MAGNETIZED TARGET FUSION AT GENERAL FUSION

Michel Laberge – SOFE 2017

generalfusion


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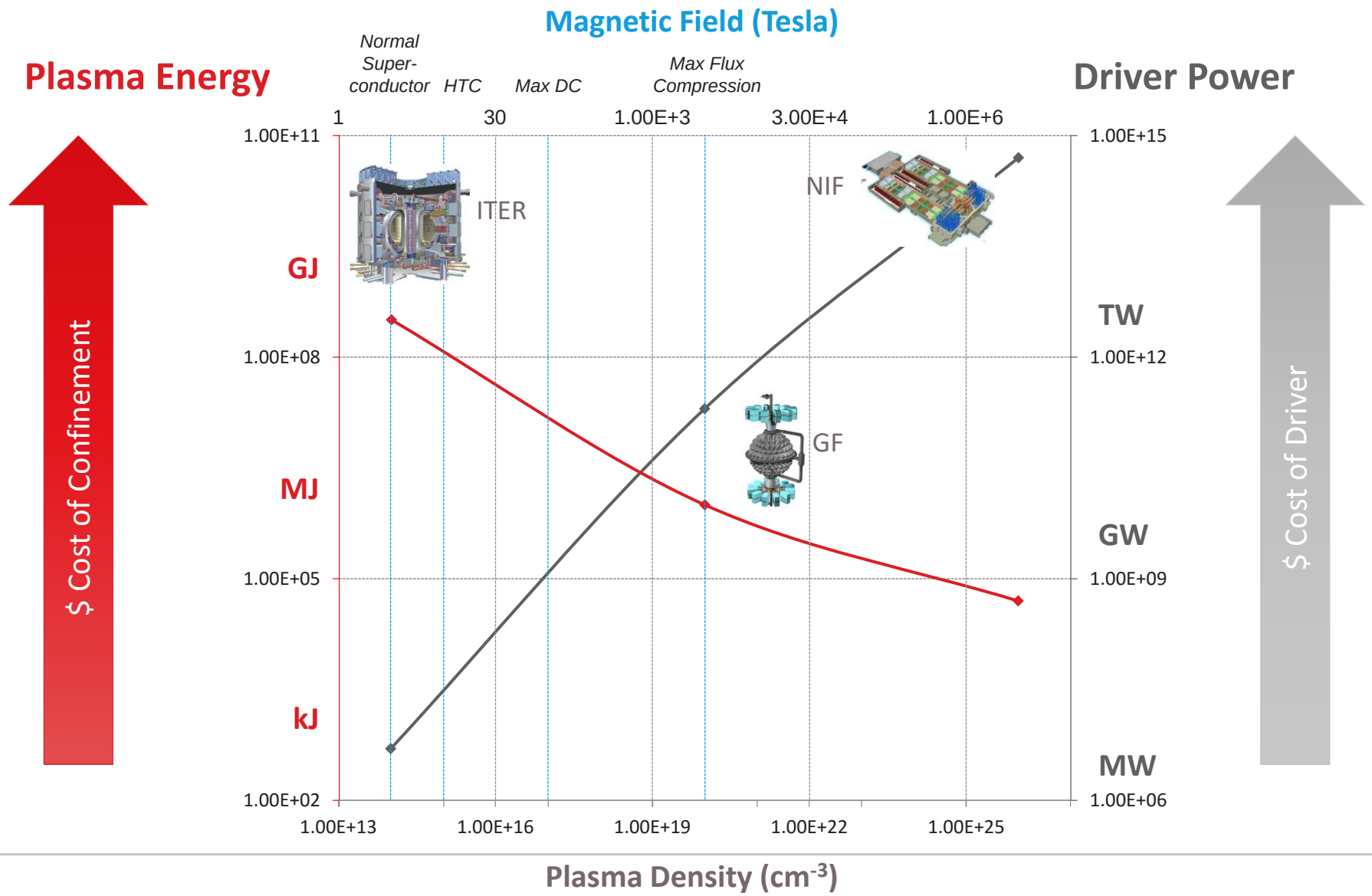
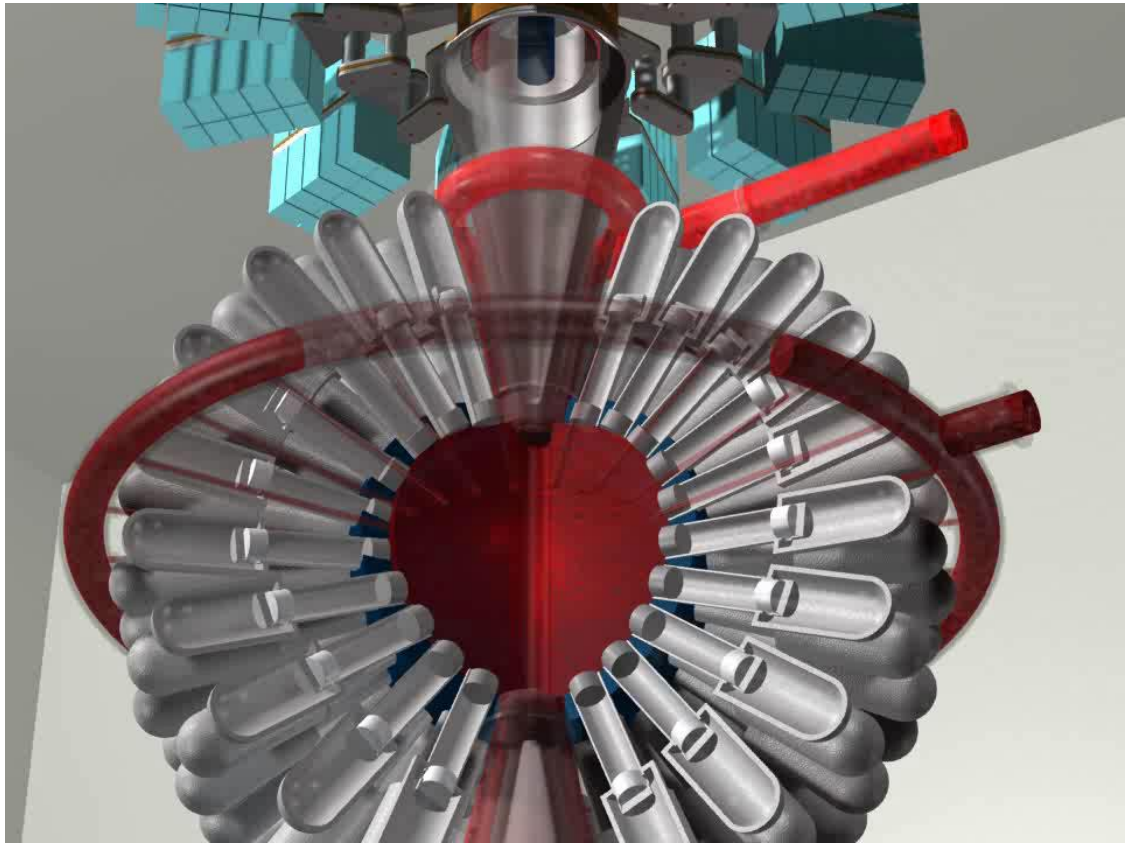
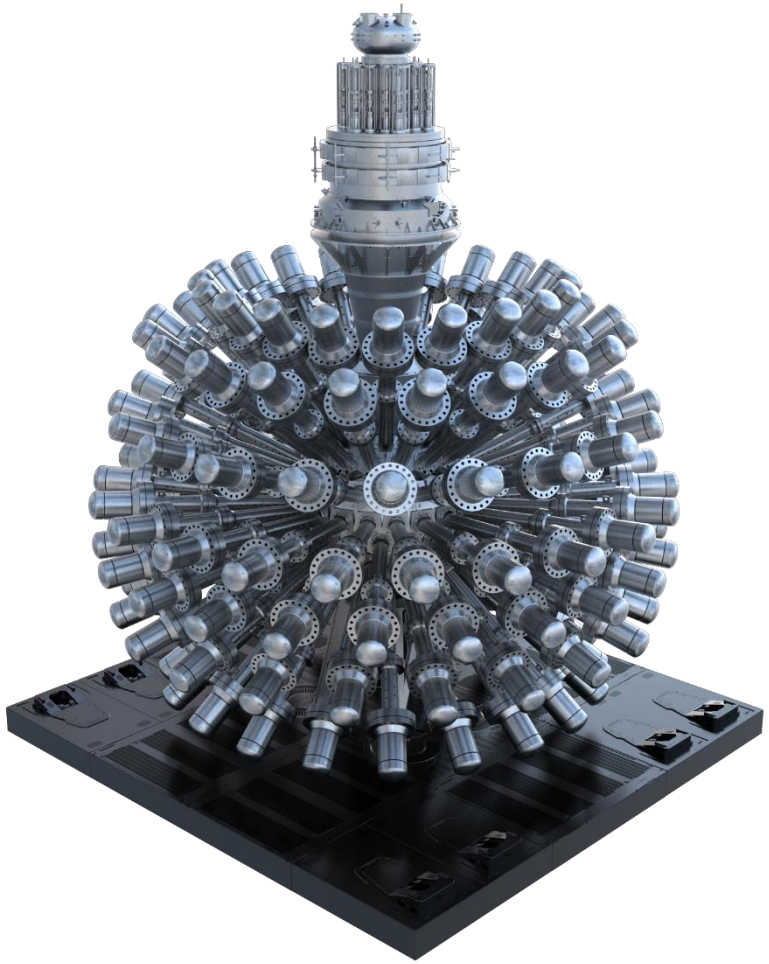
Fusion Technology Comparison

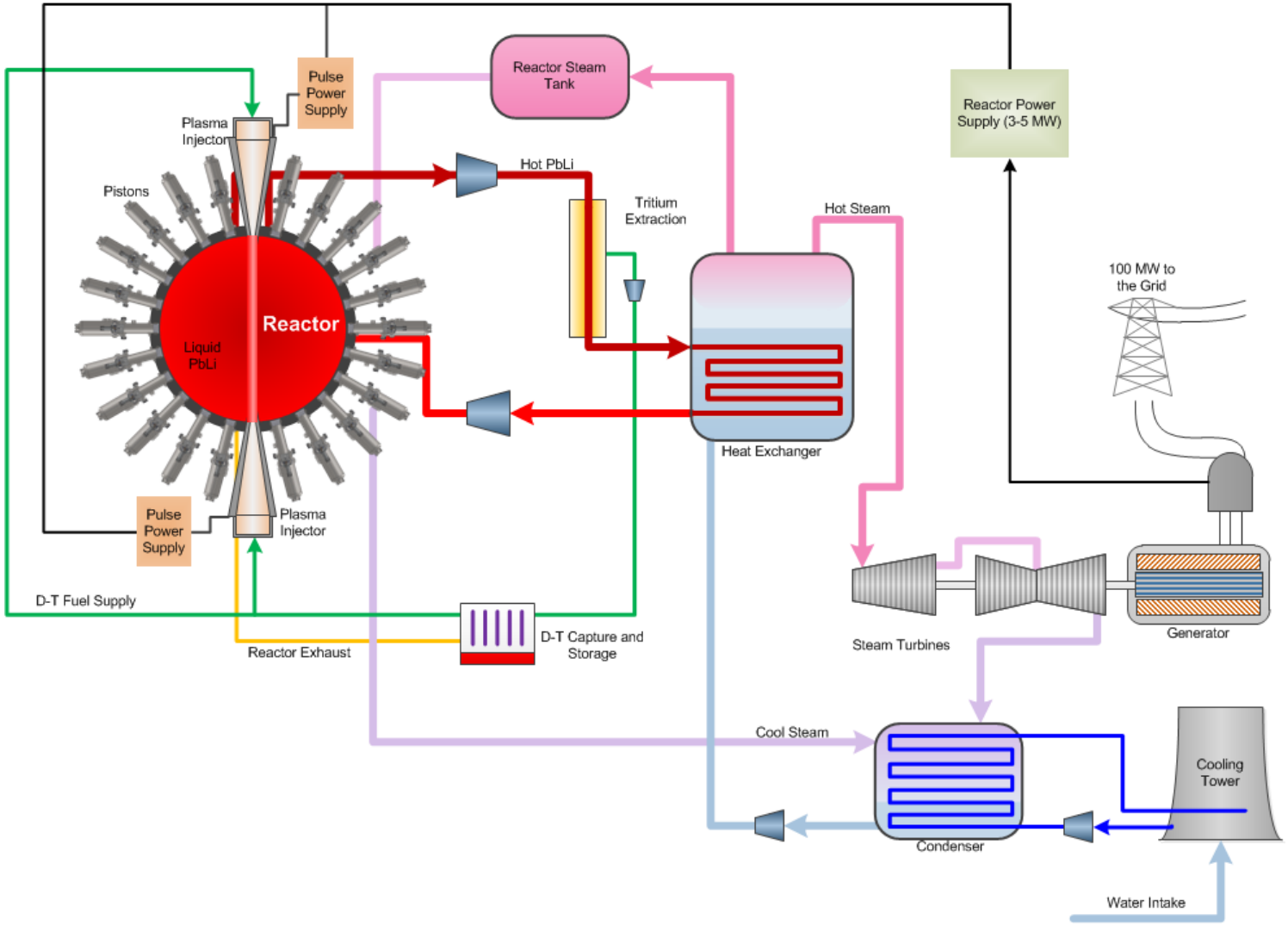


General Fusion’s Acoustically Driven MTF





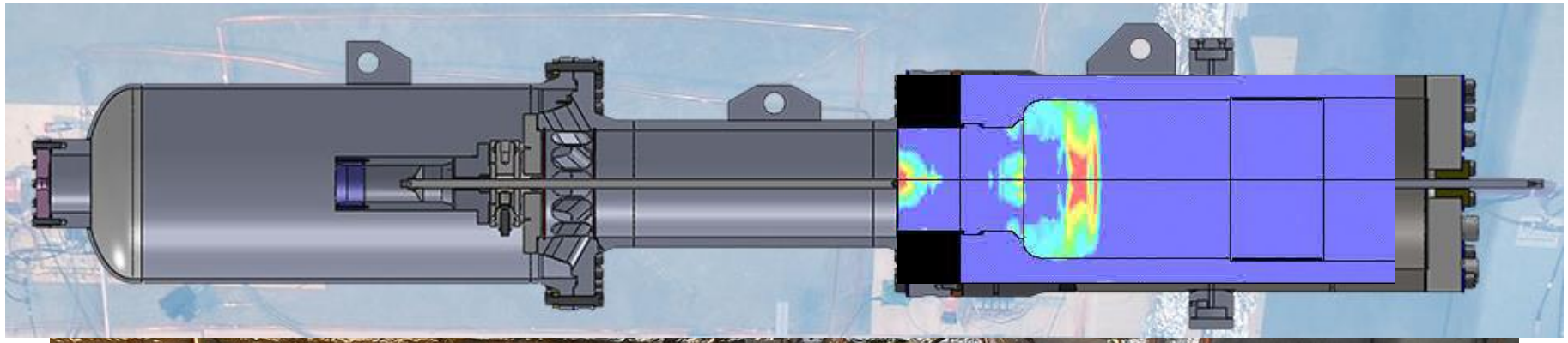
Power Plant Schematic

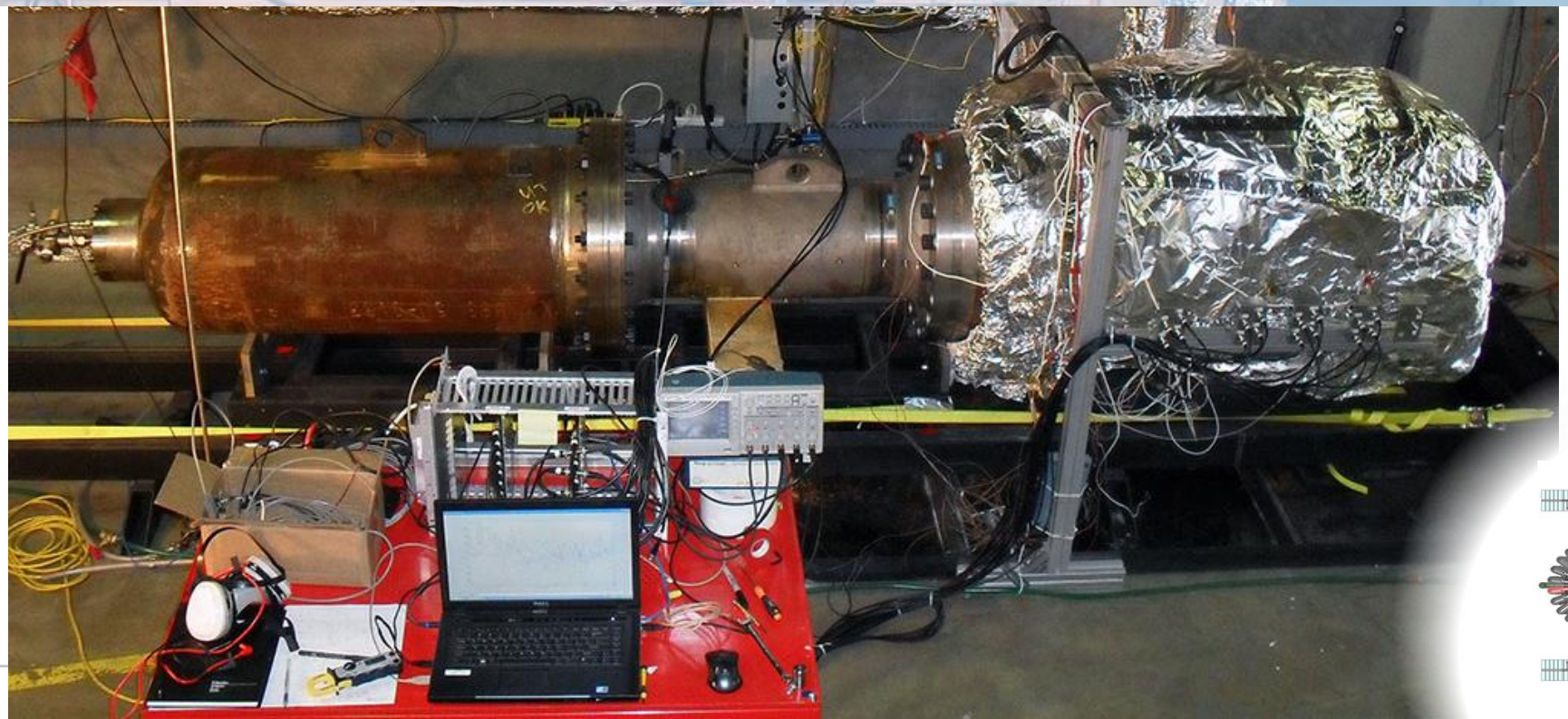


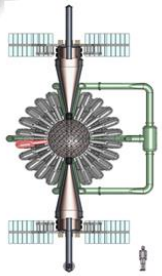
Advantages of MTF

- Less confinement required then MF
- Bohm good enough
- Slower compression (ms vs ns) than ICF
- Less compression ratio (7 vs 40) than ICF
- Rotation stabilized RT instability
- No target destroyed, cost effective
- 4 pi coverage 1.5 m PbLi
- Tritium breeding ratio 1.6 with natural Li
- 10^{-5} high energy neutrons at the metal wall
- Low DPA, long life reactor walls
- Natural way to move the heat out with the liquid PbLi
- Low cost gas driver from the thermal cycle gas

Acoustic Driver

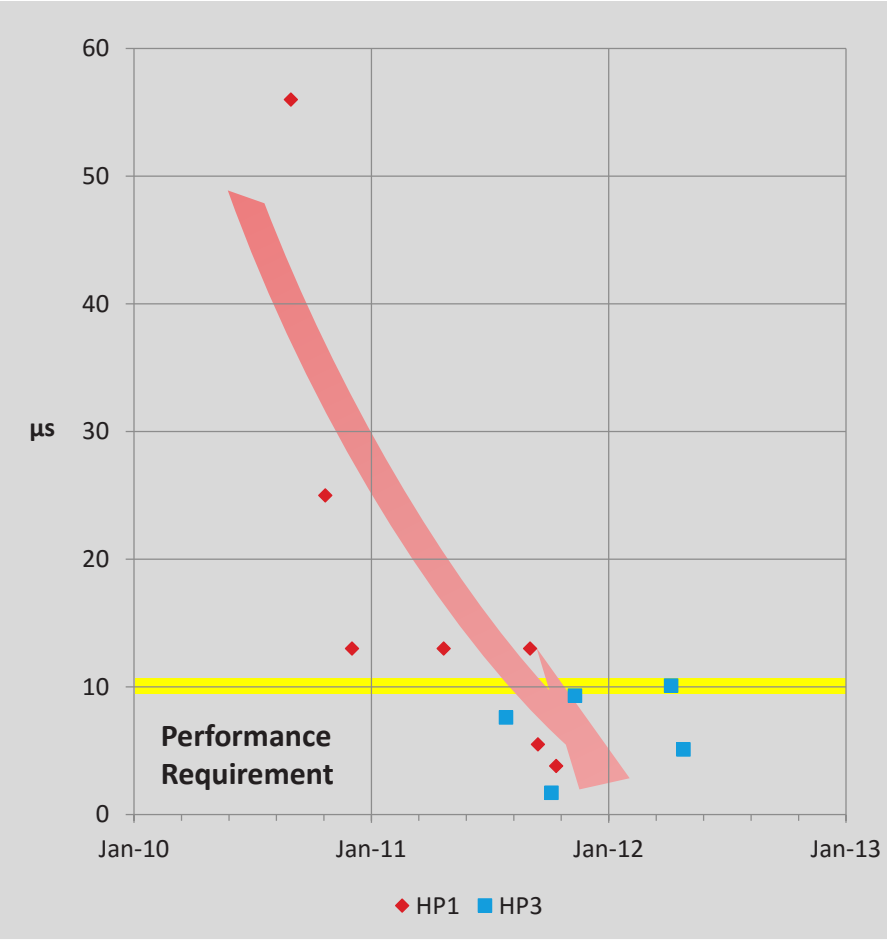




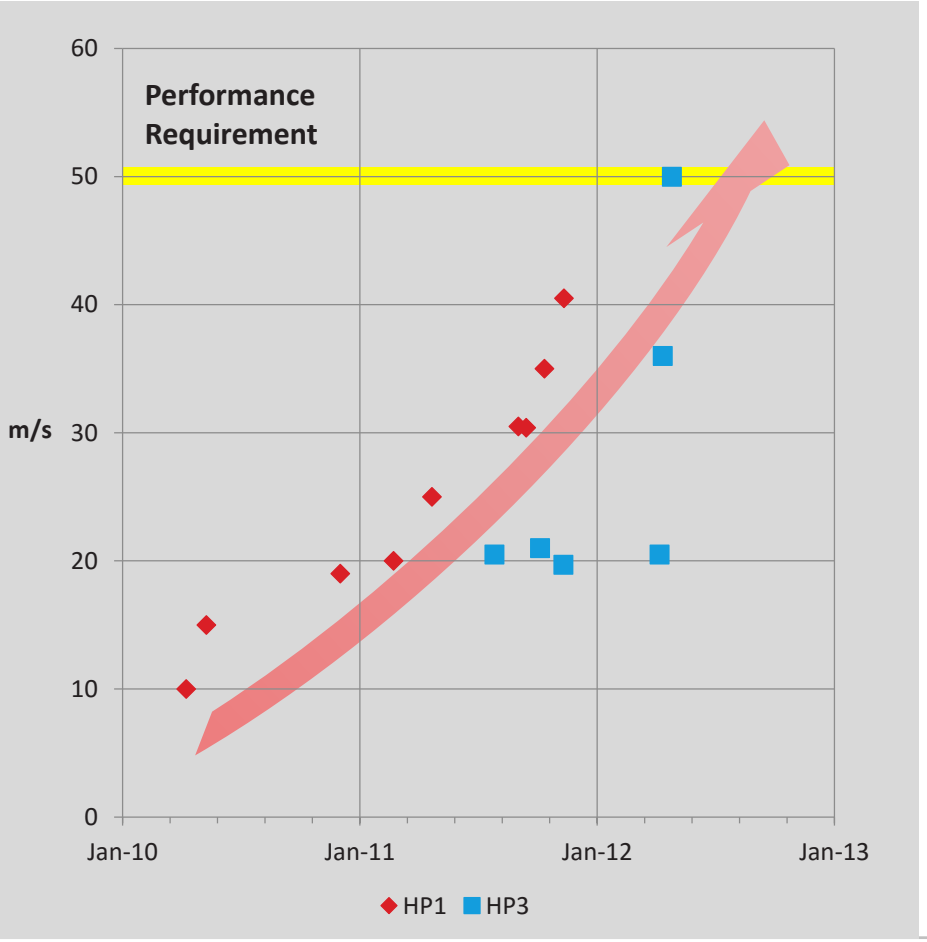


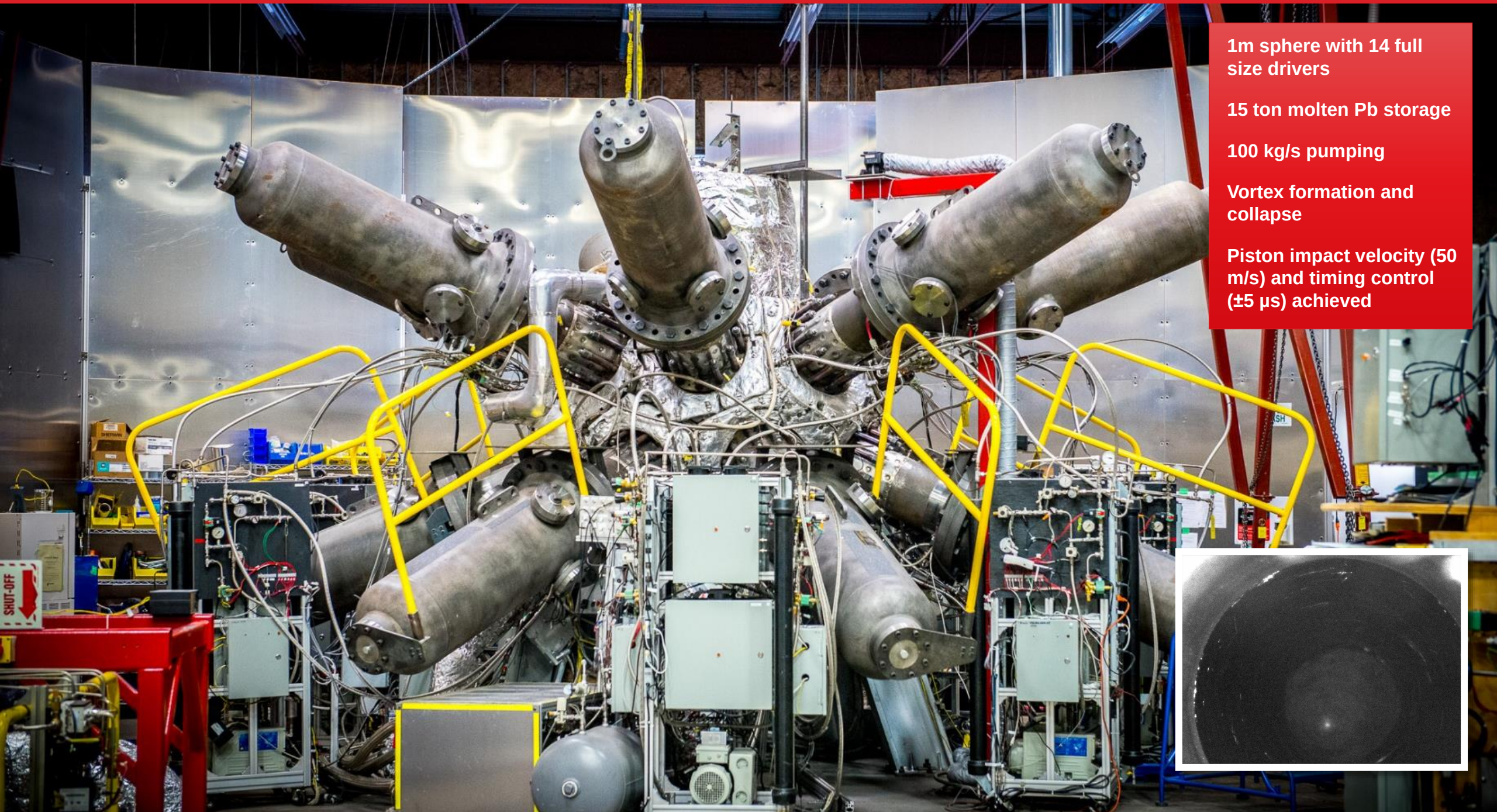
Acoustic Driver Milestones Met

Piston Impact Timing Control (5 sequential shots)



Piston Impact Velocity





1m sphere with 14 full size drivers

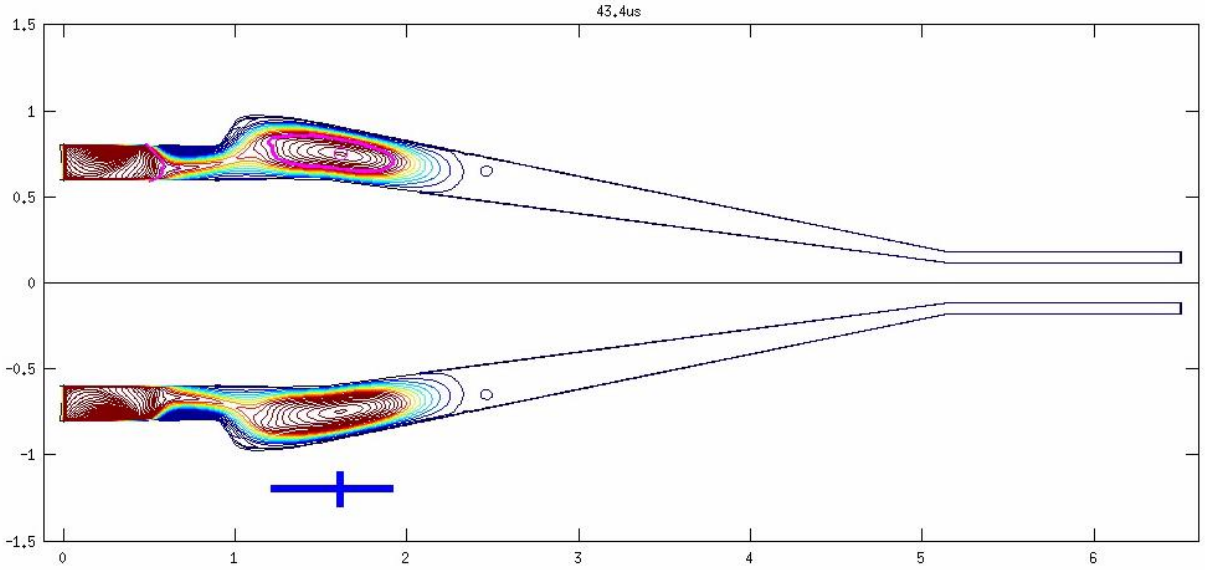
15 ton molten Pb storage

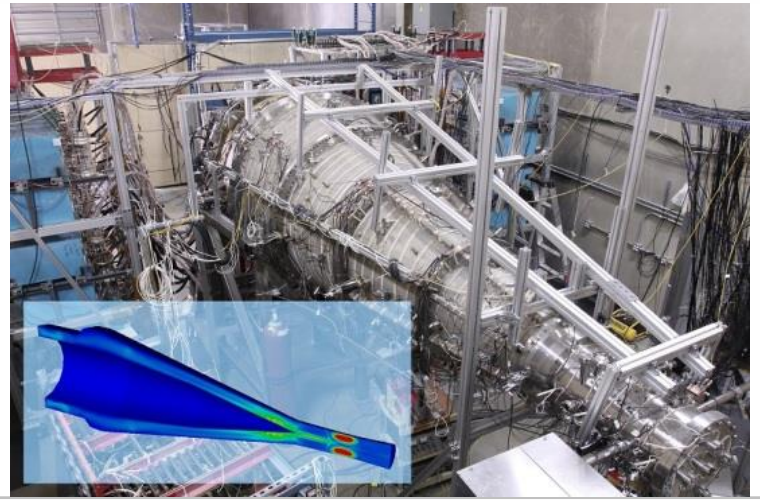
100 kg/s pumping

Vortex formation and collapse

Piston impact velocity (50 m/s) and timing control (±5 μs) achieved

Plasma Injector Simulation





Large Plasma Injector

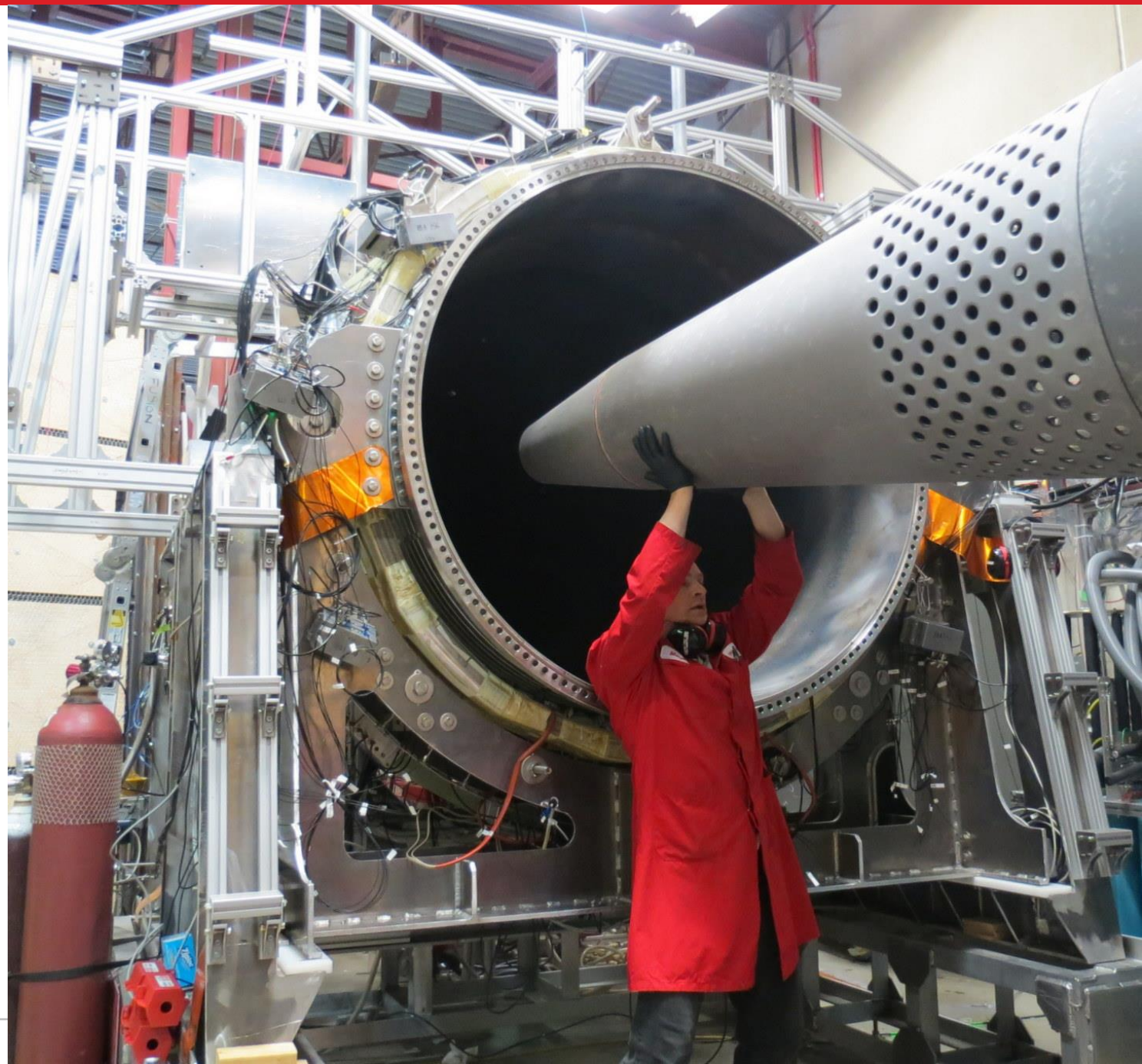
5×10^{16} cm^{-3}

300 eV

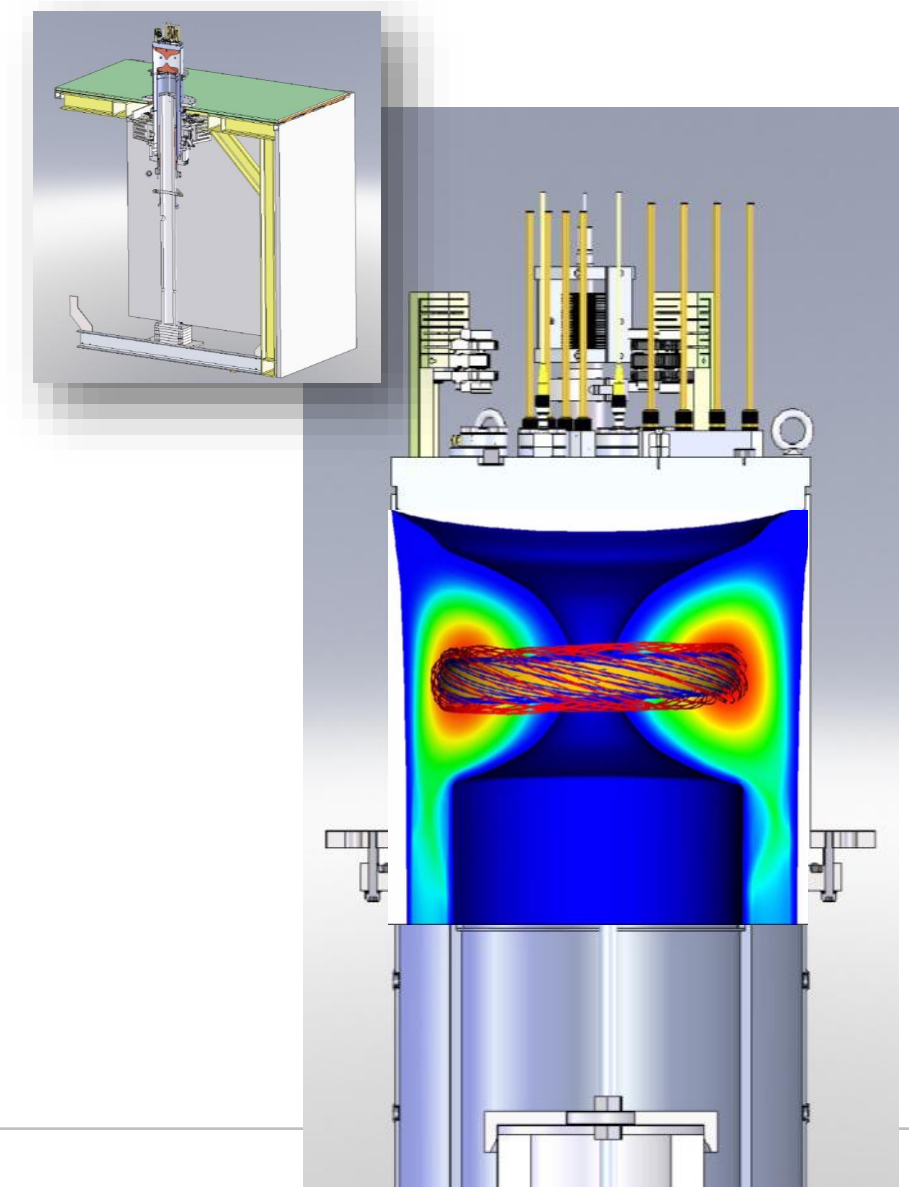
20 µs

3 T

Accelerator current damages plasma magnetic structure



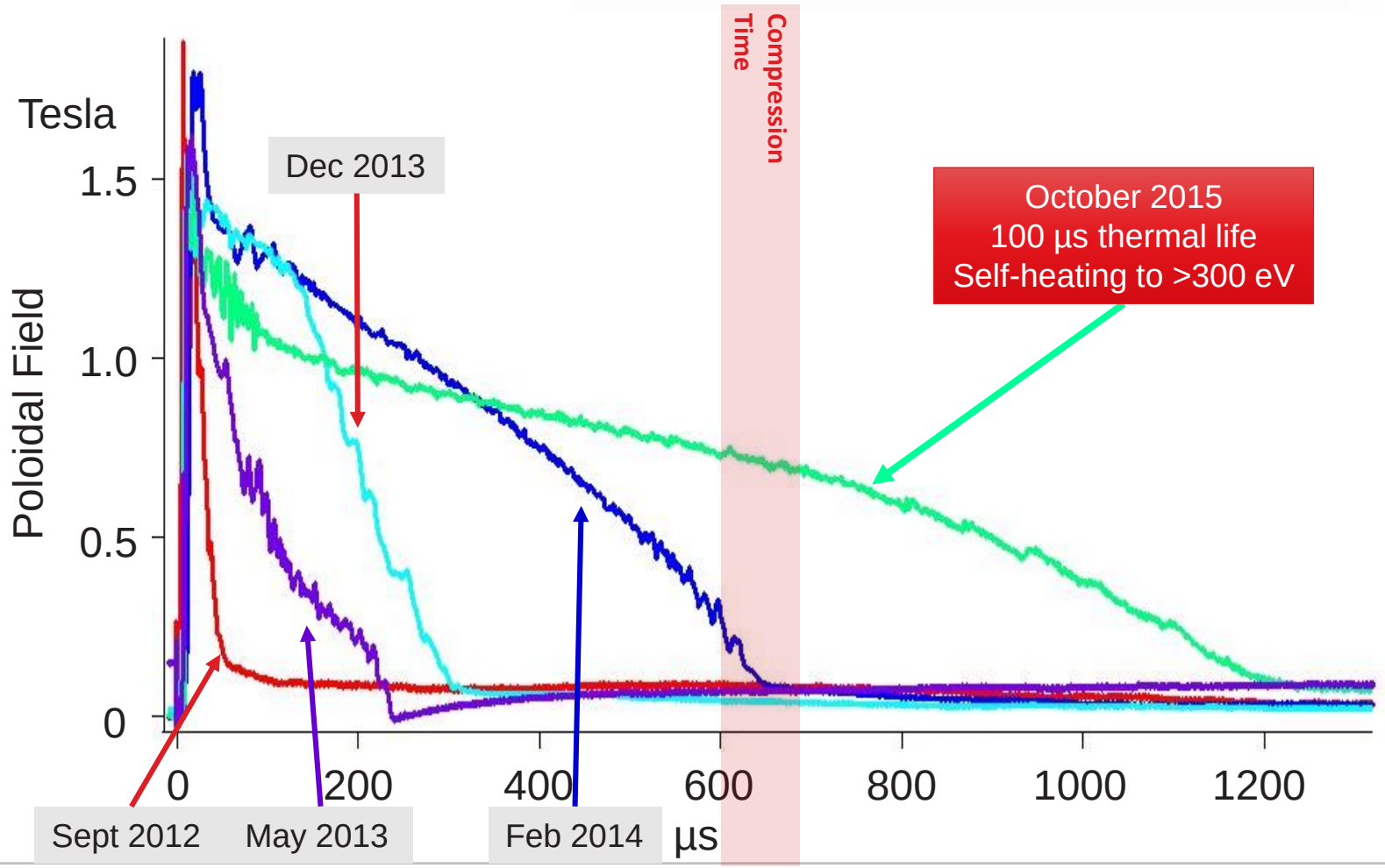
Small Plasma Injector



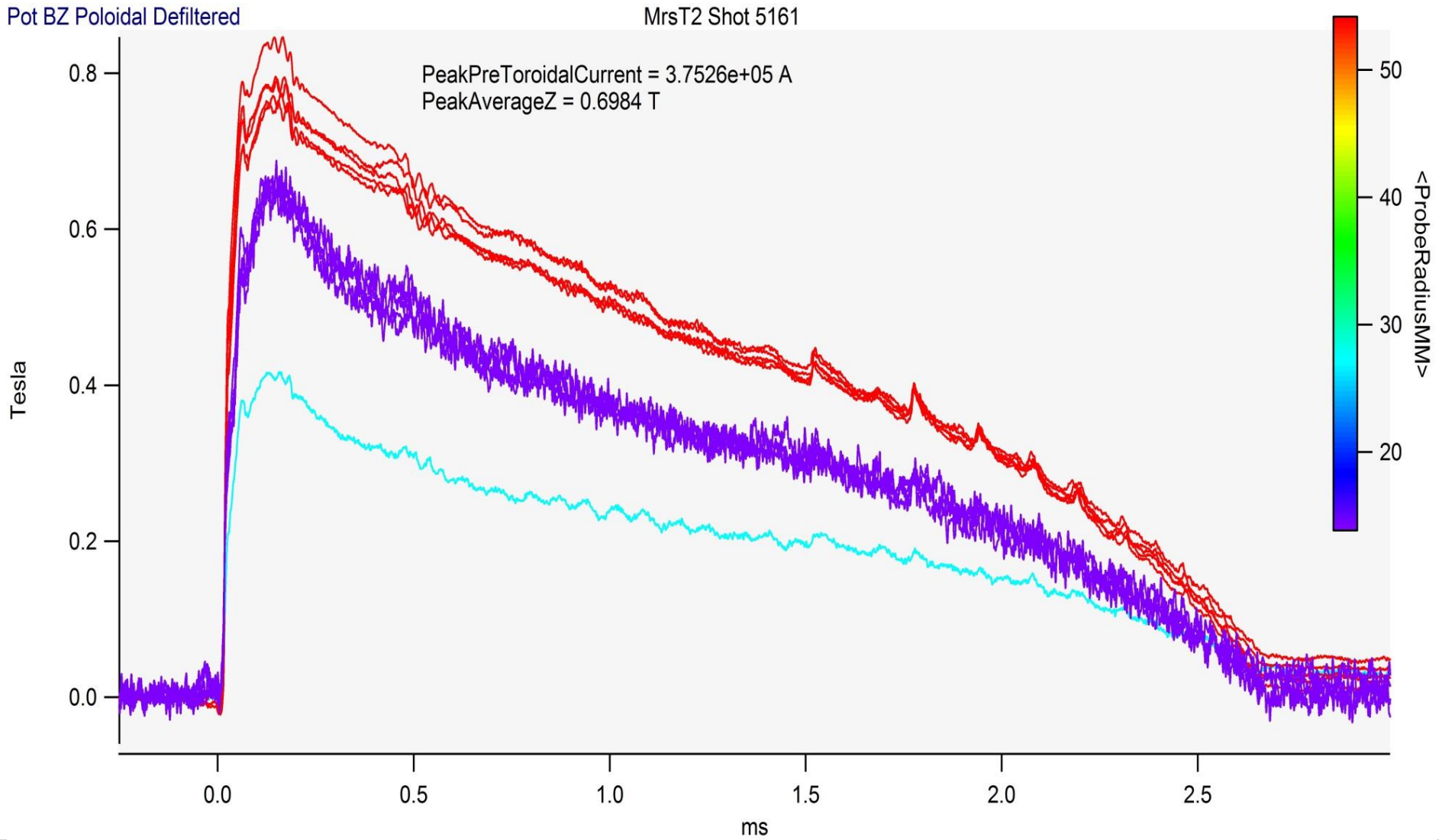
- Direct formation: no acceleration stage.
- Comparable to CTX and SSPX designs
- Lower maximum plasma density than large injectors
- Faster design iteration
- Designed for use in plasma compression experiments

Plasma Lifetime Progress

General Fusion has created a long-lived plasma that we believe is good enough to compress.



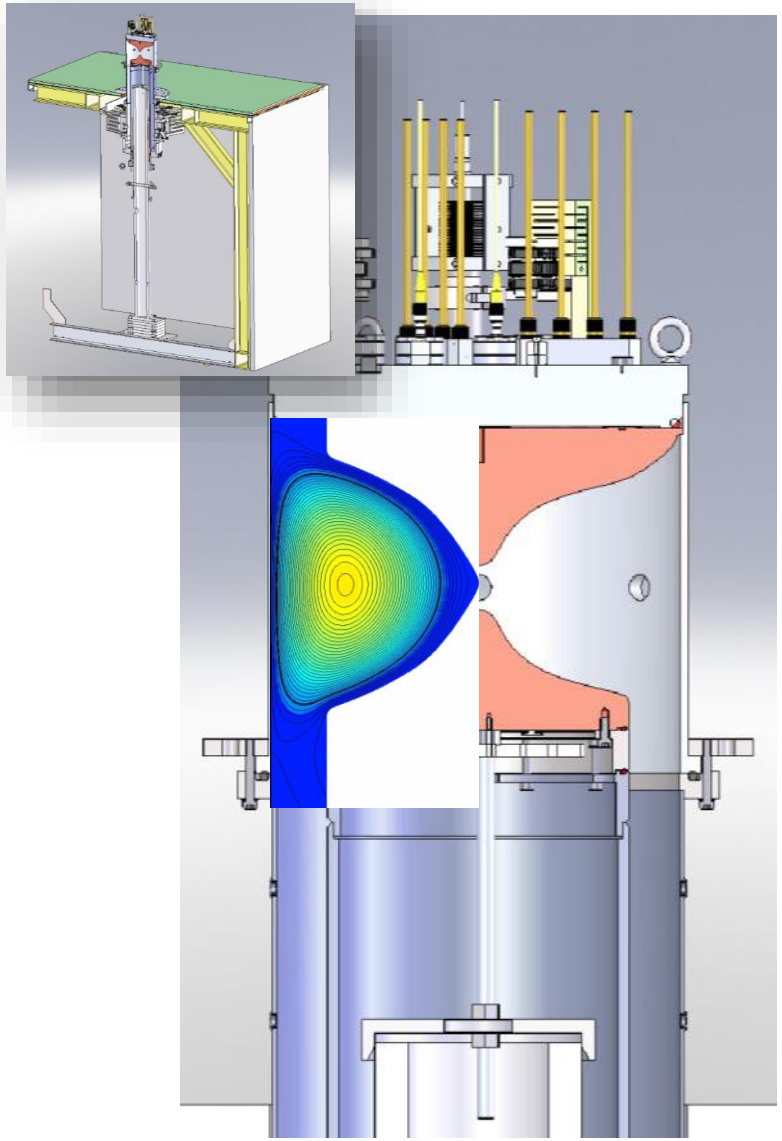
Spherical tokamak 500 eV from TS



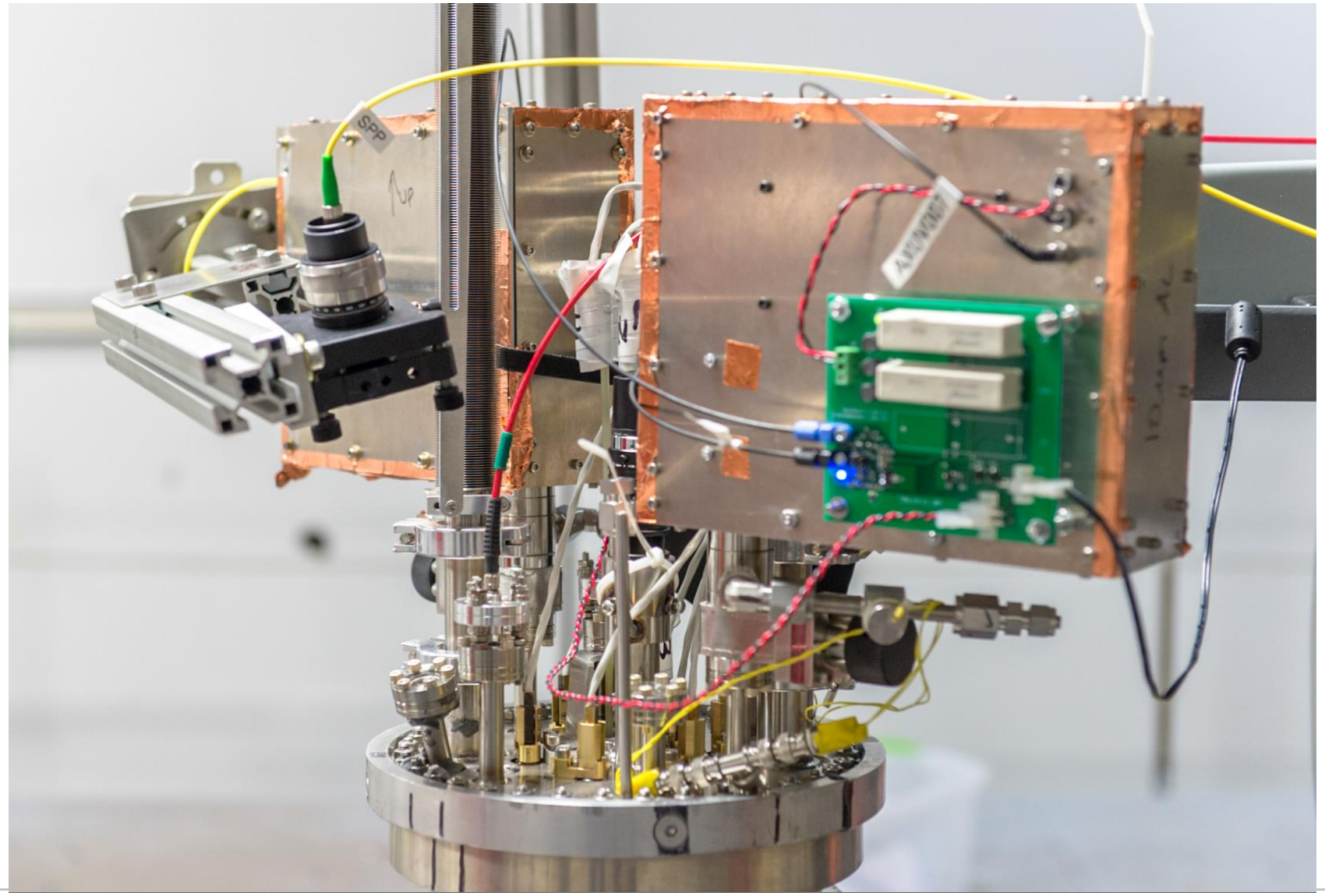
2017

- 2500 μs lifetimes
- 500 eV

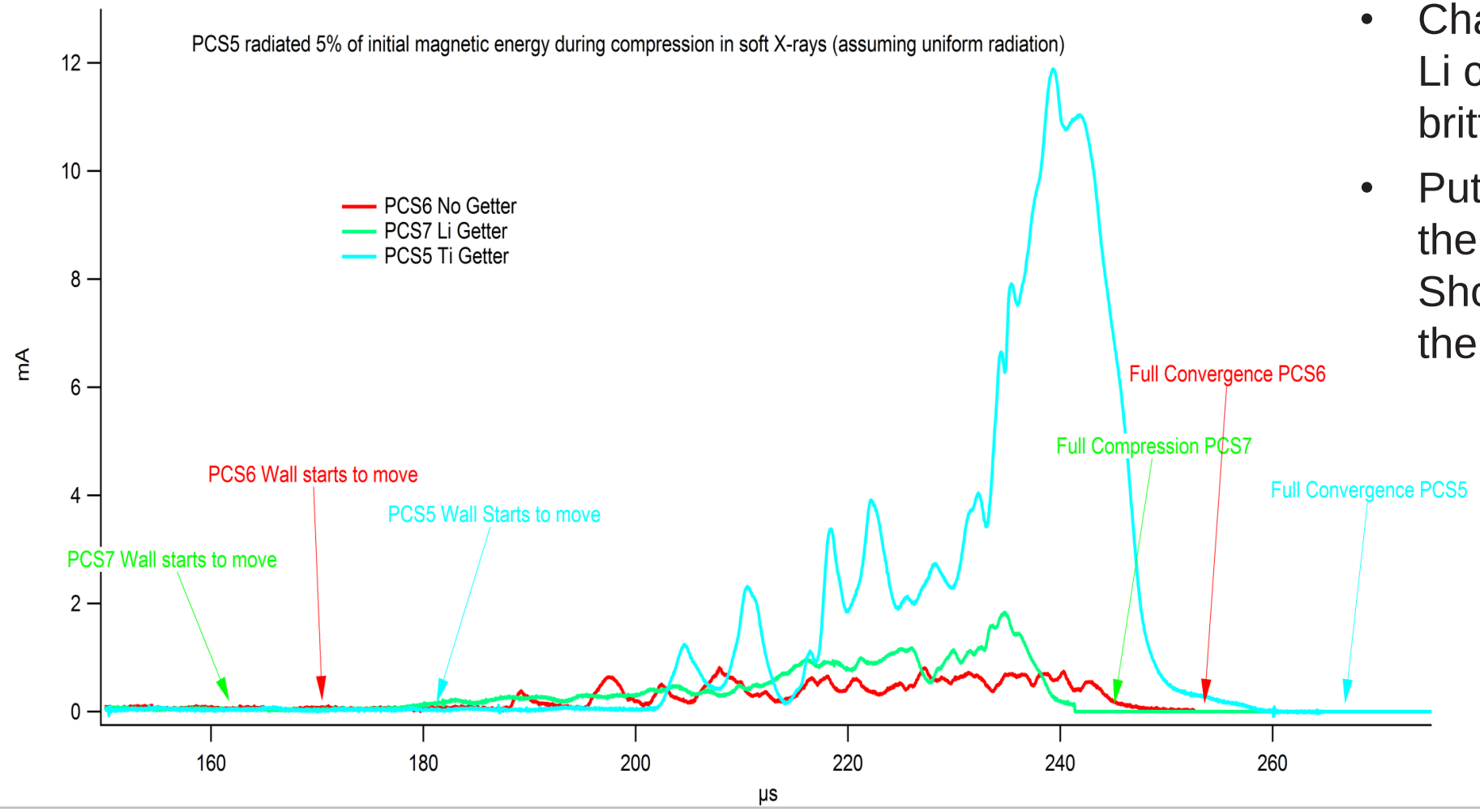
Plasma Compression Testing



Diagnostics



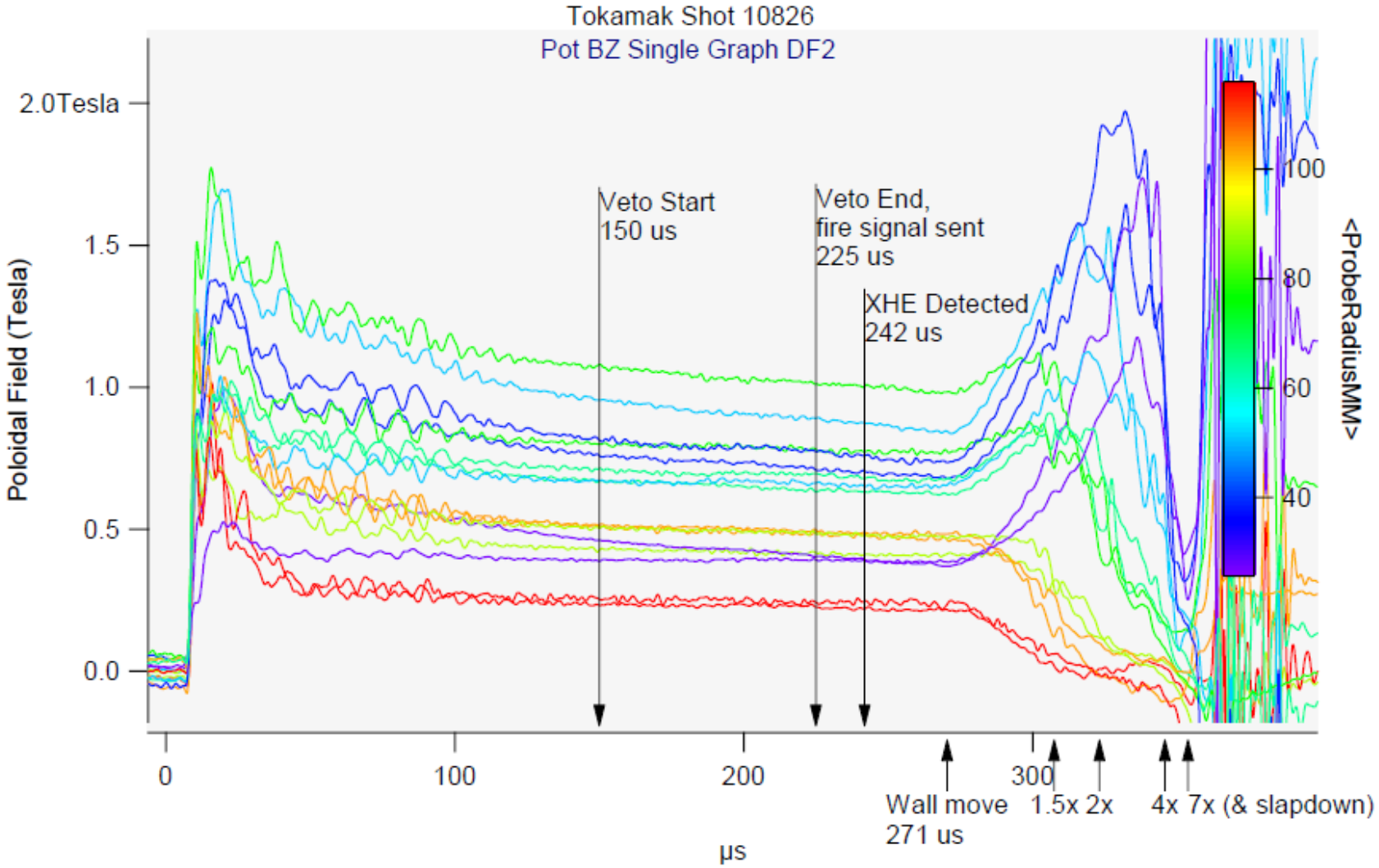
Fixed Radiation Death



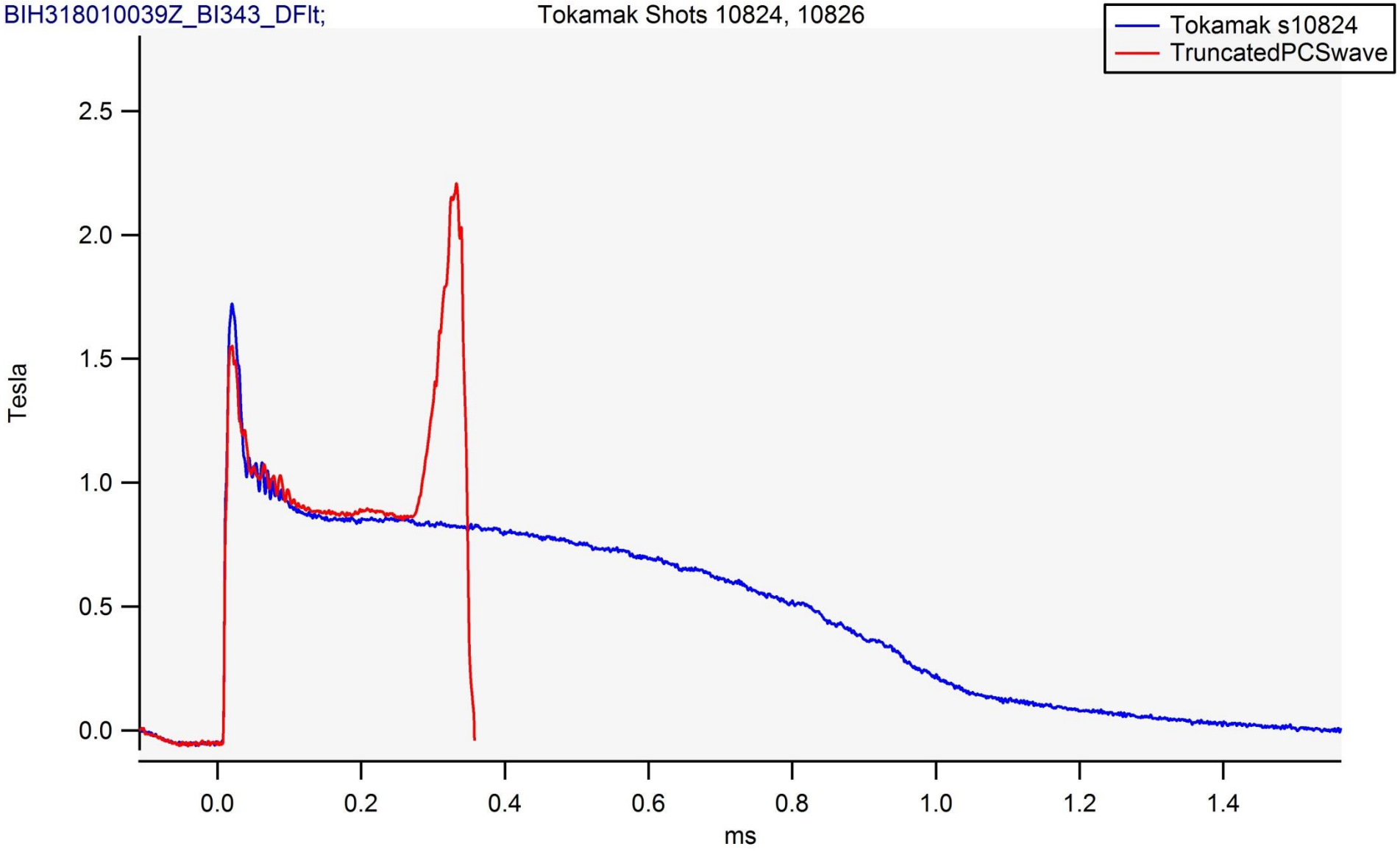
- Changed from Ti coating to Li coating. Lower Z. Less brittle coating
- Put a vacuum gap between the driver and the liner. Shockless acceleration of the liner

Poloidal Field Compression: Compression Test #12

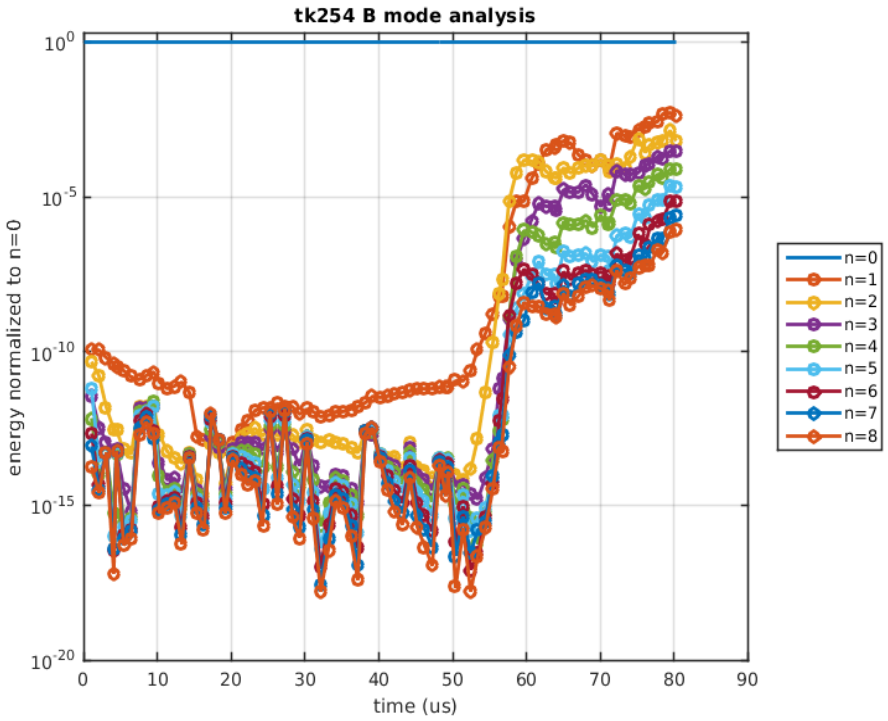
Chart of increase in magnetic field during compression

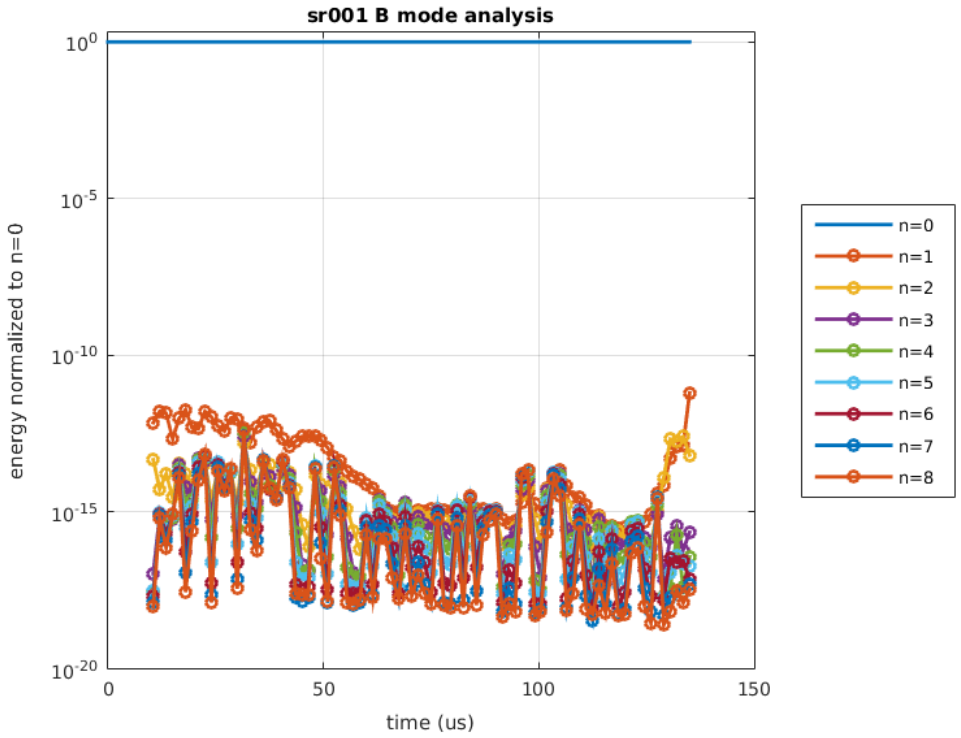


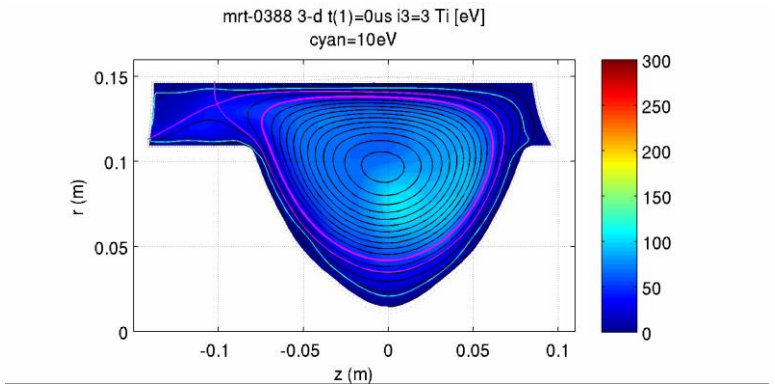
Uncompressed (blue) compared to compressed (red)

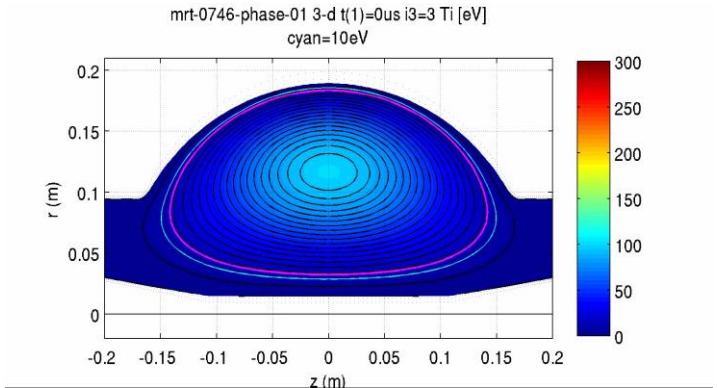


Change in Compression Geometry

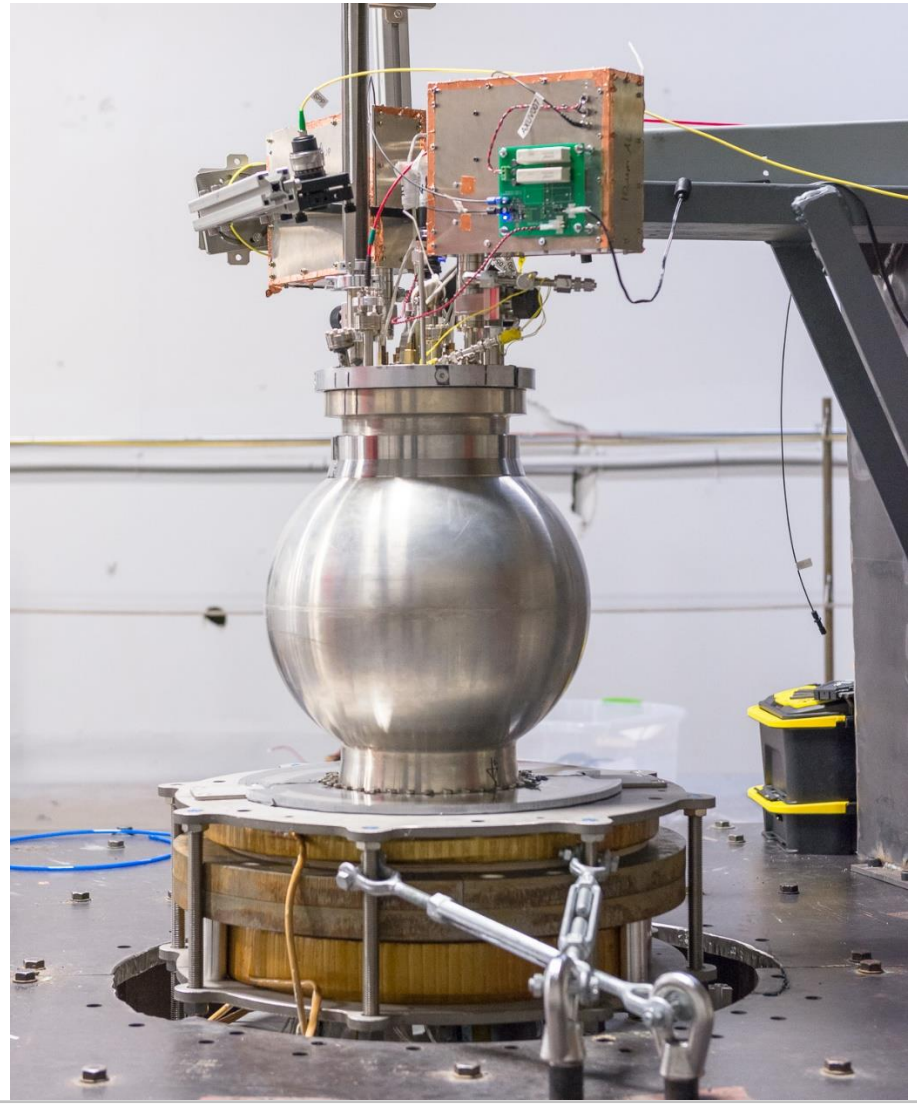




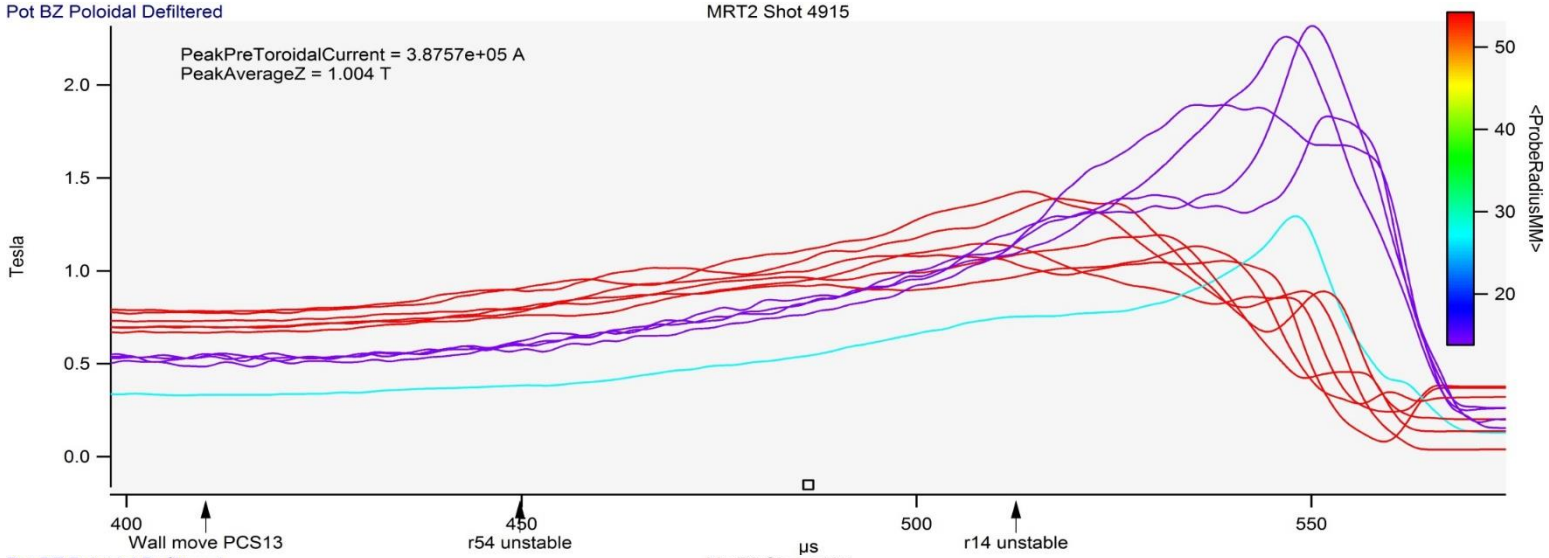


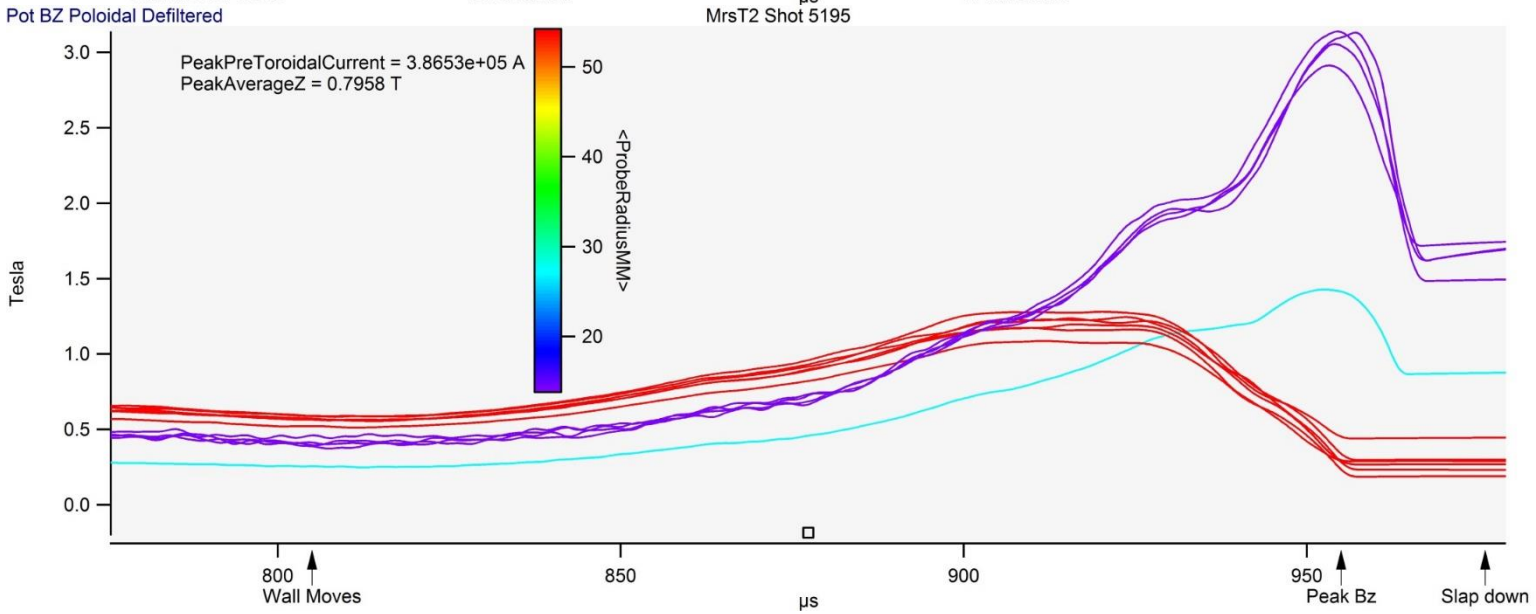


New Spherical Shape

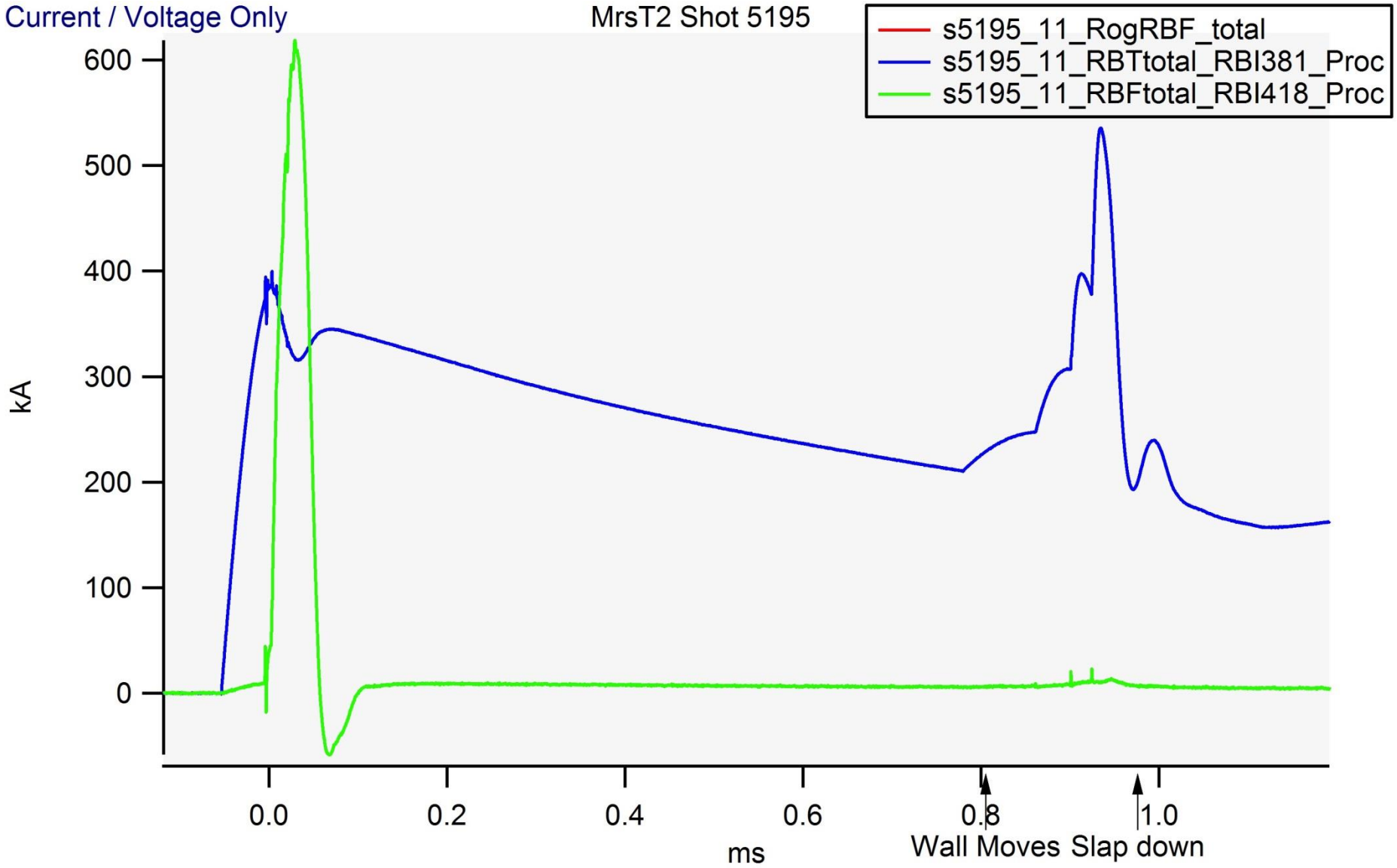


Magnetic Field During Compression

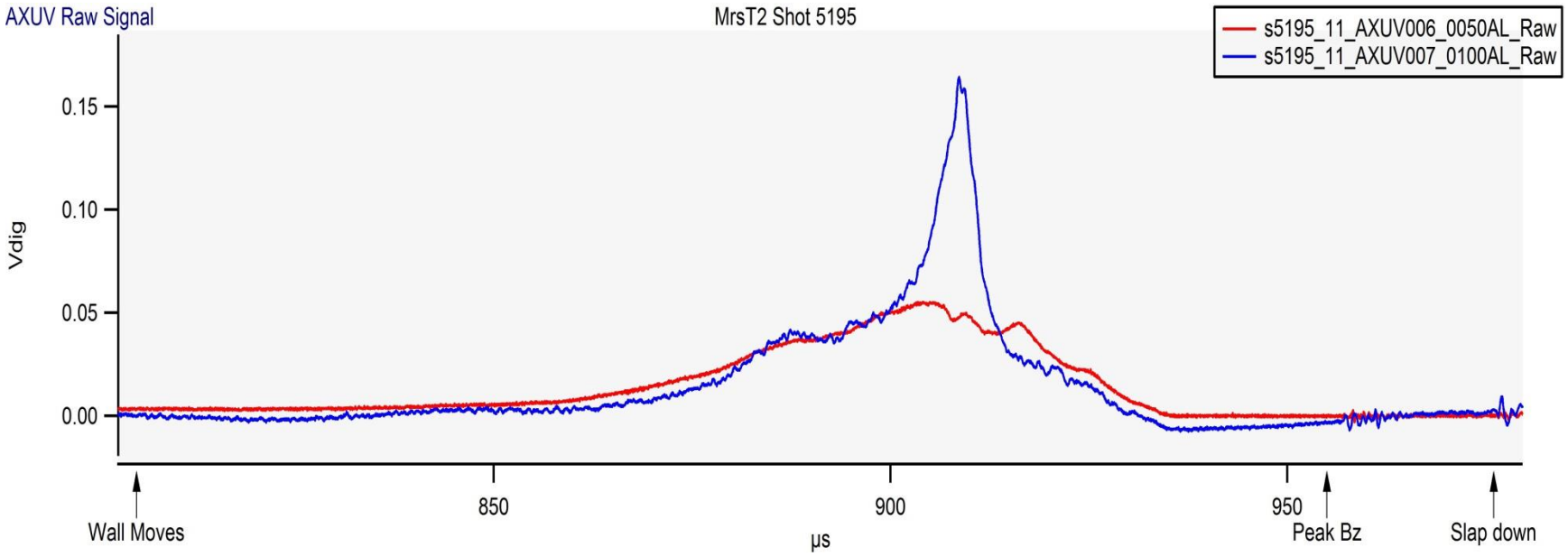


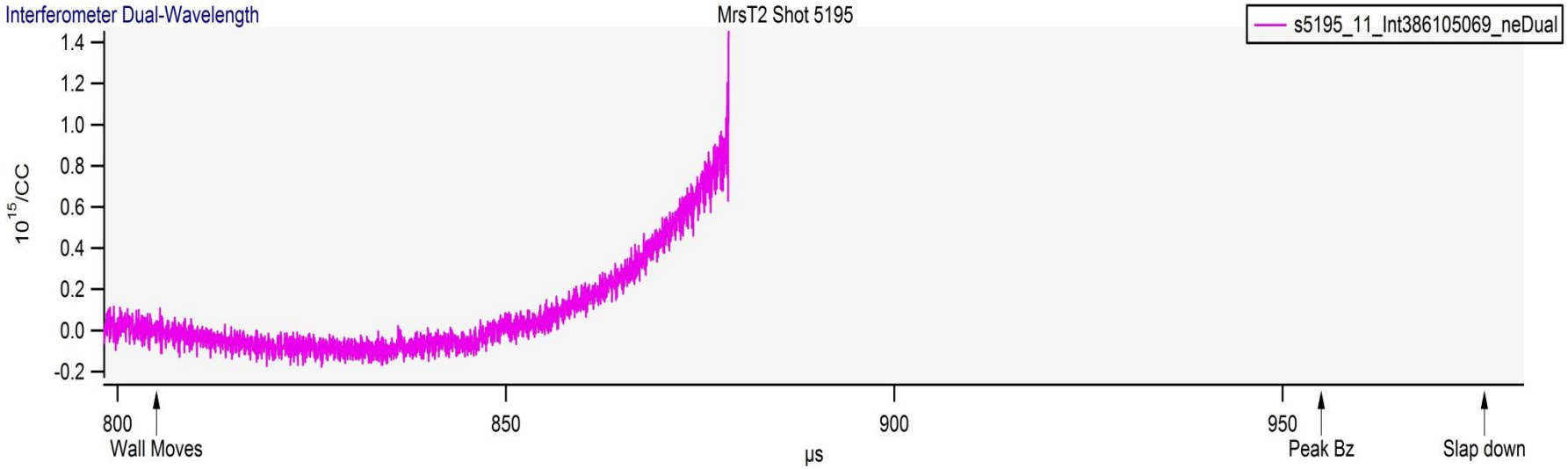


Shaft Current And Formation Current



X-Ray and Density





Conclusion

- We can make plasma with sufficient confinement before compression
- Radiation losses have been fixed and plasma stability is now maintained during compression
- There is some evidence of heating during compression in experiments so far
- Now aiming to get better heating and higher temperatures in future shots

CLEAN ENERGY. EVERYWHERE. FOREVER.

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