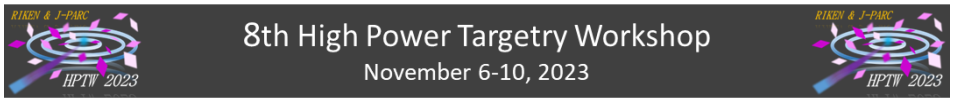

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New cryogenic helium heat exchanger for the ISIS Target Station 2 Solid Methane Moderator

Wednesday, 8 November 2023 10:00 (15 minutes)

The ISIS Target Station 2 decoupled solid methane moderator is cooled to 40 K using a helium cooling loop inside the methane vessel. However, there is currently a struggle to hold this temperature, with the moderator degrading over the user cycle to reach 65 K. There has recently been an undertaking to improve cooling and use more cooling power available from the cold box by reducing the pressure drop through the heat exchanger and increase the contact surface area for heat exchange. Colder methane temperatures (approximately 30 to 35 K) produce more neutrons at longer wavelengths for the WiSH diffractometer instrument.
This paper will report on the modelling and manufacturing development that has led to an innovative design using a plate heat exchanger. The new heat exchanger will use multiple channels of variable width plus larger cross sections at the inlet and outlet to reduce the pressure drop. Water flow tests and computational fluid dynamics (CFD) analyses provided insight into the design's performance and highlighted the potential improvements. The CFD models have shown that the plate heat exchanger allows for the mass flow rate to increase from 7 g/s to 10 g/s while maintaining the same pressure drop. This has the cumulative effect of reducing the average temperature of methane from 41 K to 36 K. The new heat exchanger is now in manufacture alongside its integration into the methane moderator assembly with the hope that testing on its performance can begin in late 2024. Meanwhile, further iterations are under development to continually improve and maximise the potential cooling power available.

Themes for the contribution

1 R&D to support concepts

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