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Electronics for beam characterization

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Der Titel muss eingetragen sein.
 Für Aussteller:
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Wer will, kann einen Abstrakt bereitstellen.
Er wird dann mit dem Programm
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To investigate the dynamics of multi-bunch electron beams in accelerator machines, two novel detector systems have been designed and produced: KAPTURE and KALYPSO.
KAPTURE is a wide-band (DC to 50 GHz) front-end electronics designed for ultra-fast detectors. The ultra-short detectors pulses, of only few tens of ps, are real-time sampled with 8 sampling points with a minimum settable sampling time of 3 ps. All incoming pulses are sampled continuously with a pulse rate up to 2 GHz. Very wide-band SiGe front-end electronics are necessary to measure the arrival time of the pulses with a ps accuracy.
KALYPSO is a linear array detector developed for the measurement of longitudinal and transversal bunch profiles. When integrated with the Electro Optical Spectral Decoding (EOSD) setup at ANKA, a sub-ps resolution has been achieved for the longitudinal profile. The system consists of a linear array of photodiodes connected to the front-end amplifier by high-density interconnection technology, based on gold ball-wedge wire-bonding. To improve the temporal resolution, a new silicon micro-strip sensor with a 25 μm pitch and based on emerging Low-Gain Avalanche Detectors (LGAD) have been designed. The analog signal is amplified and filtered by a novel low-noise ASIC operating at 10 Mfps (frames-per-second). The ASIC has been developed on CMOS 110 nm technology.
Both systems generate a data-rate of several GB/s that must be read-out and processed in real time. In order to satisfy such requirements, we developed a heterogeneous system with FPGA-based readout cards and GPU-based computing nodes coupled by fast links.
The electronics design of the two systems will be presented, with a focus on the RF design, the ASIC front-end, the new sensor and finally the high-throughput DAQ based on FPGA-GPU.
The two detectors have been installed at ANKA to directly measure the beam instabilities during the emission of coherent synchrotron radiation (CSR) in the THz domain.

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