Gain calibration of the AGIPD detector using low intensity X-ray data
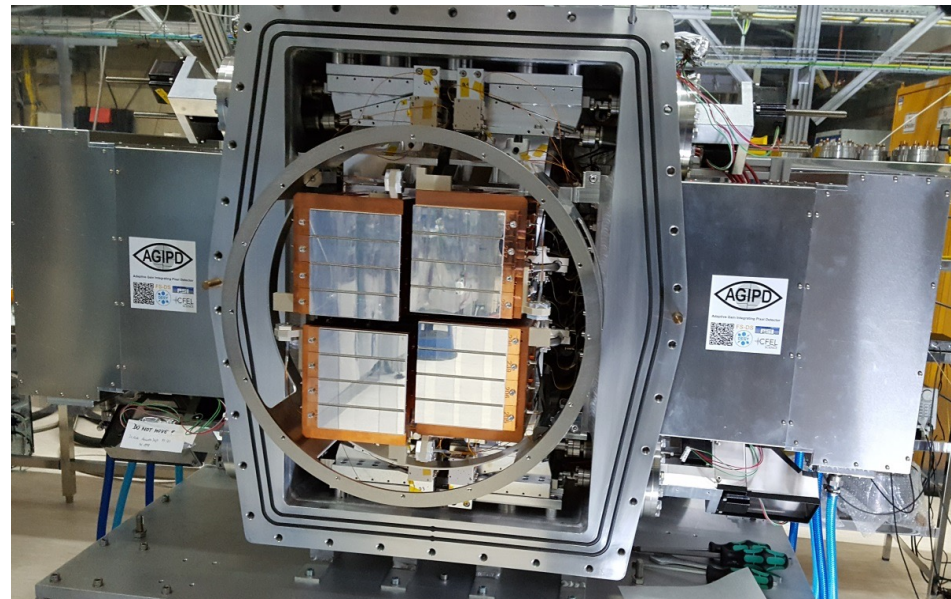
Michel Cascella

Detector Operations
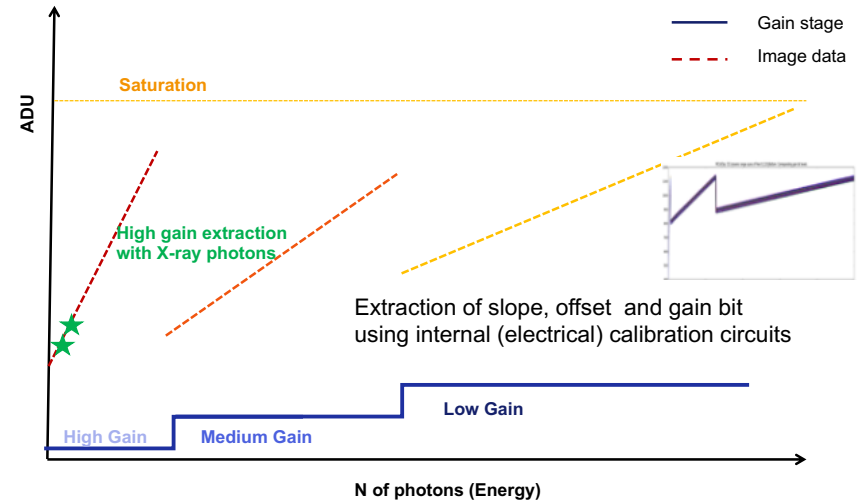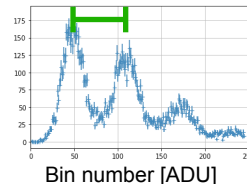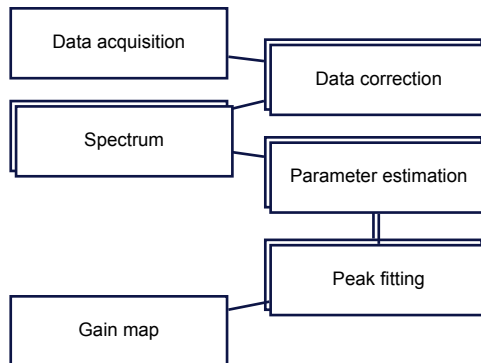
Detector Scientist
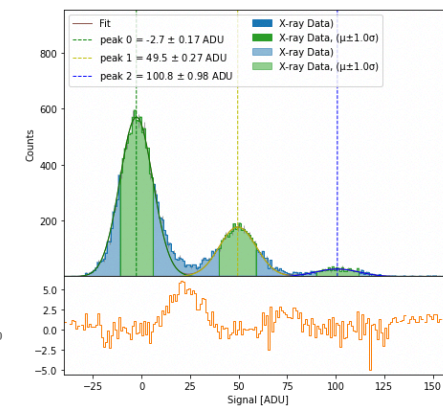
Hamburg, 1 April 2021
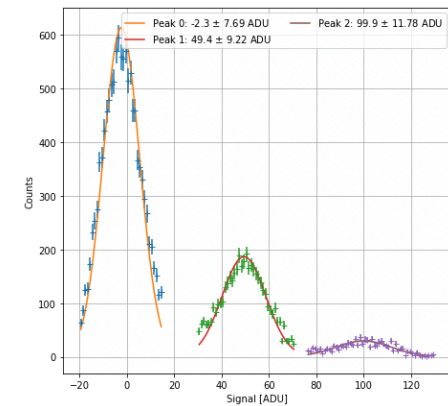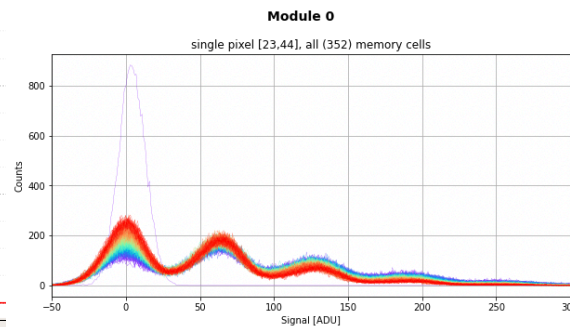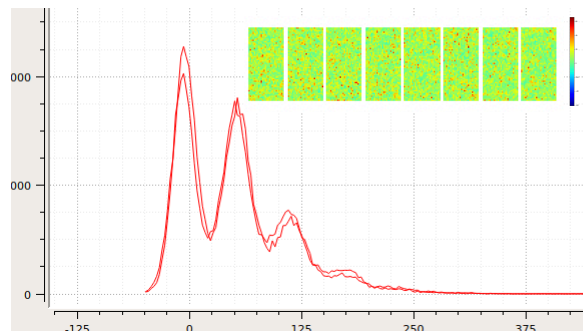
AGIPD absolute calibration

- Calibrate 352 mem cells / pixel
  - 352M constants
- Charge injection to calibrate to full dynamic range
- 8keV Cu fluorescence (~flat illumination)
  - Peak distance ~ resolution
  - Fully automated & optimised

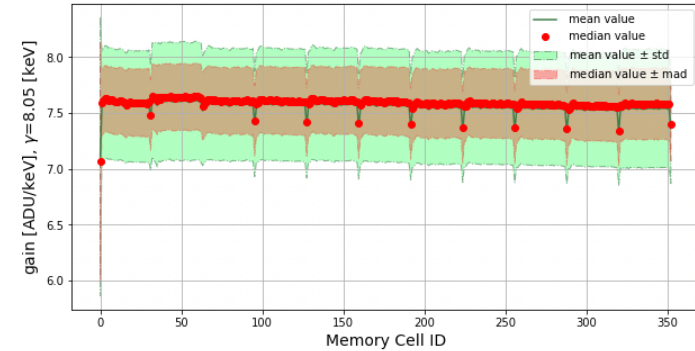Extraction of slope, offset and gain bit using internal (electrical) calibration circuits

Bin number [ADU]

Energy	3 – 16 keV
Quantum efficiency	80 %
Noise	350 e- r.m.s.
Dynamic range	1E4 γ @10keV
Pixel pitch	200 um

European XFEL

Data processing

- Data is monitored during acquisition

- Images are processed offline to correct for offset, common mode noise, …

- Spectrum histogram for each cell/px

- Estimate starting parameters
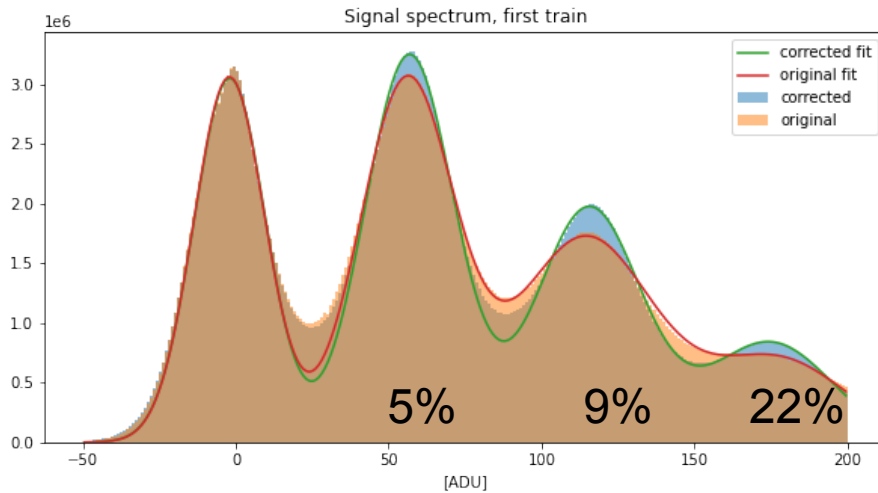
- Fit 2-4 peaks (possibly discarding "valleys")

Result summary

Gain [ADU/keV], γ=8.05 [keV]
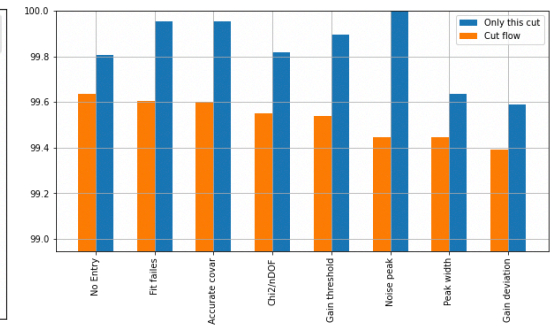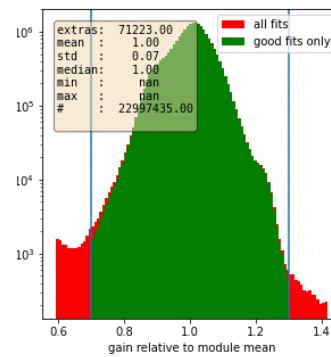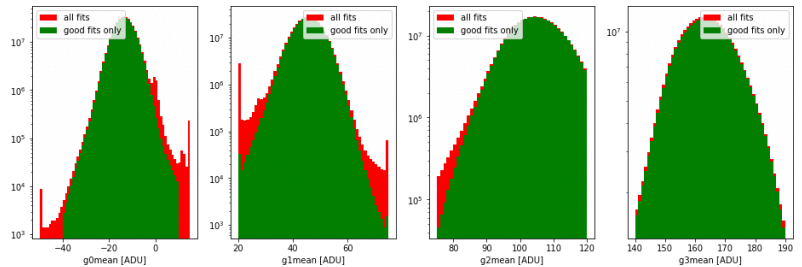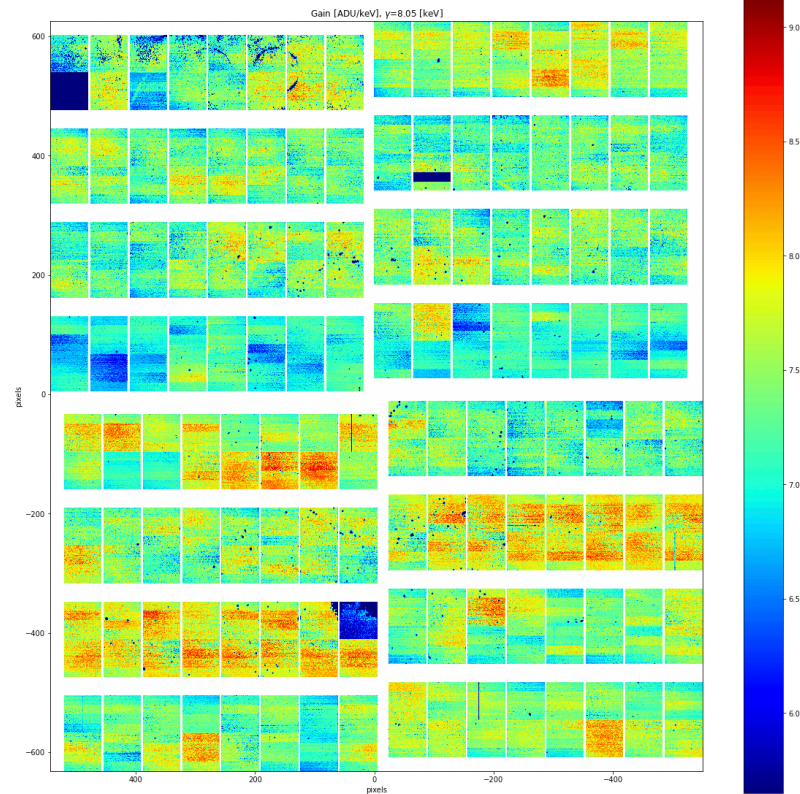
Pixels with good calibration ~98.5%

Performance and conclusions

Signal spectrum, first train

5%   9%   22%

Original data, mean across one train — Original

Corrected data, mean across one train — Corrected

- Cu fluorescence to provide absolute gain calibration

- Robust data reduction and fitting

- Resolution improvements

European XFEL