Progress of CO_2 Dispersion Interferometer on EAST

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The dispersion interferometer (DI) system on the Experimental and Advanced Superconducting Tokamak (EAST) has been successfully operated, providing measurements of plasma electron density. The DI system utilizes a continuous-wave 9.3 μm CO_2 laser source to measure line-averaged electron densities [1]. It offers significant advantages, including the ability to overcome calculation errors caused by fringe jumps in the traditional far-infrared interferometer, and immune mechanical vibration. These characteristics make it well-suited for future high-density, long-pulse plasma discharges. The DI system on EAST had provided a real-time density feedback signal to plasma control system (PCS) for routinely density feedback control for long pulse operation. Experimental results on EAST have demonstrated a good agreement between the density obtained by the DI system and the preset values of density. The DI system also shows stability in long pulse discharges. Moreover, the DI system has shown stability during experimental measurements involving rapid density changes and highly dense pellet injections. In shot 120596, the DI system exhibited stable density feedback during continuous projectile injection lasting over 50 seconds, the electron density is around $4.1\times10^{19}m^{-3}$. Additionally, in contrast to the long wavelength source interferometer, which may deflect light away from the detector due to excessive refraction angles in larger density gradient discharges, the dispersion interferometer ensures accurate density measurements. In general, the DI system on EAST has demonstrated dependability in accurately measuring electron density. As shown in Figure 1, in three adjacent plasma discharges with a plasma current of 0.3 MA and discharges duration of about 65 seconds, the electron density is measured to be around $4\times10^{19}m^{-3}$.

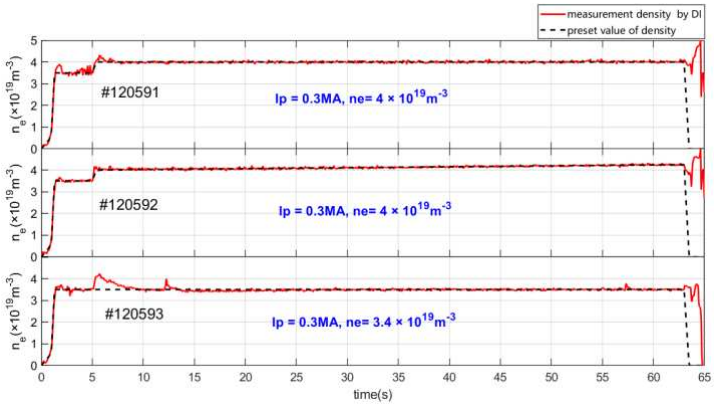

Figure 1. Good agreement between the density measurement results obtained by the DI system and the preset values of density.

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