Tango Integration of Modern 2D Detectors

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Outline

> Background

> New hybrid pixel detectors

> Lambda tango integration

- System layout
- Detector PC
- Software
- Tango servers
- Data

> Summary and Outlook

Background

> Motivation

- Provide detector with high sensitivity, high resolution, high frame rate and large area

> New detector development

- 2D detector with small pixel size

    > High resolution and large area

- Hybrid pixel technology

    > Pixelated sensor and Chip are directly connected

    > Fast read-out speed (kHz)

- Direct photon conversion

    > Provide high Quantum Efficiency

- Adaptable sensor material (e.g. Si, GaAs, CdTe)

    > Covers different range of X-ray energies

New Hybrid pixel detectors

> ## Lambda

- Based on the Medipix3 readout chip

- Single Module:1536 x 512 pixels

- Support both 12 and 24 bit image modes

- Maximum frame rate:2000 frames/second with 12 bit mode

- Maximum data rate for single module : ~2.6 GB/s

- Multi-module system (Lambda2M) available
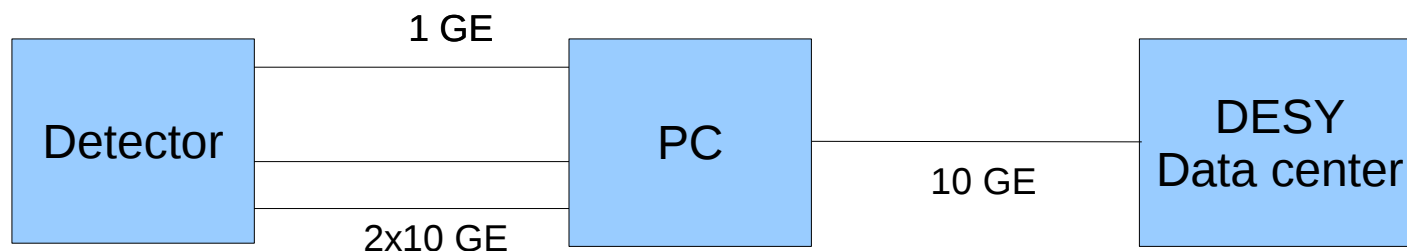
  > Lambda2M contains 3 lambda single module
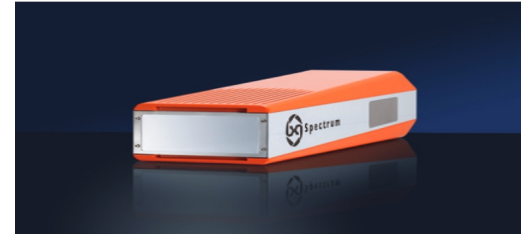
> ## AGIPD 1M

- Multi-module system (16 AGIPD single modules)

- AGIPD 1M system is designed for European XFEL
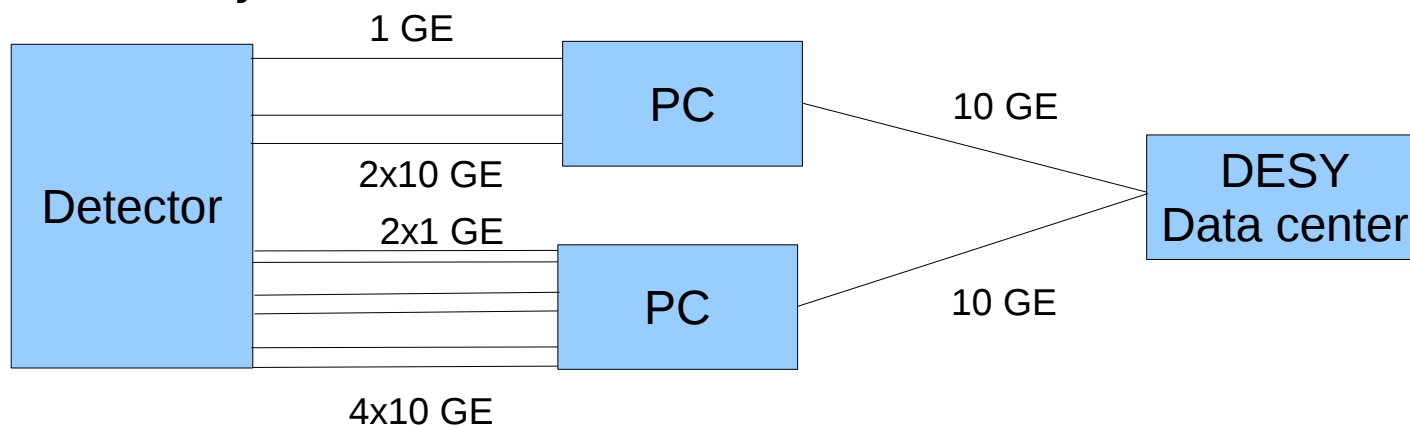
- Maximum data rate: 10GB/s

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Lambda tango integration – System layout

> Single module system

> Lambda2M system

Lambda tango integration – Detector PC

> Detector PC

- Dedicated detector PC is used for detector control and data acquisition

- Dell PowerEdge R620 Server or similar standard

- Intel(R) Xeon(R) CPU E5-2667 0 @ 2.90GHz X 12 cores

- RAM: 256 GBytes

- Hard disk: 4 TBytes

- 6 X 10 GE NICs

- 2 X 1 GE NICs

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Lambda tango integration – Software
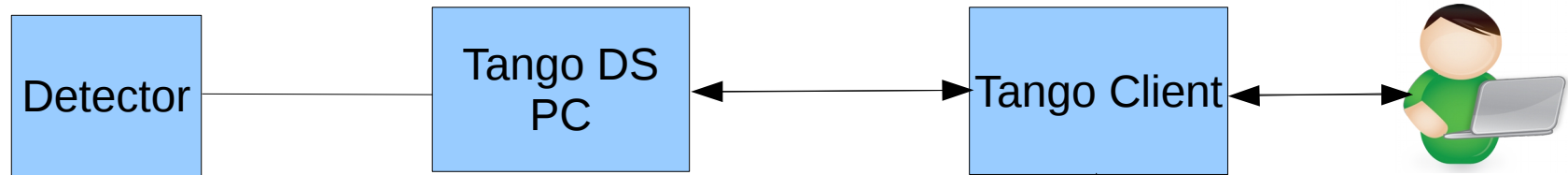
> **Detector SDK**

- Encapsulate the control and data acquisition in the SDK
- API for further control system integration or user applications

> **Tango integration**

- Based on the detector SDK, a tango device server (DS) is implemented
- DS is used to set parameters and control the behaviors of the detector
- The device is integrated into the experiment control environment
- For multiple module system, the master tango device server is used to control the slave tango device server

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Lambda tango integration – Tango servers

> Single module system

> Lambda2M system

Lambda tango integration – Data

> ## Data compression

- CPU based parallel data compression is implemented in the detector SDK
- Hardware Gzip accelerator (IBM and Comtech EF Data) is under study.

> ## Data format

- Nexus file format is used for saving the meta data and image data
- File split option is implemented and each file has a user specified size

> ## GPFS with NFS

- The GPFS is exported to detector PC using NFS.
- Detector writes data into mounted directory

> ## HiDRA

- An application based on ZMQ used to copy data from detector PC to data center
- Tested with Pilatus and AGIPD 1M system

Summary and Outlook

> Lambda system has been successfully integrated into tango control system at PETRA3 in DESY

> Both single and multi module system work reliably with full speed (2000 fps) data acquisition

> CPU based parallel compression is implemented for the image data

> Hardware compression accelerator will be used in future

> HiDRA will be used to copy data from detector PC and data center for Lambda system

> ZMQ stream of the image data will be provided by detector SDK in future

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Thank you