NIKOLAY MARKOV

UNIVERSITY OF CONNECTICUT

ANALYSIS OF ELASTIC SCATTERING AT 2.2 GEV

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RUN CONDITIONS

- Three different energies
  - 2 GeV
  - 6 GeV
  - 10 GeV

- 2 GeV
  - Beam energy: 2.221 GeV
  - Start: Jan 17
  - Finish: Jan 25
  - Beam current: 2 - 5 nA
  - Torus polarities: +1, +0.6, -0.6
  - Solenoid polarities: -1, -0.6, +0.6, +1

2476 T:+0.6/+S:0.6 WILL BE SHOWN

2596 T:−0.6/S:−0.6 WILL BE SHOWN

CROSS SECTION CALCULATION

1ST METHOD

- Selecting a good narrow theta phi range so that there is minimal geometrical acceptance issues;
- Normalizing events in the narrow theta phi range by the luminosity (no acceptance correction).

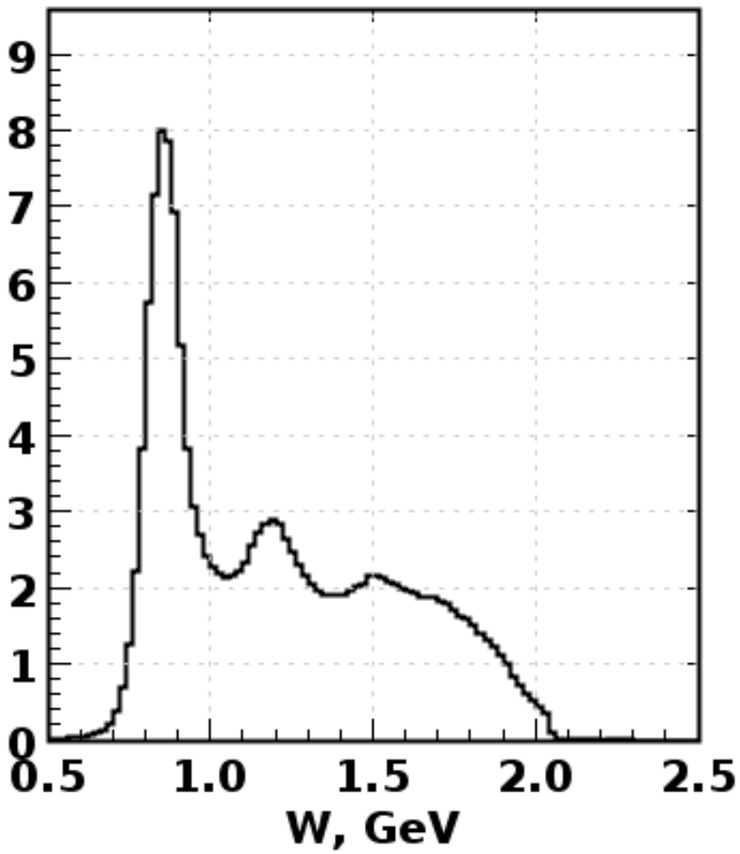
2ND METHOD

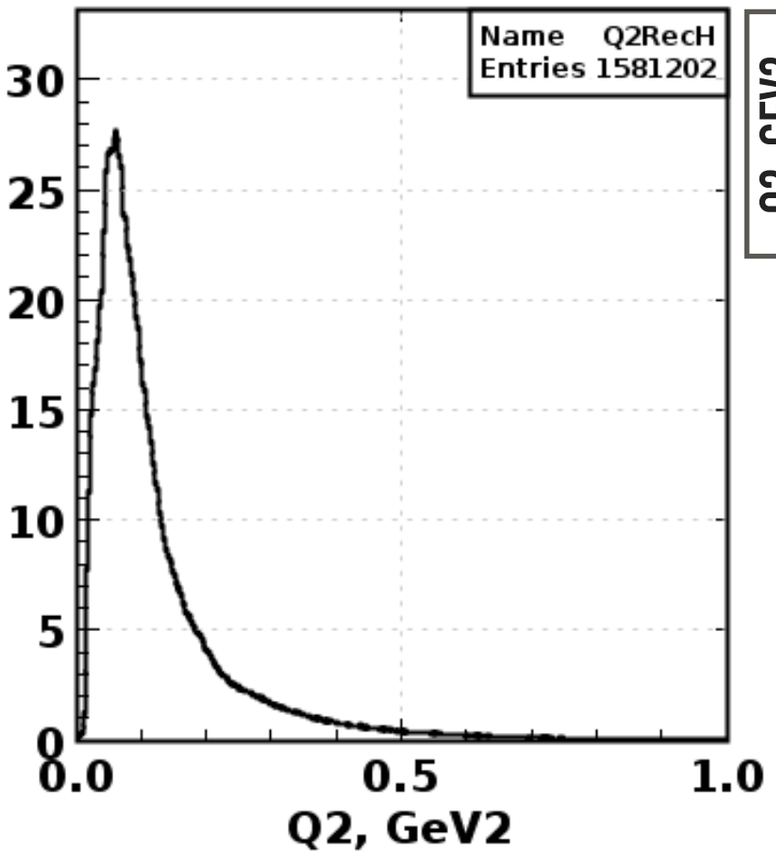
- Running a simulation using elastgen with the radiative effect
- Reconstructing using gemc, correct field configuration, recent coatjava
- Develop acceptance correction
- Normalizing events in the whole sector by the luminosity

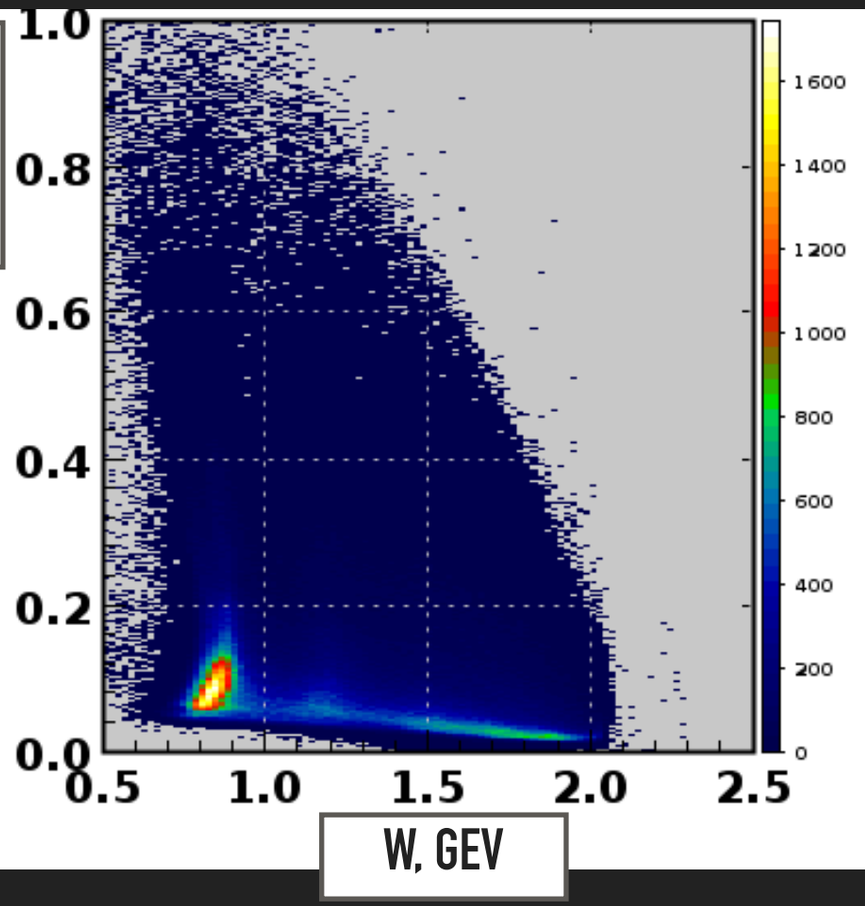
1ST METHOD

2476 T:+0.6/S:+0.6

KINEMATICAL COVERAGE







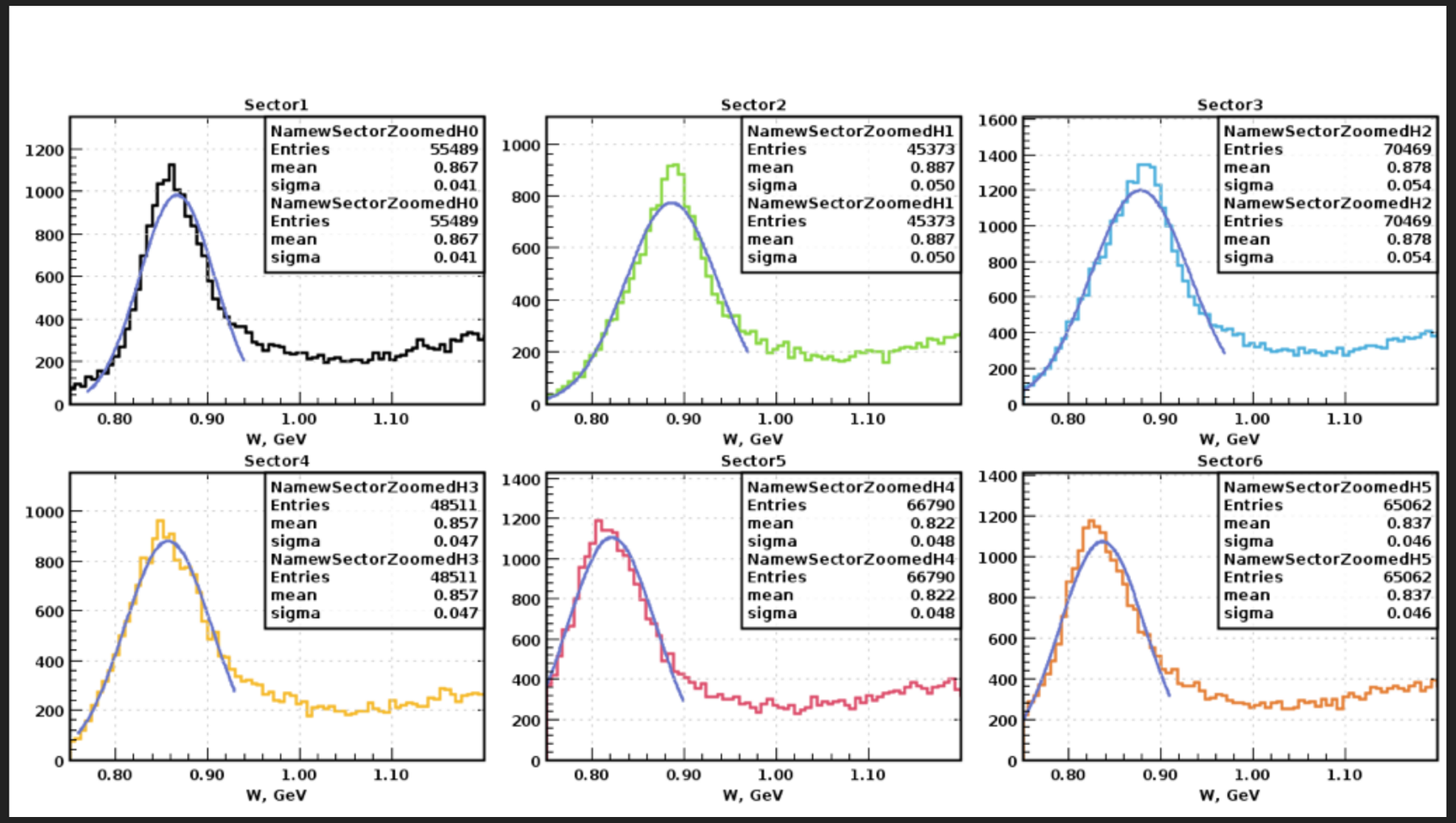
Elastic peak, Delta region and second resonance region are very prominent

Q2 starts from a very low value

1ST METHOD

2476 T:+0.6/S:+0.6

ELASTIC EVENT SELECTION



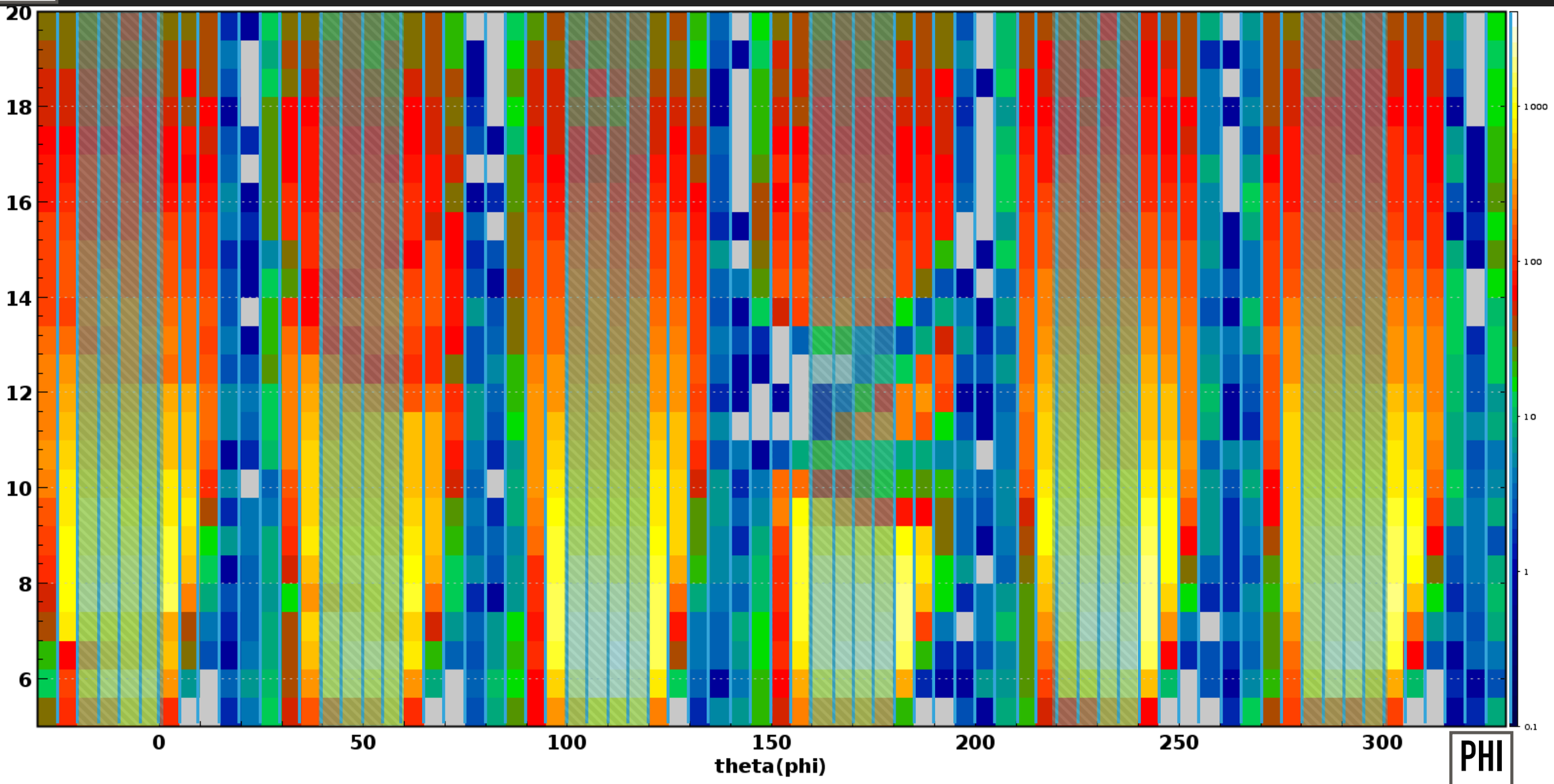
Sector dependent 3 sigma cut to select elastic events

EVENT SELECTION

1ST METHOD

2476 T:+0.6/S:+0.6

- Split in 5 degree bins over phi
- Select bins with maximum event yield (allows to select bins with the minimum effect from geometrical acceptance)
- 4 bins per sector are selected

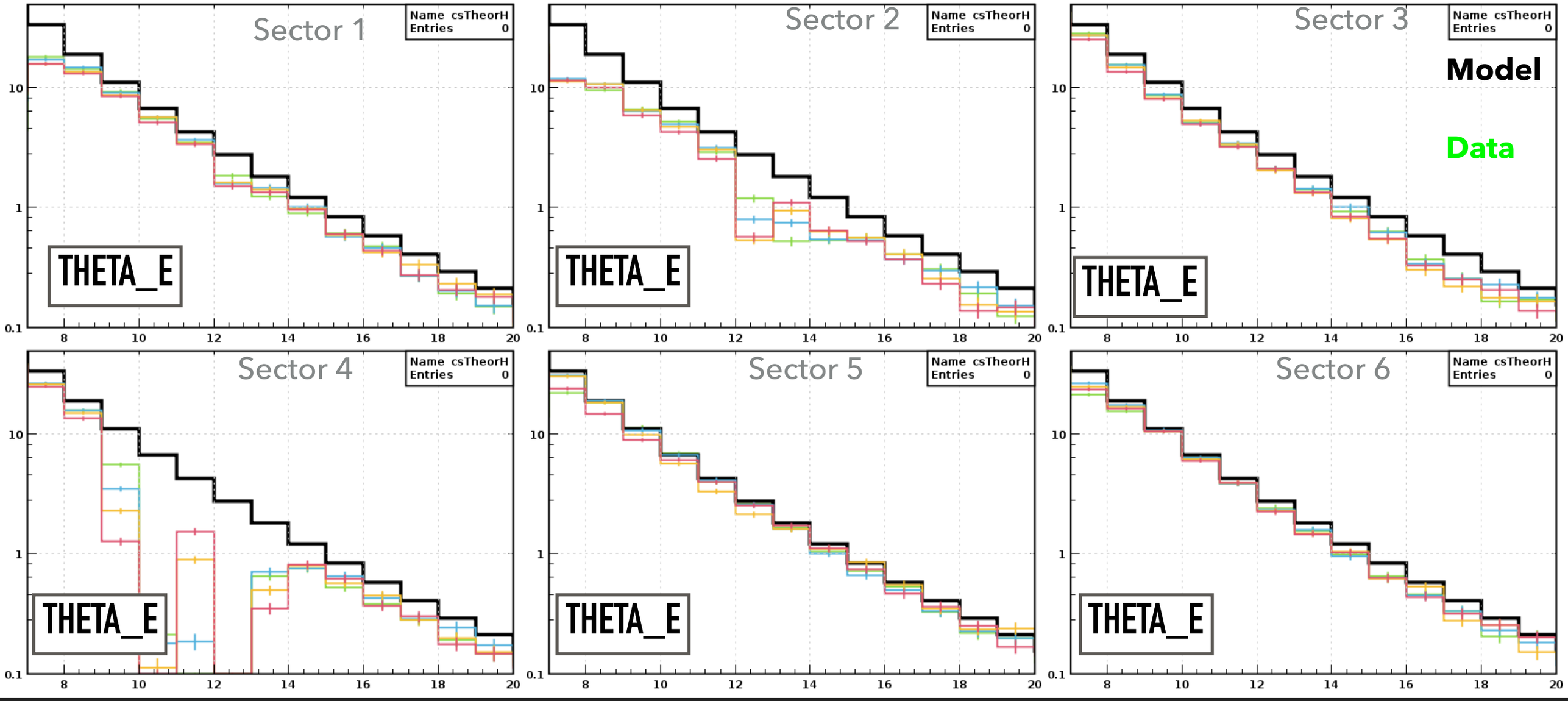


CROSS SECTION

1ST METHOD

2476 T:+0.6/S:+0.6

COMPARISON TO THE MODEL



Cross section normalized by the luminosity, overlaid with the model prediction
Different panels are different sectors

Different colors are different phi bins

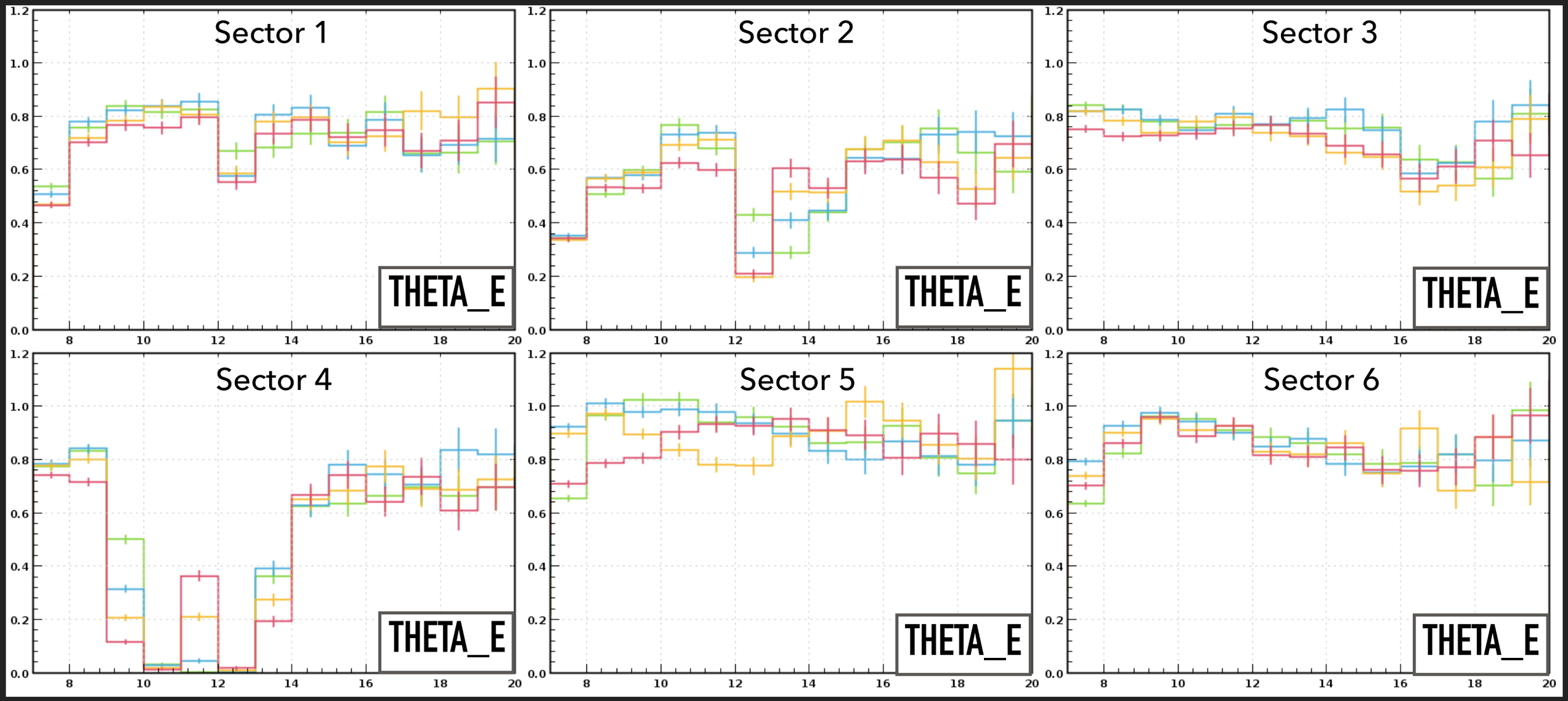
Black thick line is theory

RATIO OF THE CS TO THE MODEL

1ST METHOD

2476 T:+0.6/S:+0.6

COMPARISON TO THE MODEL



Ratio of the cross section in different phi bins to the model prediction

Different panels are different sectors

Different colors are different phi bins

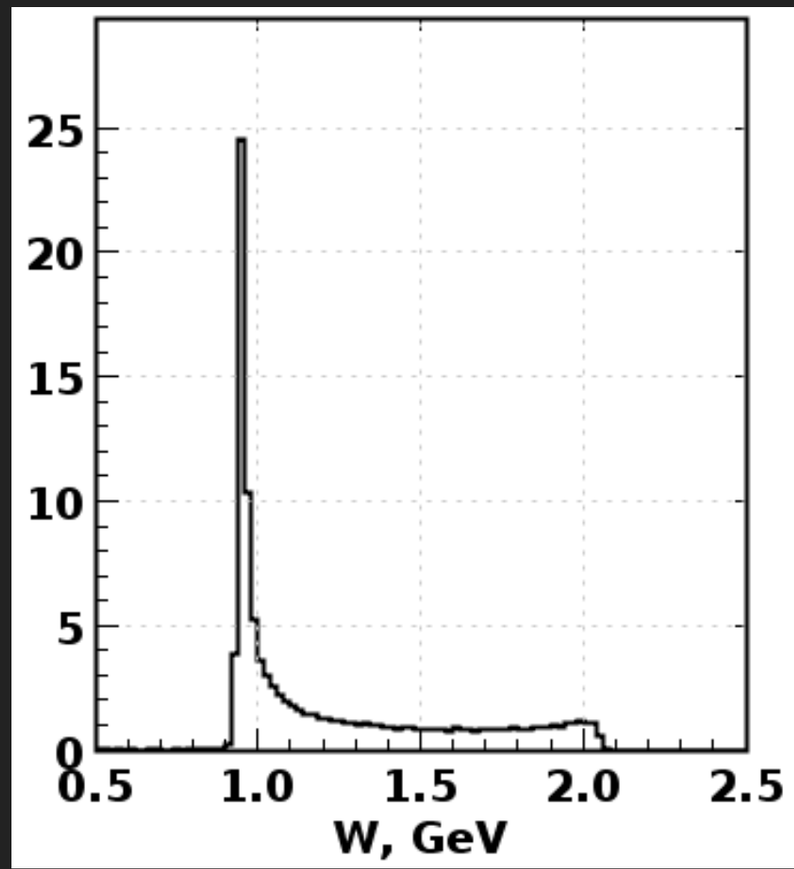
KINEMATICAL COVERAGE

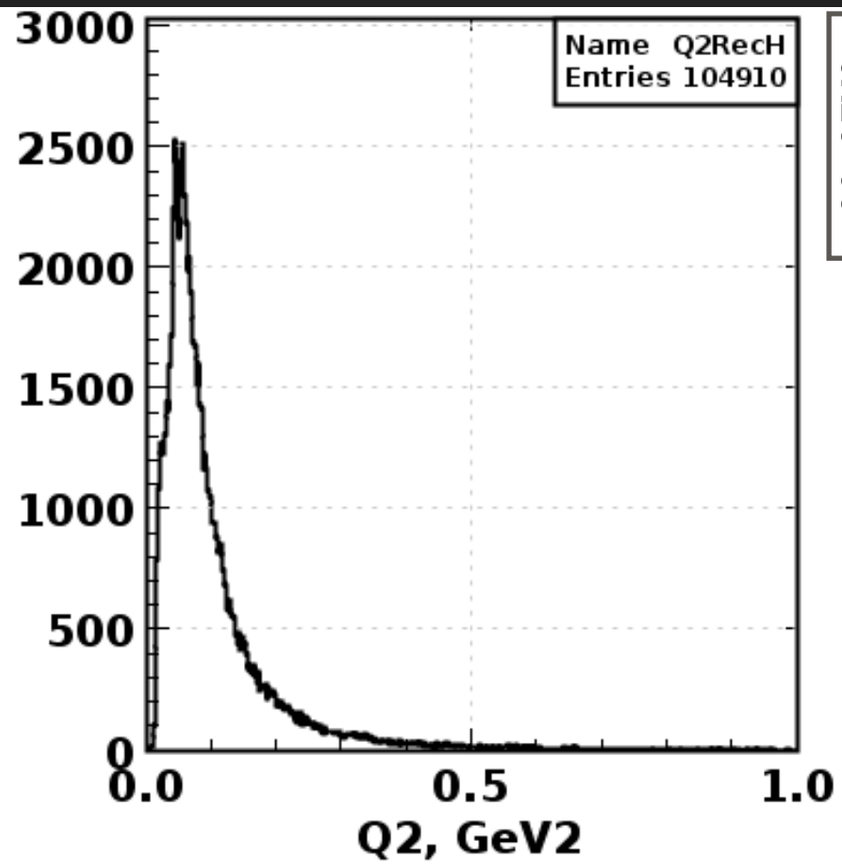
Elastgen with the radiative effect

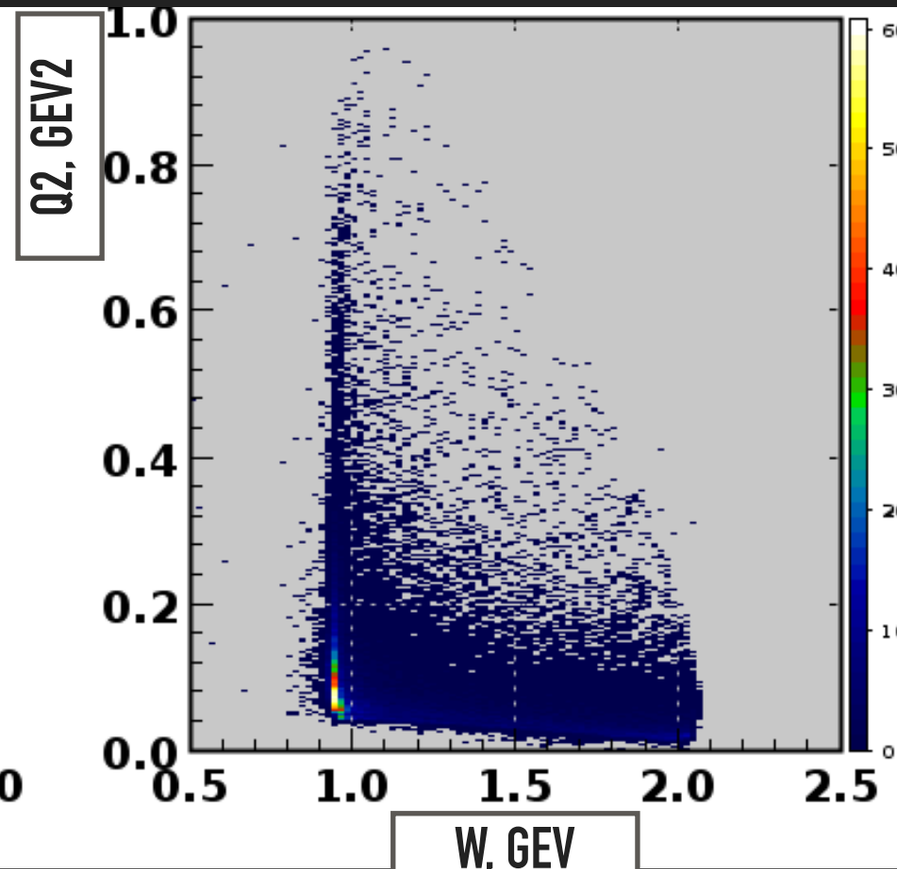
COATJAVA 5.0.10

gems 4.2.2

Magnet configuration torus/solenoid 0.6/+0.6 (same as data)

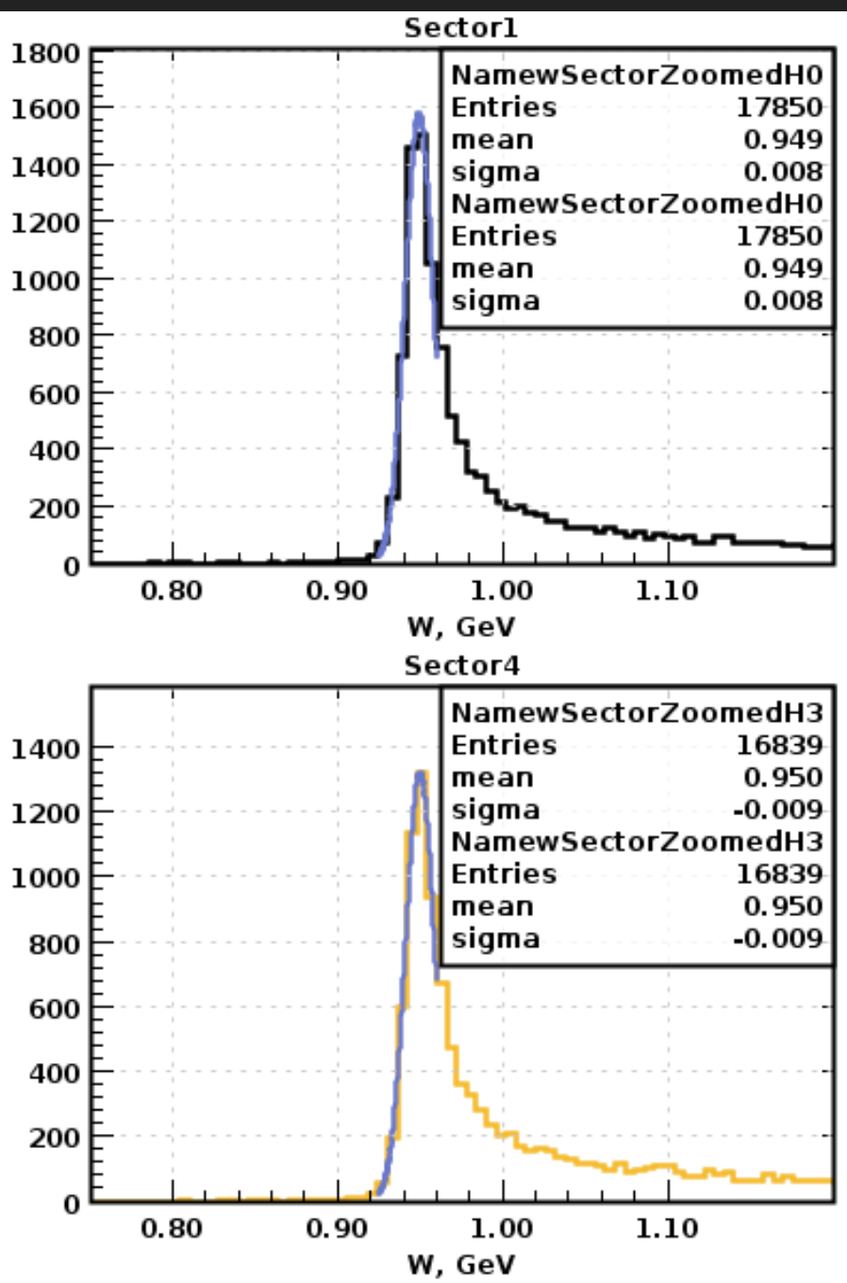


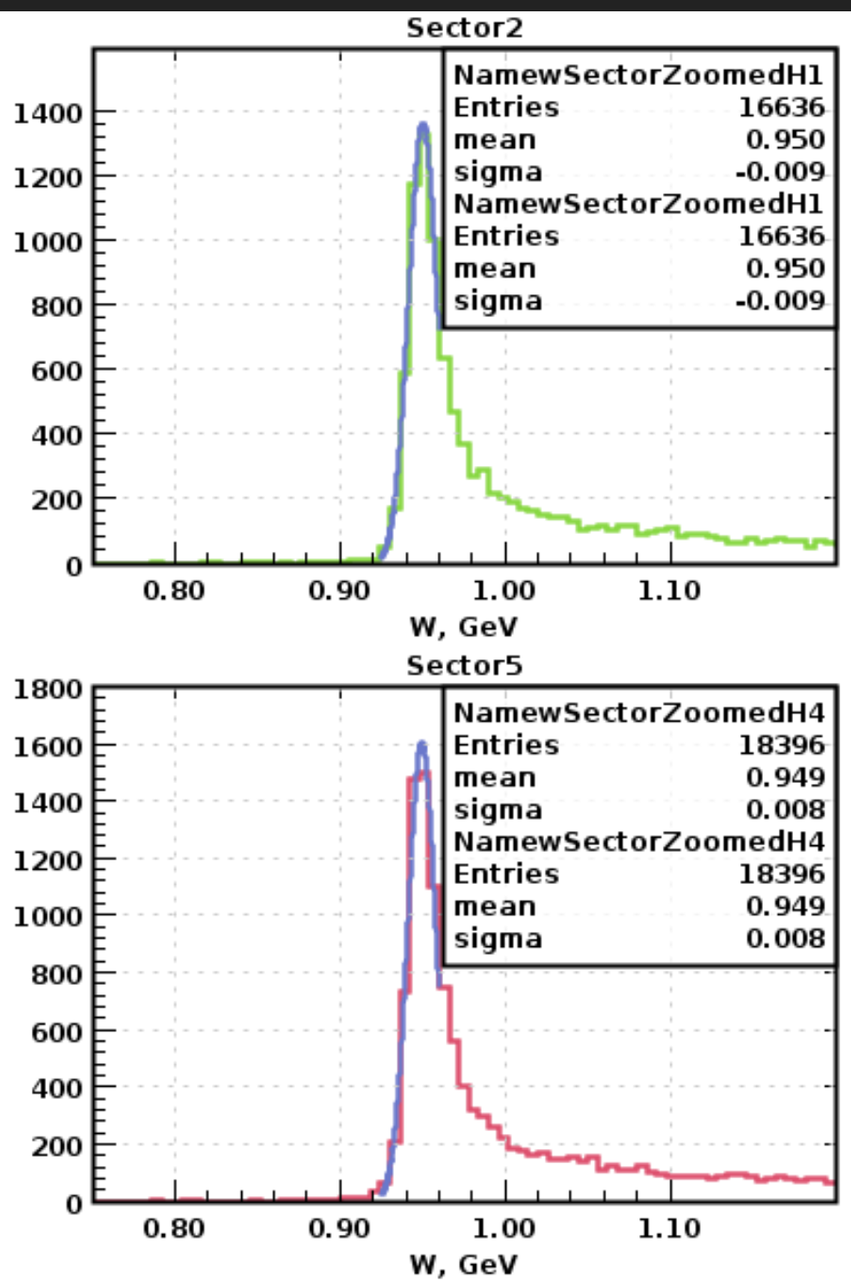


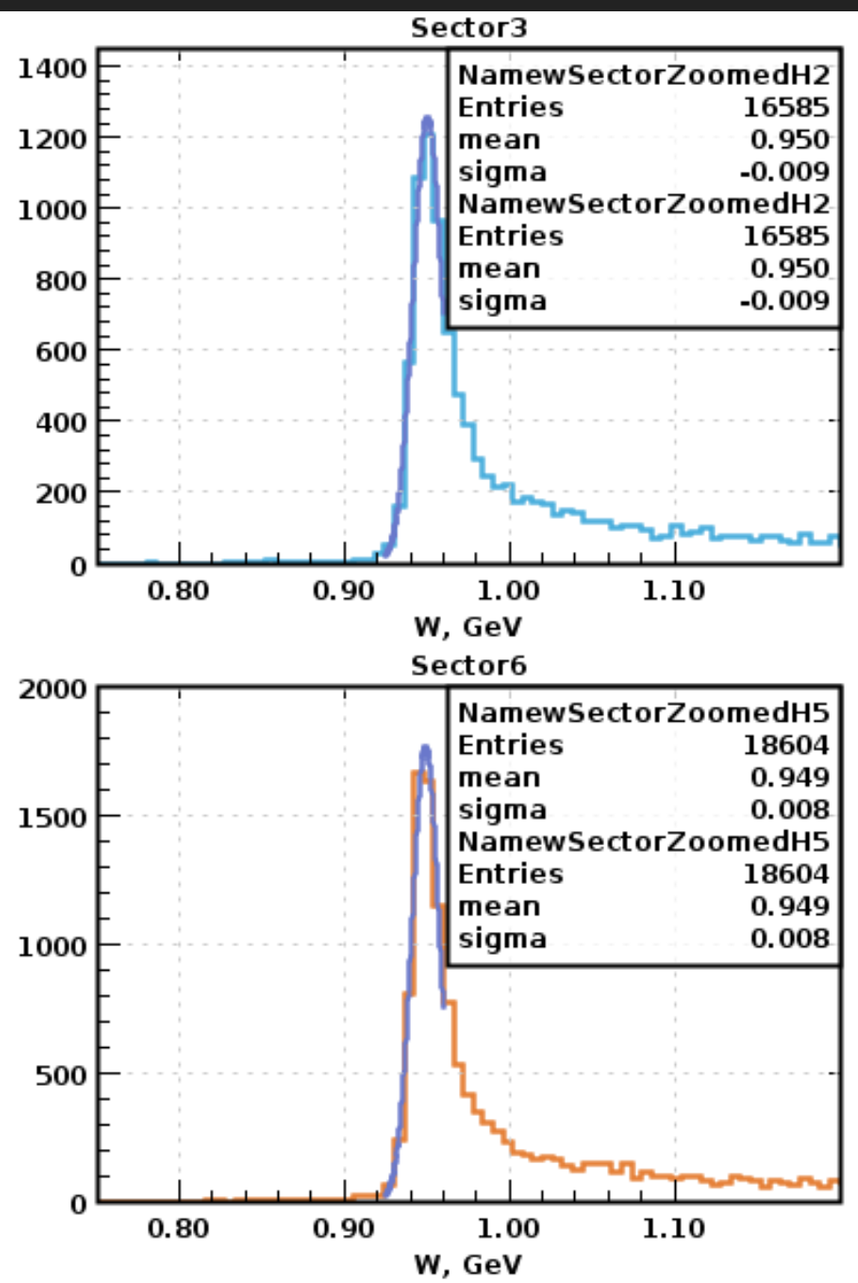


2476 T:+0.6/S:+0.6

ELASTIC EVENT SELECTION







Much narrower compared to the data

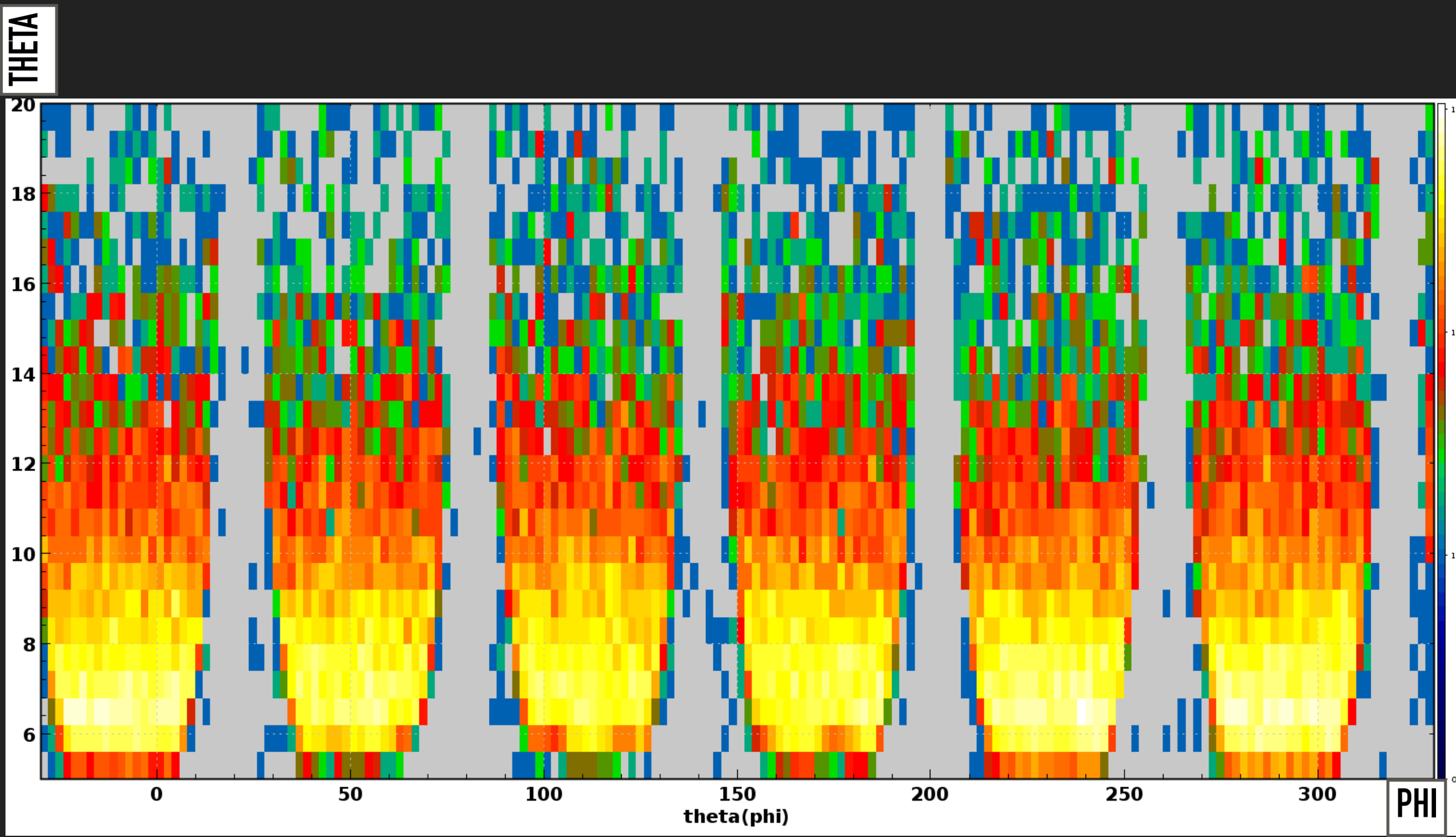
Same cut as in simulation is used (should be minimal effect)

2ND METHOD

2476 T:+0.6/S:+0.6

ANGULAR COVERAGE

No visible holes



SIMULATION

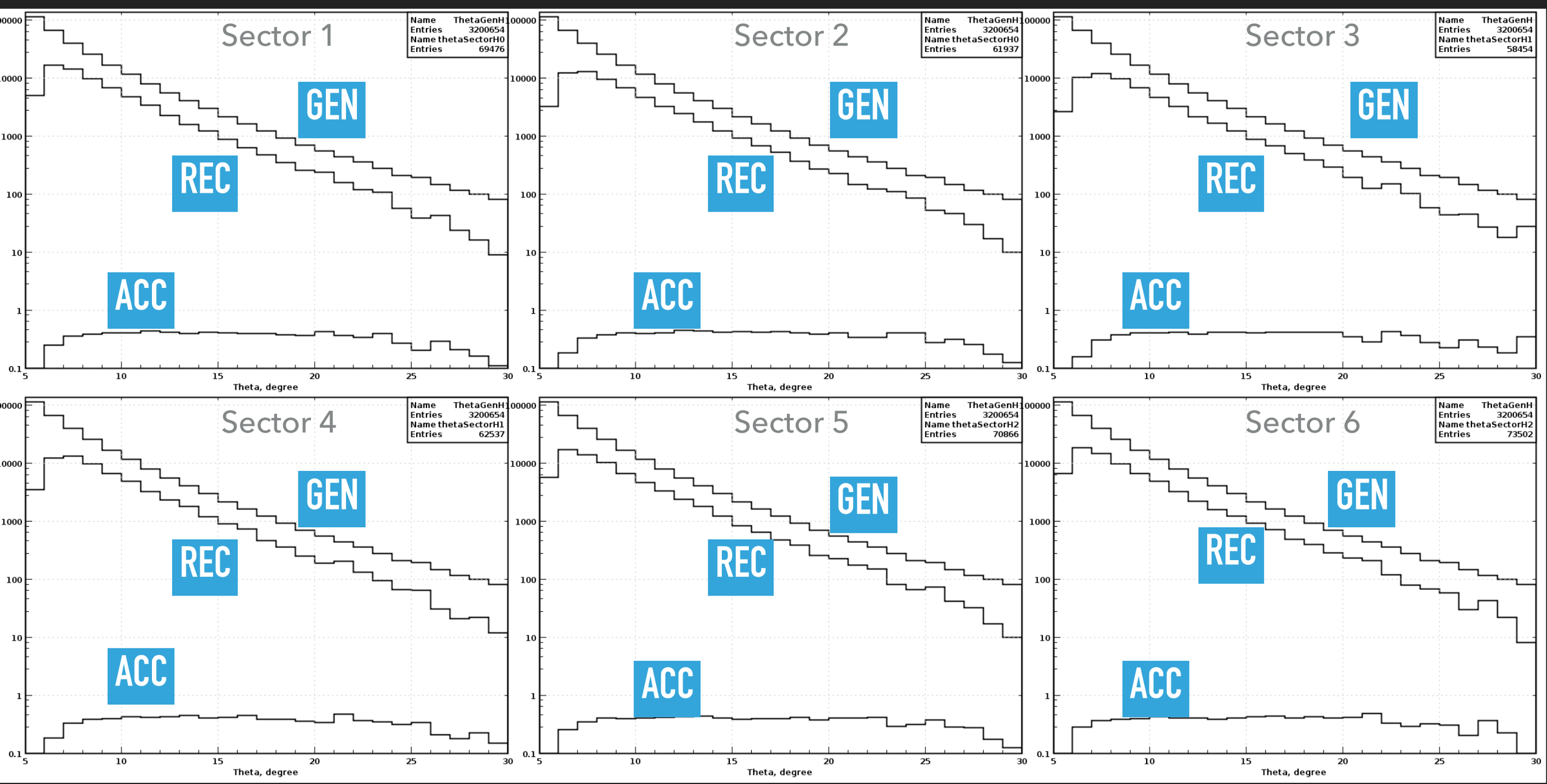
2ND METHOD

2476 T:+0.6/S:+0.6

ACCEPTANCE CALCULATIONS

Sector by sector:

- generated
- reconstructed
- acceptance

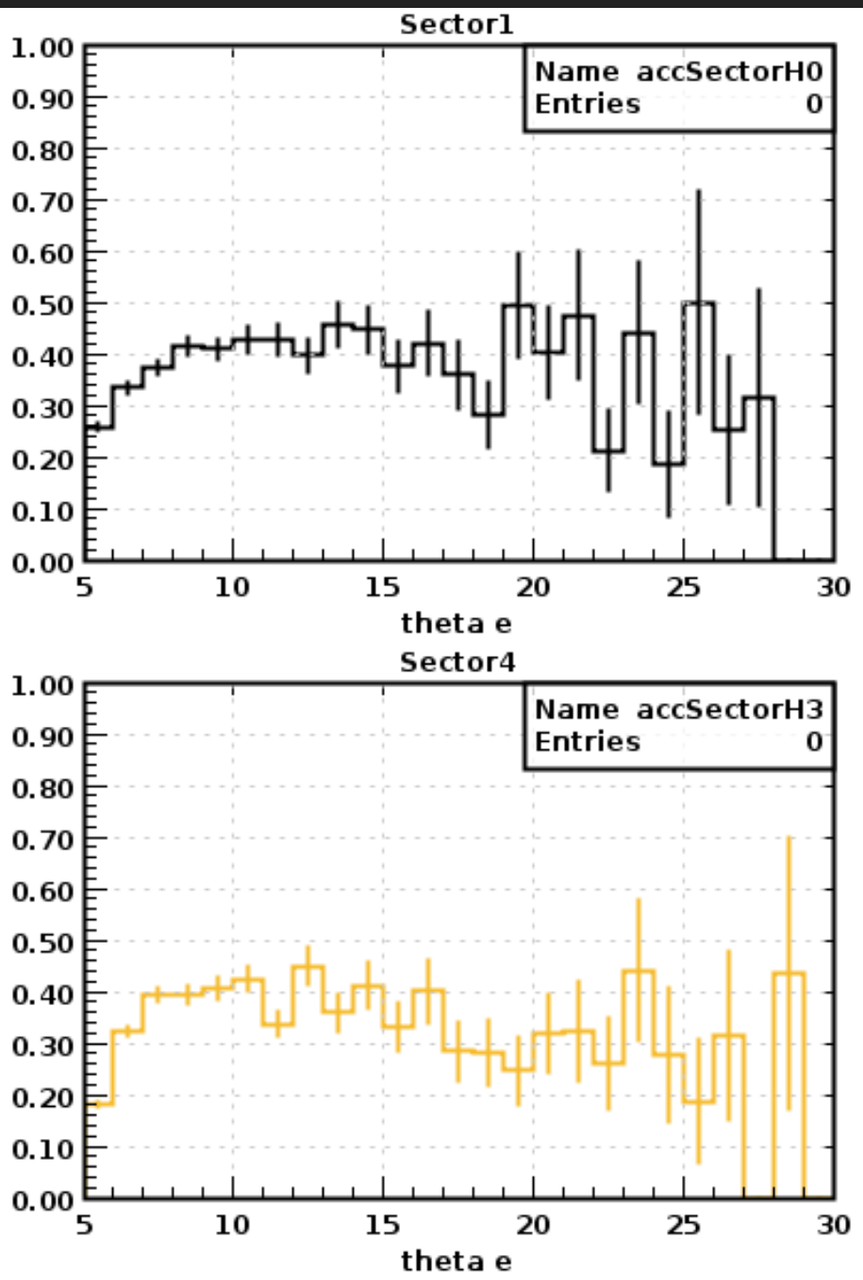


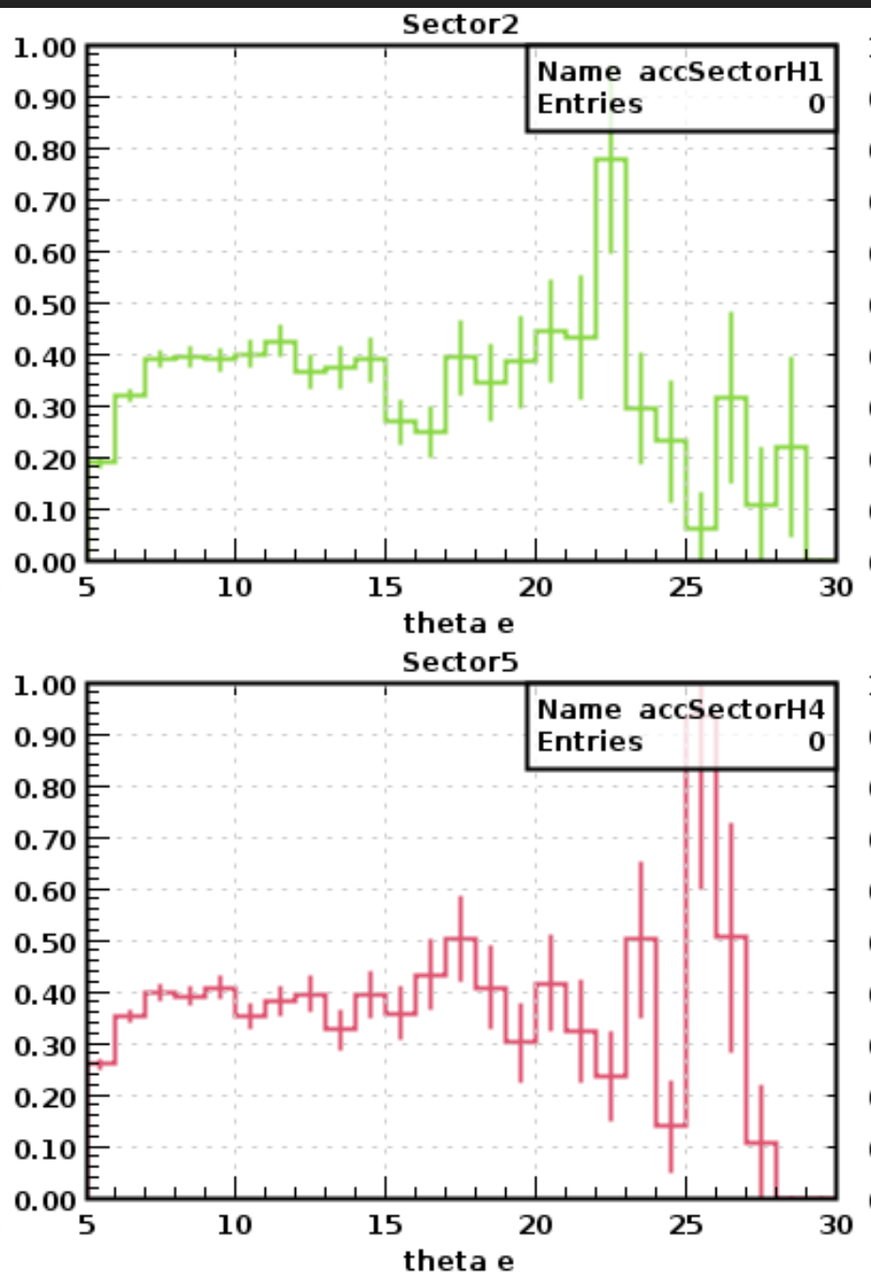
2ND METHOD

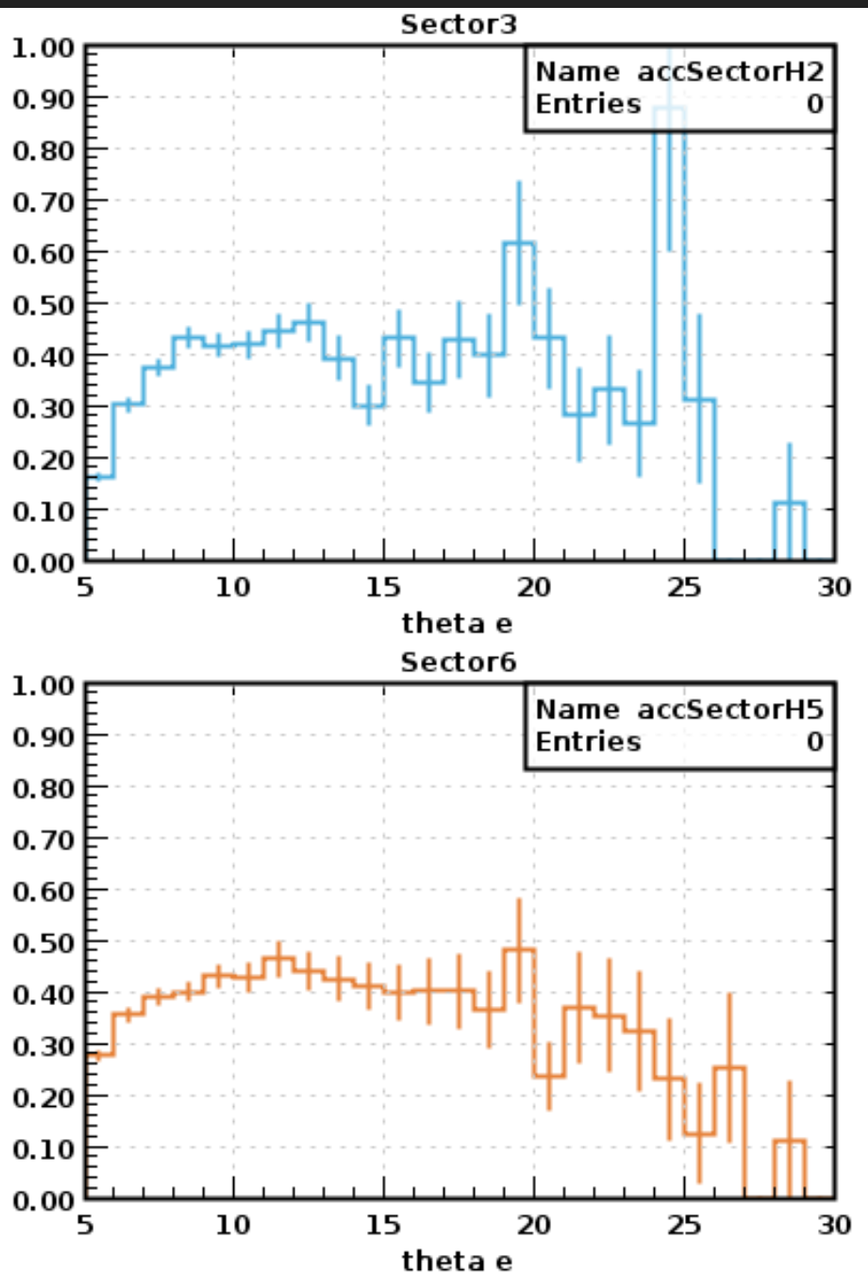
2476 T:+0.6/S:+0.6

ACCEPTANCE

Similar sector to sector



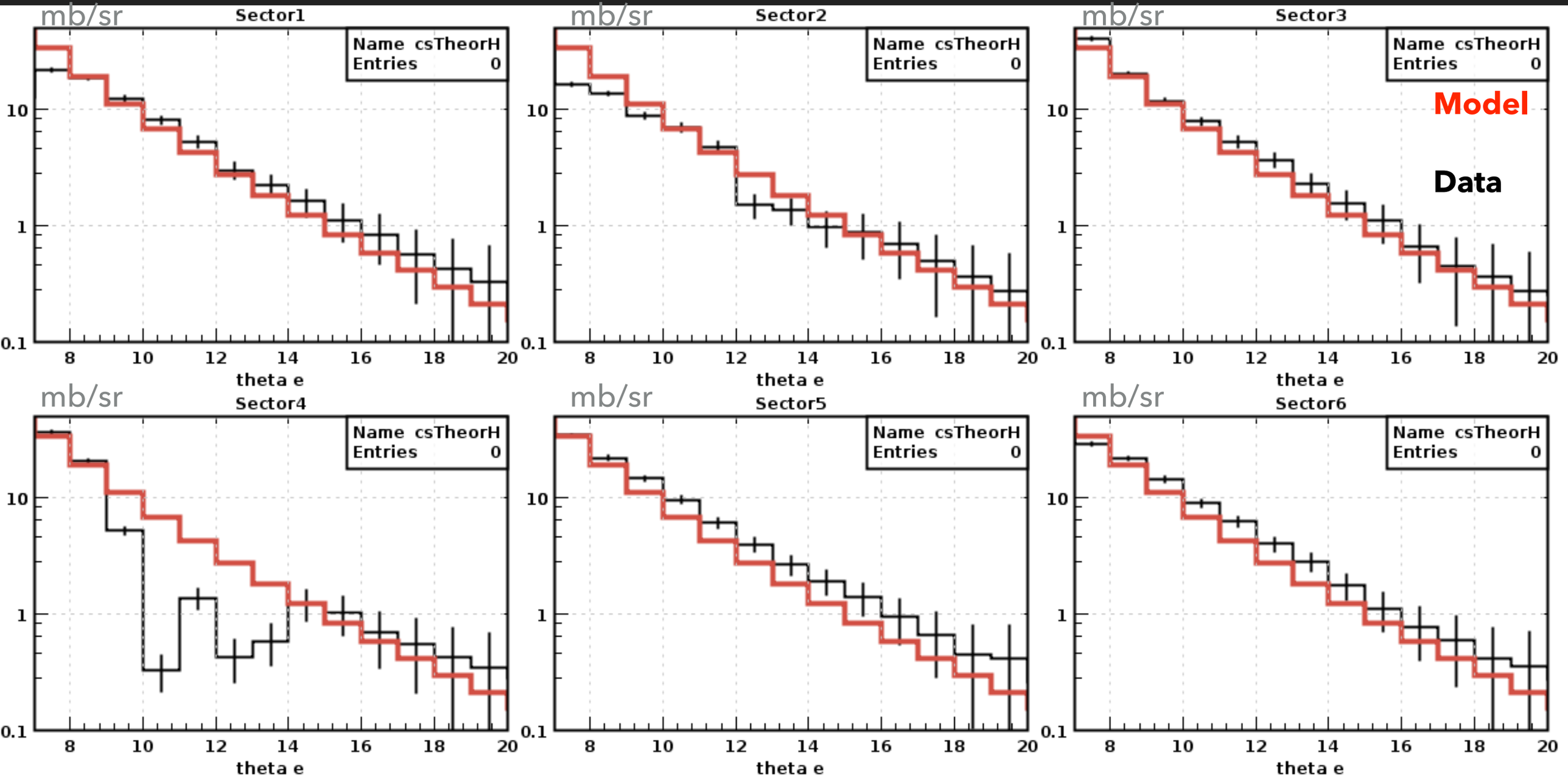




2ND METHOD

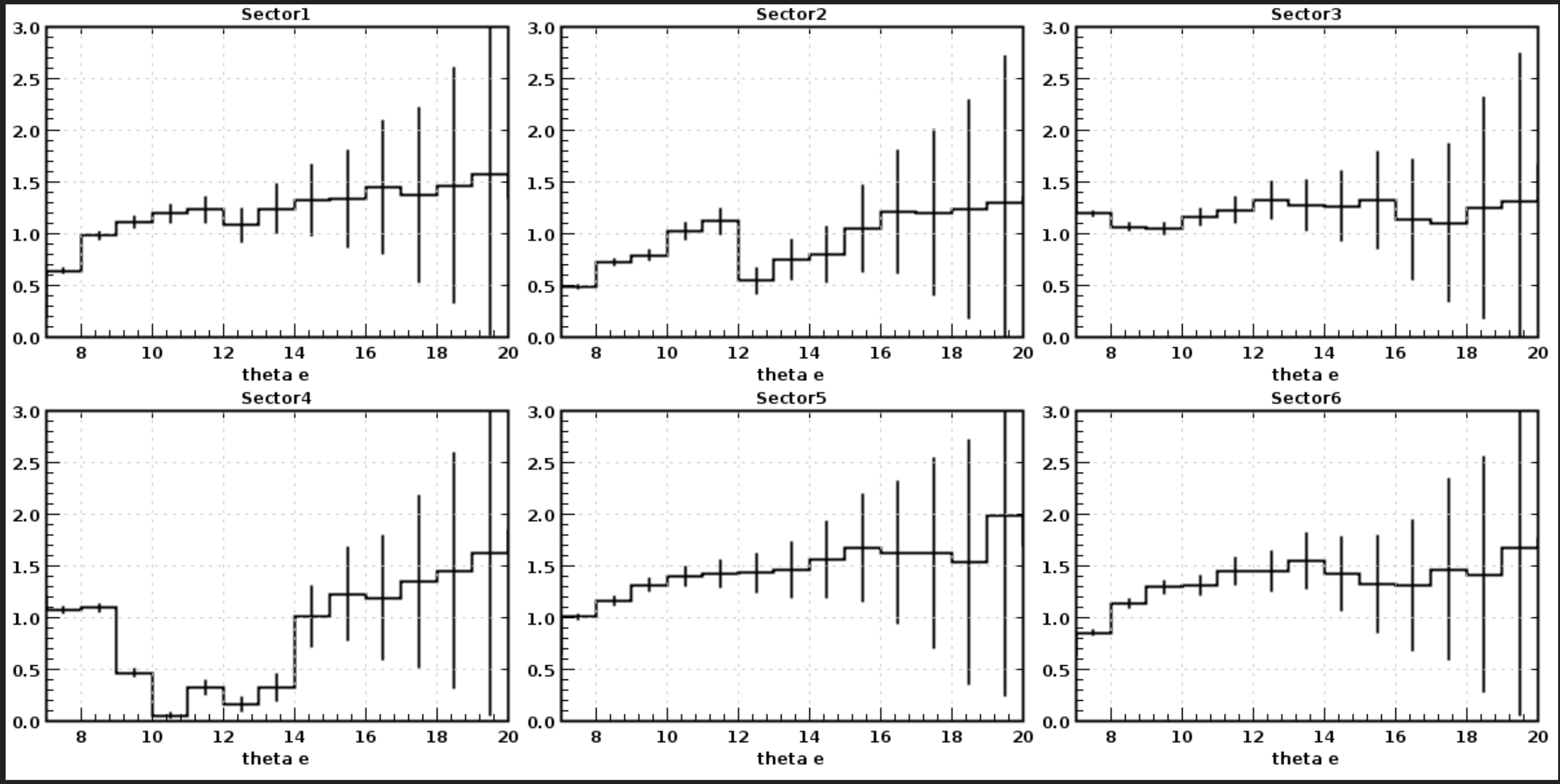
2476 T:+0.6/S:+0.6

COMPARISON TO THE MODEL



Cross section (black) overlaid with the model (red)

COMPARISON TO THE MODEL

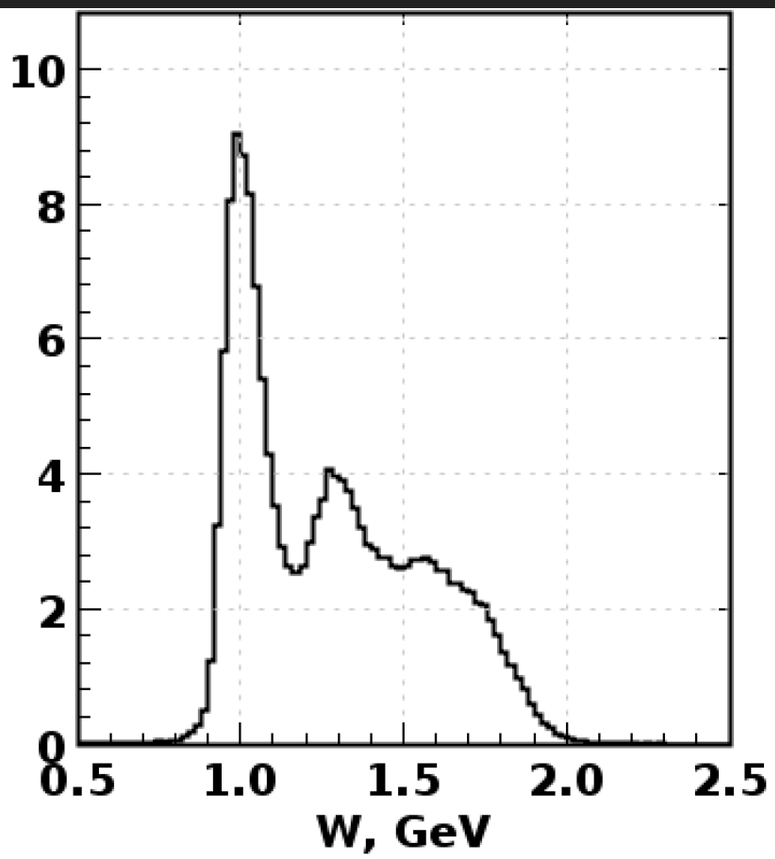


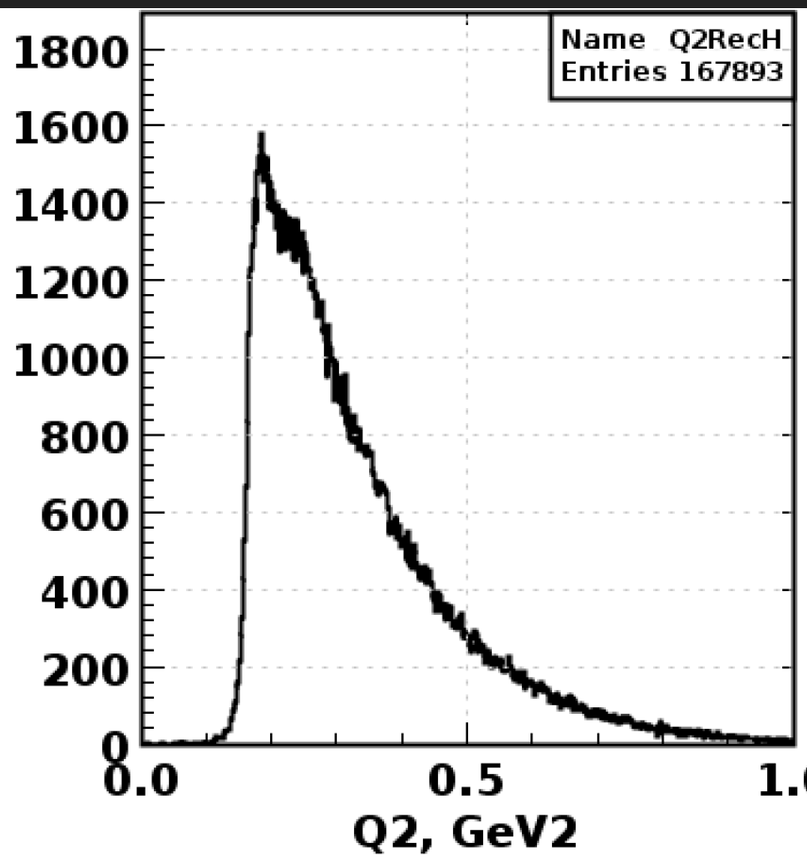
Errorbars are getting bigger after ~ 13-14 degrees

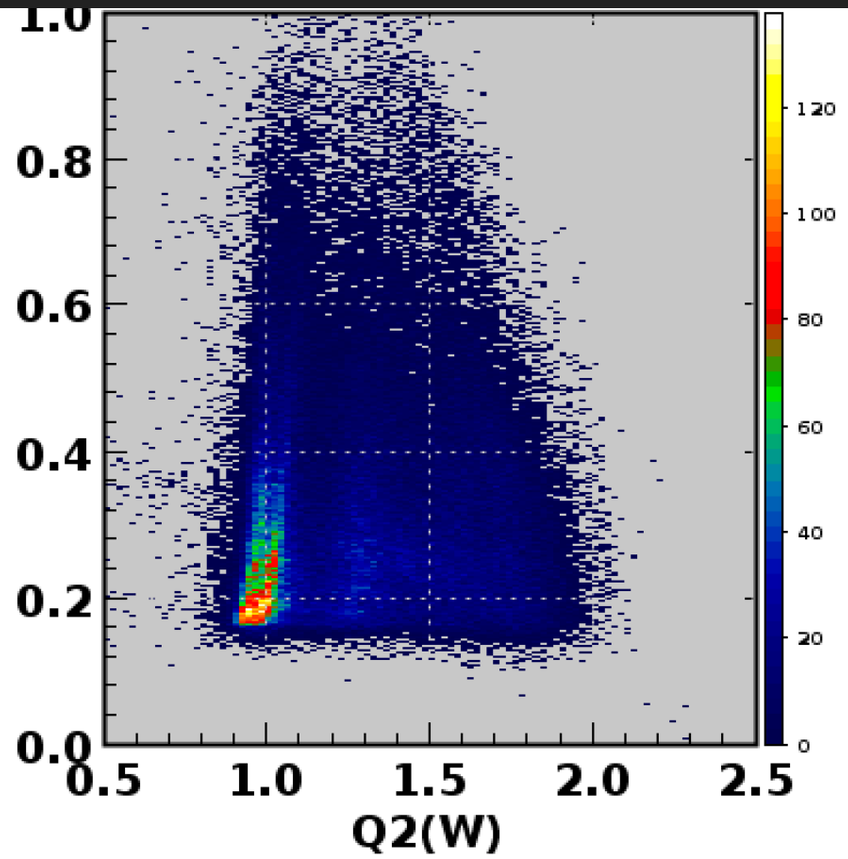
1ST METHOD

2596 T:-0.6/S:-0.6

KINEMATICAL COVERAGE



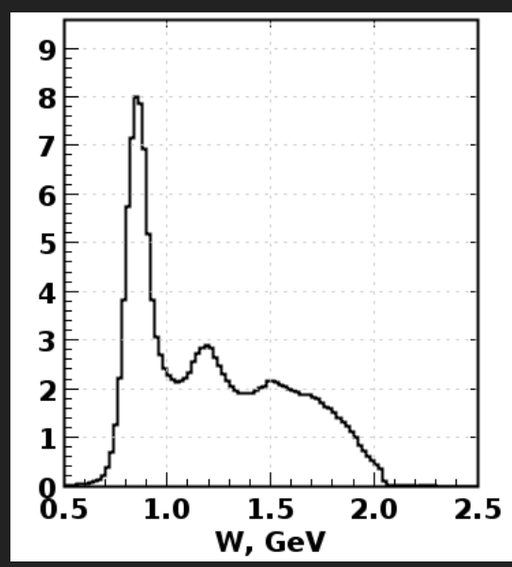


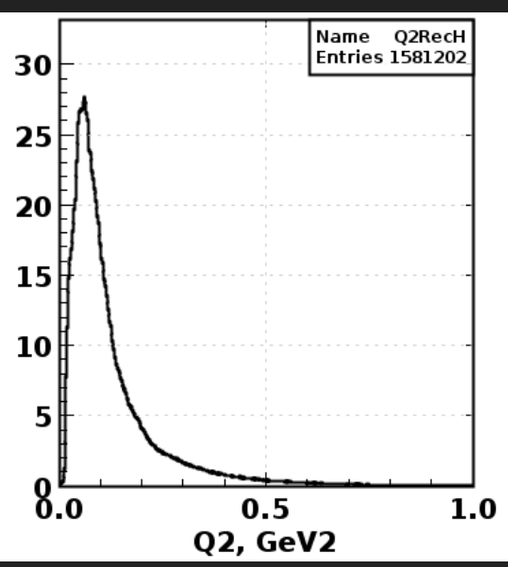


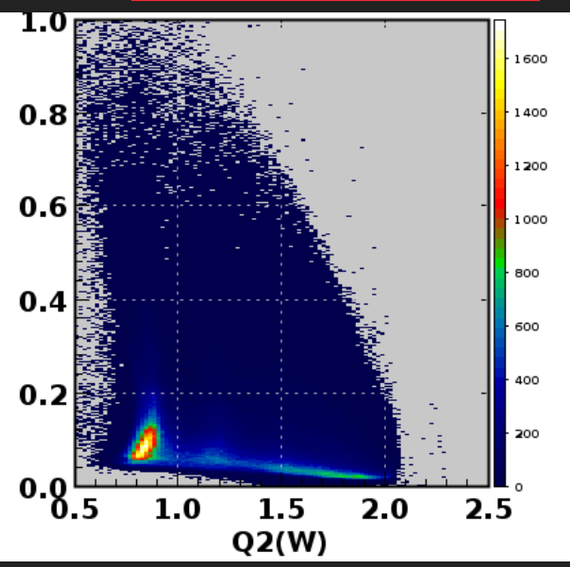
- Q2 coverage is different
- Elastic peak position if different
- Delta and second resonant regions are visible

For comparison

2476 0.6/+0.6



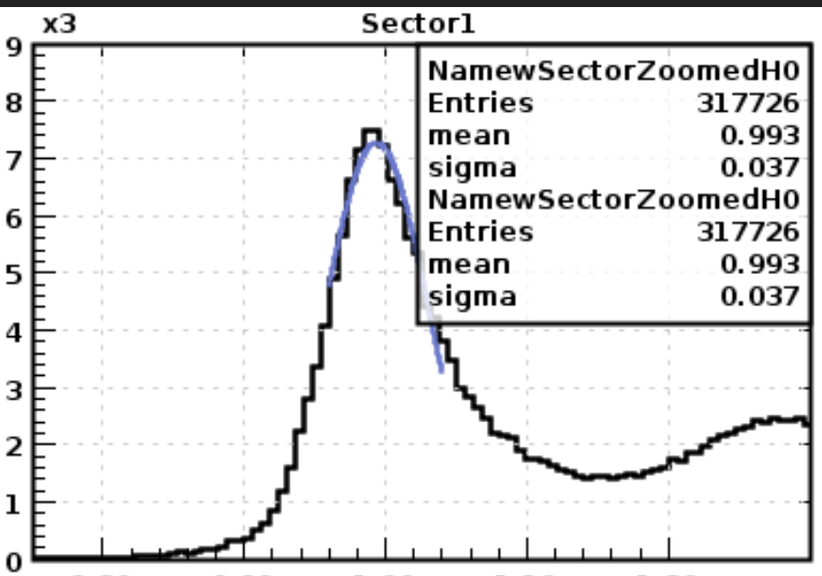


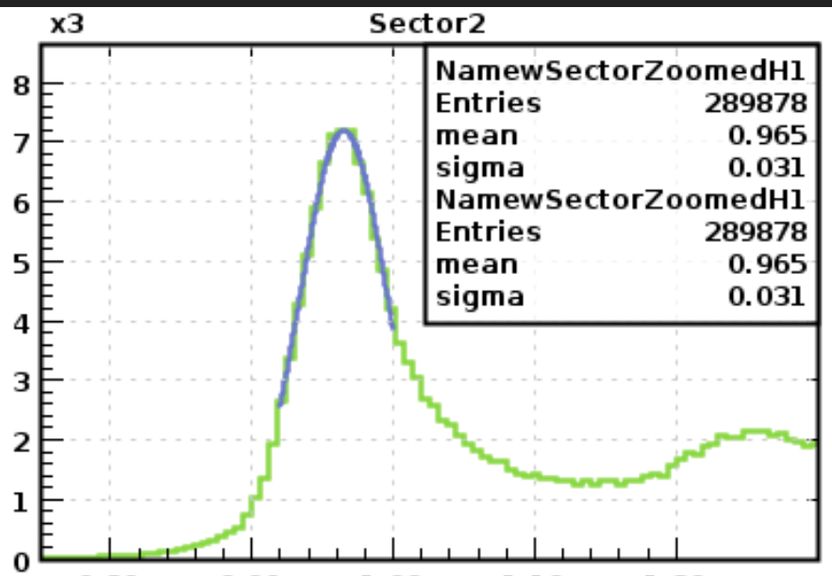


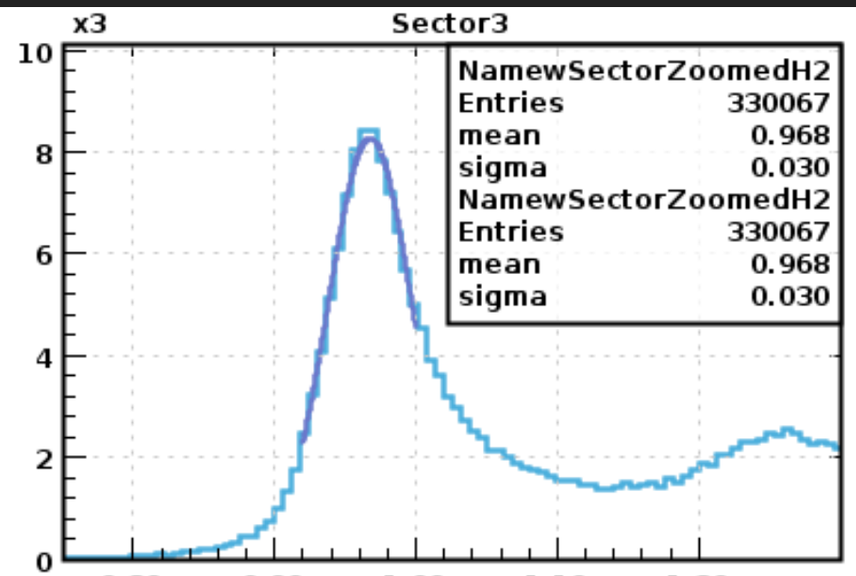
1ST METHOD

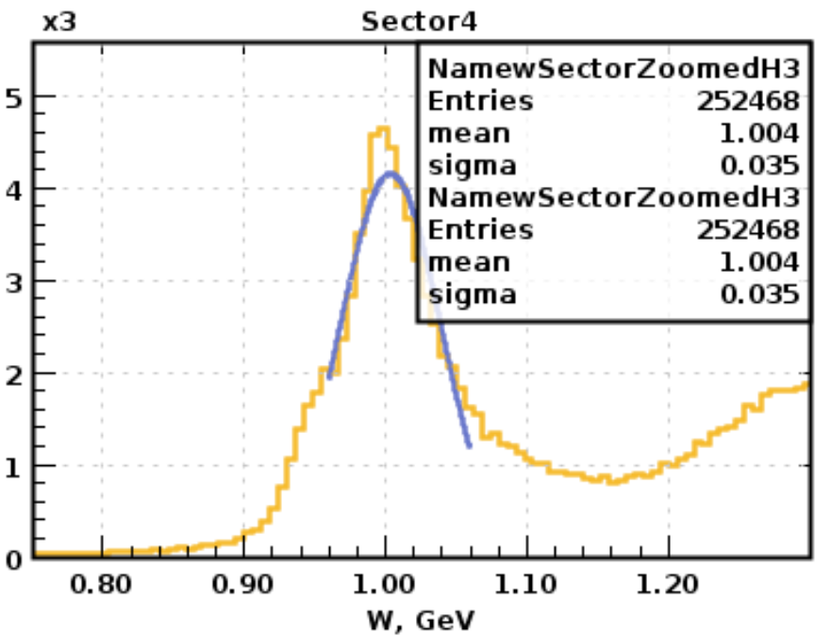
2596 T:-0.6/S:-0.6

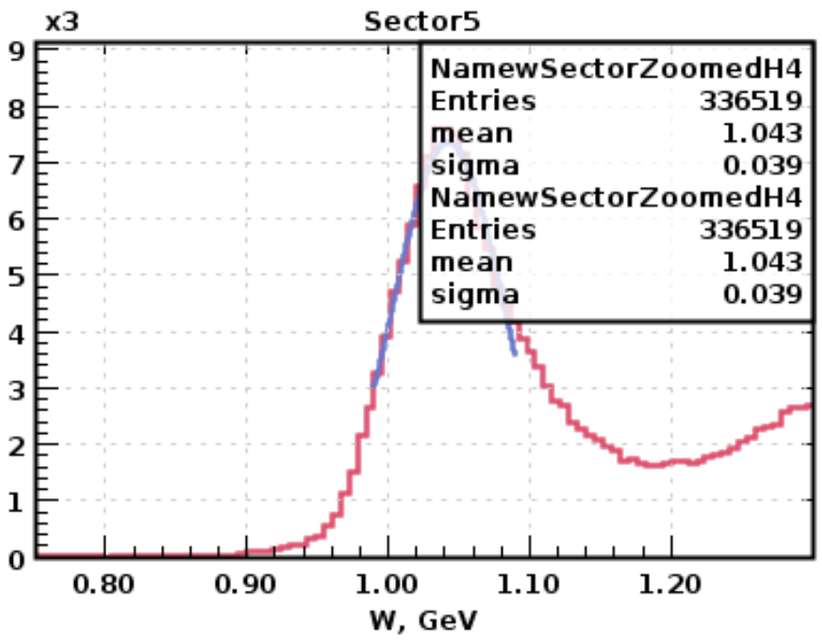
ELASTIC EVENT SELECTION

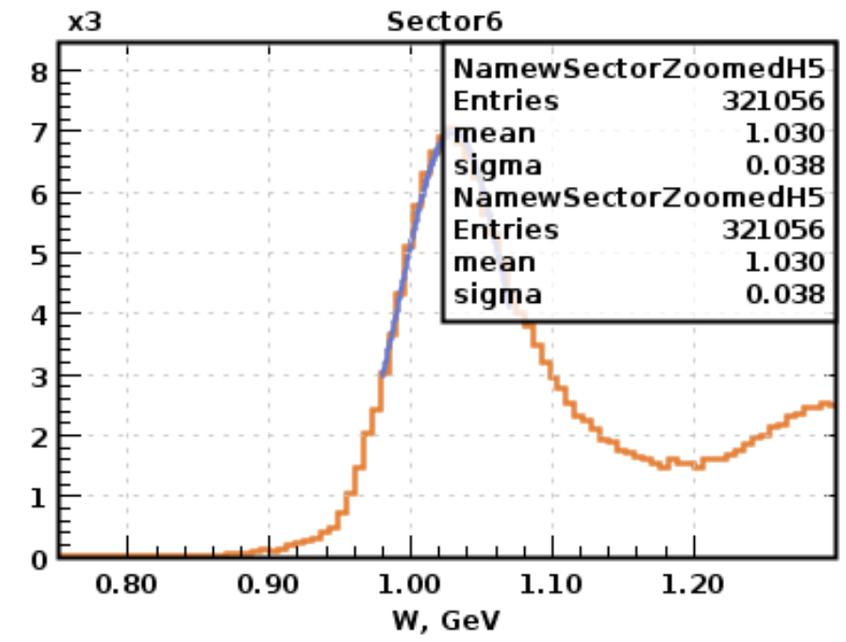












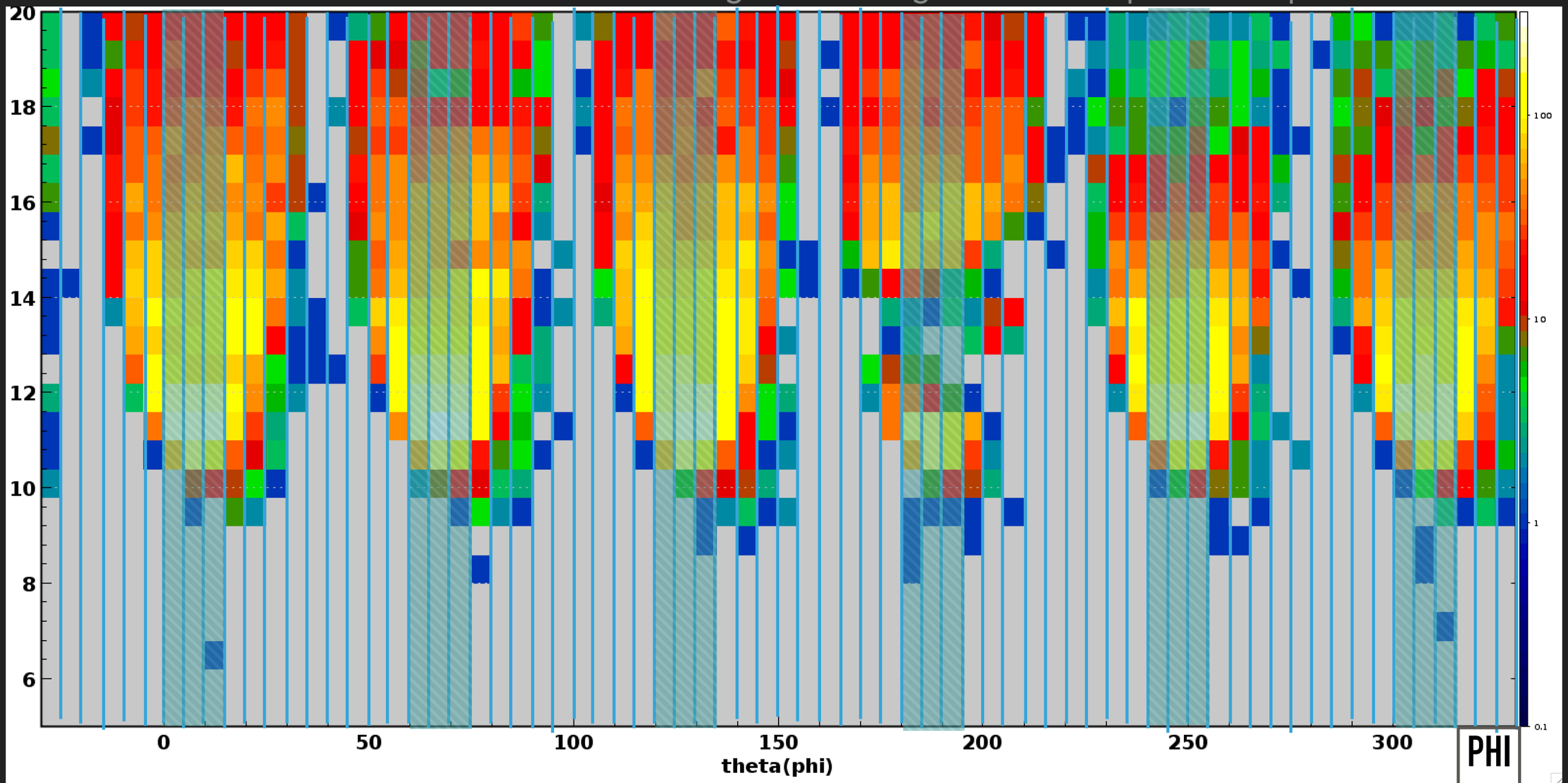
Sector dependent 3 sigma cut to select elastic events

EVENT SELECTION

2596 T:-0.6/S:-0.6

- Split in 5 degree bins over phi
- Select bins with maximum event yield (allows to select bins with the minimum effect from geometrica acceptance)
- 3 bins per sector are selected

Coverage starts at higher theta compare to the positive torus field



CROSS SECTION

1ST METHOD

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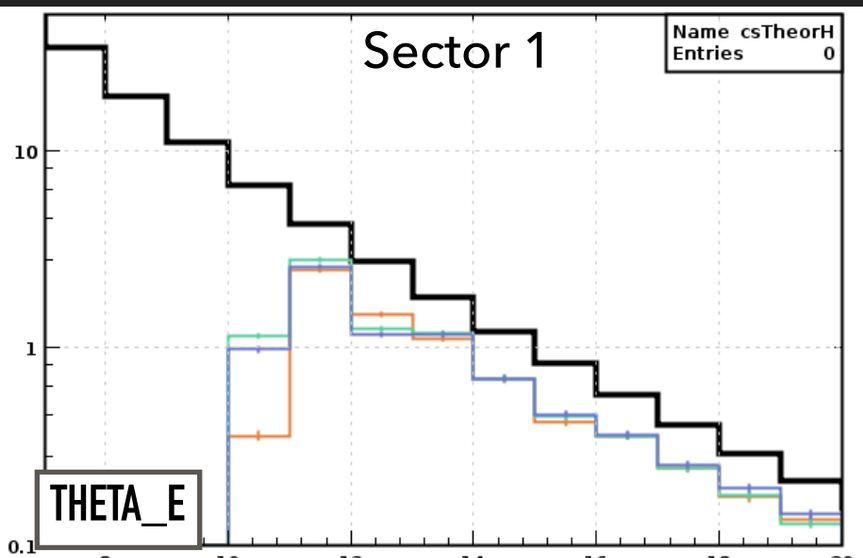
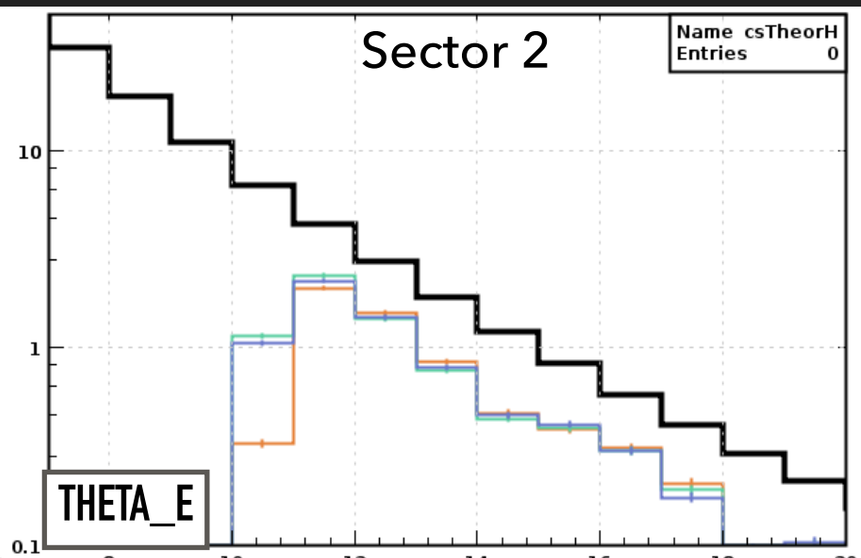
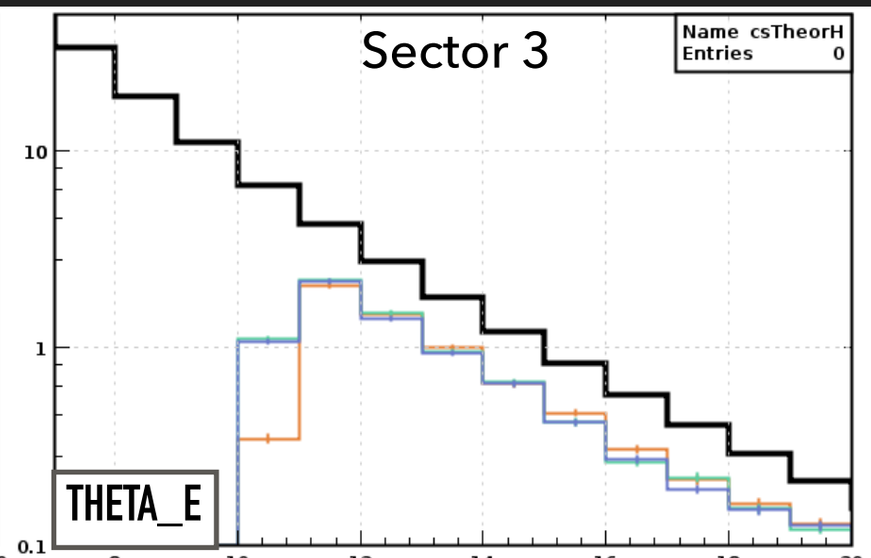
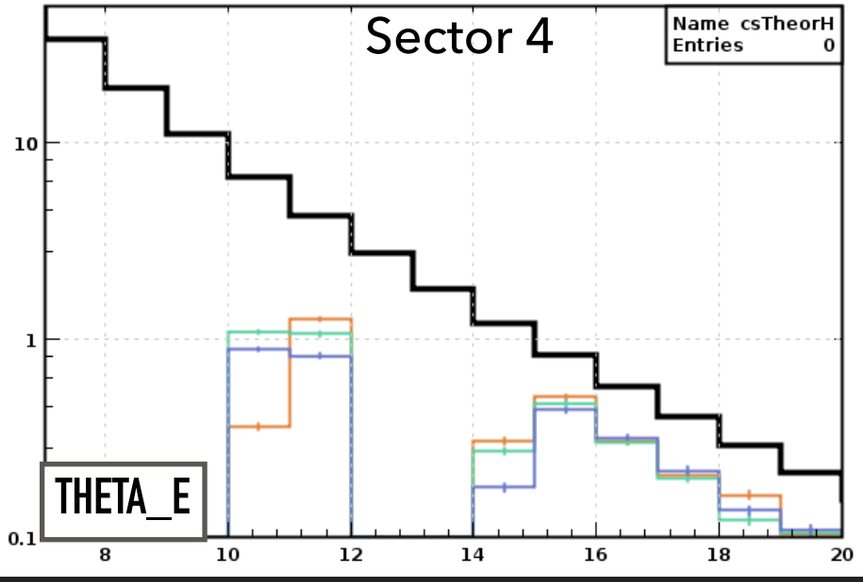
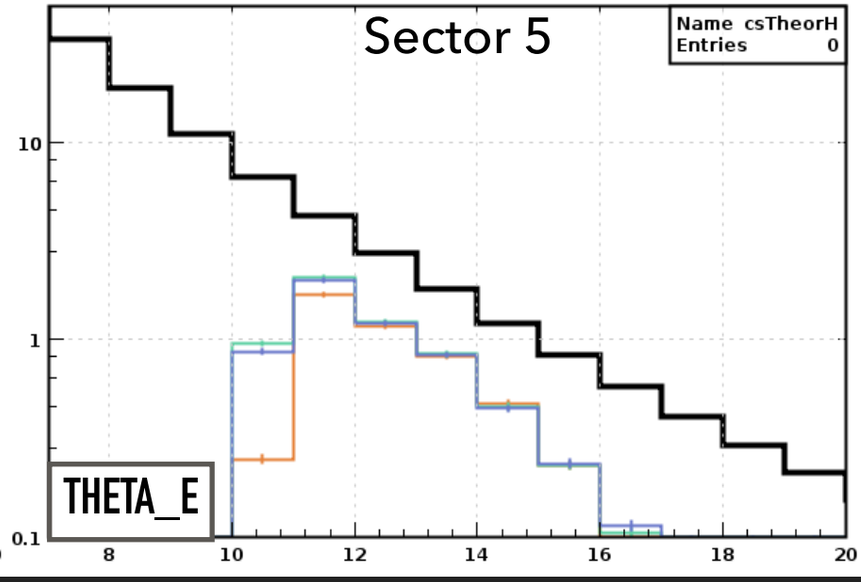
COMPARISON TO THE MODEL

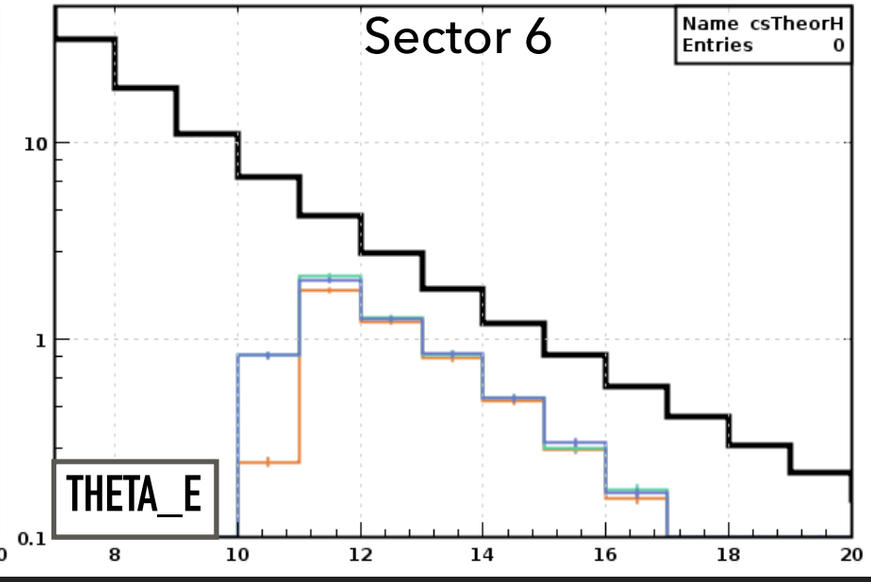












Different panels are different sectors

Different colors are different phi bins

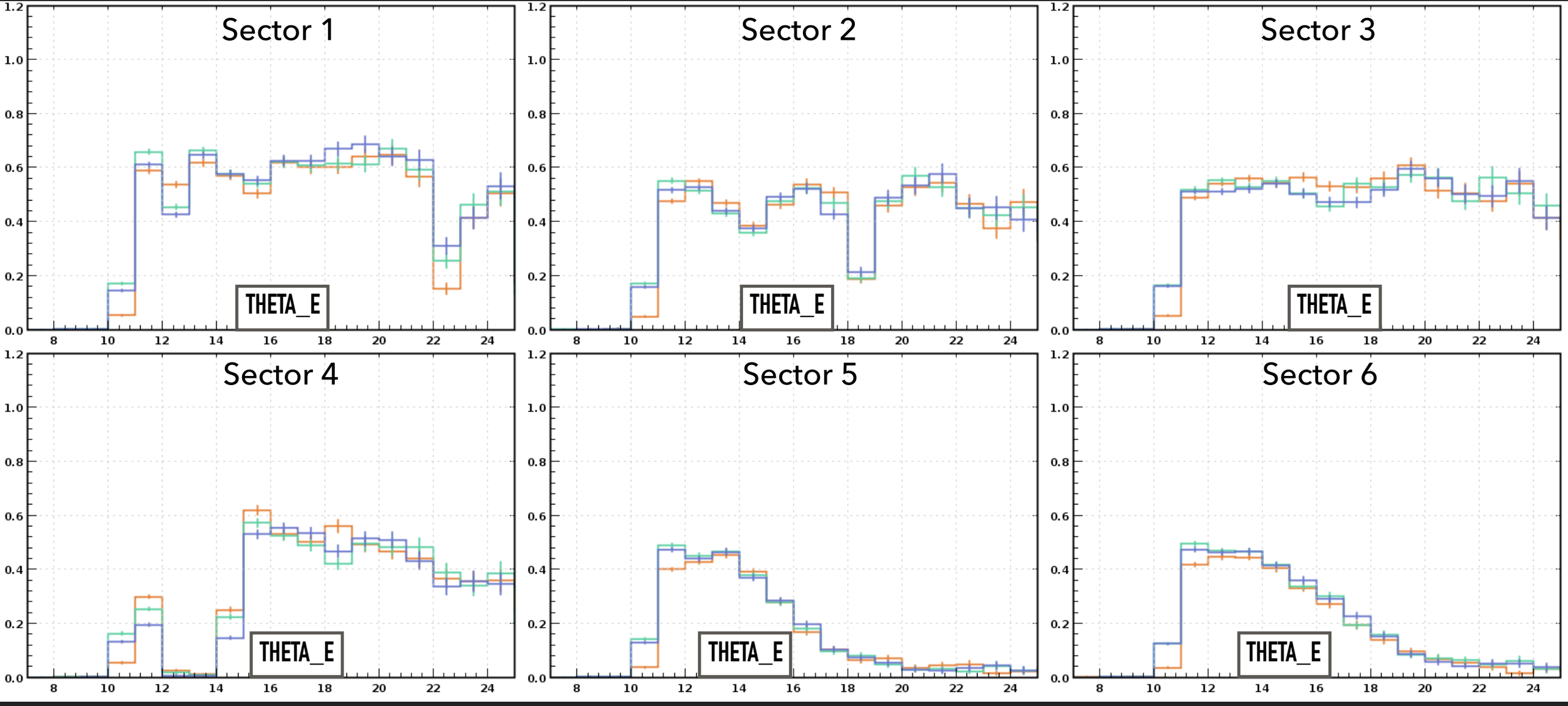
Black thick line is theory

RATIO OF THE CS TO THE MODEL

1ST METHOD

2596 T:-0.6/S:-0.6

COMPARISON TO THE MODEL



Different panels are different sectors

Different colors are different phi bins

SIMULATION

2ND METHOD

2596 T:-0.6/S:-0.6

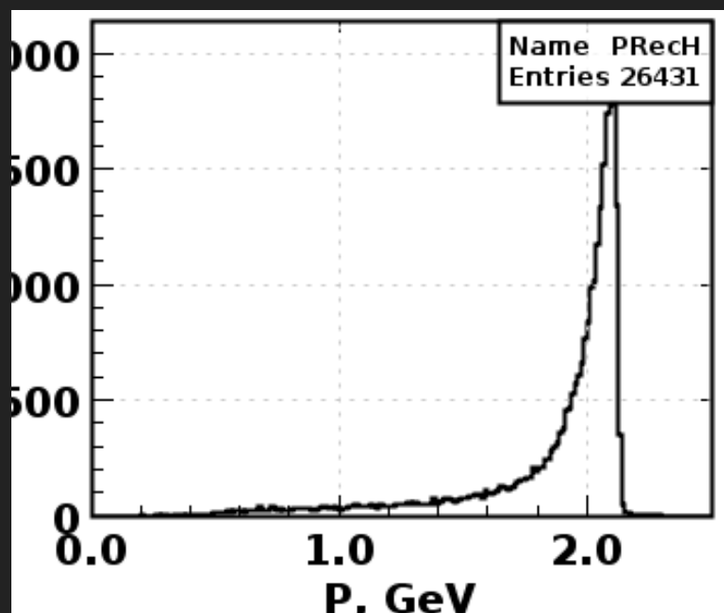
KINEMATICAL COVERAGE

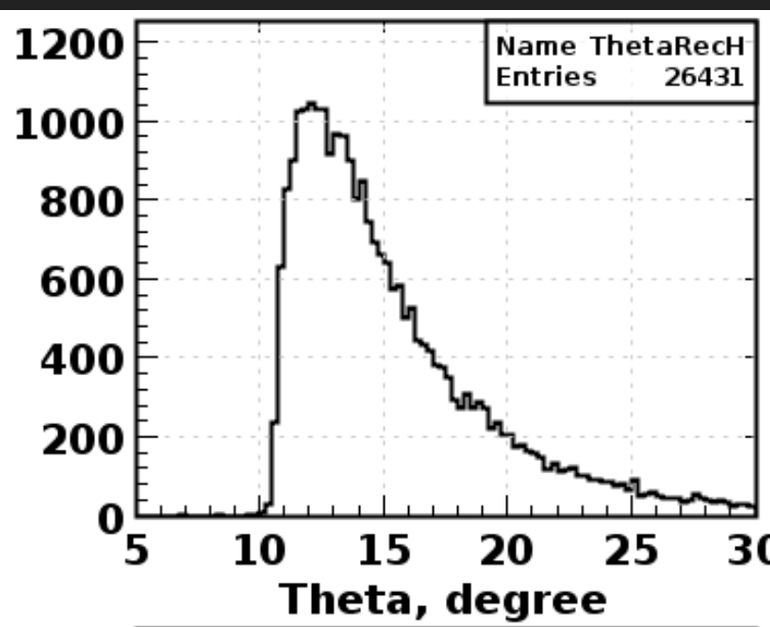
Elastgen with the radiative effect

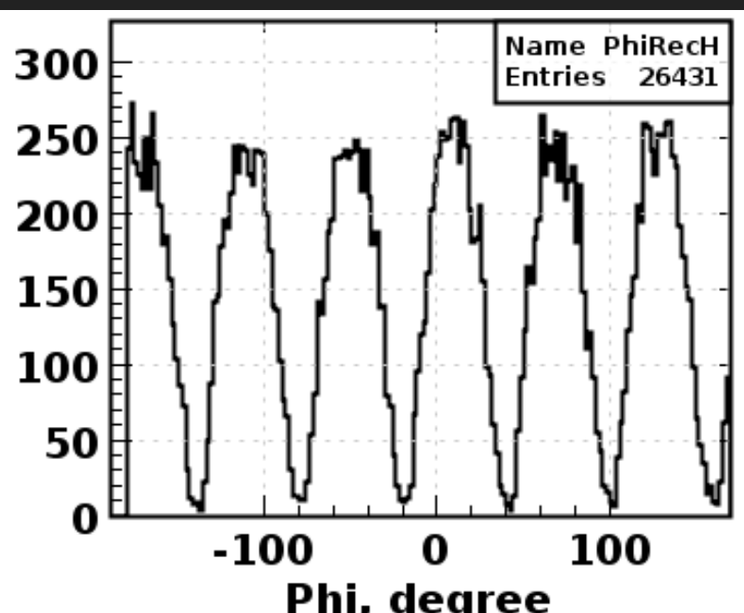
COATJAVA 5.0.10

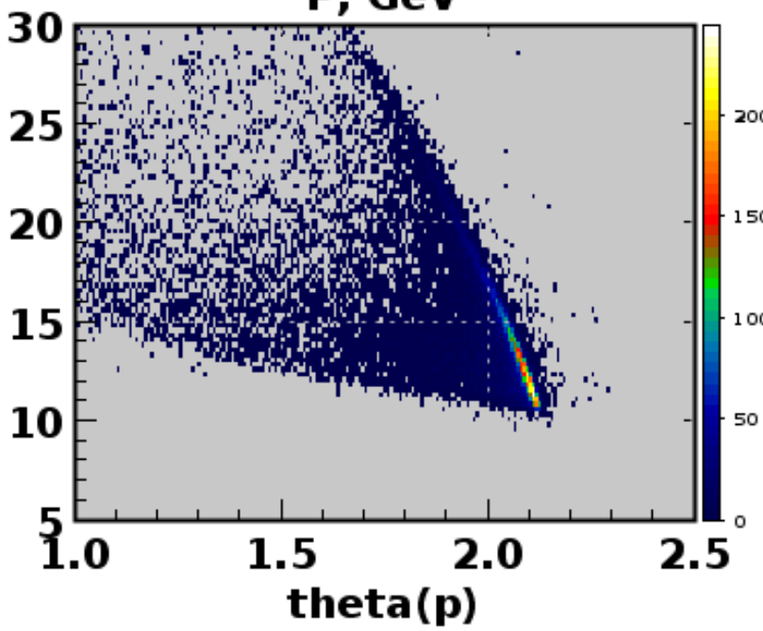
gems 4.2.2

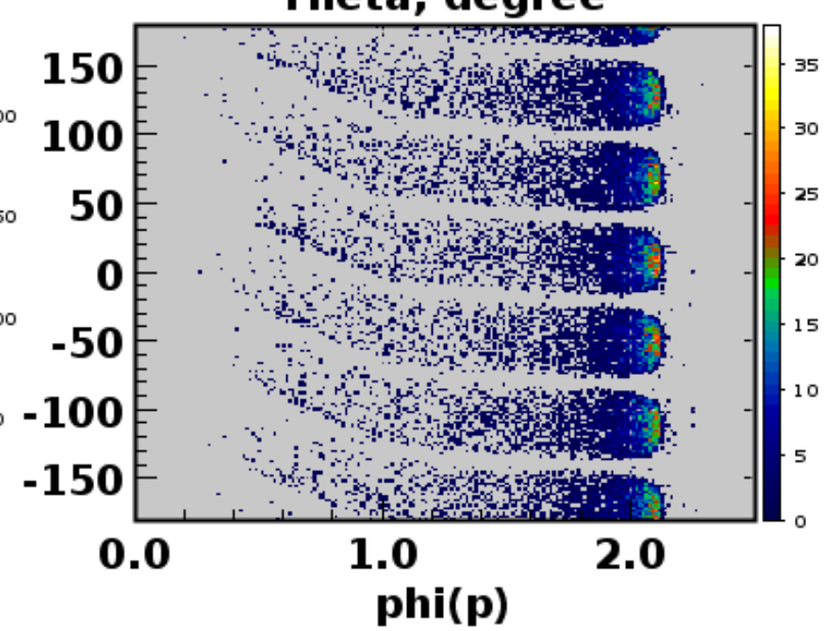
Magnet configuration torus/solenoid 0.6/+0.6 (same as data)

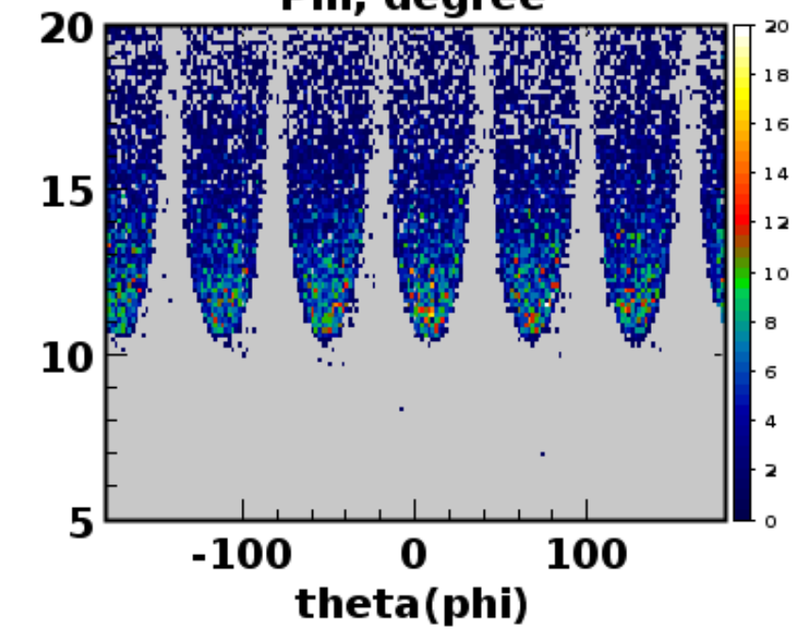








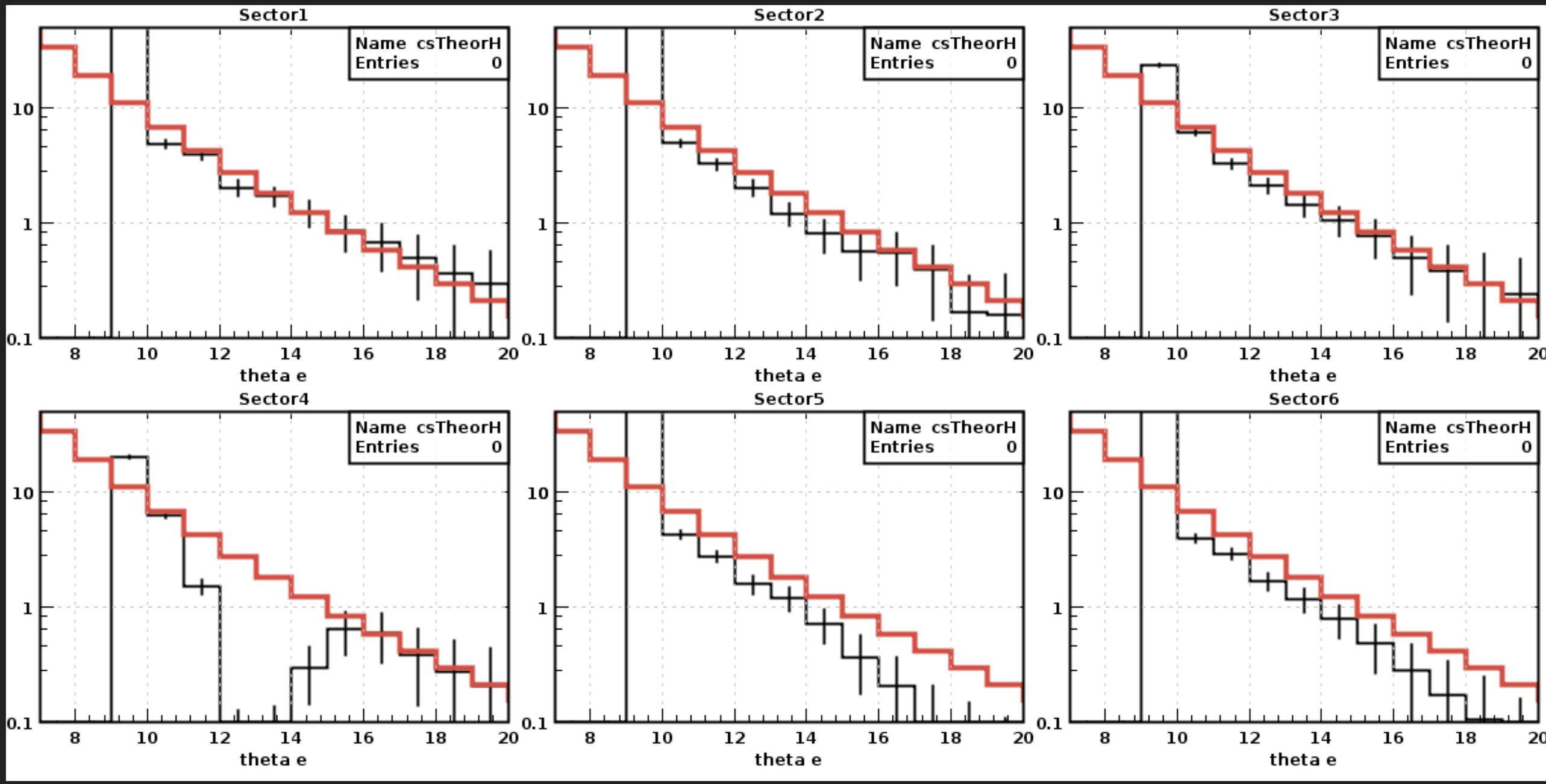




2ND METHOD

2596 T:-0.6/S:-0.6

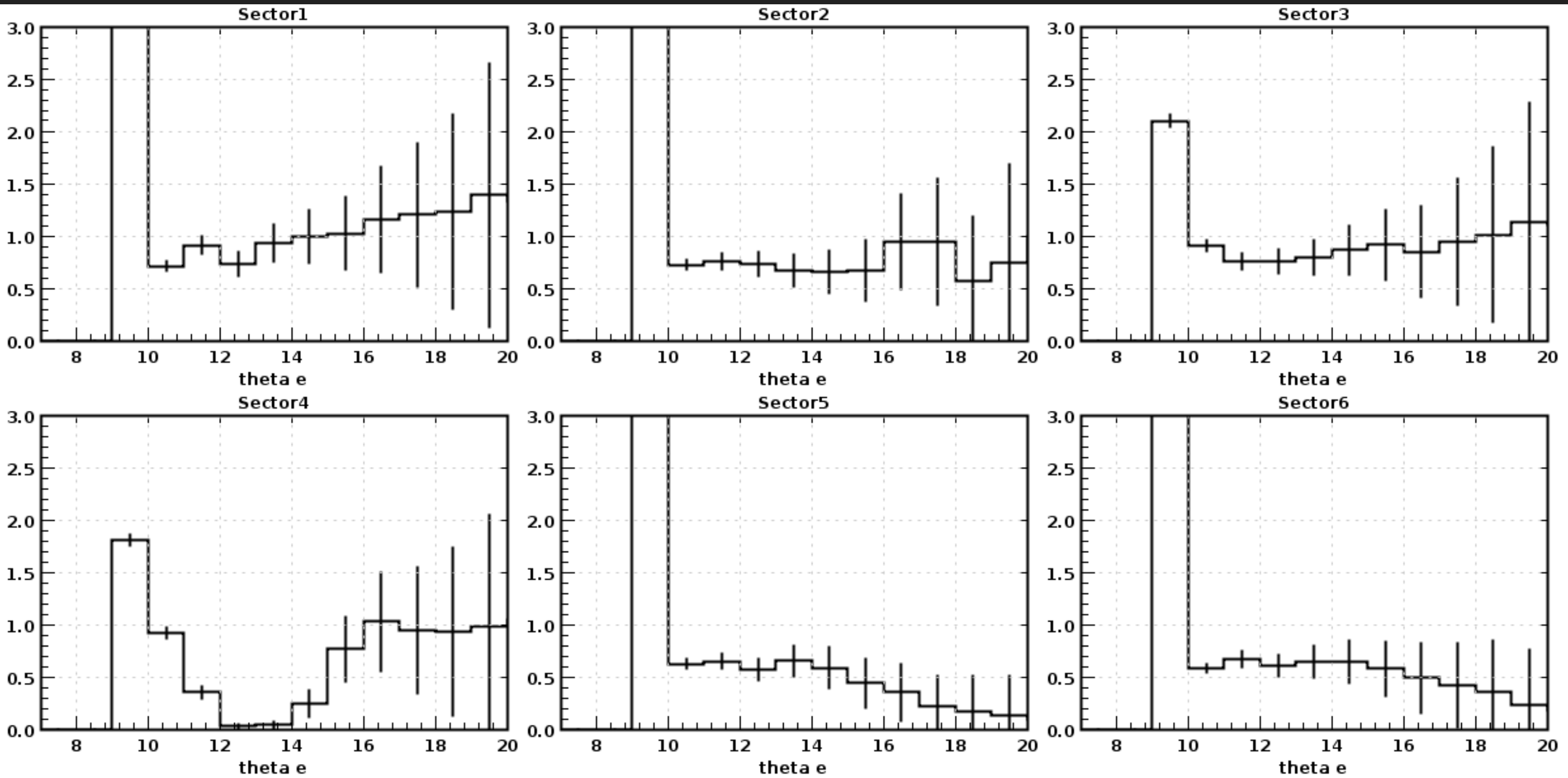
COMPARISON TO THE MODEL



Cross section (black) overlaid with the model

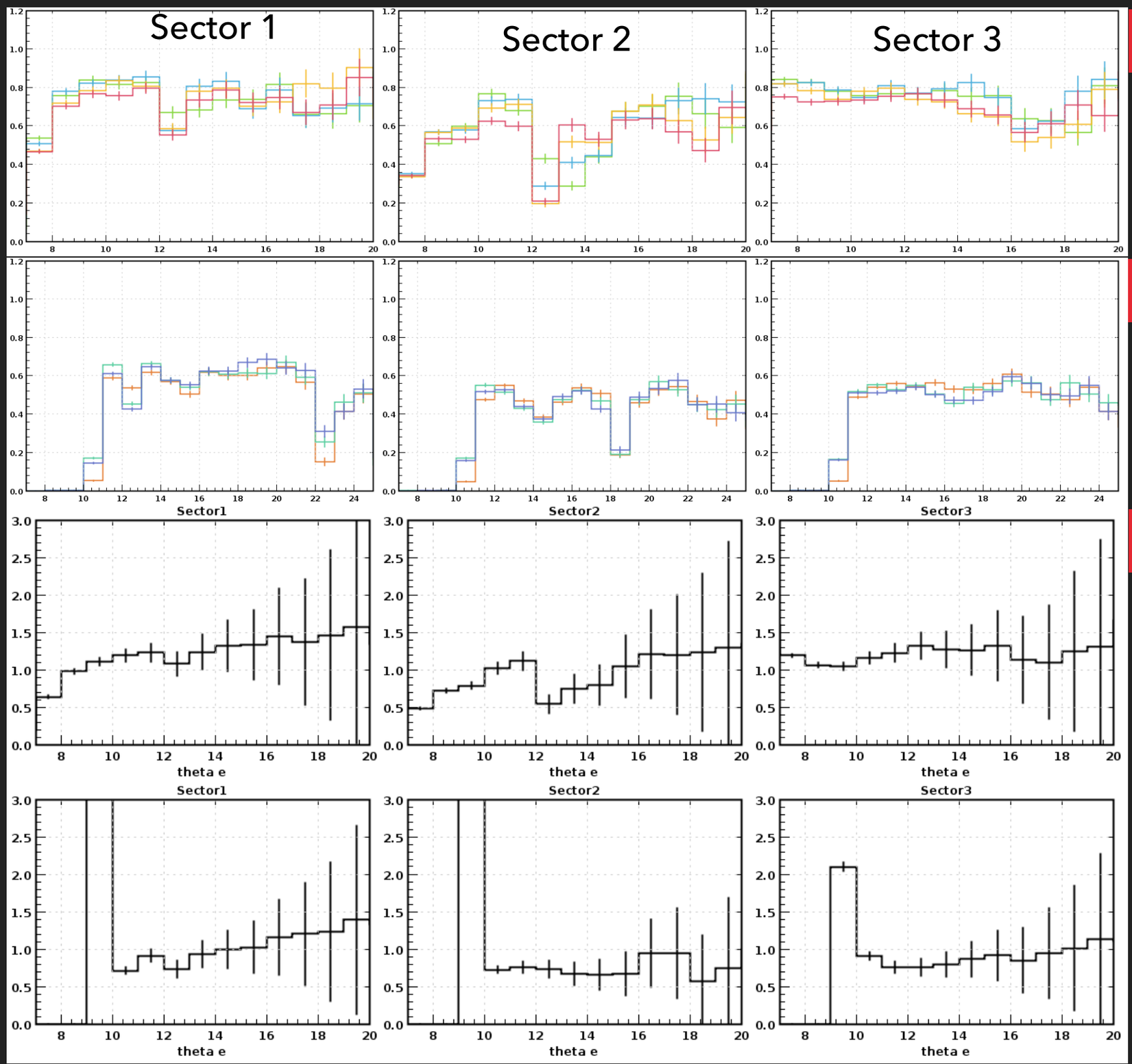
RATIO OF THE CS TO THE MODEL **2ND METHOD** **2596 T:-0.6/S:-0.6**

COMPARISON TO THE MODEL



Errorbars are big as statistics in simulation is rather low

COMPARISON OF DIFFERENT CONFIGURATIONS



2476 T:+0.6/+S:0.6

Flat dependance

2596 T:−0.6/S:−0.6

Extended theta range
Flat dependance

2476 T:+0.6/+S:0.6

2596 T:−0.6/S:−0.6

RESULTS

- Results are consistent;
- In the elastic cross section shift in a single degree over theta changes the cross section value by a factor of two. It is very sensitive to the tracking.
- Results are consistent within the 1’st order.
- need more studies (efficiency within the phi bins, correct magnetic filed map, live time correction for the FCUP, tracking improvement)