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GPU accelerated longitudinal phase space tomography

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Longitudinal tomography is widely used in the CERN synchrotrons as an essential beam diagnostics tool. In recent years, more complex applications of phase space tomography, such as voltage calibration and multi-bunch tomography, have been explored. For these applications, large numbers of reconstructions are required, and computation time has a significant impact on usability. The current implementation is Python based, with the numerically intensive components written in C++. To further increase performance, a GPU-accelerated version has been developed using CuPy and CUDA. The most computationally demanding parts of the algorithm can now be run on the GPU, whilst maintaining the Python interface for maximum flexibility. Performance benchmarks showed speedups up to a factor of 35 in the scope of the entire application and even higher values when only considering the computationally intensive parts. This contribution discusses the implementation of GPU tomography as well as the additional performance improvements it enables.

Footnotes

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