Update of the HCPB design and its corresponding mockup BLUME in IFMIF-DONES

Guangming Zhou on behalf of HCPB Team and BLUME Team

Email: guangming.zhou@kit.edu

Contributors:

HCPB Team: Guangming Zhou1, Jarir Aktaa1, David Alonso2, Ion Cristescu1, Christophe Garnier3, Francisco A. Hernández1,4, Béla Kiss5, Christina Koehly1, Luis Maqueda2, Carlos Moreno6, Iole Palermo7, Jin Hun Park1, Volker Pasler1, Anoop Retheesh1, Álvaro Yáñez2

BLUME Team: Guangming Zhou1, Arkady Serikov1, Gaurav Verma1, Frederik Arbeiter1, Salvatore D’Amico4, Yuefeng Qiu1, Santiago Becerril8, Jesús Castellanos9, Alessandro Spagnuolo10

1 Karlsruhe Institute of Technology, Germany

2 ESTEYCO, Spain

3 CEA, France

4 EUROfusion PMU, Germany

5 Budapest University of Technology and Economics, Hungary

6 Heffen Technologies, Spain

7 CIEMAT, Spain

8 IFMIF-DONES España, Spain

9 Universidad de Castilla-La Mancha, Spain

10 Eni, Italy

The tritium breeding blanket is an essential system in any deuterium-tritium (D-T) fusion electricity-producing device. Its primary functions include producing tritium to ensure fuel self-sufficiency, extracting high-grade heat for electricity generation, and shielding sensitive components from nuclear irradiation. Despite its critical role, the technical readiness level of tritium breeding blankets remains low.

This talk will first provide an overview of the current status of the Helium-Cooled Pebble Bed (HCPB) breeding blanket for the European DEMO fusion reactor. It will then emphasize the urgent need to improve the technical readiness level of tritium breeding blankets for fusion reactors. The IFMIF-DONES facility offers a unique opportunity to test tritium blanket technologies, given its large test volume and high neutron flux. In response to the need for testing blanket technology, a Blanket Functional Materials Module (BLUME) for the HCPB breeding blanket has been proposed. Preliminary designs of BLUME will be presented, followed by a discussion of future activities aimed at refining and consolidating the design.