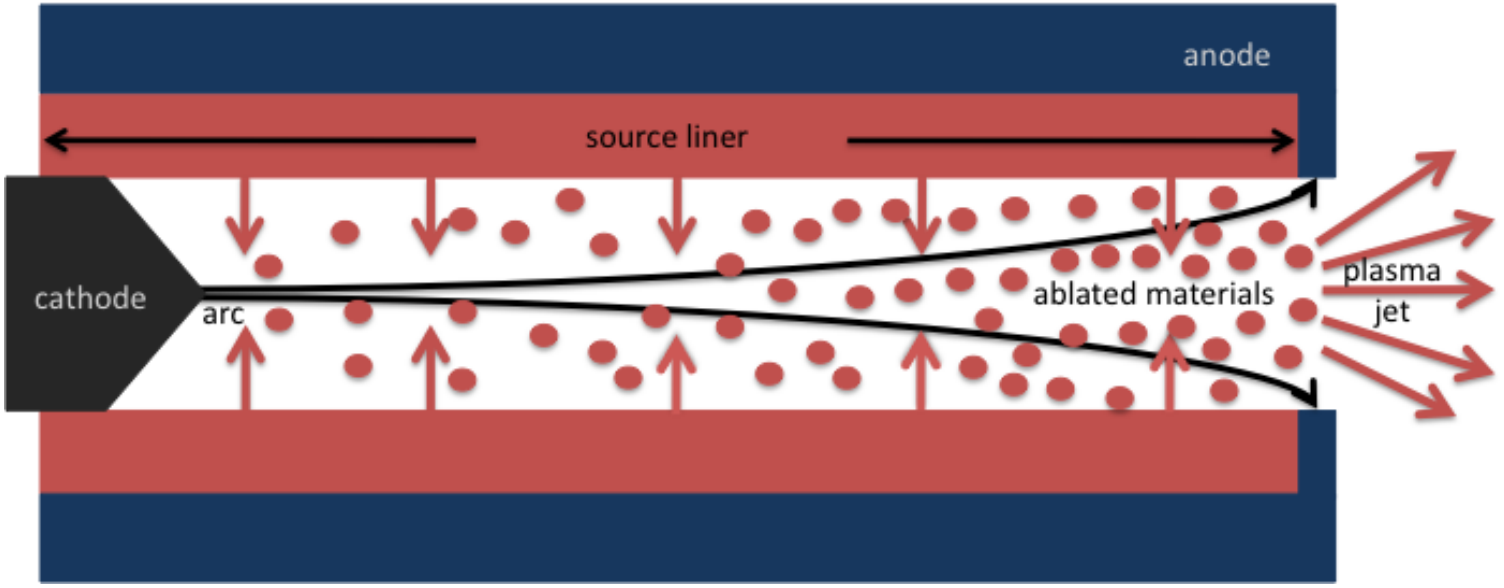
ISIS Laboratory
Areas of Research

- High Energy Density Plasmas
  - Source Modeling, New Plasma Physics
  - Materials Fabrication
  - Magnetic Confinement Fusion Fueling
- Nuclear Materials Optimization
  - Fusion: Structural and First Wall
  - Next Generation Nuclear Fuel Cladding
- Quantum Electrodynamics and Thermodynamics
  - Coherence/De-coherence Experiments
  - Single-few Atom Plasma Dynamics and QED
- Atmospheric Plasmas
  - Plasma Enhance Flow Control
  - Textile Modifications

High Energy Density Plasmas (HEDP)



n = 10^{20} -10^{28} /m^3, T = 1-3 eV, 800 MPa, V_{exit} up to 8 km/s, L = 9 cm D = 4 mm

- ET Discharges are of interest for various applications
  - **Hypervelocity launch devices**
  - **Fusion reactor pellet injectors**
  - Space propulsion systems
  - Plasma plugs for combustion control …

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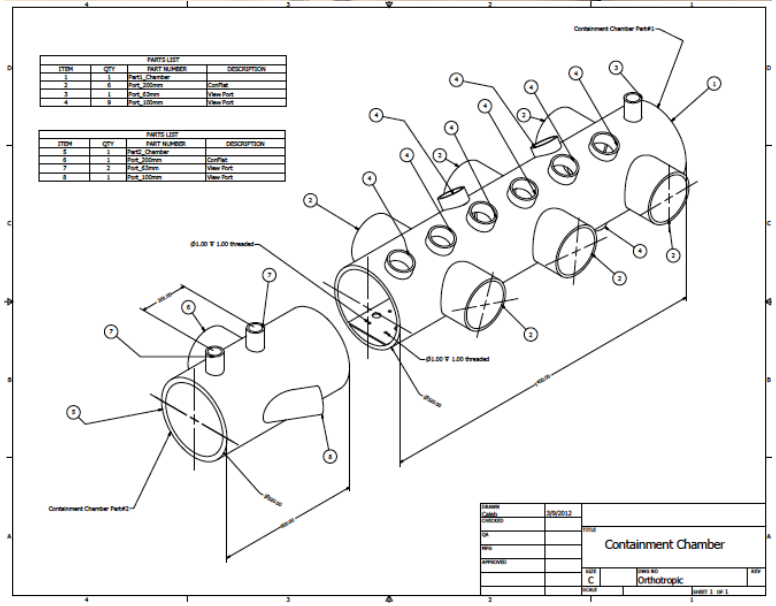
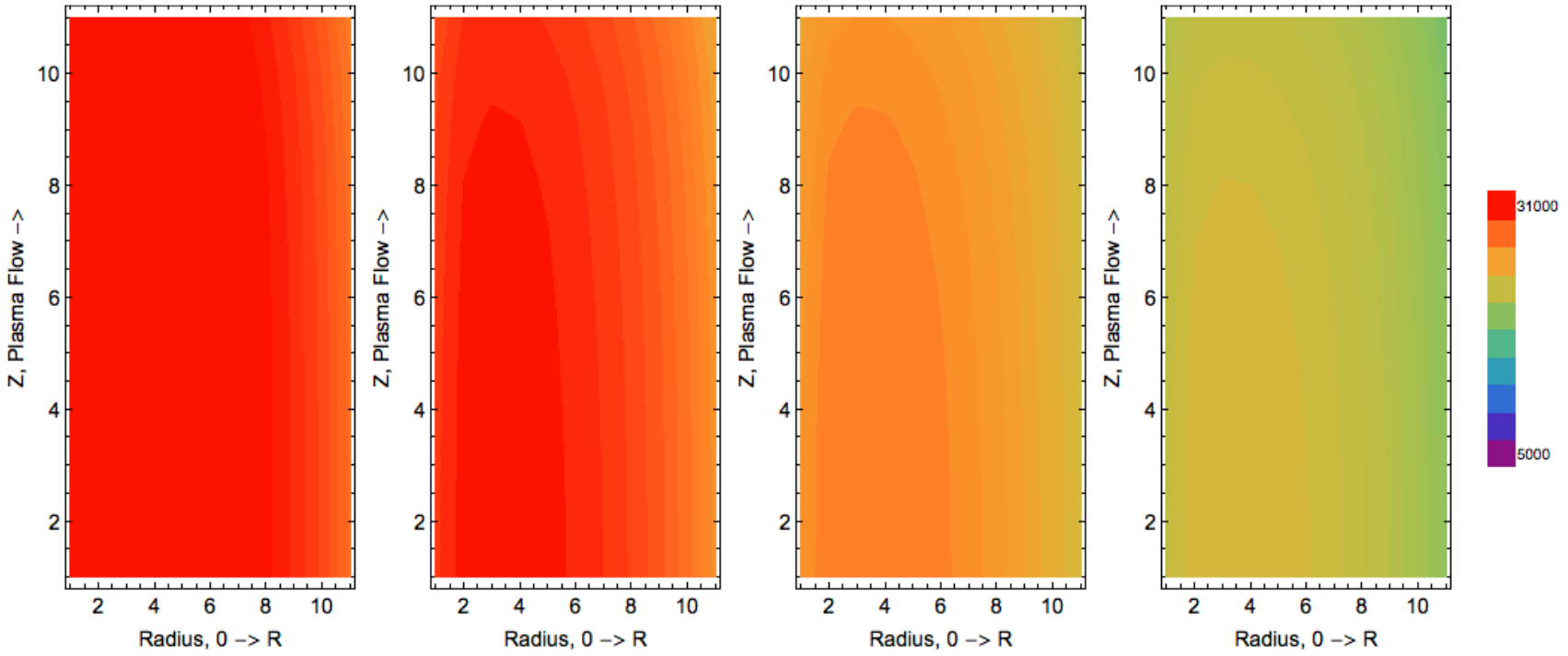
HEDP – Experiments



- Fusion Fueling: Trey Gebhart, MS-PhD ME-NE, Sara Driscoll, UG
  - Michael Barclift, UG
- Experimental Facilities
  - Fusion Pellet Injector
  - Materials Fabrication Device
- New LIF/PIV diagnostic system: Matthew Hamer, MS ME-NE

HEDP – Theory and Computation



- Micah Esmond, PhD ME-NE
  - Tyler Holladay, undergraduate research student
- 3-D Magnetohydrodynamics model

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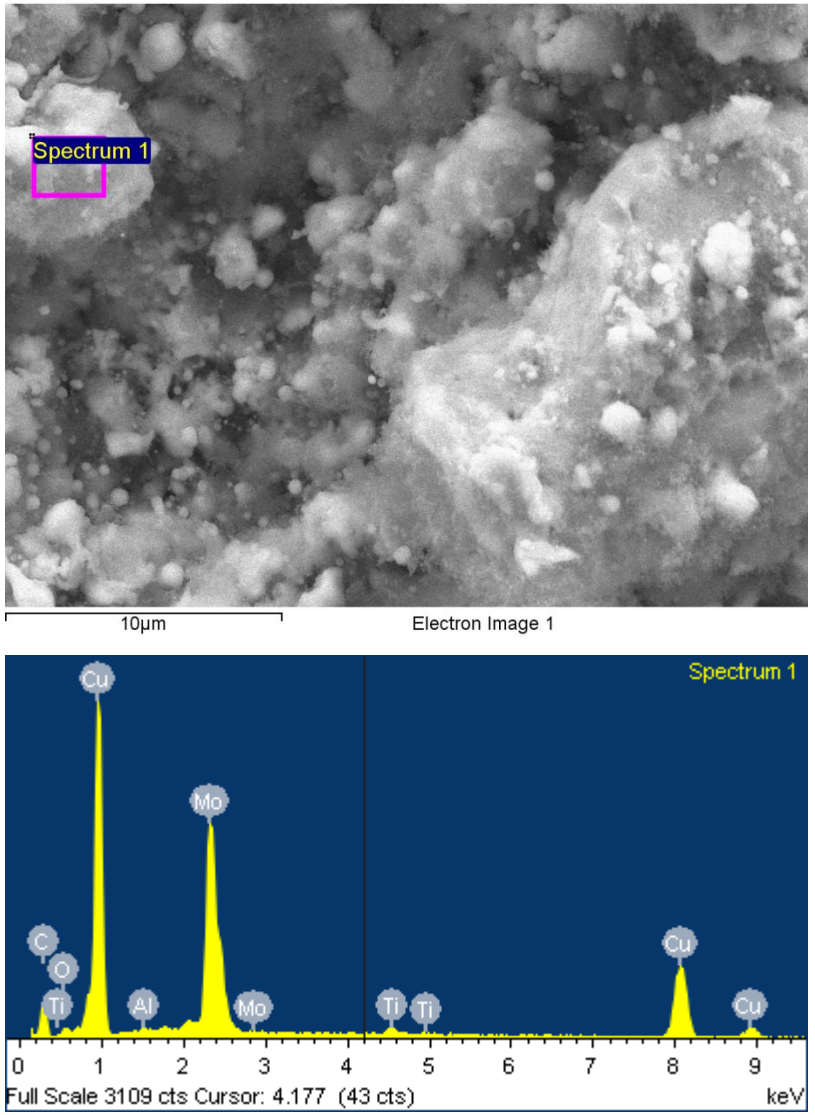
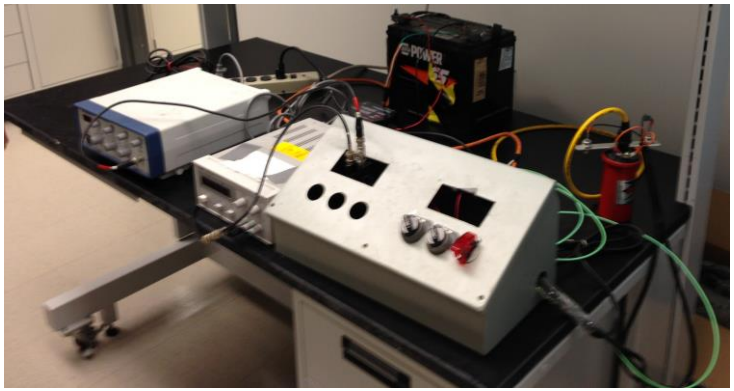
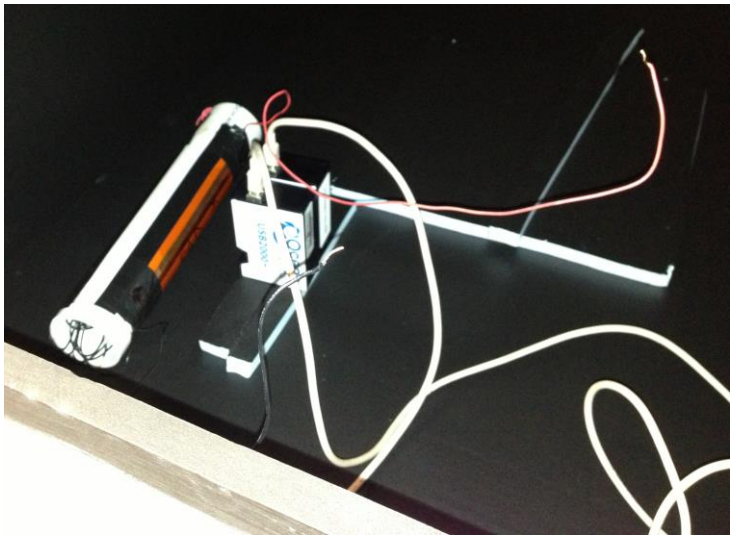
Energy Materials Research

- John Echols, MS-PhD MSE
- Materials for TH probes
- Fission, Fusion, Hydrogen storage
- Developed new HEDP deposition technique, currently optimizing
- Radiation hard PZTs
- ME Senior Design Team
- MSE Senior Design Team



Plasma Enhanced Flow Control





- Bill Schneck, PhD ME
- Atmospheric Plasmas for redistributing momentum in boundary layer in gas turbine engines
- Theory, Modeling, and Experiment

$$\text{Momentum} \begin{cases} \frac{Dr_i\vec{u}_i}{Dt} = -\nabla P_i + \vec{M}_{ii} + \vec{M}_{in} + \vec{M}_{ie} + n_i e\vec{E} \\ \frac{Dr_e\vec{u}_e}{Dt} = -\nabla P_e + \vec{M}_{ei} + \vec{M}_{en} + \vec{M}_{ee} - n_e e\vec{E} \\ \frac{Dr_i\vec{u}_i}{Dt} = -\nabla P_i + \vec{M}_{ii} + \vec{M}_{in} + \vec{M}_{ie} \end{cases}$$

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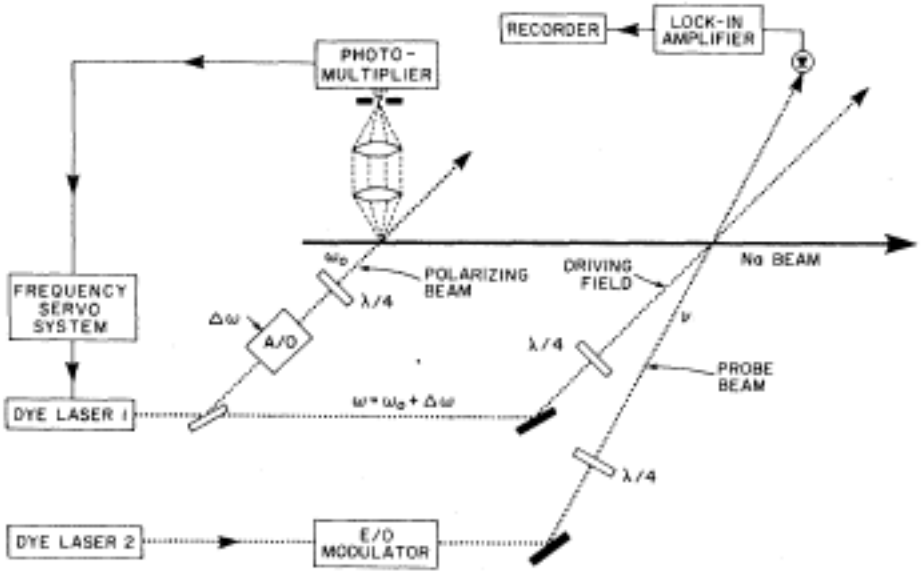
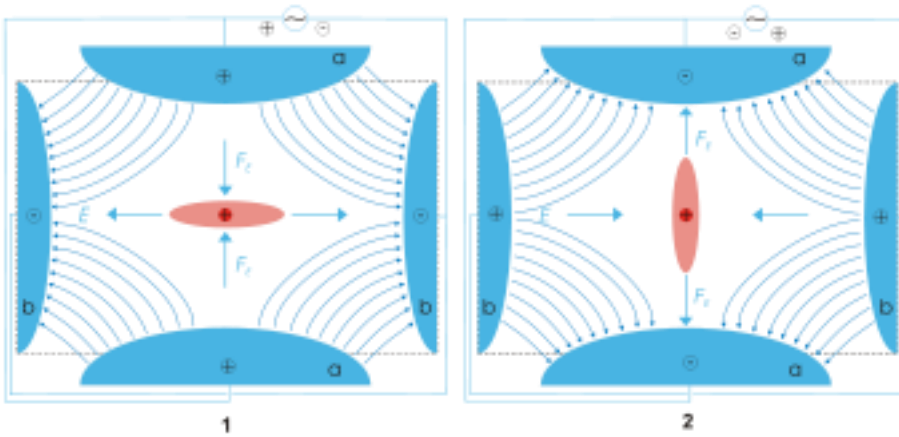
Quantum Level Plasma Studies

- Caleb Kock, MS-ESM
- Two level atom systems for quantum computing
- Experimental examination of new QED, IQT theories
- 1-5 atom plasma sytems





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