**Designing a Midplane Turbulence Probe for MAST-U**

W. G. Fuller1,2, S. Allan2, B. Hnat1, J. Omotani2, P. Ryan2, and the MAST-U Team2

*1 Centre for Fusion, Space and Astrophysics, Physics Department, University of Warwick, Coventry, UK.*

*2 United Kingdom Atomic Energy Authority, Culham Centre for Fusion Energy, Culham Science Centre, Oxford UK*

Throughout the first MAST-U campaign there was focus on investigating the Super-X divertor and how alternative divertor configurations impact the dynamics of the scrape-off layer. Key phenomena born from turbulence, such as profile broadening and filamentary transport must be investigated to avoid possible damage to the first wall in future fusion reactors, including STEP. One way to study such phenomena is by probing edge and SOL plasma with a new probe head of the midplane reciprocating probe system installed on MAST-U. The system allows direct measurement of plasma properties producing a radial profile of the scrape-off layer. Current diagnostics are not specifically designed for the variety of measurements required to fully characterise SOL turbulence. This new probe head design was first synthetically iterated through a variety of models to reach the current design and includes several arrays of probes targeting different turbulence measurements. We include a logarithmically spaced probe array sampling a range of length scales. A five-pin balanced triple probe array has been included to gather fluctuation statistics of temperature and density simultaneously. We incorporated ball-pen probes designed for direct measurements of the plasma potential. There is a linear array of probes including a radial offset to calculate velocity statistics. Along with probes in other arrays, an additional radially offset probe is included to operate a mach probe setup, allowing plasma flows to be measured. This work will present the synthetic approach we used to design our turbulence probe, and the data presented will be compared to experimental and synthetic results from the existing Mach probe head and other diagnostics to determine the turbulence probe’s suitability for purpose. Unique results and future work will also be discussed to fully exploit the diagnostic subsequently.

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