



The LIMA project update

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Talk outline

- **LIMA goals & design**
- **Features**
- **Applications**
- **Detectors**
- **Collaboration**
- **Future directions**

LIMA Goals

- **Library for Image Acquisition**
- **Control system-independent**
- **Oriented to high-speed detectors**
 - **Favour the use of detector optimizations**
 - **Highly multi-threaded**
- **Common control functionality**
 - **Provide software alternatives to “missing” hardware capabilities**
- **C++, Python/SIP**

Library structure layout

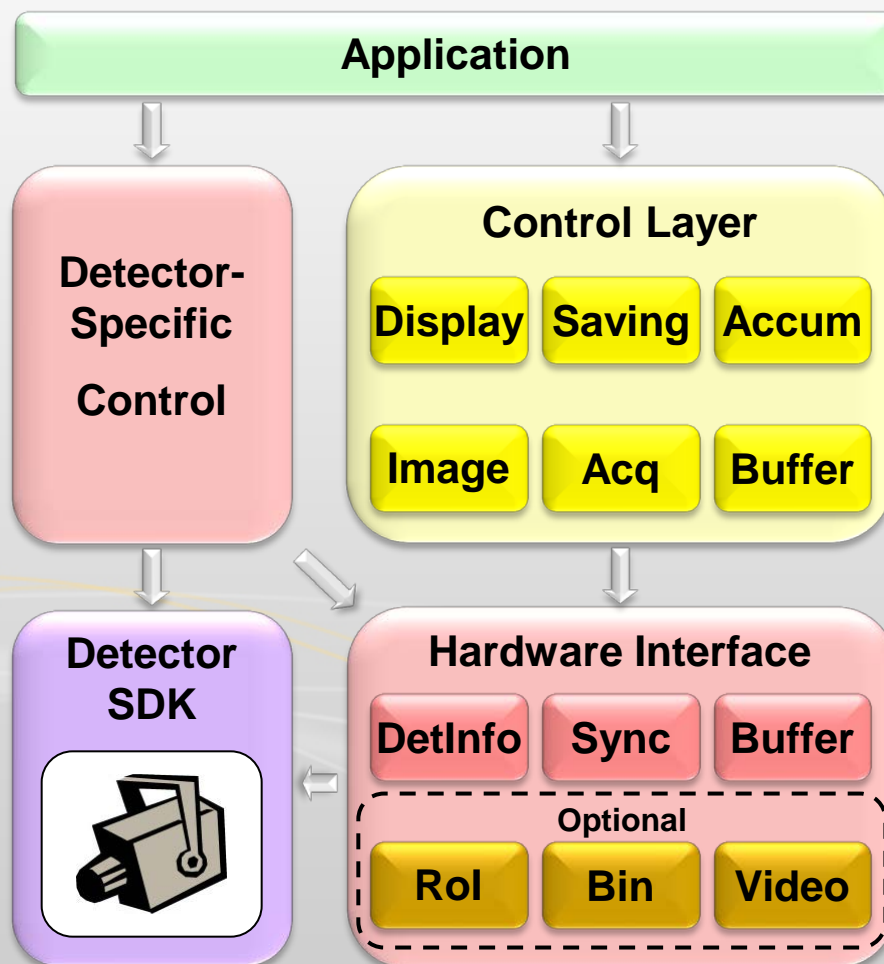
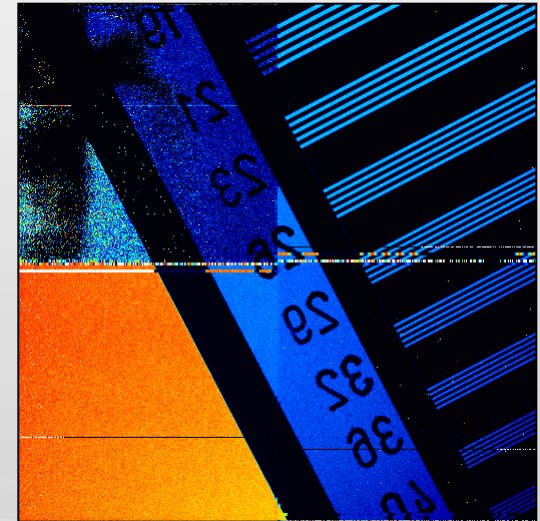
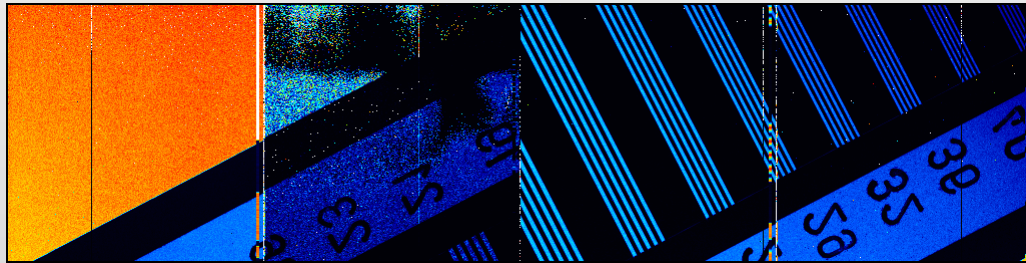


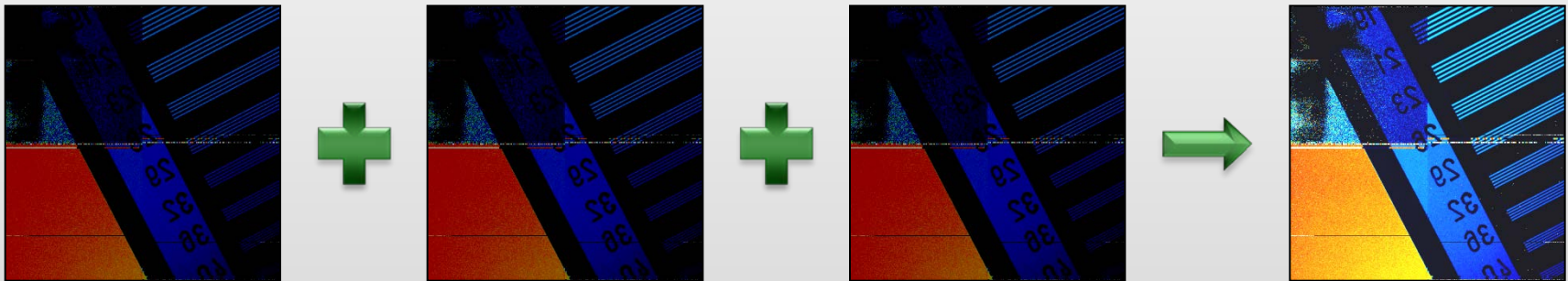
Image Reconstruction

- Data readout sequence does not follow real geometry



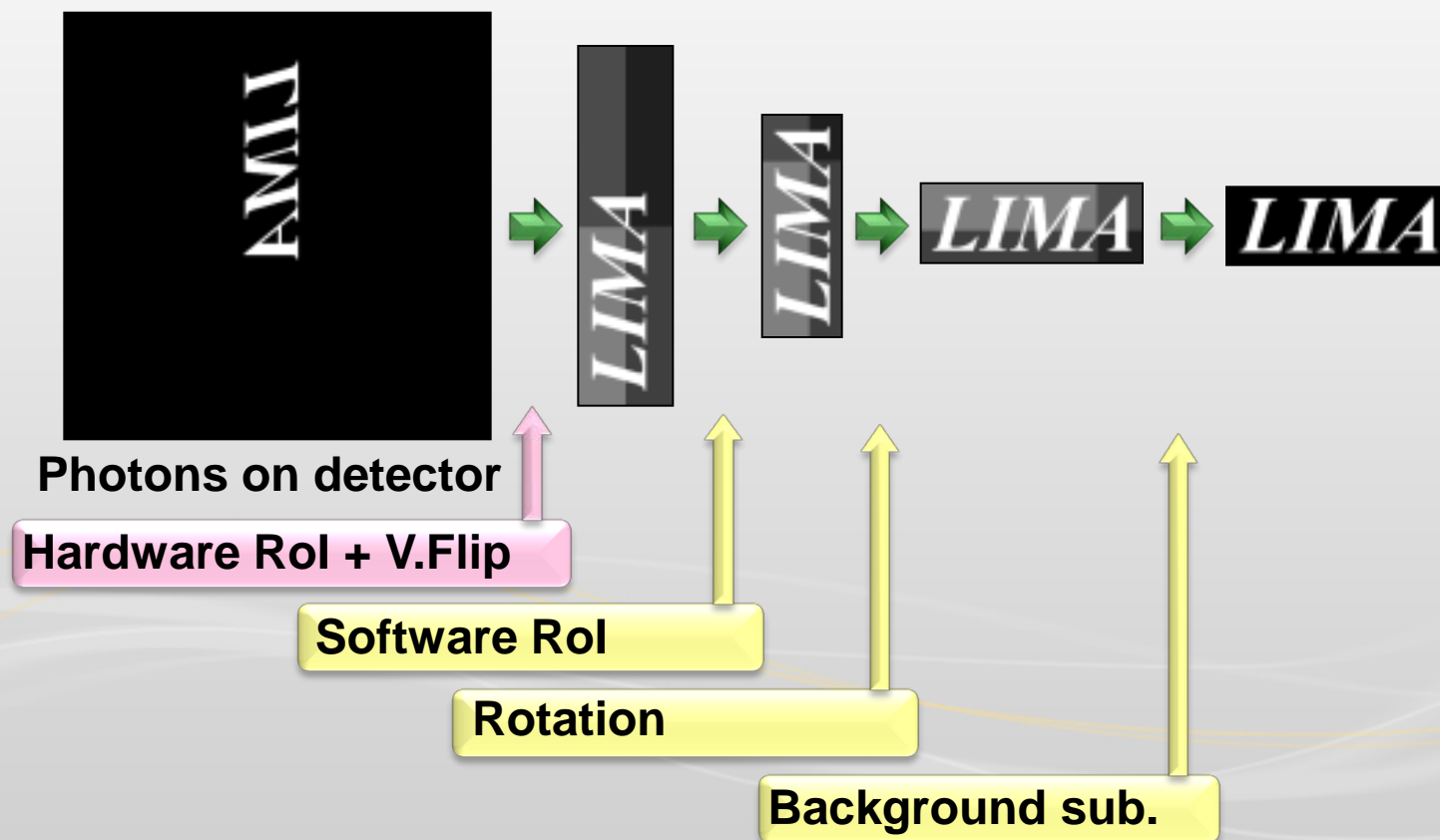
Pixel Accumulation

- Limited hardware integration: either in time or capacity



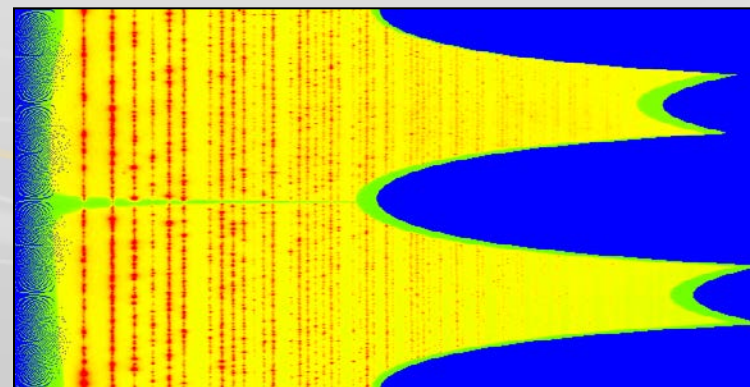
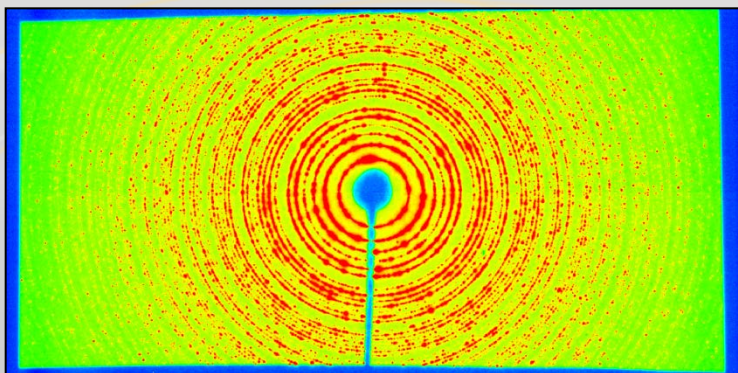
- Detect saturation (each frame) to signal non-linearity
- Intensity threshold \Rightarrow sensor protection

Image transformations



Data reduction

- **Multi-Roi Statistics \Rightarrow Scalar & Spectrum counters**
 - Polar coordinates, arbitrary shape (mask)
- **Centroid (Beam Position Monitoring)**
- **Flat-field normalisation**
- **Image Mask**
- **pyFAI \Rightarrow Fast Azimuthal Integration in Python**
 - **Spatial distortion correction**



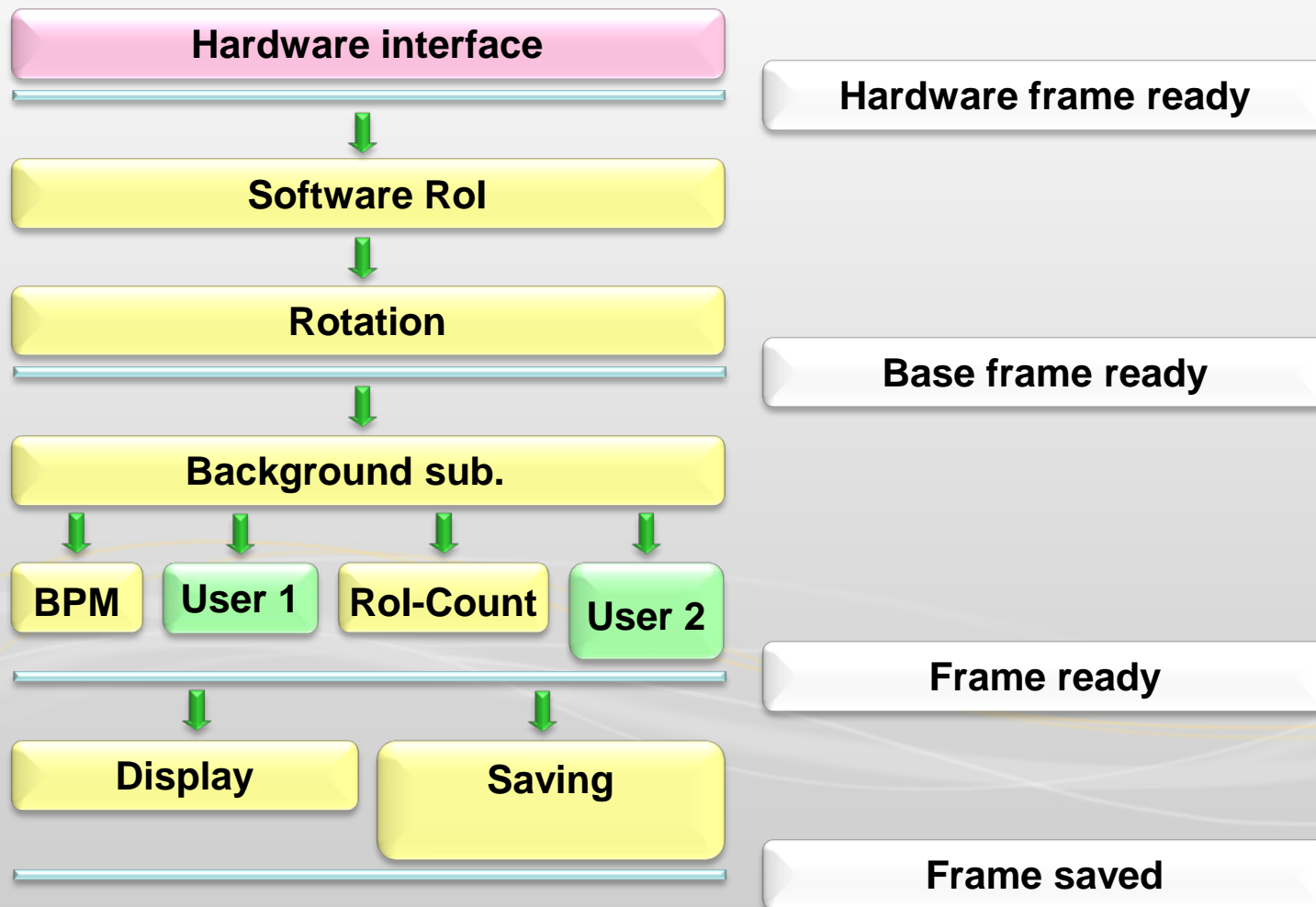
Data saving

- Automatic & manual file saving
 - EDF[GZ], CBF, Nexus/HDF5 (Common Data Model), FITS
- Different metadata components:
 - Static – detector type
 - Scan – sample name, scan conditions
 - Frame:
 - Internal – timestamp, CPU processing time
 - External – user defined: SR current, monitor intensity
- Data rate
 - 2 – 250 MB/s

Other features

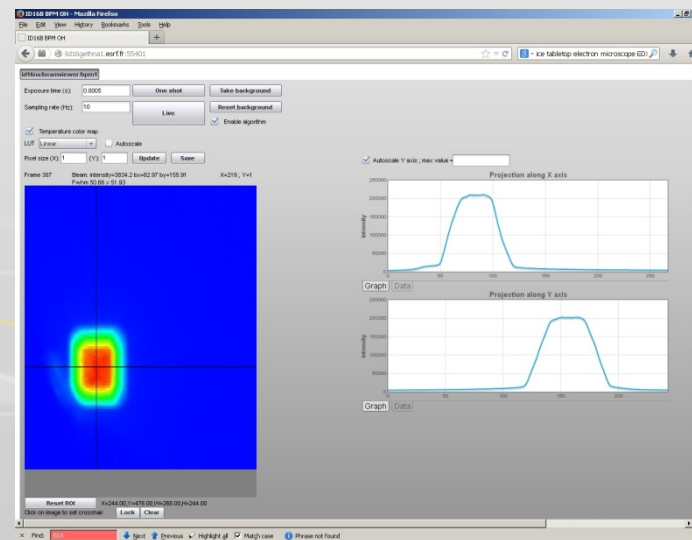
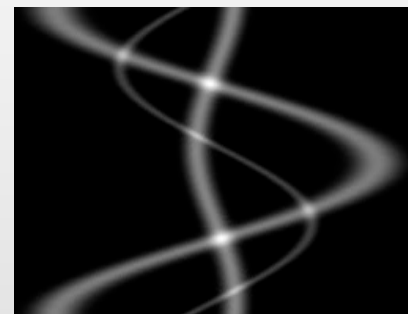
- **Basic video interface**
 - **Common video modes (mono/color)**
 - **Gain control and auto-exposure**
- **External user processing plug-ins**
 - **Arbitrary operations (C++ or Python)**

Frame processing & Events



Applications

- In operation for about 3 years
 - In more than 20 BLs
- TANGO device servers + SPEC
- Fast imaging & tomography
- Fast spectroscopy & diffraction
- Ptychography
- ...
- Beam Position Viewer & Monitoring
- Sample visualization (microscope)



LIMA collaboration

- **SOLEIL**
- **PETRA-III / DESY**
- **FRM-II / TUM**
- **ALBA**
- **MAX-Lab**
- **ADSC**
- **Rayonix**
- **DSG / Daresbury / STFC**
- **Nexeya Systems**
- **ILE/LULI/Ecole Polytechnique**

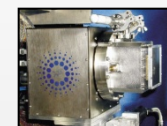


LIMA Workshop on March 2013



Detectors at the ESRF

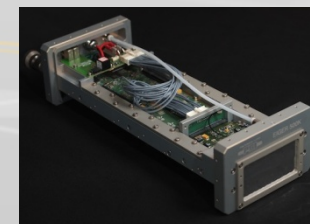
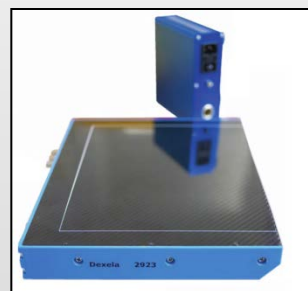
- 14 ESRF Frelon
- 14 ESRF Maxipix (Single chip, 2x2, 5x1)
- 10 Dectris Pilatus (300w, 1M, 2M, 6MF)
- 21 Basler
- 3 Prosilica
- 1 PointGrey
- 1 IDS uEye
- 2 Andor I-Kon
- 2 XPAD
- 4 PCO.Dimax & Edge
- 2 Perkin Elmer flat panel
- 2 Photonic Science



Total: 76 ... and increasing ...

Foreseen Detectors

- **Legacy:**
 - Dalsa, Sarnoff, Avix
- **Under development:**
 - Dexela CMOS flat panel
 - STFC XH
 - Rayonix HS
 - SVS Vistek SVCam HR
- **New:**
 - Pilatus III
 - PSI & Dectris Eiger



Current limitations & New Functionality

- **Delayed data processing & saving \Rightarrow dead time between scans**
 - **Need deferred frame processing**
- **Buffer memory management**
 - **Tracking of frame buffer usage**
- **Detector per-frame meta-data**
- **Sinogram software plugin**
- **More flexible saving management**
 - **Gradual migration to HDF-5 at the ESRF**

Conclusions

- **LIMA is a library for 2D detector control**
- **Oriented to high performance acquisitions**
- **Provides common functionality for a variety of detectors**
 - **Image transformations**
 - **Data reduction algorithms**
- **In operation at the ESRF on 20 BLs and in other large facilities**
- **Collaboration community around LIMA**
- **Developments on new detector plugins and acquisition strategies**

Acknowledgements

ESRF

- ISDD Detector Group
- ESRF BLs
- TID / SC
- Software group:
 - Matias Guijarro
 - Alessandro Mirone, Jerome Kieffer
 - BCU, DAU, ACU

And all the collaborators!

Thank you for your attention!

<http://lima.blissgarden.org>