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ISIS Target Station Two Horn Water Pre-Moderator Failure, Investigation, and Redesign

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The ISIS Target Station Two (TS2) Horn (water) Pre-Moderator is an integral part of the Target-Reflector and Moderator (TRaM) assembly. It is a vital component in the process of moderating neutrons to the required energy for instruments on the west side of the Target Station. The original pre-moderator, made from a 2000 series aluminium alloy, failed within the first year due to corrosion. The replacement was manufactured from the 5083-aluminium alloy for improved corrosion resistance and ran for six years before being replaced during a reflector upgrade in 2014.

The third pre-moderator began leaking toward the end of 2021. This became apparent when the Target Operations Group became aware of an increase in moisture levels detected by the residual gas analyser within the TRaM void vessel, alongside an indicated decrease in the header tank cooling water level. The spare pre-moderator was fitted while investigations began on the source of the leak. Redesign and manufacture were urgently needed; if the spare failed before a replacement was ready, then TS2 would need to be shut down until a replacement could be installed. Manufacture would be in excess of six months.

Finite Element Analysis performed in ANSYS highlighted stress concentrations where the lid was bonded to the ribs of the main structure. Design changes have been made to eradicate this weakness, with electron beam welding trials performed to validate the design for manufacture. This assembly is now in manufacture.

Themes for the contribution

5 Target facility challenges:

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