Update on the sweep magnet for the NPS experiments

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Kinematics of SI pion (E12-13-007)

#	θ_γ	θ_e	D_{mag}, m	Bdl, Tm	D_{mag}-Calo, m	angle range, degree
A X	10.57	10.27	1.57	0.3	3-1.57	
B X	16.20	11.70	1.57	0.3		
C	12.44	15.38	1.57	0.3		
D	7.93	24.15	1.57	0.3	1.43	4.7-11.1
E	16.57	15.65	1.57	0.3	1.43	
F	17.23	17.84	1.57	0.3	1.43	

X – SAM configuration is finalized. We checked 4(5) out of a total of 22 configurations.

Kinematics of DVCS (E12-13-10)

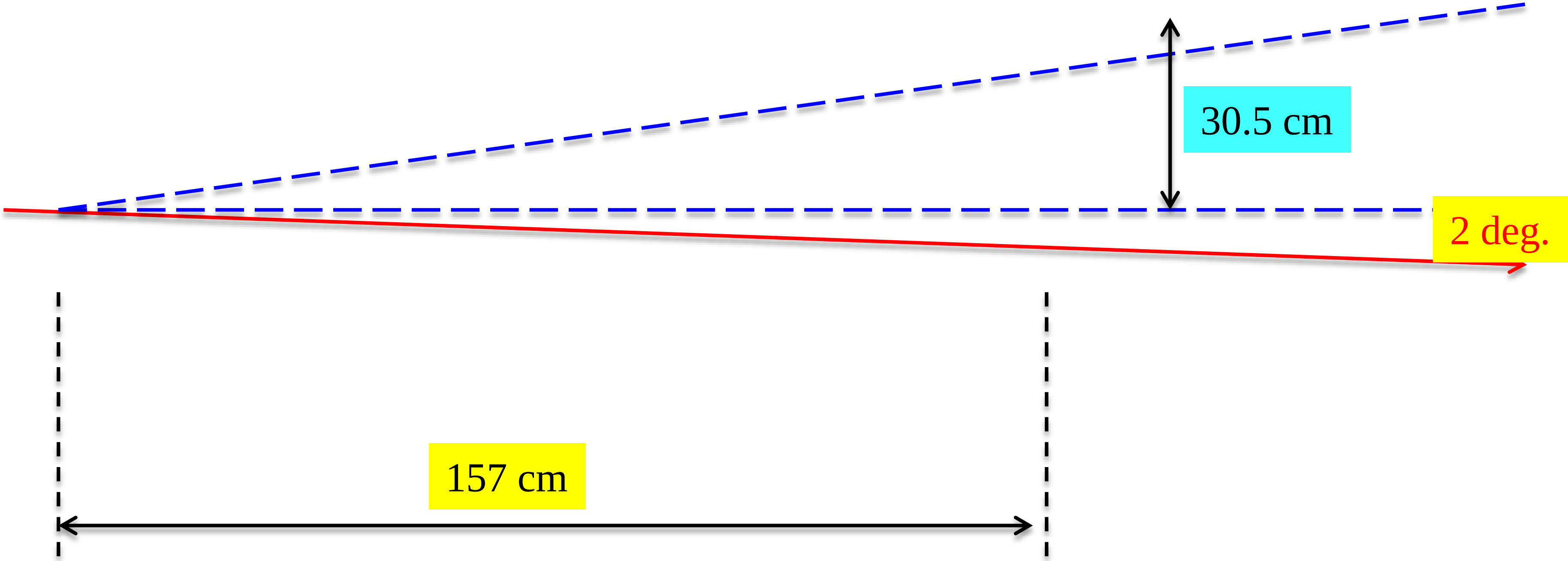
#	θ_γ	θ_e	D_{calo},m	Bdl, Tm	D_{mag}-Calo, m	angle range, degree
3 (=B)	16.2	11.7	3	0.3	1.43	
5 (~C)	12.4	15.3	3	0.3	1.43	
7	21.7	11.7	3	0.3	1.43	
8 X	16.6	15.6	3	0.3	1.43	
13	6.3	27.9	6	0.3	4.43	3.1 - 9.6
16 X	6.3	17.3	6	0.3	4.43	

range of angles: 68 cm / 300 => 12.8 degrees
range of angles: 68 cm / 600 => 6.5 degrees

Kinematics of WACS (E12-14-003) /Pion

#	θ_γ	θ_p	D_{mag},m	Bdl, Tm	D_{det}, m	D_{magr}-Calo, m	Bdl, Tm / D_{mag}-Calo, m
4A	14.2	40.1	2.45+0.2	0.3	9.0	6.15	0.3 / (9-1.57)
4B	17.9	33.7	1.65+0.2	0.4	7.0		
4C	22.5	27.8	1.65+0.2	0.5	5.0		
4D	26.9	23.7	1.10+0.2	0.6	3.5		
4E	34.0	18.9	1.10+0.2	0.6	3.0	1.7	0.61 Tm / 1.68
5A	11.0	41.7	2.45+0.2	0.25	11.0		9.3-12.7 deg
5B	13.8	35.3	2.45+0.2	0.35	9.0		

Horizontal field dipole



Parameters

1. Field integral from the target to NPS ~ 0.58 Tm, for the main coil: 1050A, 140 kW
corrector coils ~ 500 A, 20 kW

1. Field integral along the beam line from the target to magnet middle
Goal is a low transverse BdL, below 1 milli Tm -> OK (see Rolf's)
after tuning of the corrector, there is some field at the target and before it.

3. Field integral along the HMS central trajectory from the target to Q1
Goal is to have BdL below 1 milli Tm - > could be hard to do even with
the cone on the snout (t=5 mm). May need Q1 in the model.

What are the requirements?

1. A low energy tail for the thin target case, P_{loss} = P_b x 2t/3 $(E_{cut}/E_b)^2$

   It would be great to have E_{cut} = 300 MeV => 0.05% of beam power

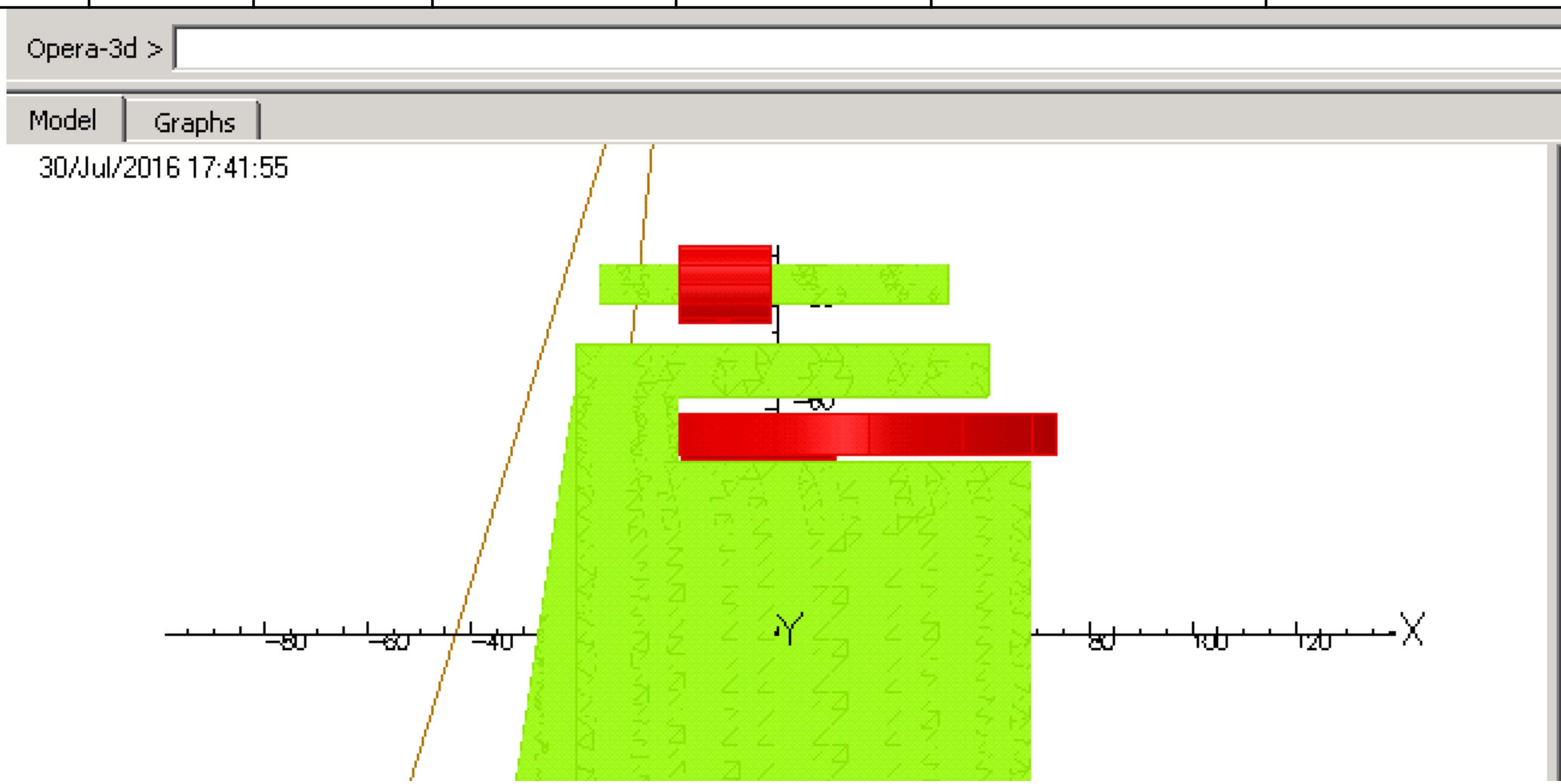
   BdL = 3 cm / 30 m * [3 x 10^8/300] = 10^3 Gauss cm = 1 milli Tm (Rolf's)

2. HMS optics aberration for 3 GeV/c and BdL = 1 x 10^3 Gauss cm (Rolf's)

   $\delta\theta$ ~ 300 x BdL /3 x 10^9 = 0.1 mrad
   vertex shift ~ < 0.5 mm?

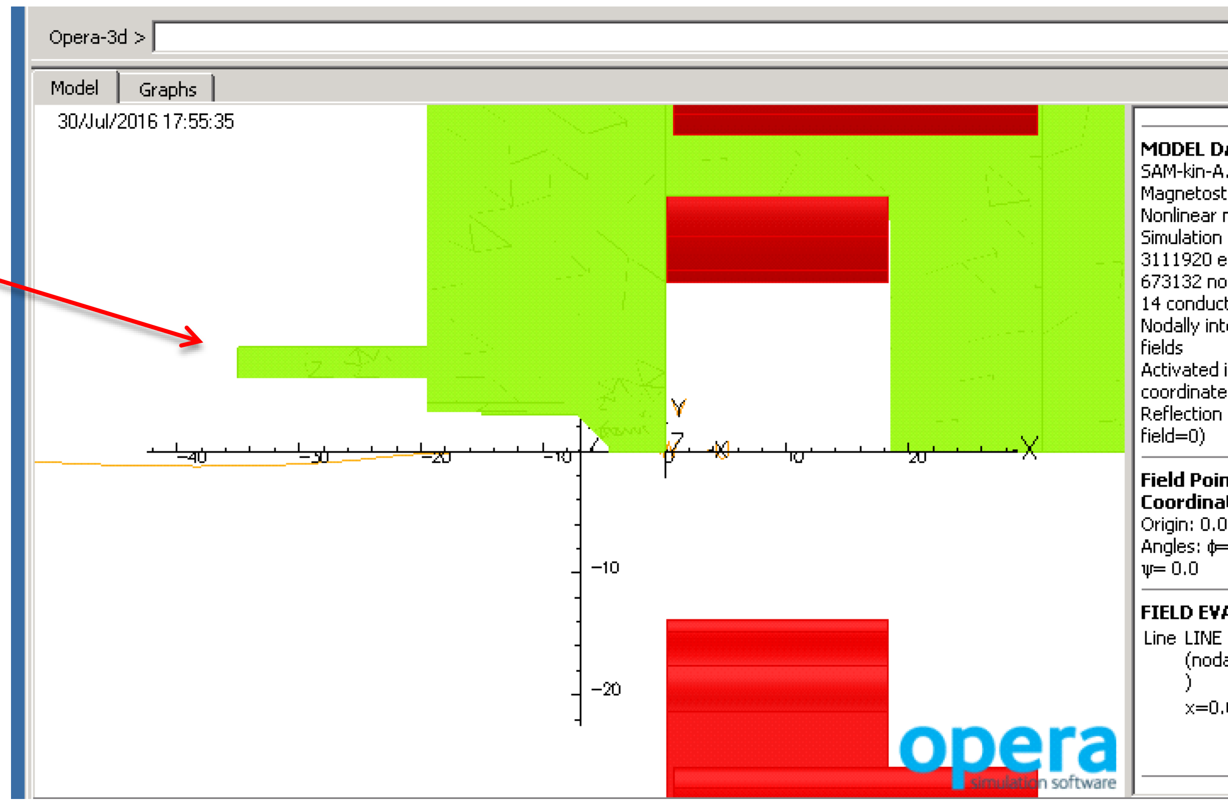
Kinematics “A” for pion

#	θ_γ	θ_e	D_{mag}, m	Bdl, Tm	D_{mag}-Calo, m	angle range, degree
A X	10.57	10.27	1.57	0.3	3-1.57	

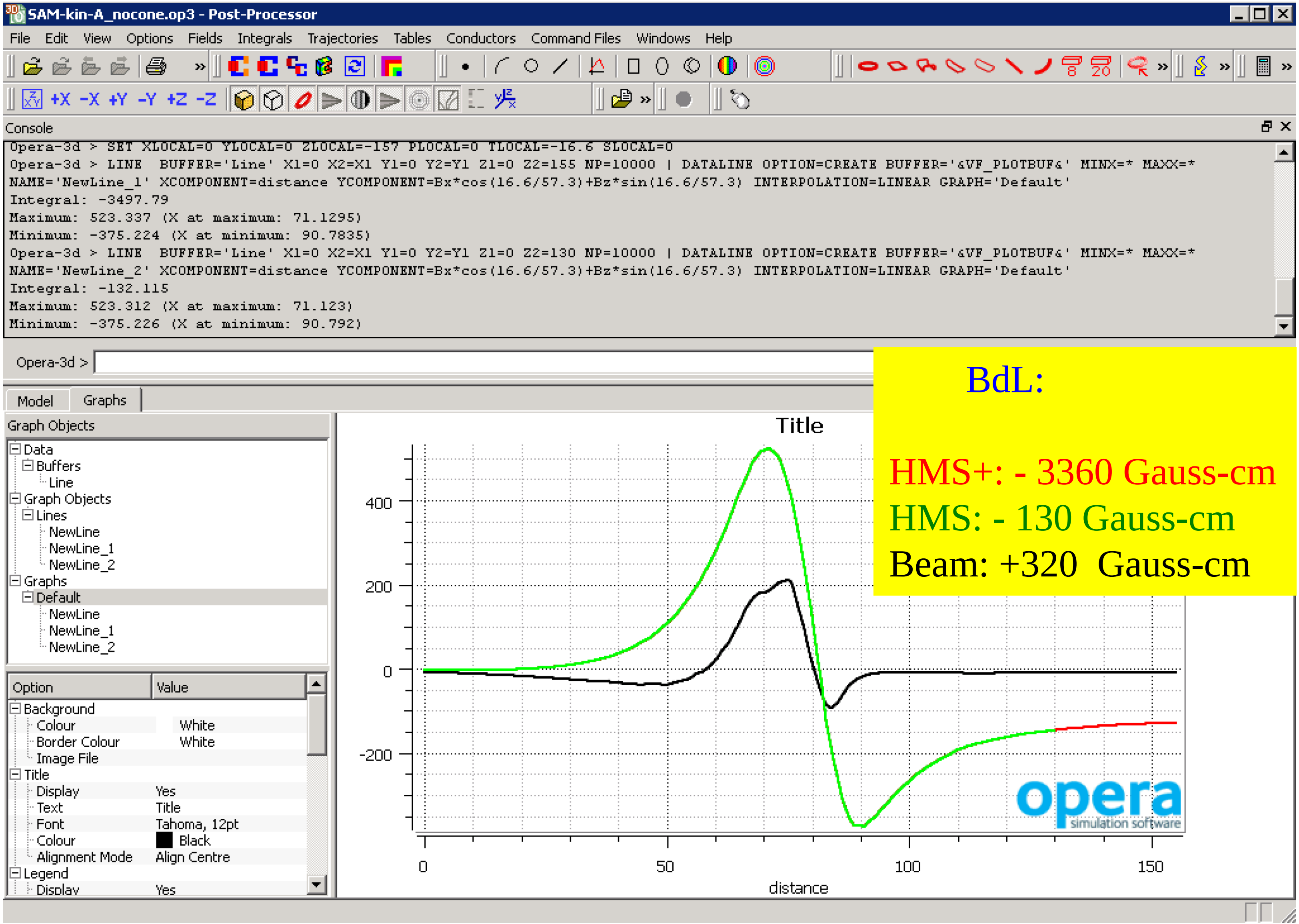


Kinematics "A" for pion

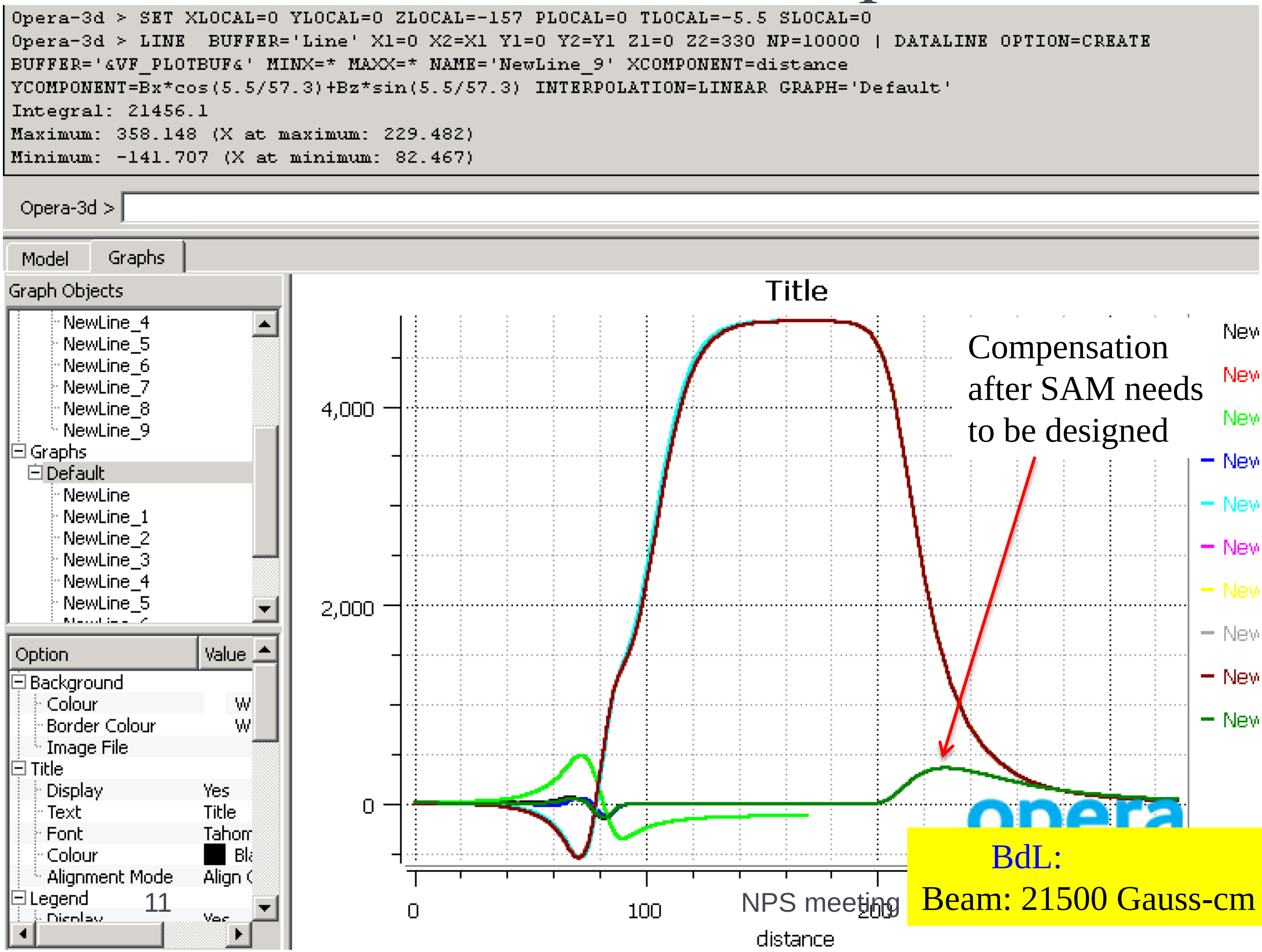
Beam line
is protected
by a 1" shelf



Kinematics "A" for pion



Kinematics “A” for pion

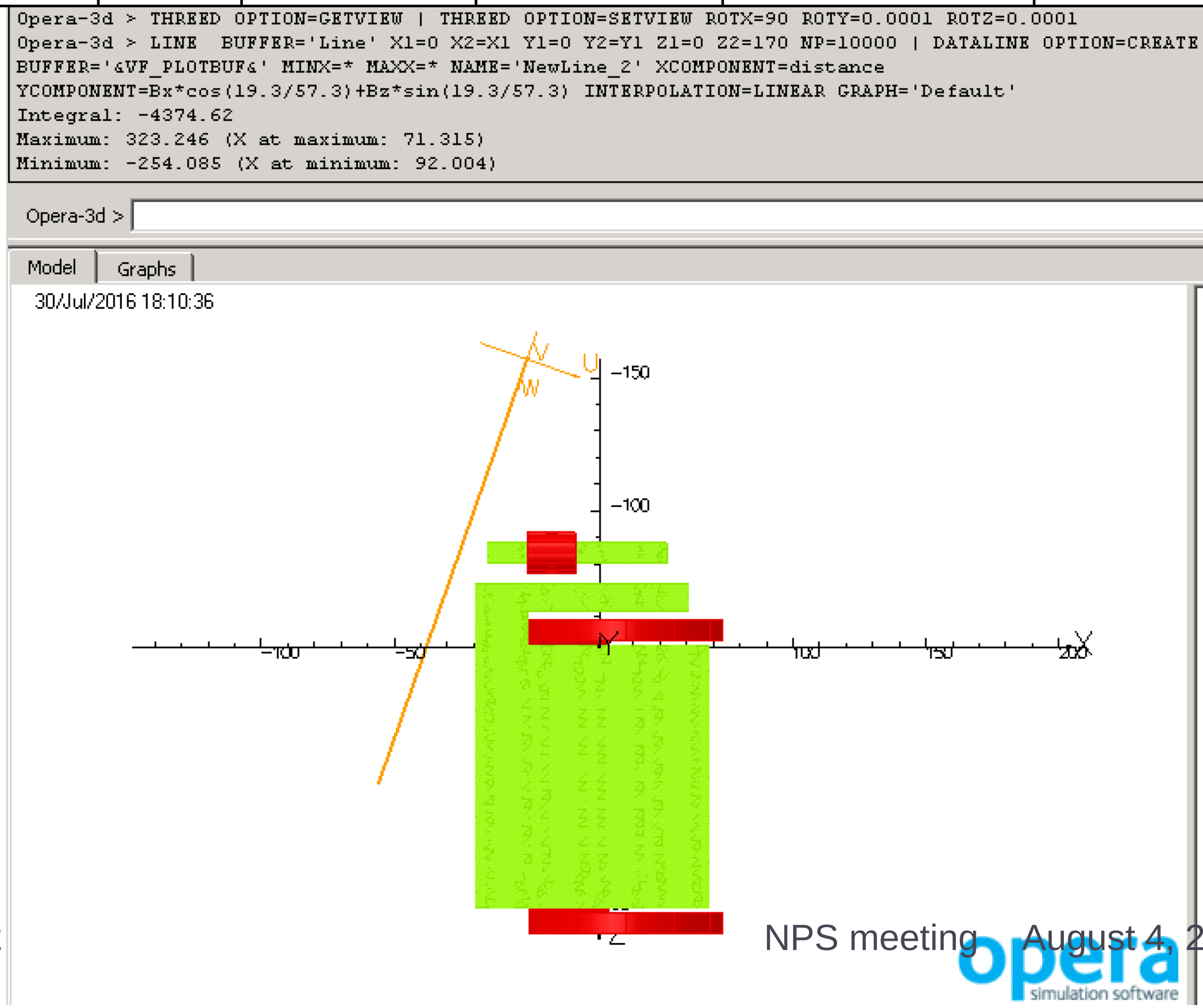


Compensation after SAM needs to be designed

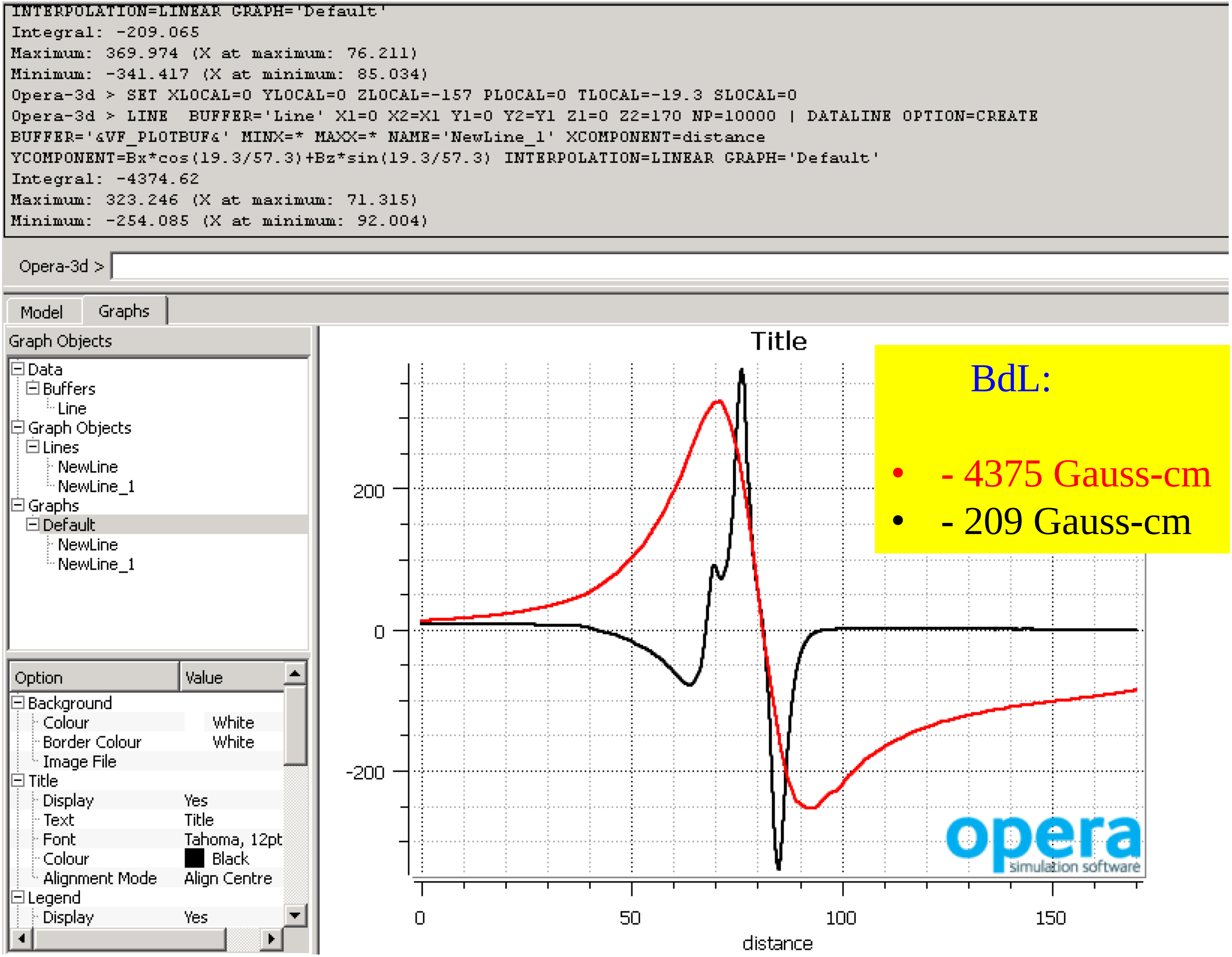
BdL:
Beam: 21500 Gauss-cm

Kinematics “16” for DVCS

#	θ $_\gamma$	θ_e	D_{calo},m	Bdl, Tm	D_{mag}-Calo, m	angle range, degree
16 X	6.3	17.3	6	0.3	4.43	



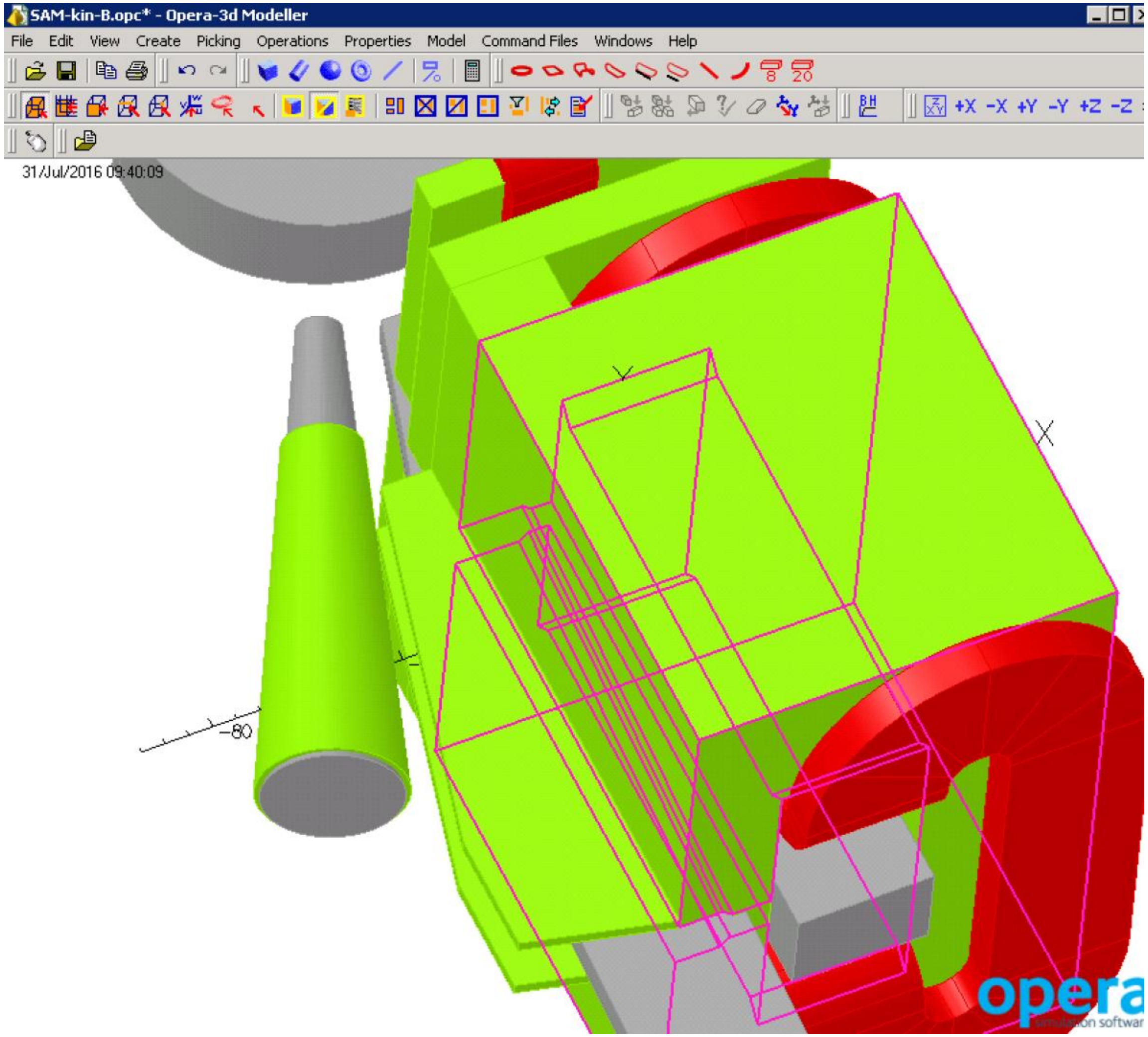
Kinematics “16” for DVCS



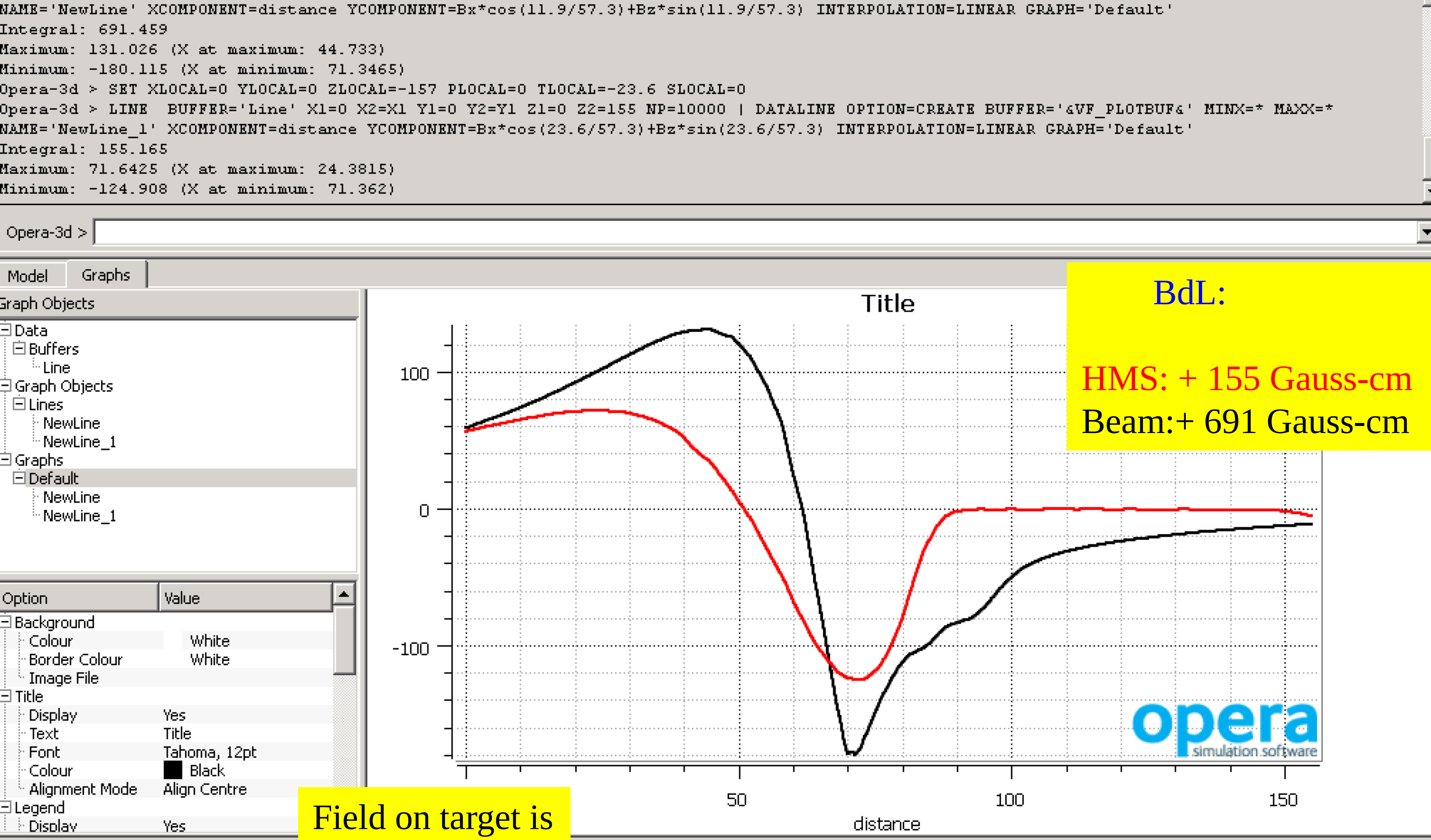
BdL:

- - 4375 Gauss-cm
- - 209 Gauss-cm

Kinematics "B" for pion



Kinematics “B” for pion



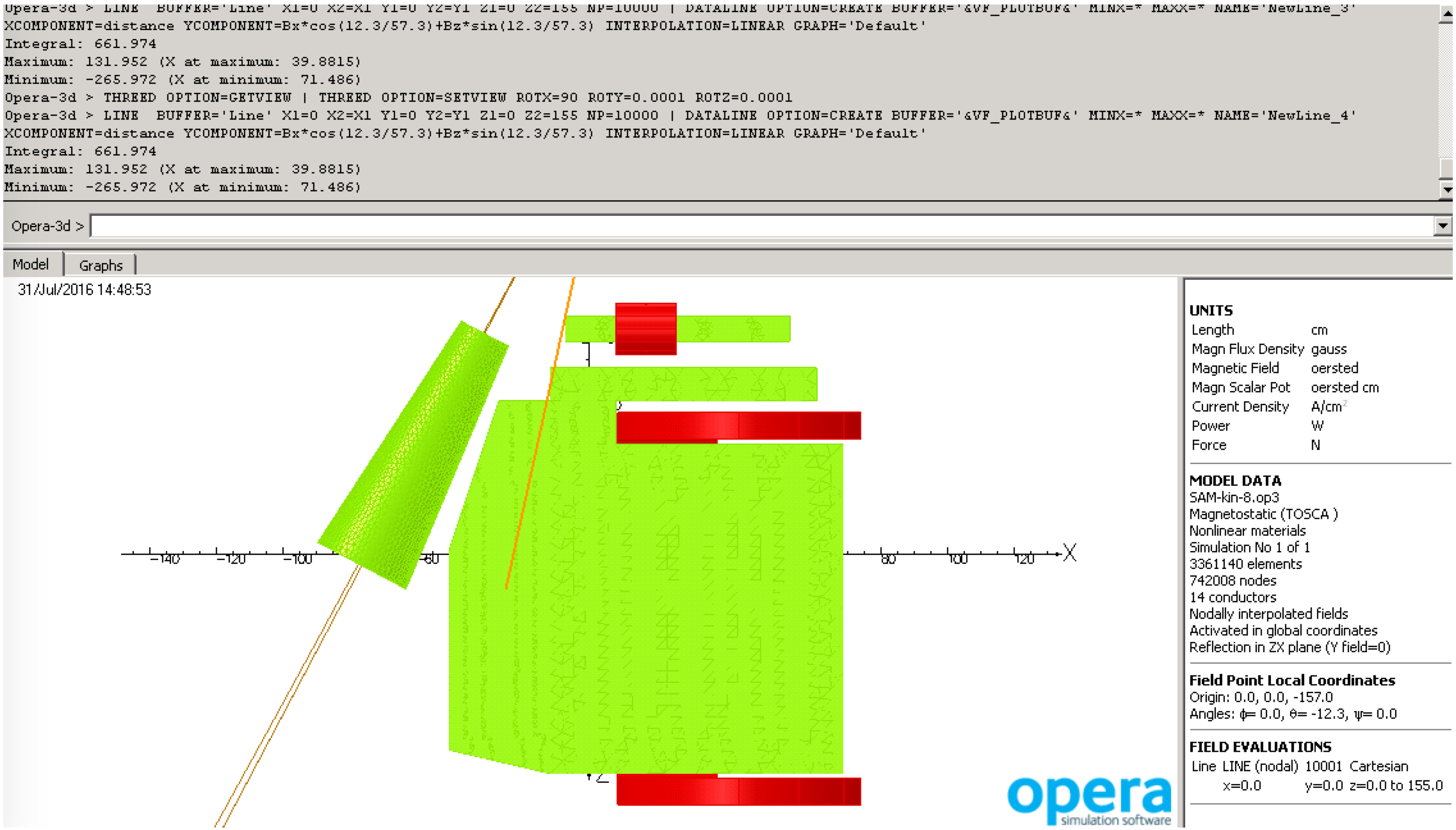
BdL:

HMS: + 155 Gauss-cm

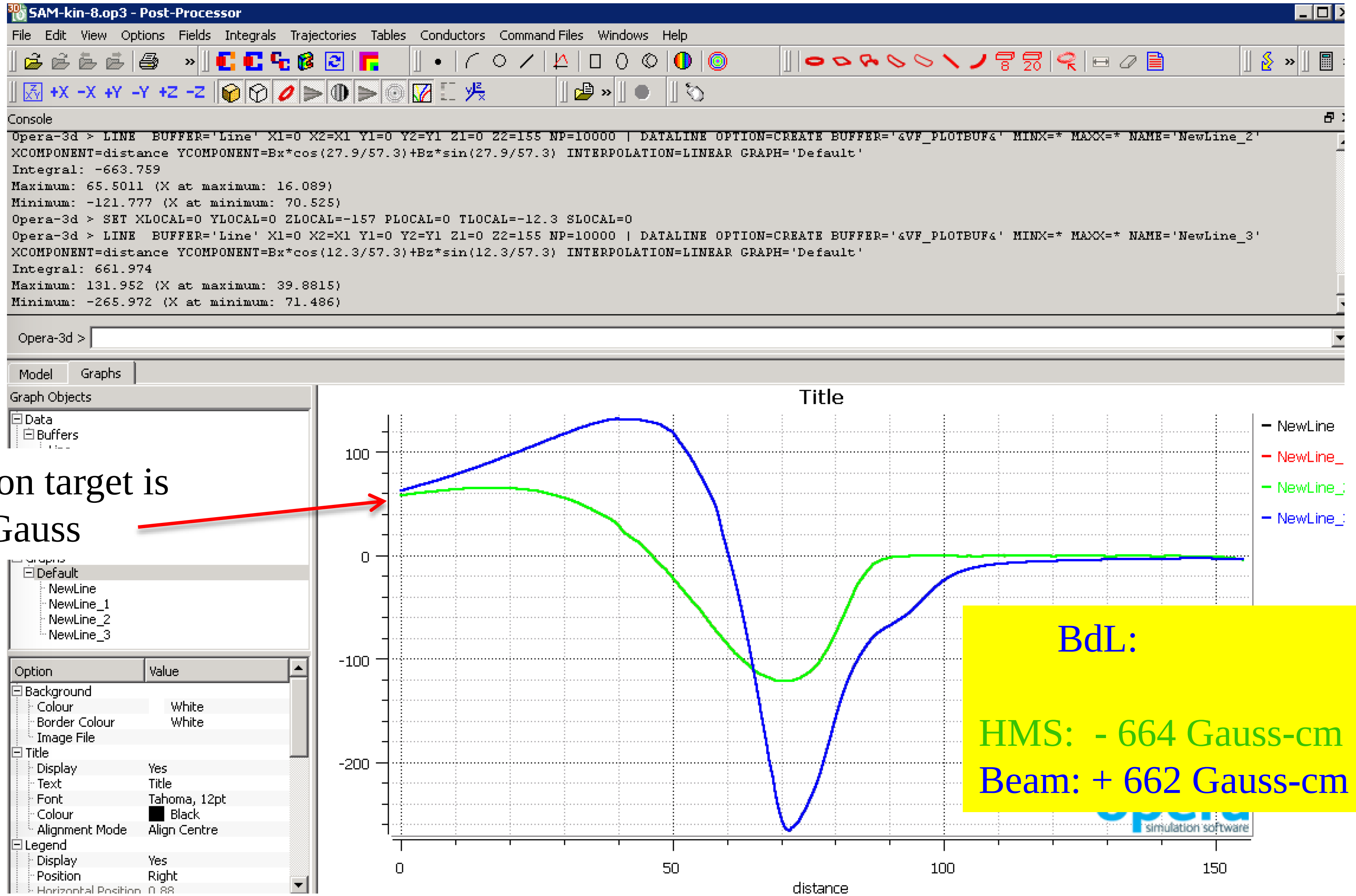
Beam:+ 691 Gauss-cm

Field on target is ~ 60 Gauss

Kinematics “8” for DVCS



Kinematics “8” for DVCS



Field on target is
~ 60 Gauss

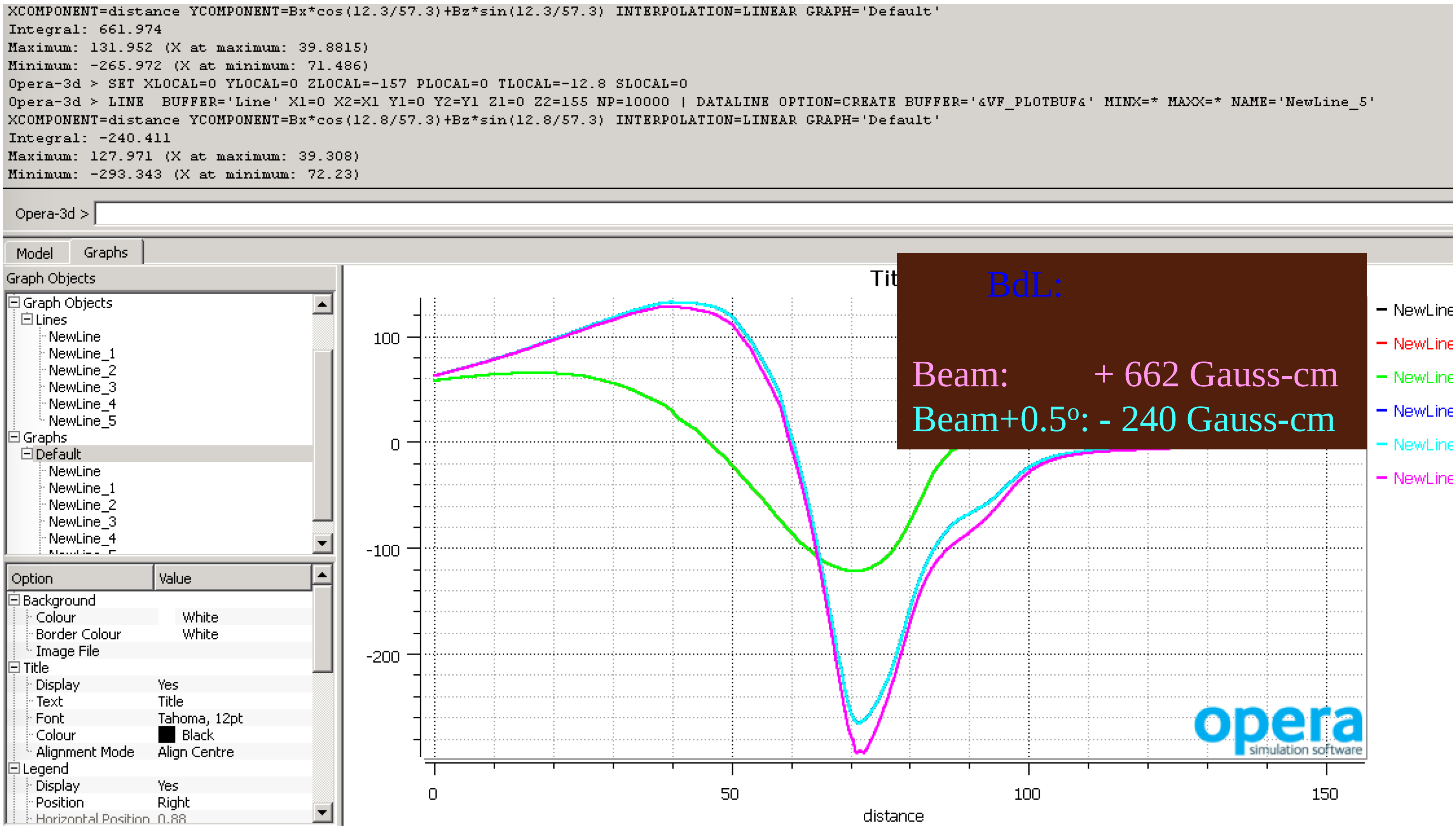
BdL:

HMS: - 664 Gauss-cm
Beam: + 662 Gauss-cm

Kinematics “8” for DVCS

Kinematics “8” for DVCS

BdL variation for 0.5 degree

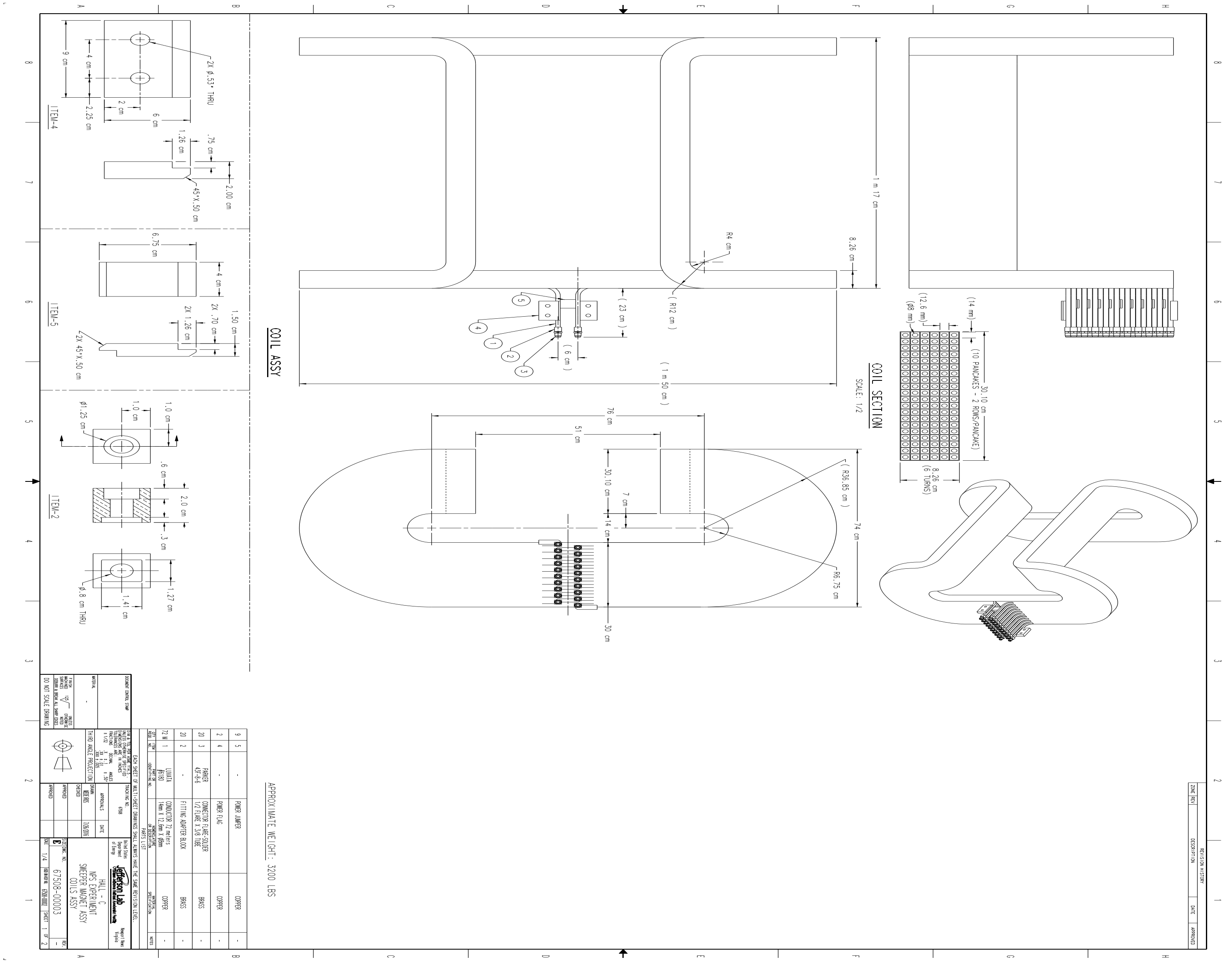


BdL:

Beam: + 662 Gauss-cm

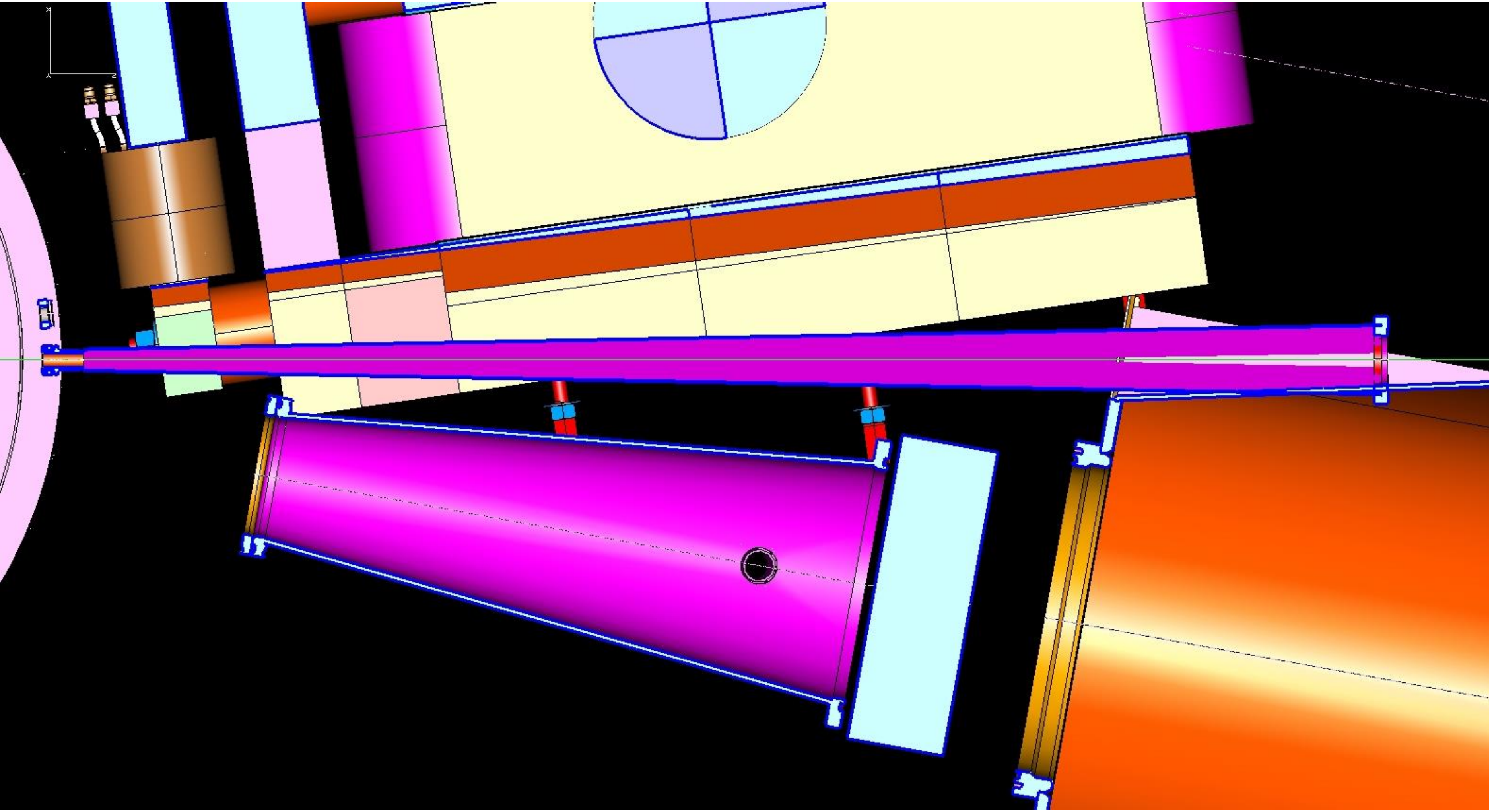
Beam+0.5º: - 240 Gauss-cm

Magnet design/procurement



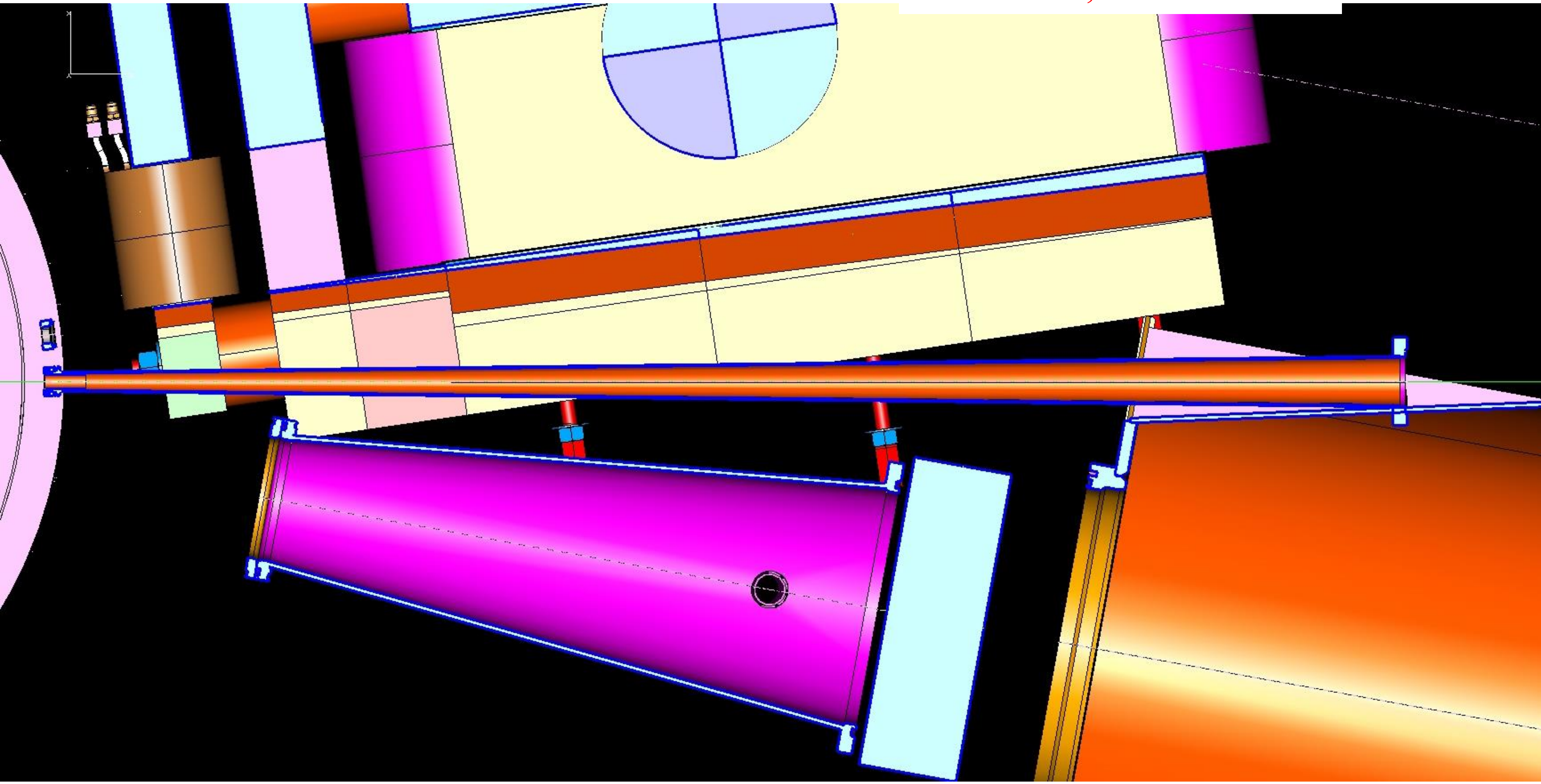
HMS-beam line

Pion – "A", HMS at 10.27

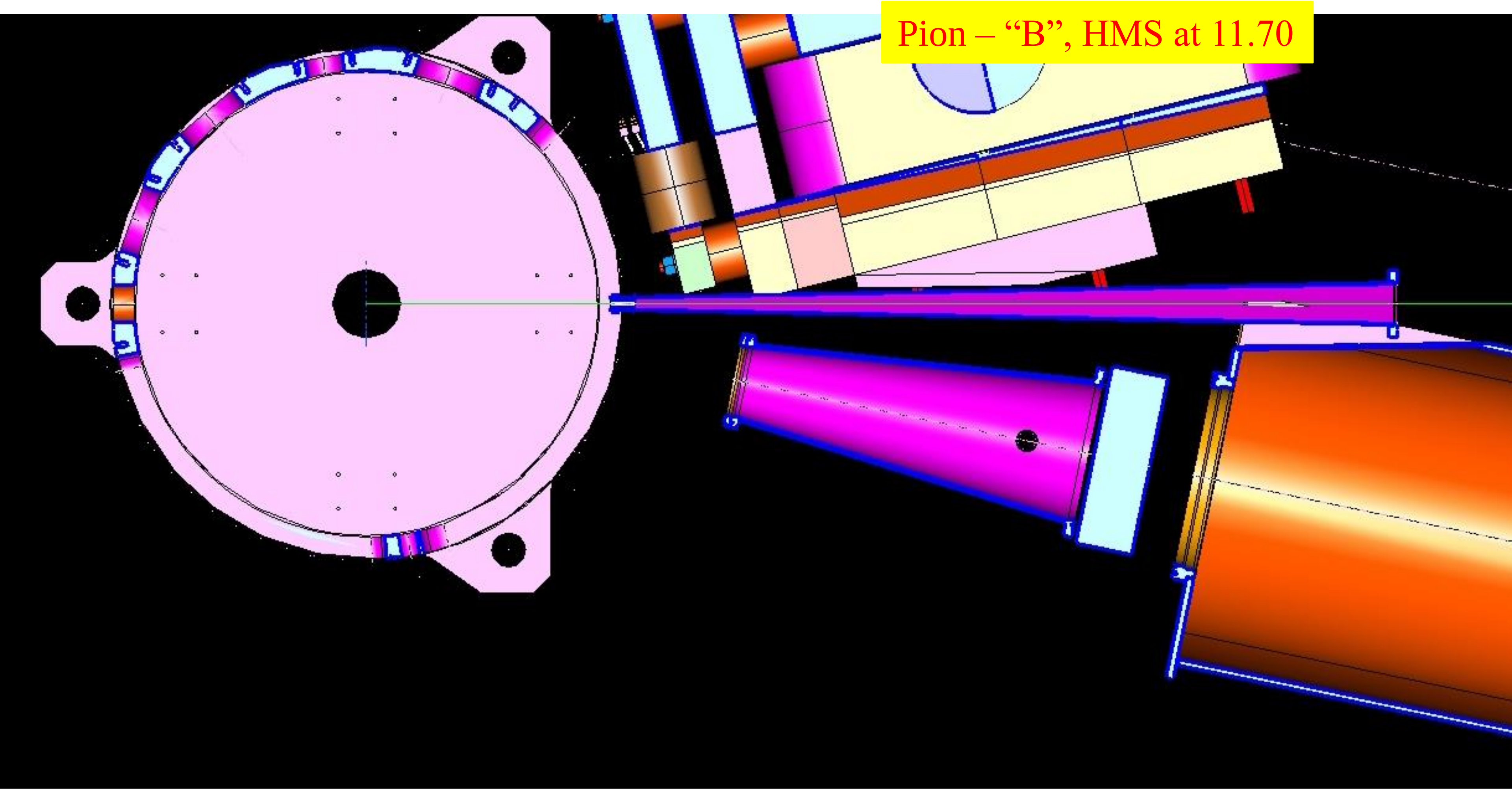


HMS-beam line

Pion – “A”, HMS at 10.27



HMS-beam line



Magnet design plans

1. Large coil: a detailed drawing is competed (P. Medeiros)
2. The main yoke: magnetic design is finalized. Detailed design could start.

3. Option with an additional air-core corrector on the beam line could help reduction of the field on the target. Partial length cone in HMS?

4. A pipe problem at 10.27 angle of HMS – a low cost pipe is a bit too wide.

5. From Rolf: adjust cone length, keep field on the target as low as possible.

6. A post magnet beam line: a corrector + pipe requires some magnetic design.