Update on integral and elemental cross sections with GSI2021 data

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5 October 2022 – Physics meeting

Cross section measurements

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

With available data total integrated and angle differential cross section are achievable (no kinetic energy)

$$\Delta\sigma(Z) = \int_{E_{\min}}^{E_{\max}} \int_{0}^{\theta_{\max}} \left(\frac{\partial^2 \sigma}{\partial\theta \partial E_{\mathrm{kin}}} \right) \mathrm{d}\theta \mathrm{d}E_{\mathrm{kin}} = \frac{Y(Z)}{N_{\mathrm{prim}} \cdot N_{\mathrm{TG}} \cdot \varepsilon(Z)}$$

$$\frac{\mathrm{d}\sigma}{\mathrm{d}\theta}(Z) = \frac{Y(Z,\theta)}{N_{\mathrm{prim}} \cdot N_{\mathrm{TG}} \cdot \Delta\theta \cdot \varepsilon(Z,\theta)}$$

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Align FOOT detectors and estimate **angular acceptance**

Extract fragment yields from TW

Calculate MC efficiencies for fragments

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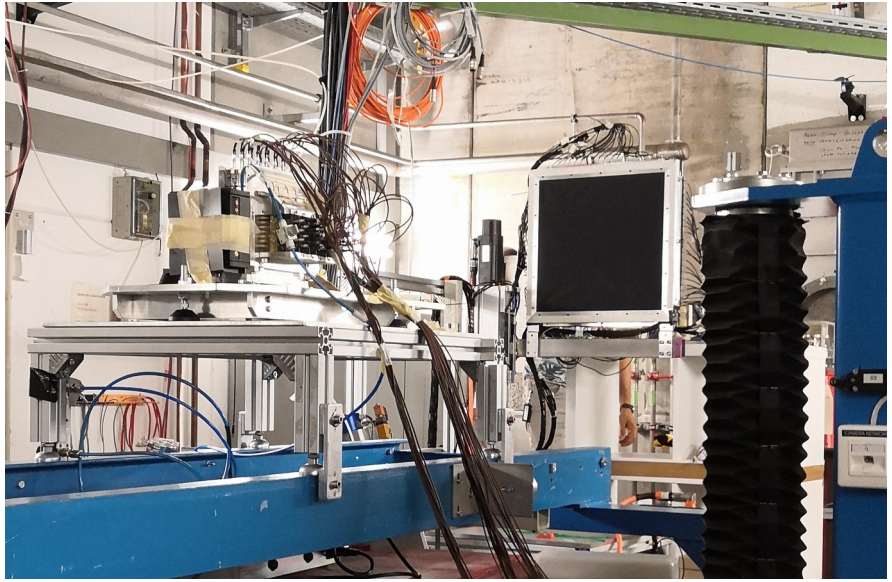
Run	Trigger type	Target	Events
4305	MB	C	162102
4306	MB	C	577096
4307	MB	C	513370
4308	Frag + MB	C	510169
4309	Frag + MB	C	531812
4310	Frag + MB	C	1012099
4313	MB	no	57133



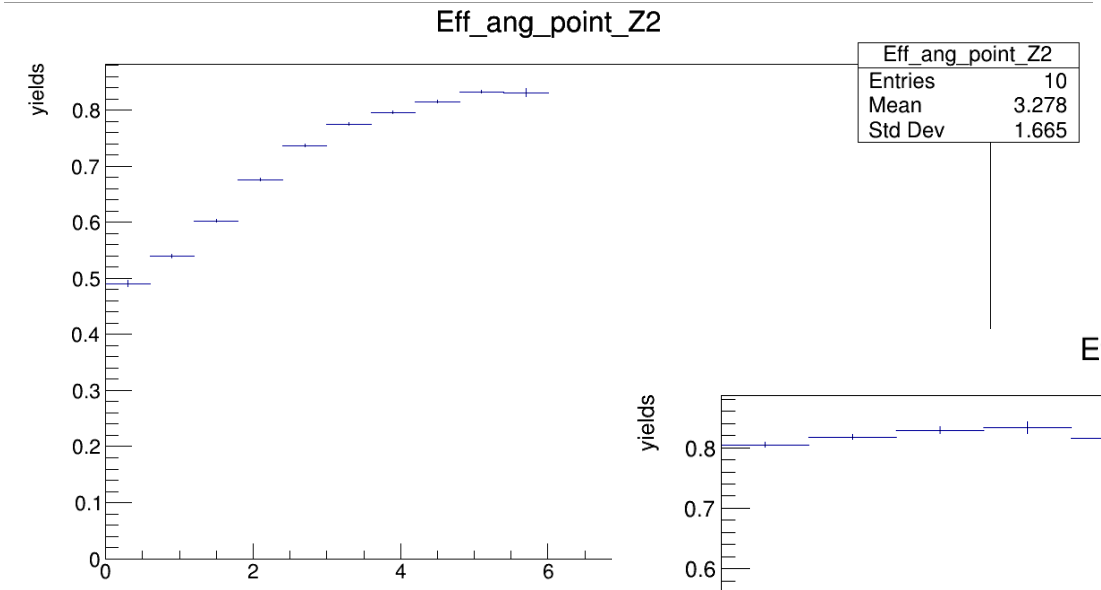
Cross section measurements

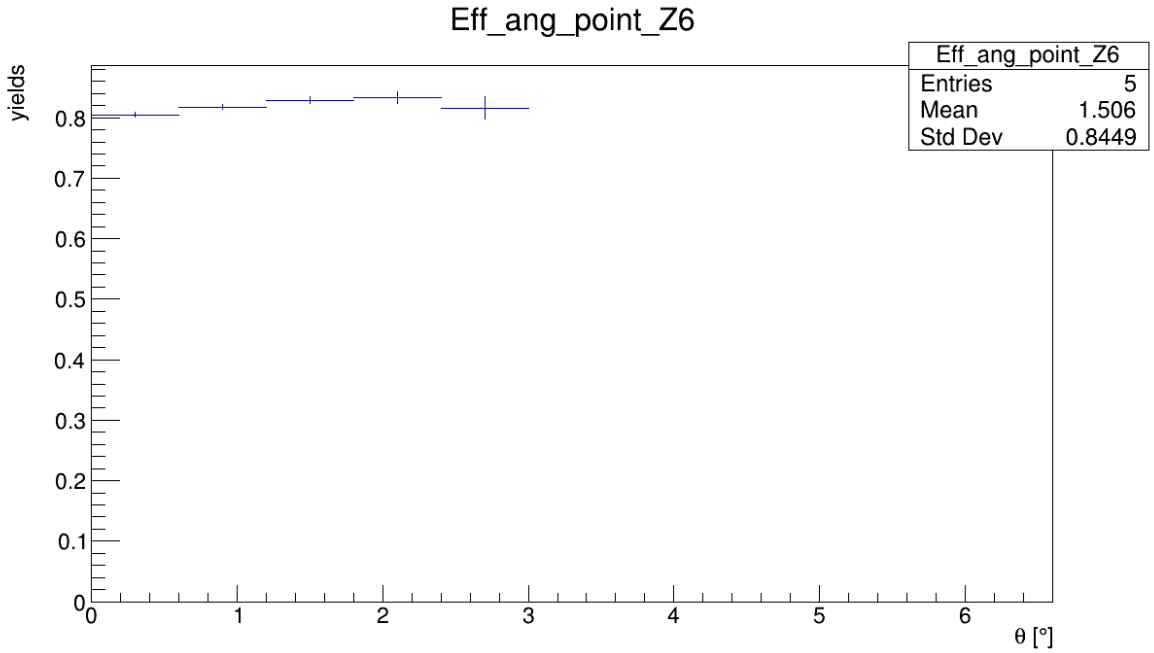
400 MeV/u ^{16}O beam on 5mm Carbon target

In this analysis VTX is not included, MSD is on track

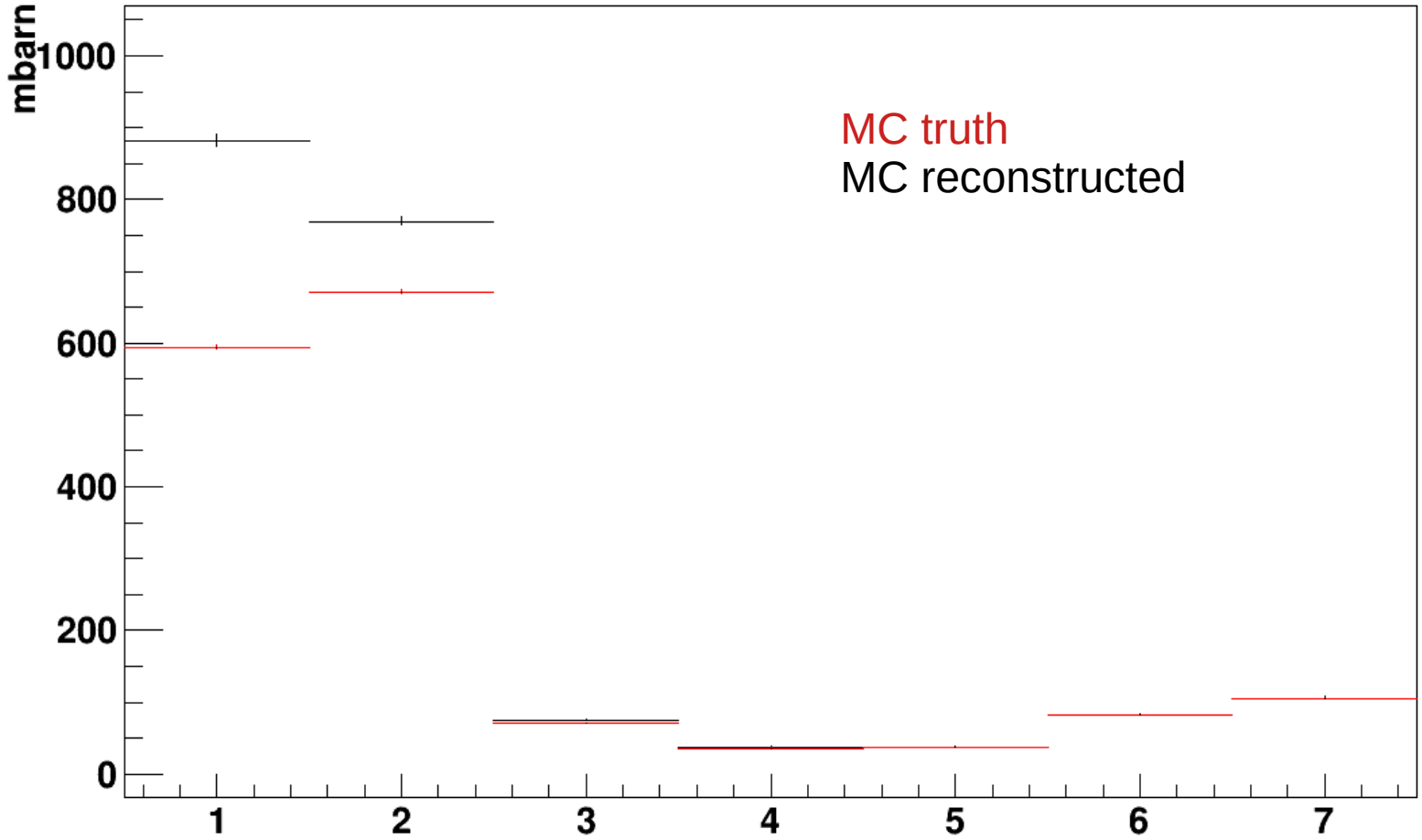
Fragmentation out of target will be estimated with no target runs

MC analysis

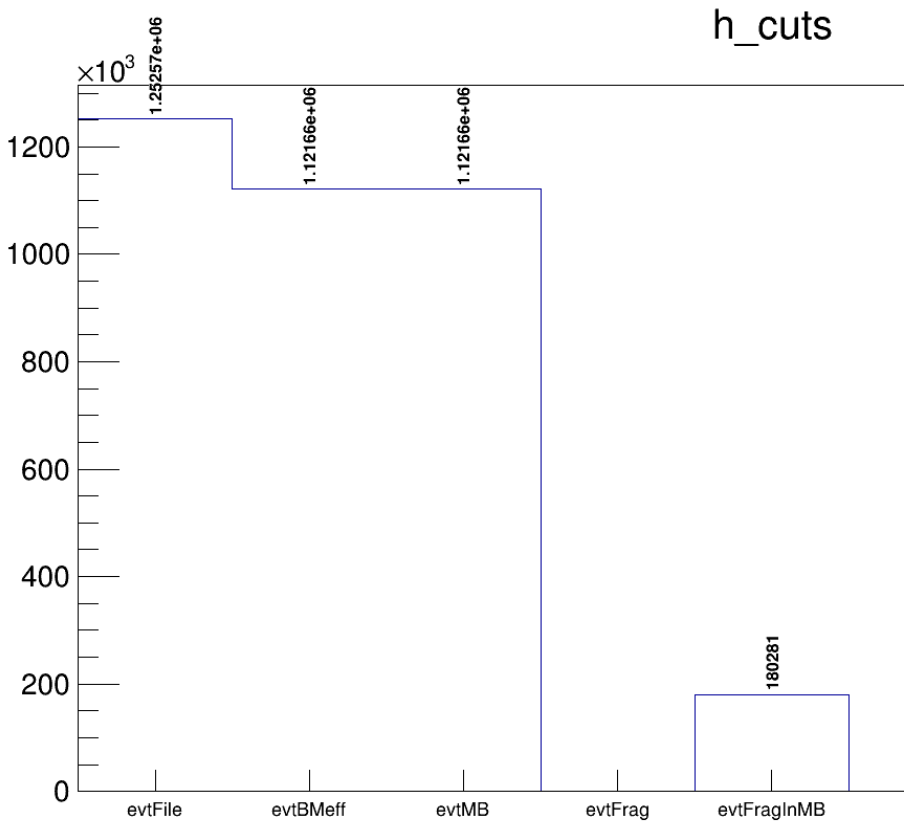

Eff_ang_point_Z2
yields
Eff_ang_point_Z2
Entries 10
Mean 3.278
Std Dev 1.665
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0
2
4
6


Eff_ang_point_Z6
yields
Eff_ang_point_Z6
Entries 5
Mean 1.506
Std Dev 0.8449
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0
1
2
3
4
5
6
θ [°]

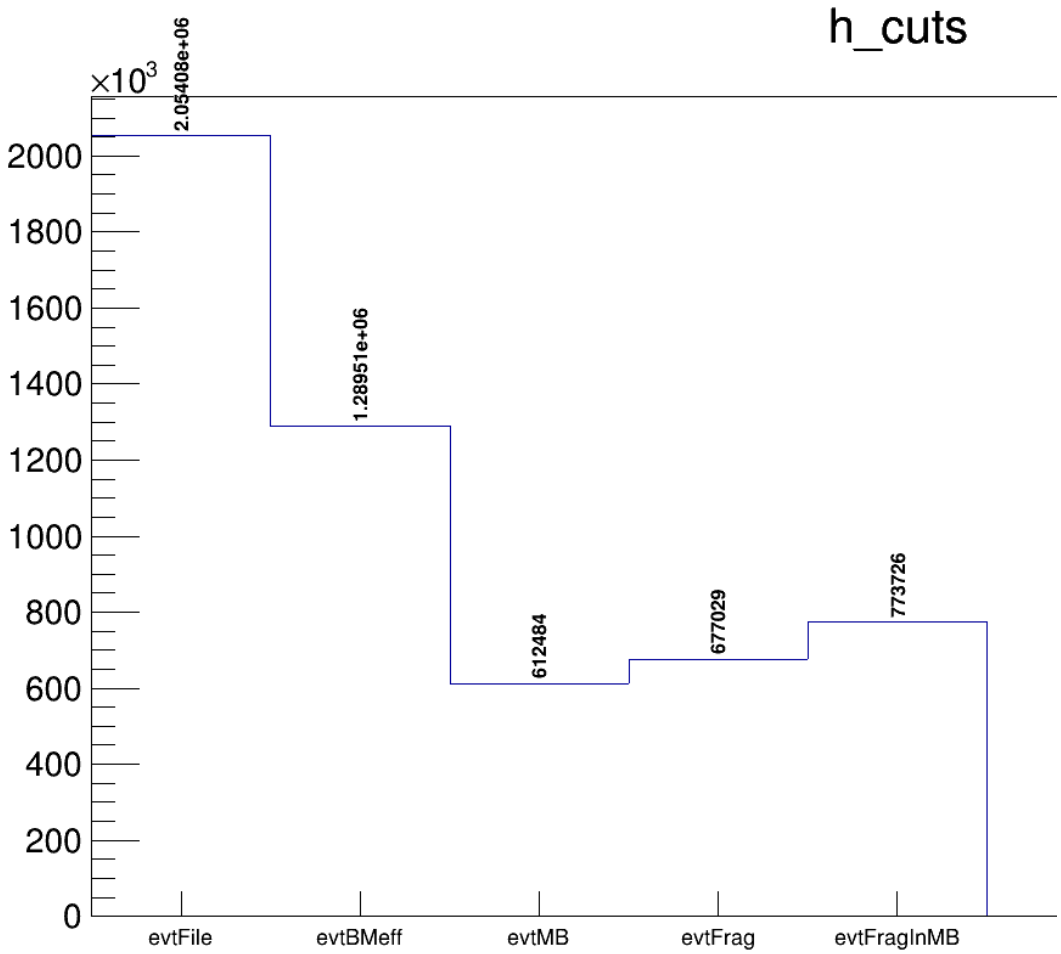
MC analysis


mbarn
1000
800
600
400
200
0
1
2
3
4
5
6
7
MC truth
MC reconstructed

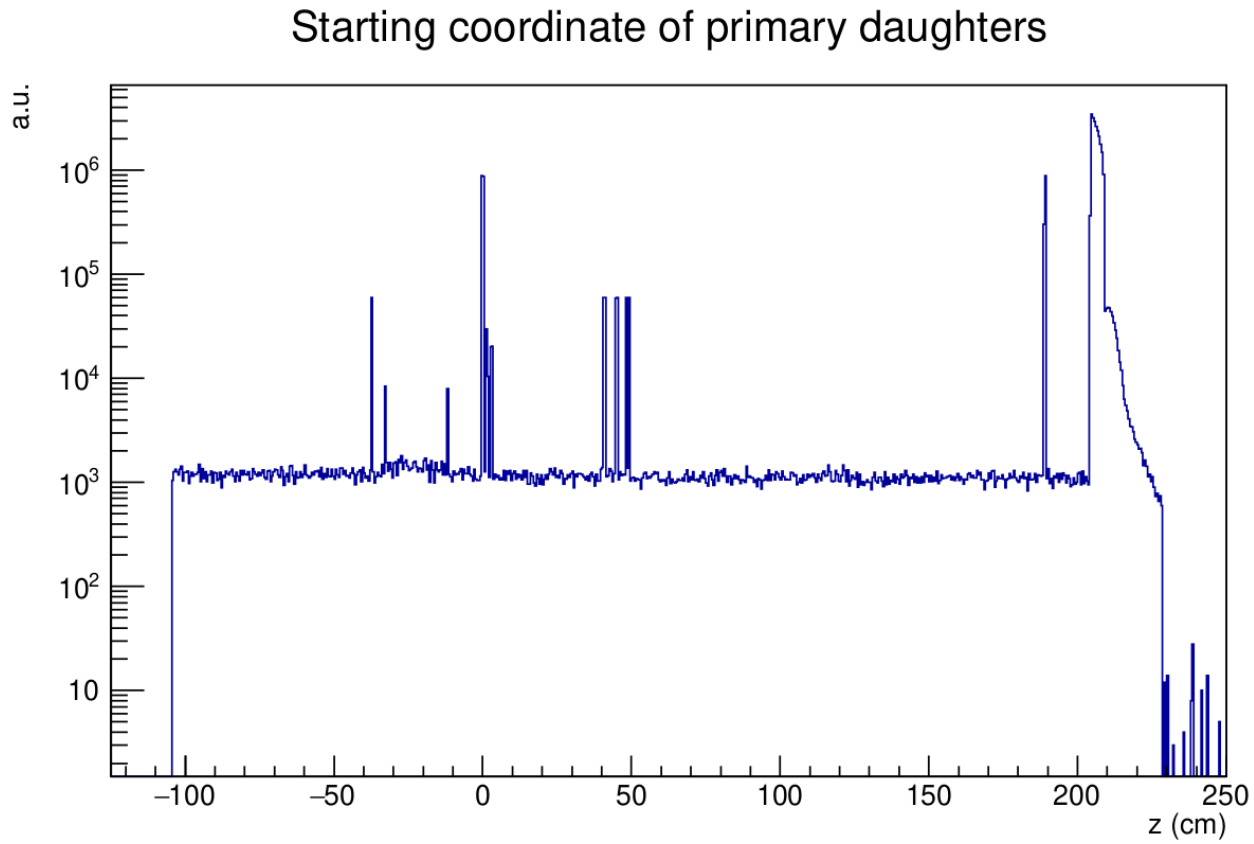
Cross section measurement MB (4305-6-7)



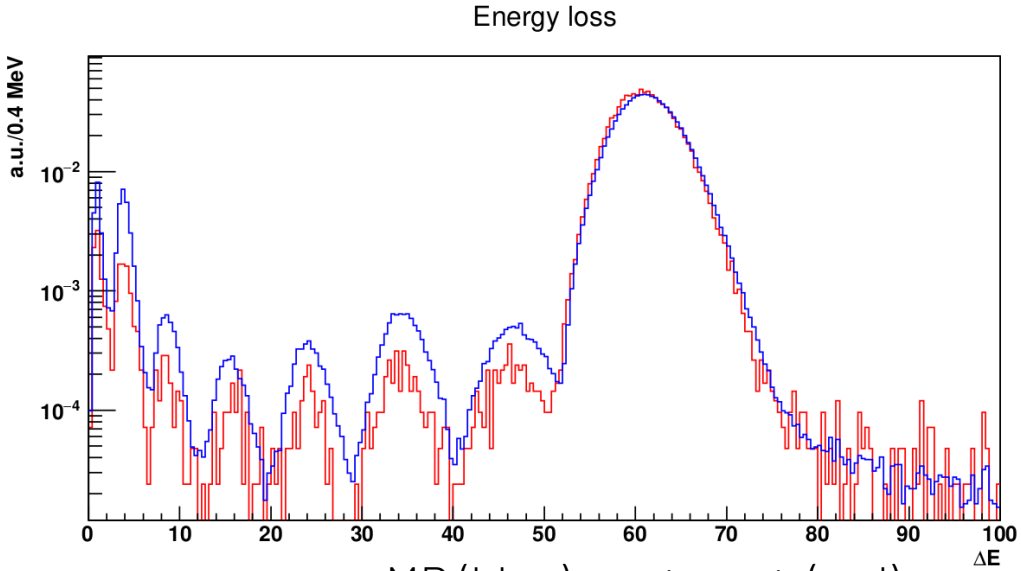
Cross section measurement FRAG (4308-9-10)



Background subtraction



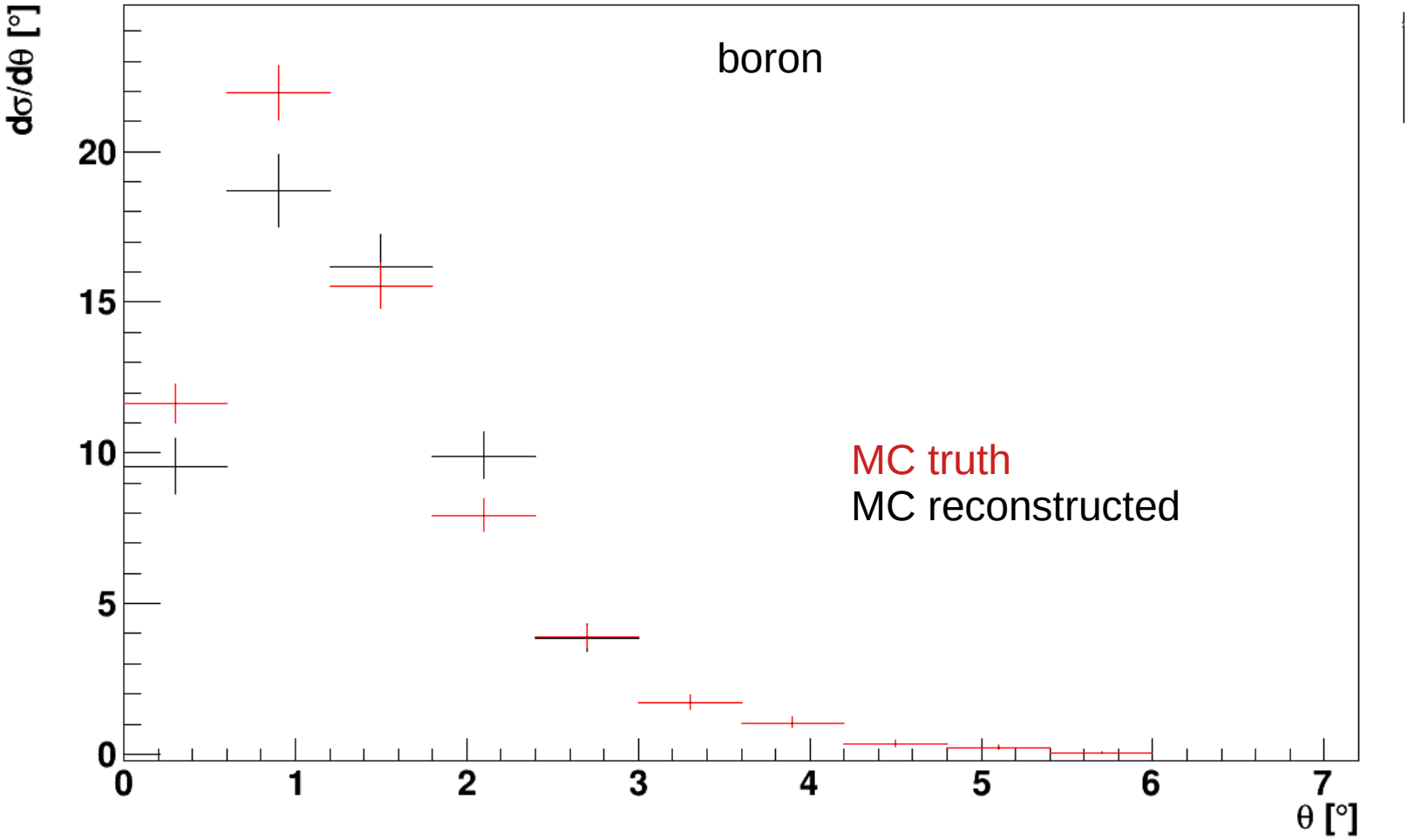
Background subtraction (4313)



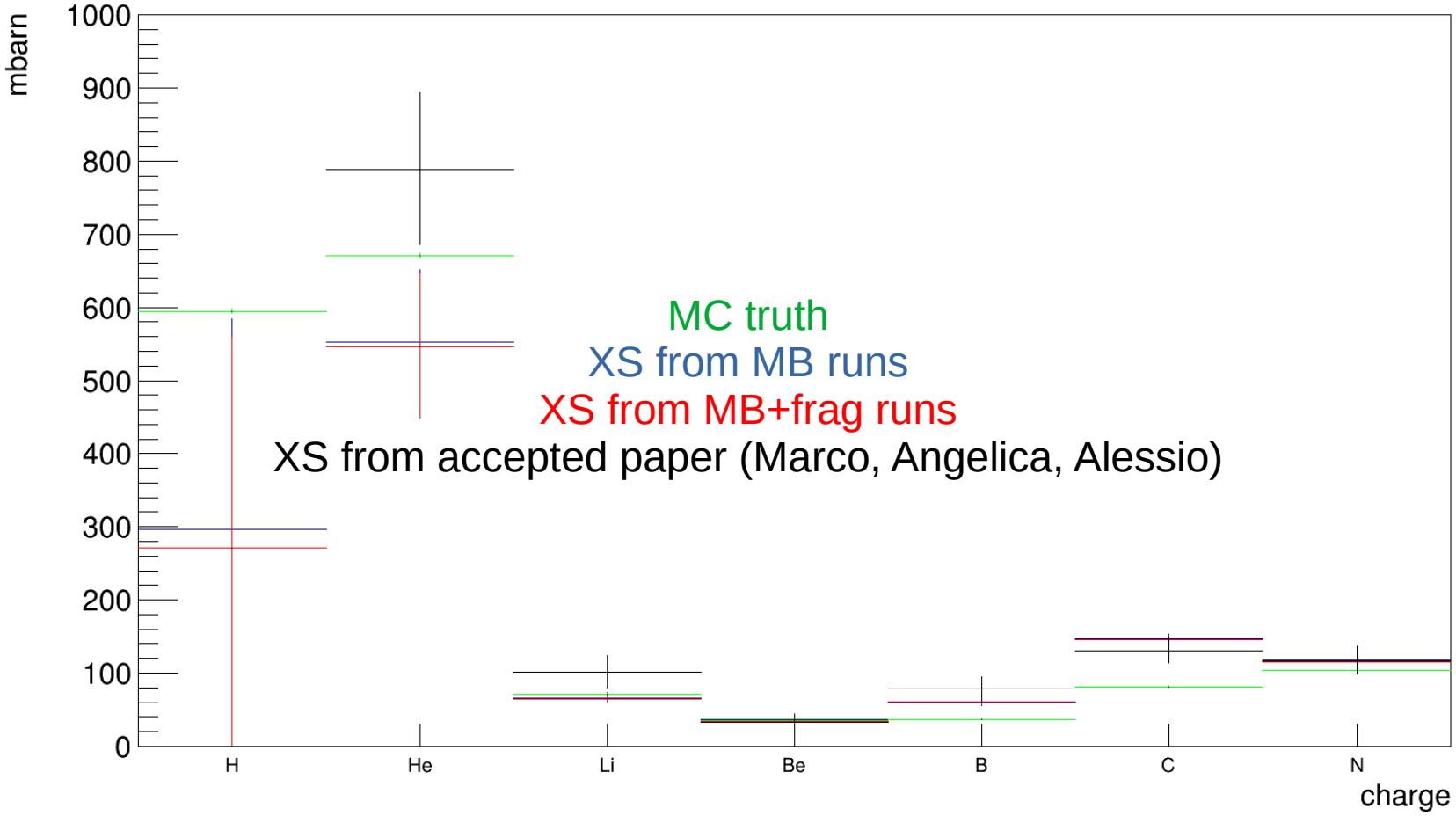
MB (blue), no-target (red)

$$\Delta\sigma(Z) = \frac{1}{N_{\mathrm{TG}} \cdot \varepsilon(Z)} \left(\frac{Y^{\mathrm{sig}}(Z)}{N^{\mathrm{sig}}_{\mathrm{prim}}(Z)} - \frac{Y^{\mathrm{bkg}}(Z)}{N^{\mathrm{bkg}}_{\mathrm{prim}}(Z)} \right)$$

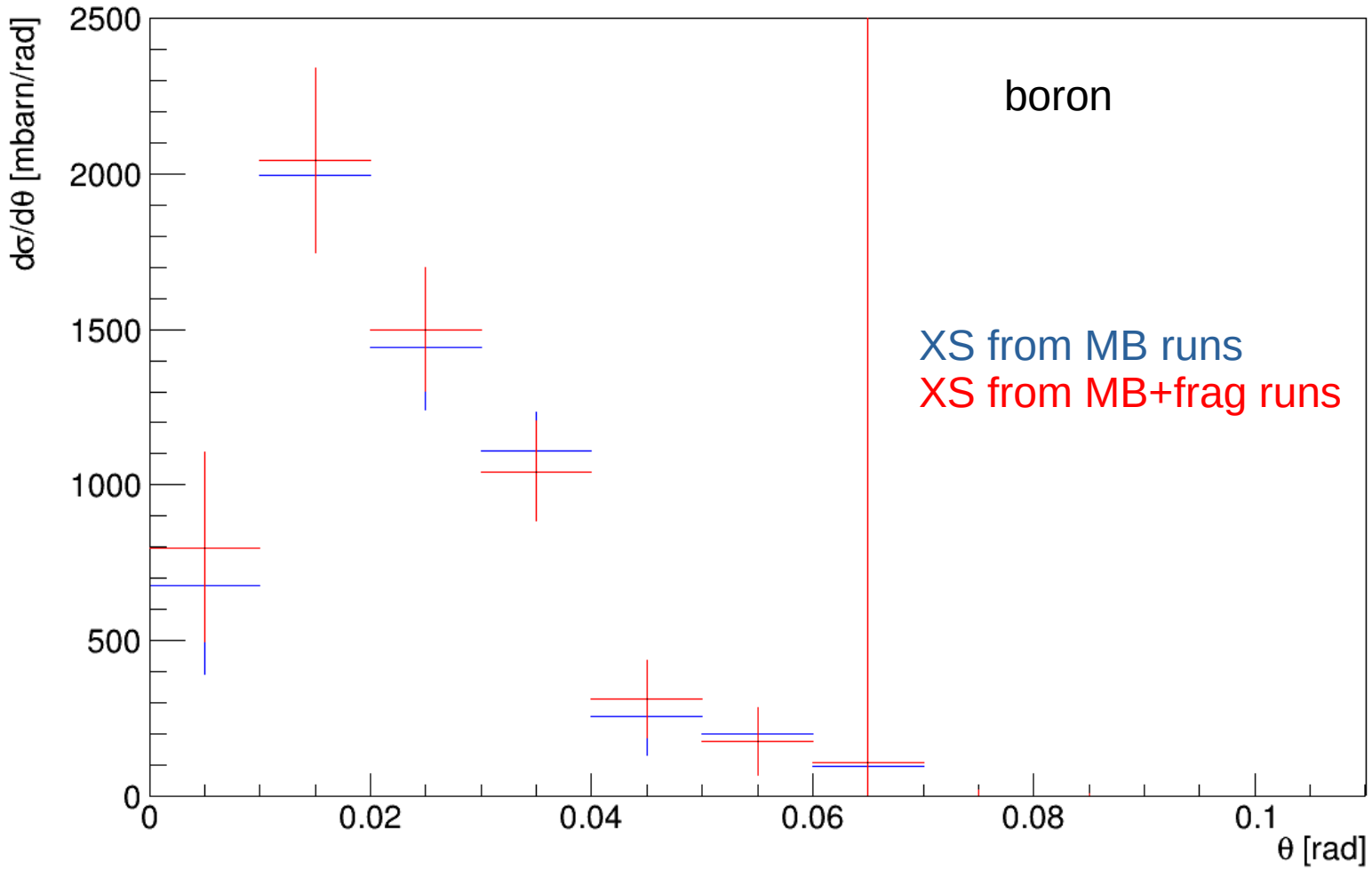
MC analysis



Results


mbarn
1000
900
800
700
600
500
400
300
200
100
0
H
He
Li
Be
B
C
N
charge
MC truth
XS from MB runs
XS from MB+frag runs
XS from accepted paper (Marco, Angelica, Alessio)

Results


boron
XS from MB runs
XS from MB+frag runs
dσ/dθ [mbarn/rad]
θ [rad]
2500
2000
1500
1000
500
0
0
0.02
0.04
0.06
0.08
0.1

Thanks for your attention!