**Reconstruction method of laser-driven ion-beam trace probe diagnosing the poloidal magnetic field in spherical tokamak**

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The poloidal magnetic field ($B\_{p})$ is a critical factor for plasma equilibrium and stability, and multiple diagnostics are in need for a more accurate profile of $B\_{p}$. The laser-driven ion-beam trace probe (LITP) has been proposed recently to diagnose the poloidal magnetic field ($B\_{p}$) and radial electric field ($E\_{r}$) in tokamak.[1-3] It measures the displacements of laser-driven ion beams which directly depend on electromagnetic field along the beam traces, and tomography methods are employed for the reconstruction. Based on the three properties of laser-driven ion beam: large energy spread, short pulse lengths, and multiple charge states, the two-dimensional profile of both $B\_{p}$ and $E\_{r}$ can be diagnosed by LITP.

Spherical tokamak (ST) is a promising compact device with high plasma beta and increased vertical stability. When applying LITP to diagnose $B\_{p}$ in ST, the larger $B\_{p}$ comparable to the toroidal magnetic field, turns the reconstruction problem into solving the nonlinear equations. In this presentation, an iterative reconstruction method is proposed to solve the nonlinear equations and a model to reconstruct $B\_{p}$ profile in ST is built. The schemes of ion traces are designed for EXL-50 (a middle-sized ST in Langfang) and simulated reconstruction has been conducted. The relative errors of reconstructed $B\_{p}$ are mostly under 10%. The effects of measurement error and system error have been evaluated, suggesting LITP can reconstruct $B\_{p}$ in ST for practical purposes.

**References**

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