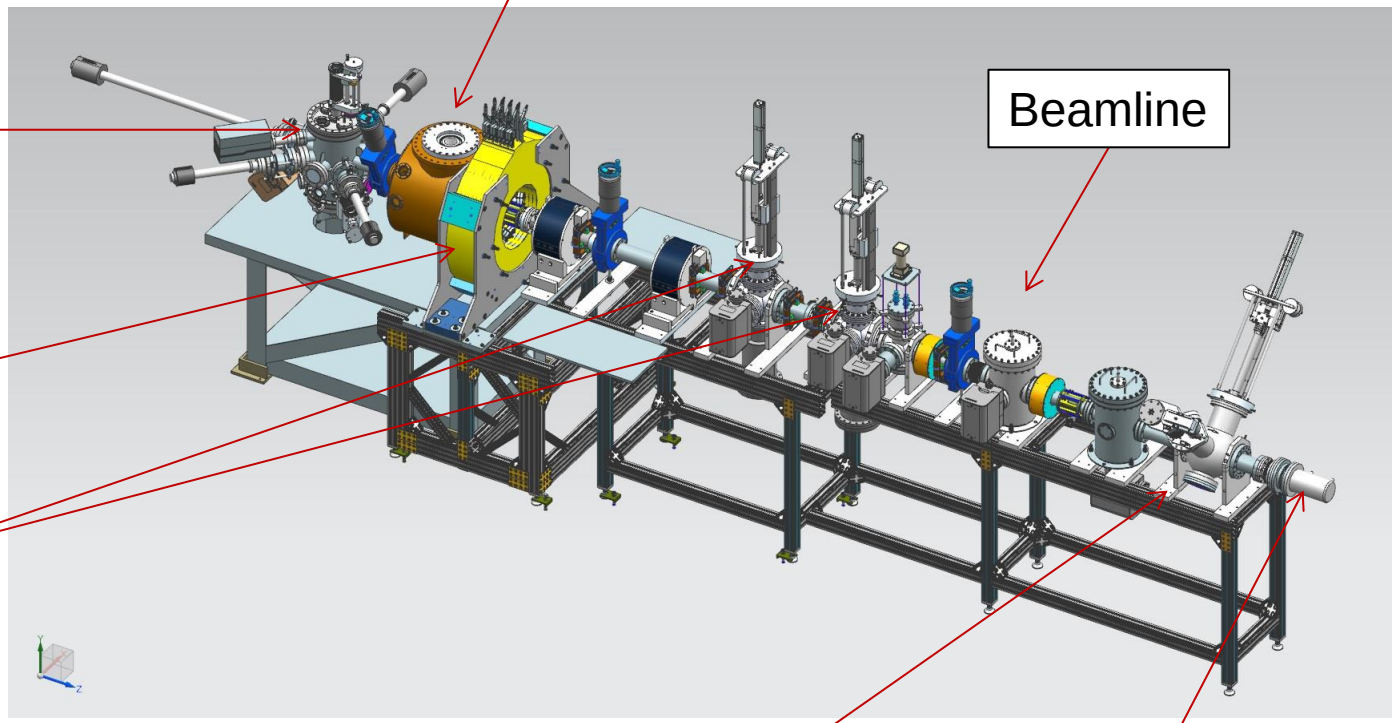
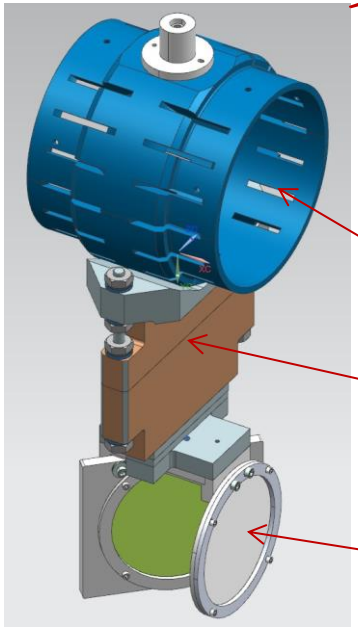
Cooler e-source

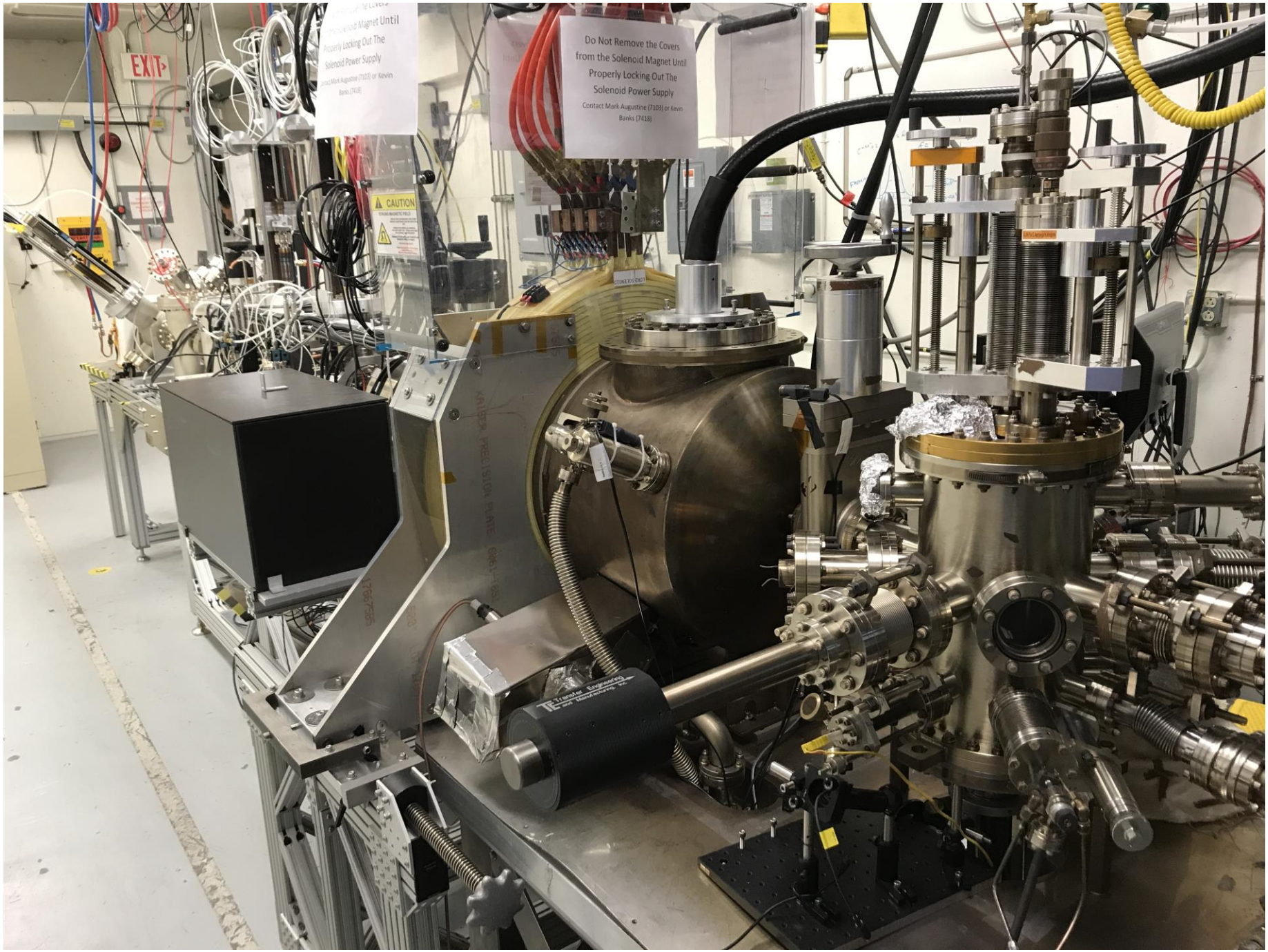
Magnetized Beam LDRD Progress Report

June 1, 2017

Magnetized Electron Source at GTS

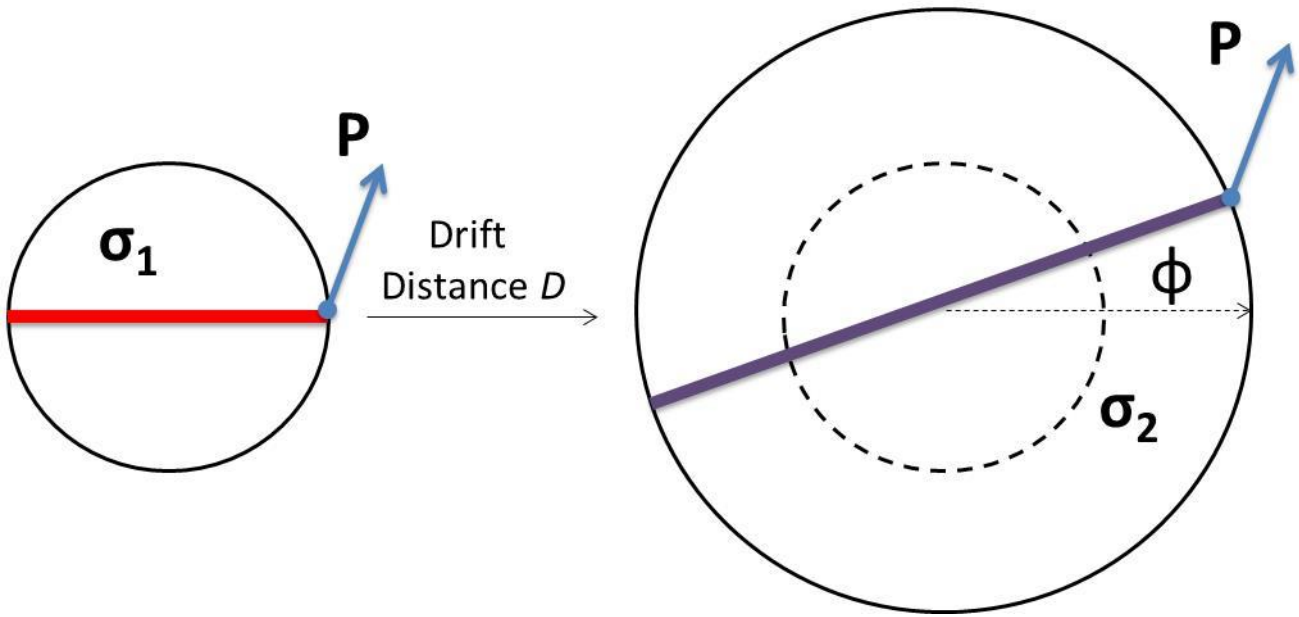





EXIT
Do Not Remove the Covers
from the Solenoid Magnet Until
Properly Locking Out The
Solenoid Power Supply
Contact Mark Augustine (7103) or Kevin
Banks (7418)
CAUTION

Measuring Beam Magnetization

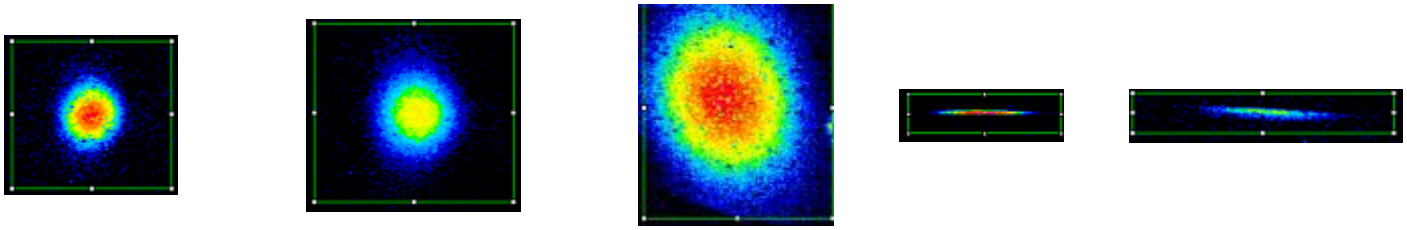
- Use slit and viewscreens to measure mechanical angular momentum:



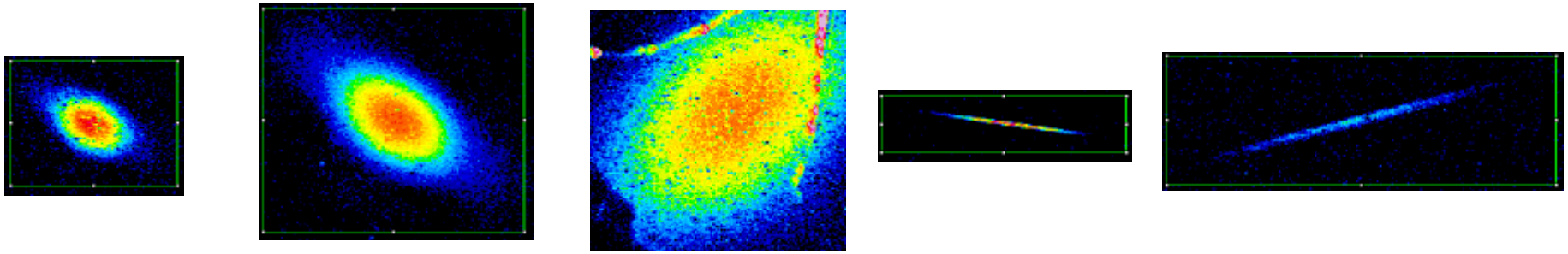
$$\langle L \rangle = 2 p_z \frac{\sigma_1 \sigma_2 \sin\phi}{D} = e B_z a_o^2$$

B_z: solenoid field at photocathode
a_0: laser rms size
Φ: rotation (sheering) angle

0 G
at photocathode



1088 G
at photocathode



Magnetized Beam Sizes

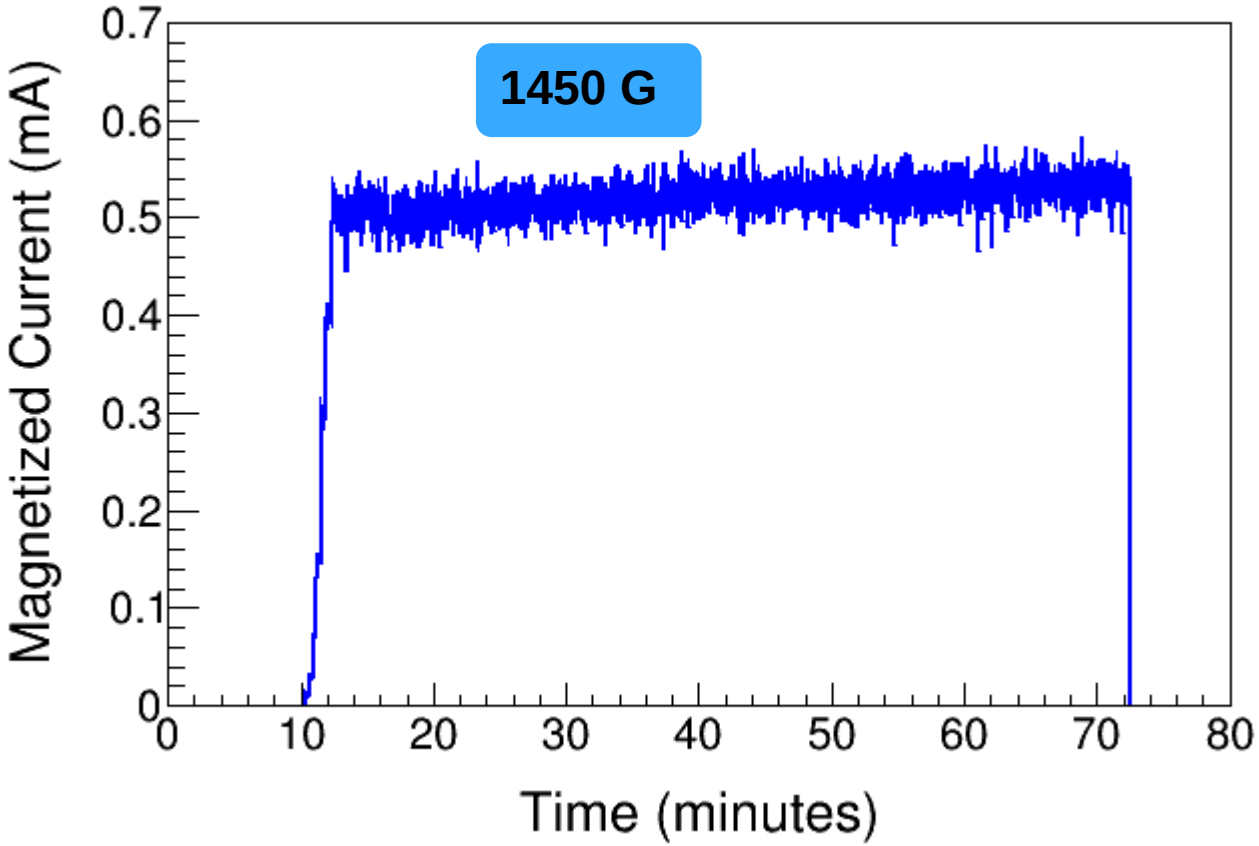
Solenoid Current (A)	Field (G)	σ_1 (mm)	σ_2 (mm)	σ_3 (mm)
0	0	1.66	2.18	4.84
25	91	0.35	0.44	0.71
50	181	1.39	2.10	4.09
75	272	1.82	0.67	1.46
100	363	4.36	1.43	2.40
150	544	0.35	0.49	1.02
200	725	0.46	0.95	4.22
250	907	1.08	2.02	6.54
300	1088	1.88	3.28	7.11

All beamline solenoids are off. Laser rms = 0.25 mm

Magnetized Beam Rotation Angles

Solenoid Current (A)	Field (G)	ϕ_2 (deg)	ϕ_3 (deg)	ϕ_2- ϕ_3 (deg)
0	0	0	0	0
25	91	3.6	18.9	15.3
50	181	-1.7	-5.7	-4.0
75	272	5.8	11.7	5.9
100	363	-3.6	-7.5	-3.9
150	544	-78.1	-54.1	24.0
200	725	5.7	8.8	3.1
250	907	-4.1	-8.5	-4.4
300	1088	-7.6	-18.8	-11.2

High Current Magnetized Beam



- Delivered 0.5 mA
- Plan for 5 mA by end of summer

Summary of Progress

- Submitted LDRD proposal for 3rd year funding
- Delivered 0.5 mA magnetized beam with 1450 G on photocathode
- Measured beam sizes and rotations with magnetic fields up to 1088 G on photocathode
- Filed patent disclosure entitled “Non-invasive RF Cavity to Measure Beam Magnetization”

Outlook: June – September

- Measure beam sizes and rotations with magnetic fields up to 1450 G on photocathode
- Simulation of magnetized beam sizes and rotation angles
- Run 5 mA magnetized beam
- Build and install a TE_{011} cavity at GTS to measure beam magnetization in collaboration with Brock and SRF Institute