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Tolerance analysis of a bunch arrival-time monitor design with rod-shaped pickups on a printed circuit board for the European XFEL and FELBE

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For arrival-time monitors of the electro-optical synchronization system at the European XFEL, FELBE and other free-electron laser facilities, a novel concept based on rod-shaped pickups mounted on a printed circuit board is proposed. New simulation results show the huge potential for low charge applications foreseen at the European XFEL and FELBE for future operation modes. A theoretical jitter-charge product $\Delta t \times \Delta B$ of 9 fs pC was estimated for this pickup structure in combination with tailor-made ultra-wideband low-pi-voltage electro-optical modulators. The design meets the desired criteria for 1 pC operation, so it is planned to produce a prototype for first tests in FELBE. The structure is assumed to be sensitive to the production accuracy, manufacturing tolerances for different components of the pickup-structure are analyzed in this work. The results allow to identify critical dimensions and will help to predict the effect of inevitable geometric deviations.

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