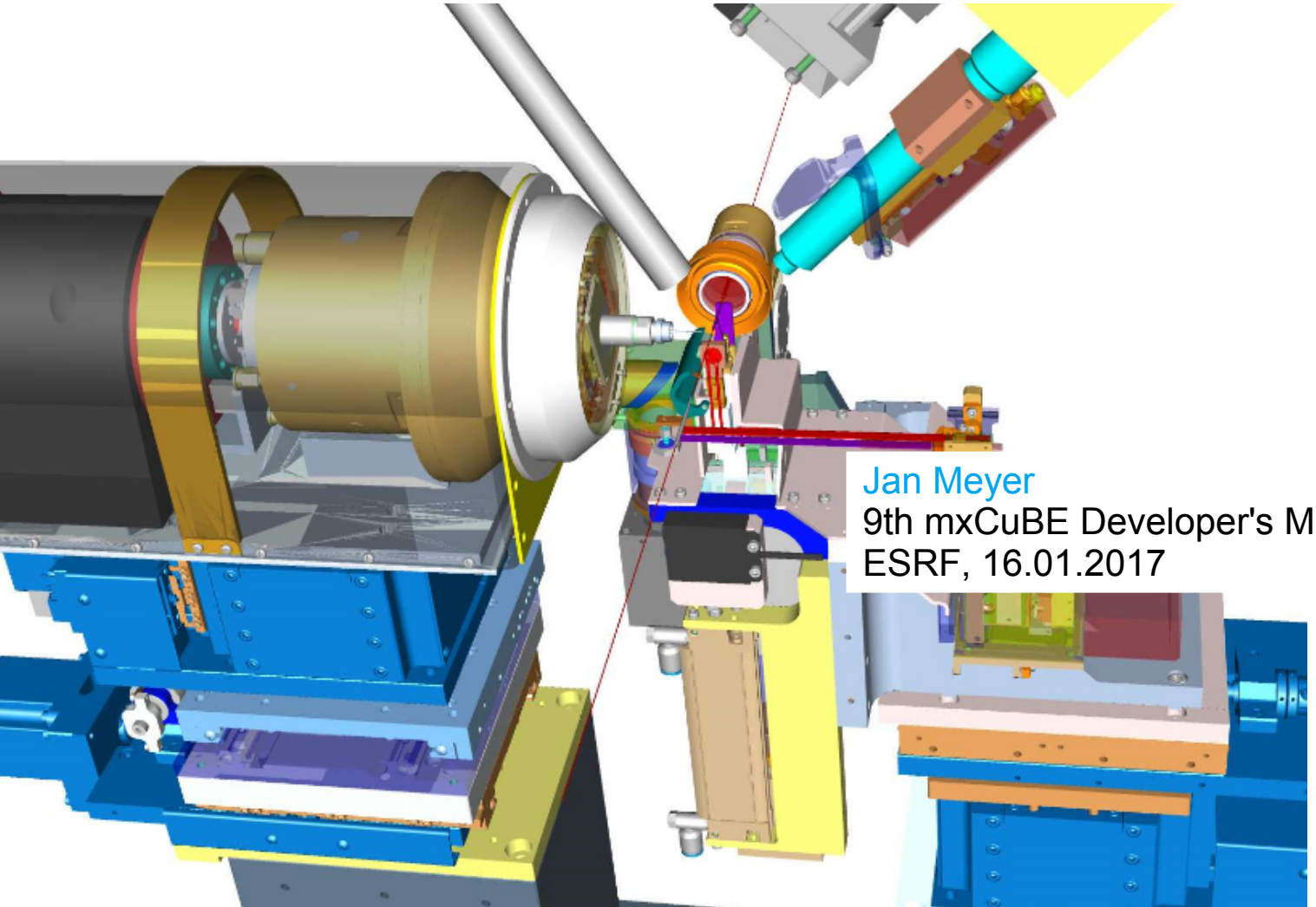
NanoDiff@P11

Usage and Setup From Actuators to Controls



Jan Meyer

9th mxCuBE Developer's Meeting
ESRF, 16.01.2017

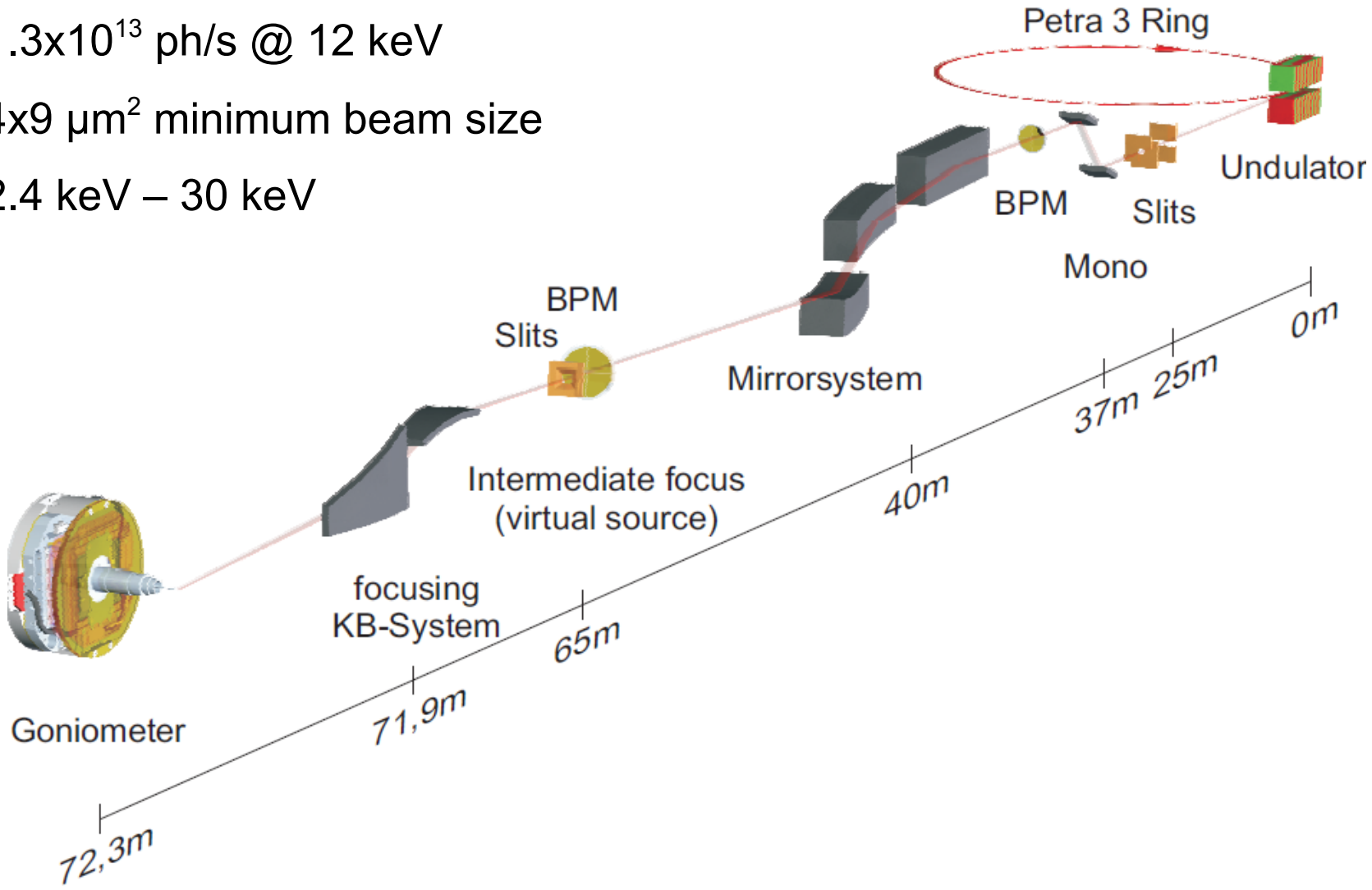
DESY

Outline

- Construction To Controllers
  - Source - Beamline P11
  - Goniometer and Accessories
  - Detectors
- Interfacing Hardware and Humans
  - Tango Layers
  - Application Internals
  - User Perspective

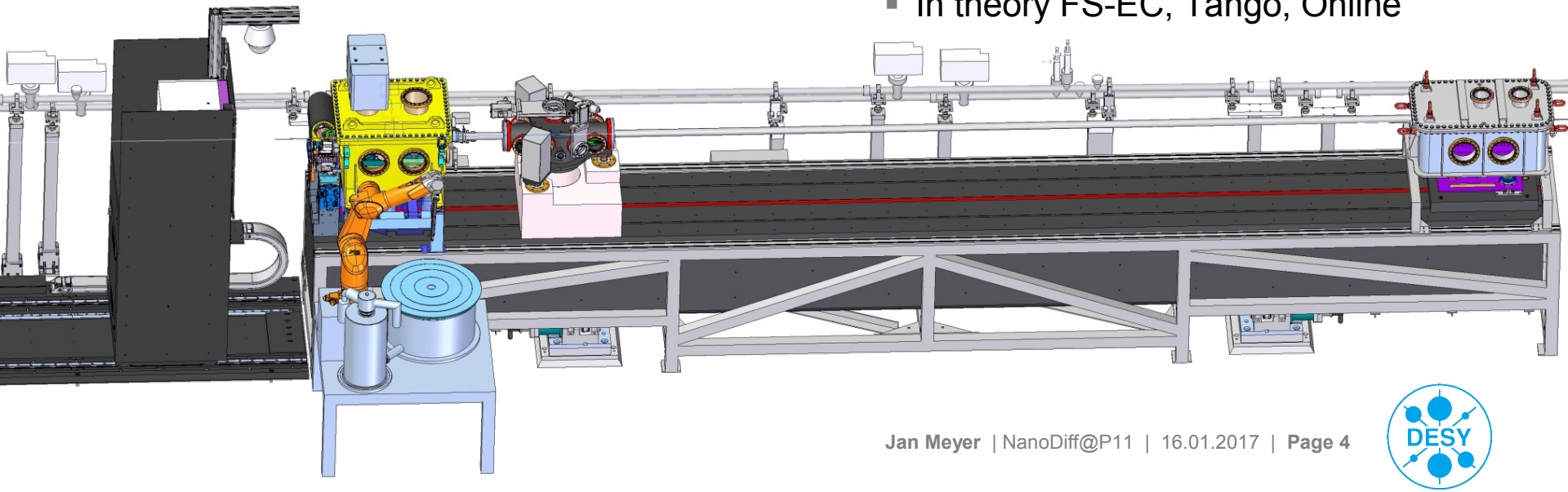
Source – Beamline P11

- 1.3x10^{13} ph/s @ 12 keV
- 4x9 µm^2 minimum beam size
- 2.4 keV – 30 keV



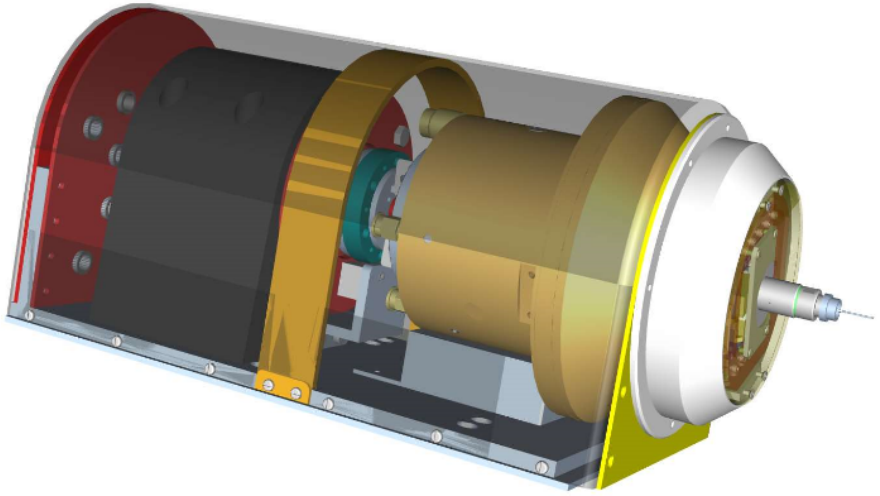
Source – Beamline P11

- Secondary source chamber
  - Attenuators
  - Slits
  - BPM
  - Chopper
  - Fast shutter
  - Beam diagnostics
- Power electronics outside the hutch
- PETRA
  - Various groups, TINE control system
- Vacuum interlock (VIL)
  - PLC controls with web interface
- Interlock Control System (ICS)
  - PLC controls with different web interface
- Experiment setup in the hutch
  - In theory FS-EC, Tango, Online



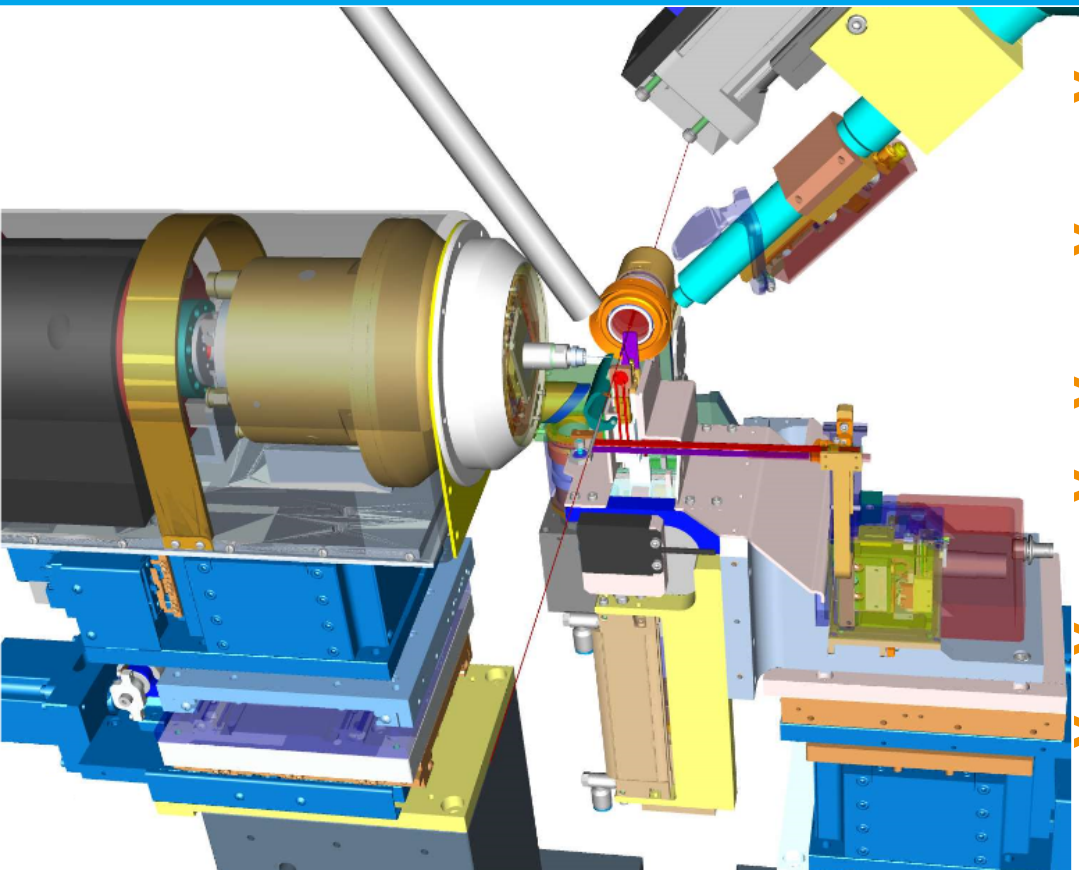
Goniometer

- Brushless servo with airbearing
- Second servo to track a slip ring
- Centering stage using flexures and PiezoLeg motors
- Sphere of confusion 100nm
- Accuracy < 0.04 arc sec



- Aerotech Ensemble
  - Linear power amp for the airbearing, PWM for the slipring
  - Commutation based on encoder counts
  - Internal controller script to synchronize axes, gearing mode after wards
  - PSO (position synchronized output) to trigger detector and fast shutter

Accessories

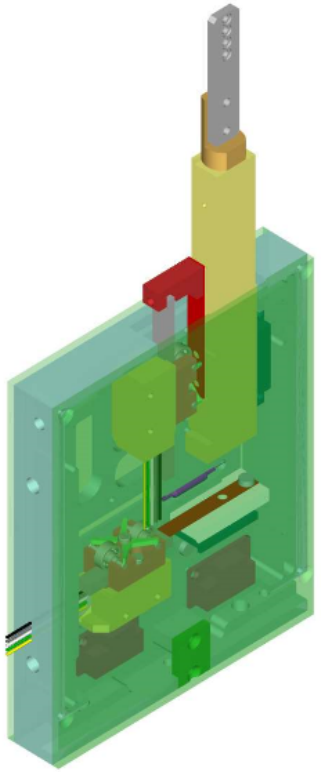


- Prosilica on axis camera with fixed zoom optics
- Apertures (200, 100, 50, 20 microns)
- Collimator (300 microns)
- Combined YAG and diode stage
- Front- and backlight
- Beamstop

- Goniometer is movable in XYZ via Kohzu stepper stages
- Accessories are movable in YZ
- Cryostreamer with shutter

Accessories – Piezo Stage

- Standard stage at P11 with universal mount
  - Collimator, Apertures, Attenuators, BPM, ...
- PiezoLeg motors
  - Up to 6 mm/s fast or accurate down to 1nm
- Long axis (30mm) with linear bearing
- Short axis (4mm) with flexure



- Driven by Galil DMC 4080 controllers
- and Nanos Instruments PiezoLegs Drive cards
  - Motor phases controlled via servo voltage +-10V
  - Stop functionality, twists the legs against each other
  - Encoder interpolation down to 200pm
- Integrated in a single case

Accessories – Other Devices Involved

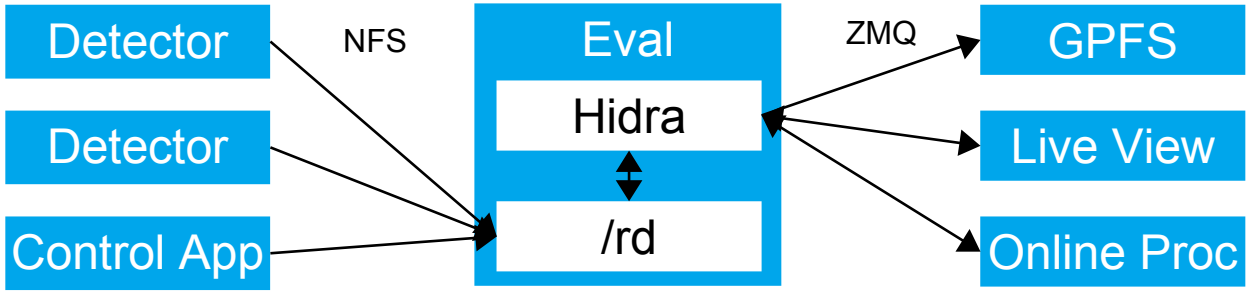
- Pneumatic actuators
  - SIS 3610 VME register card
- Position dependent switches and other (interlock) signals
  - SIS 3610 VME register card
- Front- and backlight
  - TIP 551 VME DAC card
- Stepper motors
  - OmsMaxV VME controller cards and Phytron ZMX amplifiers
- Detector distance laser sensor
  - Micro Epsilon ILR1182
- Sample changer
  - Stäubli TX60L

Detectors

- Dectris Pilatus2 6M
  - 2463 x 2527 pixel, 25Hz readout rate
  - Movable between 155mm and >2m sample distance
  - Distance is observed by a laser distance sensor
- Interlock diode
  - Diode with 1.5cm radius which is mounted on the detector shield in beam position
  - Prevents direct beam from the Pilatus
  - Useable through an ADC for other messurements
- Diode in sample position
  - Read out through a Keithley, DGG2, VFCADC combination
- Vortex EM
  - Read out with a XIA DXP spectrometer card
  - 100eV resolution, count rate of 2x10^5 cts/s

Detectors – Data Flow

- Evaluation machine is data broker as a side job
  - 512GB RAM, half of it is used as ramdisc
  - 4 x 10GB links, 40 cores with hyper threading
- Hidra daemon by Manuela Kuhn from DESY-IT
  - Written in Python
  - Observes filesystem via inotify
  - Moves data into central storage
  - Clients can register for streams or single data packages

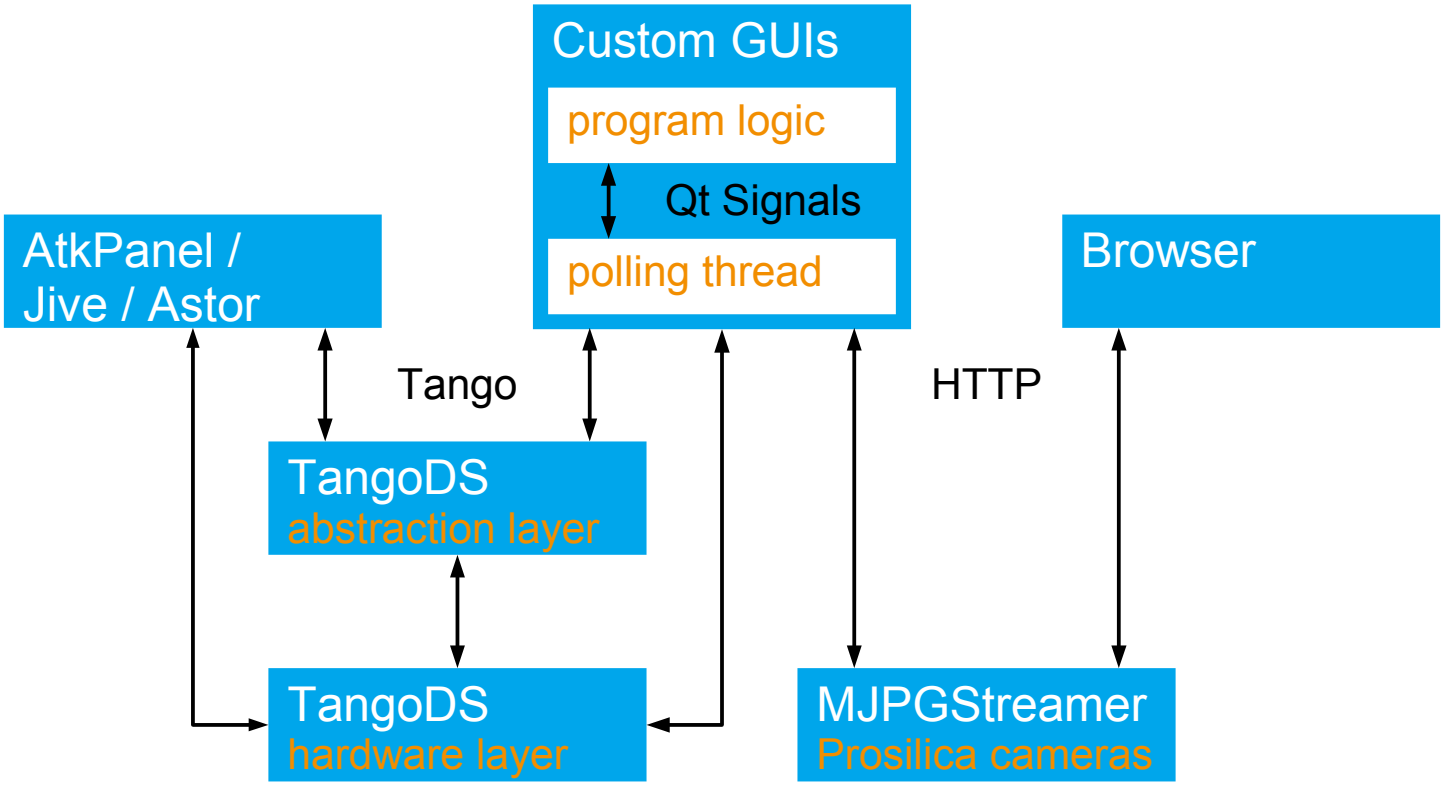


Motion Device Servers

- No other servo drives in use at PETRA when we started
- FS-EC was not able to offer a suitable solution
- As a result P11 controls are different from all other PETRA beamlines
  - Other Tango device servers
  - No “Online” but custom build Python scripts / GUIs
- OmsMaxV, AerotechEnsemble, GalilDMC are in use at P11 only
  - Focused on closed loop servo systems
  - Expose as many features as possible to the Tango client

Tango Layers

- Prosilica cameras are the only non Tango devices at P11
- An abstraction layer was introduced



Tango Device Servers

> FS-EC

- Petra3Undulator
- FMBOxfDCMEnergy
- OmsVme58
- ZMX
- Pilatus
- XIA
- SIS3610
- TIP551
- TIP830u20
- DGG2
- VFCADC

> P11 Hardware

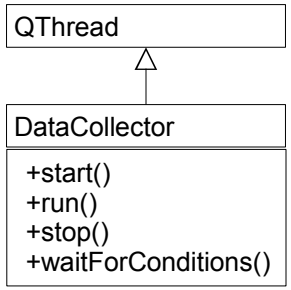
- AerotechEnsemble
- GalilDMC
- P11Robot
- MicroEpsilonILR118x
- OxfordCryostream700
- CAENelsAH501D
- BunchUhr
- MenloDDS120
- MenloSMA1000

> P11 Abstraction

- P11Energy
- P11Filters
- P11Granite
- P11SlitSystem
- P11HorizontalMirror
- P11VerticalMirror
- P11Annealer
- P11DetectorTower
- P11Interlock
- CircleDetector

Application Internals

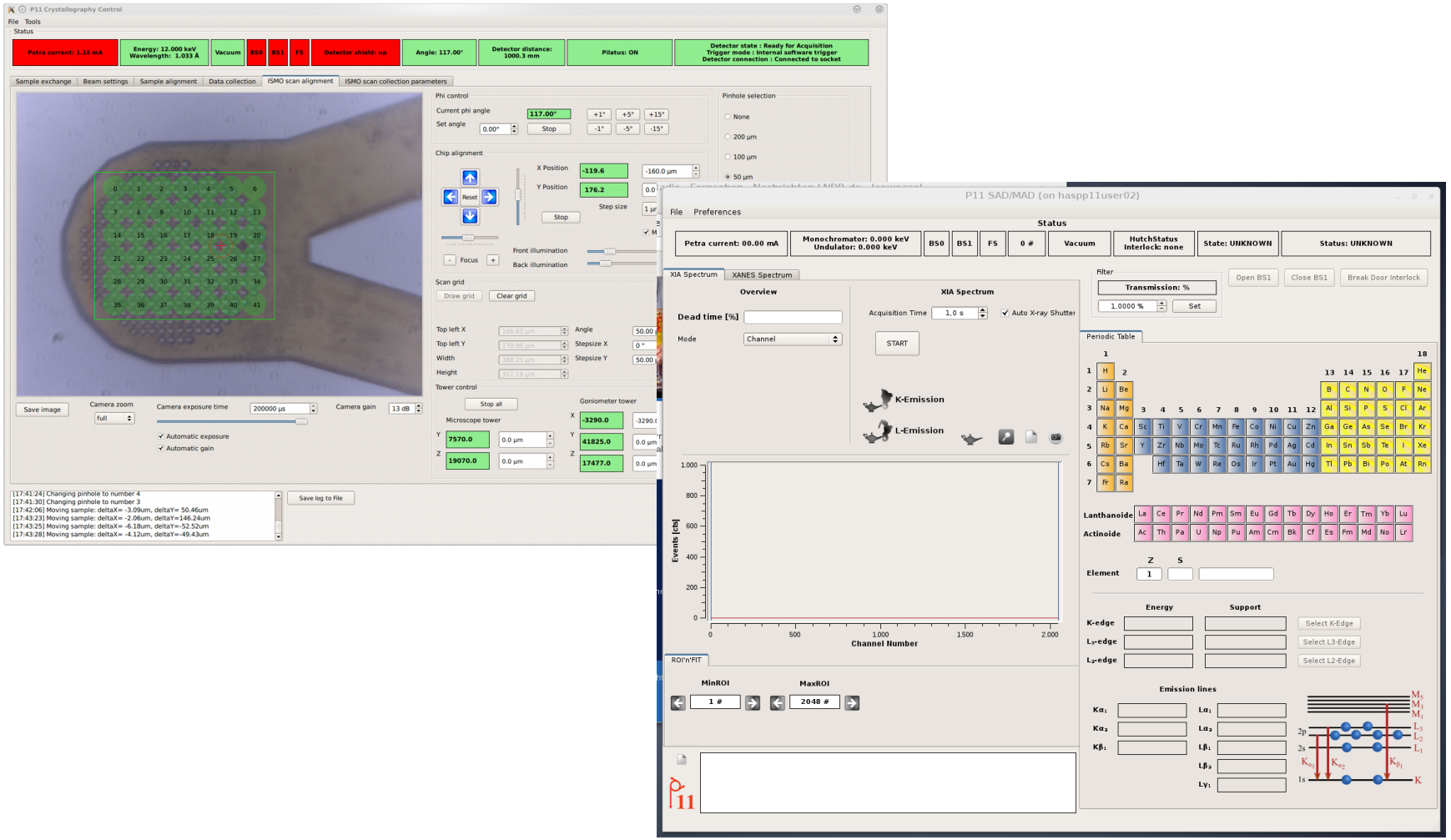
- Everything is based on Qt4 signals
- Nearly all application logic is in the application itself
- DataCollector classes are were the magic happens
  - Regular run, screening, mesh scan
  - waitForConditions() prepares everything
  - Few parameters only, most things are taken as is (centering, apperture, energy, ...)
  - run() bears the logic, it yields progress
  - Online processing (XDSAPP) is started from here, via ssh command
- Result presentation for the mesh scan lives in a separate thread
  - Waits for the images to appear in the central storage
  - Uses spotfinder through it´s HTTP interface for processing
  - Collects, normalizes and visualizes the results



CrystalControl Features

- Different tabs for sample alignment and data collection
- Screening with auto strategy calculation
- 2D mesh fly scan with diffraction rate visualization
- automatic beamstop / collimator / pinhole centering
- “move to click” sample centering
- digital On-Axis zoom
- automatic data processing (XDSAPP)
- Pilatus live view (Albula)
- Separate SADMAD tool, capable of energy fly scans
- Fully automatic energy change

CrystControl GUI



Thank You

Questions?