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Simulations of SOL turbulence in a double-null magnetic configuration

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Different magnetic geometries are being considered for handling the power exhaust in DEMO, among which is the double-null. In addition to doubling the exhaust area, experiments have found stark differences in the SOL on the HFS and LFS in this configuration [1], allowing the possibility of efficient heating from the HFS in addition to doubling the exhaust area. The contrast between the LFS and HFS calls for theoretical investigation. In fact, the asymmetry can help to disentangle the different driving mechanisms of the turbulence.

Since the temperature in the SOL is relatively low, the plasma is sufficiently collisional for a fluid model, such as the drift-reduced Braginskii, to be used. This model has been implemented in the GBS code [2,3]. Focusing on limited geometries, the SOL width – a crucial quantity to determine the heat load on the plasma facing components – was estimated by identifying the driving linear instability and turbulence saturation mechanism [4]. The analytical and simulation results were validated against a large number of experiments, showing good agreement [5].

Recently, a non-field aligned coordinate system has been implemented in GBS. This avoids the coordinate singularity present for field-aligned coordinates at the X-point, thus allowing any toroidally symmetric magnetic field configuration to be simulated. We will introduce GBS, discuss the implementation of the new coordinate system and show results of the first simulations in a double-null magnetic configuration. We will present the first insights on the nature of SOL turbulence and the SOL width on the HFS and LFS.

References

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