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Progress of the Polarimeter/Interferometer System on HL-2A

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Integrated system for FIR laser interference measurements has been commissioned at HL-2A. These systems include polarimetry for plasma current density profile measurement, interferometry for electron density profile measurement and far-forward collective scattering for density fluctuation measurement. The main feature of the system is using two HCOOH lasers with different frequencies, which can produce beat signals and measure the phase difference between the R- wave and the L- wave. With this method, the phase measurement precision can be increased to about 0.1°, which is much higher than the conventional Faraday rotation angle measurement. A digital phase comparator technique with real-time dynamic spectrum analysis is implemented that has obvious advantage over the conventional analog phase comparator. For reducing the processing time, all signal processing processes are carried out in the Field Programmable Gate Array (FPGA) chips, including an intermediate frequency identification, phase calculation and so on. Therefore, the time resolution can increase to <1 μs.

The FIR laser Polarimeter/Interferometer integrated system has been operated routinely since 2015 for all plasma conditions. The density resolution is $2\times10^{10}cm^{-3}$, the Faraday rotation angle phase resolution is 0.1° and density fluctuation wave number $k<1.6cm^{-1}$.

Key words: FIR Interferometer, Polarimetry, Tokamak

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