Neutrino Factory Nozzle Layouts

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NFMCC Friday Meeting
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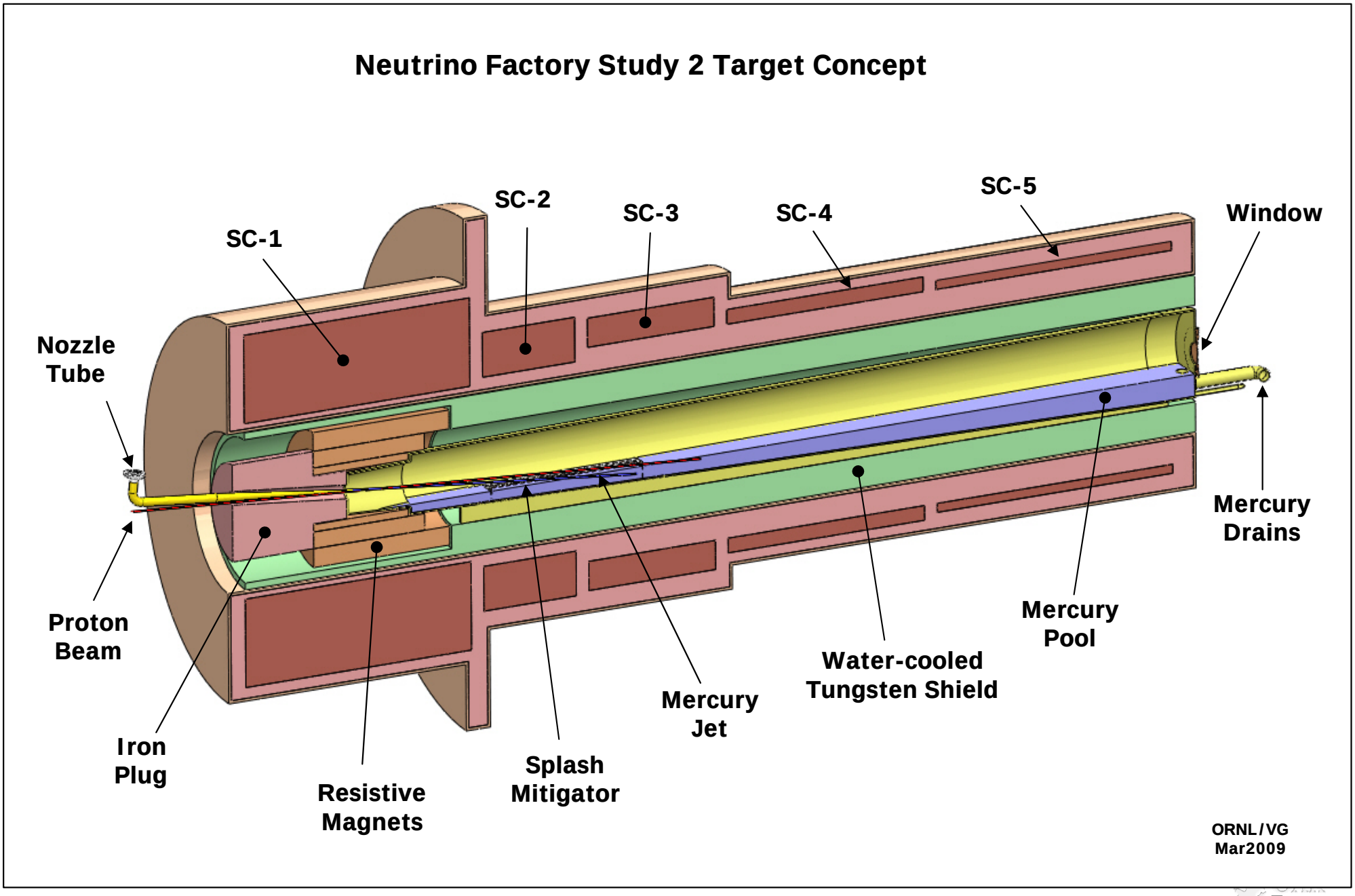
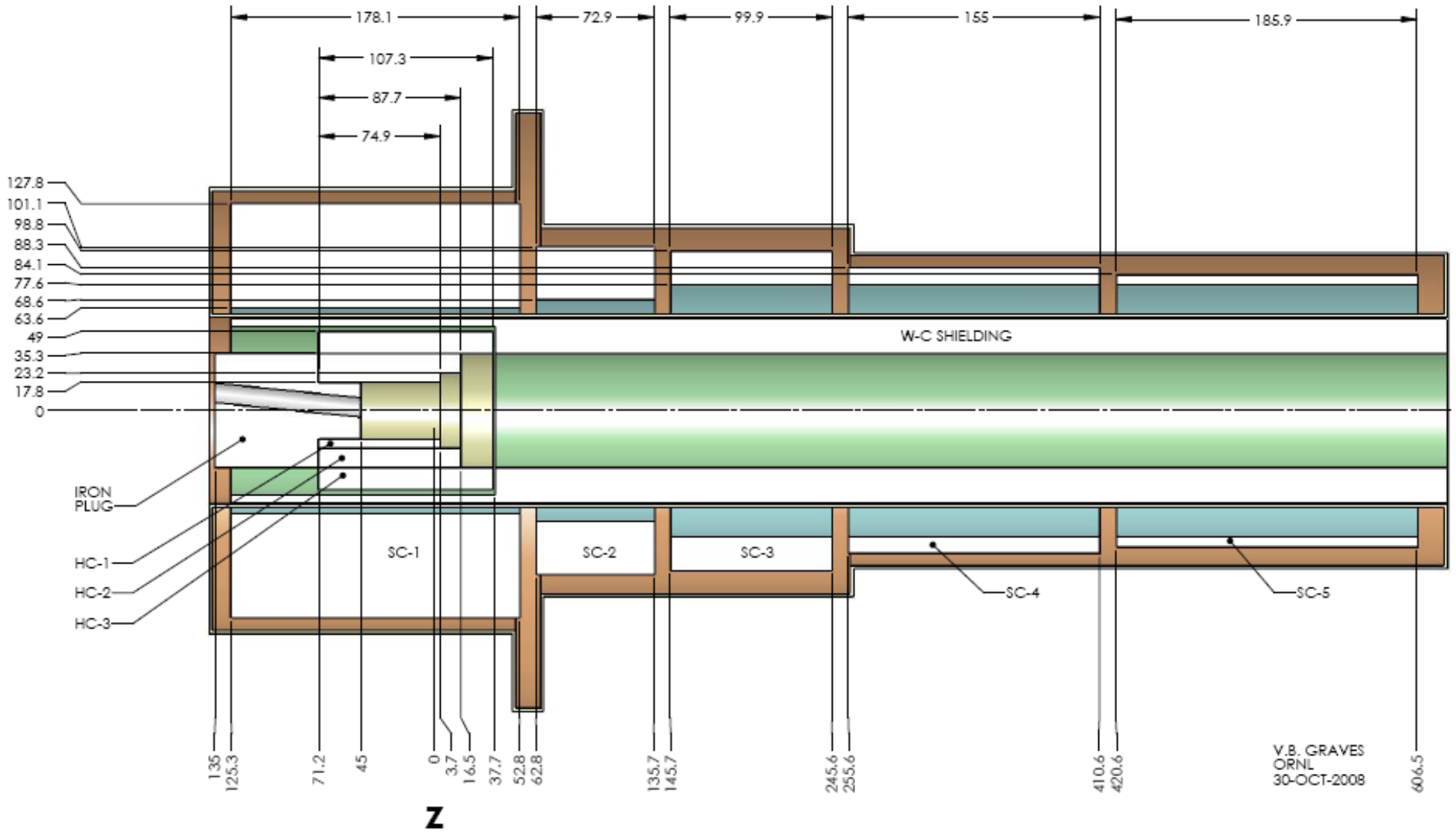
Goals

- To compare the Neutrino Factory Study II target layout with results from current studies
- Identify some mechanical issues that will need to be resolved

General Target Concept



NF Study II Dimensional Info (unchanged)



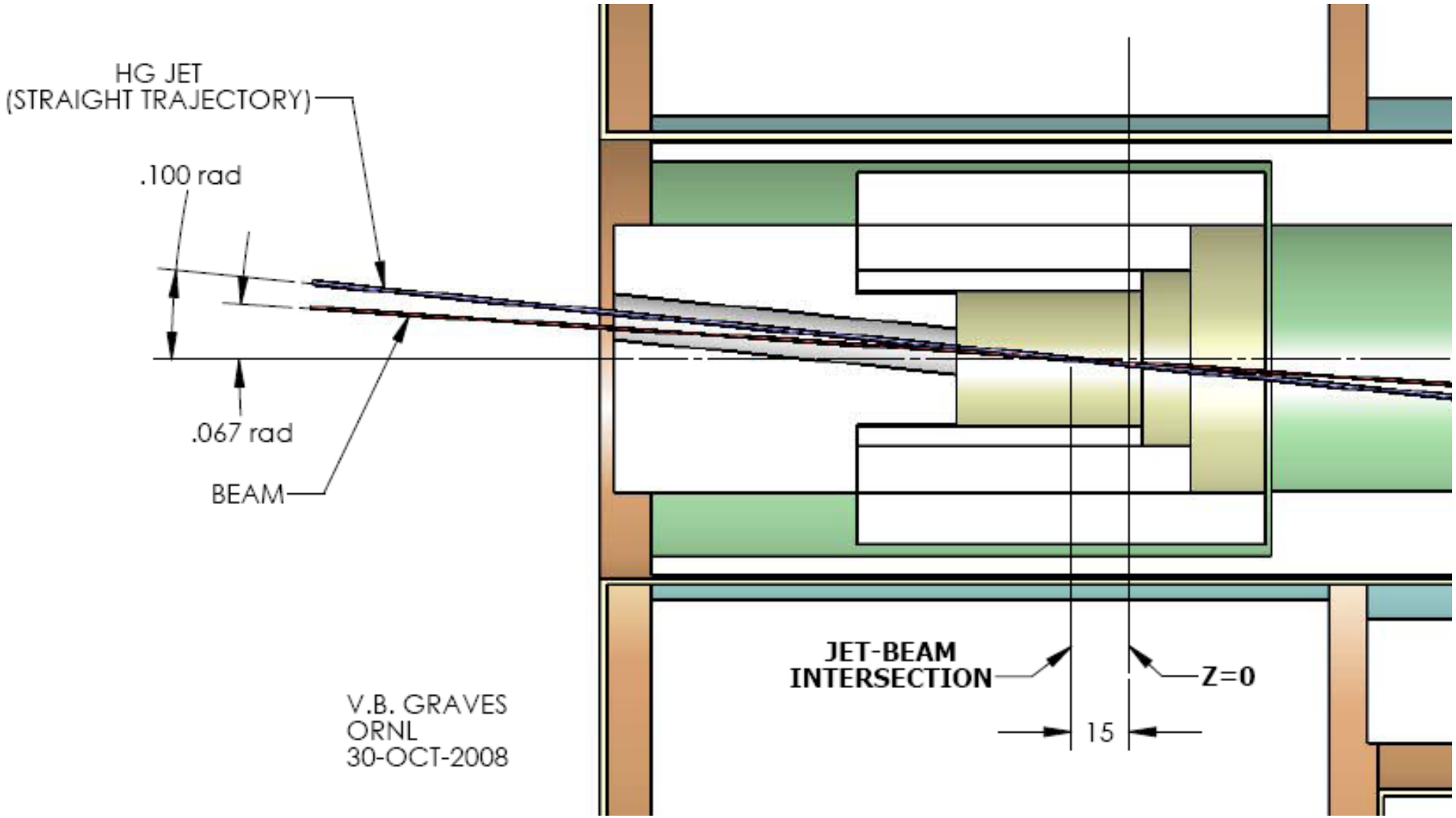
Based on Study II Tables 3.13, 3.14
Dimensions in cm

NF Study II Z Reference

- From Section 3.1.2
- Locates jet relative to solenoids

The distance over which the jet must propagate without serious magnetic disruption is from the nozzle to a point 0.6 m downstream, defined as $z = 0$ in the coordinate system used here. In order to minimize the field nonuniformity over this length, the magnetic center (approximately the point of maximum B_z) is placed at the center of this length. *i.e.*, the magnetic center is at $z_o = -30$ cm. The intersection of the jet and beam is then at $z_{\text{intersection}} = -15$ cm, and the nozzle is at $z_{\text{nozzle}} = -60$ cm.

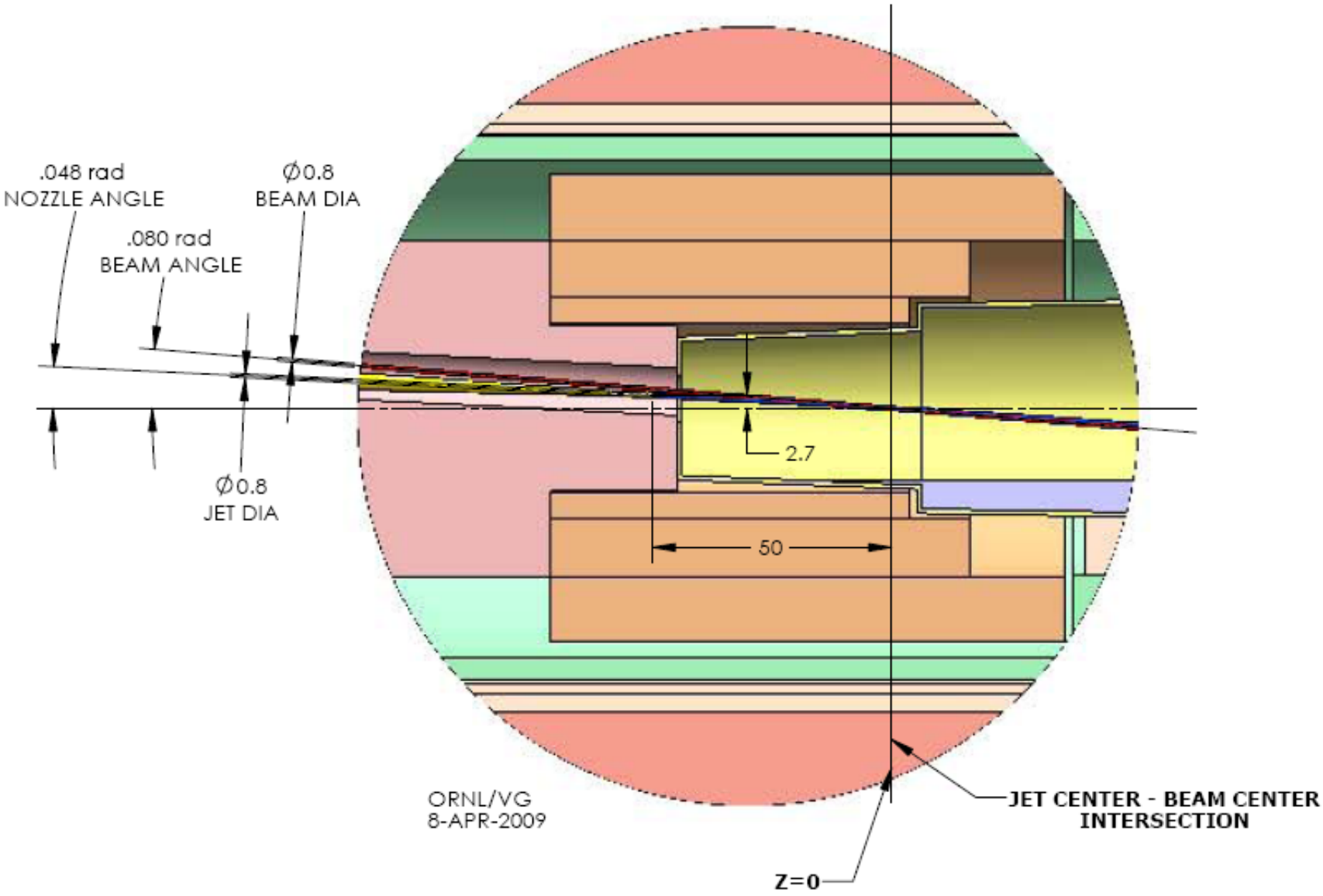
NF Study II Hg Jet Layout



Current Jet/Beam Parameters

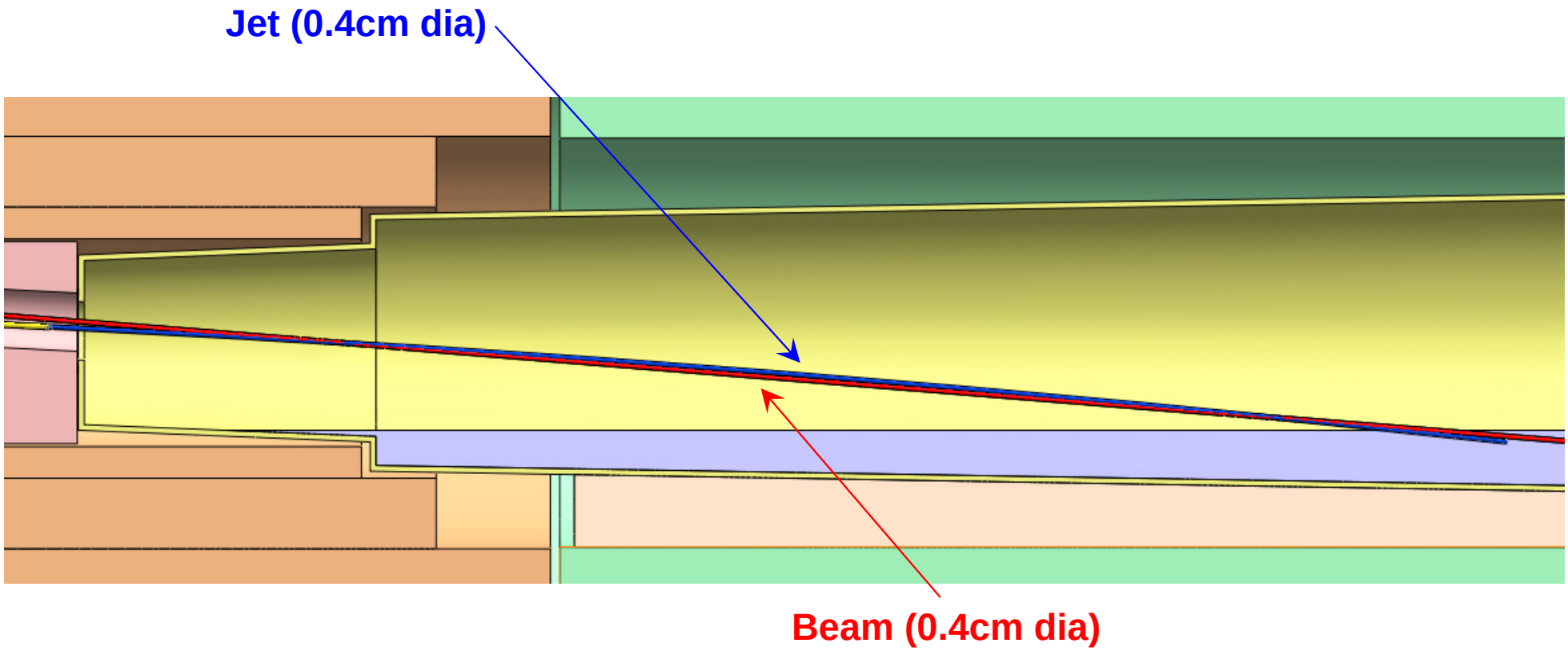
- Recent studies have caused changes to baseline target parameters
  - Consideration of gravity on jet trajectory moves nozzle below beam
  - Maximizing particle production requires steeper beam angle
- New conditions
  - Beam
    - Angle: -80 mrad, crosses magnet axis at Z=0
    - Size: 0.4 cm dia
  - Jet
    - Nozzle angle: -48 mrad
    - Nozzle location: Z=-50cm, Y=+2.7cm
    - Jet angle at Z=0: -60 mrad
    - Jet size: 0.4 cm dia
    - Jet center intersects beam center at Z=0

NF/IDS Hg Jet Layout



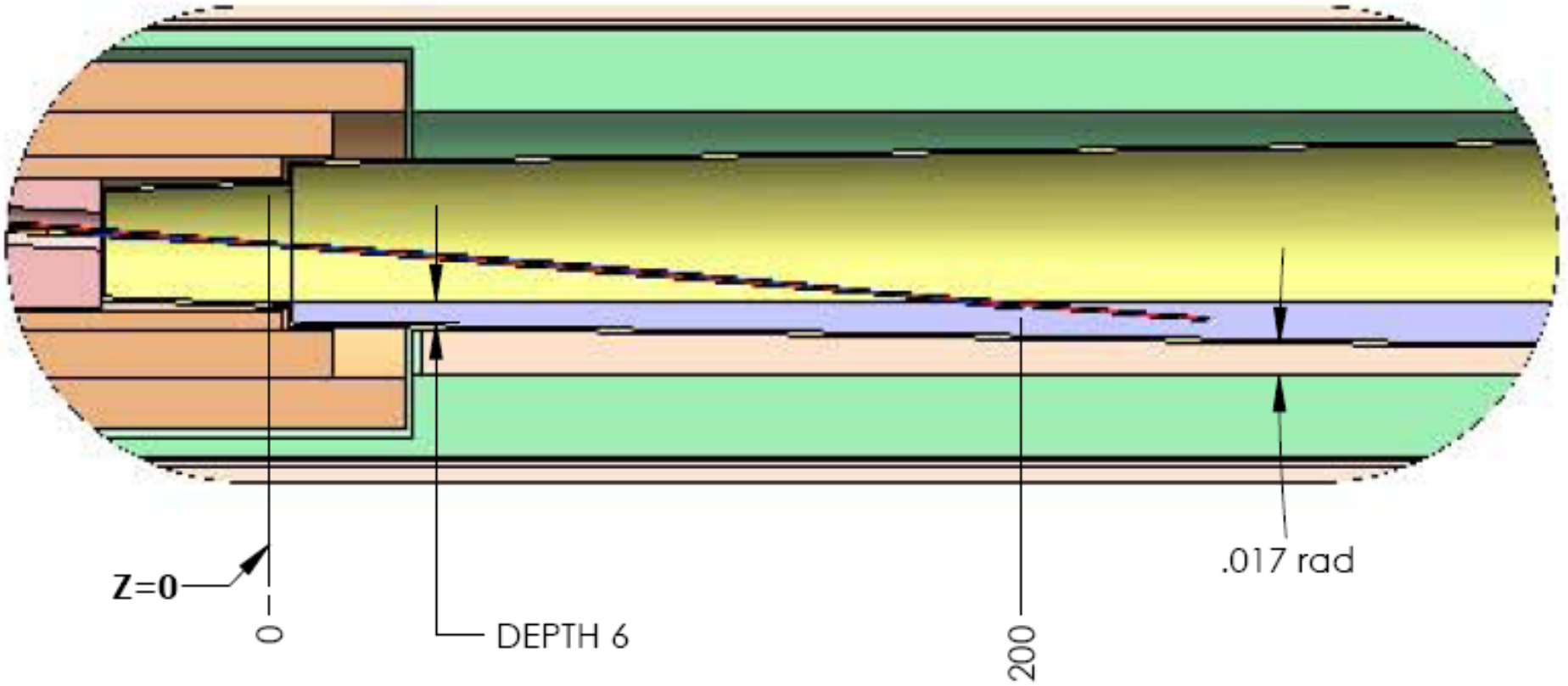
NF/IDS Jet Trajectory

- Jet curved trajectory included in model
- Beam will intersect pieces of dispersed jet all the way to the pool



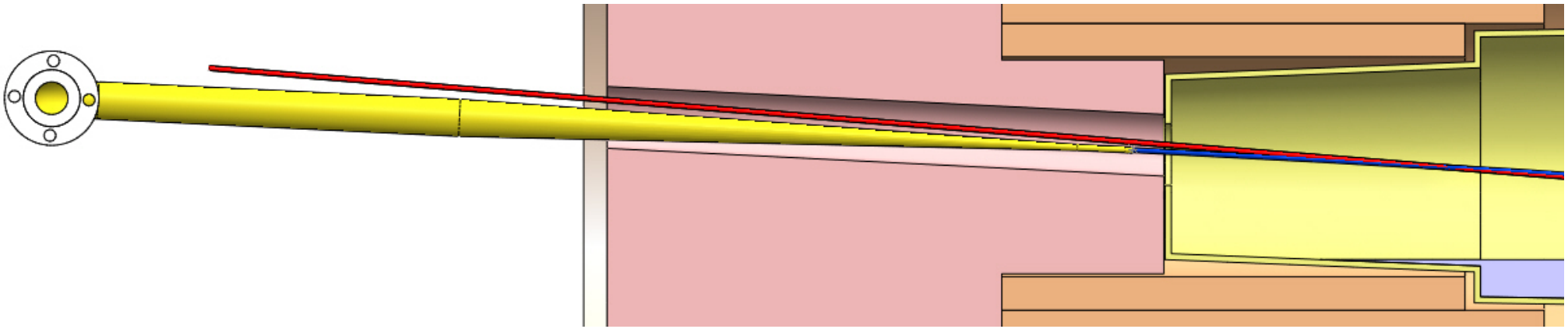
NF/IDS Pool

- Current jet parameters show pool entrance at ~ 2m
  - Pool has 1 deg slope for drainage
  - Splash mitigation not shown
  - Pool definition certainly not finalized!



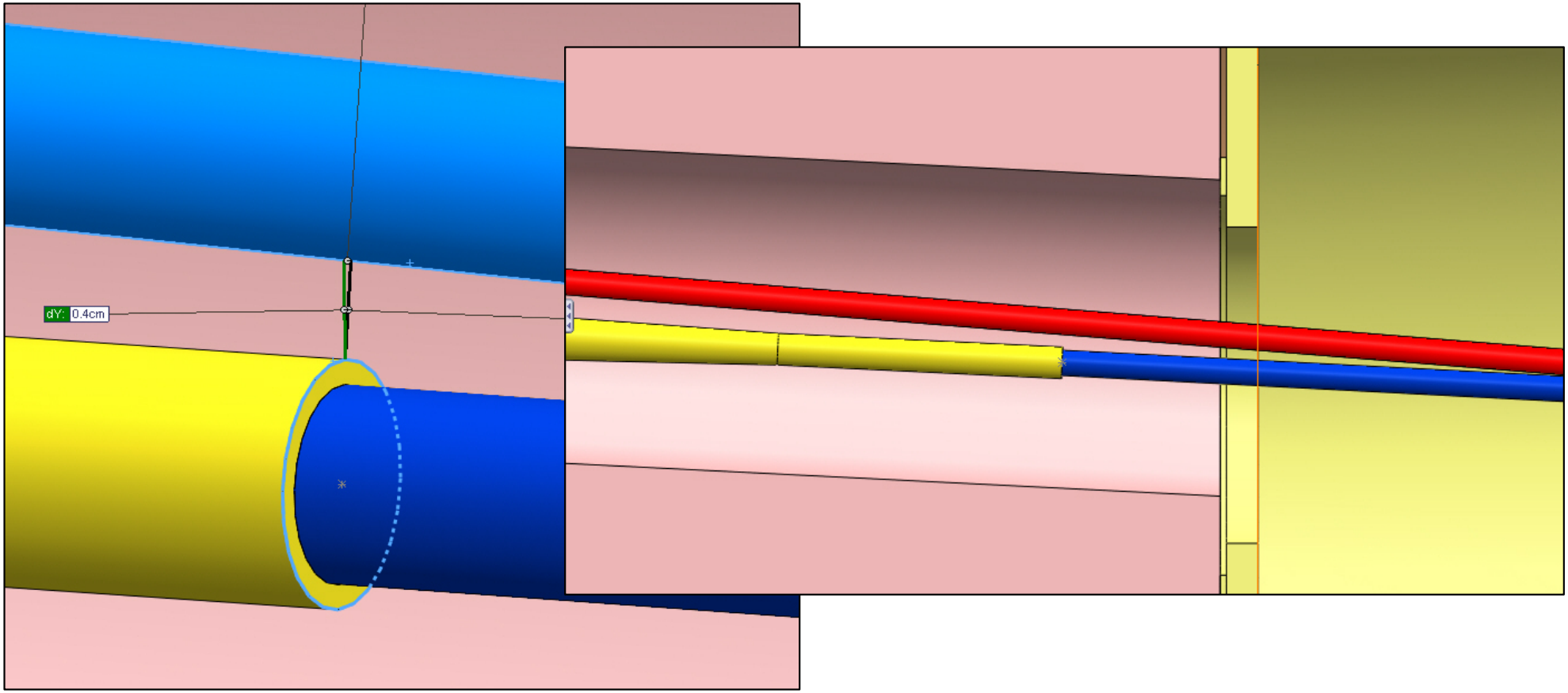
Nozzle Piping

- Beam angle limits how short the tapered section of nozzle piping can be
  - Current lore suggests shorter taper may be preferred for jet quality, but not possible with these dimensions
- Image shows 2” pipe & flange upstream of 50-cm-long taper



Nozzle Close-up

- Current clearance 4mm
- Required clearance around beam TBD



Clearance for Pion Collection

- Study 2 baseline defined in MUC0289 and MUC0296 (2004).
- Magnetic field "tapers" from B = 20 T at z = 0 to B = 1.8 T at z = 12.2 m.
- Pions within r = 7.5 cm at z = 0 stay within the curve shown below, which reaches r = 25 cm at z = 12.2 m.