GMN ERR
Charges 6 and 7
Jay Benesch

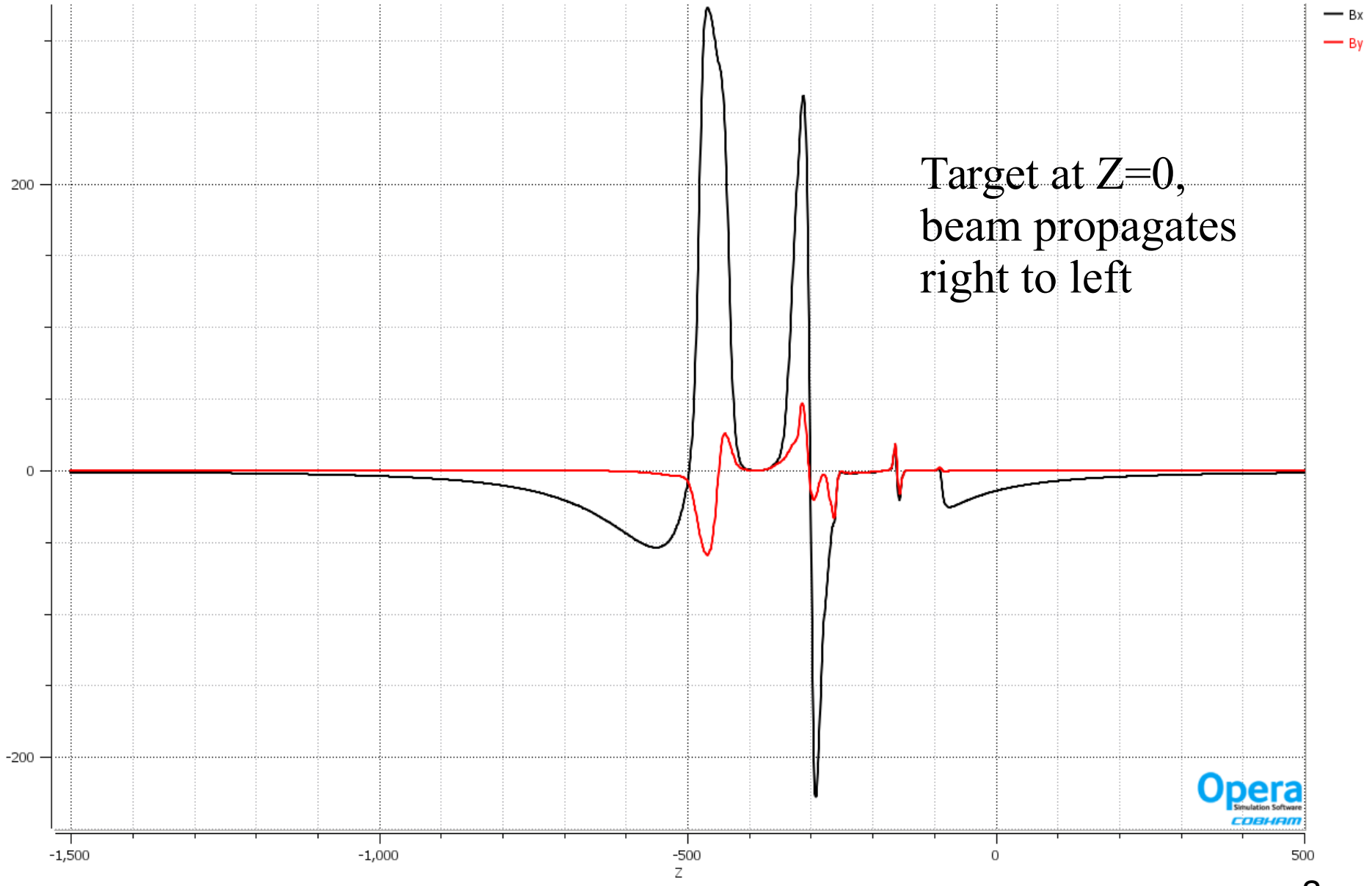
Charge Items

- 6. Is the beam delivery affected by the running configuration of BigBite and SBS? If yes, have the fringe field effects been properly mitigated?
- 7. Are the beam commissioning procedures and machine protection systems sufficiently defined for this stage?

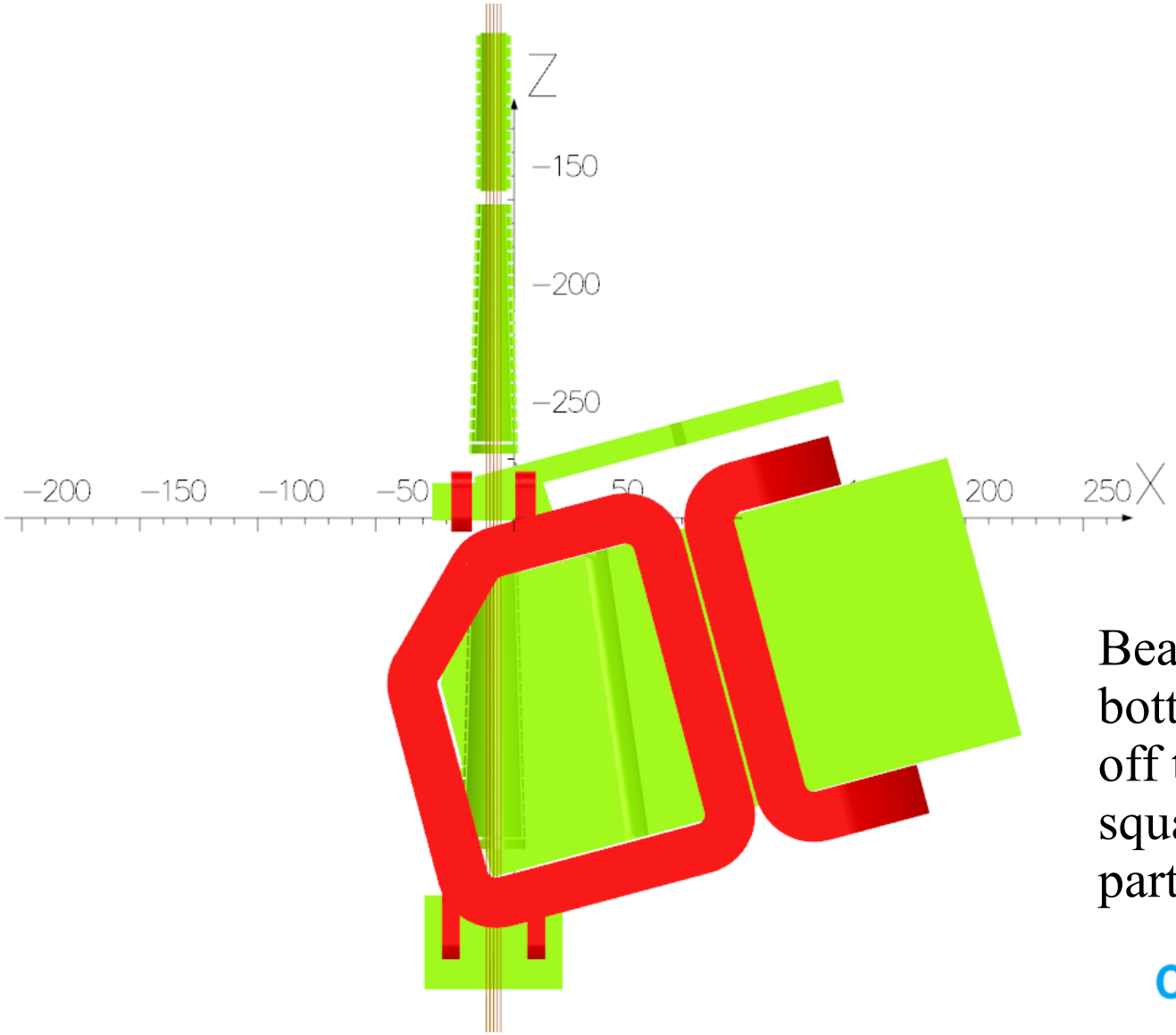
Charge 6 - fringe fields

- Opera Modeller file received from Bogdan Wojtsekhowski May 16. I meshed and solved it. Field integral 1.56 Tm vs 1.71 Tm maximum.
- Integrated Bx field along central primary beam orbit was ~5 kG-cm so I adjusted the downstream correctors to lower it. Upstream correctors have much more headroom; I chose to change only downstream, maintaining Bogdan's ratio between left and right.
- Decreased mesh size and increased volume meshed to insure fields in the region of interest were not affected by the zero forced at the boundary.
- Downstream corrector excitation was increased to reduce Bx; By increased modestly as a result of steel interactions. Current densities of 900 A/cm^2 and 1050 A/cm^2 were required to get Bx and By integrals down to acceptable levels. Correctors are water cooled and upstream correctors are barely used (0 and 75 A/cm^2) so fringe fields should be correctable even with 10% more excitation.

Stray field along Z axis (x,y = 0.707 cm)



SBS assembly bottom view



UNITS

Length	cm
Magn Flux Density	gauss
Magnetic Field	oersted
Magn Scalar Pot	oersted cm
Current Density	A/cm²
Power	W
Force	N

MODEL DATA

GMN13_try3.op3
Magnetostatic (TOSCA)
Nonlinear materials
Simulation No 2 of 2
5518938 elements
6414390 nodes
25 conductors
Nodally interpolated fields
Activated in global coordinates
Reflection in ZX plane (Y field=0)

Field Point Local Coordinates

Local = Global

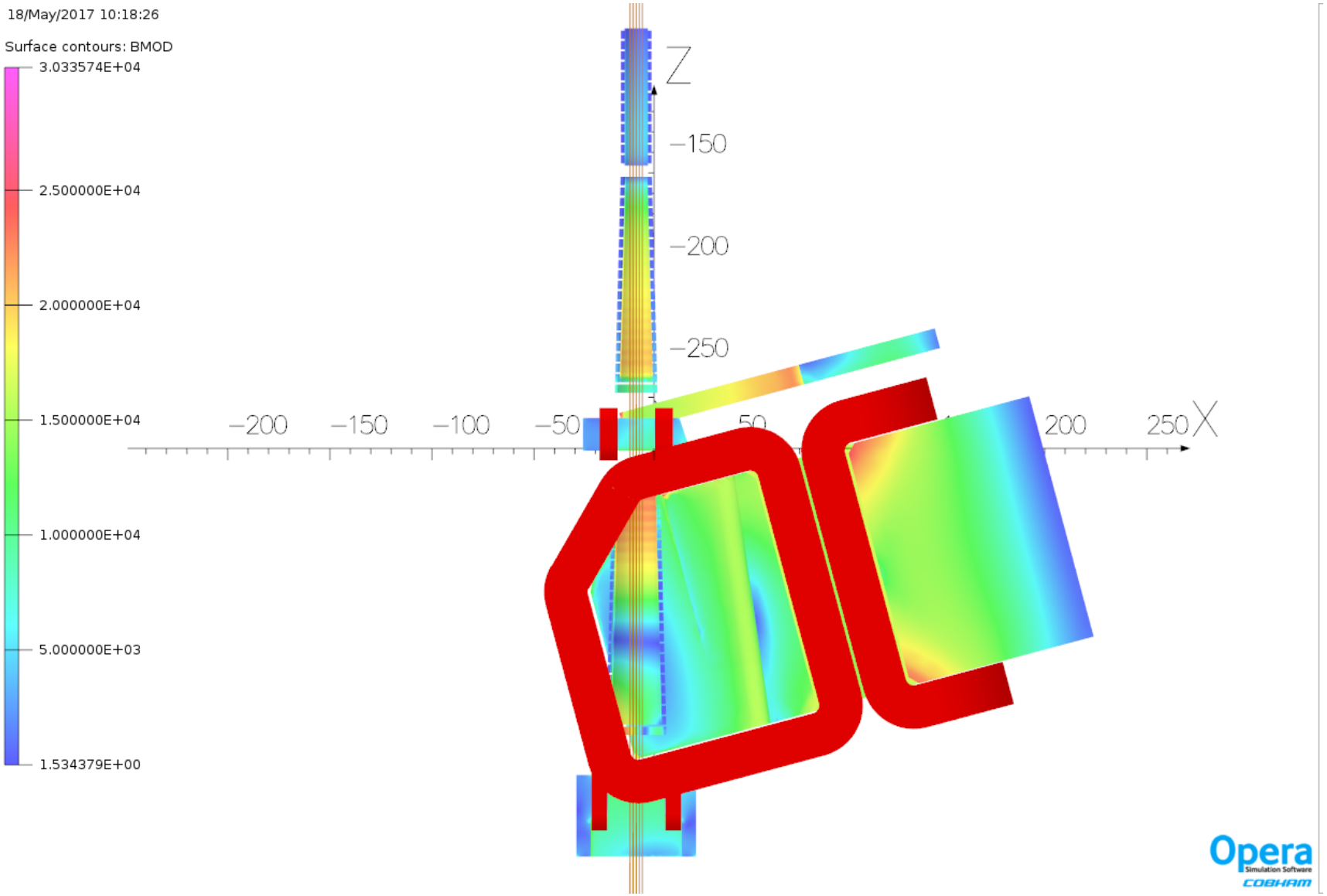
FIELD EVALUATIONS

Line LINE (nodal) 2501 Cartesian
x=0.1414 y=0.1414 z=-1500.0 to 1000.0

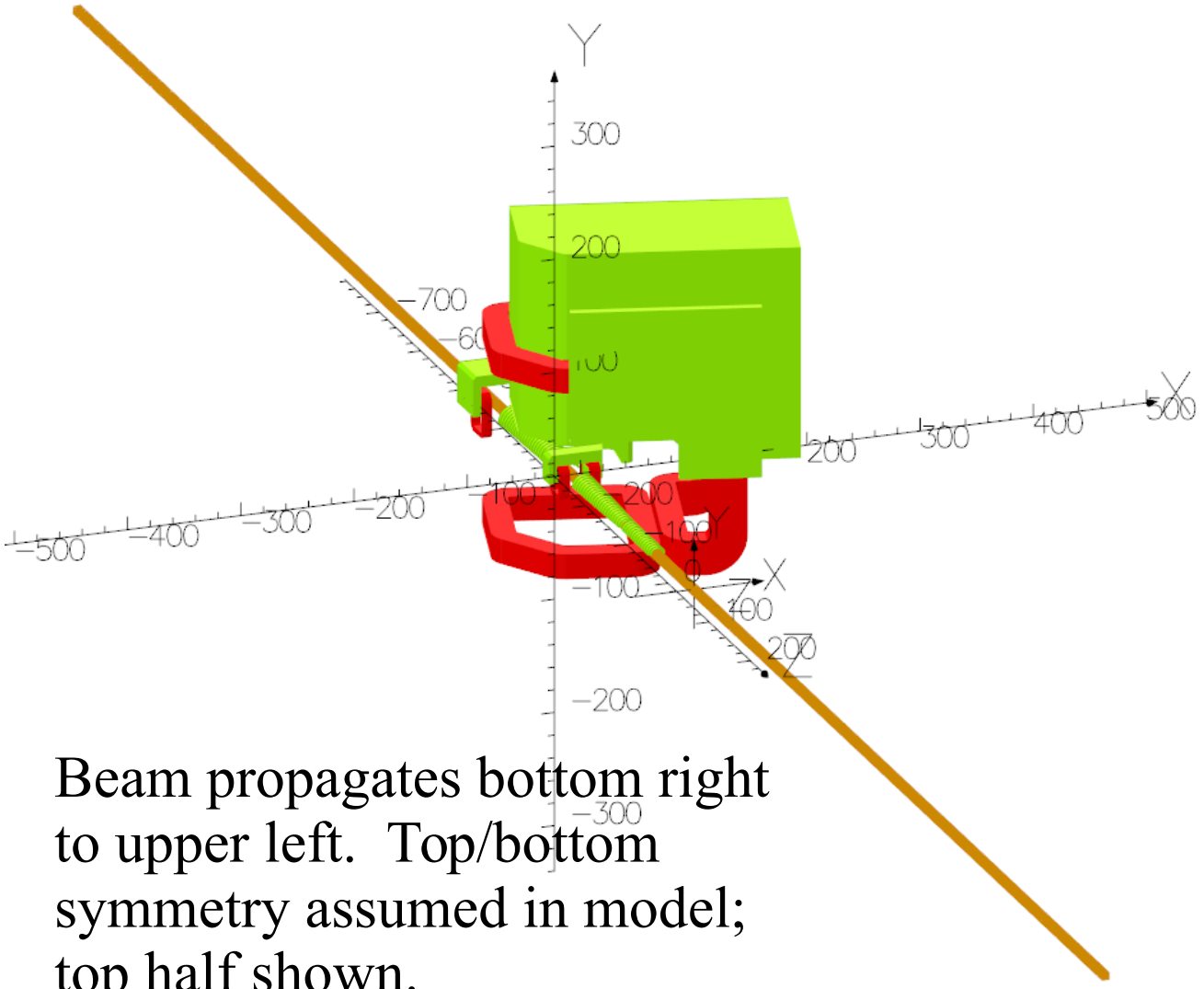
Beam propagates top to bottom; target at Z =0 off top of page. 6 cm square array of 4.5 GeV particles shown

Opera Simulation Software COBHAM

Fields on surface of model



11 GeV particle array



Beam propagates bottom right to upper left. Top/bottom symmetry assumed in model; top half shown.

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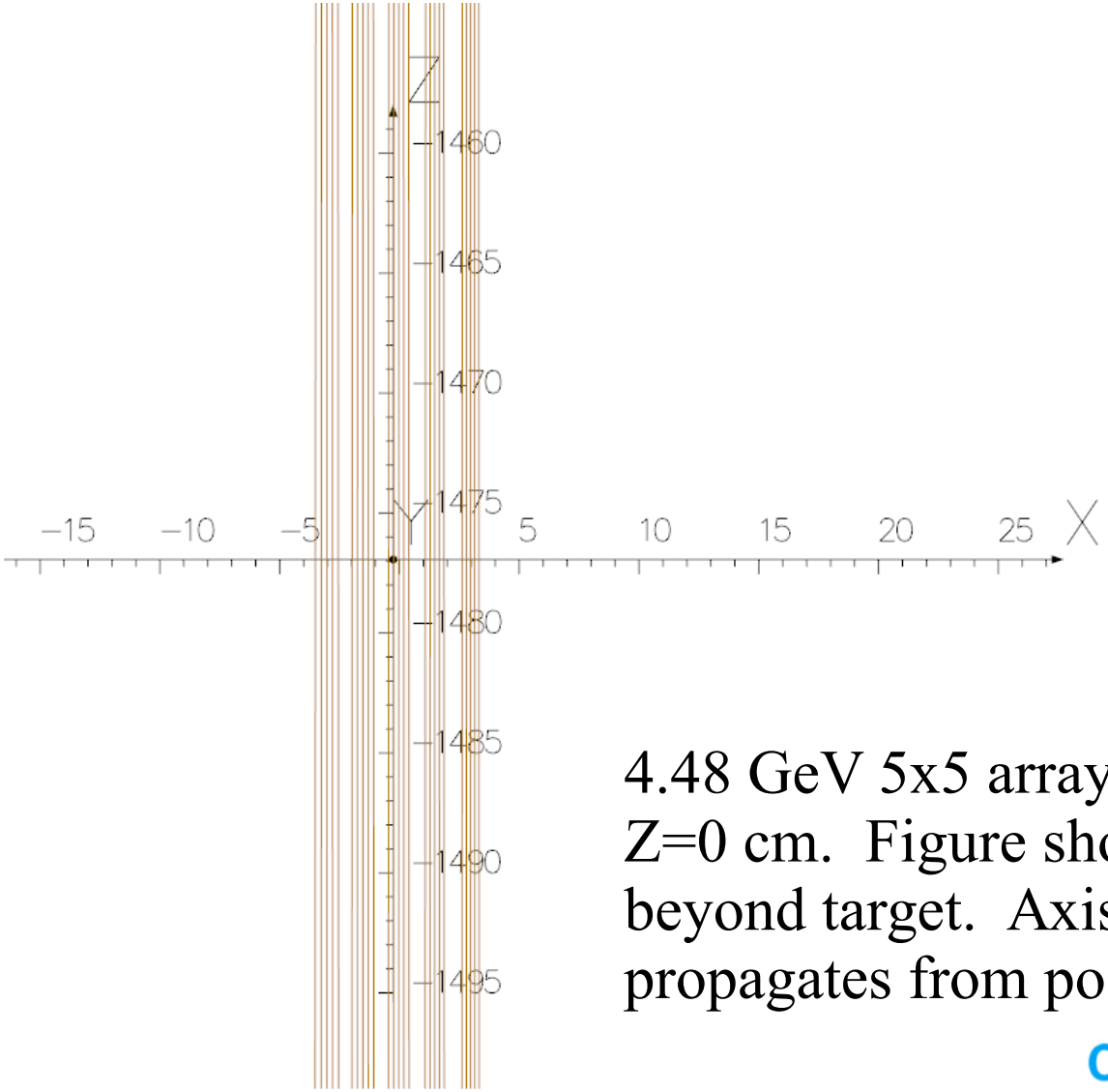
4.48 GeV particle array



UNITS

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Magnetic Field	oersted
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Current Density	A/cm²
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MODEL DATA

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5518938 elements
6414390 nodes
25 conductors
Nodally interpolated fields
Activated in global coordinates
Reflection in ZX plane (Y field=0)

Field Point Local Coordinates

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FIELD EVALUATIONS

Line	LINE (nodal) 2501		Cartesian
	x=0.1414	y=0.1414	z=-1500.0 to 1000.0

4.48 GeV 5x5 array, 6 cm square, launched at Z=0 cm. Figure shows X deflections 1500 cm beyond target. Axis scales cm. Beam propagates from positive to negative Z.

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Charge 6 conclusions

- **If** downstream correctors can each be powered and cooled to provide 42 kAT the fringe field effects have been mitigated. (38 kAT needed for 1.56 Tm, 90% of full magnet capability.) Upstream correctors have full capacity available; I simply chose not to use them.
- The only significant multipole is skew quadrupole, integral dZ -812 G. This is of the same order as the skew quadrupole of the Lambertson and is not an issue for round beams. It rotates the 5x5 arrays a little as shown on the previous slide.
- Power supply controls of downstream correctors should be ganged left:right in 6:7 ratio to simplify Operations steering to dump viewers.
- All calculations were done with main SBS coil currents as supplied by B. Wojtsekhowski, field integral 1.56 Tm.

Operations

- Eight Hall A operations procedures are at
  http://opsntsrv.acc.jlab.org/ops_docs/MCC_web_interface/interface_pages/operating_procedures.asp
- Beam has been delivered to Hall A for physics.
- PSS and MPS hardware are in place and operational
- Dump ion chambers will turn off beam if one of the SBS power supplies fails. I don't see a need for additional interlocks.
- Operational restrictions will be set by Department Leader when experiment begins commissioning.
- No difficulties are expected re charge 7.