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Construction of a Filament-RF driven hybrid negative ion source at NIFS

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Reduction of beamlet divergence angle is one of the most important targets of negative ion sources driven with Radio-Frequency (RF) to decrease the damages on the accelerator grid and improve the beam injection efficiency. Minimum beamlet divergence of RF driven source is ˜12 mrad and is much wider than the divergence accelerated from Filament-Arc (FA) drive sources; required beam divergences for ITER HNB and DNB are less than 7 mrad. The NIFS-NBI group started the commissioned research on the difference of the beamlet divergence between FA and RF ion sources with the ITER Organization (IO) and the ITER-Technology & -Diagnostic / N-NBI division of IPP Garching (IPP). Comparison of the beam divergence in FA and RF sources can be realized by adding RF system to the NBTS designed for FA operation. The RF oscillator and components of the RF driver at ion source have been exported from IPP. The ion source installed at NIFS NBTS is modified to FA-RF hybrid source by replacing the backplate available to attach the RF driver on it. The NIFS NBI test stand (NIFS NBTS) equips several diagnostic devices to measure the source plasmas and accelerated beams. It is expected to investigate the difference of the plasma characteristics, particularly, the difference of time-dependent plasma potential in the vicinity of the meniscus, in the FA and RF driven modes. So far, the maximum RF power of ˜64 kW was obtained by connecting the RF cable to a dummy load and the infrastructures of the RF system has been almost installed.
Characteristics of the RF oscillator, matching box, and design of the RF backplate will be discussed.

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