# Eiger 16M @BioMAX

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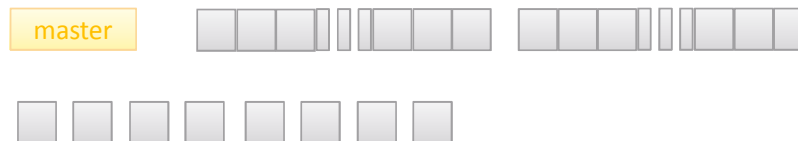# About Eiger

Data Acquisition

● Arm, prepare / config detector

● Trigger, int / ext

Eiger Data

● Monitor

● Filewriter, HDF5 / NeXus

● Streamer, zeroMQ

# Change Energy

- Important, Energy calibration, flatfiled correction, etc

- Take time, 6 - 9 s
  - Don't configure both wavelength and photon energy
  - Use non-default energy_threshold, double time to config

- Arm also becomes longer, over 3 s

- Readout time is energy depaendent, 4 – 10 µs
  - Pilatus, Exp_period = readout_time + exp_time
  - Eiger, Frame time >= readout_time + count_time
  - Use frame_time as exposure time?

  - Simple, Frame time = 10 µs + count_time
  - Precise, Frame time = readout_time + count_time (change energy first!!)

# Arm

- Configs are "locked" after arm

- Interleave, inverse beam
  - Energy
  - Image number

- Solution!?
  - Energy, don't change the energy setting, OK within 200eV (internal commu. with DECTRIS)
  - Image number
    - Streaming, rename image number
    - Repack HDF5 data
    - Can also correct the wrong energy in the master file

# ROI Mode

- 16M and 9M, have 4M mode

- ROI changes,
    - Dectector "sizes" change ➜ resolution (UI)
    - Frame_time min changes, 4M 1.3 ms vs. 16M 7.5 ms

- Resolution dependent on energy, distance, ROI (UI)

# NeXus/HDF5 - 1

Master file, meta info, extened imaged header

- NeXuS, http://www.nexusformat.org/ , NXMX

- Eiger Data is not 100% NXMX

  - Missing rotation axis

  - Different unit, beam_center_x, beam_center_y, pixel position

  This is a length, not a pixel position, and can be outside of the actual detector.
  -from nexusformat.org

  - Generate_XDS.INP from XDSwiki works directly

  - We also add /entry/instrument

```python
def add_header(self, filename):
    h5file = h5py.File (filename)
    beamline = h5file.require_group("/entry/instrument")
    beamline.attrs['name'] = 'BioMAX@MAXIV'
    omega = h5file.require_group("/entry/sample/transformations/omega")
    omega.attrs['vector'] = (0.0, -1.0, 0.0)
    h5file.close()
```

# NeXus/HDF5 - 2

- Master file, fixed size, 350 MB for 16M

  Characterization, CBF or HDF5?

  - CBF (18 MB/img)
  - HDF5, 350 MB + data file

- Data file

  – h5 container, how many imgs per file?

  – Available until the last image in the container is collected

Jie Nan @ MXCuBE Workshop ESRF

# Data handling

- Data compression
  - Bslz4, avg. ~10 fold
  - Concern, the current 10 Gb/s interface not fulfill <4 fold compression for highest frame rate
- Data size
  - 900 imgs, 5 GB, after gzip 2.6 GB
  - Ultra fine-slicing, 1/10 of mosaicity
- Data transfer
  - EPU or in-house solution
  - Minimize data transfer
- Data processing
  - Shared HPC Cluster

## Benchmark test

EIGER_16M_Nov2015.tar.bz2, 900 images in 9 containers, 0.1 osc, from Dectris website

| Server | Time(s) |
|---|---|
| **MAXIV HPC - 4 nodes** (20 cores, CPU E5-2650 v3 @ 2.30GHz) | 78.2 |
| **MAXIV HPC - 8 nodes** (20 cores, CPU E5-2650 v3 @ 2.30GHz) | 53.7 |
| **SLS - 4 nodes** (24 cores, E5-2697v2 @2.70 GHz) | 76.6 |
| **Kay** (32 cpus, HT) | 120 |
| **BioMAX BufferServer** (24 cores, CPU E5-2643 v4 @3.4GHz) | 136 |

# Useful tools

- A list of tools, hdrmx.medsbio.org
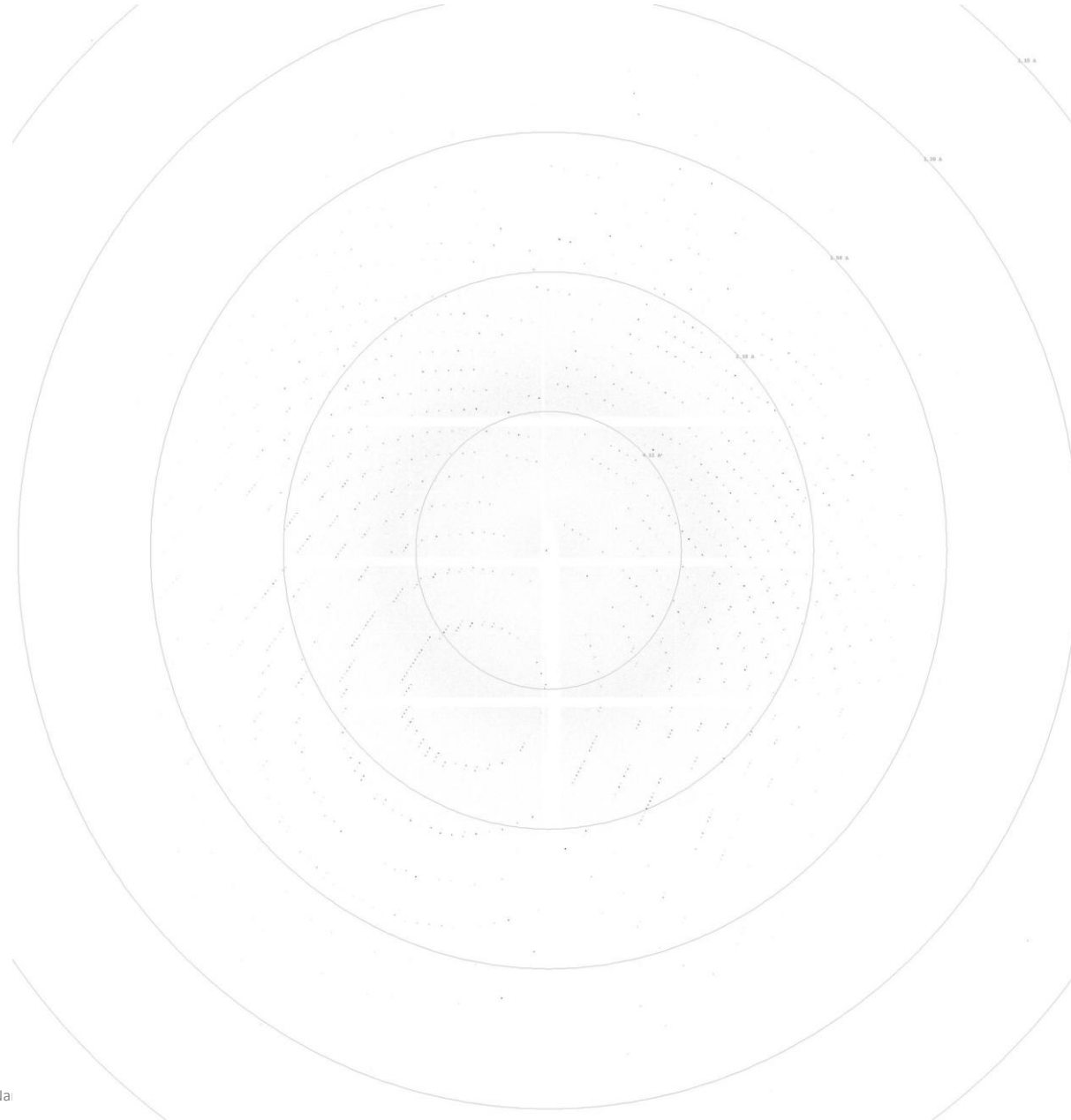  - Processing
  - Filewriter interface
  - Streaming interface
  - Many more

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- A list of tools, hdrmx.medsbio.org
  - Processing
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  - Many more
- Thumbnail generation (from Vicente)
  - Binning / summation
  - Eiger 1/4/9/16 M & ROI
- Detector calibration
  - pyFAI, MX-calibrate
  - CBF, converted with eiger2cbf https://github.com/biochem-fan/eiger2cbf

https://indico.maxiv.lu.se/event/233/