

Tritium Breeding Testing with an Intense DT Neutron Source

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SHINE Technologies operates the Fusion Linear Accelerator for Radiation Effects (FLARE) high flux, steady state, 14 MeV neutron radiation effects testing facility in Janesville, Wisconsin, USA. FLARE is comprised of a neutron generator, a tritium purification system, an irradiation bunker, and related facility infrastructure. SHINE has evaluated the use of the FLARE facility to perform tritium breeding experiments. A preliminary analysis suggests that the FLARE facility could generate 100's of MBq of tritium in the FLiBe or PbLi during a 50-hour experiment within a 30 cm tall annular vessel with 50 cm thickness. This would result in 100's of MBq of tritium per liter at the end of irradiation. This concentration of tritium in solution should be readily quantifiable, whether measured during a post-irradiation evaluation or via an online measurement of flowing FLiBe during irradiation. This indicates that such experiments should provide good validation of breeding ratios and related parameters in blankets being irradiated with DT neutrons. This paper will discuss full results of this analysis and SHINE's experimental plans.

Additionally, SHINE has been selected as the DT neutron source supplier for the United Kingdom Atomic Energy Authority (UKAEA) Lithium Breeding Tritium Innovation (LIBRTI) program. As part of the UKAEA's broader Fusion Futures initiative, LIBRTI focuses on pioneering fusion fuel advancements and stimulating general industry capacity through international collaboration. Over its four-year span, the program aims to demonstrate controlled tritium breeding, which is a critical step for future fusion power plants. The paper will discuss SHINE's contribution to the LIBRTI program and interface considerations between the neutron source and breeding test blanket.

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