§11. Application of Digitally Controlled Millimeter-wave Interferometer to GAMMA10 Central Cell Plasma for Precise Density Distribution Measurement

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We have proposed a digital based millimeter wave interferometer for precise density profile measurement[1]. Figure 1 shows a block diagram of this interferometer. This system will be installed in the central cell of GAMMA10. The image non-radiative dielectric guide (INRDG) antenna is utilized for a transmitter. The interferometer electronics provides signal with multiple frequency component to the antenna. The INRDG antenna transmits multiple probe beams which are spatially distributed according to that frequency. Transmitted beams are collected by the receiver antenna. The phase differences due to plasma are analyzed numerically in a PC.

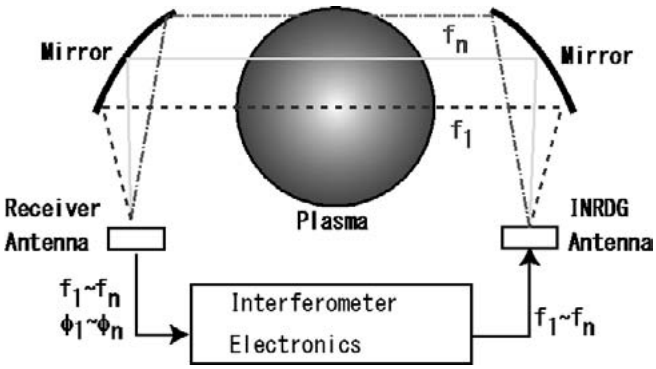

Fig. 1 Block diagram of interferometer for validity confirmation experiment

In the previous fiscal year, we have confirmed that shape of a Teflon plate is clearly observed by means of experimental system without the mirrors. In this year, we have been designing and fabricating those quasi-optical mirrors. Figure 2 shows the illustration of ray tracing performed by CODE V (Synopsys Inc.). A cylinder shown in the center is GAMMA10 plasma. Two offset parabolic mirrors are located besides the plasma. A transmitting antenna and a receiving antenna are installed at each focal point of the reflectors. The red, green, and blue colored rays correspond to the probe beams with three different frequencies. The probe beams propagate upper side of the plasma with this quasi-optical system. These parabolic mirrors have been fabricated in the machine center of Fukuoka Institute of Technology.

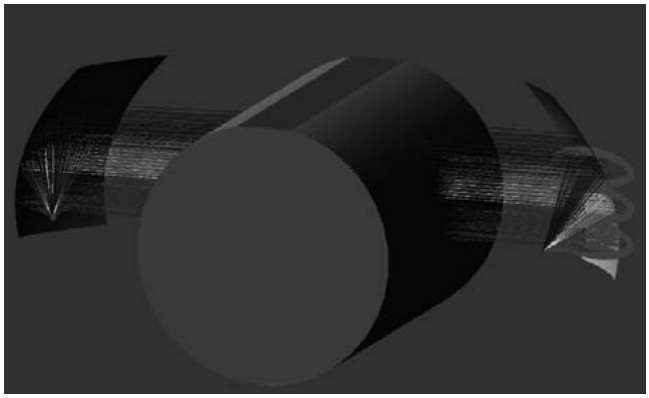

Fig. 2 Ray tracing result of the quasi-optical system for GAMMA10 plasma.

We have now installed these parabolic mirrors in the interferometer system, as shown in picture.1. The INRDG antenna, and the receive antenna are installed at the focal point of each reflectors.

Picture 1 Experimental setup of the new interferometer system performed in our experimental room (FIT).

The preliminary experiment is being performed, and shows distributed optical path shown in Fig.2. It seems that the shape of a formed styrol inserted between two mirrors is observed, however, is still bluer image. We need a proper analysis method for this data to make the image clear. Development of the software will be discussed in the next time.

1) Kogi, Y. et al.: Review of Scientific Instruments **83** (2012) 10E347.