

Eiger 9M at SOLEIL

Martin Savko

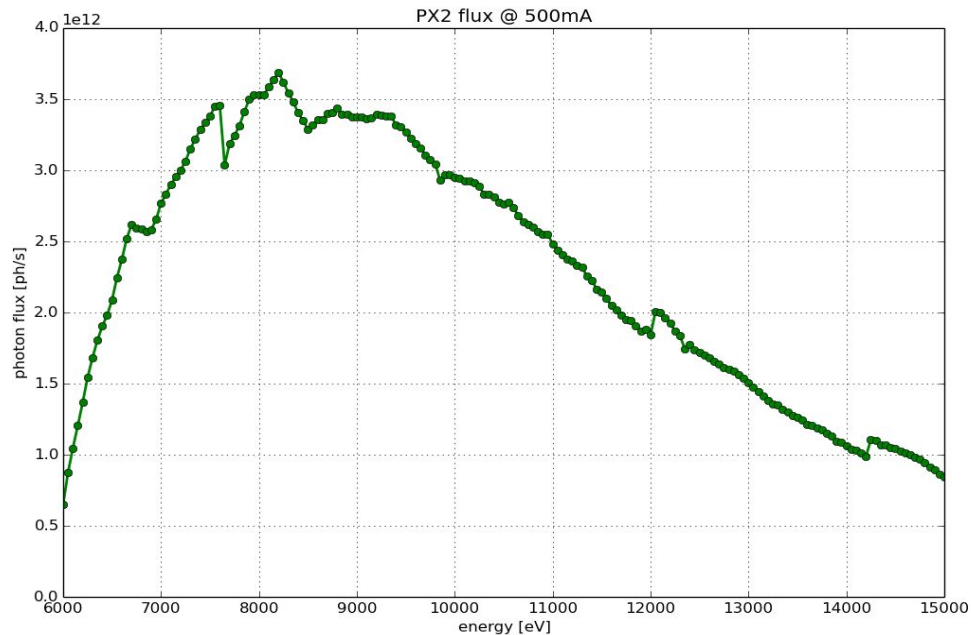
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Overview

- Beamline
- Eiger Setup
- Computational infrastructure
- Eiger Data Processing
- Conclusion

Proxima 2A

- Users since March 2013
- $10 \times 5 \mu\text{m}$, linearly polarized
- 3.6×10^{12} ph/s @ 8.1 keV
 - Tunable 6 - 17 keV
- MD2 goniometer
- CATS sample changer (9 unipucks)
- Eiger X 9M detector



Eiger X 9M at Proxima 2A

- Firmware version: SIMPLON v. 1.6.4
- User operation since December 2015
- bslz4 compression
- Max speeds
 - 238Hz @ 9M
 - 750Hz @ 4M ROI (stable as of SIMPLON API 1.6.2)

Data handling infrastructure

- 10Gbit network
- Local buffer on the processing server
 - 2.56TB RAM
 - 3TB RAID 6 SAS (to be upgraded by 16TB SSD)
- Medium and long term storage (Active Circle based), NFS access
 - Local cell: 10TB SSD, 20TB SAS
 - Remote cell: 1PB via 10Gbe

Processing infrastructure

- System dedicated to single beamline
 - Keeping data close to source
 - Tailor processing power to the detector
 - Minimizing administration overhead by going integrated system
- Huawei FusionServer RH8100 V3 Rack Server
 - 8 x XEON E7-8890 v3 @ 2.5GHz
 - 144 cores, 288 threads
 - 2.56 TB RAM (DDR4 1866MHz)
 - 4 x 10GBe
 - 5.76 TFlops (estimated)
 - 8U form factor

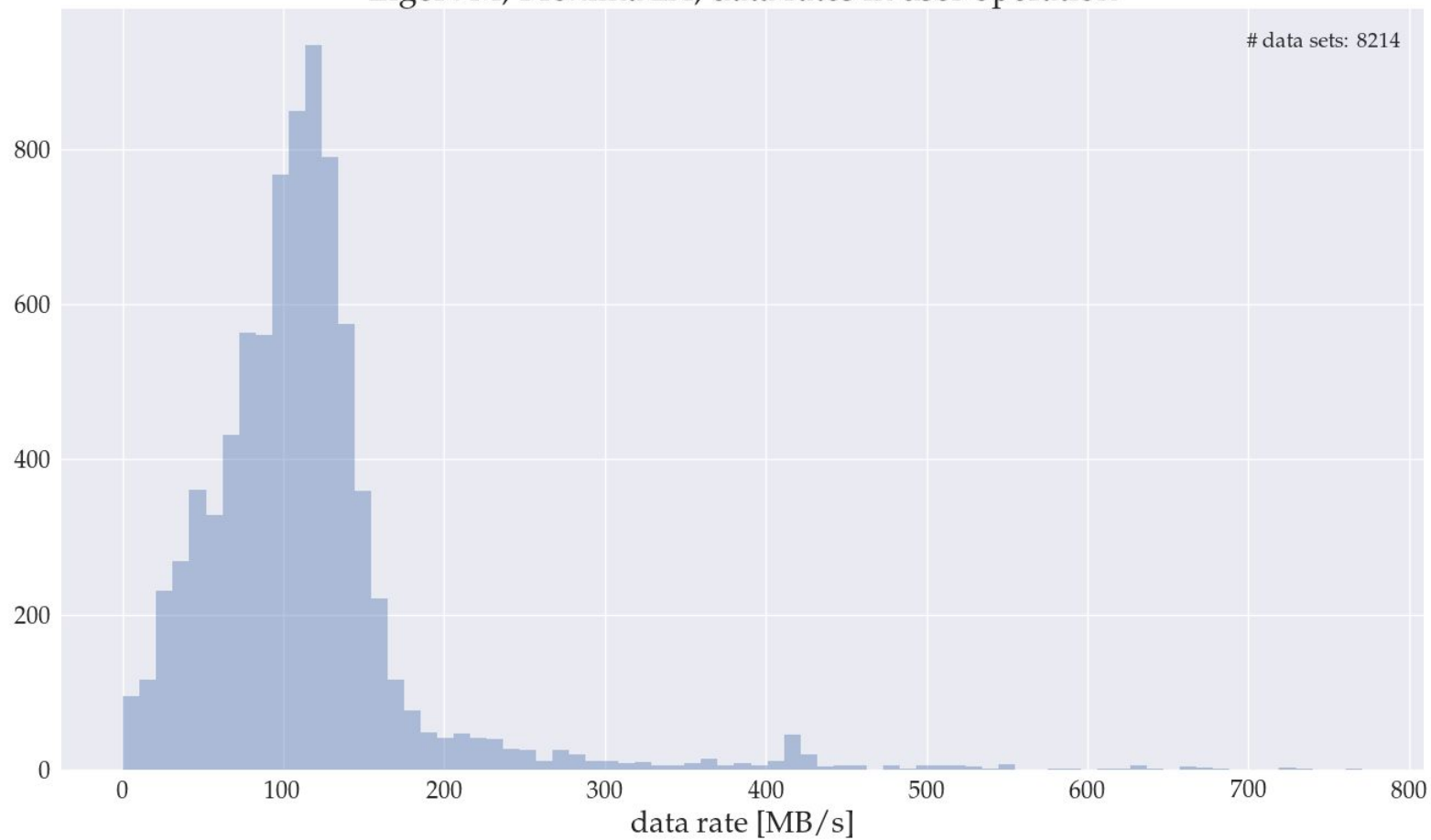
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Performance of the setup

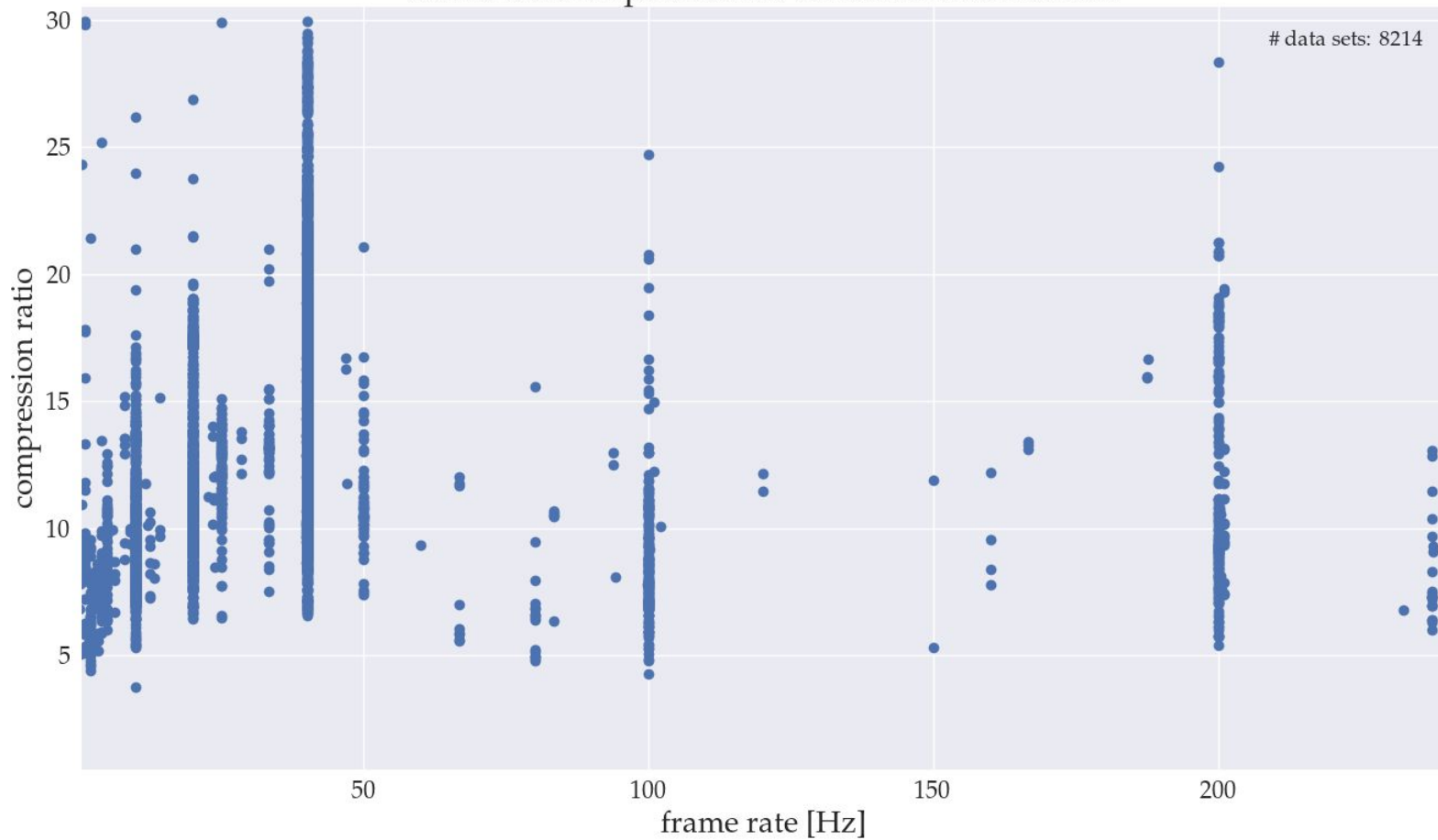
- ~ 1000 MB/sec download speed
 - Using both 10Gbit ports of the DCU
 - ~600 MB/sec with single 10Gbit port
- ~ 114 MB/s is the average data rate
 - Maximum observed data rate ~ 770.57 MB/s
 - In practice no data transfer bottleneck thanks to bitshuffle lz4
- The server has RAM cache of 170 GB
 - ~ 20 min autonomy assuming average data rate in bslz4 compression
- 12.75 is the average observed bslz4 compression ratio
 - x 14.4 per 32bit -- average compressed image size ~3 MB
 - x 10.9 per 16bit -- average compressed image size ~2 MB

Eiger 9M, Proxima 2A, data rates in user operation



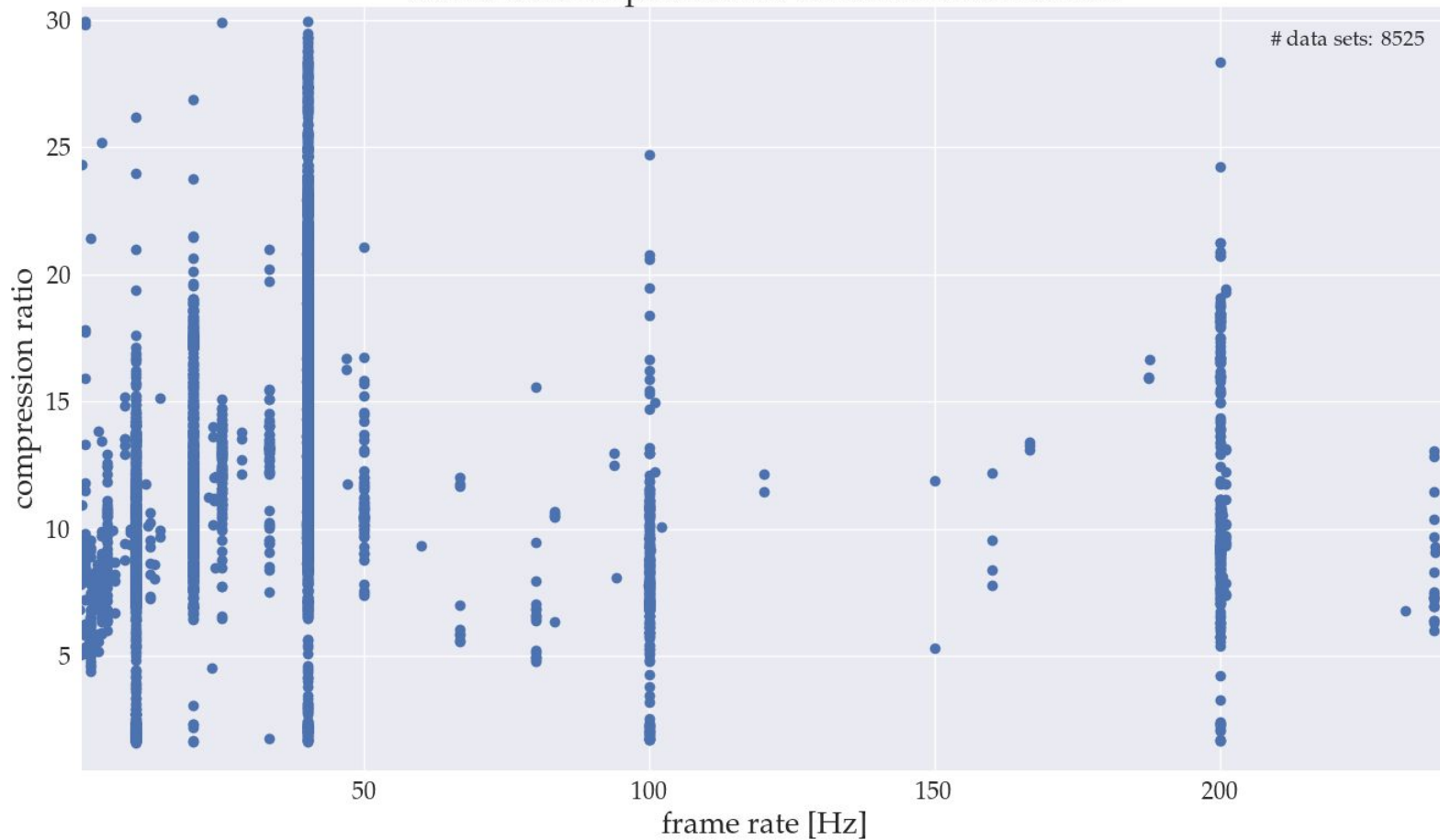
bslz4 compression

Observed compression as function of frame rate

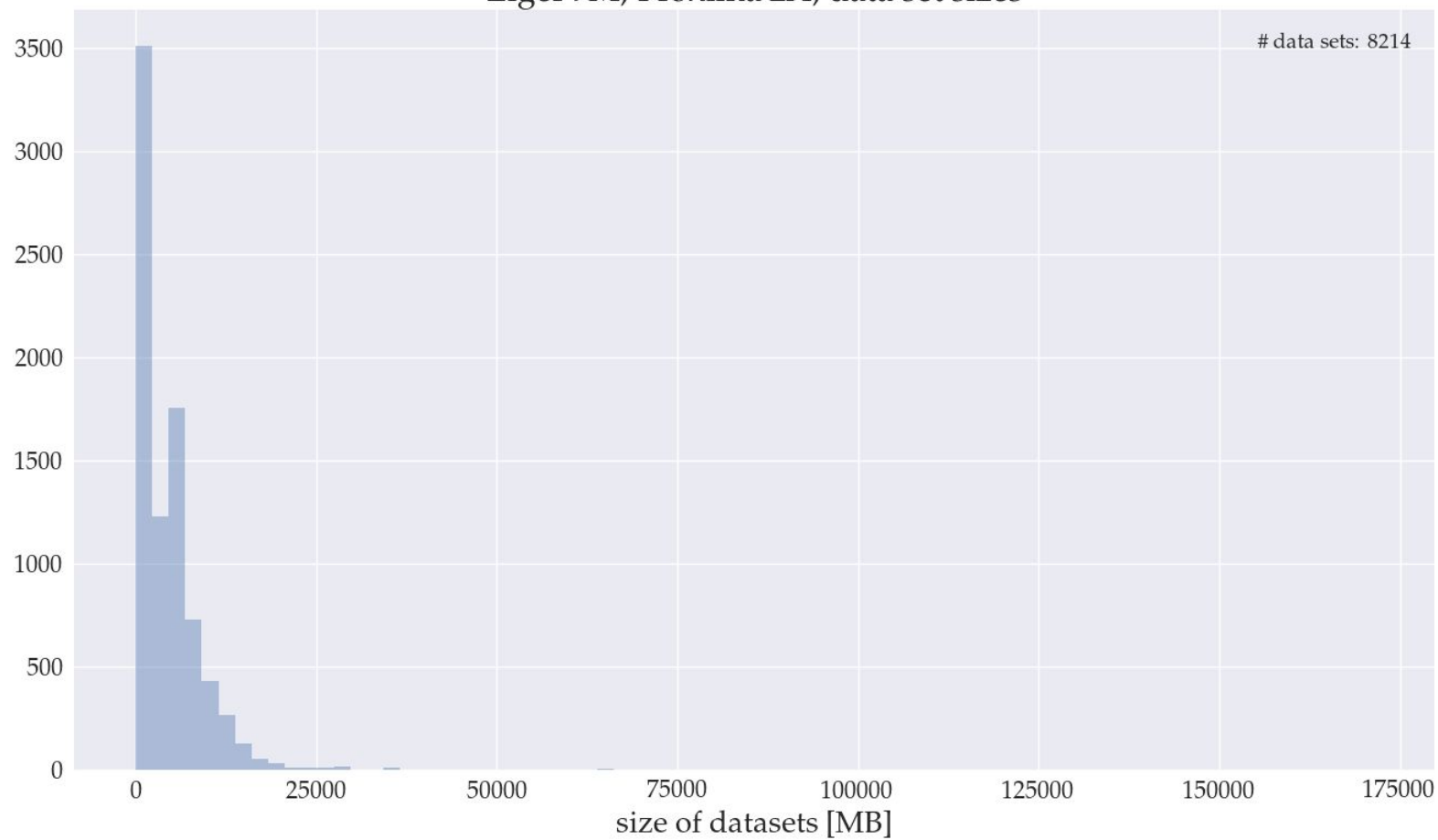


lz4 + bslz4 compressions

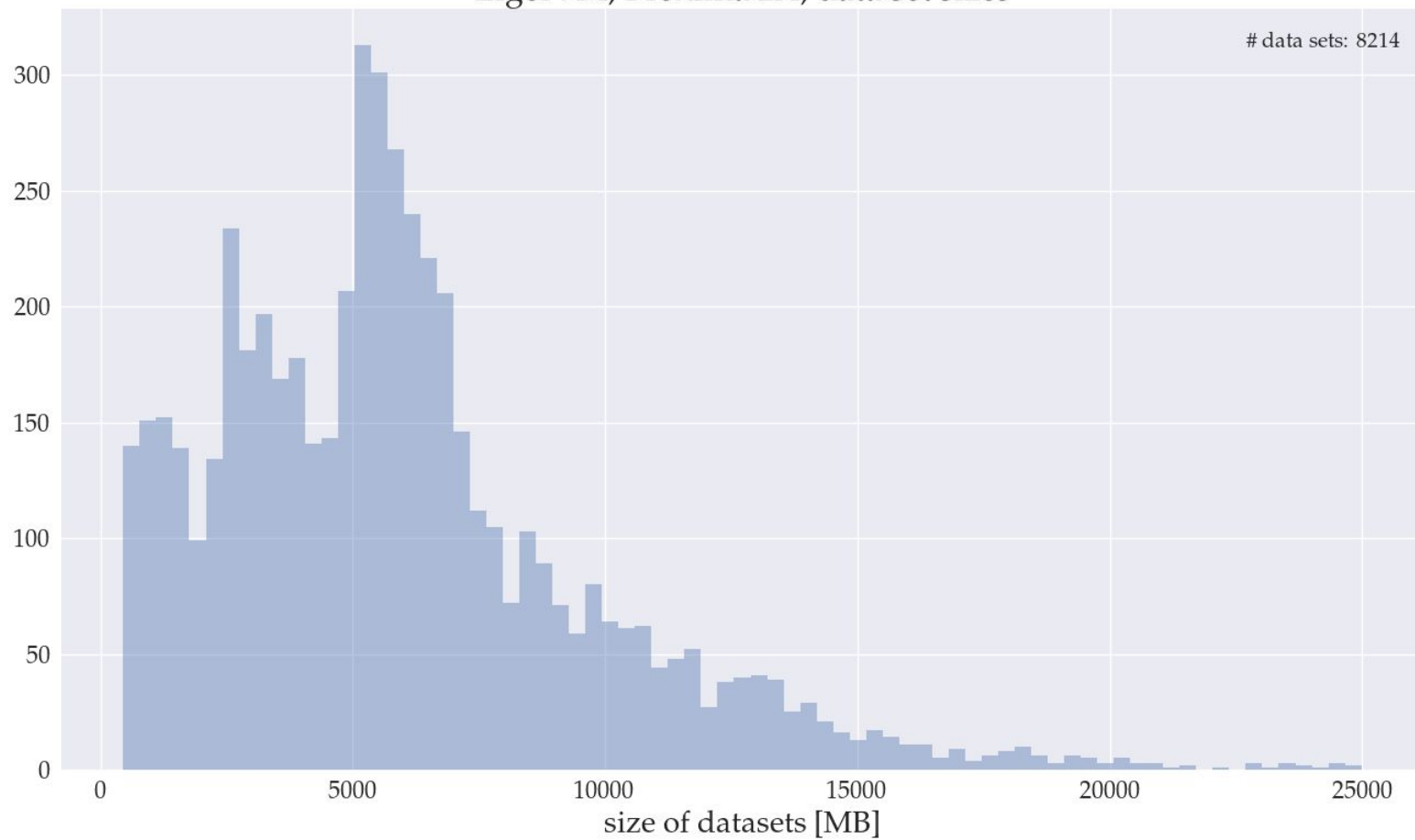
Observed compression as function of frame rate



Eiger 9M, Proxima 2A, data set sizes

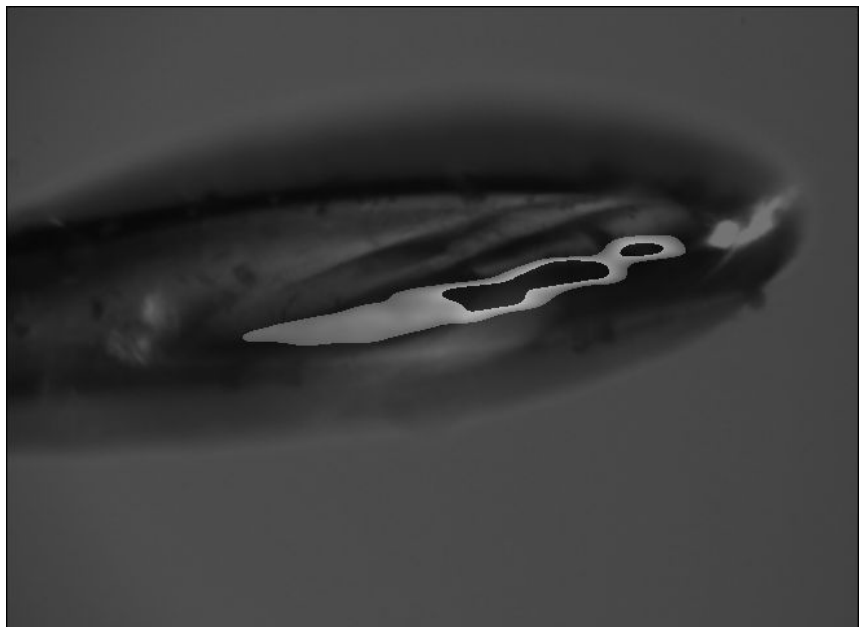


Eiger 9M, Proxima 2A, data set sizes



Raster scans

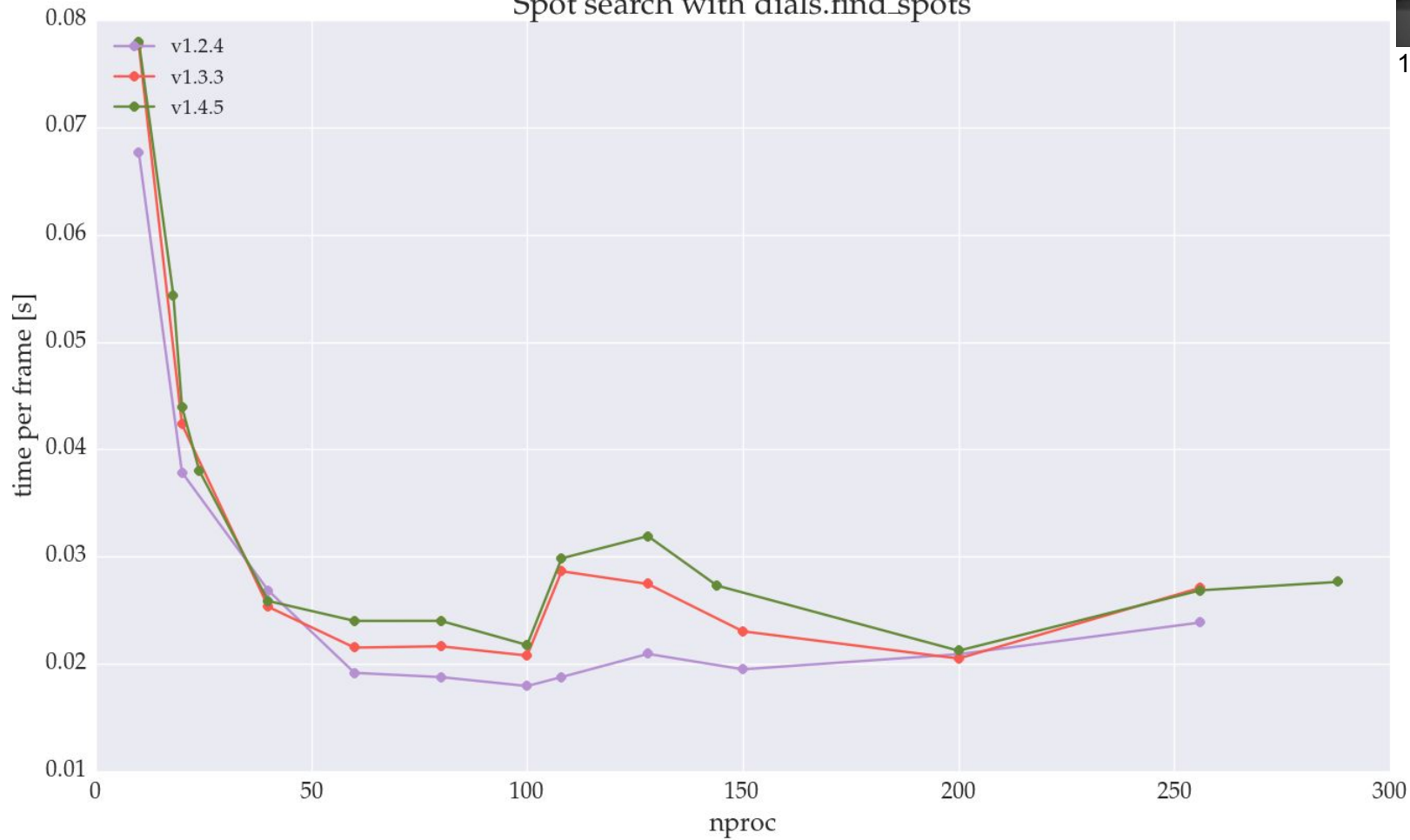
- 5x10 micrometer beam
- 40 Hz default frame rate
- fast axis speed ~0.5 mm/s
- typical grid size 0.1 mm² ~1000 images
- typical acquisition time 40 seconds
- processing time 20 seconds
 - `dials.find_spots` ~ 0.02s/image
 - native support for HDF5



Processing benchmark

- DIALS versions (1.2.3, 1.3.3 and 1.4.5)

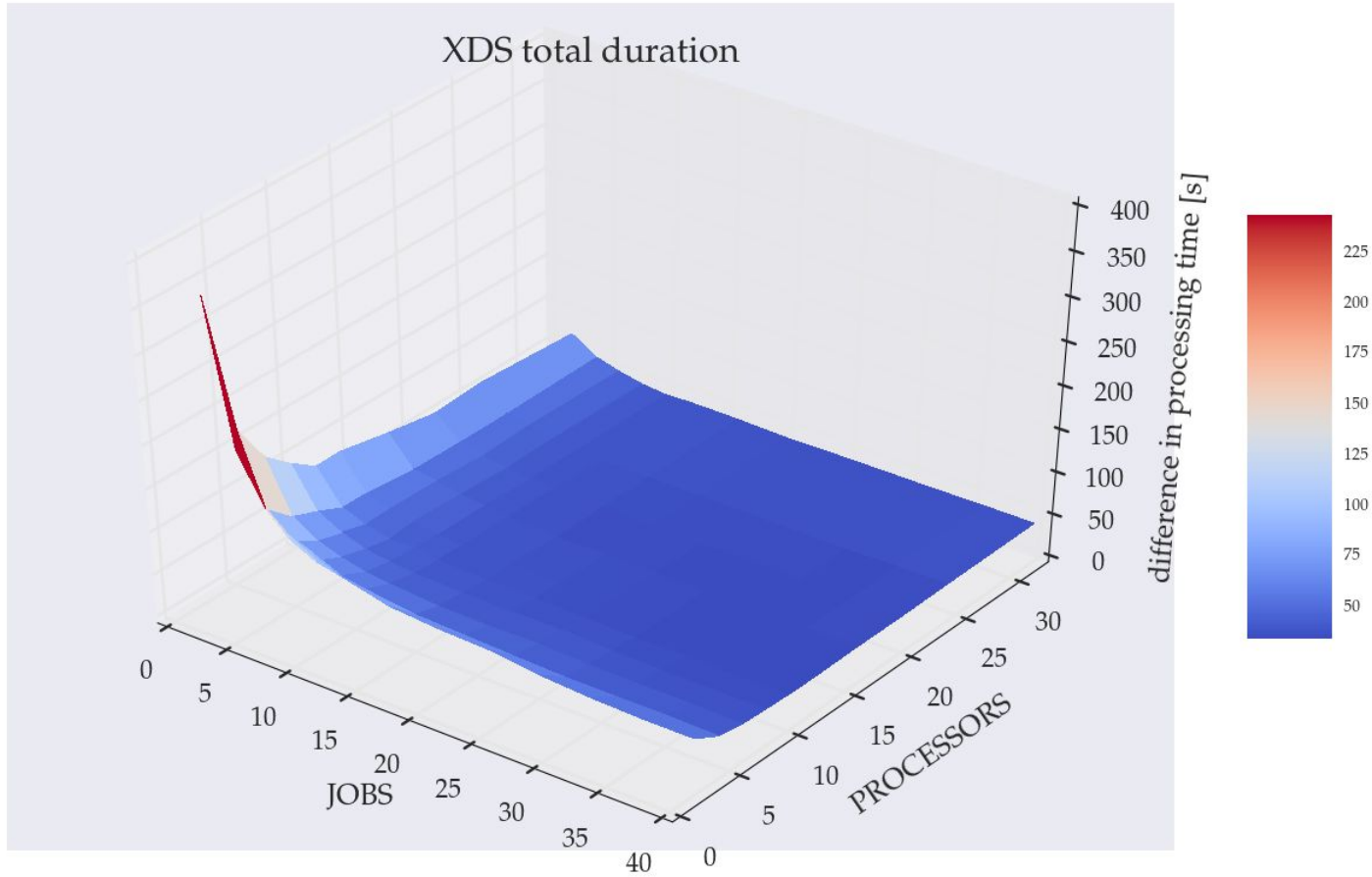
Spot search with dials.find_spots



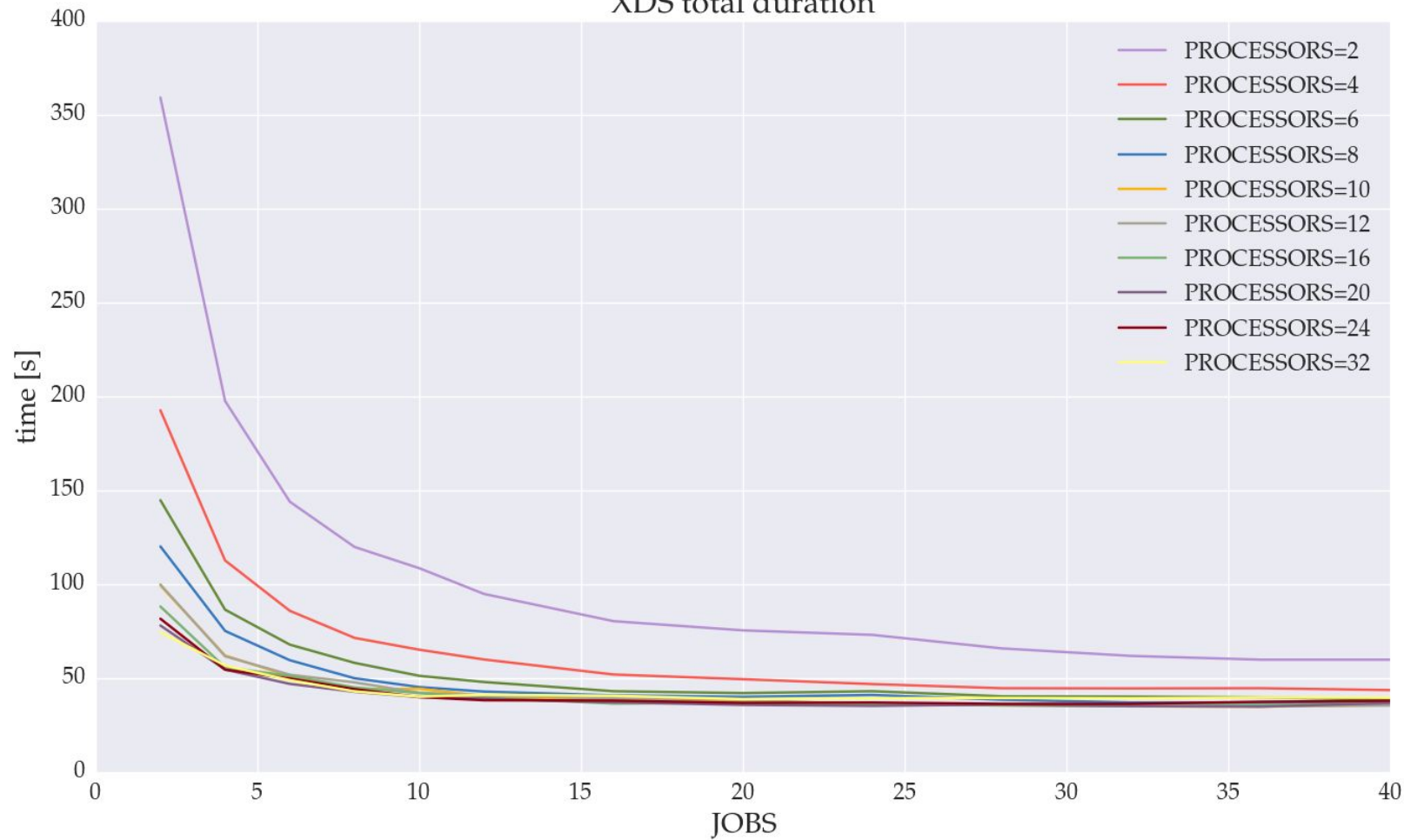
Processing benchmark

- XDS Version 20161101, BUILT=20161205
- Transthyretyn dataset available from www.dectris.com
 - 1800 frames, 180 degrees, 0.1 degree oscillation, frame rate 200Hz
 - Evaluation of influence of combination of `MAXIMUM_NUMBER_OF_JOBS` and `MAXIMUM_NUMBER_OF_PROCESSORS` on data processing duration
- Let's look at the total time and individual stages

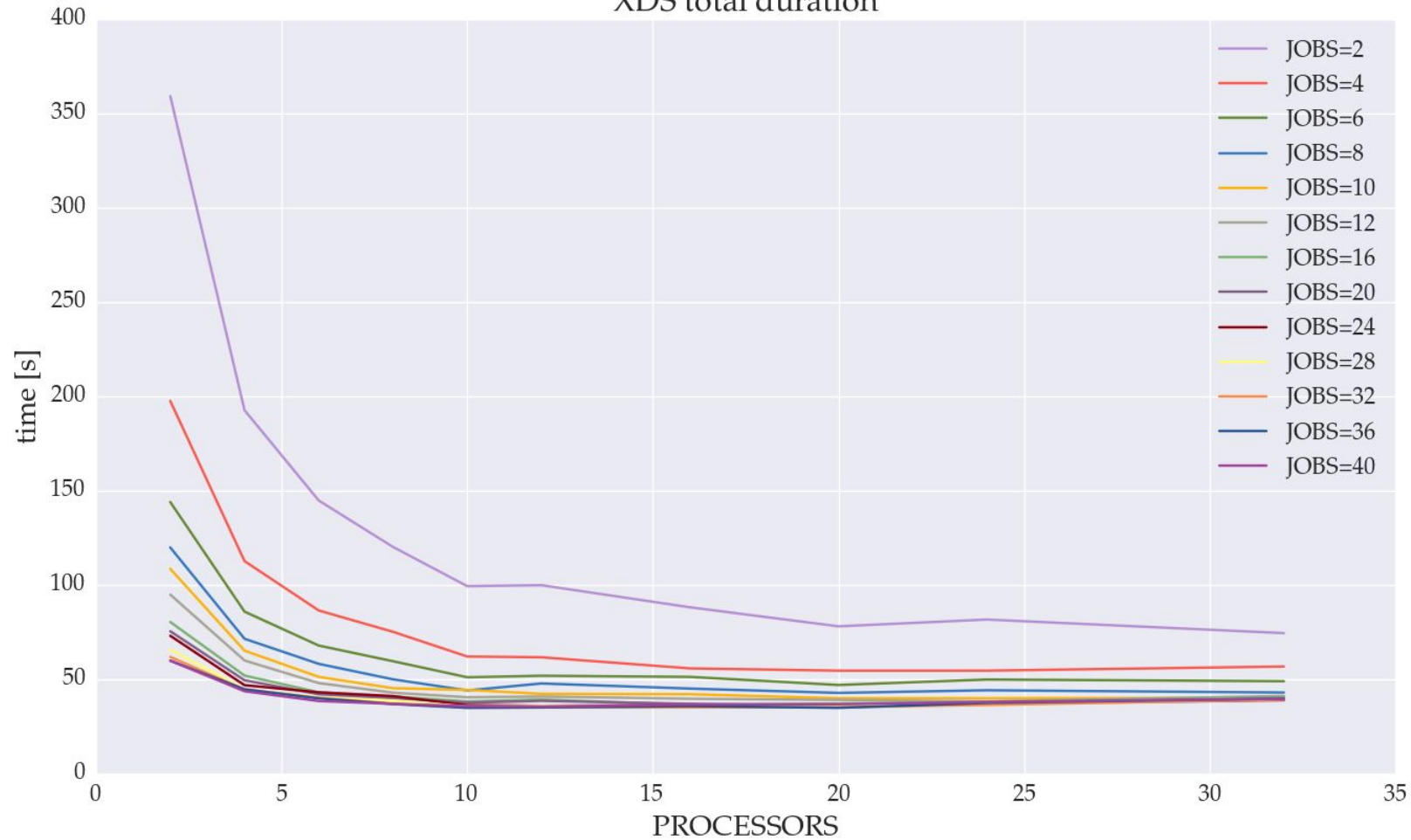
XDS total duration



XDS total duration

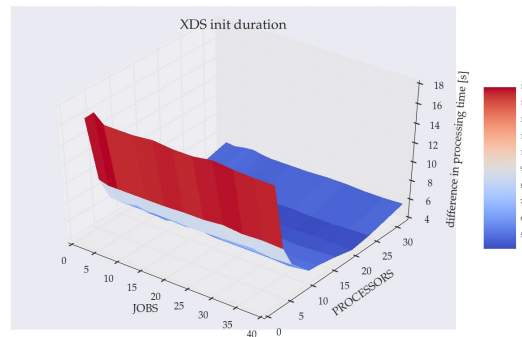
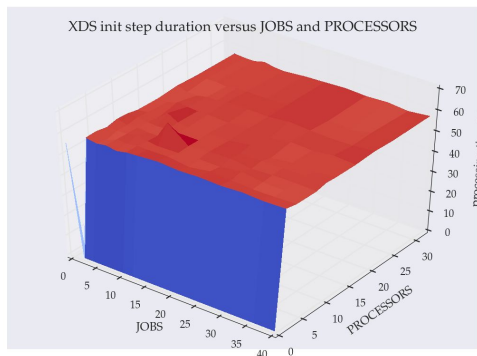


XDS total duration



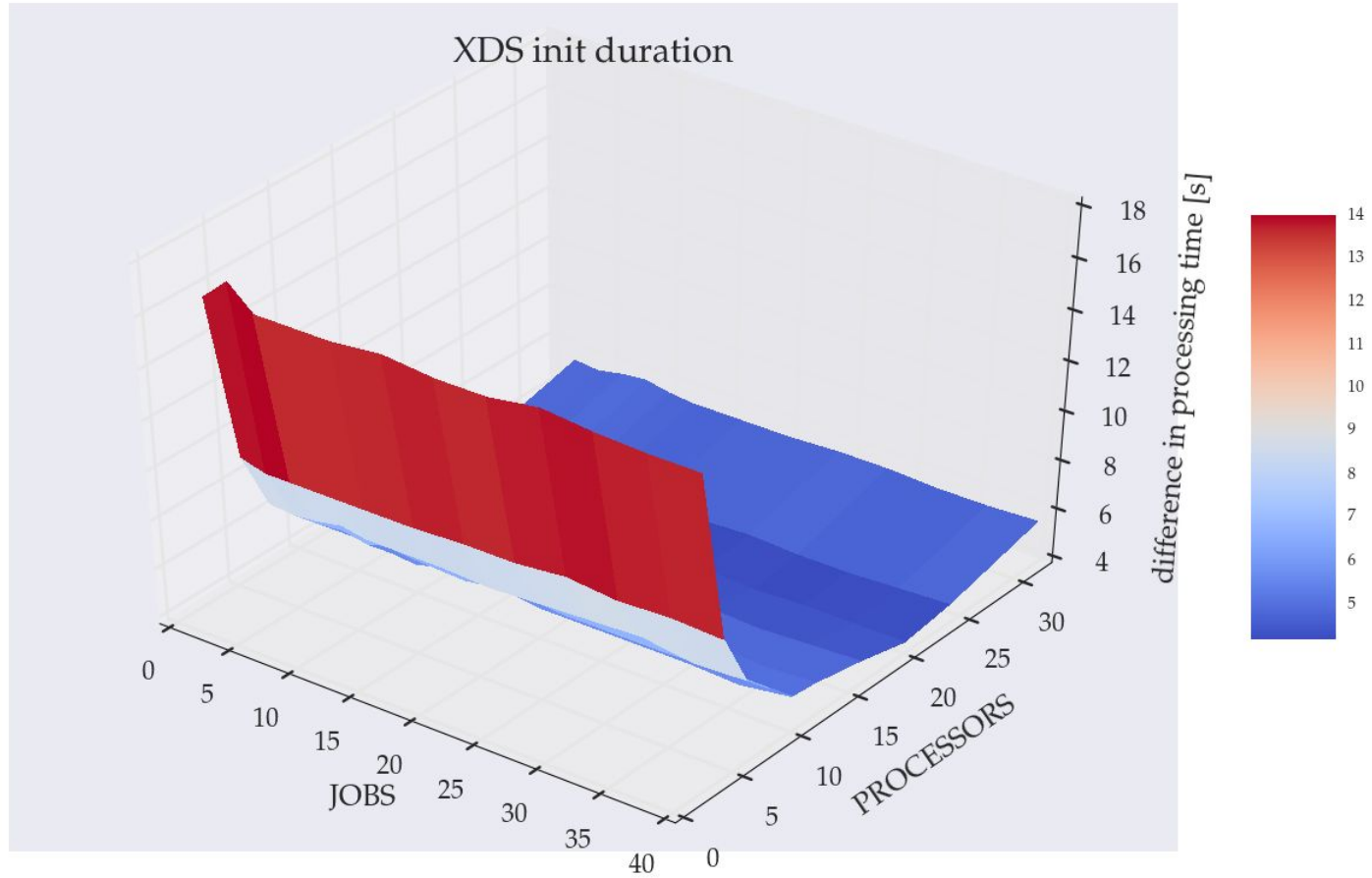
Processing XDS benchmark

- Parallel implementation of INIT step
 - Given the sufficient number of processors available the required time effectively vanishes

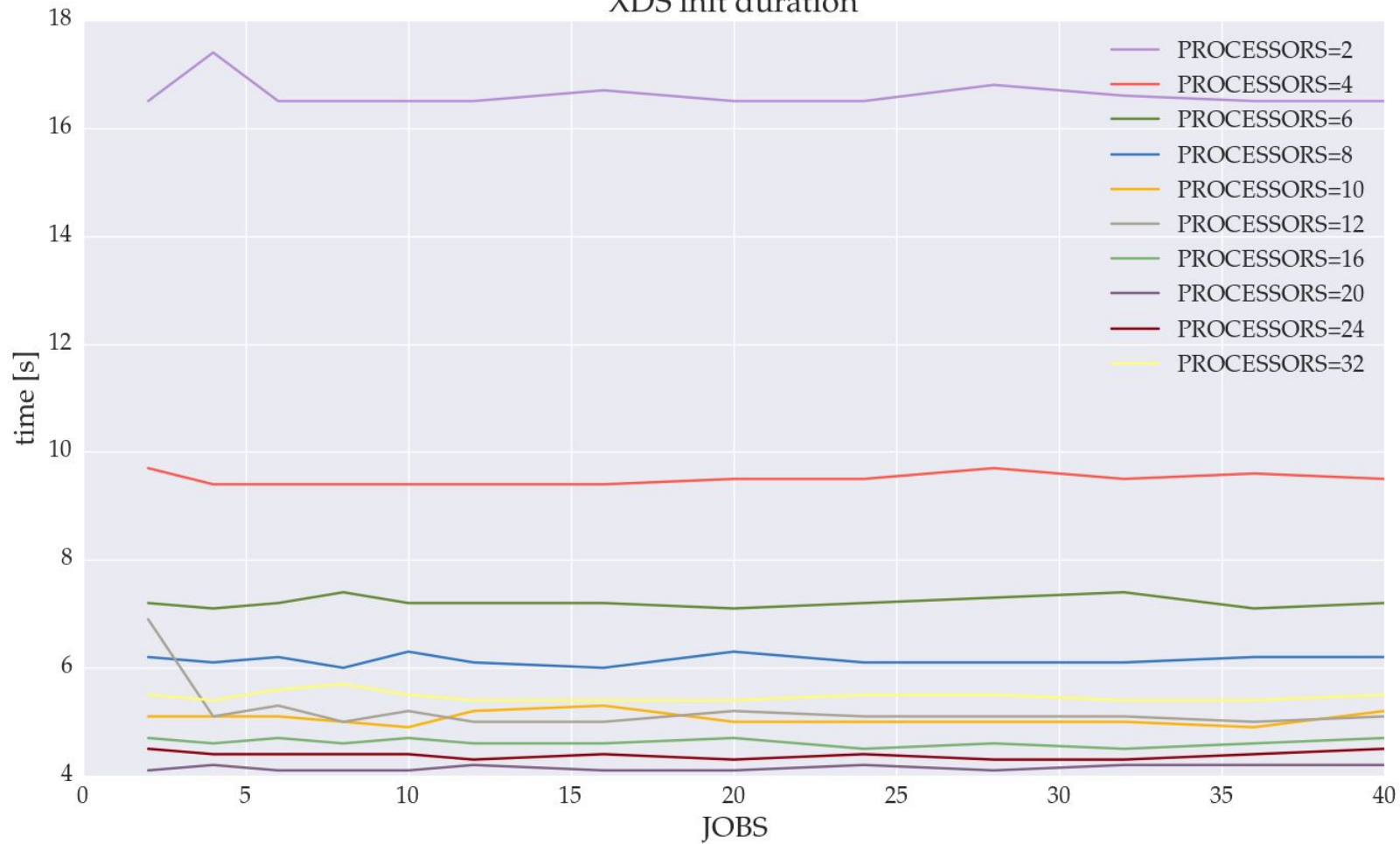


- XDS reader plugin support (testing beta version of plugin from DECTRIS)
 - Effectively removing readout overhead in comparison with the CBF baseline
 - 40 % speed up on our system
- Combined effect is total speed-up of ~60% compared to otherwise identical benchmark run from last September

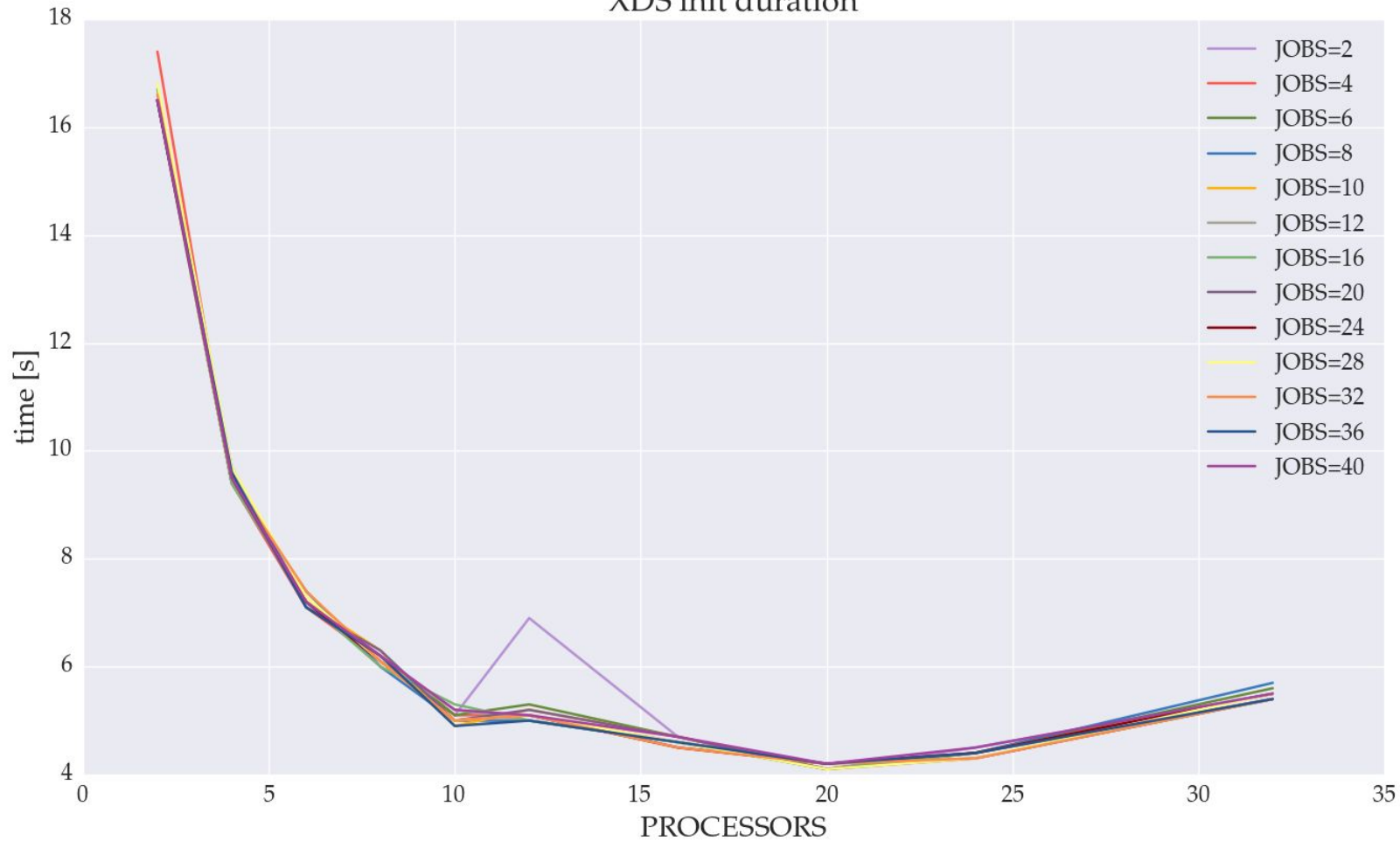
XDS init duration



XDS init duration



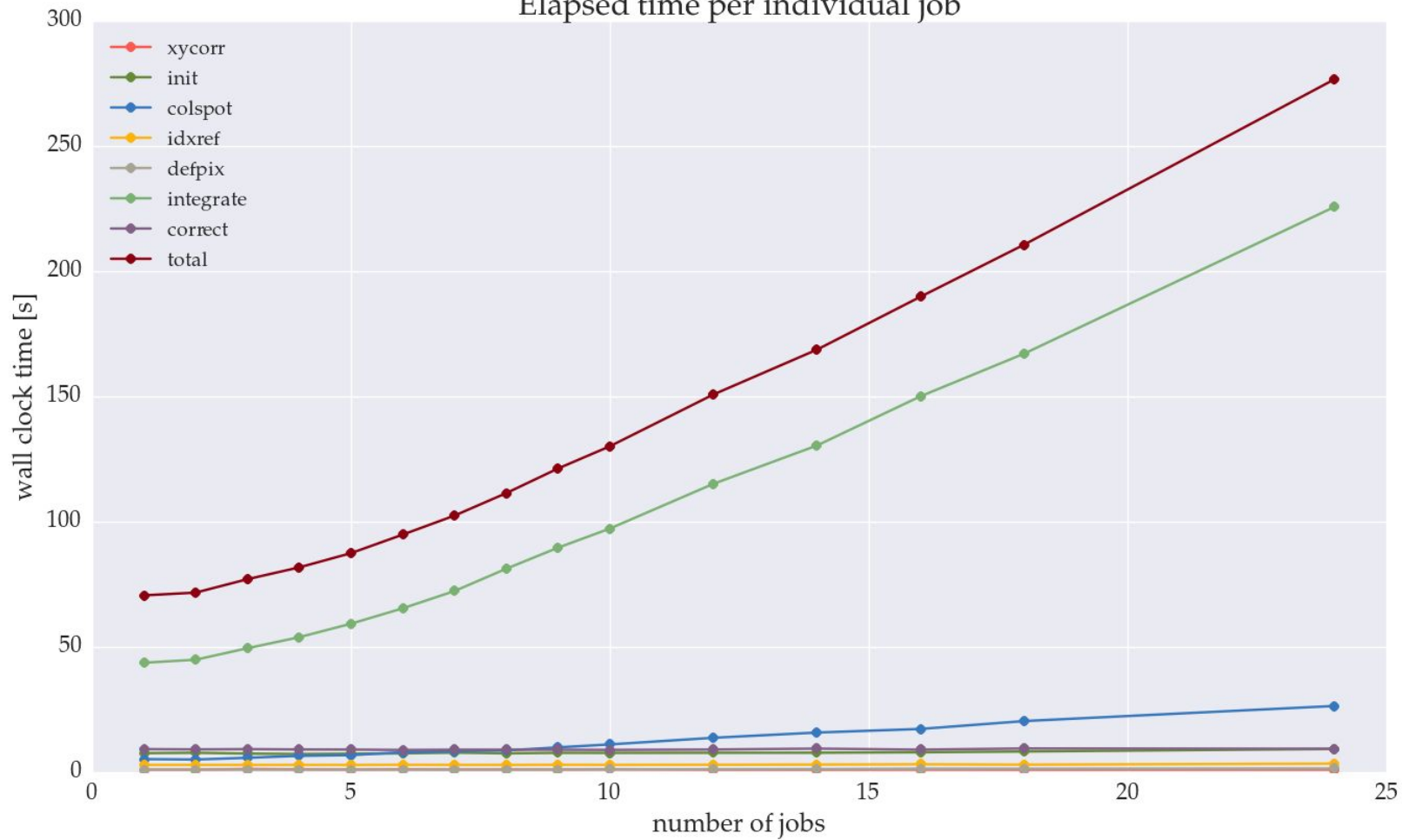
XDS init duration



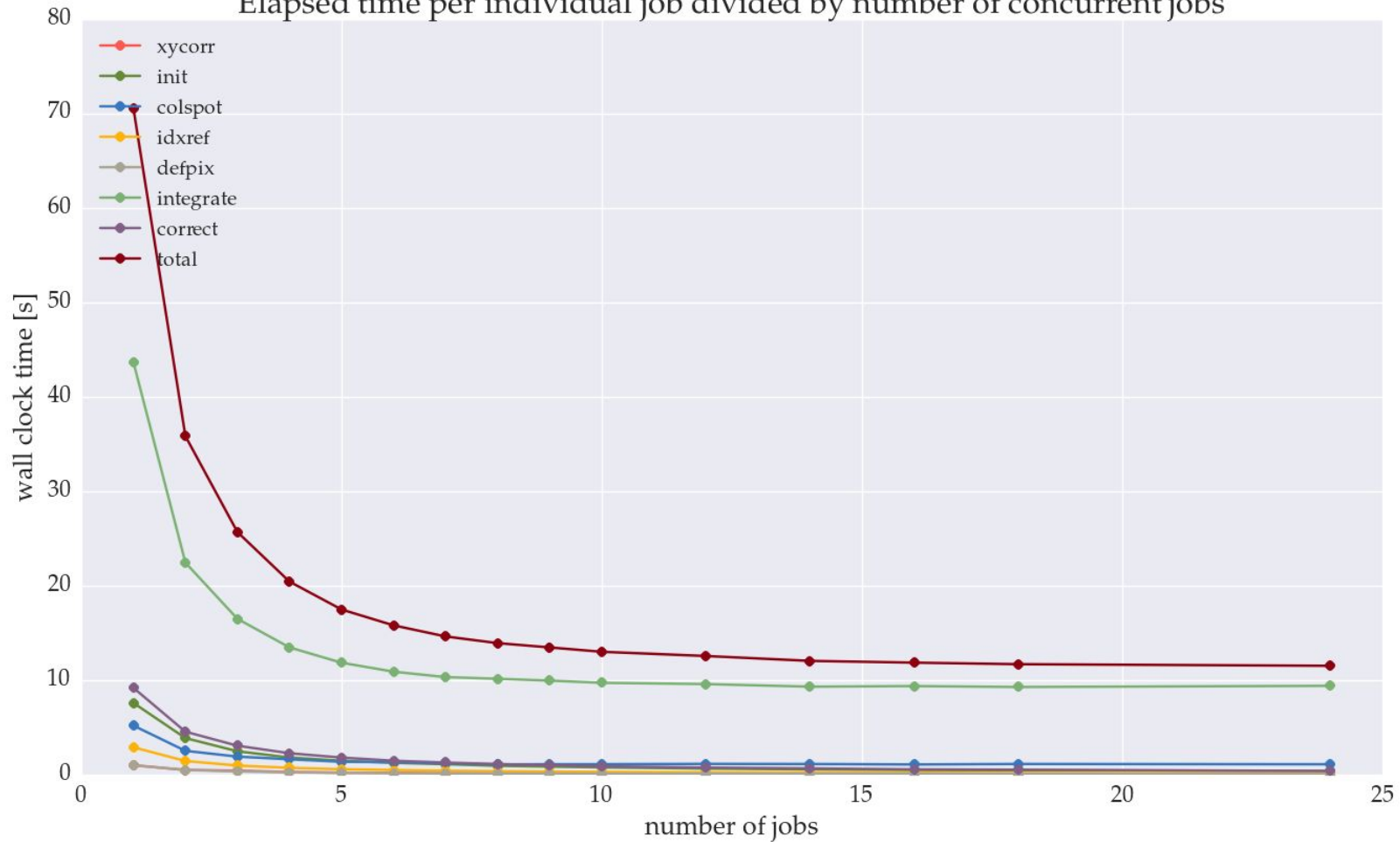
Concurrent XDS processing

- How many XDS jobs can one reasonably run on our system ?
- Is there an optimum?
- When do we need to buy another machine ?

Elapsed time per individual job



Elapsed time per individual job divided by number of concurrent jobs



For Steady Processing Performance

```
# sync; echo 3 > /proc/sys/vm/drop_caches
```

Acknowledgements

- Bill Shepard
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