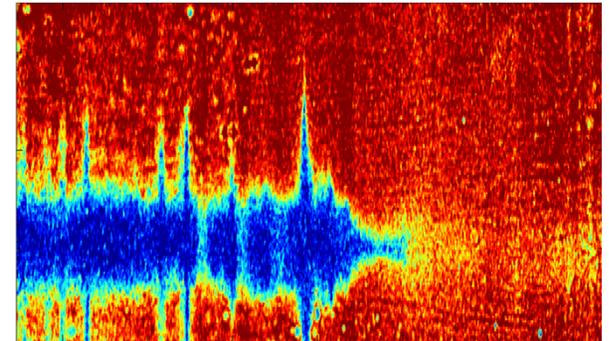
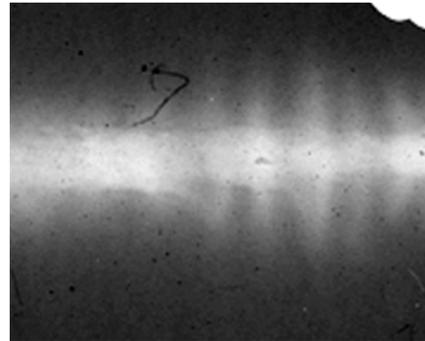
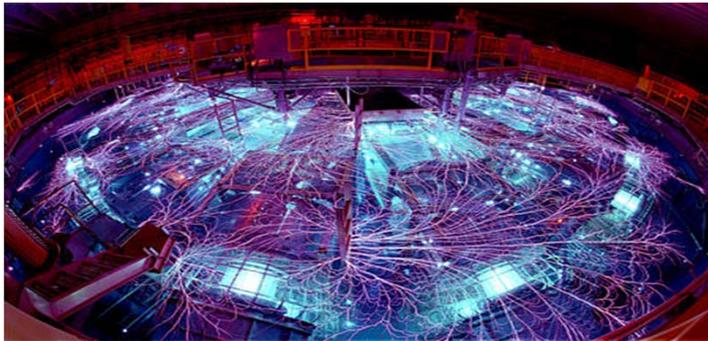


Exceptional service in the national interest



Diagnostic Prospects for X-ray Absorption Spectroscopy

Patrick Knapp



Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

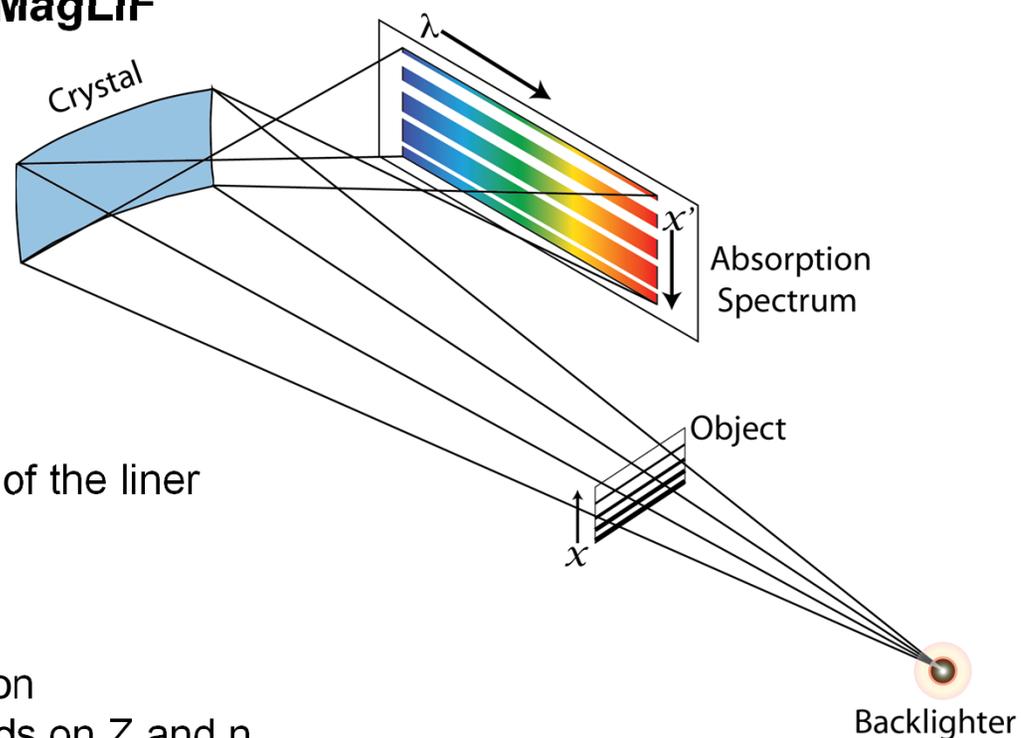
Absorption Spectroscopy Directly Measures the Line Integrated Ionization State of a Plasma

This information is well-suited to address questions in several key areas for MagLIF

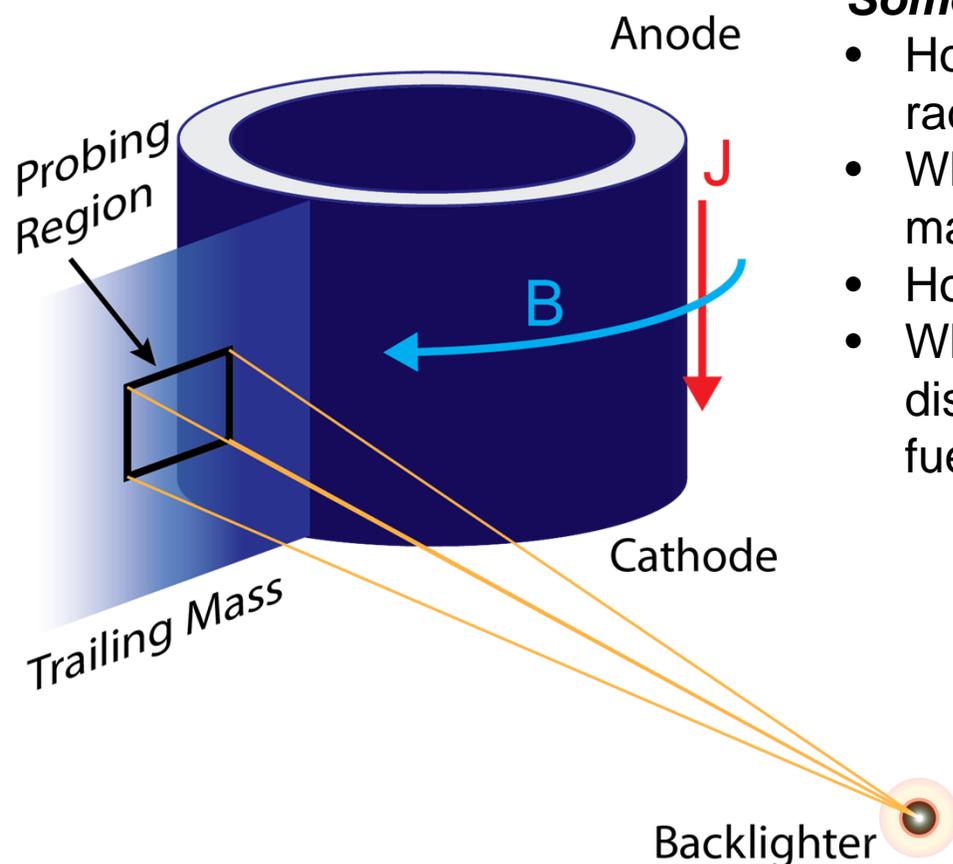
- Trailing Mass
 - Density and temperature
 - Conductivity, Ohmic heating
 - How do instabilities effect Drive

- Liner Conditions
 - Shape of K-edge can tell us state of the liner
 - Density from Stark Broadening
 - Surface ablation

- Preheated Fuel Conditions and evolution
 - Inverse Brems. Absorption depends on Z and n_e
 - Bleaching wave propagation in r and z
 - Ionization equilibration dynamics



Liner Trailing Mass and Current Distribution



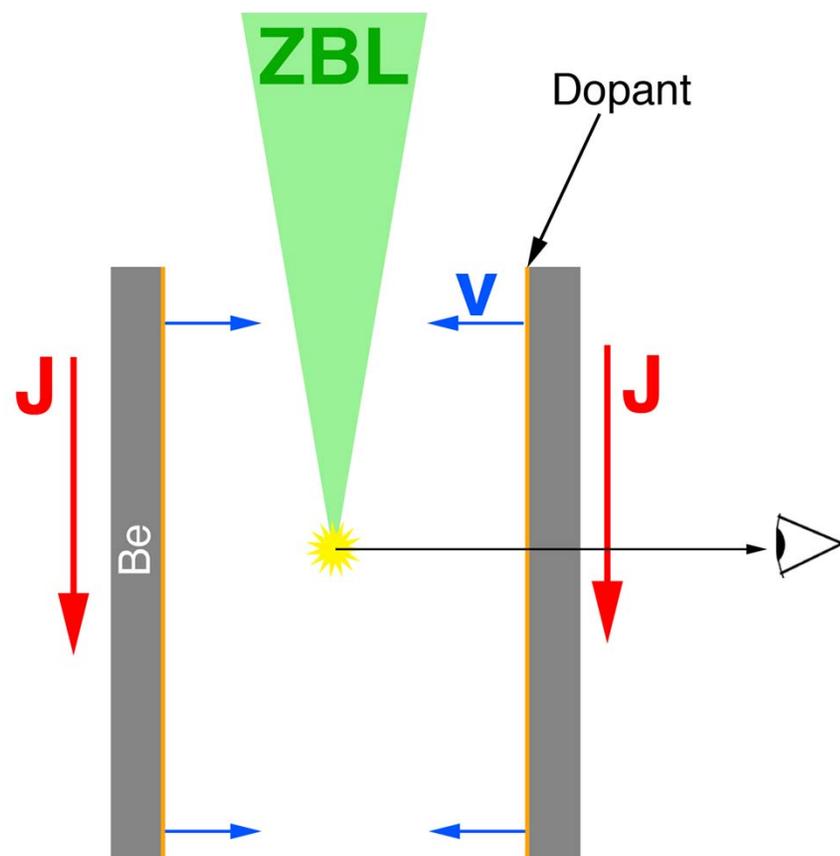
Some Outstanding Questions

- How much material stays out at large radius?
- What Conditions characterize this material?
- How much current is it carrying?
- What is the impact of the current distribution on the drive as seen by the fuel?

These questions *directly* address sources of significant uncertainty in design codes

- atomic physics
- treatment of low density material

Liner Surface/Interior Conditions



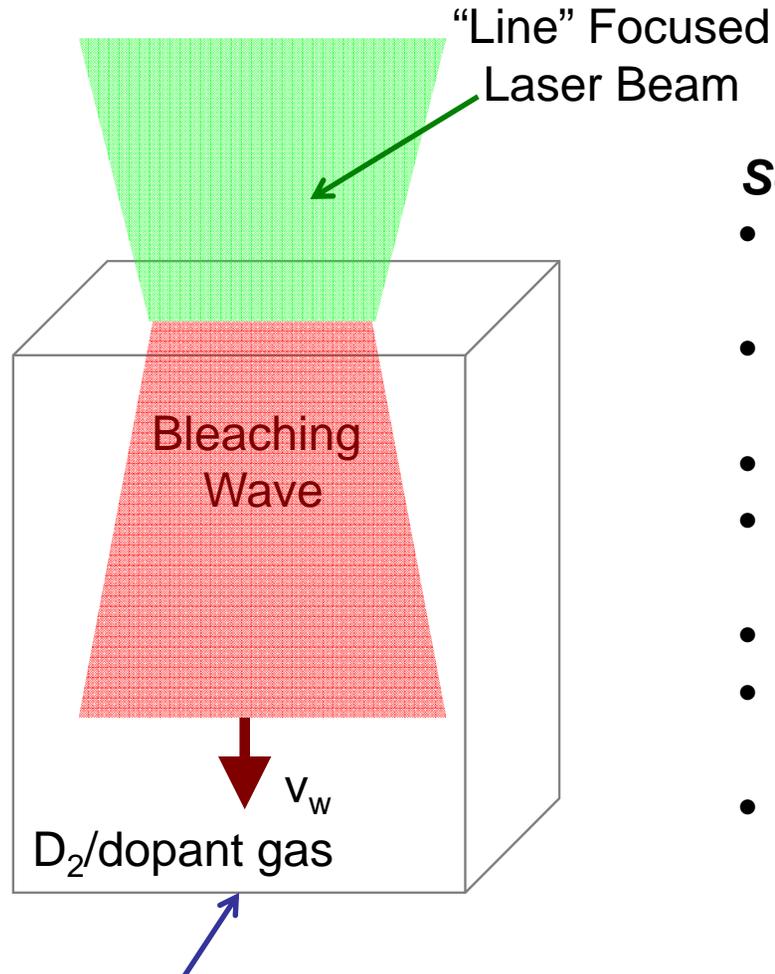
Some Outstanding Questions

- What are the conditions of the liner material in contact with the fuel?
- Does the inner surface ablate?
- How do liner conditions change axially due to MRT?
- How fast is the liner inner surface moving?

What can we measure?

- Temperature and Density vs. time and space
- Instantaneous Liner surface velocity (doppler shift)
- Observe change in state
 - K-edge, NES (solid, WDM)
 - Satellite Absorption (plasma)

Preheated Fuel Dynamics and Conditions



Some Outstanding Questions

- What do the T_e and ρ distributions look like OR How is the energy deposited
- How fast does the bleaching wave propagate?
- What are the ionization dynamics?
- How fast does the plasma equilibrate or redistribute
- How does B_z change these questions?
- Does the LEH window ablate and mix with the fuel?
- Does the cathode ablate and mix with the fuel?