Contribution ID: **521** Type: **Poster**

ITR/P5-08: Effort on Design of a Full Tungsten Divertor for ITER

Thursday, 11 October 2012 08:30 (4 hours)

This paper will report on the results of the design efforts which have been launched at the IO following a recent decision to develop the option to start with W Divertor targets.
According to the current ITER physics Research Plan, the first divertor installed will be exposed to two helium/hydrogen campaigns, a single deuterium campaign and one full DT campaign, at the end of which the first mission goal of long pulse operation at fusion gain (Q ≥ 10) would be achieved.
Amounts of stationary heat fluxes of ˜10 MWm-2 and of slow transient heat flux expected to reach as much as 20 MWm-2 for transient periods of a few seconds were estimated and will be used as a basis to define the technology qualification programme.
Lifetime is determined as well by thermal transients resulting, for example, from vertical displacement events (VDE) and major disruptions. It was found from new analyses of VDE undertaken with the DINA code that, at the moment of the thermal quench, the inner vertical target and divertor dome areas appear to be extremely rarely impacted and thus do not require particular design modifications compared with the existing CFC variant. On the other hand, for most of the downward VDE events, the plasma becomes limited by the outer divertor baffle for which the same "roof-shaping"principle used in the ITER First Wall panel design will be implemented. Toroidal "set-backs"(typically 20 mm) are proposed on each side of the baffle to completely shadow any direct leading edge whilst optimizing the load spreading over the remaining wetted surface.
Regards to the strike point region, in addition with the PFCs tilt when assembled onto the CB, ensuring protection of leading edges, introducing W also requires the systematic shadowing of monoblock edges at the PFU scale, for this a simple "fish-scaling"solution is foreseen.
Designing in this way introduces the need for a transition from global roof-shaping to local fish-scale shaping in the HHF regions. That is one of the main difficulties of the current full-W design. The reality is that a compromise must be sought between perfect shadowing protecting all possible misalignments and the increase of manufacturing costs due to complex shapes.
Supporting analysis is being performed in parallel with the evolving full-W design and will be briefly discussed in the paper.

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Session Classification: Poster: P5

Track Classification: ITR - ITER Activities