

Abstract Submitted  
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**A Multi-Grid Solver for Up-Down Asymmetric Tokamak Equilibrium**<sup>1</sup> S.K. WONG, M.S. CHU, Y.R. LIN-LIU, General Atomics — The computer code TOQ produces tokamak equilibria in a coordinate system which uses the poloidal flux surfaces as coordinate surfaces. It is well-suited for providing accurate equilibria to stability analyses. It has been extremely used for beta-optimization in modeling Advanced Tokamak scenarios and the study of bootstrap current driven Spherical Torus. To solve the Grad-Shafranov equation, TOQ uses a multi-grid (MG) package,<sup>2</sup> which has been shown to be very robust in solving elliptic problems. The MG algorithm as implemented has to be modified in order to deal with up-down asymmetric equilibria. In this work we discuss an implementation of the new MG algorithm and give examples of up-down asymmetric high-beta equilibria using the DIII-D geometry and the ITER geometry. We also explore the stability of such equilibria vis à vis the up-down symmetric ones.

<sup>1</sup>Supported by U.S. DOE Grant DE-FG03-95ER54309.

<sup>2</sup>P.M. De Zeeuw, *Matrix-dependent prolongations and restrictions in a black box multigrid solver*, J. Comp. and Appl. Math. **33** (1990) 1-27.

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