Compact Photon Source

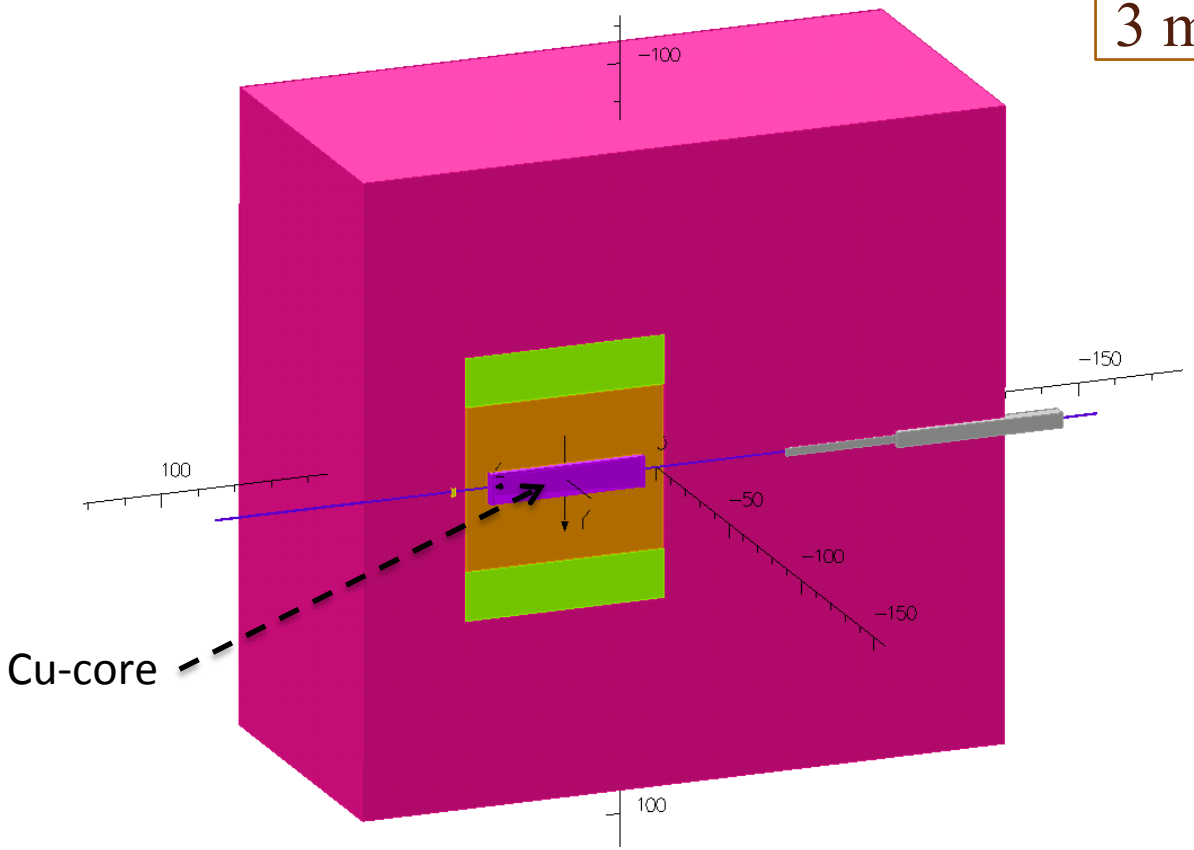
update for 2/13/2018

B. Wojtsekhowski for collaboration

Current model of γ-Source

Distance to target ~200 cm
photon beam diameter on target ~0.9 mm

3 mm x 3 mm hole



New developments

the list from our previous meeting

1. The raster is 2 mm x 2 mm (requires pol. target rotation)

2. The magnet pole is shaped to boost the B field to 3.2 T -> length reduction which allows a longer front shield and a wedged absorber.
3. The central absorber of Cu has 1.9 x better heat conductivity, 4.2 x longer radiation length than the W-Cu (20%) alloy.
4. W-powder external shield (16 g/cm^3 density) for better shielding.
5. Gradual "stepped" opening of the beam line for rad. leak reduction
6. Shielding requirement logic: The radiation from the source should be a few times lower than that from the photon beam interaction with the material of a polarized target.

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+ vertical movement

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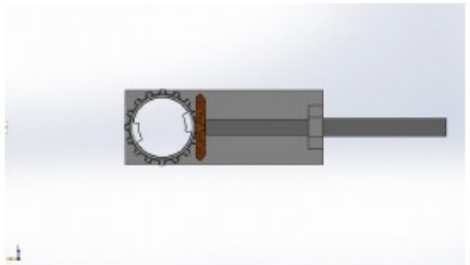
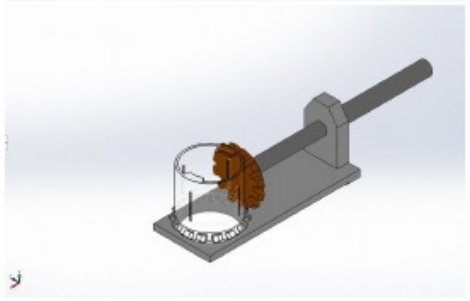
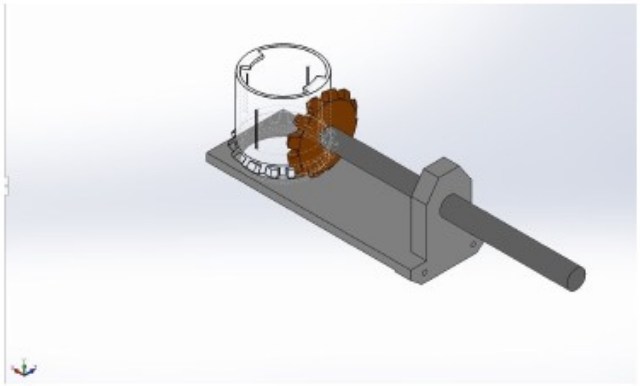
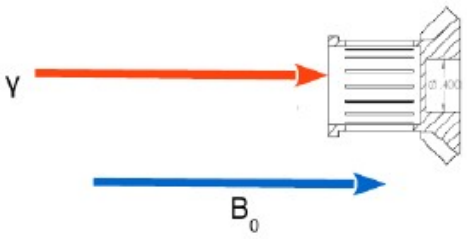
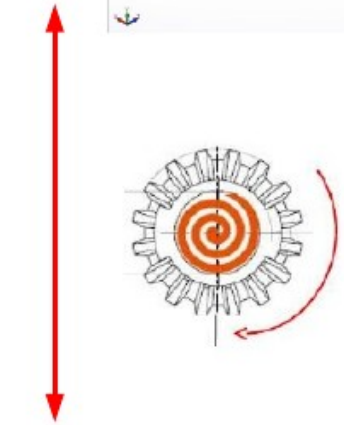
From the recent talk by Dustin Rotation Design





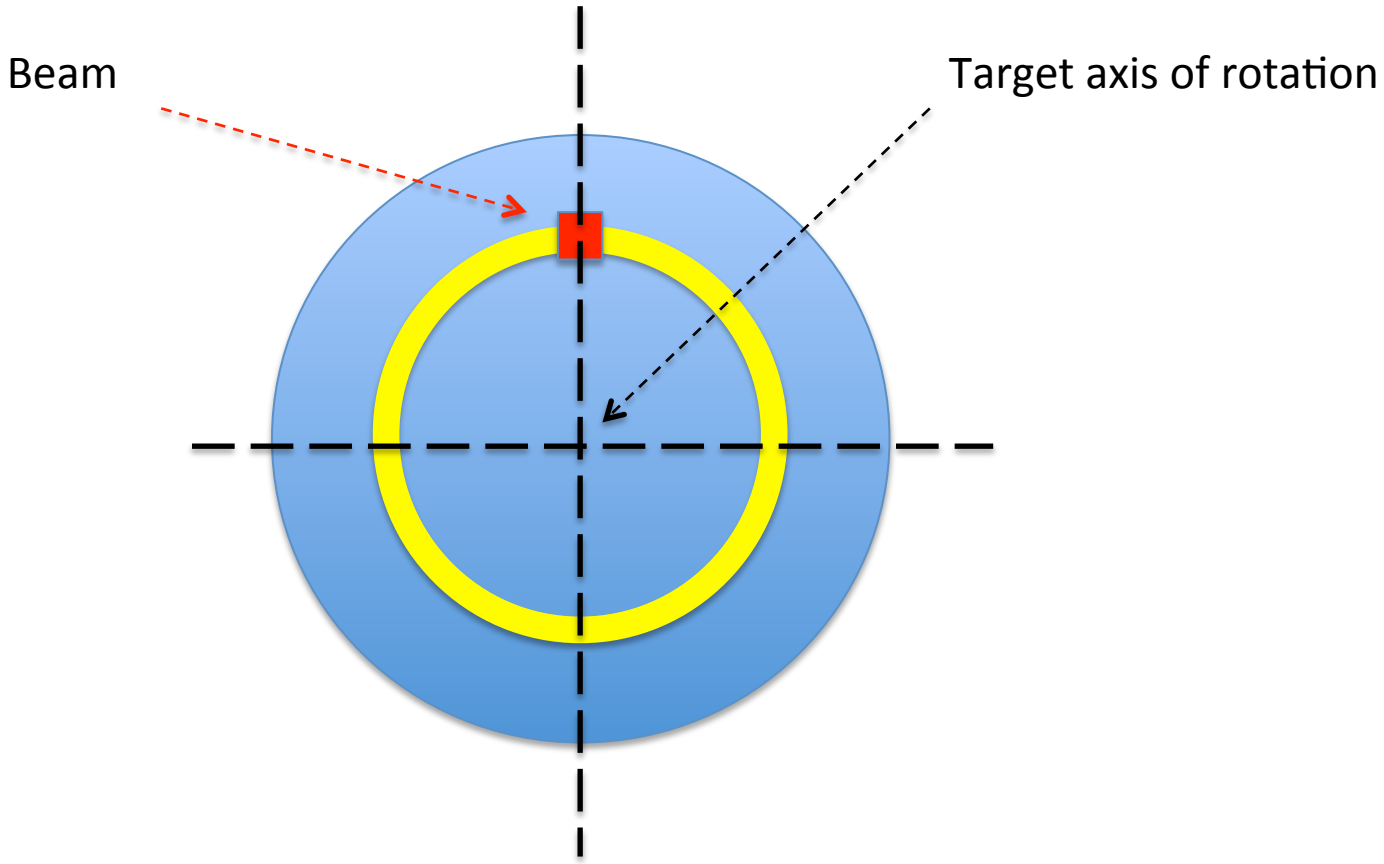




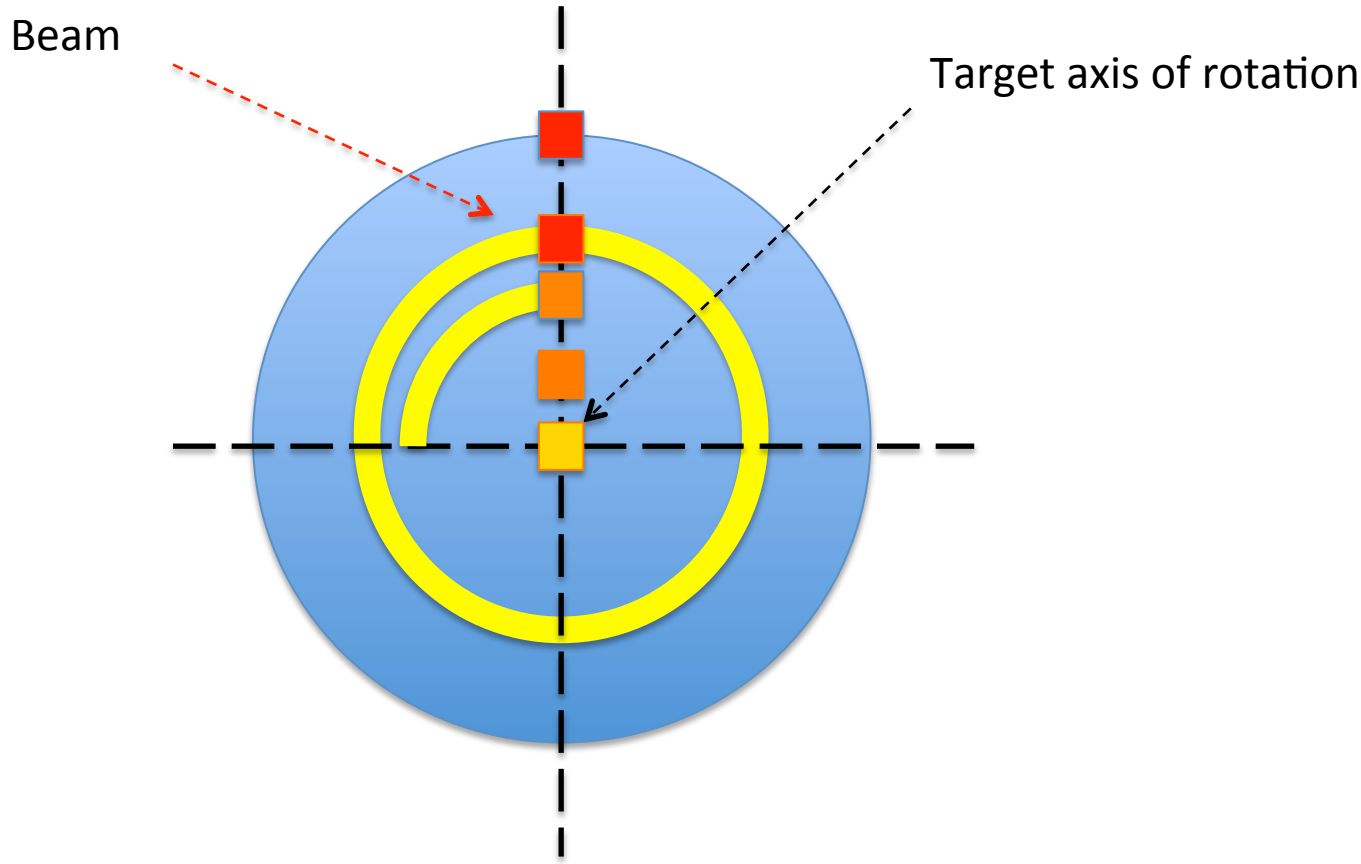


- Control target position
- Rotate while moving up and down
- Similar to standard dimensions 3 cm x 2.7 cm
- Also possible to expand dimensions
- Keep rotation cycles consistent per physics run for systematic regularity

Target cell irradiation, rotation



Target cell irradiation, rotation and vertical motion



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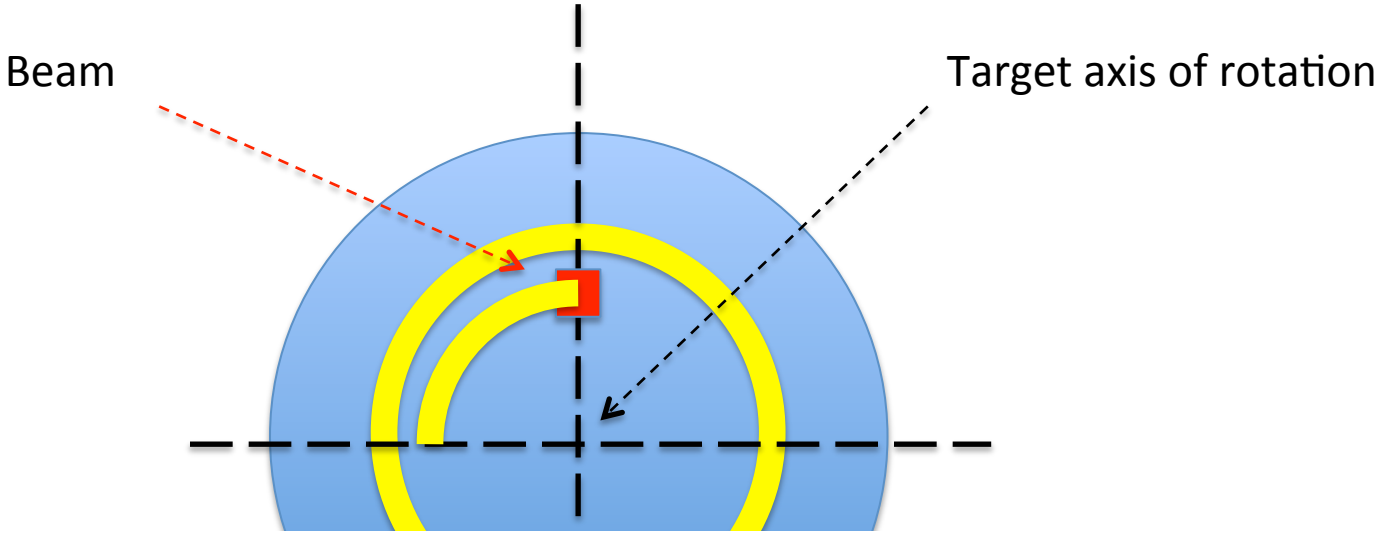


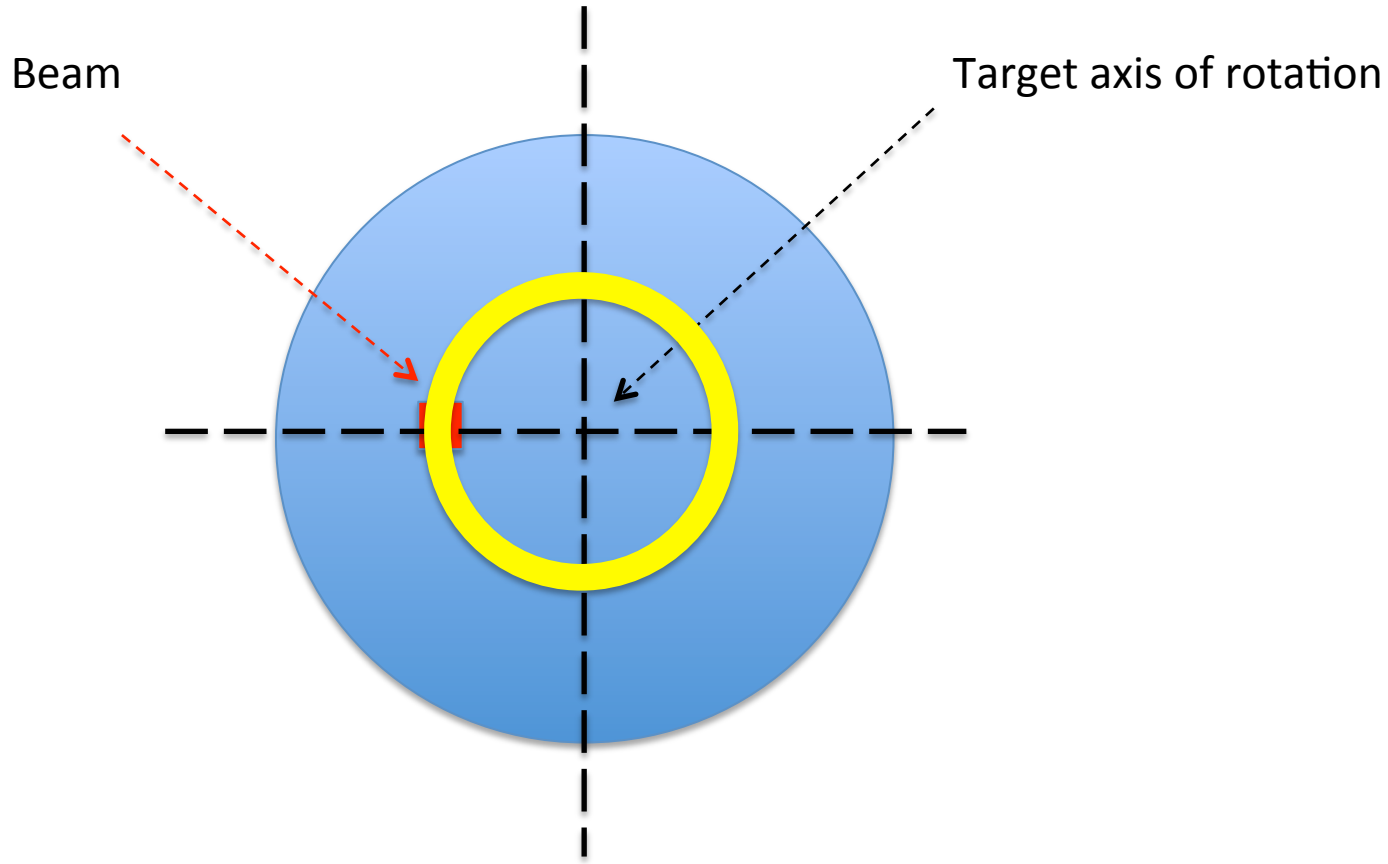
The typical slow raster had 100 Hz cycle.

Our experiment will be a month+ long.

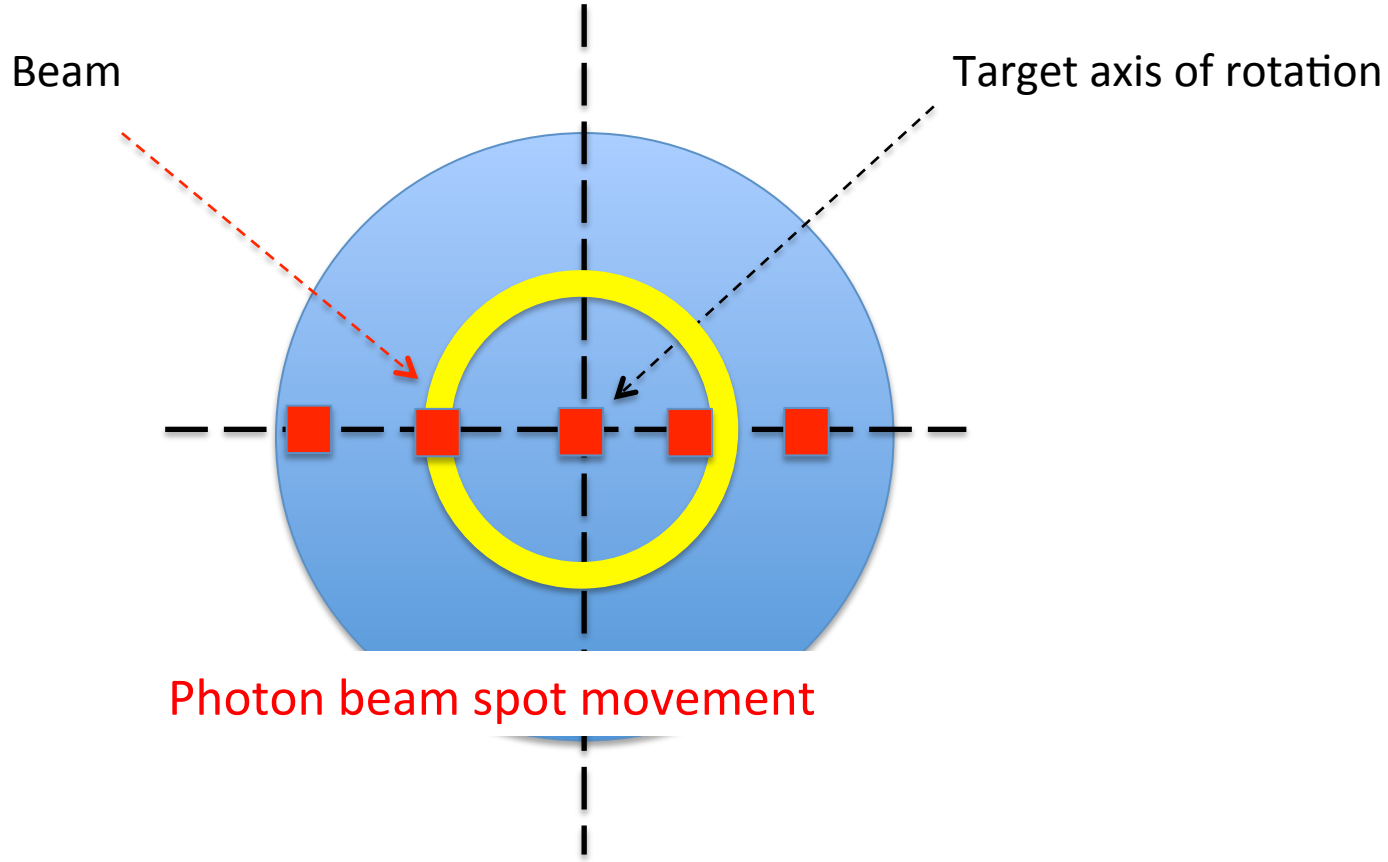
It will be a huge number of motion cycles ~ 10^8.

The vertical motion of the target is not easy.

Target cell irradiation, rotation



Target cell irradiation, rotation with horizontal beam spot movement



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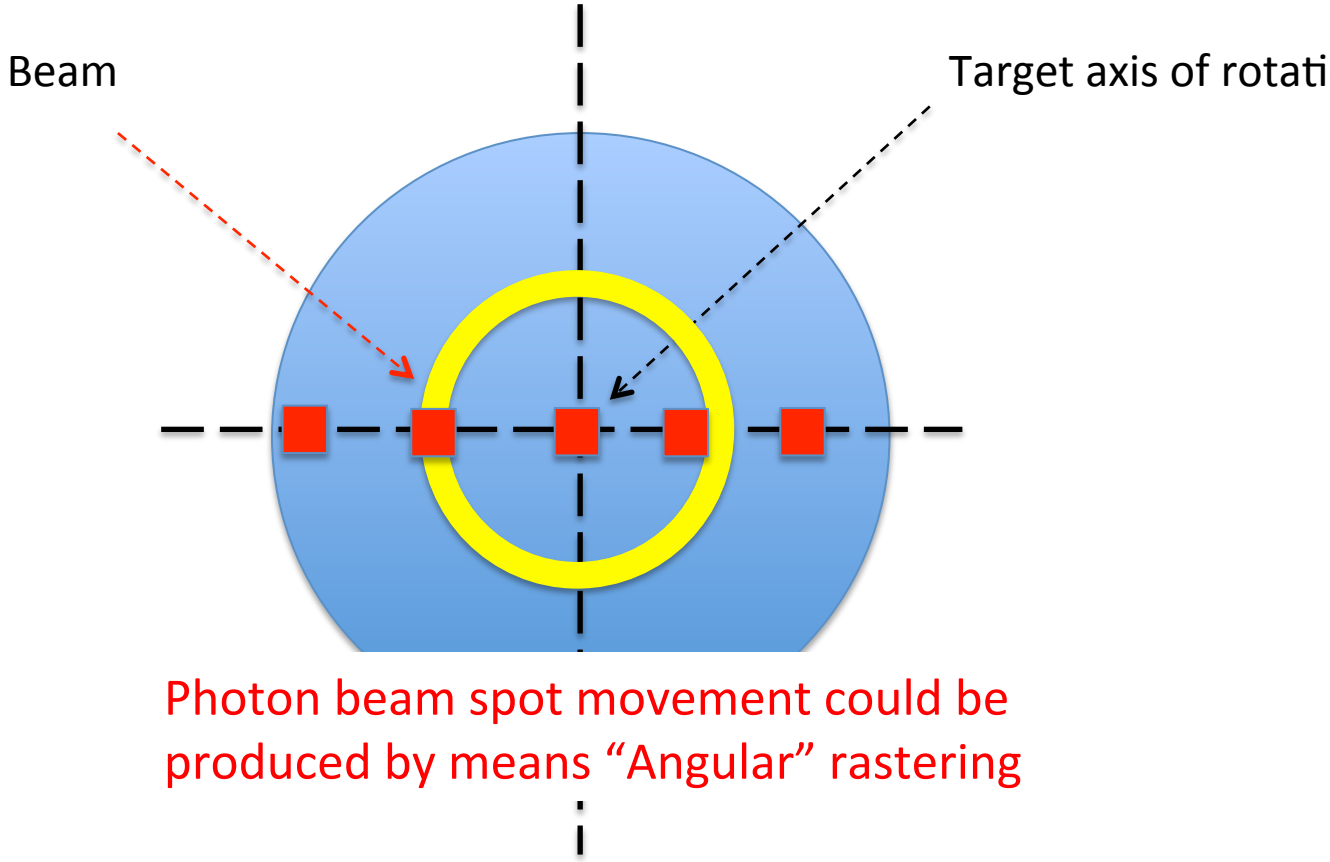
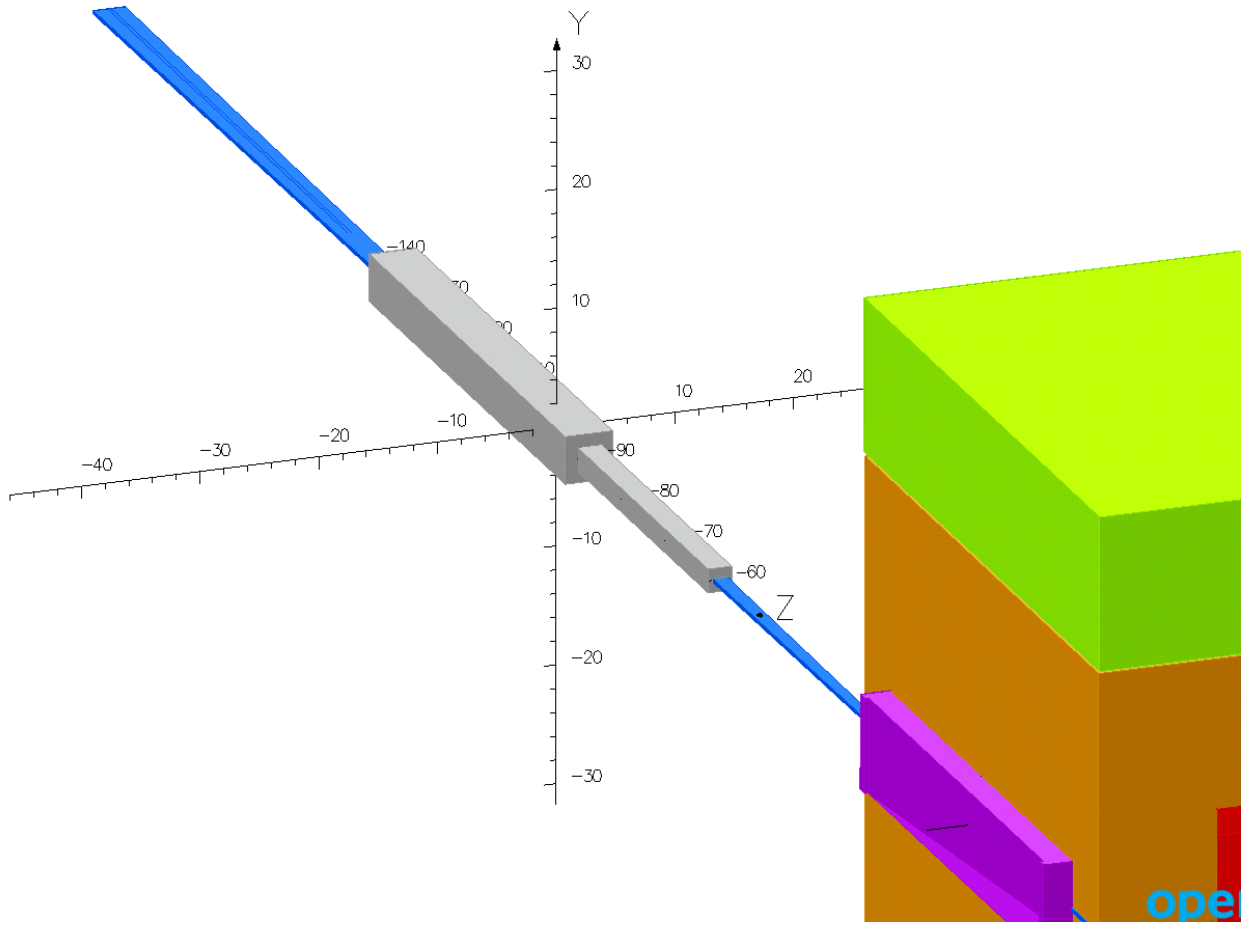


Photon beam spot movement could be produced by means “Angular” rastering

A horizontal angular raster by +/- 5 milli radian



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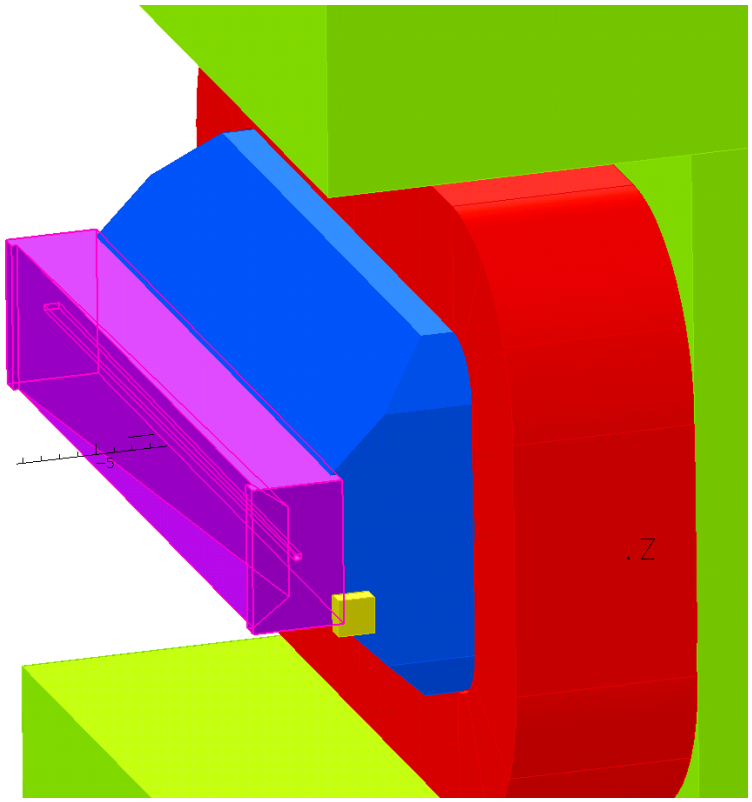
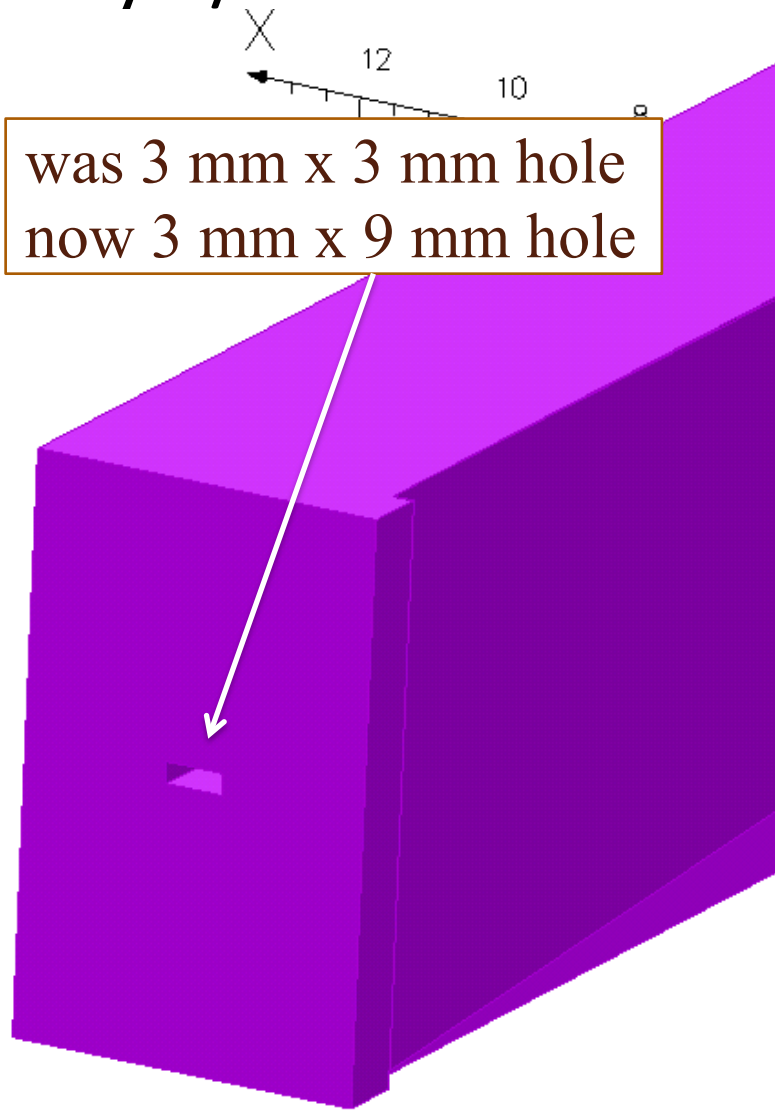
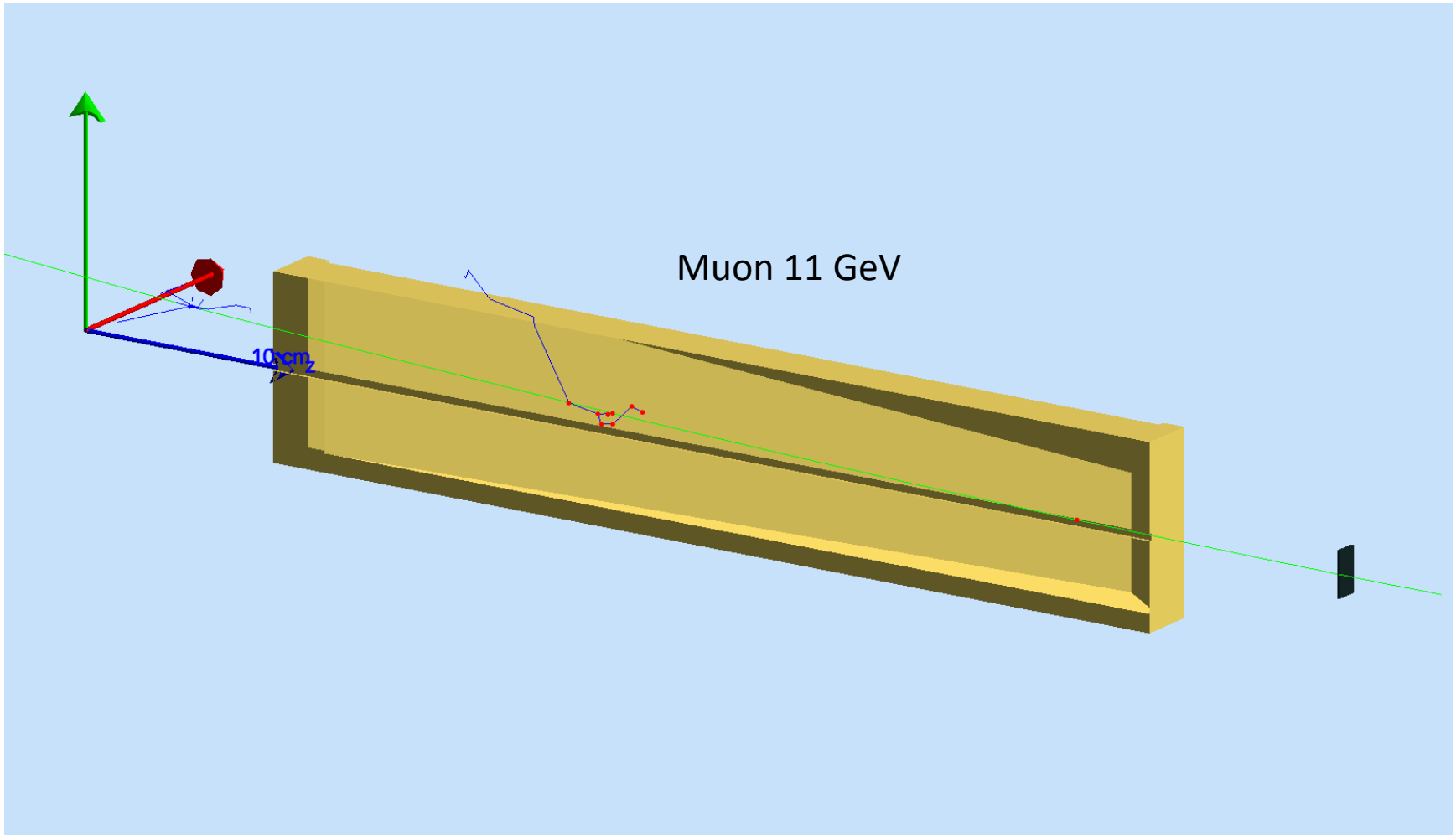


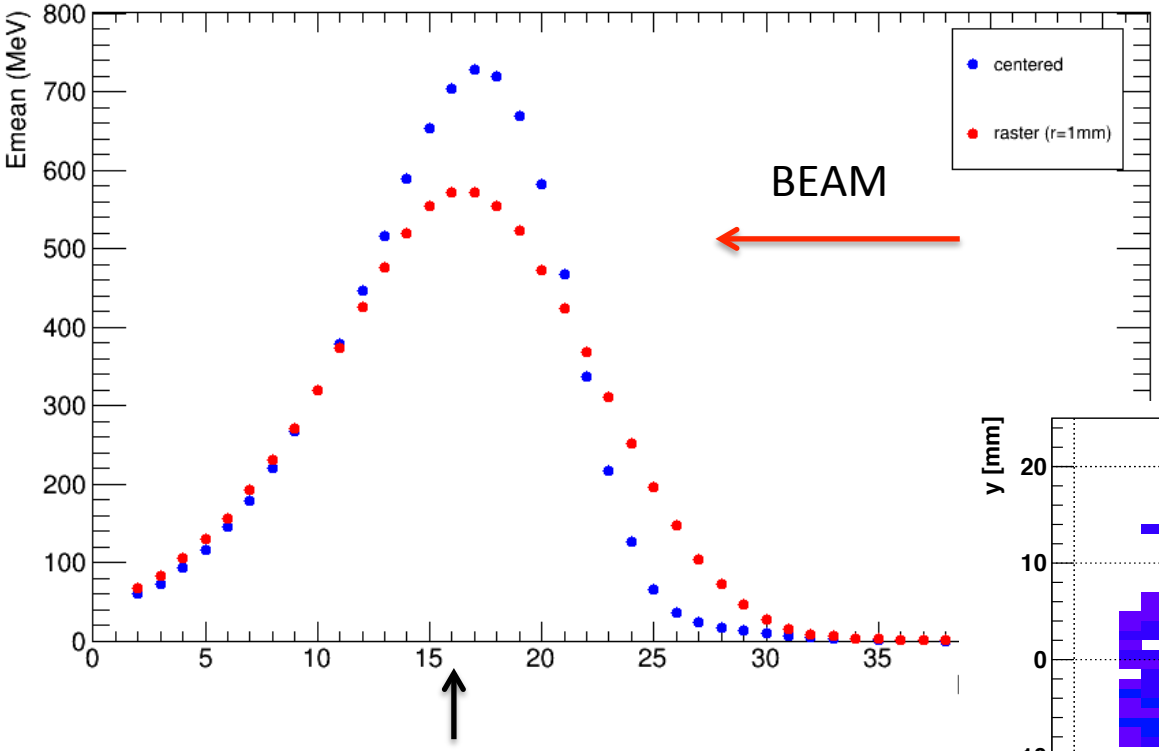


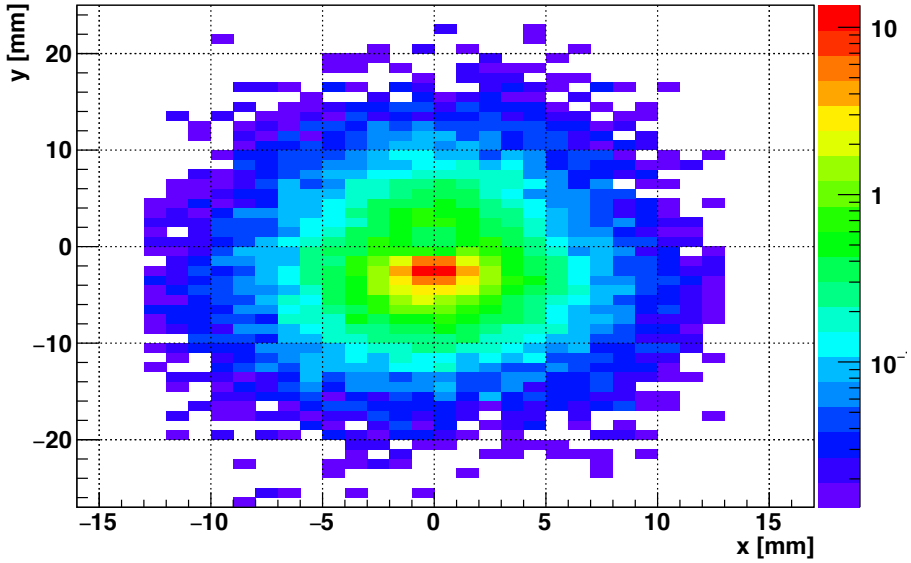
Geant4 model (GEMC framework)



Geant4 model (GEMC framework)

Marco got the power profiles





from the tech note for the 2015 WACS proposal

Conceptual Design Report
A Compact Photon Source

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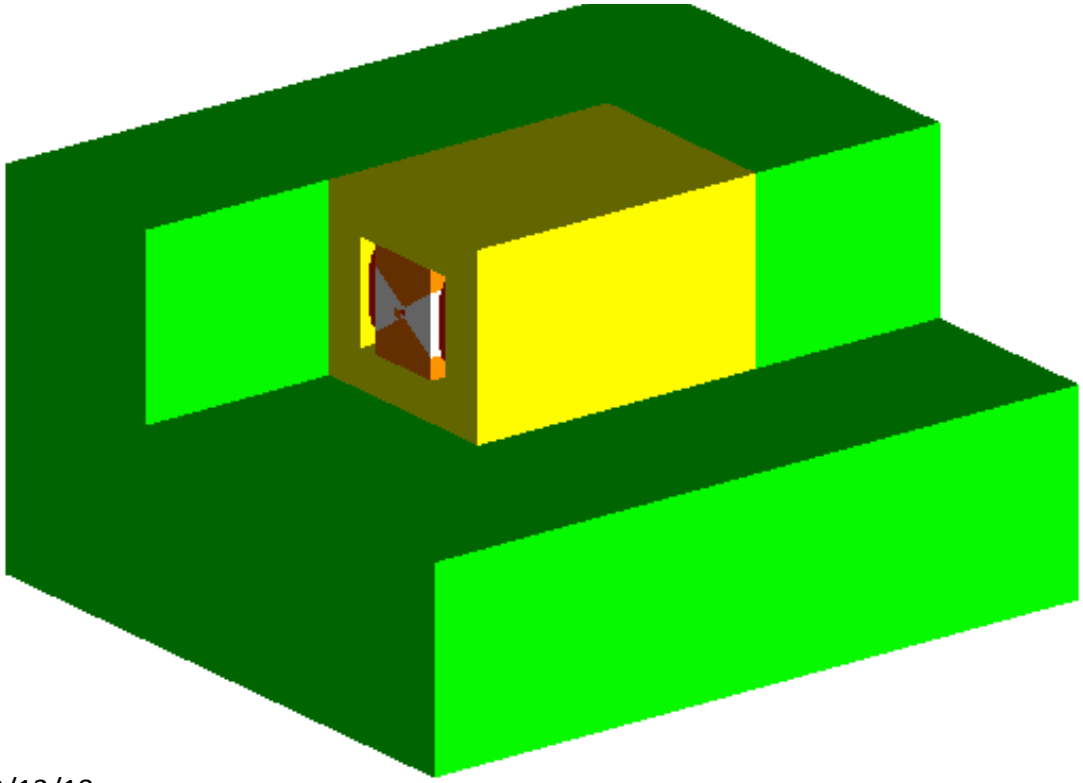
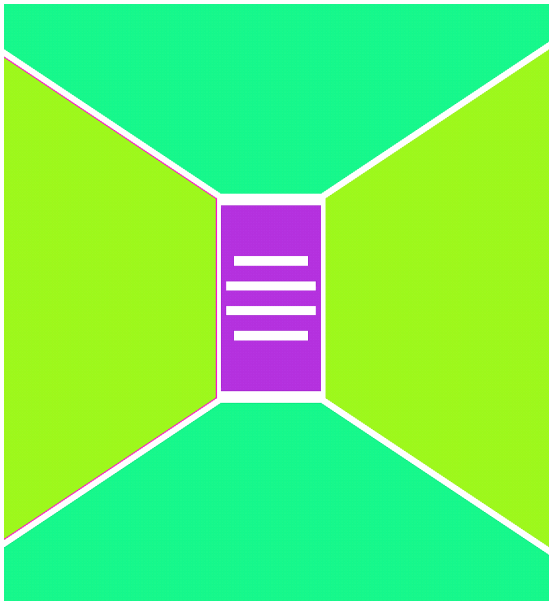
June 22, 2015



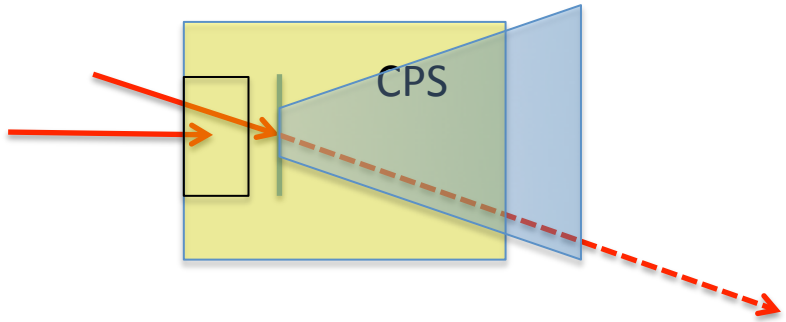


Angular raster for 11 GeV beam

Deflection angle of 5 mrad requires

Bdl = $(1.1 \times 10^{10}/300)*0.005$ = 18 Tesla x cm => 30 cm magnet

Angular raster 60 Hz



Photon beam is moving by +/-1 cm at the target location and +/-15 cm at the beam dump which needs(?) a local shielding

Conclusions

- Angular raster of the beam will require just

a small increase of the exit channel horizontal aperture, which according to previously made MC is acceptable for the radiation at the target.

- Combination of the rotation with the horizontal

beam spot movement could be the best approach for uniform irradiation of the polarized target cell.