Contribution ID: **29** Type: **not specified**

Overview of the MTCA.4 and ATCA based data acquisition electronics and concepts for photon beamlines and experiments at the European XFEL

Tuesday 11 December 2012 18:10 (20 minutes)

The European X-Ray Free Electron Laser, currently under construction in northern Germany, will provide up to 2700 less than 100fs short x-ray pulses with wavelengths between 0.05 and 6 nm at a repetition rate of 4.5MHz at several beamlines. It allows in-depth research in various scientific fields.
In order to set-up the beam, position the sample and capture the
measured variables, information from the accelerator, diagnostic devices and detectors have to be digitized, converted, processed, transferred, concentrated, distributed, reorganized, controlled and saved. Boundary conditions like the high data rate and amount, frequently changing processing algorithms in FPGAs, low-latency FPGA-to-FPGA control loops and limited access to hardware reduces the choice of products and standards available. Adopting the MTCA.4 and ATCA standards for the fast DAQ system provided a suitable solution for these requirements. In collaboration with industry and other labs an almost complete framework of hardware components became available. Furthermore, the detector and data acquisition electronics group develops a modular high-level firmware programming environment, which provides an easy-to-use and flexible framework for processing algorithms for the used MTCA.4 and ATCA modules.

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Session Classification: Use of MTCA in Large Scale Facilities

Track Classification: Session 2: Use of MTCA in Large Scale Facilities