Progress of the Houghton College Fusor

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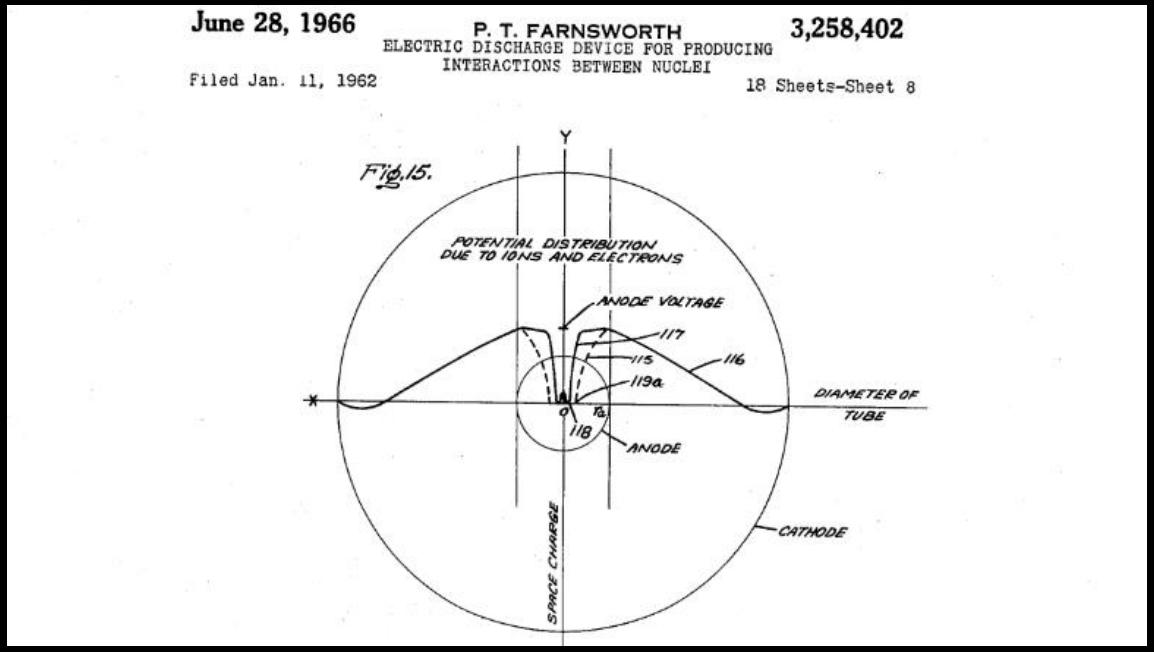


Motivation

- Fuse hydrogen and deuterium

- Radiation source

- Electric potential inside fusor

- Behavior of plasma

Nuclear Fusion

Incident high energy deuterium particles

Product helium nuclei and neutrons

Product tritium nuclei and protons

Distribution Functions

$$N_s(\boldsymbol{x}, \boldsymbol{v}, t) = \sum_{i=1}^{N_0} \delta(\boldsymbol{x} - \boldsymbol{X}_i(t))\delta(\boldsymbol{v} - \boldsymbol{V}_i(t)) \quad (1)$$

$$\frac{d\boldsymbol{X}_i(t)}{dt} = \boldsymbol{V}_i(t) \quad (2)$$

$$\frac{d\boldsymbol{V}_i(t)}{dt} = \frac{e_s}{m_s}\{\boldsymbol{E}^m[\boldsymbol{X}_i(t), t] + \boldsymbol{V}_i(t) \times \boldsymbol{B}^m[\boldsymbol{X}_i(t), t]\} \quad (3)$$

Plasma Equations

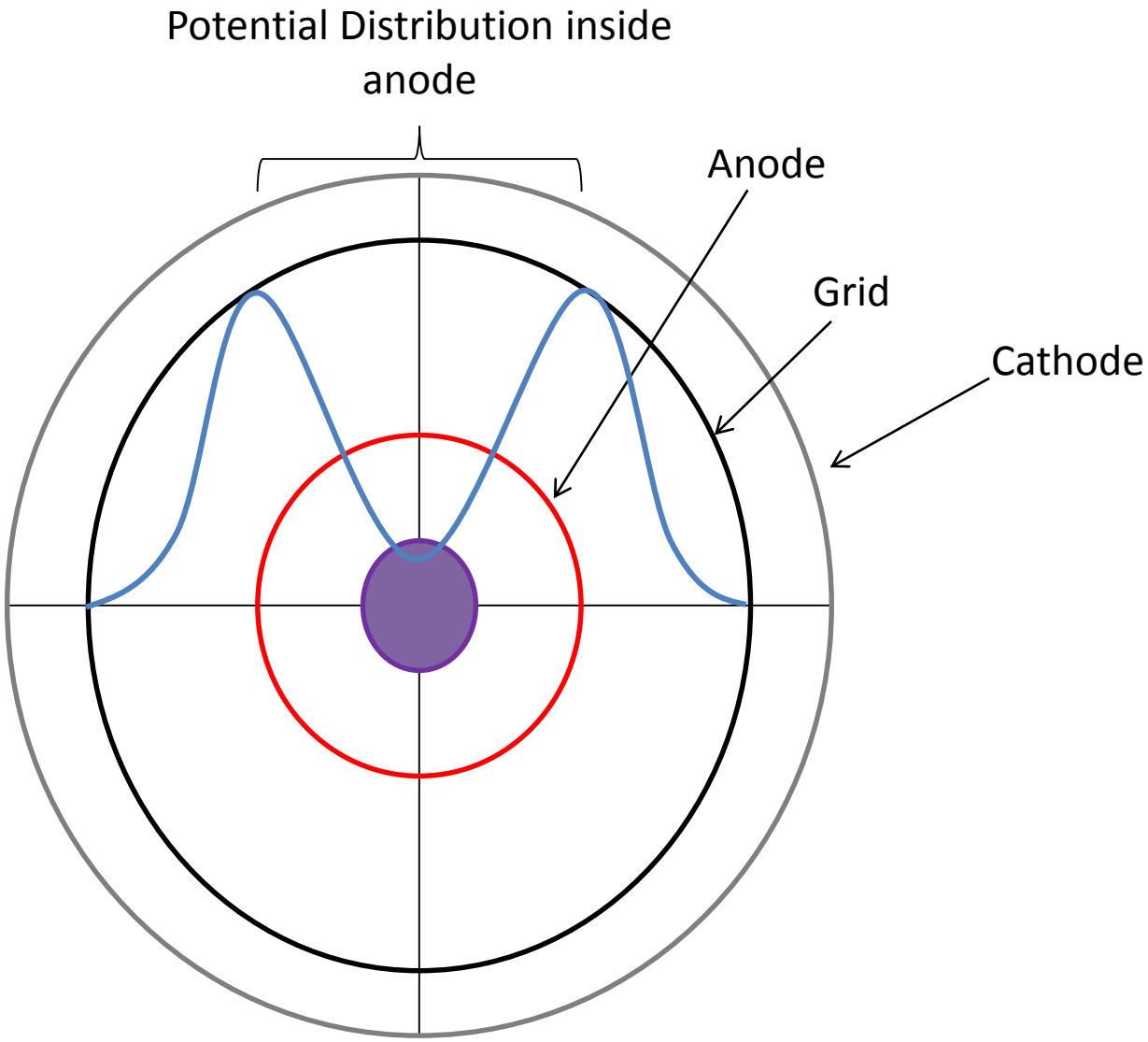
The Klimontovich Equation

$$\frac{\partial N_S(\boldsymbol{x},\boldsymbol{v},t)}{\partial t} = -\boldsymbol{v}\cdot\boldsymbol{\nabla}_{\boldsymbol{x}}N_s - \frac{q_s}{m_s}\left\{\boldsymbol{E}^m[\boldsymbol{x},t] + \frac{\boldsymbol{V}}{c}\times\boldsymbol{B}^m[\boldsymbol{x},t]\right\}\cdot\boldsymbol{\nabla}_{\boldsymbol{v}}N_s \quad (1)$$

The Vlasov Equation

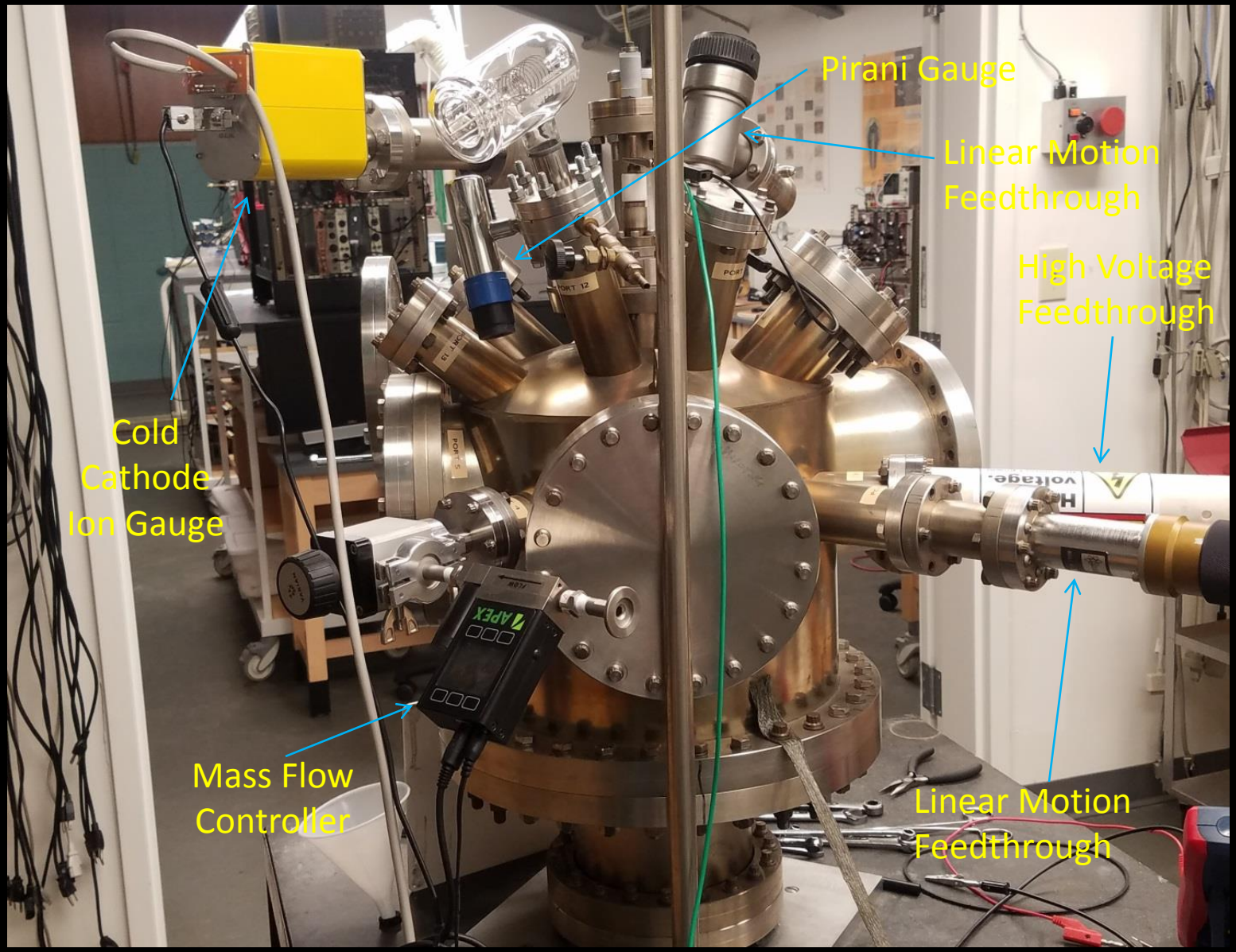
$$\frac{\partial f_S(\boldsymbol{x},\boldsymbol{v},t)}{\partial t} + \boldsymbol{v}\cdot\boldsymbol{\nabla}_{\boldsymbol{x}}f_s + \frac{q_s}{m_s}\left\{\boldsymbol{E}[\boldsymbol{x},t] + \frac{\boldsymbol{V}}{c}\times\boldsymbol{B}[\boldsymbol{x},t]\right\}\cdot\boldsymbol{\nabla}_{\boldsymbol{v}}f_s = 0 \quad (2)$$

Potential Distribution Inside Chamber

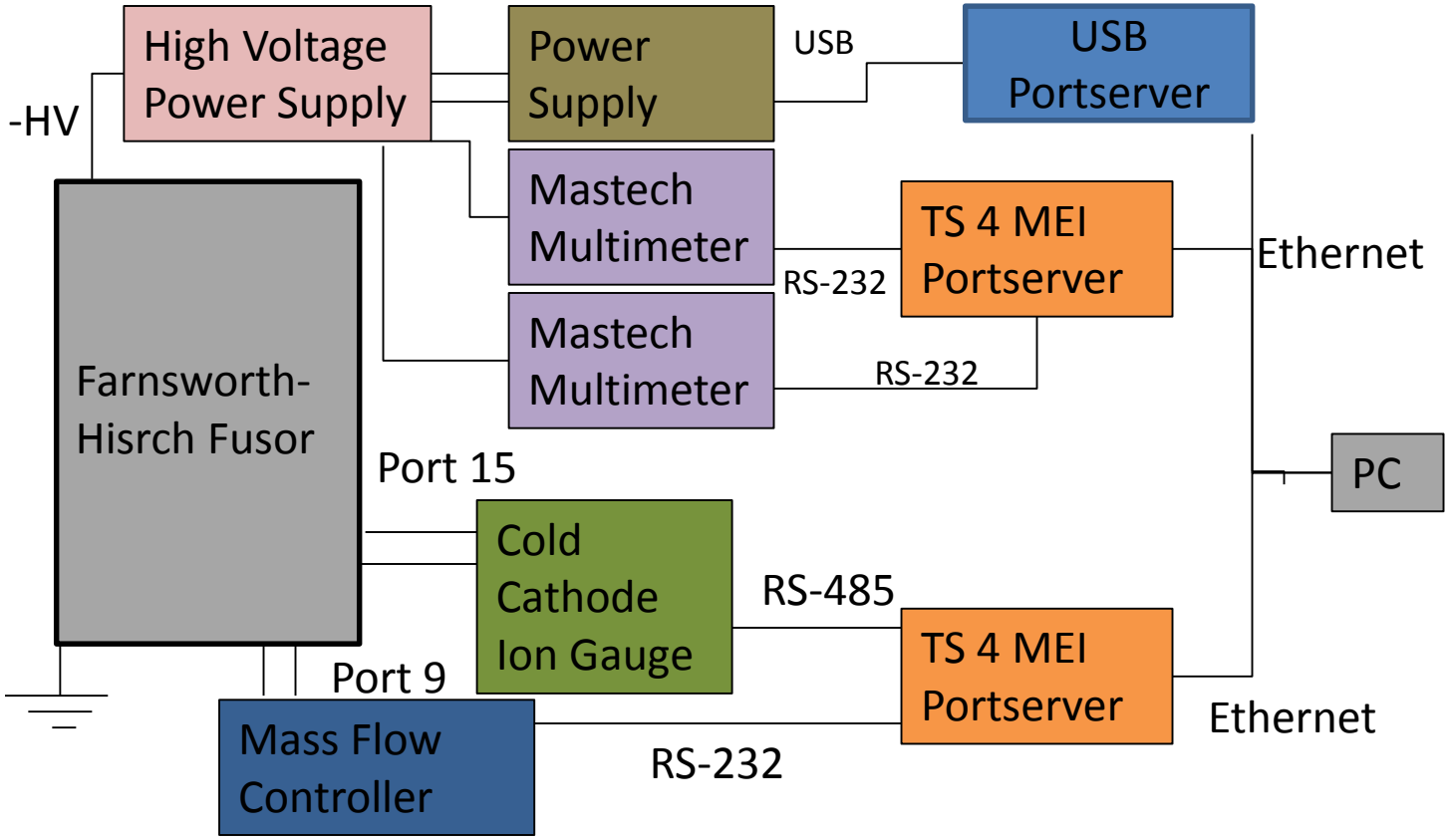


Inertial Electrostatic Confinement Fusion

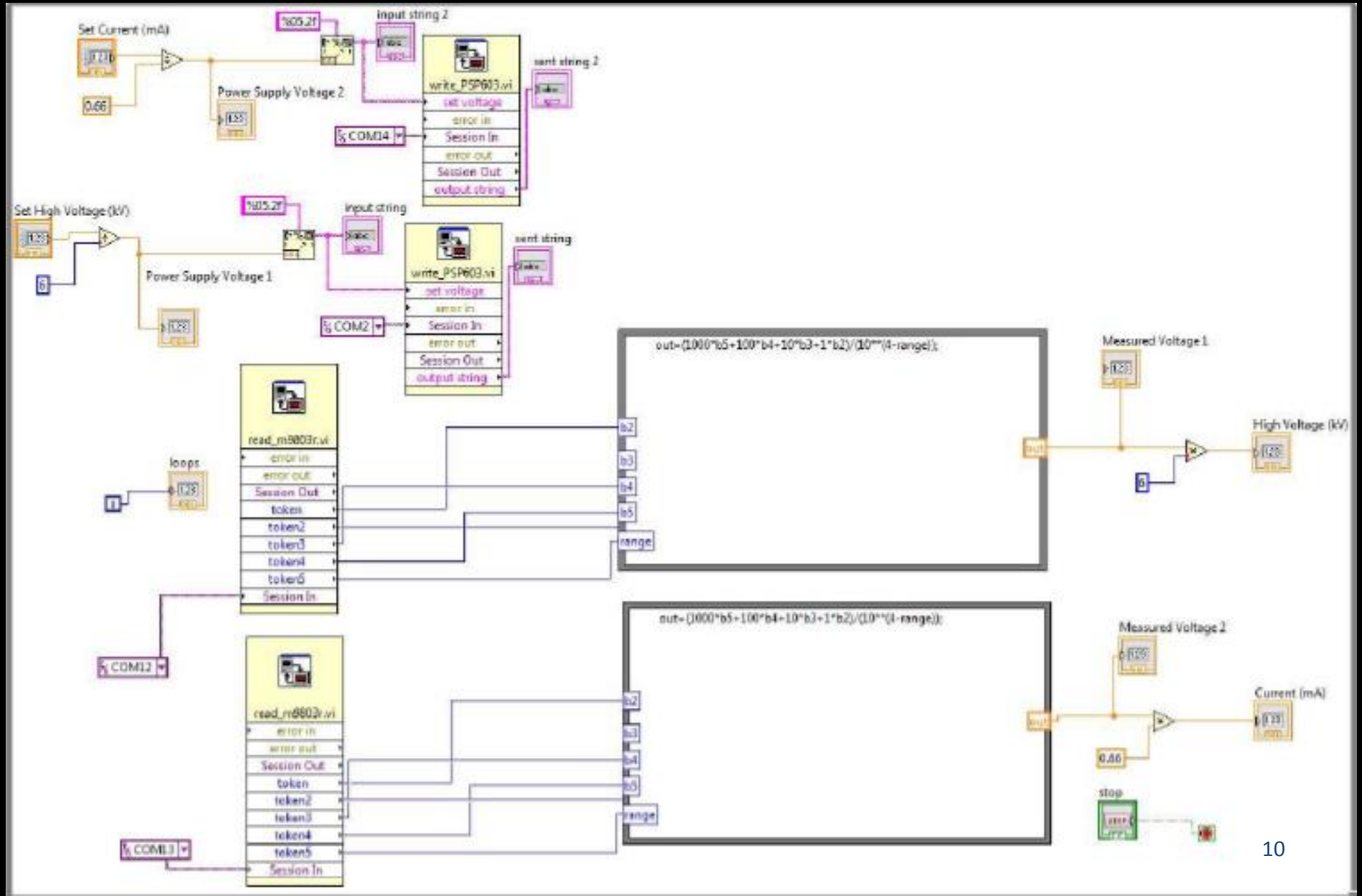
IEC at Houghton



Electronics

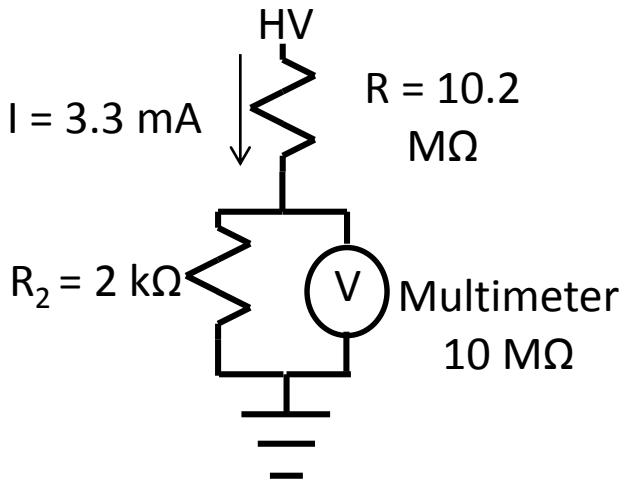


LabView Controls

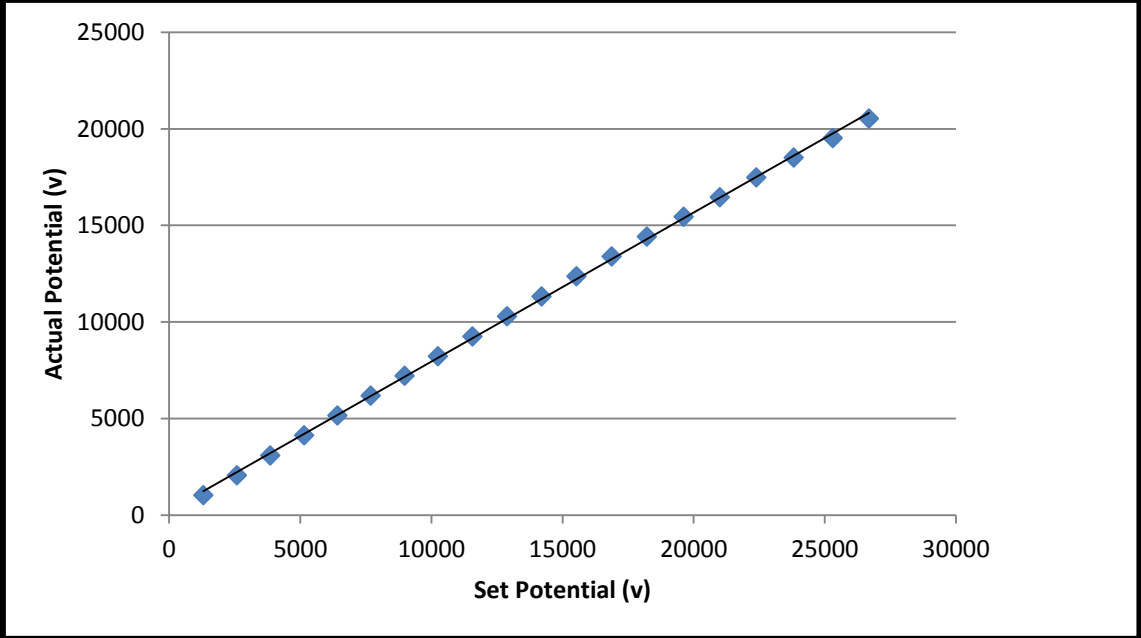


High Voltage Test Circuit

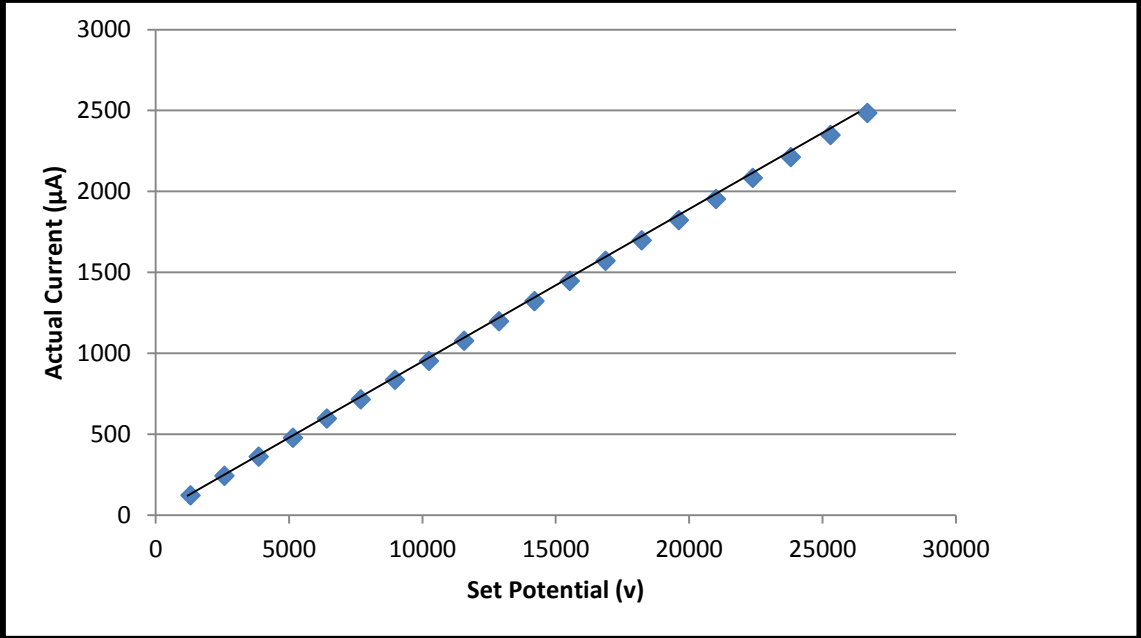
High Voltage Circuit Diagram



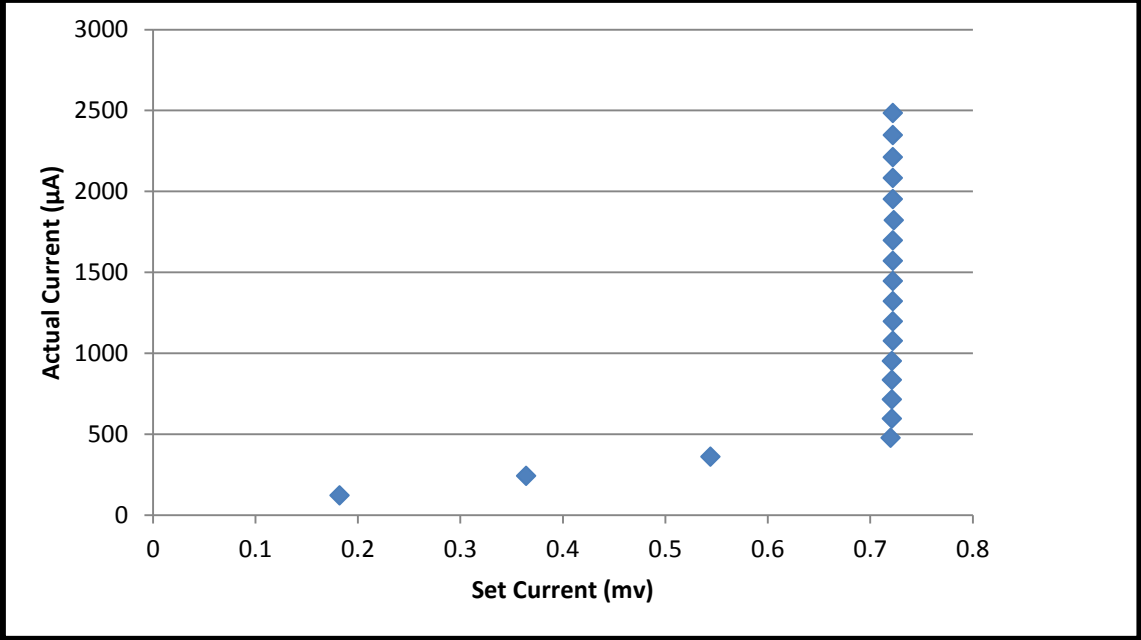
High Voltage Calibration Curve



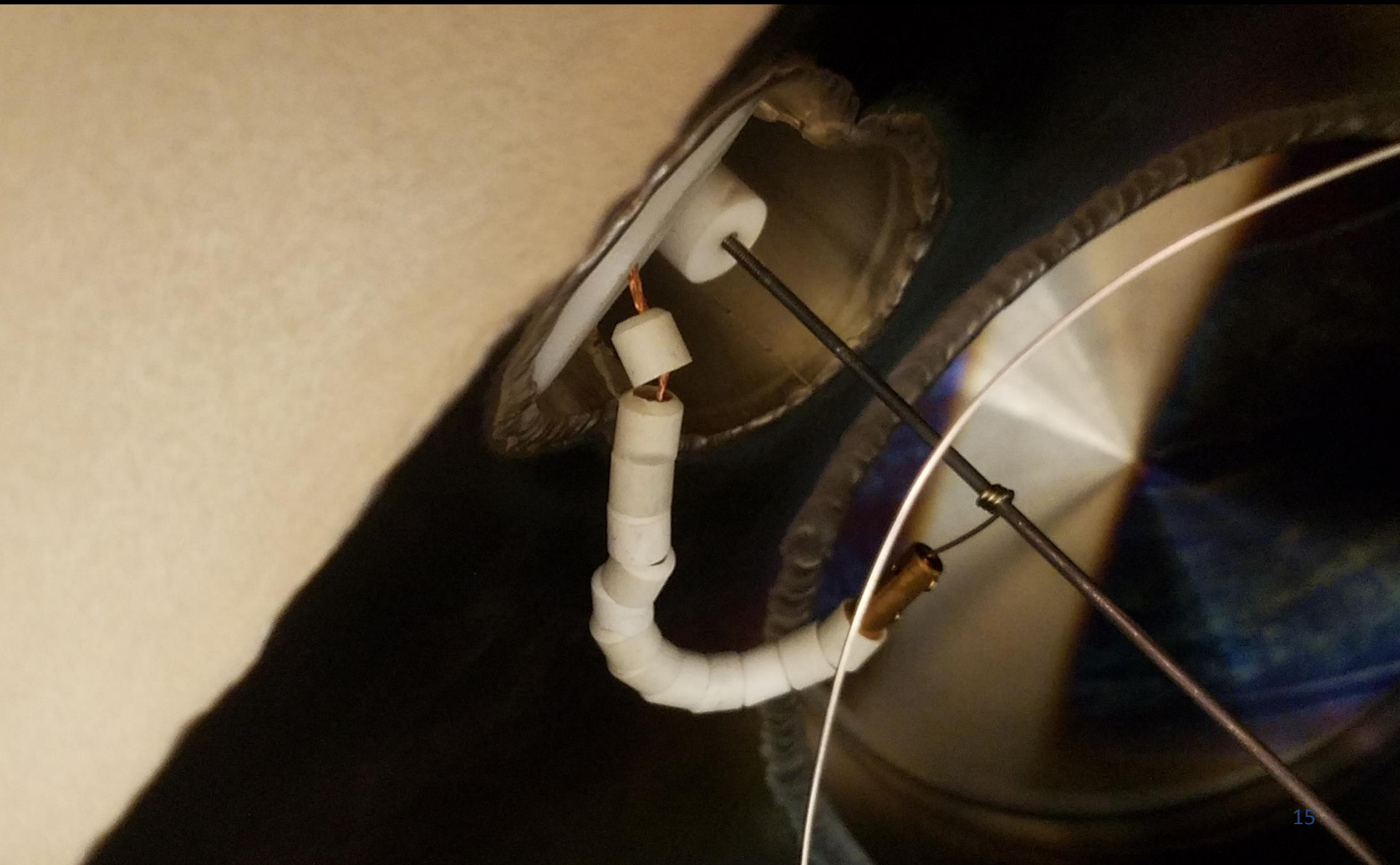
Current Calibration Curve



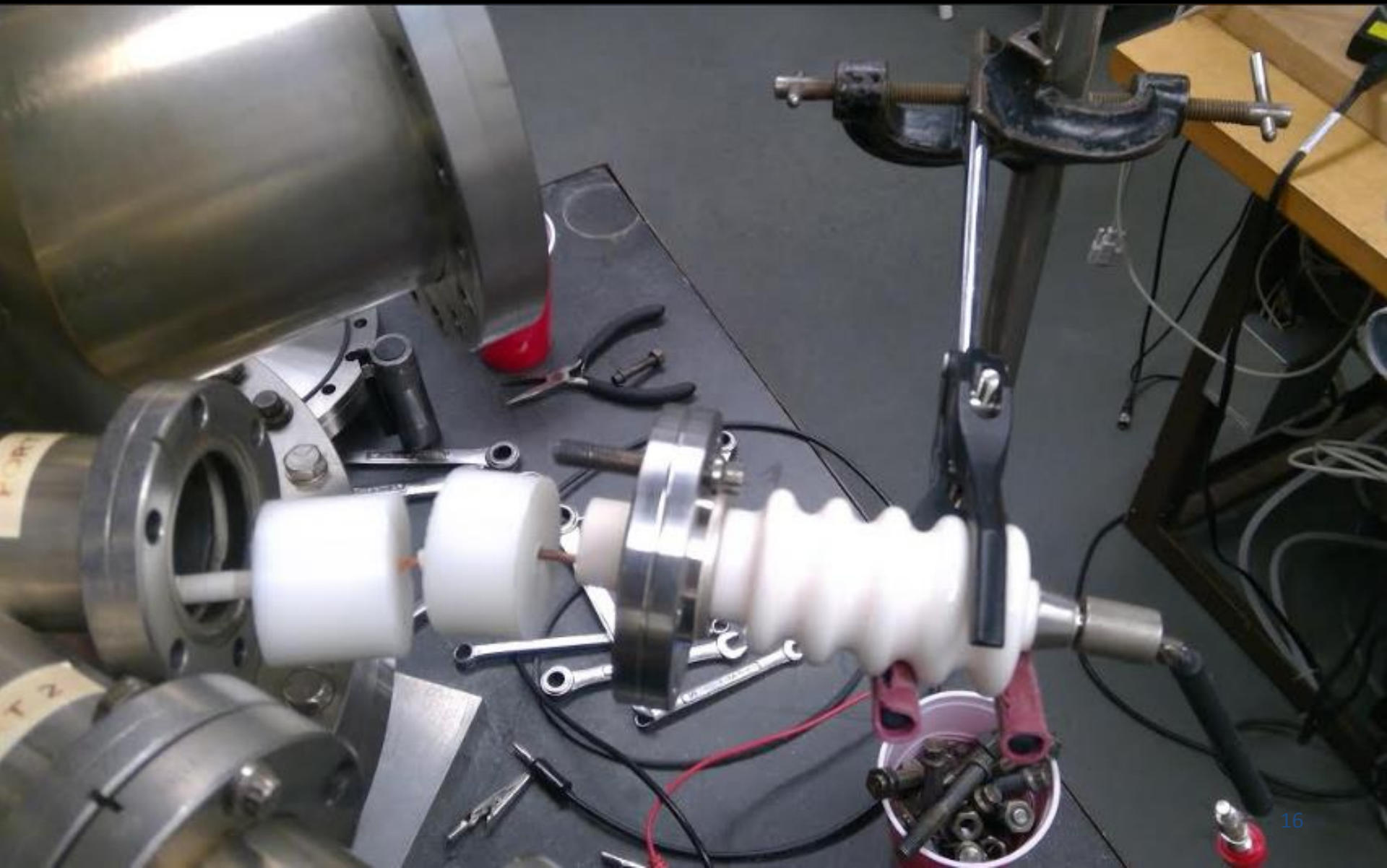
High Voltage Calibration Curve



High Voltage



Fix Sparking



Conclusion

- Fix sparking
- Connect remotely to computer
- Test with hydrogen and deuterium

Work Cited

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