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Flowing breeder LIBRTI experiments –concept design and stakeholder engagement

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Liquid breeder-based blanket concepts have been proposed for fusion power plants around the globe. While there are ongoing projects addressing key challenges, such as flow under magnetic fields, safety, and heat transfer; the tritium breeding via neutron irradiation in flow is only scheduled to take place in over a decade from now [1] [2]. This has motivated the demonstration of flowing breeders under DT-neutron irradiation in the LIBRTI facility. This new UKAEA facility will offer a unique engineering-scale testbed for flowing breeder experiments before other planned large neutron sources (e.g. IFMIF-DONES [1], WCLL-TBM (ITER) [2], EU-VNS⋯), this enables early integrated performance assessment and validation of blanket mock-ups, accelerating scientific progress and liquid blanket development that the mock-ups in larger neutron sources will achieve. In this presentation we will show the progress towards a concept design of a flowing breeder LIBRTI experiment, including definition of sub-systems and functions, geometry analysis, tritium quantifiability, hazard identification, and preliminary neutronic results. We will also discuss progress related to facility integration and interfacing (for example lifting, filling, and draining the mock-up), and stakeholder engagement –key objectives of the work. Future work will focus on onboarding partners, including national programmes and industrial collaborators, progressing the facility integration, and refining the designs of the mock-up and support systems.

References:
[1] D. Rapisarda et al., 'Breeding blanket mock-up testing in IFMIF-DONES', *Nuclear Fusion*, vol. 65, no. 11, p. 116002, Sep. 2025, doi: 10.1088/1741-4326/AE0657.
[2] F. Rueda et al., 'Major improvements in the WCLL TBM design towards next review gates', *Fusion Engineering and Design*, vol. 201, p. 114225, Apr. 2024, doi: 10.1016/J.FUSENGDES.2024.114225.

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