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## **Status and Perspectives of INFN Simulation Tools: from Beam-Plasma Interaction to a Self-Consistent Plasma-Target Modelling**

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Since 2012, the INFN ion source group has been undertaking an intense activity on numerical modelling, started in a European context with the EMILIE Project, and presently continuing in the framework of the PANDORA project. The work mainly concerns the study of two aspects: on one hand, the interaction of an ion beam with a magnetized plasma, a topic of interest in the field of ECR-based charge breeding of radioactive ion beams, as well as Astrophysics and inertial confinement fusion. On the other hand, the energy coupling to plasma electrons by the microwave field set-up inside the plasma chamber and their consequent dynamics, under the influence of both magnetostatic and electromagnetic fields. Equations describing the particular physics case are implemented through the Langevin formalism in a Matlab environment, including a self-consistent 3D plasma modelling obtained by the interaction between COMSOL Multiphysics and Matlab. This contribution describes the state-of-the-art of the work on both fronts: it will show an overview of the beam-plasma interaction, showing the latest results about the ECR-plasma density fine structure, as well as electron spatial temperature distribution.

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