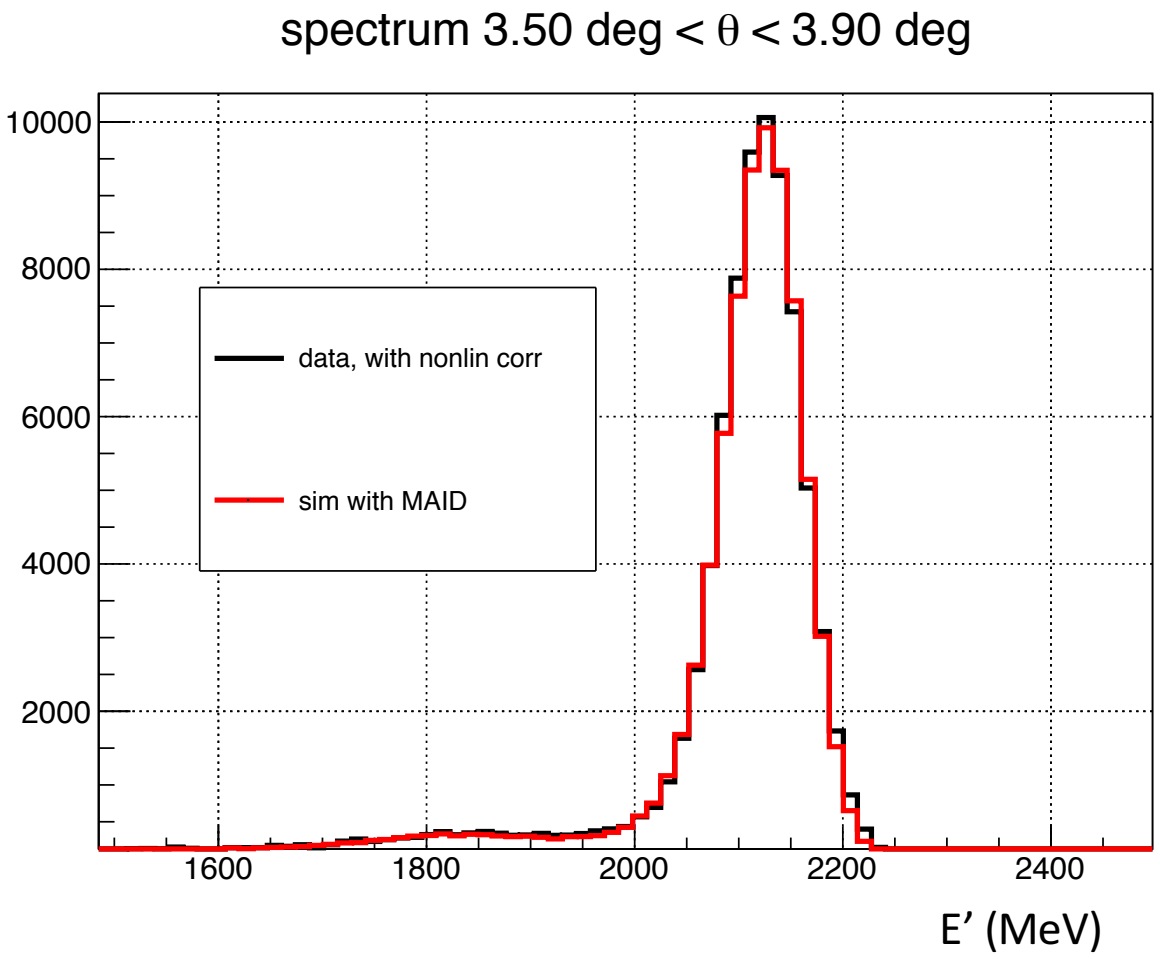
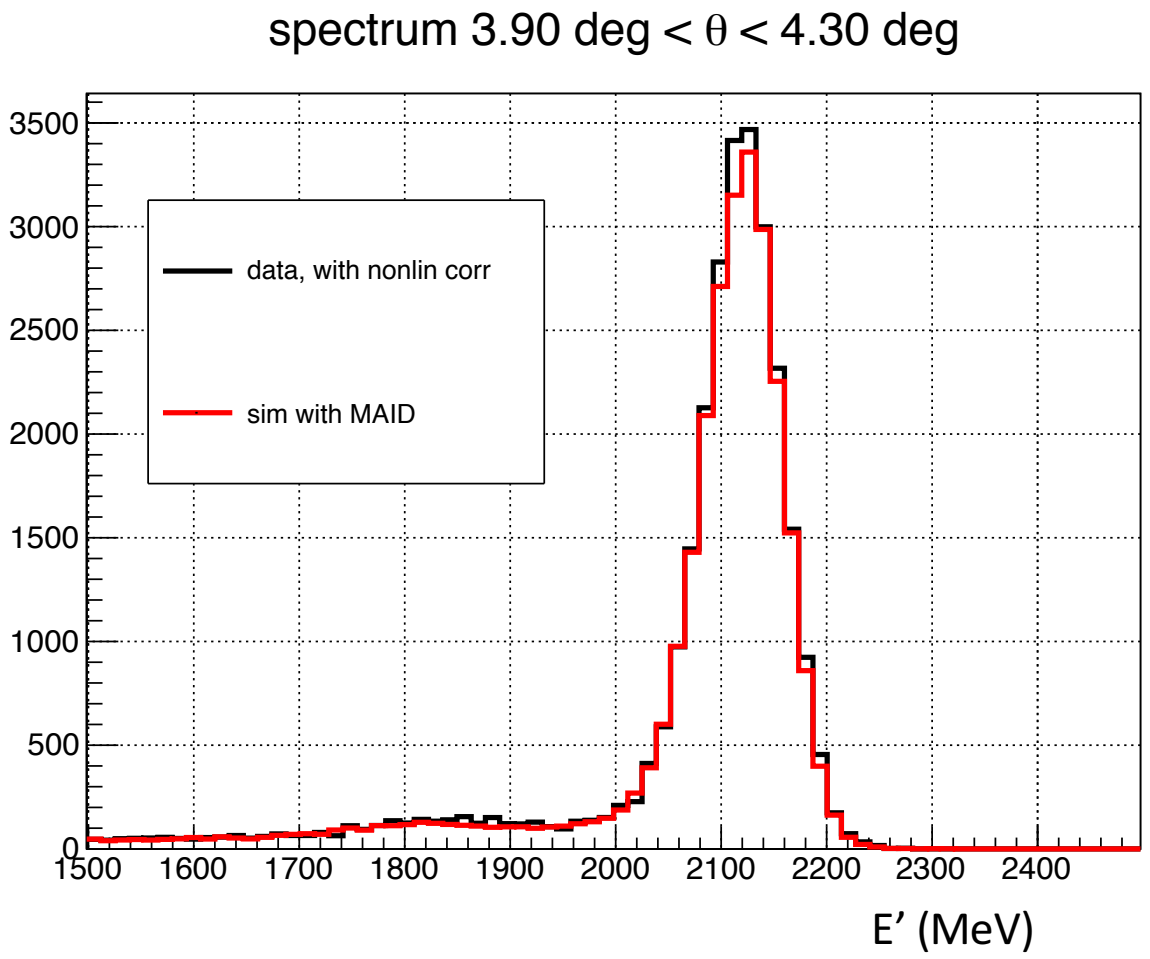
Spectrum comparison

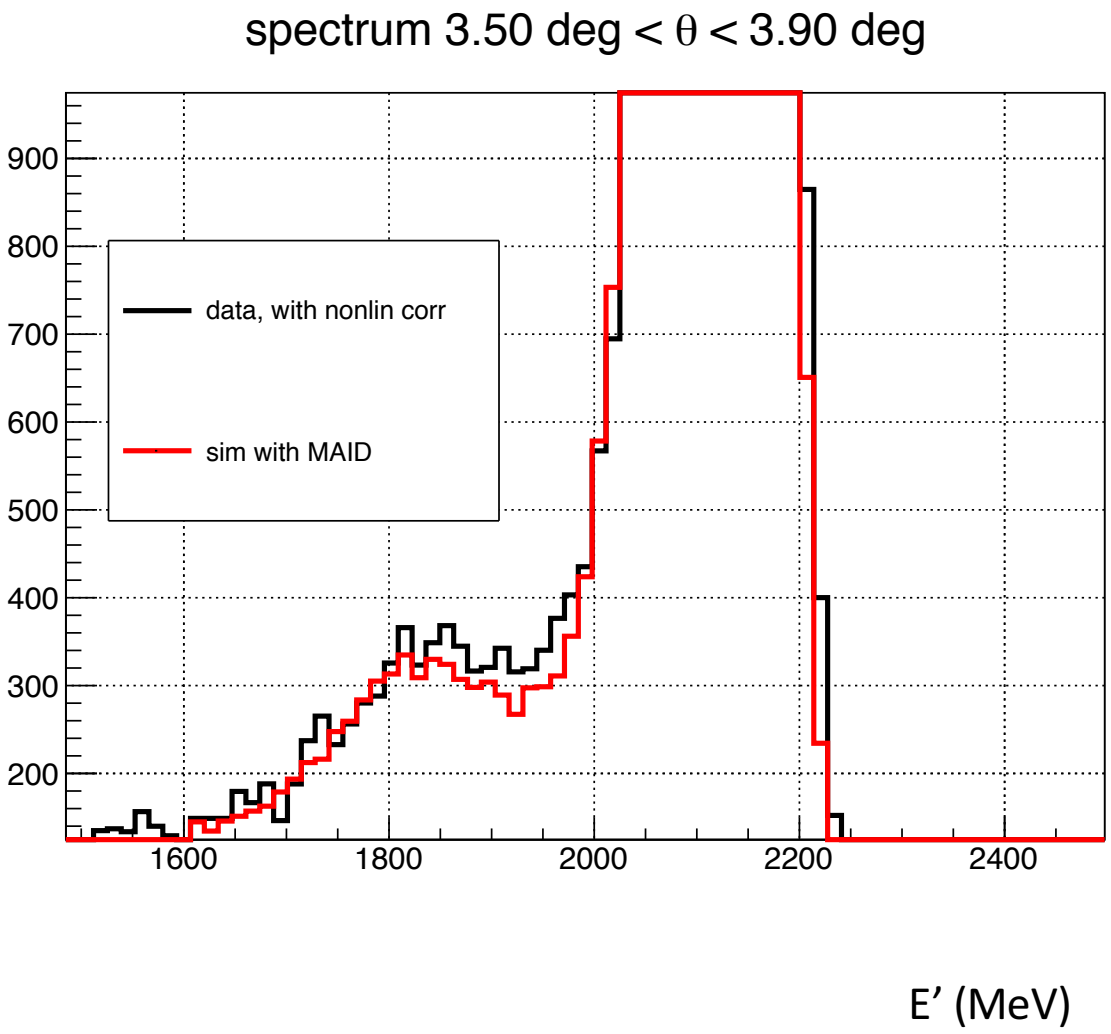
Only PWO modules, 1st layer at transition excluded

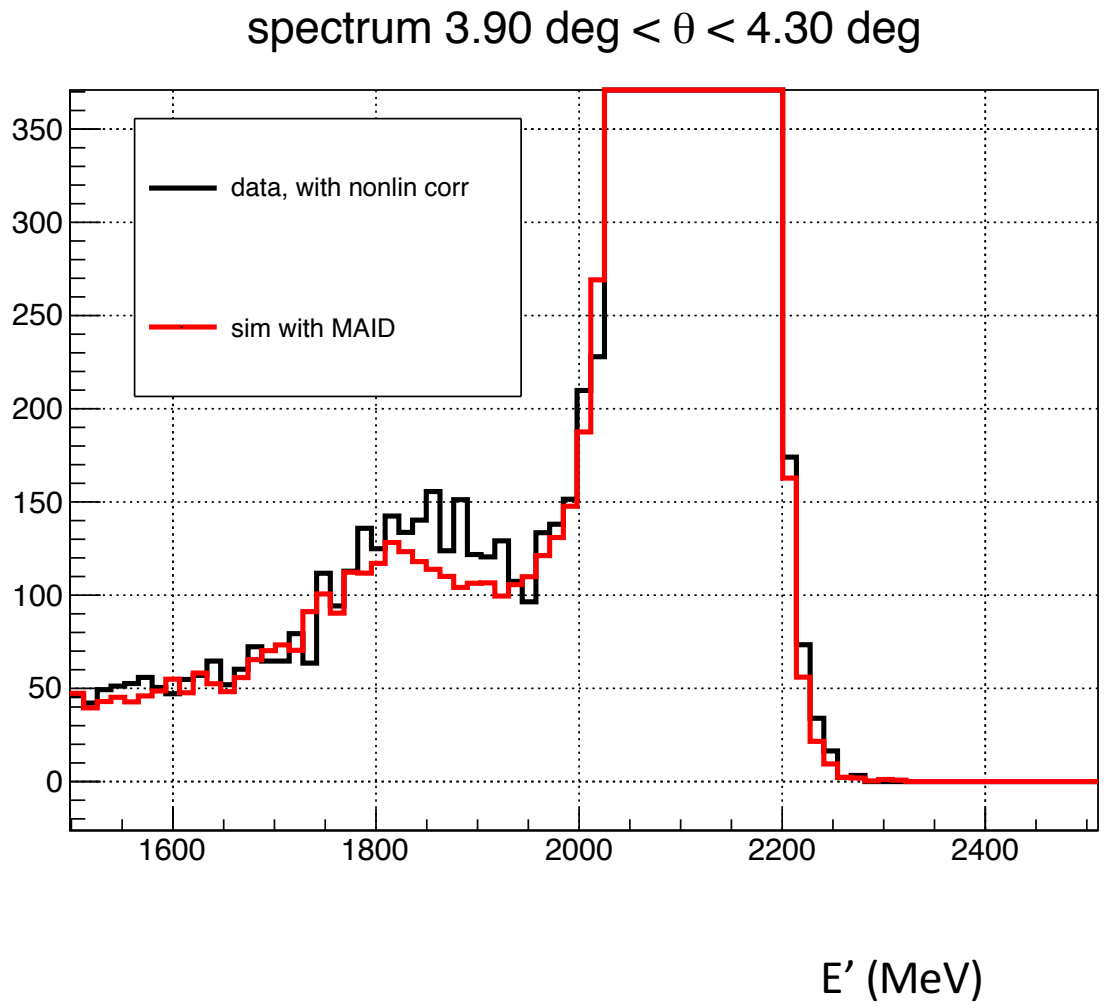




Spectrum comparison

Only PWO modules, 1st layer at transition excluded

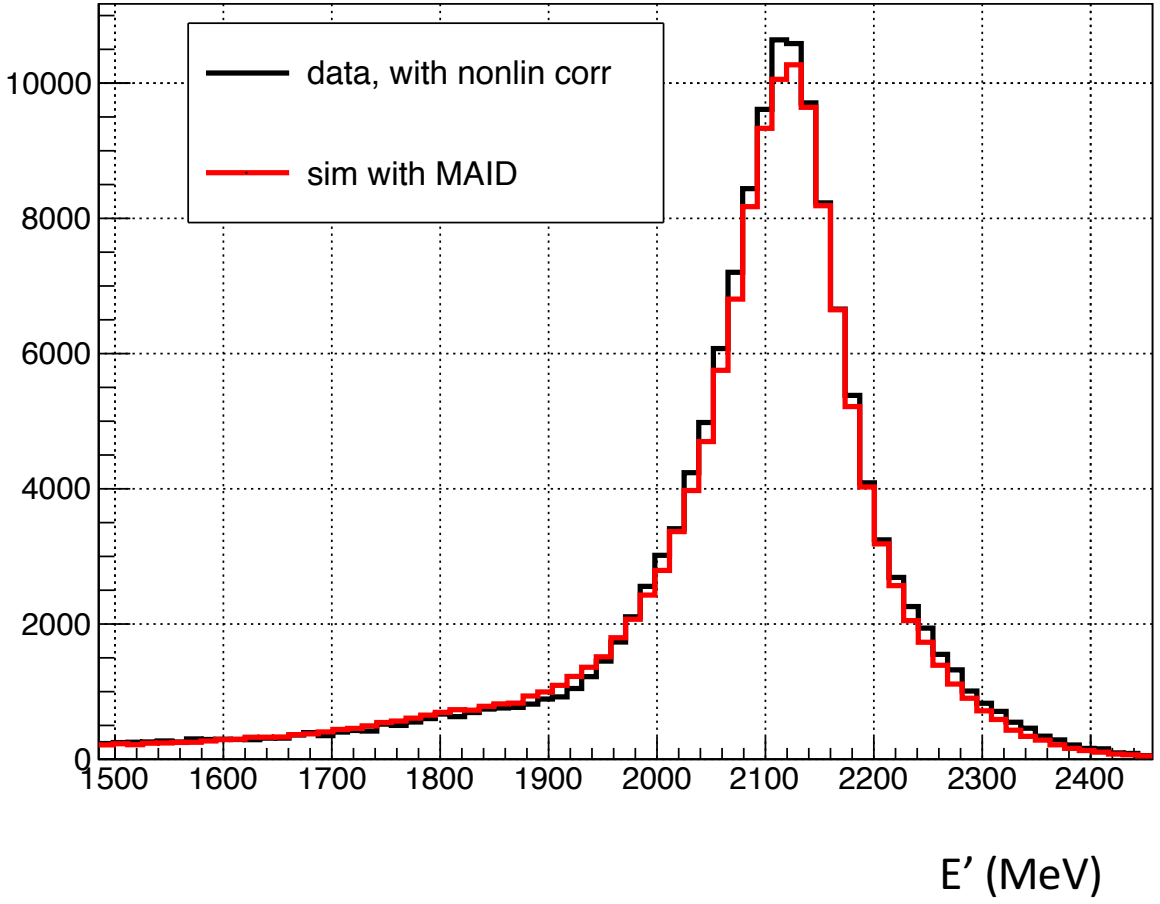




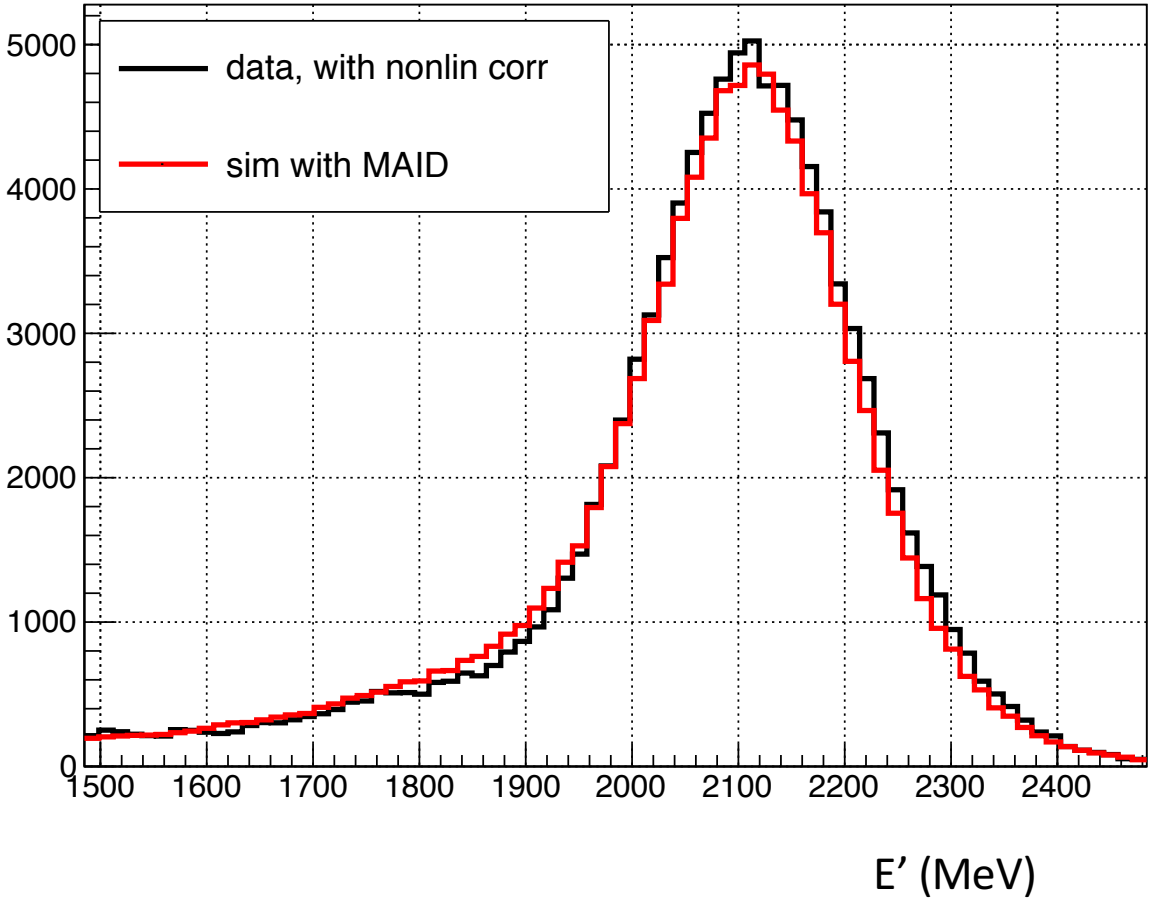
Spectrum comparison

Include LG

spectrum 3.90 deg < θ < 4.30 deg



spectrum 4.70 deg < θ < 5.20 deg

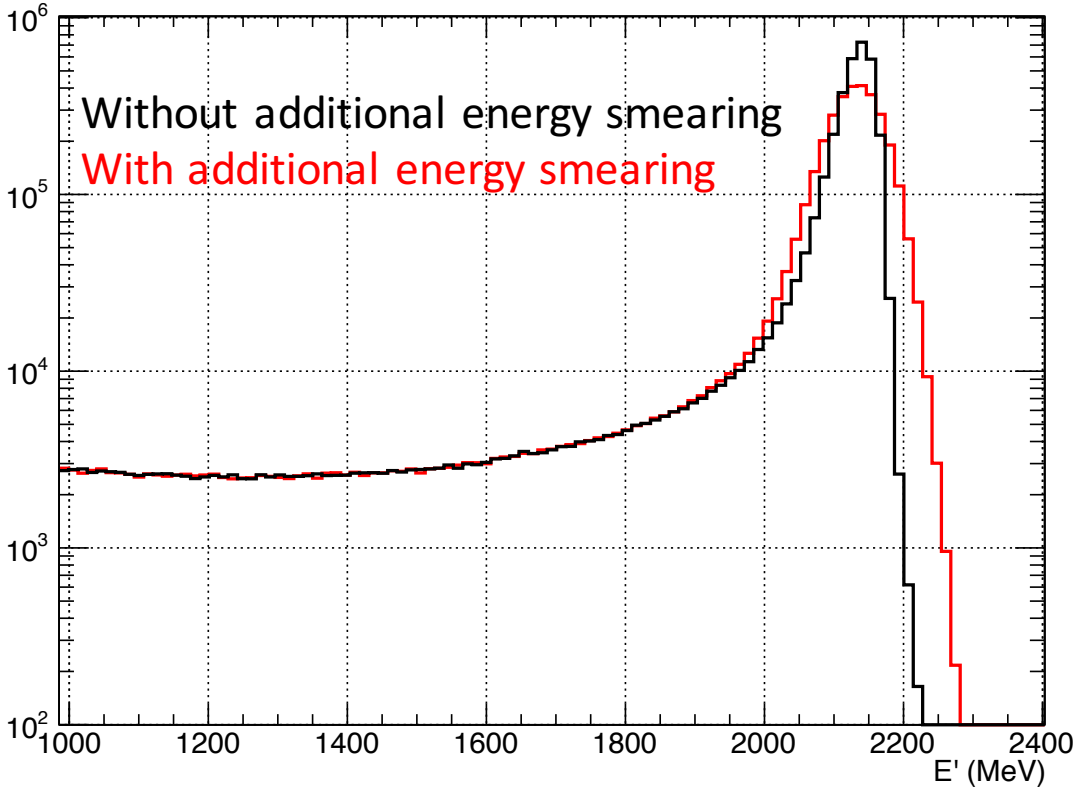


Spectrum comparison

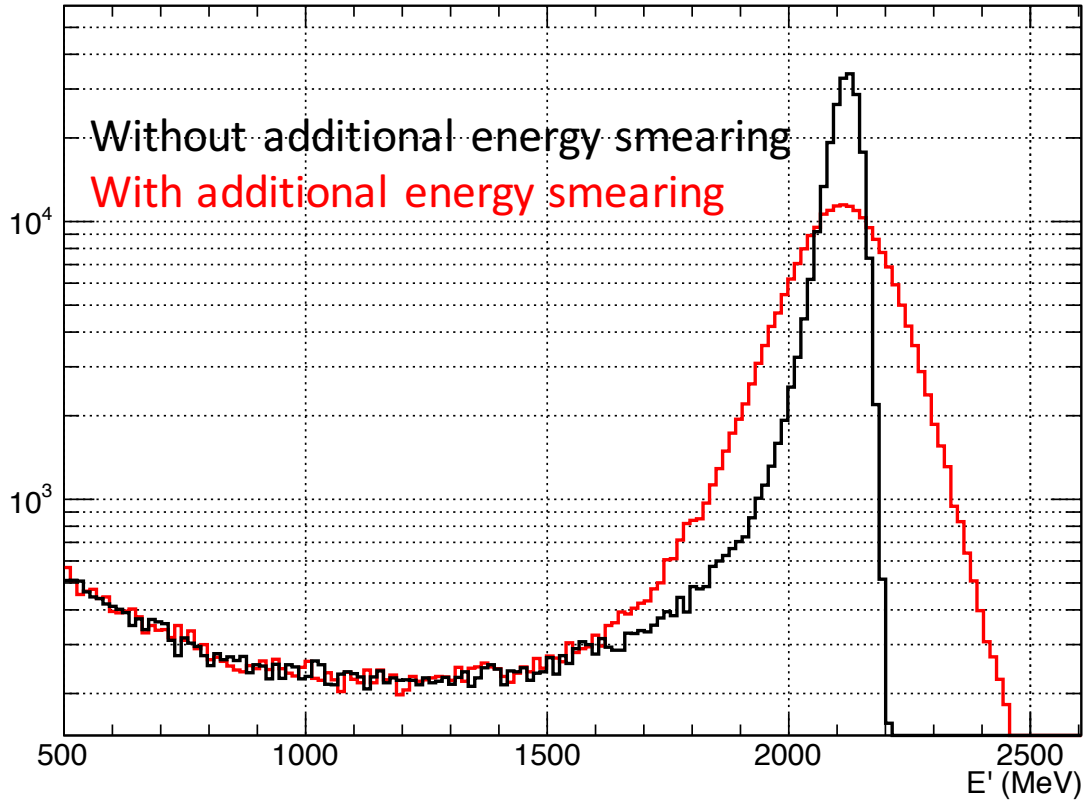
2 GeV ep simulation

The elastic peak from the simulation is a lot narrower than the data, so we put the additional smearing in order to have a better match for the width of the elastic peak

spectrum for $1.80 < \theta < 2.20$ deg

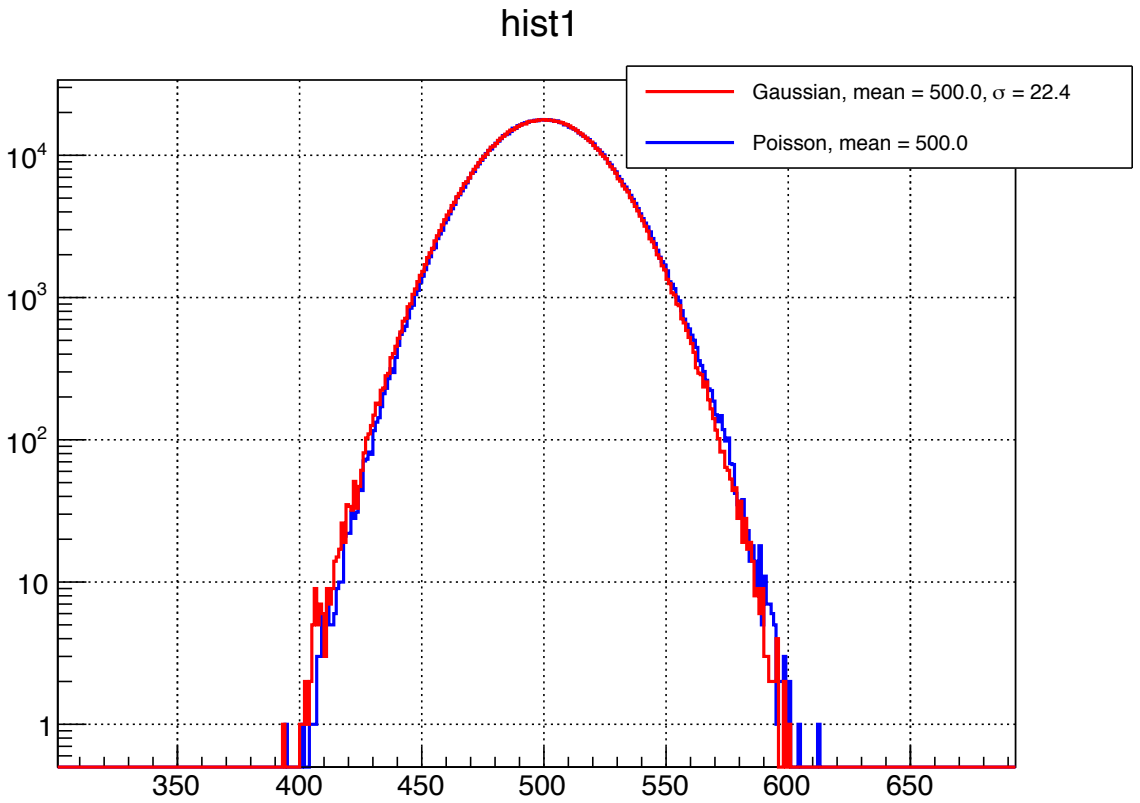


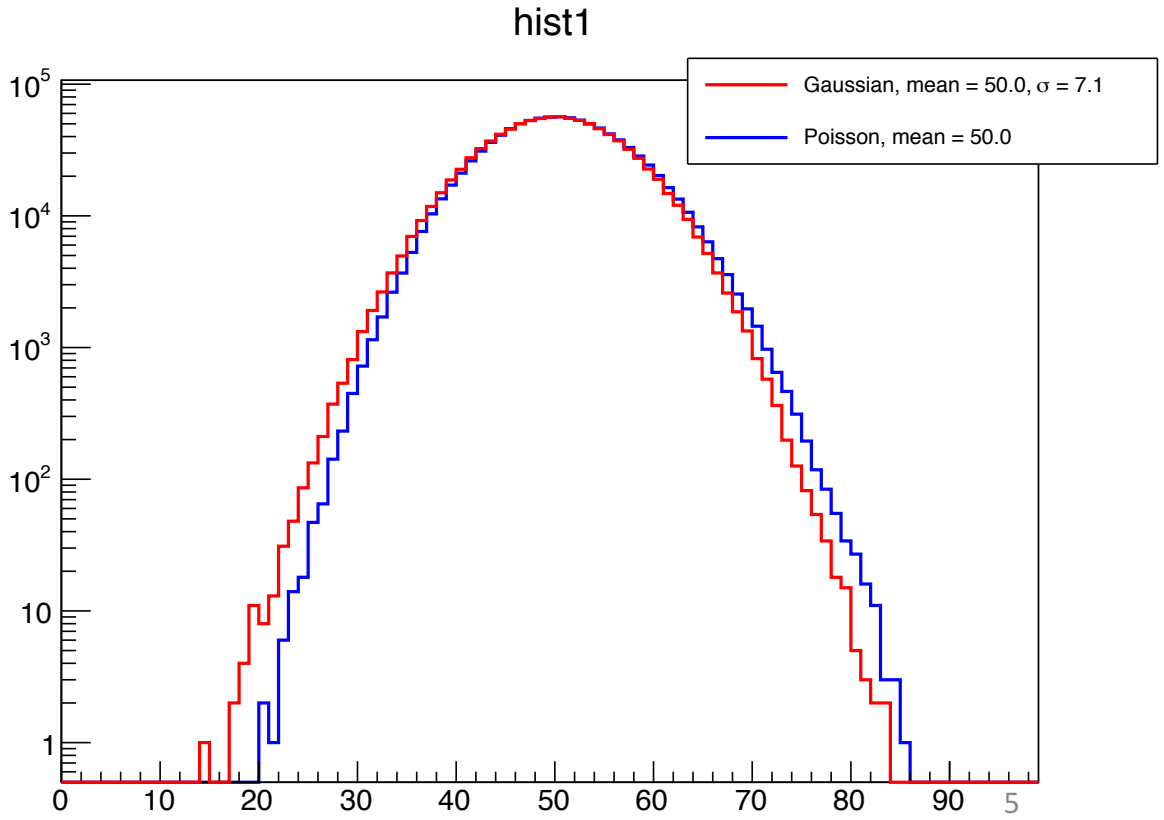
spectrum for $4.70 < \theta < 5.20$ deg



Spectrum comparison

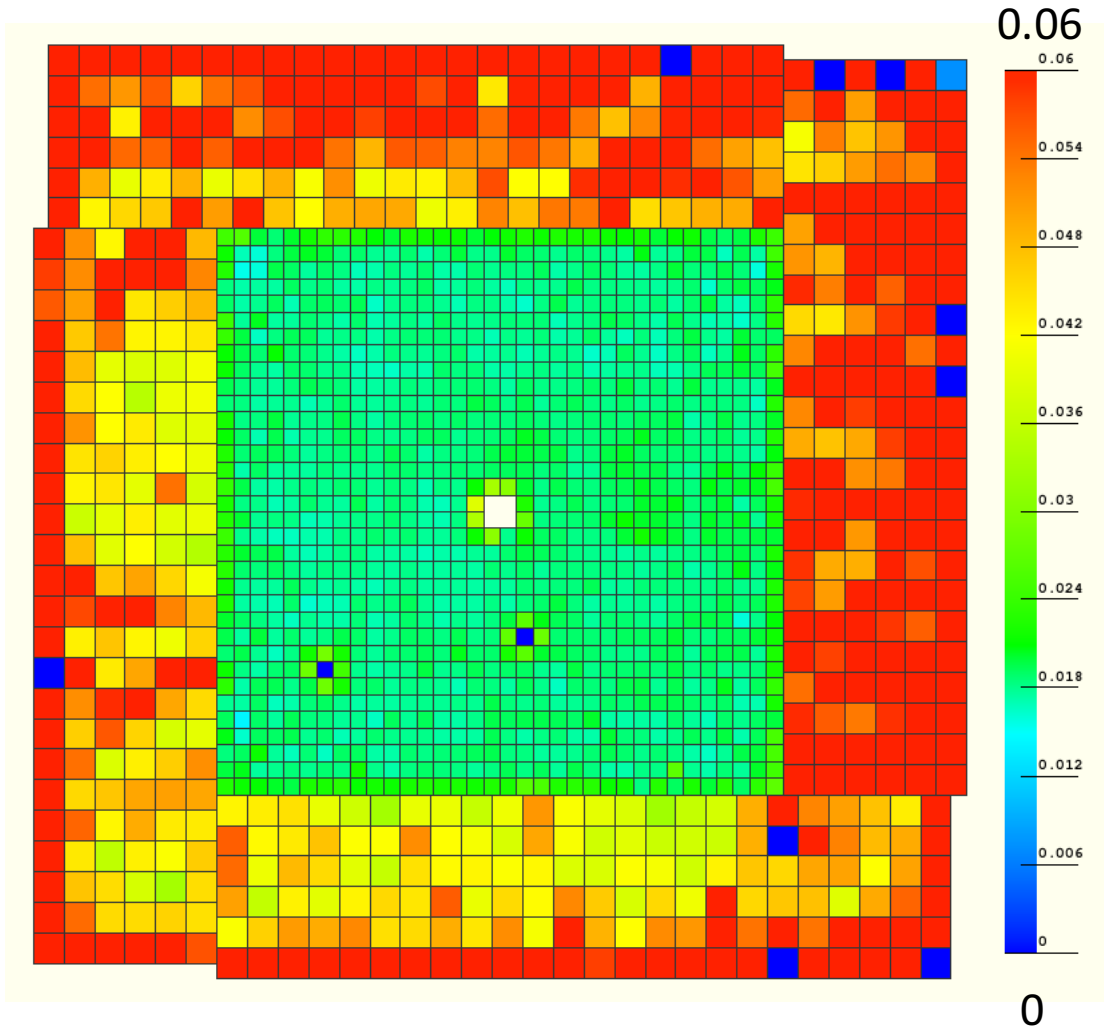
- Right now, the additional smearing is done using a Gaussian random number generator
- In reality, energy deposition convert into photon, which is more likely follow a Poisson distribution
- Poisson converges to Gaussian when mean is large, otherwise has asymmetric tails
- The long tail in the LG simulation may be related to the low light yield LG



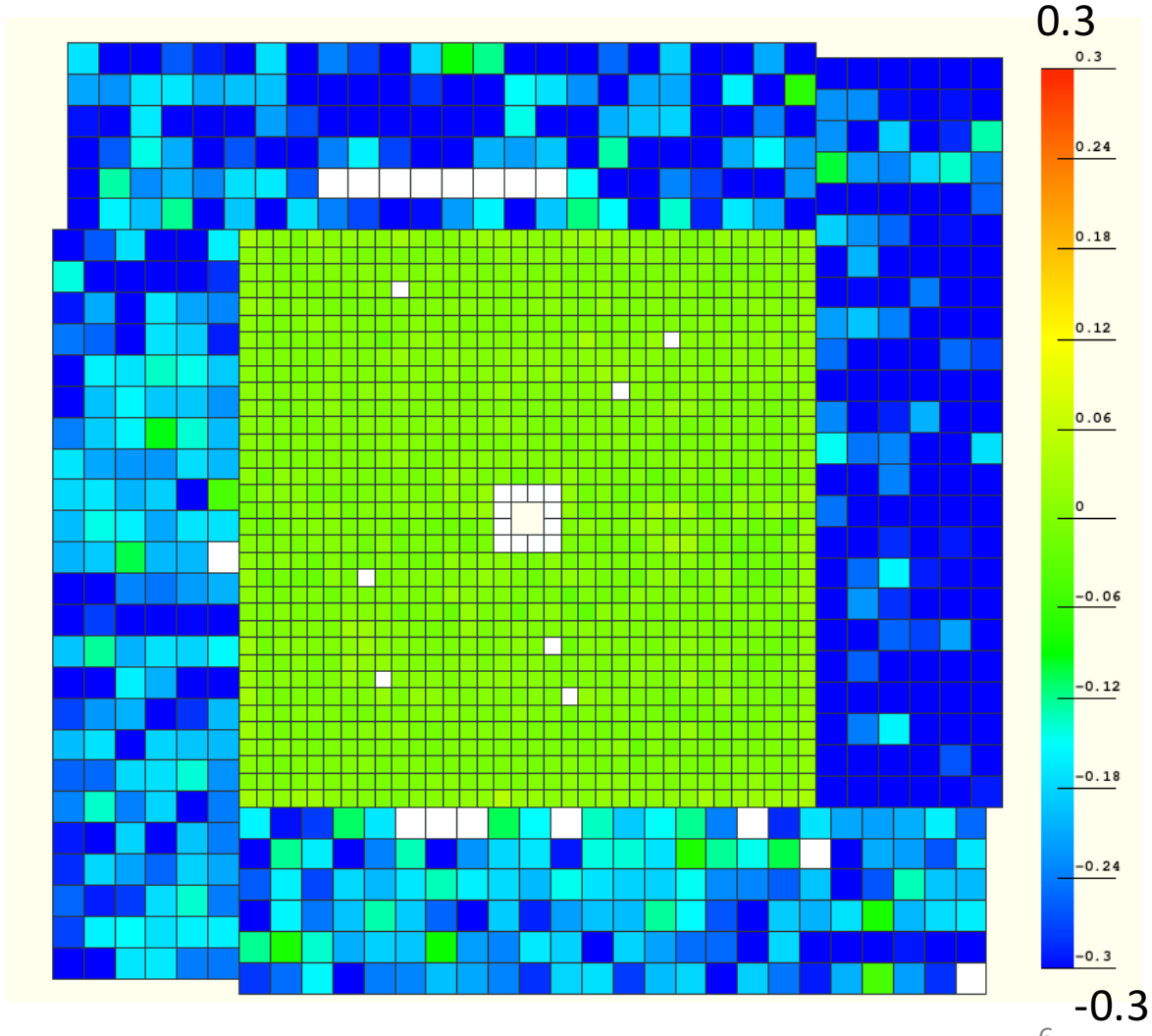


LG non-uniformity

Energy resolution from 2 GeV ep

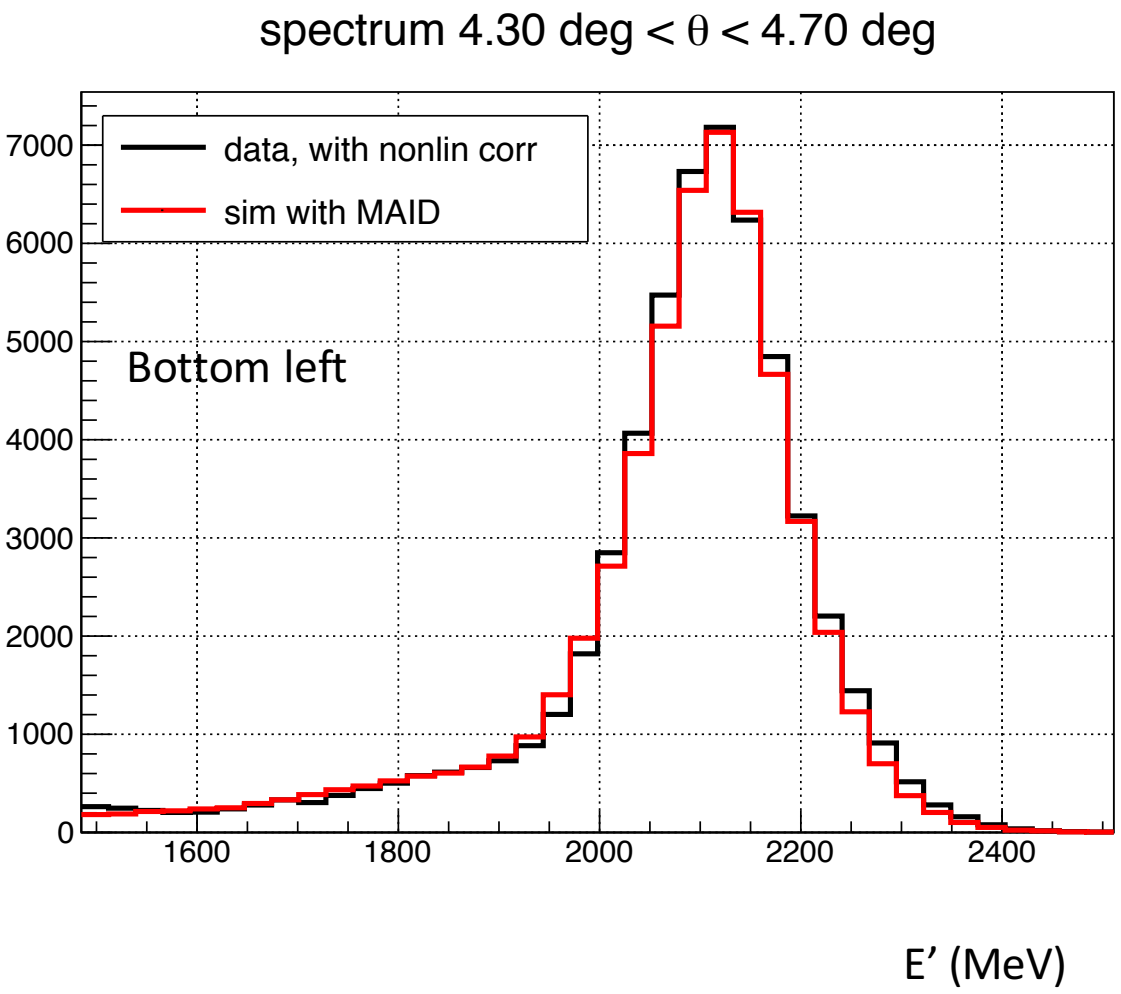


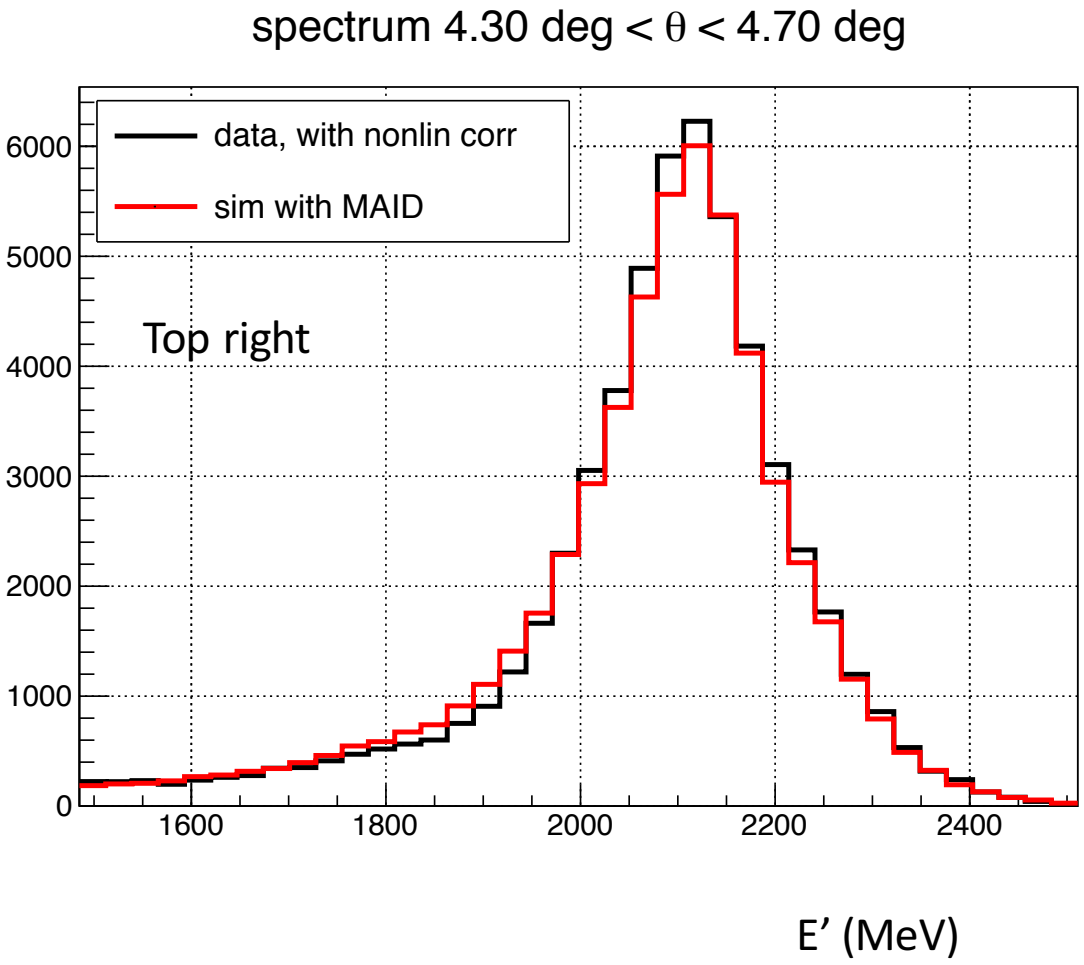
Non-linearity constants from snake runs



Spectrum comparison

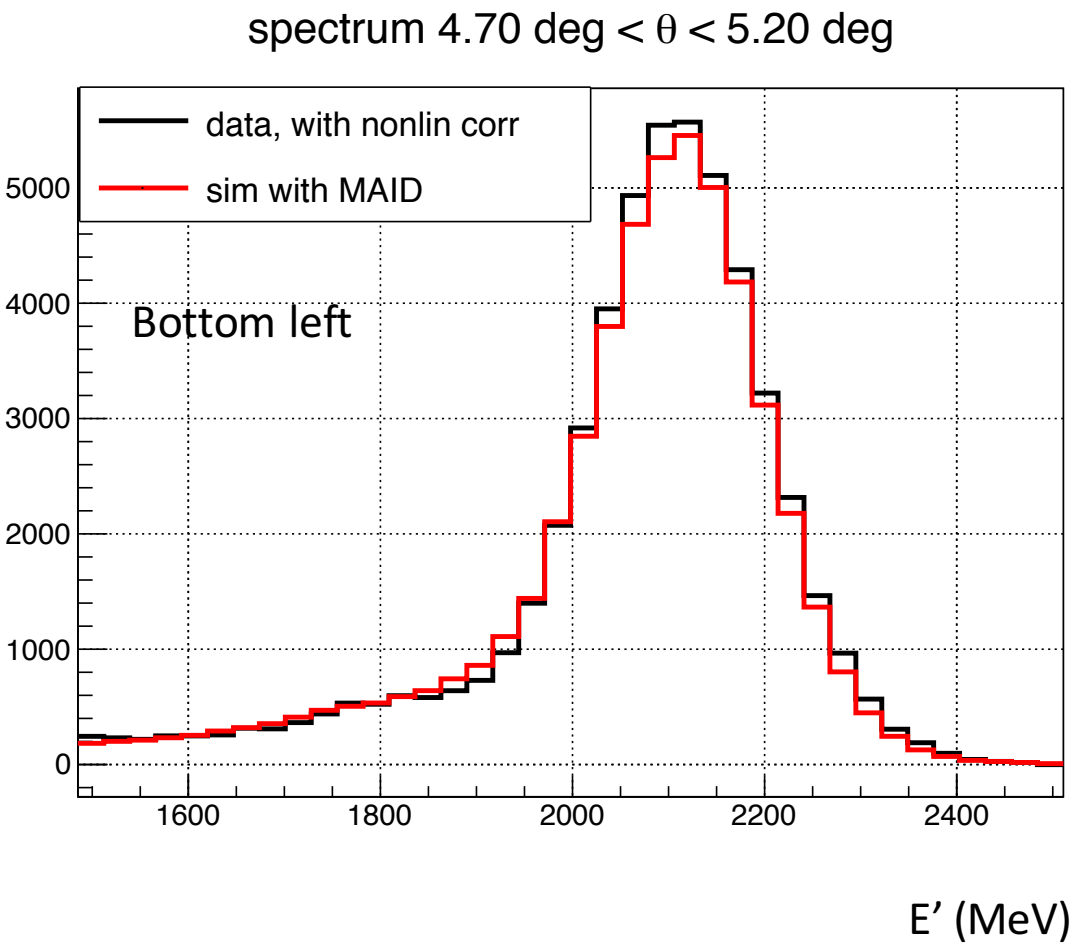
Include LG

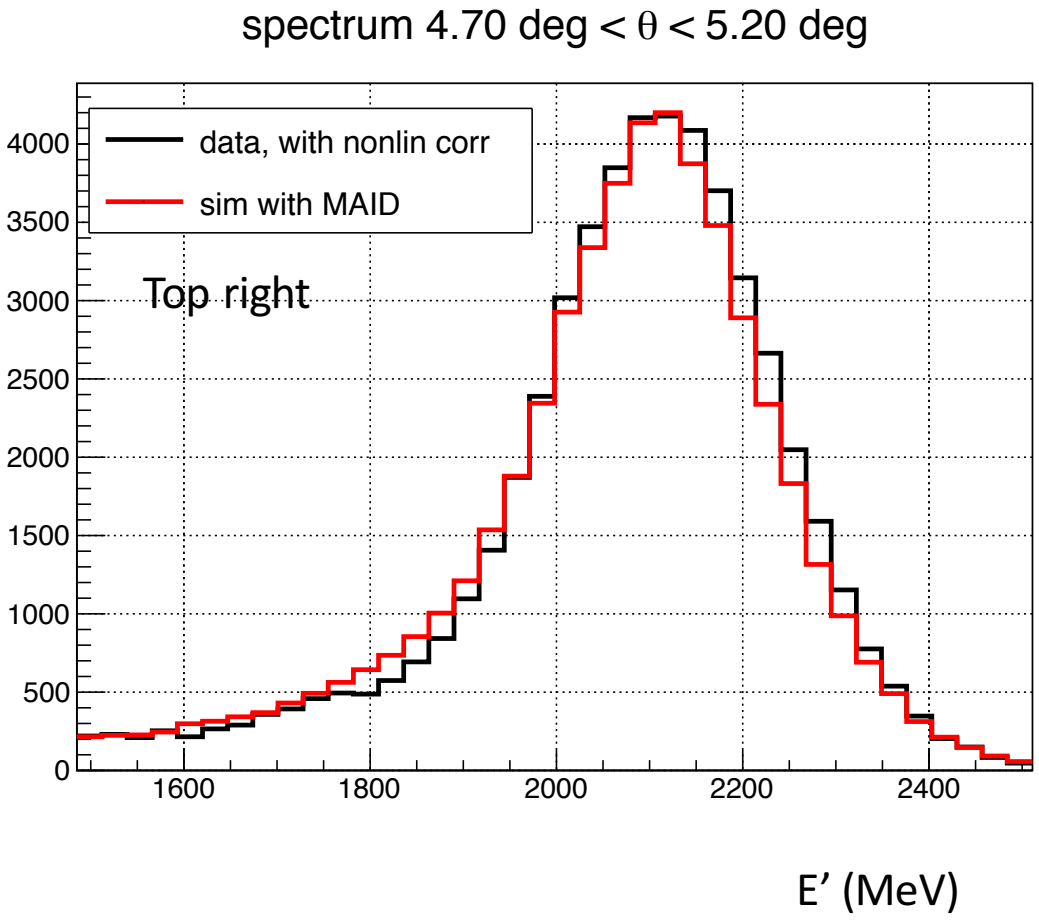




Spectrum comparison

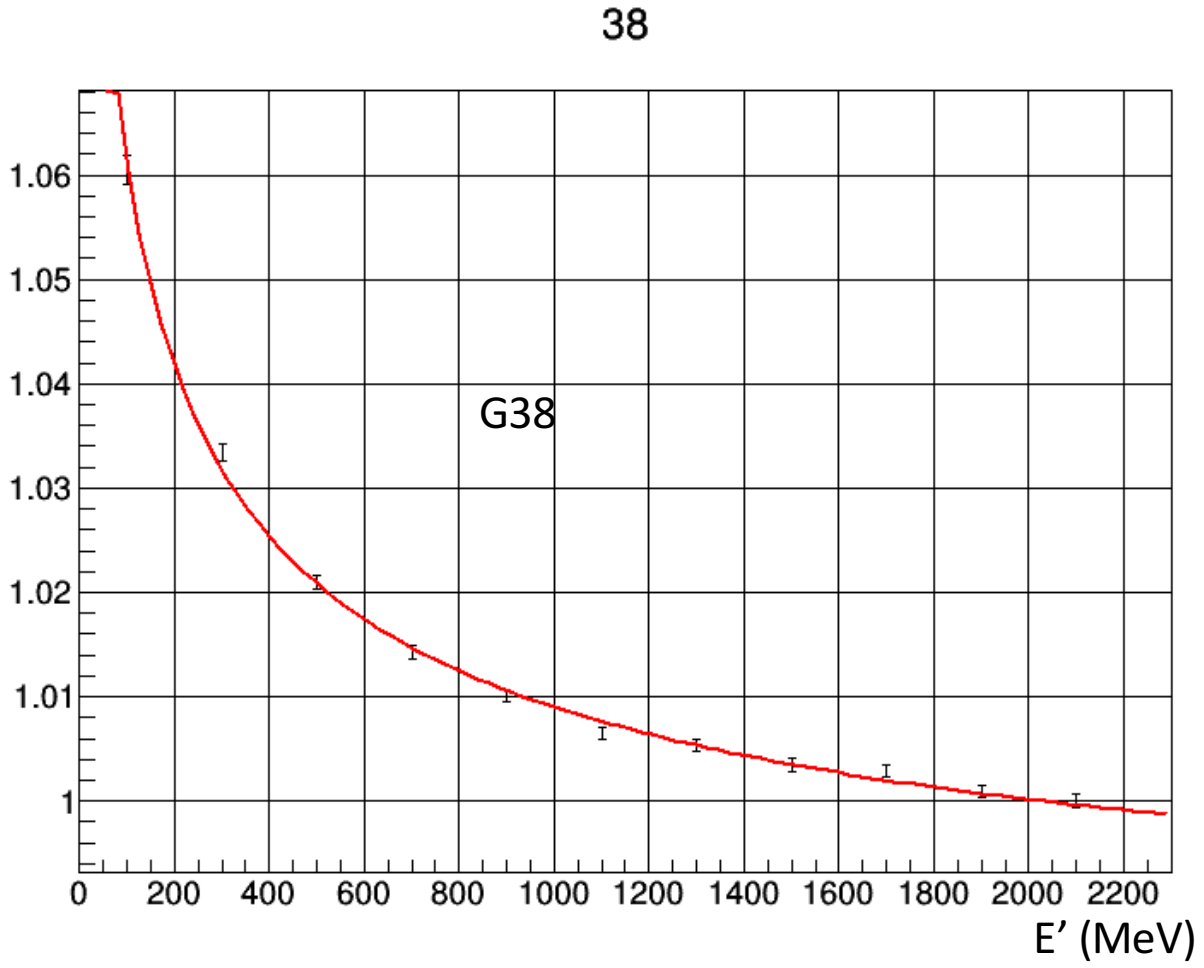
Include LG

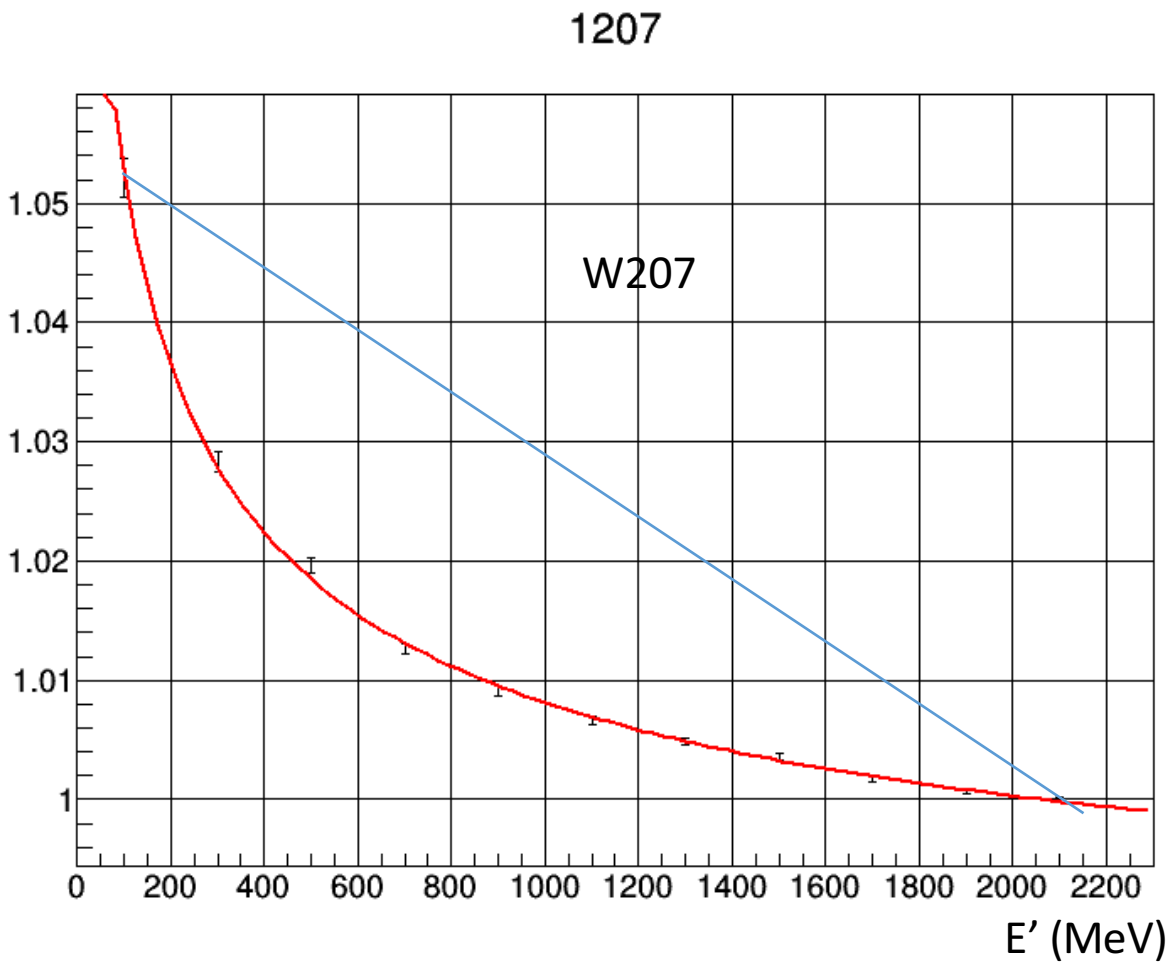




Non-linearity correction for Simulation

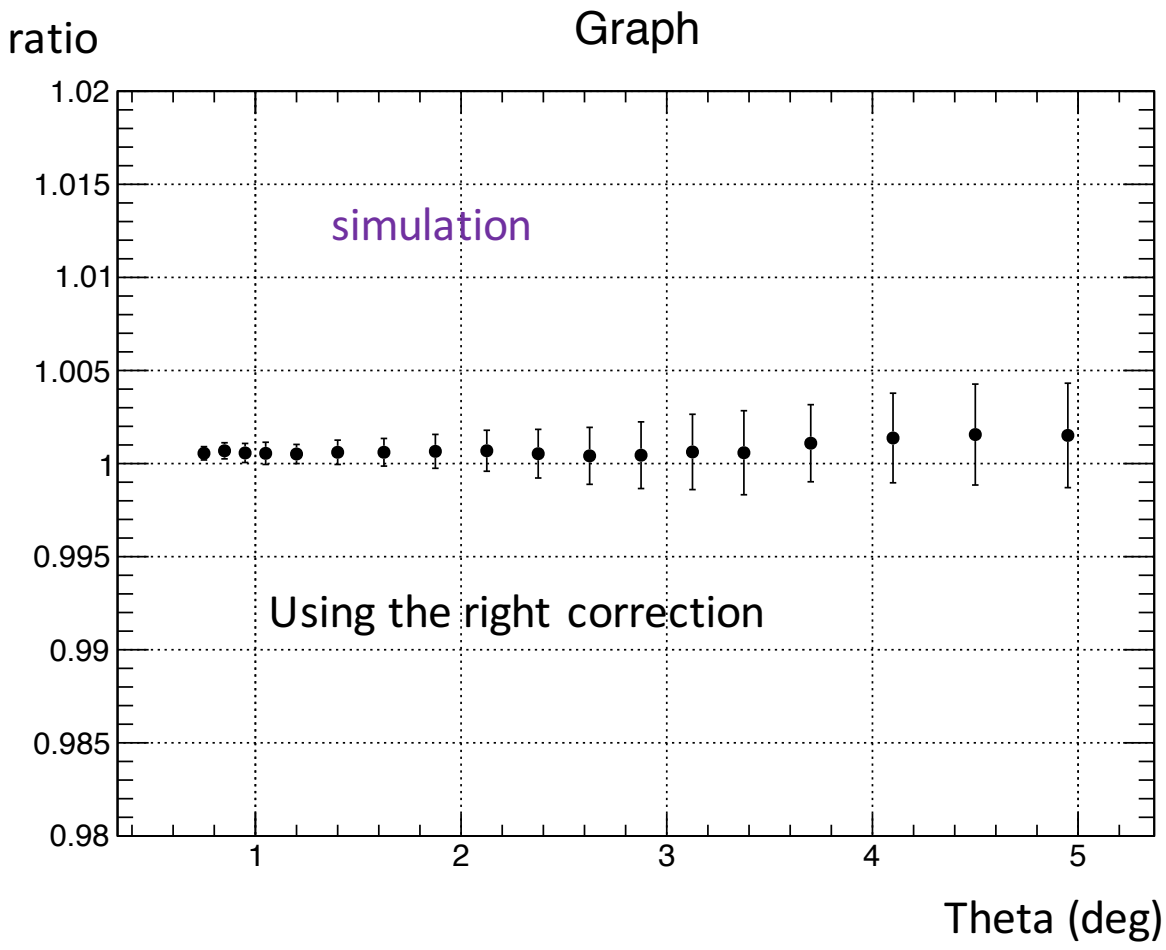
- Non-linearity behavior in the simulation can be well described by function: A + B/sqrt(E) + C/E
- Fit each module to get the correction function and correct it during the reconstruction
- Effect is very small (~0.1-0.2%) at the delta resonance peak
- There could be a large error if using only two points and a straight line assumption

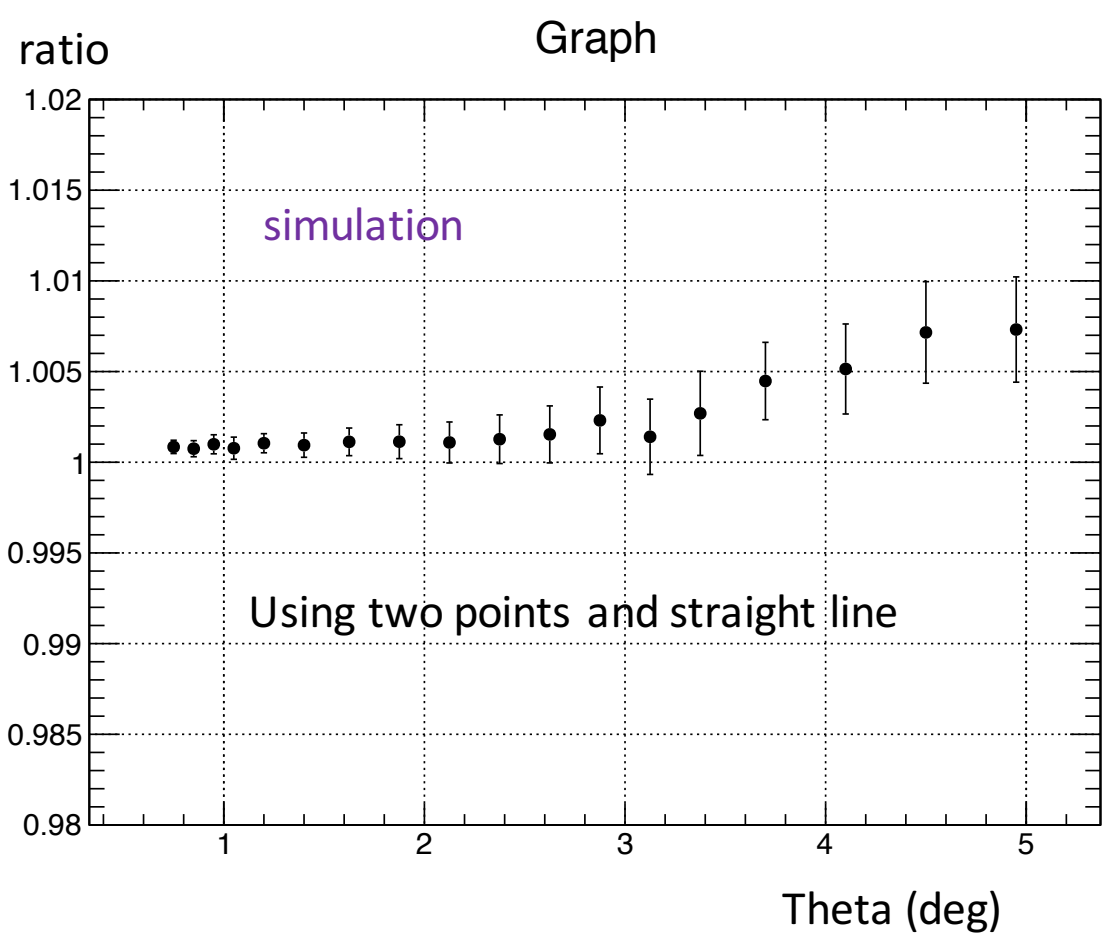




Non-linearity correction for Simulation

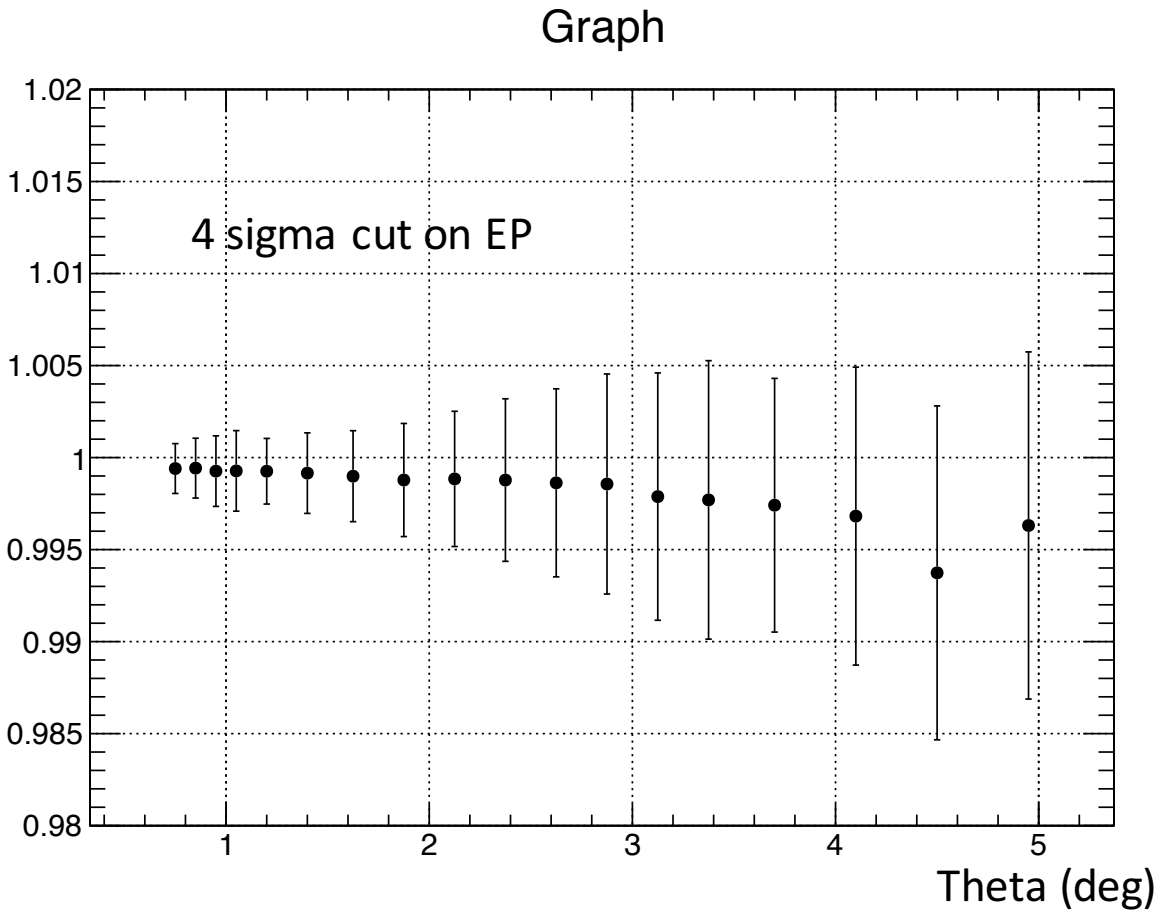
ep yield with non-lin correction / ep yield without non-lin correction

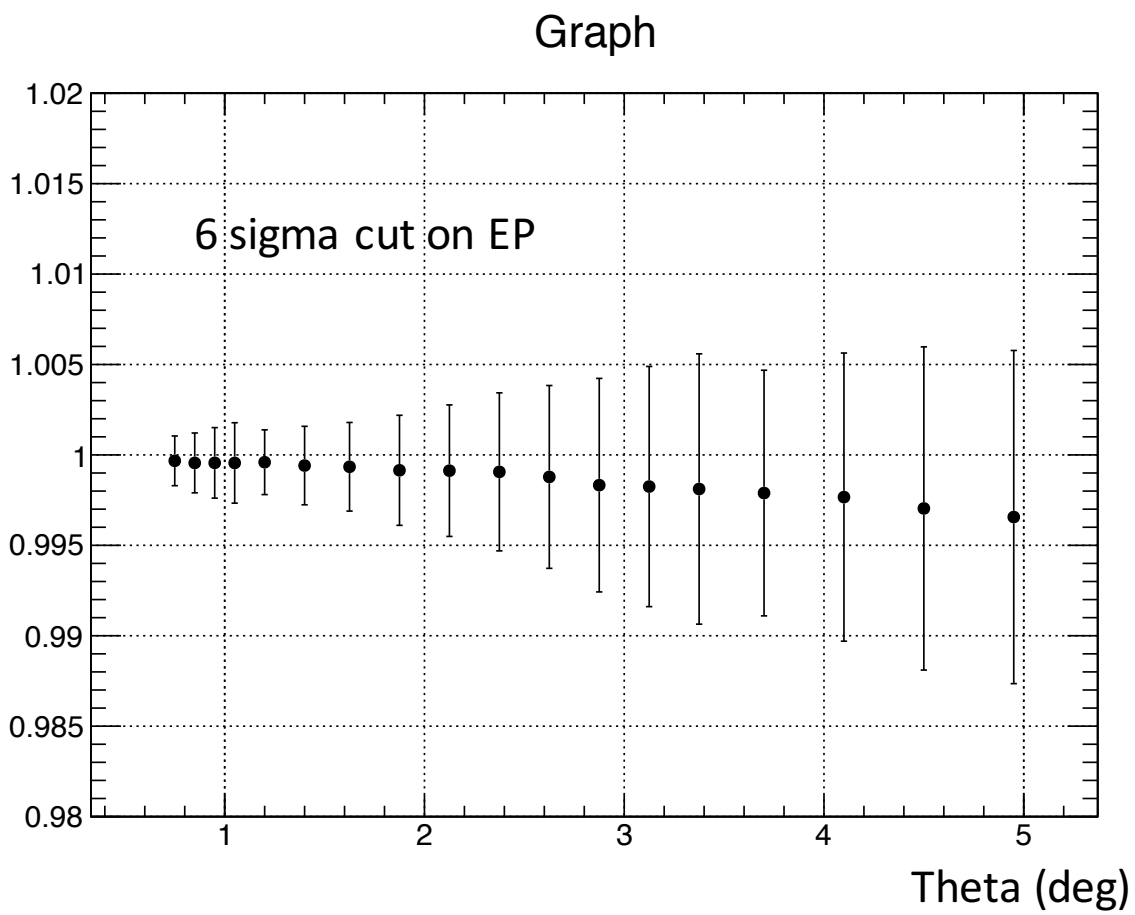




Non-linearity in data

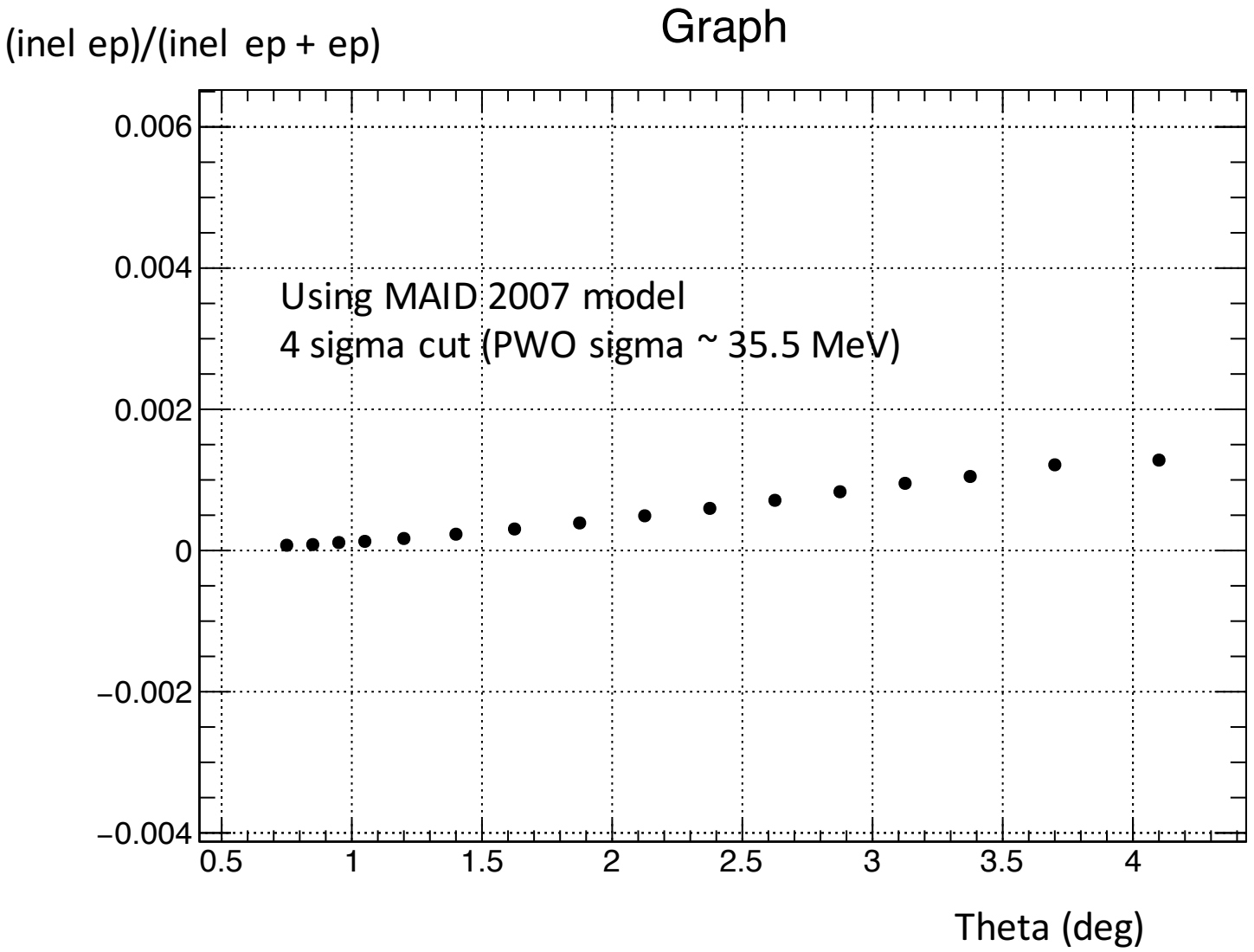
(ep yield without nonlin)/(ep yield with nonlin)





Inelastic contribution

Only PWO modules, 1st layer at transition excluded

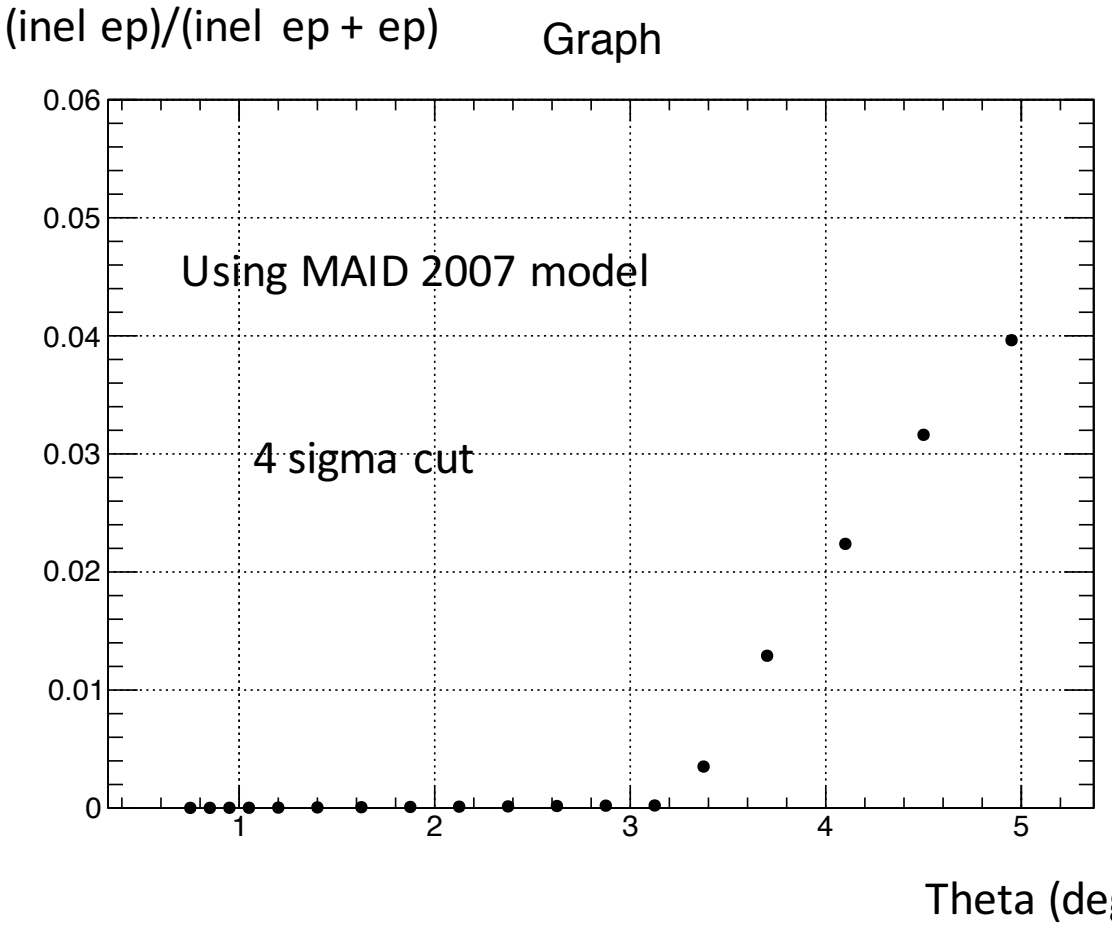


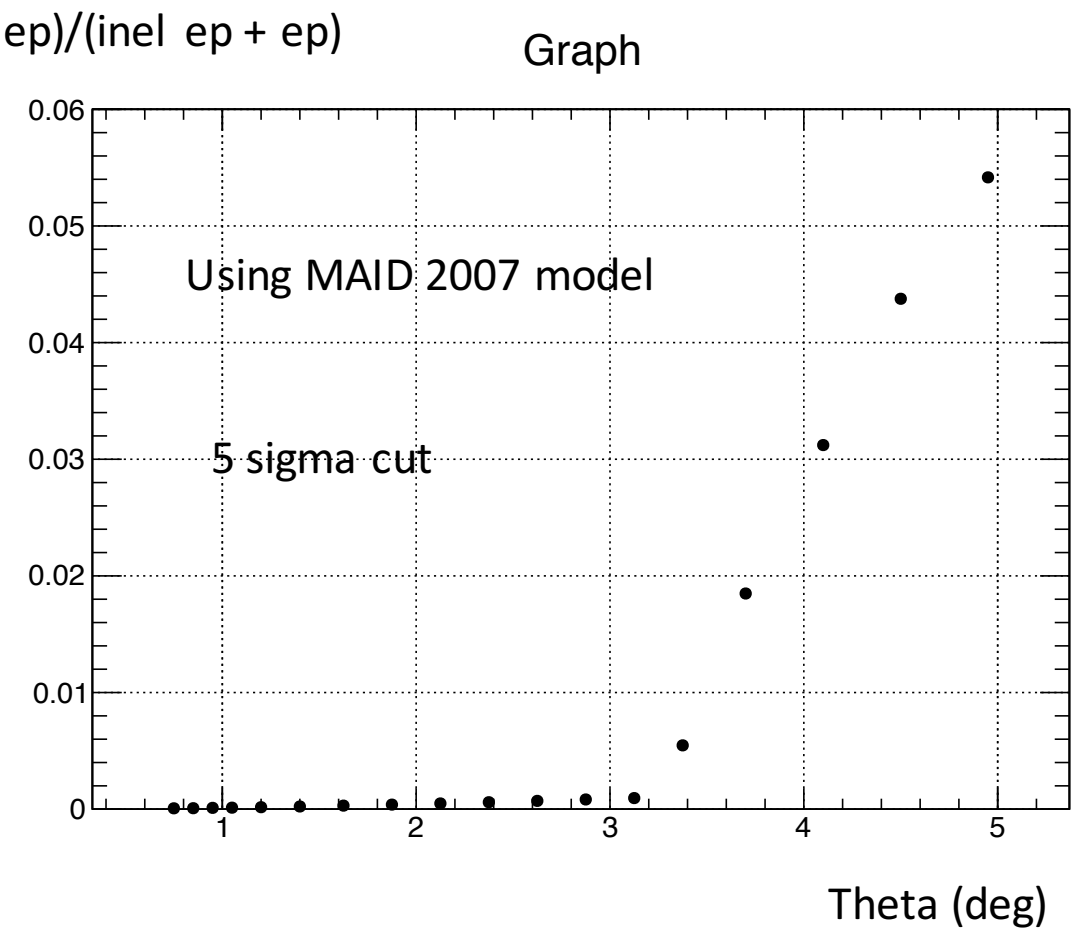
Inelastic contribution

Include LG

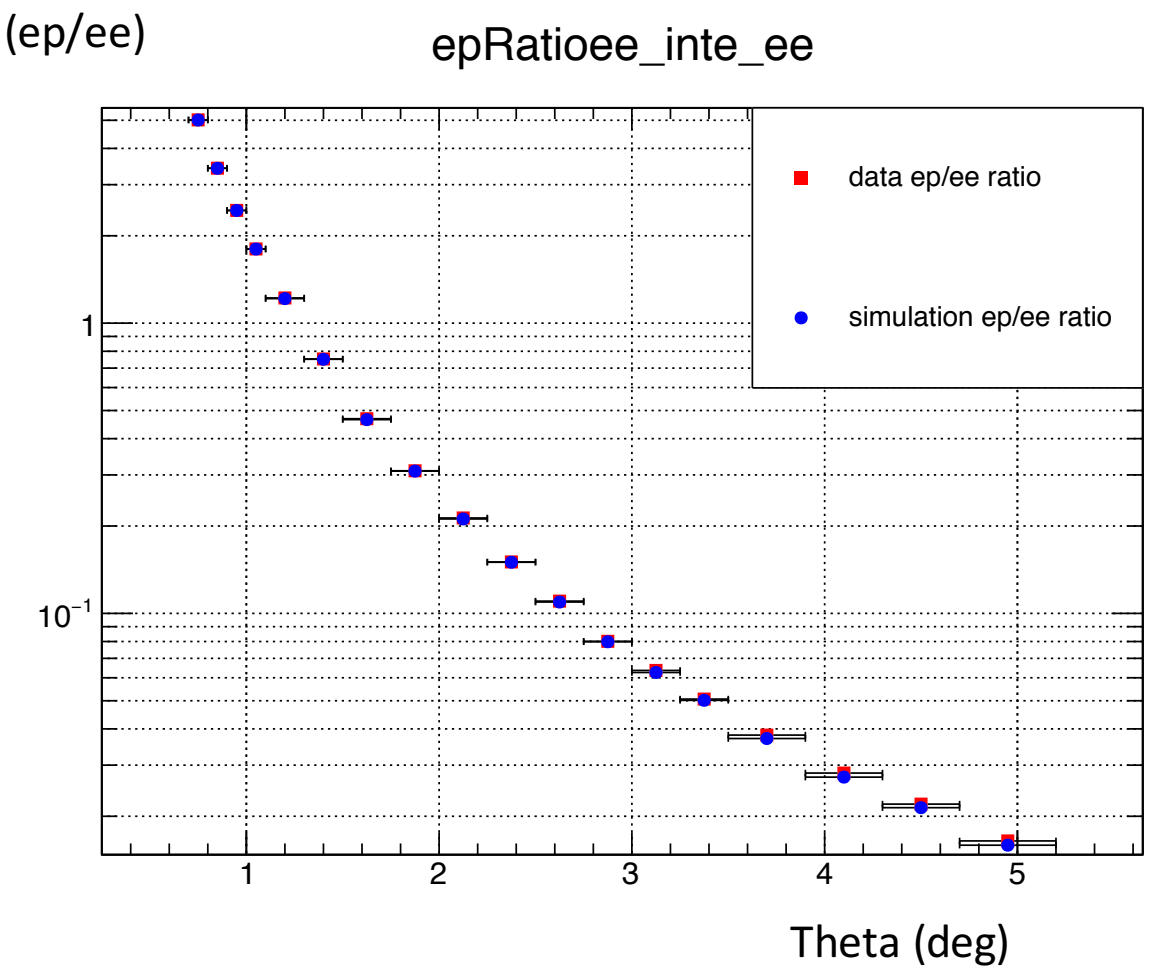
PWO sigma ~ 35.5 MeV

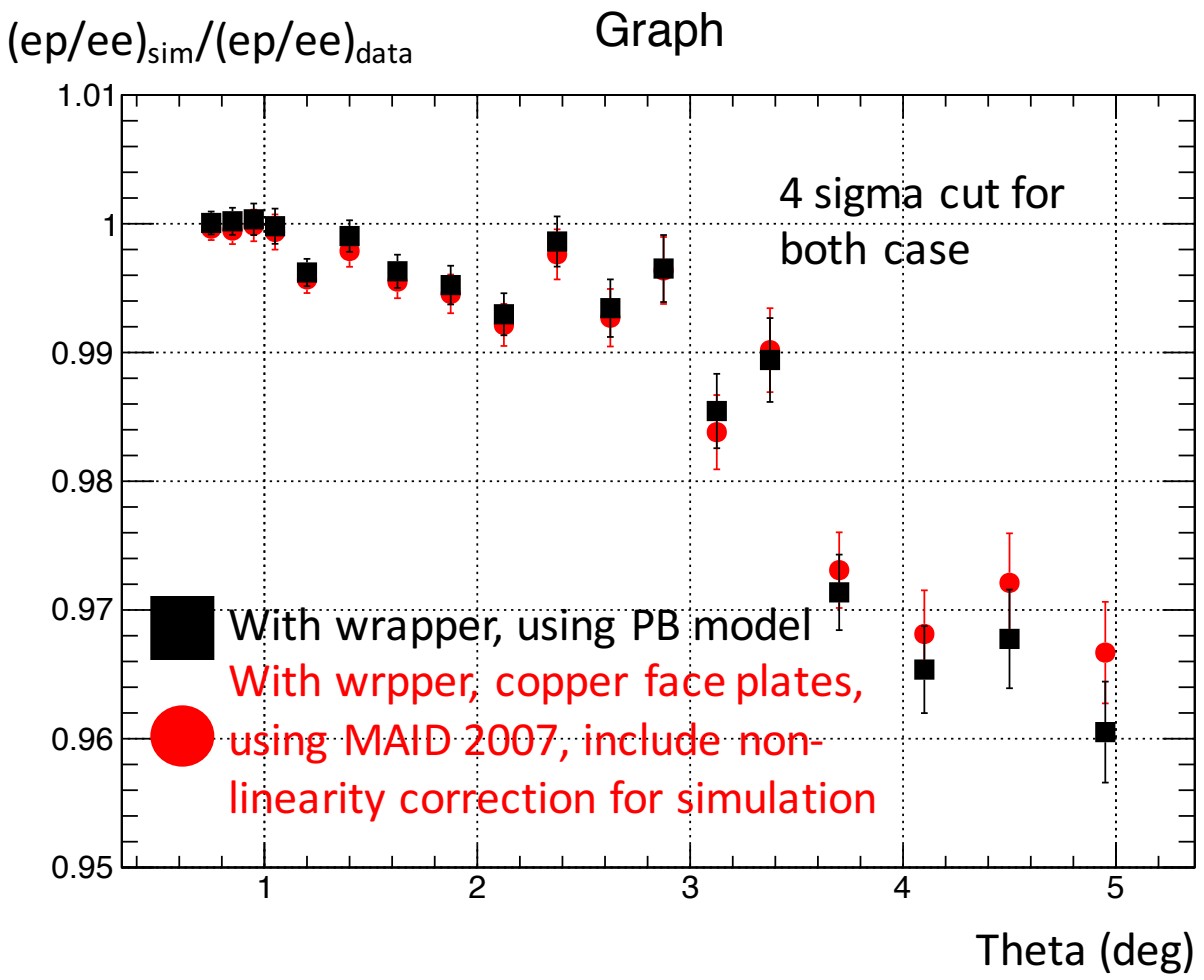
LG sigma ~ 90.7 MeV





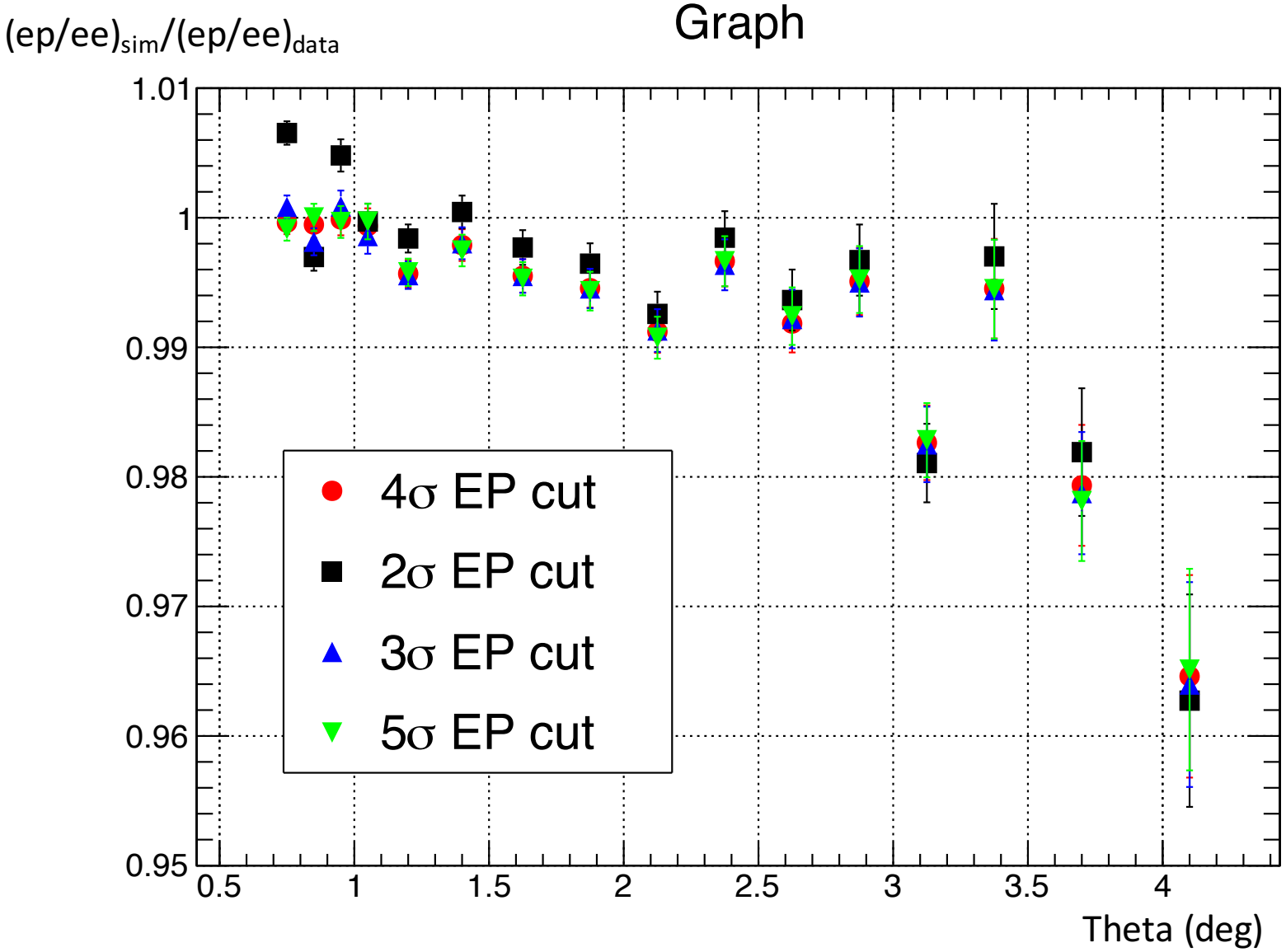
Super ratio comparison





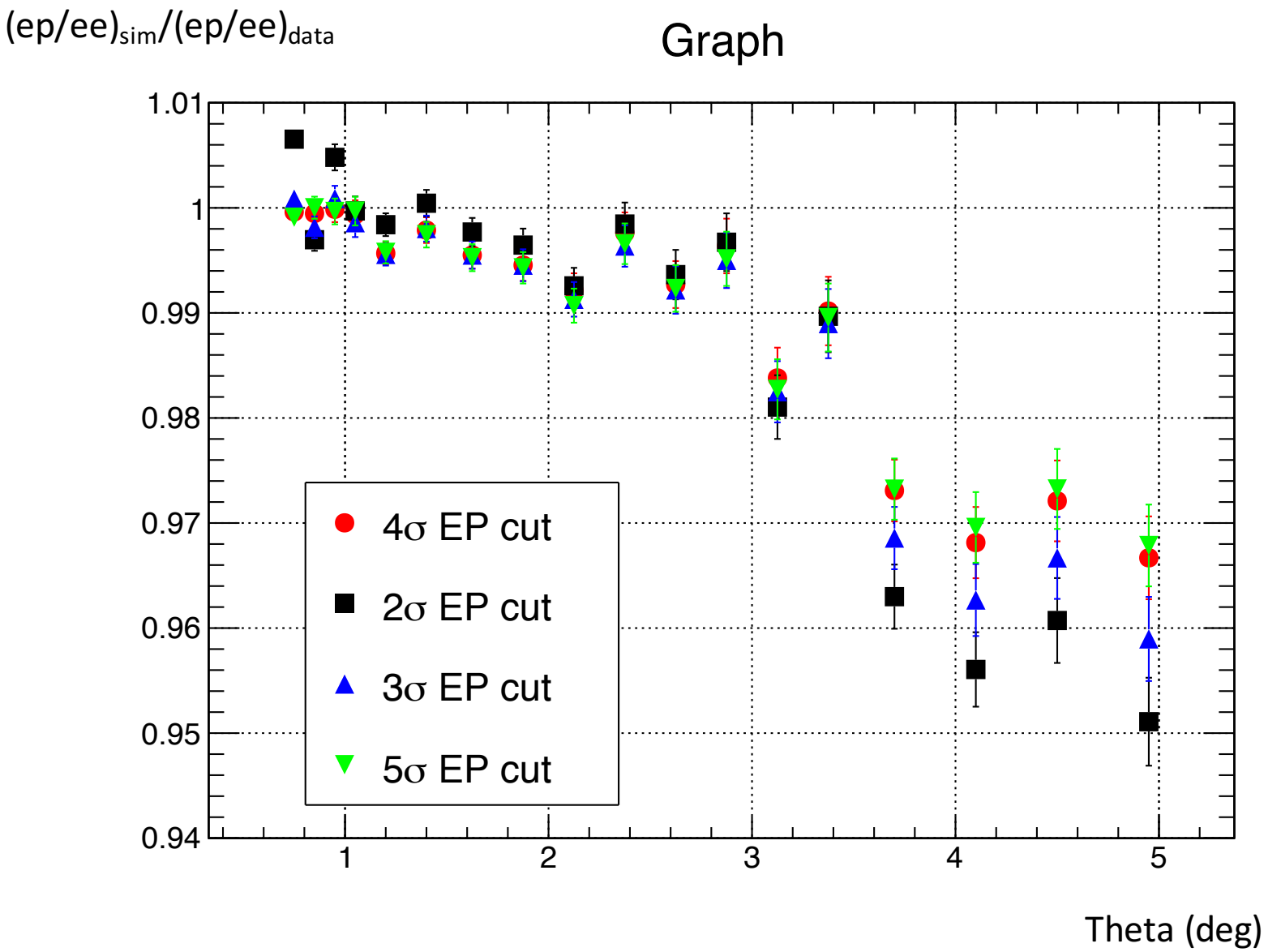
Super ratio comparison

Only PWO modules, 1st layer at transition excluded

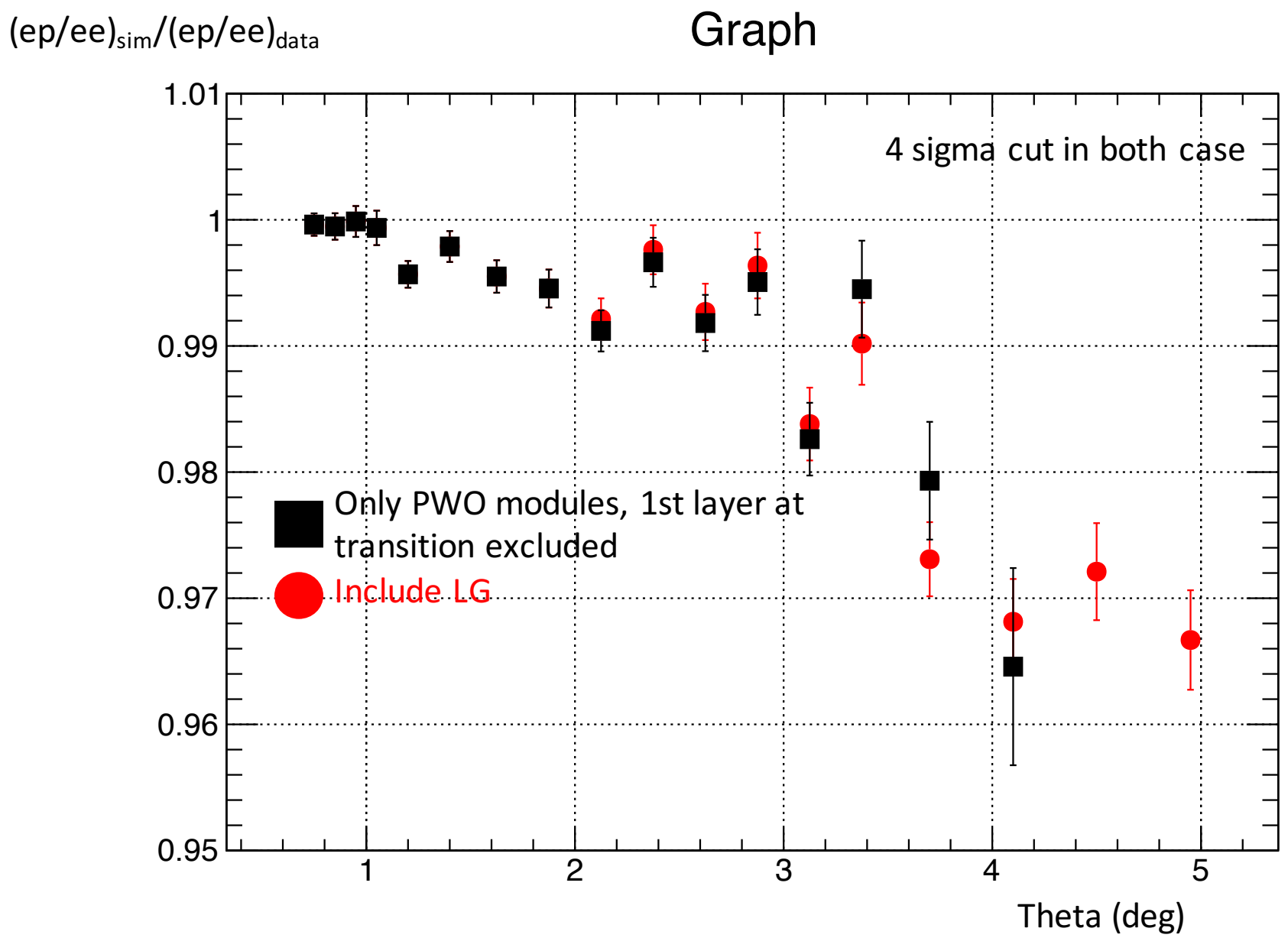


Super ratio comparison

Include LG

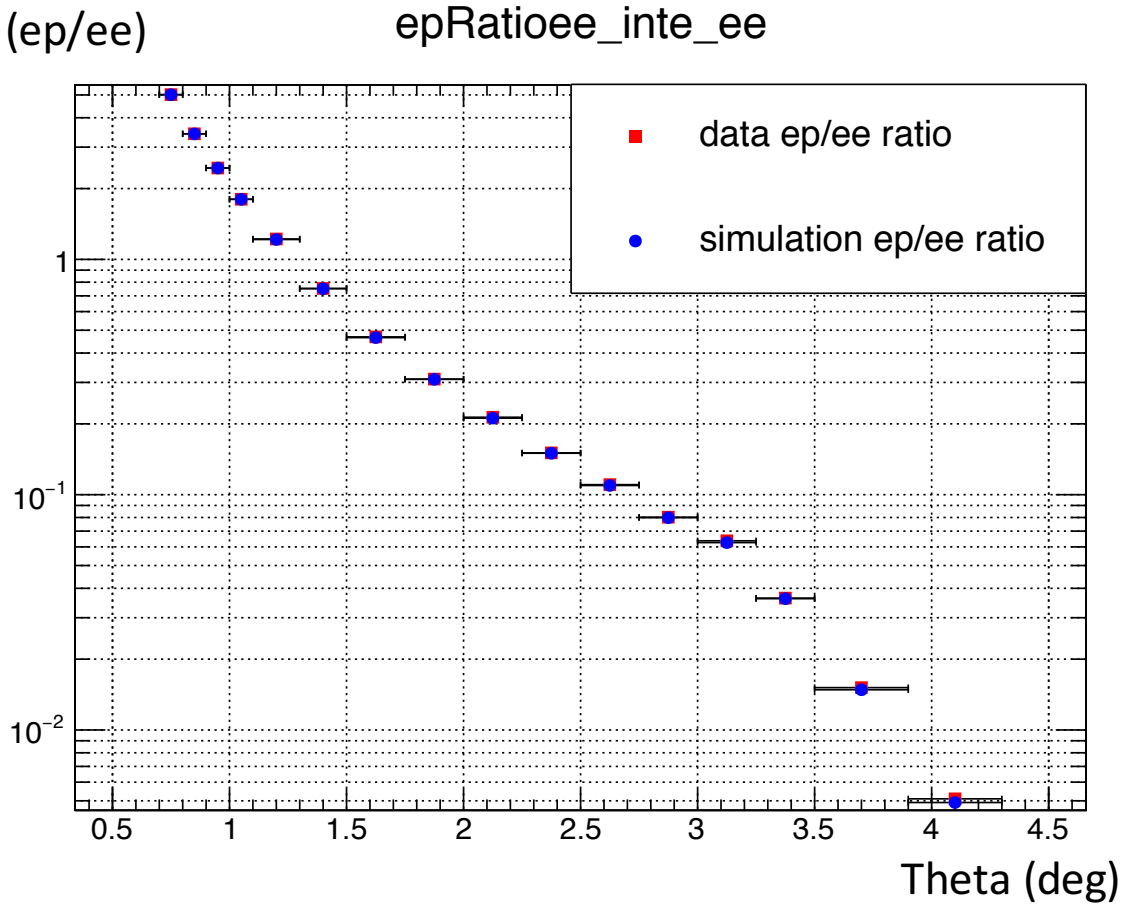


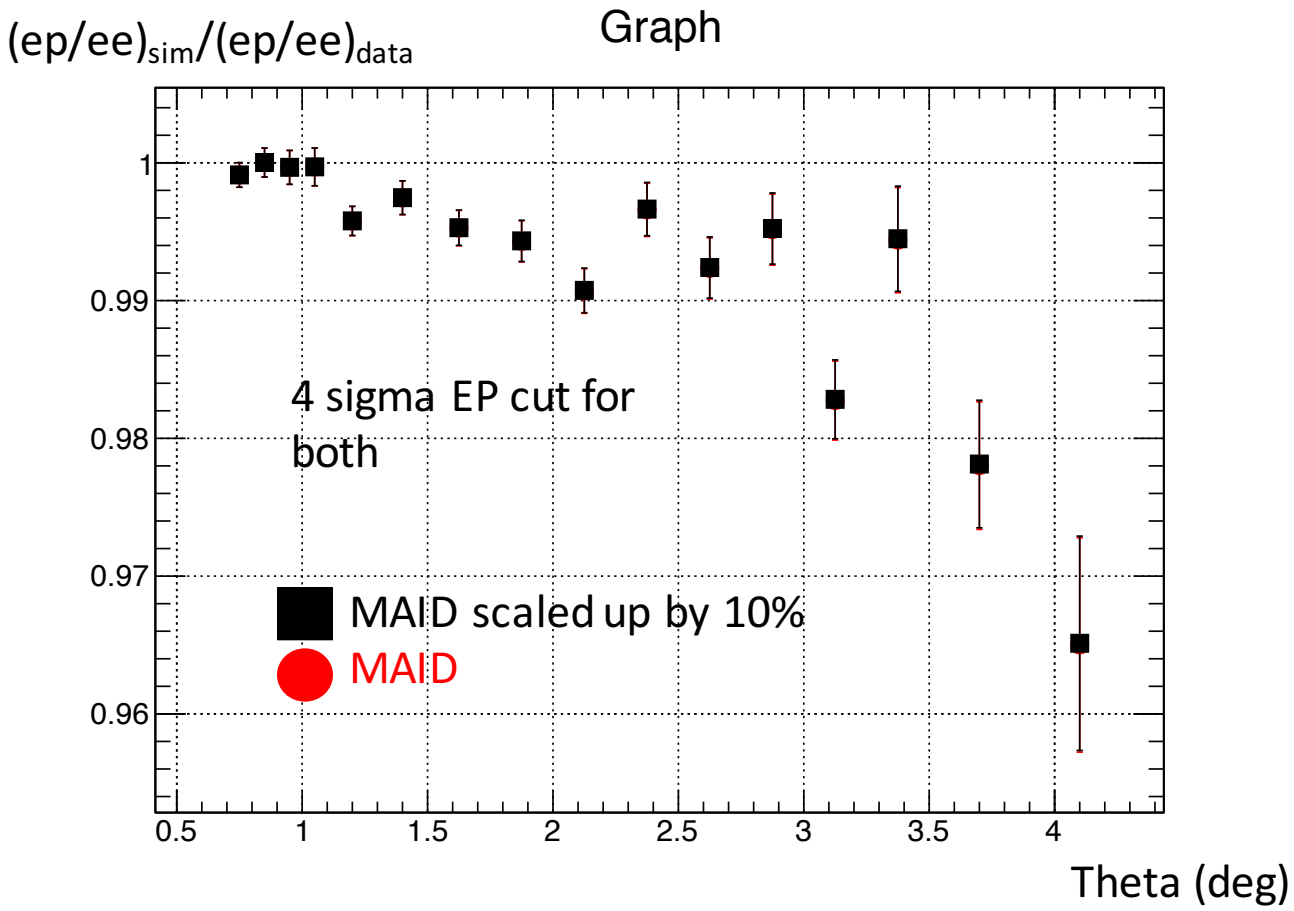
Super ratio comparison



Super ratio comparison

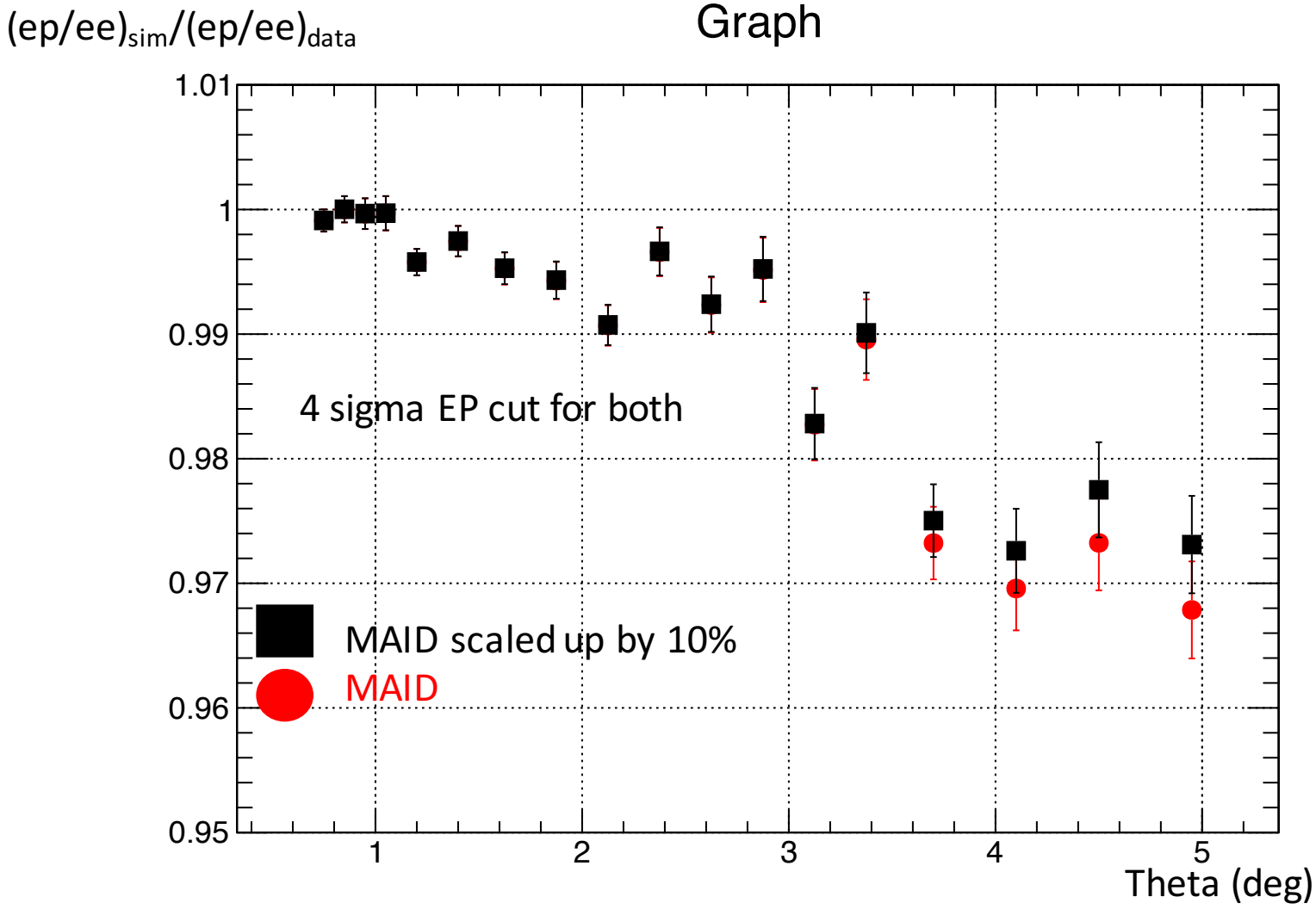
Only PWO modules, 1st layer at transition excluded





Super ratio comparison

Include LG



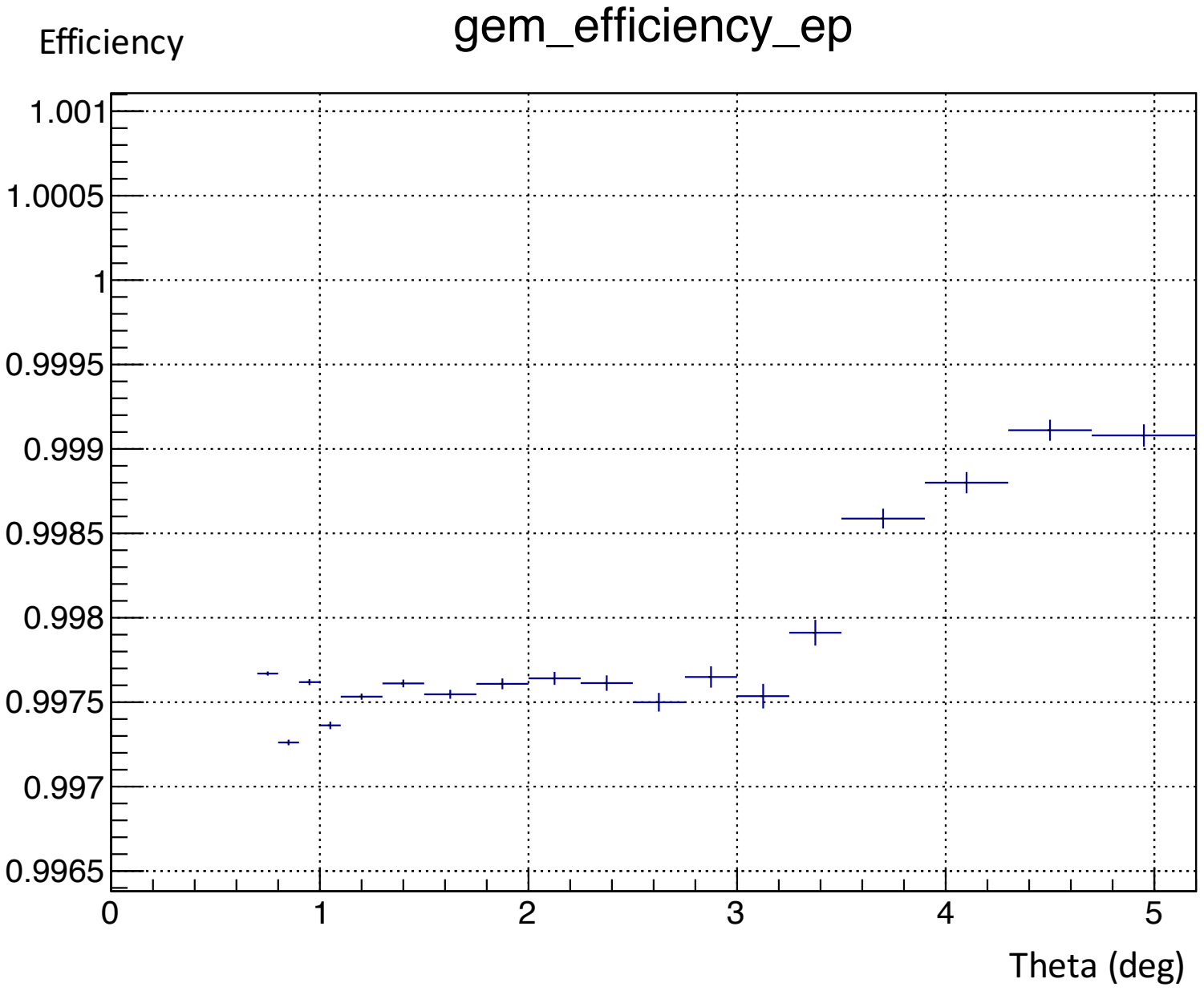
Summary

- Based on the super ratio in the PWO only region, it is clear that the super ratio significantly smaller than 1 after theta > 3.5 deg for the 2GeV data
- Statistics is not enough to claim that there is a discrepancy between PWO and LG data at large angle, (even after scaling inelastic ep by 10%)

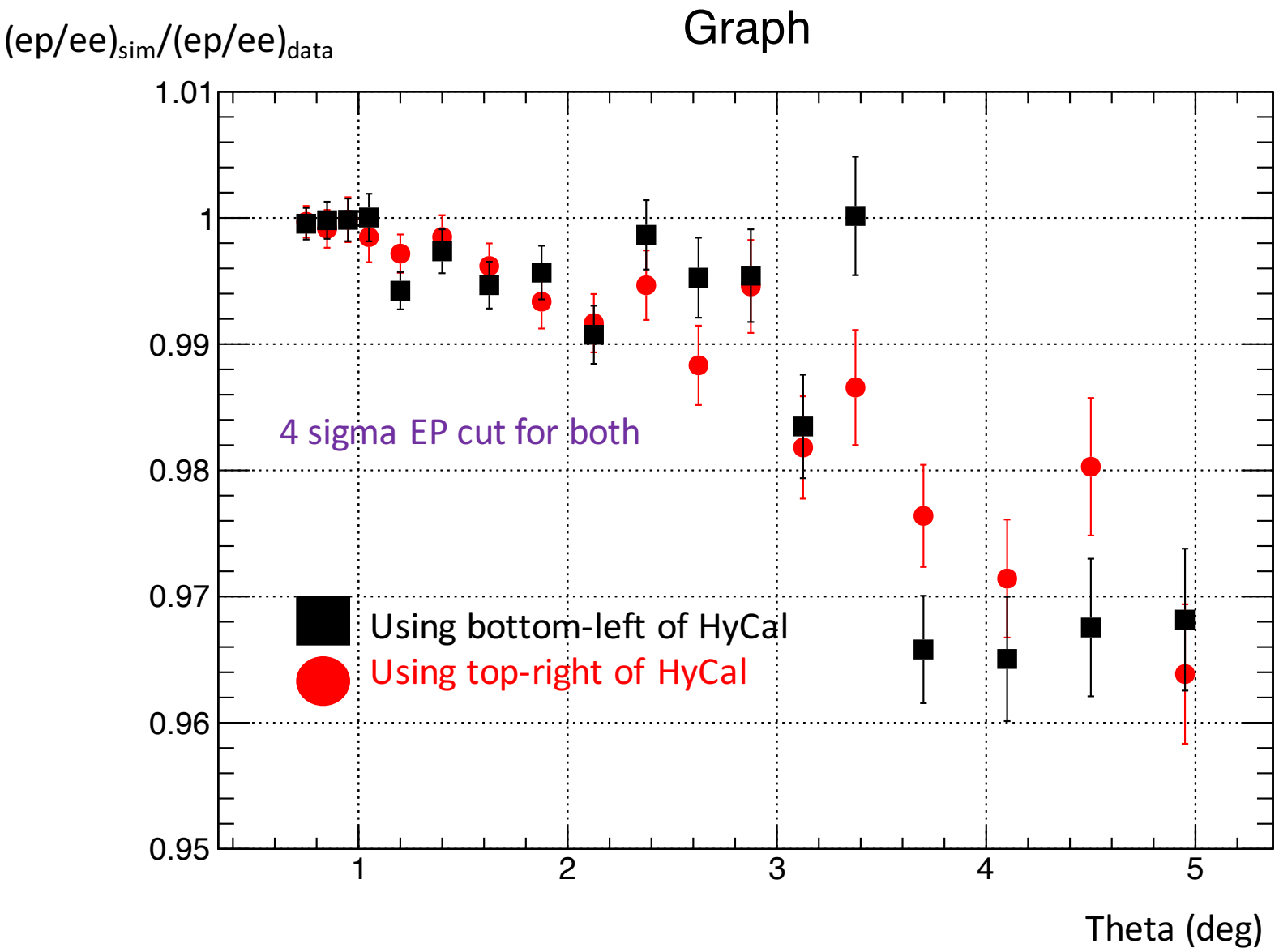
- Known problems that can affect the super ratio
  - Long tail of the LG simulation (increase super ratio with larger elasticity cut)
  - Inelastic ep amplitude (increase super ratio with larger scale factor)
  - GEM efficiency for simulation (increase super ratio by 0.2% at maximum)
  - Non-linearity for data (increase super ratio by 0.4% at maximum if without non-linearity correction for data)

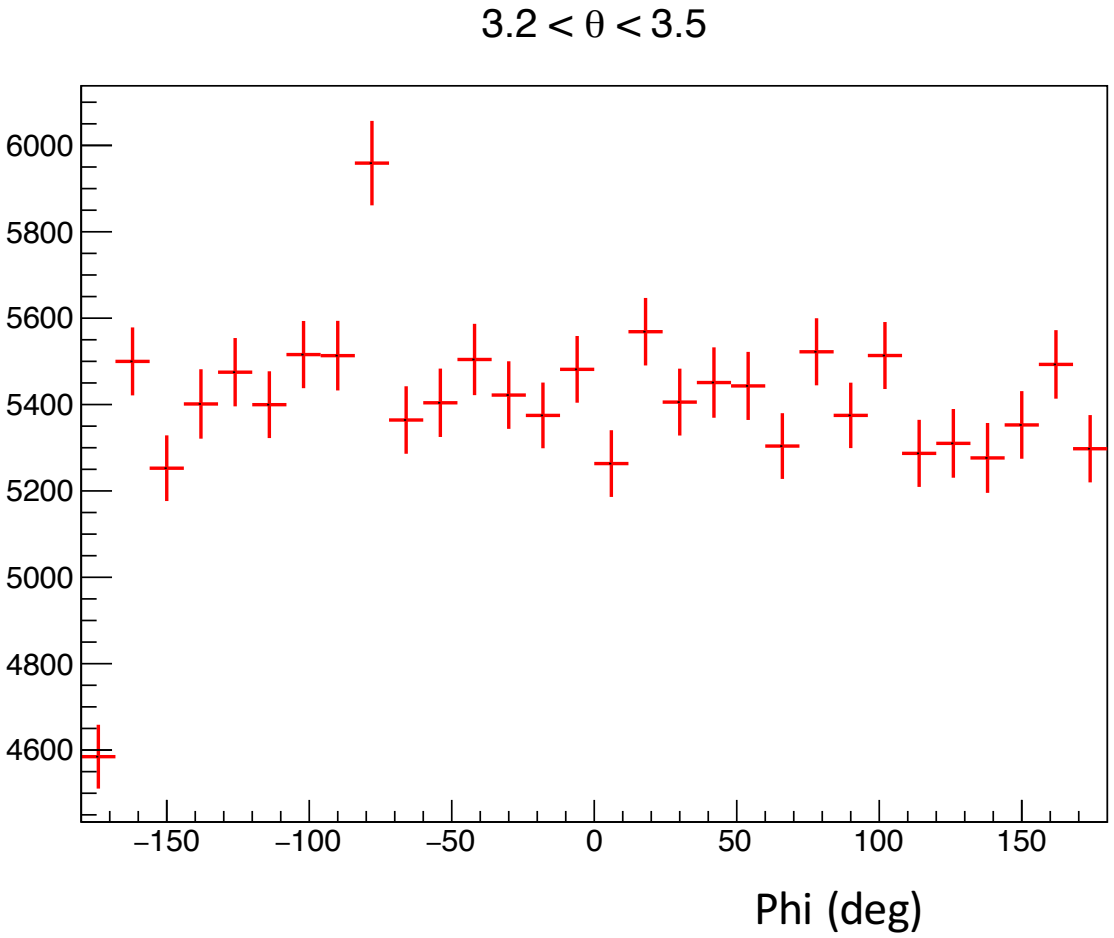
- Trigger efficiency? Can affect the super ratio, not checked with physics data

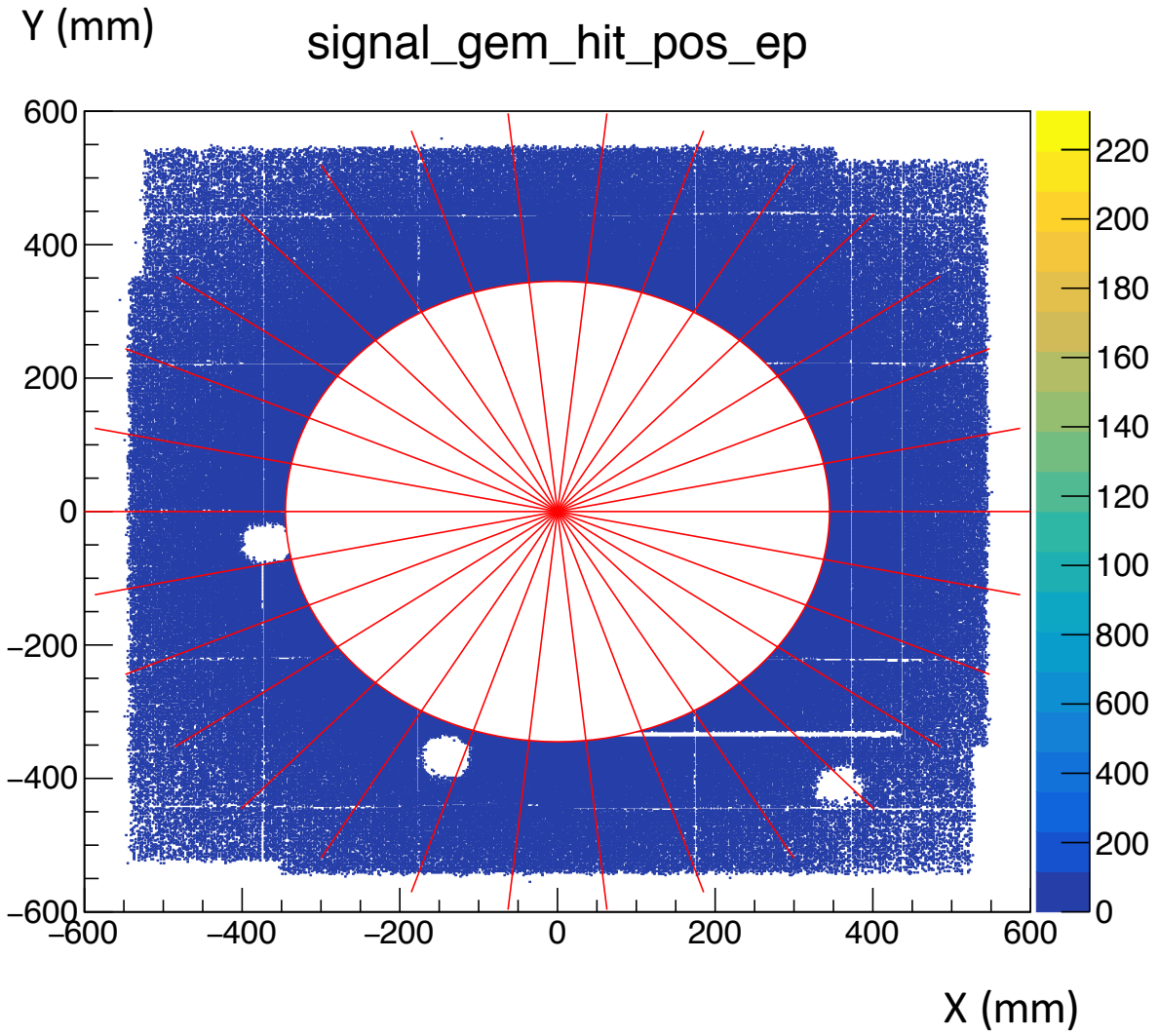
GEM efficiency in simulation



Super ratio comparison




3.2 < θ < 3.5
6000
5800
5600
5400
5200
5000
4800
4600
−150
−100
−50
0
50
100
150
Phi (deg)


Y (mm)
signal_gem_hit_pos_ep
600
400
200
0
−200
−400
−600
−600
−400
−200
0
200
400
600
X (mm)
220
200
180
160
140
120
100
800
600
400
200
0