General Fusion
General Fusion

Making affordable fusion power a reality.

- Founded in 2002, based in Vancouver, Canada
- Plan to demonstrate proof of physics DD equivalent “net gain” in 2013
- Plan to demonstrate the first fusion system capable of “net gain” 3 years after proof
- Validated by leading experts in fusion and industrial engineering
- Industrial and institutional partners
- $42.5M in venture capital, $6.3M in government support
General Fusion’s Acoustically Driven MTF
Development Plan

**PHASE I**
Proof of principle
Completed

- **2009 PHASE IIa**
  Construct key components at full scale
  Prove system can be built
  Plasma compression tests

- **2013 PHASE IIb**
  Build net gain prototype

- **2016 PHASE IIc**
  Test prototype – Net Power out

- **2013**
  Demonstration of Net Gain

**PHASE II**
Demonstration of Net Gain

- **2013**
  Build net gain prototype

- **2016**
  Test prototype – Net Power out

- **2020**
  Electricity generation and commercialization
  $1 billion+

**PHASE III**

- **2013**
  Demonstration of Net Gain

- **2016**
  Test prototype – Net Power out

- **2020**
  Electricity generation and commercialization
  $1 billion+
### Full Scale Component Design and Test

<table>
<thead>
<tr>
<th>Component</th>
<th>Temperature</th>
<th>Density</th>
<th>Lifetime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma Injector</td>
<td>100eV</td>
<td>1E16</td>
<td>100 μs</td>
</tr>
</tbody>
</table>

### Acoustic Driver

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Velocity</td>
<td>50m/s</td>
</tr>
<tr>
<td>Impact Timing</td>
<td>10us</td>
</tr>
</tbody>
</table>

### Vortex Collapse

- 10X symmetric compression

### Plasma Compression Tests

- **Small Tests**
  - 10 keV

- **Large Tests**
  - Equivalent Net Gain

### Build Strategic Relationships

- Customer / Partner
Plasma Injector Performance
Plasma Injector Simulation
Plasma Injector I
Plasma Injector II
Magnetic Fields
Plasma Temperature from ion doppler

Temperature vs location during compression (shot 21804)
Compressible Plasma Challenge

Plasma rapidly cools when entering pot
Acoustic Driver Development

• Full scale piston for servo development
• Servo control meeting requirements
• Material failures at higher velocities successfully addressed

<table>
<thead>
<tr>
<th>Single Piston Requirements</th>
<th>Impact Velocity (m/s)</th>
<th>Impact Timing (μs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target</td>
<td>50</td>
<td>± 10</td>
</tr>
<tr>
<td>Achieved</td>
<td>50</td>
<td>± 5</td>
</tr>
</tbody>
</table>
Vortex collapse
Plasma Compression Experiments
Science Objectives

Experiments designed to verify:

a) Plasma heat loss
b) Plasma / wall interaction

PC Small Tests
• Achieve 10 keV

PC Large Tests
• Achieve 10 keV, $10^{20}\text{cm}^{-3}$, 10µs
✓ Equivalent net gain
Objectives for Phase II – Subsystem Development

Full Scale Component Design and Test

Plasma Injector
- Temperature
- Density
- Lifetime

Target is 100 μs

Acoustic Driver
- Impact Velocity
- Impact Timing
- Vortex Collapse

On Track. Commissioning Now.

Plasma Compression Tests

Small Tests
- Ongoing

Large Tests
- Starting in 2013
- Net Gain Experiment

Build Strategic Relationships

Customer / Partner
- Cenovus Energy - Invested 2011

Clean energy.
Everywhere.
Forever.

generalfusion