Staged Z-pinch for Fusion
Magneto-Inertial Fusion Technology Inc. (Tustin, California)

Project Overview

- Develop a Staged Z-pinch (SZP) to efficiently and stably transfer energy from a radially-imploding liner to a target plasma.

- Demonstrate a target-load design that can scale to high-shot rate for fusion-relevant conditions

Accomplishments and ARPA-E Impact

<table>
<thead>
<tr>
<th>Line</th>
<th>( t_{\text{imp}} ) (ns)</th>
<th>( N_l ) (cm(^{-3}))</th>
<th>( T_i ) (KeV)</th>
<th>Neutron Yield ( Y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ar</td>
<td>146.6</td>
<td>9.0x10(^2)</td>
<td>10.0</td>
<td>2.0x10(^8)</td>
</tr>
<tr>
<td>Kr</td>
<td>146.6</td>
<td>6.2x10(^2)</td>
<td>15.0</td>
<td>2.0x10(^9)</td>
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</tbody>
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- Demonstrated the stability of staged Z-pinch
- Achieved reproducible neutron yield of \( \sim 10^{10} \)
- Demonstrated thermonuclear origin of neutrons
- Detected the secondary DT neutron production
- The yield is as per predictions of MACH2 code.
- Two patents and 5 Publications so far
- Three publications under preparation

Key Insights and Innovations
- A concept that produces a stable high energy density plasma.
- Simulation and experiments match closely.

Future Plans
- Transfer the technology on the 1MA LTD3 machine at UCSD
- Simulation shows 30% efficiency; conventional machines: 5%
- Build 9-10 MA LTDX machine for high fusion yield

LTDX machine parameters
- Peak current \( \sim 9 \) MA
- 250 kJ delivered to the load
- \( \sim 120 \) ns rise time
- 30% energy efficiency
- 47 cm/\( \mu \)s implosion velocity

For Xe liner on DT target
- \( Y_{DT} = 8.0x10^{16} \) (MACH2)
- \( E_{\text{fusion}} = 225 \) kJ (MACH2)