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## Designing a femtosecond-resolution longitudinal profile monitor using simulated and experimental coherent transition radiation images

Ultra-short bunch length measurements with femtosecond (fs) resolution are essential for characterizing electron beams in novel accelerator experiments like EuPRAXIA and any other short pulse accelerators, such as Free Electron Lasers (FELs). This contribution shows the progress towards a non-invasive and single-shot longitudinal profile monitor by showcasing a prototype of a broadband imaging system for Coherent Transition Radiation (CTR) recently installed at the MAX IV Short Pulse Facility. A THz-based imaging system was designed and tested using optical system simulation software, and preliminary CTR images were captured experimentally. This talk will cover the processes behind conceptualizing the bunch length monitor, the current experimental setup, supporting simulation work, and the system's installation. It will also provide an early preview of the data acquired experimentally and a discussion on the considerations for future iterations of the prototype aimed at the monitor being less invasive, achieving higher resolution, and exploring alternative design options.

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