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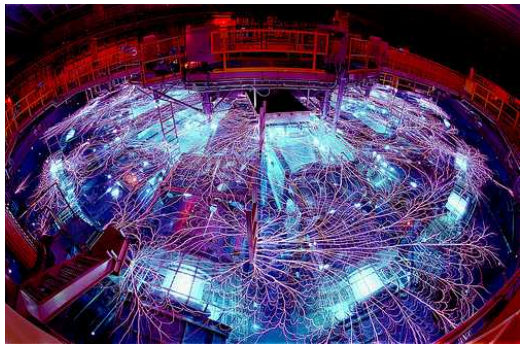

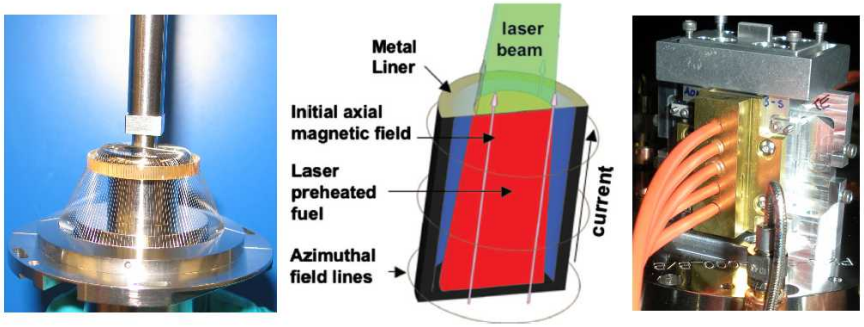

Preliminary results from the first integrated Magnetized Liner Inertial Fusion (MagLIF) experiments on the Z accelerator

M. R. Gomez, S. A. Slutz, A. B. Sefkow, A. J. Harvey-Thompson, T. J. Awe, M. E. Cuneo, M. Geissel, M. C. Herrmann, C. A. Jennings, D. C. Lamppa, M. R. Martin, R. D. McBride, D. C. Rovang, D. B. Sinars, I. C. Smith

U.S. DEPARTMENT OF ENERGY

NNSA Nuclear National Security Administration

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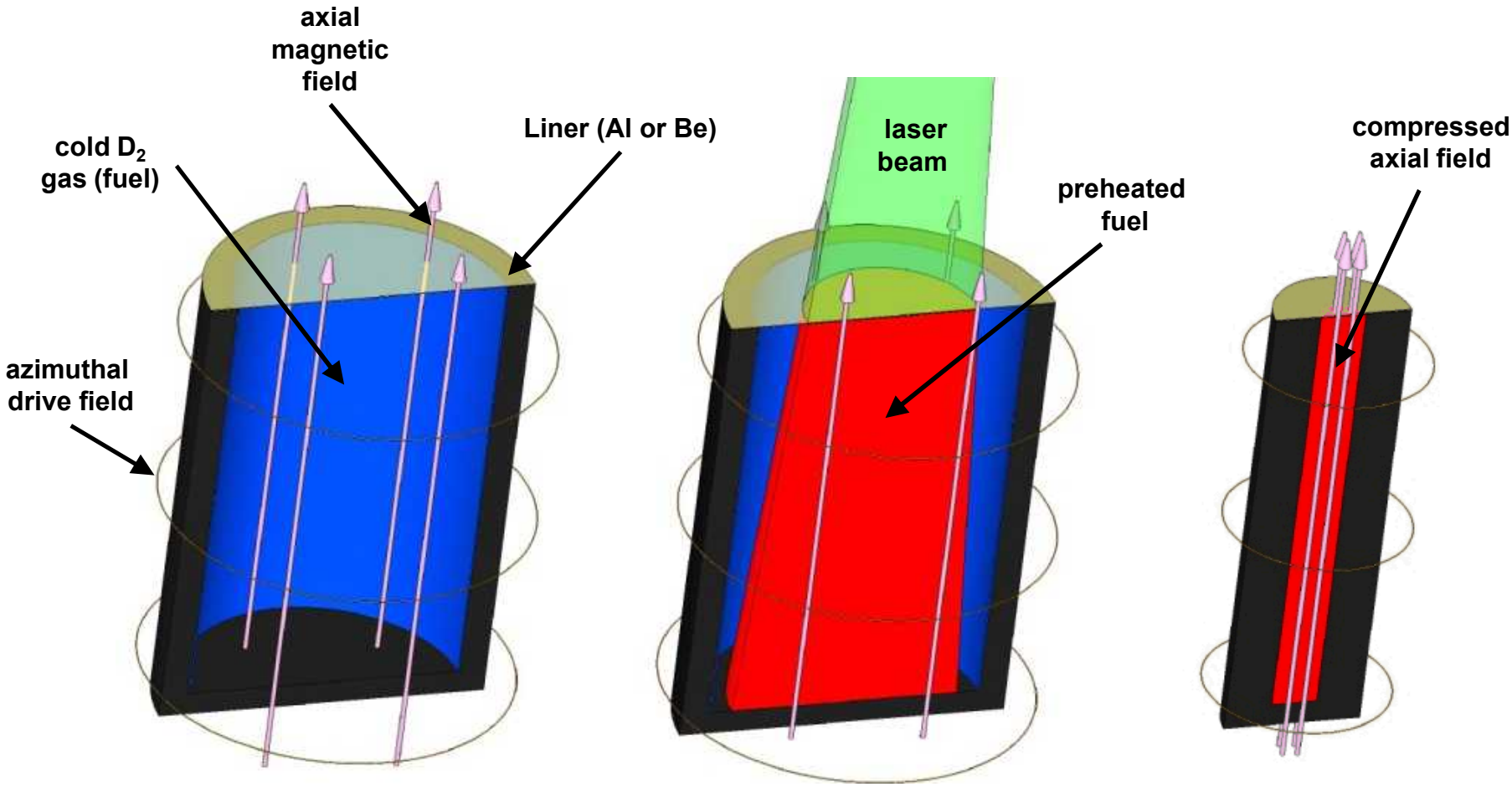
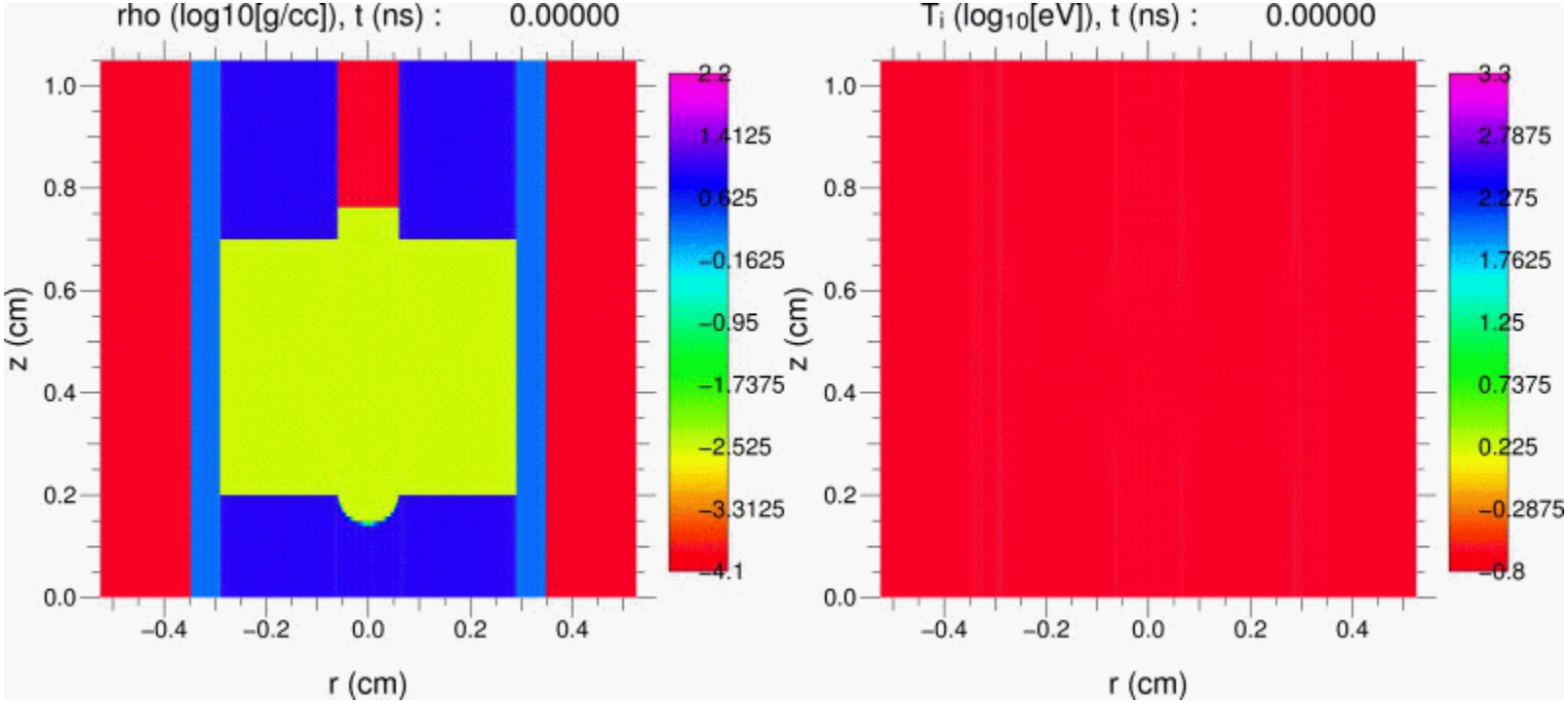
MagLIF is a magnetically-driven ICF concept presently being evaluated on the Z accelerator



S. A. Slutz, M. C. Herrmann, R. A. Vesey, A. B. Sefkow, D. B. Sinars, D. C. Rovang, K. J. Peterson, M. E. Cuneo, Phys. Plasmas **17**, 056303 (2010).

The MagLIF concept has been extensively studied analytically and through simulations



We have systematically tested components of the MagLIF concept over the last few years

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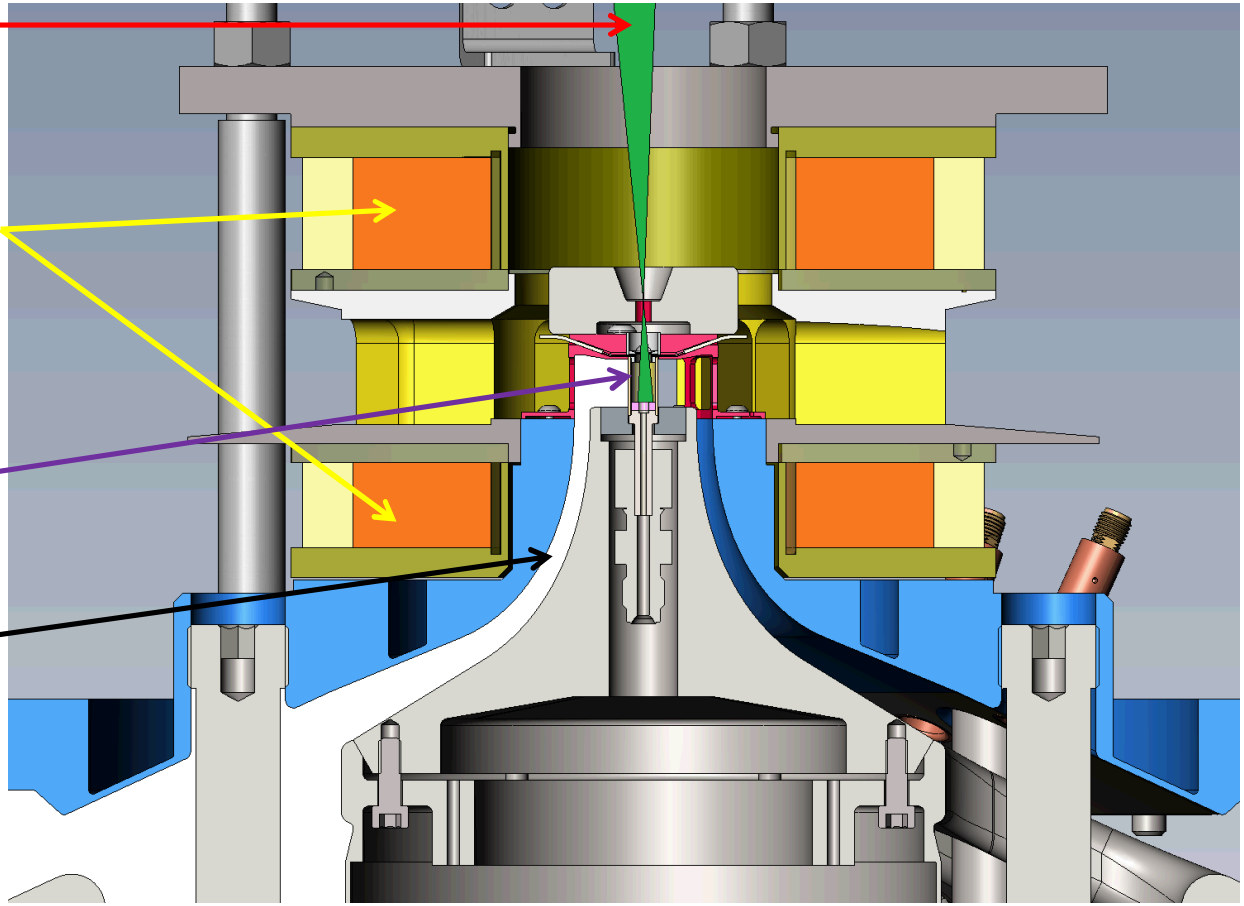
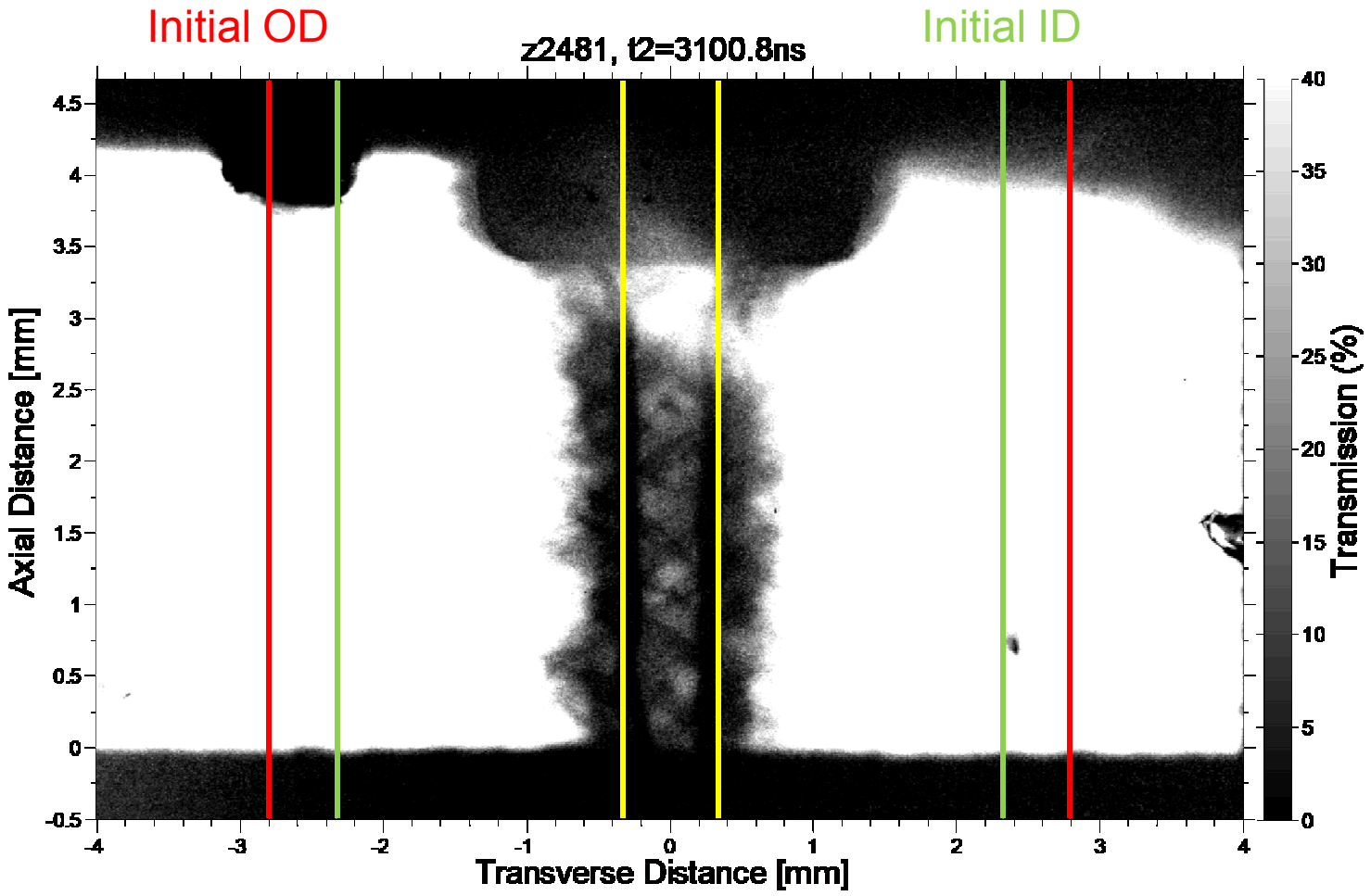
- Laser preheat
  - 8 laser only experiments
- Applied magnetic field
  - 8 Z shots
  - 6 laser only experiments
- Liner Stability
  - 30+ Z shots
- Modified power flow
  - Geometry scan to minimize losses
  - 15 Z shots



We demonstrated sufficient liner stability to a convergence ratio of 7 (goal is CR ~ 20)

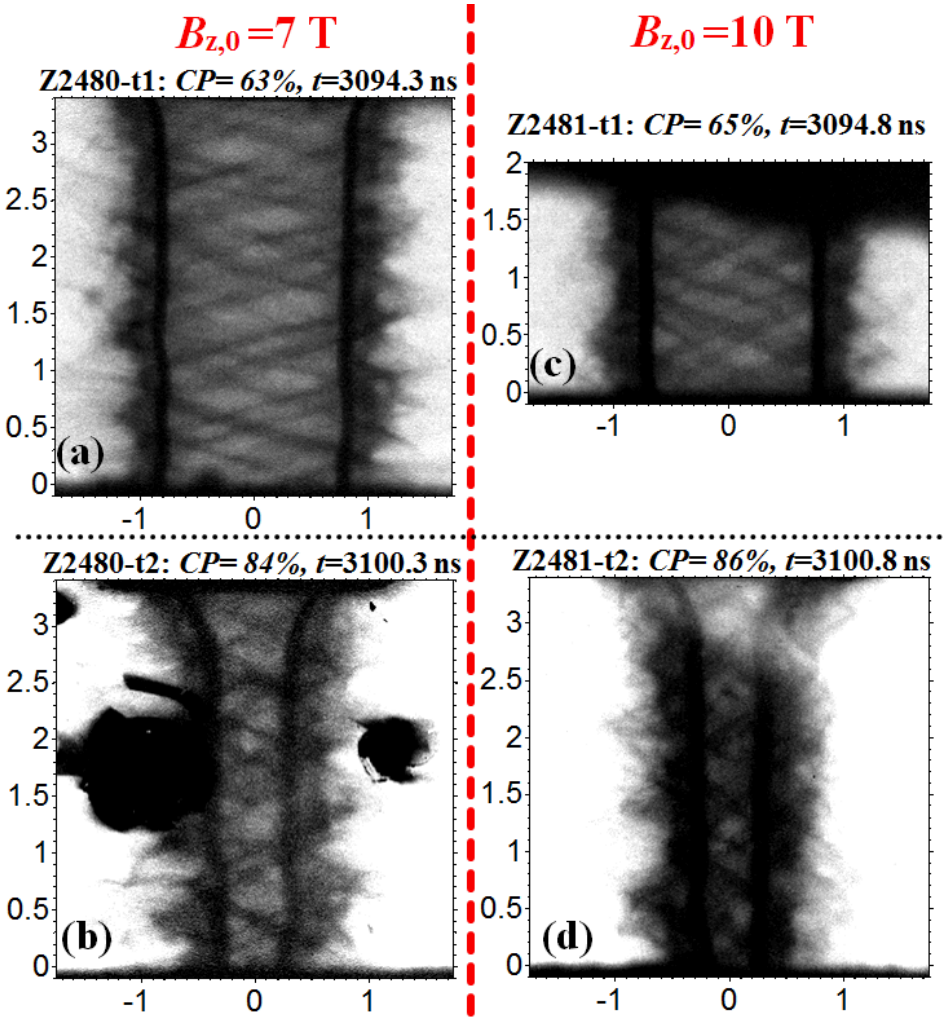


T. J. Awe et al. Phys. Rev. Lett. (accepted)

Applied B-field capability successfully demonstrated; may improve stability of liner

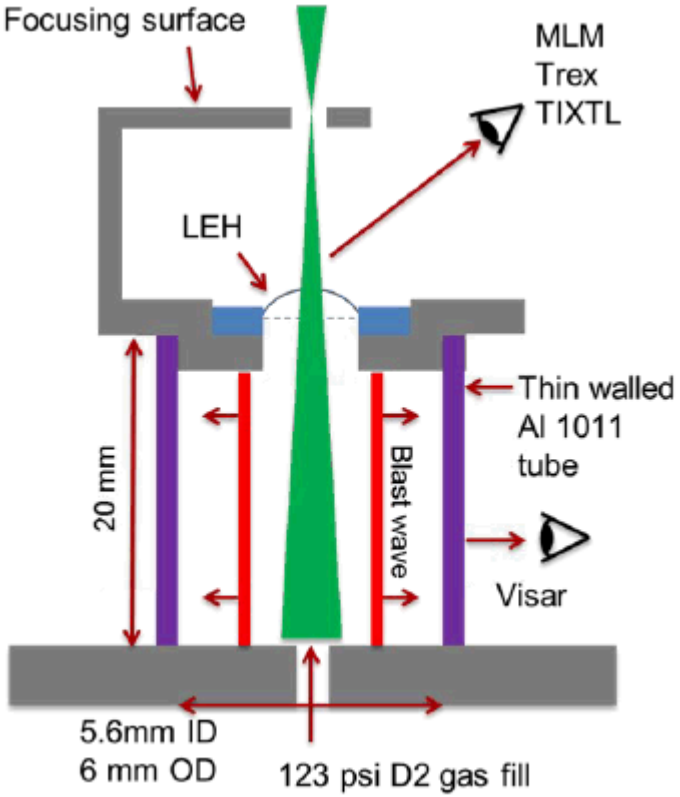
MRT growth normally yields azimuthally correlated structures, but in this case produces helical structures

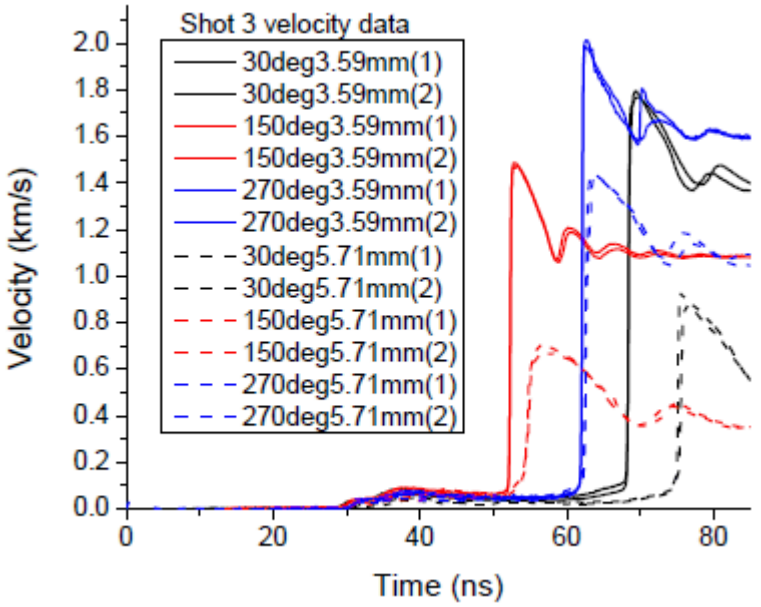
Cross hatch pattern is observed because MRT instabilities in front of and behind target are recorded in radiograph



T. J. Awe et al. Phys. Rev. Lett. (accepted)

Laser preheat experiments indicate that a significant fraction of laser is absorbed by fuel





Simulations indicate ~ 1 kJ absorbed by fuel to produce ~ 2 km/s velocities

Successful testing of all subsystems indicates the integrated experiments will be successful

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- Experiments in February 2013 utilized D2 fuel, applied B-field, and Z drive current (no laser preheat)
  - DD yield 5-8e9
- Simultaneous engineering tests of all components were conducted in August/September 2013
  - Commissioned new vacuum final optics assembly
  - Discovered issue with laser alignment technique
  - Discovered issue related to communication between systems
  - Resolved issues and confirmed resolution on subsequent Z experiments
- First integrated MagLIF experiments to be conducted November 21-26, 2013

Parameters for the initial experiments are not ideal, but expected yields are > 10^{10} DD

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- Initial experiments:
  - Load current: 16-20 MA
  - Applied B field: 10 T
  - Laser preheat: 1-2 kJ
  - Fuel: D_2 at 1.5 mg/cc
- Expected improvements in FY 14/15
  - Load current: >25 MA — 2-4 x
  - Applied B field: 30 T — 2-3 x
  - Laser preheat: 6-8 kJ — 4-8 x
  - Potential improvement — 1-2 orders of magnitude
- DT fuel eventually possible — 2 orders of magnitude

Focused experiments will be conducted in parallel with integrated MagLIF experiments

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- Upcoming measurements include:
  - Integrated experiments
    - Q4 CY13, Q1-4 CY14
  - Magnetic flux compression
    - Q4 CY13, Q2 CY14
  - Helical perturbation
    - Q1 CY14
  - Deceleration MRT
    - Q1 and Q3 CY14
  - Electro-thermal instability suppression
    - Q1 CY14
  - Laser preheat
    - ZBL experiments Q1 and 3 CY14
    - Omega experiments Q2 and 4 CY14

For more details about a specific topic, please see the following MagLIF related talks at this conference

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- Additional MagLIF talks in this session
  - Steve Slutz Monday 10:42
  - Ryan McBride Monday 10:54
  - Matt Weis Monday 11:30
- 2D and 3D simulations of integrated experiments (invited)
  - Adam Sefkow Monday 2:00
- Experimental helical instability measurements (invited)
  - Tom Awe Monday 2:30
- Experimental magnetic field measurements at the load
  - Stephanie Hansen Thursday 9:30
- Experiments and simulations on ETI mitigation
  - Kyle Peterson Friday 10:06