Cycle of studies: Master LM
Degree course: Physics
Title of the thesis: Modelling of the propagation of a large negative ion beam
Type: modelling
RFX Supervisor: Emanuele Sartori, Valeria Candeloro
Academic supervisor: Gianluigi Serianni
Head of the RFX research group: Matteo Zuin
Leader of the RFX research program: Vanni Toigo

Description of the thesis:
Negative ion-based Neutral Beam Injectors (N-NBI) are one of the most widespread plasma heating techniques used in fusion relevant experiments. The heating power is deposited by a highly energetic neutral beam, which is obtained by neutralising a precursor negative ion beam. The propagation of the latter is guaranteed by the positive charges that stem from the interaction between the background neutral gas and the beam itself: these positive ions allow to compensate the negative charge of the beam ions, in such a way to prevent the beam dispersion due to mutual repulsion. The beam propagation ultimately influences both the beam optics and the net current density. The aim of this thesis is the numerical investigation of the negative ion beam propagation by means of a 2D-3V PIC-MCC code. To begin with, the already existing code will be improved and applied to simulate the beam propagation; the model should then be benchmarked against some experimental results obtained from a N-NBI hosted by NIFS (Japan). The activity will then continue with the application of the model to study and characterise the negative ion beam of the SPIDER source, verifying both the beam optics and the beam current measurements. These analyses will result in some proposals to further investigate the beam propagation from the experimental point of view.

Previous experience (if necessary):
Date: 11/02/2022
Status: assigned
Name of the student: Daniele Mussini