Multi-antenna RF ion source under a high RF power level

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For a large area filament-less RF ion source in the neutral beam injector, we had been proposed two concepts of the plasma sources; (1) a large volume source plasmas [1 and 2] expanded by a number of small RF plasma generators, of which concept has been used primarily as a concept of an ITER-source [3], and (2) a large area RF ion source with multi-antenna system [4] like multi-filament arc discharge source. This multi-antenna source has feature of producing potentially high dense plasmas with high RF power, simply uniform plasmas over a large source area, and of being all metal source chamber which would be robust structurally/preferably for ion source under the radioactive circumstances.

In the 2nd step of studies, multi-antenna RF ion source (1/6th LHD source) assembled with Faraday shield (Fig.1) was tested under the operation condition of high RF power level up to 200kW at 9MHz for 10msec pulse duration. Antenna system was set on the back plate of multicusp plasma source with a magnetic filter arrangement. Four antennas were used, and each had 20cm in length. Negative/positive ion beam from hydrogen plasmas was extracted with a small extractor (5 ϕ). When the RF net power was increased to 130-160kW, H^- ion current reached about 0.05mA. This corresponds to a negative ion current density of 0.25mA/cm^2 at the PG hole. Under a high power level, 0.7 ~ 1.5mA/cm^2 appeared. H^- ion current decreased with the increase of gas pressure. In the extraction of positive ions, maximum ion current density reached 30mA/cm^2 in the external magnetic filter.

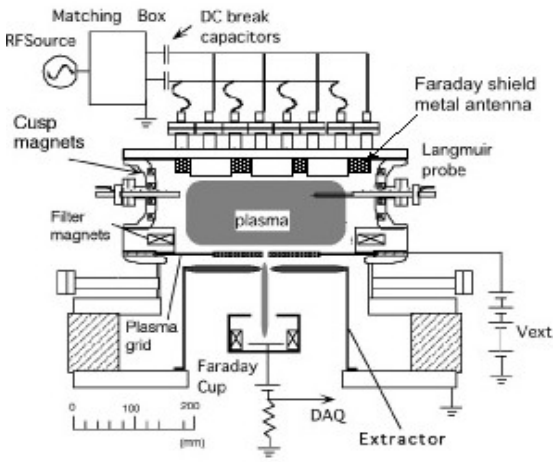

Fig.1 Multiantenna RF ion source with Faraday shield

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Topic: (1)

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