GSI2021 analysis without tracking

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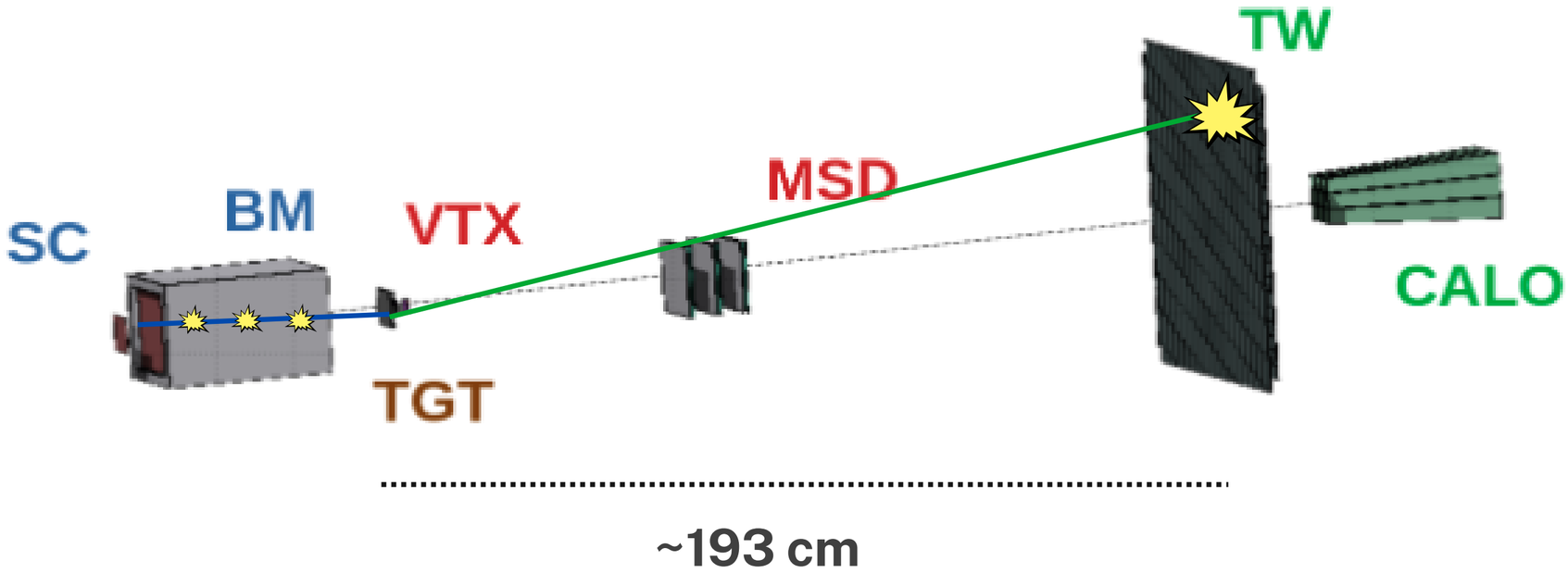
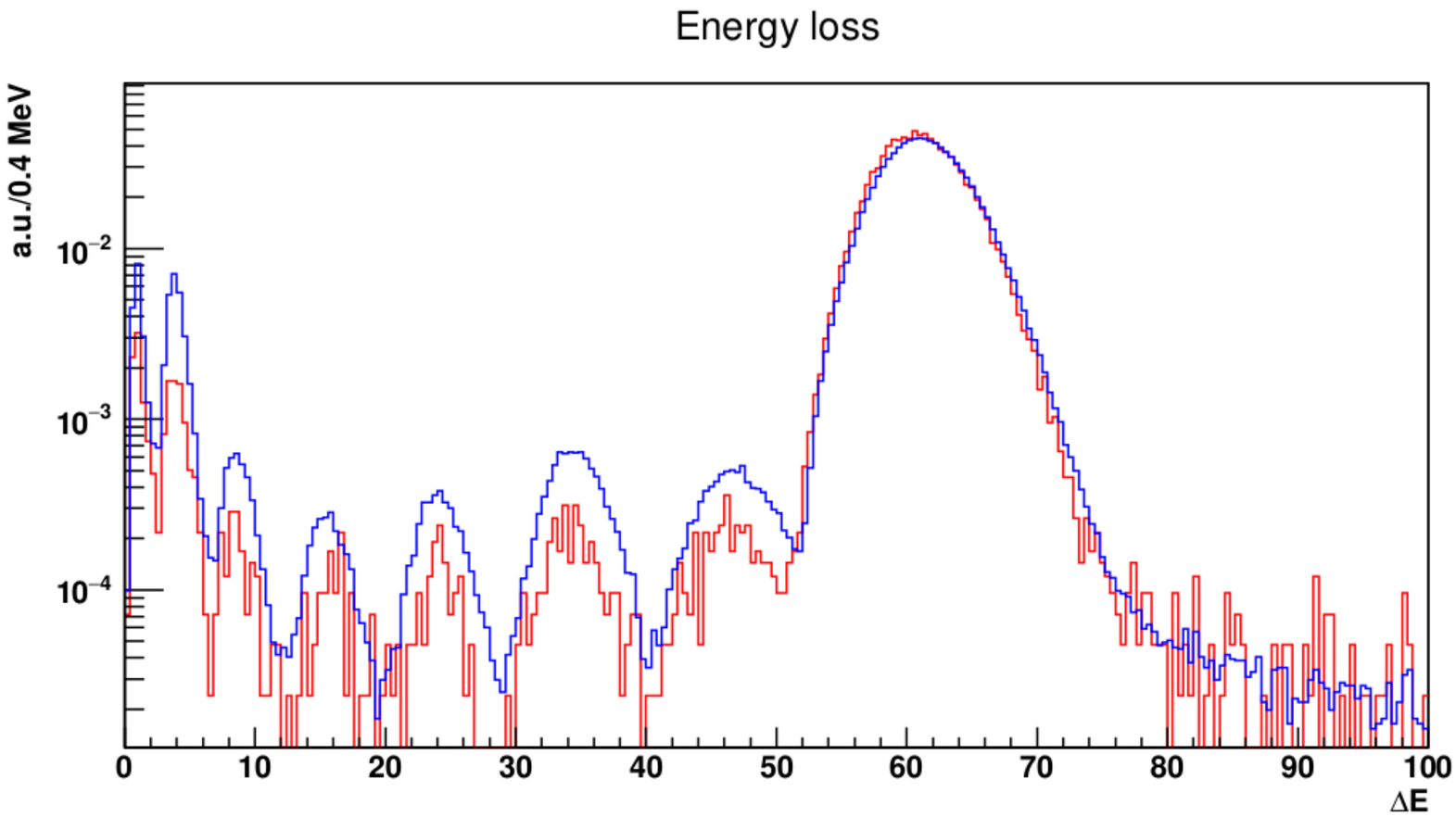
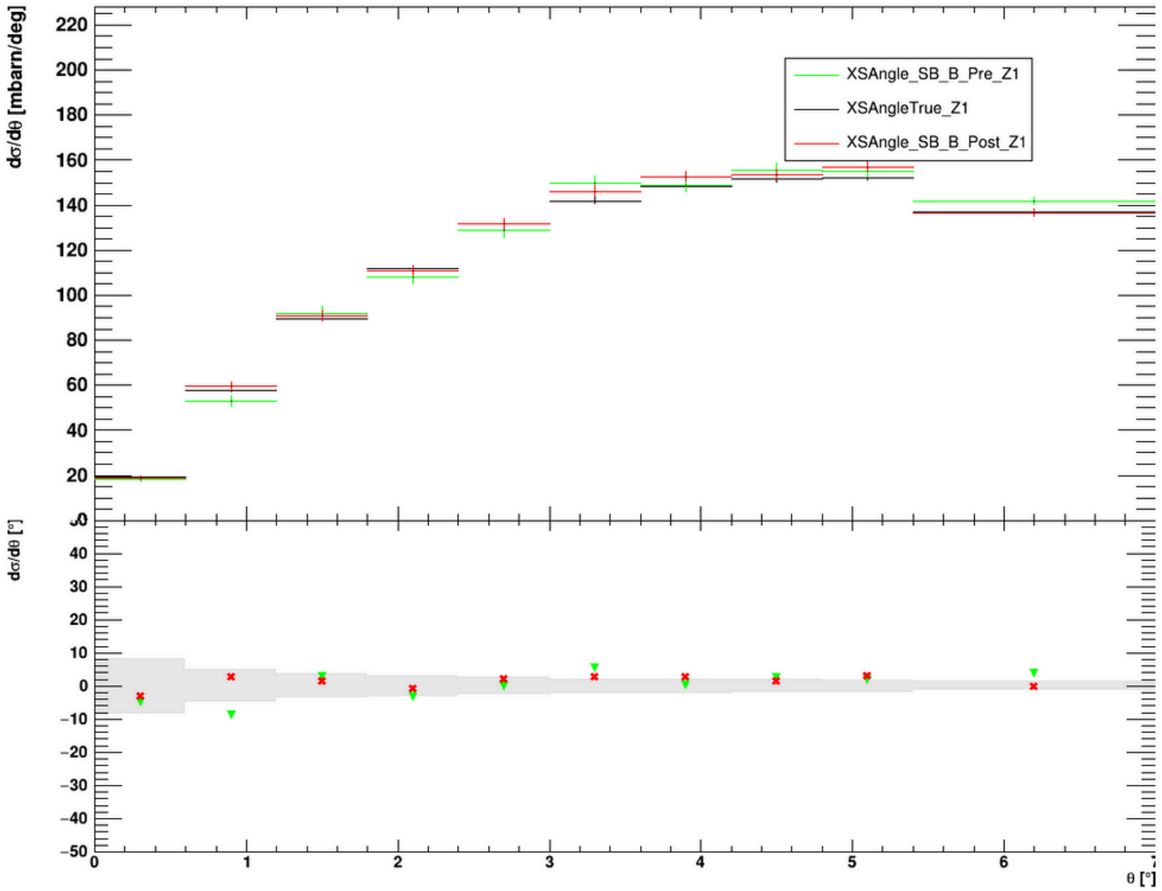
23 April 2024

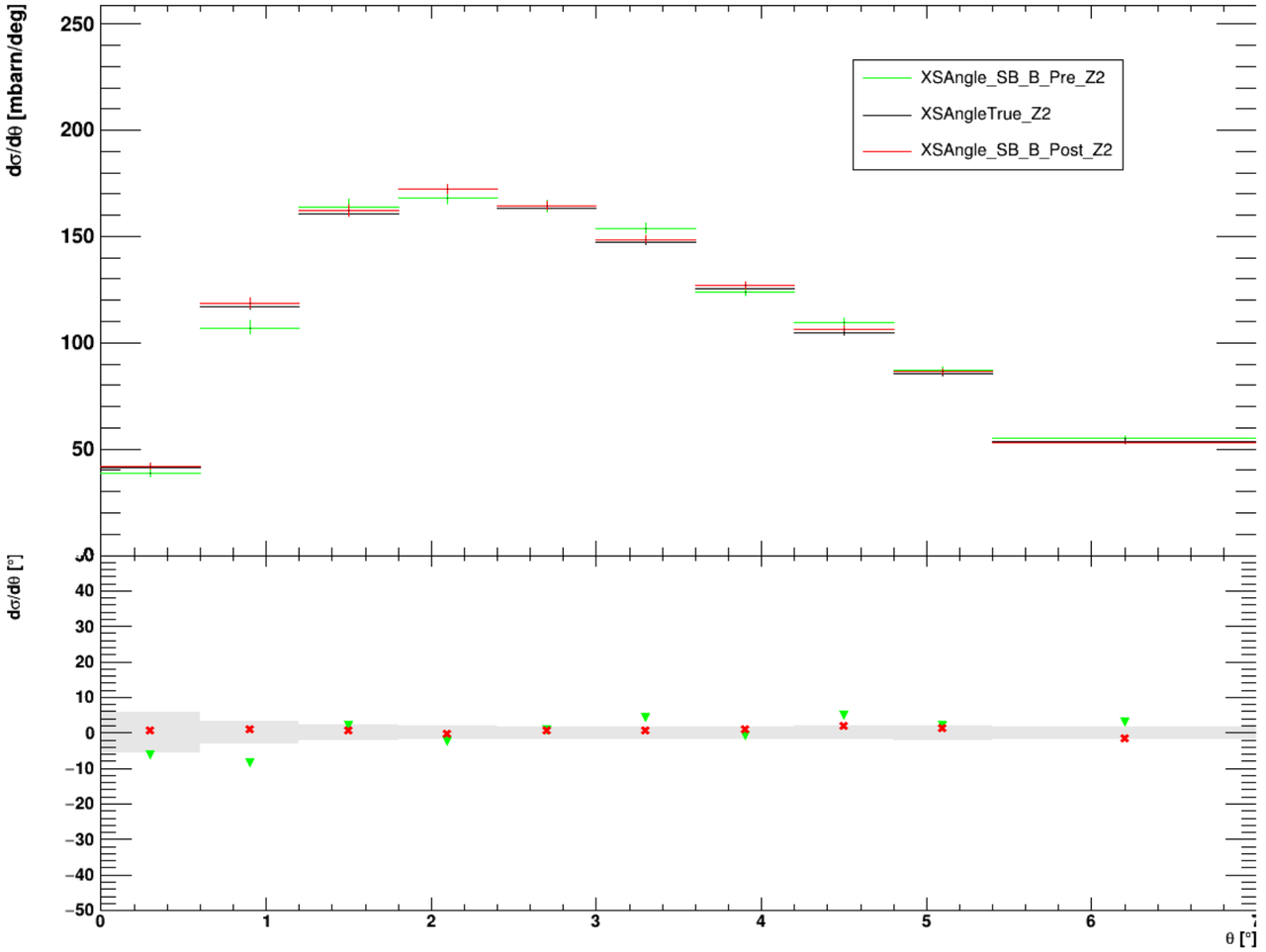
Angle measurement

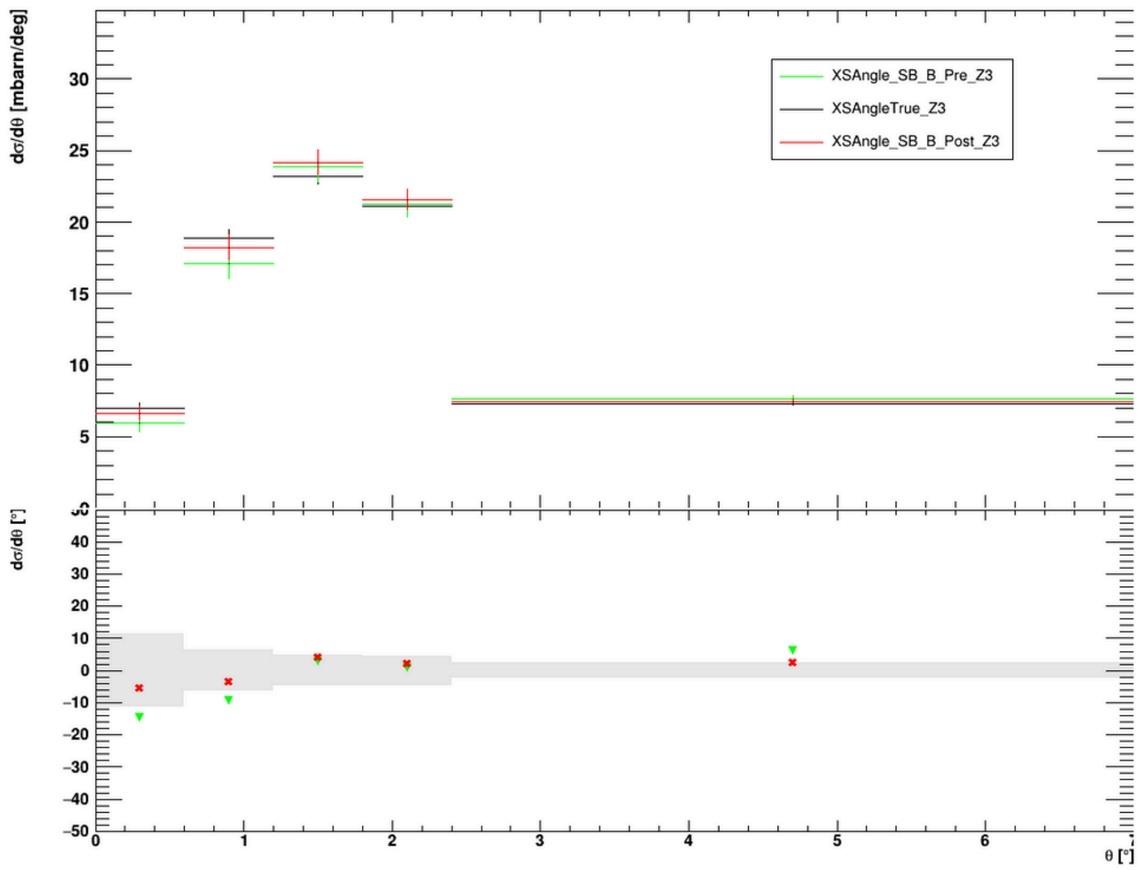


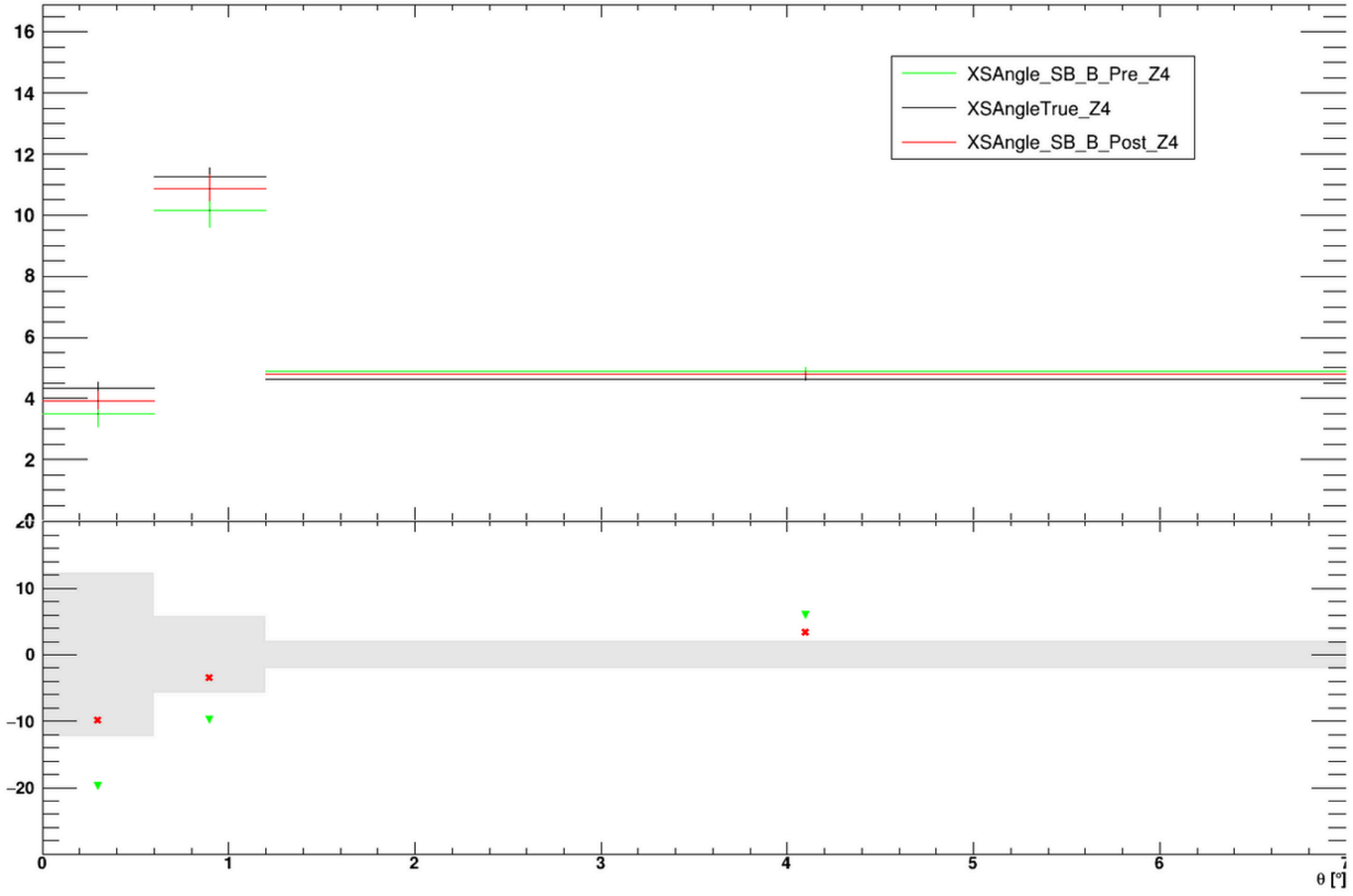
Why background subtraction?

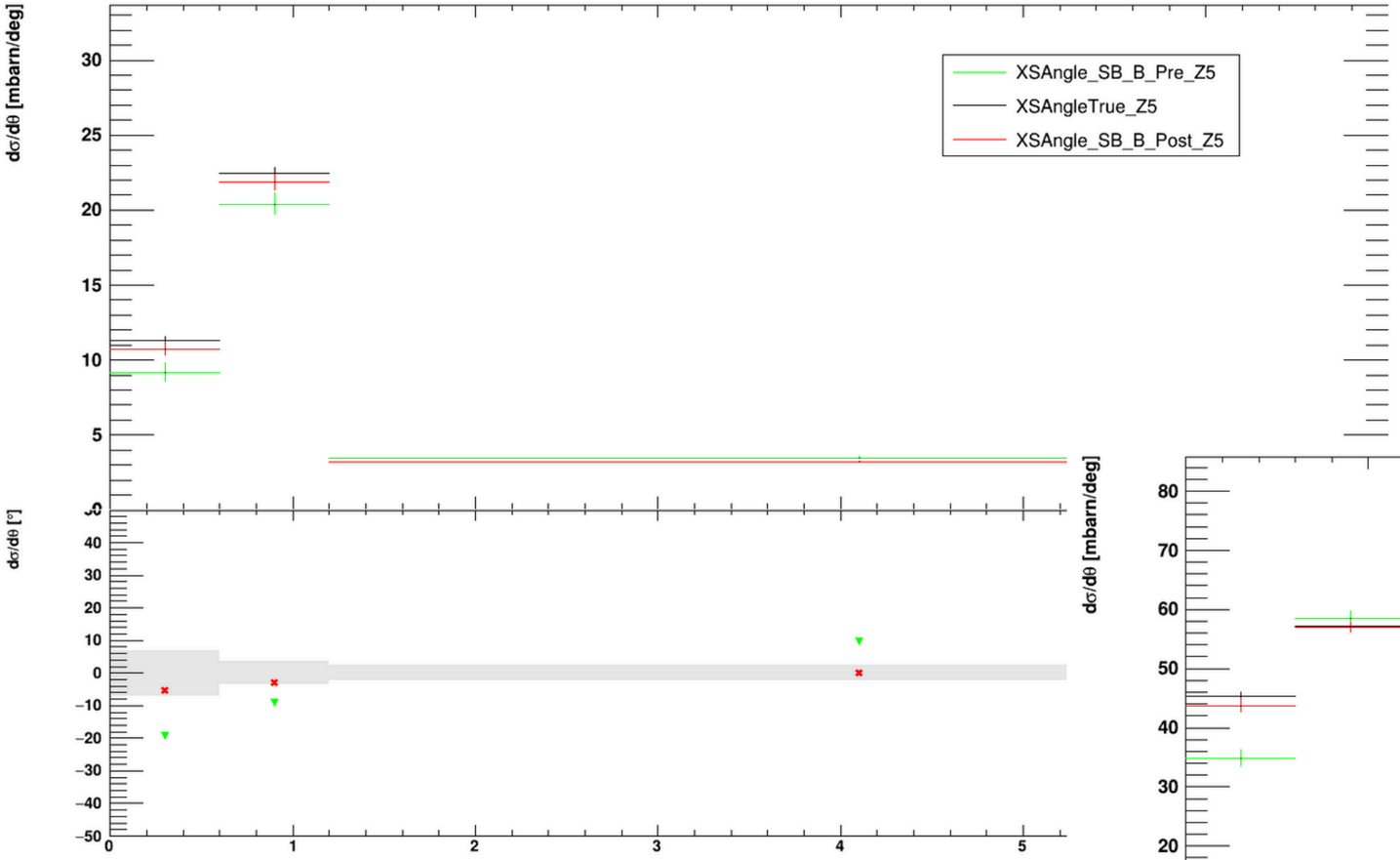


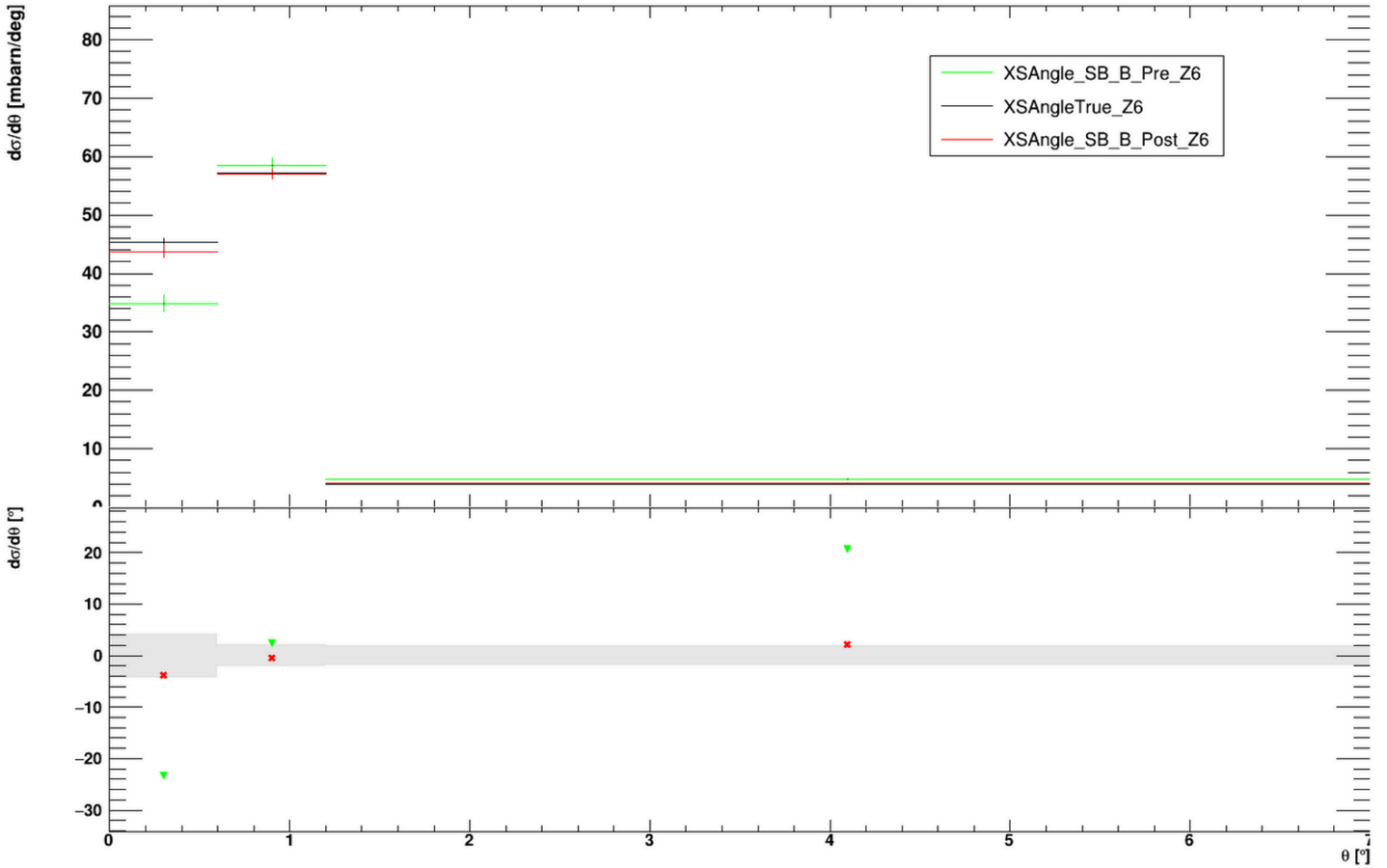

dσ/dθ [mbarn/deg]
XSAngle_SB_B_Pre_Z1
XSAngleTrue_Z1
XSAngle_SB_B_Post_Z1
dσ/dθ [°]
θ [°]

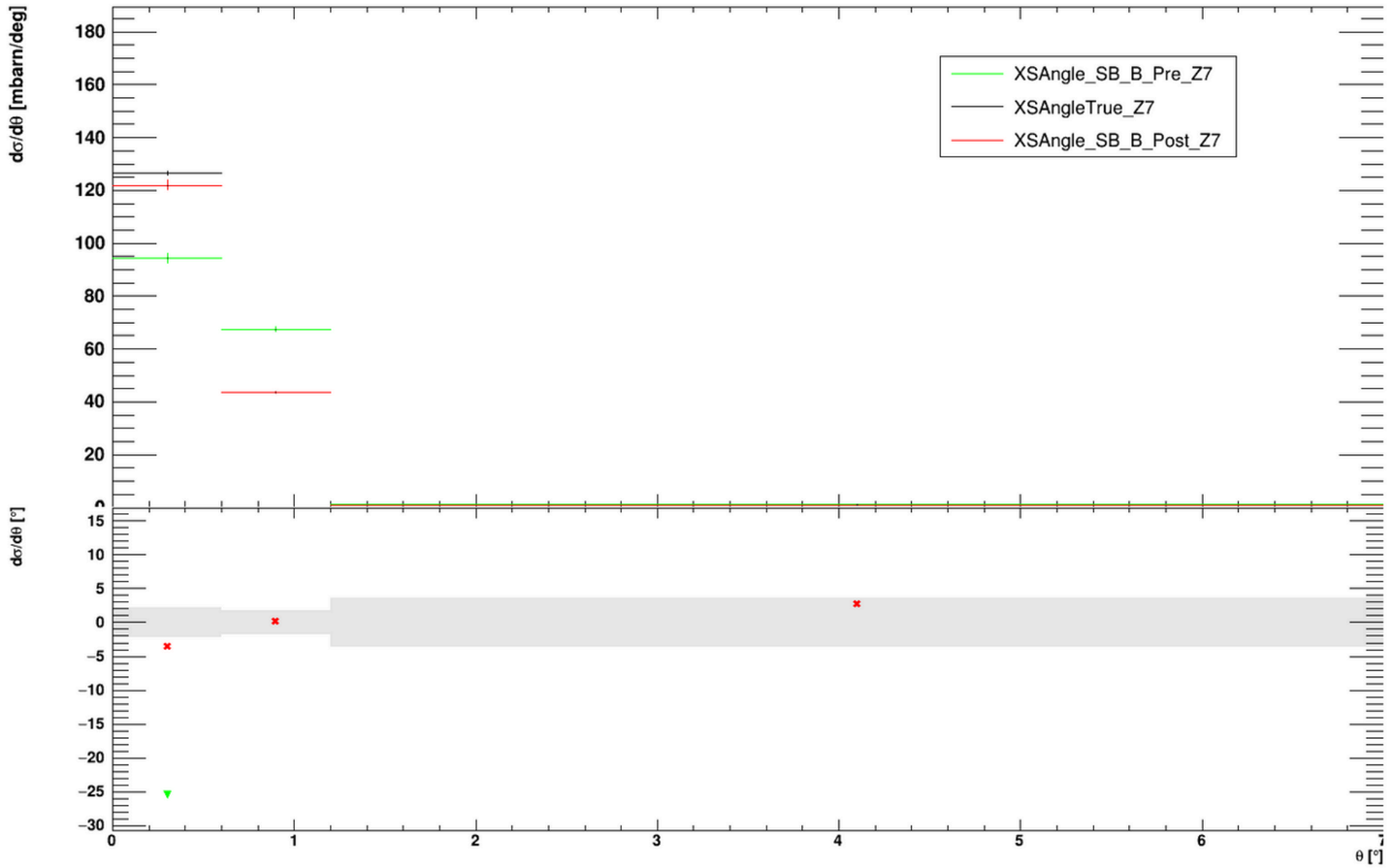

dσ/dθ [mbarn/deg]
XSAngle_SB_B_Pre_Z2
XSAngleTrue_Z2
XSAngle_SB_B_Post_Z2
dσ/dθ [°]
θ [°]

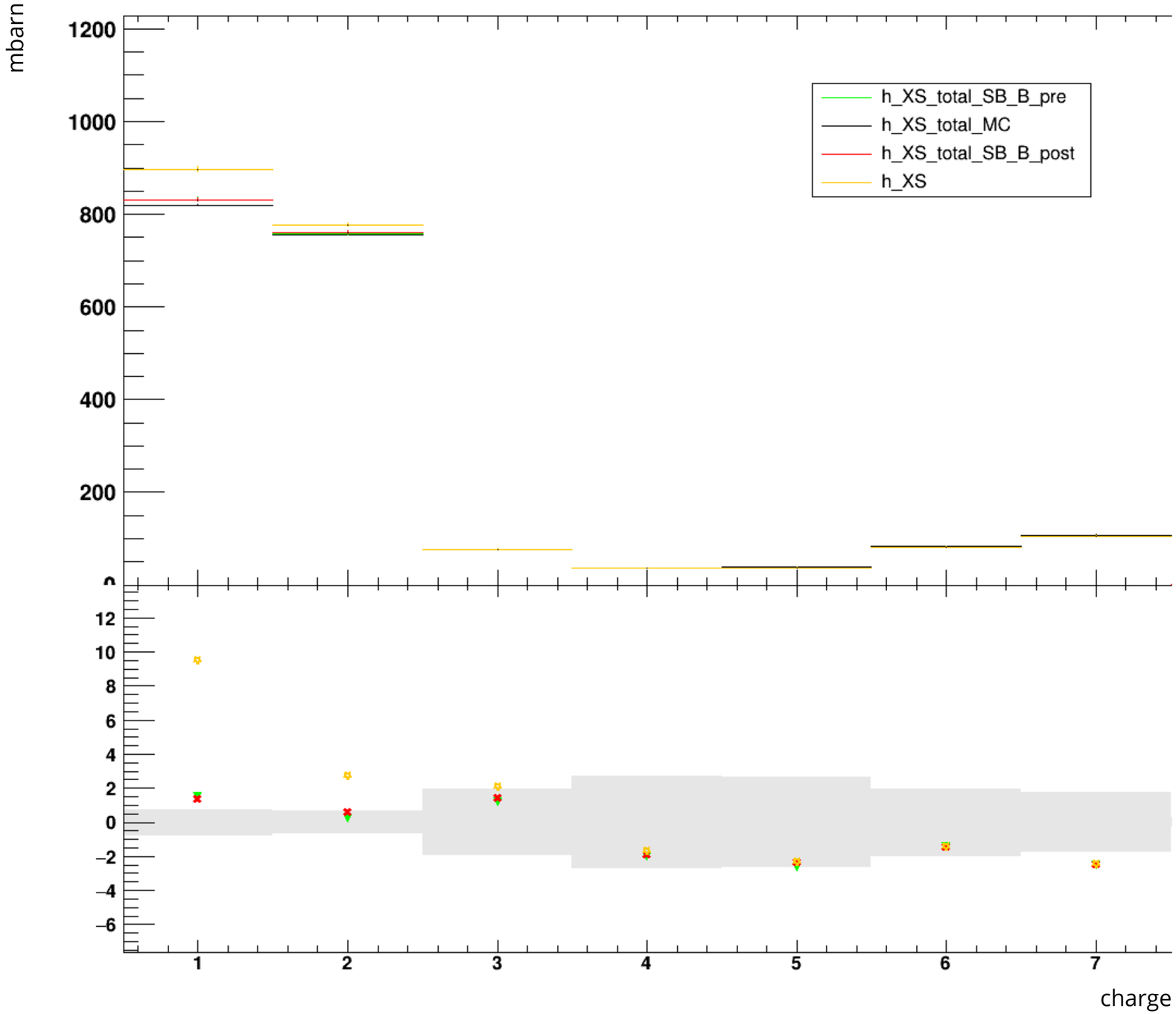

XSAngle_SB_B_Pre_Z3
XSAngleTrue_Z3
XSAngle_SB_B_Post_Z3
dσ/dθ [mbarn/deg]
dσ/dθ [°]
θ [°]


XSAngle_SB_B_Pre_Z4
XSAngleTrue_Z4
XSAngle_SB_B_Post_Z4
θ [°]


dσ/dθ [mbarn/deg]
XSAngle_SB_B_Pre_Z5
XSAngleTrue_Z5
XSAngle_SB_B_Post_Z5
dσ/dθ [°]


dσ/dθ [mbarn/deg]
XSAngle_SB_B_Pre_Z6
XSAngleTrue_Z6
XSAngle_SB_B_Post_Z6
dσ/dθ [°]
θ [°]


dσ/dθ [mbarn/deg]
180
160
140
120
100
80
60
40
20
XSAngle_SB_B_Pre_Z7
XSAngleTrue_Z7
XSAngle_SB_B_Post_Z7
dσ/dθ [°]
15
10
5
0
−5
−10
−15
−20
−25
−30
0
1
2
3
4
5
6
θ [°]

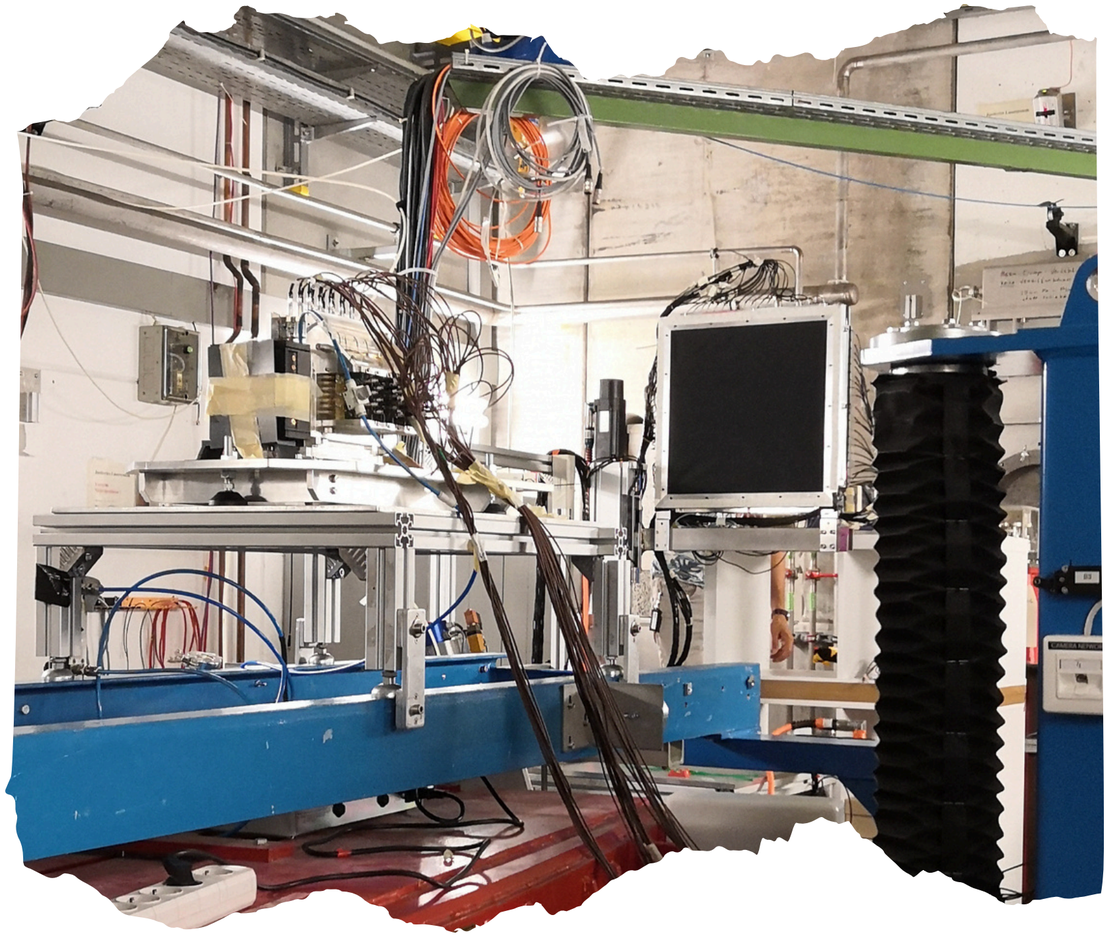

mbarn
1200
1000
800
600
400
200
0
h_XS_total_SB_B_pre
h_XS_total_MC
h_XS_total_SB_B_post
h_XS
12
10
8
6
4
2
0
−2
−4
−6
1
2
3
4
5
6
7
charge

Next steps (from 6 March)

Run on data with the same steps of MC analysis

400 MeV/u ^{16}O beam on 5mm Carbon target

Run	Trigger type	Target	Events
4305	MB	C	162102
4306	MB	C	577096
4307	MB	C	513370
4308	Frag + MB	C	510169
4309	Frag + MB	C	531812
4310	Frag + MB	C	1012099
4313	MB	no	57133



Next update soon! (here it is)

New analysis flow

Evaluate **efficiencies** and **purities**

Repeat for with and w/o target samples

Apply reconstruction cuts (SC, BM)

Normalize yields and **subtract** background

Apply efficiency and **purity** for fragmentation in target

Unfolding

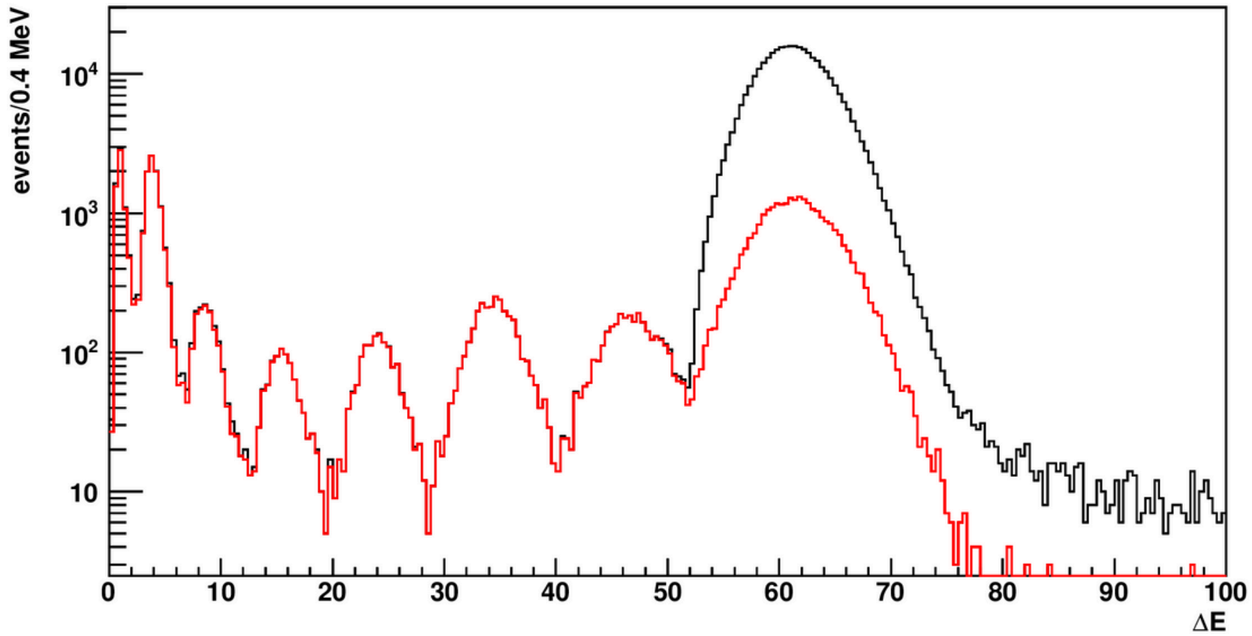
Calculate angular **cross sections**

Data analysis

In MB runs the number of primaries is the number of events passing selection cuts

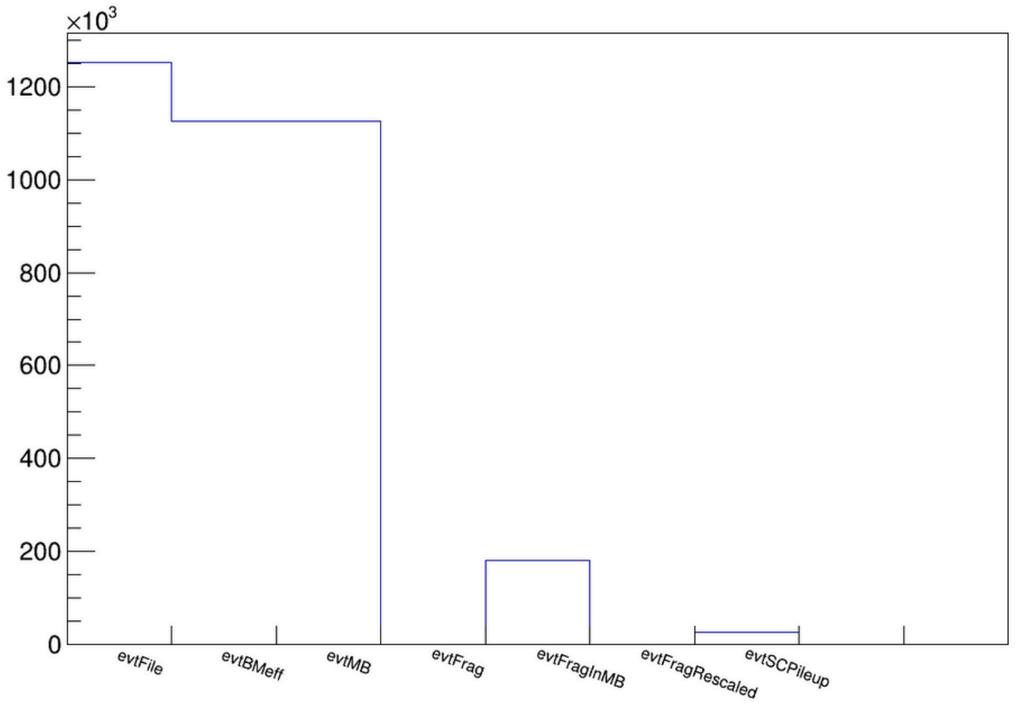
In fragmentation runs the number of primaries has to take into account the **trigger rejection factor**

It can be evaluated from MB runs (fragmentation flag: ON)

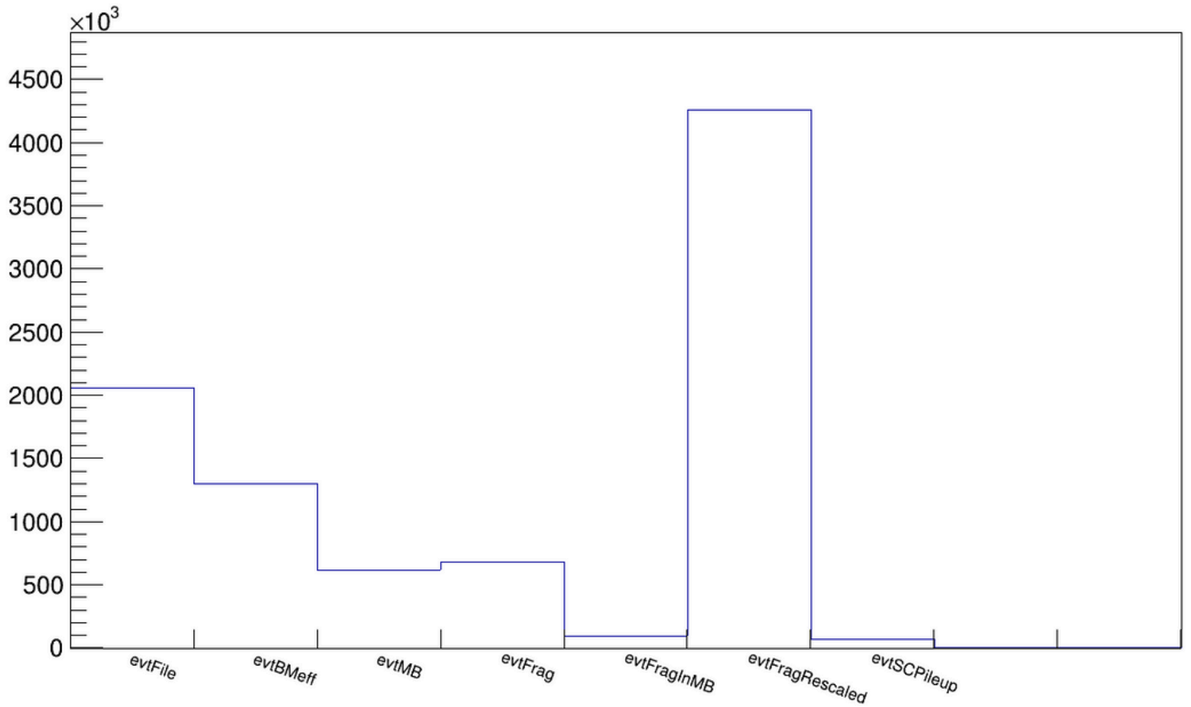


Number of events

Minimum bias (4305,4306,4307)

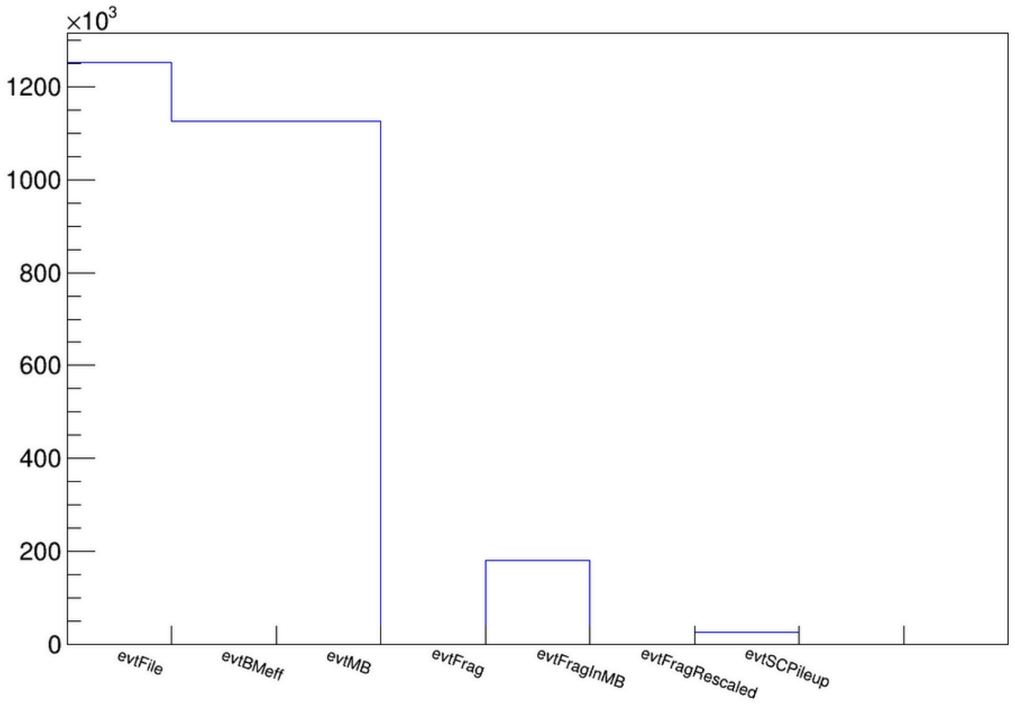


Fragmentation+MB (4308, 4309, 4310)

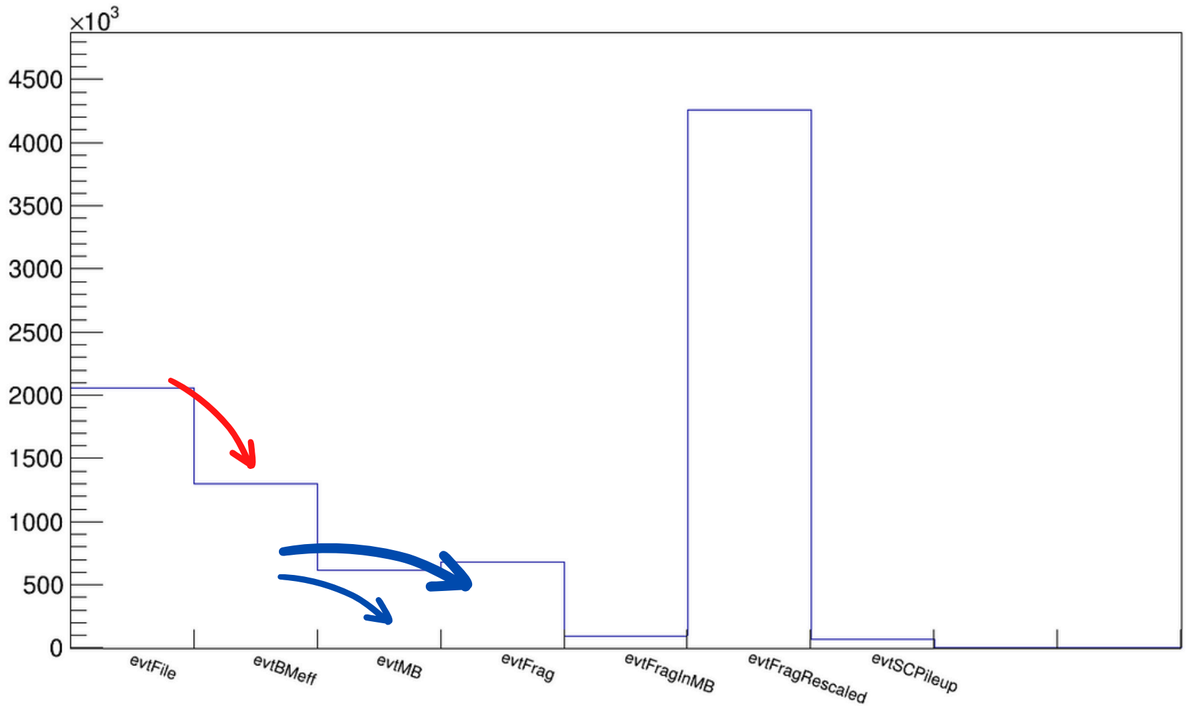


Number of events

Minimum bias (4305,4306,4307)

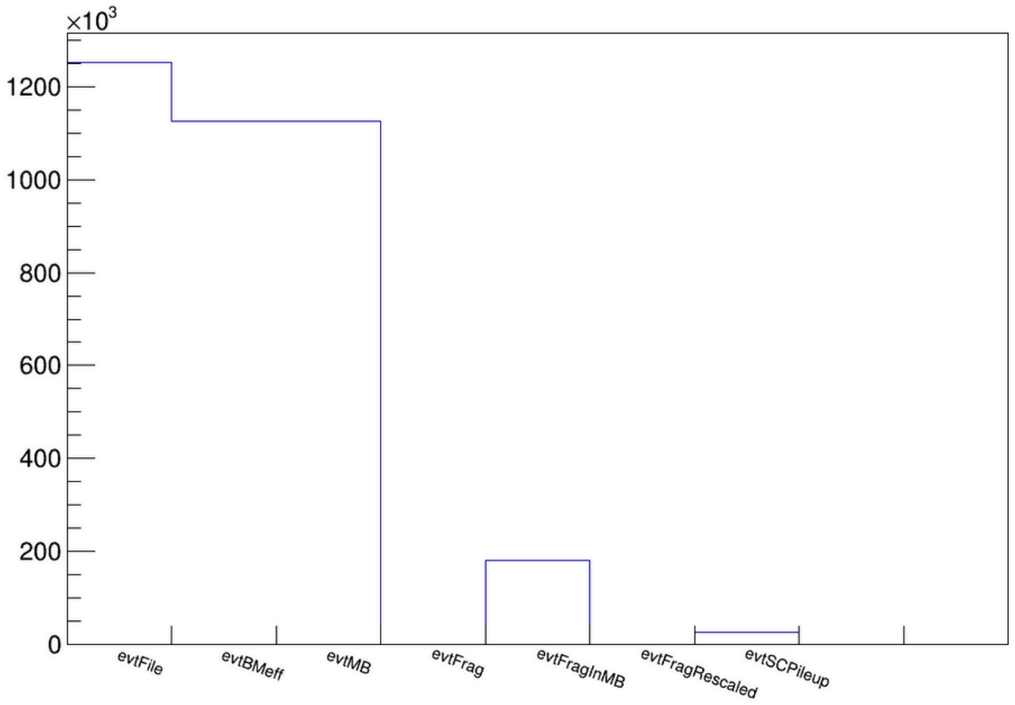


Fragmentation+MB (4308, 4309, 4310)

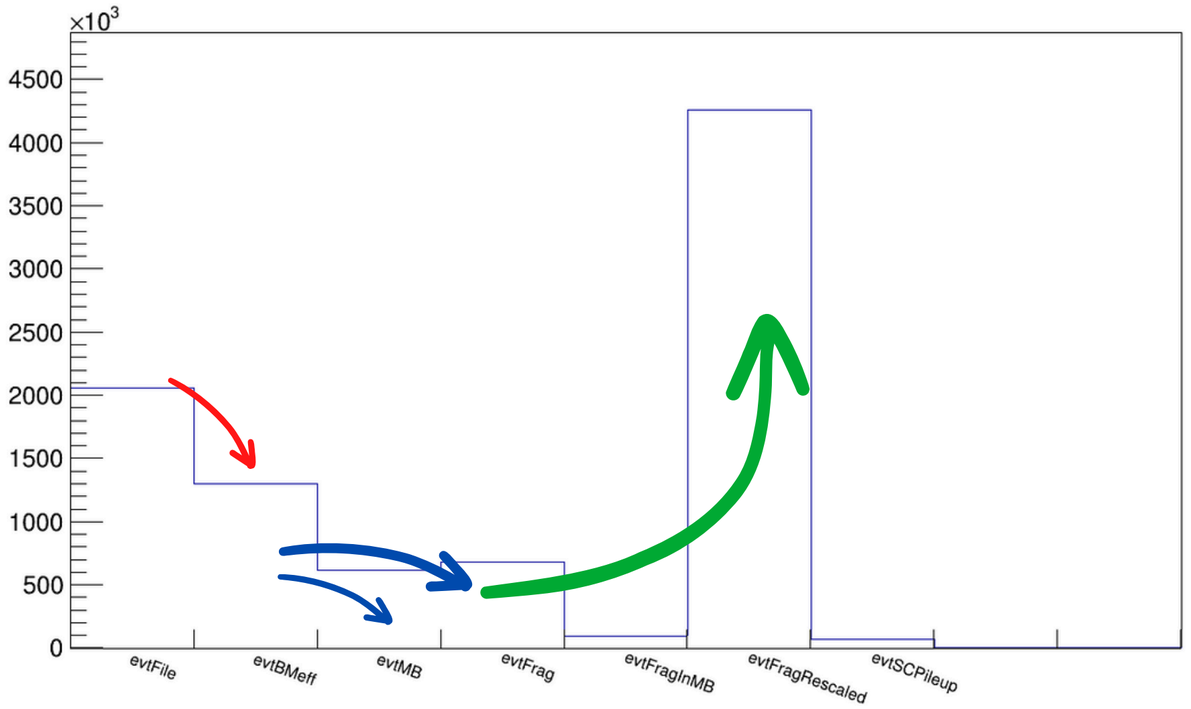


Number of events

Minimum bias (4305,4306,4307)



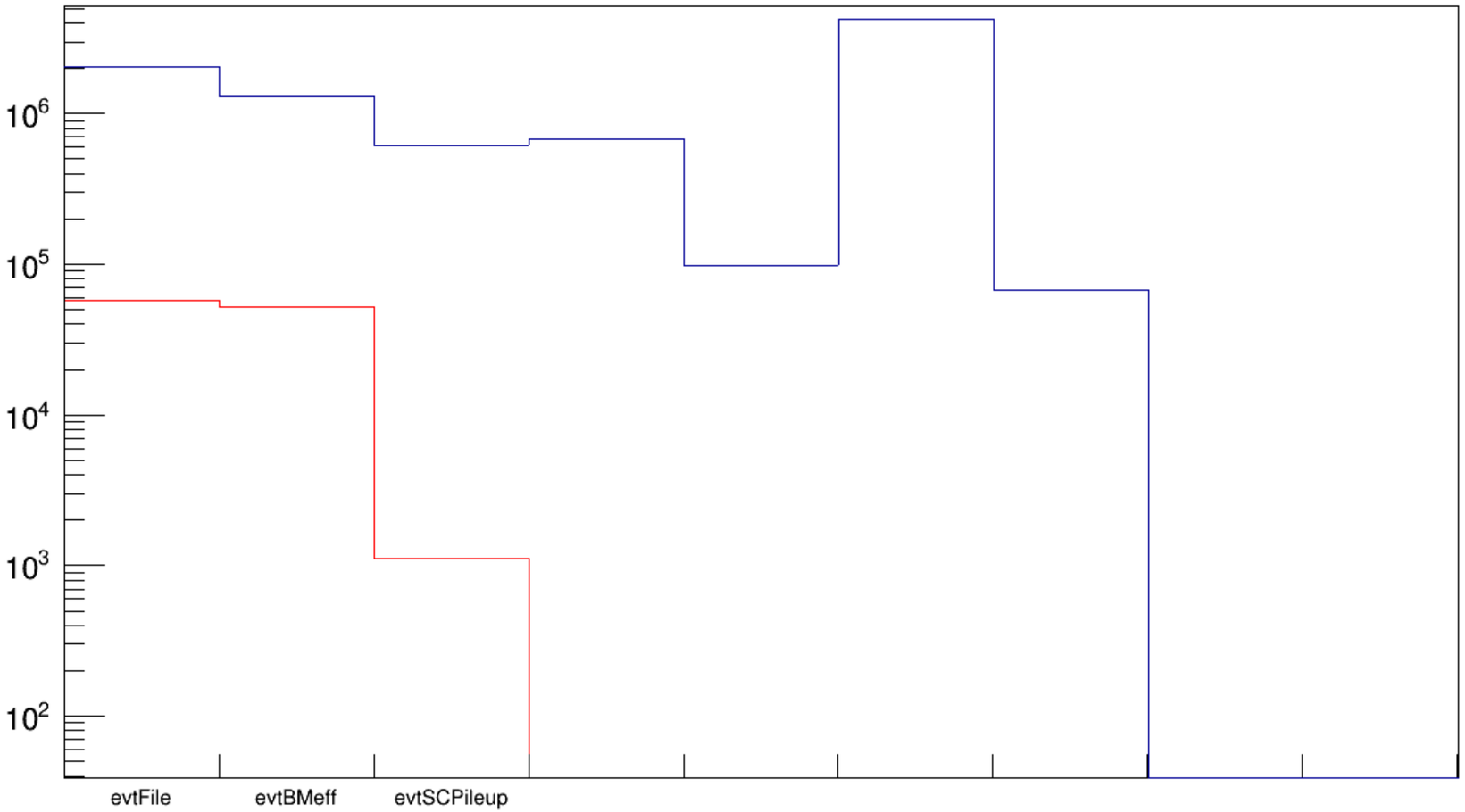
Fragmentation+MB (4308, 4309, 4310)



Number of events

Fragmentation+MB (4308, 4309, 4310)

Background MB (4313)



Impact of statistics on XS resolution

Relative uncertainties in XS (only stat)

$$\sigma(Z) = \frac{1}{N_{\mathrm{TG}} \cdot \varepsilon(Z)} \cdot \left(\frac{Y_S(Z)}{N_S} - \frac{Y_B(Z)}{N_B} \right) = \frac{1}{N_{\mathrm{TG}} \cdot \varepsilon(Z)} \cdot (S(Z) - B(Z))$$

$$\frac{\Delta\sigma}{\sigma} \approx \left(\frac{1}{S-B} \right) \cdot \sqrt{S^2 \cdot \left[\left(\frac{\Delta Y_S}{Y_S} \right)^2 + \left(\frac{\Delta N_S}{N_S} \right)^2 \right] + B^2 \cdot \left[\left(\frac{\Delta Y_B}{Y_B} \right)^2 + \left(\frac{\Delta N_B}{N_B} \right)^2 \right]}$$

Fragmentation physics

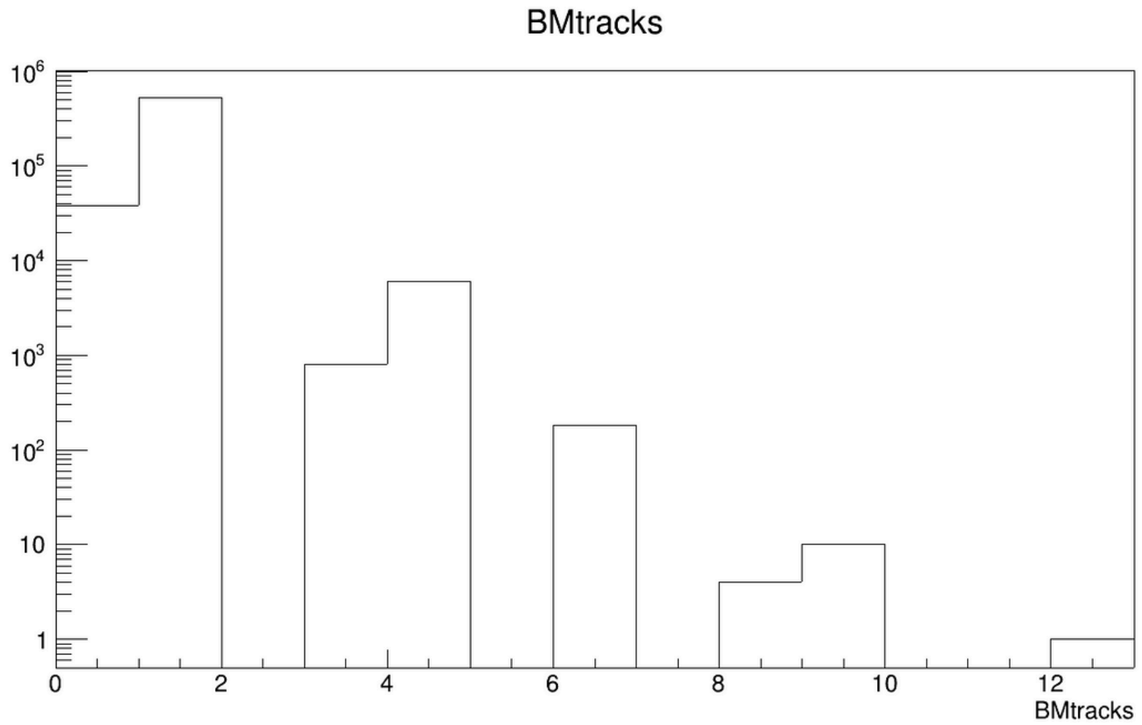
Available Statistics

$$S = \frac{Y_S}{N_S} \qquad B = \frac{Y_B}{N_B}$$

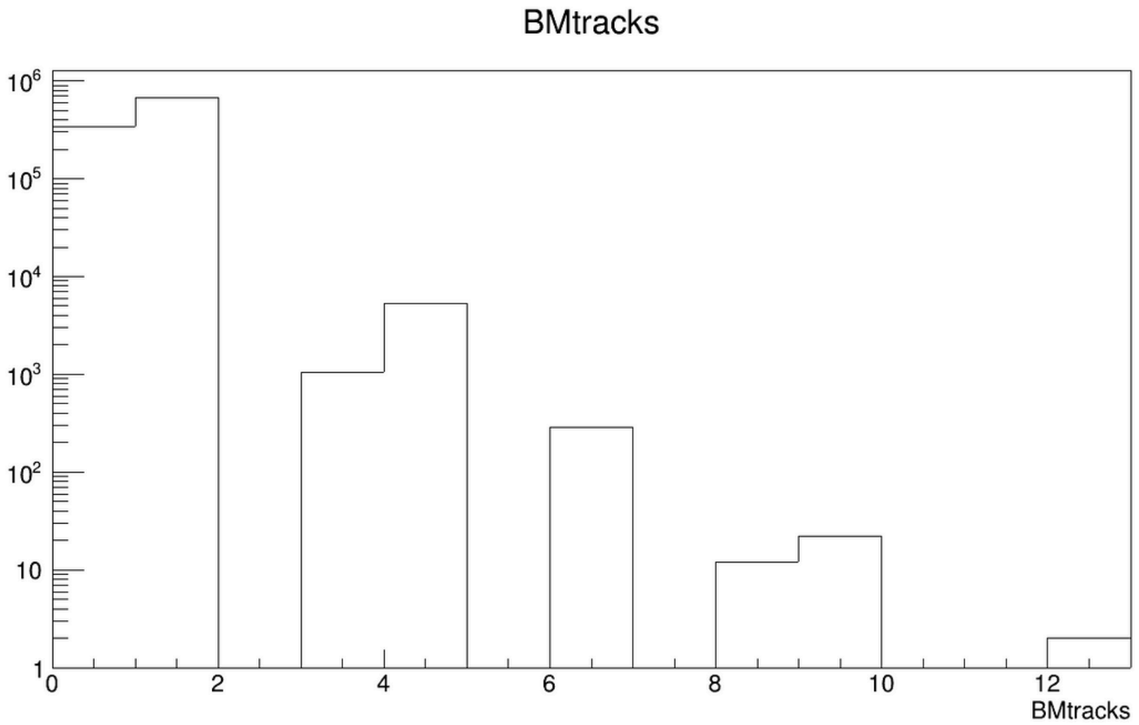
- Y_S fragments yields in TG runs (S->S+B)
- N_S primaries in TG runs (S->S+B)
- Y_B fragments yields in NO TG runs
- N_B primaries in NO TG runs

Selection cuts

Minimum bias (4306)

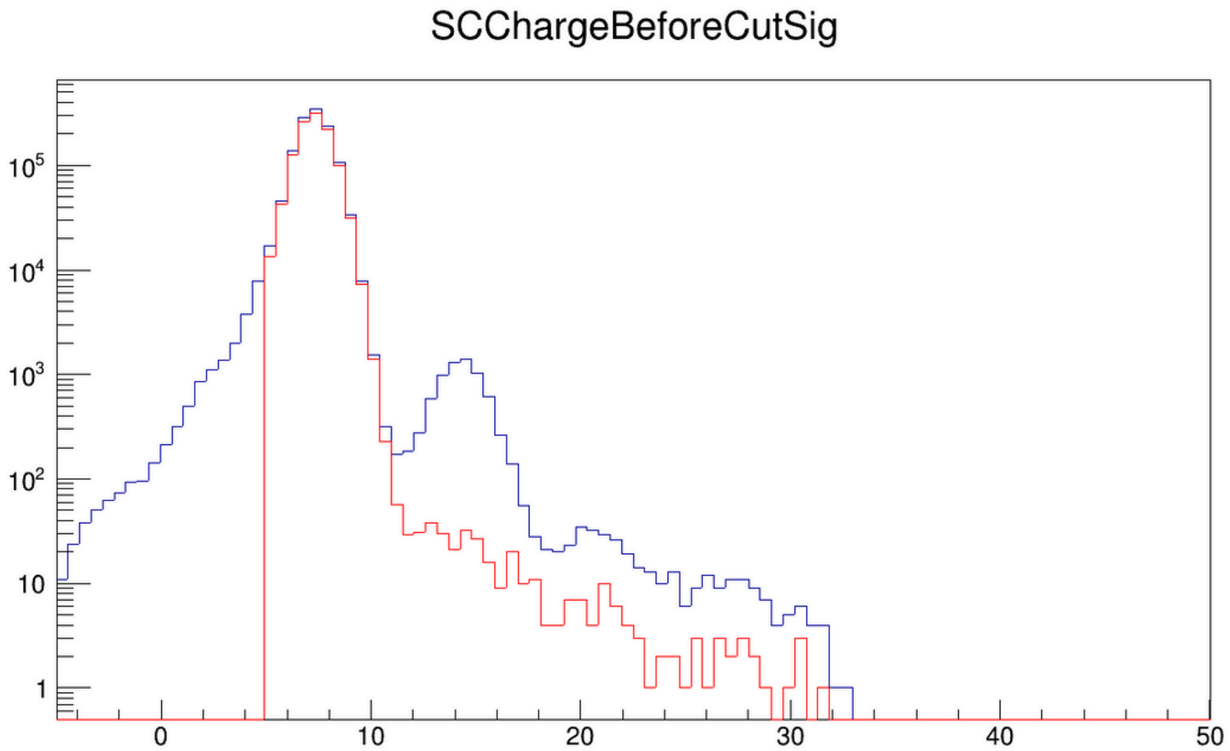


Fragmentation+MB (4310)

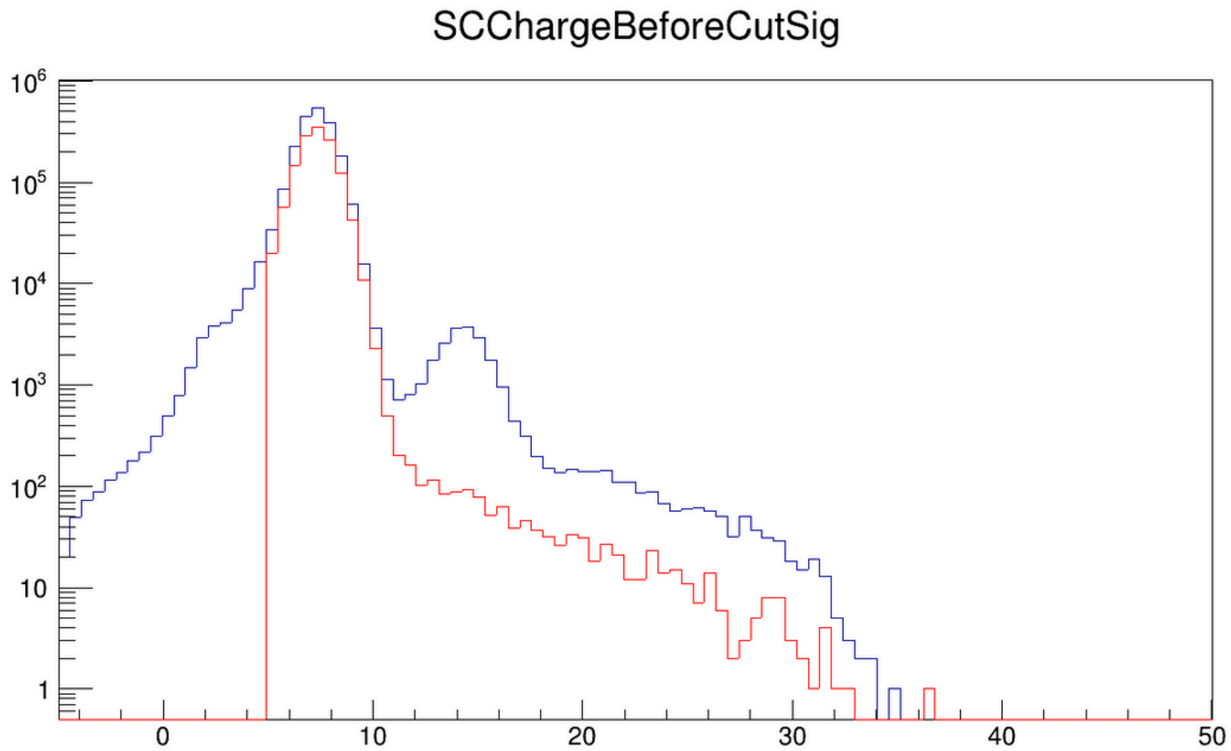


Selection cuts

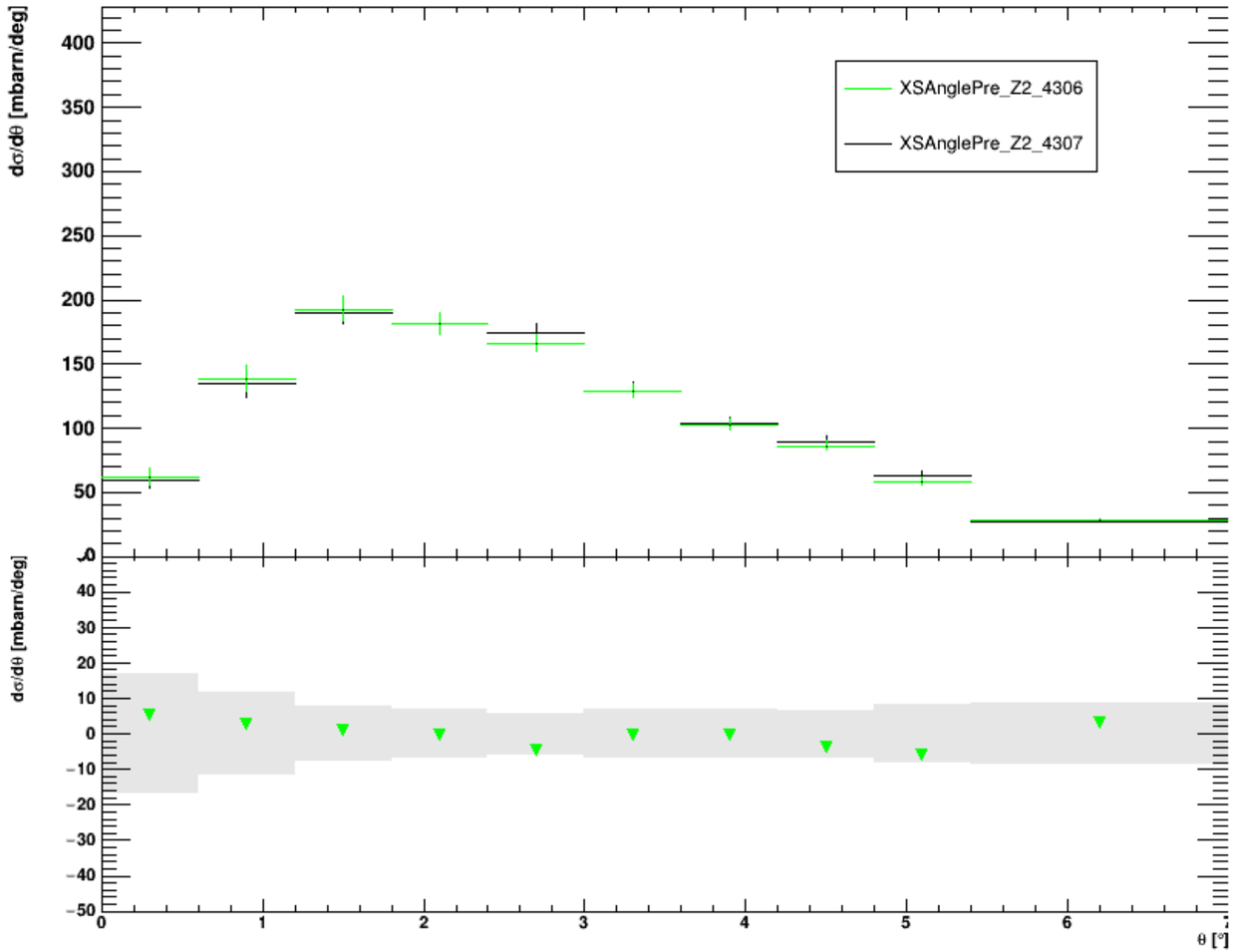
Minimum bias (4305, 4306, 4307)

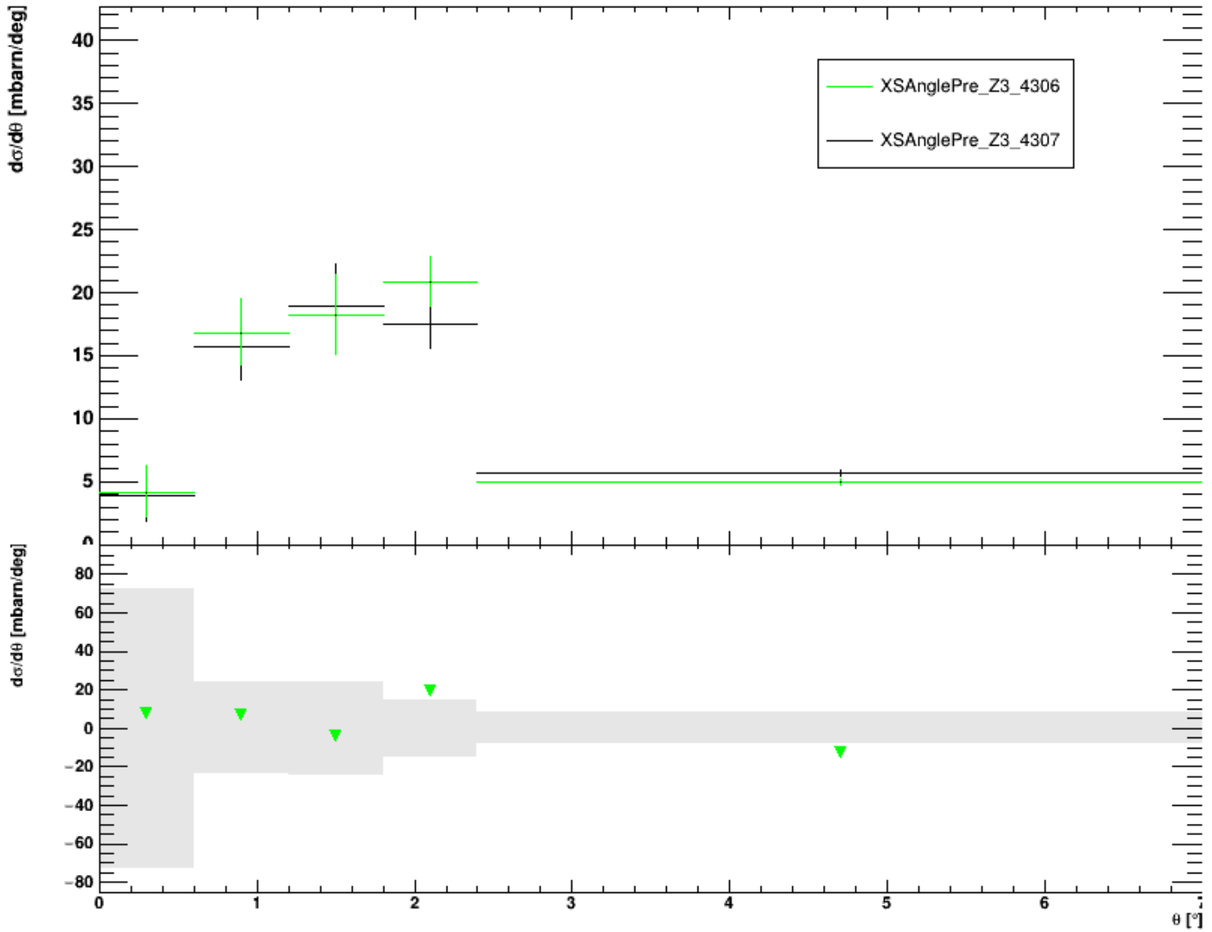


Fragmentation+MB (4308, 4309, 4310)

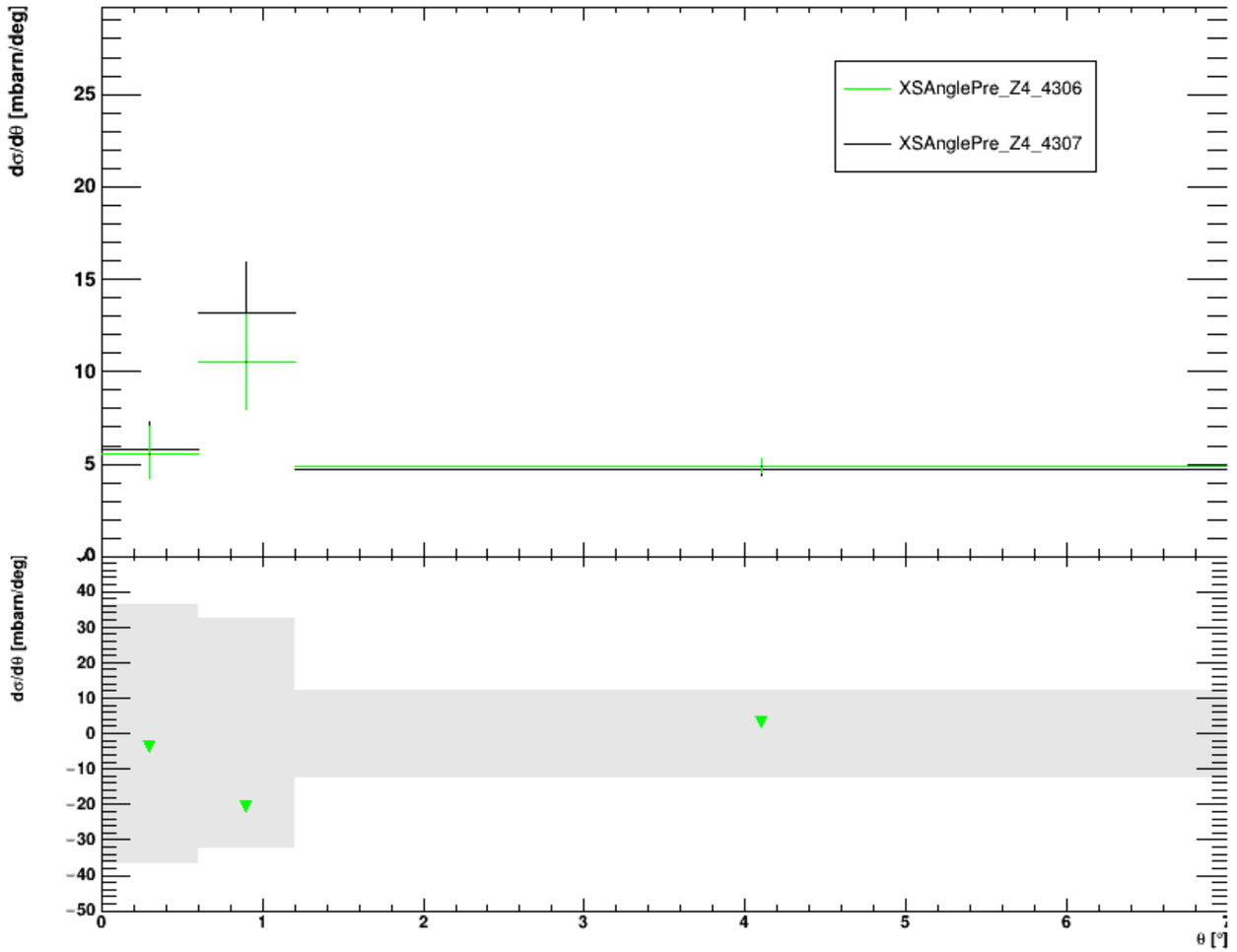


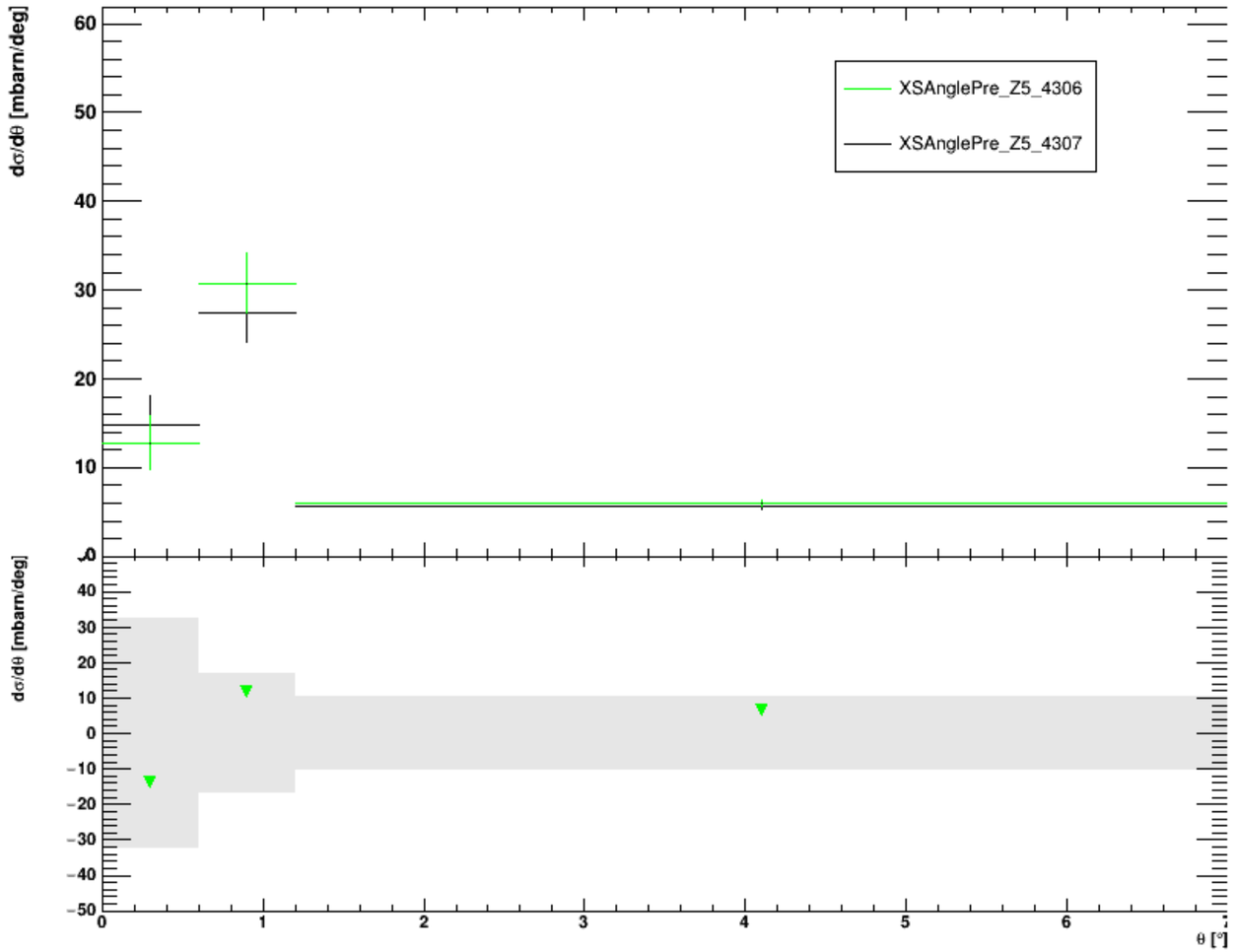
Consistency checks on data



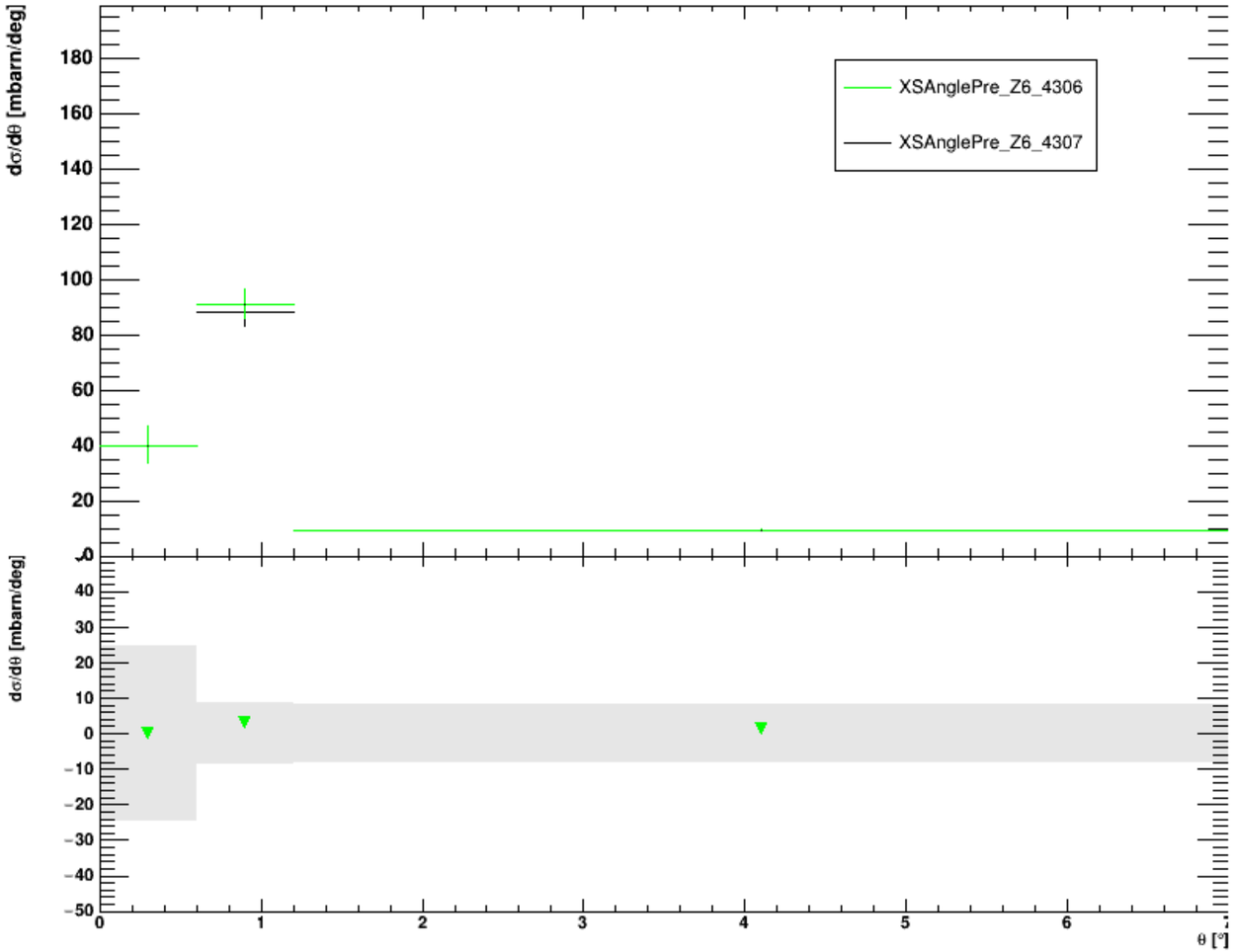


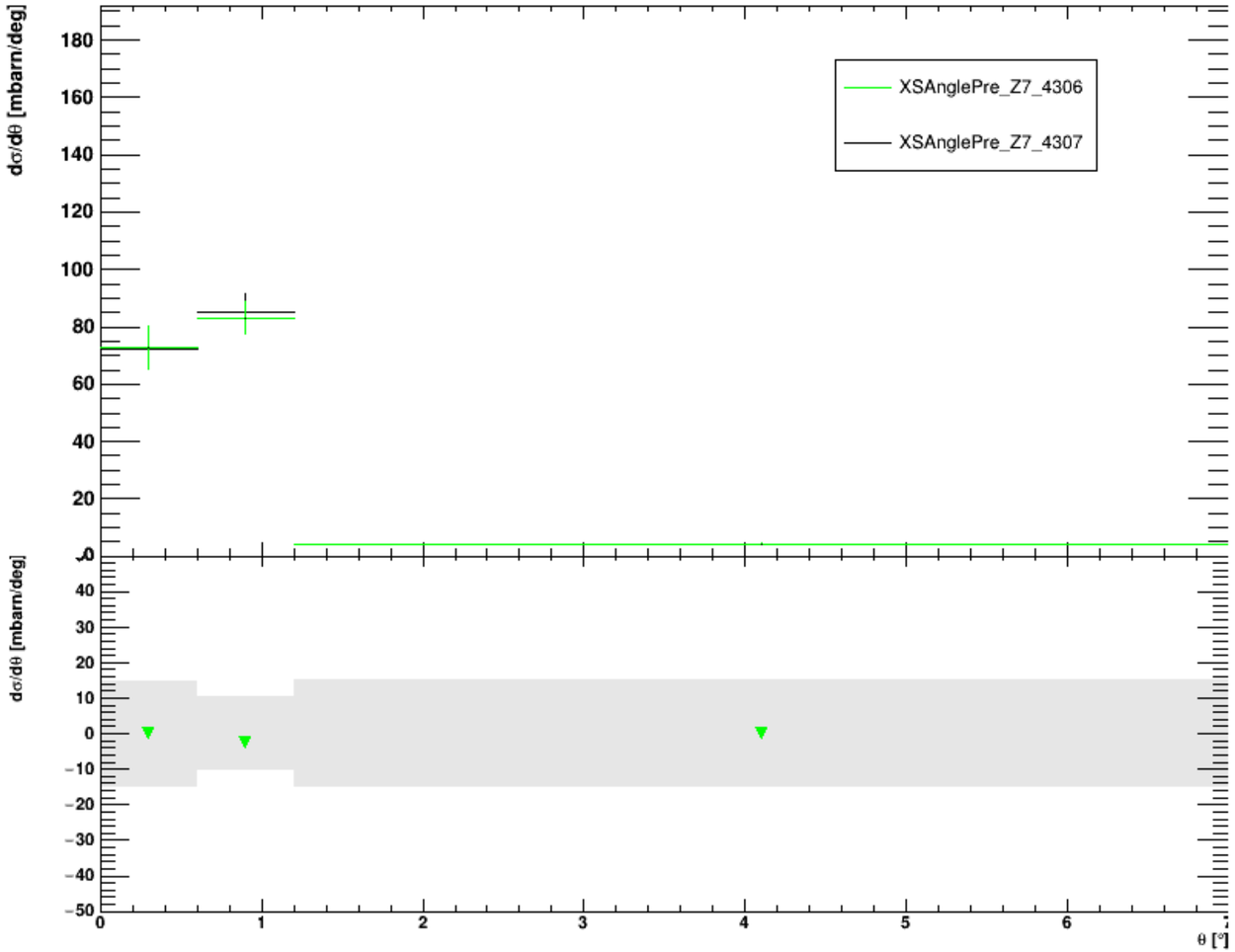
Consistency checks on data



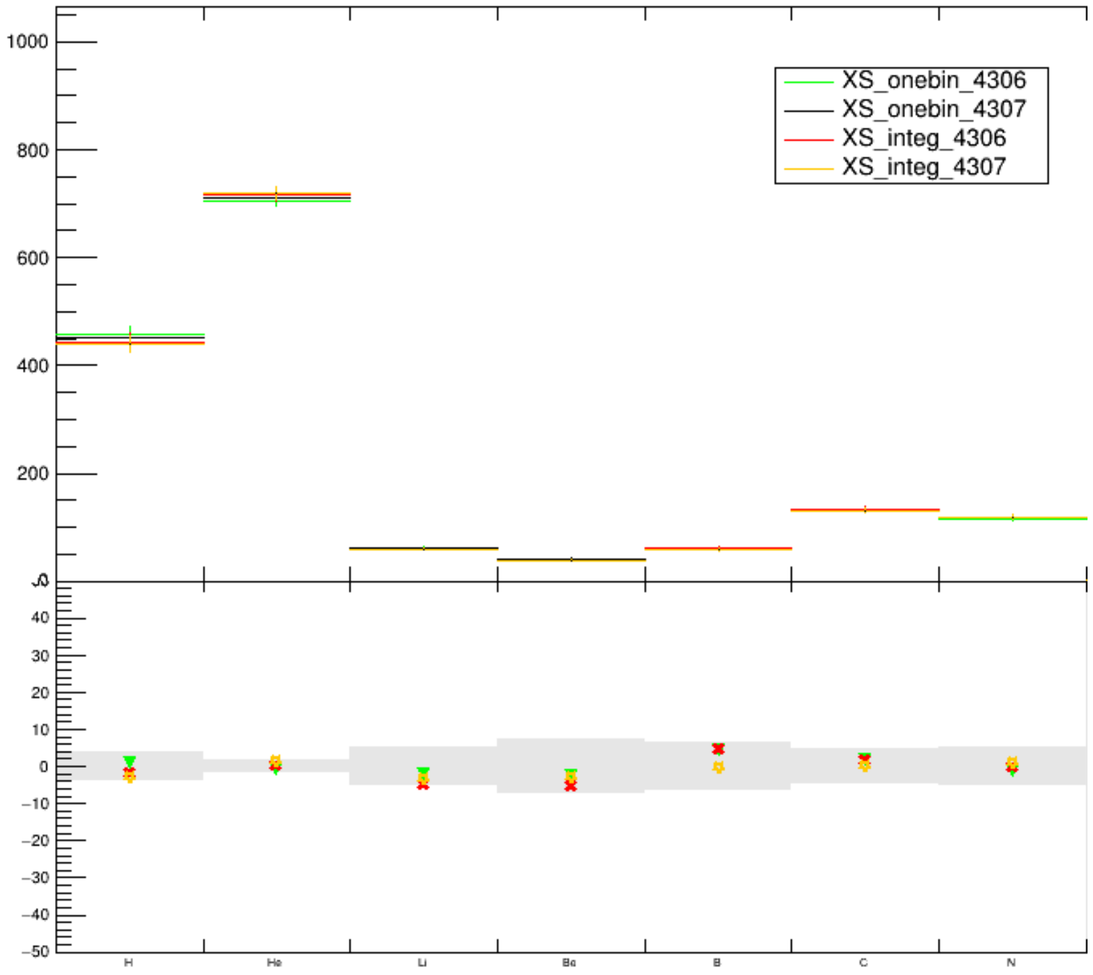


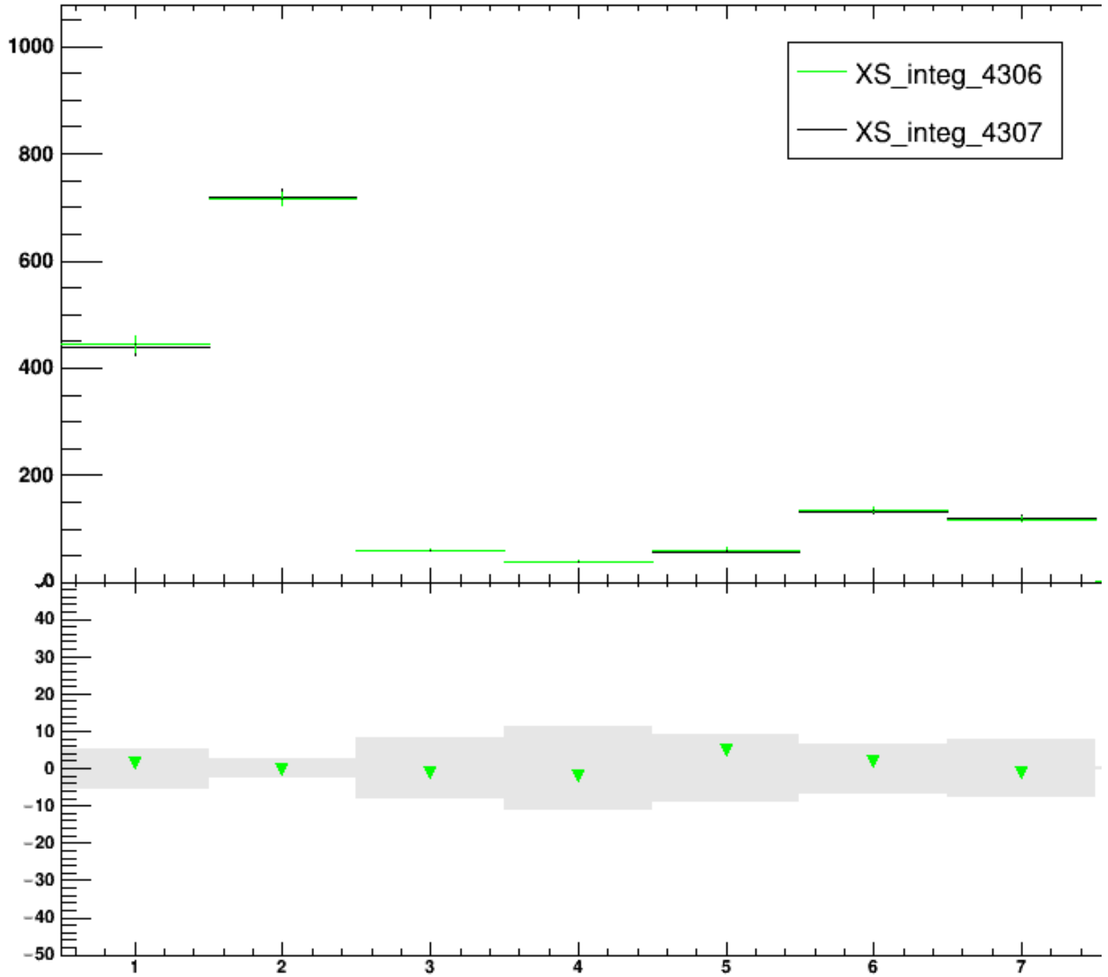
Consistency checks on data



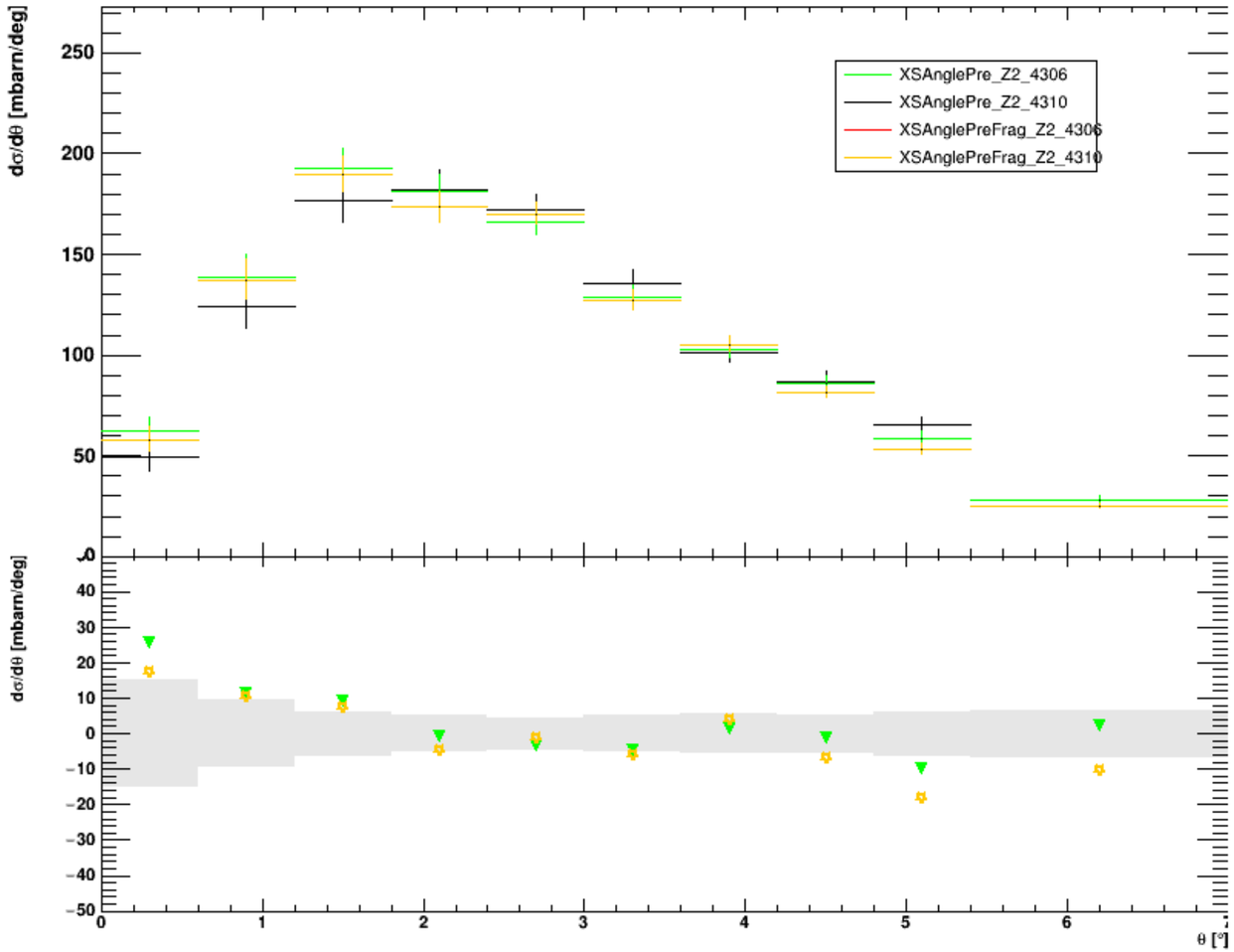


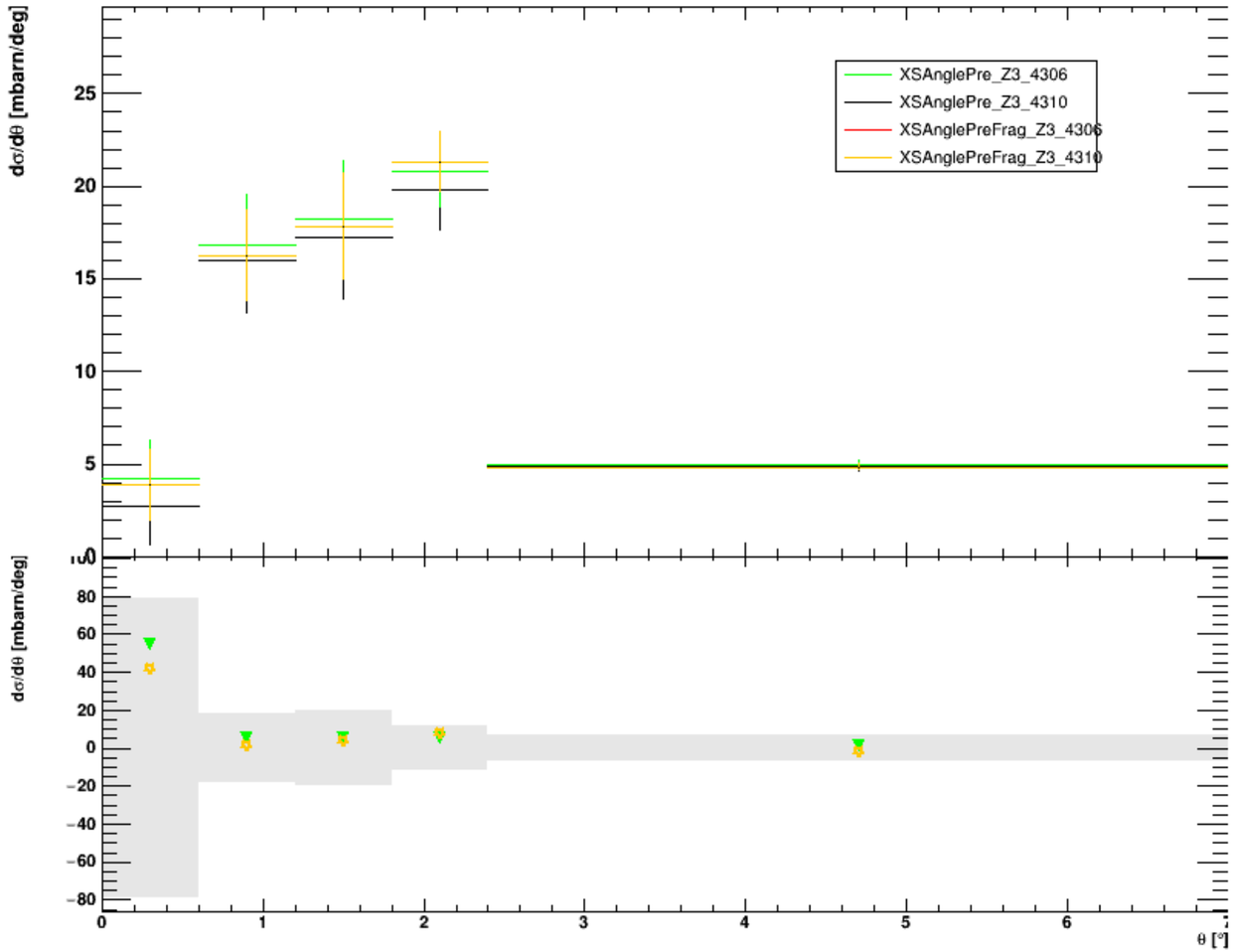
Consistency checks on data



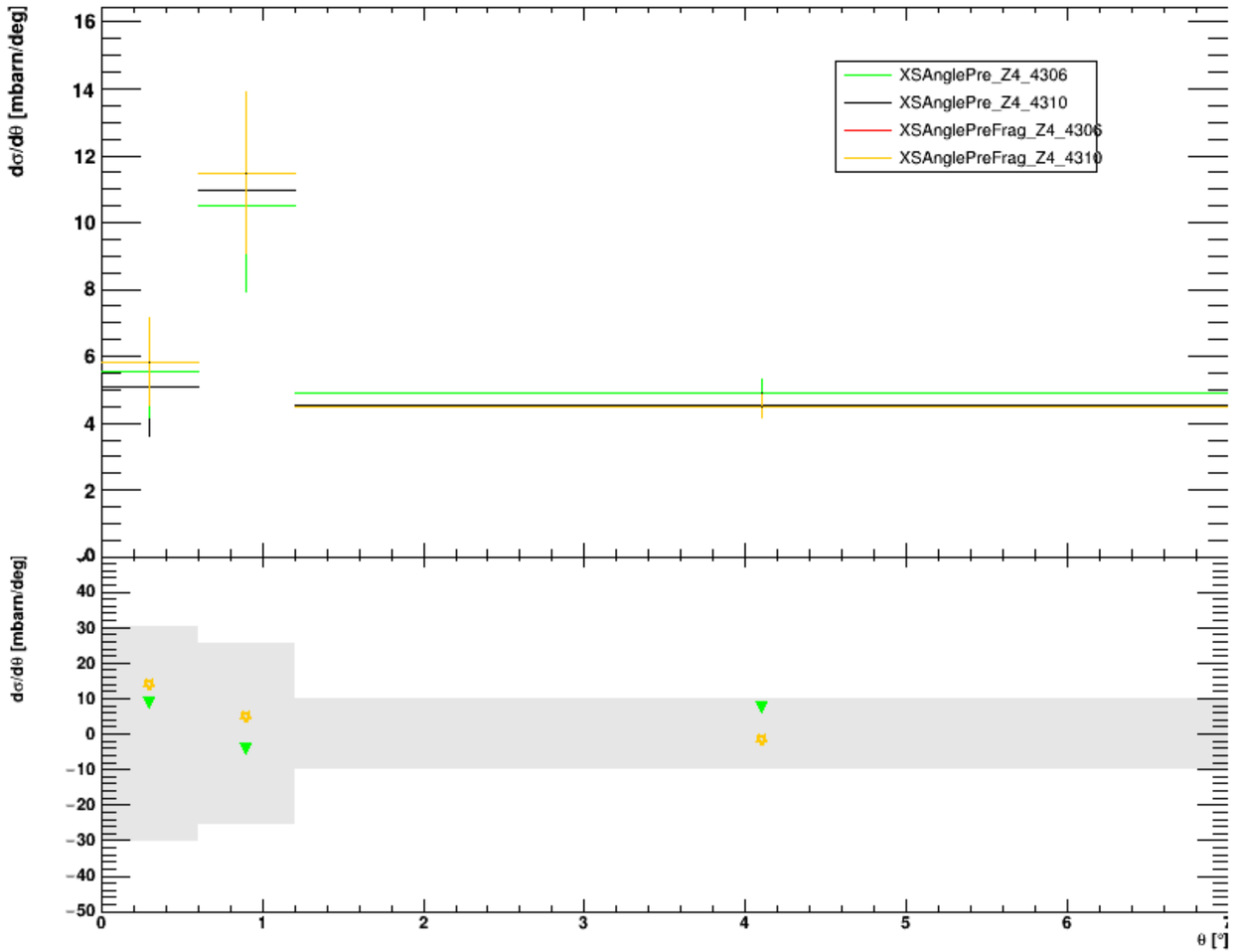


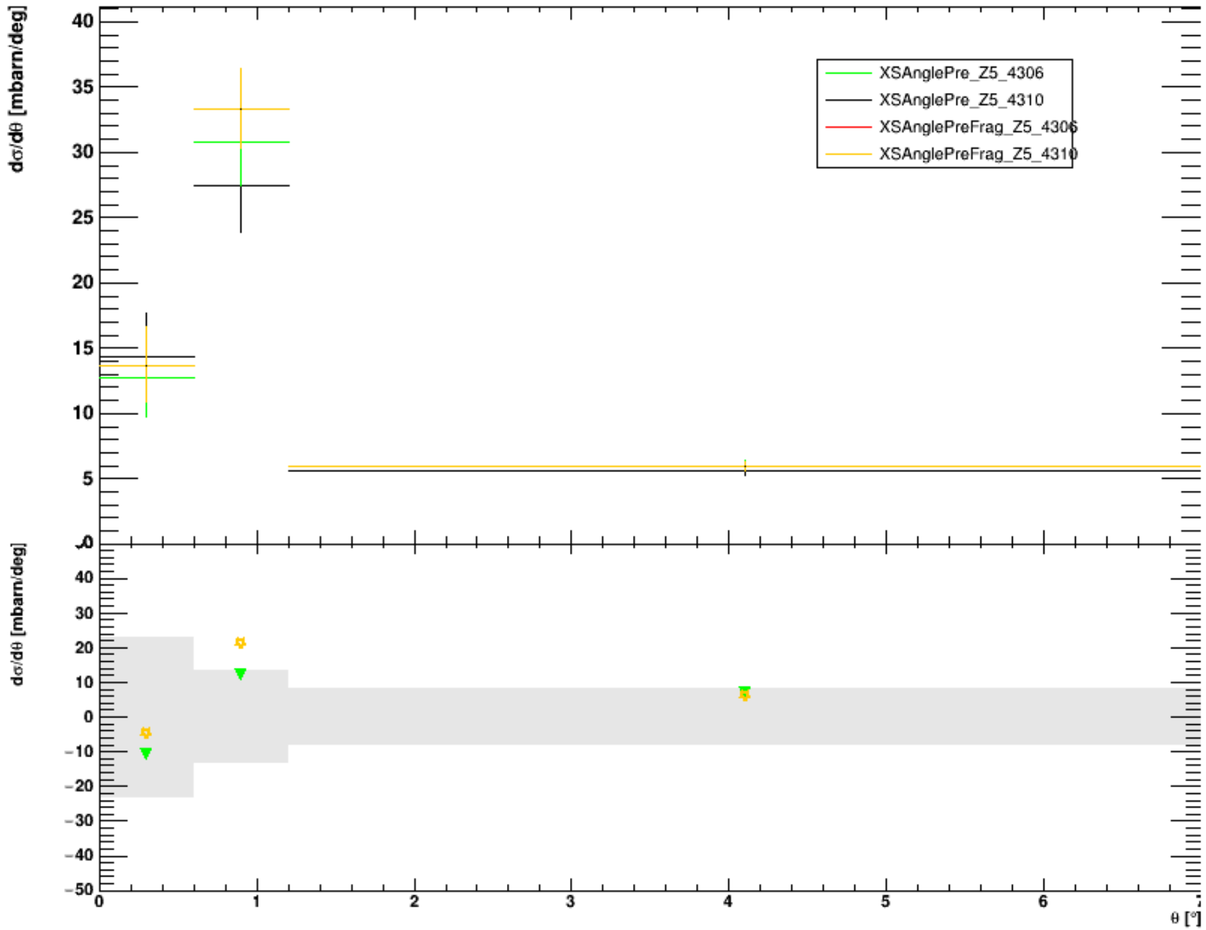
Consistency checks on data



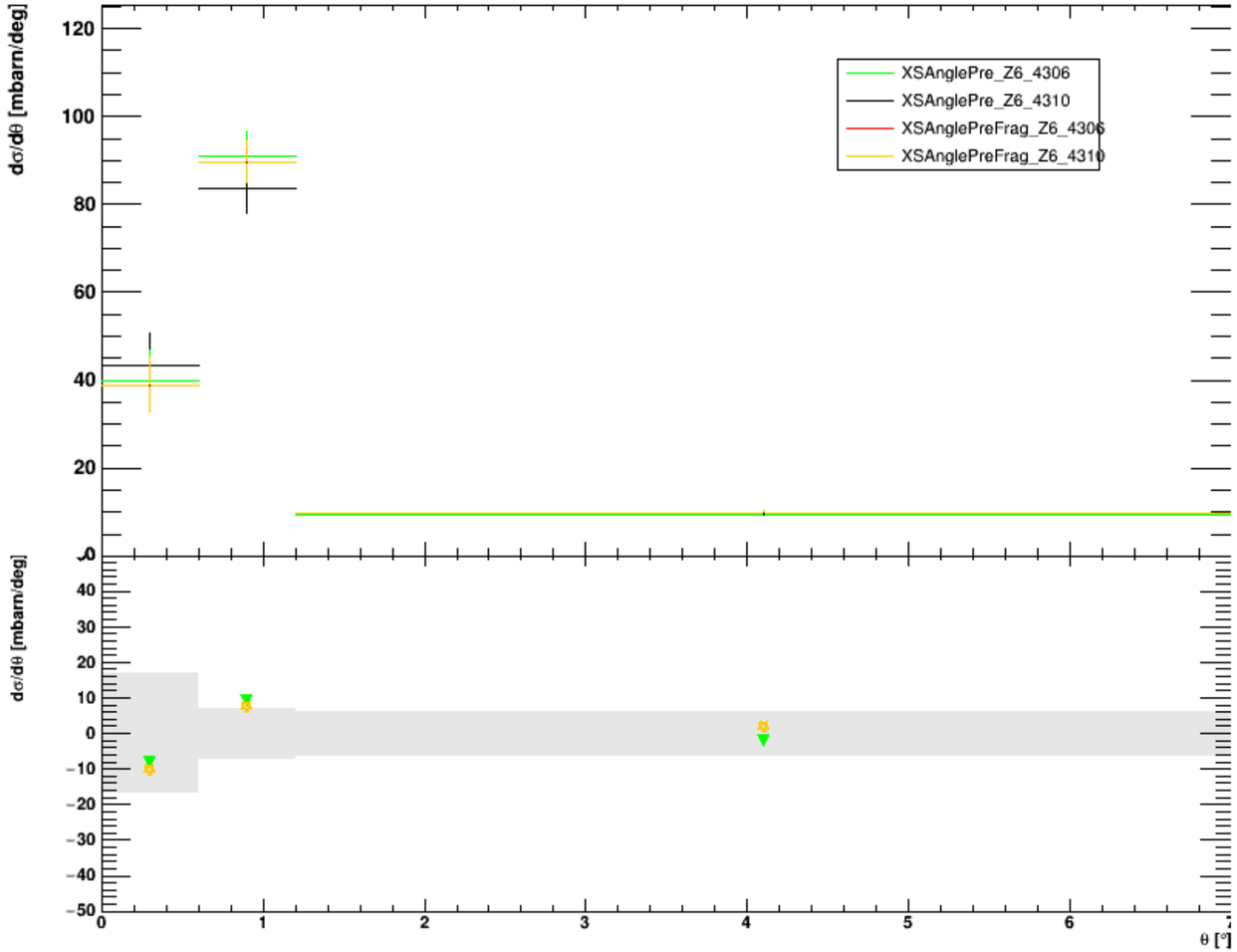


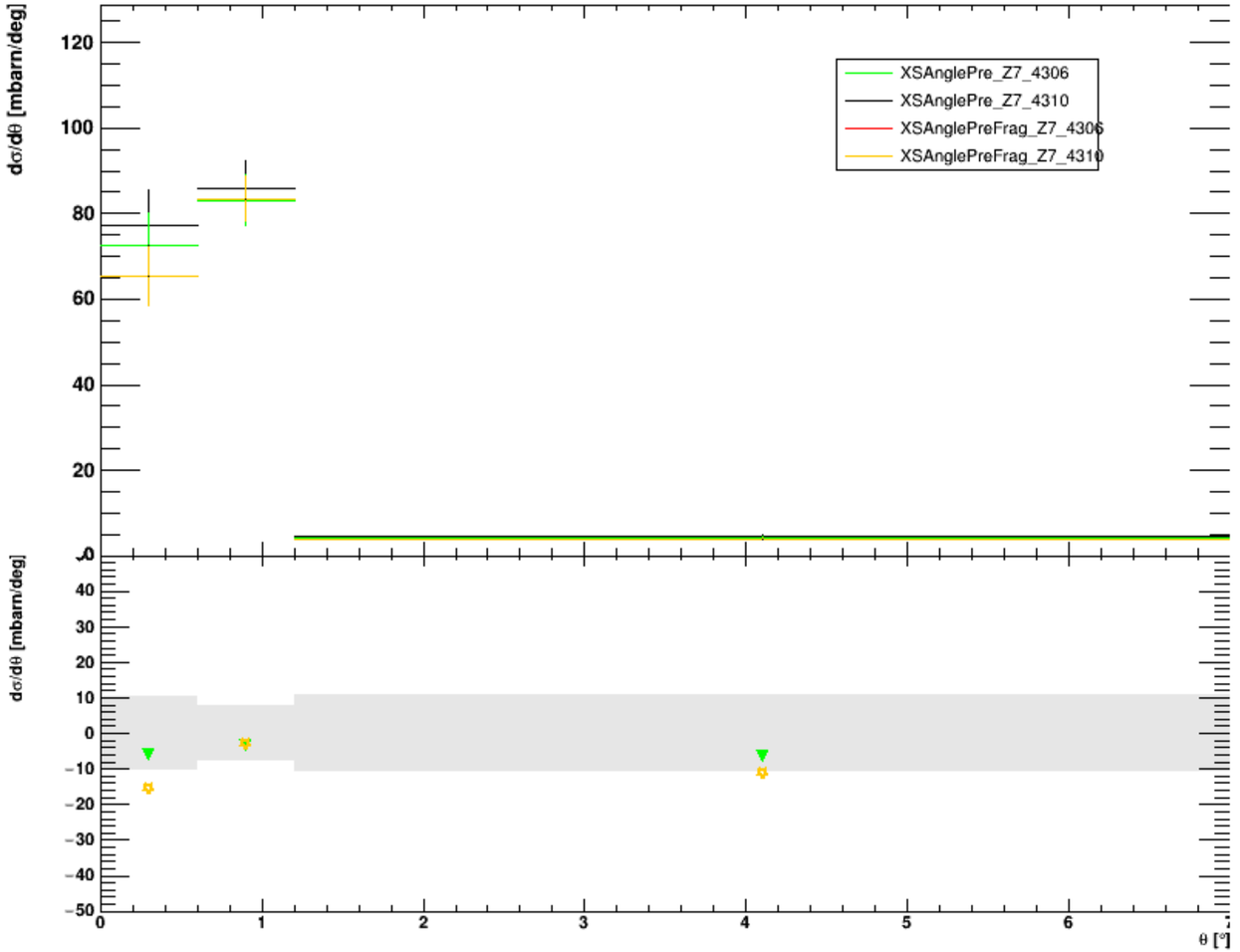
Consistency checks on data



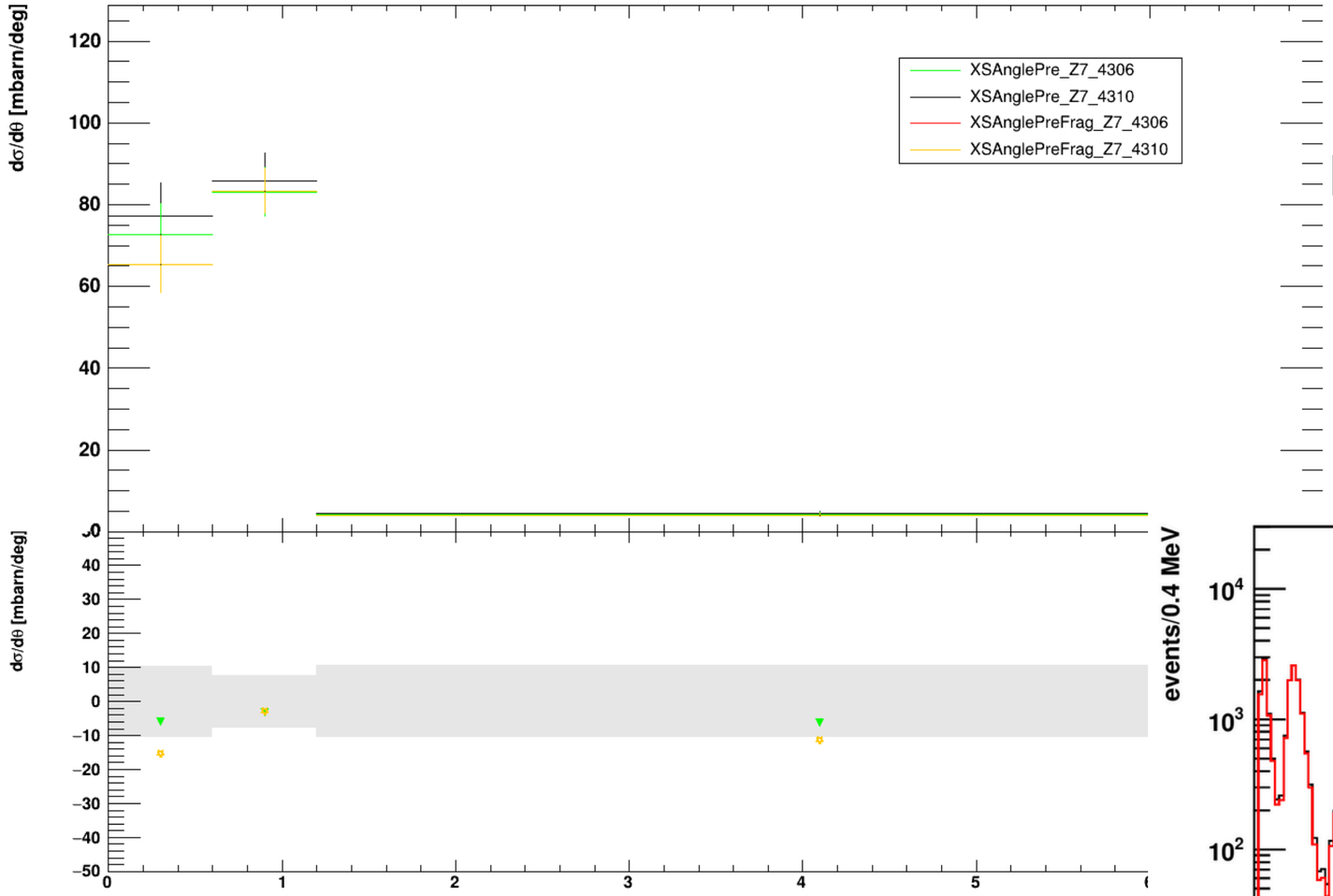


Consistency checks on data

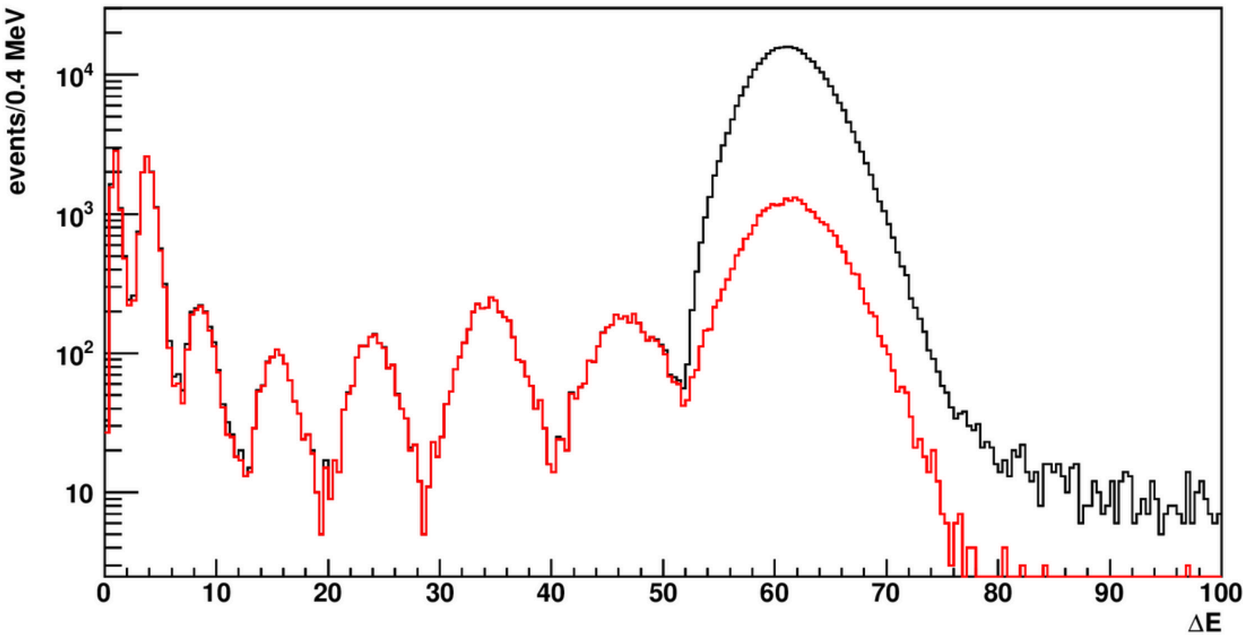




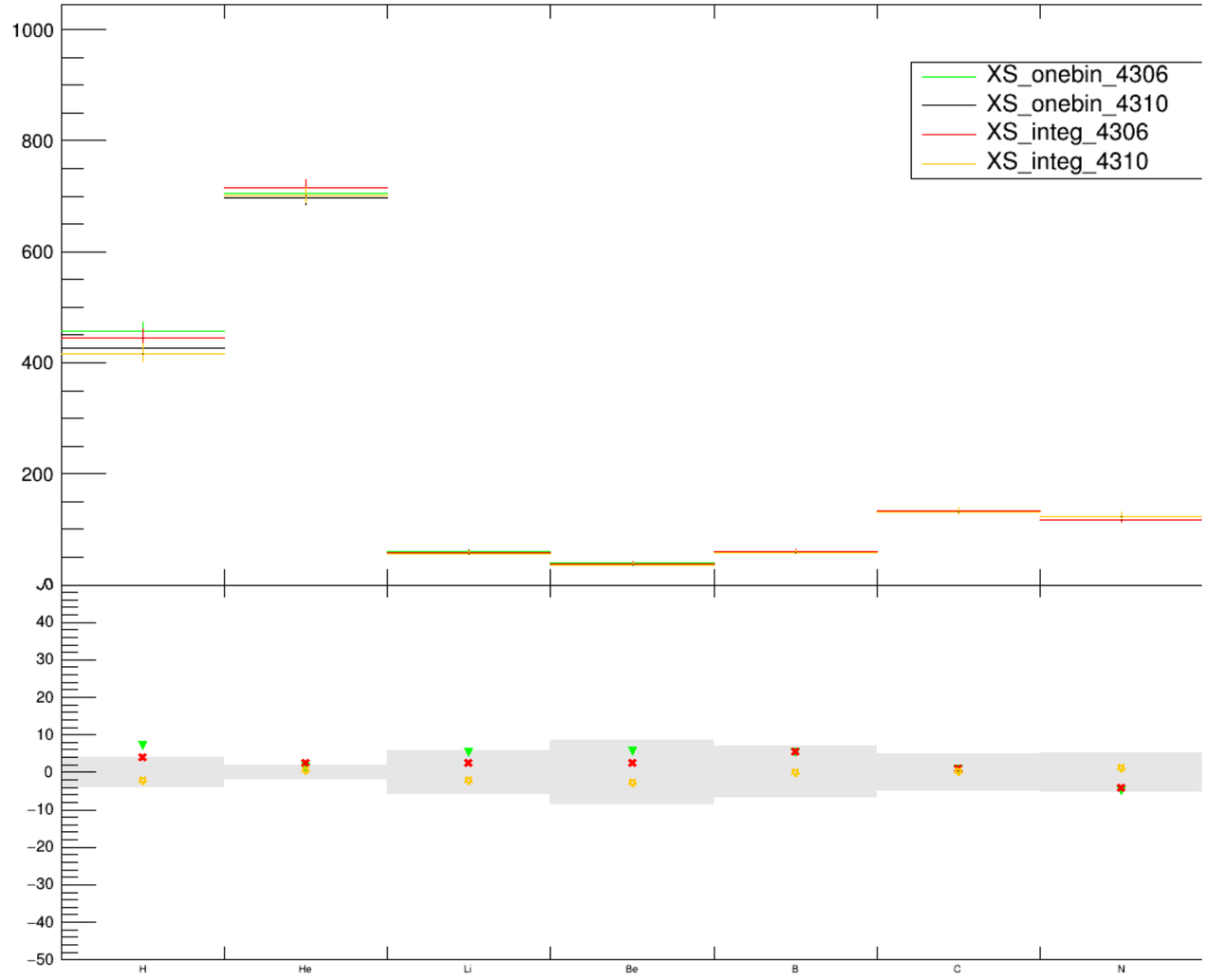
Consistency checks on data

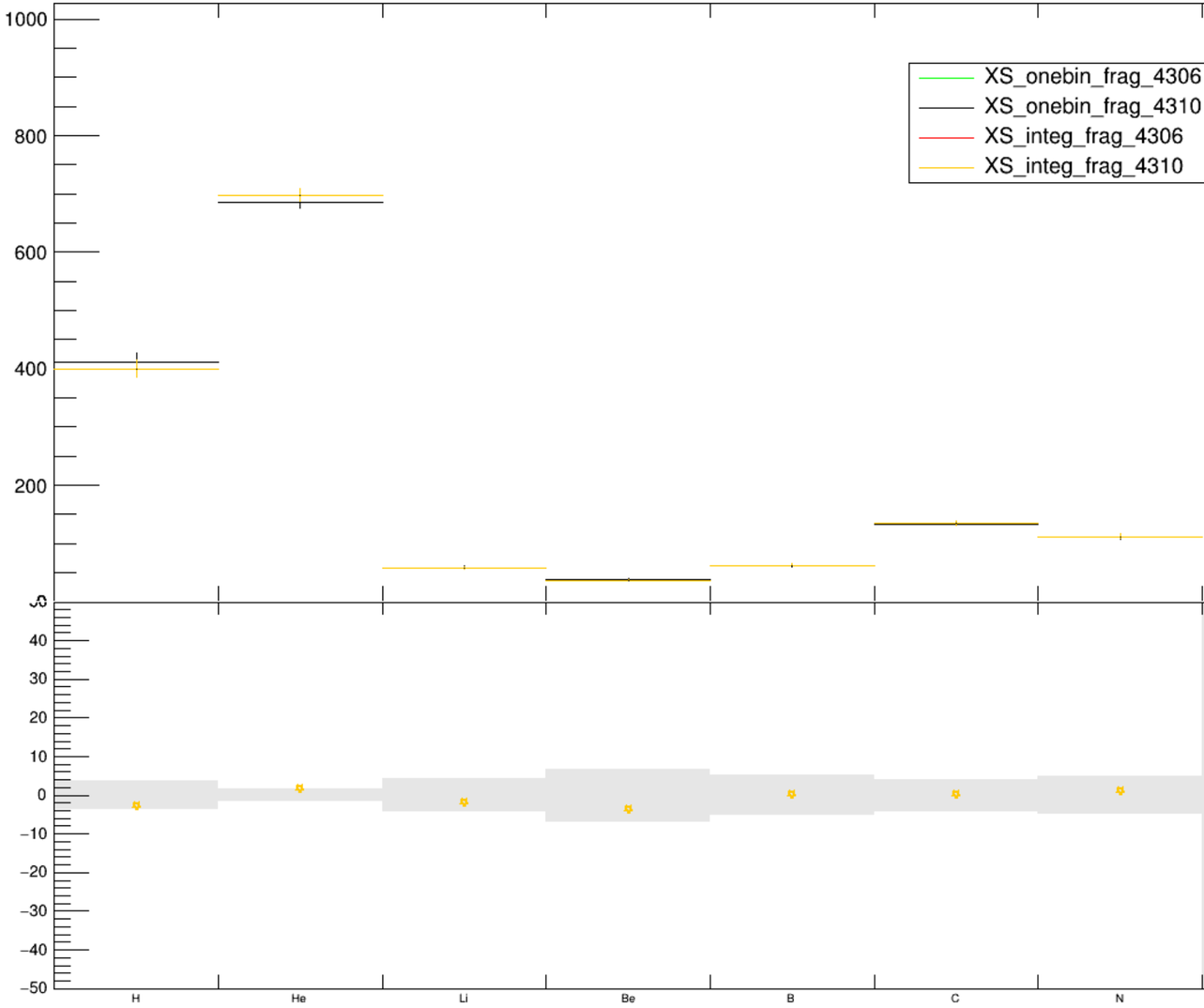


Fragment rescaling maybe useful for N if outside our uncertainties

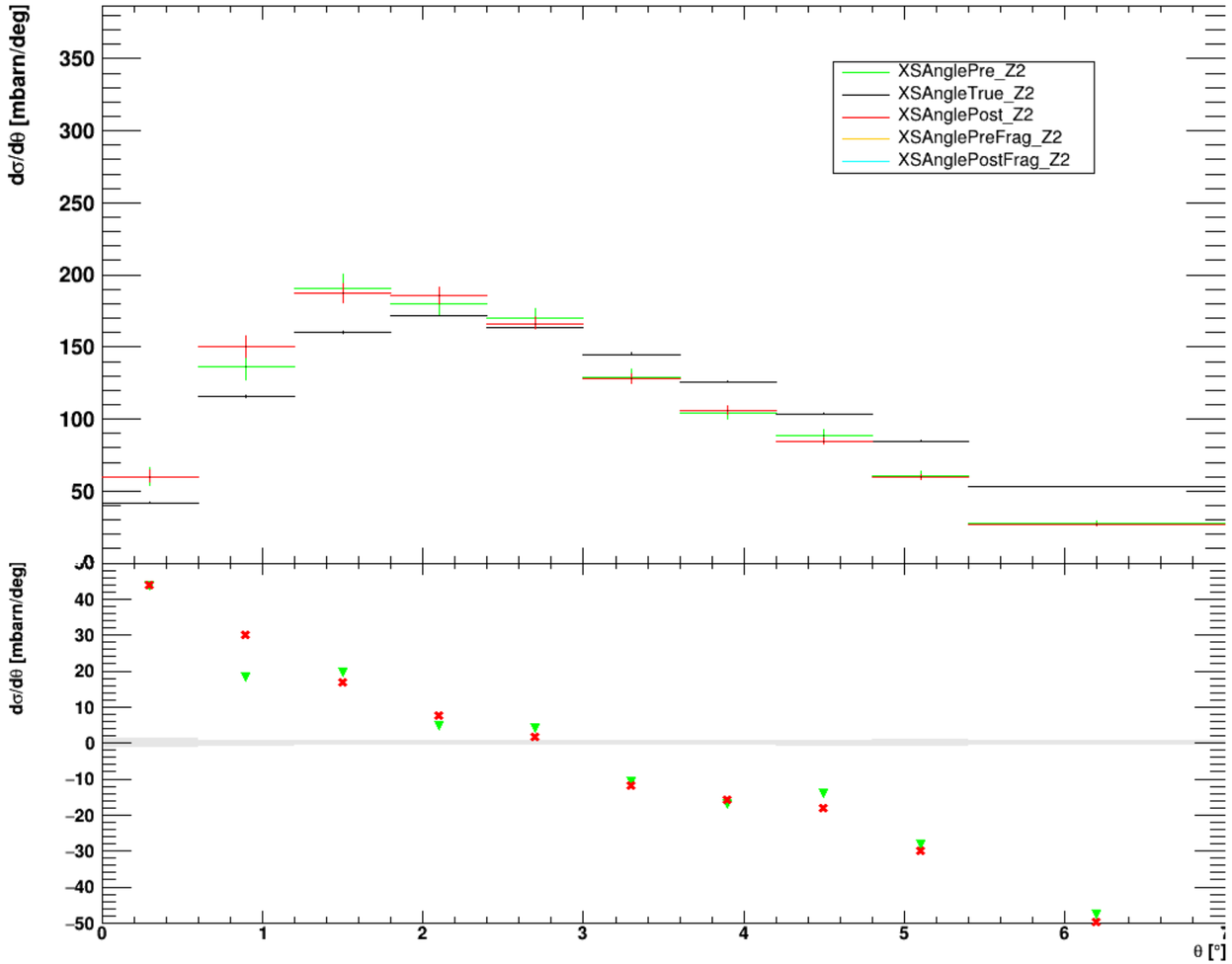


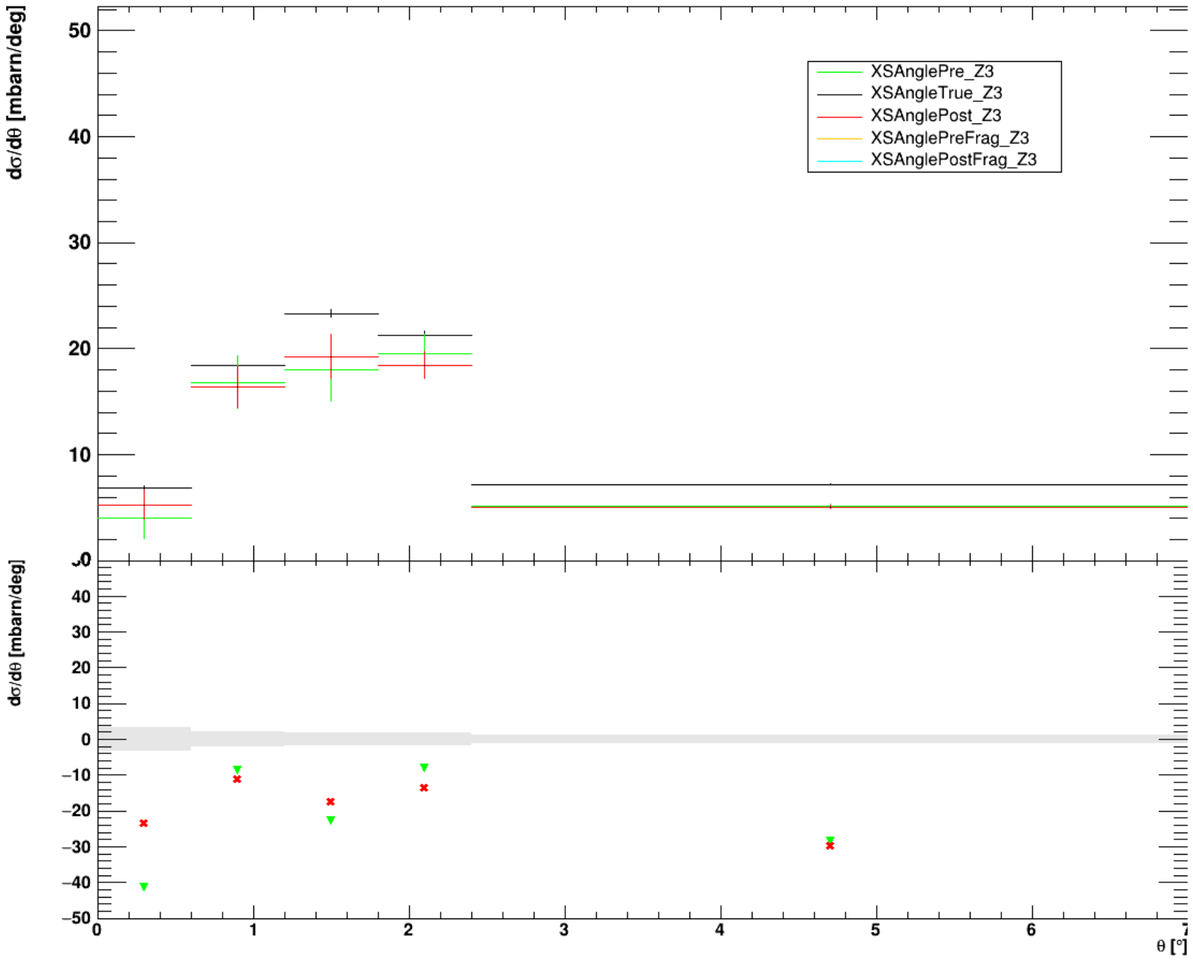
Consistency checks on data



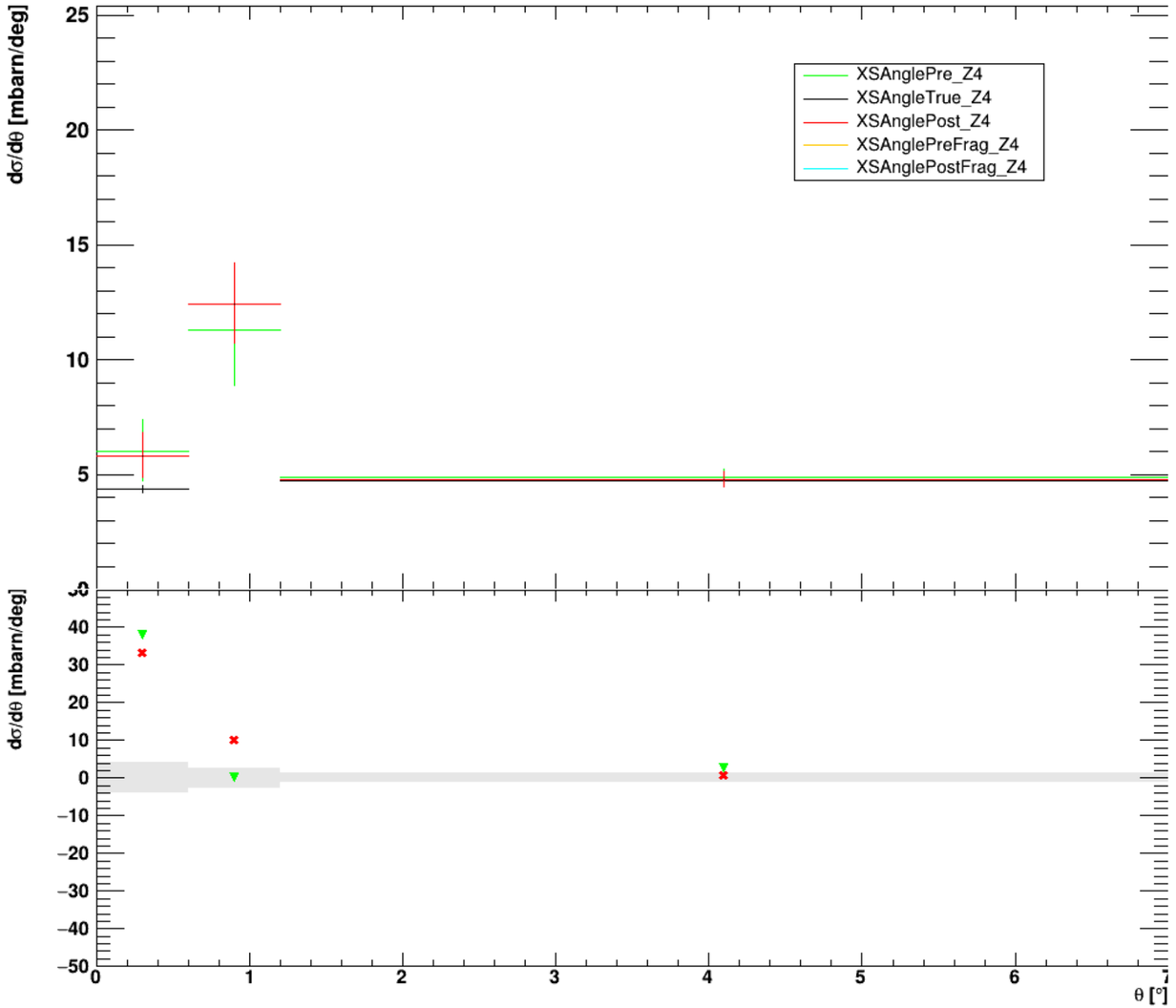


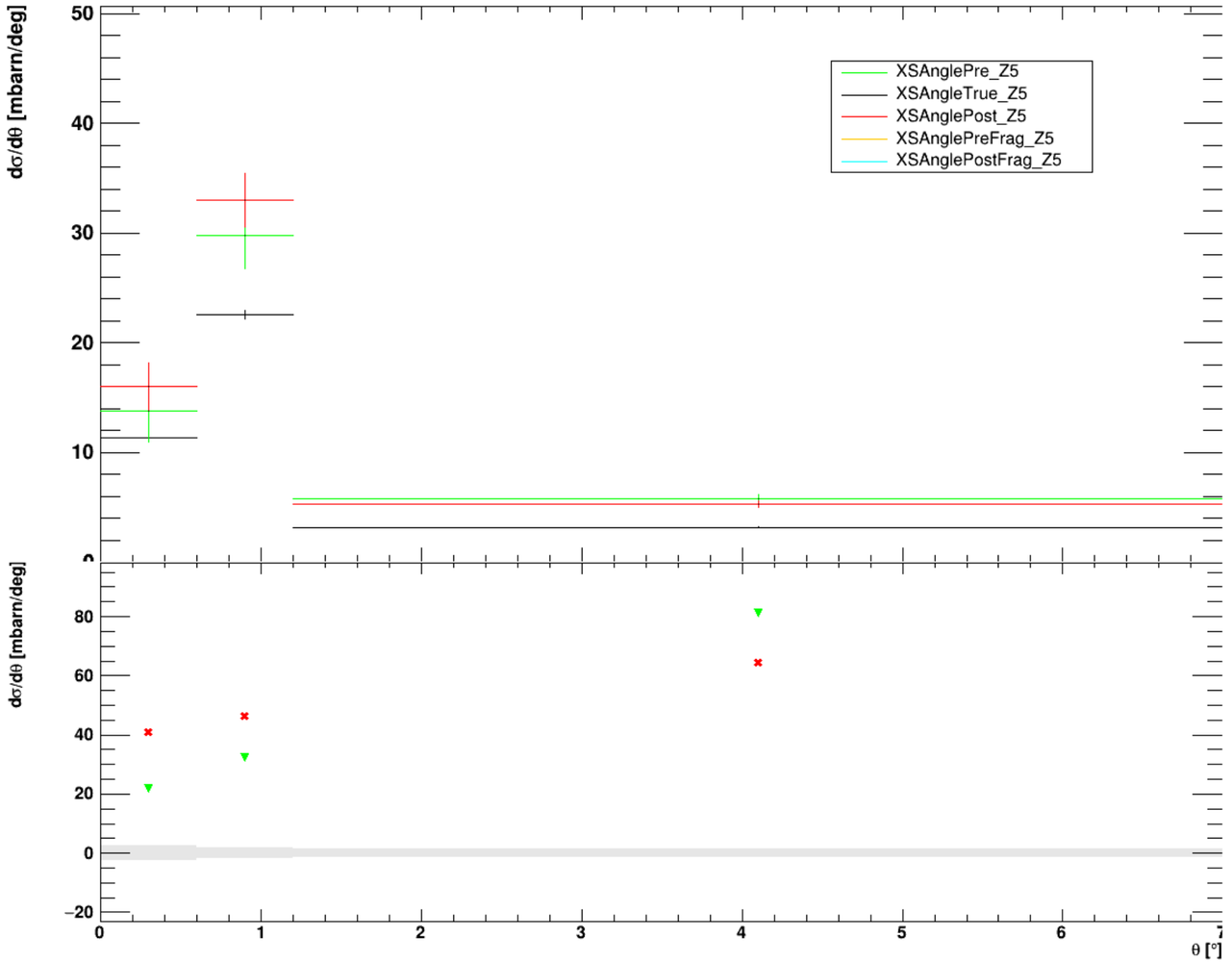
Checks on data vs MC



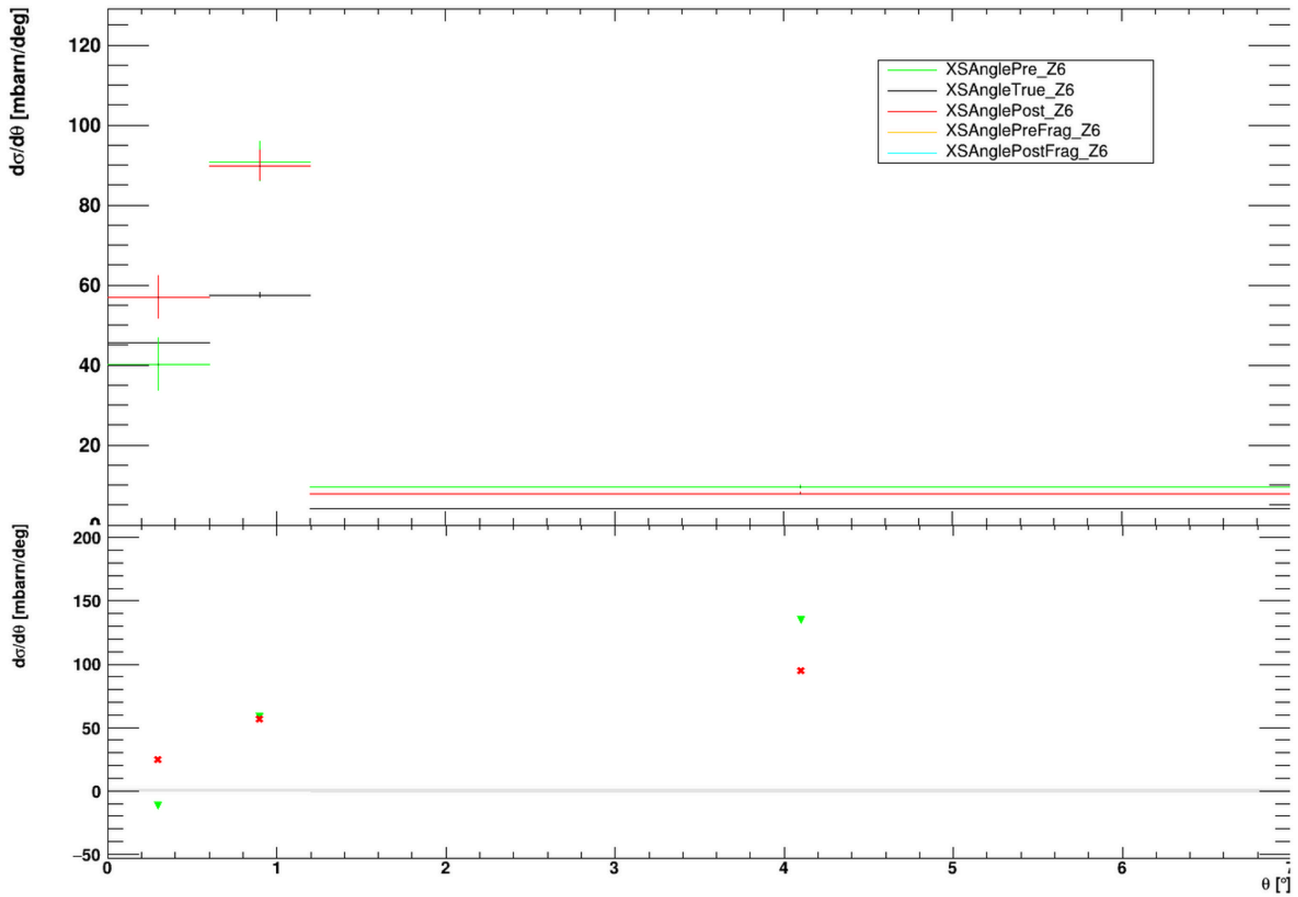


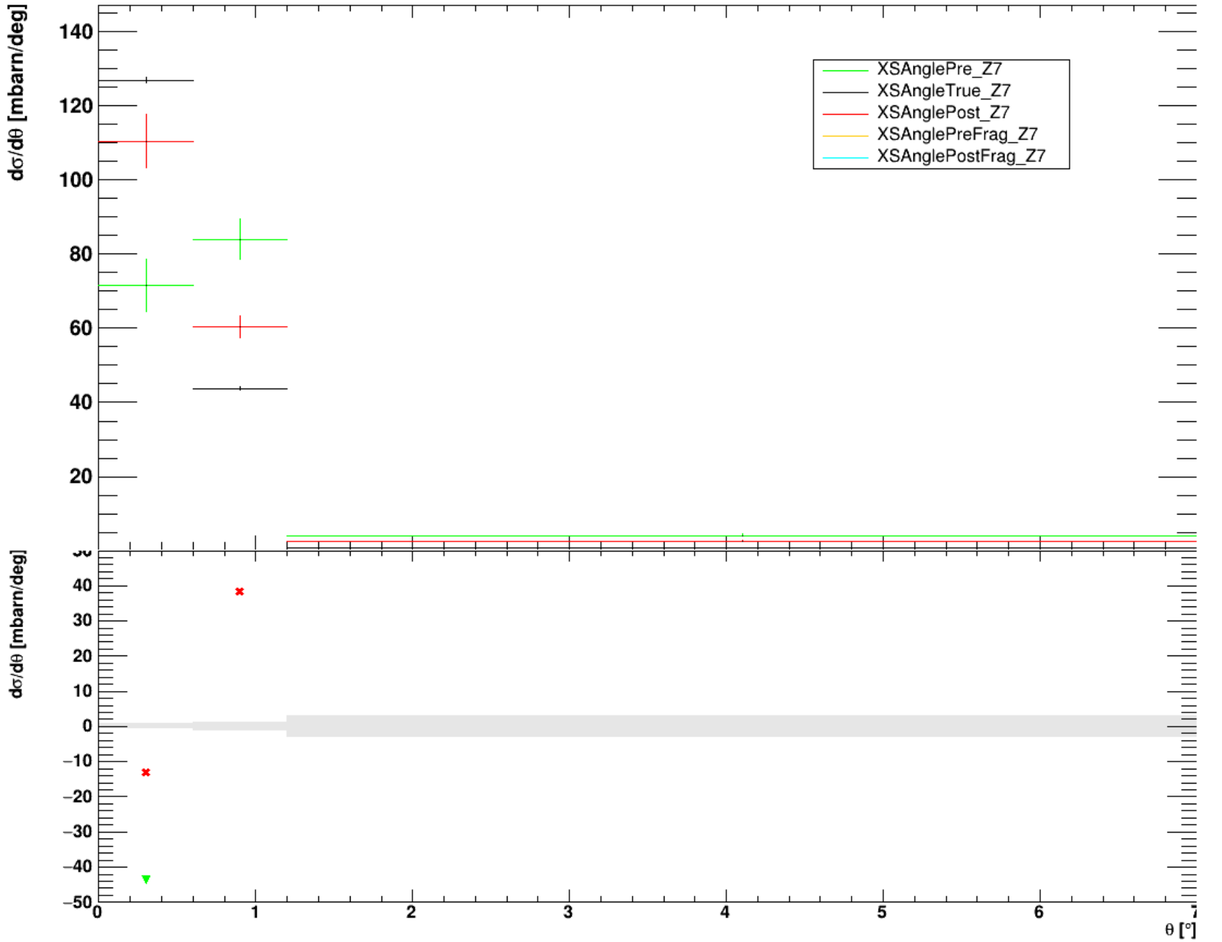
Checks on data vs MC



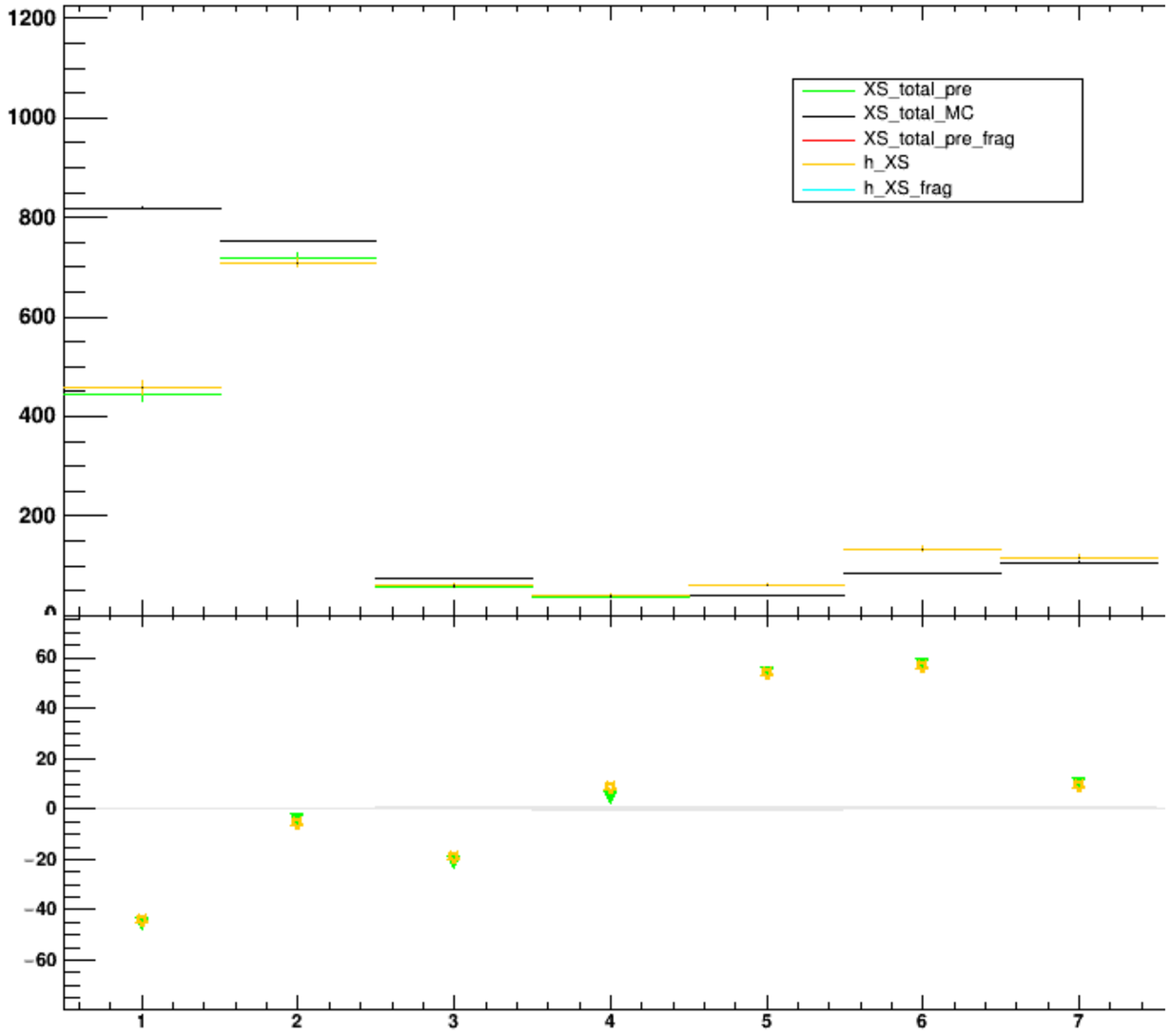


Checks on data vs MC





Checks on data vs MC



Next steps

Data seem to agree among runs

Unfolding under study, we would like to have control over 2 different methods in MC

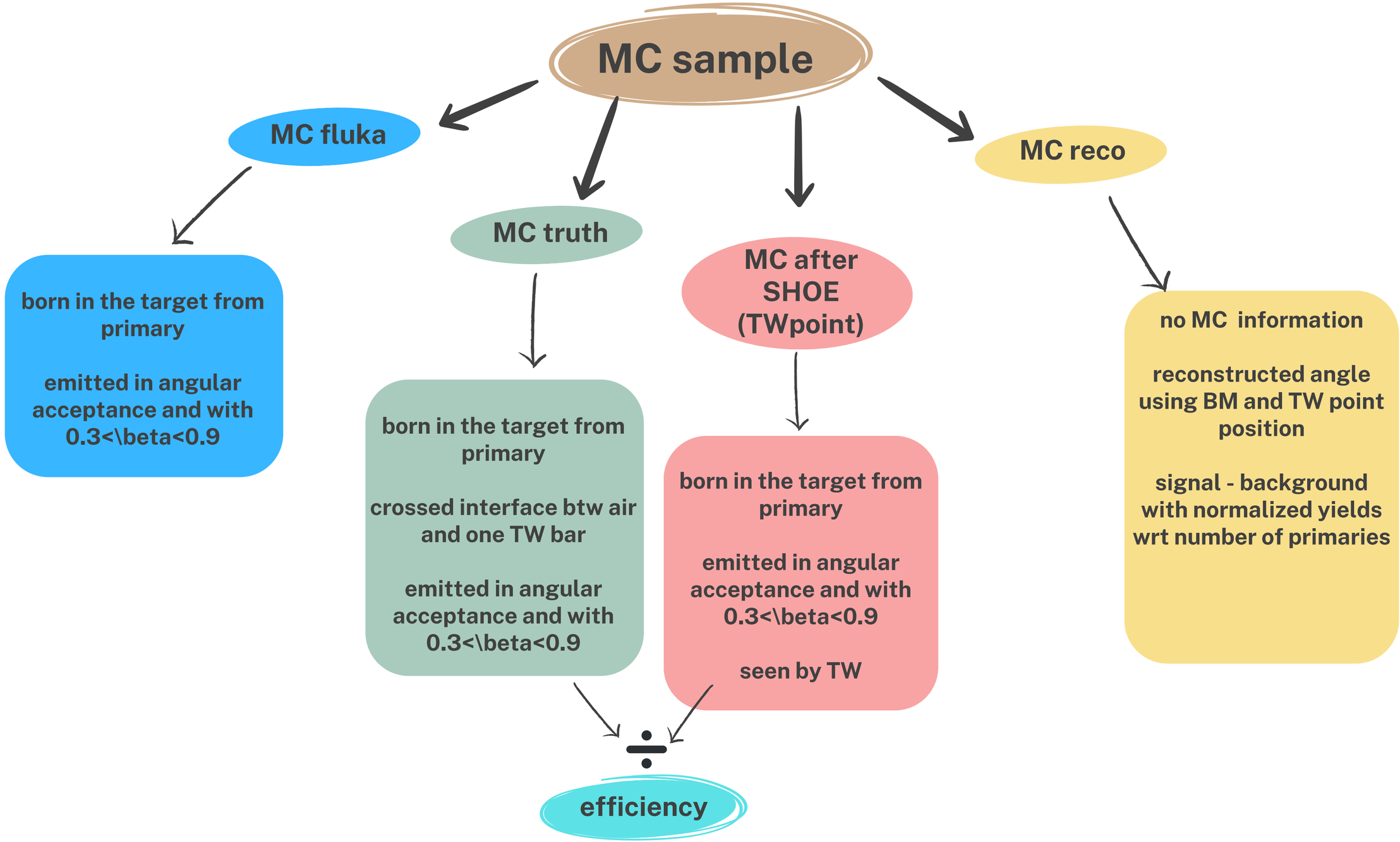
Evaluate trigger efficiencies impact on fragment yield

Analysis with new GSI21PS_MC campaign to be run very soon

Geometric efficiency

Start writing soon!

Thanks for listening!


MC sample
MC fluka
MC truth
MC after SHOE (TWpoint)
MC reco
born in the target from primary
emitted in angular acceptance and with 0.3<\beta<0.9
born in the target from primary
crossed interface btw air and one TW bar
emitted in angular acceptance and with 0.3<\beta<0.9
born in the target from primary
emitted in angular acceptance and with 0.3<\beta<0.9
seen by TW
no MC information
reconstructed angle using BM and TW point position
signal - background with normalized yields wrt number of primaries
÷
efficiency