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P2.155 Issues of the Vertical Blanket Segment Architecture in DEMO: current progress and resolution strategies

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Due to the limited irradiation lifetime of the structural material used for in-vessel components in DEMO, and subsequent future fusion power plants, it will be necessary to replace all breeding blankets within the given planned maintenance window in order to meet DEMO availability targets. It is assumed that failure of in-vessel components cannot be excluded, whilst in-situ repair is unrealistic. Hence the replacement of individual breeder blankets must be technically feasible. As such, remote maintenance replacement of the breeding blankets is a mission critical operation. The baseline concept utilises vertical segment architecture to aid in the removal of the blankets. This choice impacts on the tokamak and plant architecture and also affects operational maintenance strategy.

Within the EUROfusion PPPT program efforts have been made to perform cross work package investigations on eight Key Integration Issues needed to show the feasibility of the DEMO pre-concept design. Key Design Issue 4 is an investigation into the feasibility of the Vertical Segment Architecture blanket feasibility.

The present work documents the approach, current progress and developments within this investigation. This includes the strategy, identified risks and proposed solutions. An alternative variant, an Equatorial Divided Blanket Segment is proposed. A design overview and the impacts, both positive and challenging, on the design of the affected systems are provided and evaluation criteria are proposed.

The removal of breeding blankets and replacement with new or refurbished components is a complex machine operation. It will require the interfacing and developing of multiple systems and components. Due to the performance trade-off between the operational performance of in-vessel components and the remote handling suitability, the interrelationships and possible interacting challenges of extracting breeder blankets needs to be consider at the pre-concept design stage.

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