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Formation and Acceleration Physics on Plasma Injector 1
STEPHEN HOWARD, General Fusion Inc., GF PLASMA INJECTOR 1 TEAM TEAM — Plasma Injector 1 (PI-1) is a two stage coaxial Marshal gun with conical accelerator electrodes, similar in shape to the MARAUDER device, with power input of the same topology as the RACE device. The goal of PI-1 research is to produce a self-confined compact toroid with high-flux (200 mWb), high-density ($3x10^{16}$ cm^{-3}) and moderate initial temperature (100 eV) to be used as the target plasma in a MTF reactor. PI-1 is 5 meters long and 1.9 m in diameter at the expansion region where a high aspect ratio (4.4) spheromak is formed with a minimum lambda of 9 m^{-1}. The acceleration stage is 4 m long and tapers to an outer diameter of 40 cm. The capacitor banks store 0.5 MJ for formation and 1.13 MJ for acceleration. Power is delivered via 62 independently controlled switch modules. Several geometries for formation bias field, inner electrodes and target chamber have been tested, and trends in accelerator efficiency and target lifetime have been observed. Thomson scattering and ion Doppler spectroscopy show significant heating (>100 eV) as the CT is compressed in the conical accelerator. B-dot probes show magnetic field structure consistent with Grad-Shafranov models and MHD simulations, and CT axial length depends strongly on the lambda profile.

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