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O2.108 Effect of fuel isotope mass on q-profile formation in JET hybrid plasmas

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See the full abstract here http://ocs.ciemat.es/EPS2019ABS/pdf/O2.108.pdf

The initial current ramp phase of JET hybrid plasmas is used to optimise the q-profile to allow access to high beta and avoid MHD instabilities. Mixed protium-deuterium experiments have shown that the q-profile evolution during this phase varies systematically with average main ion isotope mass (Meff), as seen in Fig.1, indicating the need for re-optimisation for future T and D-T experiments. <Te> increased with Meff, consistent with improved Ohmic confinement and/or reduced electron-ion coupling (a). But the 3.6 effect on plasma resistivity was compensated by an onset time of 1,1 MHD (s) increase in Zeff with Meff due to increased metallic impurity contamination, consistent with increased 3.4 sputtering by higher mass isotopes (b,c). Current diffusion modelling shows that the key factor for 3.2 the change in q-profile evolution was a reduction in Te peaking as Meff was increased, which was due to increased radiation. Reduced Te peaking can lead to magnetic shear reversal, 2/1 double tearing modes and disruptions, suggesting an increased likelihood of disruptions in T and D-T. To mitigate this risk Te peaking measurements are being included in the real-time control system to allow disruptions to be avoided by central heating, gas puffing or early pulse termination. These results and the experience being gained at JET will help to guide the safe transition to D and D-T in ITER.

(a) E. Delabie et al 2017 Proc 44th EPS Conference on Plasma Physics (Belfast, Northern Ireland, UK) P4.159
(b) D. Borodin et al 2018 Proc 27th IAEA Fusion Energy Conference (Ahmedabad, India) EX/P1-14
(c) S. Brezinsek at al 2018 Proc 27th IAEA Fusion Energy Conference (Ahmedabad, India) EX/9-4

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