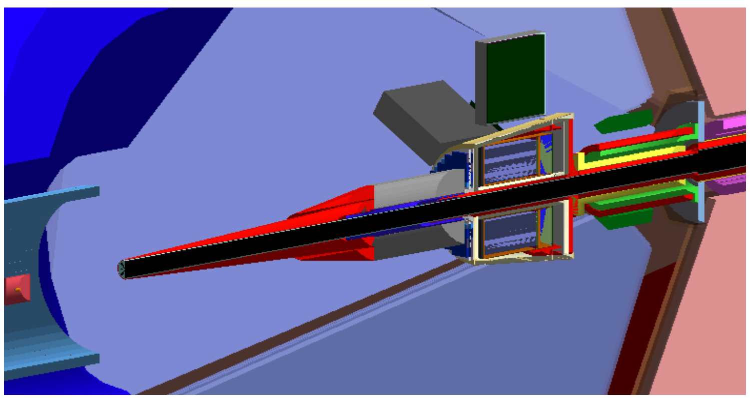
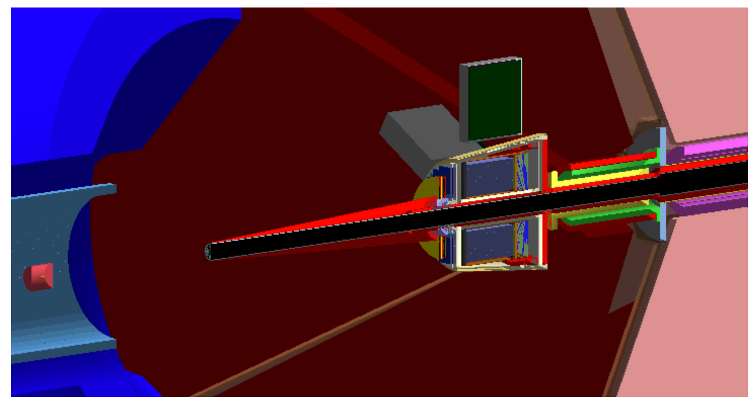
Beamline Studies

J. Artem Tan, R. Devita, R. Miller, D. Riser, S. Stepania, M. Ungaro, M. Zarecky



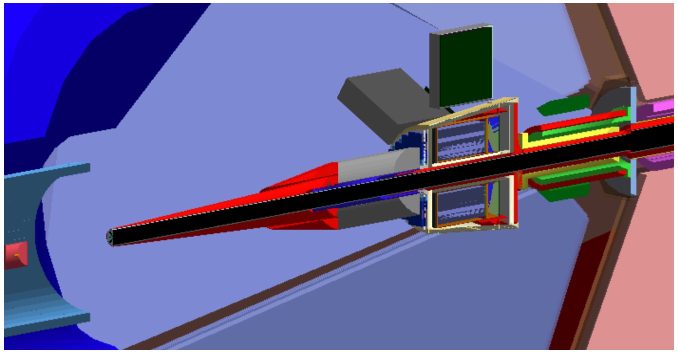
"FT OFF"



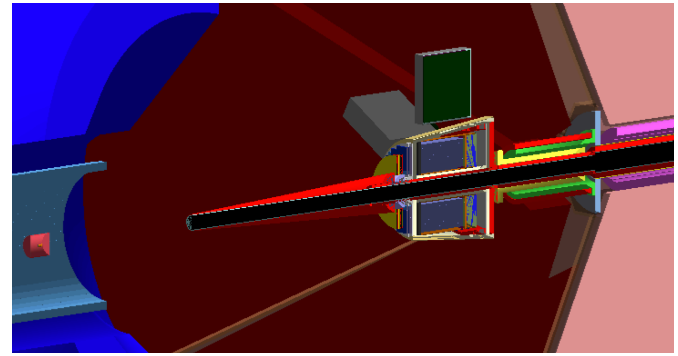
"FT ON"

FT Tracker removed,
Shield is 30cm upstream
Additional Lead shield

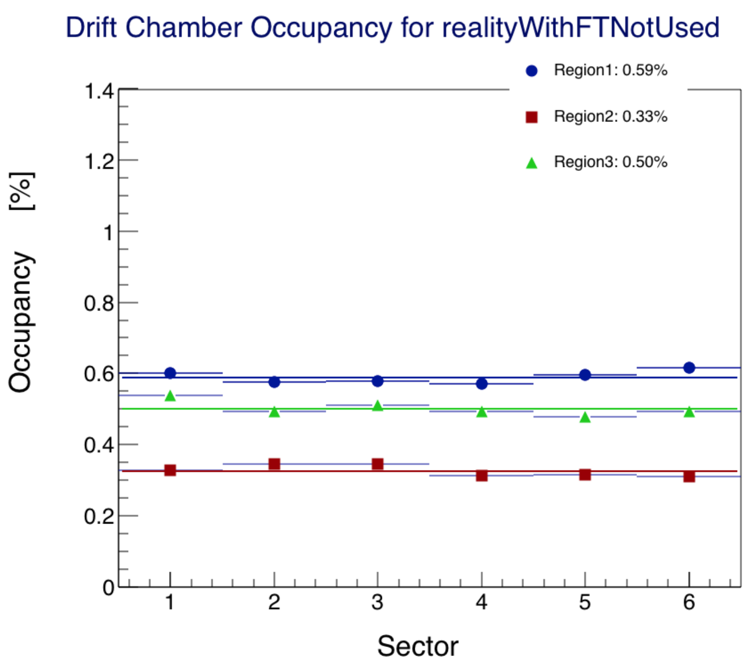
Two Configurations

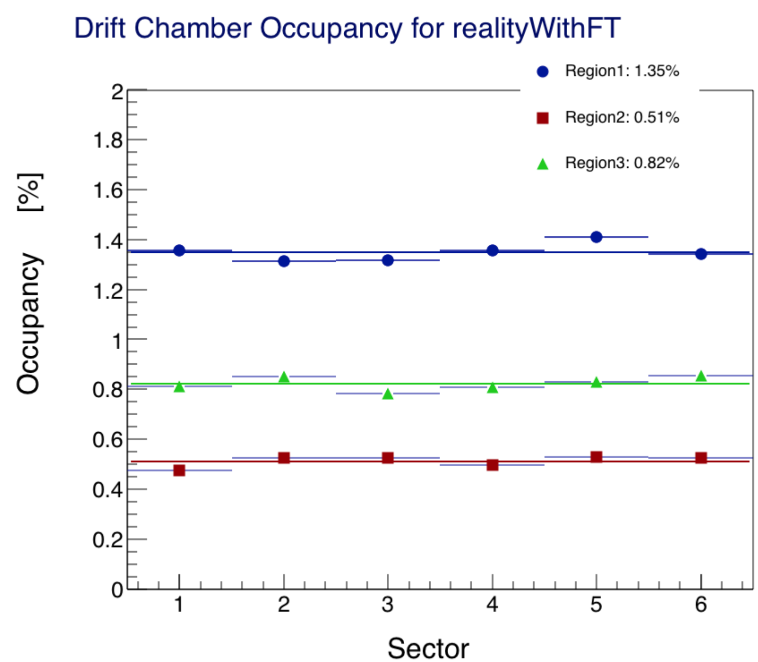


"FT OFF"



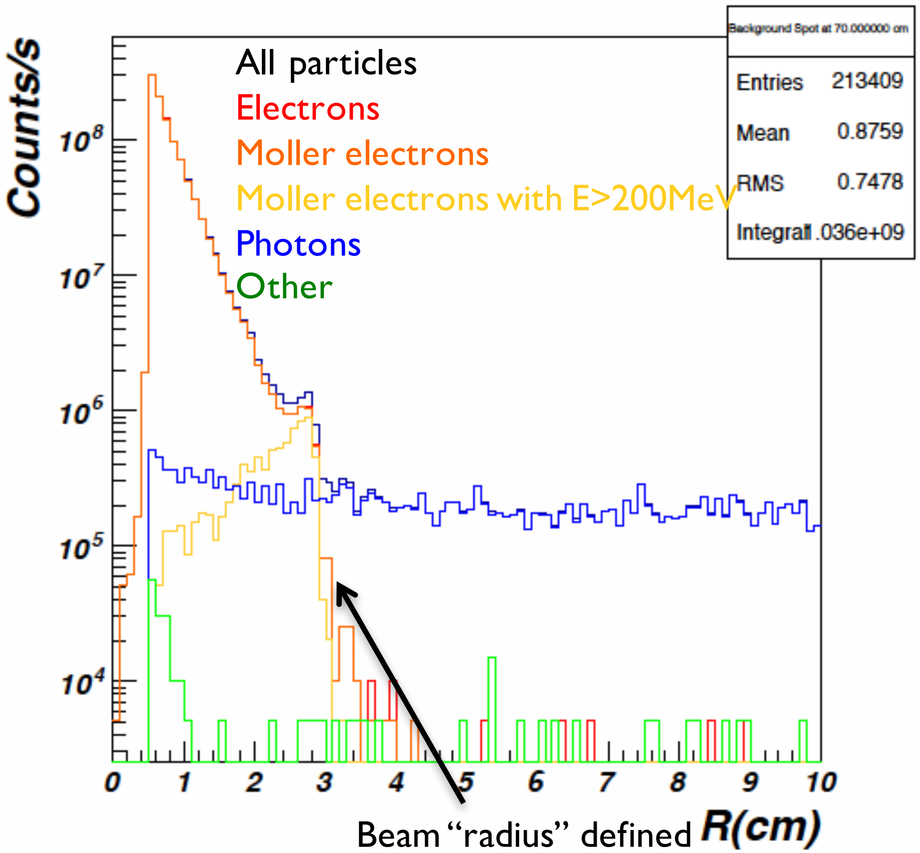
"FT ON"



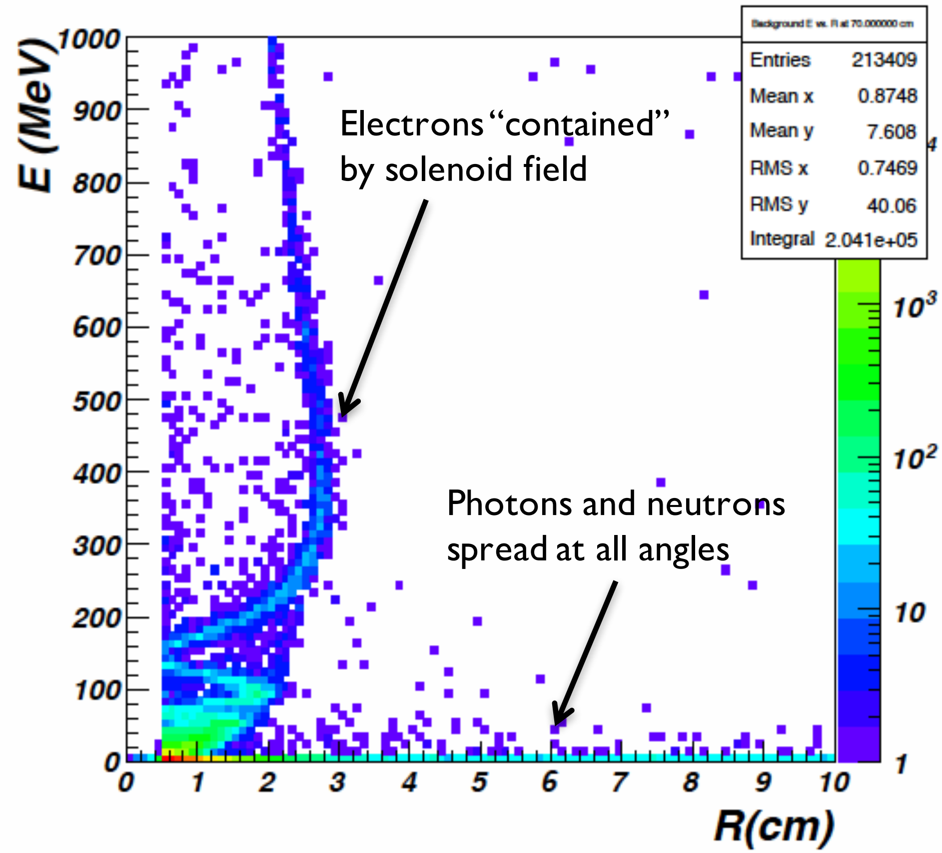


Beam profile

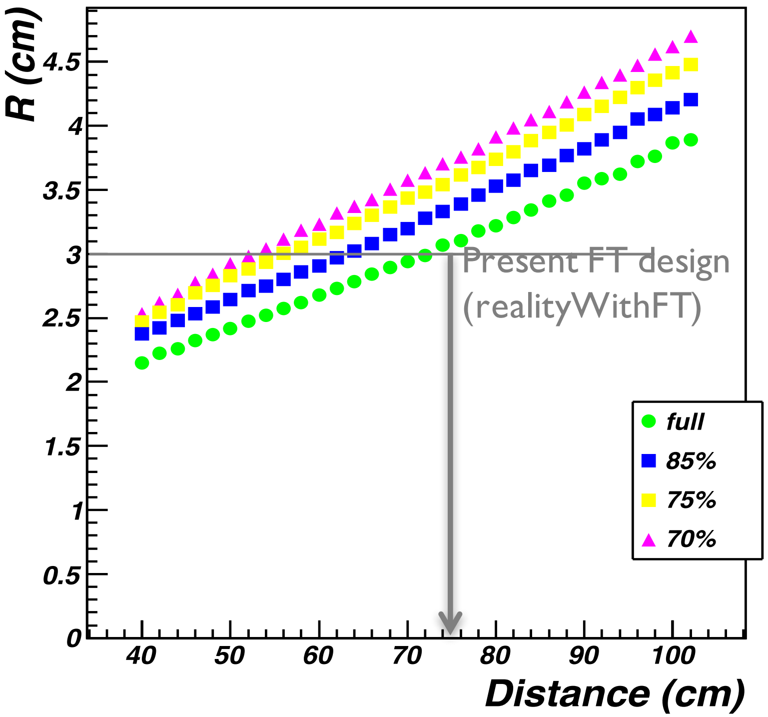
Profile at Z=750mm (entrance of Moller Cone in FT configuration)



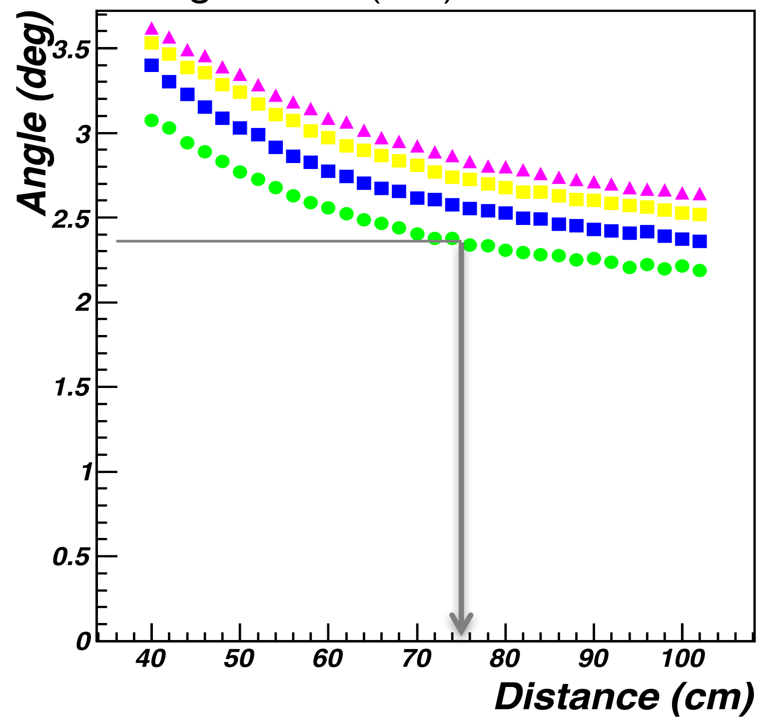
Beam "radius" defined from edge of moller electron distribution



Beam profile: field dependence

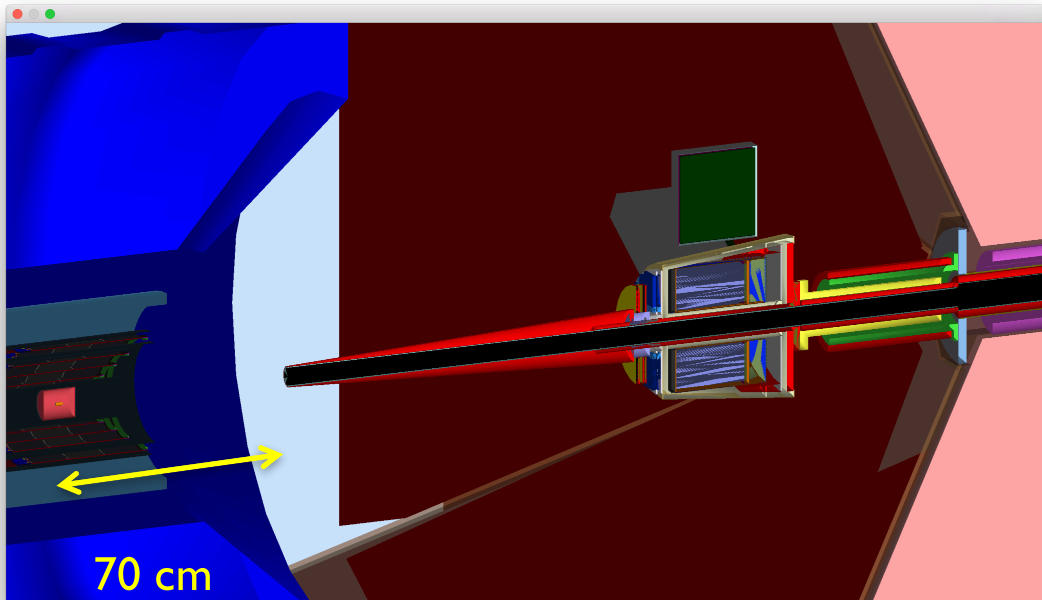


Beam spot "angle" defined as:
Angle = $\tan^{-1}(R/Z)$

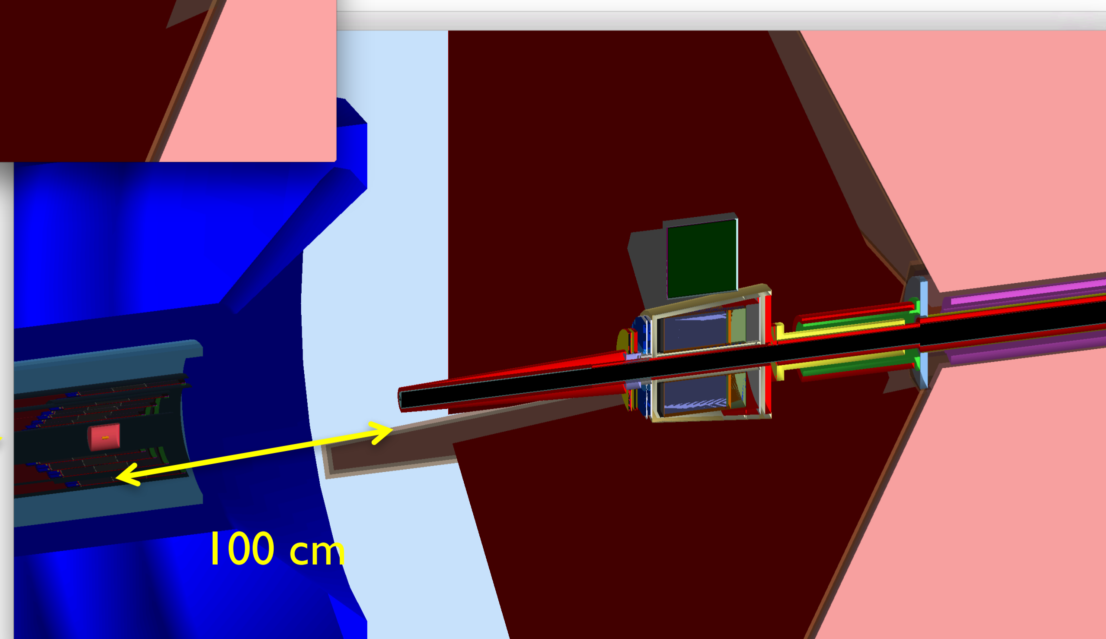


- When FT is used the cone radius was selected to match the Moller while minimizing the distance from the target to reduce the contribution from beam interaction in air

RealityWithFT: dependence on cone length



Cone "shape" is always the same (2.5 deg aperture)
Difference in where the cone tip is cut

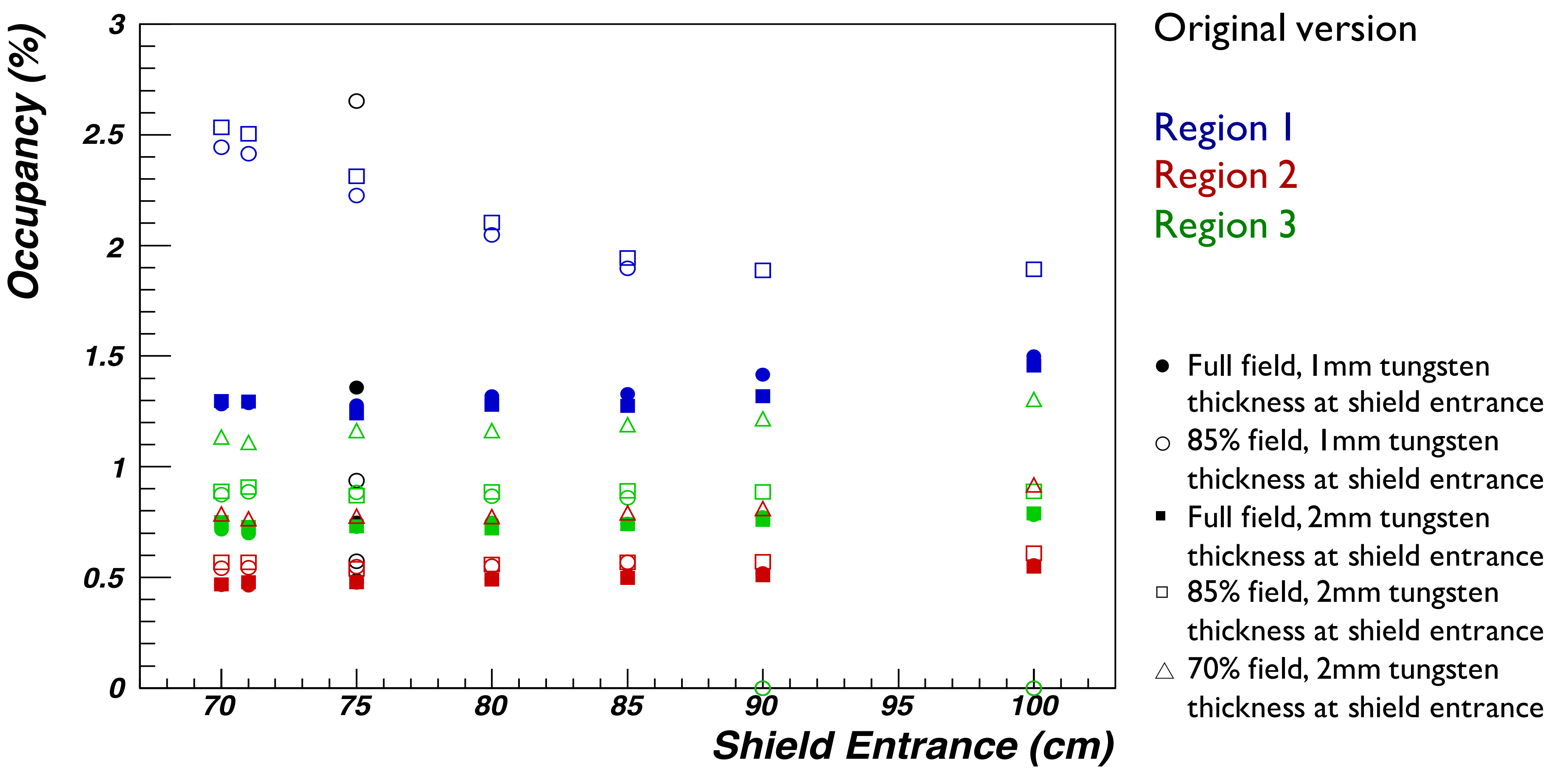


Study:

from 70 cm to 100 cm

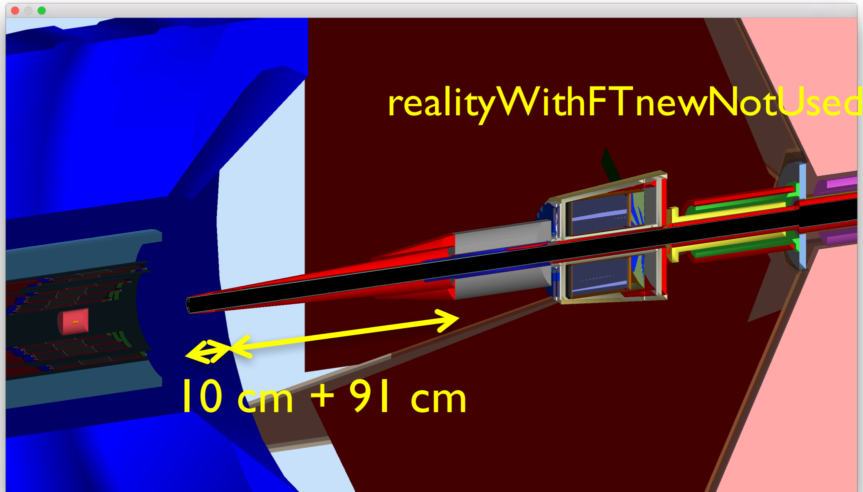
(original was 75)

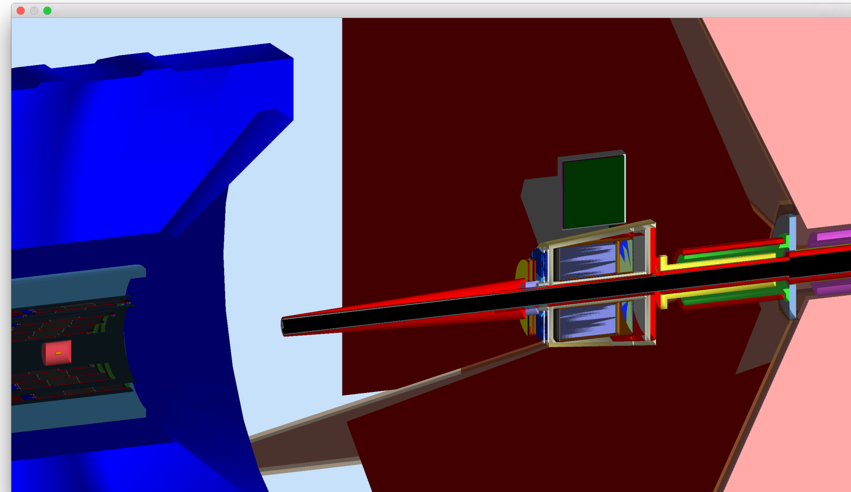
RealityWithFT: dependence on cone length

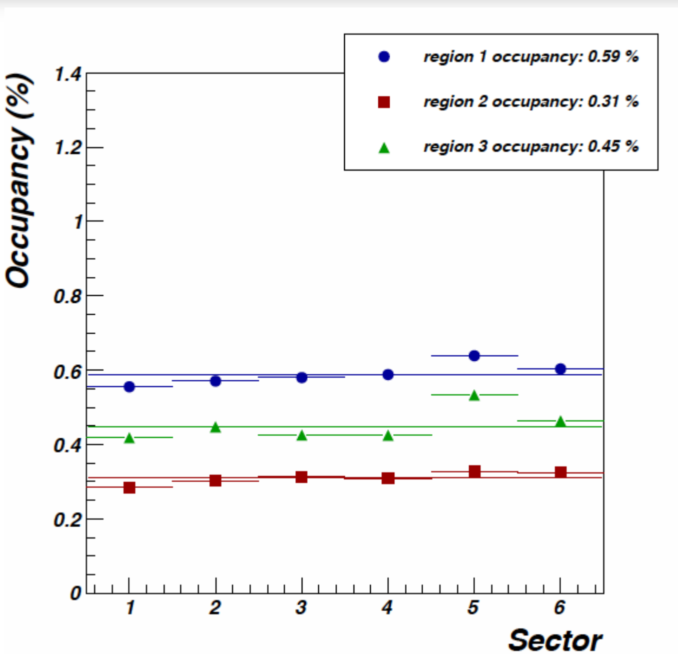


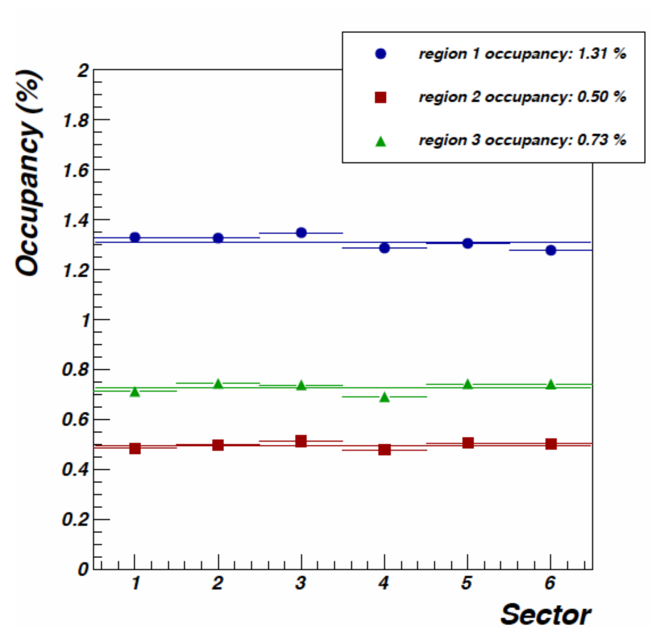
- No significant increase of occupancies up to 85 cm
- Improved occupancies at low solenoid field for large distances
- 85 cm chosen as the best compromise (10 cm shorter cone, lower weight)

Modular Cone

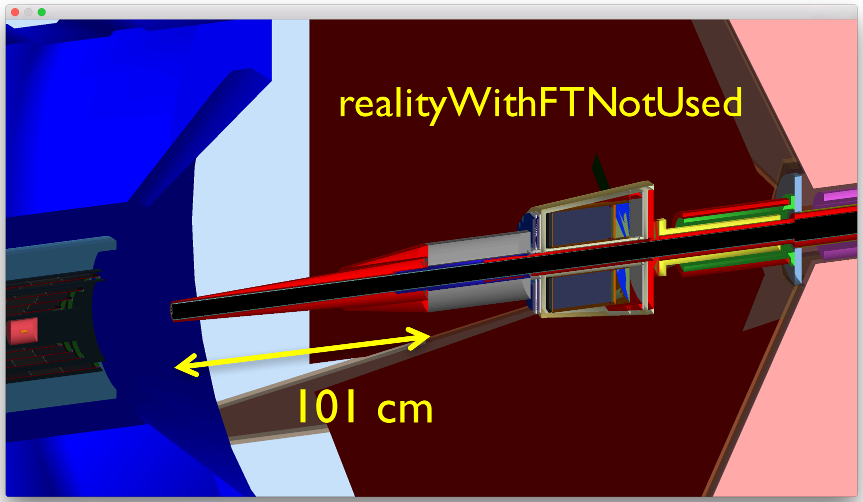


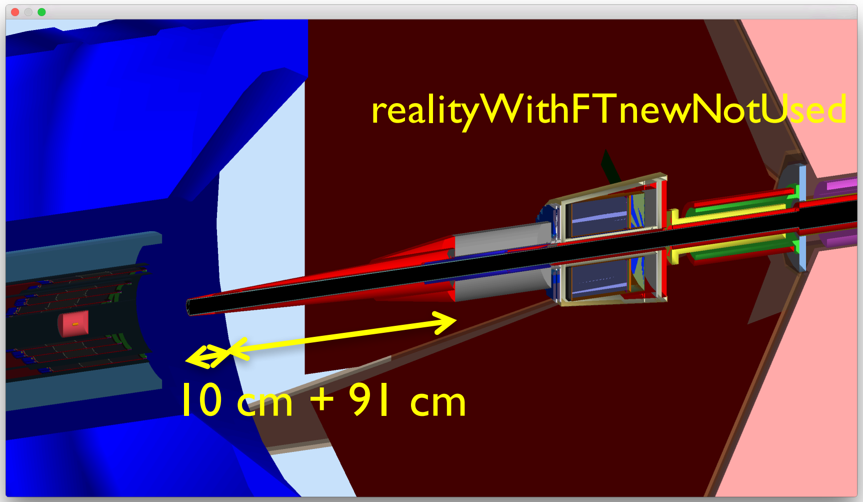


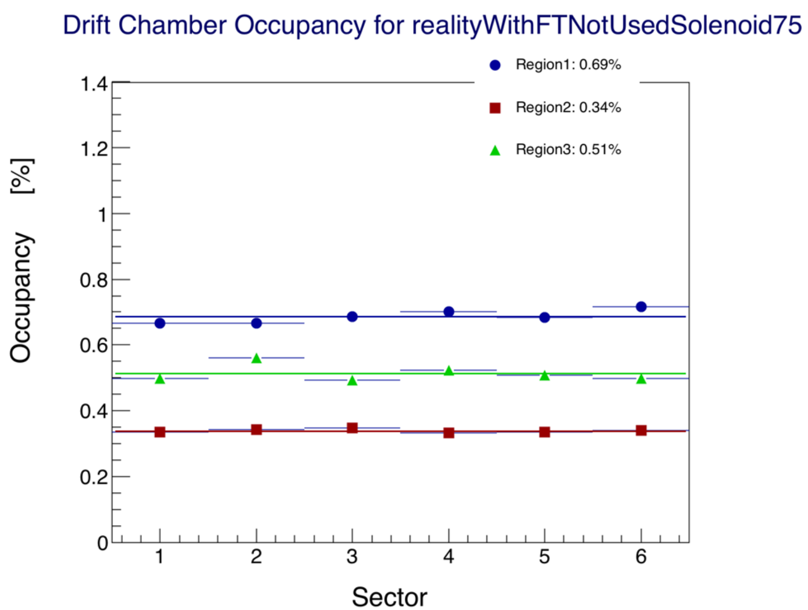


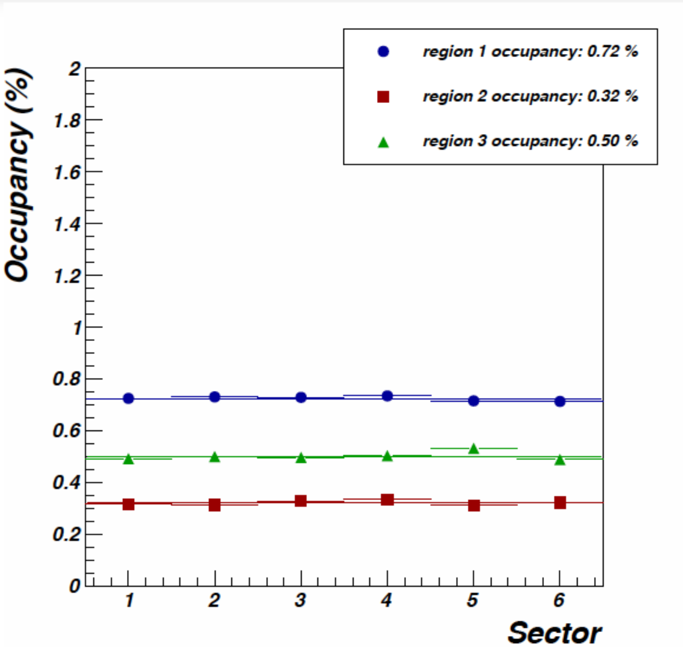


Modular Cone: 75% solenoid

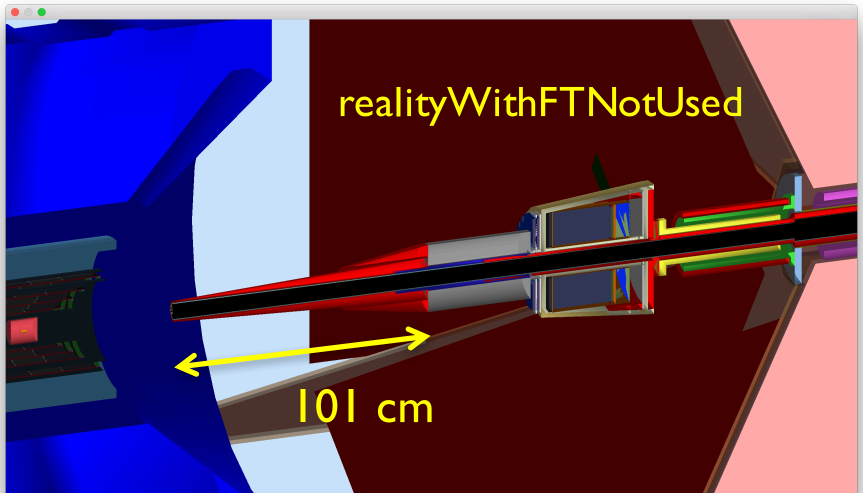


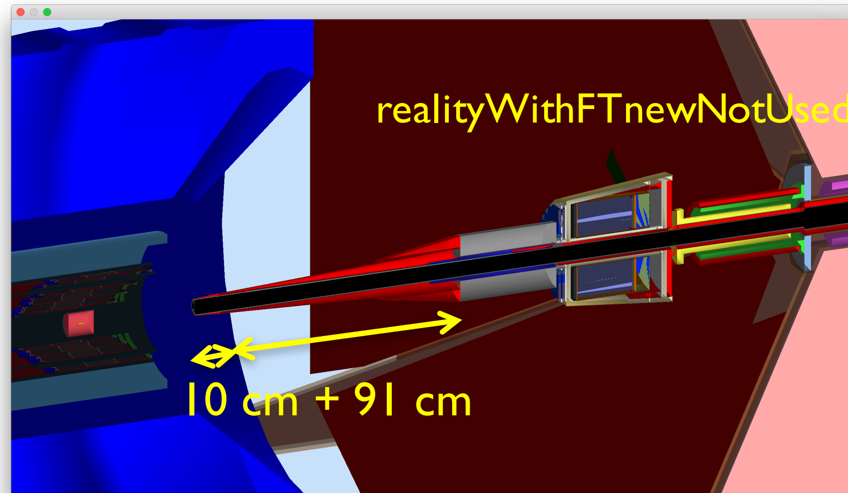


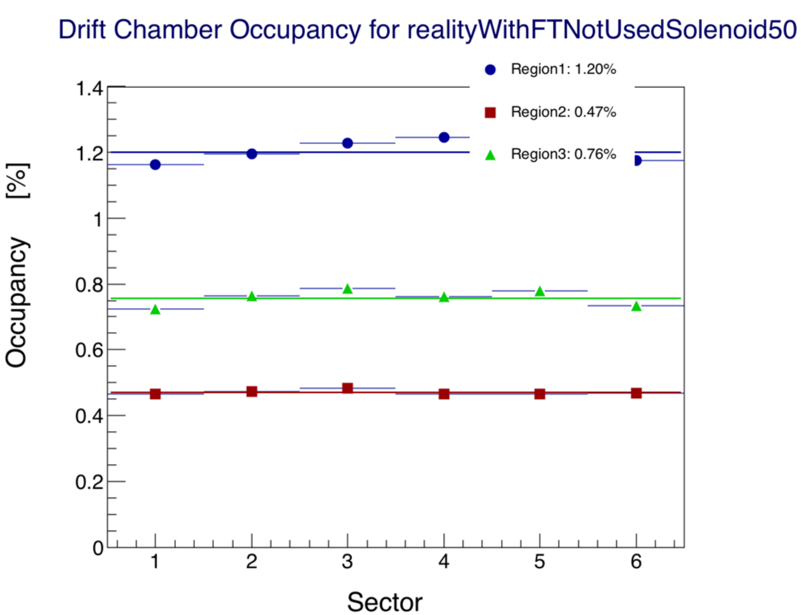


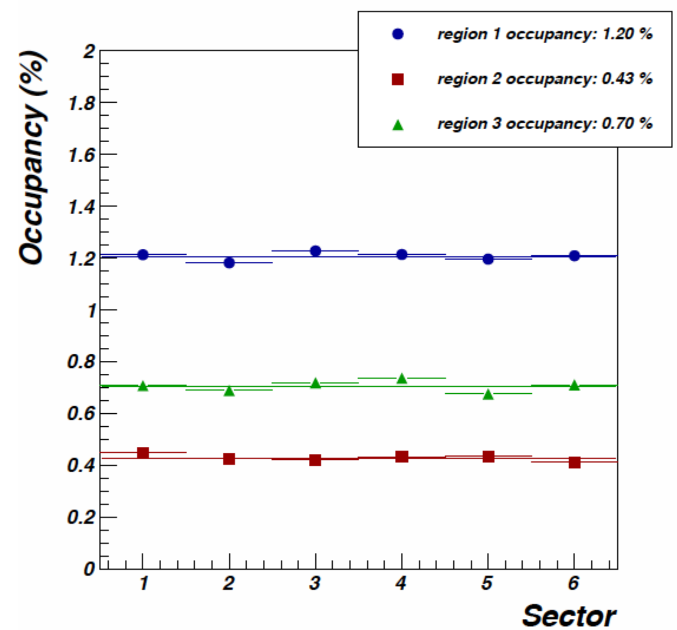


Modular Cone: 50% solenoid

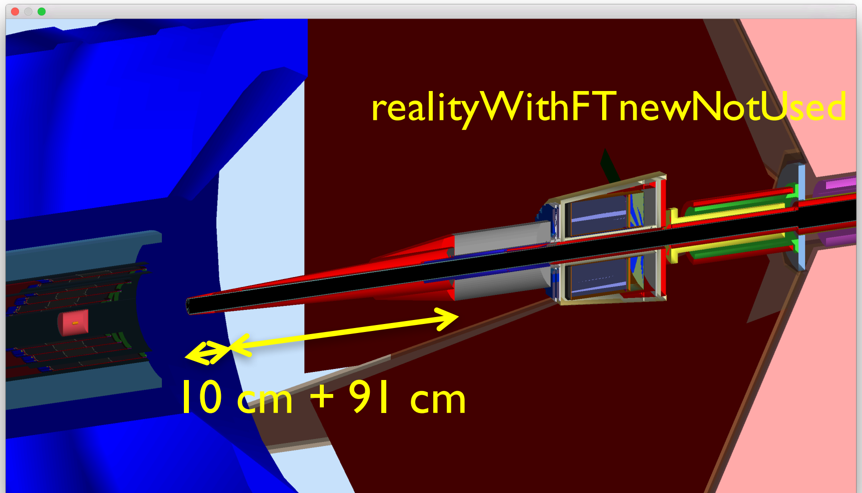


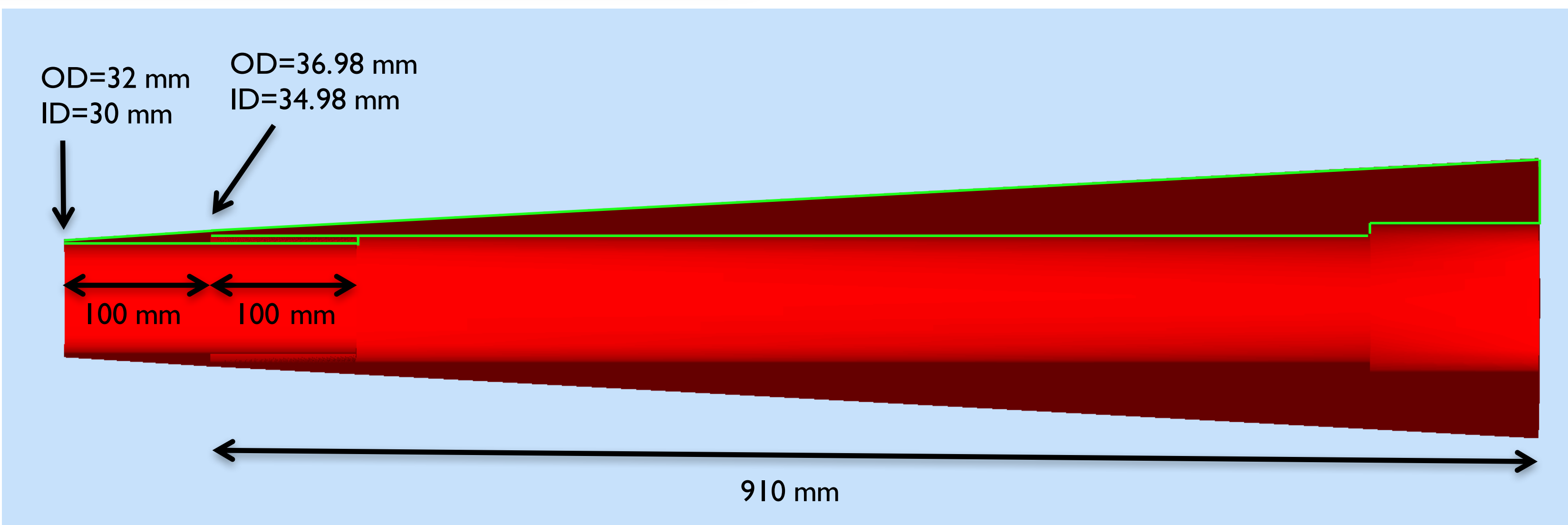






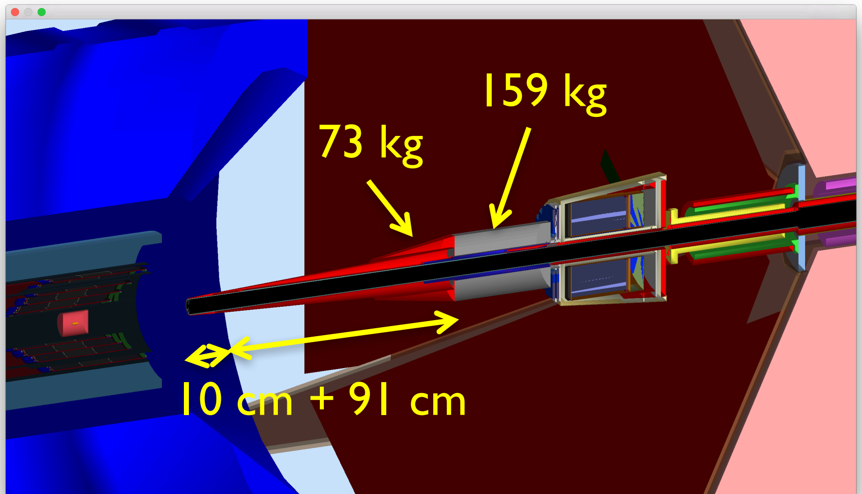
Modular Cone

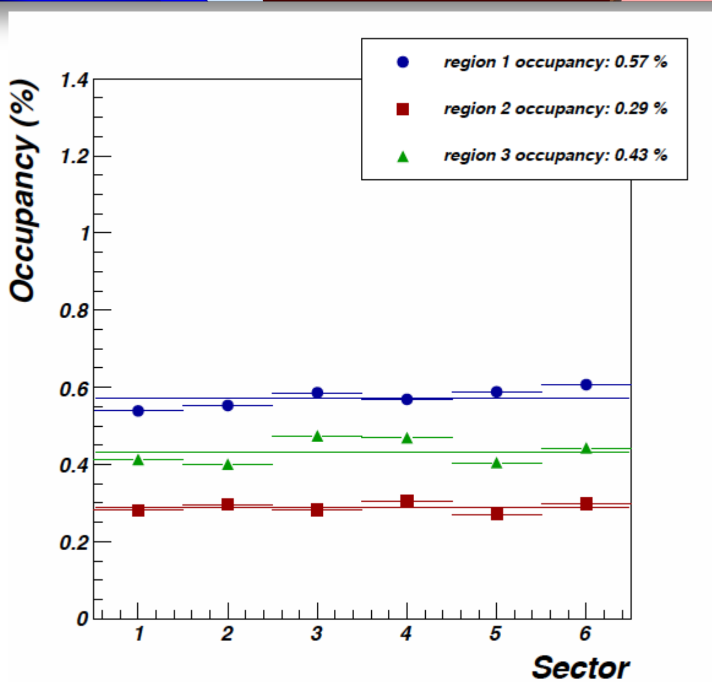




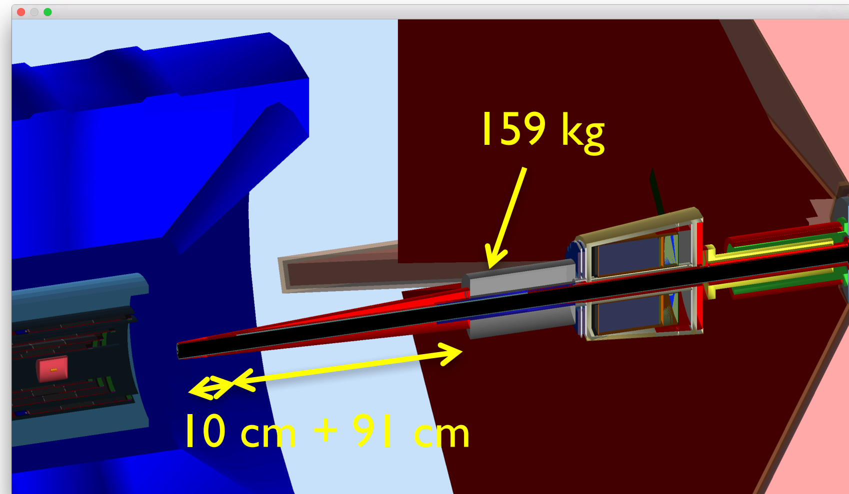
realityWithFTNotUsed: additional shield

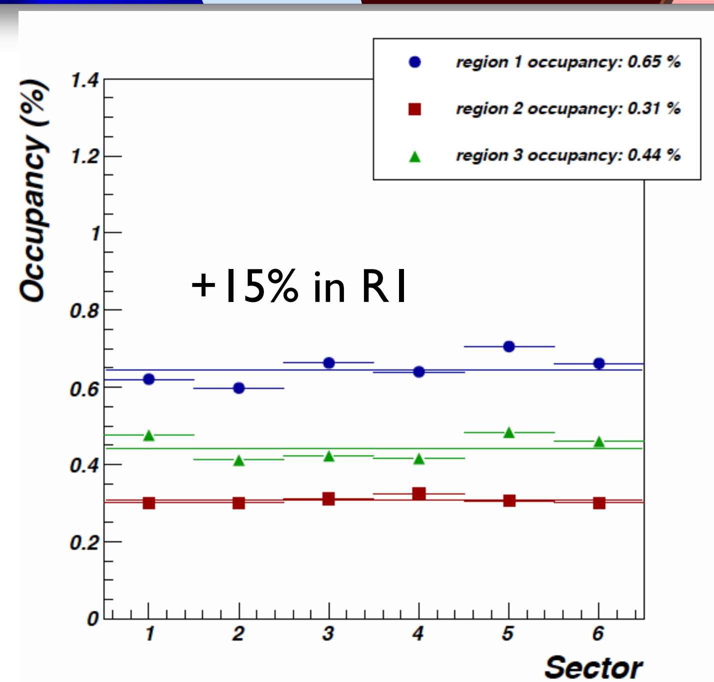
Lead: ID=88.4mm OD=241.1mm





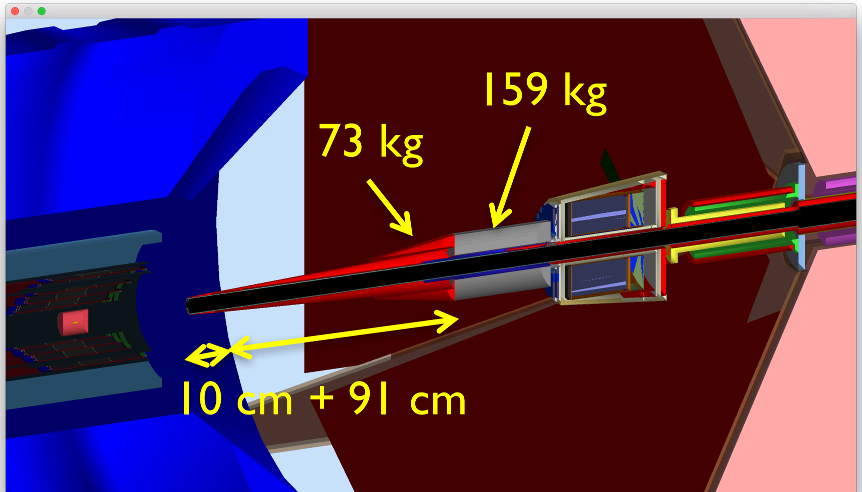
Lead: ID=88.4mm OD=241.1mm

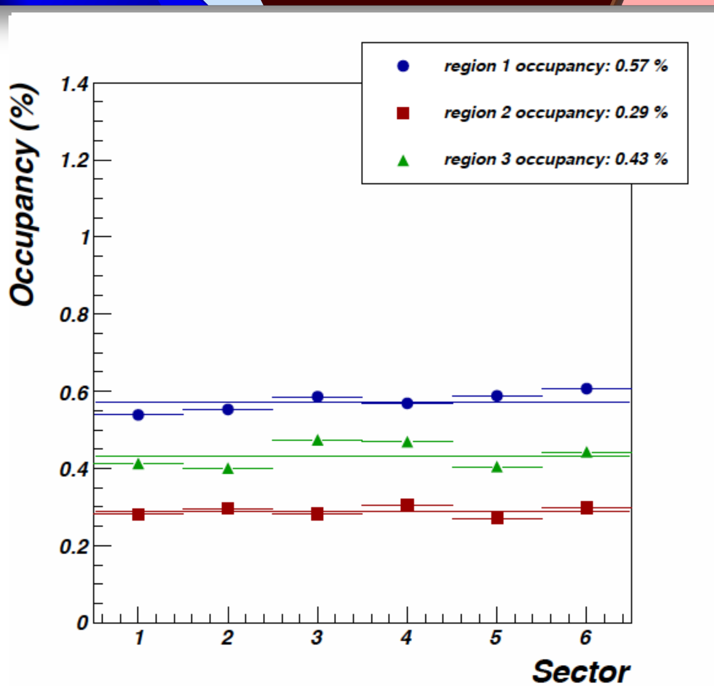




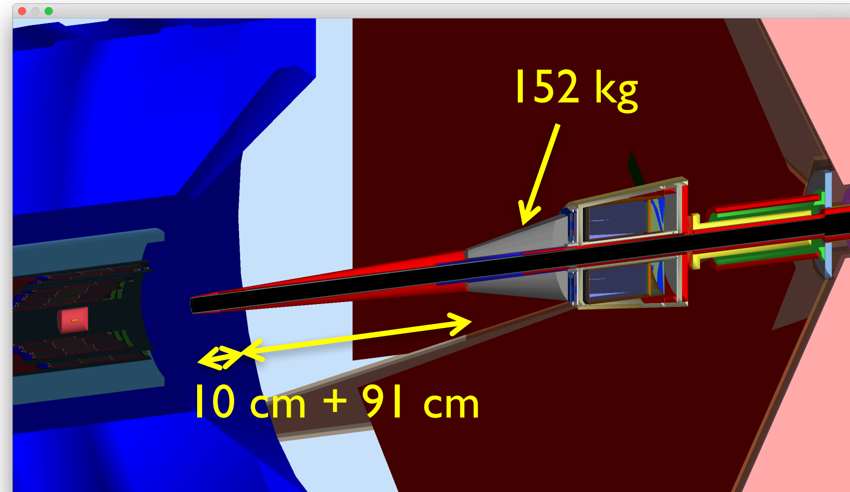
realityWithFTNotUsed: additional shield

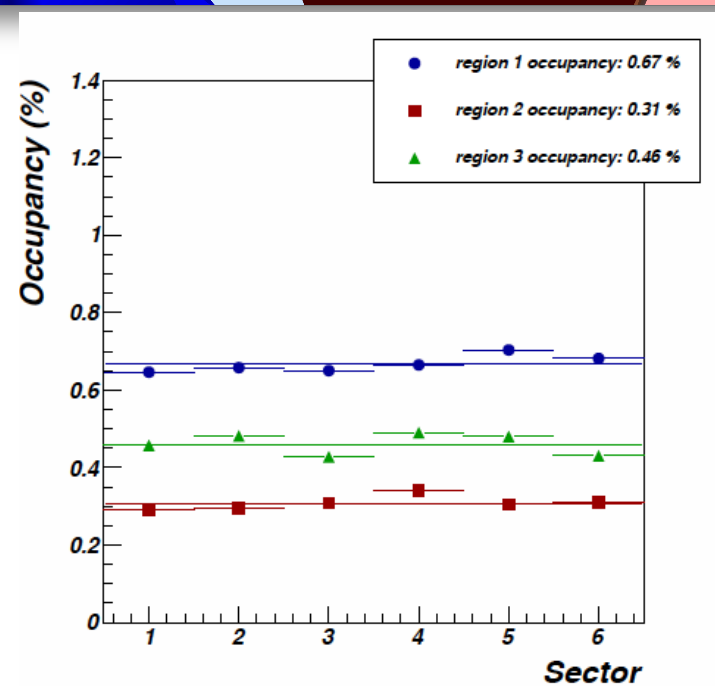
Lead: ID=88.4mm OD=241.1mm



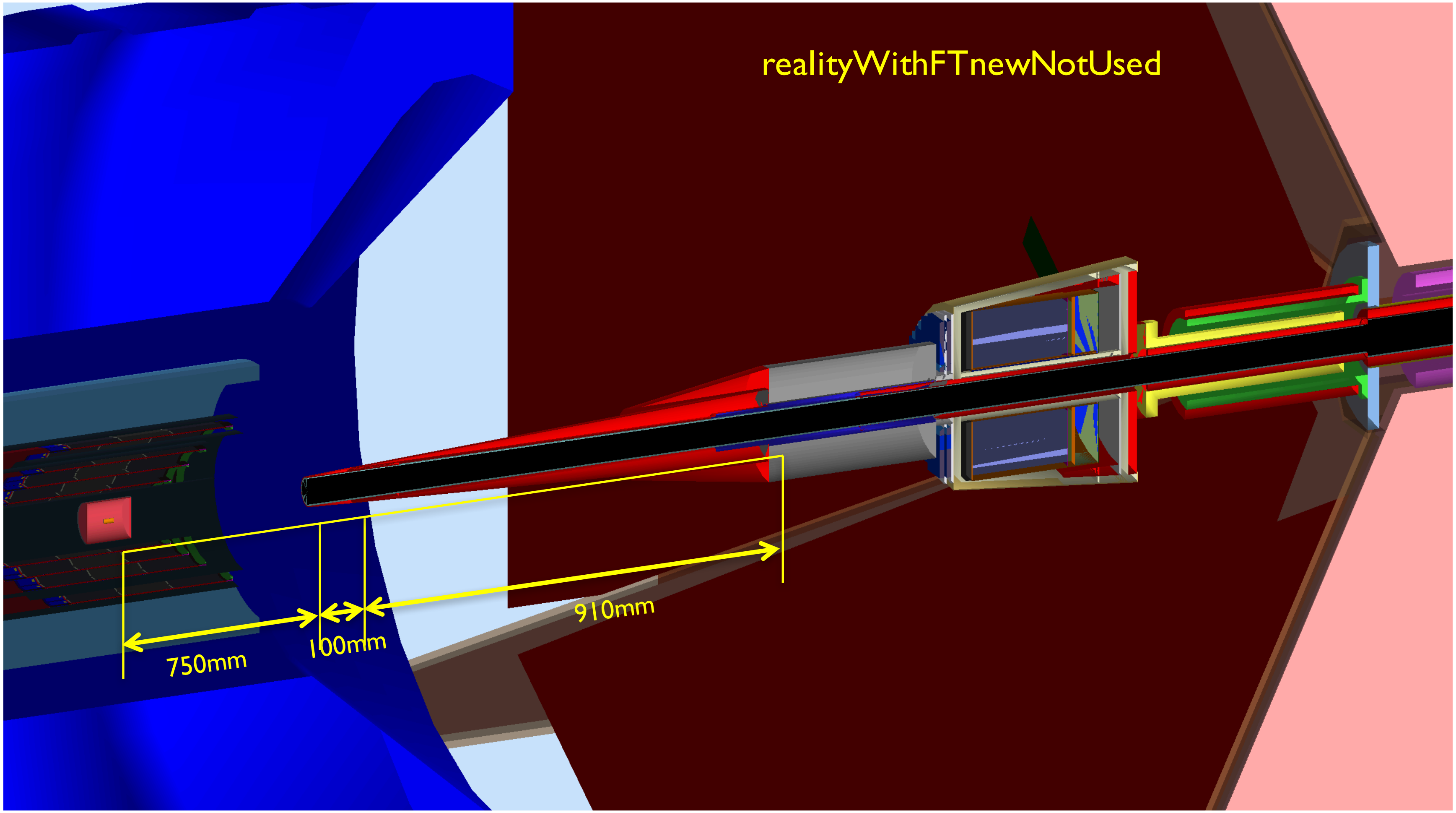


Lead: ID=88.4mm OD=152.1/312 mm





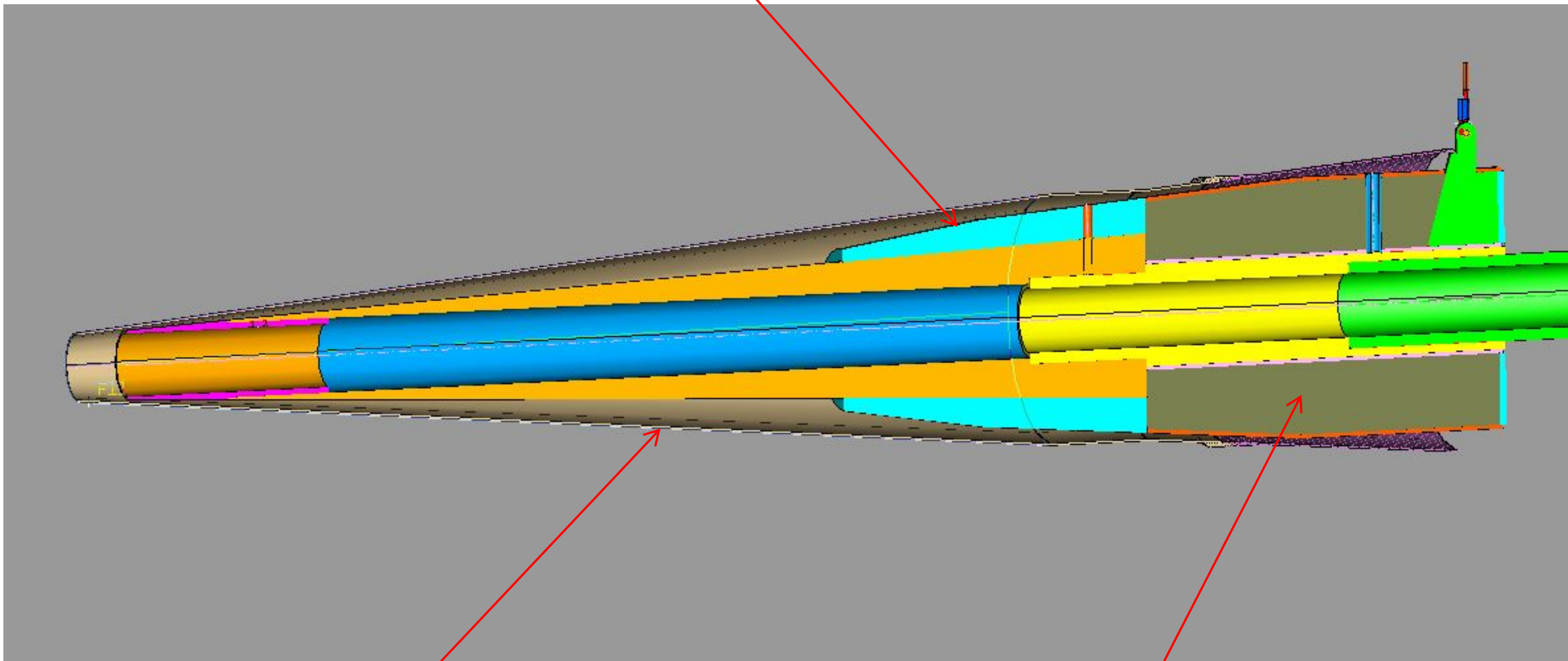
Final Configuration: Cone Tip



- With FT used: cone at 85 cm from the target
- With FT not used: 10 cm tip extension, additional shield
- Additional tungsten: -15% in region-1

Engineering reality

Additional Cone



HTCC Exit Cone

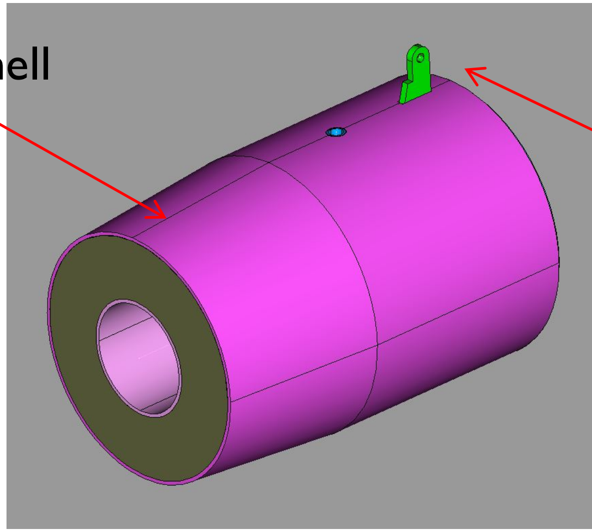
Lead Shield

changed outside shape of additional cone & shield to provide 5mm radial clearance at 4.5 degrees.

Shortened lead to allow for 10mm clearance to Hodoscope

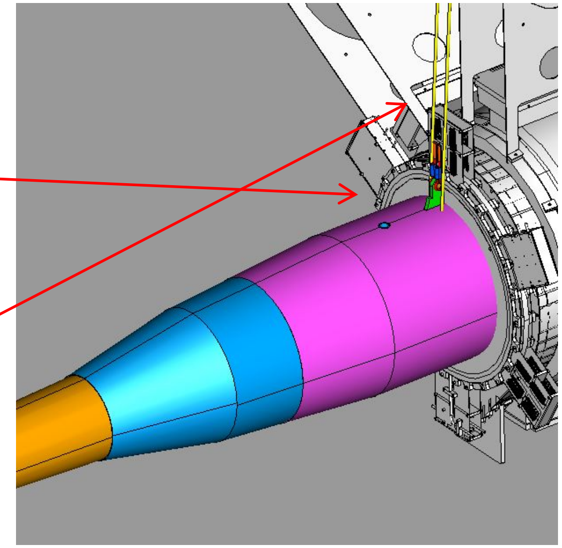
Engineering reality

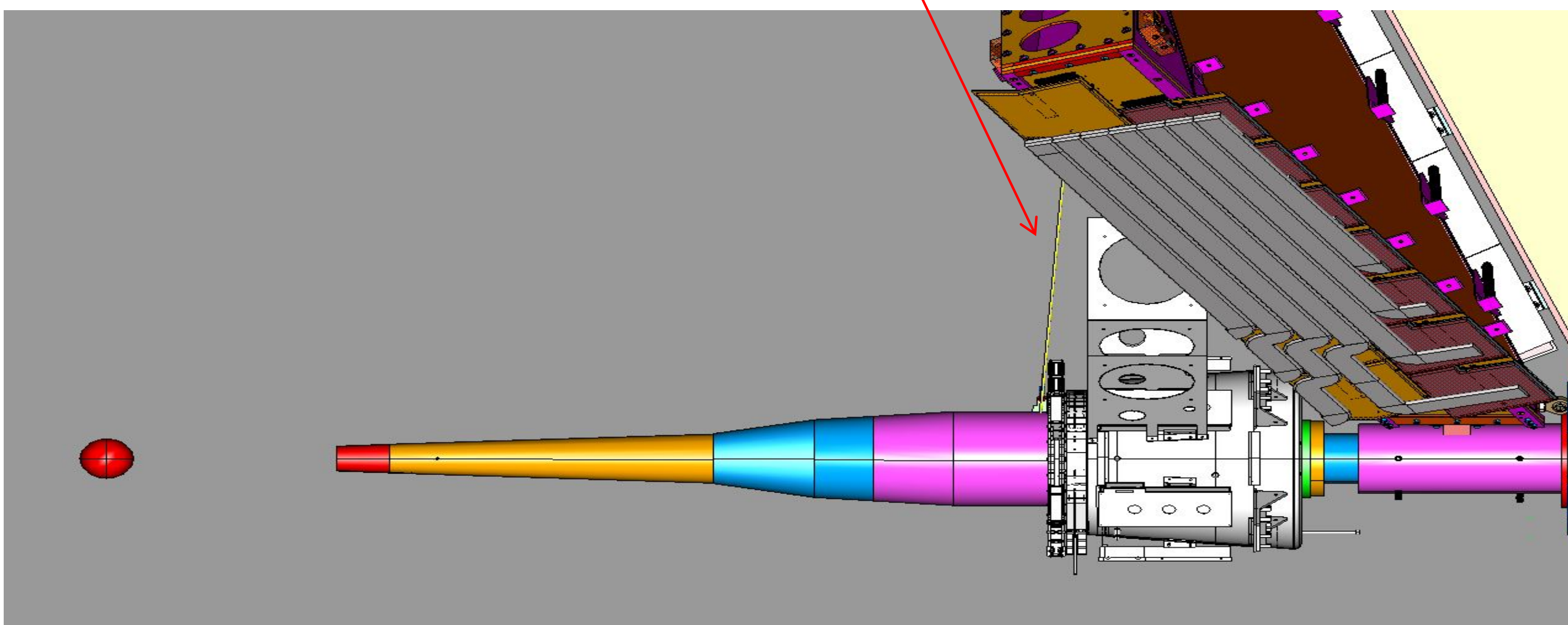
SST Shell



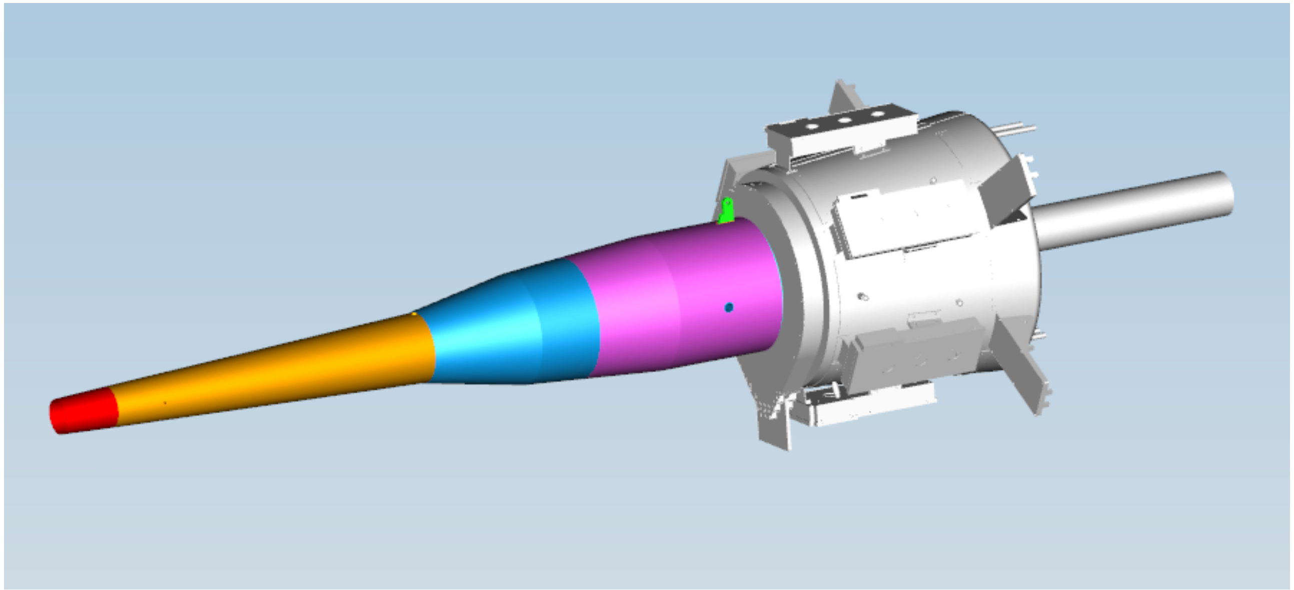
Support Eye

2 4mm SST cables





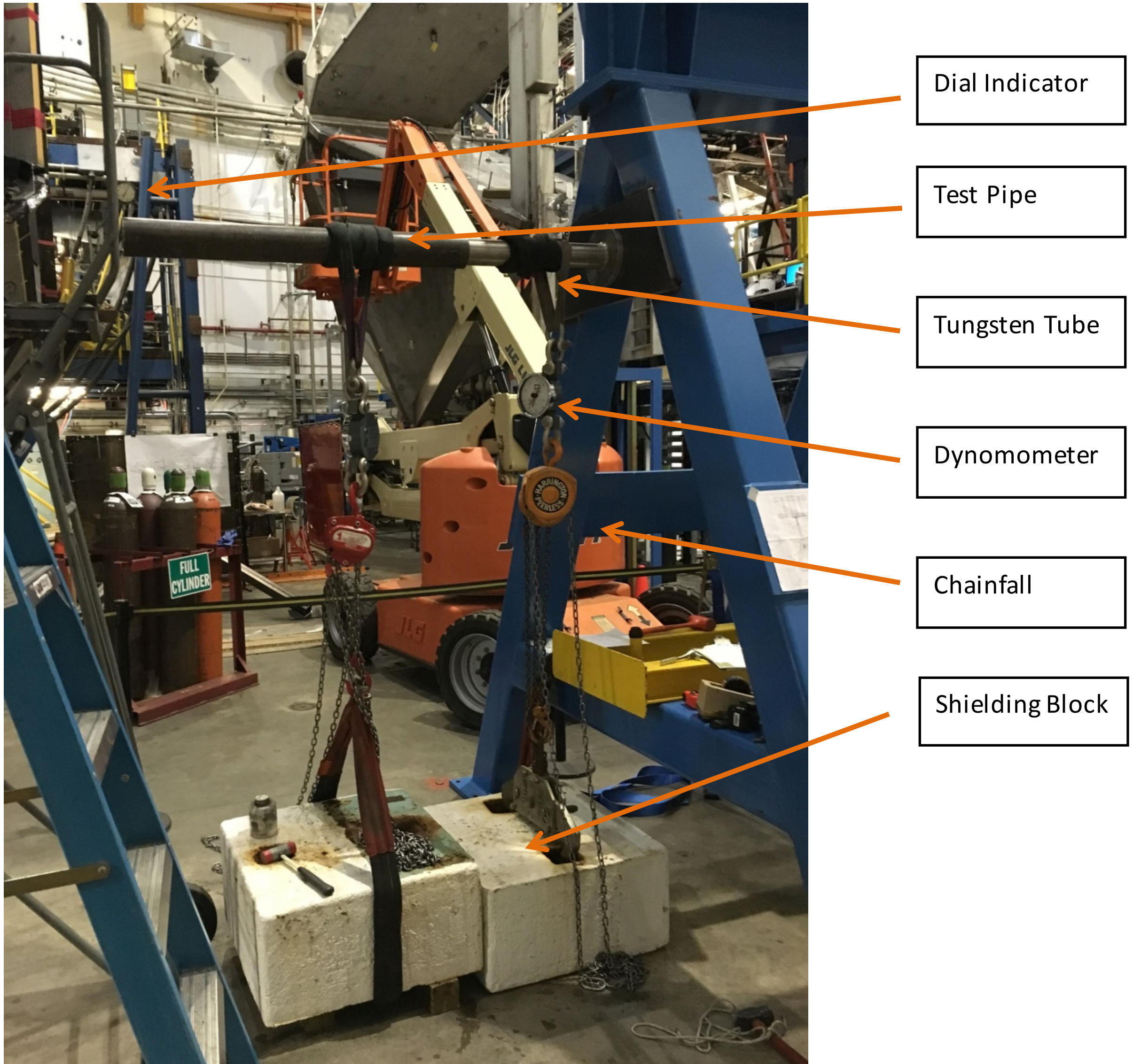
Supporting the shield



Shielded configuration

a. Calorimeter, Hodoscope – 580 lbs.
b. Lead shield, moeller shield with outer cone and nose cone – 720 lbs.

Load Test



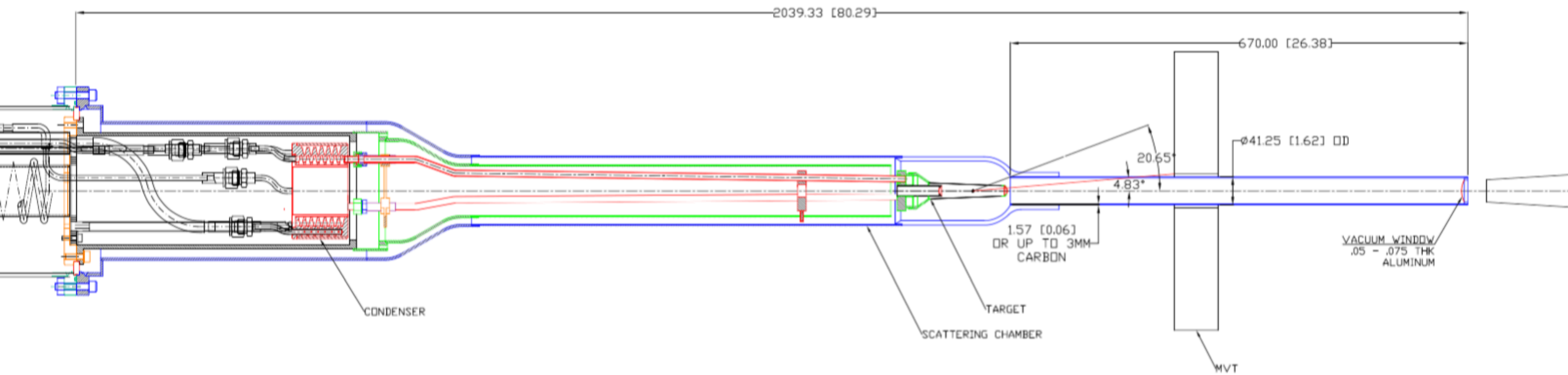
Loadtest on the c.m.
@ 100%, 125% and 150%

The 150% test for each configuration was held for 10 minutes.

The tungsten tube passed each load test and the deflection was comparable to the calculated deflection.

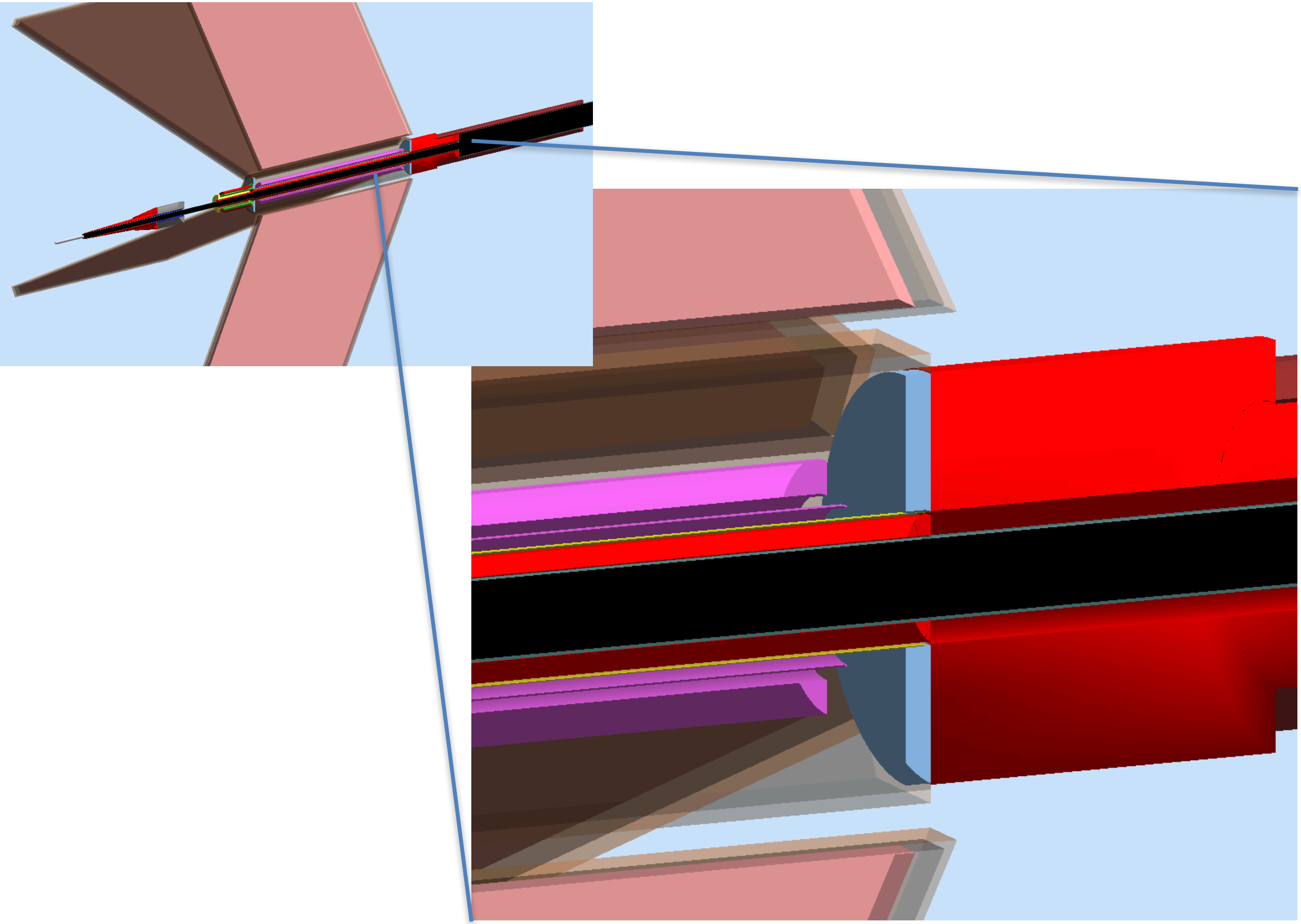
Target to shield

Vacuum improves occupancy 10%-50% (FT Off / FT On)

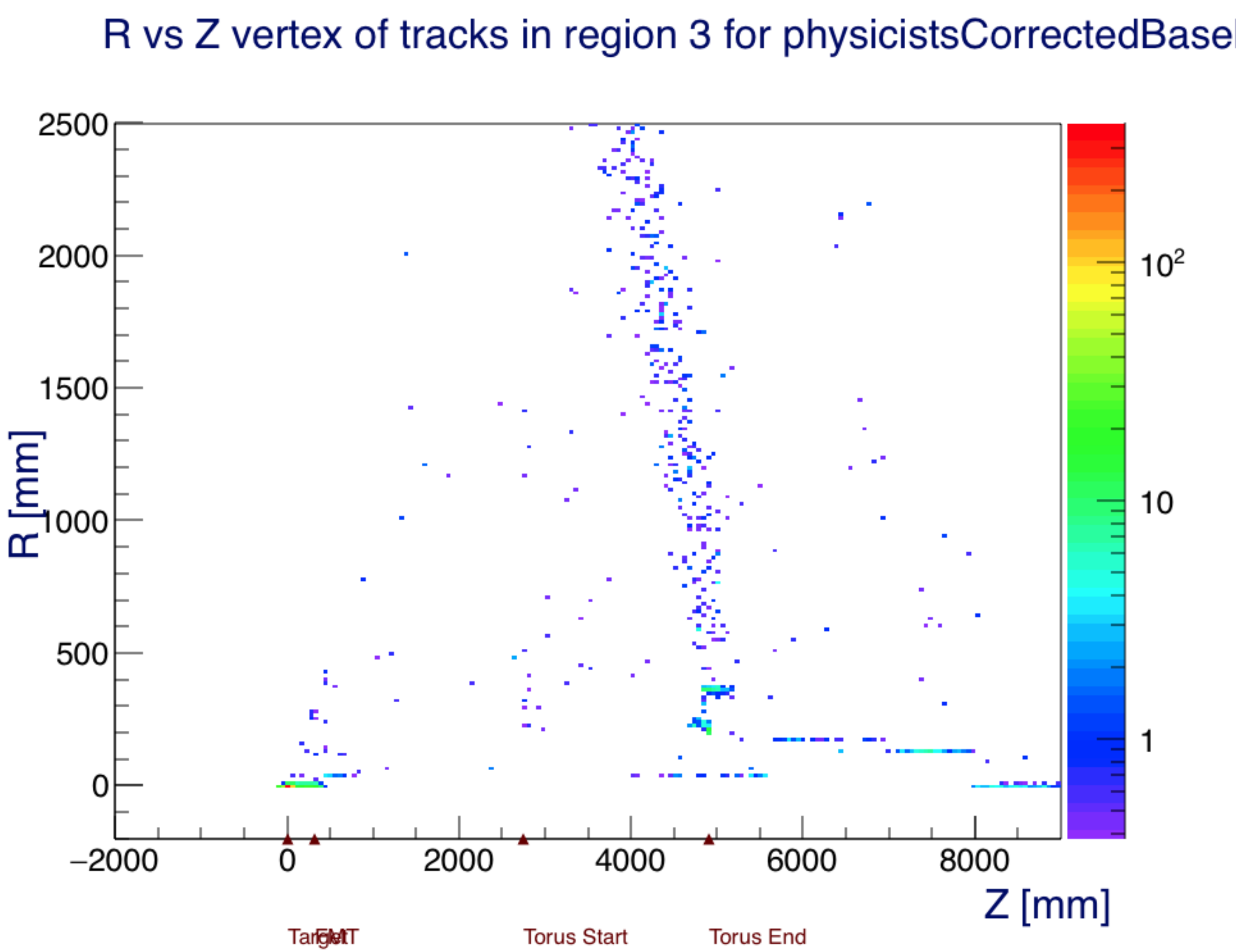


Work in progress (FX, Stepan, S. Christo)
Also on scattering chamber to be spherical between 5 and 32 degrees

Downstream



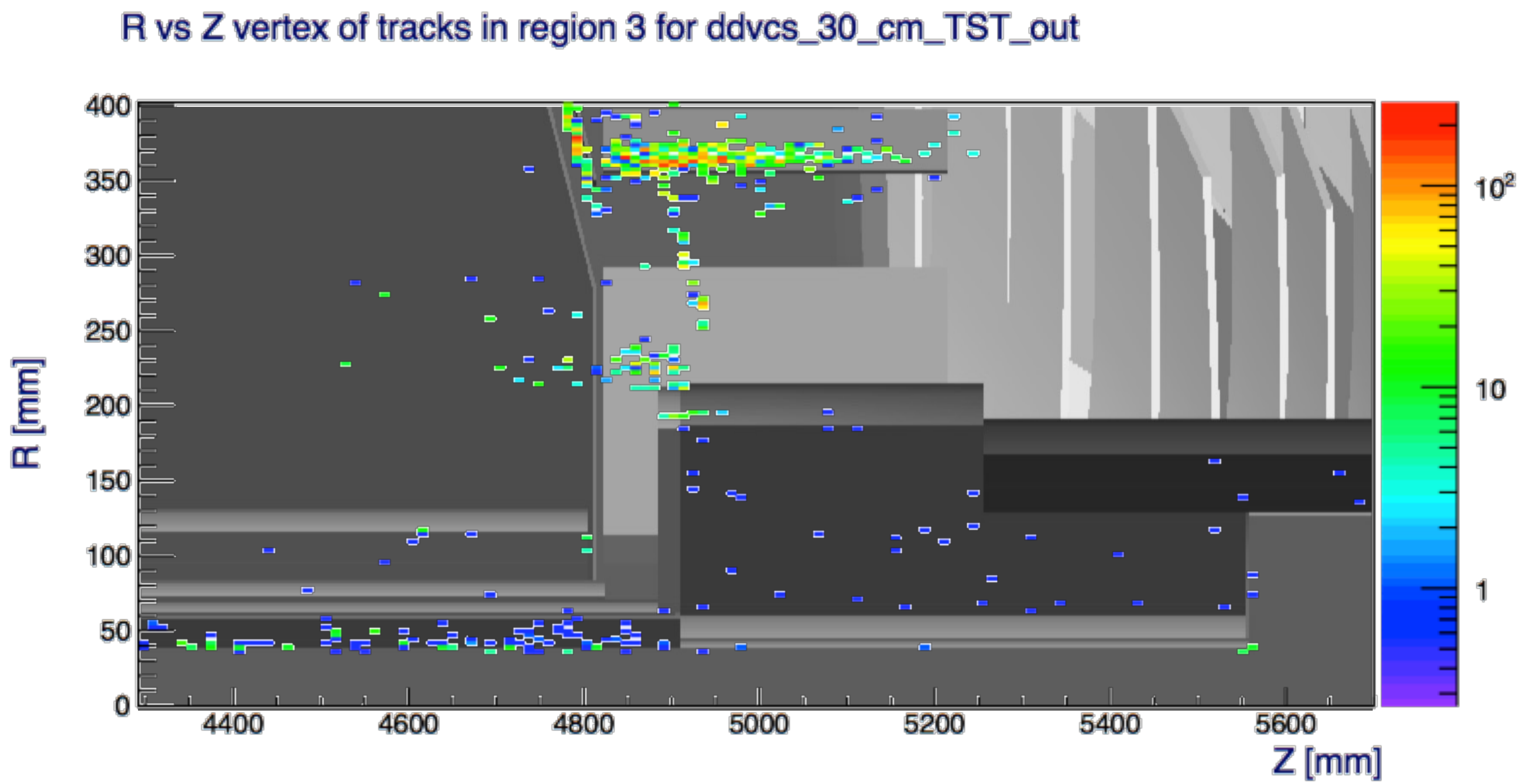
Downstream


R vs Z vertex of tracks in region 3 for physicistsCorrectedBaseI
R [mm]
Z [mm]
2500
2000
1500
1000
500
0
−2000
0
2000
4000
6000
8000
10^2
10
1
Target
FMT
Torus Start
Torus End

Downstream

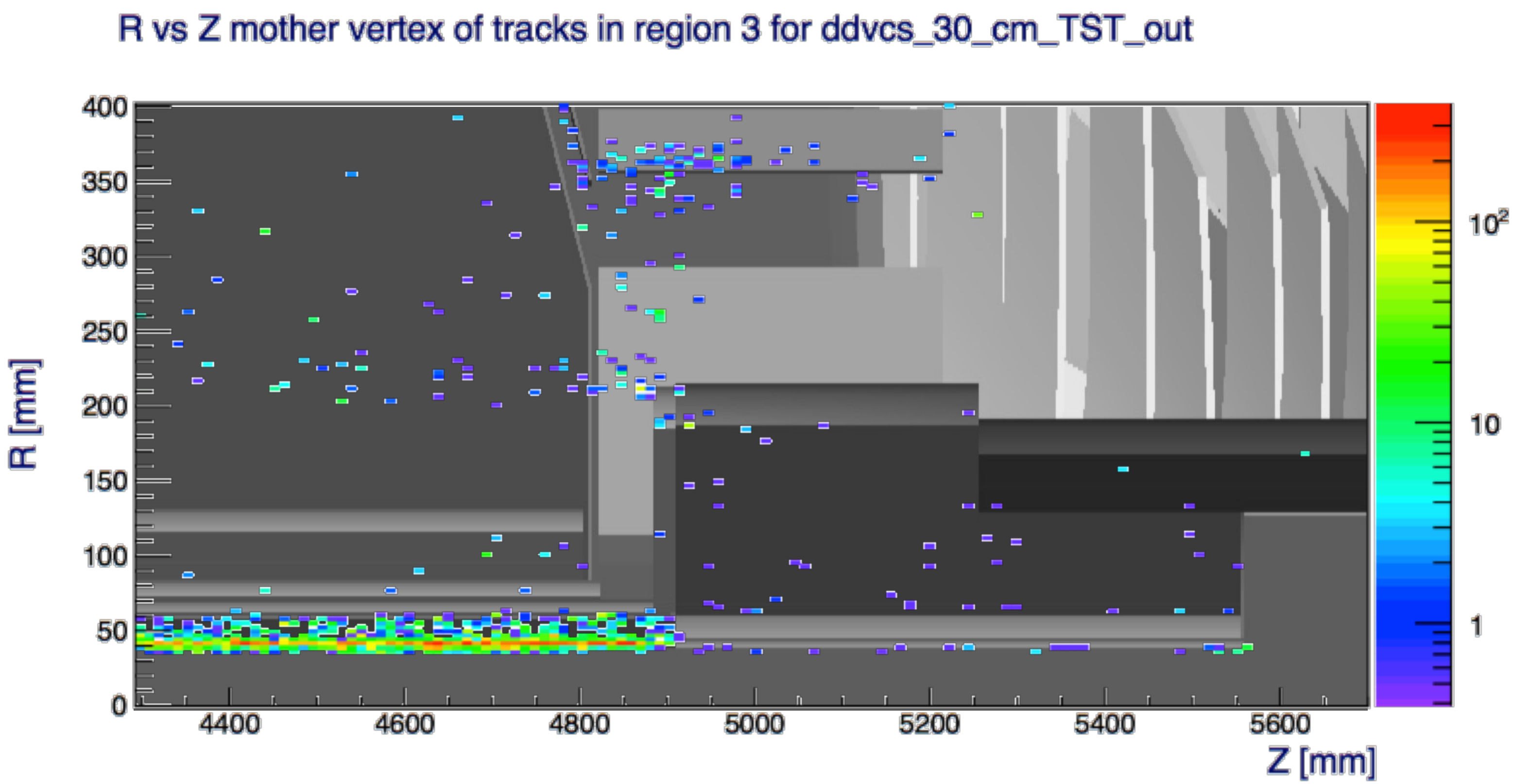
2D slice of downstream geometry

Downstream



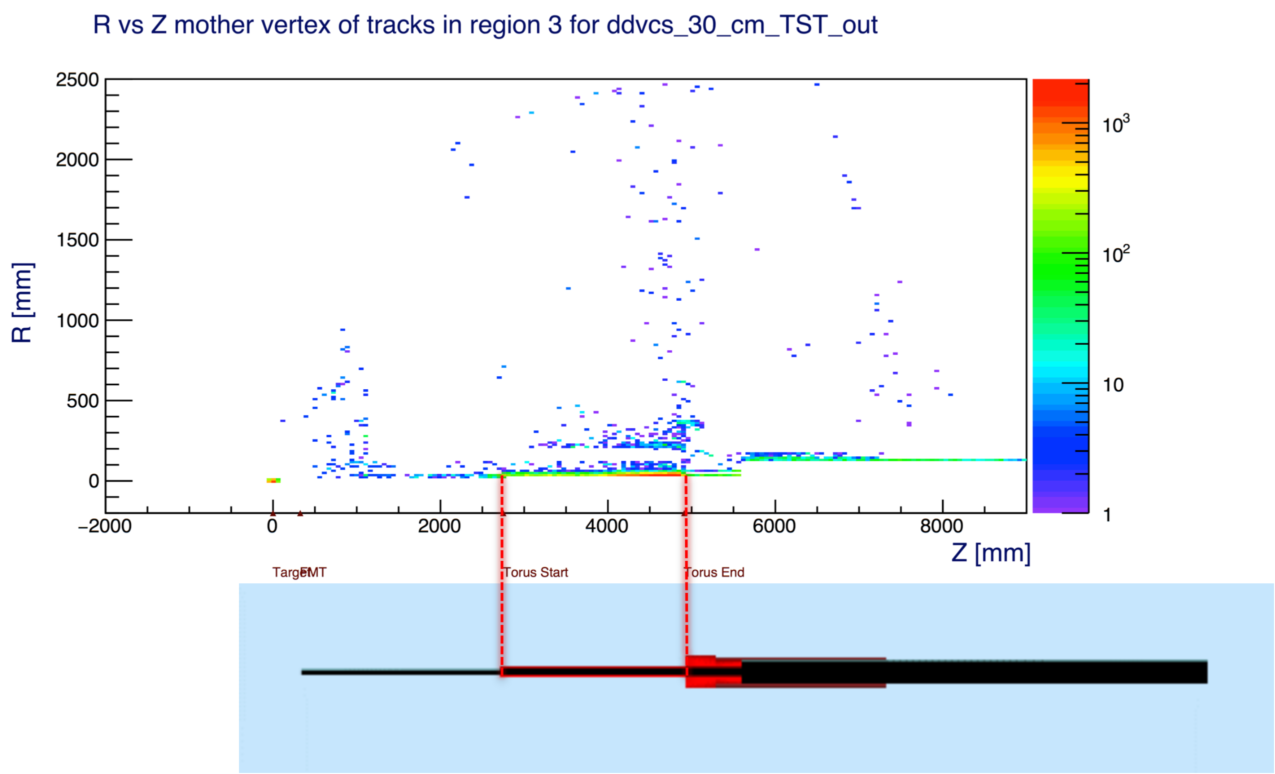
Vertex of particles hitting DC Region 3

Downstream



Vertex of mother particles hitting DC Region 3

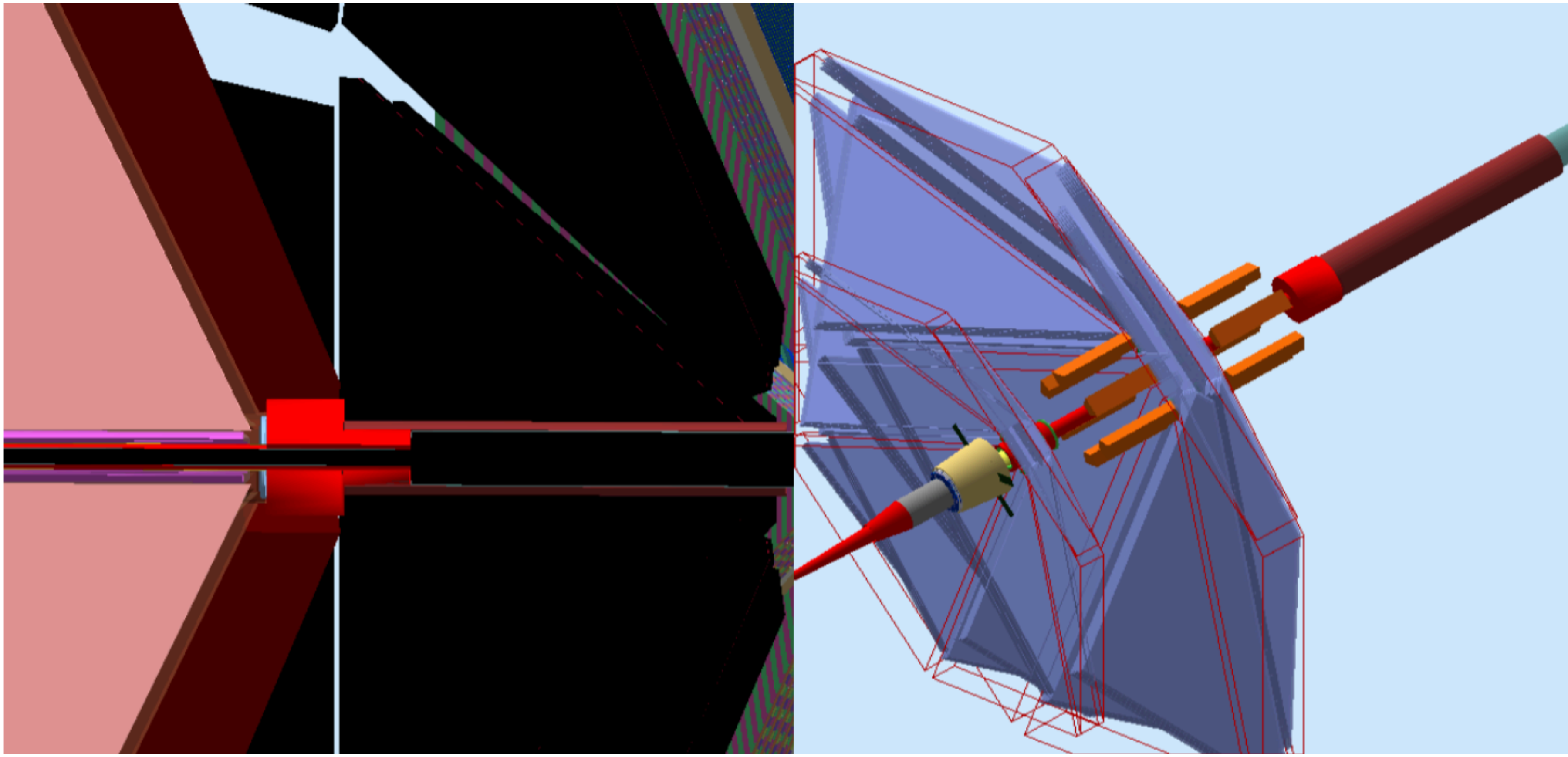
Downstream



Beam is spreading inside torus.
Removing parts of inner shields does not work.

Downstream

Work by David Riser

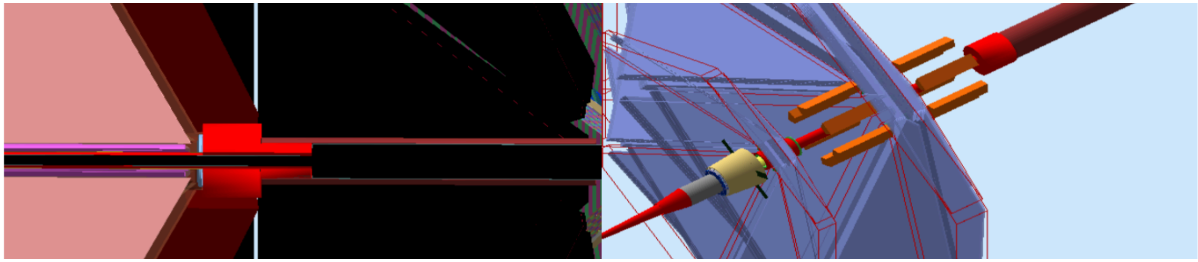


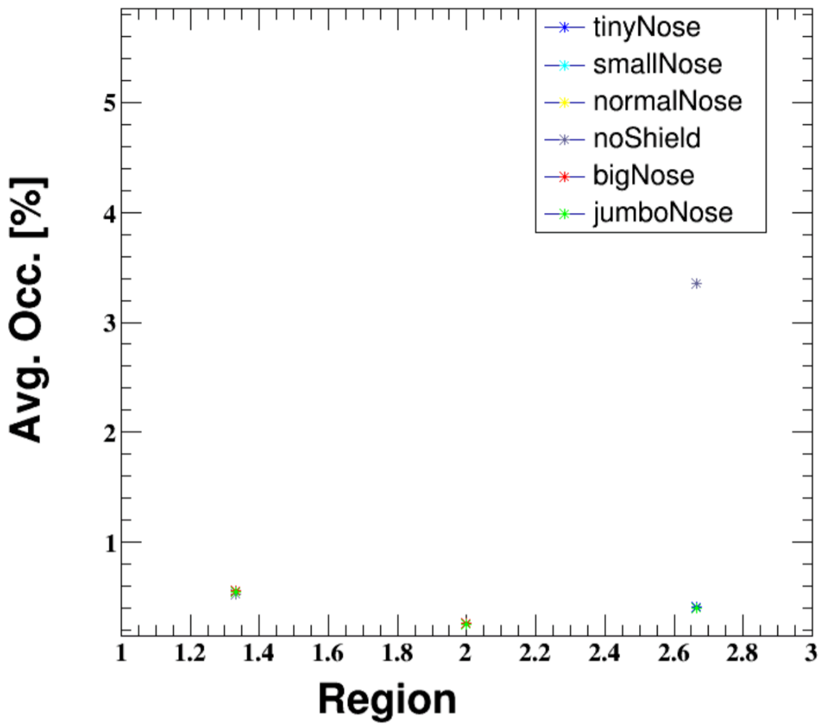
Vary thickness, length of nose

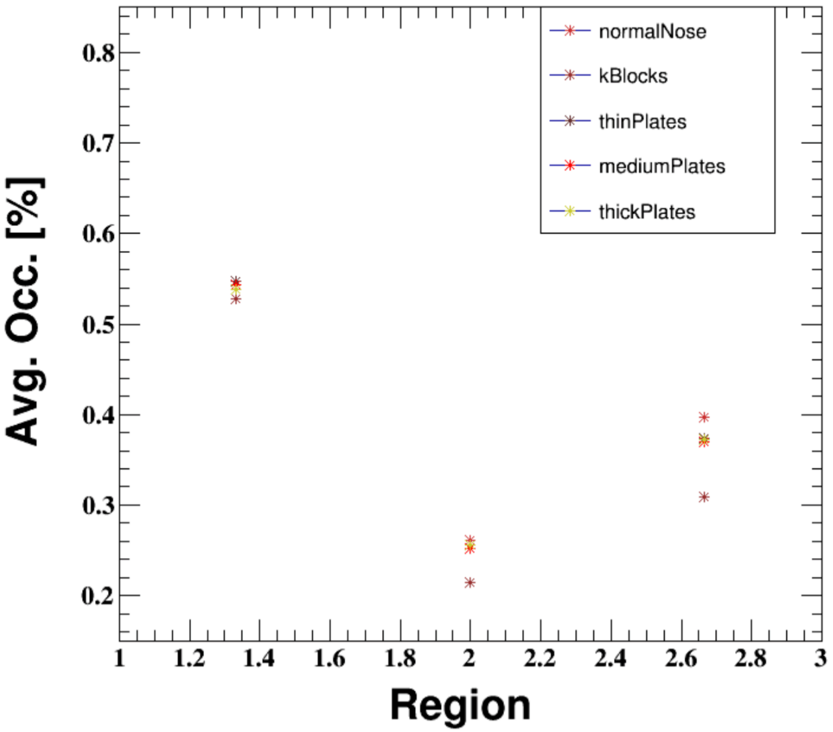
Vary thickness, length of tungsten (lead) bricks between the coils

Downstream

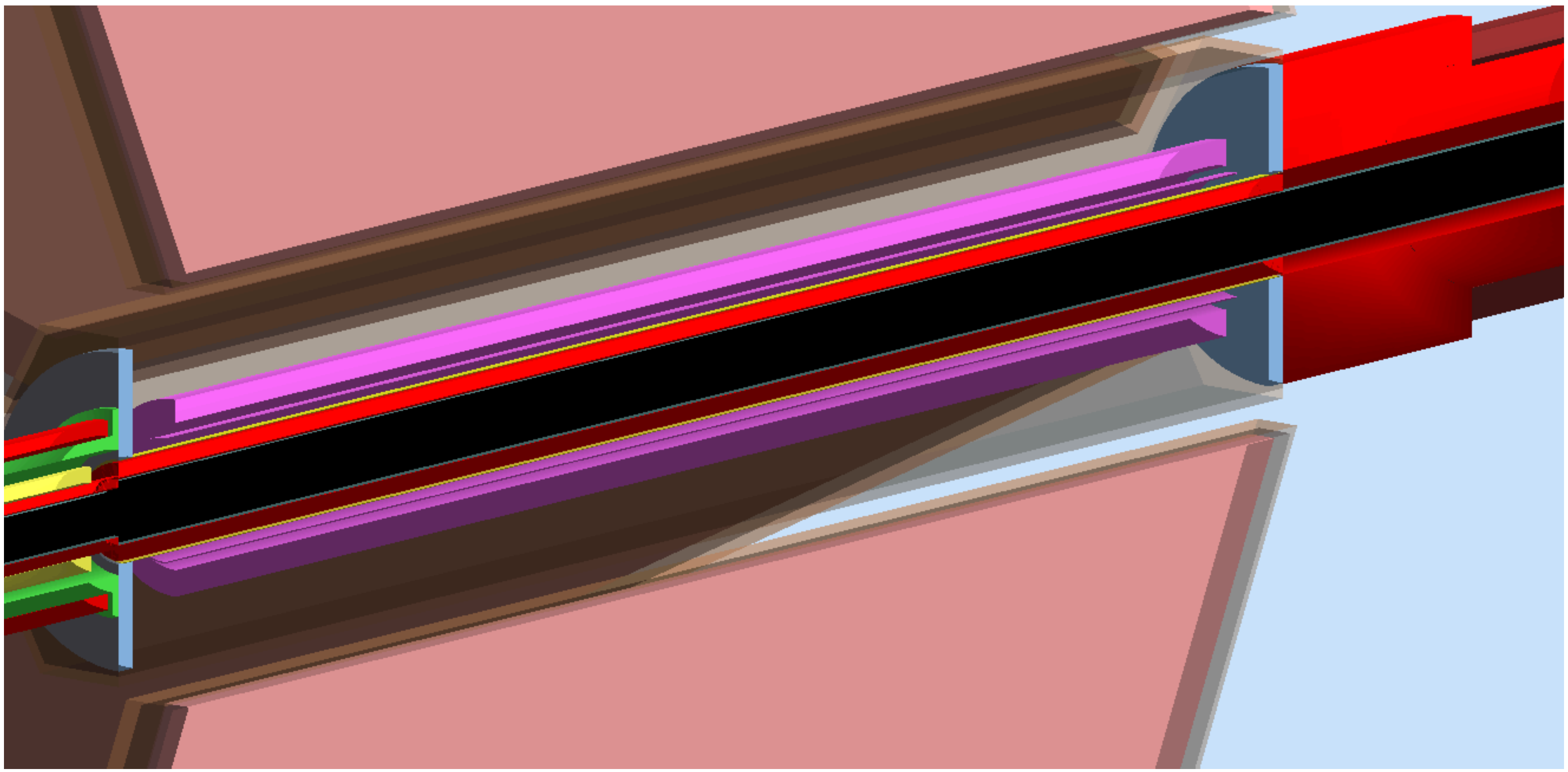
Work by David Riser







Final Physicsts Design

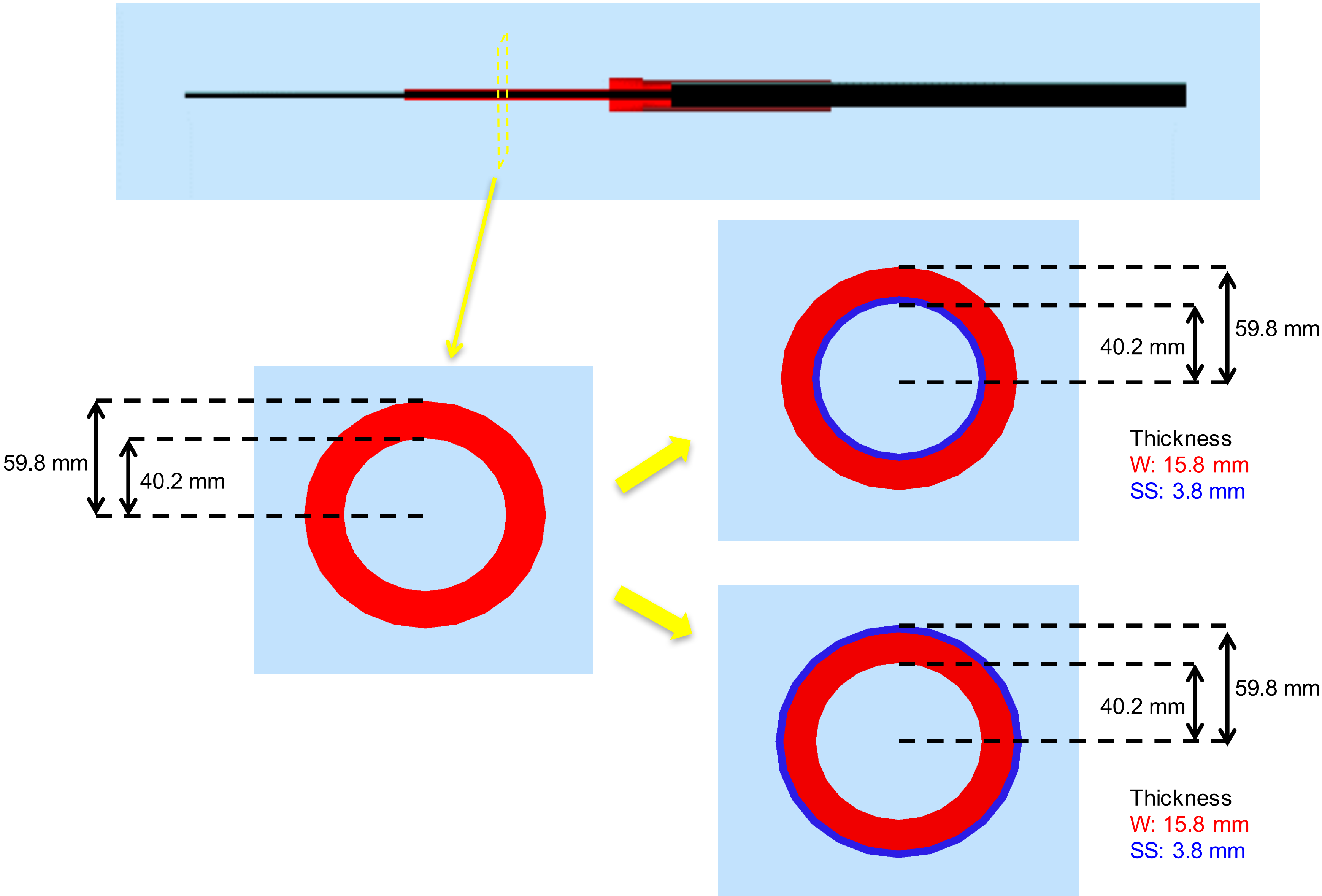


2cm thick tungsten pipe ~2m long

Physicsts Design

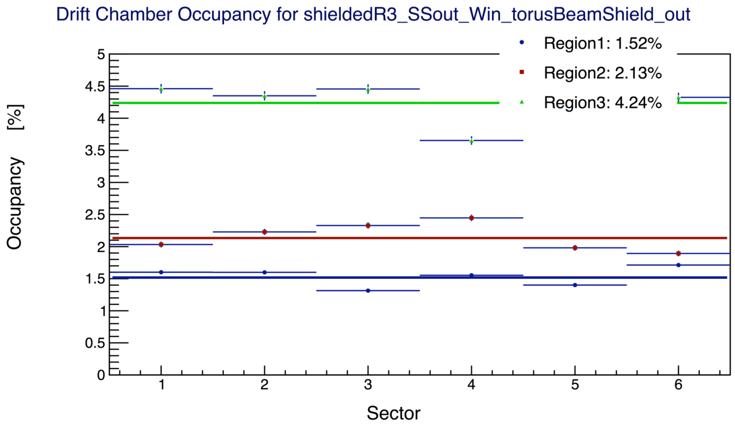
Supporting Shield inside Torus

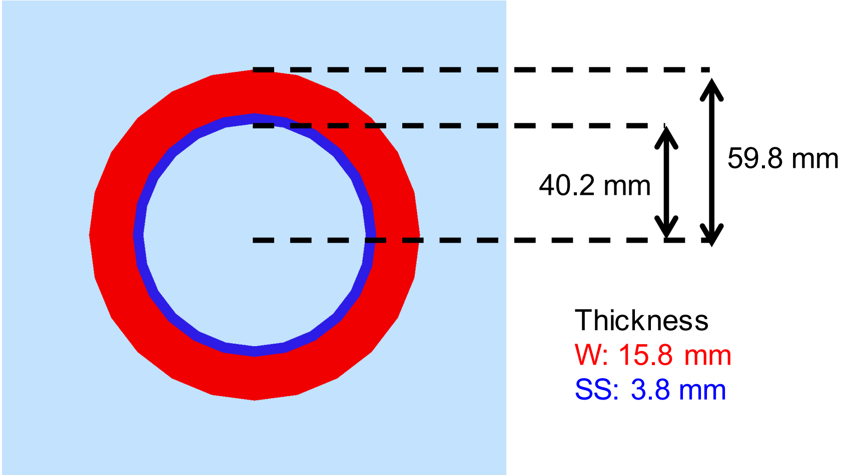
Work by Joshua Artem Tan

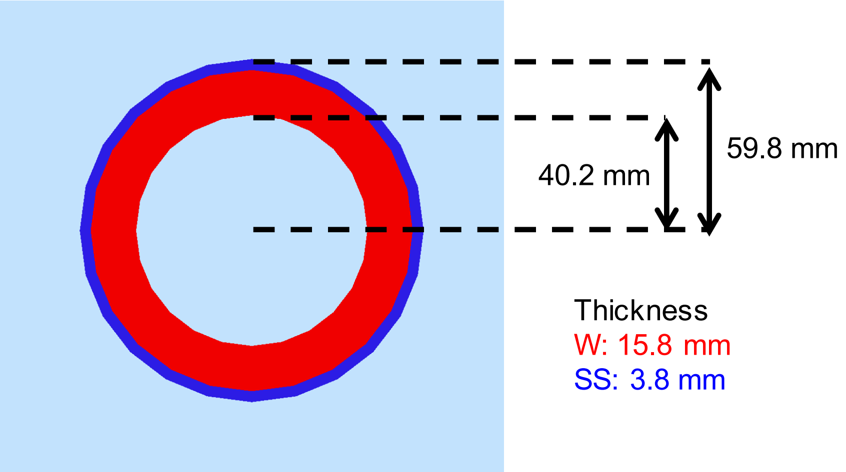


Supporting Shield inside Torus

Work by Joshua Artem Tan



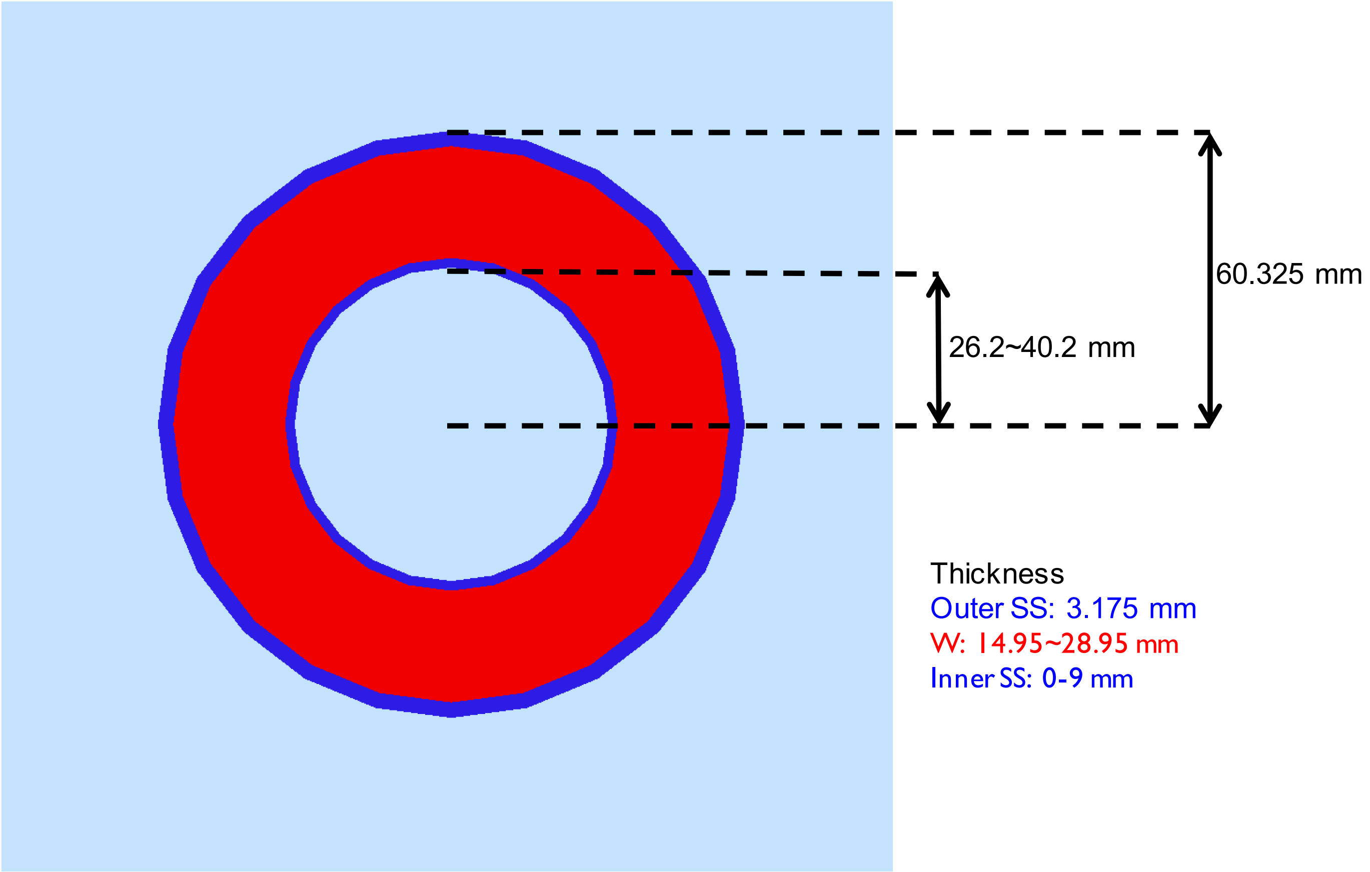




*Region 3 occupancy for unmodified torus beam shield: 3.39%

Supporting Shield inside Torus

Work by Joshua Artem Tan



Supporting Shield inside Torus

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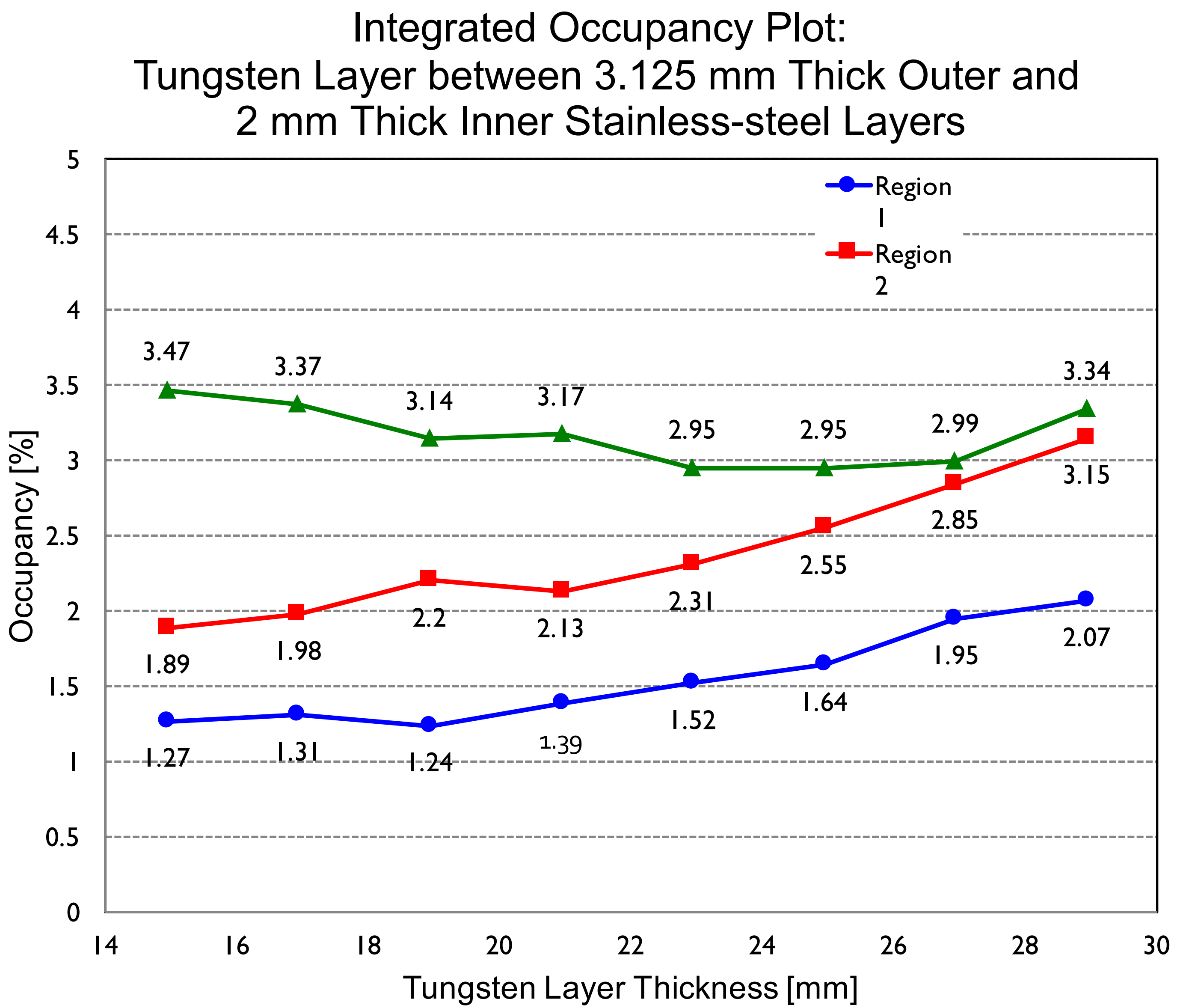

Supporting Shield inside Torus

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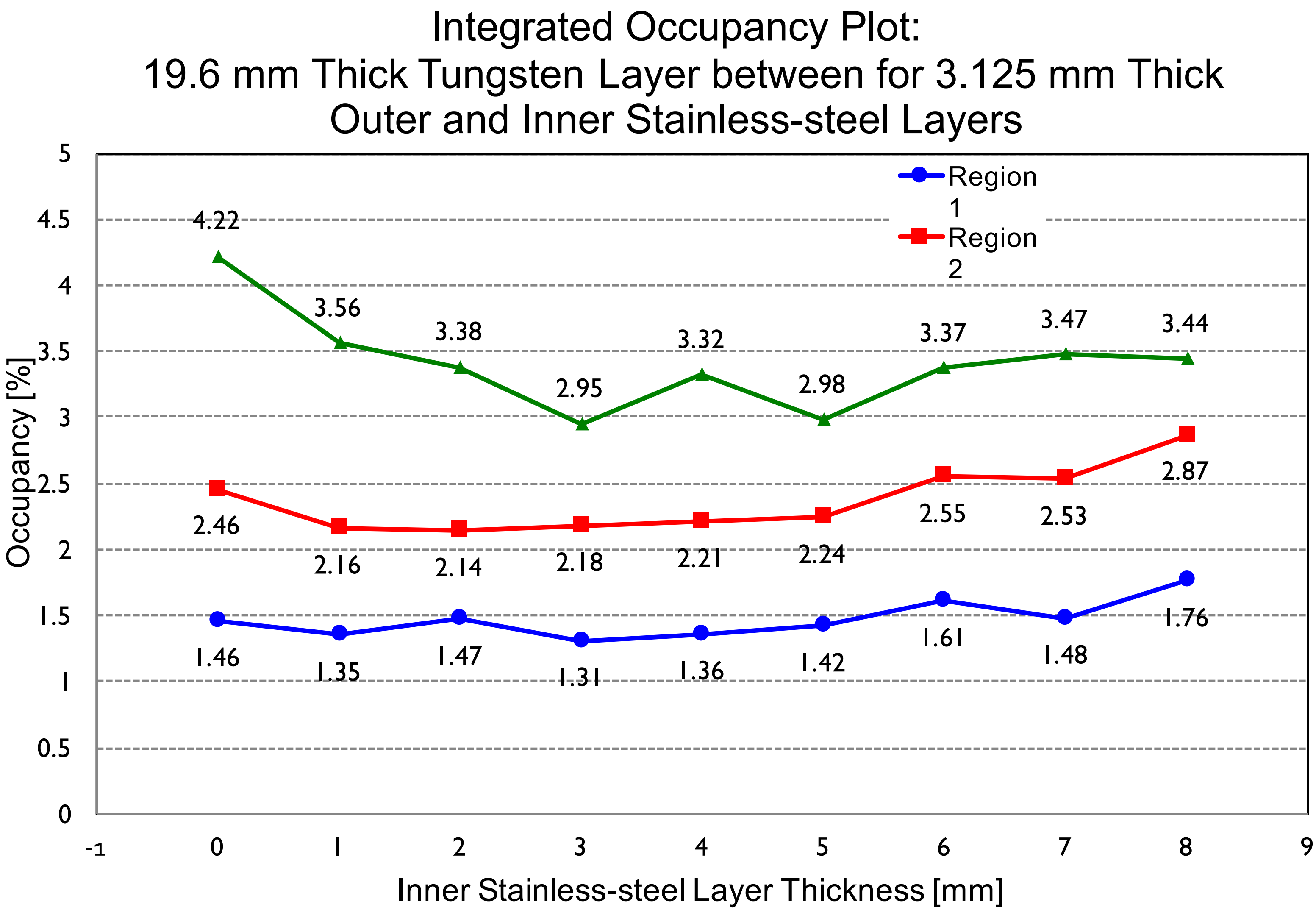

Summary

- Physicists should be more practical
- Beamline between target and torus: finalized. Ready to order.
- Shielding inside torus: being finalized.
- Shielding downstream of the torus: canbe improved.