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12.54 Development of Phase Contrast Imaging on HL-2A Tokamak

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Phase contrast imaging (PCI) has been recently developed on HL-2A tokamak. In this article we will present the construction and calibration of this diagnostic. The system is able to diagnose the chord integral density fluctuations by measuring the phase shift of a CO₂ laser beam with a wavelength of 10.6 μm when passing through the plasma region vertically. There are 32 channels of HgCdTe detector array, covering the plasma region of $0.625 < r/a < 0.7$. This diagnostic is designed to detect plasma density fluctuations with the maximum wavenumber of 15 /cm. The designed wavenumber resolution is 2 /cm restricted by the window size and the time resolution can reach 2 μs . The broad normalized wavenumber k_{ps} ranging from 0.2 to 3 makes it suitable for turbulence measurement. The error field caused by magnetization of a large steel-made optical platform of the system on the top of HL-2A is evaluated for safety reasons. Sound waves are used to calibrate PCI diagnostic. The signal series in different PCI channels show a pronounced modulation of incident laser beam by the sound wave. Frequency-wavenumber spectrum is achieved. Calibrations by sound waves with different frequencies exhibit a maximal wavenumber response of 12 /cm.

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