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Characterization of the IOTA Proton Source

Samantha Young, Loyola University Chicago

Lee Teng Internship Presentations

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In partnership with:

LOYOLA UNIVERSITY CHICAGO

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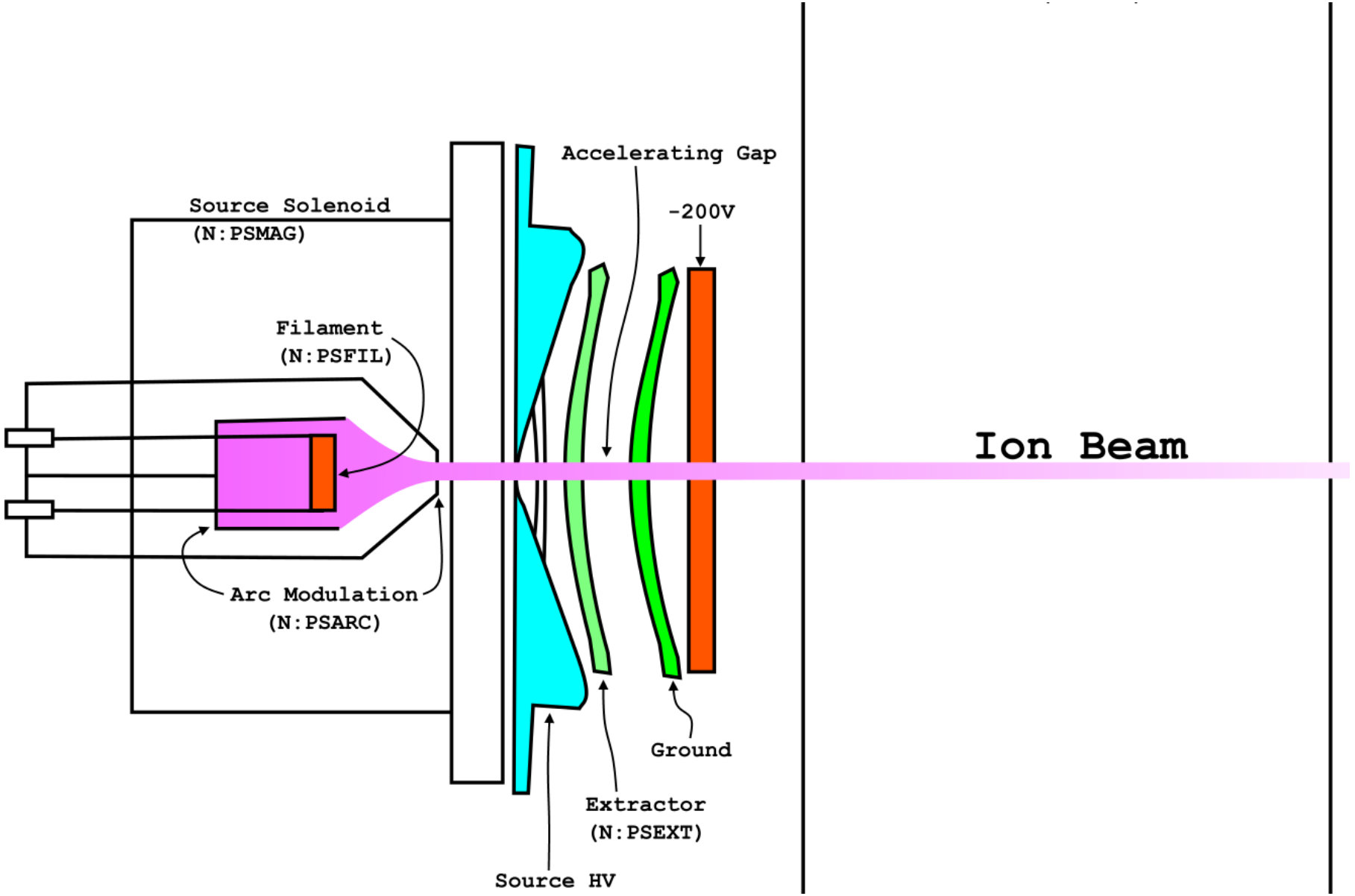
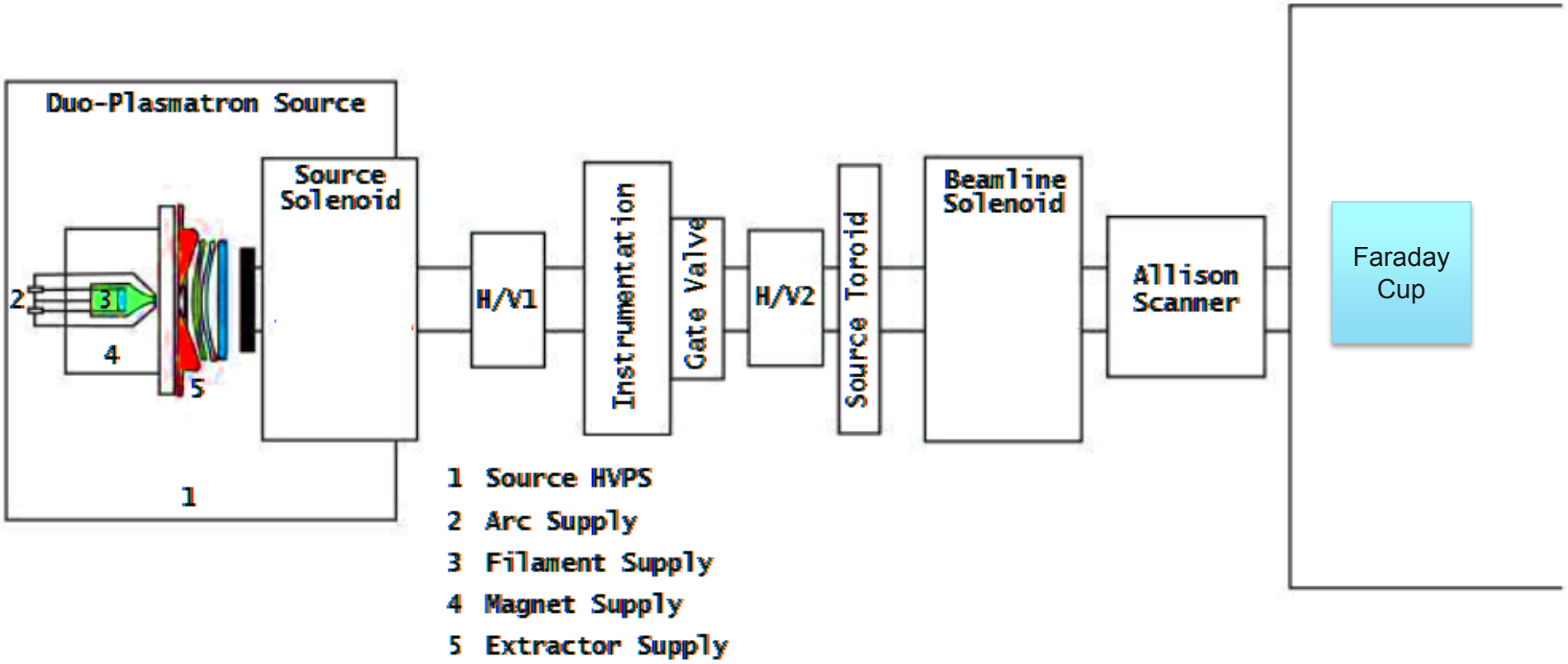
Integral-Optics Test Accelerator (IOTA)

- Formed from the High Intensity Neutrino Source (HINS)
- Goals
  - integrable optics with non-linear magnets and with electron lenses
  - optical stochastic cooling of particle beams
  - innovative emittance exchange
- Storage ring
  - 39m in circumference
  - protons and ions
- Focus on injection into RFQ
  - Duoplasmatron
  - Nickel filament

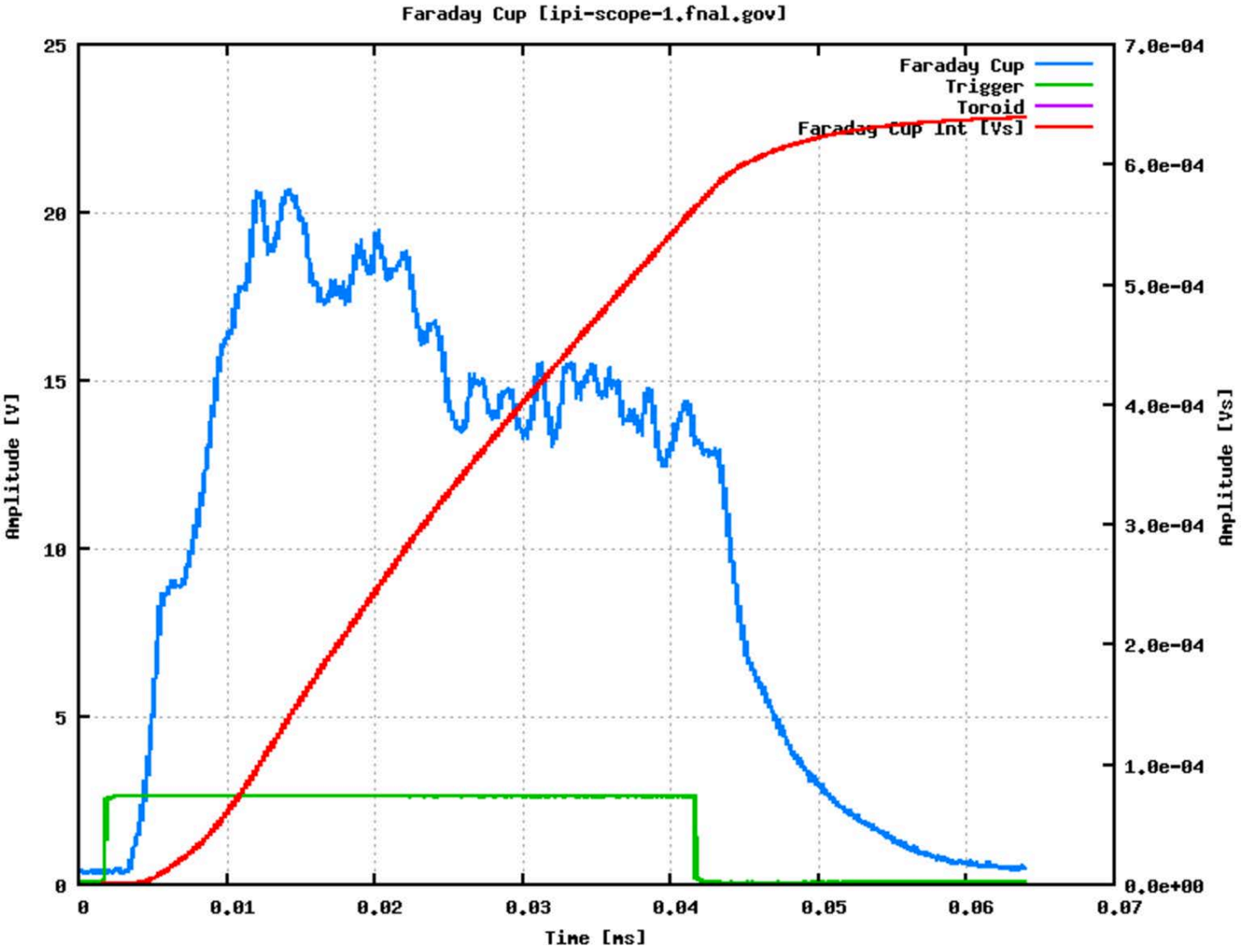

Accelerating Gap
-200V
Source Solenoid
(N:PSMAG)
Filament
(N:PSFIL)
Ion Beam
Arc Modulation
(N:PSARC)
Ground
Extractor
(N:PSEXT)
Source HV

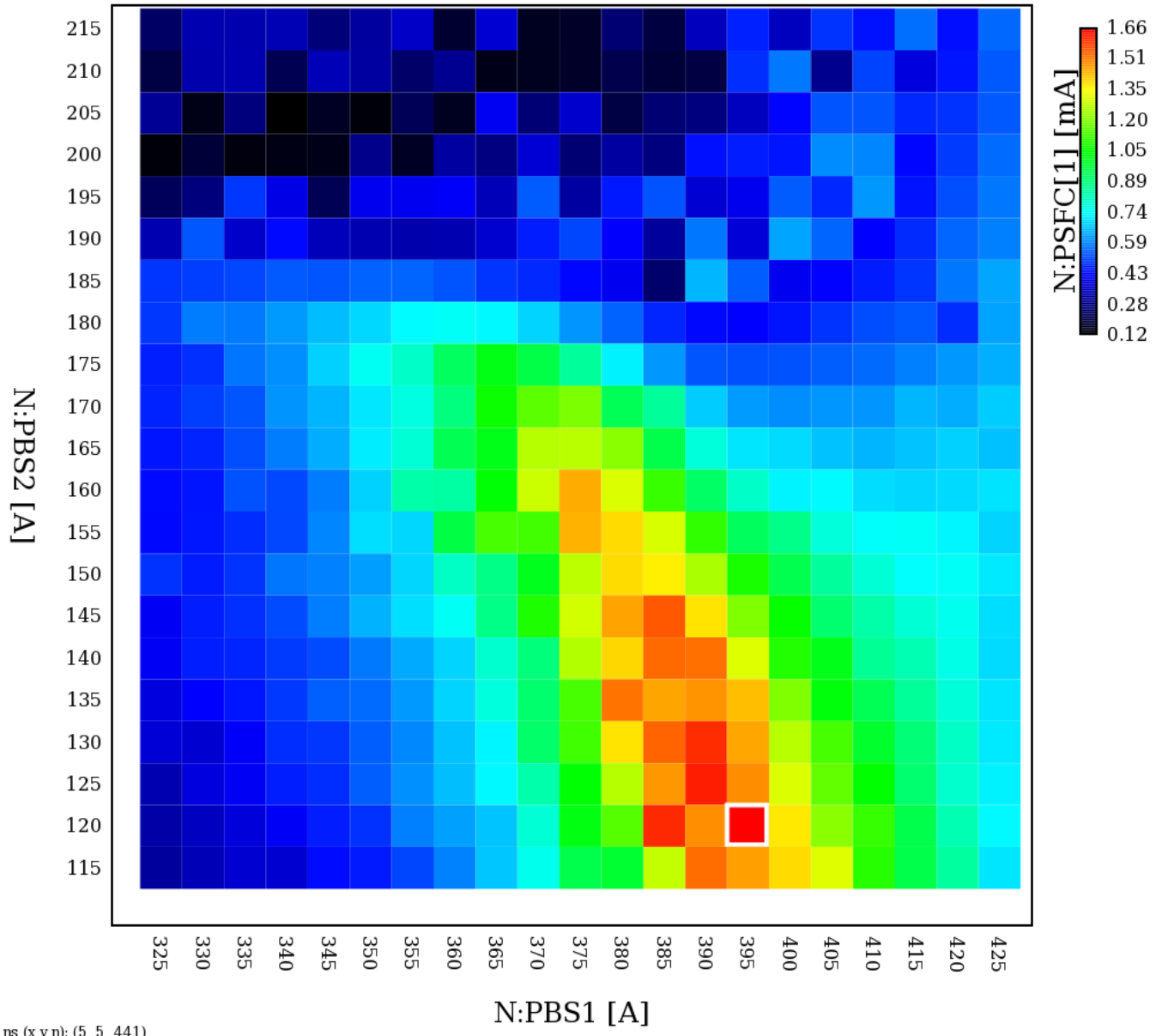

Duo-Plasmatron Source
Source Solenoid
2
3
4
5
1
H/V1
Instrumentation
Gate Valve
H/V2
Source Toroid
Beamline Solenoid
Allison Scanner
Faraday Cup
1 Source HVPS
2 Arc Supply
3 Filament Supply
4 Magnet Supply
5 Extractor Supply

Methodology

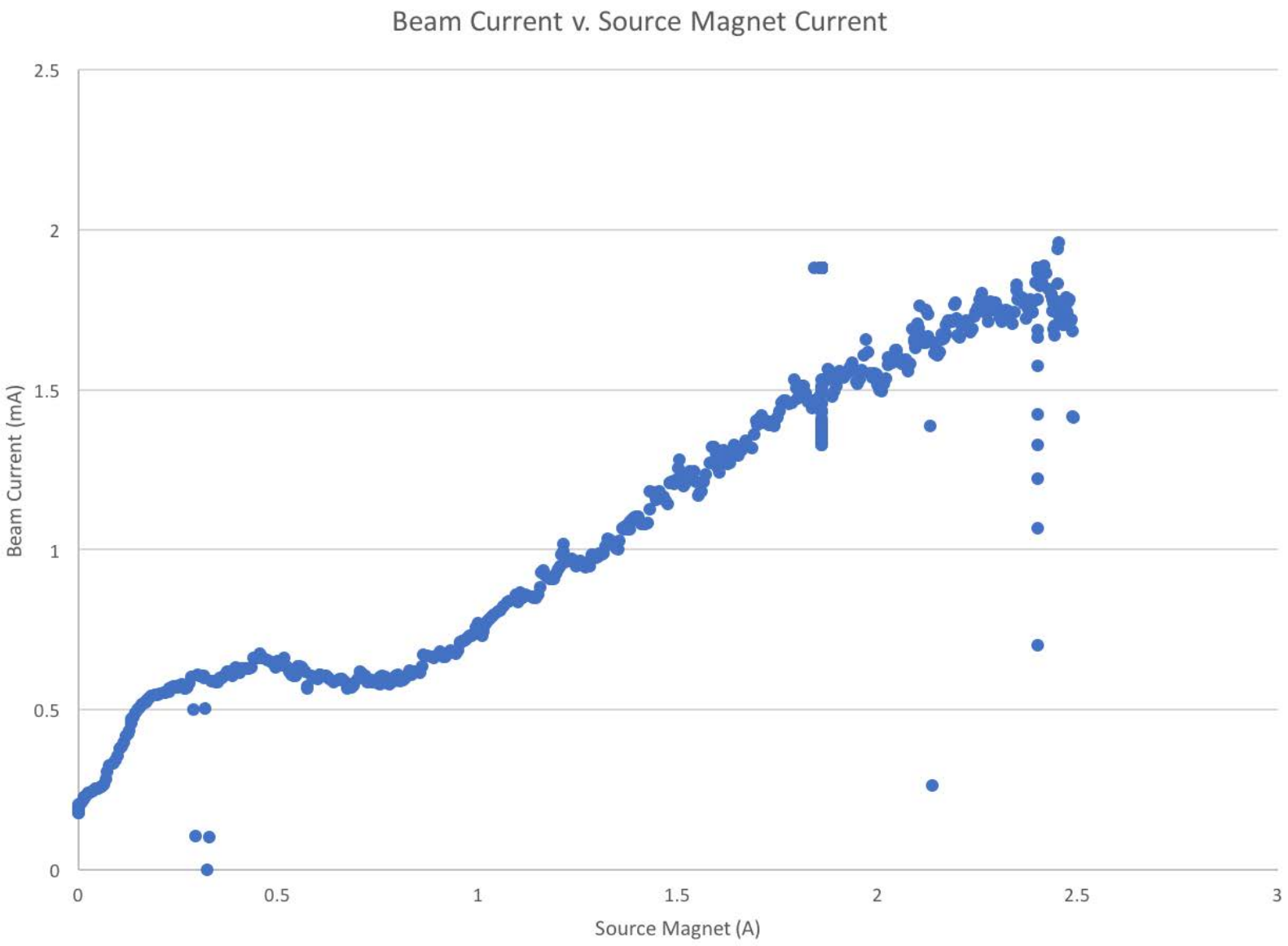
- Testing variables associated with beam current
  - Beamline solenoids (2)
  - Source solenoid, “Lens”
  - Horizontal and vertical trims
  - Gas pressure
- Systematic scans of one variable within a “safe” range
  - Dependent on cooling abilities of the source
  - Capacity of the “old” filament
- Adapt source to optimized parameters based on peaks of current measured

Results


Faraday Cup [ipi-scope-1.fnal.gov]
Faraday Cup
Trigger
Toroid
Faraday Cup Int [Vs]
Amplitude [V]
Amplitude [Vs]
Time [ms]
0
5
10
15
20
25
0.0e+00
1.0e-04
2.0e-04
3.0e-04
4.0e-04
5.0e-04
6.0e-04
7.0e-04
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07



Bins (x,y,n): (5, 5, 441)
Max (x,y,z): (394, 118, 1.6611801386)


Beam Current v. Source Magnet Current
Beam Current (mA)
2.5
2
1.5
1
0.5
0
0
0.5
1
1.5
2
2.5
3
Source Magnet (A)

Adjusting Vacuum Pressure