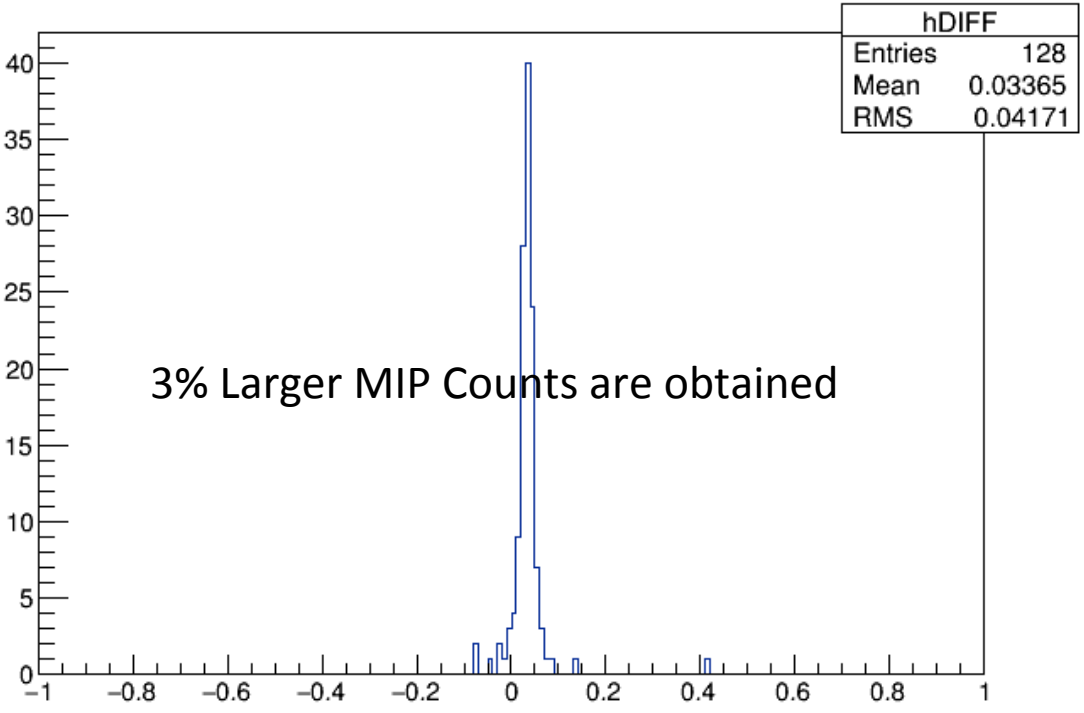


True energy deposit



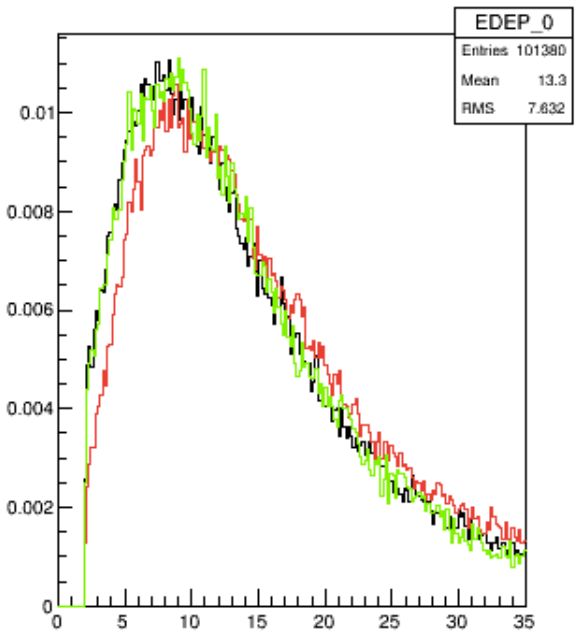


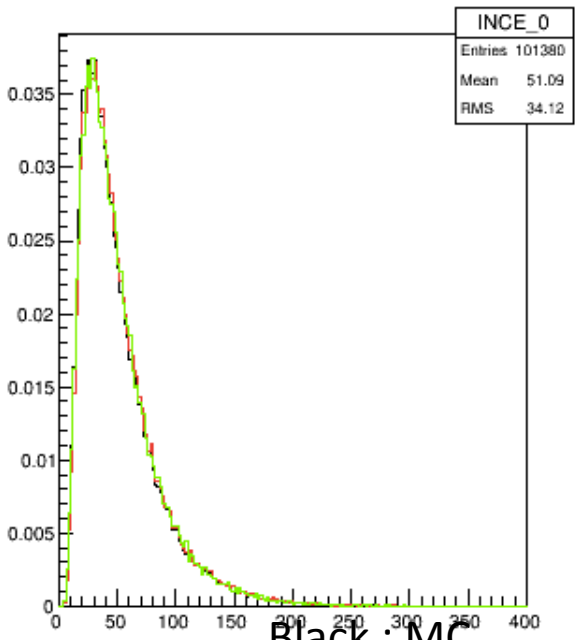
Difference of Calibration constant

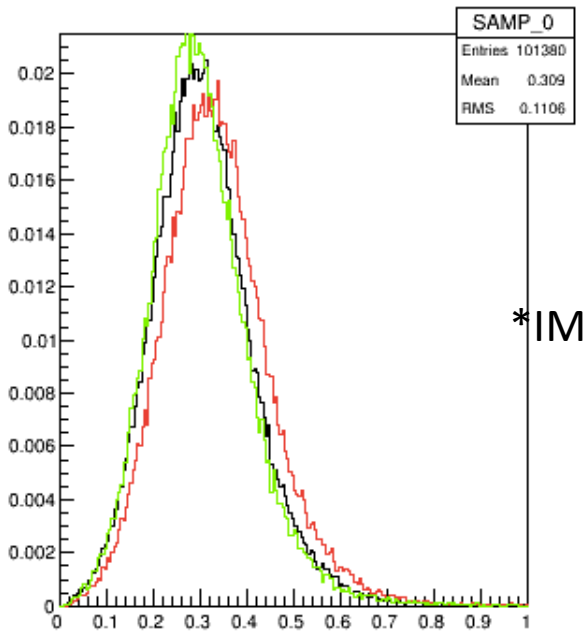


$$\text{Energy} = \frac{\text{IntegratedADC}}{\text{MIP Count}} \text{TargetEnergy}$$

	MIP Count	Target Energy	Energy
IMB	3% increased	5% decreased	~8% decreased
OMB	3% increased	No change	~3% decreased





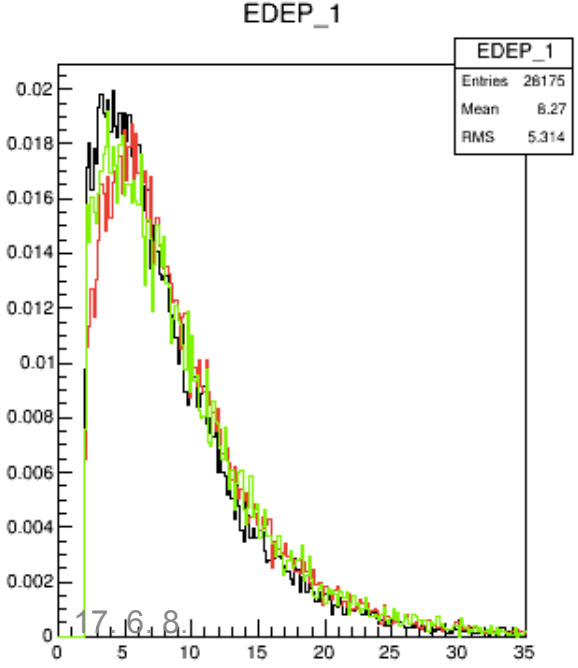


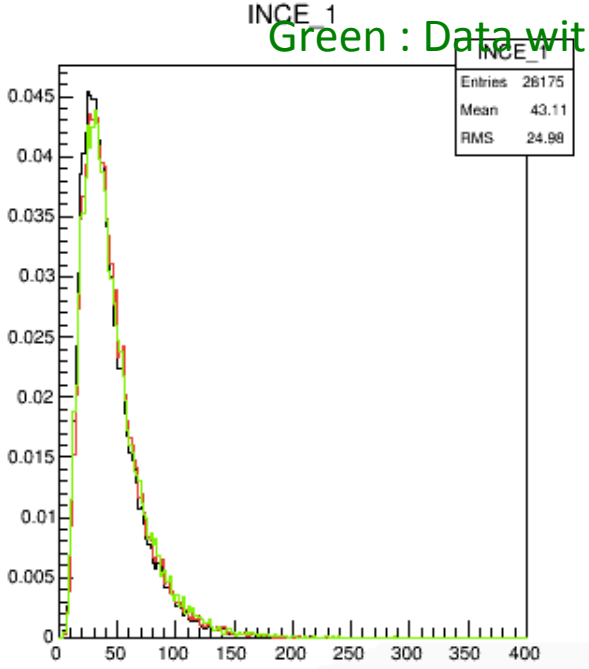
*IMB

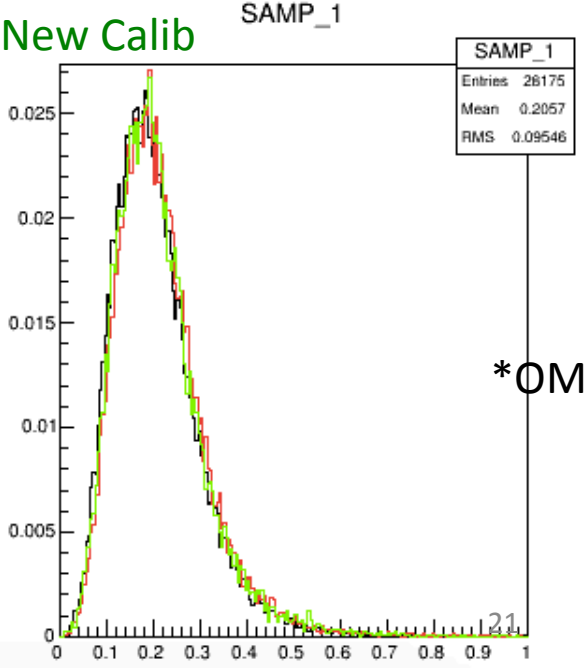
Black : MC

Red : Data with Old Calib

Green : Data with New Calib

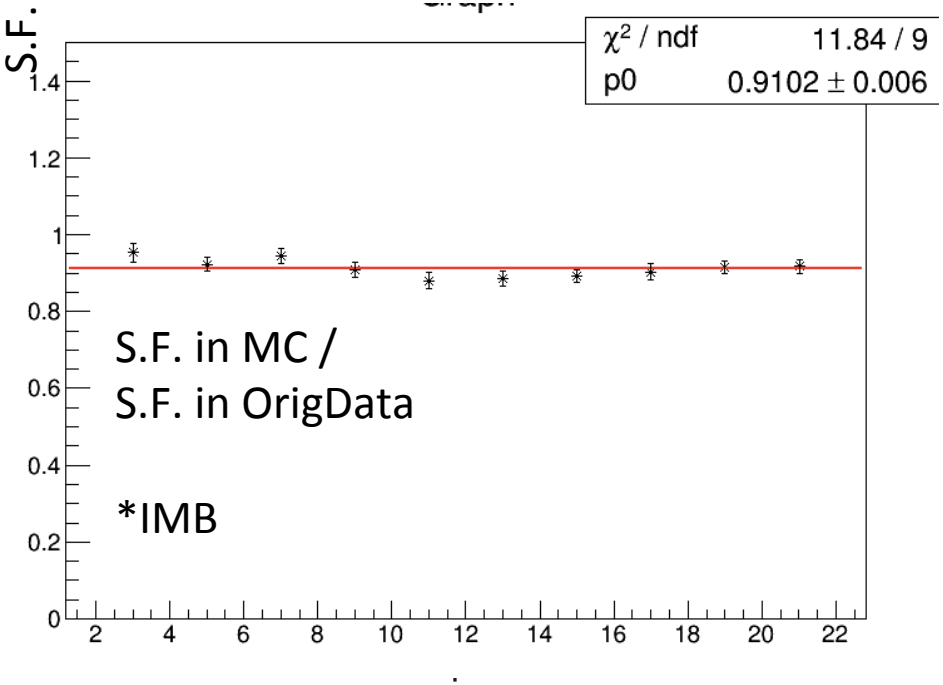


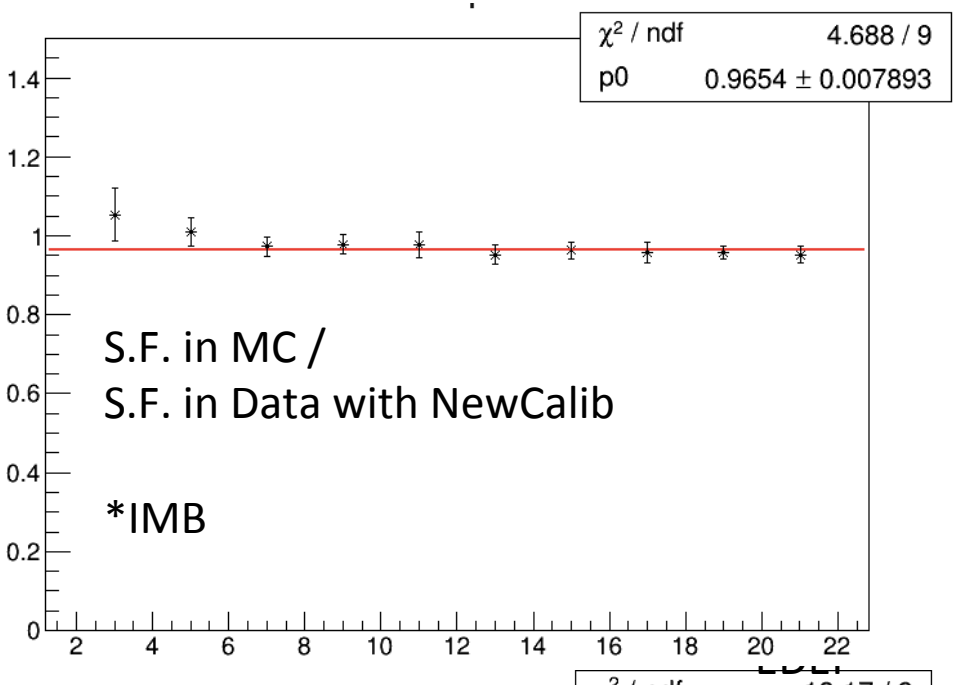


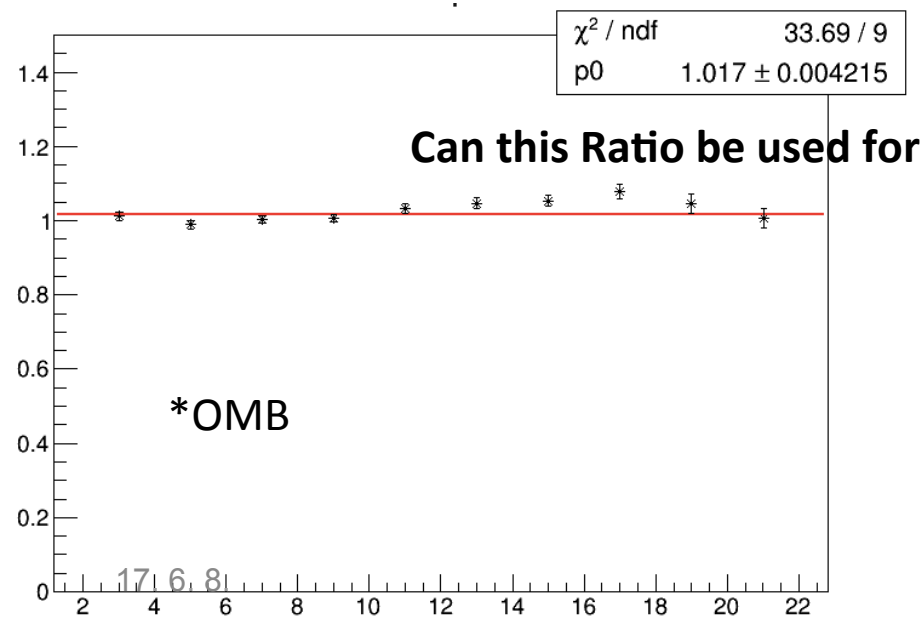


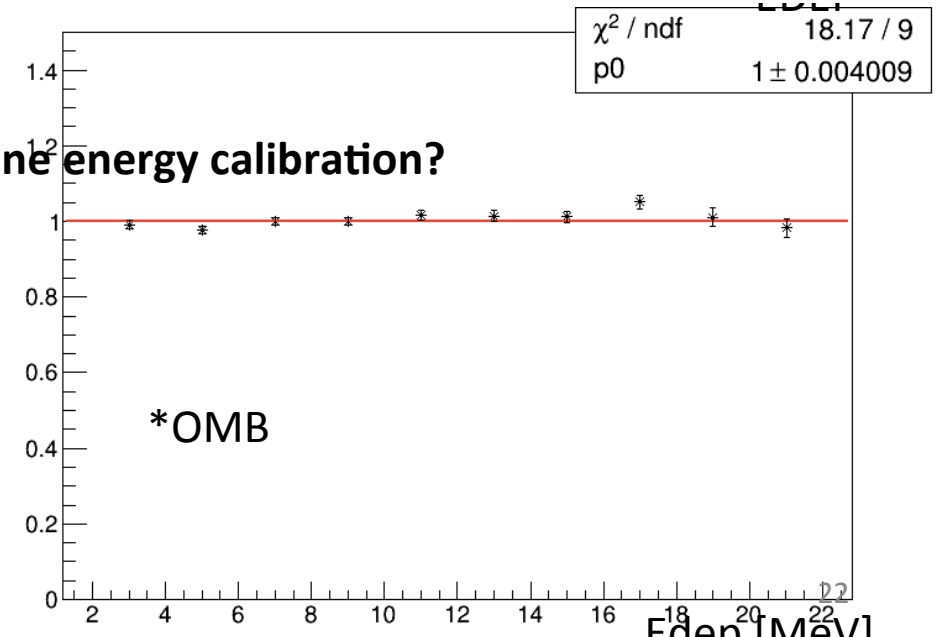
*OMB

Ratio of MC/Data (p.13)



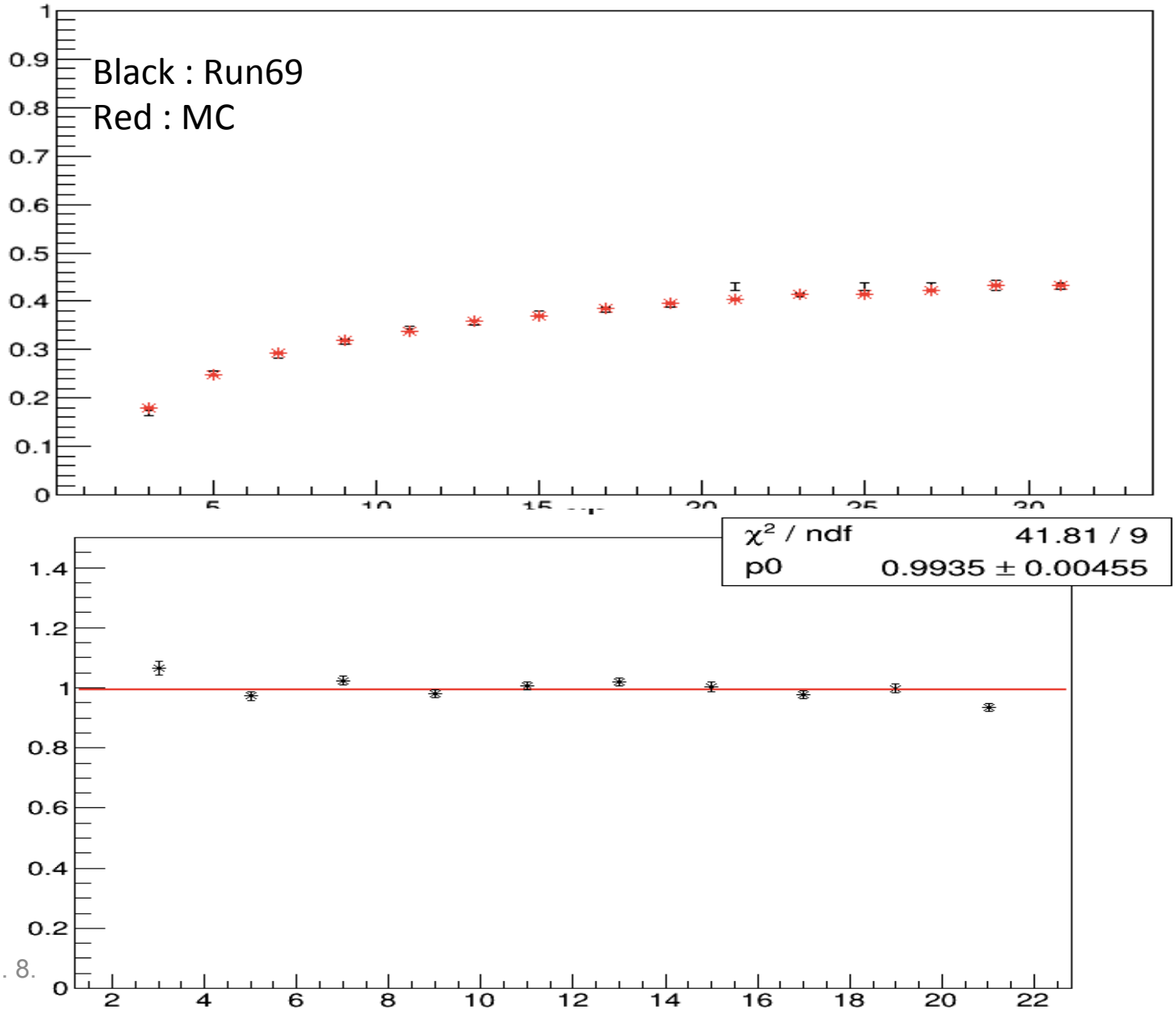






Can this Ratio be used for fine energy calibration?

Sampling Fraction of IB



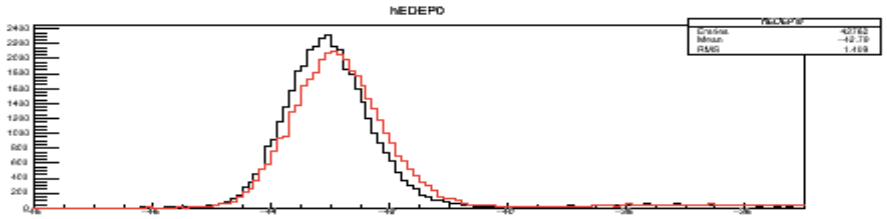
Summary

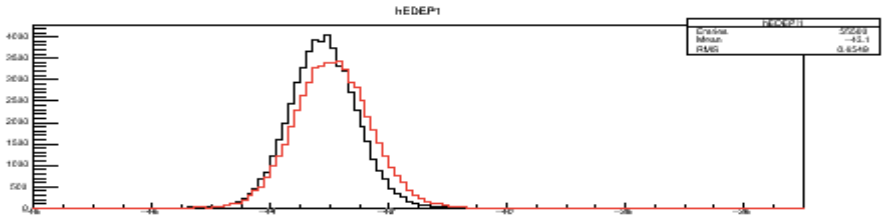
- Vertex X, Y of KL are calculated using C.O.E.
  - Iteration of vertex X,Y and incident gamma energy
- Timing Resolution of IB is updated
  - With proper module correction
    - Module correction can be used for fine timing calibration
- New energy calibration is done
  - with different Target Energy for MIP
  - with new MIP Count

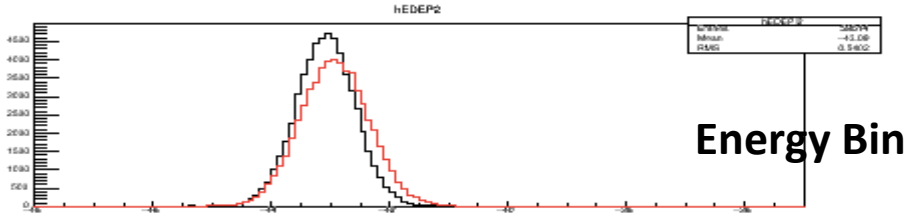
Raw Histograms

Black : After Module Correction (Run74)

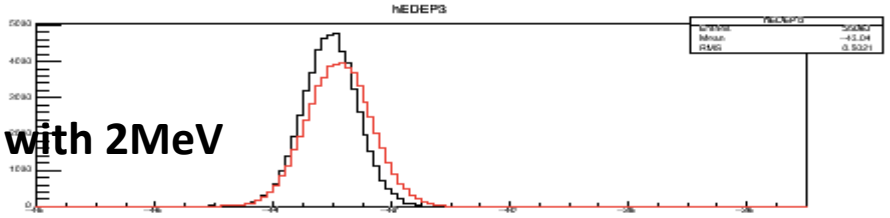
Red : Before Module Correction (Run74)

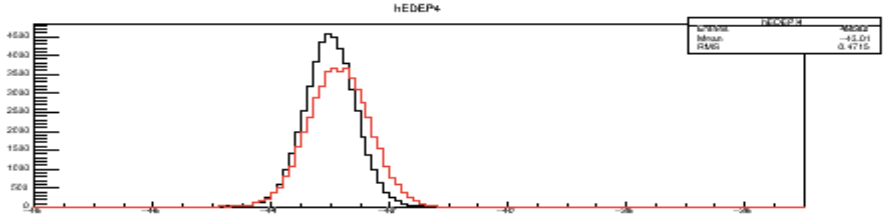


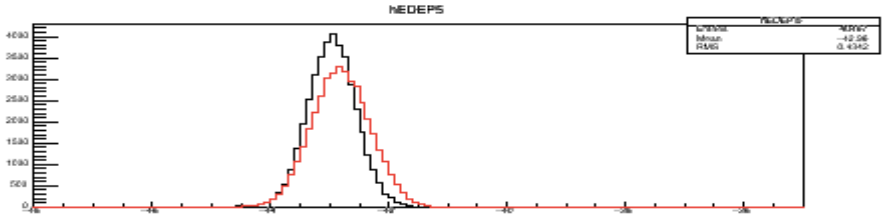


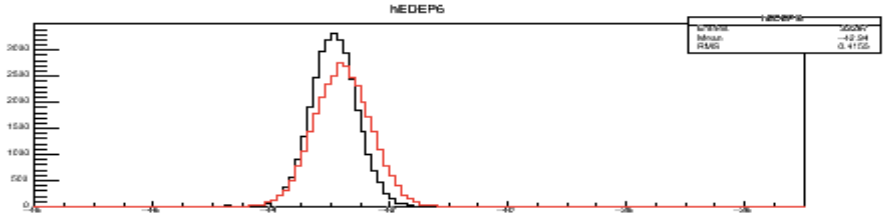


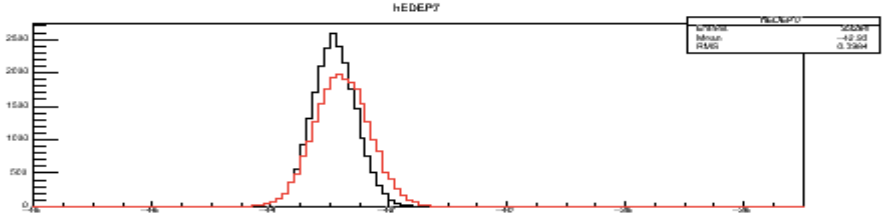
Energy Binning with 2MeV

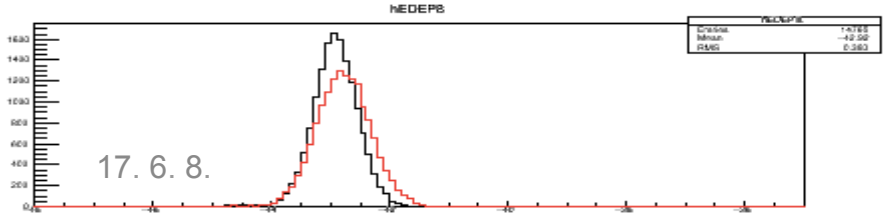


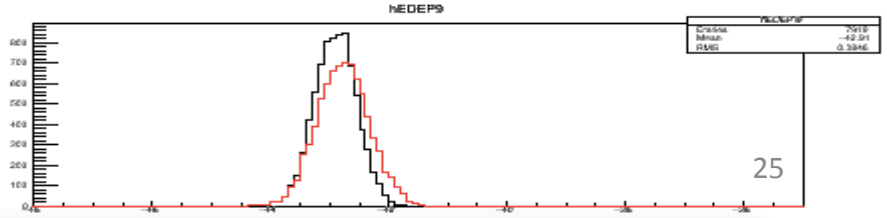












Timing Distributions (MB)

Red : MC (with Resolution)
Black : Data

$$\sigma = \frac{C}{\sqrt{EDep}}$$

- CV && OEV && BCV veto applied