Remote Operation of a Farnsworth-Hirsch Fusor

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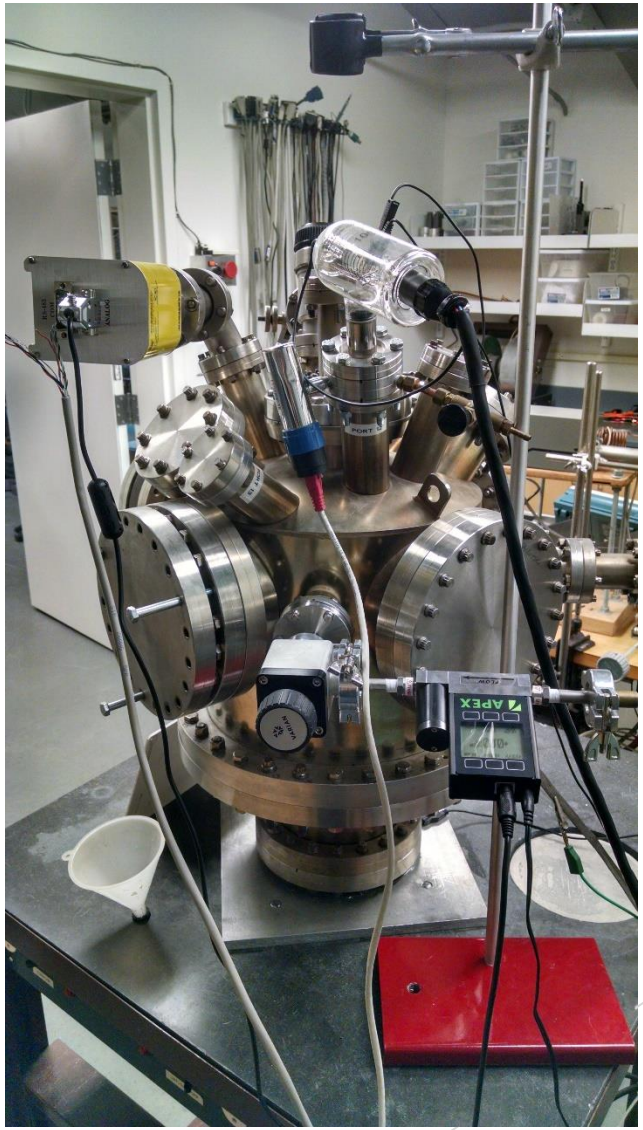
Outline

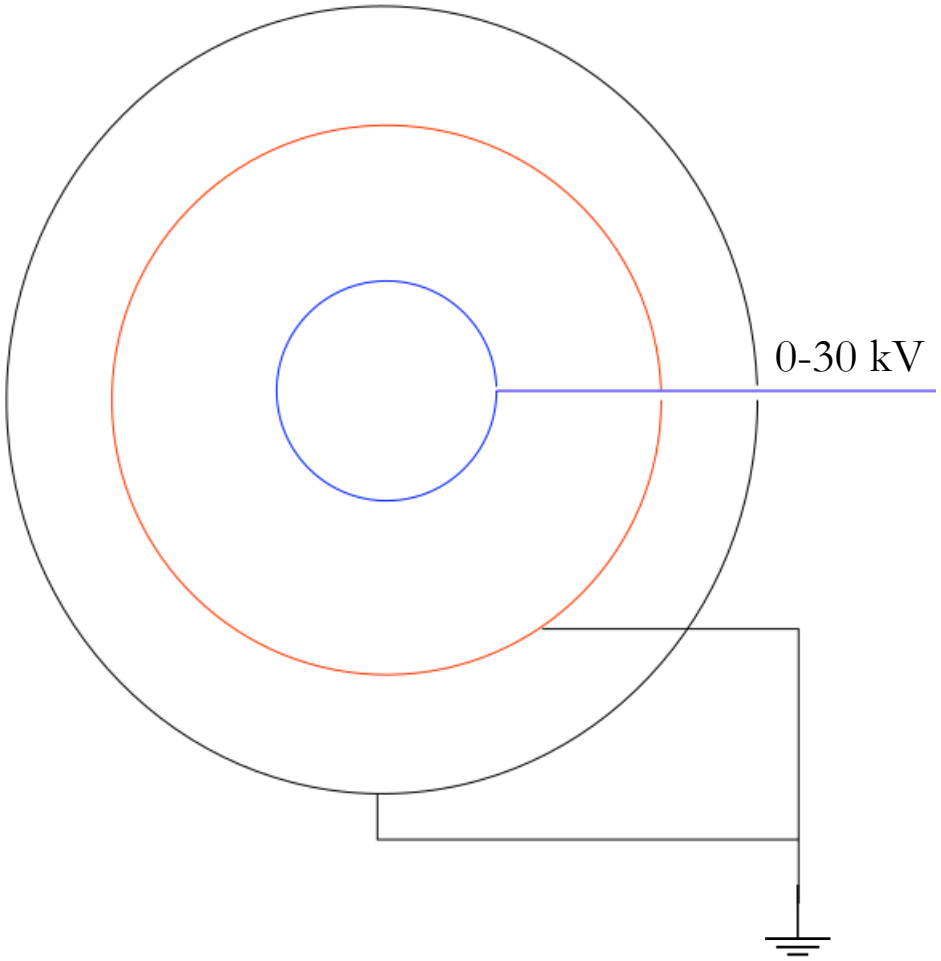
- What is a Farnsworth-Hirsch Fusor?
- Why do we want to have a Farnsworth-Hirsch Fusor?
- Implementation of electronics
- Data from mass flow controller
- Results from operation with air
- Future work

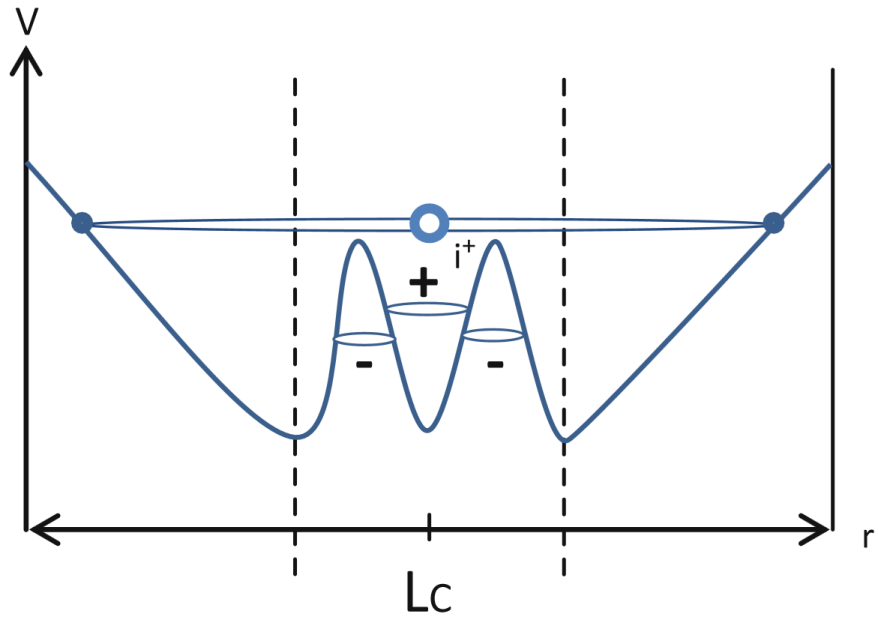
Farnsworth-Hirsch Fusor

- Inertial electrostatic confinement
- Developed first by Philo T. Farnsworth and further developed by Robert Hirsch
- Patents from 1966 to 1970



Inertial Electrostatic Confinement





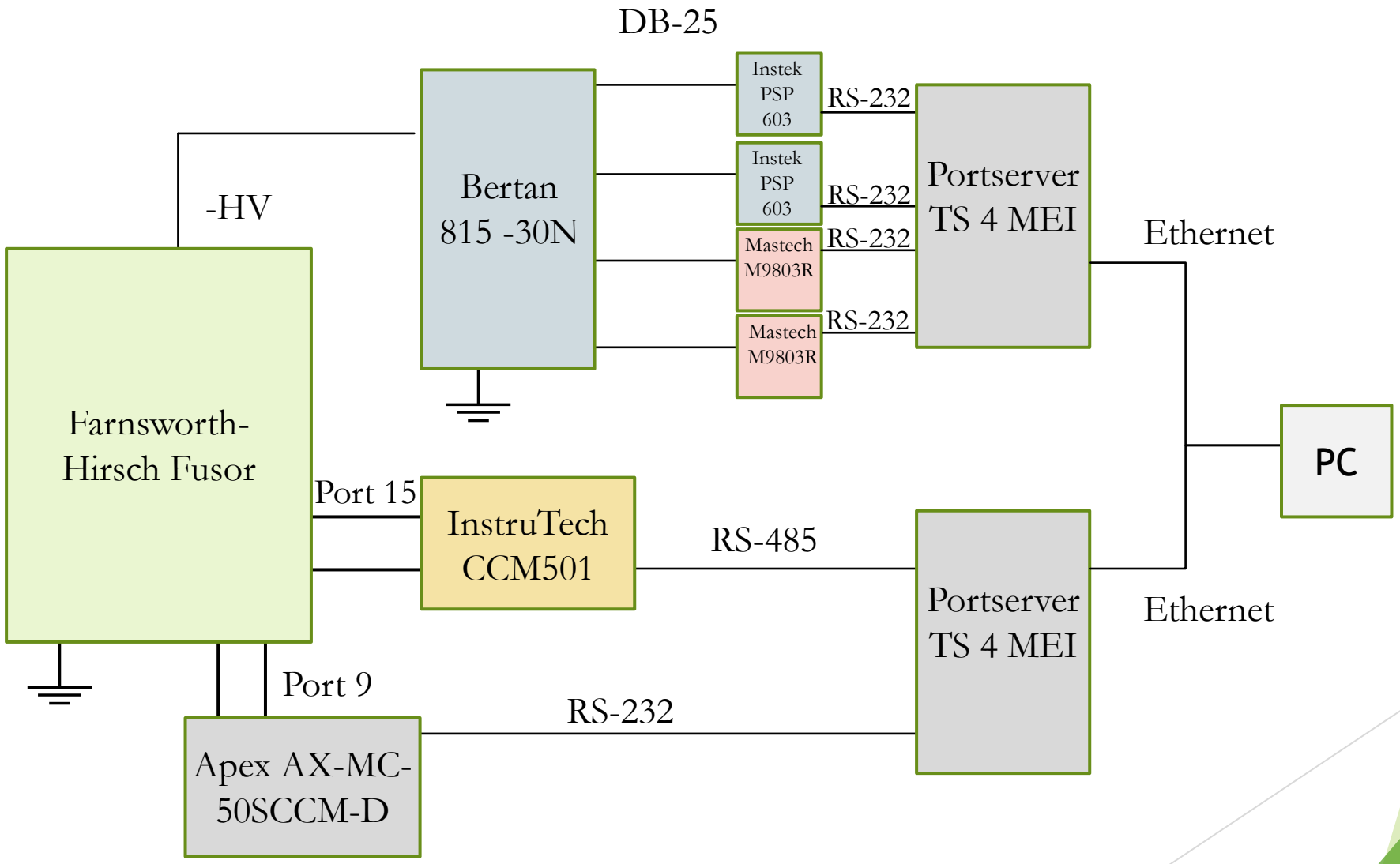
(Miley and Murali)

Motivation

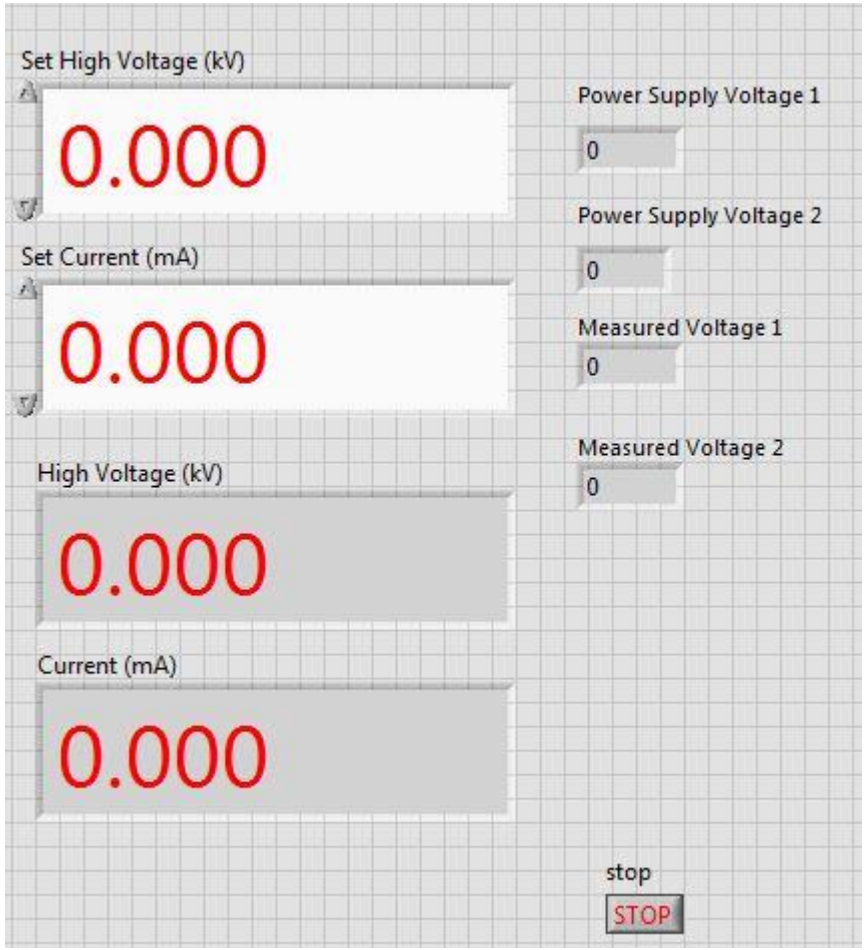
- Study plasmas
- Study nuclear reactions
- Produce x-ray and neutrons

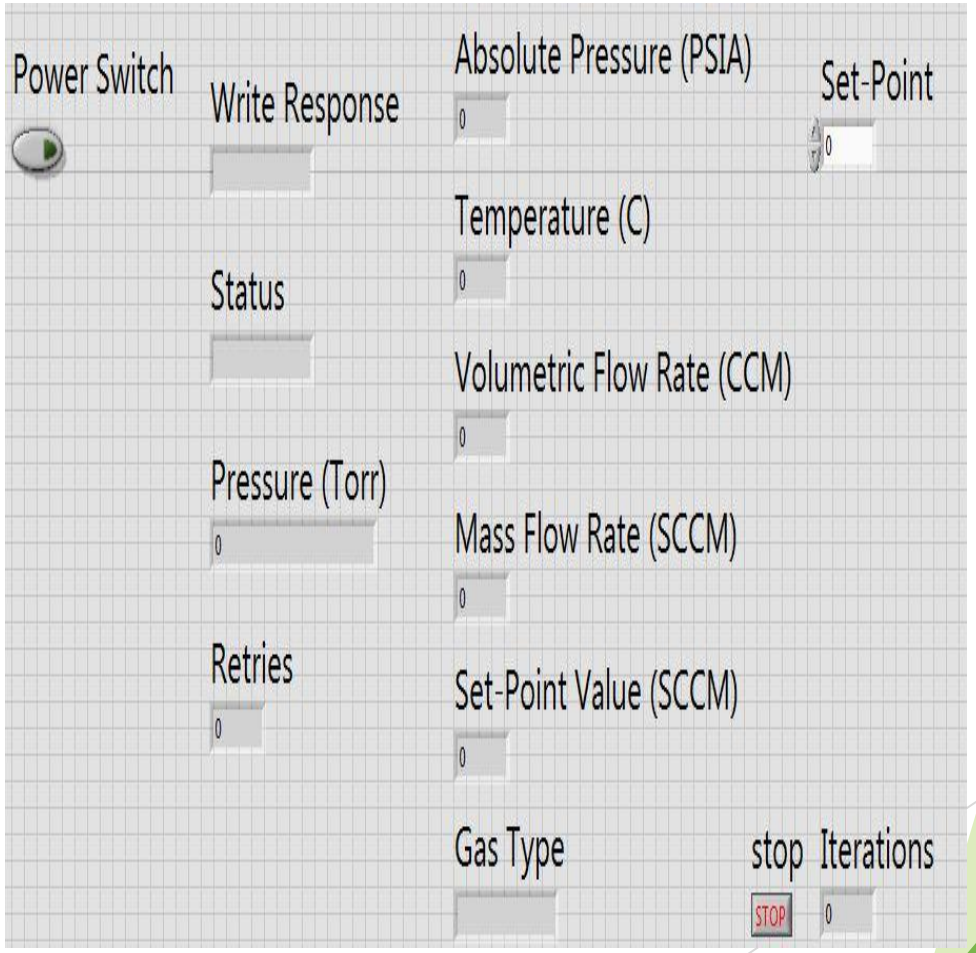
- Safety precautions
- Automation

Electronics Set-up

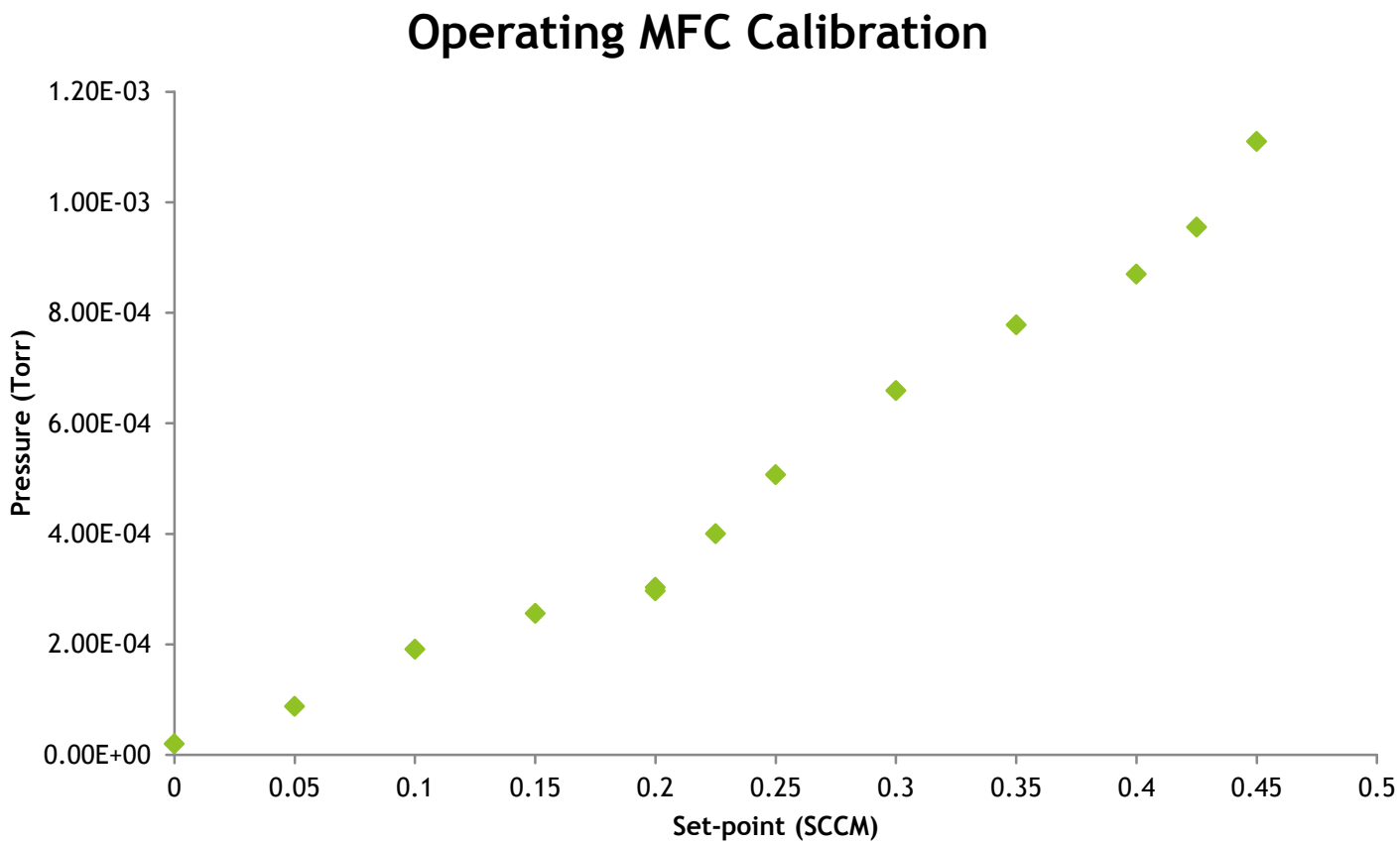


Fusor Controls

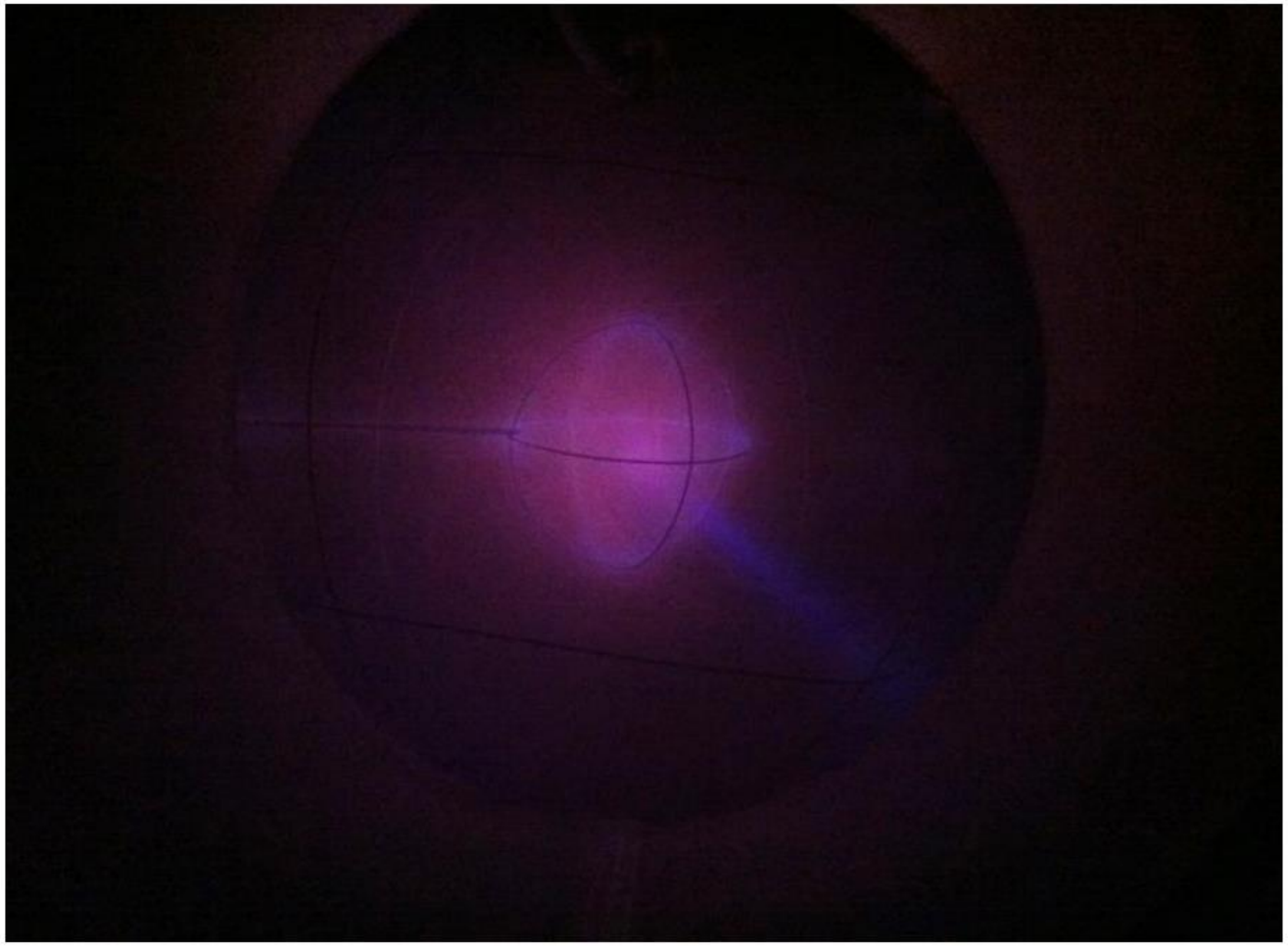




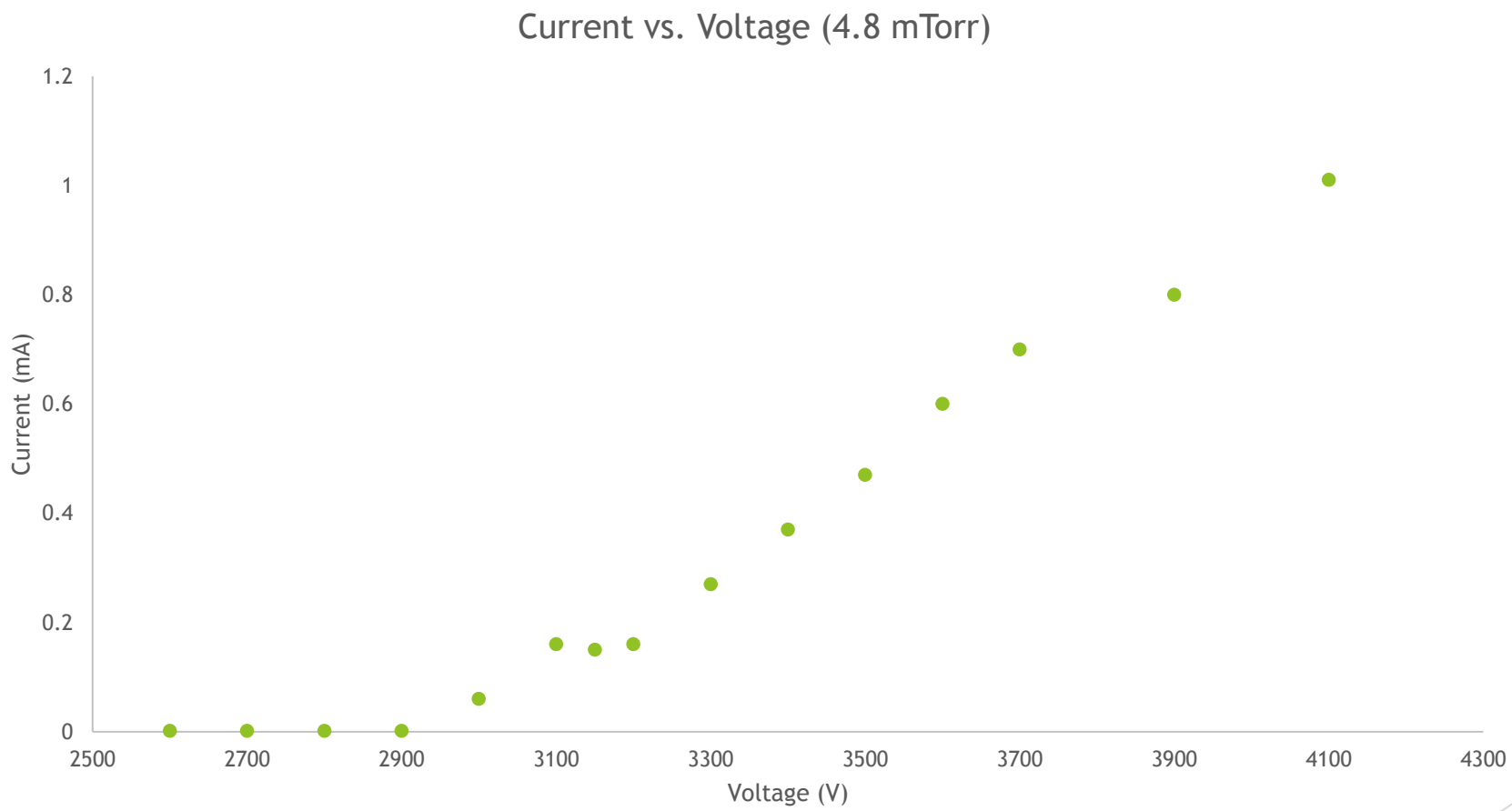
Apex AX-MC-50SCCM-D Mass Flow Controller



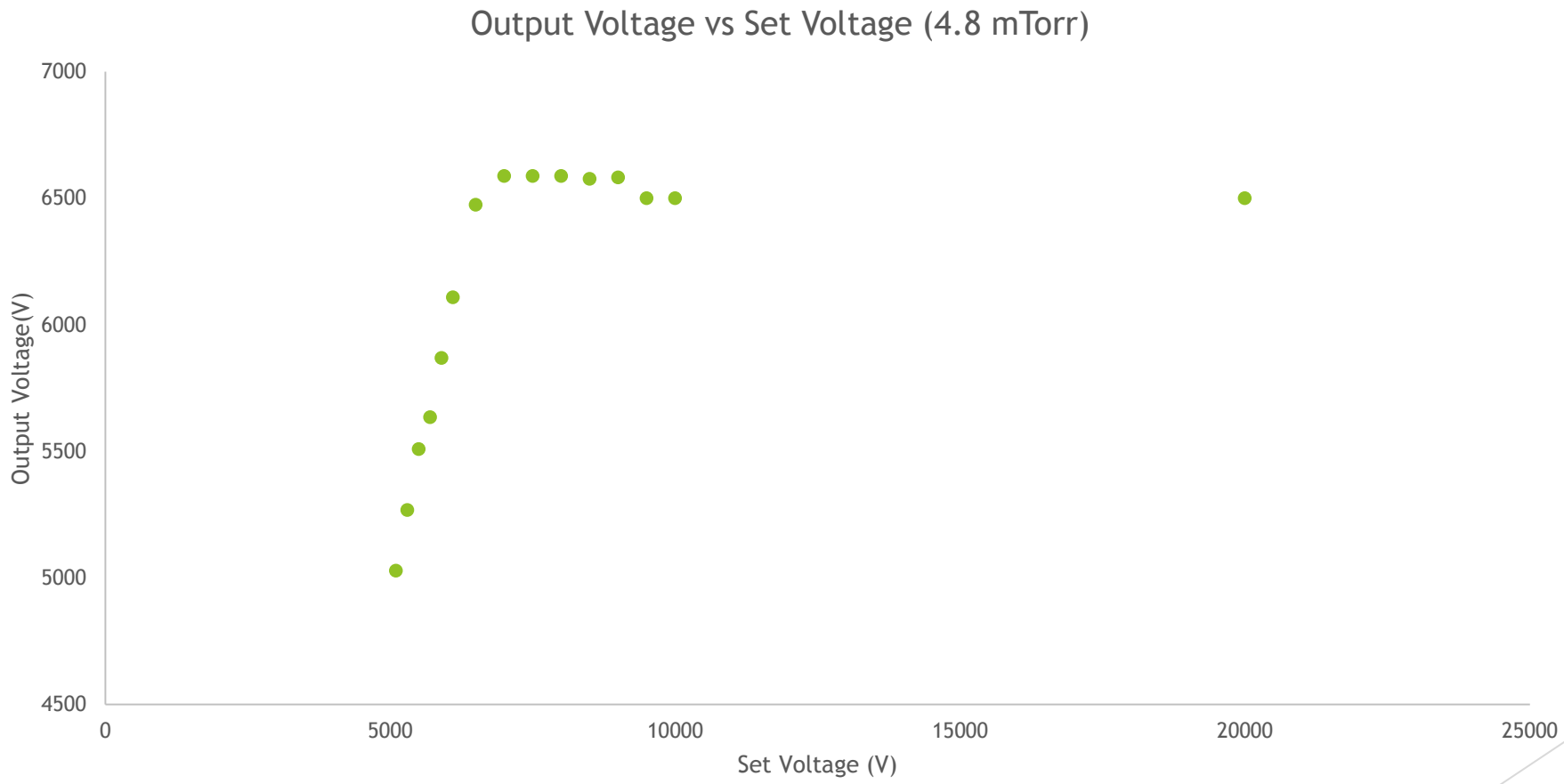
Results



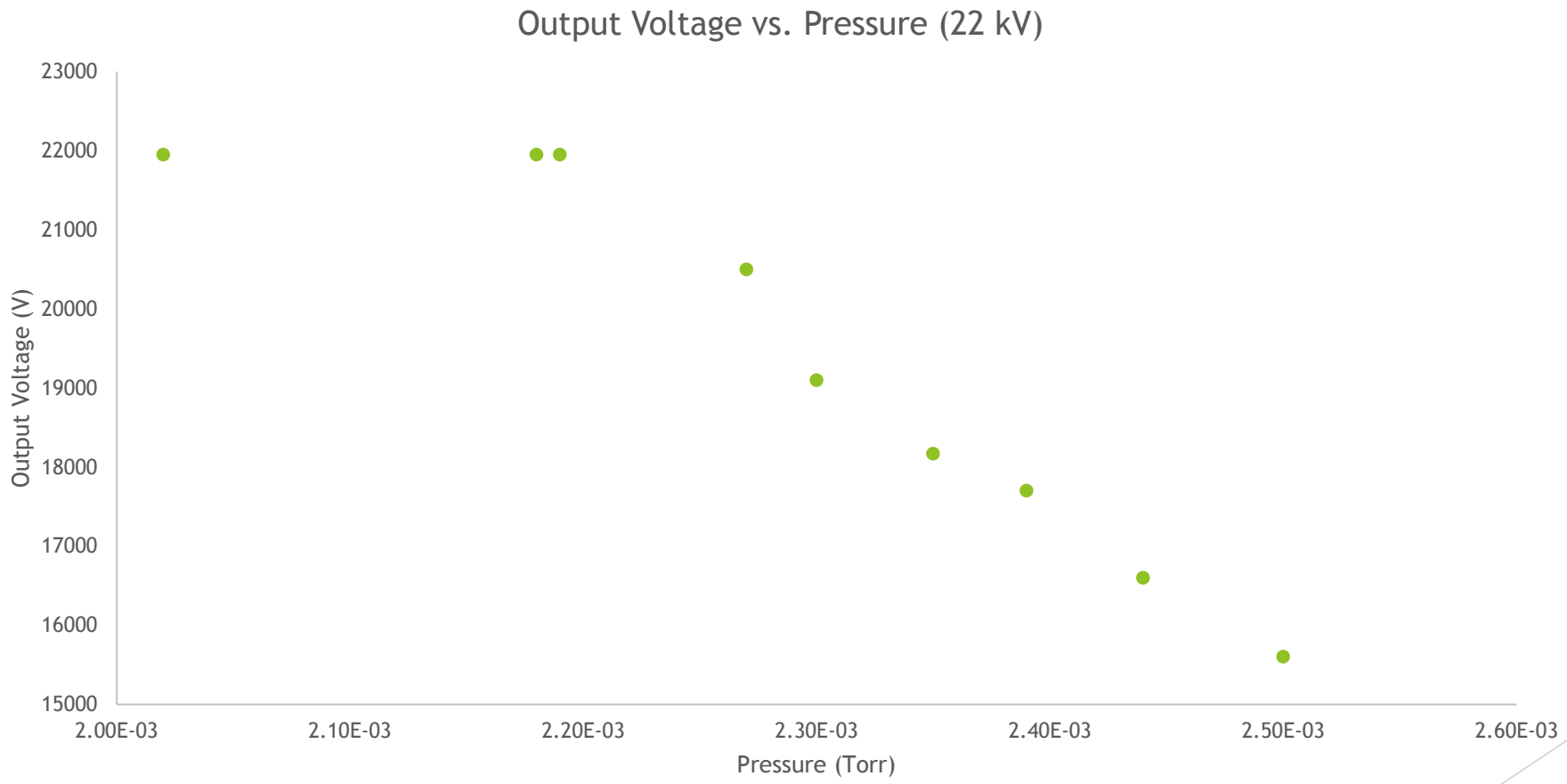
Results


Current vs. Voltage (4.8 mTorr)
Current (mA)
1.2
1
0.8
0.6
0.4
0.2
0
2500
2700
2900
3100
3300
3500
3700
3900
4100
4300
Voltage (V)

Results


Output Voltage vs Set Voltage (4.8 mTorr)
Output Voltage(V)
7000
6500
6000
5500
5000
4500
0
5000
10000
15000
20000
25000
Set Voltage (V)

Results


Output Voltage vs. Pressure (22 kV)
Output Voltage (V)
23000
22000
21000
20000
19000
18000
17000
16000
15000
2.00E-03
2.10E-03
2.20E-03
2.30E-03
2.40E-03
2.50E-03
2.60E-03
Pressure (Torr)

Future Work

- Sparking and discharge occurred with hydrogen in entrance to fusor
- Replace feedthrough to relocate discharge
- Operate with hydrogen for testing
- Operate with deuterium

References

- G.H. Miley and S.K. Murali, *Inertial Electrostatic Confinement Fusion: Fundamentals and Applications* (Springer, New York, 2014).