

Aperture size effect on extracted negative ion current density

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This paper discusses experimental results from CEA Cadarache that appear to show a higher extracted D^- current density from small apertures.

During SINGAP operation at CEA-Cadarache plasma grids with different shapes have been installed and tested. All grids had one single aperture. The tests were done in volume operation and in caesium operation. Subjects of consideration were the arc efficiency (defined as the amount of accelerated D^- current density per unit of arc power) and the beamlet optics (in particular the amount of halo). The accelerated D^- current was measured by measuring the thermal power on an inertial carbon target using an infrared camera. The current density is then defined as the measured current divided by the aperture area in the plasma grid.

We tested three grids with $\varnothing 14$ mm, $\varnothing 11$ mm and $\varnothing 8$ mm aperture. We did not find significant differences in beamlet halo between the apertures. All halos were below 4% in volume operation. In caesiated operation, halos up to 10% have been identified. The halo analysis is still preliminary.

In volume operation (before any caesium was introduced into the source) any differences in accelerated current density between the different grids could be attributed to differences in stripping losses: there is no aperture size effect in volume.

In caesium operation we took care to reproduce the caesium conditions. For every new grid the source and accelerator were completely cleaned. The source walls were kept at 40°C all the time. Then 145 mg/hr Cs was injected until the Cs effect manifested itself. During the experiment 30 mg/hr was continuously injected. The extracted current density for the $\varnothing 8$ mm aperture appears to be significantly higher (~50%) than for the $\varnothing 14$ mm aperture. All runs with the small aperture resulted in higher current density than any of the runs with the large aperture.

Simulations with a 3D Monte Carlo Trajectory Following Code have shown an aperture size effect of about 10%

The results will be shown and discussed.