Experiment Control Upgrades at DESY

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- PiLC Logic Controller
- ADQ412 Digitizer
- Diffractometer in Sardana
- GPFS storage system

Tango Meeting
ONERA, 21-06-16

PiLC Logic Controller

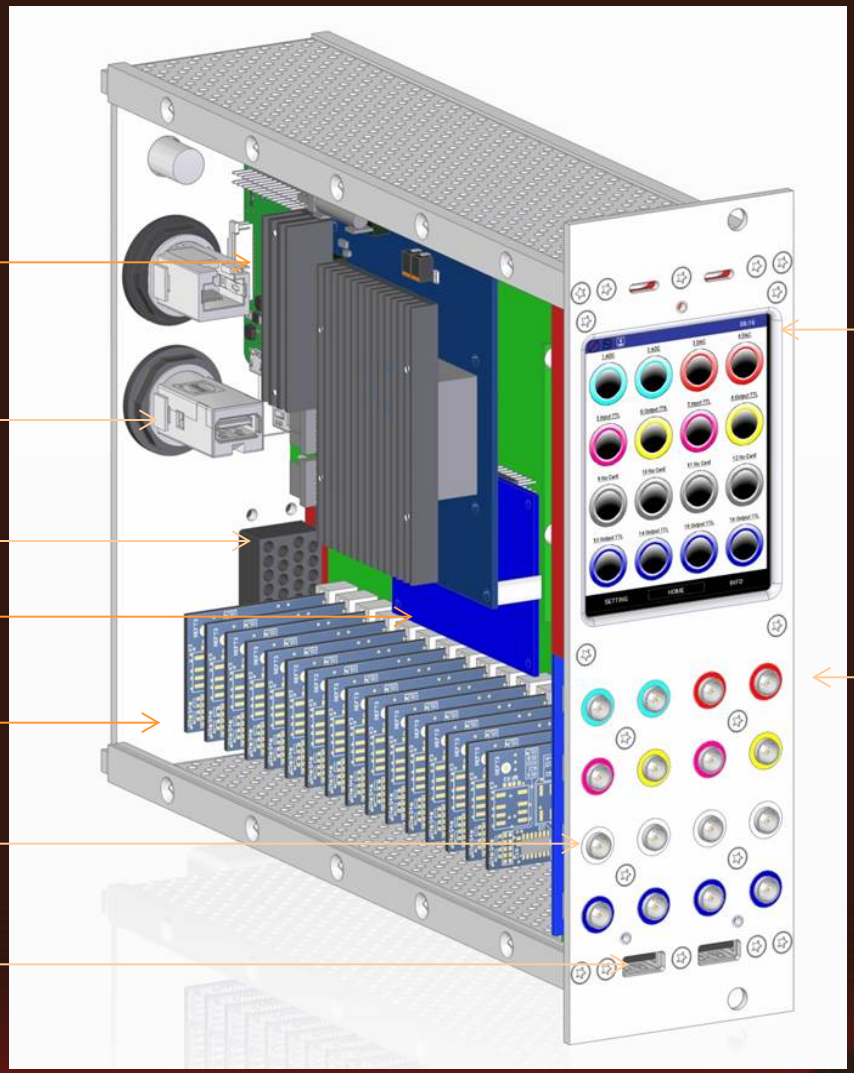
Multifunctional and customizable module for fast signal processing

- Data processing power, speed, synchronity -> FPGA
- Configurable input/outputs -> NIM/TTL I/O, ADC and DAC cards
- High-level user-friendly interface -> Raspberry Pi 2

Scope of applications only limited by the FPGA functionality

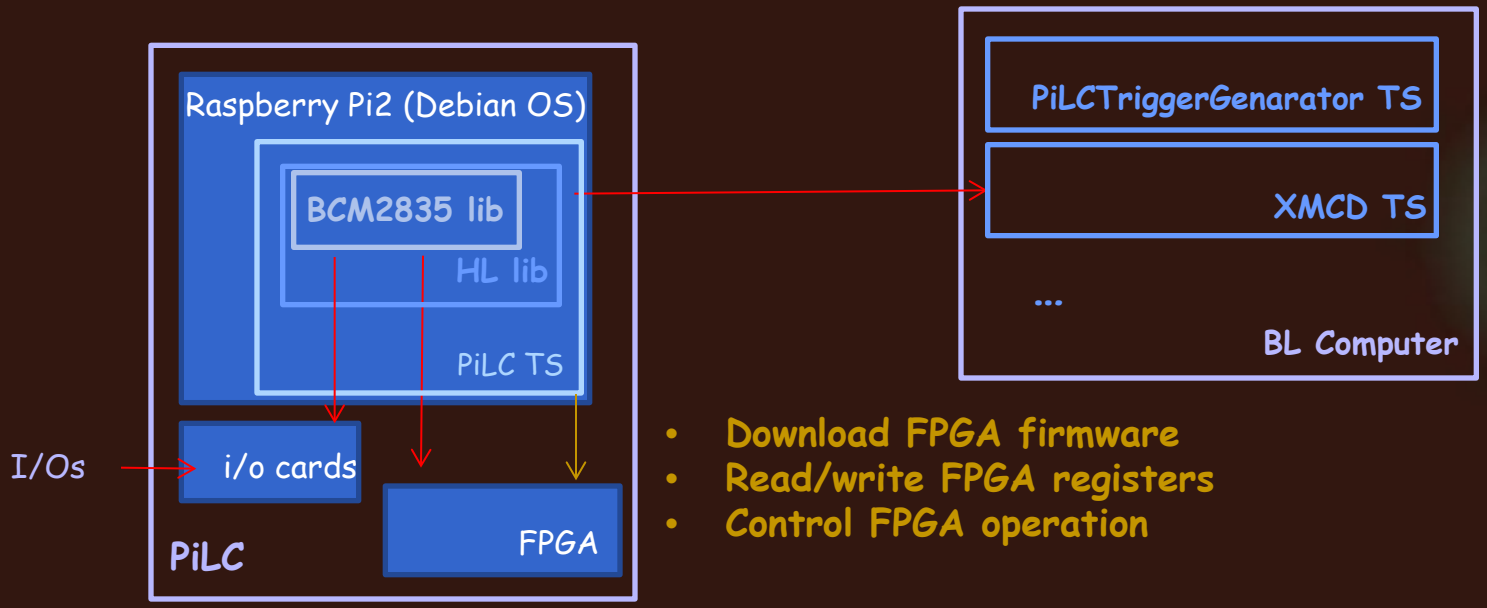
Developed at DESY (FS-EC group)

PiLC Logic Controller (ctd.)



PiLC - Software

Configured and controlled via Tango Servers

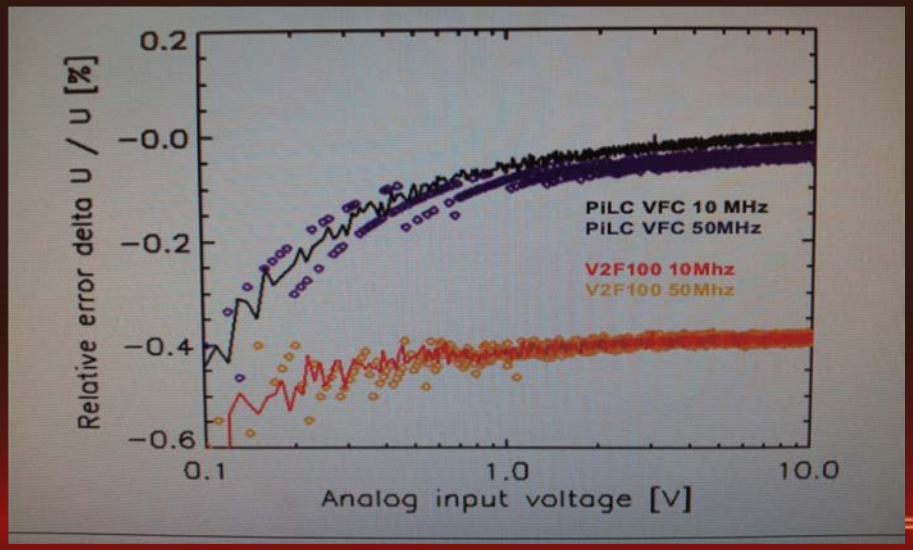


- Download FPGA firmware
- Read/write FPGA registers
- Control FPGA operation

PiLC – Applications

Dedicated Tango Server for each application

- Delay Generator for Pump-Probe experiments
- Detector counts collection based on input signal depending on magnet state for XMCD measurements
- VFC: frequency generator linearly dependent on an analog input



PiLC – Applications (ctd.)

- Trigger Generator:

Continuous scans triggered by PiLC

- Six trigger modes: based on time and/or position (start and frequency, position 'zig-zag' selectable) or external signal.
- Up to five encoder and one counter values (extensible) stored in circular buffer (32 MB depth) during scans
- Selectable encoder triggering
- Data (encoders/counter readings) accessible during scan
- Maximum trigger rate depends on stored data and requested number of triggers (limited by buffer full): up to 11.2 kHz in worst scenario

Integrated in Sardana via Macros and TriggerGenerator controller (under test)

ADQ412 Digitizer

Portable high performance digitizer with customizable FPGA and µTCA interface

- Analog inputs -> sampled with high resolution, capture rate and bandwidth
- FPGA -> offering resources for customized applications
- µTCA interface and easy-to-use API

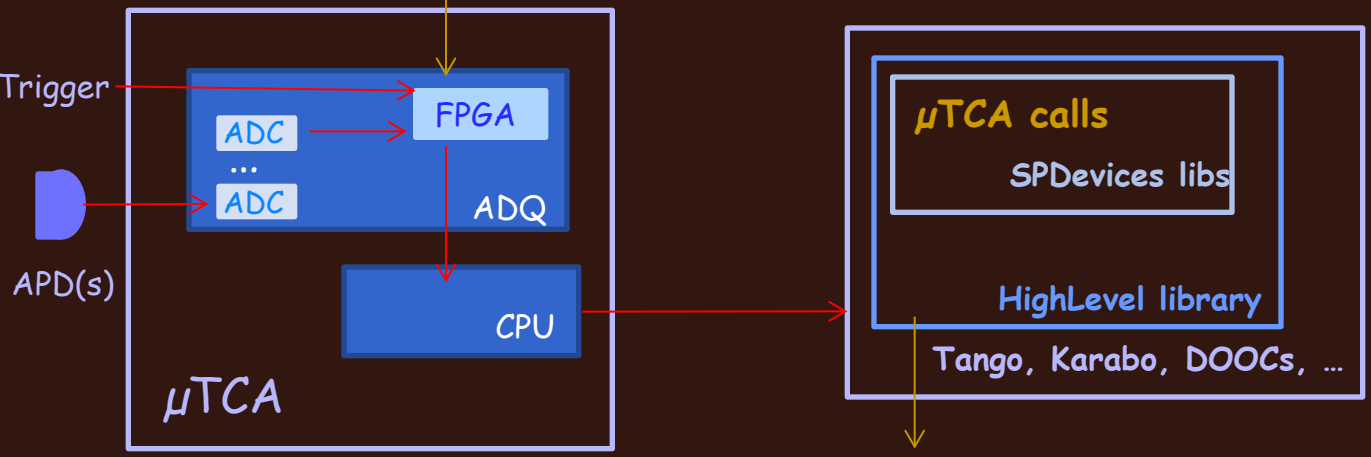
Ideal for broadband applications and high speed data recording

High Speed Digitizer from SP Devices

ADQ412 Digitizer - Software

Integrated into Tango , DOOCS and Karabo via a High Level library

Upload user logic: prepocess acquired data -> peak detection, energy calculation, …
routing trigger signal
train ID



- Configures FPGA (clock, trigger, acquisition)
- Handles data transfer to CPU (PCIe backplane)
- Provides data to user in specified data streams
- Allows more than one ADQ per µTCA

HighLevel library: developed at XFEL (A.Beckmann)

ADQ412 Digitizer – Applications

Analog signals sampling with up to 7GSample/s

- Fully time resolved nuclear resonant scattering (P01):
  - Peak detection, deconvolution and fitting implemented in FPGA
  - Dedicated Tango Server for configuring FPGA and getting/storing processed data

Overcome limitations of conventional systems
(no information on pulse height, only one single event timed per excitation)
in burst and average rates

Herzlich willkommen!

Diffractometer in Sardana

Implementation accepeted and available in Sardana develop branch and releases > 2.0.0

- Diffractometer controller
- Dedicated macros
- Dedicated Taurus GUIs

Documentation in Sardana SEP4

GPFS storage system

Handle massive data production at the experiments

- Cope with data rates
- Accept data from 'everywhere'
- Implement authorization
- Provide long term storage
- Support data processing

Common initiative of DESY-CC and IBM (Speed)

GPFS storage system (ctd.)

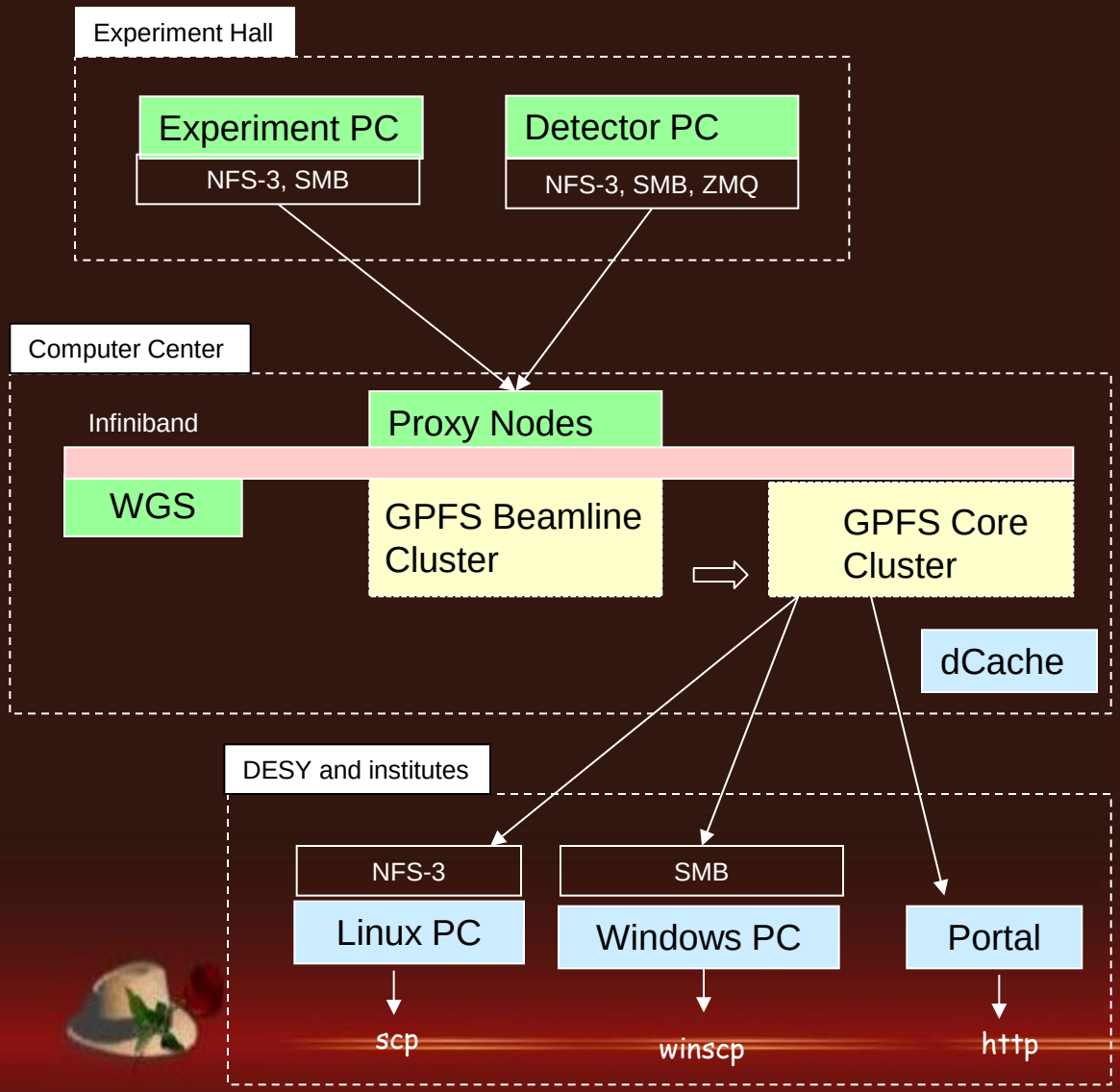
Two gpfs servers installed at Computer Center:

- Beamline FS: optimized for ingestion of data at high speed bursts
- Core FS: optimized for capacity and concurrent parallel access

Several protocols for data transfer to storage system:

- ZMQ:
  - ✓ high throughput
  - ✓ decouples operating systems
  - ✓ reduces disk I/O
  - ✓ not necessarily site-specific
- NFS-3, SMB

GPFS storage servers (ctd.)



PETRA III, in-house and derived data

Proxy Nodes
- Cache data
- NFS, SMB to GPFS

BL Cluser
- Stores data during beamtime
- Data are copied to the Core cluster within minutes

Core Cluster: ACLs

WGS: Analysis, NRTA

dCache: Tape archive

Portal: File discovery, downloads