TTU Ion Generator Development

A Marler, M. M Rajabali
(Physics Department)

Introduction

The Future TTU Ion beam Facility is developing an optimized ion source to facilitate tests that require ion beams. A critical but small component of such a device is the ion source used to create the ion beam.

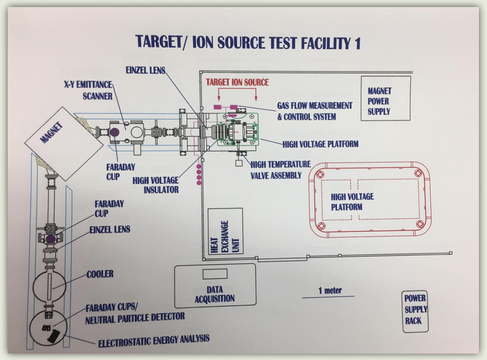

Figure 1: Ion Facility Layout

How This Works

Ions can be generated via heating, photon excitation (Lasers), and even electric stimulus. Using one of these methods a gas or solid is excited by the added energy and becomes a plasma. The plasma contains ionized atoms and free roaming electrons. These ions can then be manipulated magnetically into a focused shape and propelled as a beam of ions.

Ion Source Options

Given several choices of Ion generators we will need to select the best fit in terms of cost, complexity, and productiveness. Some promising options include:

- Laser ion source
- Penning ion source
- Sputter ion source

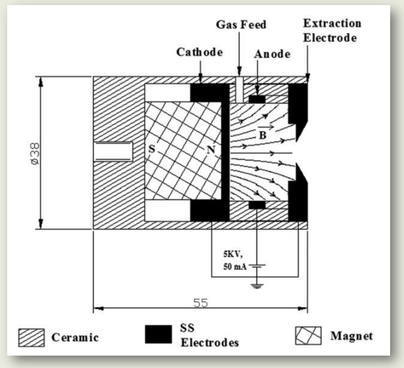

Figure 2: Penning Ion Source General Design Cross-section [1]

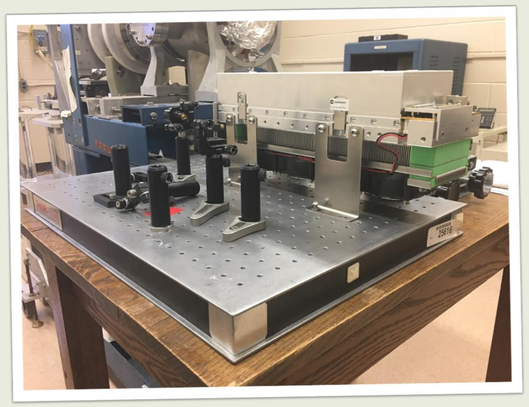

Figure 3: Optical Table & Laser

Ion Source Designs

- Laser Sources use photons to excite a target material into an ionized plasma.
- Sputter Sources use a very hot vapor to "Sputter off" of a target material. This target then releases ions.
- Penning Sources use high voltage and low pressure to release ions from a target material.

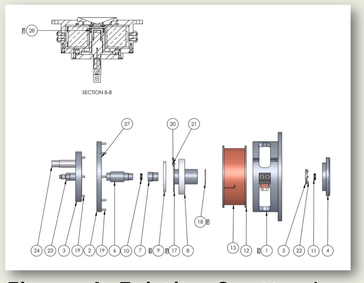

Figure 4: Existing Sputter Ion Source

Conclusion

Using simulation software such as IBSimu[2] we will begin exploring the form of our ion source before we spend our resources. As shown in figure 4 we already have an ion source that we are eager to test in simulation.

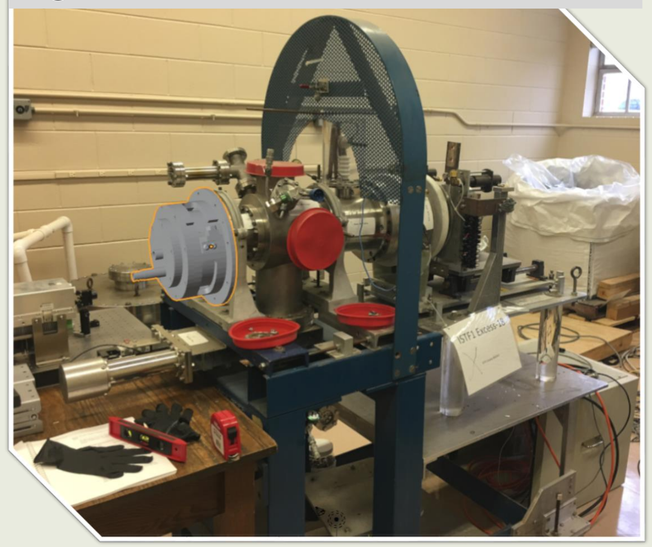

Figure 5: High Voltage Platform w/ Proposed Ion Generator in grey

References

[1] Das, B.k., et al. “Development of Hollow Anode Penning Ion Source for Laboratory Application.” Nuclear Instruments and Methods in Physics Research Section A:
[2] Kalvas, Taneli. “IBsimu.” Ion Beam Simulator , 1.0.6, SourceForge, 7 Aug. 2015, ibsimu.sourceforge.net/.

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