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Relaxation, Single Helical states and toroidal geometry effects in RELAX

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In a recent study [1] the experimentally measured states in the low aspect ratio (R/a=2) RELAX device [2] have been compared with a cylindrical relaxation theory [3], taking also into account the mode number change observed in the experiment for different plasma conditions.

A substantial deviation of the experimental states from the theoretical predictions have been observed, in particular for cases corresponding to a large reversal of the edge toroidal field.

In the attempt to explain this discrepancy, in this work we consider the effect of the toroidal geometry by employing the VMEC equilibrium code [4]. Both 2D axi-symmetric and 3D helical simulations are considered. In the 2D cases the VMEC solver, is initialized by the safety factor profile as deduced by the cylindrical model and the resulting profiles are compared with those obtained by the code RelaxFit that reconstructs the toroidal equilibrium by taking into account the experimental magnetic measurements. The sensitivity of the calculated profiles upon slightly different initialization assumptions is analyzed.

In the 3D cases the VMEC predictions for the helical deformation are compared with a model that solves iteratively the helical equilibrium problem in cylindrical geometry.

References

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