The physics base for NTM stabilisation by ECCD in ITER

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One of the main tasks of ECCD in ITER is the stabilisation of Neoclassical Tearing Modes (NTMs). It is the main driver for the design of the Upper Launcher system. The requirements for NTM stabilisation in ITER have been defined as

- steering range sufficient to access the (3,2) and (2,1) surface in scenarii 2, 3 and 5 including a variation of β and l_i.
- steering speed sufficient to scan half the scanning range within 3 s.
- beam geometry such that for all the surfaces mentioned above, NTMs can be fully stabilised, assuming that this means $\eta_{NTM} = j_{ECCD}/j_{bs} > 1.2$, at $P_{ECCD} \leq 20$ MW.

While the first and second point are based on relatively well understood physics assumptions, the third point is based on an analysis using the modified Rutherford equation with the difficulty that the physics at small island width is not unambiguously clear. Recent progress in this field includes an analysis of the impact of NTMs on Q [1] and an approach to benchmark the modified Rutherford equation to experimental data from NTM stabilisation in ASDEX Upgrade, DIII-D and JT-60U [2]. It is the aim of this paper to review the predictions of the generalised Rutherford equation for ITER, to point out the open questions and to discuss the implications of these uncertainties for the ITER requirements.

[1] O. Sauter and H. Zohm, Proc. of the 26th EPS conference on Plasma Physics, Tarragona, Spain, ECA, Vol. **29C** P-2.059 (2005).

[2] R. La Haye, R. Prater, R. Buttery, N. Hayashi, A. Isayama, M.E. Maraschek, L. Urso and H. Zohm, *Cross-machine benchmarking for ITER of Neoclassical Tearing Mode stabilisation by Electron Cyclotron Current Drive*, to appear in Nucl. Fusion (2006).