

Preliminary results of a combined interferometer using 340 GHz solid state source and a HCN laser on ENN's XuanLong-50 (EXL-50)

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A millimeter wave solid state source - far infrared laser combined interferometer system (MFCI) consists of a three-channel 890 GHz hydrogen cyanide (HCN) laser interferometer and a three-channel 340 GHz solid state source interferometer (SSI) is developed for real-time line-integrated electron density feedback and electron density profile of the EXL-50 spherical tokamak device. The interferometer system is a Mach-Zehnder type, with all probe-channels measured vertically, covering the plasma magnetic axis to the outermost closed magnetic plane. The HCN laser interferometer uses an HCN laser with a frequency of 890 GHz as a light source and modulates a 100 kHz beat signal by a rotating grating, giving a temporal resolution of 10 μ s. The SSI uses two independent 340 GHz solid-state diode source as the light source, the frequency of the two sources is adjustable, the temporal resolution of SSI can reach 1 μ s by setting the frequency difference of the two sources at 1 MHz. The main optical path of the two interferometers is compactly installed on a set of double-layer optical platform directly below EXL-50. Dual optical path design using corner cube reflectors avoids the large support structures. At present, the phase noise of the HCN interferometer and SSI is 4.1 deg and 2.1 deg respectively, corresponding to a line-integrated electron density of $0.75 \times 10^{17} \text{ m}^{-2}$ and $1.5 \times 10^{16} \text{ m}^{-2}$ respectively, 6-channel measuring result was obtained by the MFCI system, and the highest density measured is about $1 \times 10^{19} \text{ m}^{-2}$ [1].

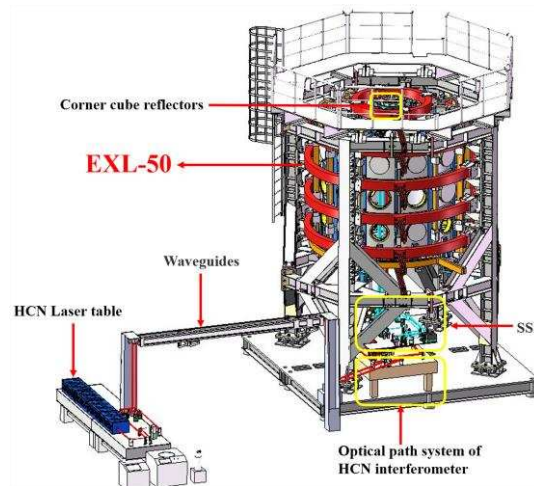


Figure 1. The MFCI system on EXL-50.

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