KL3pi0 reconstruction from 5g on CsI and 1g on Barrel

160826

Korea Univ,

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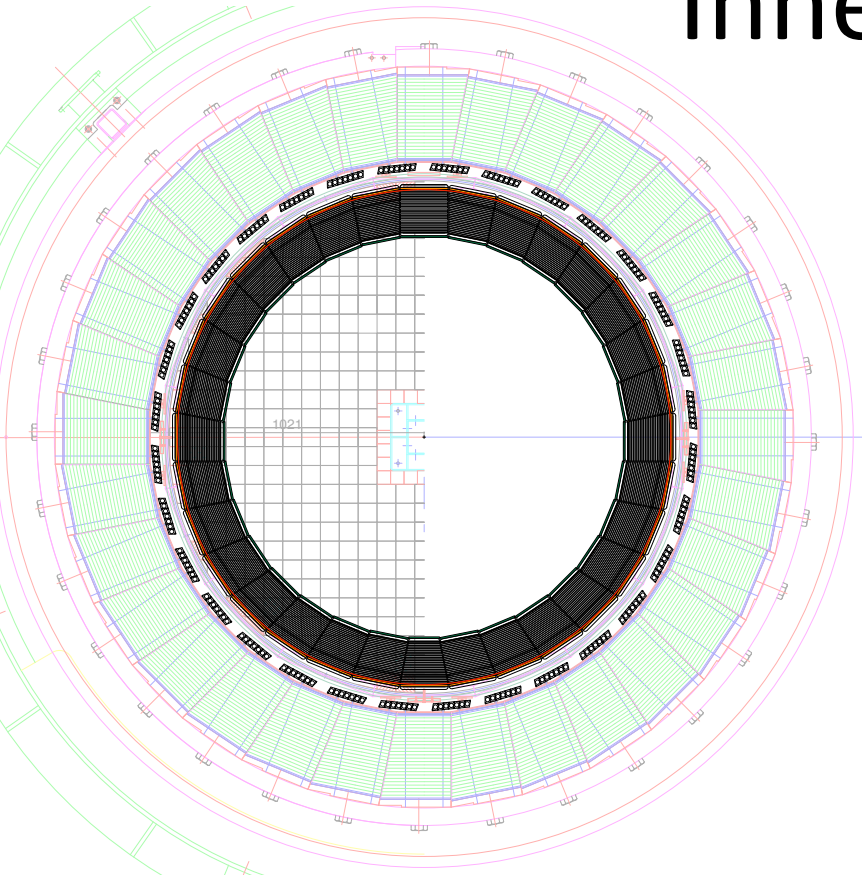
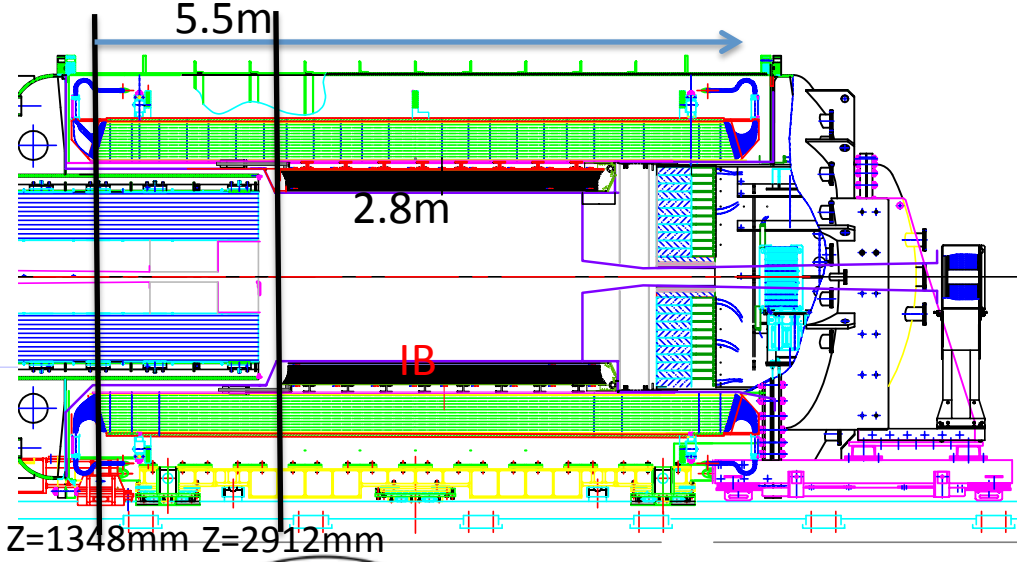
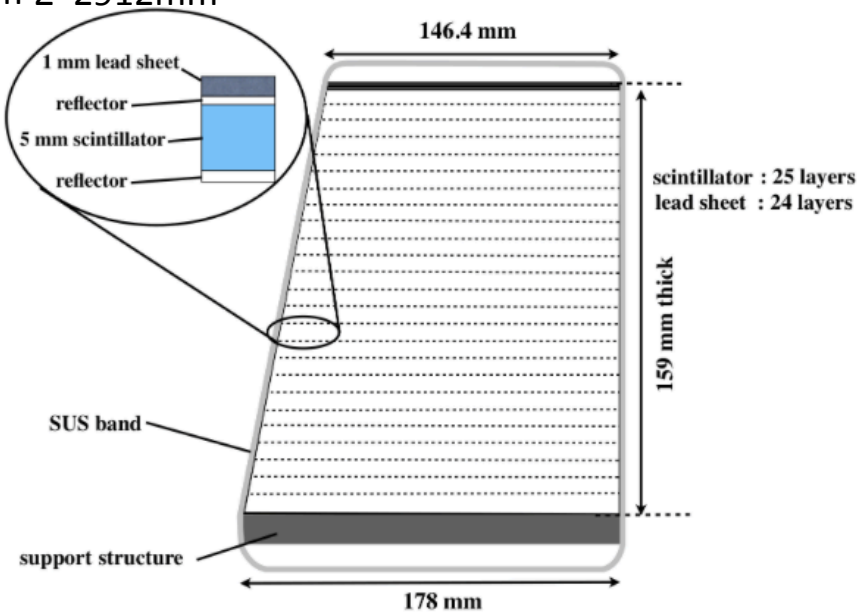
Inner Barrel



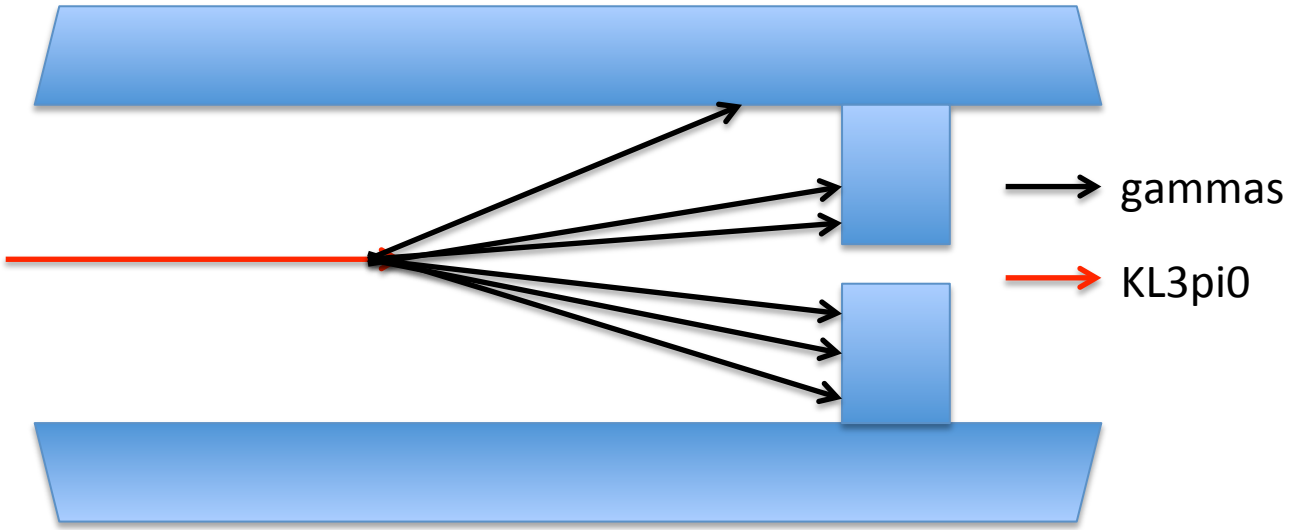




- Additional $5X_0$ radiation length (IB)
  - Reduce detection inefficiency of gammas

From toyoda san,

E14g5ana (1)



- Calculate kinematics of 1 missing gamma.
  - 5g on CsI
    - Find 2pi0 vertex from 4g
    - Select minimum vertex chi2
  - output of barrel detectors
    - Z position from timing differences between upstream PMT and downstream PMT
    - X, Y position from Module ID.

e14g5ana (2)

E_s, P_s : Energy, Momentum of gamma which is not participator of 2pi0

E_r, P_r, : Energy, Momentum of missing gamma which goes to barrel

$$2(E_s E_r - \overrightarrow{p_s} \cdot \overrightarrow{p_r}) = m_\pi{}^2$$

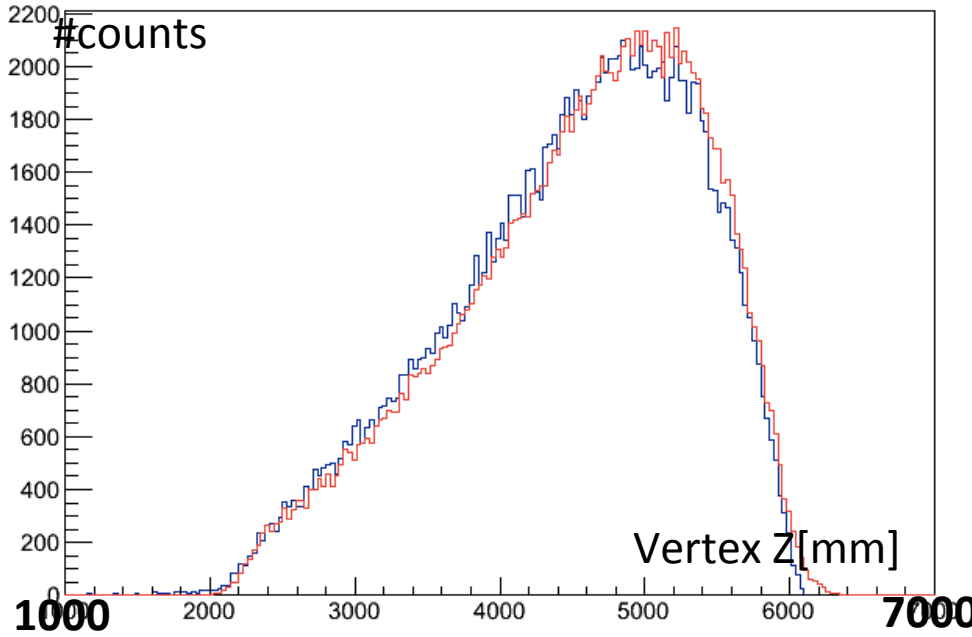
$$\overrightarrow{p_s} \cdot \overrightarrow{p_r} = E_s E_r \cos(\theta)$$

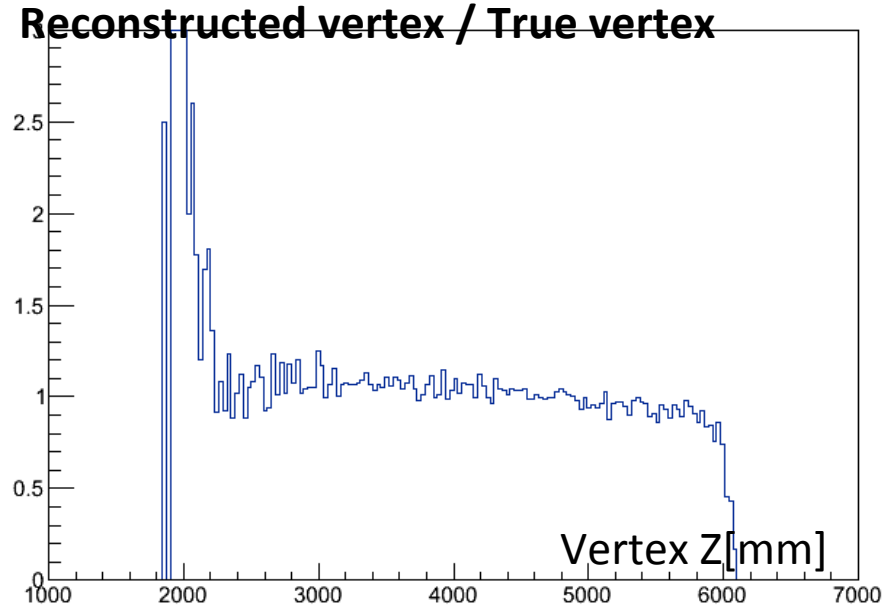
$$E_r = m_\pi{}^2/(2E_s(1\text{-}\cos(\theta)))$$

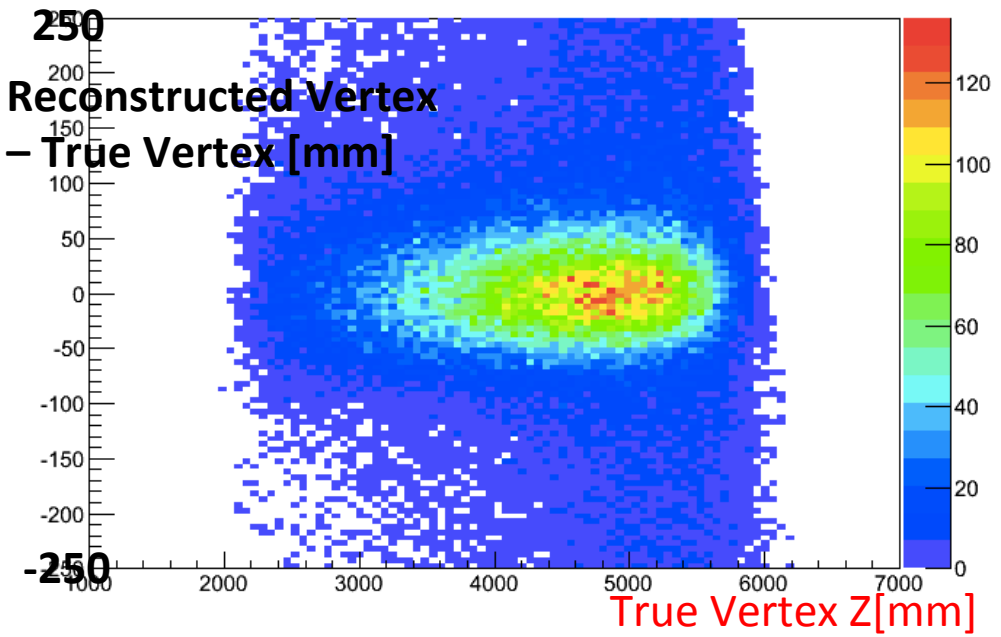
After finding kinematics of missing gamma, Calculate invariant mass of 6gamma

KL3pi0 MC check (vertex)

- Red : True Vertex Z from MC
- Blue : Reconstructed Vertex Z of 2pi0

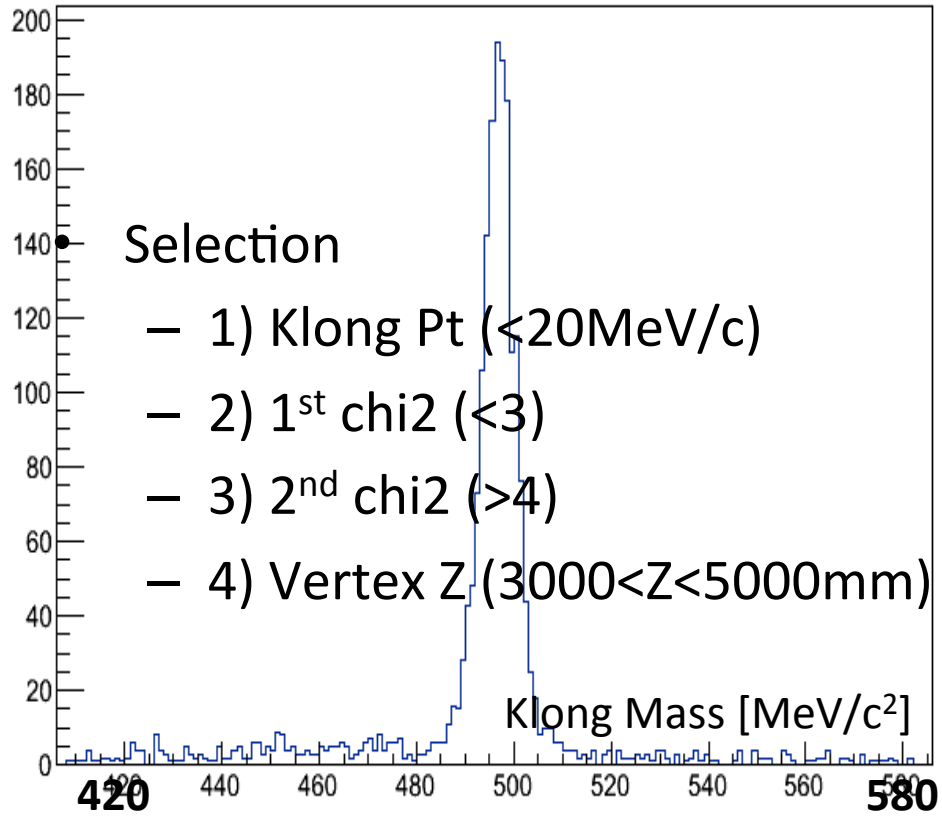


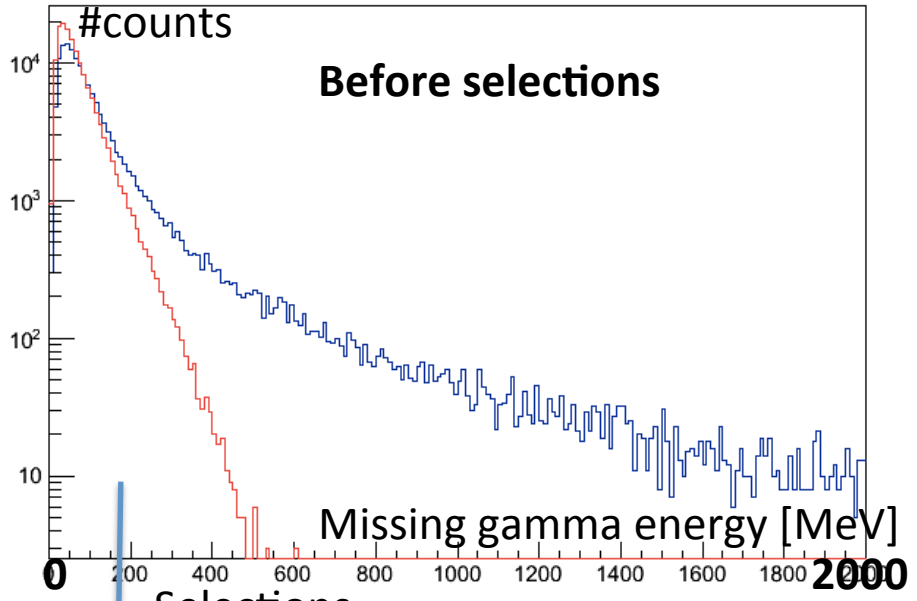




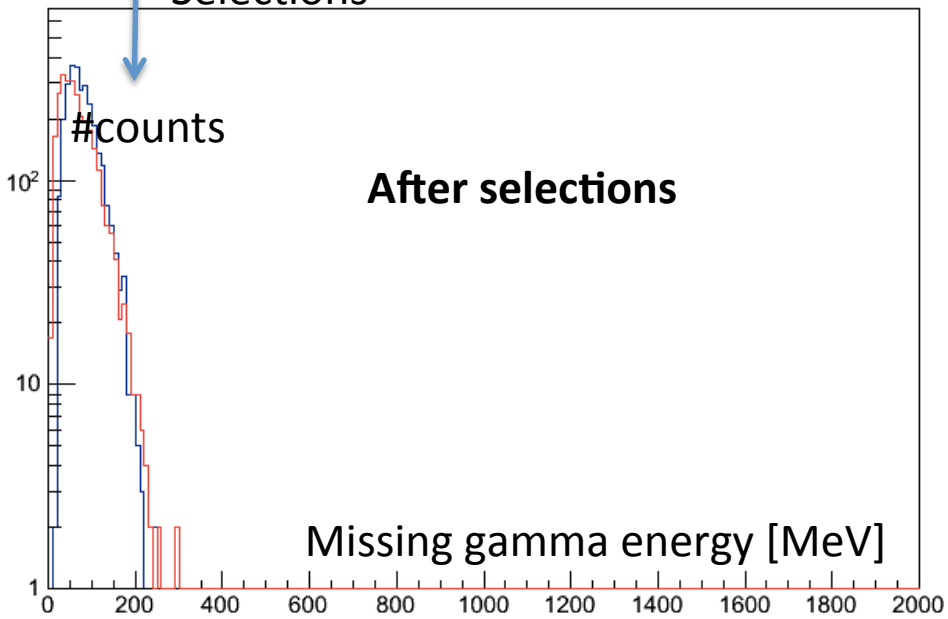
KL3pi0 MC check (energy, mass)

- Red : True Vertex Z from MC
- Blue : Reconstructed Vertex Z of 2pi0





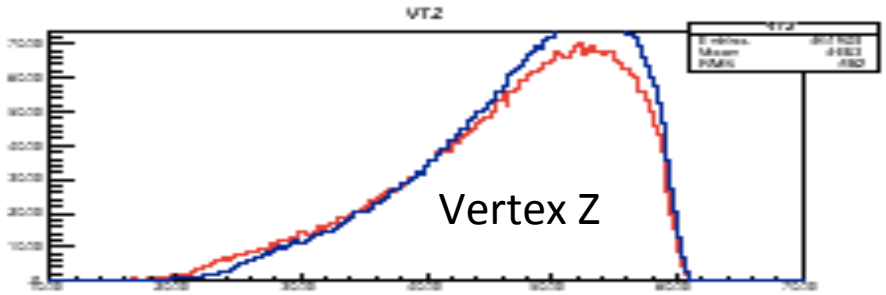
Selections

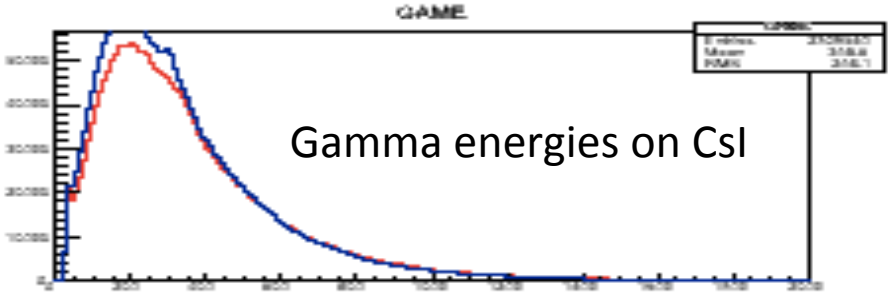


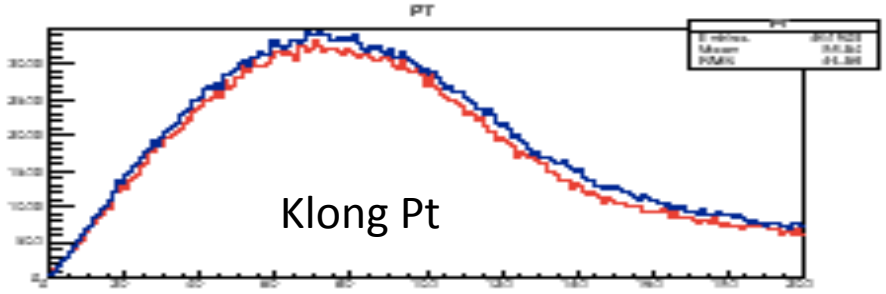
KL default MC vs data

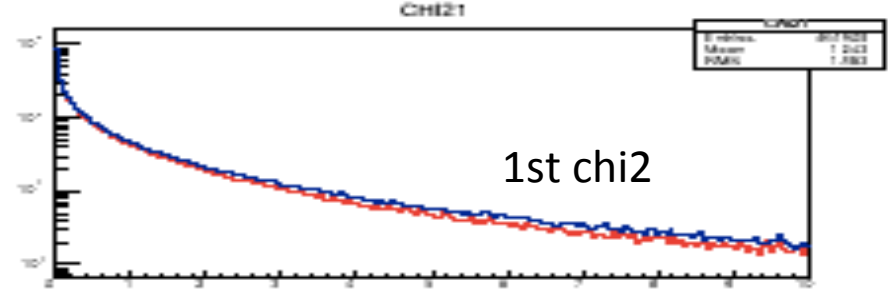
- Data
  - Run62, 27kW minimum bias data
  - For using MB data without online-veto
  - Select proper data using nakagiri san's DAQ summary
  - Total P.O.T. of Min. bias = 4.253e15
- MC
  - KL default MC
  - #KLs = $5*10^8$ (= 2.778e15 P.O.T from jack's result)
  - Accidental overlay : 18932

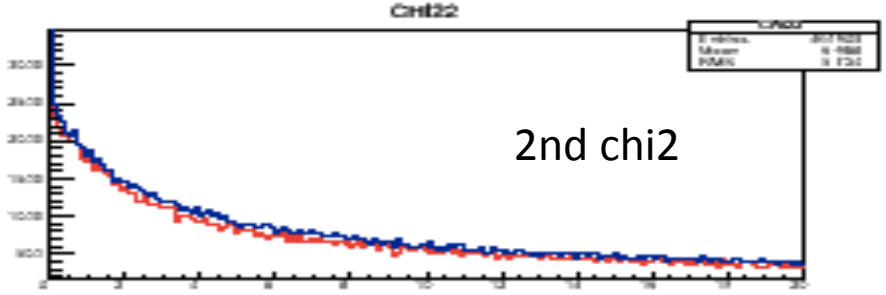
Variables

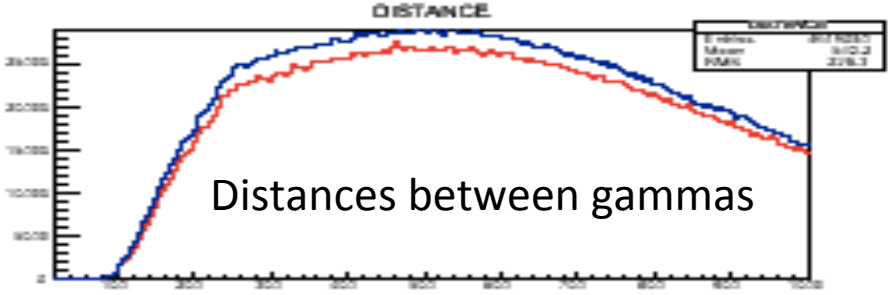


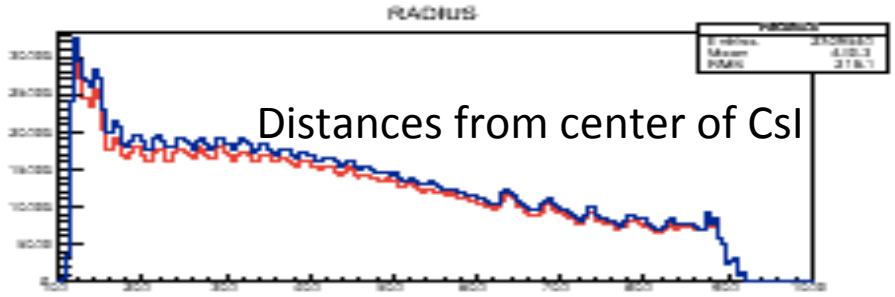










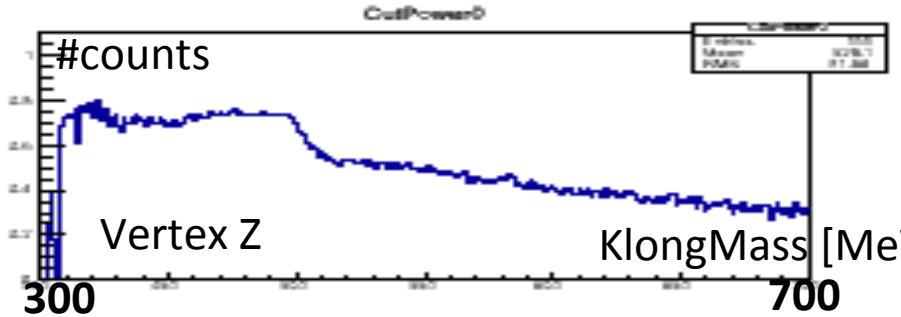


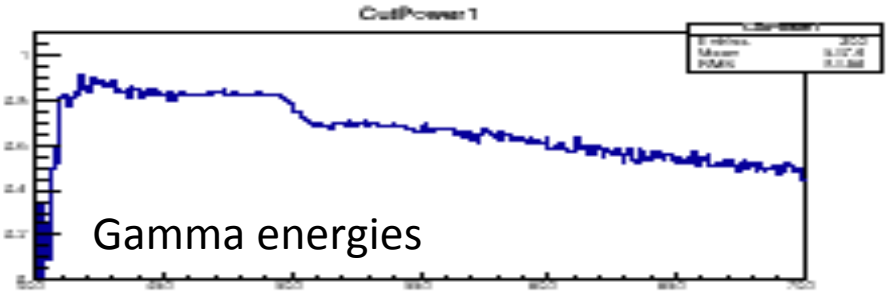
- Blue : data
- Red : MC
- Normalized with POT

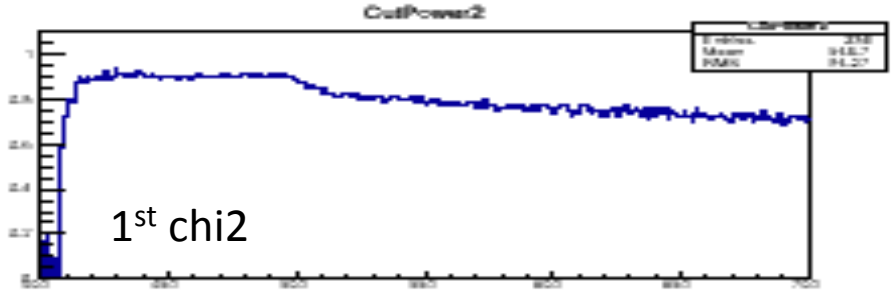
Kinematical Cuts

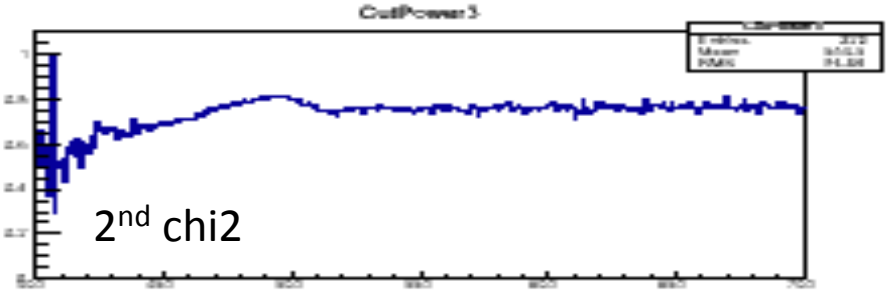
- 1) vertex Z
  - 2500<Z<5000 [mm]
- 2) gamma energies on CsI
  - 100<E<2000 [MeV]
- 3) KlongPt
  - PT<30 [MeV/c]
- 4) 1st chi2
  - <4
- 5) 2nd chi2
  - >10
- 6) distances between gammas
  - >175 [mm]
- 7) distances from center of CsI
  - 150<R<900 [mm]

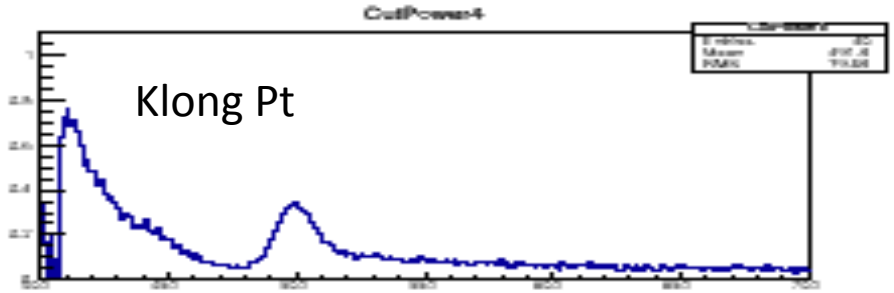
Cut Power

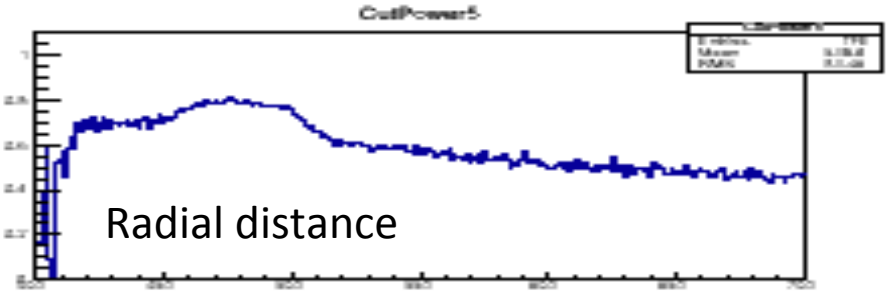


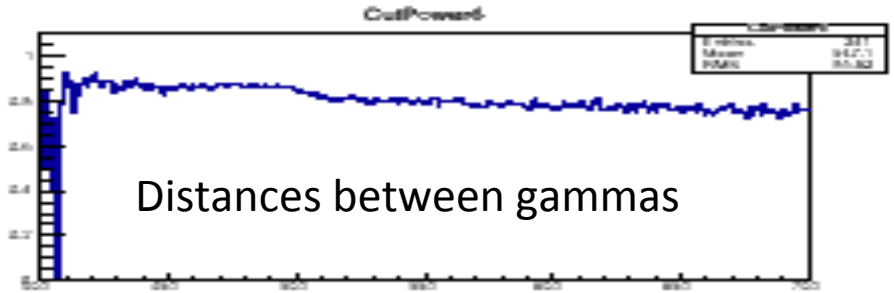






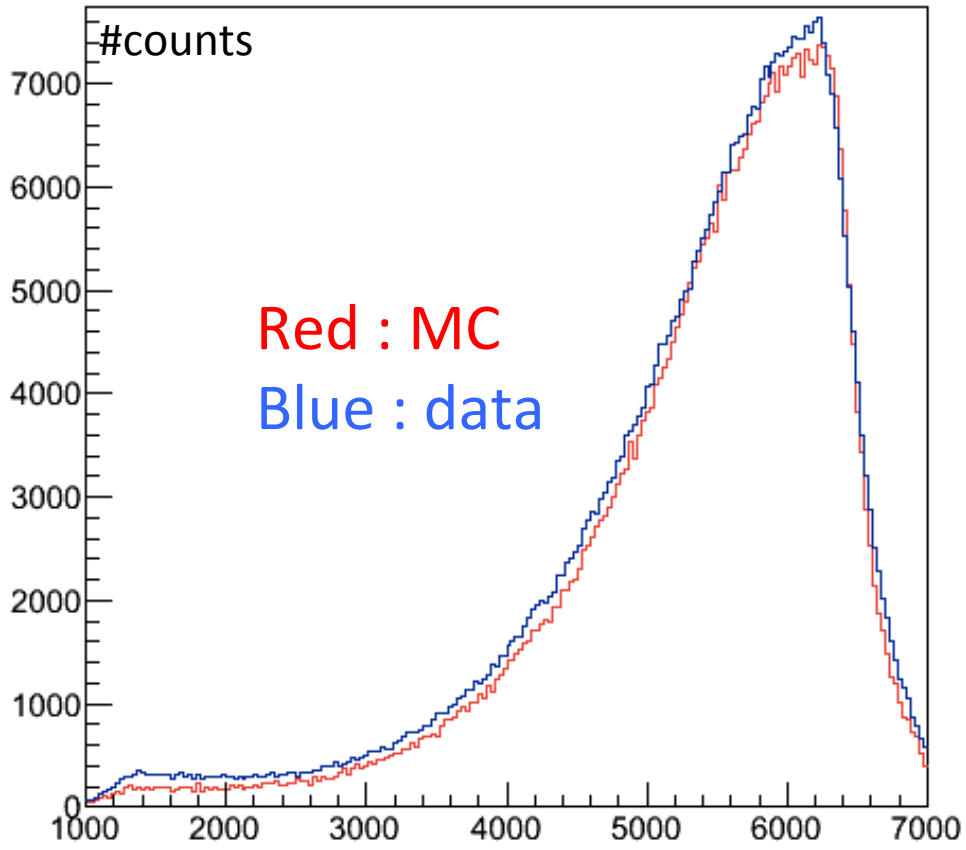


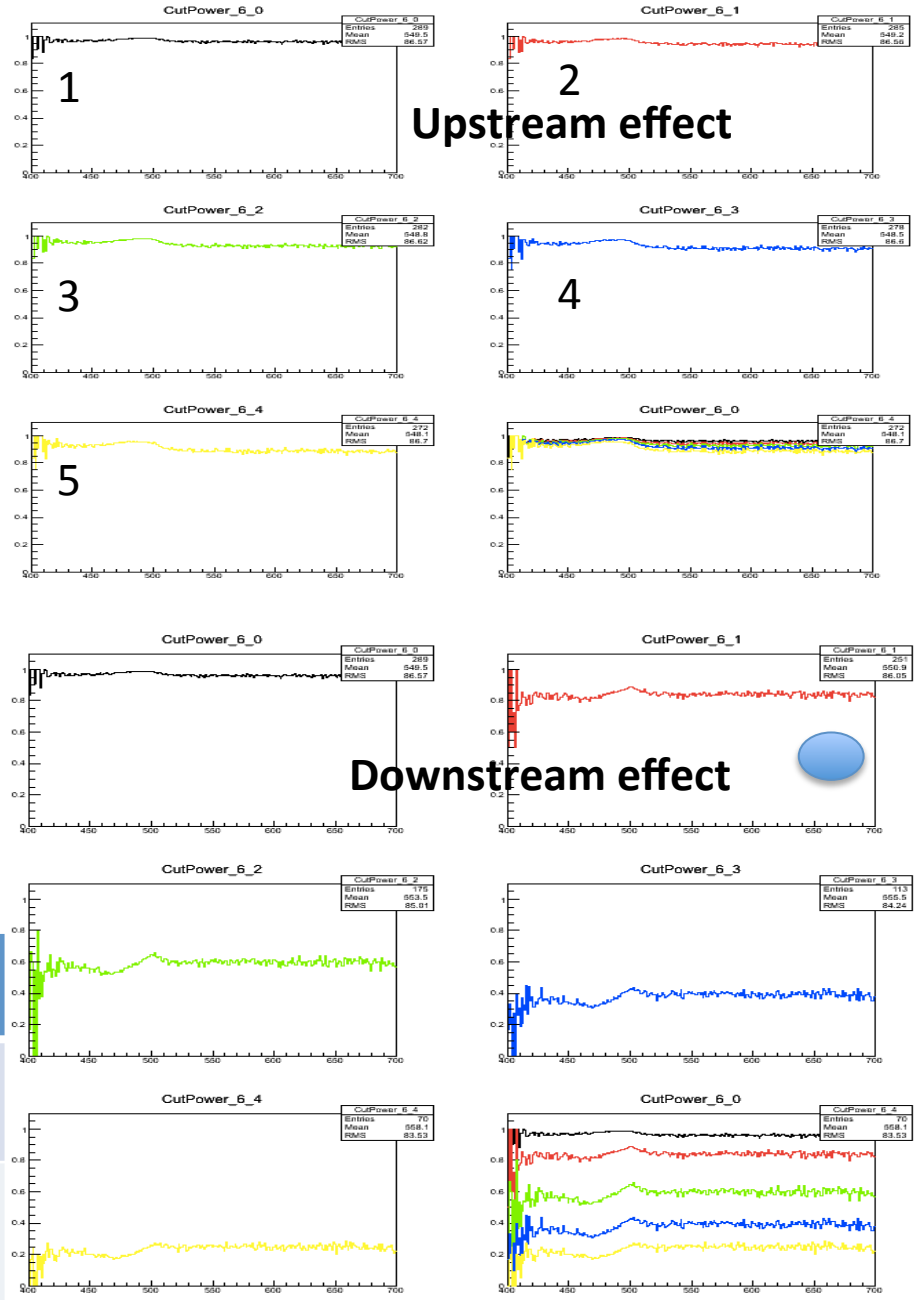




Cut Power =
#counts after cut i
/ #counts of no cut

Barrel Cuts

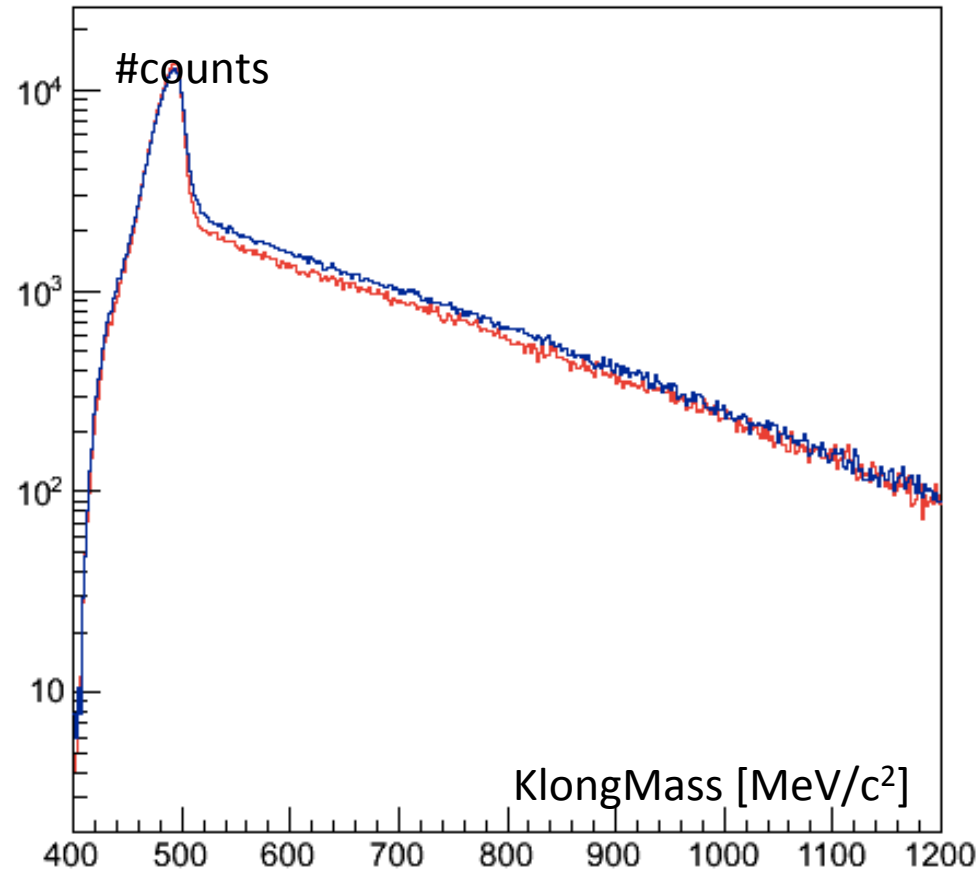




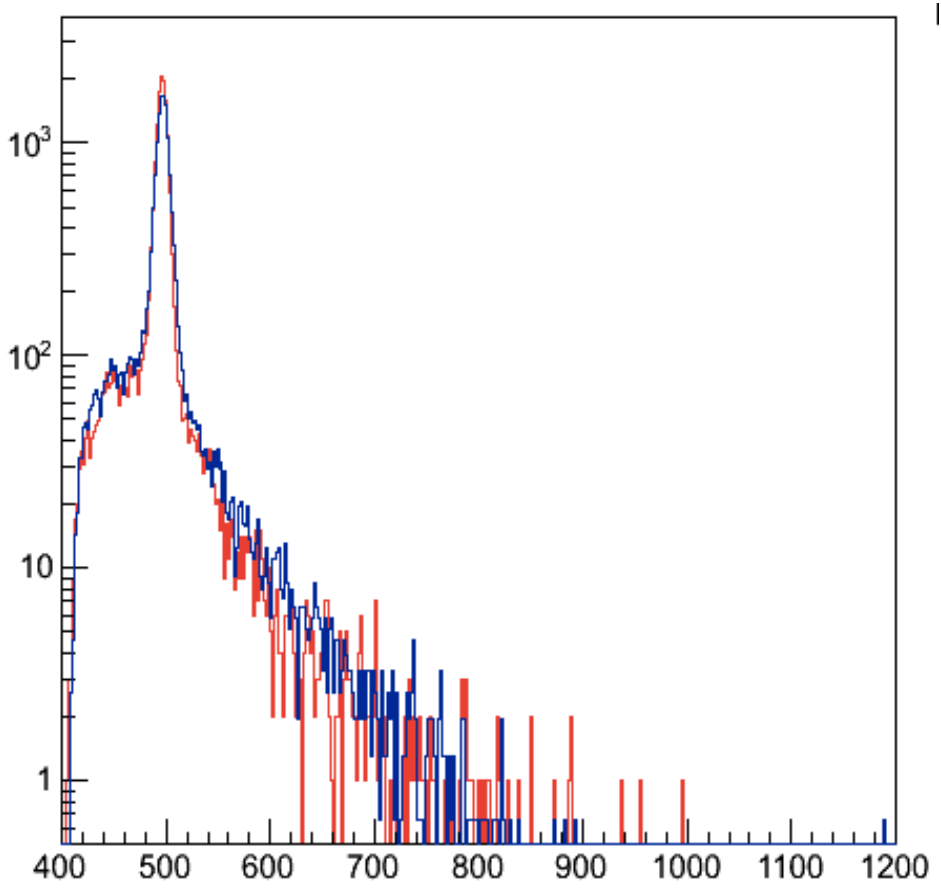
	1	2	3	4	5
Up. Cut region	1348~ 6798	1848~ 6798	2348~ 6798	2848~ 6798	3348~ 6798
Down. Cut region	1348~ 6798	1348~ 6298	1348~ 5798	1348~ 5298	1348~ 4798

KLmass After applying all cuts

Before cut



After all cut



In MC, mass distribution has only error from CsI
In data, not only CsI, But also barrel give errors to mass distribution

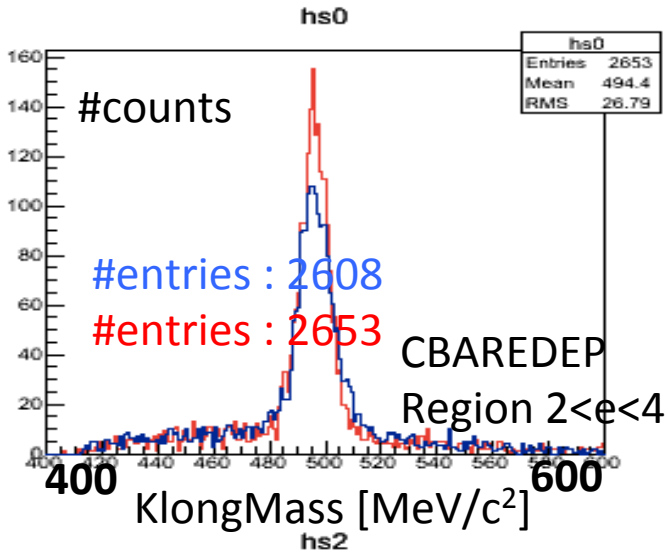
Red : MC

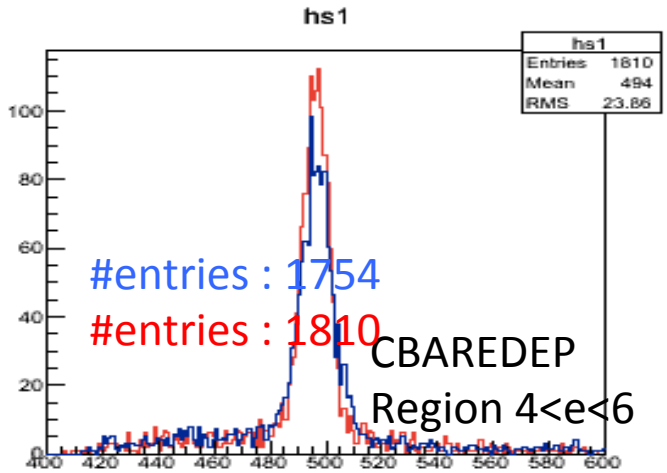
Blue : data

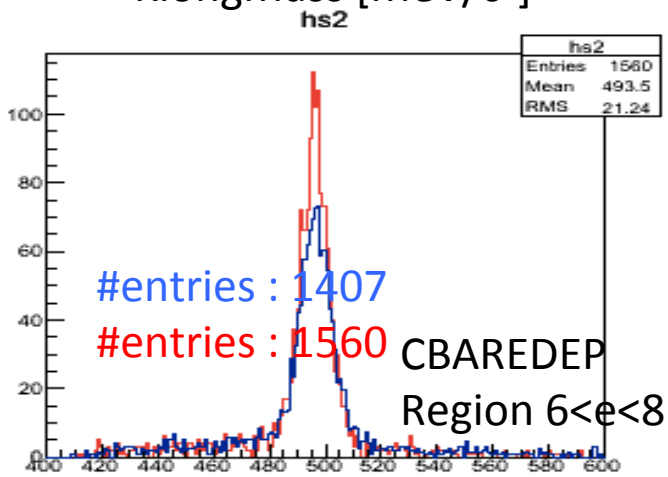
Dispersion of mass distribution VS MB energy deposits

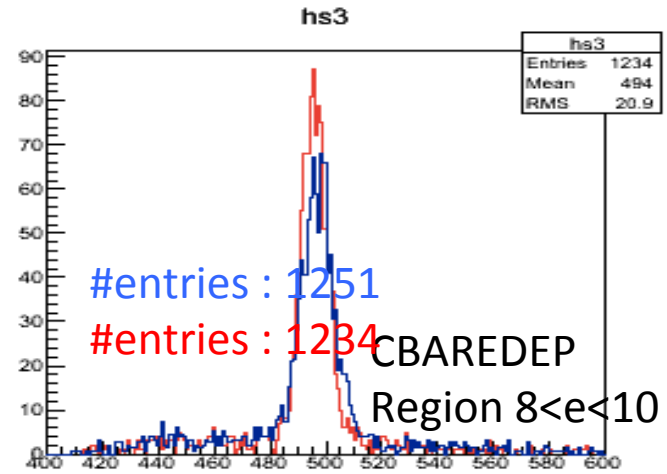
Red : MC

Blue : data









(normalized with POT)

Run69

- Data
  - Minimum bias data
  - Use run list which togawa san made for kl2pi0 analysis
  - Total POT = 7.393e15
  - Reconstruct kl3pi0 using inner barrel in same way.

Compare mass distribution

Inner barrel data

- 질량분포 가우시안 피팅으로 가우시안의 시그마 확인
  - CsI + barrel(MB or IB
- 에러prop?