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Control software and data acquisition at the MHz repetition-rate FLASH

At the time when FLASH was constructed, controlling a high-repetition SASE FEL represented a bunch of challenges like the extraordinary requirements on timing on the femtosecond scale and the high number of electron bunches accelerated by the superconducting Linac. Especially the operation of the FLASH1 and FLASH2 beamlines by the same accelerator in parallel requires a reliable synchronization. The control system DOOCS (Distributed Object Oriented Control System) makes use of hardware based synchronization fiber optical networks while software controlled parameters are transferred via Ethernet.

With a typical 10 Hz rate of RF pulses with a duration of up to 800 μ s, trains of electron bunches can be accelerated with up to 5000 bunches per second divided between FLASH1 and FLASH2.

All data taken at FLASH, from the experimental as well as from the machine side, is tagged with the current time stamp and train Id as primary index and saved on a central data acquisition server.

During the experiment is jDDD, a Java-based graphical tool for control system panel design, the main instrument to control the beamline and experiment although it is possible to use the DOOCS client API for device control and online data analysis.

For easier access the user's data are converted to the HDF5 format during or after the beamtime and can be analyzed at DESY's high power computing resources.

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