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P2.1014 Overview of ST40 results and planned upgrades

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Tokamak Energy Ltd. have recently completed the first programme of operations within the compact (R = 0.4 m) spherical tokamak ST40. During the first programme ST40 was operated without a central solenoid and start-up was achieved using the Merging/Compression technique. Plasmas with a 15 ms (flat top) duration were sustained with a plasma current of 220 kA (peak transient current of 400 kA) and with a toroidal field of 0.7 T at R = 0.4 m (highest TF field achieved: 1 T at R = 0.4 m). Magnetic reconstruction has been performed using both EFIT and a new real-time reconstruction algorithm which calculates the plasma current centroid (RIp, ZIp and Ip) and plasma shape. Ion doppler spectroscopy has been used to measure the ion temperature, which has exceeded 1.5keV. We have analysed the Merging/Compression startup and developed a dimensionally correct scalings for plasma current. We have also identified high frequency MHD activity with a strongly anti-ballooning nature and an n = 0 toroidal mode number.
In the next programme we will be installing a Diagnostic Neutral Beam (DNBI) and using charge exchange recombination spectroscopy to measure the ion temperature. The plasma current will be increased and sustained using a central solenoid. Later, Thomson Scattering will be installed to measure the electron temperature. In future programmes ST40 will be upgraded to its design parameters of 2 MA plasma current, 3 T toroidal field with up to 4 MW of heating from a combination of NBI and EC. Planned experiments on ST40 will look at how the energy confinement time scales with the toroidal field. How the integral power width, q, scales in spherical tokamaks. By varying the mix of NBI and EC heating we will explore how rotation affects the confinement time.

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