講演番号をこちらに
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# Development and construction of 320 GHz interferometer system for Heliotron J

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Fueling techniques such as pellet, Supersonic molecular beam injection (SMBI), and short-pulsed high-intensity gas puffing (HIGP) are used to increase the plasma density in the medium-sized helical device, Heliotron J, [1]. To understand the physics of high-density plasma production, a new 320 GHz solid-state source interferometer with multichannel has been designed and is being constructed in Heliotron J for the high-density plasma measurement with high time resolution.[2]

This interferometry system depends on the principle of heterodyne with two independent solid-state sources, one as the probe source and the other as the reference source. Each source provides up to 50mW output power. One source output the fixed frequency at 320.16 GHz, the other output tunable frequency in the range of 312-324 GHz. The frequency shift between two sources is adjustable to increase the IF frequency and to achieve a high time resolution. Depending on the quasi-optical techniques, two oversized waveguides are utilized to transmit the microwaves to near Heliotron J device.

As a commissioning before the construction of the multi-channel system, the signal-channel interferometer system is under construction in Heliotron J, as shown in Fig. 1. On the optical bench A, concave mirrors and plane mirrors carefully adjust the beam width and the beam waist position at the waveguide inlet to optimize microwave transmission efficiency.

On the optical bench B close to the diagnostic port, the arrangement with concave mirror and plane mirrors inject the probe beam to the plasma along the mid-plane. A retroreflector array installed at the vacuum chamber wall reflects the probing beam to the incident direction. The reflected beam combines with the reference beam and is detected by the mixer.

The construction and alignment of microwaves are finished and the detail will be presented in this presentation.

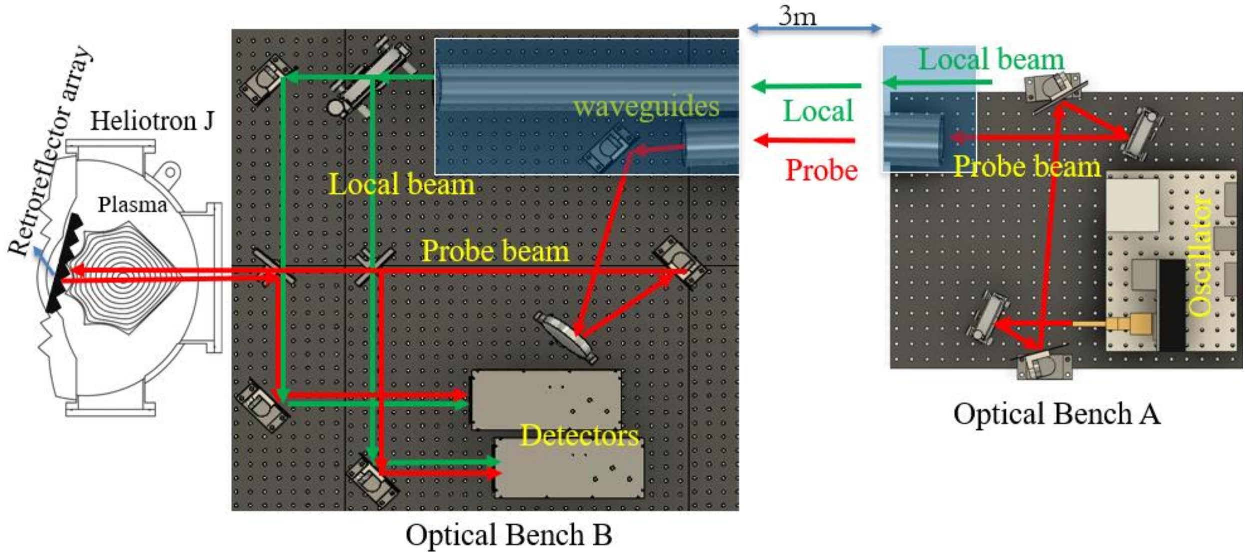


Figure 1. Schematic of the optical layout of the signal-channel interferometer. The source is located on optical bench A and produces microwave, and microwave transmit through the waveguide to optical bench B and inject into the plasma

[1] T. Mizuuchi et al., Journal of Nuclear Materials 438 (2013) .

[2] S. Ohshima et al., Review of Scientific Instruments 92, 053519 (2021).