MAX IV Facility Report IFDEPS 2024

Paul Bell Scientific Data Group/Technical Division



Status and organisation

- 16 beamlines in operation
- Detector activities receiving increased focus
 - Today's operational support
 - Future planning
- *Scientific Data* group formed 2023 within new Technical Division, to manage:



- o Integration of commercial systems into control and DAQ and support in their operation
- Perform SATs and performance/calibration studies (e.g. module alignment, flat fields)
- Increasingly: integration of non-commercial systems for tests or user operation (PSI Jungfrau, PSI Eiger, DLS TRISTAN... others to come)
- o Provide associated online data processing and visualisation specific for experiments
- Supported by other groups for specific hardware such as MCPs, SDDs/Ge, DLDs



Integration of commercial detectors/cameras



 Consolidated 30 systems/10 unique types into common Kubernetes-managed DAQ cluster (many instances of common data receiver-file writer).



Online data processing and visualisation

- Data processing steps deployed in same K8s cluster with data passed via ZMQ
- Algorithms range from simple operations (frame accumulation, ROI sums...) to real time tomography reconstruction on Nvidia GPUs
- Azimuthal integration common to many beamlines using in-house python implementation "azint" [*]





[*] Very large-scale diffraction investigations enabled by a matrix-multiplication facilitated radial and azimuthal integration algorithm: *MatFRAIA*, J. Synchrotron Rad., 2022. See https://maxiv-science.github.io/azint/



Collaborative & internal development activities

- Top MAX IV requirement: time resolution for hard and soft X rays
 - To exploit coherence especially in soft X-ray regime and enable techniques such as XPCS
- Will obtain MCP+Timepix3 system from Berkeley
- In longer term, interest in LGADs (+ Timepix3)
 - Part of LEAPS INFRA TECH application but seeking other opportunities to collaborate
- Timepix-based system could also have future role in replacing DLDs in RIXs experiments
- In process of obtaining R&D licence for Timepix3: improve in-house knowledge of detector readout and FPGA systems in general

Hardware accelerated data reduction

- For robust real time data processing from next generation detectors
- Testing on Arria10 and Stratix10 boards
- Mainly using Intel OpenCL and more recently oneAPI
- Activities:
 - Azimuthal integration up to 20Gpix/s
 - Bslz4 decompression

See:

- <u>https://gitlab.com/MAXIV-SCISW/compute-fpgas</u>
- <u>https://indico.desy.de/event/39343/contributions/15</u> <u>1774/</u>)



