Appendix D. MAST programme strengths & near-term plans in the context of the ReNew research elements

Program goals

- Explore the long-term potential of the ST as a CTF and/or power plant
- Advance key tokamak physics issues for optimal exploitation of ITER/DEMO

Plasma current formation & ramp-up

- EBW-assisted start-up at 28GHz (EU-US-JA collaboration)
- Merging-compression (using internal coils) – incl. study of reconnection process in collaboration with JA (where plasma merging is being studied using external PF coils).
- Design studies on use of iron core, retractable solenoid
- Ramp-up by NBCD (+ higher power proposed) and EBW-CD (18 – 20GHz proposed)

Divertor & PFCs

- Radiative detachment
- Divertor/first wall heat loads
- Mitigation of transient events (ELMs, disruptions) – see below
- Divertor Science Facility (cf. DIMES, DIII-D) for studies of erosion, deposition, and material injection/migration
- Super-X divertor with cryo-pumping (proposed).
- Increased TF and solenoid flux (proposed) will allow longer pulse, higher current operation*

** Also relevant to other research elements*

Confinement & stability

- Confinement scaling & transport understanding exploiting excellent suite of high resolution diagnostics (TS, CXRS, MSE…..)
- Turbulence studies using BES (+ 2D imaging system under construction), PCI (proposed)
- Edge turbulence (probes, upgraded Doppler spectroscopy system)
- L-H transition physics and pedestal stability/transport
- Impact of rotation on stability, effect of instabilities on rotation, NTV studies
- NTM island physics exploiting very high temporal/spatial resolution of upgraded TS system
- Impact of fast ions on beta limit
- Fast particle instabilities – fast ion interaction exploiting NPA, collimated neutron detector (under construction), FIDA (planned), high frequency Mirnov coils. Influence of fast particle instabilities on transport, NBCD.
- TAE damping exploiting active antenna array.

Stability control

- ELM control using RMPs (installation of additional coils in 2010 will allow n = 6 perturbations)
- Disruption mitigation by Massive Gas Injection
- Off-axis NBCD for q(r) control.

Maintenance of current and control of profiles

- NBCD. Higher power, more adaptable NBI system with on/off-axis and co/cntr capability (proposed)
- EBW-CD (proposed)
- Pellet injection fuelling; ablation physics and particle transport incl. interaction with RMPs. Impact of drifts & microturbulence on pellet deposition. New pellet injector (proposed)
- Divertor cryopump (proposed)

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