Numerical study of the effect of stray magnetic field on the beam quality of the 170 GHz, 2MW gyrotron gun for ITER

Ioannis Gr. Pagonakis, Jean-Philippe Hogge and Stefano Alberti

Centre de Recherche en Physique des Plasmas,Association Euratom-Confédération Suisse,
EPFL Ecublens, Station 13, CH-1015 Lausanne, Switzerland

The gyrotron performance are intrinsically associated to the electron beam properties in the interaction cavity, which are related to the gyrotron magnetic field structure. In an application where these gyrotrons are used for ECRH heating, different gyrotrons are placed in close vicinity of other ones and also in vicinity of the Tokamak. In this situation the stray magnetic field of neighbor gyrotrons and/or the Tokamak might affect the electron beam properties. Since these fields in general brake the two dimensional symmetry commonly assumed in electron beam propagation codes, for taking into account the effect of stray fields one needs to use a three-dimensional code.

As a direct application, in this work, the degradation of the electron beam of the 170 GHz, 2 MW gyrotron for ITER is studied for several values of the stray magnetic field. In particular, the radius and the width of the electron beam, together with the average value and the spread of the parallel and the transverse velocity of the beam electrons are numerically calculated at the entrance the interaction region. For the beam simulation the three-dimensional, self-consistent, electrostatic and parallel code *ARIADNE* has been used. The simulation results indicate the maximum stray magnetic field for safe gyrotron function.