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## Simulated and Measured Performance of ISIS TS1 Project Target

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As part of the ISIS TS1 Project [1], a new design of spallation target has been installed and operated at ISIS TS1. Detailed Finite Element Analysis (FEA) simulations were used to guide the design process and predict target performance. Since the TS1 Project target began operation in November 2022, operating data has been collected and used to validate the target simulation approach.

Relatively quickly after receiving beam, it was noted that the temperature of the front target plate was elevated compared to predictions and compared to the other plate temperatures. Because the installed target was now too radioactive to permit hands-on inspection, FEA simulations became a vital tool to understand the possible causes and safety implications of this anomalous behaviour.

The elevated temperature appears to be confined to the front target plate only, indicating a highly localised effect. The other nine target plate temperatures agreed closely with FEA simulations of both steady-state and transient behaviour. This gives confidence in the overall simulation approach, while also ruling out several proposed causes of the elevated front plate temperature.

Recent reports [2] [3] have shown a significant reduction in the thermal conductivity of tungsten after irradiation. The installation of a new, fully instrumented TS1 Target offered an opportunity to observe this effect in-situ on a working spallation target. Detailed records were kept of plate temperatures over time, and compared to FEA simulations which included irradiation-degraded material properties.

### References

- [1] ISIS TS1 Project summary –S. Gallimore et al 2018 J. Phys.: Conf. Ser. 1021 012053 DOI 10.1088/1742-6596/1021/1/012053
- [2] Thermal diffusivity of tungsten irradiated with protons up to 5.8 dpa –J. Habainy et al., Journal of Nuclear Materials, 2018
- [3] Thermal diffusivity degradation and point defect density in self-ion implanted tungsten –A. Reza et al., Acta Materialia, 2020

### Themes for the contribution

7 Operation of targets and beam dumps:

**Primary authors:** Mr WILCOX, Dan (Technology, Science and Technology Facilities Council, UK Research and Innovation); Dr PROBERT, Molly (ISIS Neutron and Muon Source, Science and Technology Facilities Council, UK Research and Innovation); Mr GALLIMORE, Stephen (ISIS Neutron and Muon Source, Science and Technology Facilities Council, UK Research and Innovation); Mr FINDLAY, David (ISIS Neutron and Muon Source, Science and Technology Facilities Council, UK Research and Innovation); Mr JAGO, Stephen (ISIS Neutron and Muon Source, Science and Technology Facilities Council, UK Research and Innovation)

**Presenter:** Mr WILCOX, Dan (Technology, Science and Technology Facilities Council, UK Research and Innovation)

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