ThuPE11

Concepts of Magnetic Filter Fields in Powerful Negative Ion Sources for Fusion

Werner Kraus, Ursel Fantz, Bernd Heinemann, Markus Fröschle, Rudi Riedl, Loic Schiesko, Dirk Wünderlich

Max-Planck-Institut für Plasmaphysik, Garching, Germany

Corresponding Author: Werner Kraus, e-mail address: kraus@ipp.mpg.de

In large negative ion sources for fusion a magnetic field in front of the first grid of the extraction system is essential to reduce the current of co-extracted electron below a required limit. In case of the ITER source the electron current has to be smaller than the ion current. At Max-Planck-Institut für Plasmaphysik (IPP) two RF sources of different size are currently being tested, the small 0.3 x 0.6 m^2 prototype source and the 0.9 x 1.0 m^2 source at the ELISE testbed, which has the same width, but only half the height of the ITER source.

Due to the small width of the prototype source it is possible to span the magnetic field between two rows of permanent magnets placed close to the lateral walls. In the large source the field has to be generated by a current of several kA flowing through the plasma facing grid and returning thorough three rods on the top side of the source. These two concepts have substantial different field profiles perpendicular and parallel to the plasma grid. The field strength of the permanent magnets is higher close to the grid and the field lines converge to the sides like in a magnetic bottle. An advantage of the field produced by the current is the possibility to adjust the field strength according to the experimental situation.

Filter field variations have great impact on the currents of negative ions and electrons as well as on the plasma density, the plasma drift in the source and the beam homogeneity. Magnetic fields in the volume, where the plasma is produced, have influence on the plasma sustainment at low pressure.

Many experiments carried out with the small source and the large ELISE source now allow comparing between the source performances achieved by the two concepts of magnetic filter fields. The result of this comparison and possible improvements of the ELISE filter field configuration will be reported.