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The Design of the DONES Lithium Target System

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In the framework of the EU fusion roadmap implementing activities, an accelerator-based Li(d,n) neutron source called DONES (Demo-Oriented early NEutron Source) is being designed within the EUROfusion work-package WPENS as an essential irradiation facility for testing candidate materials for DEMO reactor and future fusion power plants. DONES will employ a high speed liquid lithium jet struck by a 125 mA, 40 MeV deuteron beam to generate the intense neutron flux used to irradiate the materials sample up to the desired level of displacement damage (~10 dpa/fpy for iron in 0.3 l) and He production rates (~10-13 appm He/dpa).

In order to rapidly achieve a sound and stable design, a new configuration of the DONES target system based on the so-called integral concept has been proposed as reference solution in place of the former baseline design that envisaged a target assembly endowed with a replaceable back-plate, being the latter solution not fully qualified yet and thus not readily implementable.

Moreover, following the outcomes of a detailed dedicated analysis taking into account several integrated aspects (such as tritium generation, cavitation issues, maintenance strategy, etc...) a decision was taken to move the Quench Tank inside the Test Cell while in the former design it was arranged in the lithium loop area, below the Test Cell floor.

Further modifications have also been introduced concerning inlet pipe and vacuum chamber configuration as well as support structure layout. A more consolidated design of the interfaces with the lithium loop and the accelerator beam line has been proposed too.

In this paper, a brief description of the current design of the DONES target system is presented including all the above mentioned aspects. Main results of supporting neutronic and thermomechanical analyses are also reported, showing the capability of the system to fulfil the prescribed requirements.

Co-author: ARENA, Pietro (Department of Energy Information Engineering and Mathematical Models (DEIM) University of Palermo)

Presenter: ARENA, Pietro (Department of Energy Information Engineering and Mathematical Models (DEIM) University of Palermo)

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