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Measurement of Magnetic Flux Compression in Imploding Liners by Faraday Rotation in Tb Doped Optical Fibers

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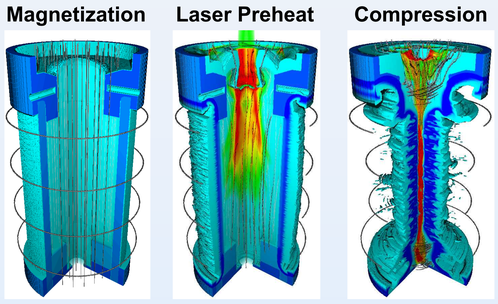
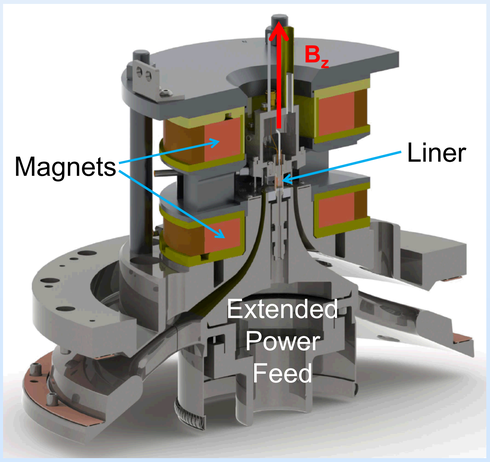
MagLIF Concept

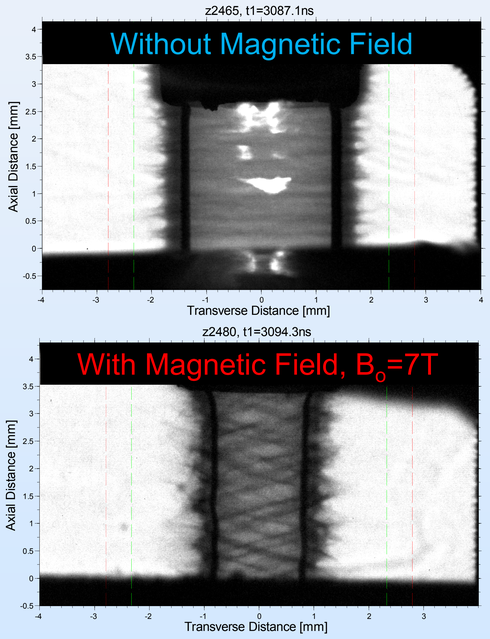
S. A. Slutz *et al.*, Phys. Plasmas **17**, 056303 (2010).

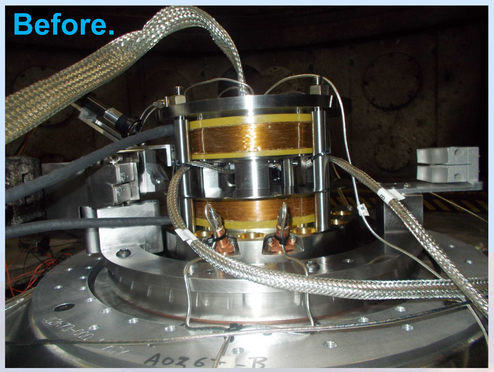




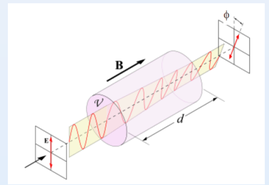
Question

How much magnetic flux remains inside the fuel during compression and how much diffuses into liner?





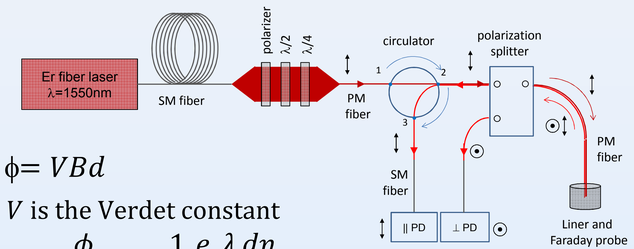
Measurement of the Faraday rotation angle utilizes a specialty Tb doped (65% wt.) fiber and COTS components from optical communication industry.

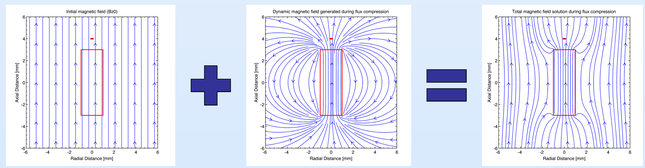


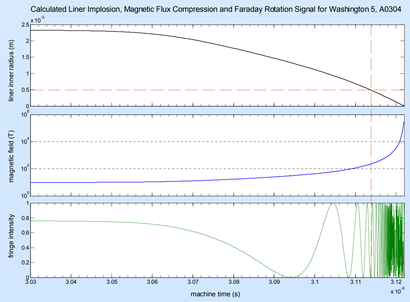
$$\phi = VBd$$

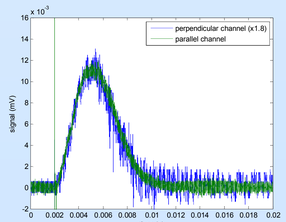
V is the Verdet constant

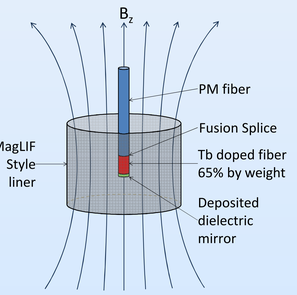
$$V = \frac{\phi}{Bd} = -\frac{1}{2}\frac{e}{m}\frac{\lambda}{c}\frac{dn}{d\lambda}$$

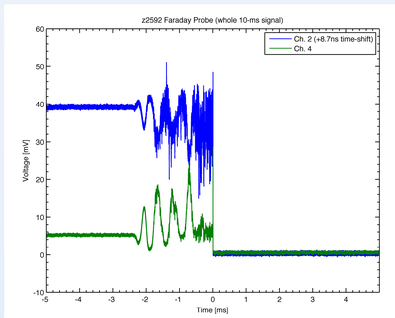


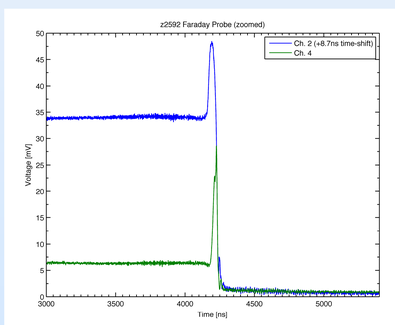




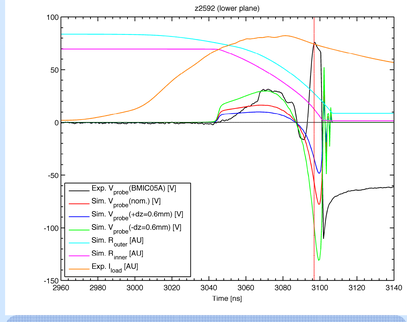








μ-Bdot Results



- One of four μ-Bdots (black curve), gave a good signal that agrees well with a simple simulation. Its differential-pair partner did not survive.
- The red vertical dashed line indicates the time when the liner hits the outer radius of the Faraday probe housing.

- Faraday probes can accurately measure seed magnetic fields, 3-18T.
- Machine vibration of the SM fibers causes polarization noise. Vibration isolate laser and use only PM fiber for the send fibers.
- The Tb fiber fusion splice is extremely fragile. We've broken several.
- Light emission from the converging liner is comparable to laser power. Use an optical add/drop module (FBG and circulator) to separate signal from liner emission.

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