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Cryopumps applied to Fusion Energy - MAST-U Enhancements Double Beam Box System

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The MAST-U –Mega-amp Spherical Tokomak –is undergoing enhancements which will position it at the forefront of fusion energy research. The enhancements will allow the reactor to run at elevated temperatures, provide more flexibility with studying plasma physics exhaust and increase our understanding of the underlying physics of tokomaks. It will also be essential to validate models when designing future fusion demonstrator reactors, making it a crucial part of fusion energy research.

The double neutral beam injection system (or Double Beam Box -DBB) is one of the main components of this enhancement as it will increase the heat injection power into the tokomak. A bespoke cryopump will be installed within the double beam box to create a high/ultra-high vacuum during standby operations and pump a high gas throughput during a pulse. This will allow it to extract impurities and reduce the re-ionisation of the neutral beam before it enters the tokomak.

We are currently at the latter end of the design and manufacture of the double beam box cryopump. The poster will show the developments and requirements with design and analysis, the challenges, and considerations with the final stages of design and manufacture, a literature review drawing on experiences of the already existing JET –(Joint European Torus*) cryopump, and a look ahead into future completion of the MAST-U DBB cryopump.

*JET was operating regularly on UKAEA Culham site until recently shutting down. It has its own neutral beam injection system with a working cryopump that was running for over 60 years.

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