IOTA Proton Source Allison Scanner Update

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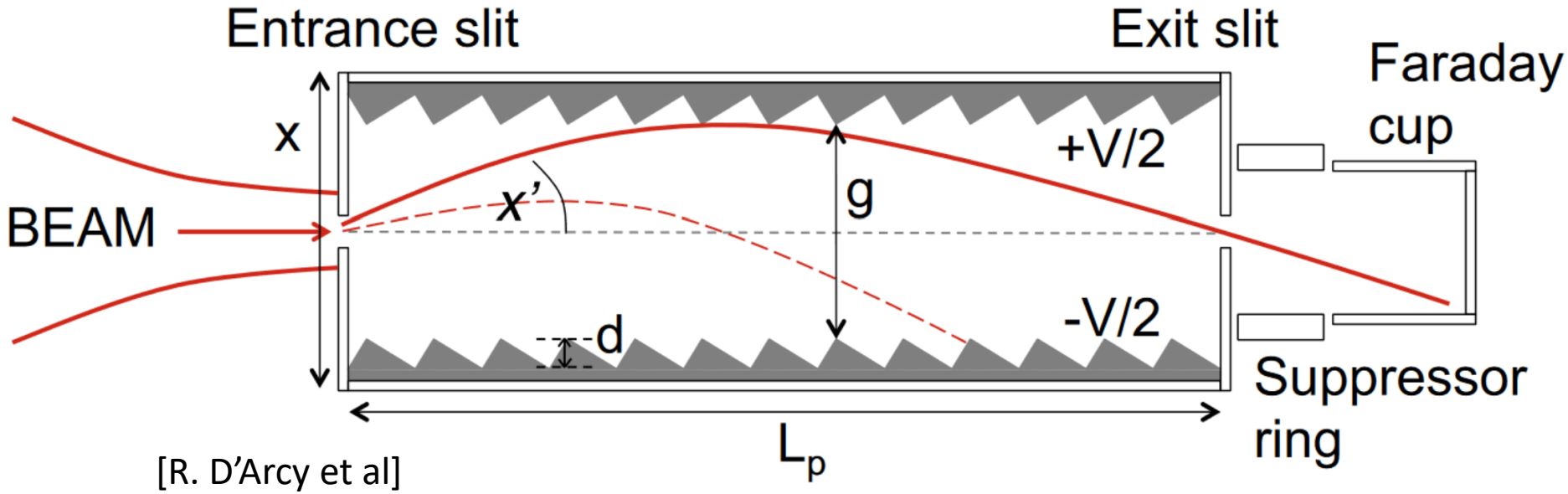
Allison Scanner Basics

- Device to measure phase space distribution of beam
- Measures beam intensity on a faraday cup behind two slits
- Two Experimental degrees of freedom
  - Position of scanner head - position
  - Voltage across plates in head – accepted angle

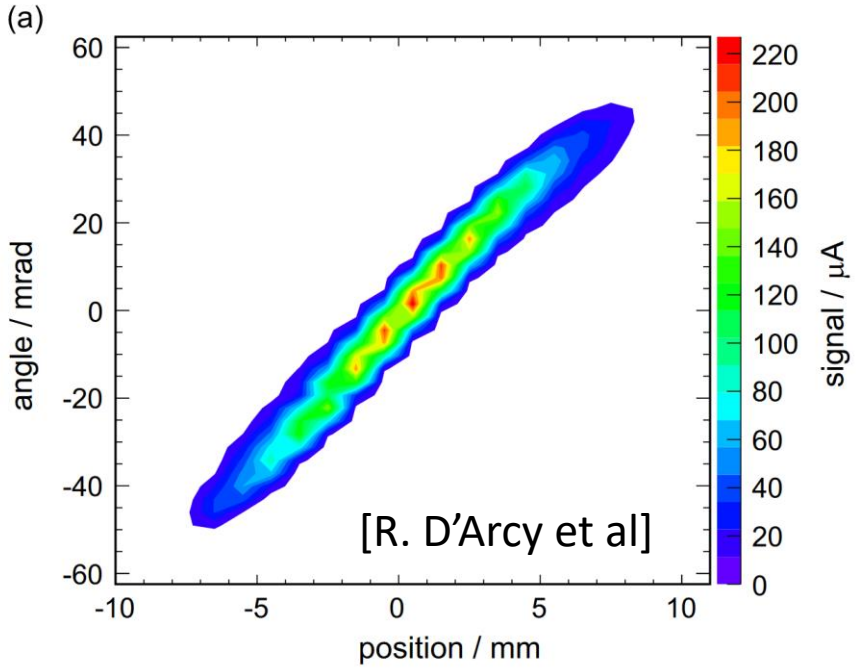


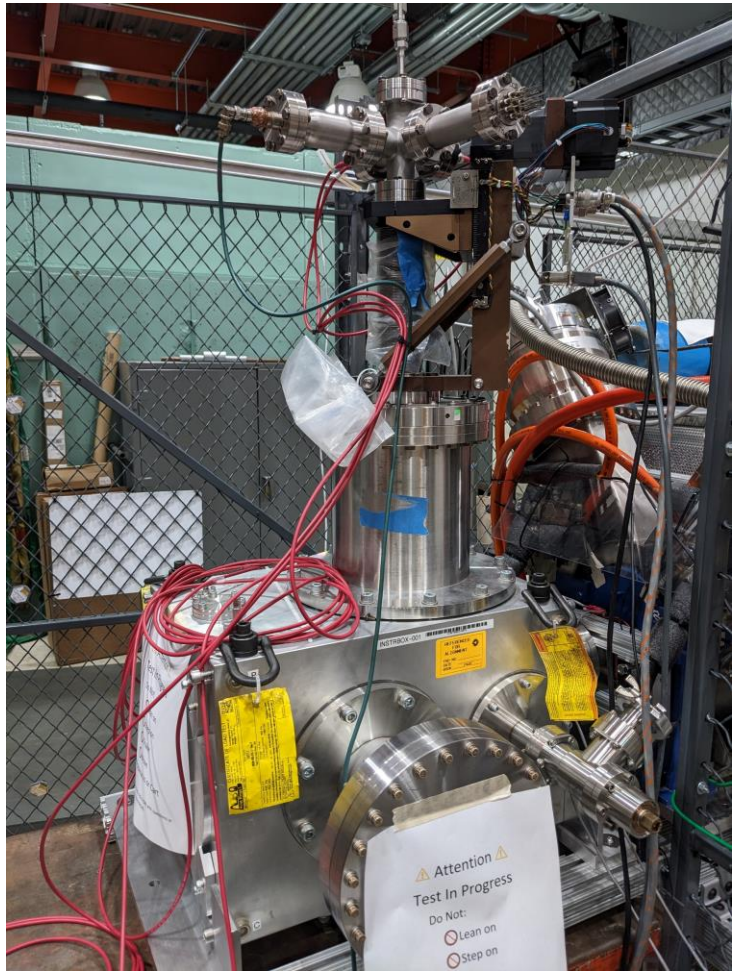
[R. D'Arcy et al]

Fermilab

IOTA Proton Source Installation

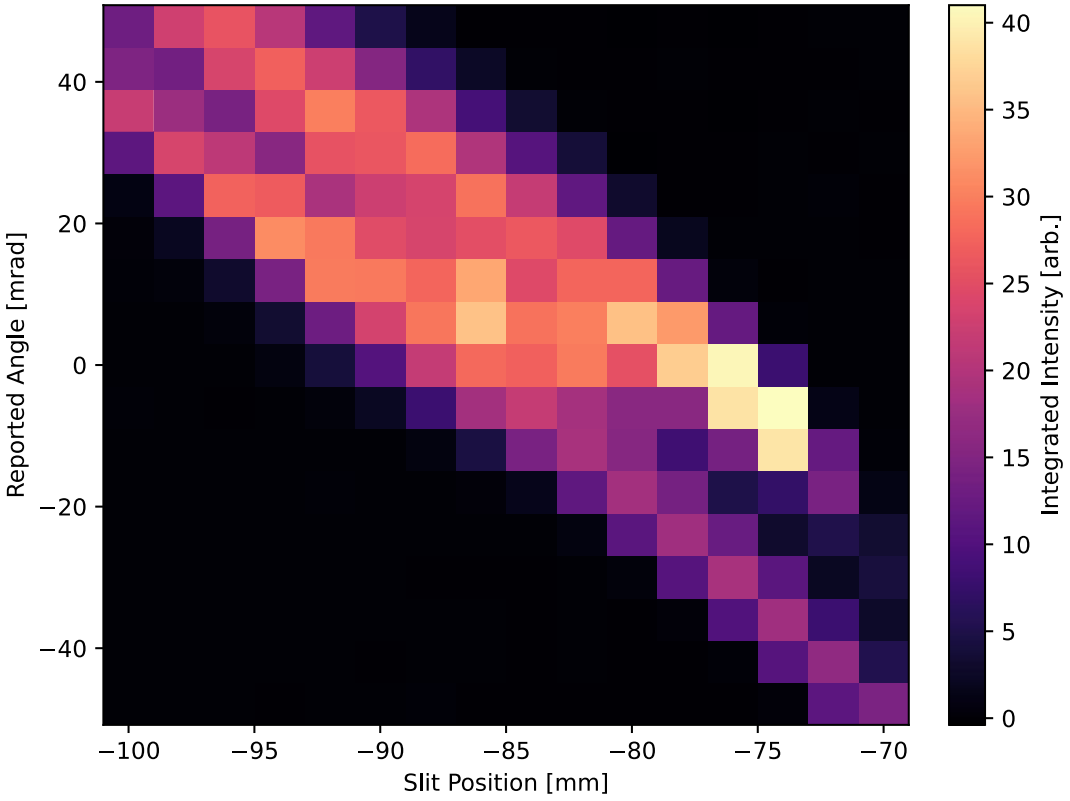
- PIPII-IT prototype Allison scanner
- Similar configuration to MEBT Allison scanner
- Gain experience with operational software and analysis of output data

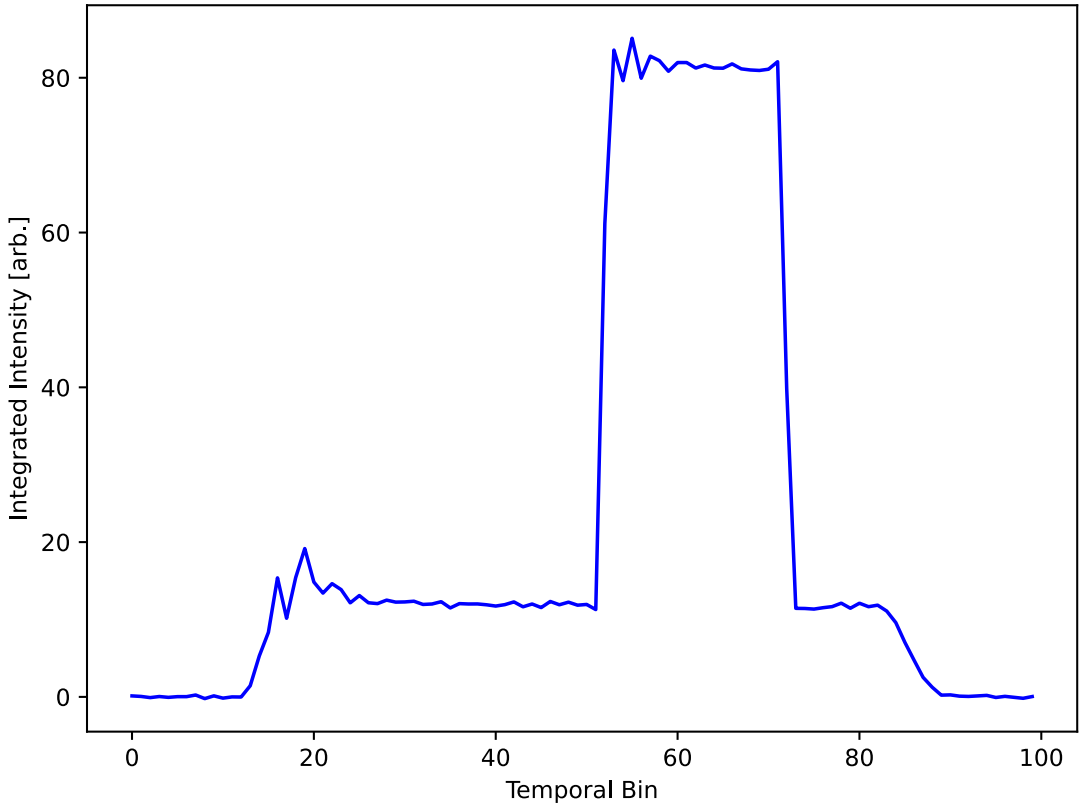




IOTA Source Example

- Basic Hardware tests – quite coarse
- Angle is quoted from output software, cannot yet invert





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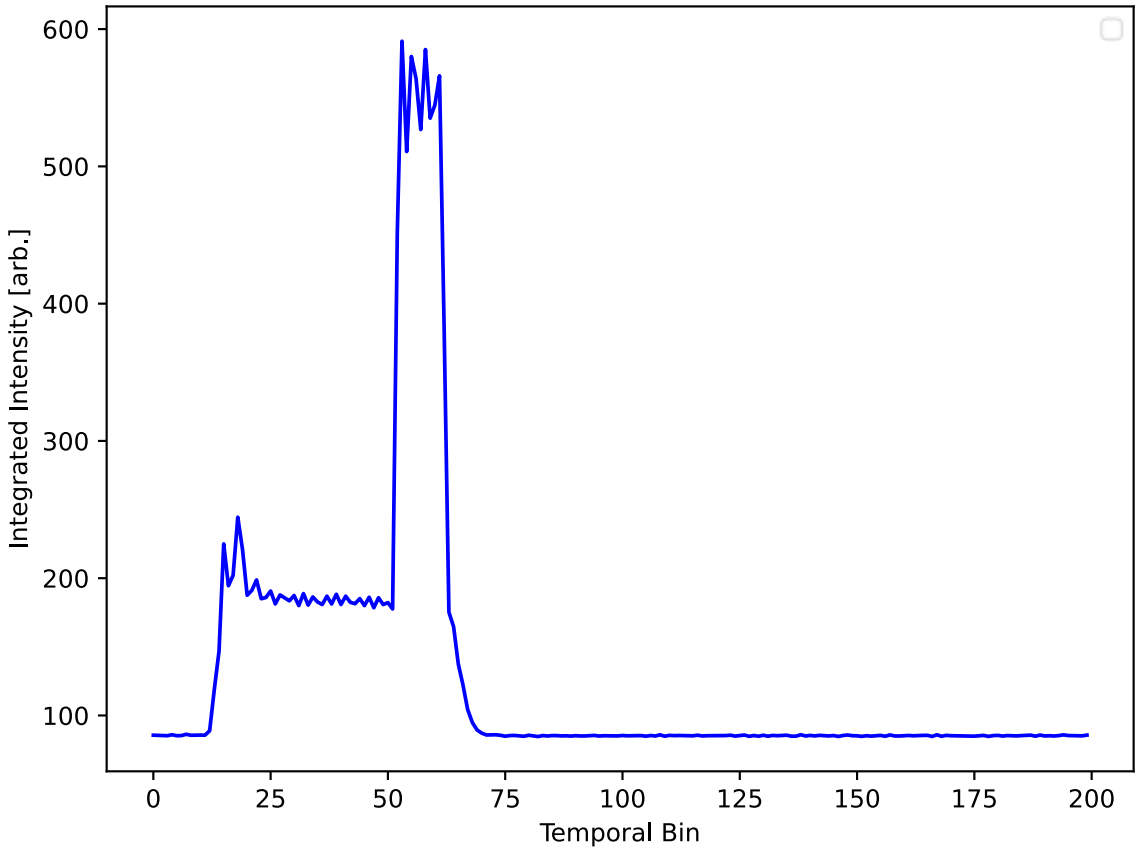
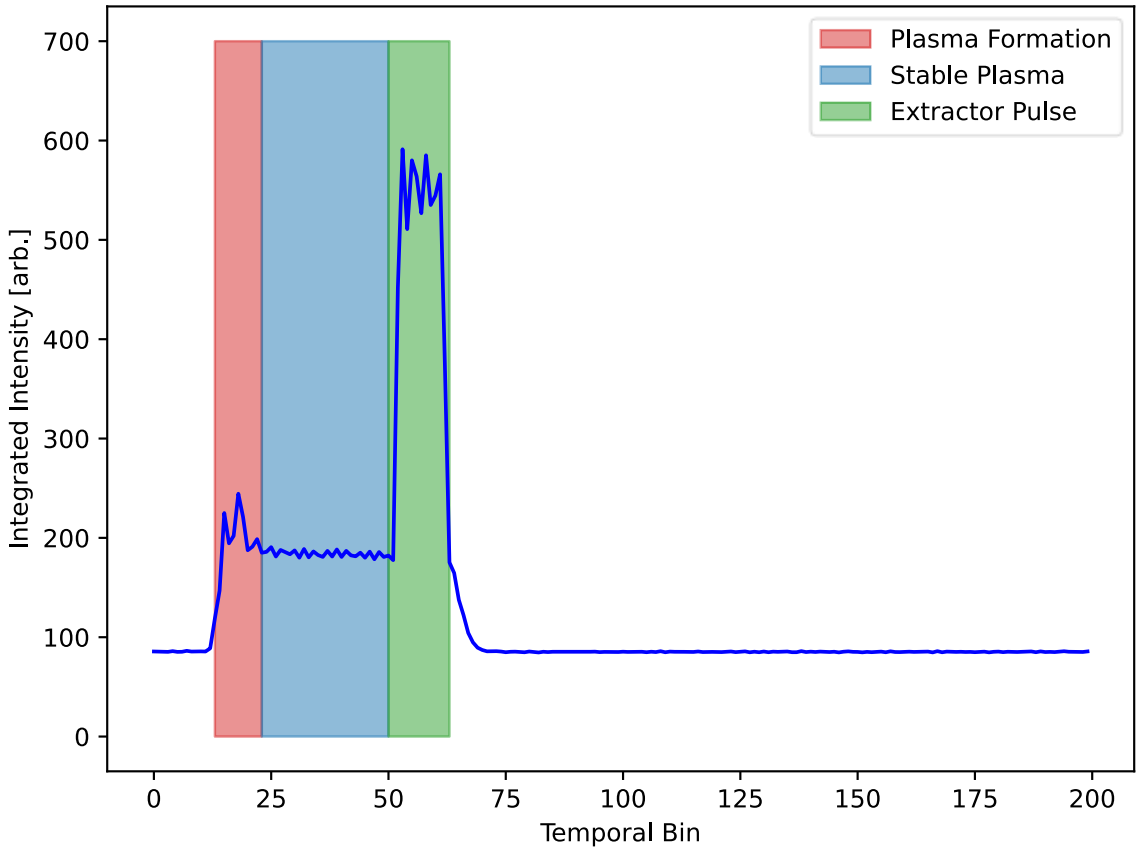
Temporal Response Sectioning

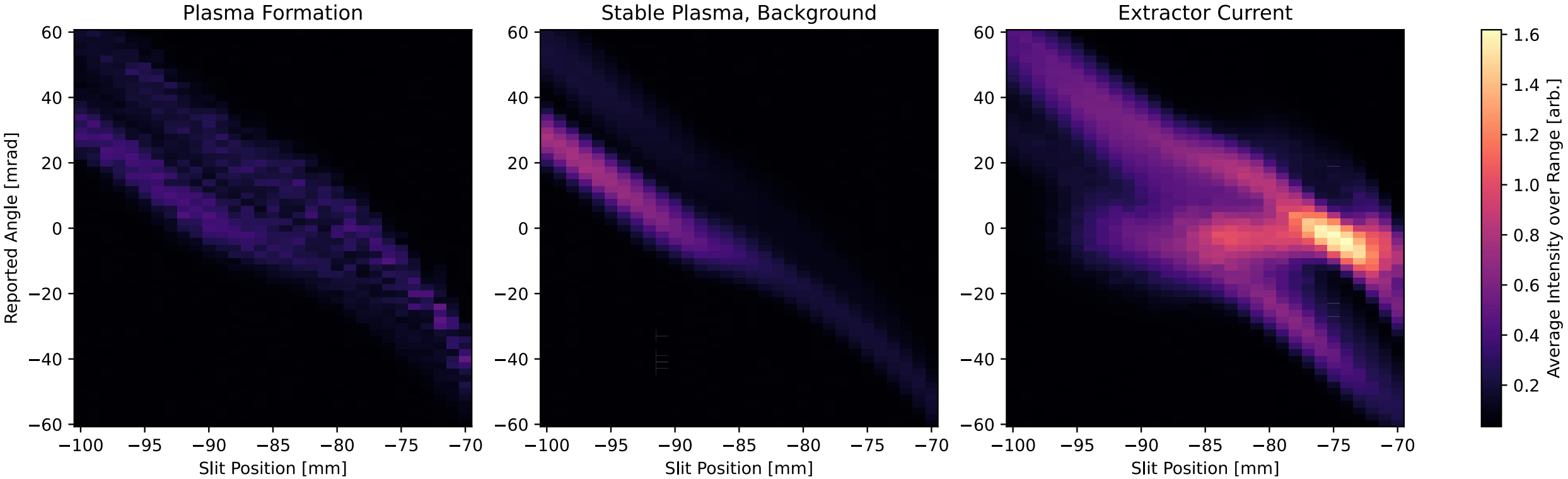
- Good Temporal resolution on Faraday cup ~1μs
- Can separate into a few regions of interest





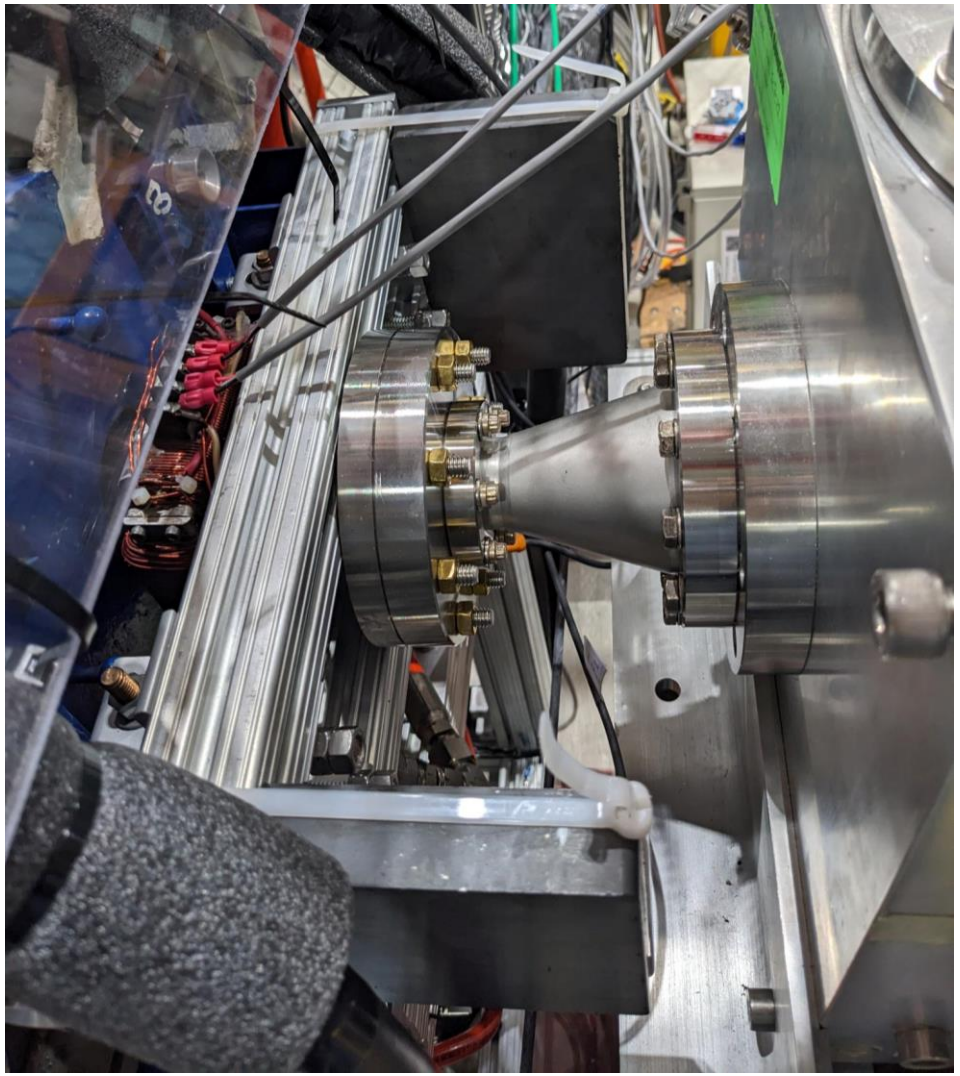
Separated Distribution

- Allison scanner distributions for earlier temporal ranges
- Phase space distribution changes at extractor voltage



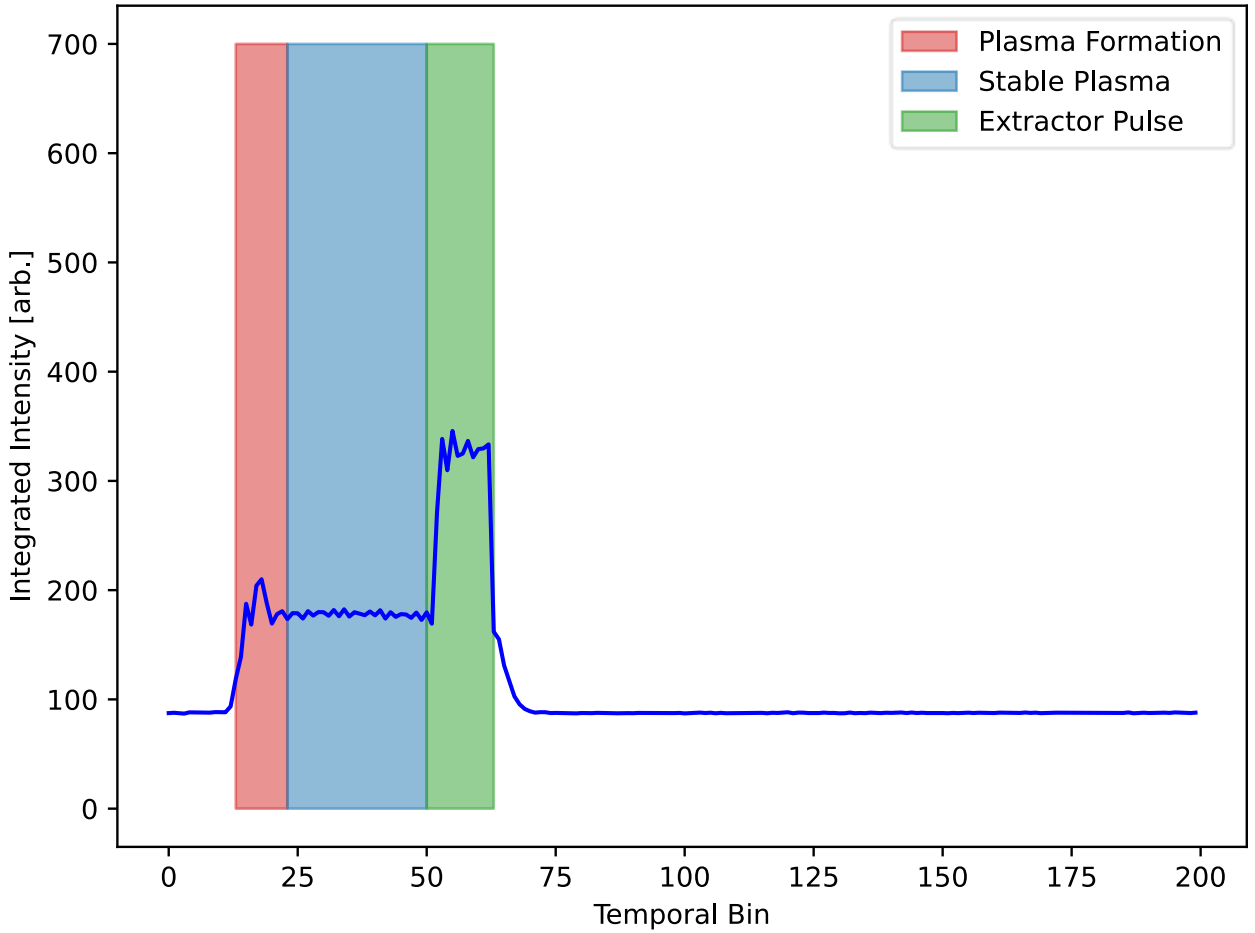
Spectrometer Setup

- Try and separate ion species
- Other solutions have mechanical complications
  - Bent beam pipe has rather large bend radius compared to available correctors
  - Zero angle setup for different species needs long bellows
- Quick setup with permanent magnets from an ion pump into Allison scanner
- Limited space in current configuration, mostly an effect on the angle of the beam and not the position



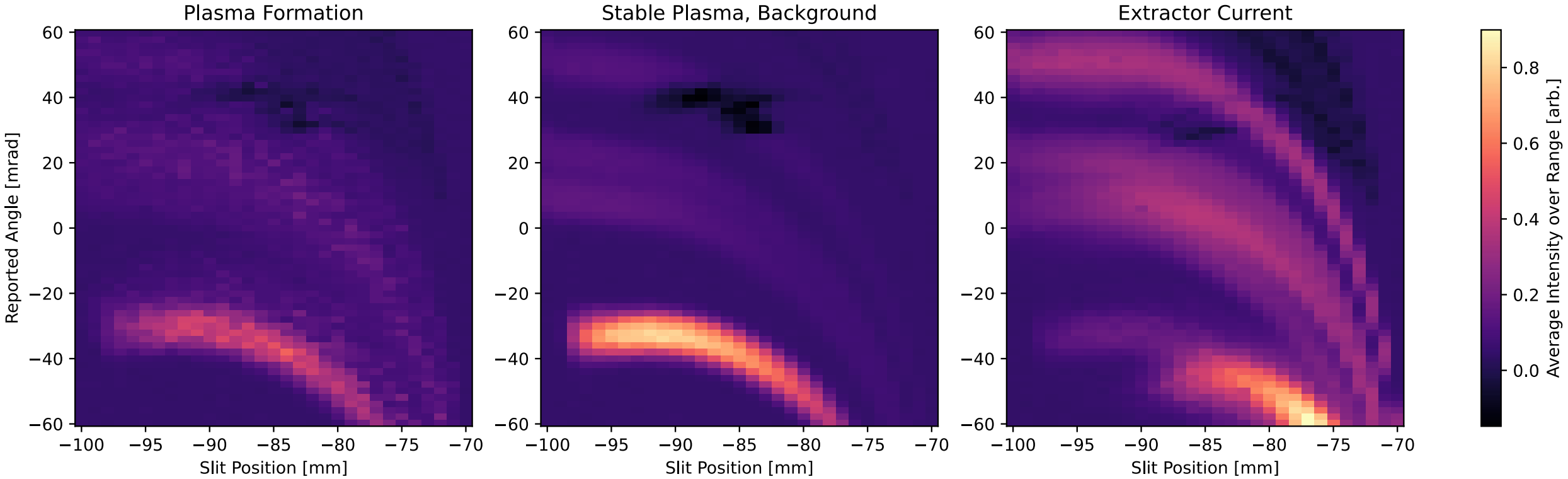
Spectrometer results

- Temporal response looks similar with reduced intensity



Spectrometer Distributions

- Separation of species! Many other questions arise
- Negative signal in certain regions, apparent increase in angle for one species



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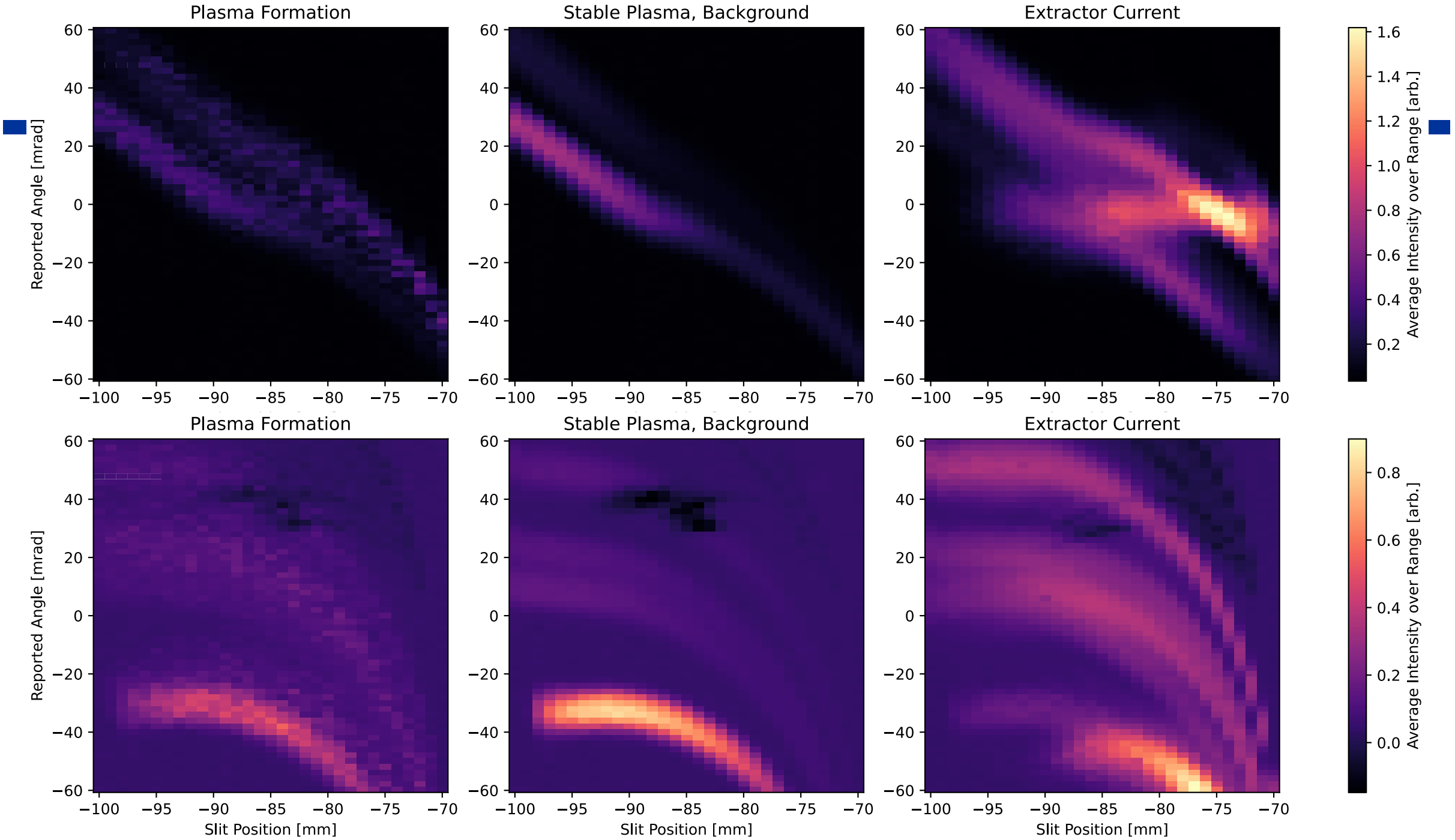
Plasma Formation
Stable Plasma, Background
Extractor Current
Reported Angle [mrad]
Slit Position [mm]
Average Intensity over Range [arb.]
60
40
20
0
−20
−40
−60
−100
−95
−90
−85
−80
−75
−70
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0

Large Spectrometer scan

- Same Configuration, larger ranges sampled
- Source configuration clearly changed somehow, profiles are different than last example