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Lessons learned for the Breeding Blanket designers from the design development of the European Test Blanket Module Systems (He, Tritium, Liquid Metal Systems)

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The general objective of the ITER TBM Program is to provide the first experimental data on the performance of the breeding blankets in the integrated fusion nuclear environment. Such data are essential to design and predict the performance of DEMO and future fusion reactors.
To achieve this objective, the TBM programme will have to:
• test and validate technologies and materials in a fusion relevant environment in view of their further development for DEMO and power plants
• validate and qualify predictive tools for the design of the breeding blankets in DEMO and power plants
To comply with this mission, the TBM programme will cover the full lifetime of ITER operation, with testing of series of TBM specifically instrumented for maximizing the ROX (Return on Experience) for each ITER operational phase in view of the DEMO breeding blanket design.
The design of the European Test Blanket Systems (TBS), Helium Cooled Lithium Lead (HCLL) and Helium Cooled Pebble Bed (HCPB), has concluded its conceptual phase. Particularly during the development of the design of the TBM systems (also known as "TBM ancillary systems"), several lessons learned can be already now considered very important for the designers of the DEMO breeding blanket. They deal with:
- the impact of the safety requirements on the design of systems and components
- the impact of the licensing procedure on design requirements and implementation
- the definition and implementation of the main safety functions
- the compliance with the nuclear pressure equipment (ESPN) regulation
- the functional analysis of the different systems and components
- the selection of technological solutions for the TBM systems which appear relevant for the breeding blanket design
- major integration issues, like the management of the tritium contamination due to permeation and leakage.
After a synthetic recall of the main design features of the HCLL and HCPB-TBS, all above mentioned topics are discussed in this paper, addressing the analysis onto the original inputs and ROX for the designers of a breeding blanket for DEMO from the current TBM systems design experience.

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