

# Data acquisition and on-the-fly processing from high rate detectors at MAX IV

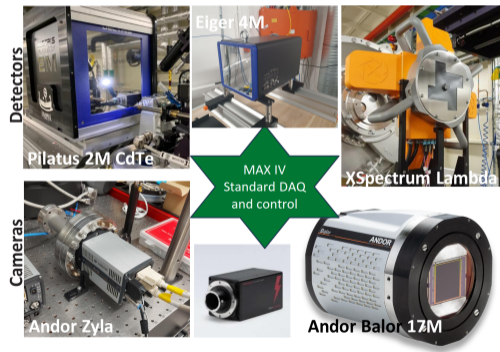
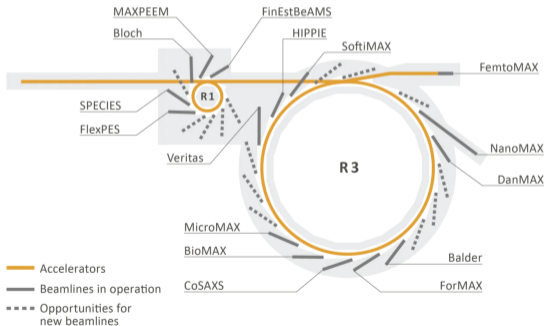
Aleko Lilius, Scientific Data

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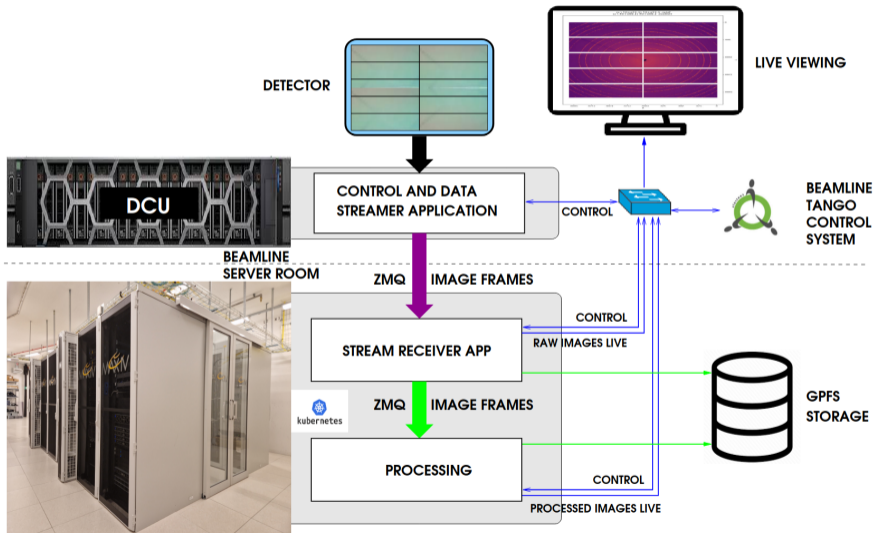
September 22, 2025

# MAX IV

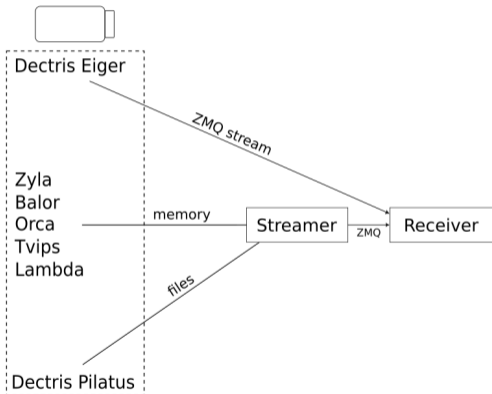
- Approximately 30 detector systems of 10 uniquely different hardware types in operation.



# Data acquisition system (DAQ)



# Unified Streaming



## Dectris Eiger

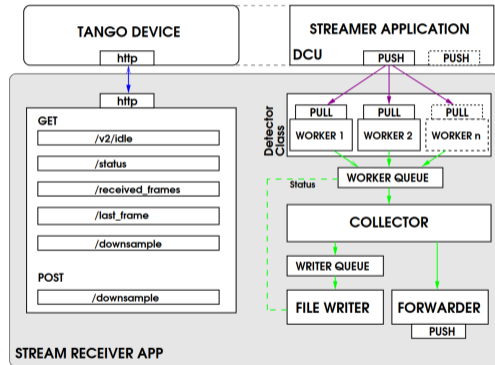
- Dectris provided DCU
- Send data in ZMQ frames direct to receiver

## Streamer

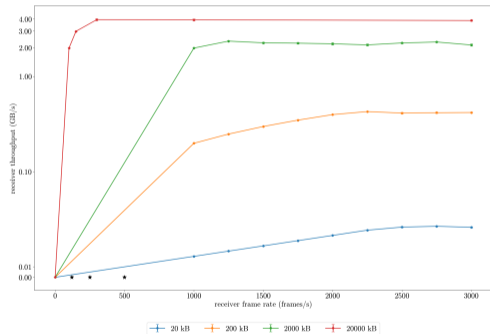
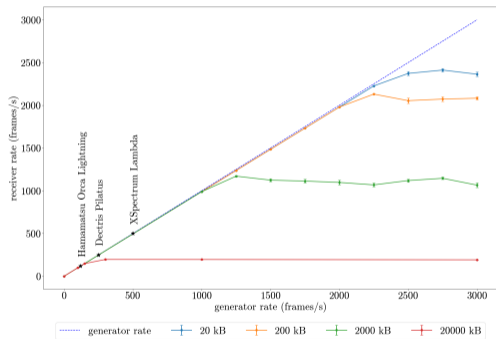
- Take frame buffers from SDK
- Access files from local disk
- Wrap data in ZMQ frames
- Send data to receiver

# Streaming Receiver

- Parallell workers for compression and transformations (e.g rotations)
  - Custom detector class for edge cases
  - Forwarder streaming over ZMQ
  - HDF5 filewriter writing to GPFS storage
- HTTP interface for status, last frame and downsampling



# System Benchmark



# Live Analysis

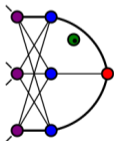
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## Reasons

- Live analysis save precious beamtime
- Existing infrastructure allow it
- MAX IV is a streaming-based facility

## Potential Problems

- Analyses often require a lot of computation
- A need to combine information from several sources
- Single bottleneck



**Potential solution:** Dranspose

# Dranspose

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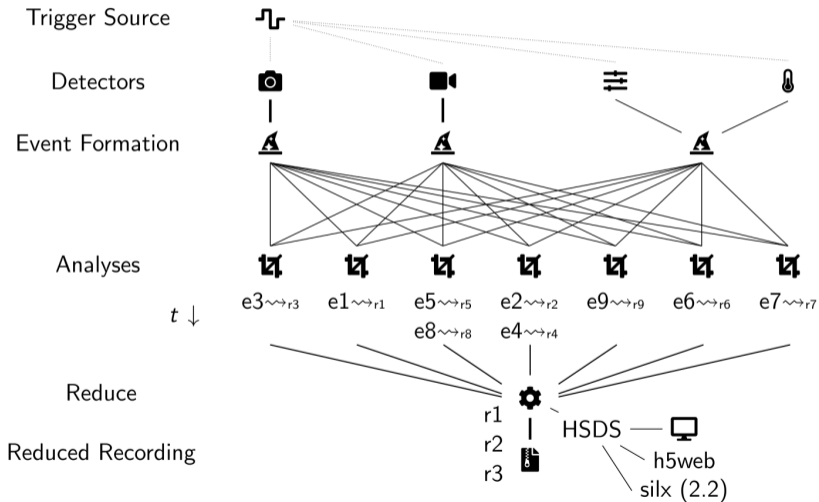
Deployment of Dranspose in Kubernetes DAQ cluster:

## Components

- One **controller** that coordinates all the parts
- Several **ingesters**, one for each source (detectors, control elements...)
- A few **workers** (heavy lifting)
- One **reducer** (summarizing, publishing)
- One **keydb** (Redis) that all other components use to stay synchronized

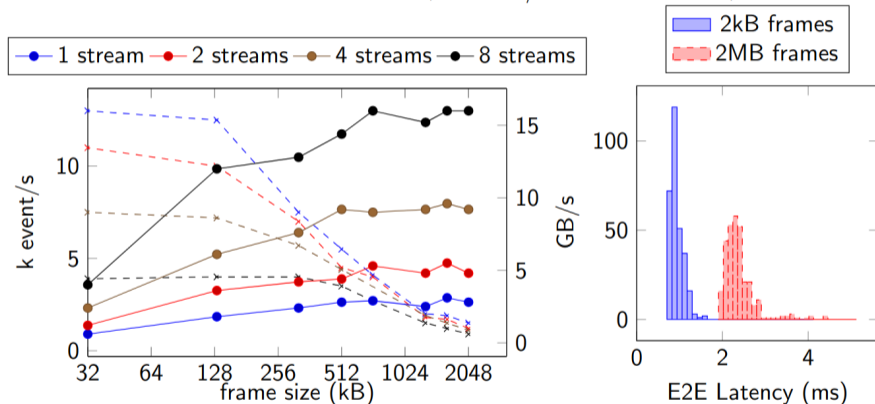
Data is sent over ZMQ, configuration and status messages over Redis

# Dranspose



# Dranspose Performance

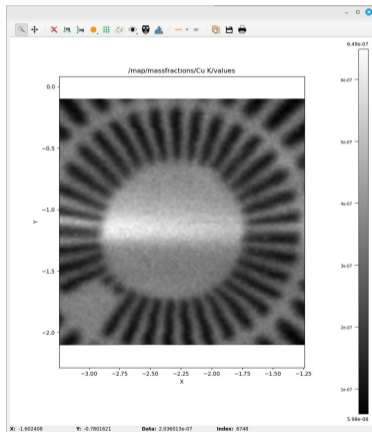
K8s cluster of 10: dual Xeon<sup>®</sup> Gold 6326, 100 Gbit/s Mellanox SR-IOV, 465 GB RAM



limits on around **2 GB/s** per stream or **12 kHz** at a few ms

# Dranspose Examples

## Live PyMCA spectrogram fitting



## Live tomography

- Merge 16MB frames of Orca camera
- Use together with encoder positions from PandABox
- Feed to reconstruction engine to get live reconstruction

# Thank you for listening

Dranspose documentation: <https://dranspo.se>