Particle Production of Graphite Target (20to2T5m4PDL) from Focused Proton Beam (KE of 6.75 GeV) with Different Emittance

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Target Studies
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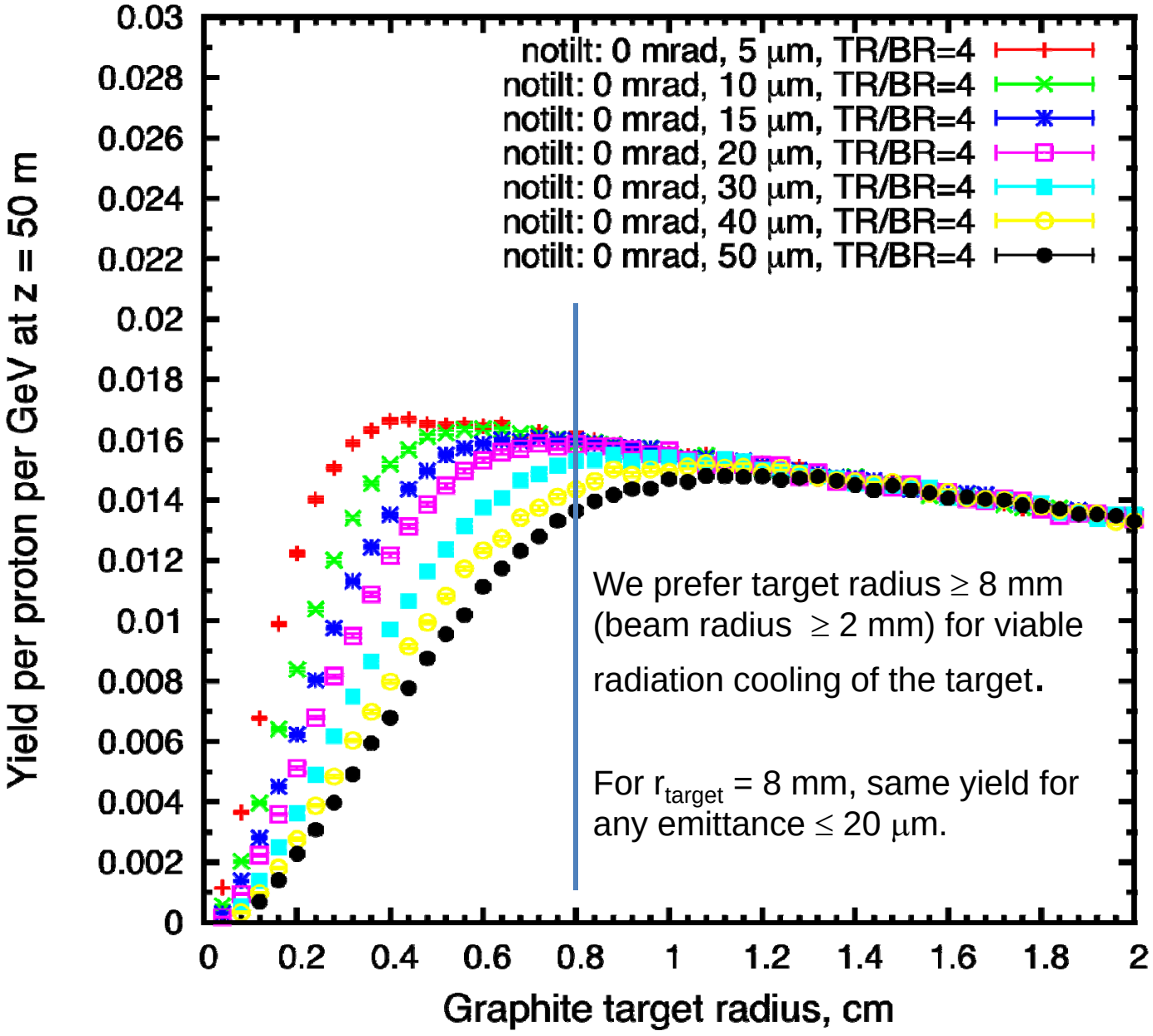
Target Setting

- Carbon target with 20to2T5m4PDL Configuration (with resistive copper) and Fieldmap (20T➔2T);
- Code: MARS15(2014) with ICEM 4 = 1;
- Proton beam: 6.75 GeV (KE) and launched at z = -100 cm,

  Focal beam with waist at z= 0 m and varied emittance;
- Production Collection: (50 m downstream, 40 MeV < KE < 180 MeV).
- BeamRadius/TargetRadius = ¼, at waist of carbon target
- ENRG 1 = 6.75, 2 = 0.02, 3 = 0.3, 4 = 0.01, 5 = 0.05, 6 = 0.01, 7 = 0.01 (Energy card setting)

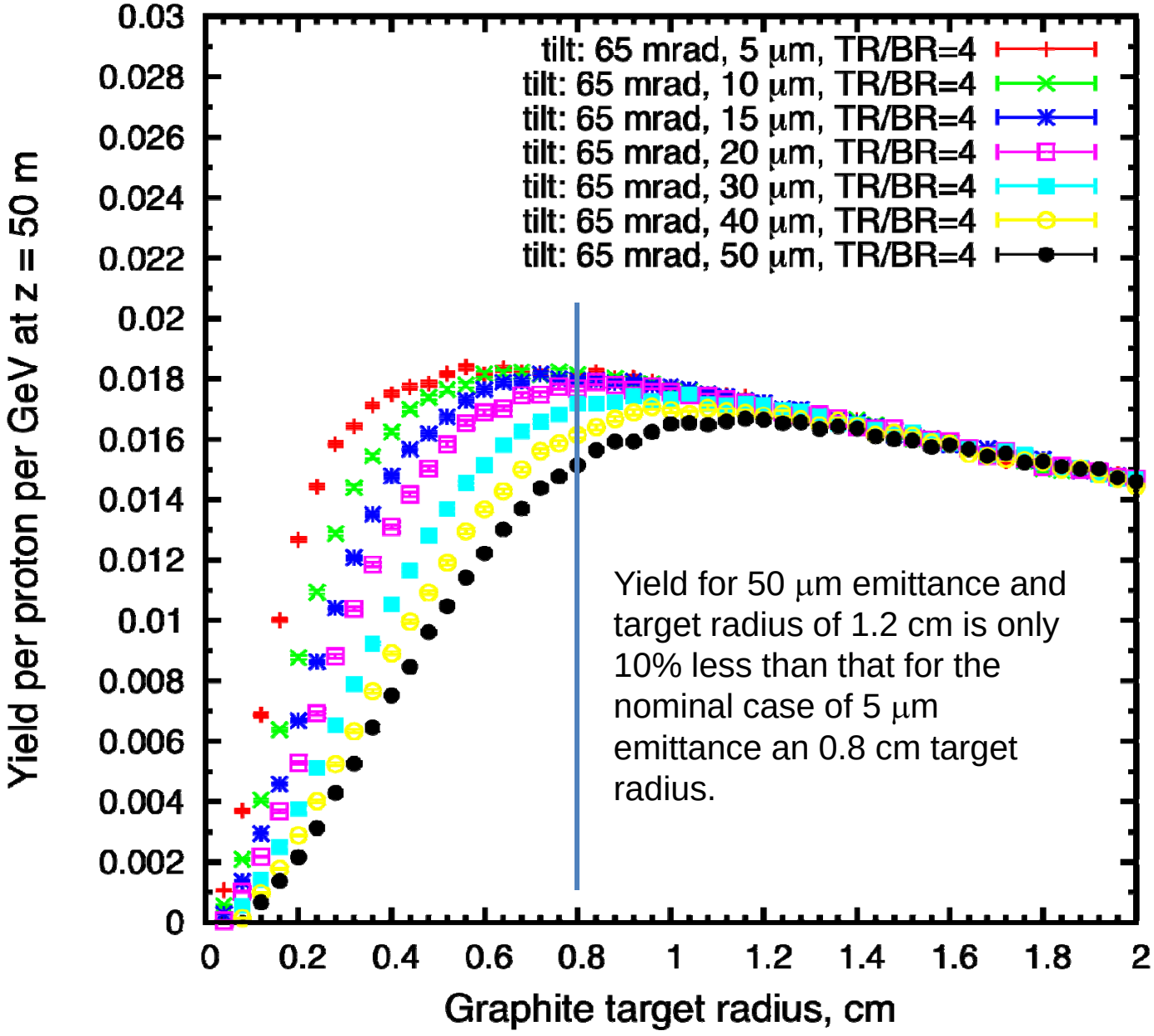
Yield for target without tilt

for various geometric, rms, transverse emittances



Yield for target with tilt

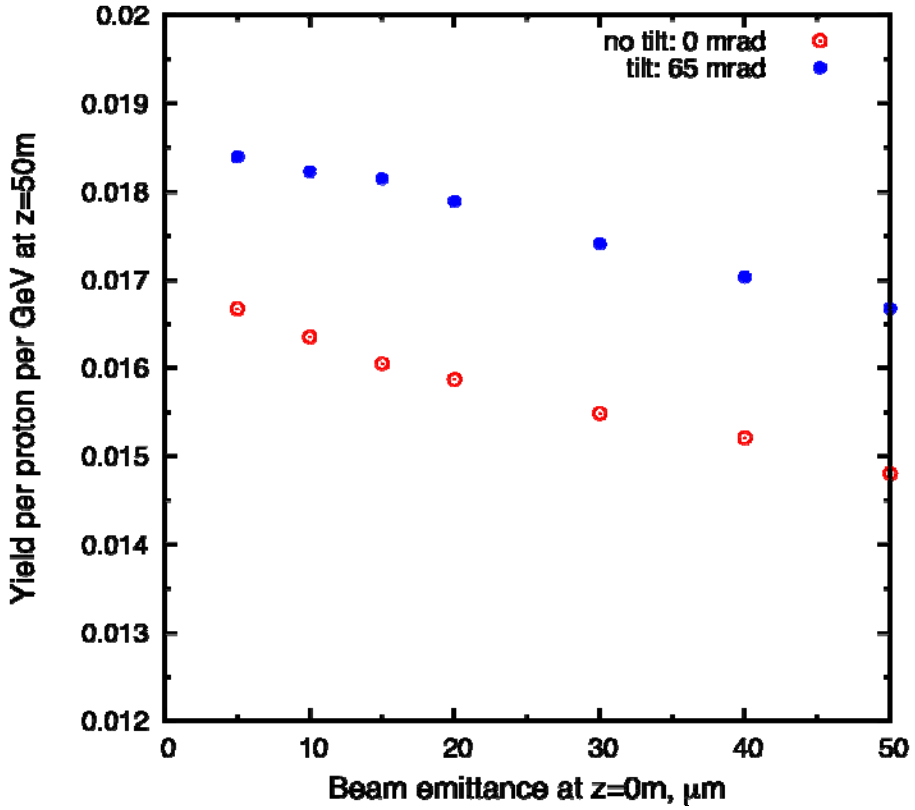
(65 mrad to SC axis)

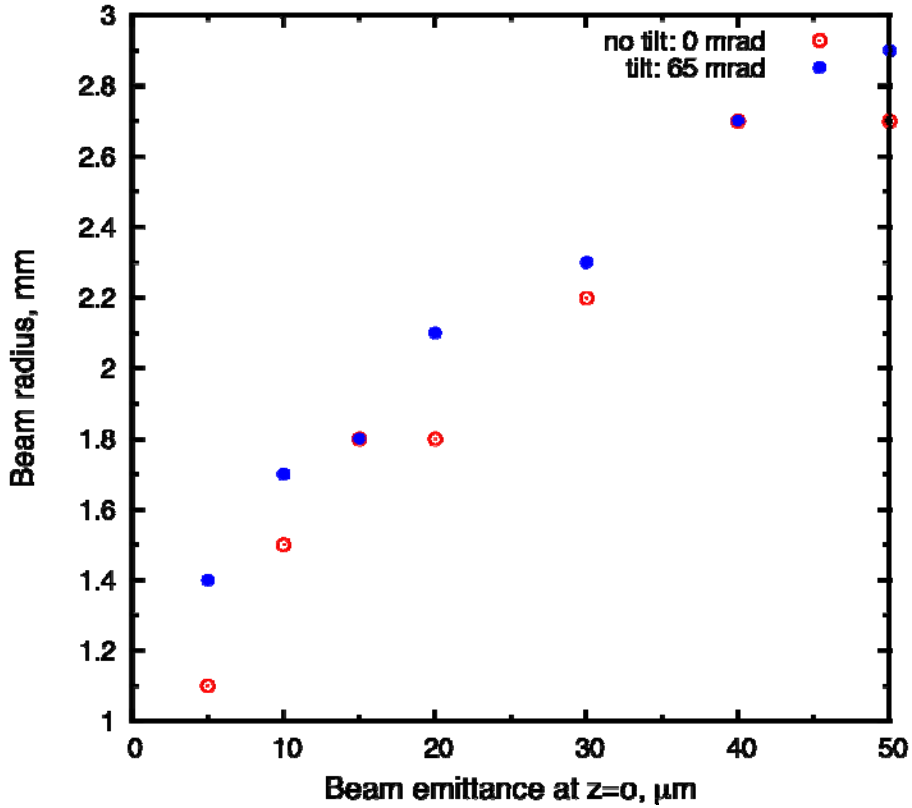


Yield and Beam Radius *vs.* Emittance

Comparison between tilt and notilt

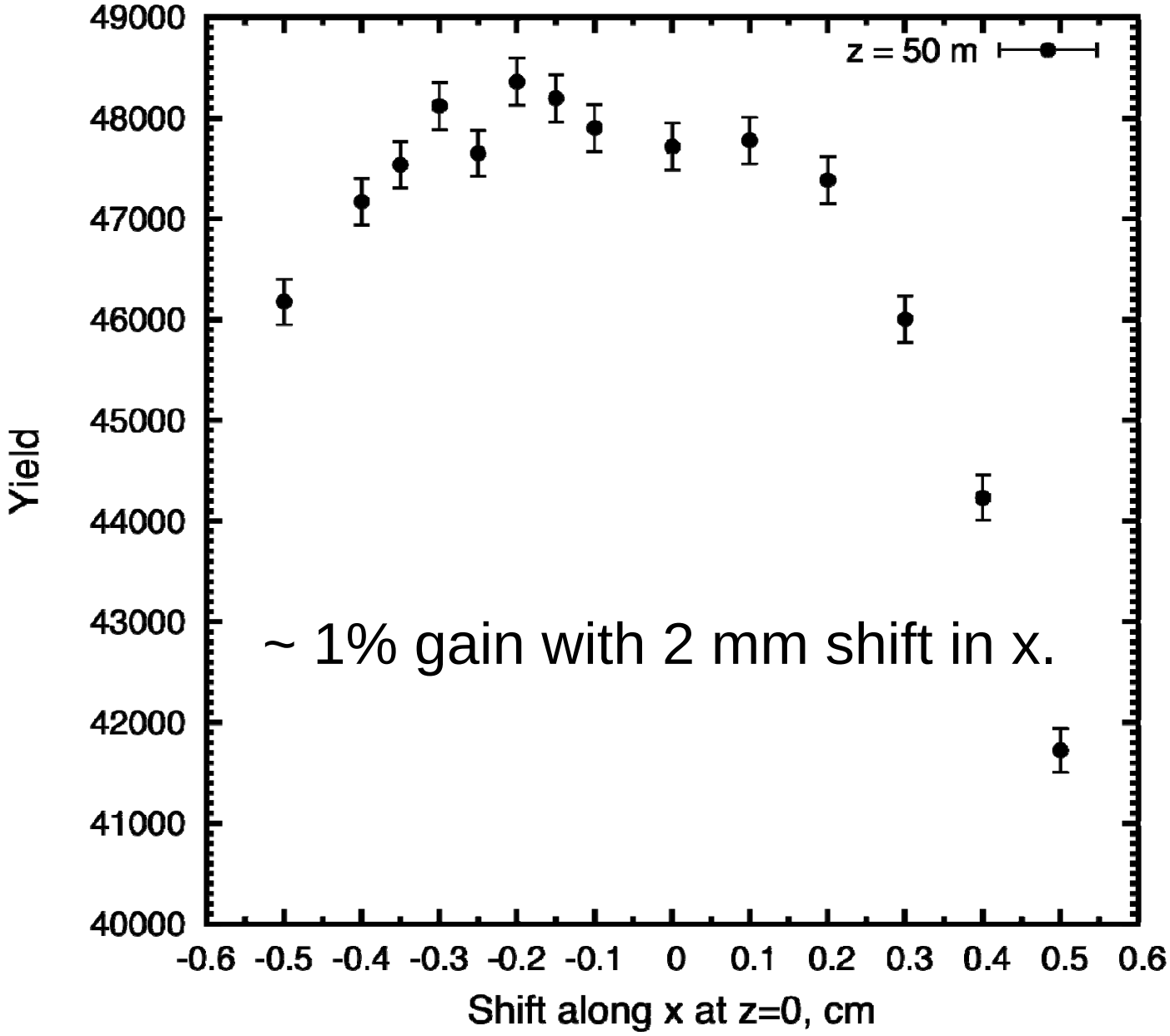
Target radius = 4 · beam radius





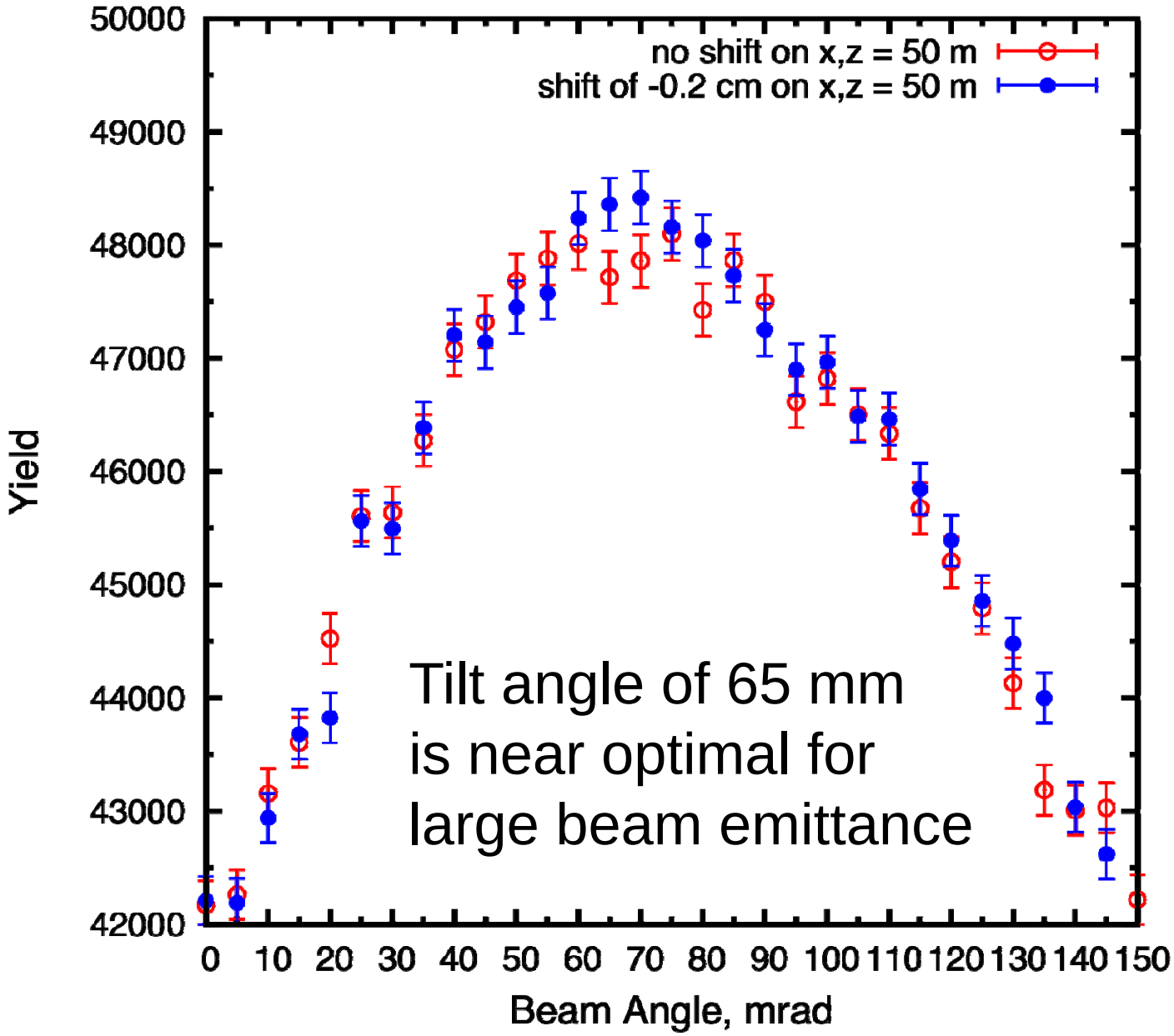
Beam Shift along x at z=0

(beam radius of 2.25 mm, tilt angle of 65 mrad and emittance of 20 μm)



Yield vs. Beam Angle

(beam radius of 2.25 mm, beam emittance of 20 μm)



Power Deposition in the Target

For a fixed target radius (8 mm on this page), higher beam emittance ⇒ higher beam divergence, More diffuse beam at upstream end of target, ⇒ lower peak power deposition.

For emittance ≥ 20 μm the peak power deposition is only ≈ 1/2 that for 5 μm, ⇒ additional advantage to use of higher emittance beams.