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Simulations and plans for possible DLA experiments at SINBAD

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In this work we present the outlines of possible experiments for dielectric laser acceleration of ultra-short relativistic electron bunches produced by the ARES linac, currently under construction at the SINBAD facility (DESY Hamburg). The experiments are to be performed as part of the Accelerator on a Chip International Program (ACHIP), funded by the Gordon and Betty Moore Foundation. At SINBAD we plan to test the acceleration of already pre-accelerated relativistic electron bunches in laser-illuminated dielectric grating structures. We present outlines of both the acceleration of ultra-short single bunches, as well as the option to accelerate phase-synchonous microbunch trains. Here the electron bunch is conditioned prior to the injection by interaction with an external laser field in an undulator. This generates a sinusoidal energy modulation that is transformed into periodic microbunches in a subsequent chicane. The phase synchronization is achieved by driving both the modulation process and the DLA with the same laser pulse. In addition to the conceptual layouts and plans of the experiments we present start-to-end simulation results for different ARES working points.

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