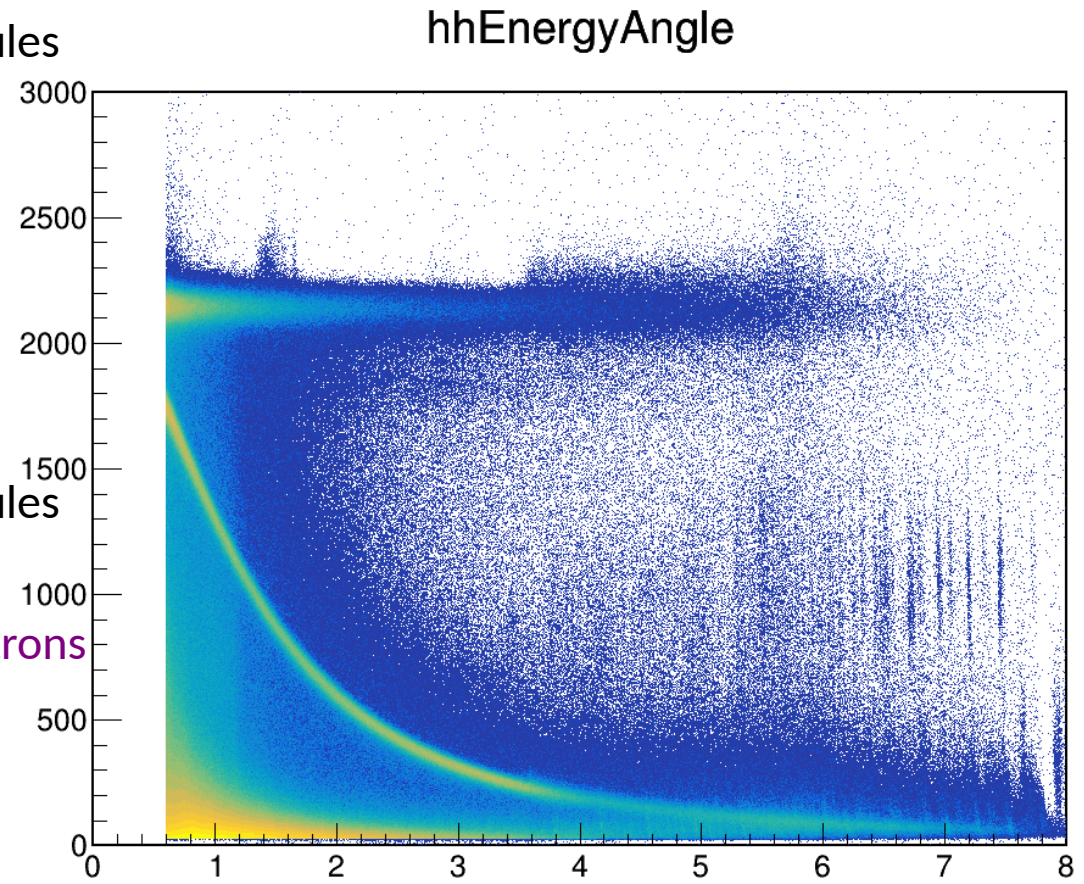
GEM Efficiency – Event Selection

Ep cuts:

- HyCal cluster size cut for discharge modules
- Elasticity cut
- HyCal Dead modules cut
- Overflow channels cut

Moller cuts:

- HyCal cluster size cut for discharge modules
- Kinematics cut for each electron
- Elasticity cut for energy sum of two electrons
- Coplanarity cut
- Moller Z cut
- HyCal Dead modules cut



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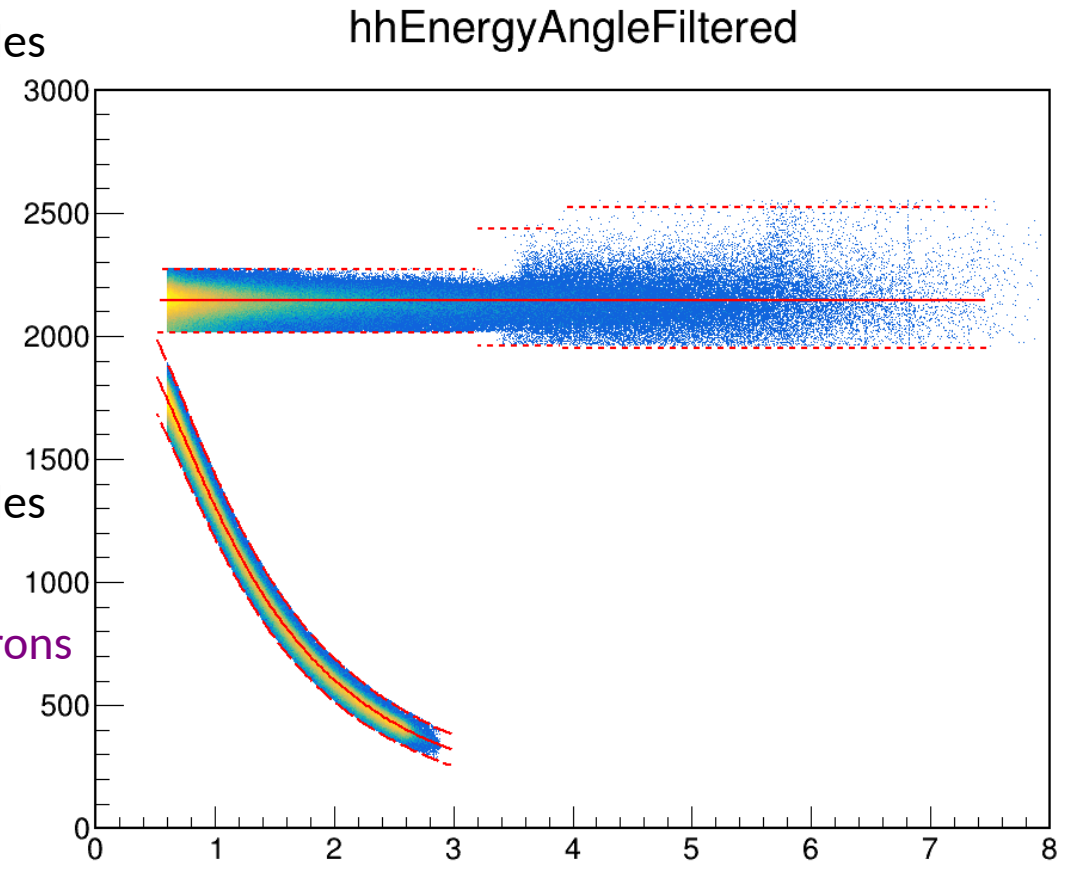


EE2 kinematics cut

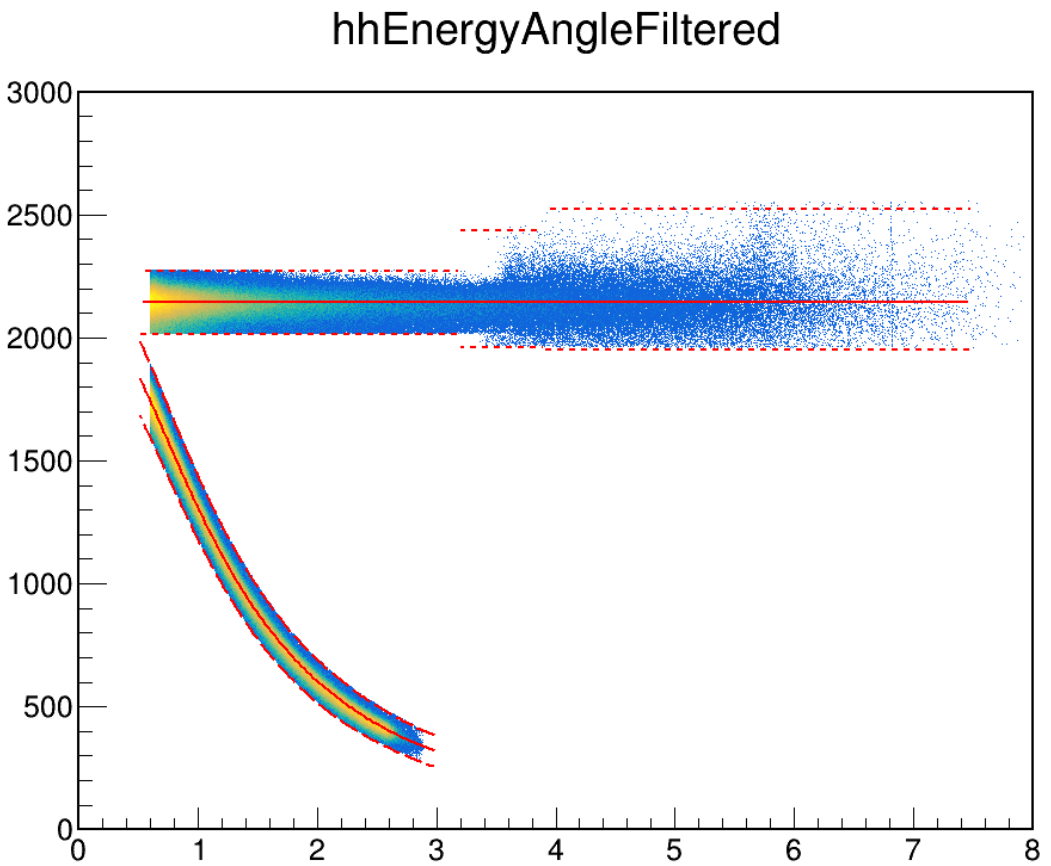
- HyCal cluster size cut for discharge modules : applied to both ep/ee2
- Kinematics cut and Elasticity cut are both energy cuts, they share the same cut threshold (number of sigma)
- Overflow channels cut only applied to ep

Kinematics cut for ee2:

$$\left|E_{measure} - E_{expected}\right| < N_{\sigma} \times \sigma_{energy}$$

$$E_{expected} = E_{moller}(\theta)$$

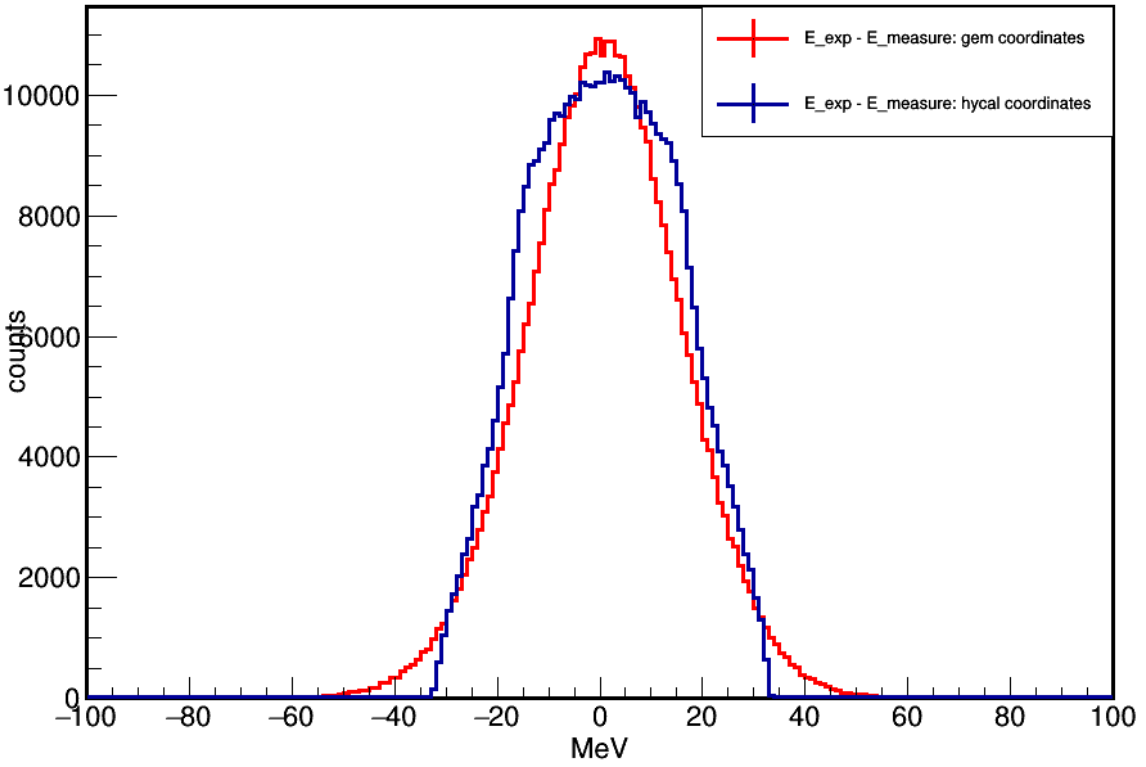
θ : *Scattering angle* from HyCal



EE2 kinematics cut

- Check E_expected using GEM coordinates

$$E_{measure} - E_{expected}$$



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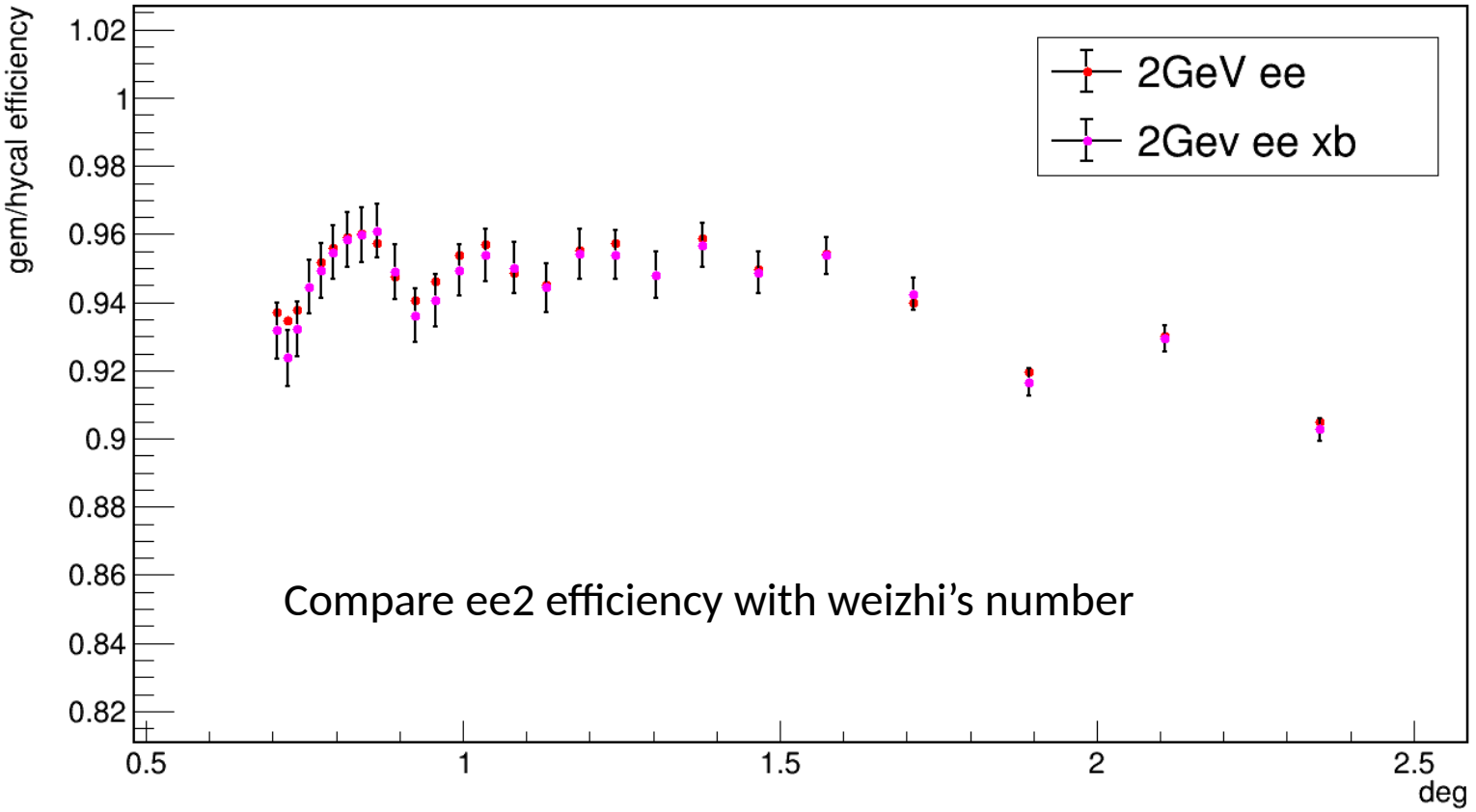
$$E_{expected} = E_{moller}(\theta)$$

θ : *Scattering angle* from HyCal

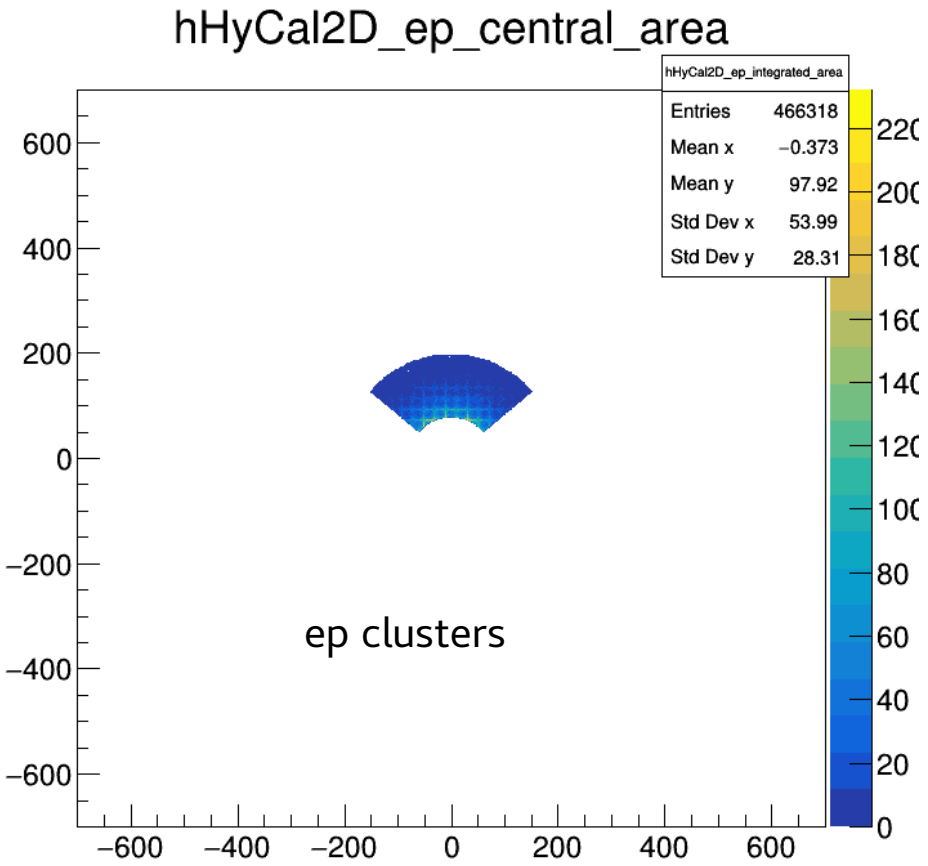
GEM Efficiency

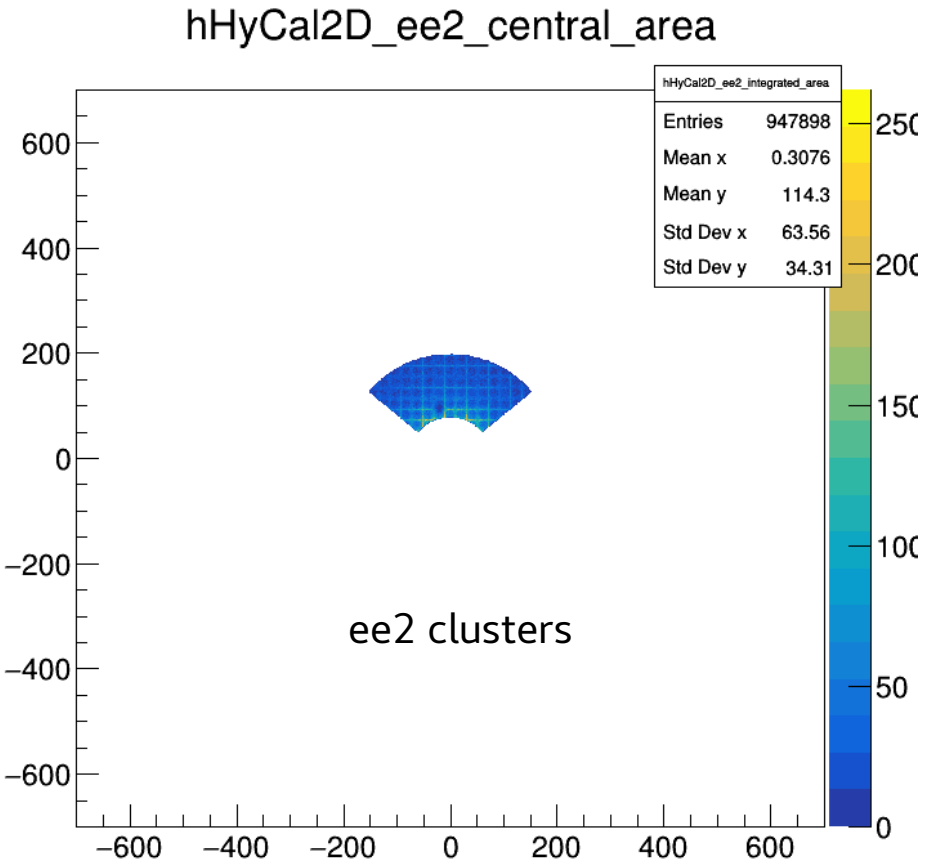
- Red number – weizhi's efficiency number
- Purple number – xb efficiency number with 2 sigma HyCal cluster energy cut, combined 4 production runs
- Basically the two agrees, some angle has ~ 0.2% difference probably due to different HyCal dead module cut, and other cuts for ee2
- This difference is reasonable also due to we are using different runs, usually different runs have slightly different efficiency



GEM Efficiency

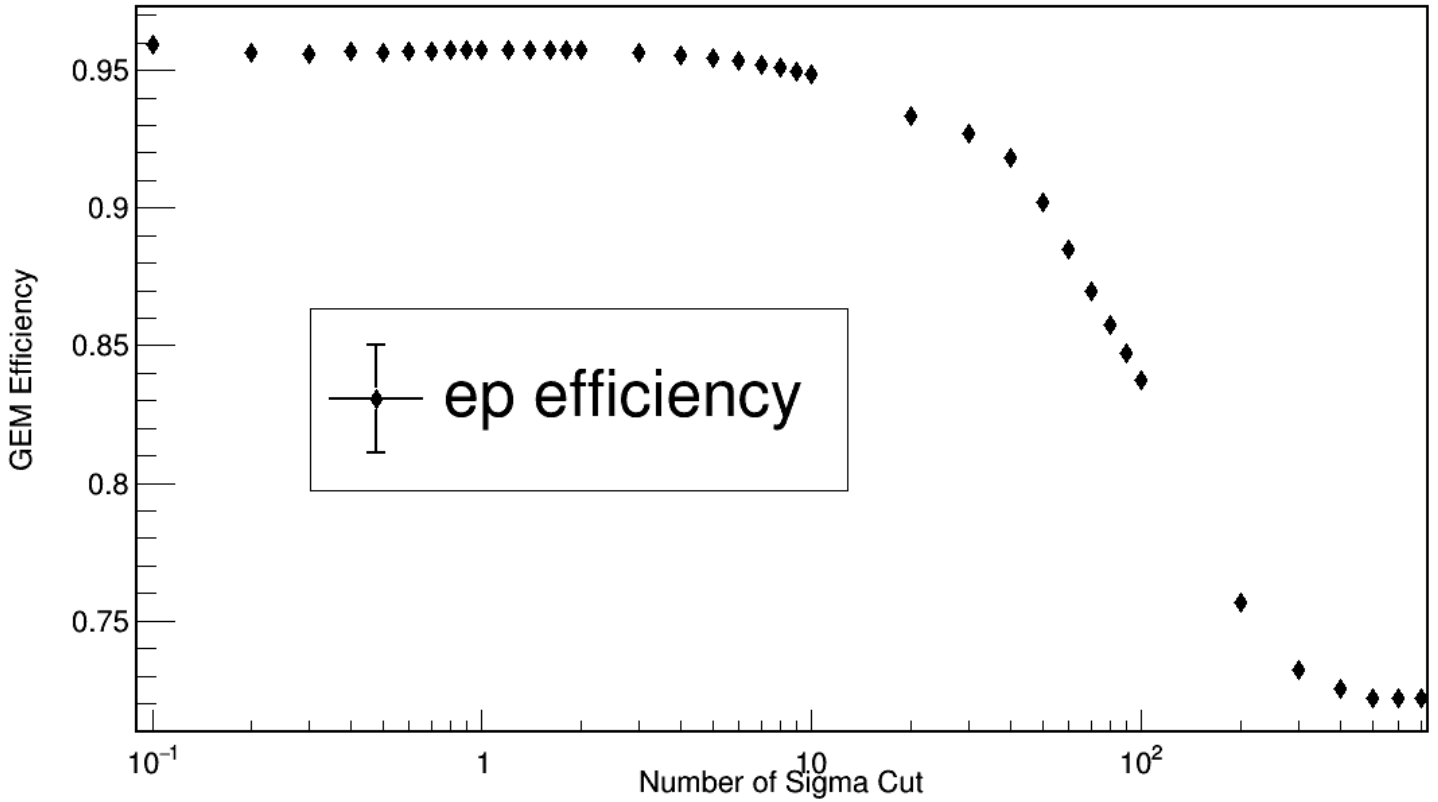
- GEM efficiency in a specific integrated area
- ep/ee2 clusters in this area





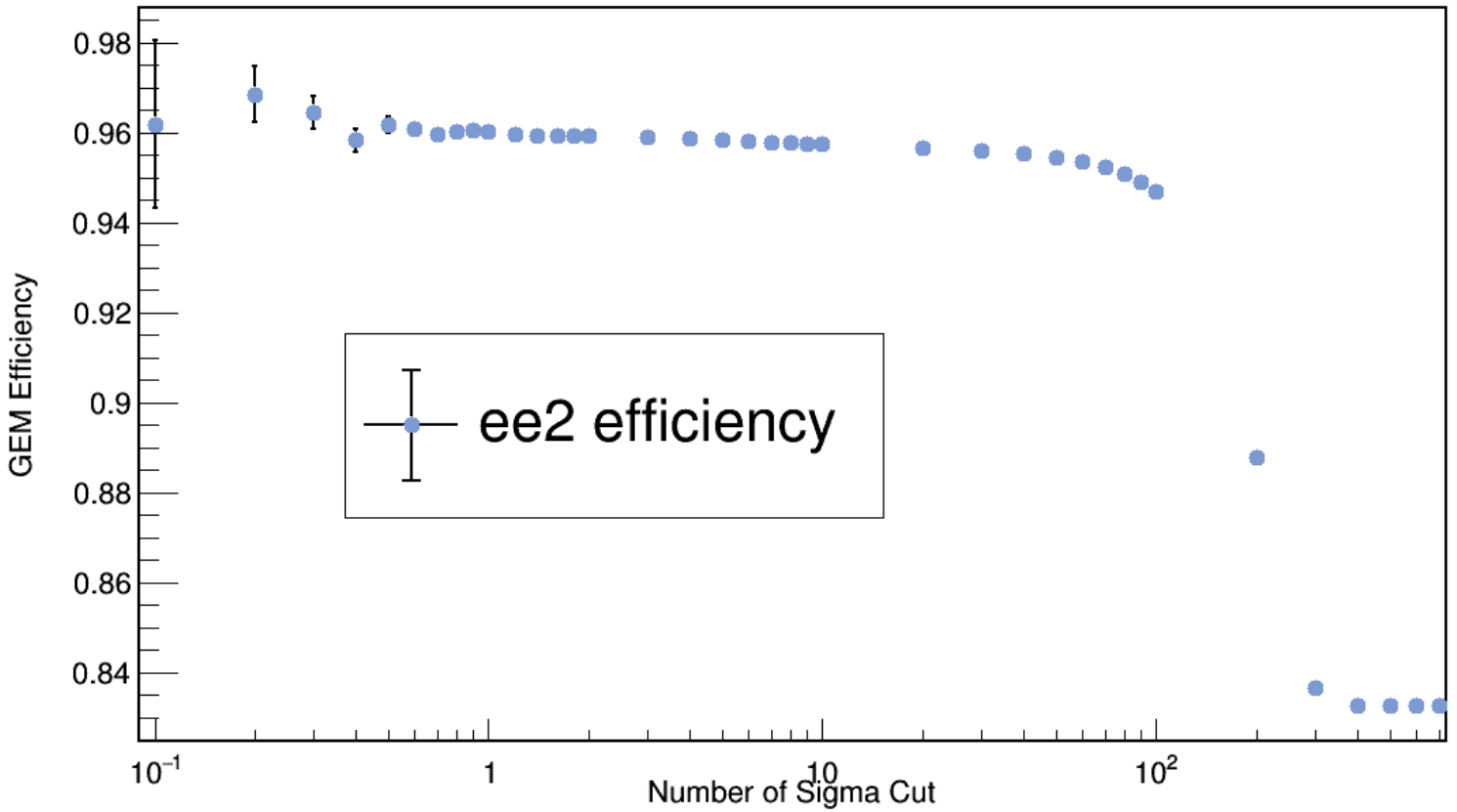
GEM Efficiency

- GEM efficiency in a specific integrated area
- Scan the efficiency change against different HyCal cluster energy cut
- At ~4 Sigma, efficiency reached a flat region, keep shrinking number of sigma cut won't increase efficiency



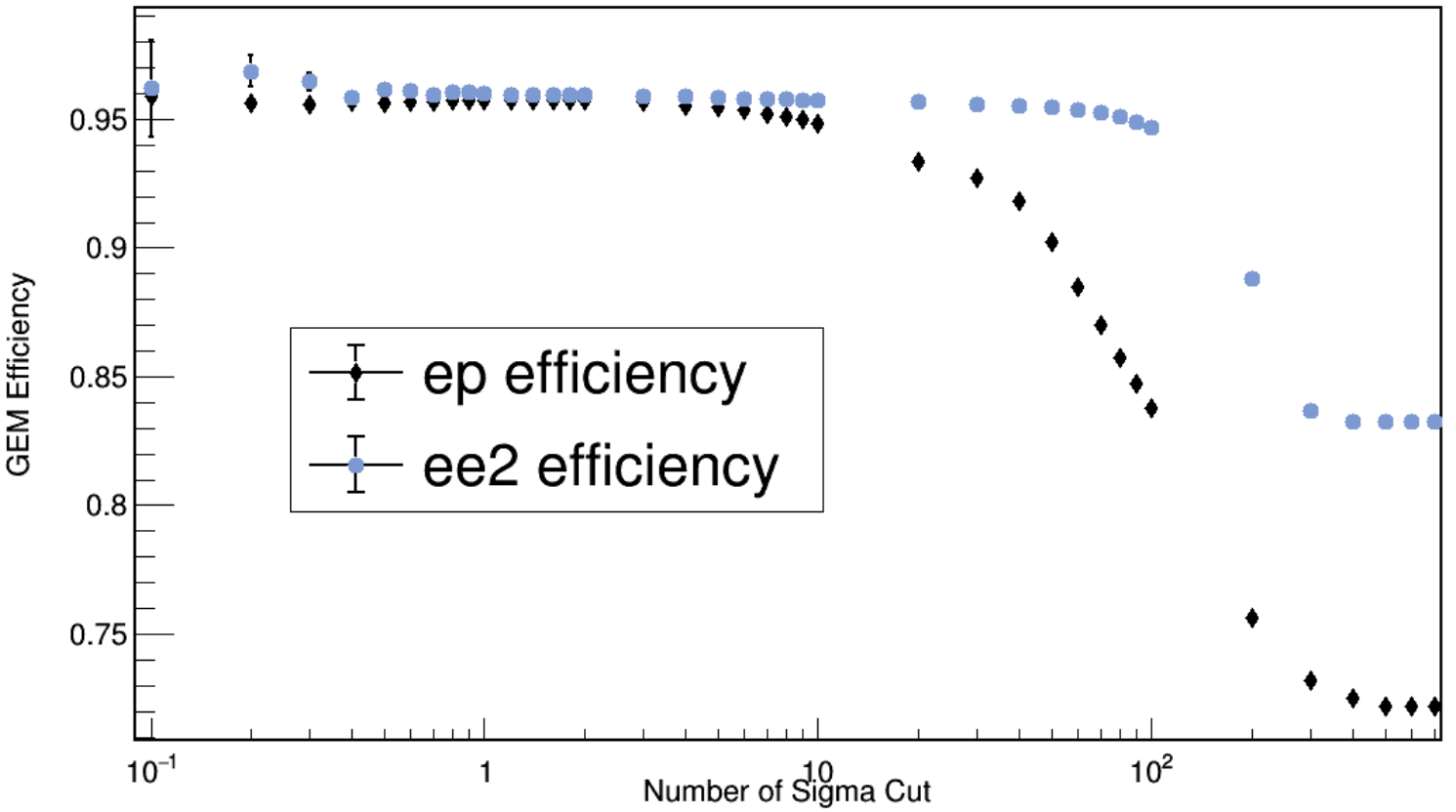
GEM Efficiency

- GEM efficiency in a specific integrated area
- A plateau appears at very large number (~10) of energy sigma cut
- The other cuts already made ee2 very tight



GEM Efficiency

- GEM efficiency in a specific integrated area
- ee2/ep efficiency converge at around 3 sigma cut



GEM Efficiency

- GEM efficiency in a specific integrated area
- ee2/ep/ee1 converge at < ~2 energy sigma cut