Impact of 3D fields on plasma confinement parameters in MAST-U

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In this paper, we will investigate the changes in plasma density, temperature and rotation as a function of applied 3D field structure on MAST-U. MAST-U has been exploring the use of n=1 and n=2 Resonant Magnetic Perturbations (RMP) for Edge Localized Mode (ELM) suppression [2]. So far ELM suppression has not been achieved with either n=1 and n=2 fields at various strengths and parities. Mitigation was observed with n=1 RMPs, whereas the application of n=2 RMPs indicated that MAST-U has an intrinsic n=2 error field. ELM suppression and mitigation has been attributed to changes in plasma profiles to avoid stability limits, the potential creation of a magnetic island at the top of the pedestal and a change in stability due to the 3D corrugation of the plasma shape. Prior work has focused on identifying the MHD response, in this paper we would like to focus on changes in transport using the full database of RMP scenarios from MAST-U and compare this to prior results on how 3D fields enhance transport locally and globally.

[1] J R Harrison et al, 2019, Nuclear Fusion, 59, 112011.
[2] D A Ryan et al, 2024, Nuclear Fusion, Submitted.