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# MAST Upgrade Microwave Heating and Current Drive System - Engineering Design Overview

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MAST-Upgrade (MAST-U) is undergoing several enhancements to deliver increased performance and functionality. One such enhancement is the design, development, and implementation of an Electron Bernstein Wave (EBW) Heating and Current Drive (HCD) System. The MAST-U EBW System aims to provide experimental data for model validation, and to provide a greater understanding of EBW physics and its capabilities. The MAST-U EBW System provides up to 1.8MW of microwave power into the plasma, through a system comprising: high voltage power supplies; gyrotrons; evacuated transmission lines; and a steerable in-vessel launching system. The gyrotrons from Kyoto Fusioneering have a 0.9MW output power capability at the dual frequencies of 28GHz and 34.8GHz, allowing start-up and current drive studies to be carried out at their respective optimum frequencies, with current drive studies targeting the second harmonic.

The in-vessel launching system is designed to provide maximum experimental flexibility. A switching arrangement ex-vessel allows the selection of either on or off axis injection into the plasma via either the mid-plane or upper launcher. Each launch path has two sets of mirrors, with one set steerable for varying the injection angle, aiming for a high positional accuracy and precision. Additionally, for the on-axis launcher, large angular steering ranges allow for both co and counter injection.

Finally, additional diagnostics, termed interceptor plates, are proposed to sit in the path of the first reflection. These will measure the reflected power from the plasma, to both act as an interlock if the reflected power is too high, and provide key information on the coupling efficiency.

This presentation outlines the key objectives of the system, the preliminary system design, and the current status, looking in particular at challenges associated with the chosen frequencies, spatial integration constraints, and the design of the in-vessel launching system.

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