Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Challenging current alternative divertor concepts ROBERTO MAURIZIO, BASIL DUVAL, BENOIT LABIT, HOLGER REIMERDES, CHRISTIAN THEILER, EPFL - Swiss Plasma Center, JAMES HARRISON, CCFE, NICOLAS FEDORCZAK, CEA - IRFM, TCV TEAM[1], EUROFUSION MST1 TEAM[2] — An unprecedented range of innovative magnetic divertor concepts were realized on TCV to investigate their ability to enhance the target wetted area in attached conditions, as this reduces the power exhaust challenge by lowering the upstream SOL density required for detachment. Unexpectedly, the results reveal advantageous aspects of the standard low flux expansion Single Null for power exhaust. With the target field line grazing angle fixed by engineering limits, innovative concepts can enhance the wetted area by increasing either target major radius or the heat channel width. At fixed target radius, TCV experiments show two ways of increasing the wetted area. First the heat channel width scales with the square root of the divertor leg length. A long-legged divertor benefits, thus, of enhanced wetted area but has higher realization costs and aggravates heat handling at the inner plate, as a longer outer leg is seen to redistribute heat from the outer to the inner plate. Second and surprisingly, the heat spreading in the divertor and the heat channel width during ELMs scale with the inverse of target flux expansion. A small flux expansion divertor benefits, thus, of enhanced wetted area with increased tolerance to ELMs at usual realization costs.

[1]See the author list of S. Coda et al, 2019 Nucl. Fusion (accepted)
[2]See the author list of B. Labit et al, 2019 Nucl. Fusion 59 086020

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Date submitted: 02 Jul 2019 Electronic form version 1.4