

generalfusion

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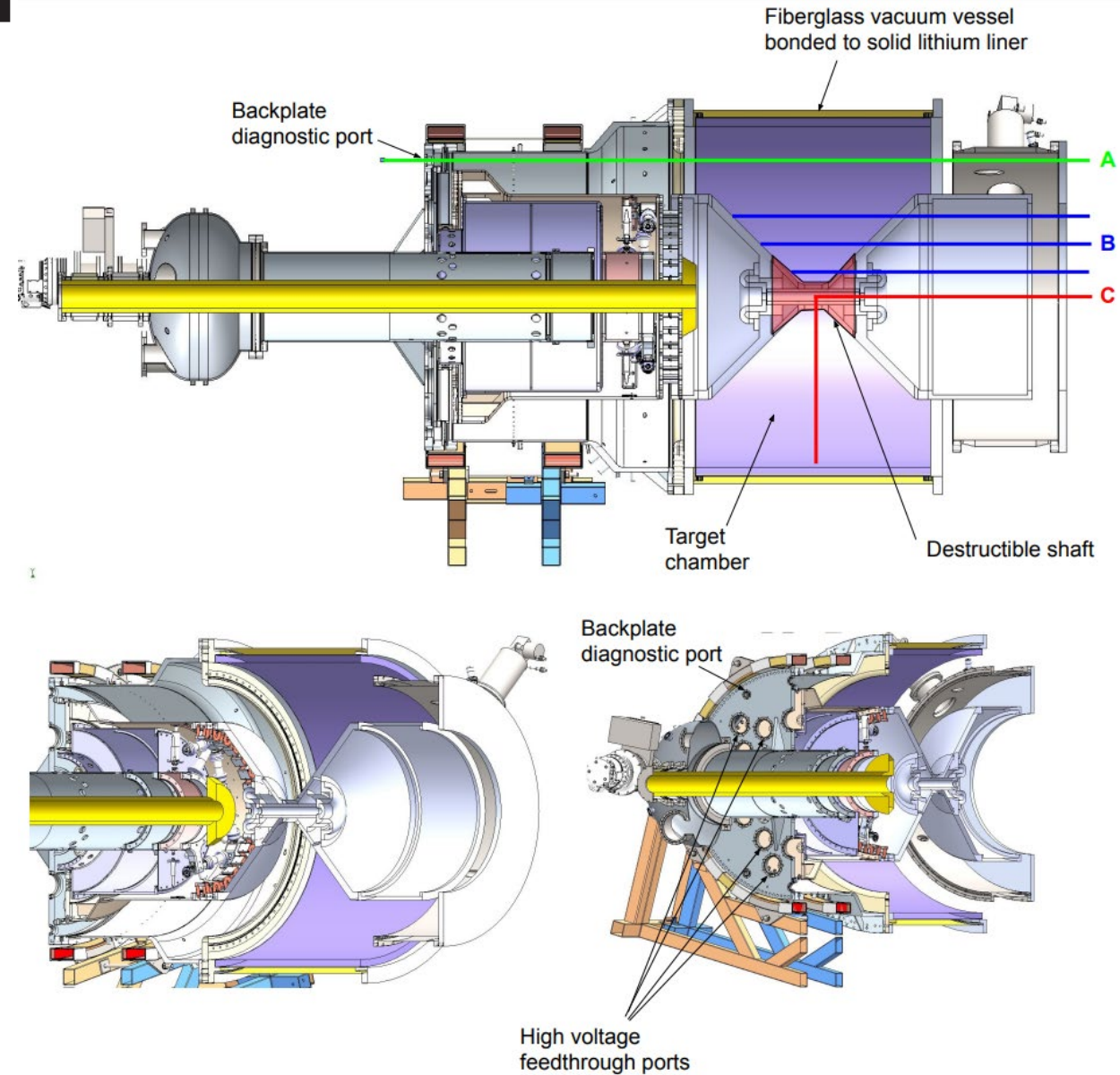
# General Fusion Diagnostics

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# Magnetized Target Fusion at GF

## LM26 experiment:

- Marshall Gun forms magnetized plasma and pushes it into 1 m radius target chamber lined with solid Li
- Magnet coils around target chamber are pulsed and push solid Li liner, which collapses on plasma
- 10:1 radial compression in 3 ms
- Temperature: 300 eV  $\rightarrow$  10 keV
- Density:  $5 \times 10^{19} \text{ m}^{-3} \rightarrow 10^{23} \text{ m}^{-3}$
- B-field: 1 T  $\rightarrow$  100 T



**Typical plasma parameters of interest:**

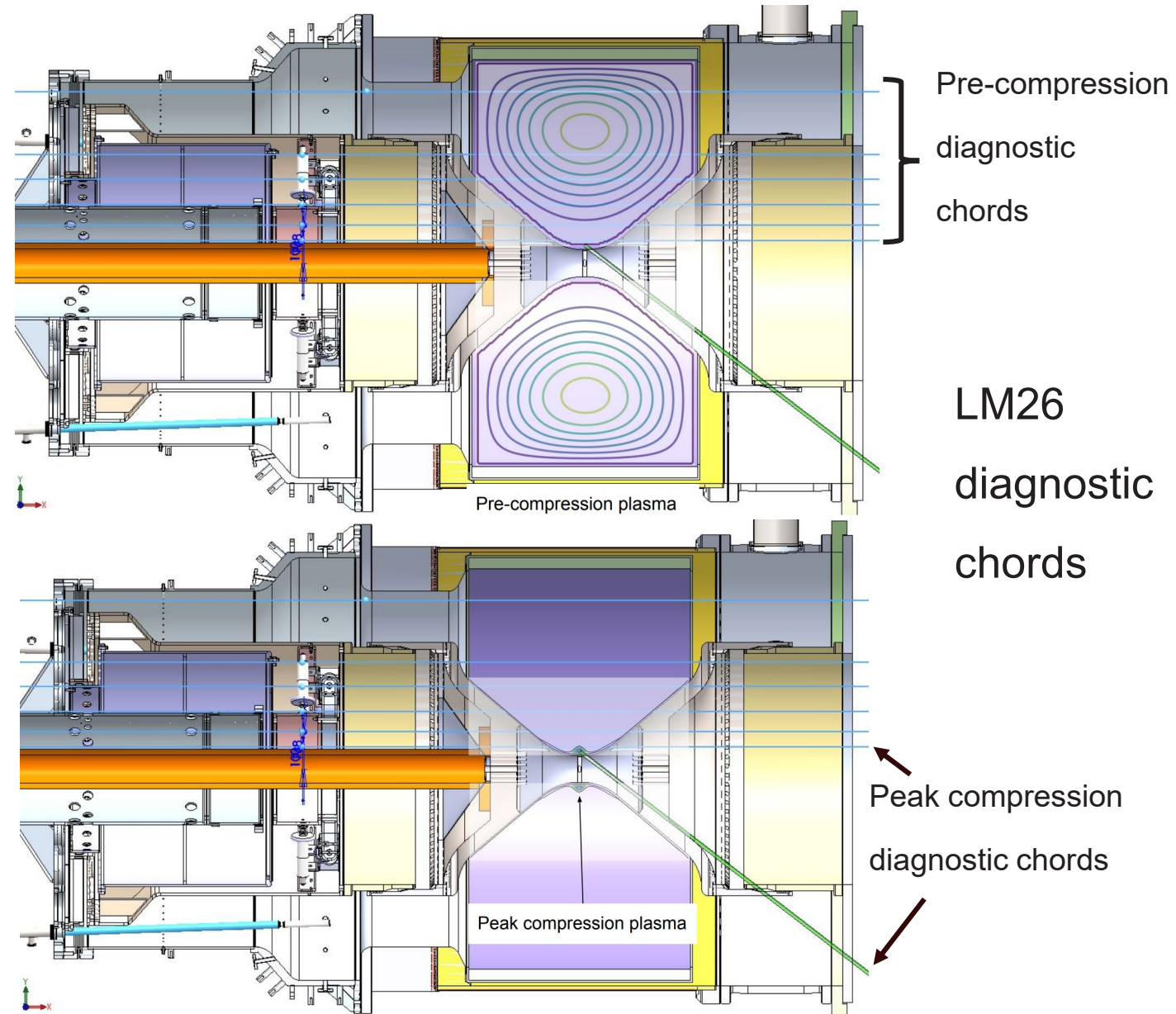
- Density
- Temperature
- Energy confinement time
  - Ohmic power (requires good understanding of magnetics)
  - Thermal energy

**Diagnostics at GF in use or planned:**

- Surface Mirnov (magnetic) probes
- Thomson scattering (ne, Te)
- Interferometer (ne)
- Polarimeter (internal magnetic field)
- Spectroscopy visible/UV and X-ray (Ti, fluid velocity, Zeff, impurity identification)
- Pulse height analyzers (Te)
- Filtered soft X-ray AXUV detectors (Te)
- Bolometer (radiated power): foil, unfiltered AXUV
- Scintillators (neutron yield, Ti)
- Neutron spectrometer (Ti)
- High speed cameras
- Wall diagnostics

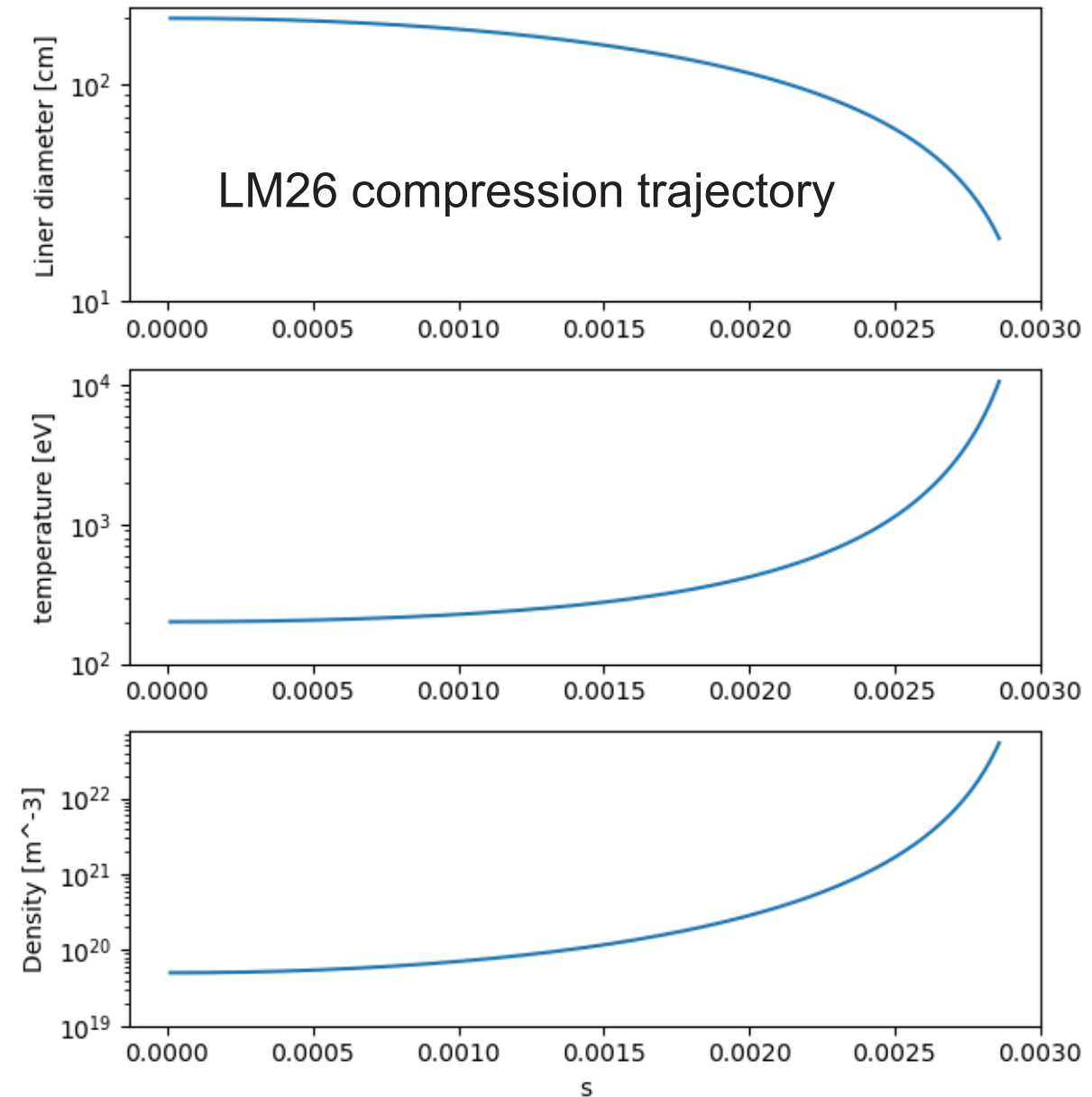
# Diagnostic Challenges

- Poor access to plasma especially at peak compression



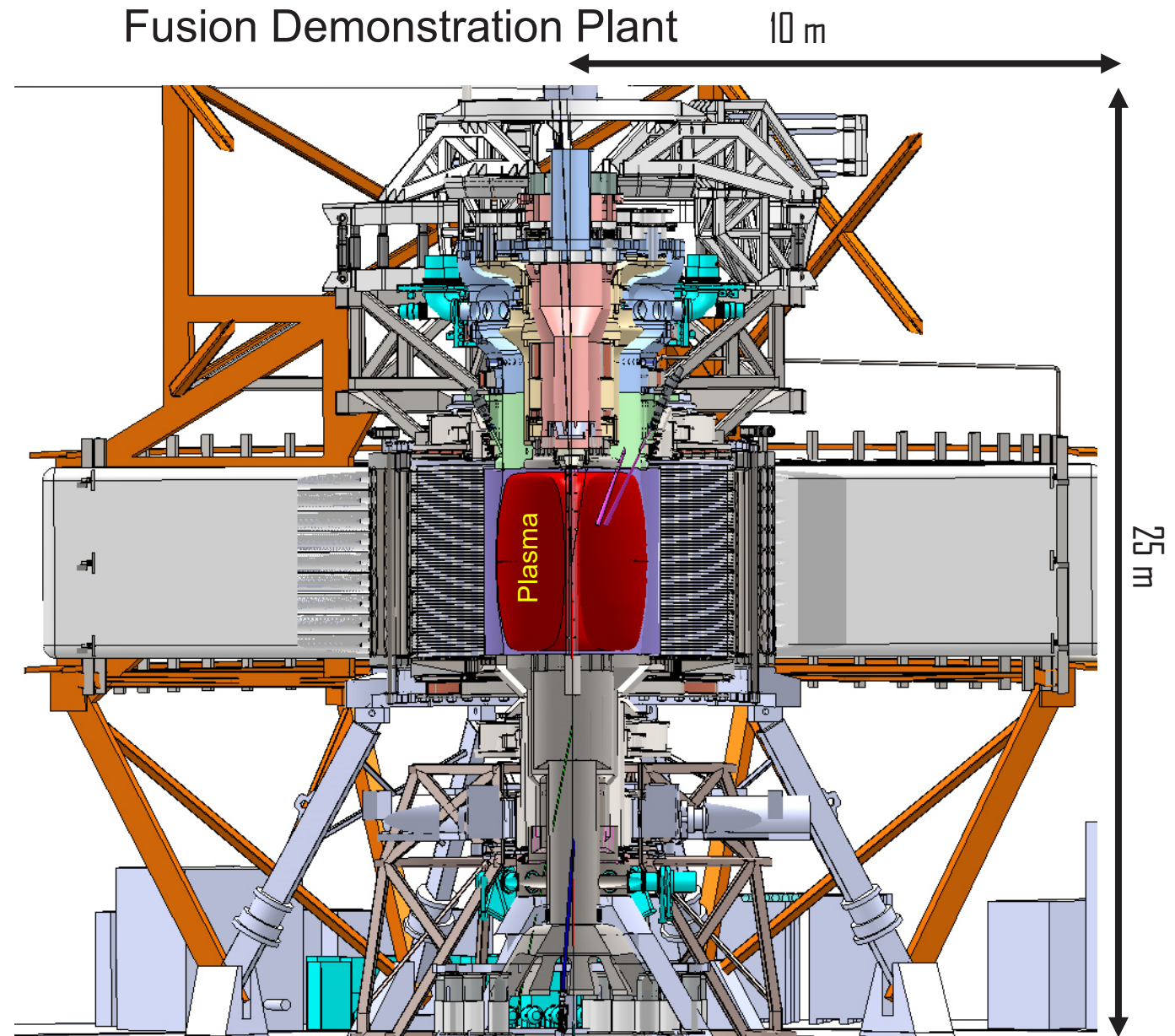
# Diagnostic Challenges

- Poor access to plasma especially at peak compression
- **Temperature, density changing rapidly near peak compression. Need diagnostics with  $\sim 5\mu\text{s}$  time resolution.**



# Diagnostic Challenges

- Poor access to plasma especially at peak compression
- Temperature, density changing rapidly near peak compression. Need diagnostics with  $\sim 5\mu\text{s}$  time resolution.
- **Diagnostic protection:**
  - Li coating of diagnostics
  - **Survivability in high temperature environment**  
**200C+ nominal, 500C transient**
  - **Protection from Li jets, shocks, vibration**



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