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P4.112 Measures to overcome deep crack issues in the tungsten tiles of the ASDEX Upgrade divertor

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A massive tungsten divertor, Div-III, was installed into ASDEX Upgrade (AUG) in 2014. Div-III is an adiabatically loaded component and consists of massive tungsten tiles clamped into their supporting structures. Before installing the new component, extensive studies, including Finite Element Modeling and high heat flux tests in the test facility GLADIS, were carried out. After the first experimental campaigns the tile inspection reveals most of the tiles were cracked [1]. The difference between the high heat flux tests and the AUG behavior was attributed to mechanical loads due to disruptions and/or the thermal load profile and history. The actions to understand the cracks comprise tests with the Divertor manipulator, DIM-II, and FEM analysis of different target design options. DIM-II was used to test 'split' tiles, i.e. the deep crack is avoided by cutting a wide tile into two small tiles. FEM calculations were done to investigate the behavior of castellated targets with reduced tensile stress on top of the target and a clamping with a more elastic material, titanium instead of stainless steel. In addition more ductile tungsten heavy alloy (THA) was qualified for use in AUG. Based on this, a new set-up of tungsten tiles was installed in 2016. The paper reports on the inspection of this target arrangement after about 1000 plasma shots.

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