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SImplified fluid models of radiofrequency and plasma density for NIO1 and design

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Inductive coupling of radiofrequency power to plasma is a complicate process, since it depends from the density of plasma itself for two major reason: (1) ionization is a chain reaction process; (2) with no Faraday screen (as in many sources and until now NIO1), a capacitative coupling may mix with inductive coupling. Several empirical 2D model can be developed, depending on collisional effect, which usually include stoschatic heating and filter action. Typical implementation with nonlinear partial differenstial equation (PDE) systems is reviewed. Together with a gallery of selected result for NIO1 original design (5 turn coil) and as built (7 turn coil), paper addresses some theoretical points. It can be recognized that (1) implies that PDEs have singularities, which fully justifies guided convergences of the solver; in particular lower bounds for field variables shoulb enforced. Comparison with hydrodymical models is attempted. Typical convergence is slow. Filter strength in the order of 8 mT (or line integrals of 7×10^{-4} T m) seems needed to achieve electron temperature lower than 2 eV (for negative ion production) at extraction.

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