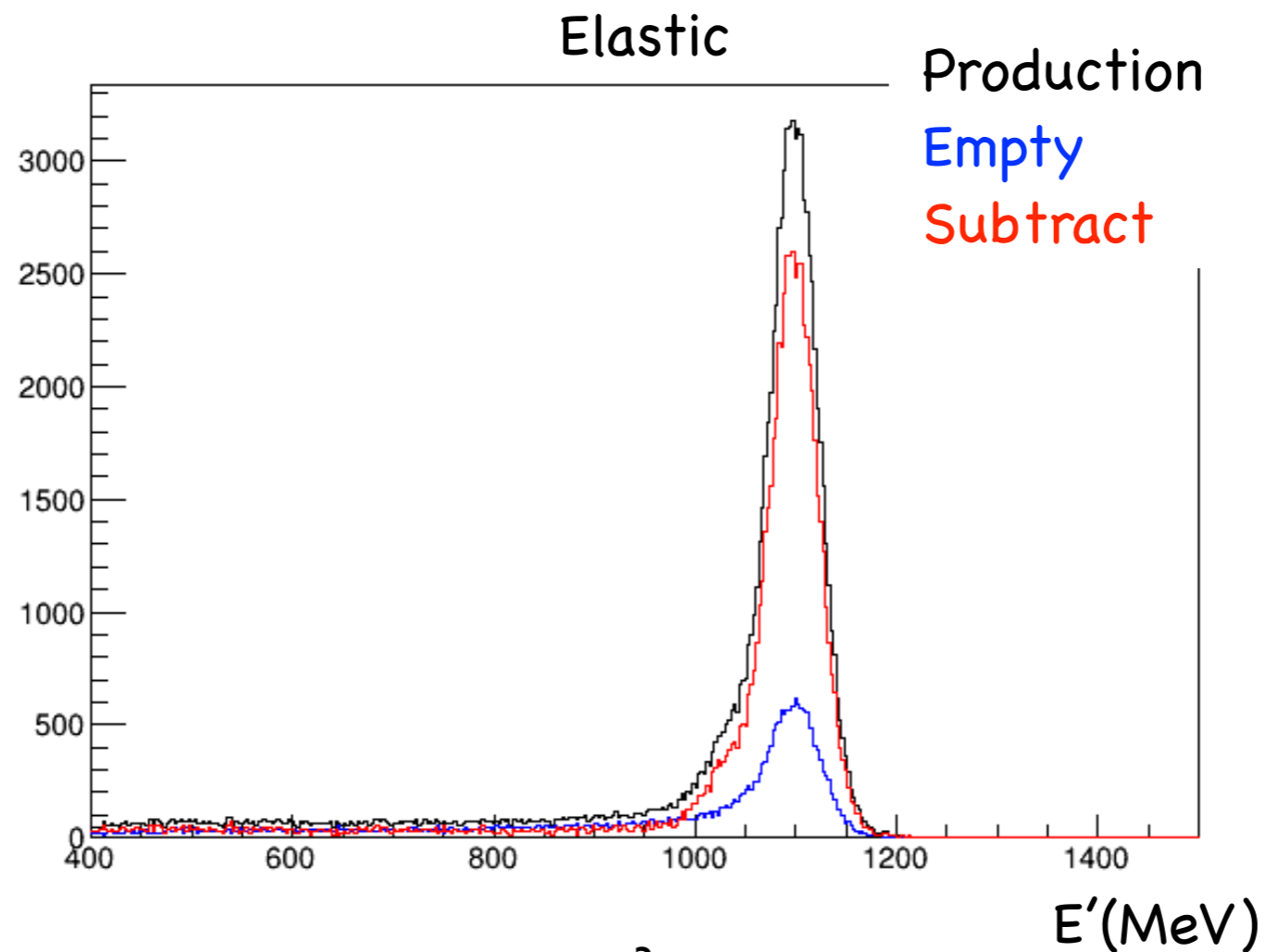# Simulation Update

Chao Gu

Progress Update

- Compare the simulation result with the data (prepare for the radiative correction study)

- Simulation:

  - Geant4 simulation originally written by Chao Peng

  - The geometries is updated with survey reports and drawings, the z position of detectors is updated with Weizhi's calibration results (a backup slide lists all the references)

  - The digitization and reconstruction part (for HyCal) of the simulation package is rewritten with the most recent database

- Data:

  - Roughly background subtraction with the empty run

Progress Update

- Compare the simulation with the data

  - 1.1 GeV production run 1288, empty target run 1289

  - The yield of the empty target run is scaled by the ratio between the live charge of the production run and the empty target run
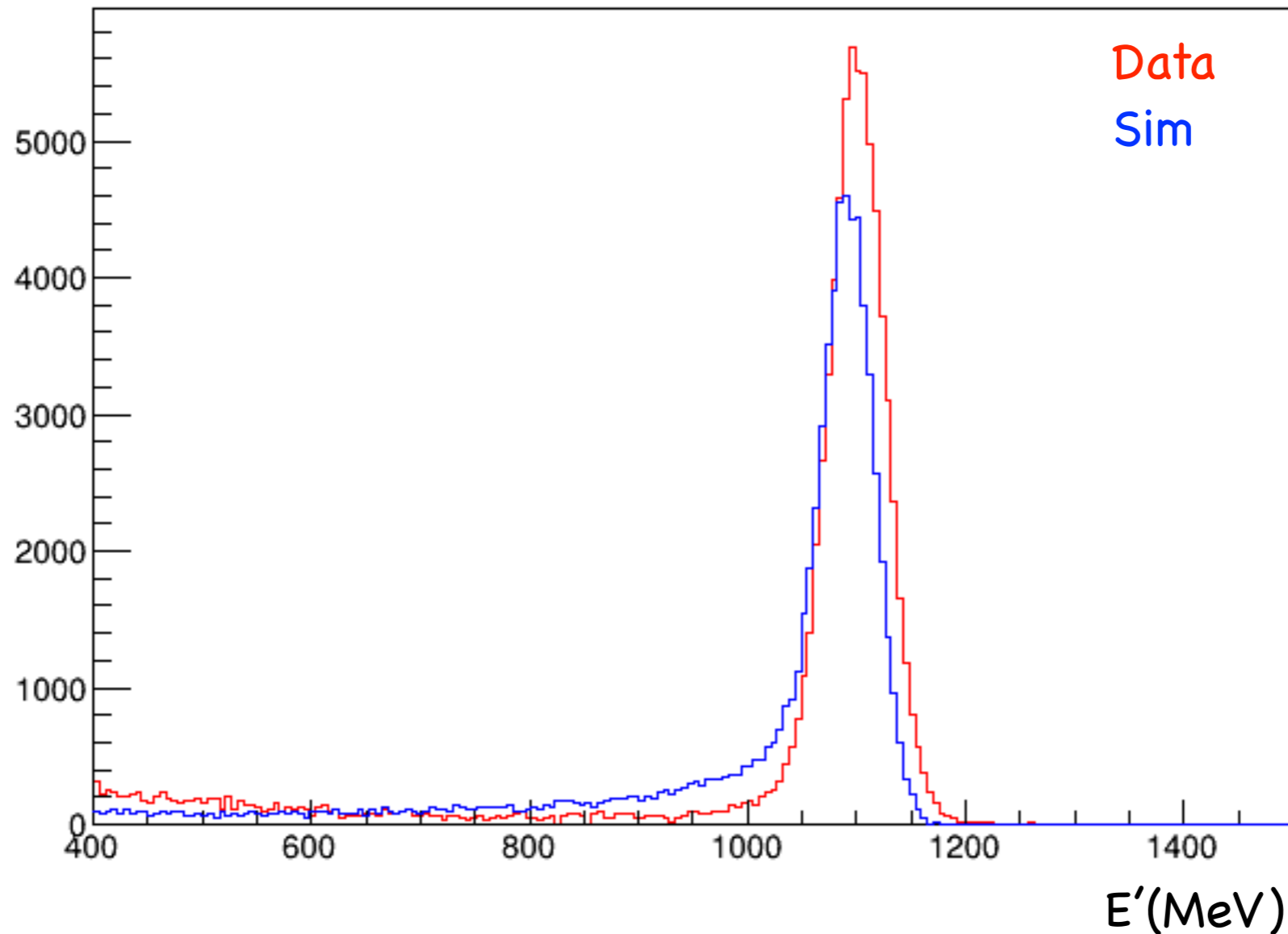
Progress Update

- Compare the simulation with the data

  - Only compare elastic peak at first

  - Apply the luminosity to the simulation to compare with data

  - Density of the H_2 target: 1.8×10^{18} atoms/cm^2

  - 30000 events were generated for simulation: the integrated cross-section for these events is 2199.3 ubarn, so the effective luminosity is 13.64 ubarn^{-1}, thus the effective beam charge for 30k events is $13.64 \times 10^{30} / (1.8 \times 10^{18} / 1.6 \times 10^{-19}) = 1212.5$nC

  - The live charge of run 1288 is 40731.3nC, only the first 1M events (out of 12.2M) is selected for compare, so the charge used for compare is 3338.6nC

  - Which means that if we scale the simulated spectrum with 3338.6/1212.5=2.754, the simulation and the data would have the same luminosity
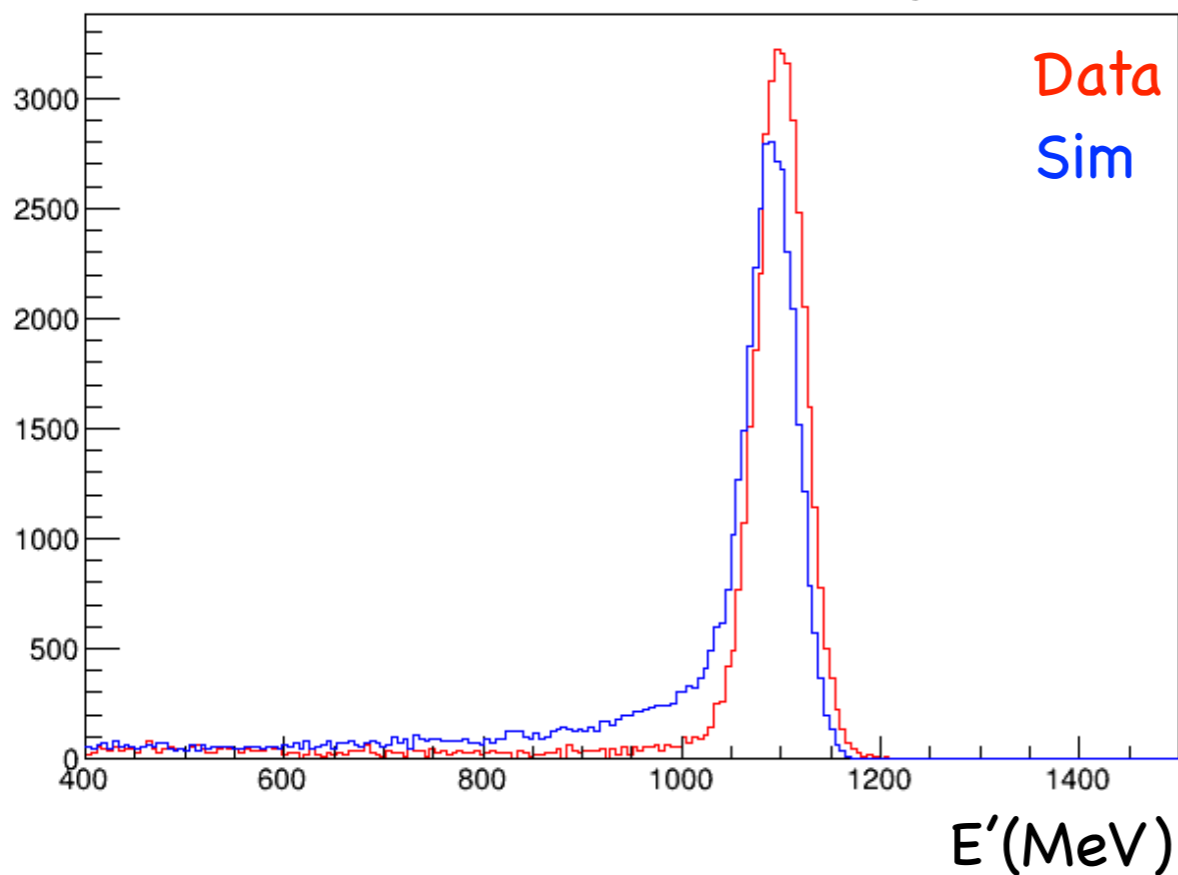
Progress Update

Elastic spectrum
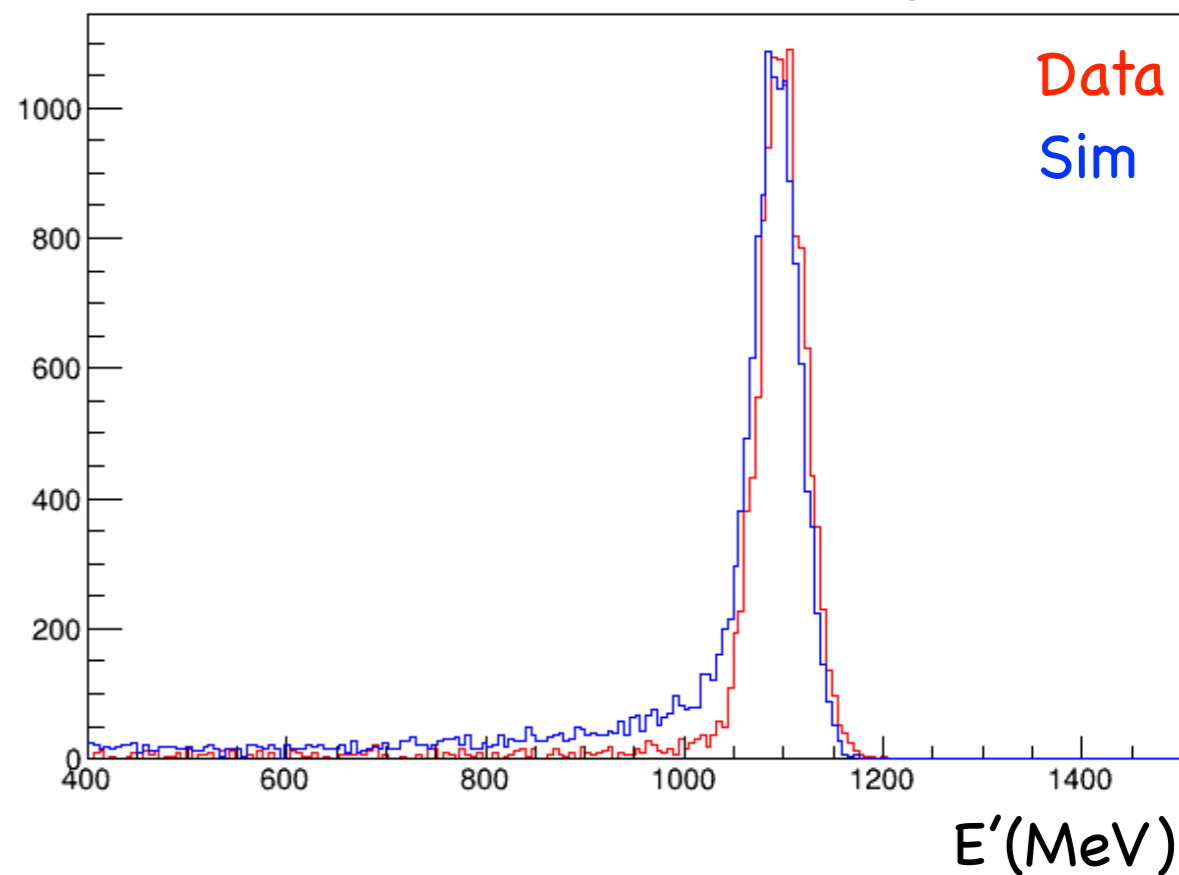

In this plot, the elastic peak of the simulation is scaled by the luminosity difference, the scale factor is 2.754
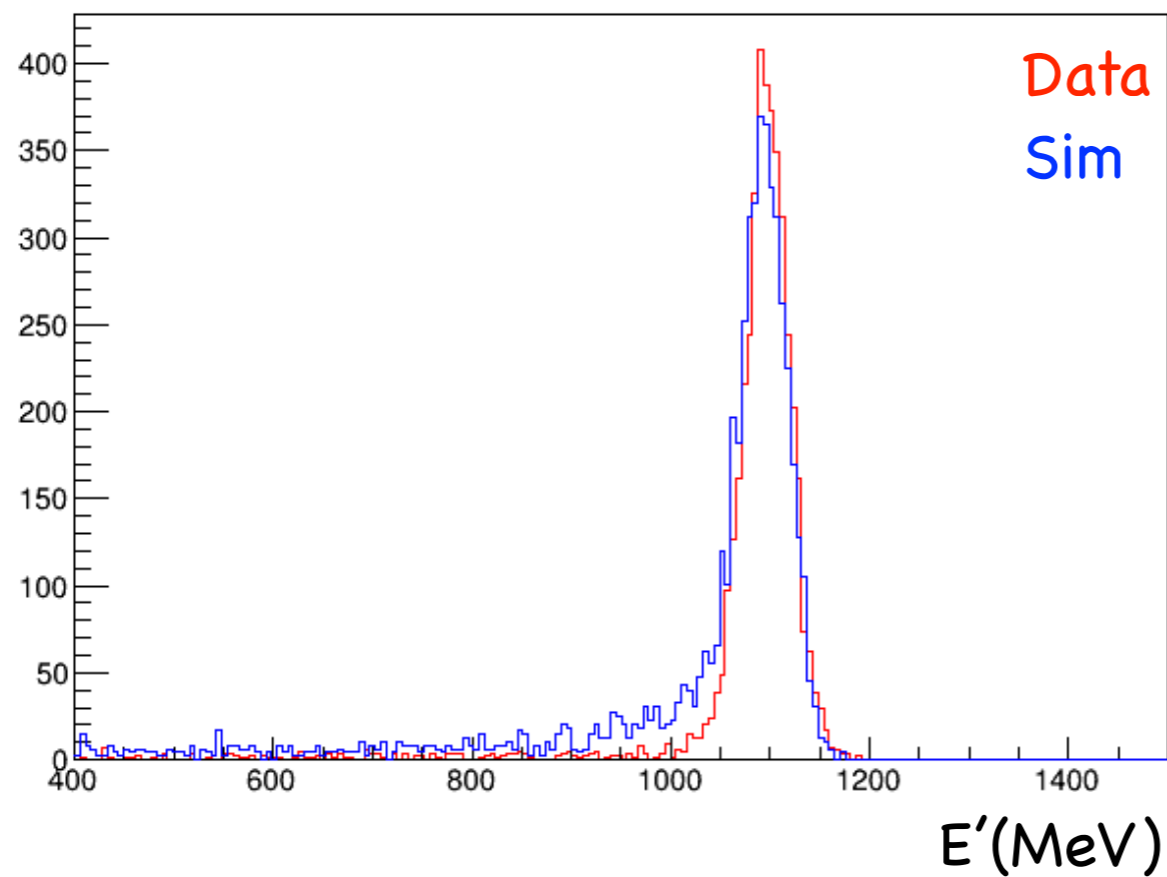
6

Progress Update
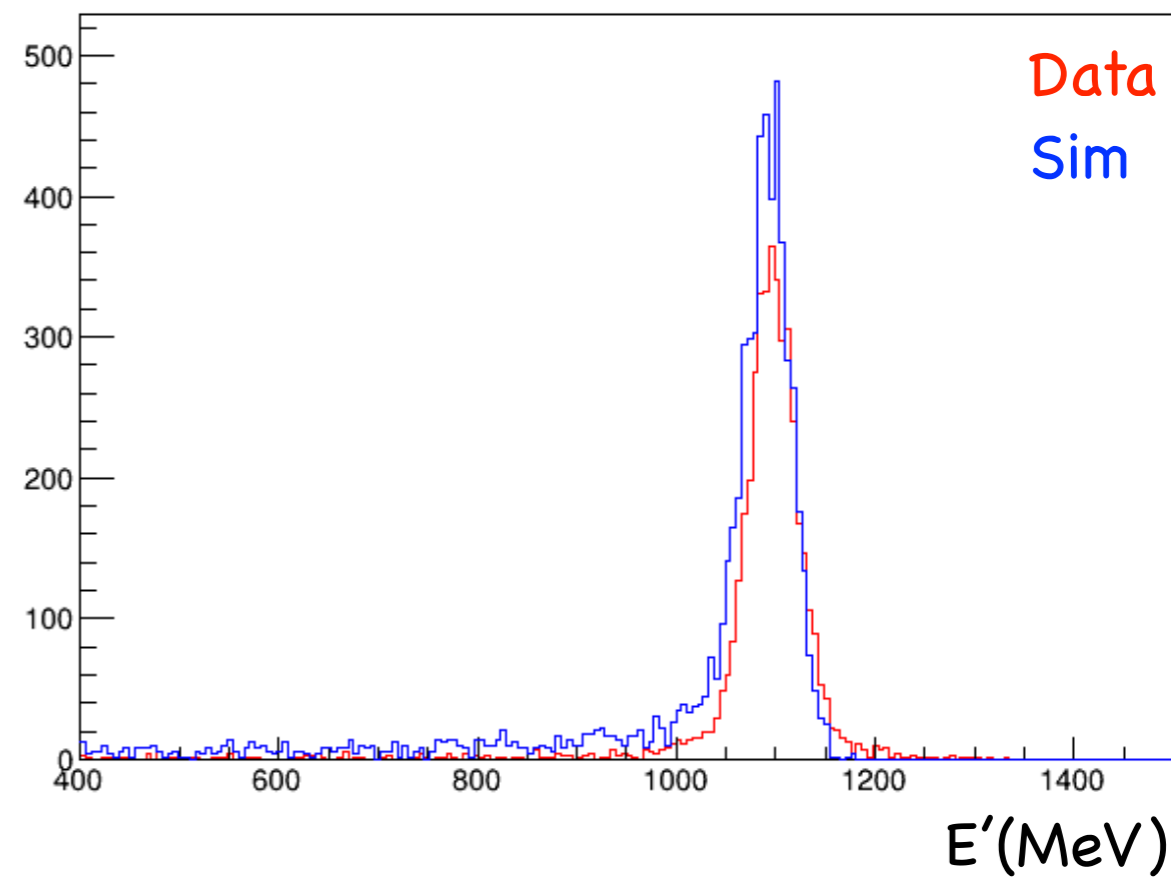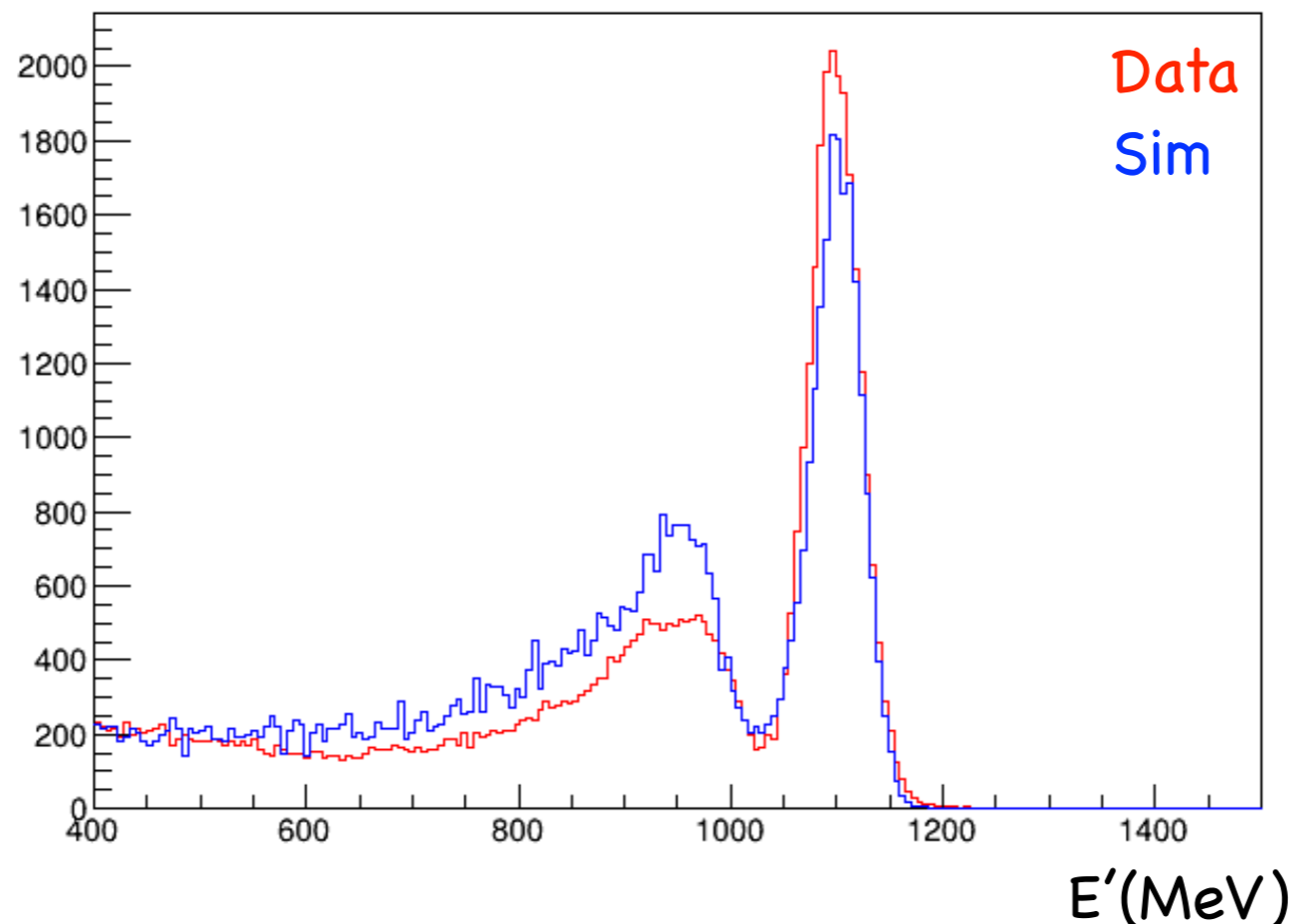
- Compare the simulation with the data

  - Compare the elastic and the Moller events together

  - The Moller events is simulated separately and scaled by the effective beam charge to give the same luminosity as the elastic simulation

  - The scale factor of the elastic simulation is 2.754, and the scale factor of the Moller simulation is 3.198

Elastic + moller spectrum

Backups

Simulation Update

- Geometry in the simulation:

  - Z position for target, GEM and HyCal (most critical): survey reports and Weizhi and Xinzhan's calibration results

  - Target windows: https://drive.google.com/file/d/0B1LlET0ObD0MREc2aEhfMmNhMzQ/view

  - Downstream chamber: https://userweb.jlab.org/~mezianem/PRAD/2nd_chamber_final.pdf

  - Vacuum box: https://userweb.jlab.org/~mezianem/PRAD/PRad_Vacuum_box.pdf and https://userweb.jlab.org/~mezianem/PRAD/PRad_window.pdf

  - GEM: personal discussion with Xinzhan

  - HyCal: https://userweb.jlab.org/~mezianem/PRAD/HyCal_Drawings.pdf and a few other talks