GSI RUN ORGANIZATION: EMULSION CLOUD CHAMBER

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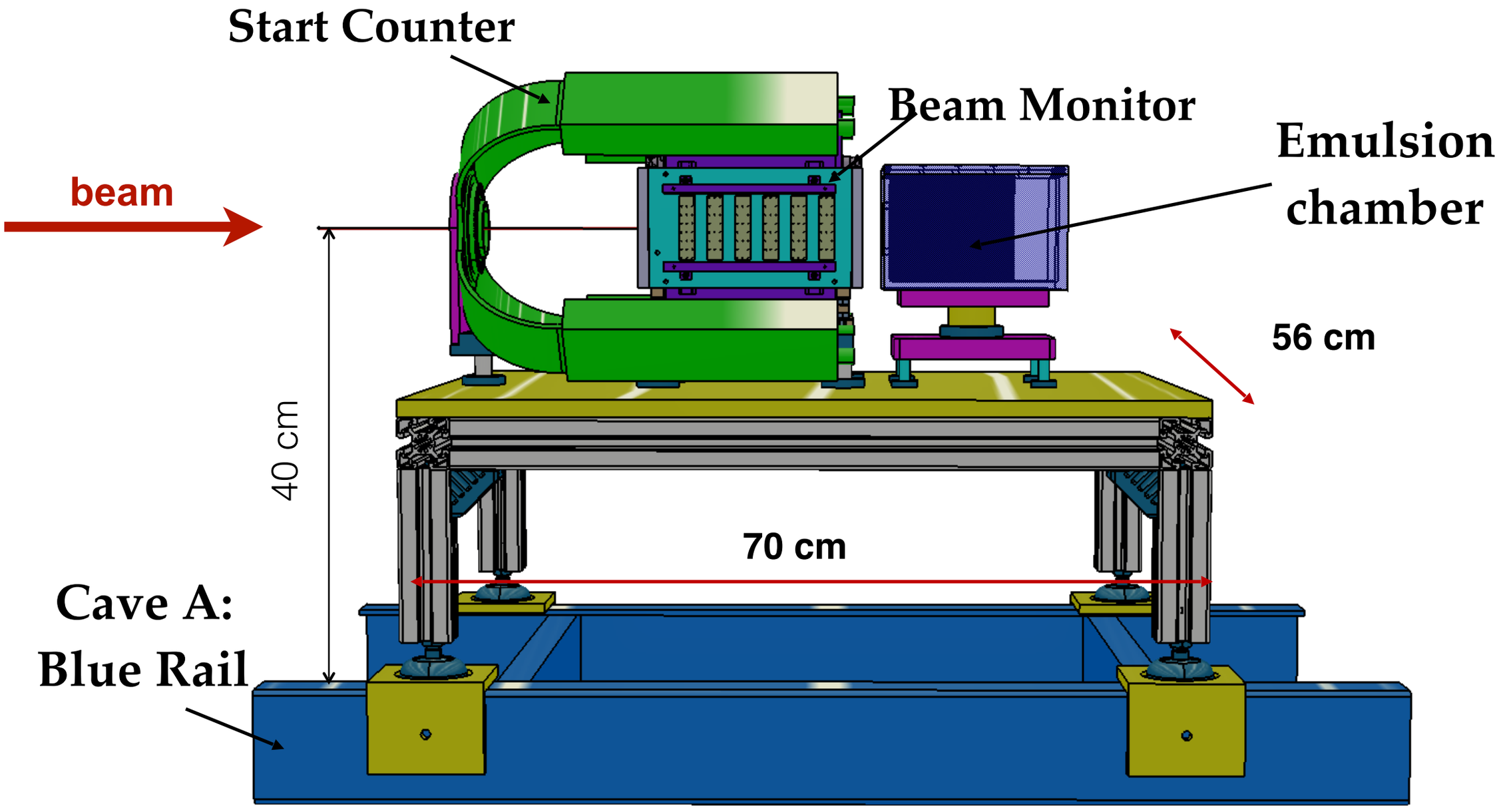
EMULSION EXPOSURE AT GSI (4-9 APRIL 2019)



All mechanical supports are ready, including the adapter for the emulsion translation stage (not shown in the picture)

Emulsion Exposures

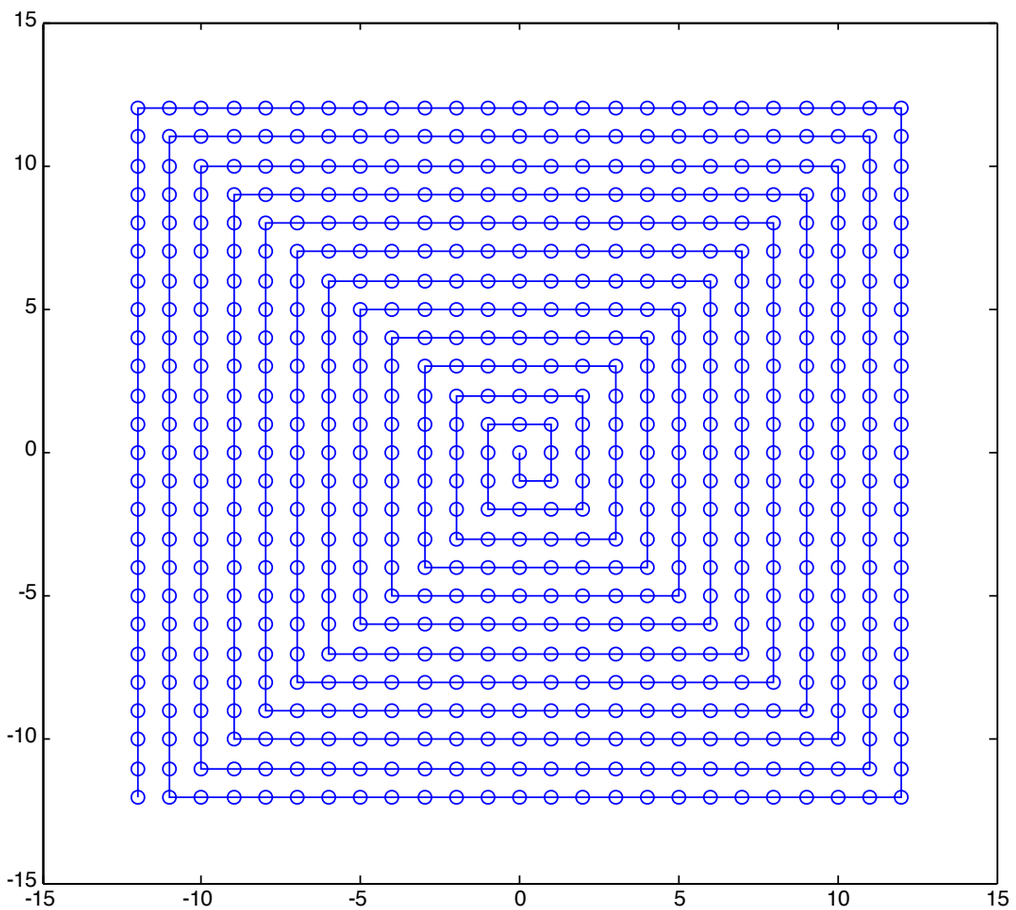
4 different measurements are planned:

Target \ Beam	Oxygen 200 MeV/n	Oxygen 400 MeV/n
Carbon	1	3
Polyethylene	2	4

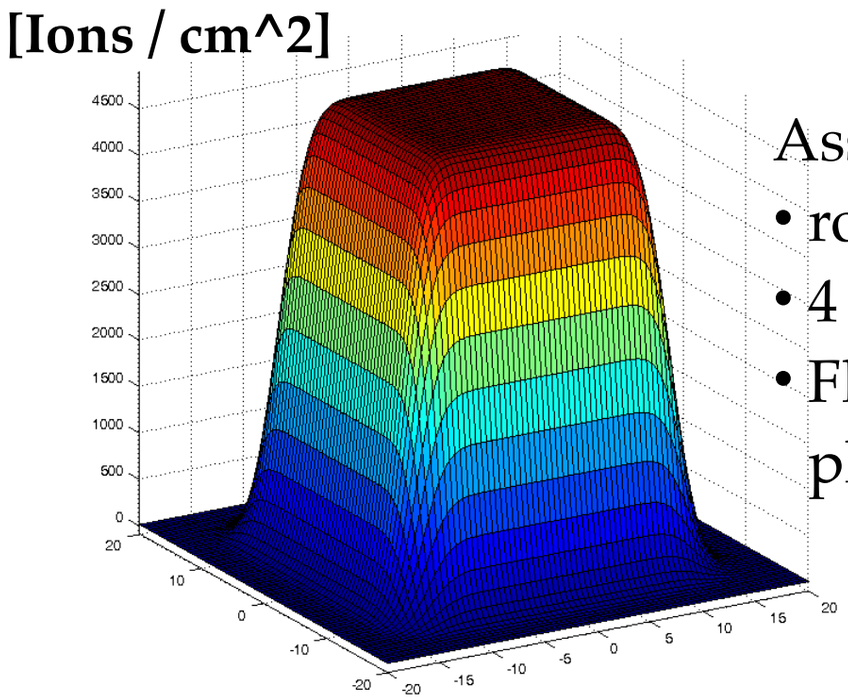
Beam Characteristics

BEAM	TARGET	BEAM INTENSITY (beam particles/5.76cm²)
^{16}O @ 200 MeV/n	C	$18x10^3$
	C_2H_4	$19x10^3$
^{16}O @ 400 MeV/n	C	$13.5x10^3$
	C_2H_4	$14x10^3$

Scanning Geometry



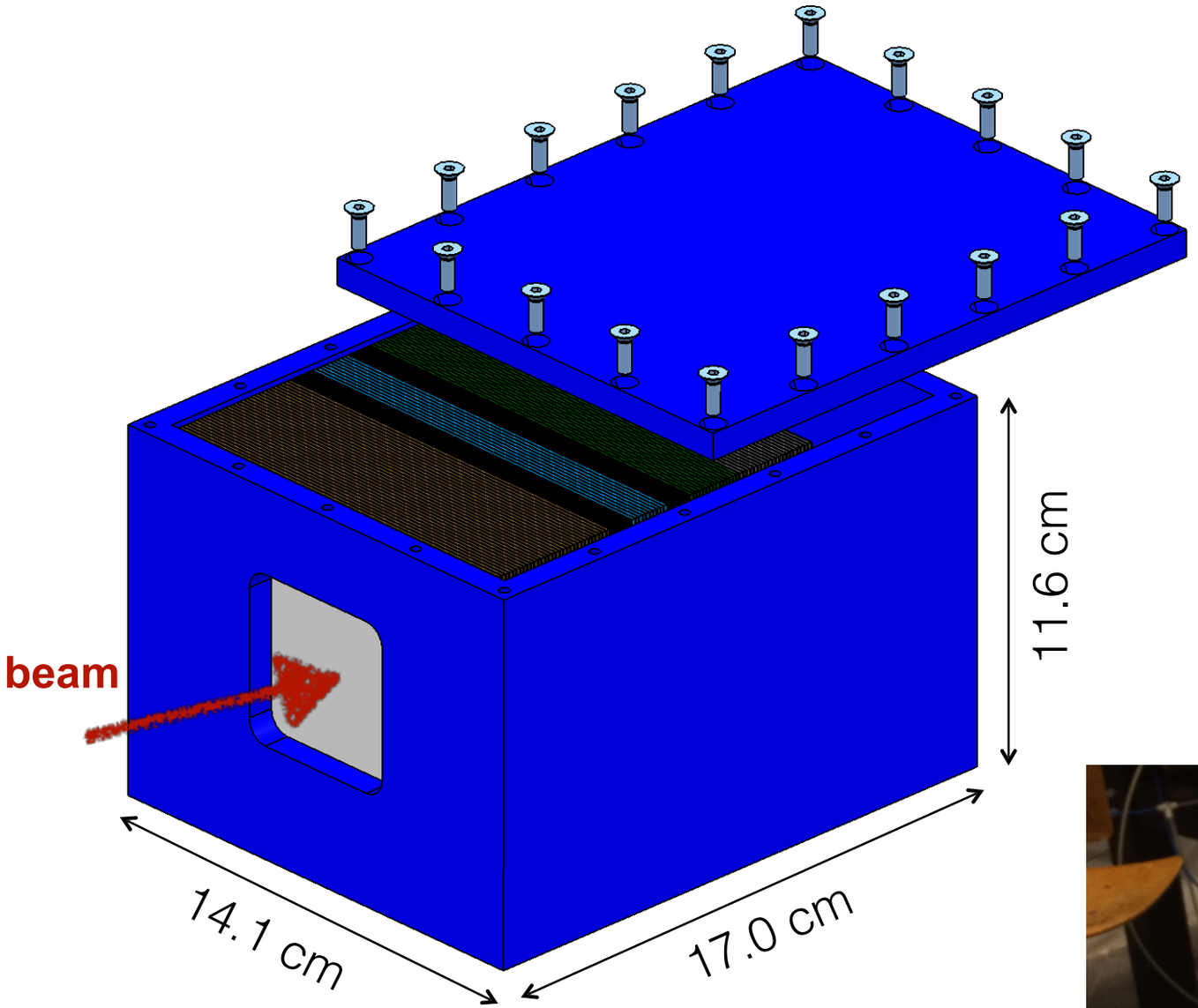
- Start position in the middle
- 1 mm grid in x/y
- -12 … +12 mm size
- 48 ions per beam spot
- Total 30.000 ions: 4800 ions/cm² in the plateau



Assumptions:

- round Gaussian profile
- 4 mm FWHM
- Fluence in the plateau=4800 ions/cm²

EMULSIONS CHAMBER



- plastic material (polycarbonate)
- 3D printer
- 0.8 cm thickness
- 5 x 5.6 cm^2 entrance window
- 14.6x22.6 x12.2 cm^3
- Weight: 15-20 kg

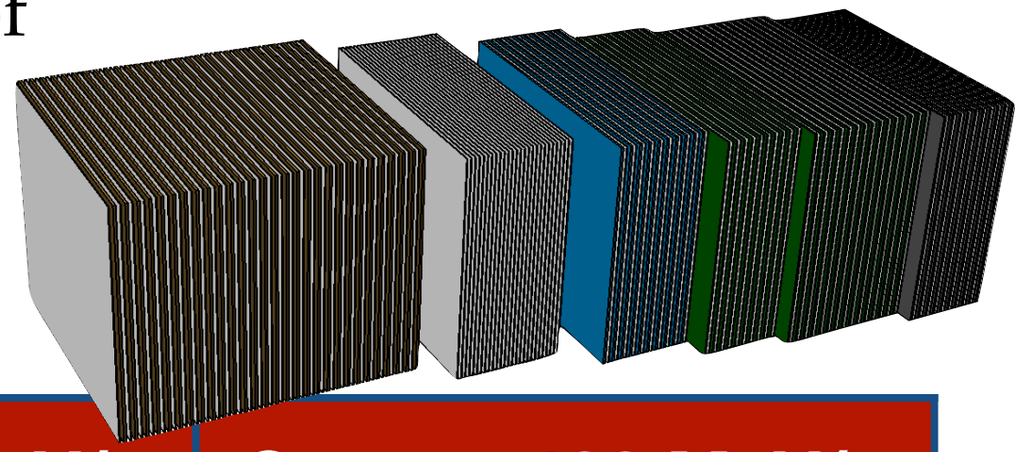
- 4 chambers realized for run and 1 dummy for alignment

SIMULATIONS

DETECTOR STRUCTURE

What is changed:

- Fluka version: from FLUKA2011 version 2x.3 to FLUKA2011 version 2x.4
- geometry: number of layers of W, number of layers of Pb (1mm and 2mm)
- geometry: target C2H4 of 2 mm instead of 1 mm
- bug in track reconstruction solved

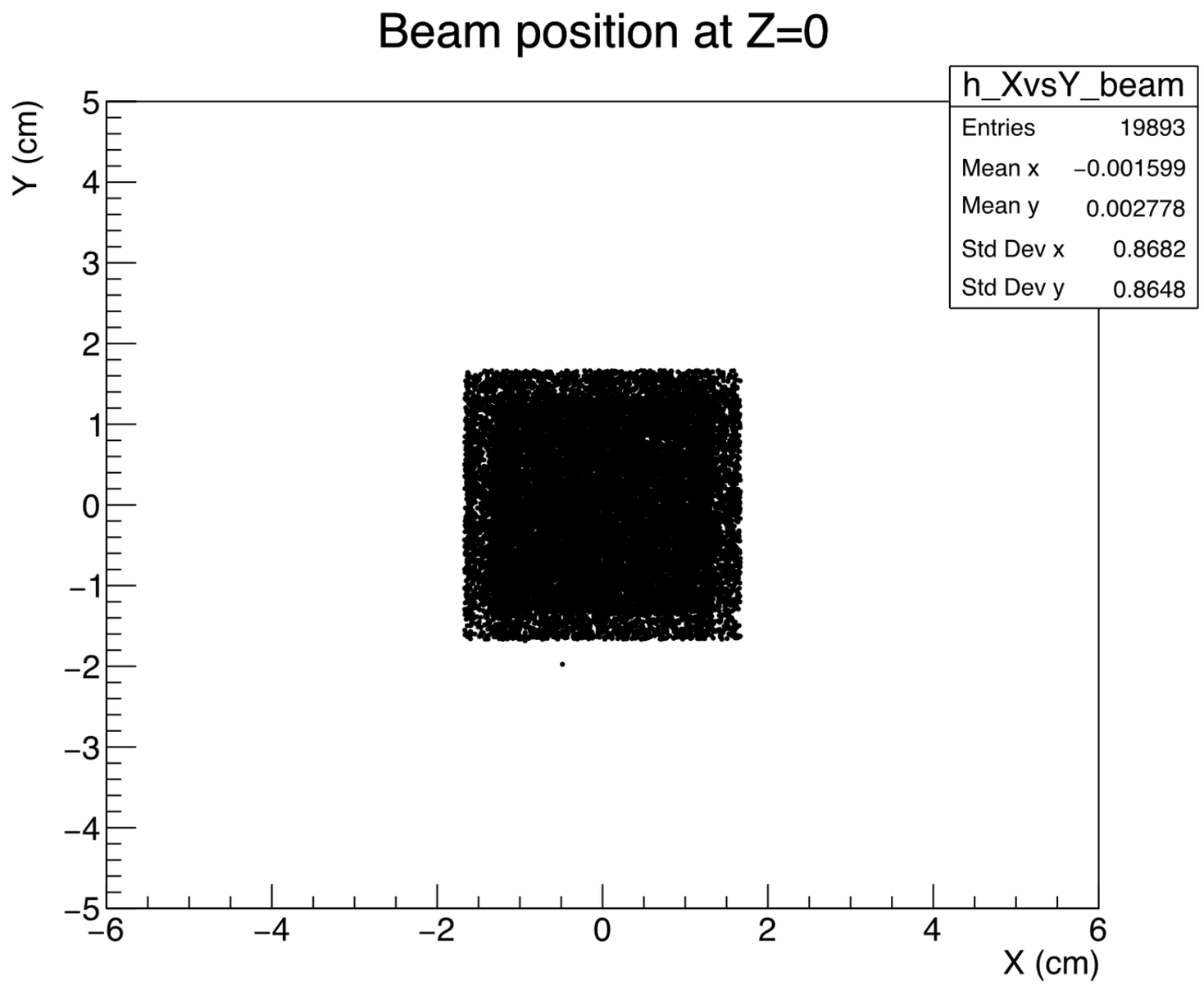


		Oxygen 200 MeV/n	Oxygen 400 MeV/n
Vertexing	S1	C (30x1mm) / C2H4 (30x2mm) + 30 emu	
Charge meas.	S2	Emu (27)	
Momentum measurement and isotope identification	S3	Lexan (10x1mm)+10emu	
	S4	W (7x0.5mm)+7emu	
	S5	W (7x0.9mm)+7emu	
	S6	Pb (20x1mm)+20emu	Pb (40x1mm)+40emu
	S7	Pb (9x2mm)+10emu	Pb (9x2mm)+10emu

Beam: Oxygen 200 MeV/n

BEAM CHARACTERISTICS

- Oxygen @ 200 MeV/n
- 20000 events
- Rectangular Shape
- Isotropic distribution
- @-30cm in z



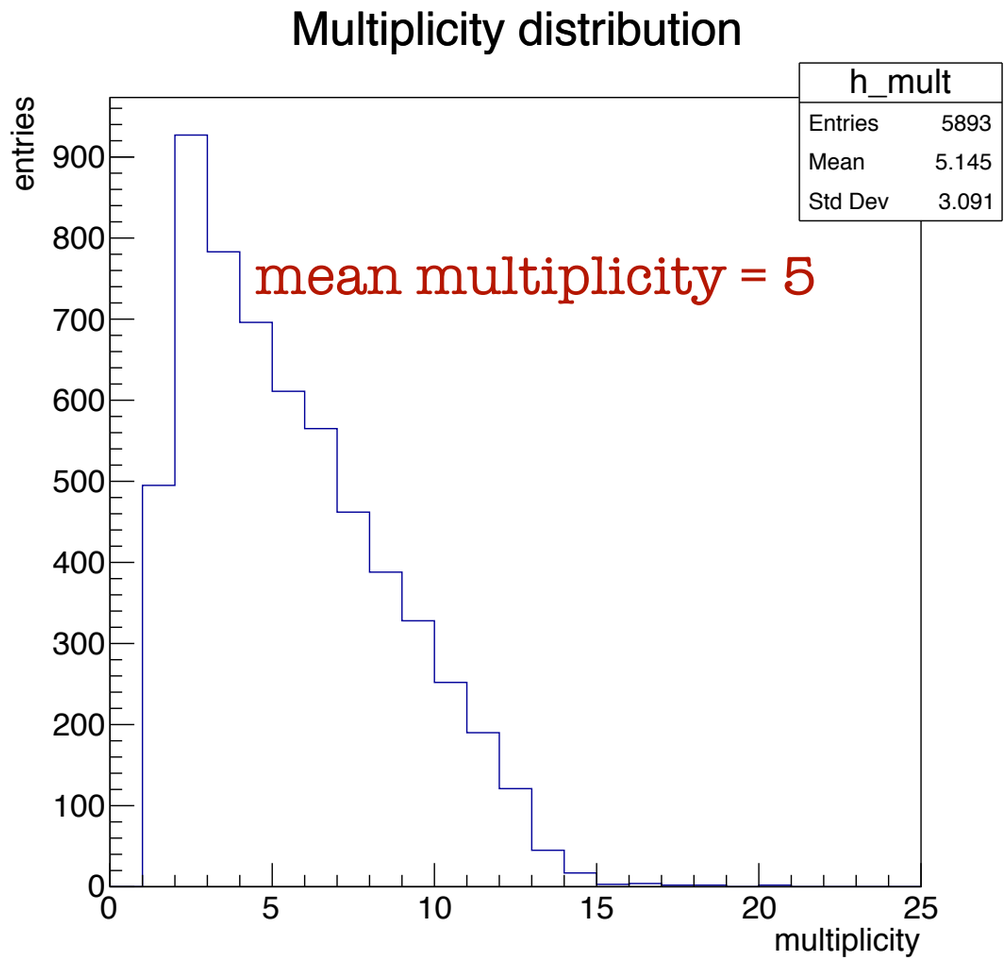
INTERACTIONS

	TARGET	
	Carbon	Polyethylene
Beam particles	20000	
Reach S1	99.5%	99.3%
VTX in S1	29.5%	32.4%

with FLUKA2011 version 2x.3 was 27.5%

Target S1 Carbon

CHARGED PARTICLES PRODUCED IN S1



Total products	30321
Exit lateral	0.9%
Exit at the end	1.6%
Contained	97.6%
Absorbed in S1	44.1%
Silver	40.4%
Golden	38.3%

- EXIT LATERAL = last segment coordinates at 0.5 cm from the edge
- EXIT AT THE END = end point in the last 2 plates
- CONTAINED = not exiting laterally nor at the end
- CHARGE MEASURED = at least 6 segments in S2
- P MEASURED = at least 5 segments in S3+S4+S5+S6+S7
- SILVER = charge and p measured
- GOLDEN = contained + charge and p measured

CHARGED PARTICLES PRODUCED IN S1

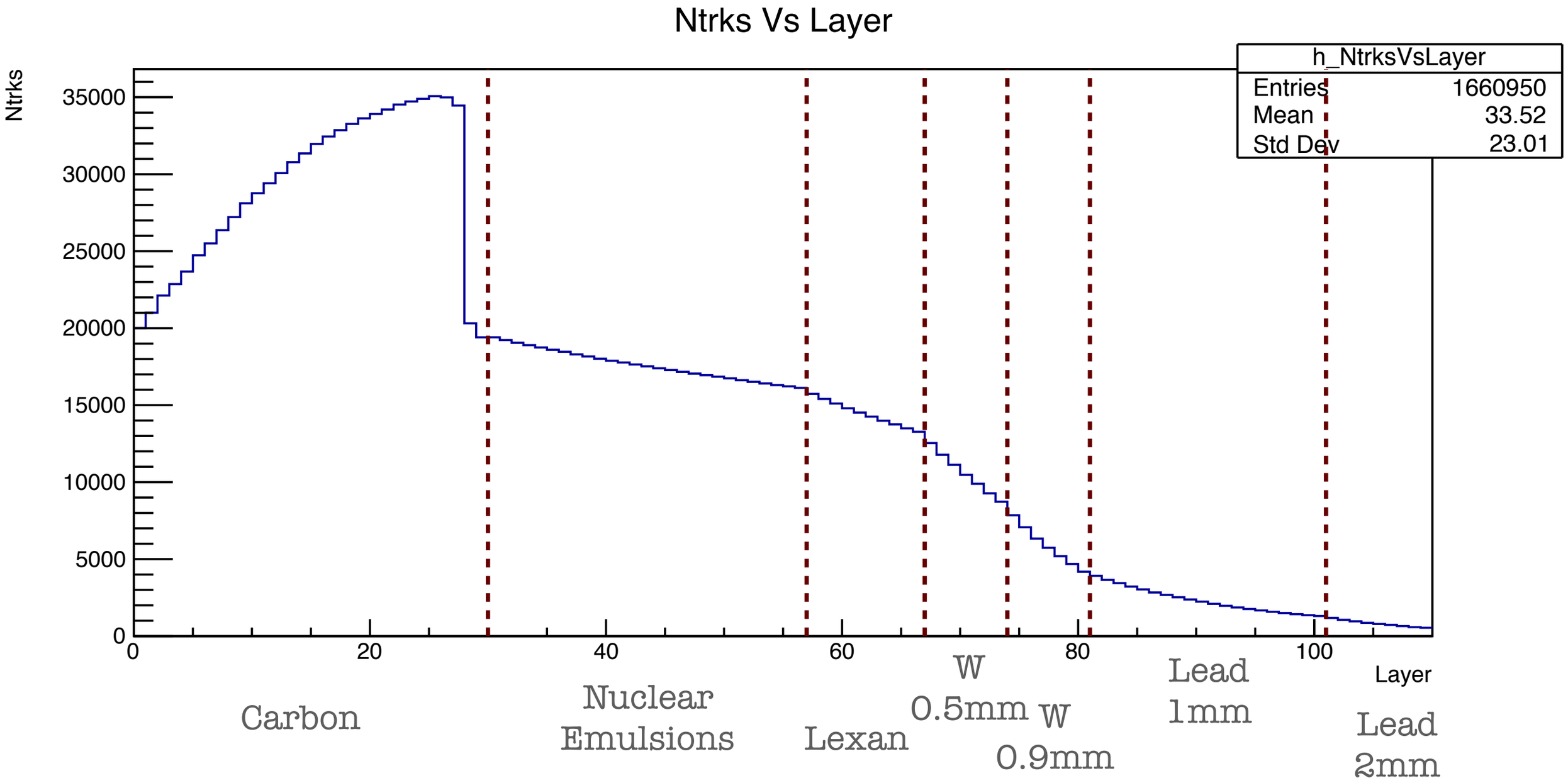
	TRUE	SILVER	GOLDEN
Total	30321	12261	11617
Protons Deuteros Tritium	64.9%	64.8%	62.7%
He3 He4	23.2%	31.2%	33.0%
Heavy Ions Pions	11.9%	4.1%	4.3%

- SILVER = charge and p measured
- GOLDEN = contained + charge and p measured

Beam: Oxygen@200MeV/n - Target: S1 Carbon

OCCUPANCY (ALL TRKS)

Layer 0 = max 2180 trks/cm^2



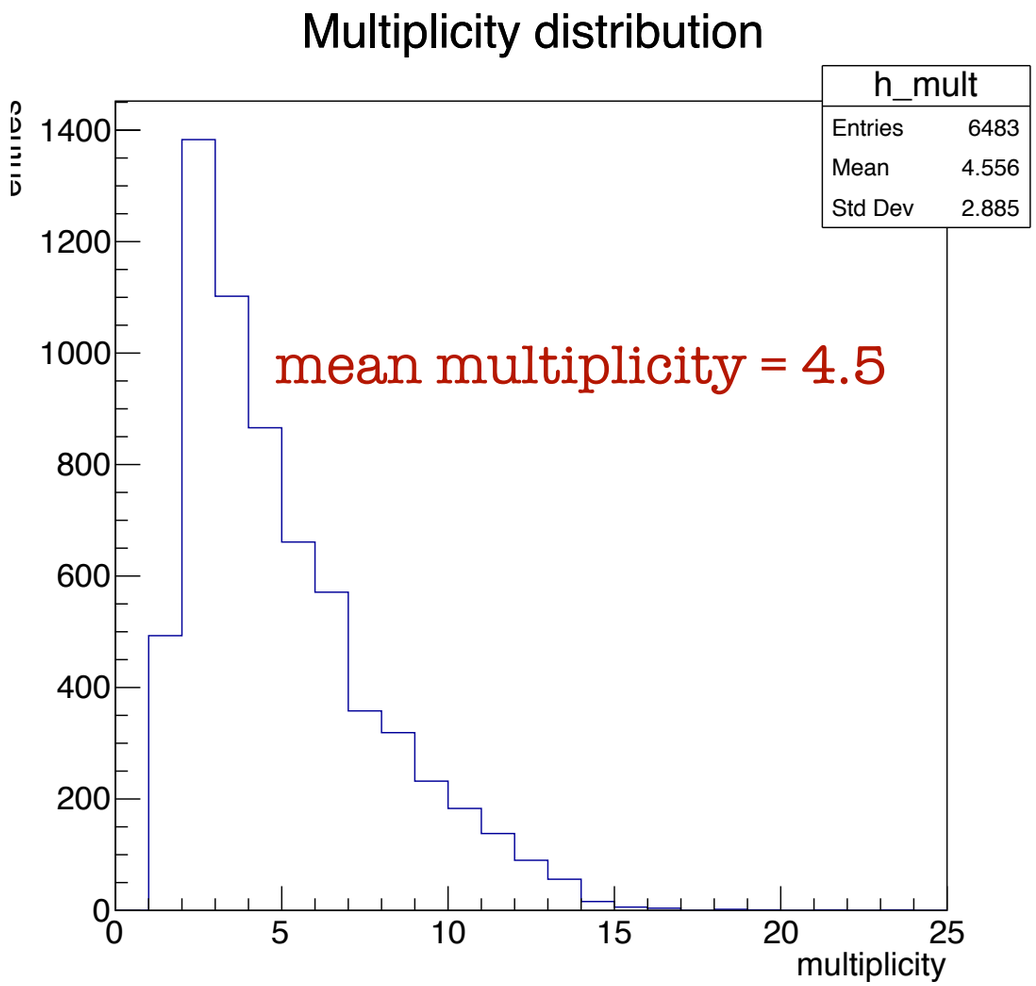
Max occupancy: layer 25 = 3502 trks/cm^2

Bragg Peak: plate 28

Beam: Oxygen@200MeV/n - Target: S1 Carbon

TARGET S1 POLYETHYLENE

CHARGED PARTICLES PRODUCED IN S1



Total products	29539
Exit lateral	2.6%
Exit at the end	1.61%
Contained	95.8%
Absorbed in S1	49.6%
Silver	37.7%
Golden	34.9%

- EXIT LATERAL = last segment coordinates at 0.5 cm from the edge
- EXIT AT THE END = end point in the last 2 plates
- CONTAINED = not exiting laterally nor at the end
- CHARGE MEASURED = at least 6 segments in S2
- P MEASURED = at least 5 segments in S3+S4+S5+S6+S7
- SILVER = charge and p measured
- GOLDEN = contained + charge and p measured

Charged Particles Produced in S1

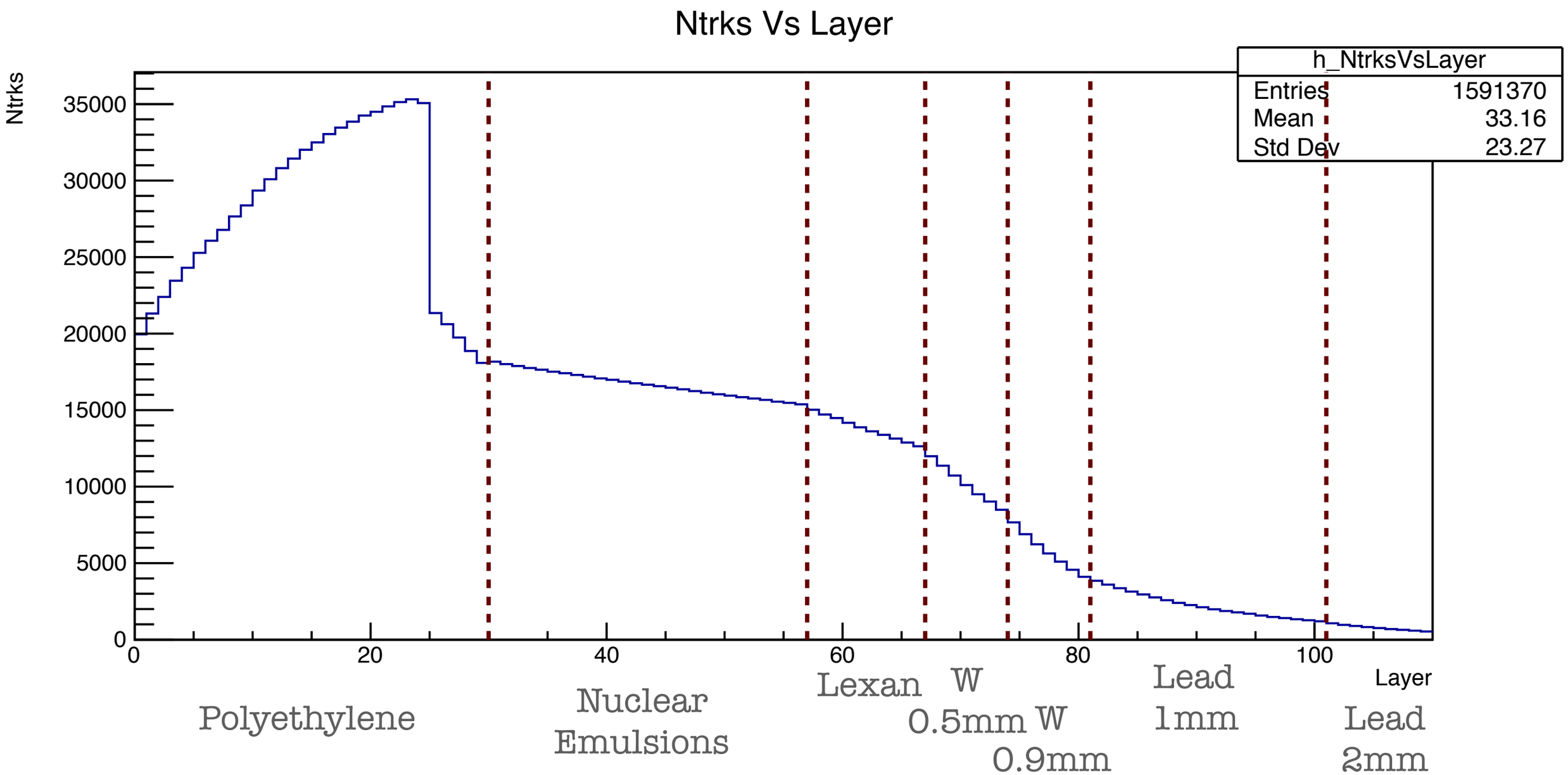
	TRUE	SILVER	GOLDEN
Total	29539	11143	10321
Protons Deuteros Tritium	61.8%	62.8%	59.8%
He3 He4	23.3%	33.4%	36.0%
Heavy Ions Pions	14.9%	3.8%	4.1%

- SILVER = charge and p measured
- GOLDEN = contained + charge and p measured

Beam: Oxygen@200MeV/n - Target: S1 Polyethylene

OCCUPANCY (ALL TRKS)

Layer 0 = max 2177 trks/cm^2



Max occupancy: layer 23 = 3353 trks/cm^2

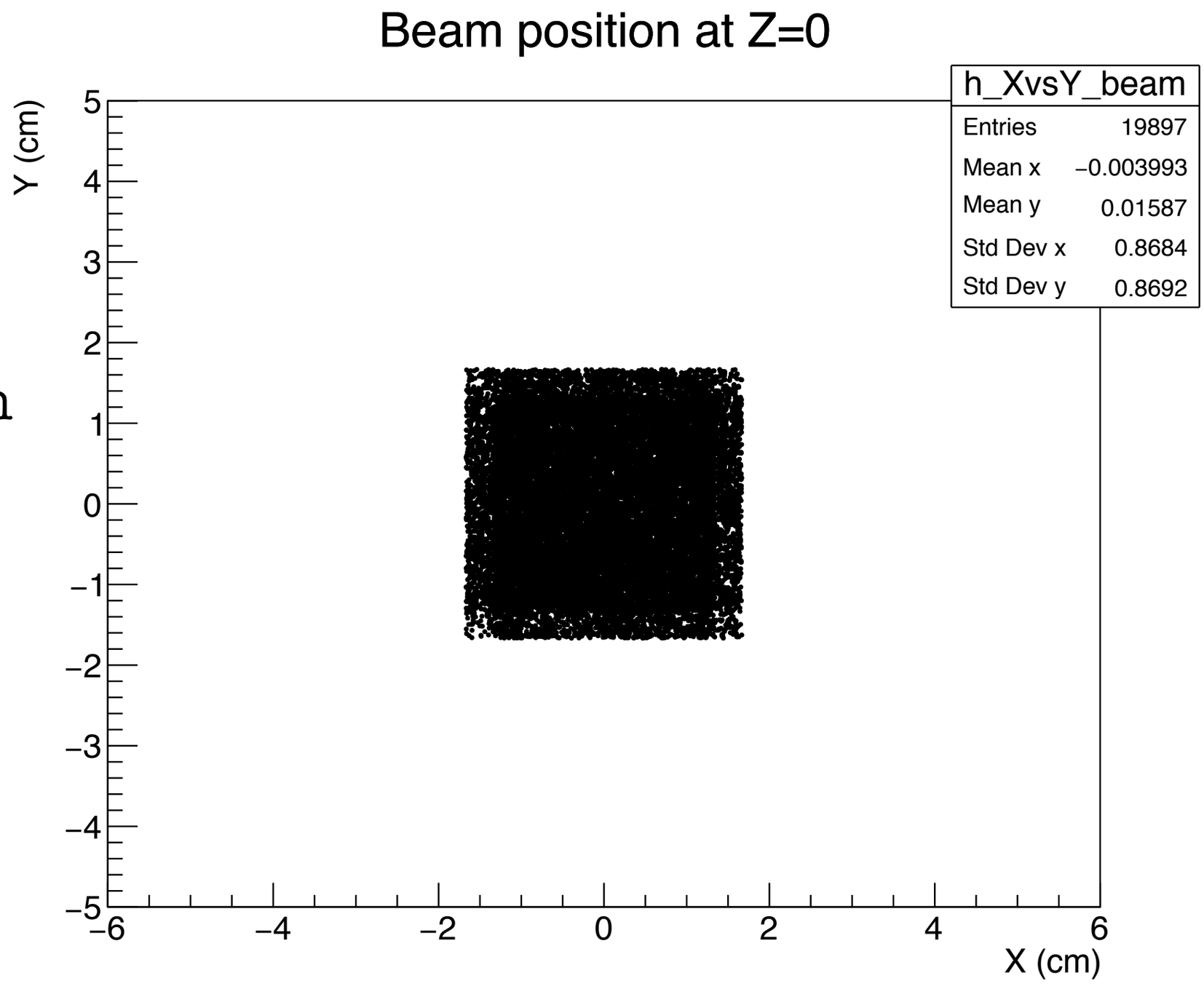
Bragg Peak: plate 25

Beam: Oxygen@200MeV/n - Target: S1 Polyethylene

Beam: Oxygen 400 MeV/n

BEAM CHARACTERISTICS

- Oxy @ 400 MeV/n
- 20000 events
- Rectangular Shape
- Isotropic distribution
- @-30cm in z



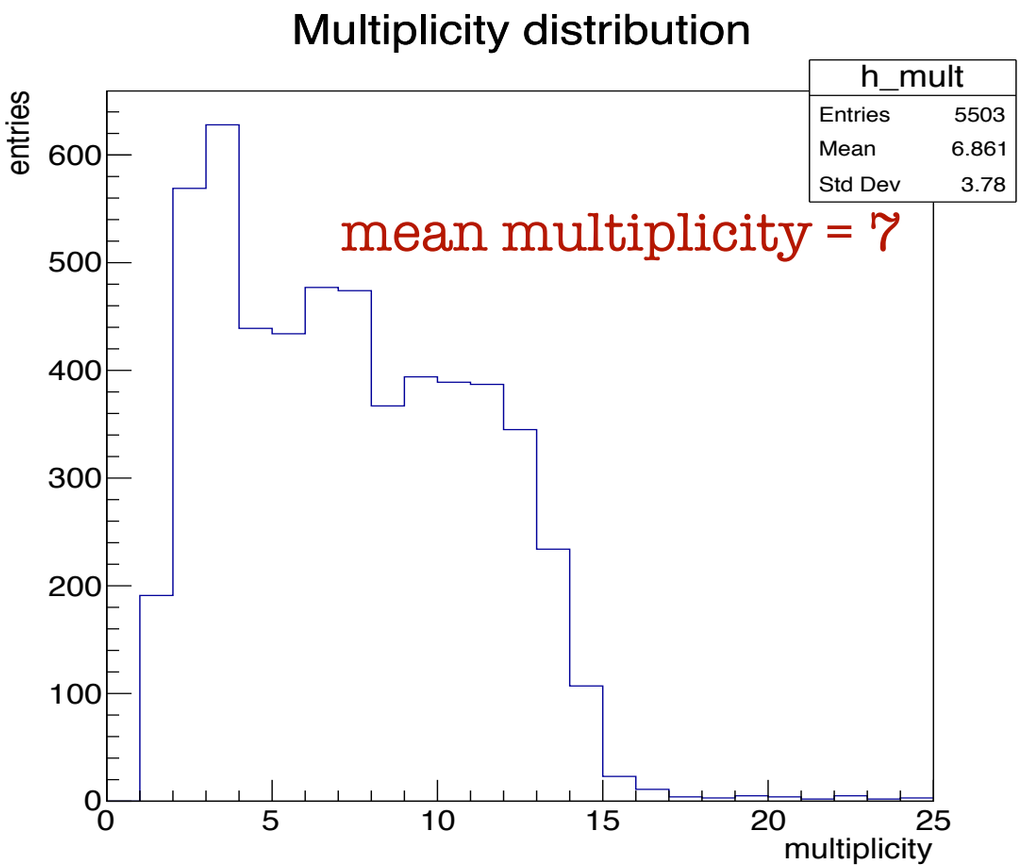
INTERACTIONS

	TARGET	
	Carbon	Polyethylene
Beam particles	20000	
Reach S1	99.5%	99.4%
VTX in S1	27.5%	33.4%

with FLUKA2011 version 2x.3 was 25%

Target S1 Carbon

CHARGED PARTICLES PRODUCED IN S1



Total products	37873
Exit lateral	6.74%
Exit at the end	16.9%
Contained	76.7%
Absorbed in S1	23.6%
Silver	68.9%
Golden	47%

- EXIT LATERAL = last segment coordinates at 0.5 cm from the edge
- EXIT AT THE END = end point in the last 2 plates
- CONTAINED = not exiting laterally nor at the end
- CHARGE MEASURED = at least 6 segments in S2
- P MEASURED = at least 5 segments in S3+S4+S5+S6+S7
- SILVER = charge and p measured
- GOLDEN = contained + charge and p measured

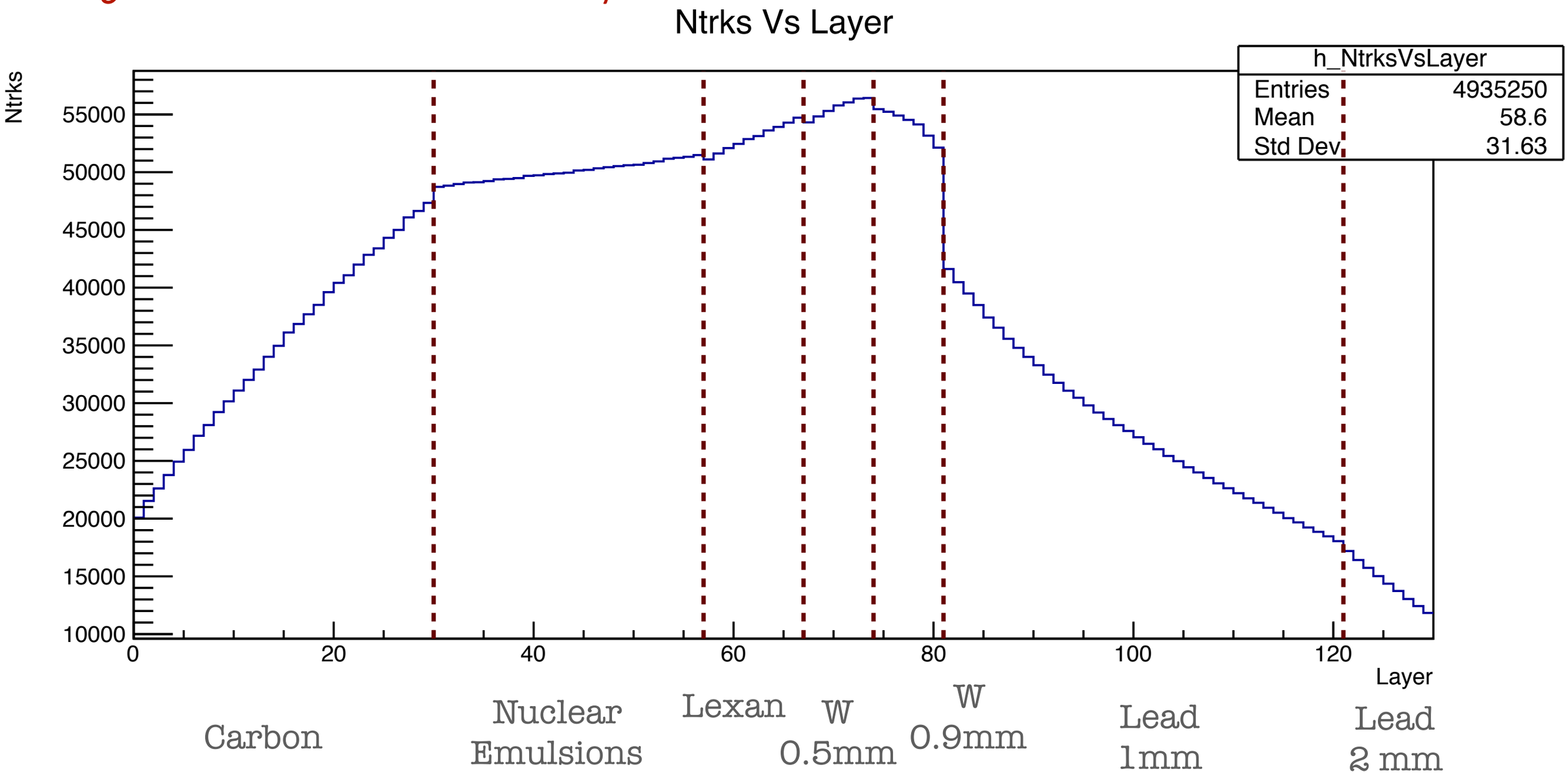
Charged Particles Produced in S1

	TRUE	SILVER	GOLDEN
Total	37873	26105	17788
Protons Deuteros Tritium	79.9%	76.0%	74.8%
He3 He4	12.1%	15.3%	12.9%
Heavy Ions Pions	8.0%	8.8%	11.5%

- SILVER = charge and p measured
- GOLDEN = contained + charge and p measured

OCCUPANCY (ALL TRKS)

Layer 0 = max 2202 trks/cm^2



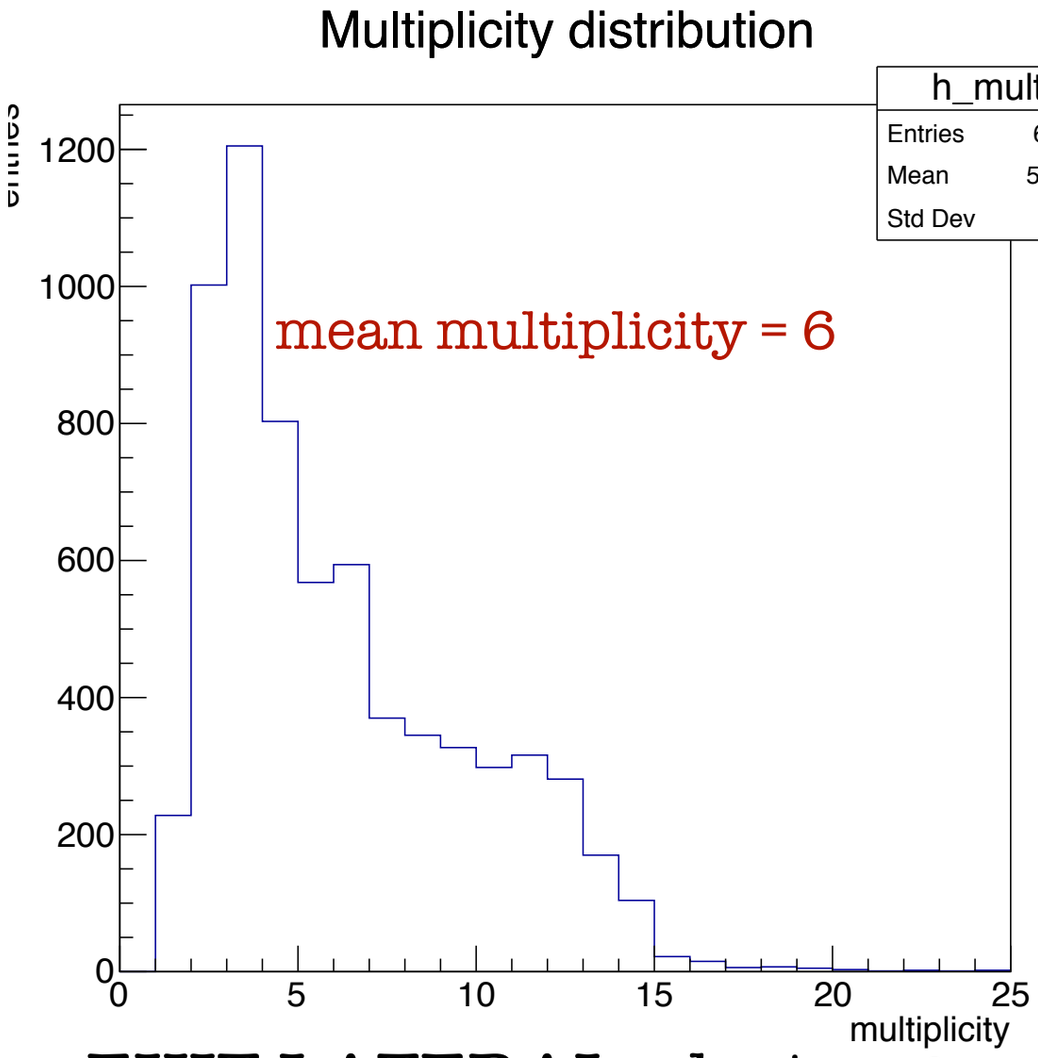
MAX OCCUPANCY: 4789 trks/cm^2, evaluated on layer: 73

Bragg Peak: plate 81

Beam: Oxygen@400MeV/n - Target: S1 Carbon

TARGET S1 POLYETHYLENE

CHARGED PARTICLES PRODUCED IN S1



Total products	38655
Exit lateral	12%
Exit at the end	16.8%
Contained	71.7%
Absorbed in S1	24.7%
Silver	67.8%
Golden	44.1%

- EXIT LATERAL = last segment coordinates at 0.5 cm from the edge
- EXIT AT THE END = end point in the last 2 plates
- CONTAINED = not exiting laterally nor at the end
- CHARGE MEASURED = at least 6 segments in S2
- P MEASURED = at least 5 segments in S3+S4+S5+S6+S7
- SILVER = charge and p measured
- GOLDEN = contained + charge and p measured

Charged Particles Produced in S1

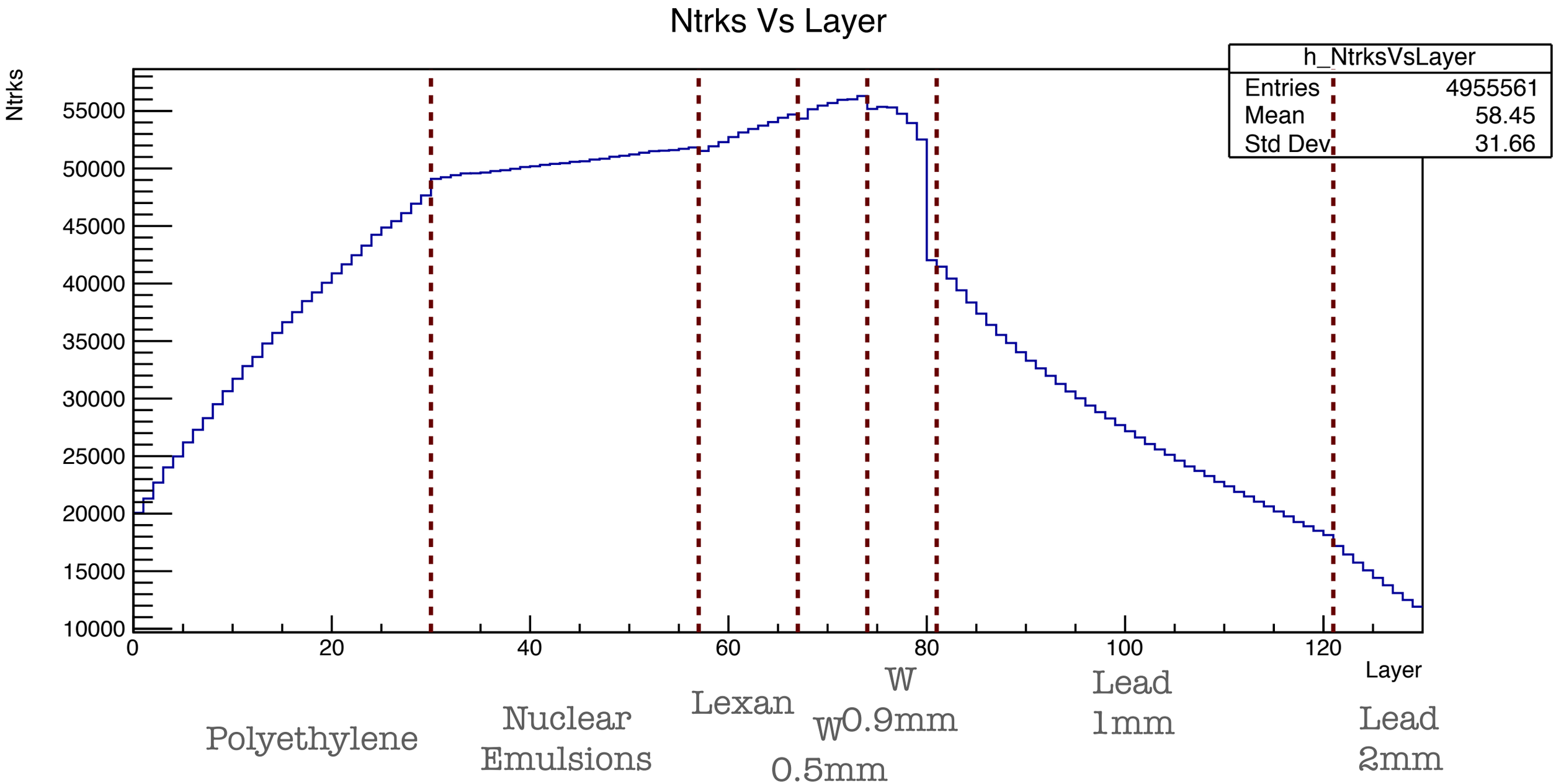
	TRUE	SILVER	GOLDEN
Total	38655	26203	17036
Protons Deuteros Tritium	74.8%	70.0%	66.4%
He3 He4	13.8%	17.6%	14.8%
Heavy Ions Pions	11.4%	12.6%	17.7%

- SILVER = charge and p measured
- GOLDEN = contained + charge and p measured

Beam: Oxygen@200MeV/n - Target: S1 Carbon

OCCUPANCY (ALL TRKS)

Layer 0 = max 2198 trks/cm^2



MAX OCCUPANCY: 4623 trks/cm^2, evaluated on layer: 73

Bragg Peak: plate 80

Beam: Oxygen@400MeV/n - Target: S1 Polyethylene