# KAPTURE DAQ System

Karlsruhe Pulse Taking Ultra-Fast Readout Electronics

General Description

KAPTURE is a new real-time and high-accuracy data acquisition system designed for ultra-fast detectors. Four samples are taken for each pulse with a minimum sampling time of 3 ps. The KAPTURE system allows the users to resolve single bunches in a multi-bunches environment and to monitor the signal on a turn-by-turn basis for long observation times.

System Architecture
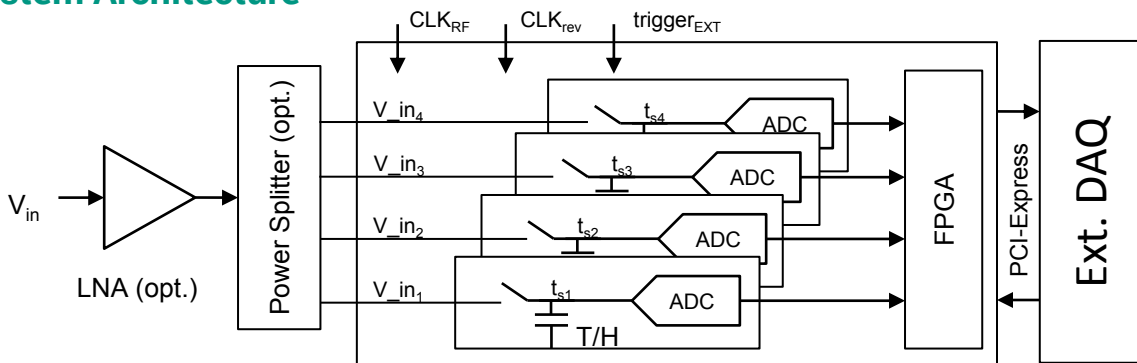
Features

- Developed for ultra-fast detectors in the GHz-THz range. Successfully tested with YBCO, NbN and Zero-Biased Schottky Diodes
- Suitable for a wide range of bunch numbers and revolution frequencies f_{rev}: from 10 kHz to 550 MHz (opt. more than 550 MHz)
- Four independent sampling channels operating in parallel
- Different measurement options when combined with 2-way or 4-way power-splitters:
  - 4 sample points for 1 detector
  - 4 detectors with 1 sample point for each one
- External trigger for synchronous acquisition with other detector systems
- High-throughput communication based on PCI-Express standard
- Real-time GPU-based data elaboration
- GUI with peak reconstruction, FFT, etc.

Applications

- Simultaneous and continuous monitoring of a all bunches
- Study of bunch-bunch effects
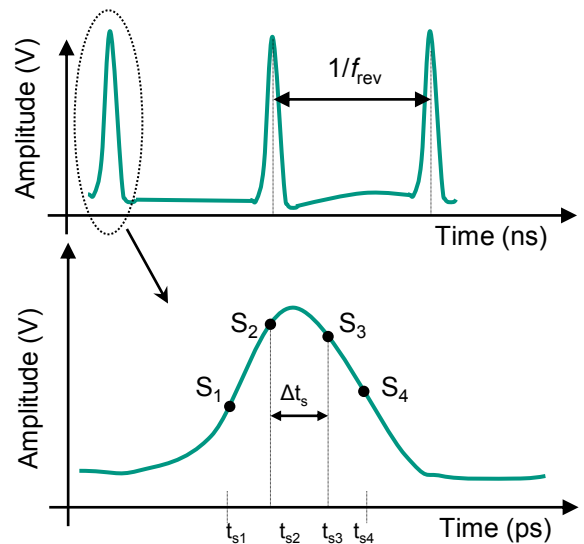- Simultaneous acquisition with different detectors
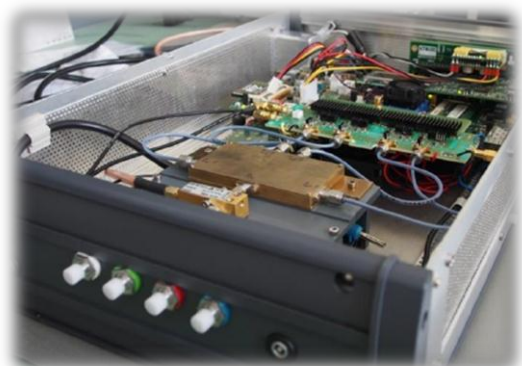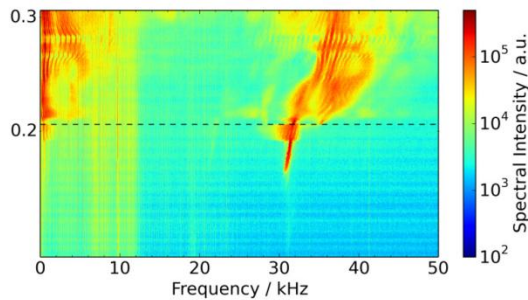

The KAPTURE system

Specifications

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Number of inputs	4
Min. sampling time step (Δt_s)	3 ps
Max. pulse rate (f_{rev})	550 MHz
Timing resolution (RMS jitter)	1.7 ps
Analog bandwidth	DC-60 GHz
ADC Resolution	12 bits
RMS noise	1 mV
Dynamic range	± 800 mV
Internal memory	2 GB

Timing diagram


Measurements taken with KAPTURE at ANKA

Study of bursting behavior: frequency analysis of the time domain signal taken simultaneously for different bunches.
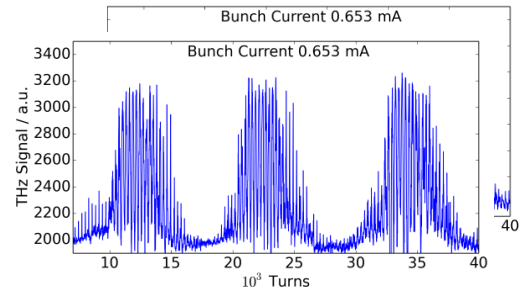
Simultaneous acquisition with 2 "identical" detectors (e.g. for balanced detection).

Now available for other facilities

- Delivery time: 2 months
- Also included: RF Low-Noise Amplifier, 2-way and 4-way power splitters
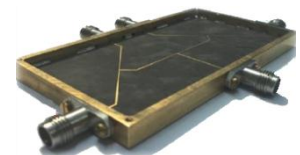
Selected publications

- "Studies Of Bursting CSR In Multi-bunch Operation At The Anka Storage Ring", *V.Judin, M. Caselle et al.,* IPAC 2014, 15-20 June 2014. Dresden. Germany. MOPRO063
- "Commissioning Of An Ultra-fast Data Acquisition System For Coherent Synchrotron Radiation Detection", *Michele Caselle et al.,* IPAC 2014 15-20 June 2014. Dresden. Germany. THPME113
- "An Ultra-fast Data Acquisition System For Coherent Synchrotron Radiation With Terahertz Detectors", TWEPP 2013, Perugia 23-27 September 2013. JINST_124P_1113
- "Studies Of Bunch-bunch Interactions In The ANKA Storage Ring With Coherent Synchrotron Radiation Using An Ultra-fast Terahertz Detection System" *A.-S- Muller et al.*, IPAC 2013. 12-17 May 2013. Shanghai China. MOPEA019

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