Developing magnetic platforms for basic HED Science

- Tens of megagauss fields are needed to magnetize electrons at typical ICF parameters
- It can be created by compression of a seed field
- If compression is faster than magnetic diffusion, magnetic flux is conserved

Magnetization of plasma electrons inhibits heat-conduction losses
The seed B field is created by a compact, self-contained magnetic field generator

- MIFEDS—Magnetized Inertial Fusion Electrical Discharge System
- Various coils were tested
- Seed fields up to 150 kG can be obtained (depends on the coil size and geometry)

MIFEDS is installed in an OMEGA Diagnostic Inserter
Compressed magnetic fields up to 30 MG were inferred in cylindrical implosions using proton deflectometry.

Field compression of ~ 550 has been achieved. Agrees with flux conservation.

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* A. D. Sakharov, Sov. Phys. Usp. 9, 294 (1966)
Single-coil B field was used for fusion-enhancement measurements in spherical geometry

- Single-coil provides stronger seed fields (80 kG), less interference with laser beam
- 40 beams (18 kJ/1 ns) were used for compression
- Implosion uniformity is diagnosed using x-ray BL radiography
- nTOF diagnostic was used for Ti and neutron-yield measurements
The fusion enhancement is thought to be limited by the open-field line geometry

- Ratio of open field-lines area to target-surface area ~1/2, so less than 50% of conduction losses is reduced
- Challenge: create closed-flux surfaces inside the shell

- Could be done (for example) by driving current through the target
Closed magnetic field lines can be created by driving current through the target

$I = 10 \text{ kA}$
$B = 10 \text{ T (at } r = 200 \text{ } \mu\text{m)}$