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**Recent progress of plasma modelling at INFN-LNS**

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The ion sources R&D team of the INFN-LNS has been working on the modelling of microwave generated plasmas for many years, dealing with the demands coming from different projects like ESS, AISHA, ECR-based charge breeders, VESPRI, Daeðalus. At first a stationary version of the PIC code was developed following a path that now is going to become a standard for particle tracking code also in commercial products. Electromagnetic properties of the plasma and full-waves simulations are now affordable for non-homogenous and magnetized (i.e. non-isotropic) plasma via “cold” approximation. The diffusion and thermalization of plasma particles by elastic Coulomb collisions via the Fokker-Planck equation are now included instead of the Spitzer collisions. High level of performance was reached with optimization of the code for parallel environment. A wide database of different cross sections related to reactions occurring in an hydrogen plasma was collected and implemented. The next step consists of merging such a variety of approaches for retrieving an “as-a-whole” picture of plasma dynamics in MDIS sources for intense proton beams production. The preliminary results will be summarized in the paper, that shows as the realization of a predictive software including the complete processes involved in plasma formation is still rather far, but a better comprehension of the source behaviour is possible and so the simulations may support the optimization phase.