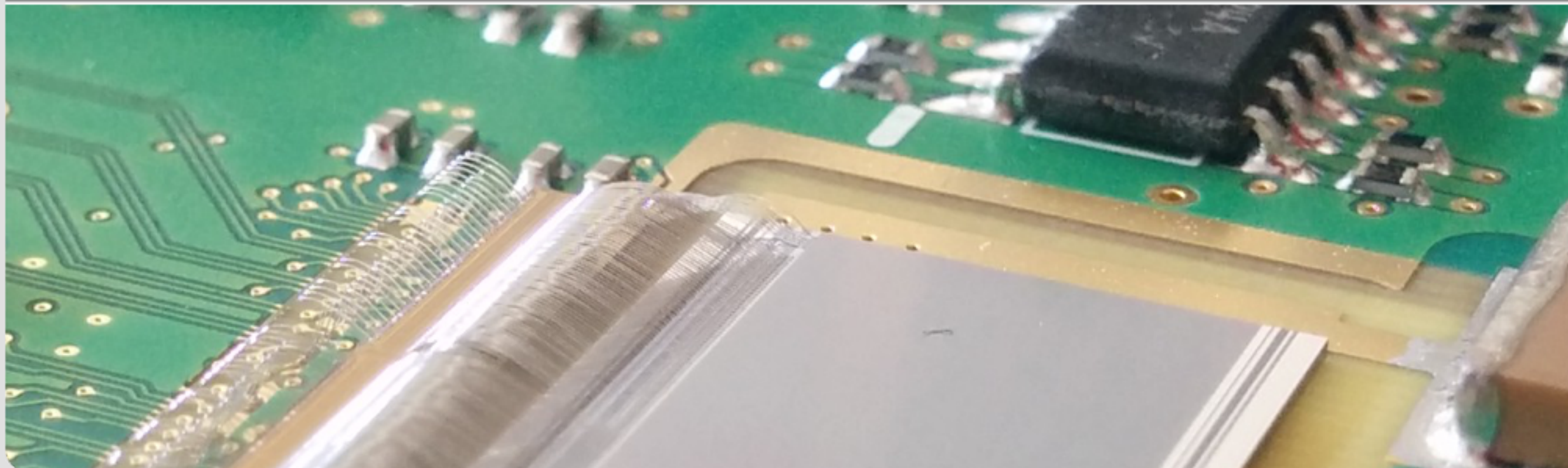


Ultra-Fast Linear Detector Array Development

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Institute for Photon Science and Synchrotron Radiation (IPS) / Laboratory for the Applications of Synchrotron Radiation (LAS)



Motivation for an Ultra-Fast Line Array

■ Turn-by-Turn Electro-Optical Bunch Length Measurements

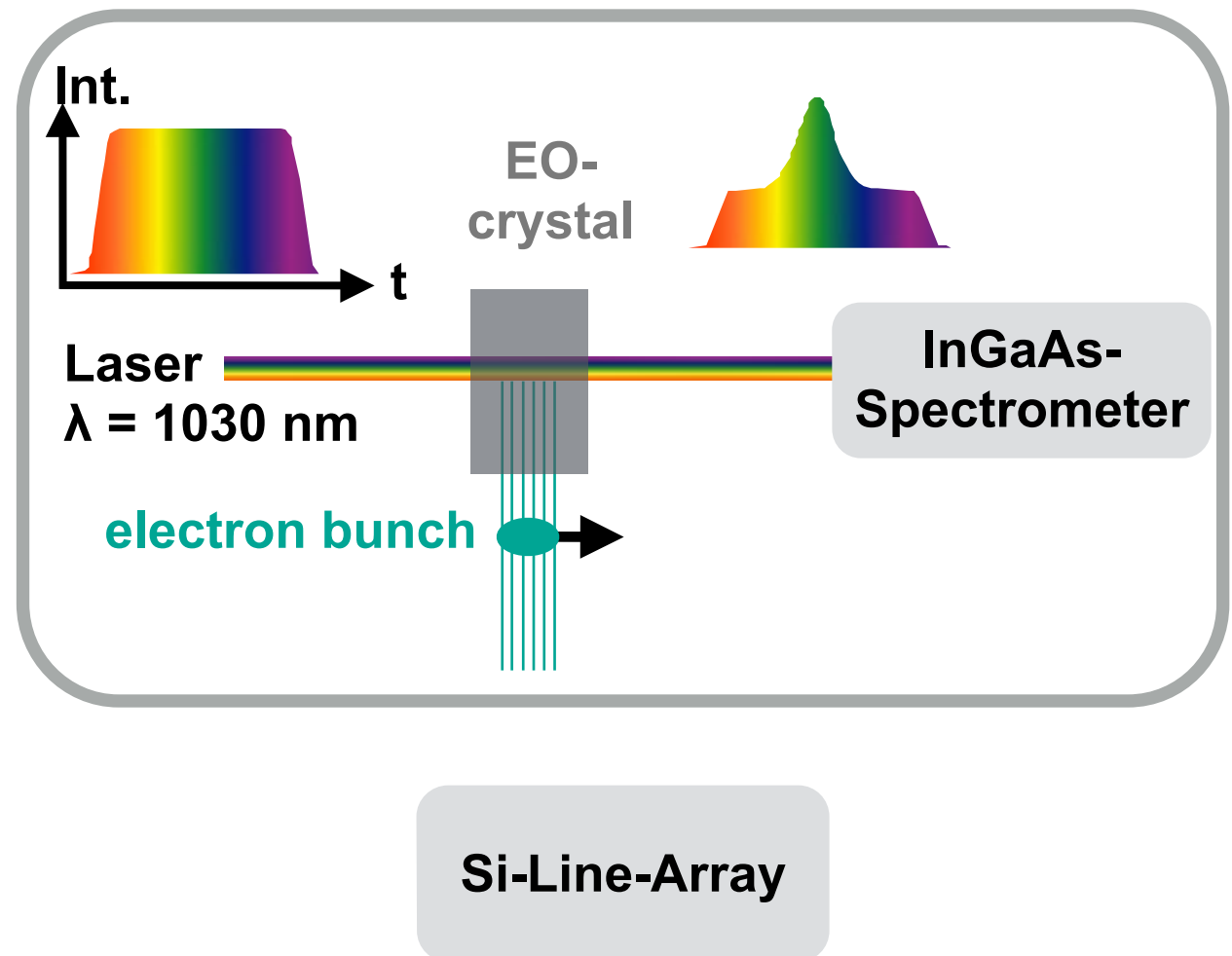
- Readout rate of commercial InGaAs spectrometers is limited ~100 kHz
We would like 2.7 MHz
(or even more e.g. XFEL 5 MHz)

■ Visible light diagnostics

- Monitoring changes in the transverse synchrotron light profile on a turn-by-turn basis

■ Other applications?

- Lasers diagnostics
- 2D detectors



Specifications

■ Version 1.0 - 2015 (now)

- InGaAs / Si
- 256 pixels
- 2x GOTTHARD V1.4 (max. 32 MHz)
- Integration time min. 2 ns
- Readout rate: 1.0 Mfps
- Readout:
 - via PCIe Gen2 (KIT, HZDR)
 - via SFP (DESY)

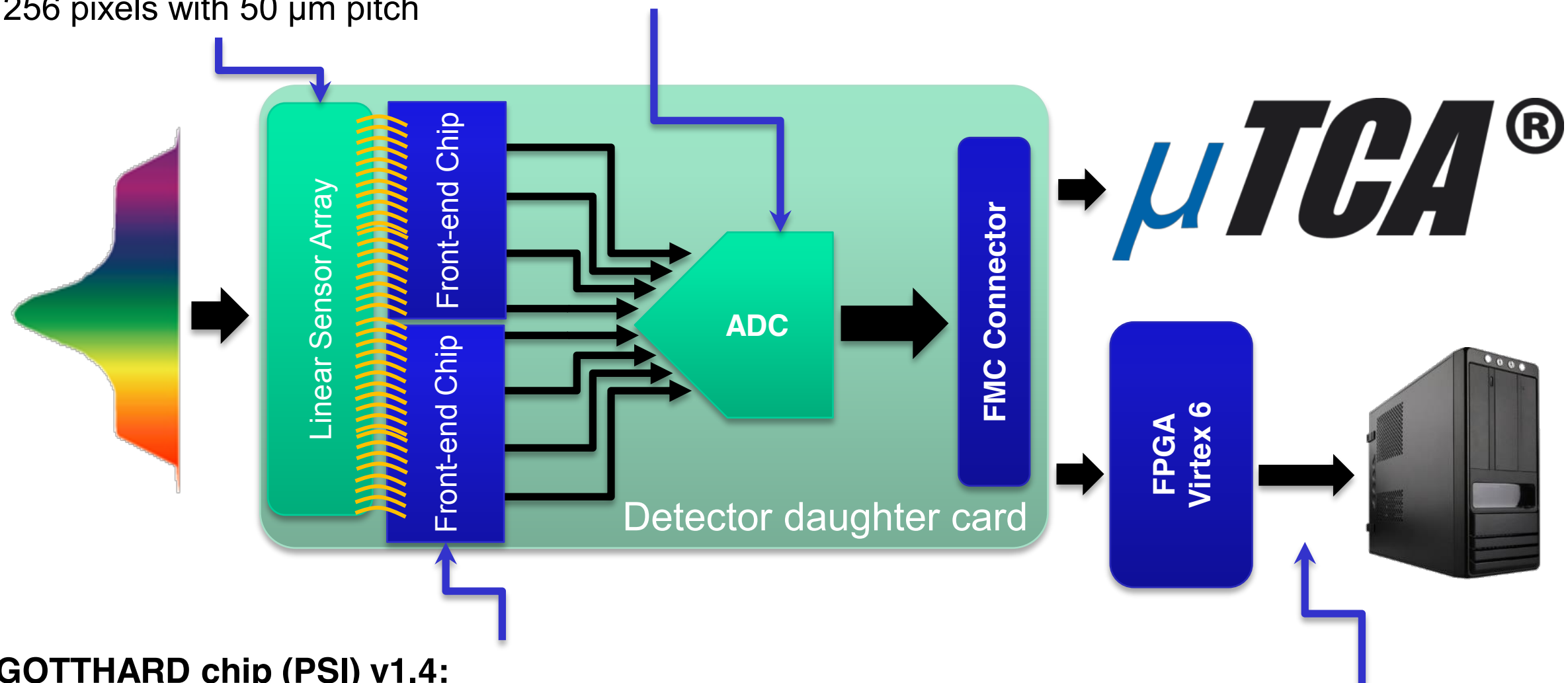
■ Version 2.0 - 2015/2016

- 512 pixels
- 8x GOTTHARD V1.6 (40-50 MHz)
- Readout rate: 5.0 Mfps
- Readout:
 - via PCIe GEN3 (high performance KIT-DMA)

Setup - Version 1: 900 kfps (2015, now)

InGaAs (Xenics) / Si (PSI):
256 pixels with 50 μm pitch

ADC9252: 8 channels @ 14-bit, 50 MSPS

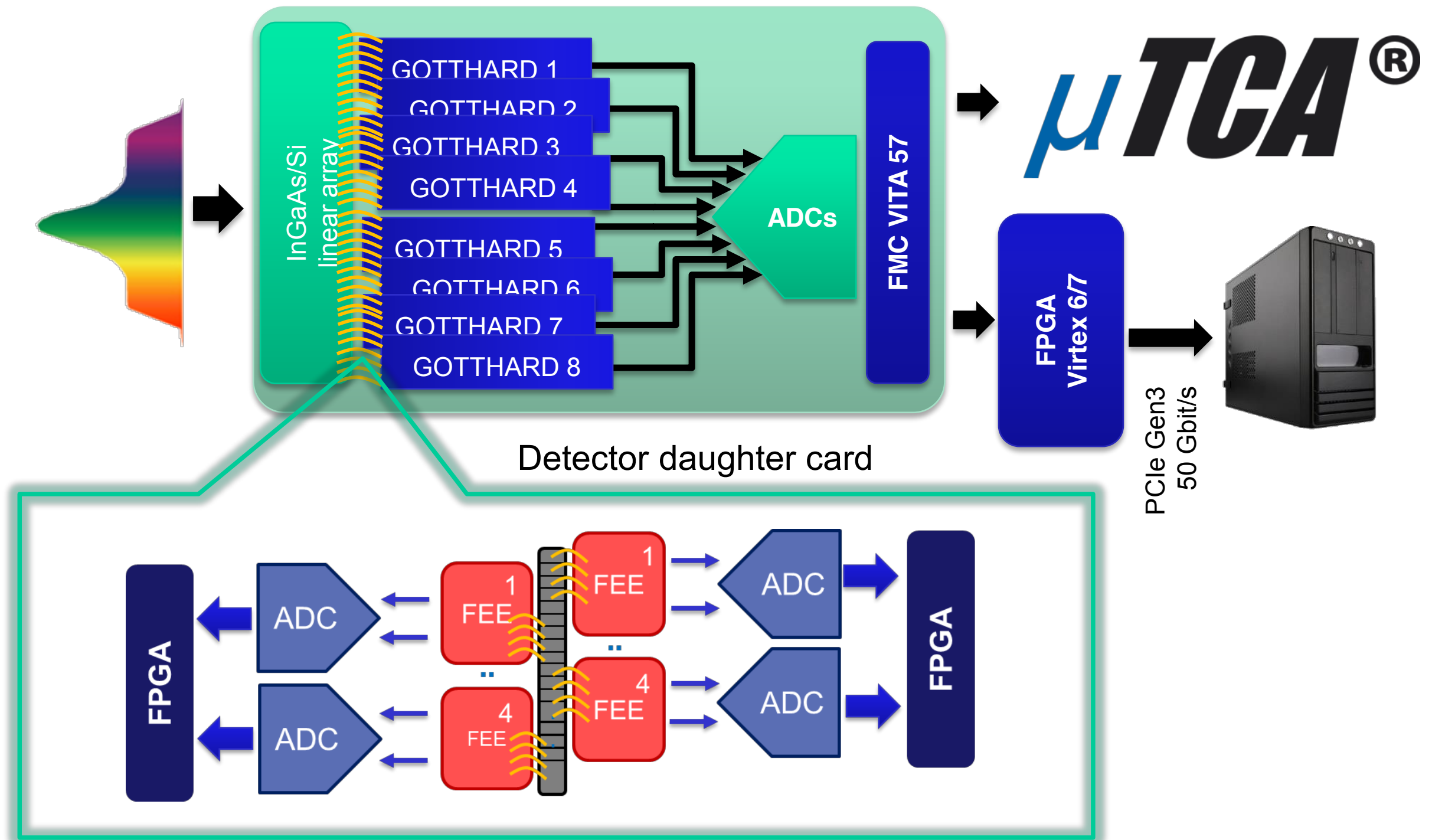


GOTTHARD chip (PSI) v1.4:

Gain Optimizing microStrip system with Analog Readout
Charge Integrating readout for XFEL strip-detector - IBM 0.13 μm
128 inputs, 4 analog outputs operating at 32 MHz
Max. read-out rate: 1 Mfps

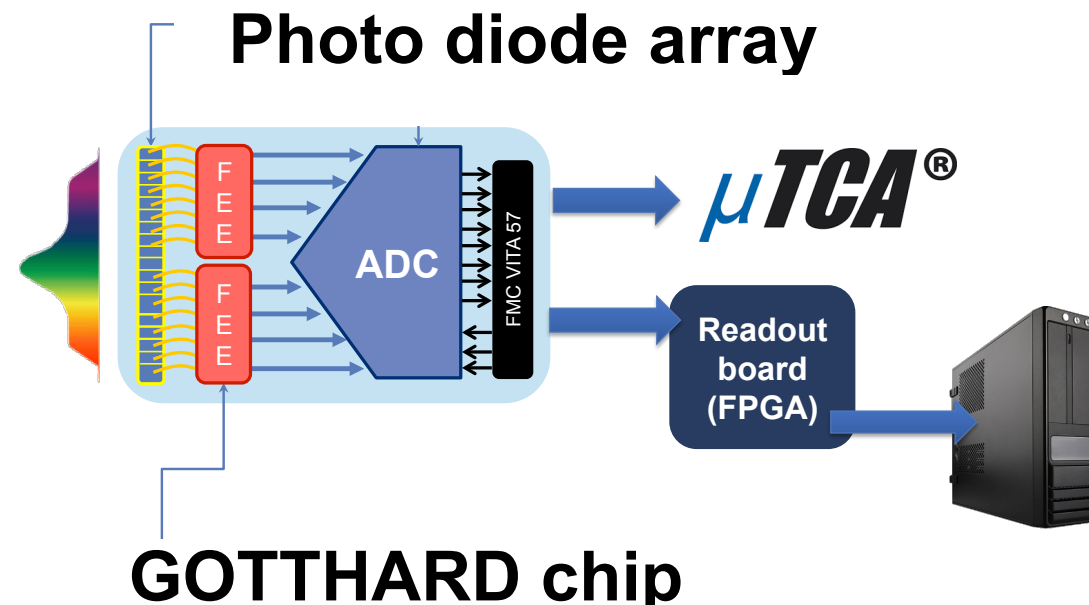
Fast KIT-DAQ:
Based on PCIe/DMA

Setup - Version 2: 5 Mfps (2015/2016)



Ultra-Fast Line Array Collaboration

Scientific collaboration:



- Hardware & partly software implementation of daughter card
- Fast readout based on PCIe/DMA
- Real-time GPU data evaluation



- GOTTHARD front end development
- Si arrays

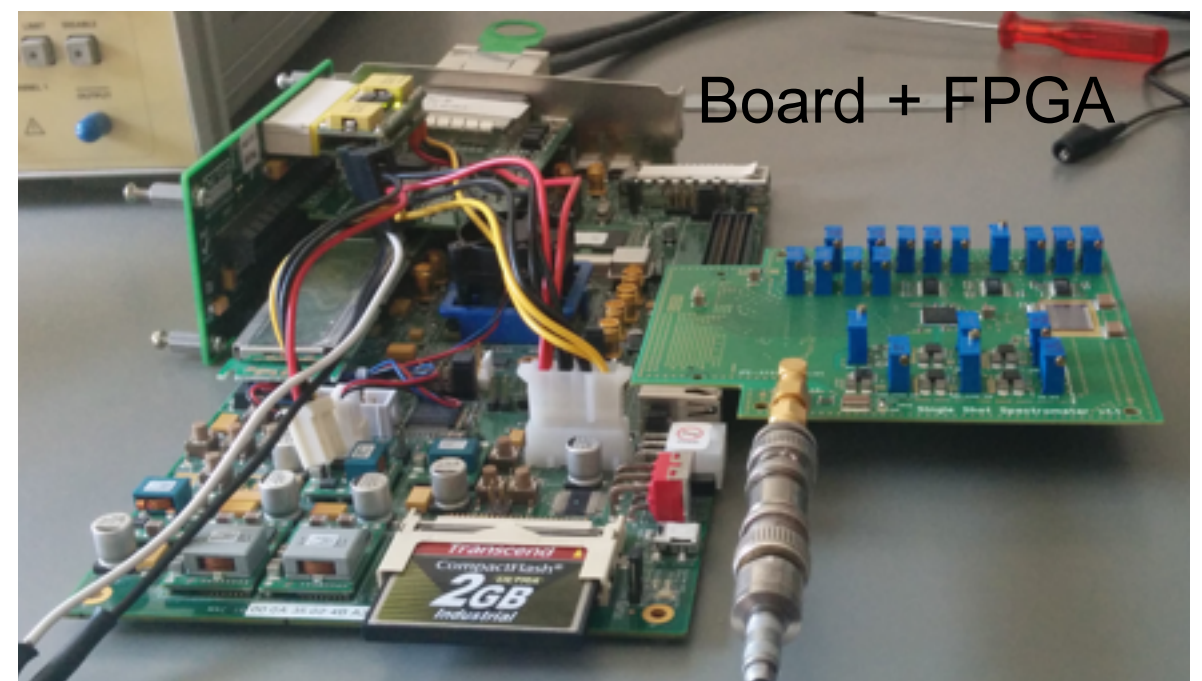
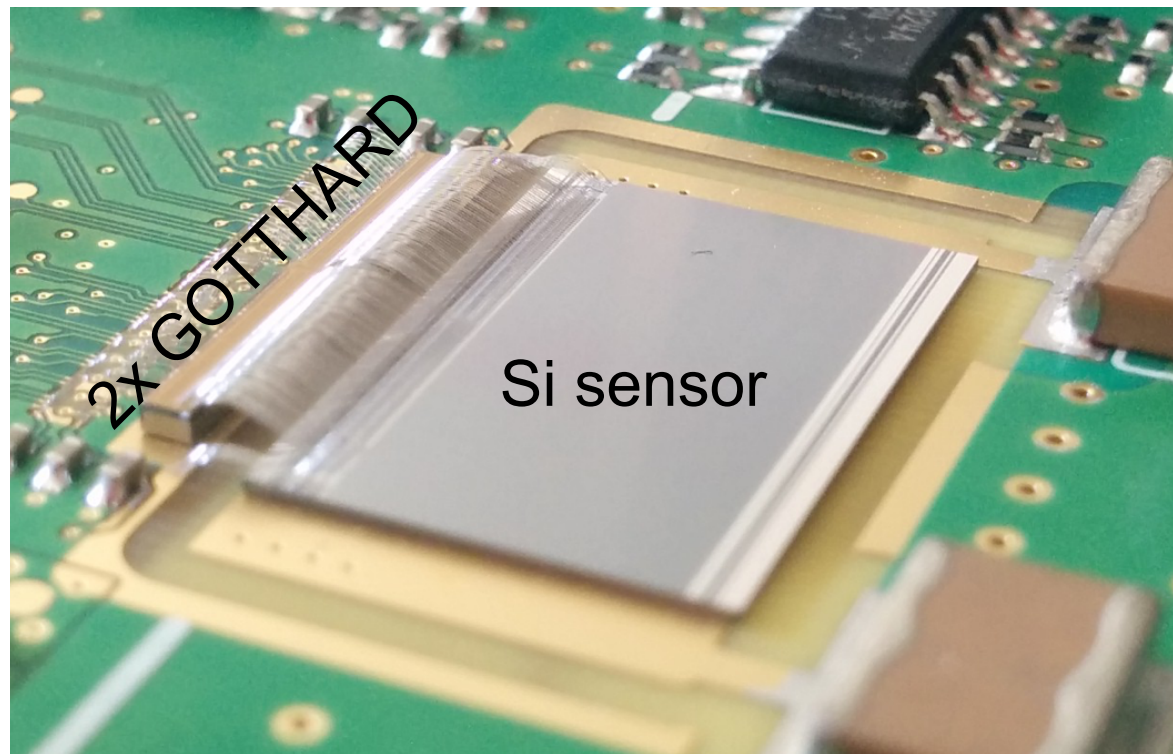
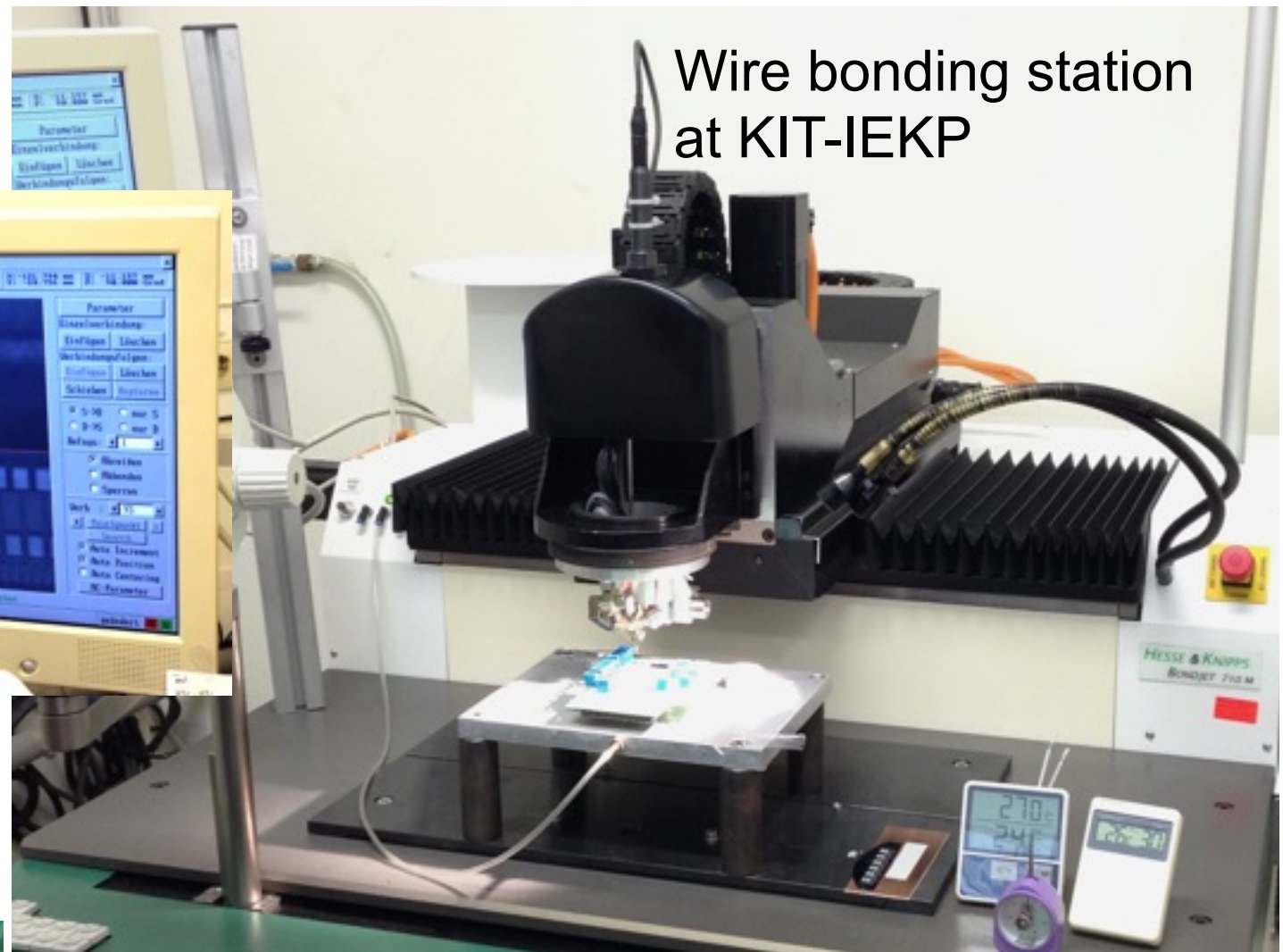
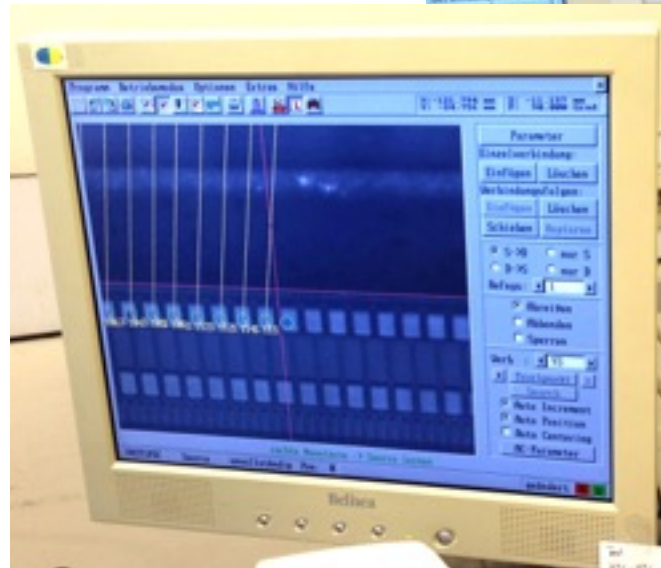


Lodz University of Technology

- Firmware for daughter card control
- μTCA integration

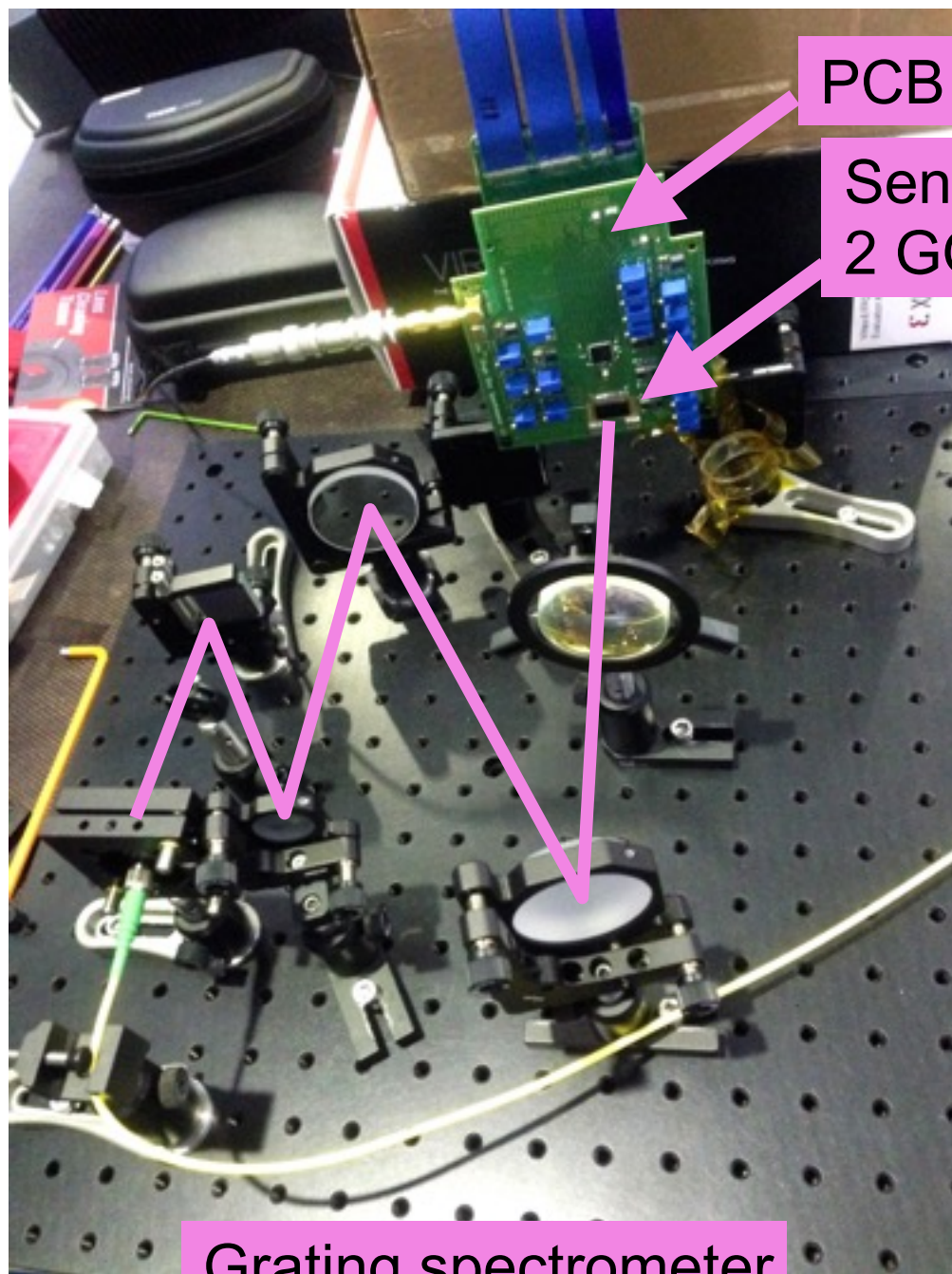
In-House Hybrid Assembly

- In-House glueing & wire-bonding at KIT
29th May 2015
- First bonded the Si sensor, InGaAs will follow now



First tests with the Prototype & Laser

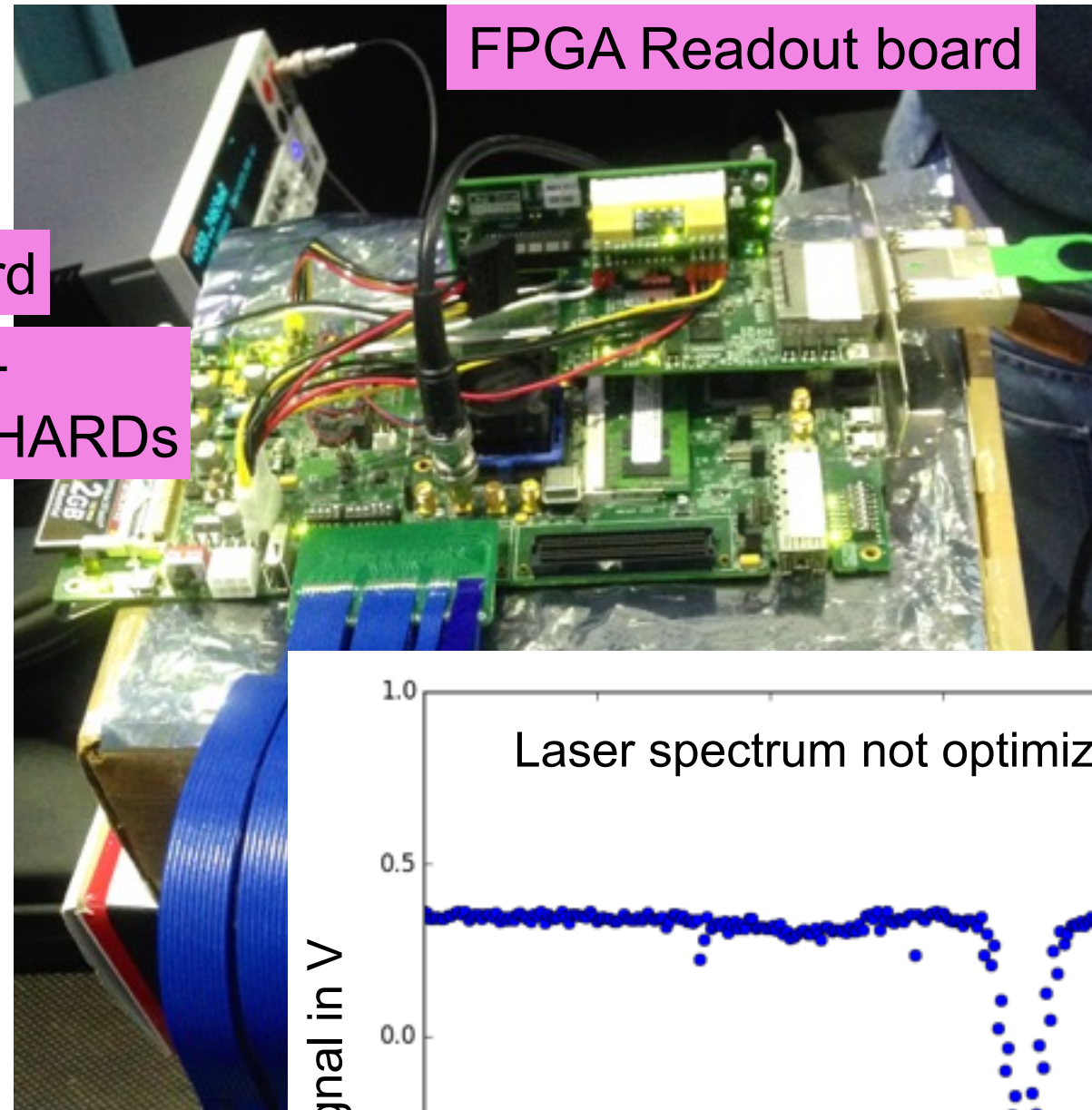
■ 10th June 2015



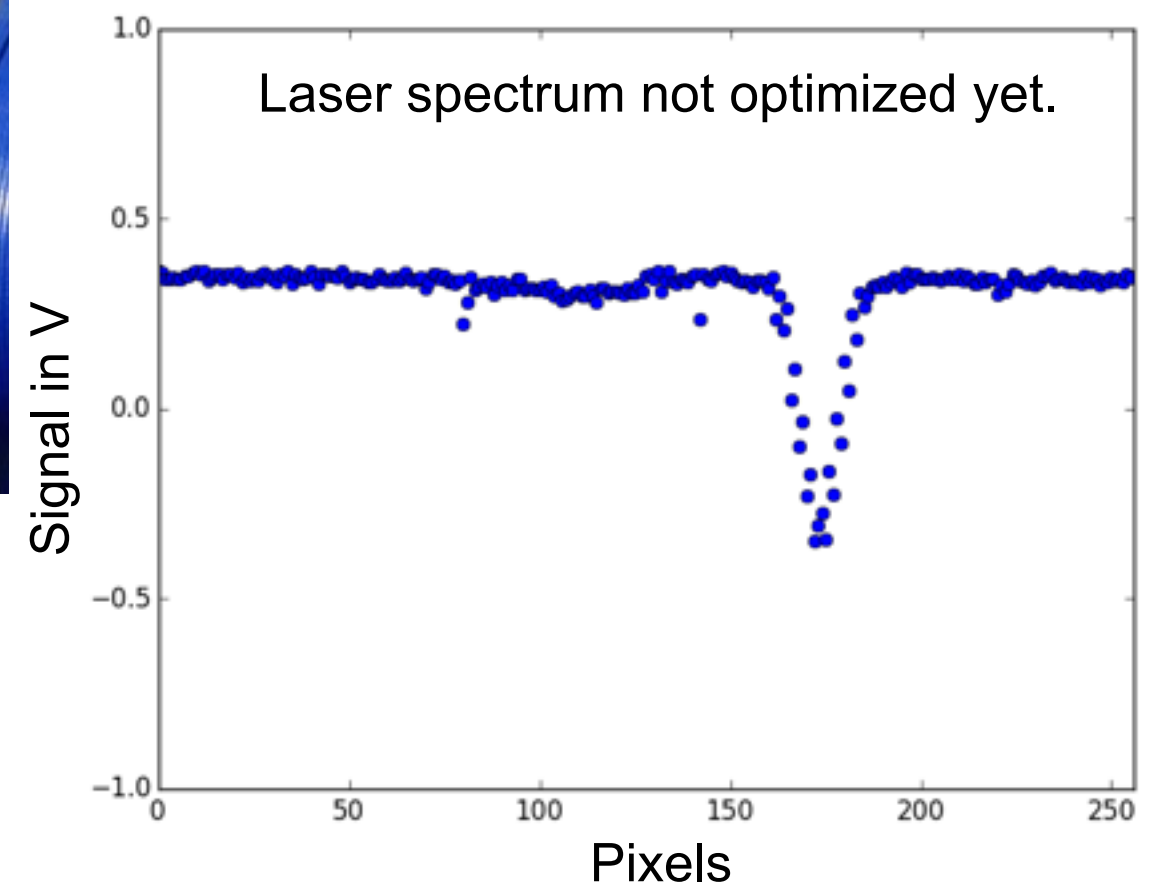
Grating spectrometer

PCB board

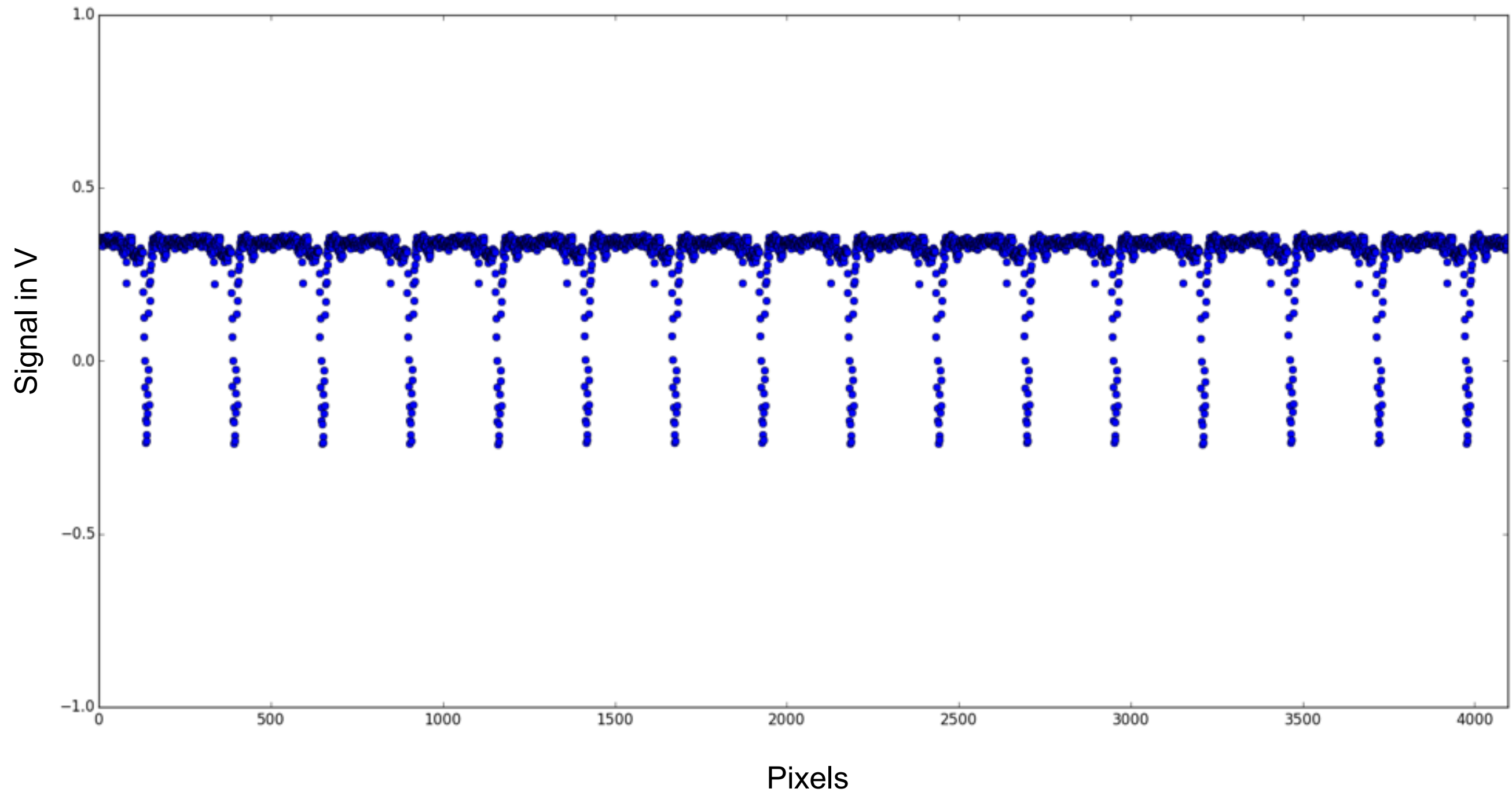
Sensor +
2 GOTTHARDs



FPGA Readout board



16 Consecutive Recordings at 900 kfps



- First prototype of Version 1 (Si) is fully assembled and working
- First tests with laser beam successful; more tests will follow
- InGaAs-based prototype will follow next
- For readout at KIT, existing “UFO-Framework” is used
- Firmware development & μ TCA-integration at DESY ongoing
- Redesigned GOTTHARD (KIT-version) now at KIT undergoing tests