

## Conceptual design of ELM control coils for the TCABR tokamak

An upgrade of the TCABR tokamak ( $R_0 = 0.62$  m,  $a \leq 0.18$  m,  $I_p \leq 120$  kA and  $B_0 \leq 1.1$  T) is being designed to enable the generation of a well controlled environment to assess the impact of resonant magnetic perturbation (RMP) fields on edge localised modes (ELMs). This impact can be investigated over a broad range of (i) plasma shapes, (ii) RMP coil geometries and (iii) perturbed magnetic field spectra. To address this issue, a unique set of in-vessel RMP coils was designed and, in this work, their conceptual design is presented. This set of coils is composed of three toroidal arrays of coils on the low field side and three toroidal arrays of coils on the high field side. Each of these six toroidal arrays is composed of 18 coils, hence, enabling the application of RMP fields with toroidal mode numbers  $n \leq 9$  to control/mitigate ELMs. To study dynamical effects of RMP fields with different toroidal mode numbers, all rotating simultaneously with different velocities, each of the 108 RMP coils will be powered independently by power supplies that can provide voltages of up to 4 kV and electric currents of up to 2 kA, with frequencies varying continuously from 0 Hz (DC) to 10 kHz. A set of physical criteria was used to determine the optimal coil geometry and their respective number of turns to reduce the coil currents and voltages during operation with alternate current. The conceptual design of the RMP coils was executed using the so-called vacuum approach and the linear, single-fluid plasma response model implemented in the visco-resistive MHD code M3D-C<sup>1</sup>. Work supported by the Ministry of Science, Technology and Innovation: National Council for Scientific and Technological Development - CNPq.

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