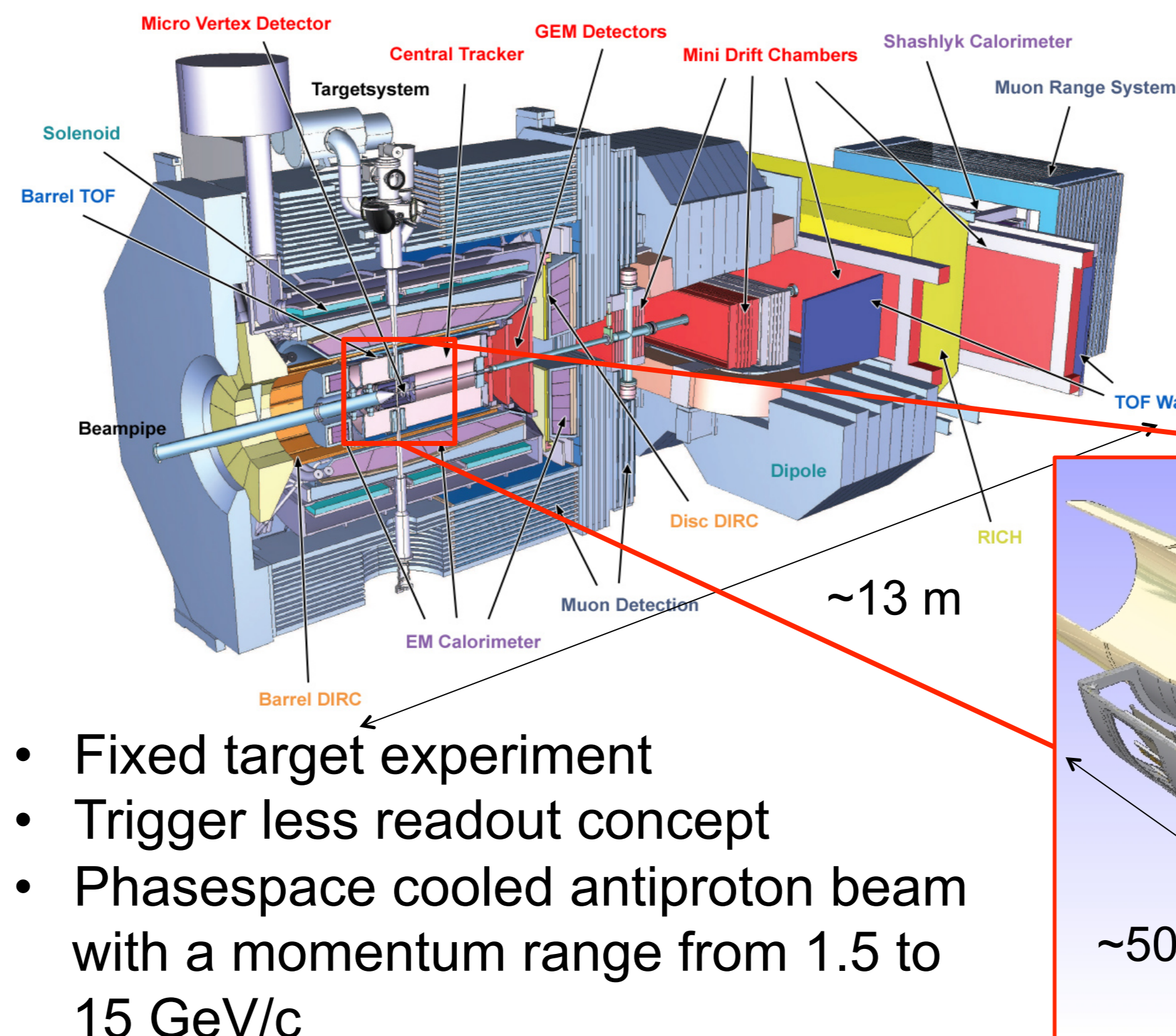


Development of a Readout System for the PANDA Micro Vertex Detector

Motivation

- Front end ASIC testing and characterization for PANDA MVD
 - Readout system has been developed in Jülich
- Modular design for fast and simple adaption to new front end prototypes
- Hardware upgrade to use off the shelf components in the lab
- Testing of detector parts and readout chain

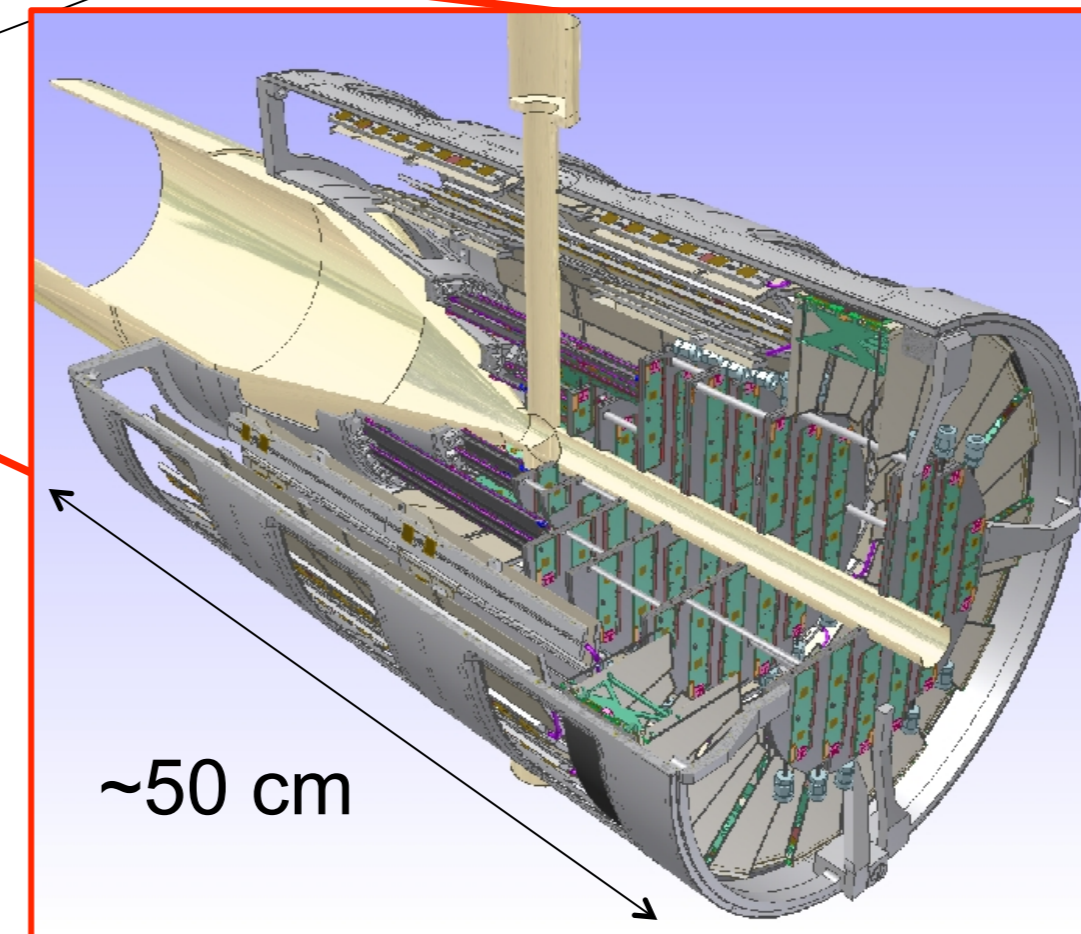
The PANDA Detector



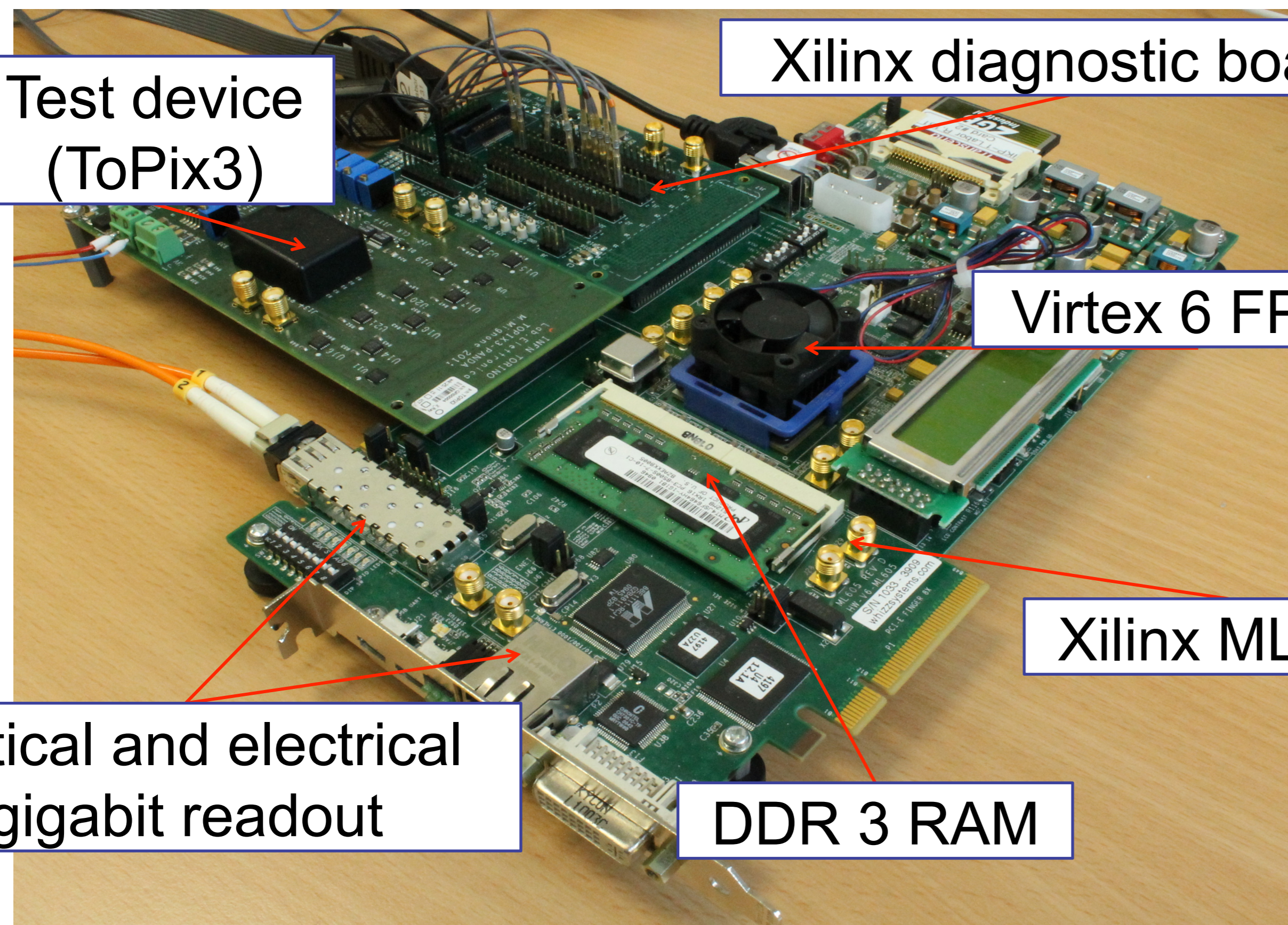
- Fixed target experiment
- Trigger less readout concept
- Phasespace cooled antiproton beam with a momentum range from 1.5 to 15 GeV/c

The Micro Vertex Detector

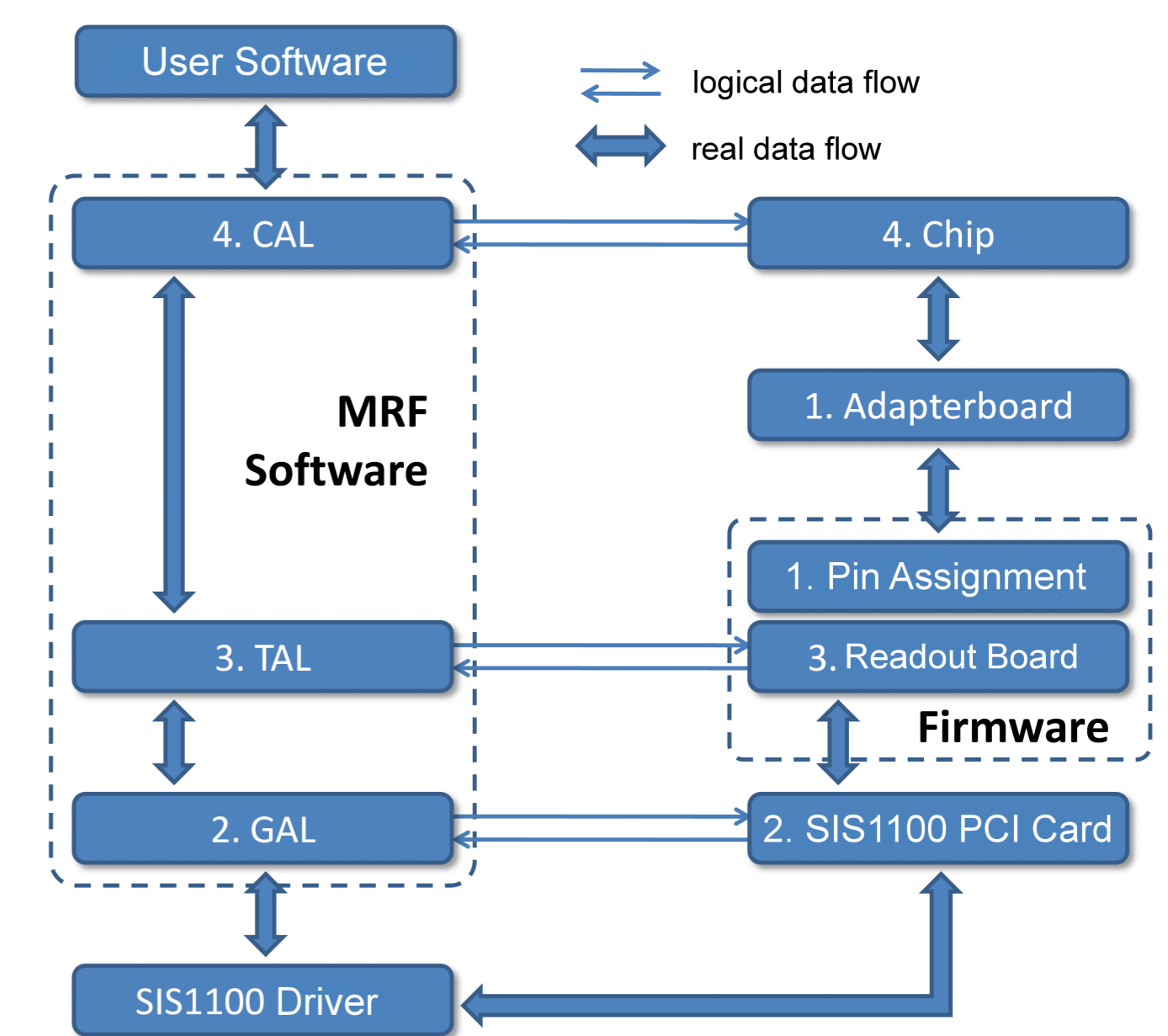
- Innermost tracking detector
- Main task: vertexing of D-mesons ($c\tau \sim 312 \mu\text{m}$)
- Four barrel layers and six disks of semiconductor detectors
 - Vertex resolution $< 100 \mu\text{m}$
 - Hybrid silicon pixel detectors with custom readout ASIC
 - ToPix (Torino Pixel)
 - Double sided silicon strip detectors



The Jülich Digital Readout System

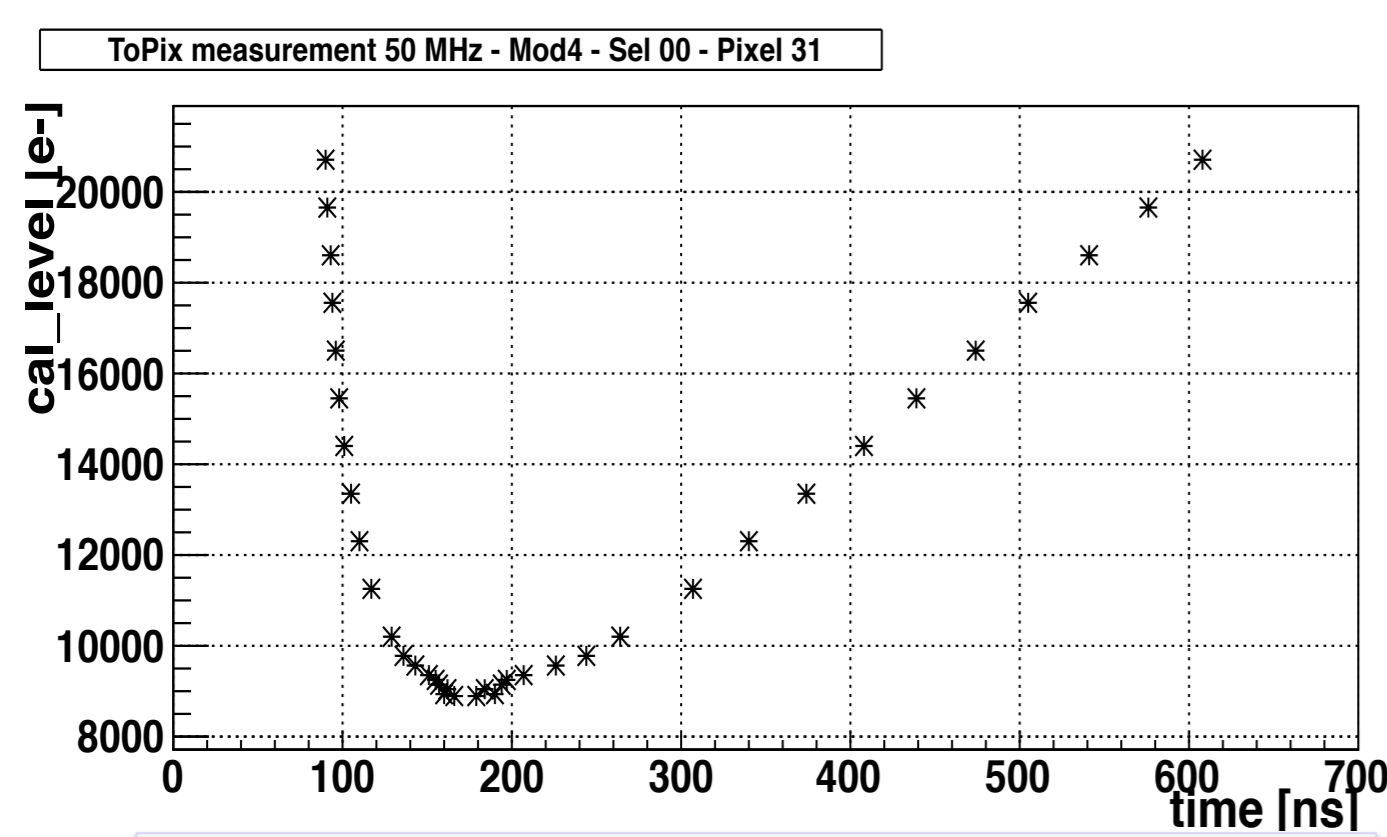


- The system consists of readout hardware, firmware and software (MVD Readout Framework – MRF)
- Central component is an FPGA-based readout board – ML605.
- Modular concept – minor changes necessary to adapt the system to different ASICs.
- Data is transferred over a 1 gigabit optical connection (SIS1100)
- Four communication layers implemented. Every hardware component is treated by a software class (modular design)

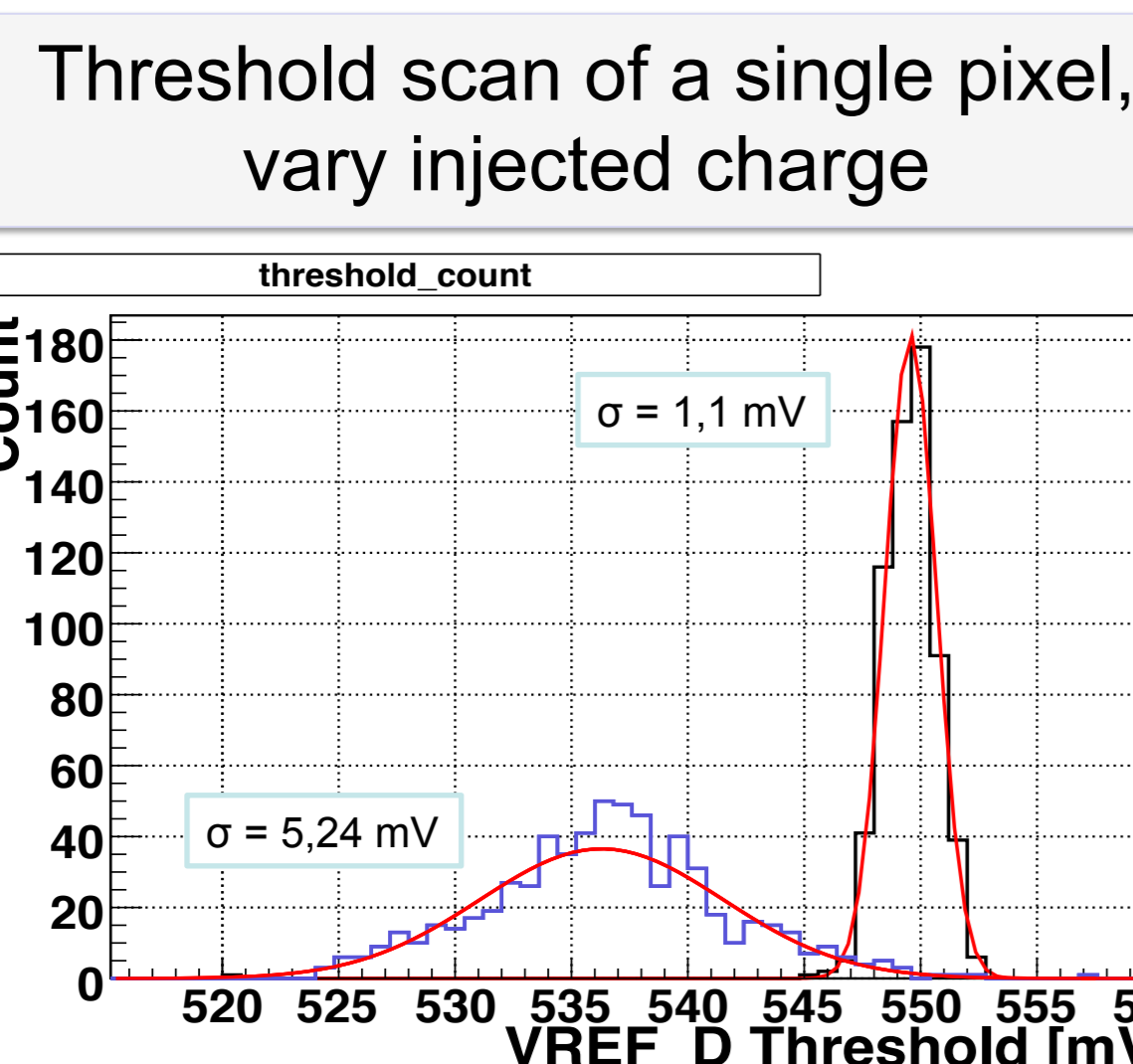
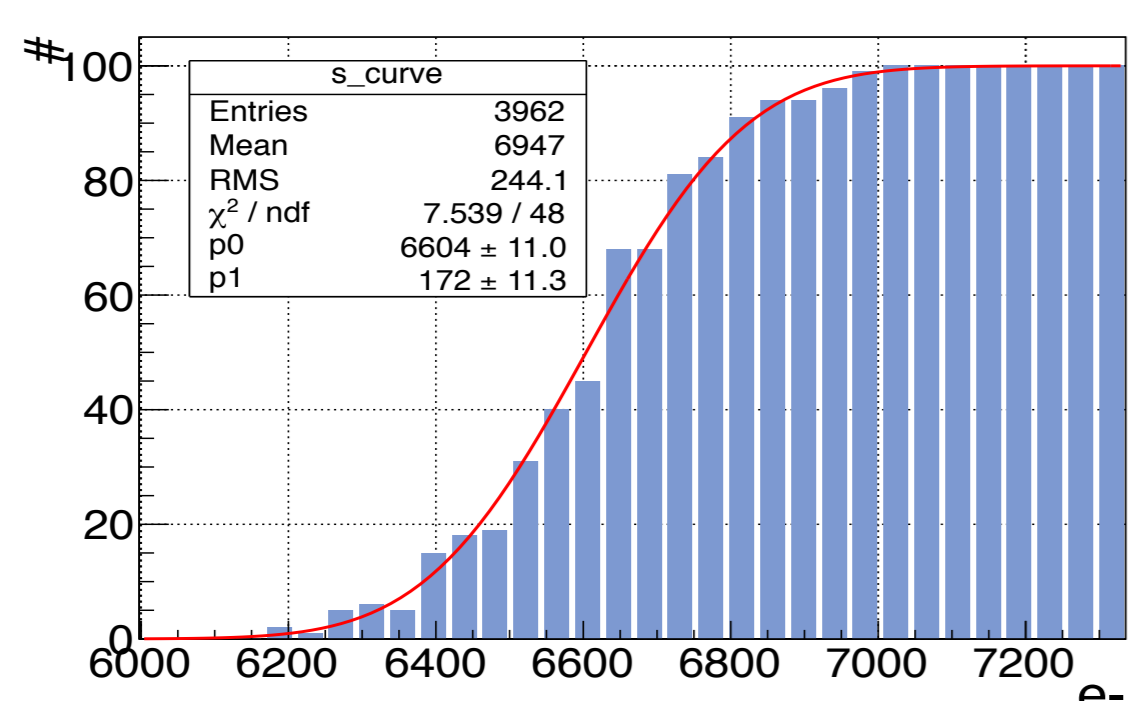


CAL – Chip access layer
TAL – Transport access layer
GAL – Generic access layer

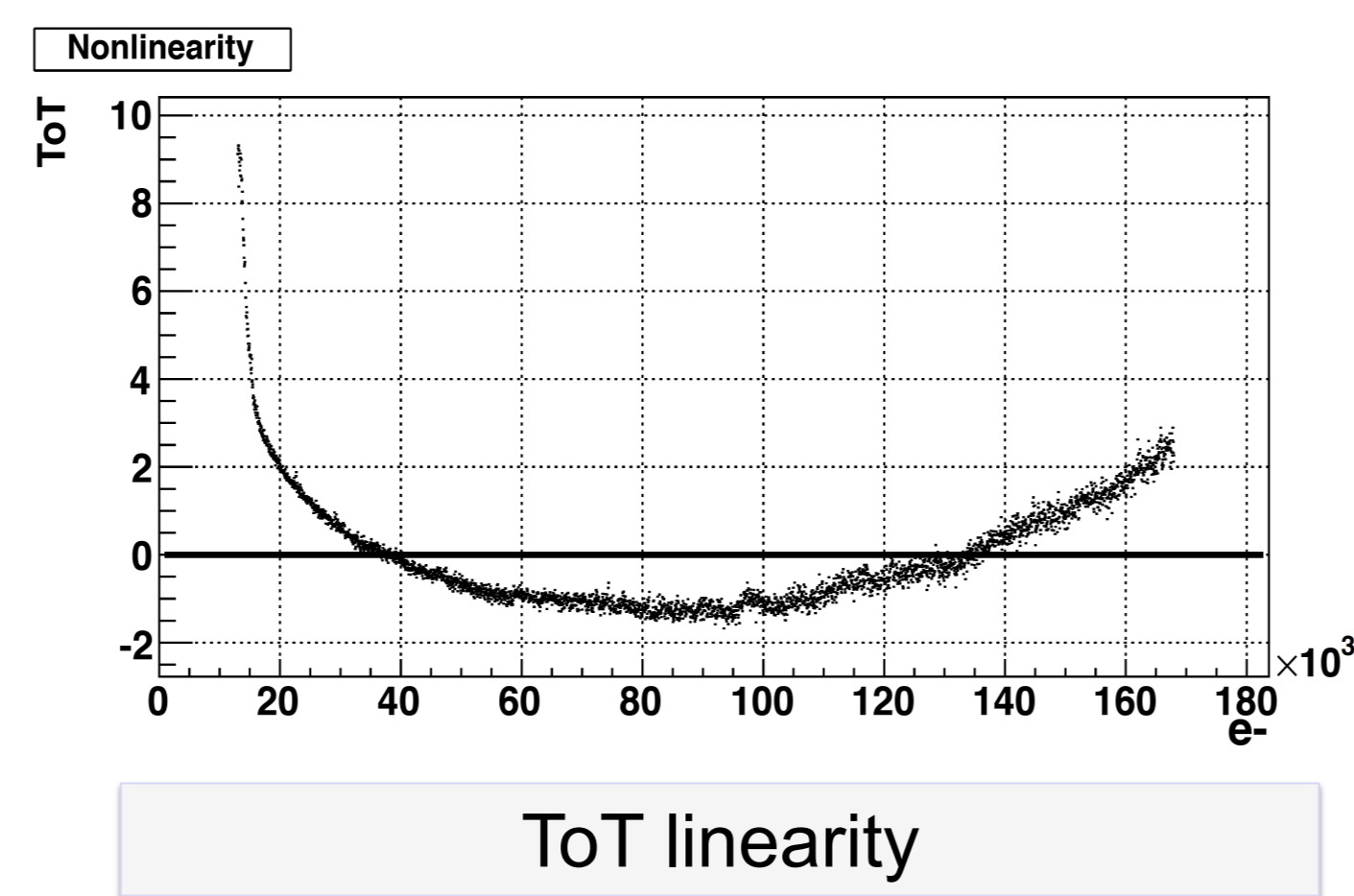
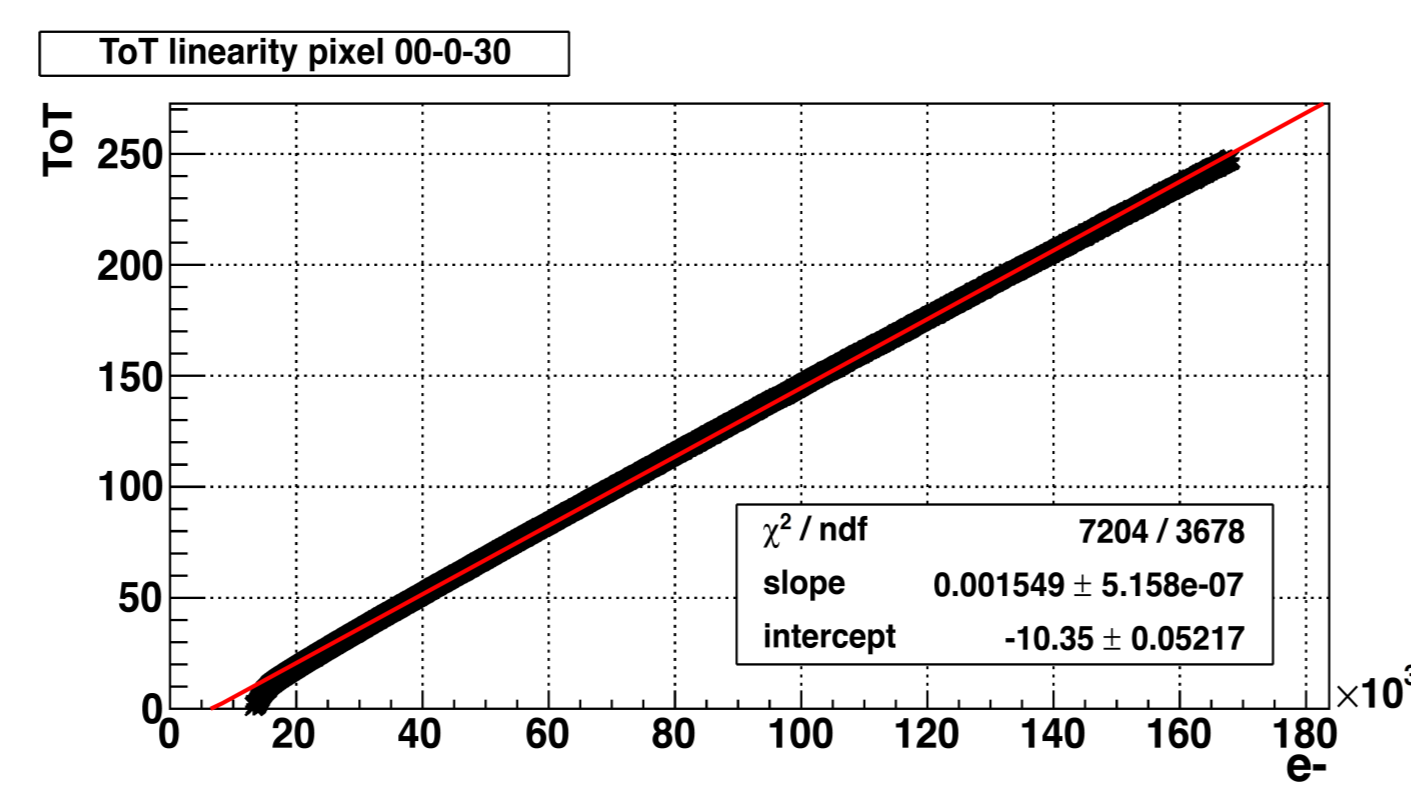
Measurements with ToPix 3



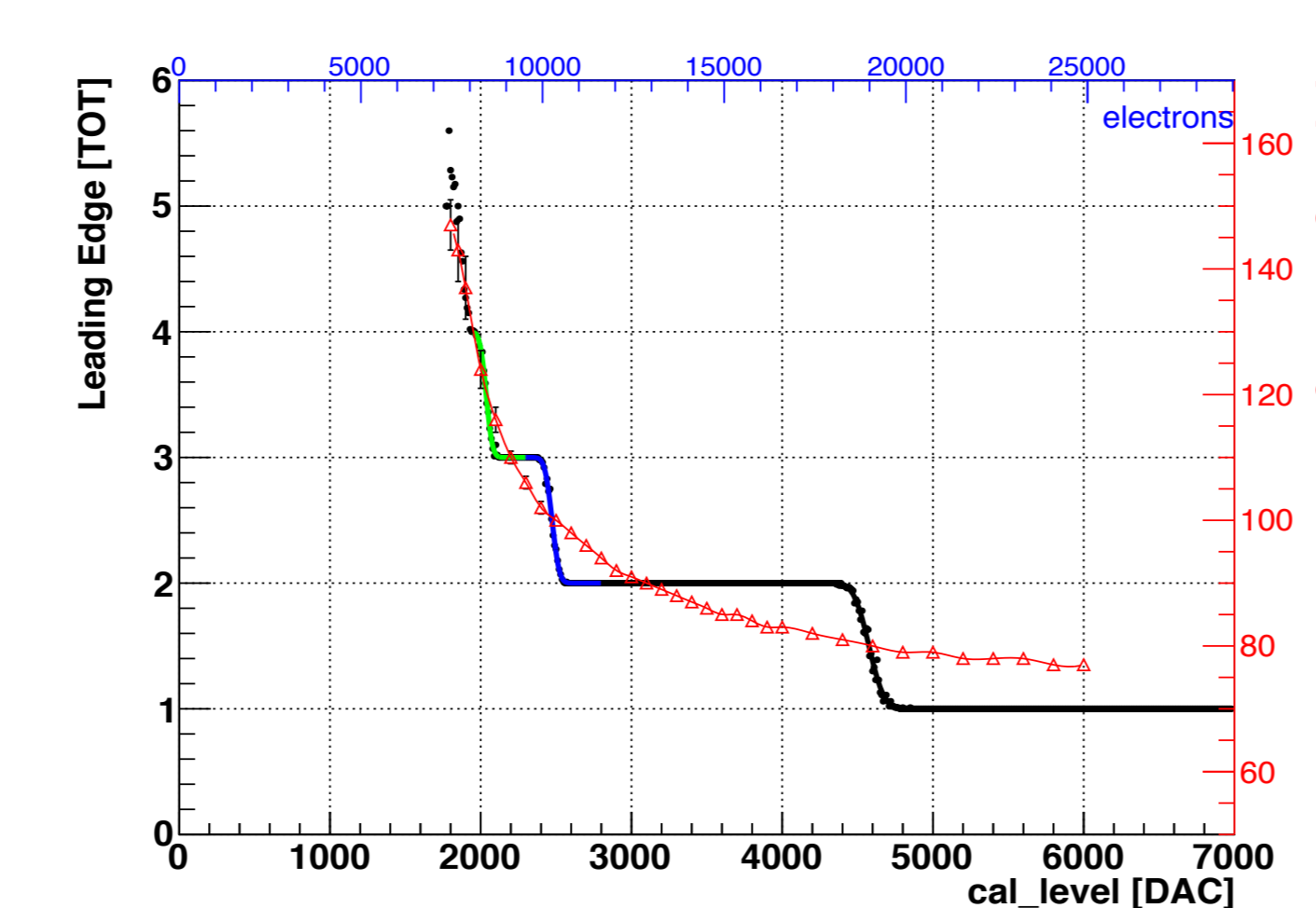
Reconstructed preamplifier output of a test pulse



Threshold distribution before/after tuning

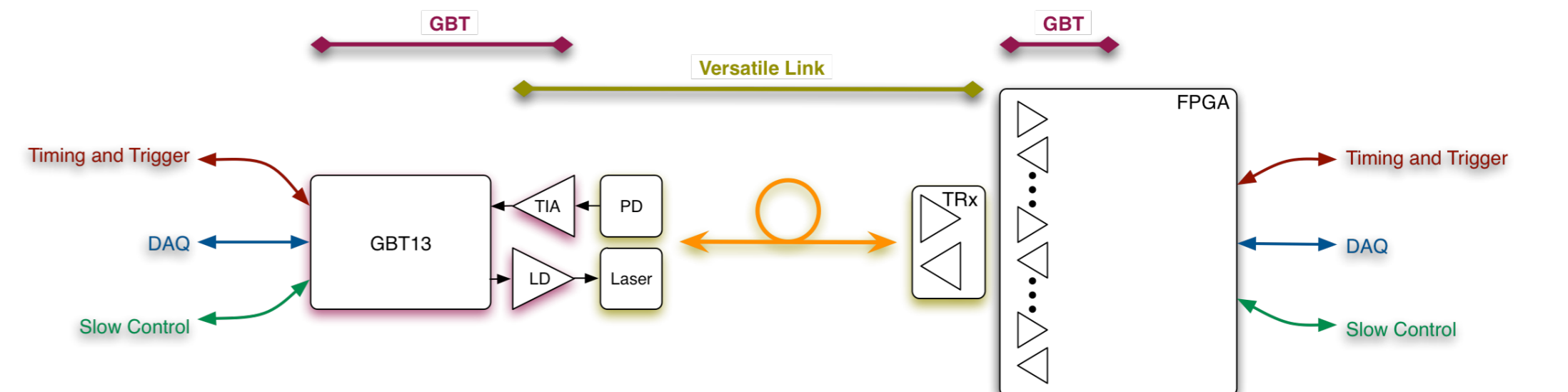


ToT linearity

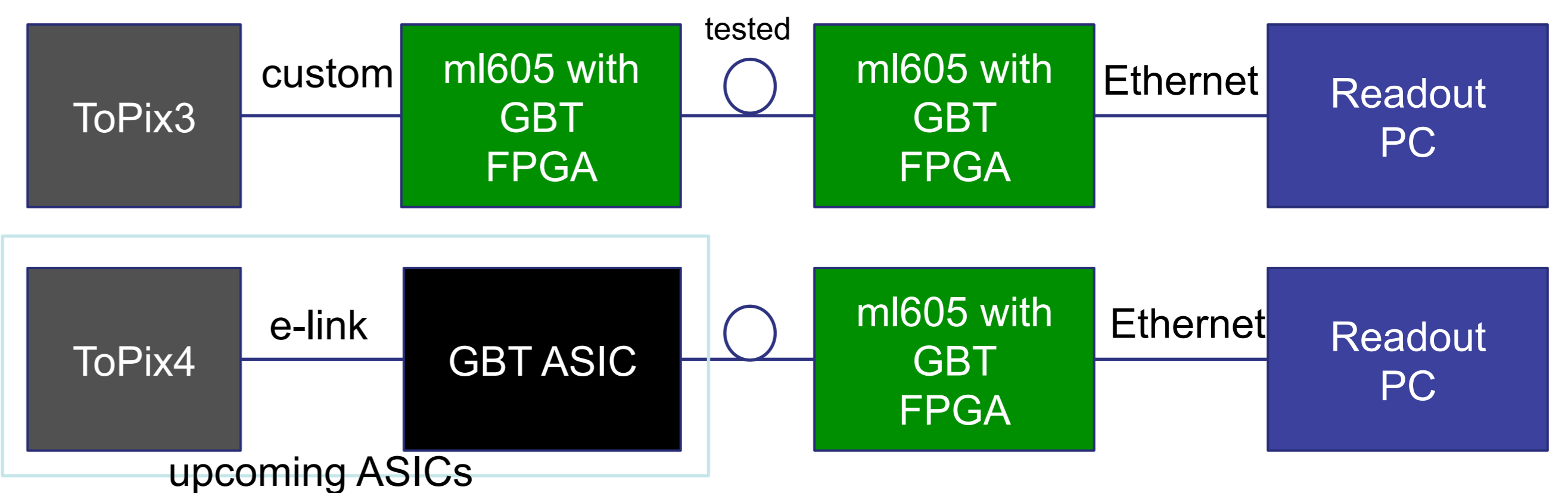


Time Walk measurement of a single pixel, vary injected charge.

Outlook: GBT Transfer Protocol



- GBT is a radiation hard optical link with a speed of 4.8 Gb/s
- Under investigation for MVD data transport from front end ASIC to compute node
- Implementation of protocol for ML605 done, continuous transmission between two ML605 established
- Next steps: readout of ToPix 3 and future ToPix 4 over GBT



Summary

- A readout system exists to characterize front end ASICs
- Full functionality of Jülich Digital Readout System achieved, first characterization of ToPix 3 done
- The GBT protocol has been tested in the Jülich Digital Readout System to test future detector readout chain