

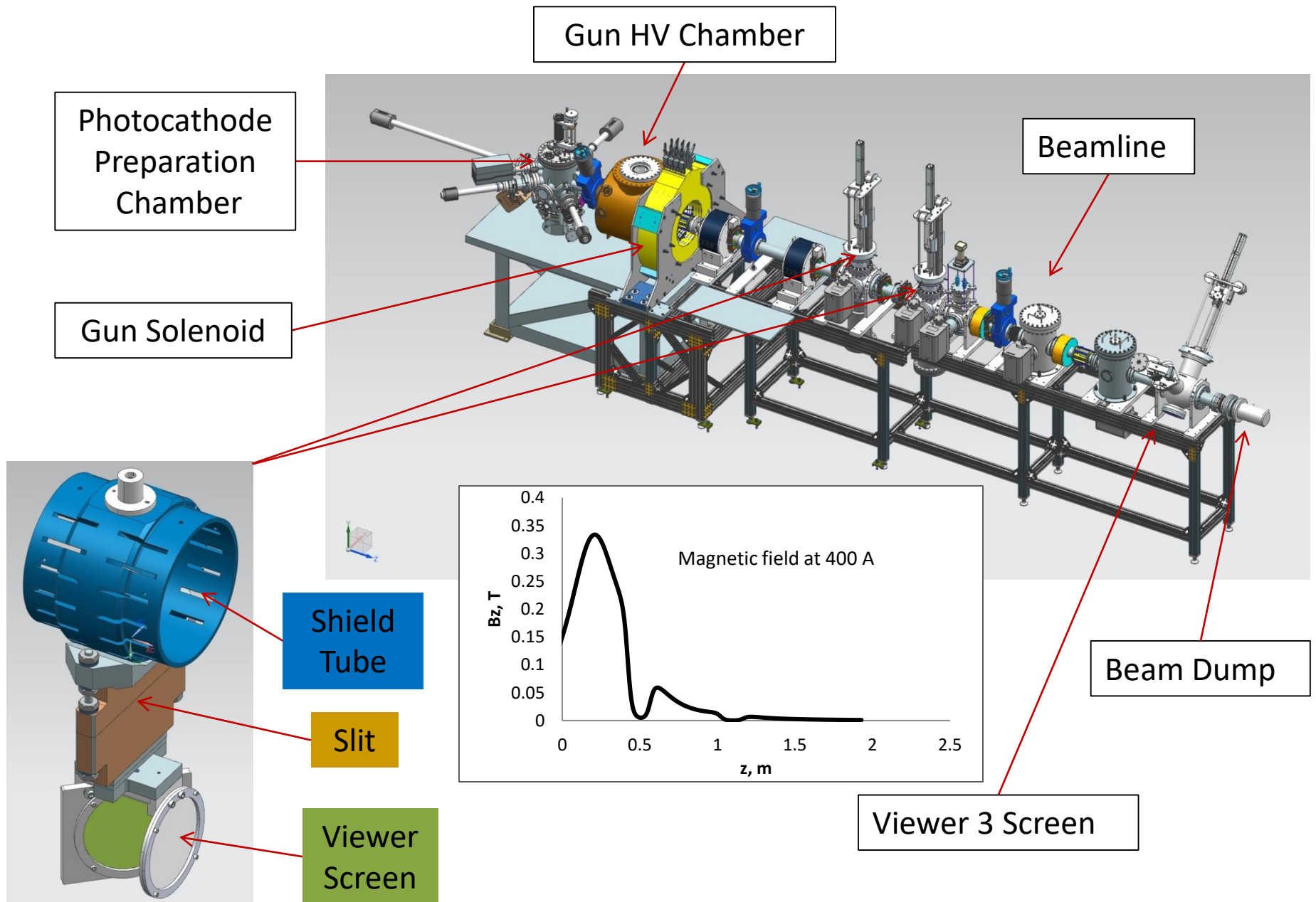
Cooler e-source

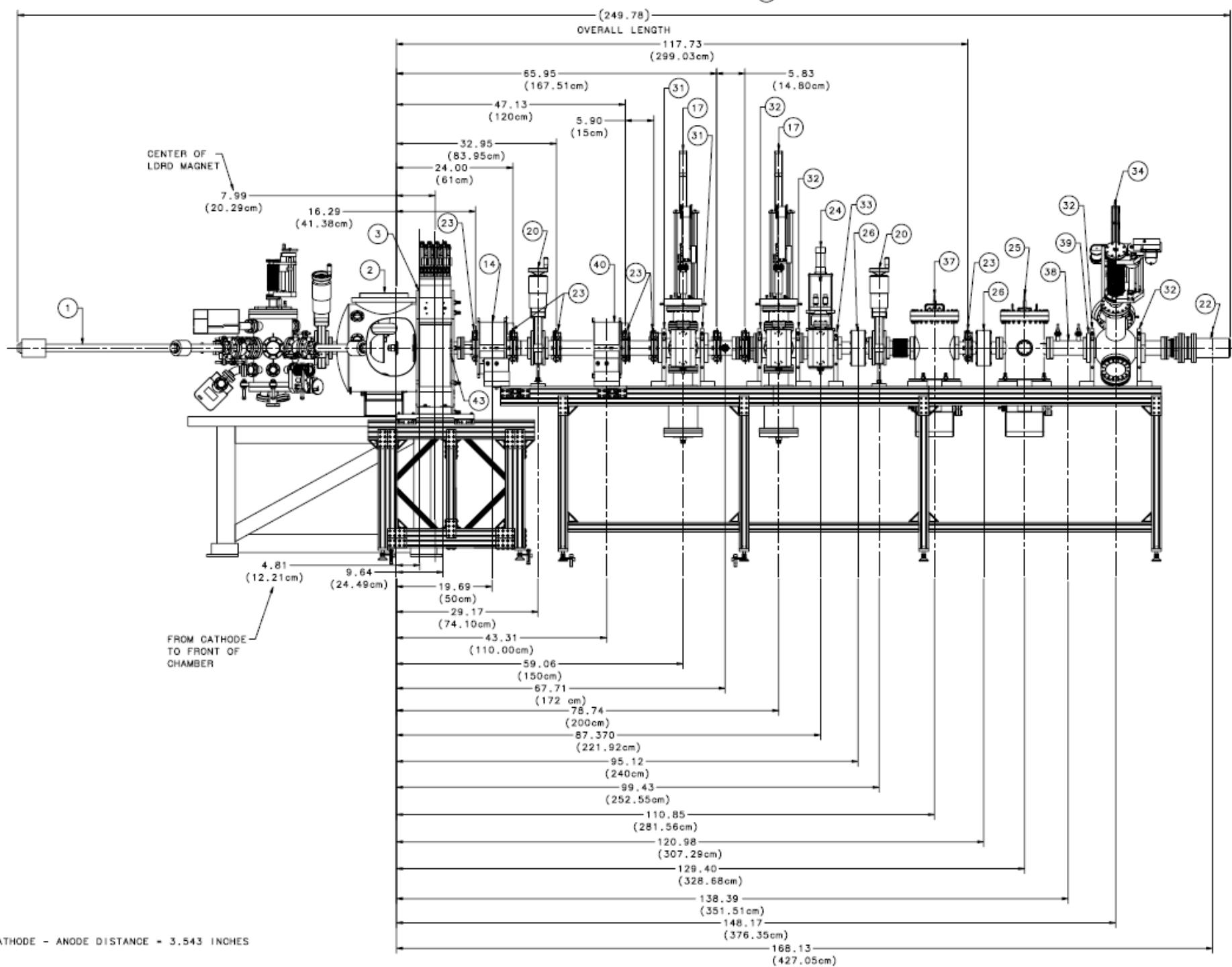
**Magnetized Beam LDRD Progress
Report**

Abdullah Mamun

August 17, 2017

Magnetized Electron Source at GTS





CATHODE - ANODE DISTANCE = 3.543 INCHES

Magnetized Beams on Viewers

- Magnetic field on the gun solenoid was varied with solenoid current varying from 0-400 A (0-1511 G on photocathode).
- All other beamline lenses were turned off.
- The rms beam sizes on 3 viewers were measured and compared with simulation using ASTRA.

Measurement of Rotation Angles

- Beamlets through slit 1 was imaged on viewers 2 & 3
- Beamlets through slit 2 was imaged on viewers 3
- The beamlet images were analyzed for rotation angle with respect to x (+ve) axis as function of gun solenoid field
- A linear least square fit was used for rotation angle evaluation
- Sign convention used:
 - a clockwise rotation w.r.t. x-axis is +ve angle
 - a counter clockwise w.r.t. x-axis is -ve angle

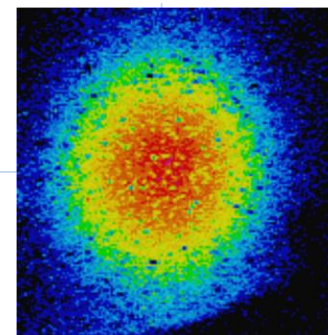
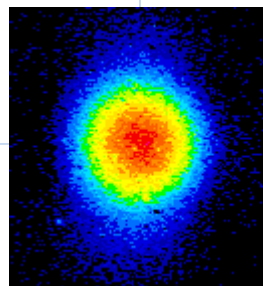
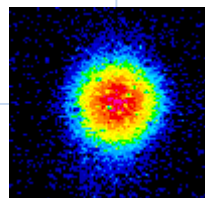
0 A

Viewer 1

Viewer 2

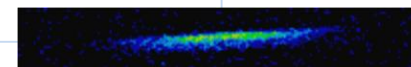
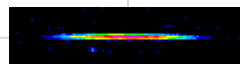
Viewer 3

Beam

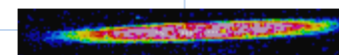


Beamlet

Slit 1



Slit 2



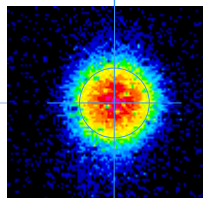
Viewer 1
(z=1.5 m)

Viewer 2
(z=2.0 m)

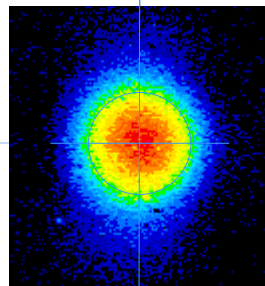
Viewer 3
(z=3.8 m)

0 A

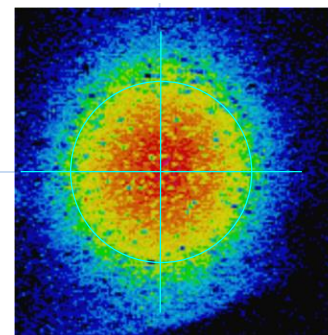
Viewer 1



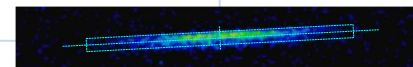
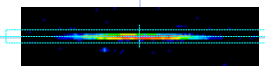
Viewer 2



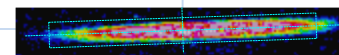
Viewer 3



Slit 1



Slit 2



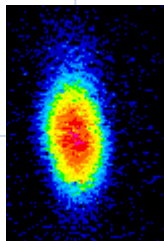
Viewer 1

Viewer 2

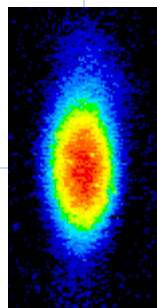
Viewer 3

400 A

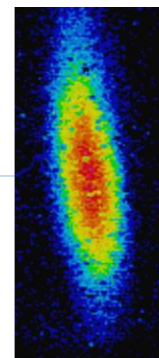
Viewer 1



Viewer 2

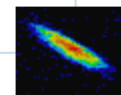
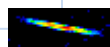


Viewer 3



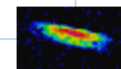
Beam

Slit 1



Beamlet

Slit 2



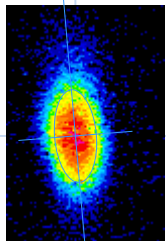
Viewer 1

Viewer 2

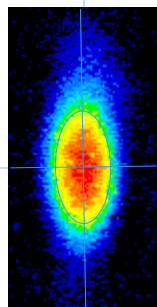
Viewer 3

400 A

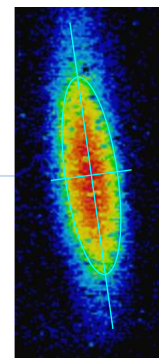
Viewer 1



Viewer 2

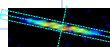


Viewer 3

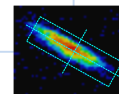


Beam

Slit 1



Slit 2

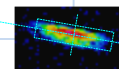


Beamlet

Viewer 1

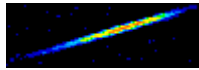
Viewer 2

Viewer 3

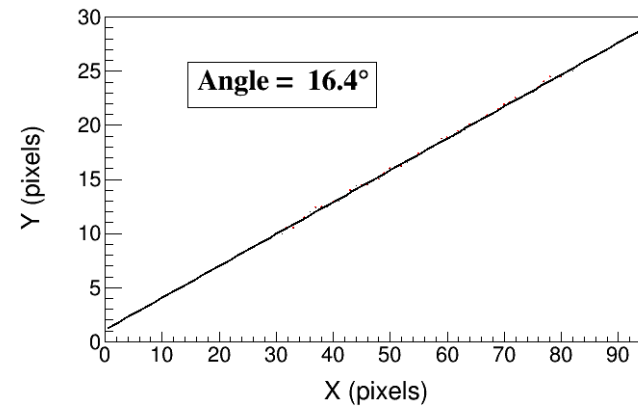
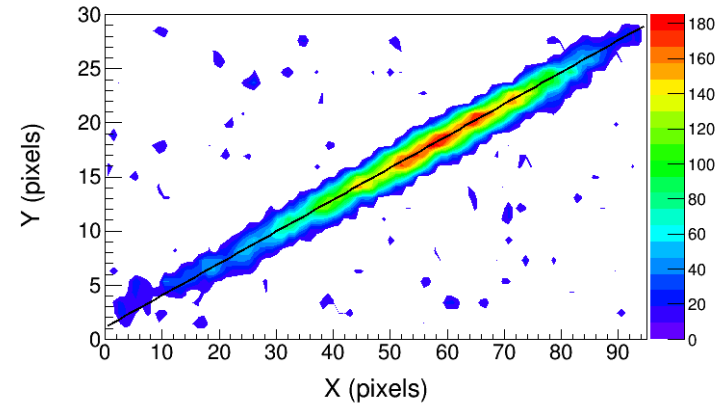


Rotation Measurement

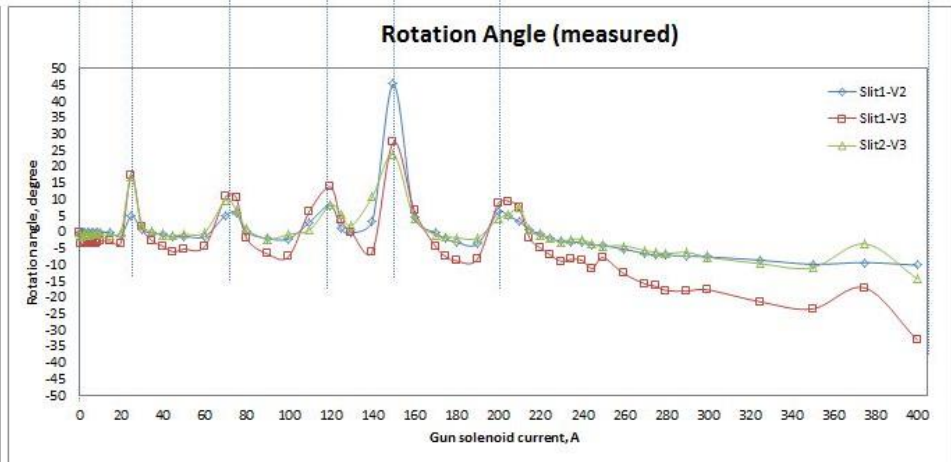
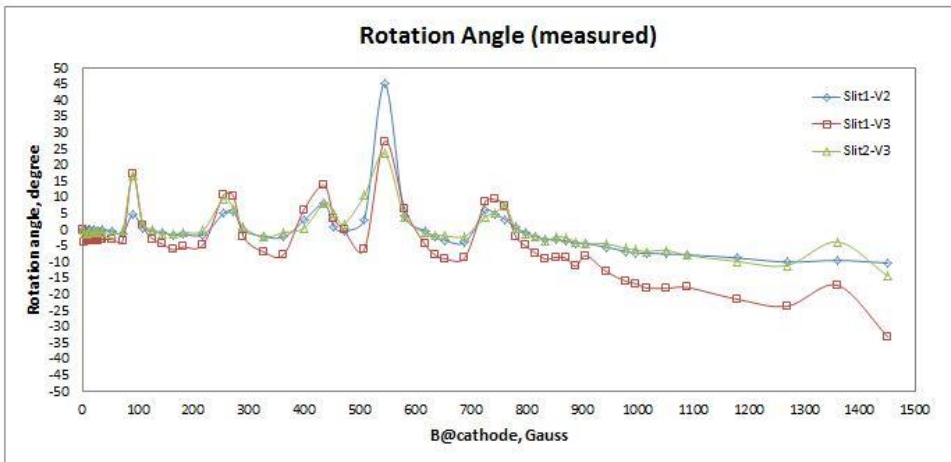
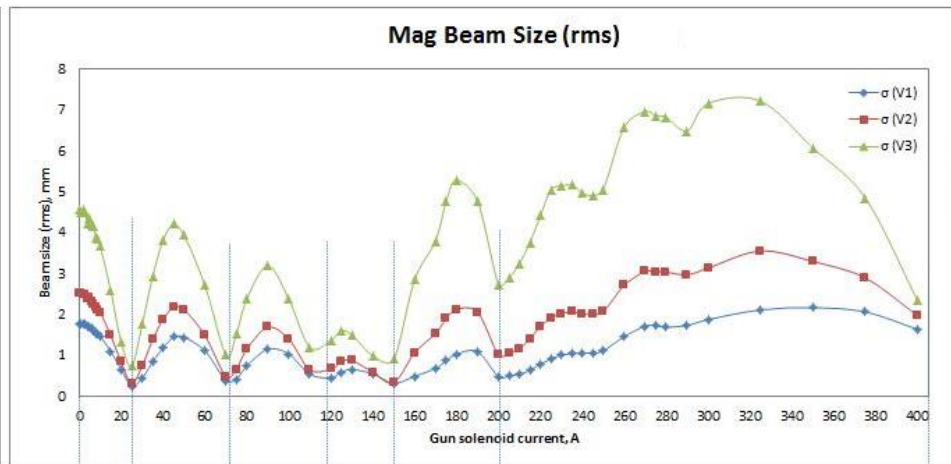
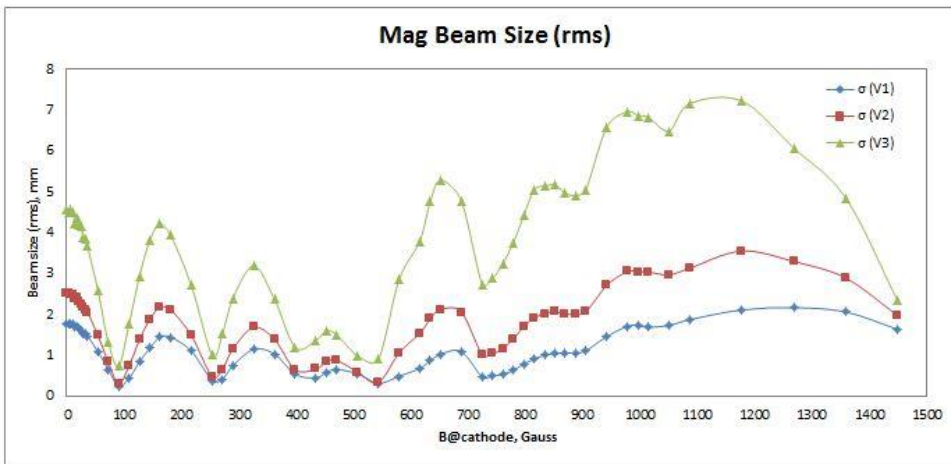
Captured Image



Post-analysis



Experimental Results: Beam Size and Rotation Angle

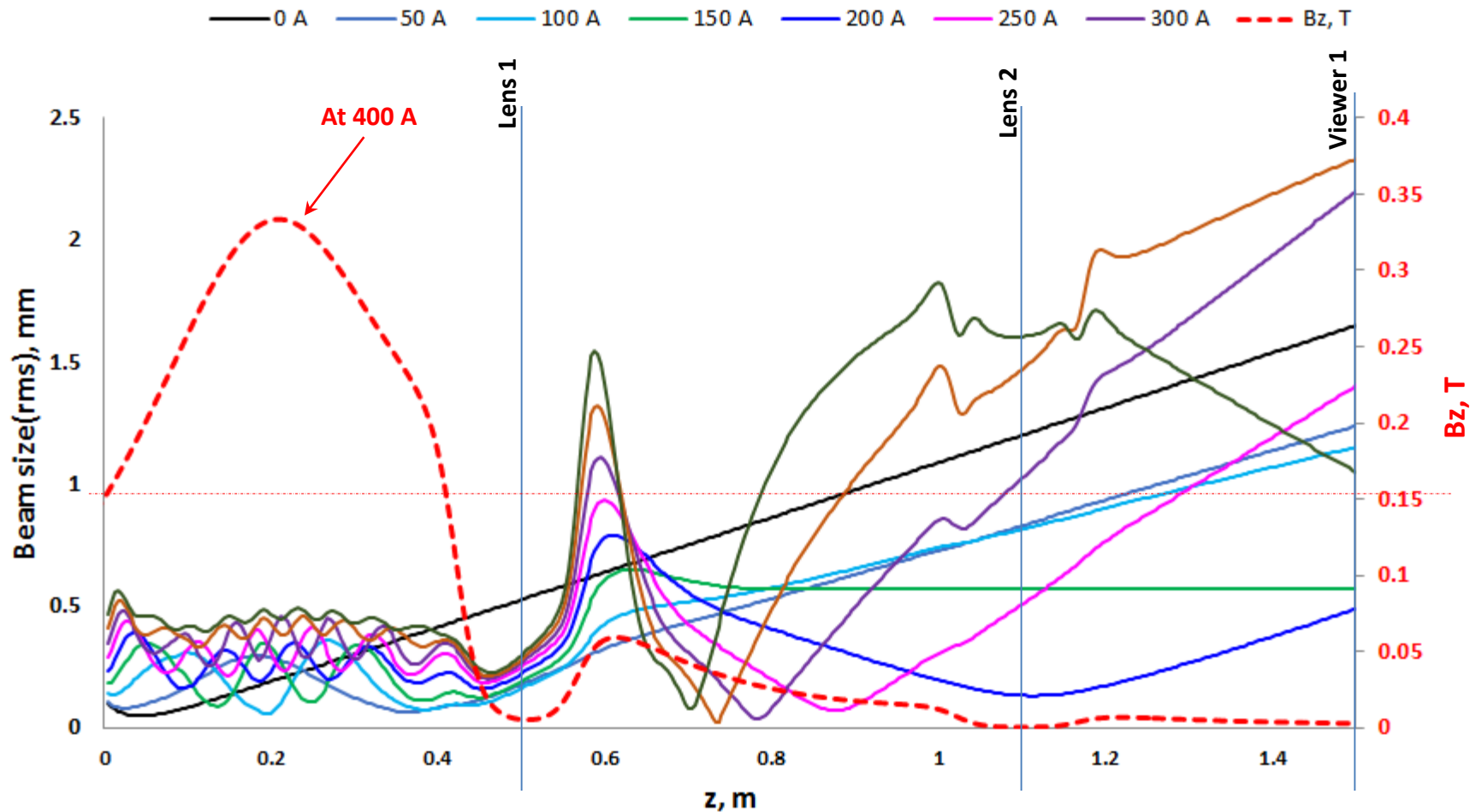


Laser spot size (rms), mm: 0.106

for=	S1-V2	S1-V3	S2-V3
Inter viewer distance, m:	0.5	2.2965	1.7965
Gun HV:	300 kV		

ASTRA Simulation

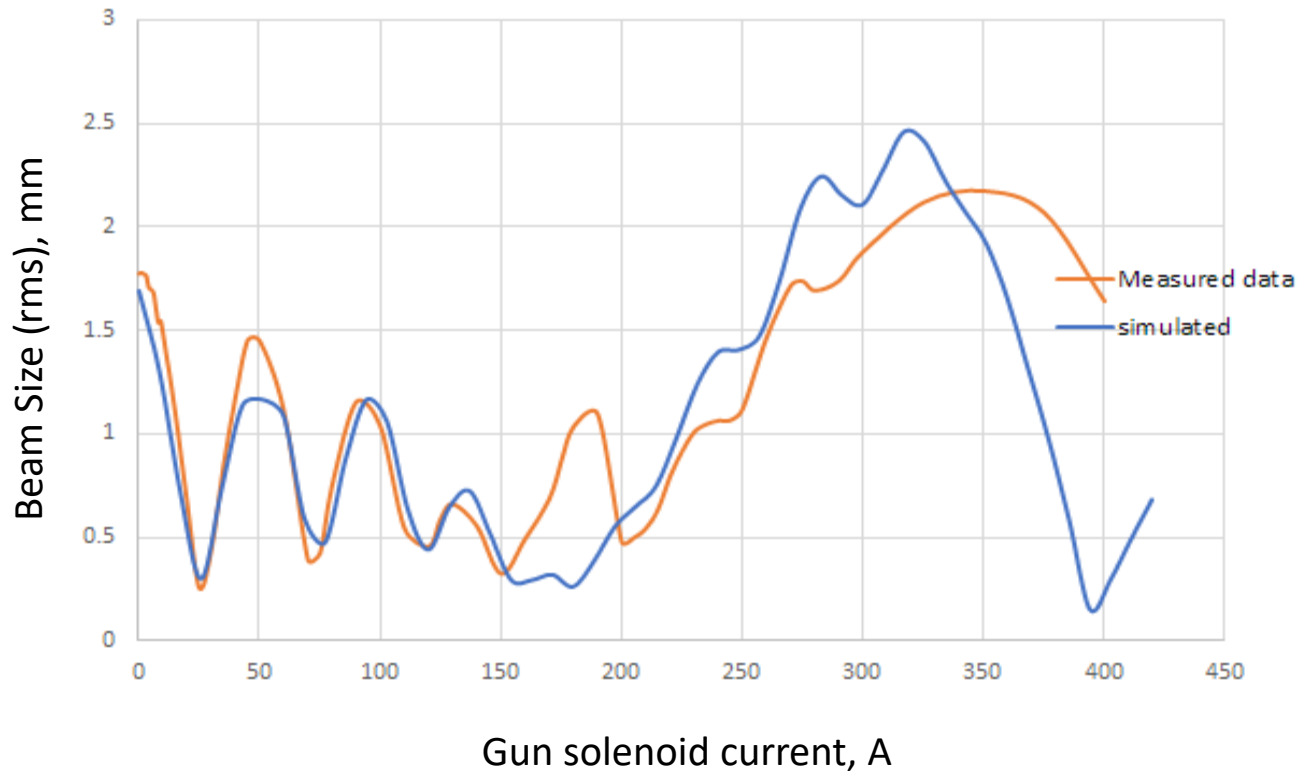
Beam size and magnetic field



Sajini's work

Beam size on viewers depends on the initial beam size and the angular momentum at the exit of the solenoid field.

Beam Sizes on Viewer 1 (measurement vs. simulation)



Summary

- Beam sizes and rotation angles were measured for different gun solenoid fields up to 1511 G on photocathode.
- Simulation for beam sizes is underway and shows reasonable agreement with the measurement.
- Simulation for beam rotation will be performed soon.
- Demonstrated 0.5 mA magnetized beam(>1 h) with 1511 G on photocathode.
- Next priority will be to run high current magnetized beam of 5mA.