



ECC: SUMMARY OF MC ANALYSIS

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STATE OF ART

SIMULATIONS FOR EMULSION EXPOSURE AT GSI

Already done with the following beams:

- He@700 MeV / n $\longrightarrow$ space radio protection
- C@200 MeV / n $\longrightarrow$ hadron therapy fragmentation

Next:

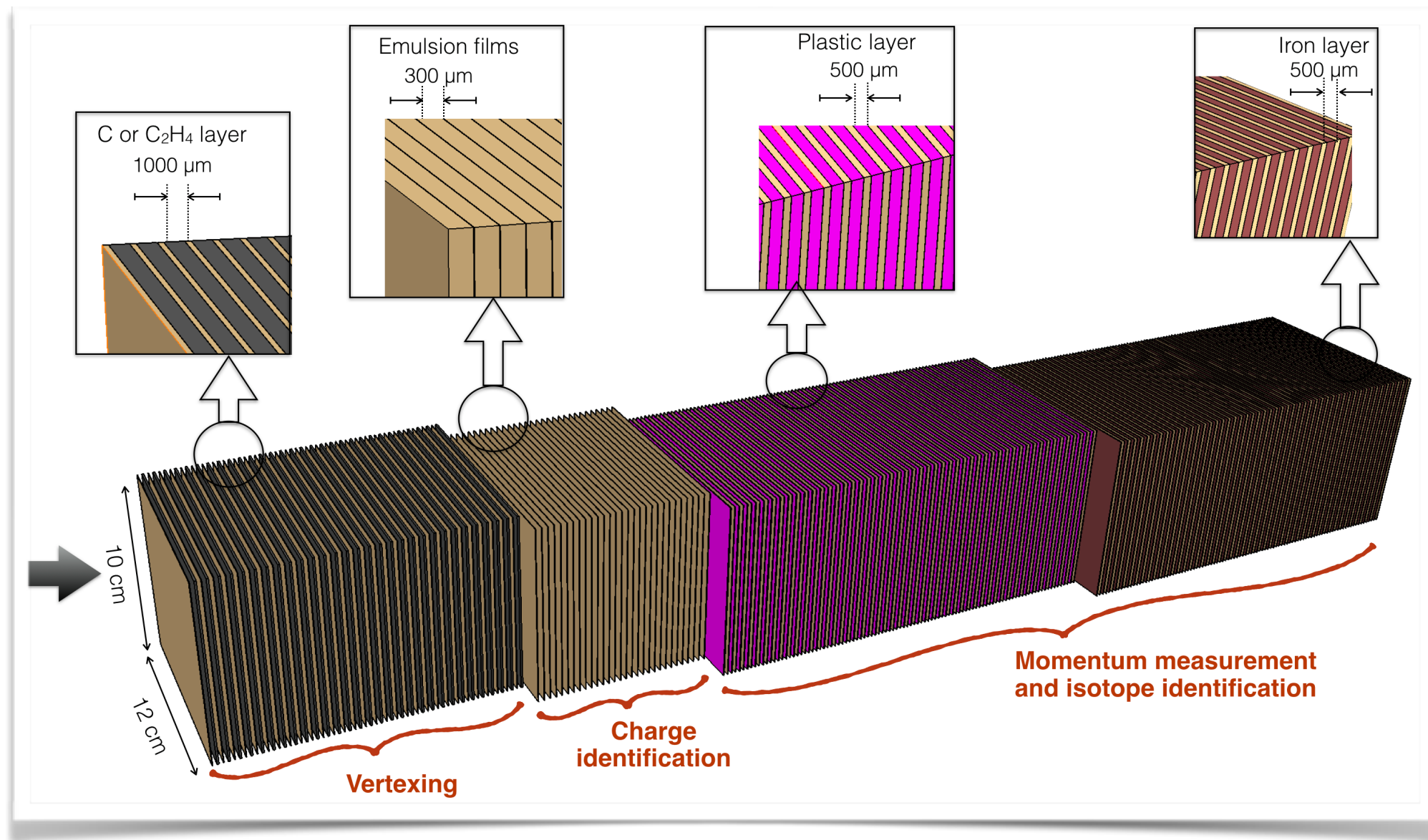
- O@200 MeV / n $\longrightarrow$ hadron therapy fragmentation
- O@400 MeV / n $\longrightarrow$ hadron therapy fragmentation

GENERAL STRUCTURE OF EMULSION DETECTOR

SECTION 1: alternated layers of emulsion films and target (C/C_2H_4) —> vertexing

SECTION 2: emulsion films only —> charge identification

SECTION 3 and followings: alternated layers of emulsion films and passive materials —> momentum measurement and isotope identification



Optimisation on-going: materials, thickness, number of layers...

OPTIMISATION REQUIREMENTS

- Primary beam interactions in S1 ~ 10-15%
- Containment of the entire event in order to measure all tracks momentum (including secondary re-interactions)

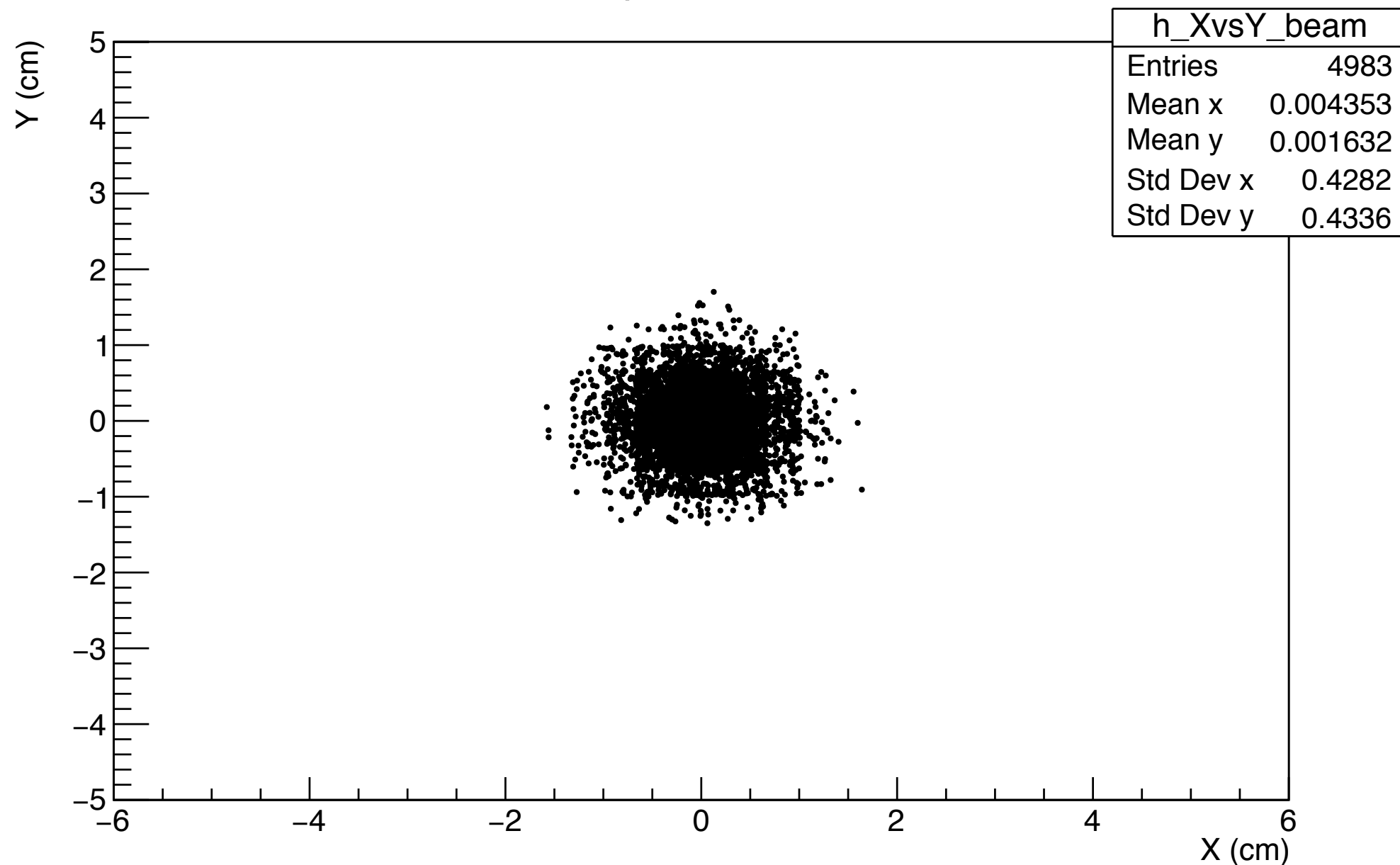
Optimisation on-going: materials, thickness, number of layers...

SIMULATION WITH He@700 MeV

BEAM HE4

- He4 @ 700 MeV/n
- 5000 events
- Gaussian Shape, FWHM 1cm
- @-30cm in z

Beam position at Z=0



DETECTOR STRUCTURES

GEO1:

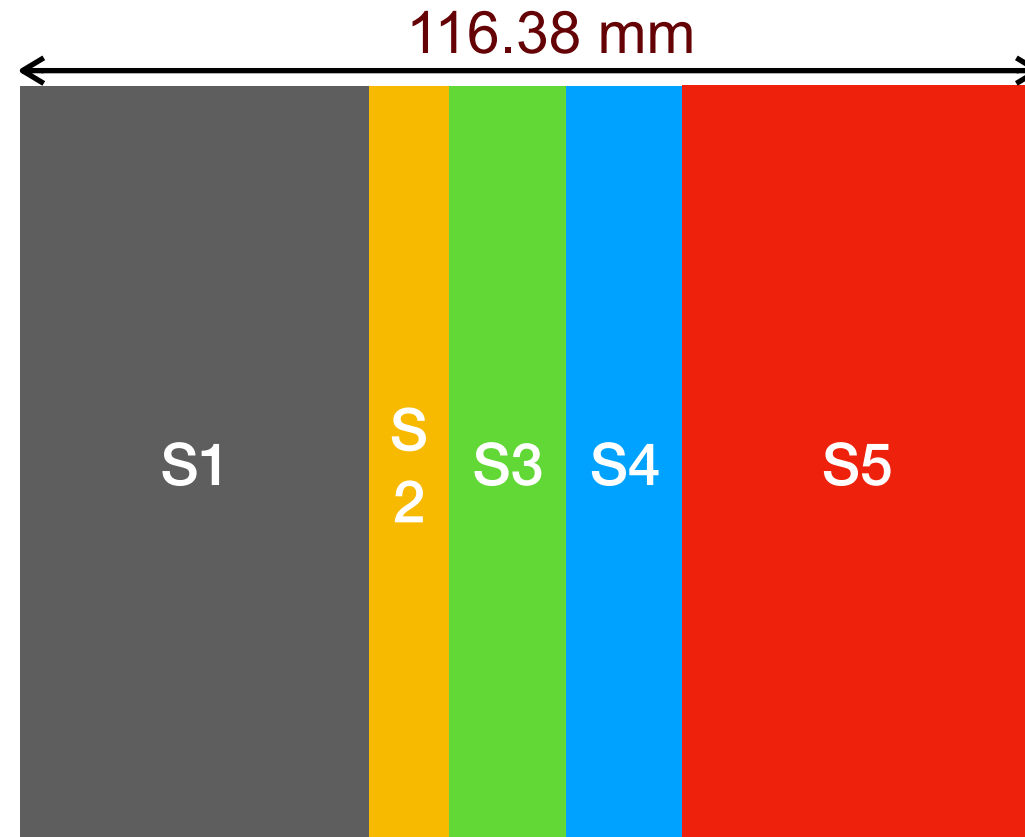
S1: C / C₂H₄ (30x1mm)+30emu

S2: Emu (27)

S3: C (10x1mm)+10emu

S4: Fe (10x1mm)+10emu

S5: W (30x1mm)+30emu



GEO2:

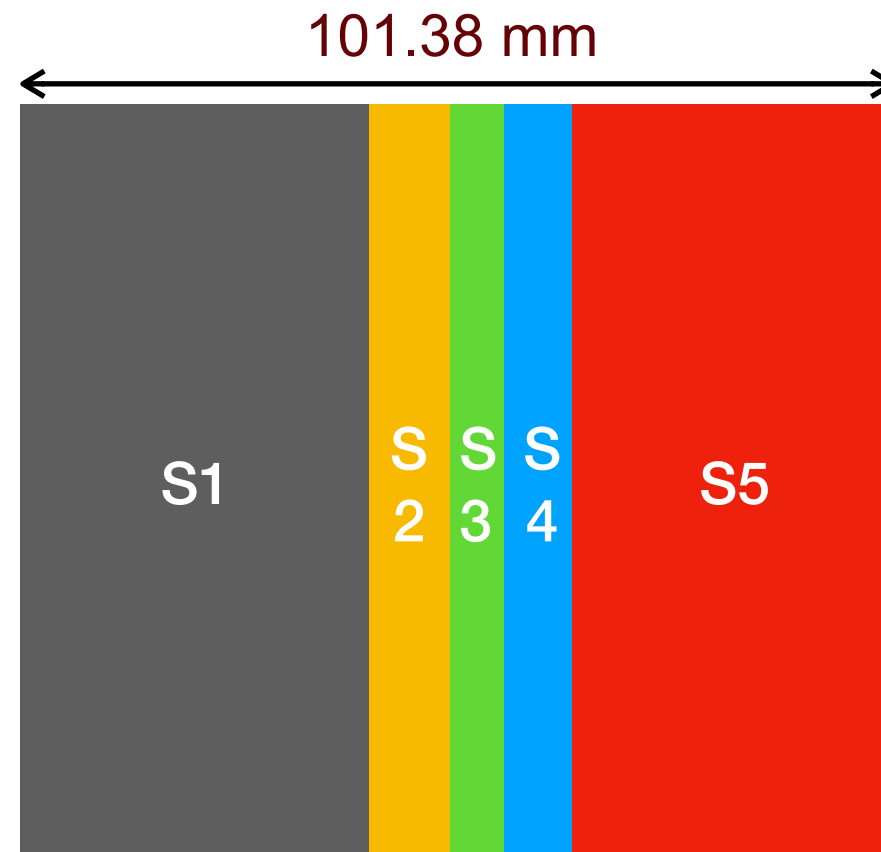
S1: C / C₂H₄ (30x1mm)+30emu

S2: Emu (27)

S3: W (10x0.3mm)+10emu

S4: W (10x0.5mm)+10emu

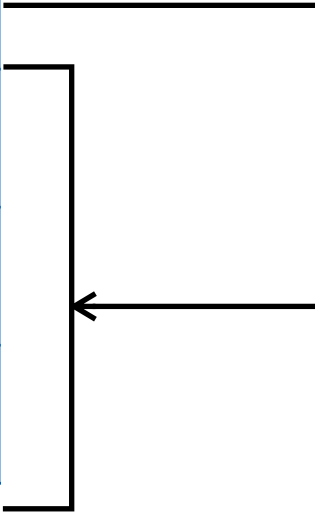
S5: W (30x0.9mm)+30emu



HE4@700 MeV / n
TARGET (S1): CARBON

RECONSTRUCTION

Step	GEO 1 (S3 CFeW)		GEO 2 (S3 W)
Beam	5000		
Reaches in S1	99.6%		
VTX in S1	15.7%		
All He4 daughters contained	2.6%		4.3%
Exit lateral(*)	2.2%		1.4%
Exit at the end (**)	10.9%		10.1%

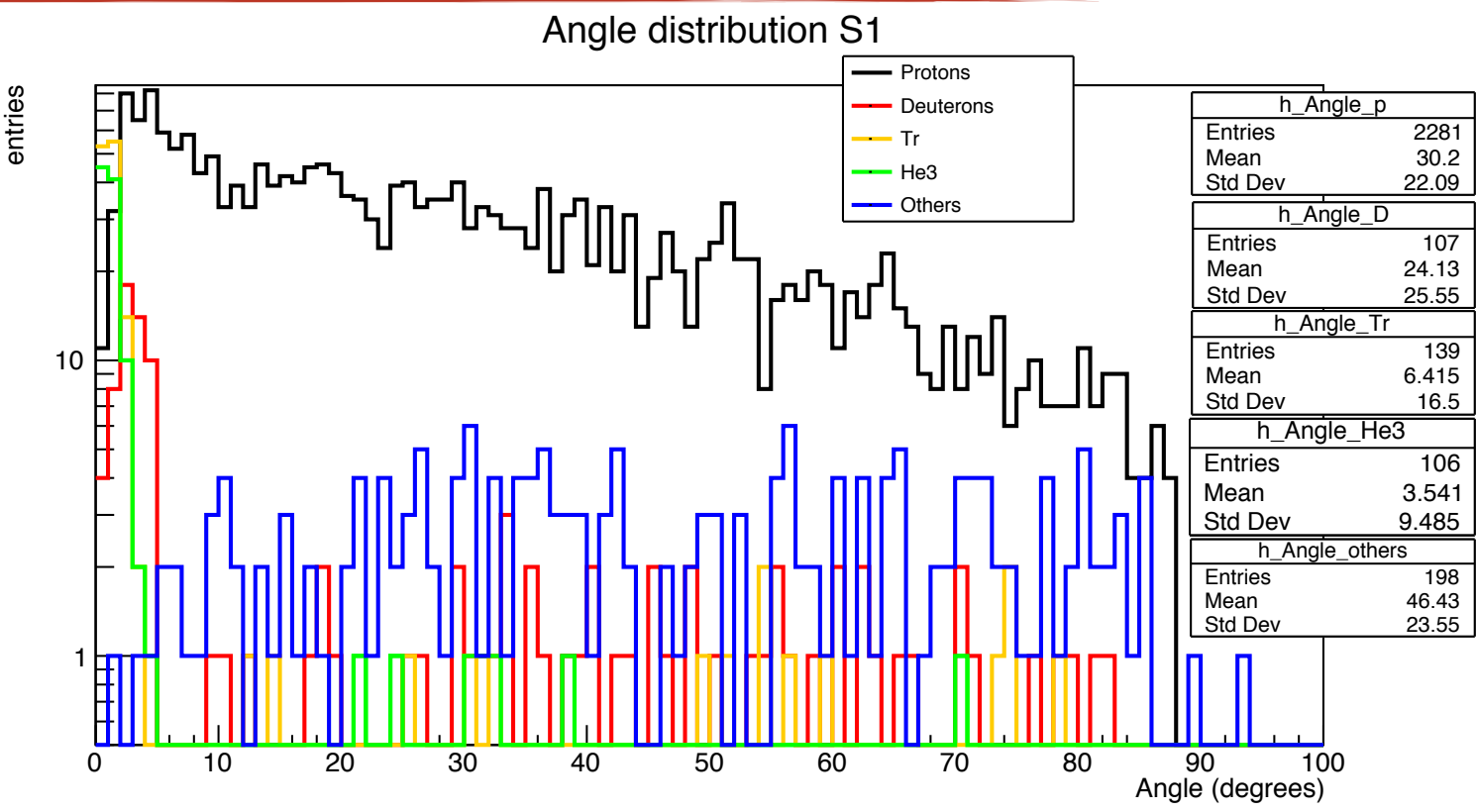
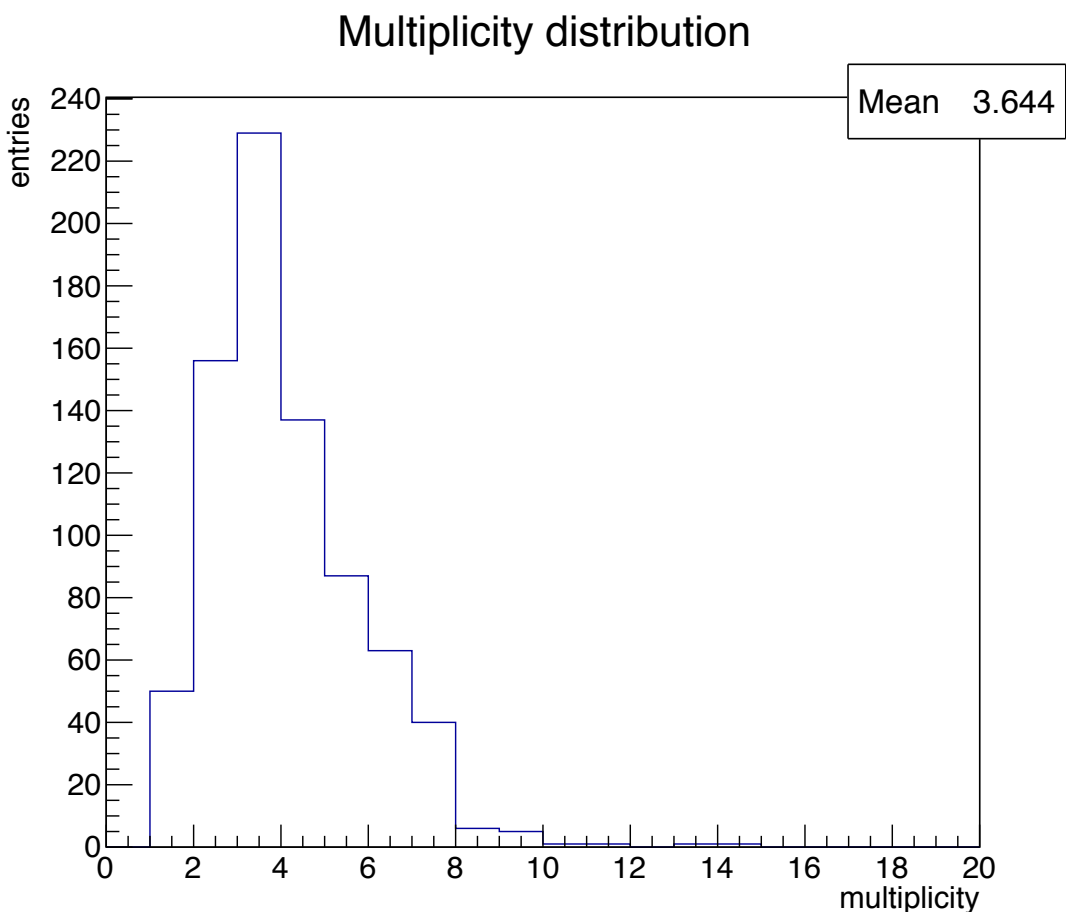


* = last segment coordinates at 0.5 cm from the edge

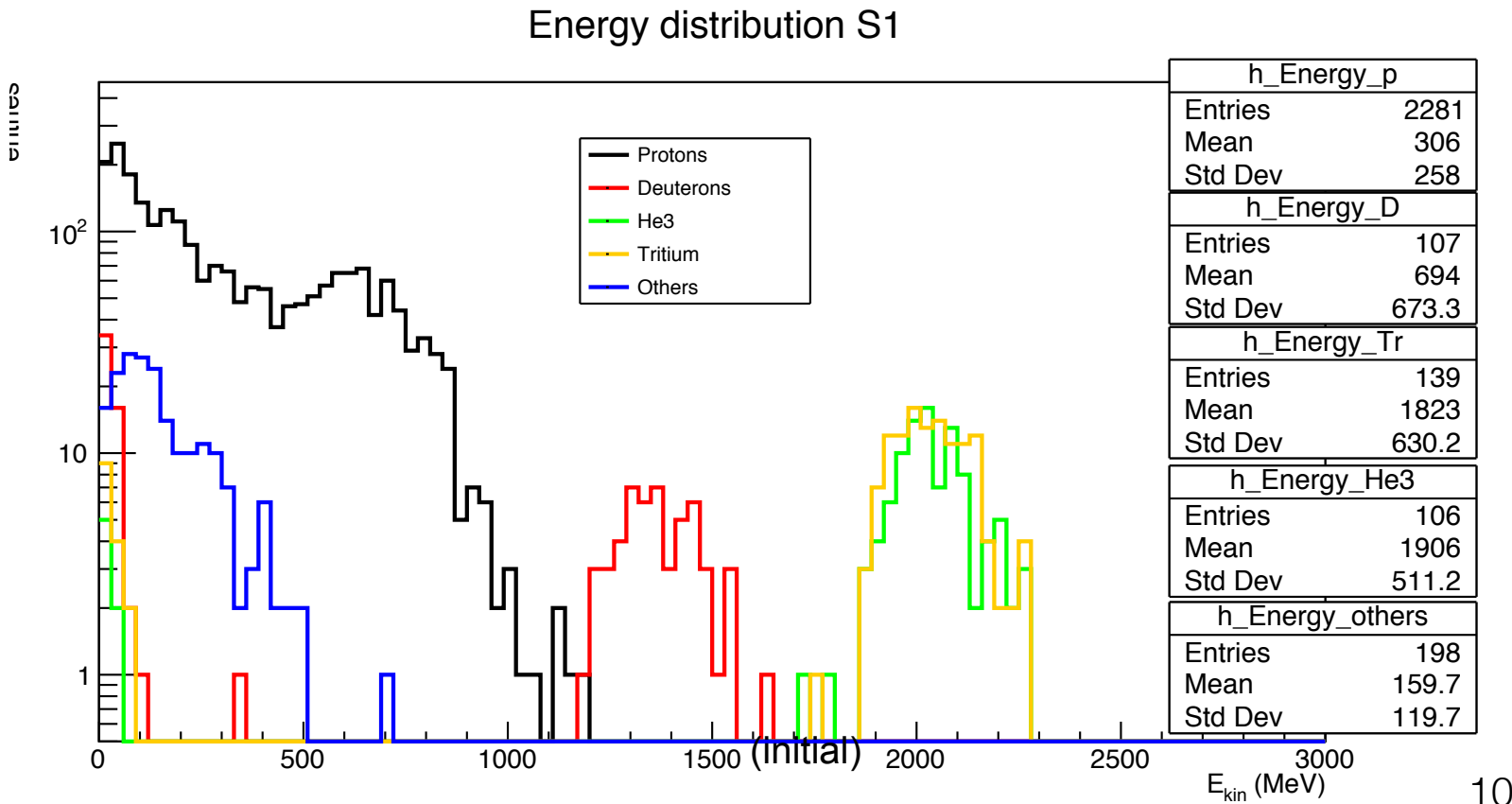
** = end point in the last 2 plates

ANGLE DISTRIBUTION

MULTIPLICITY S1



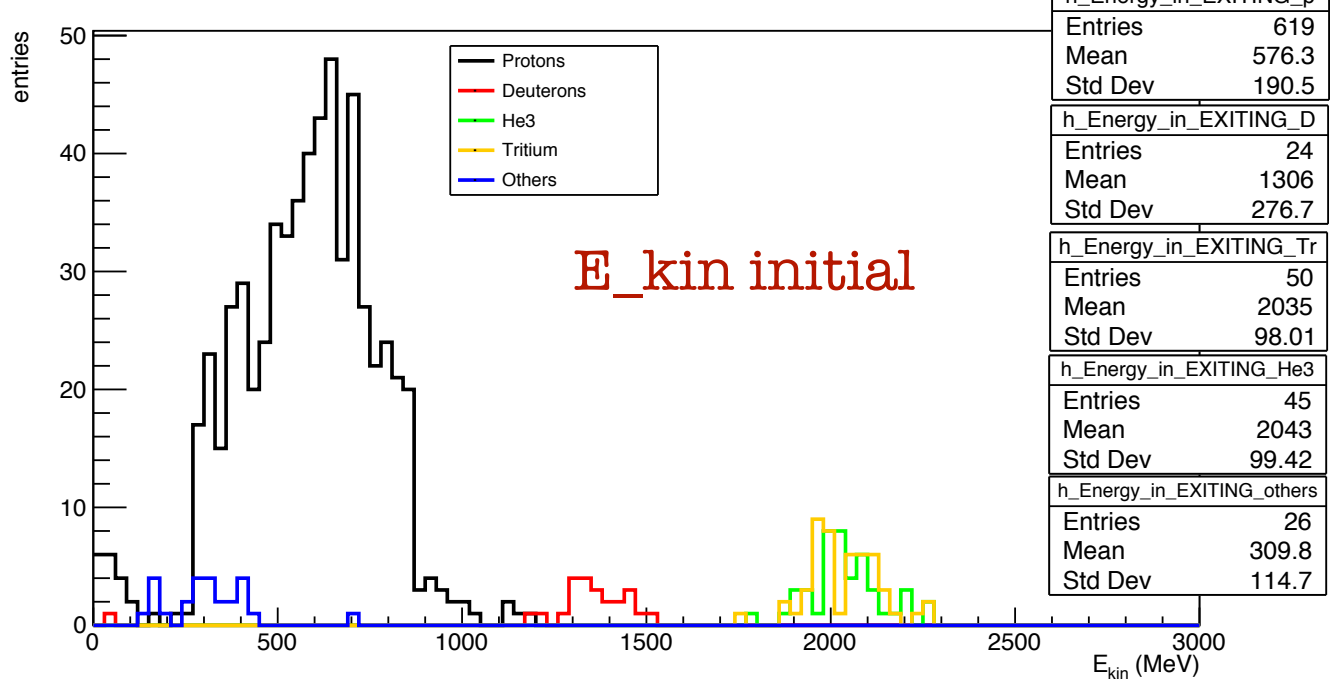
ENERGY DISTRIBUTION



TRACKS EXITING AT THE END OF S5

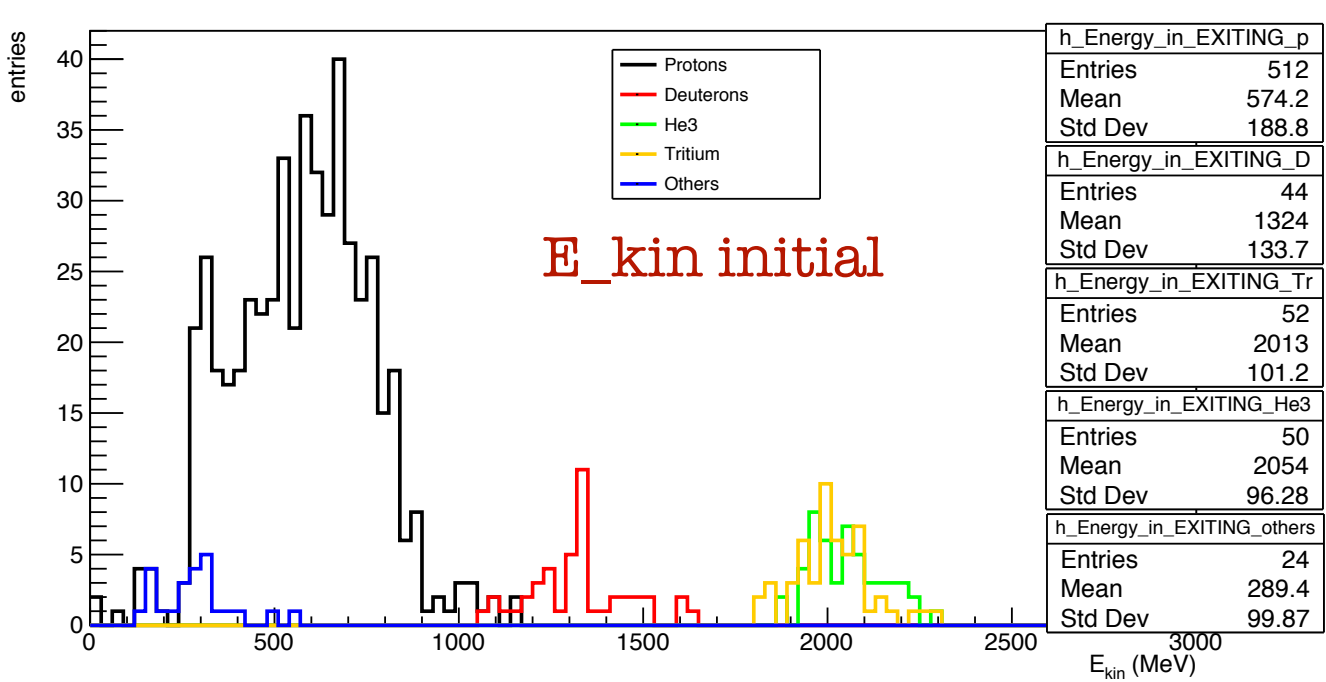
Geo1

Initial E_{kin} distribution for tracks exiting last plate

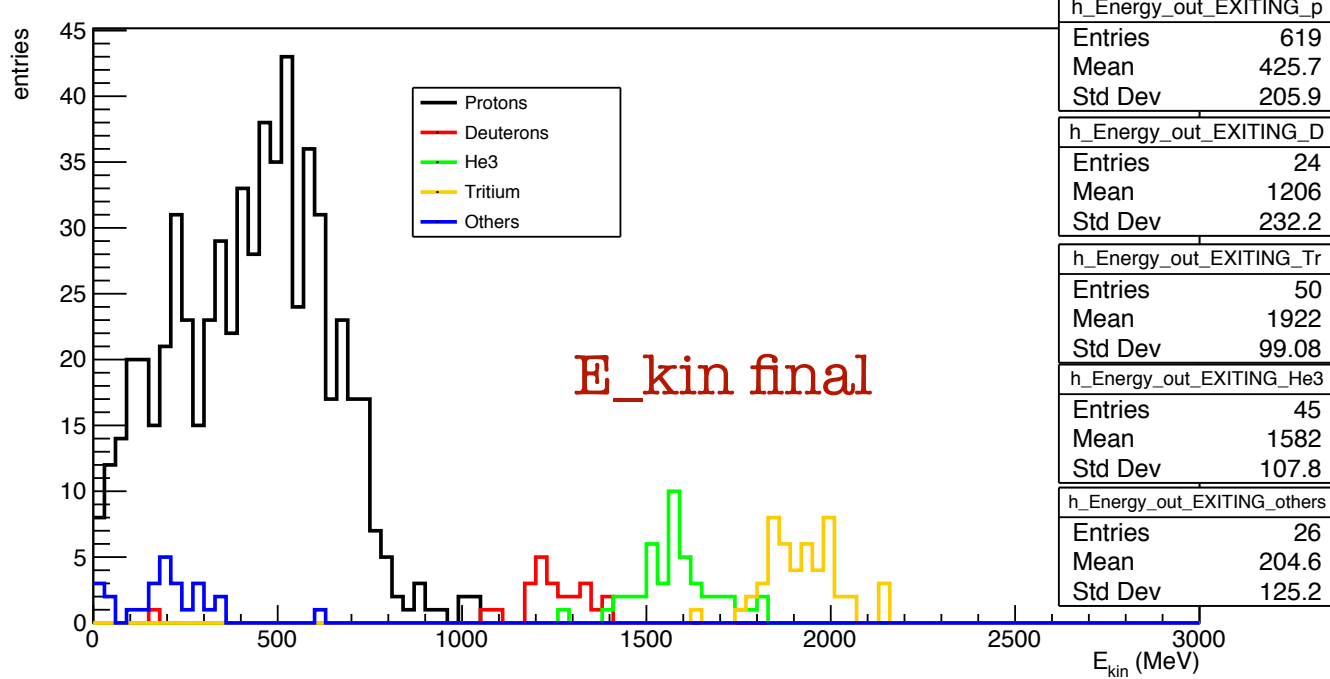


Geo2

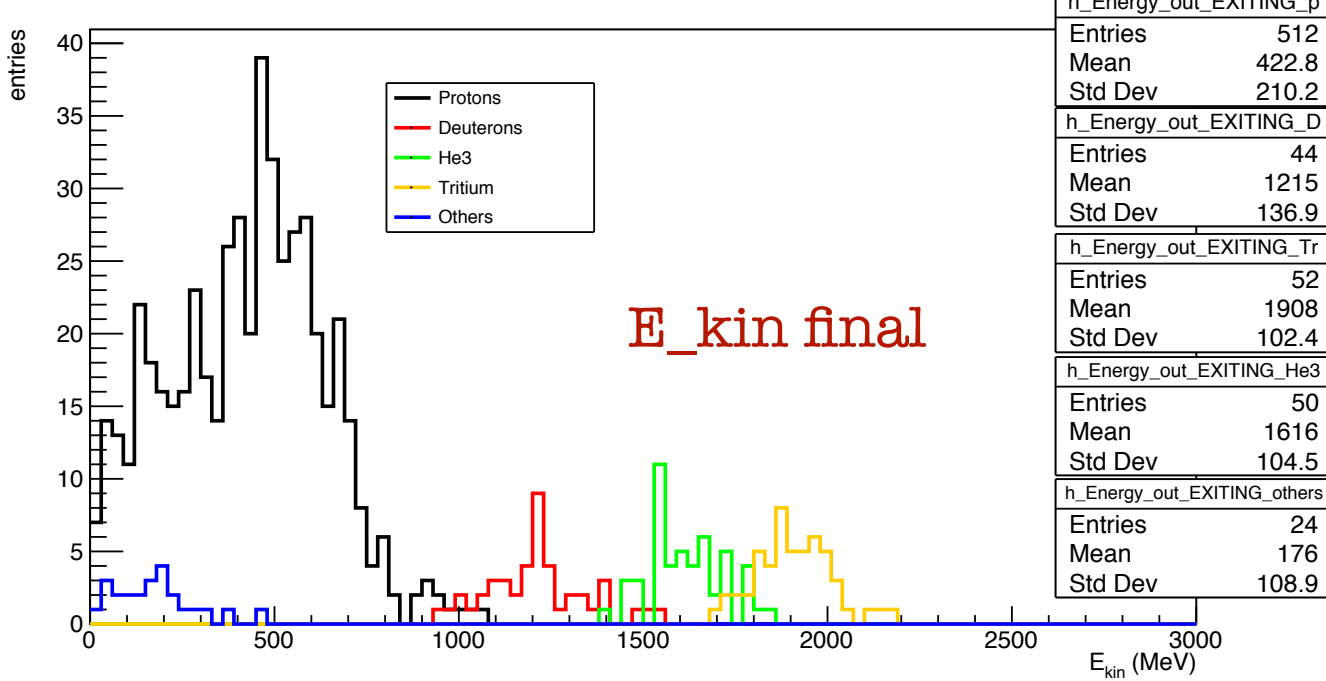
Initial E_{kin} distribution for tracks exiting last plate



Final Energy distribution for tracks exiting last plate



Final Energy distribution for tracks exiting last plate



He4@700 MeV / n
TARGET (S1) POLYETHYLENE

RECONSTRUCTION

Step	GEO 1 (S3 CFeW)		GEO 2 (S3 W)
Beam	4999		
Reaches in S1	99.8%		
VTX in S1	10.2%		
All He4 daughters contained	1.5%		1.3%
Exit lateral(*)	1.2%		1.0%
Exit at the end (**)	7.9%		7.5%

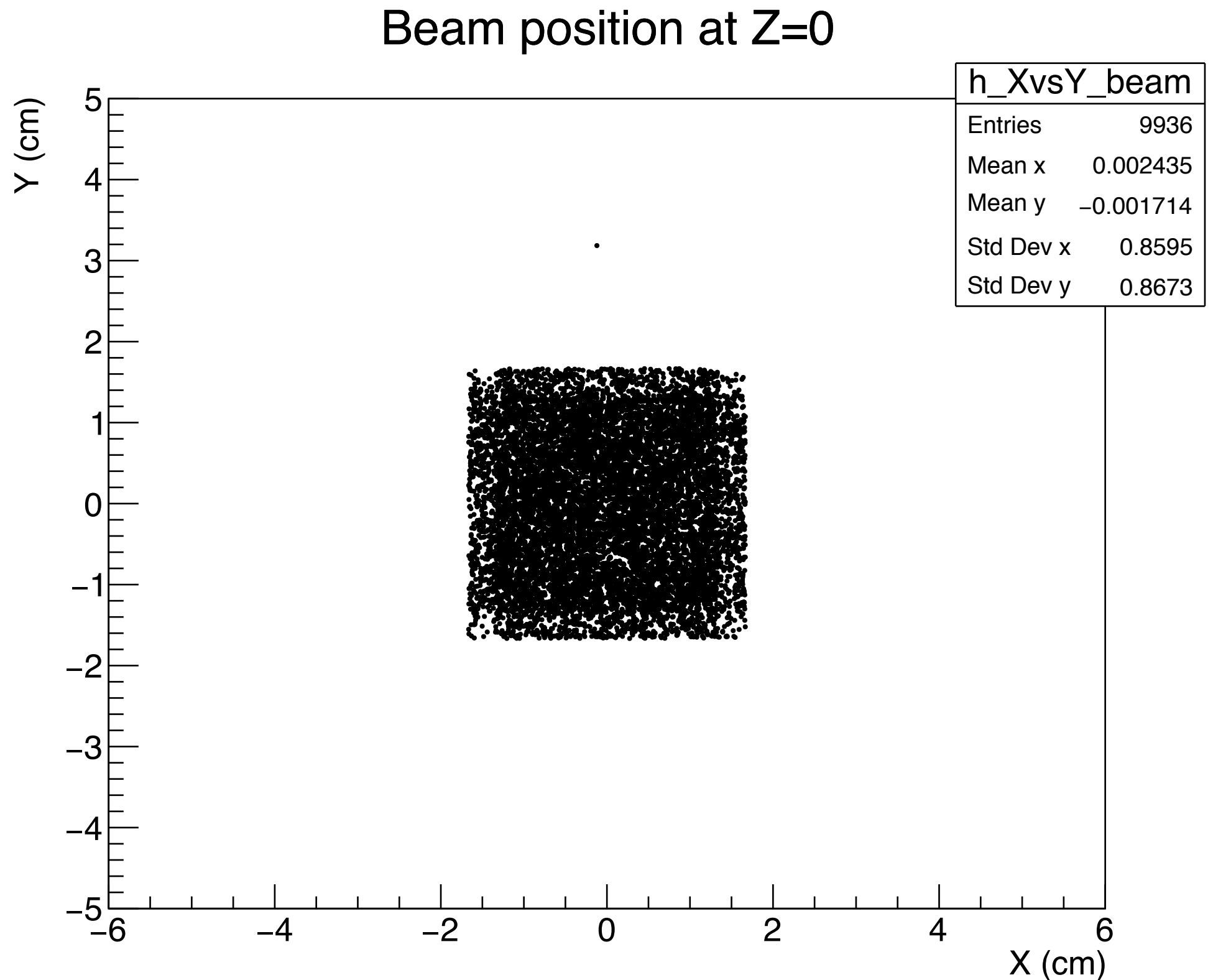
* = last segment coordinates at 0.5 cm from the edge

** = end point in the last 2 plates

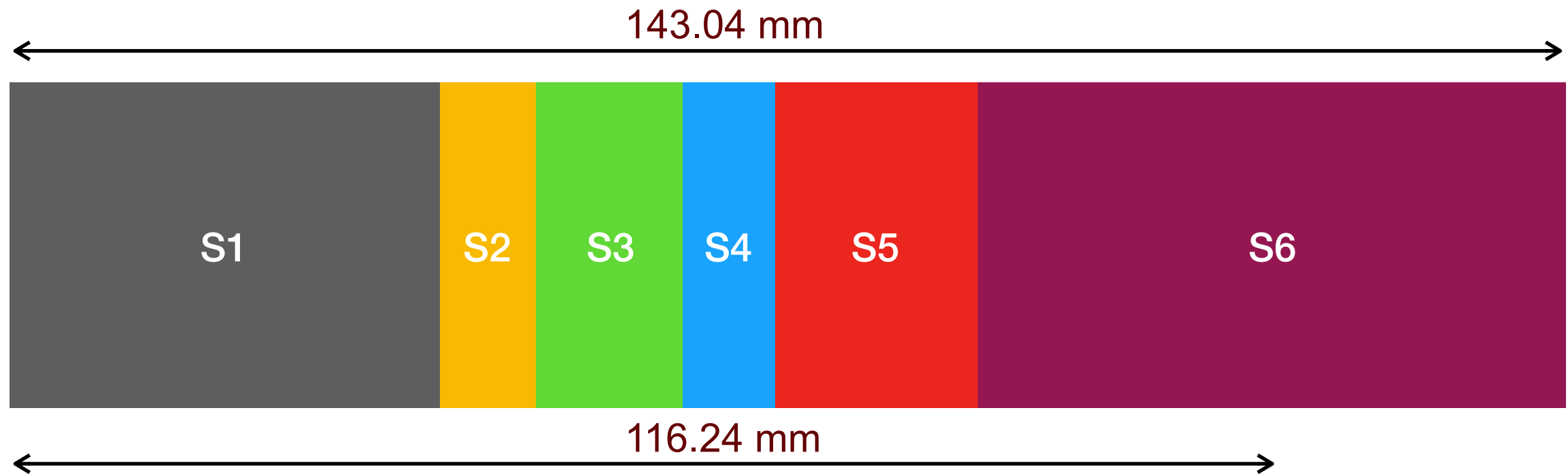
SIMULATION WITH
C@200 MeV / n

BEAM C

- C @ 200 MeV/n
- 10000 events
- Rectangular Shape
- @-30cm in z



DETECTOR STRUCTURE



GEO3:

S1: C (30x1mm)+29emu

S2: Emu (27)

S3: Polyethylene (10x1mm)+10emu

S4: W (10x0.5mm)+10emu

S5: W (15x0.9mm)+15emu

S6: Pb (40x1mm)+40emu

C@200 MeV / n
TARGET (S1): CARBON

RECONSTRUCTION

Step	S5	S6 (10 layers)	S6 (20 layers)	S6 (40 layers)
Beam	10000			
Reaches in S1	99.4%			
VTX in S1	23.7%			
All He4 daughters contained	14.8%	17.5%	19.4%	21.2%
Exit lateral(*)	0.5%	0.7%	0.8%	0.9%
Exit at the end (**)	8.4%	5.5%	3.5%	1.5%

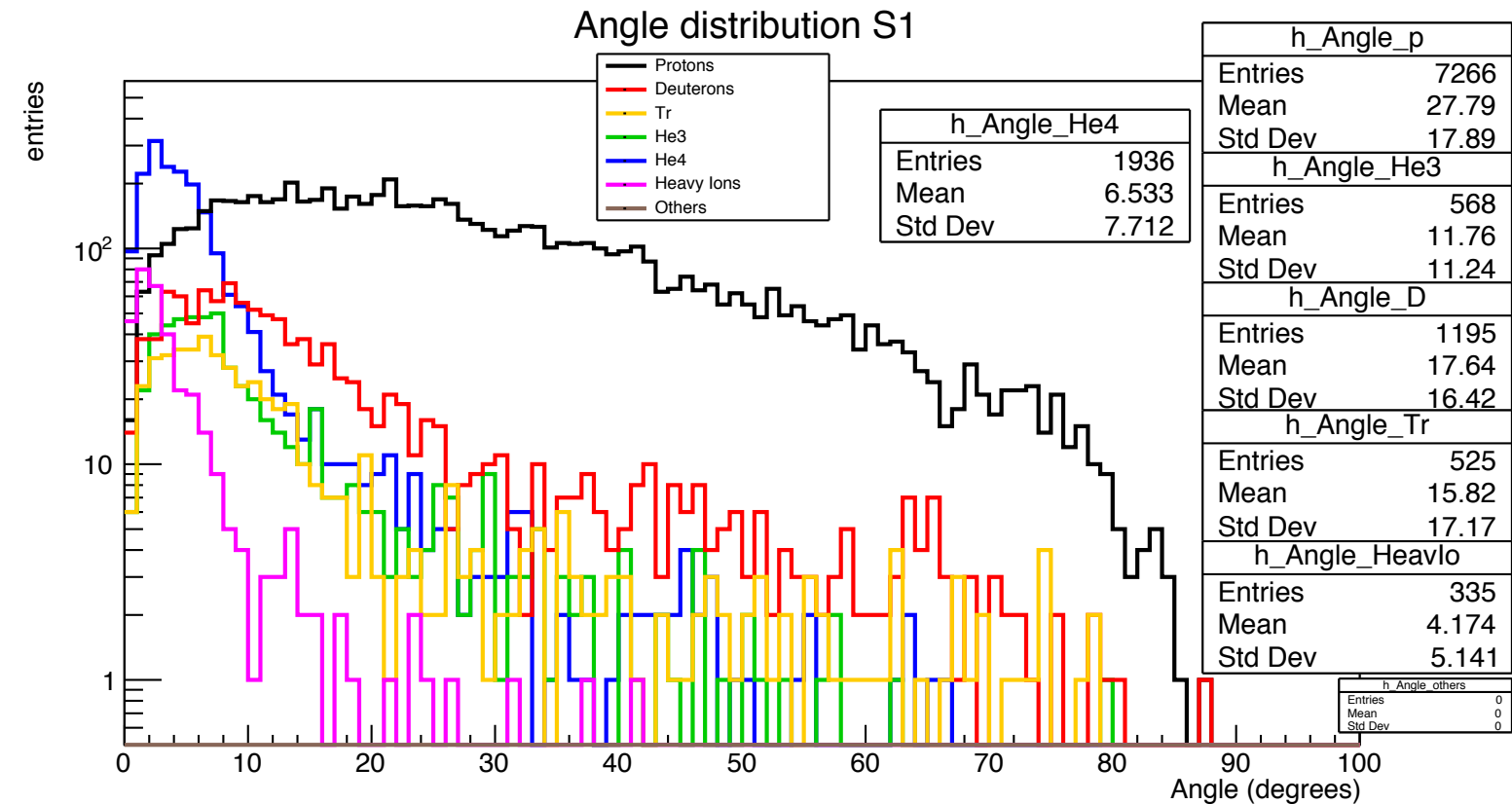
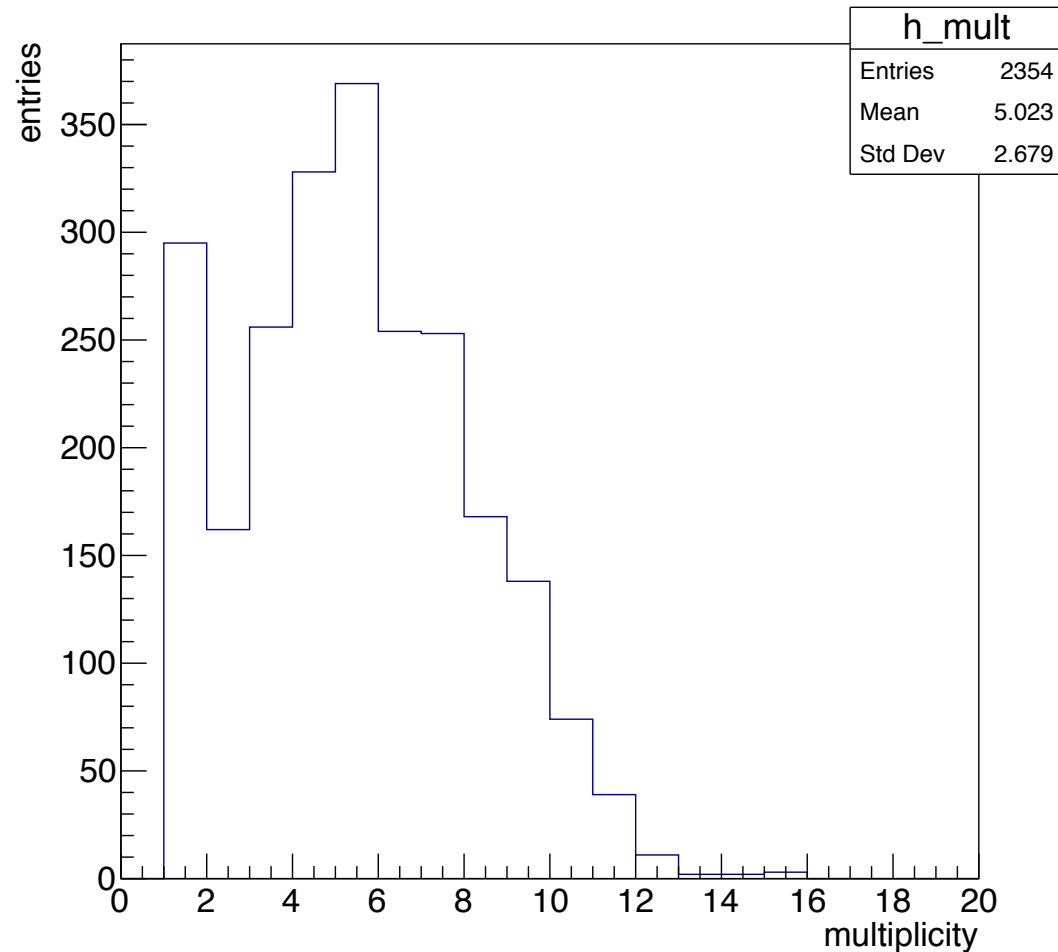
* = last segment coordinates at 0.5 cm from the edge

** = end point in the last 2 plates

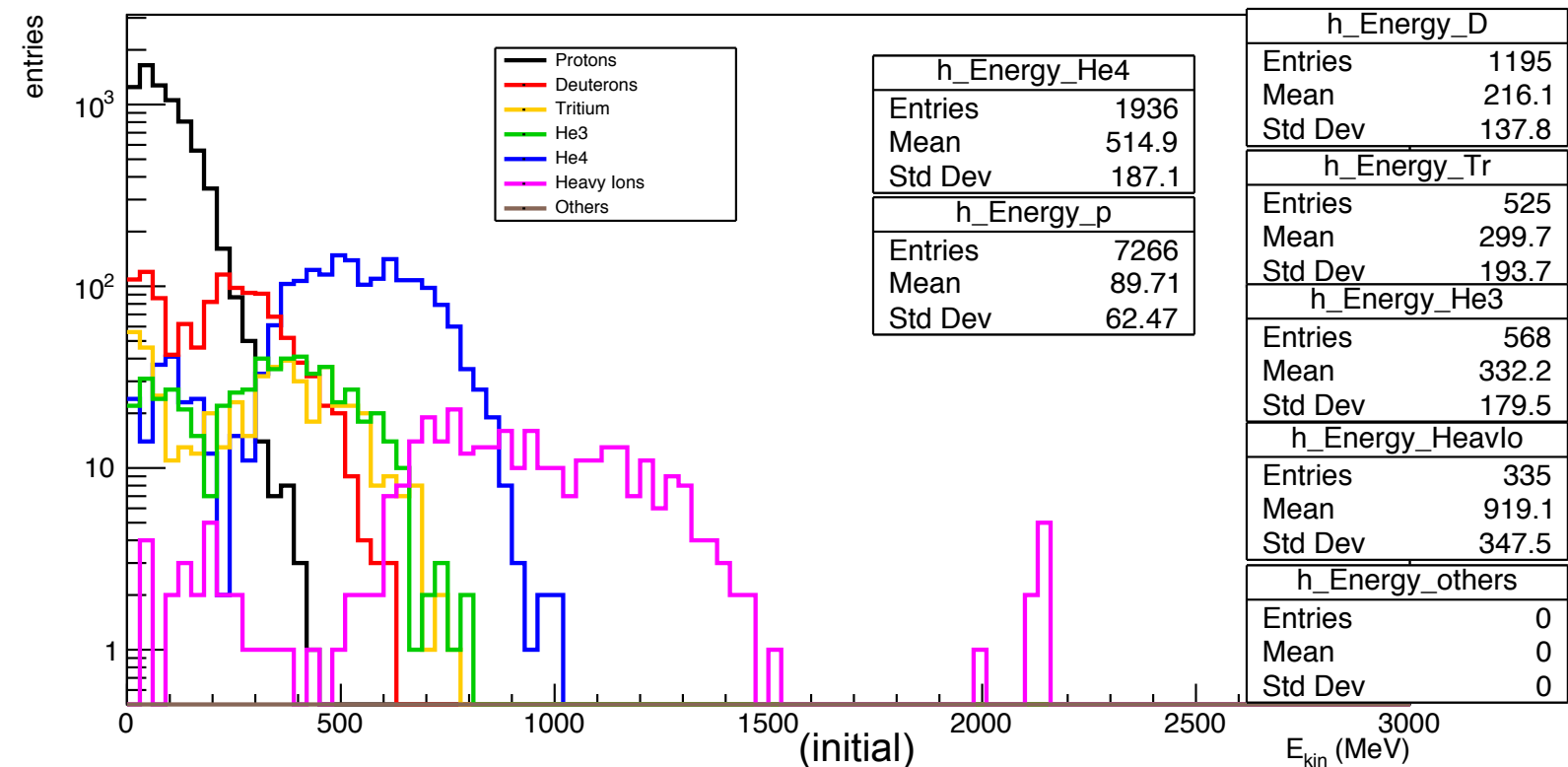
ANGLE DISTRIBUTION

MULTIPLICITY S1

Multiplicity distribution

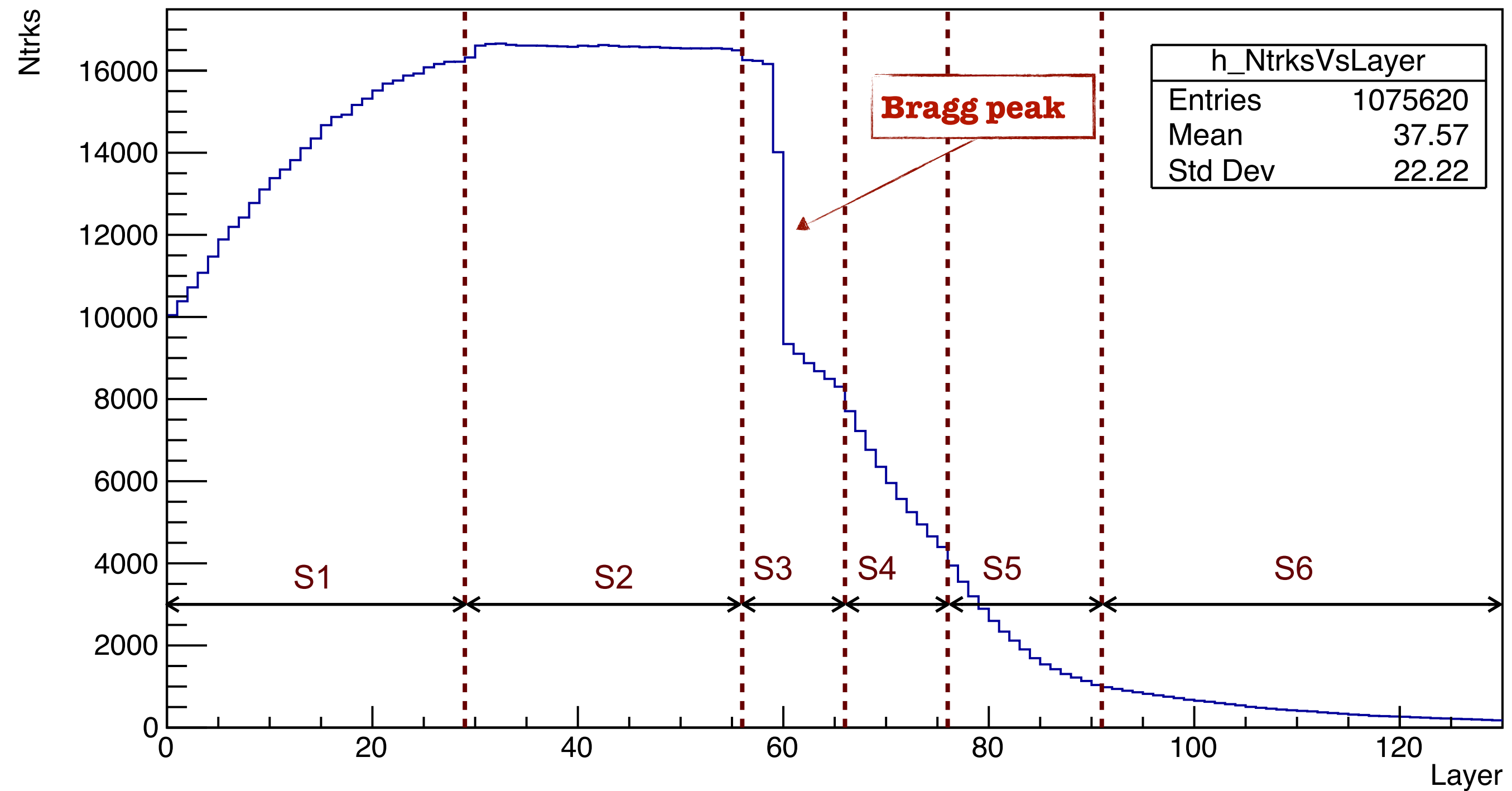


ENERGY DISTRIBUTION



TRACKS PER LAYER

Ntrks Vs Layer



NEXT STEPS

- March 2019: Measurement at GSI
O@200MeV / n - O@400MeV / n beams
Simulation's results will be presented at next meeting
(December)
- On-going: strategy for isotopes identification and momentum measurement for the tracks exiting at the end of the detector