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Overview of MAST Results

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n=2,3,4,6 has been demonstrated: at higher and lower collisionality; for the first ELM; during the current ramp-up; when a sub-set of in-vessel coils fail; and with rotating n=3 RMPs. n=4,6 fields cause less braking whilst the power to access H-mode is less with n=4 than n=3,6. Refuelling with gas or pellets gives plasmas with mitigated ELMs and reduced peak heat flux whilst less than 10% drop in stored energy. The 3d structure of the post-pellet plasmoid has been imaged, with increased fluctuations during pellet ablation. A synergy exists between pellet-fuelling and RMPs, since mitigated ELMs remove fewer particles. JOREK and CAS3D stability codes show that 3d deformations influence peeling-ballooning stability. ELM precursors strikingly observed with Doppler-backscattering (DBS) and beam emission spectroscopy (BES) are consistent with gyrokinetic simulations of micro-tearing modes (MTMs) in the pedestal. Global gyrokinetic runs show kinetic ballooning modes mediate the pedestal width, whilst nonlinear simulations suggest that MTMs carry significant electron heat flux. A scan in beta at the L-H transition shows that pedestal height scales strongly with core pressure. The observed tilt of low-k turbulent vortices increases with flow shear, due to a decrease in poloidal wave number. Fast ion redistribution by fast particle modes depends on density, and access to a quiescent domain with 'classical'fast ion transport is found above a critical density. Highly efficient electron Bernstein wave (EBW) current drive (1A/W) has been achieved in solenoid-free start-up. A new proton detector has characterised escaping fusion products. Langmuir probes and a high-speed camera suggest filaments play a role in particle transport in the private flux region whilst coherence imaging has measured scrape-off layer (SOL) flows. BOUT++ simulations show that fluxes due to filaments are strongly dependent on resistivity and magnetic geometry of the SOL, with higher radial fluxes at higher resistivity. MAST Upgrade is due to operate in 2015 to support ITER preparation and importantly to operate with a Super-X divertor to test extended leg concepts for particle and power exhaust. This work was part-funded by the RCUK Energy Programme and the EU Horizon 2020 programme.

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