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## Improvements in Longitudinal Phase Space Tomography at PITZ

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At the Photo Injector Test facility at DESY in Zeuthen, Longitudinal Phase Space (LPS) tomography is done to reconstruct the LPS before the booster. In order to improve the existing technique, methodical studies were done where some core concerns were addressed e.g. booster phase scan range, momentum resolution and space-charge effects. An analytical model was developed to quantify RMS energy spread, bunch length and phase advance. Phase advance analysis determined the booster phase range and step size to be used for obtaining momentum projections. The signal resolution of these projections was improved by careful beta function control at the reference screen of the momentum measurements. The reconstruction method was updated from algebraic reconstruction technique to image space reconstruction algorithm and an initial scientific presumption of LPS from low energy section momentum measurements was established. The aforementioned reforms resulted in reduced noise-like artefacts, better convergence speed and accurate longitudinal emittance. The method was tested on simulations as well as on experimental data. It can diagnose not only linear chirp in LPS but also higher order effects. Experiment with modulated laser beam was also designed to demonstrate the diagnostic capability.

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