23Pp02

Quasi-optical design of a multi-channel 320GHz interferometer

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Density profile measurement with a high temporal resolution is required for understanding particle transport in the study of fusion plasmas, and the Far-InfraRed(FIR) interferometer is generally applied to the measurement of high-density plasma regimes.

In Heliotron J, the upgrade plan of the single-channel 320 GHz interferometer[1] to a multi-channel system[2] is in progress.

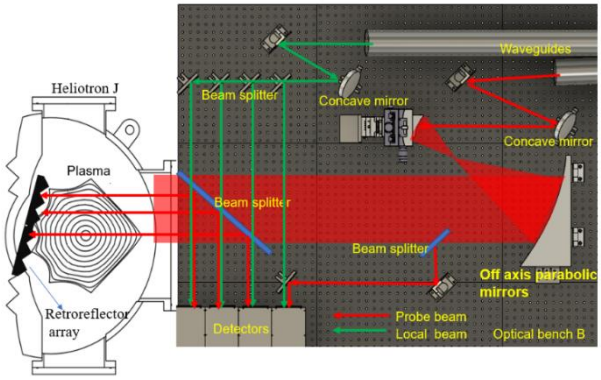

FIG.1. OAP system on optical bench B

In the multi-channel system, a pair of off-axis parabolic mirrors (OAP) extends the submillimeter wave beam into a vertical sheet beam for realizing multi-channel measurement. Since the submillimeter wave being extended leads to a decrease in power density, it is necessary to increase the beam transmission efficiency. A terahertz imaging sensor can be used to optimize submillimeter wave transmission, thus increasing the power

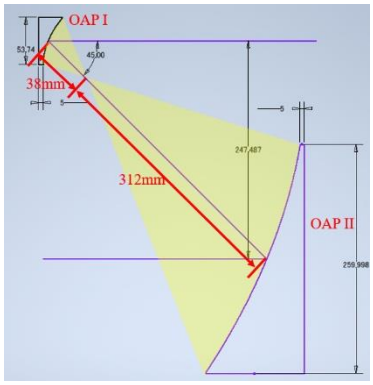

FIG.2. Design of OAP system

density of the submillimeter wave and avoiding the distortion of the submillimeter wave beam profile. By comparing the submillimeter wave power density and profile data with those of last year's single-channel 320GHz interferometer system, better transmission efficiency and microblogging profile were successfully realized with the method using the imaging sensor.

We plan to complete the construction of a multi-channel 320 GHz interferometer based on this research and apply it to plasma experiments.

[1]P. Zhang et al. Review of scientific instruments, to be published.

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