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Recent Results on the Study of Machine Imperfection Effects and the Development of a Laser-Induced-Fluorescence Diagnostic on the Paul Trap Simulator Experiment (PTSX)[1] HUA WANG, ERIK GILSON, RONALD DAVIDSON, PHILIP EFTHIMION, RICHARD MAJESKI, Princeton Plasma Physics Laboratary — The Paul Trap Simulator Experiment (PTSX) is a cylindrical Paul Trap that simulates the nonlinear transverse dynamics of intense charged particle beams propagating through a magnetic alternating-gradient (AG) focusing system. Machine imperfections cause the degradation of the charged particle beam's quality when the external perturbation is resonant with the collective modes of the charged particle beam. Rearranging the external perturbation can mitigate the machine imperfection effects by eliminating the frequency components at the collective mode frequencies. A laser- induced-fluorescence (LIF) diagnostic will allow us to measure the 4D, time dependent, transverse phase space profiles of the charge bunch and better understand critical issues including emittance growth, and halo particle formation. A stable and high-number-density barium ion source has been developed. A detailed analysis of the LIF signal-to-noise ratio has been conducted and the computed ratio is favorable. The measurements of the radial density profiles of the barium ion source using the LIF diagnostic are calibrated and compared to measurements using a charge collector. The LIF diagnostic system includes an excimer laser, a dye laser, and a CCD camera system. Recent results on the machine imperfection effects will be presented. The LIF diagnostic system and the initial results of the radial density profiles measured by the LIF diagnostic will be presented.

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