Diffusivity effects on density Scrape-off width $\lambda_n$ in toroidally discontinuous limiters in Aditya using EMC-EIRENE simulation

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The medium to small scale tokamaks might offer suitable set up examining several issues expected in start up phase of a reactor scale with a discrete set of limiters. The density Scrape-off width $\lambda_n$ in Scrape-Off Layer (SOL) shows dependence on toroidal periodicity $N$ of the outboard block limiters (BL) from geometrical considerations [1]. This dependence can be influenced by fluid effects with increasing diffusivity for longer connection lengths. We estimate this situation in Upgrade version of Aditya tokamak where it will be difficult to access the required critical field line pitch $q^*$ for the discrete limiters to act as belt limiter. We have performed Monte-Carlo fluid simulations of 3D discrete SOL configurations of Aditya using EMC3-EIRENE [2, 4] and obtained $\lambda_n$ as a function of perpendicular diffusivity $D_\perp$. For large enough values of $D_\perp$, estimated during Ring limiter (RL) experiments [3], we see a reducing poloidal shear in the upstream flow along flux tubes and therefore increasing influence of fluid flow effects. We additionally find that recycling flux increases with increase of $D_\perp$ for large $N$, it however remains smaller than the original RL configuration ($N = 1$) of Aditya for a finite range of upstream densities. This indicates that higher upstream density will be accessible in Upgrade BL configuration for equivalent SOL conditions of the original Aditya RL configuration.

References