PAUL SCHERRER INSTITUT

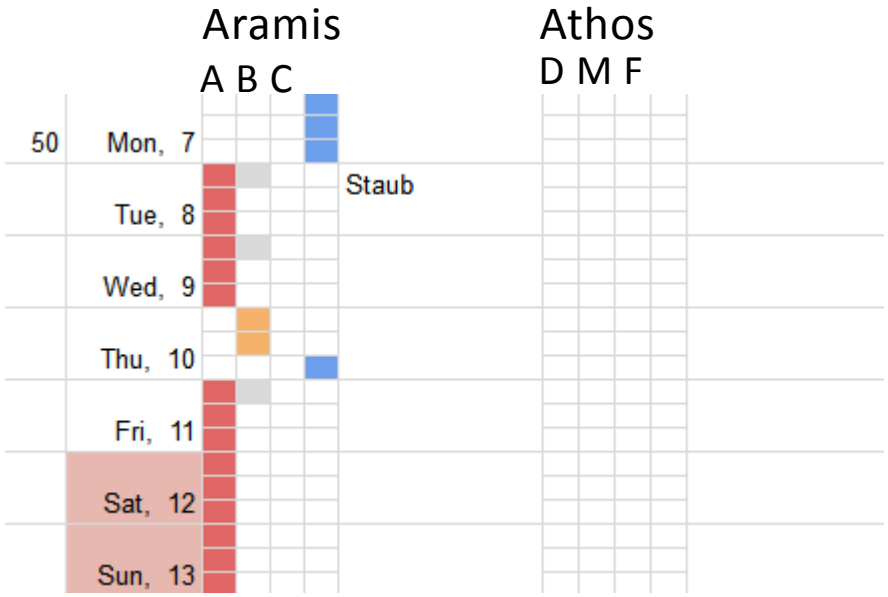
PSI

Alvra user beamtime, proposal number 20200756

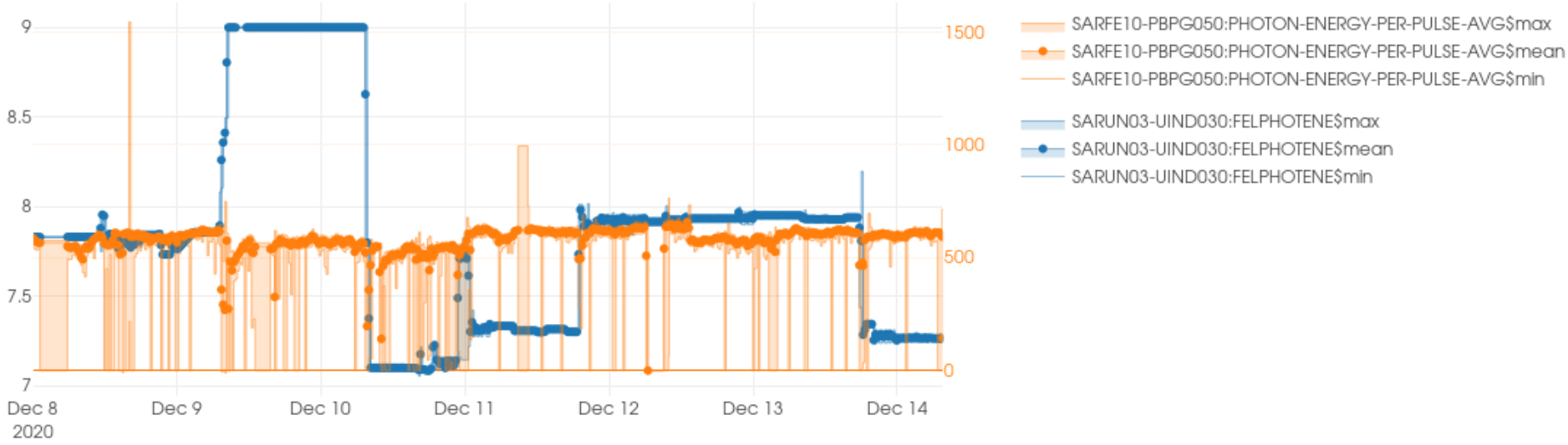
Clarifying the microscopic mechanism of all optical magnetization switching

December 8th to 13th, 2020

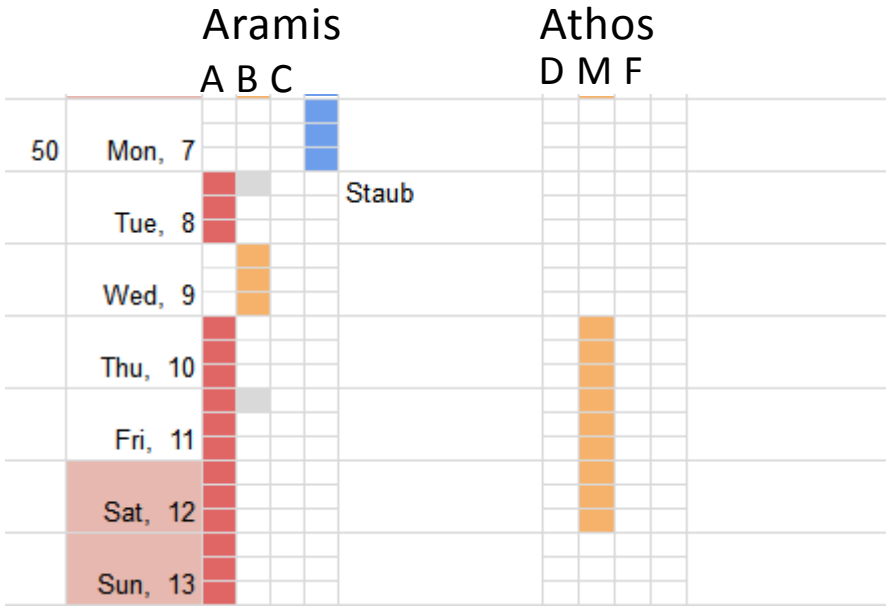
Schedule KW50



- 7.1 & 7.7 keV photon energy
- Narrow bandwidth (~ 0.13%)
- 600 uJ pulse energy



Schedule KW50



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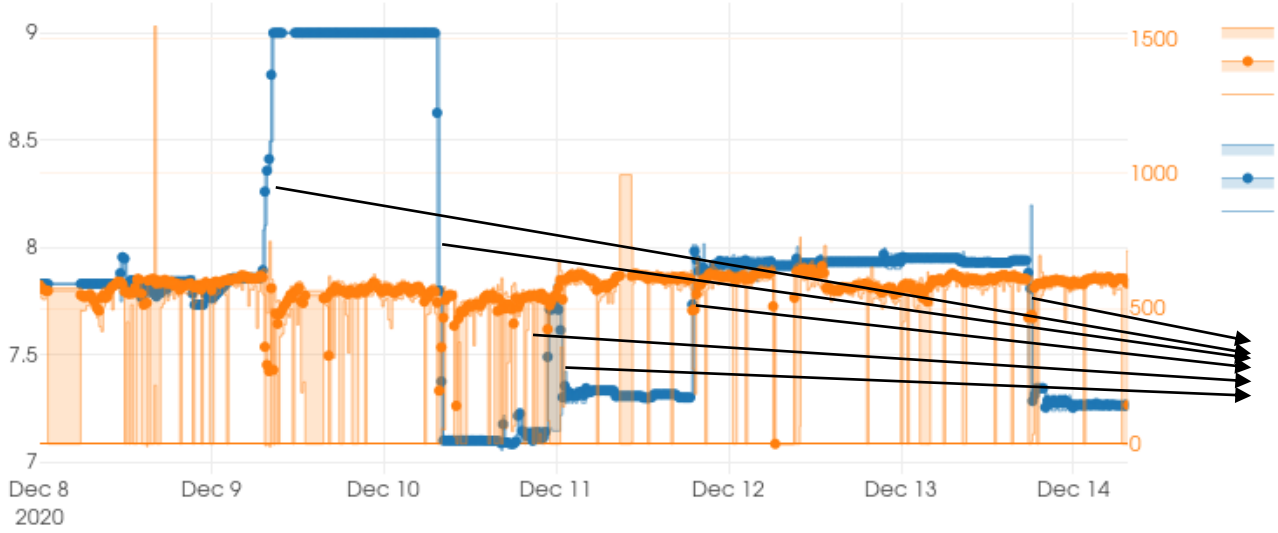
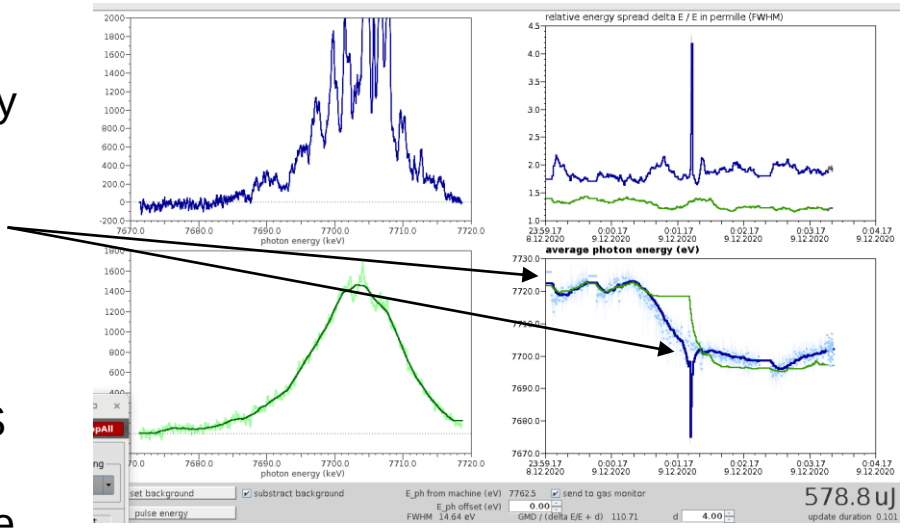
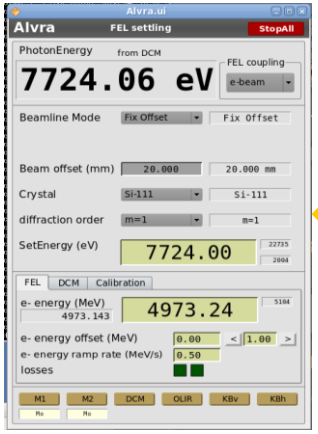


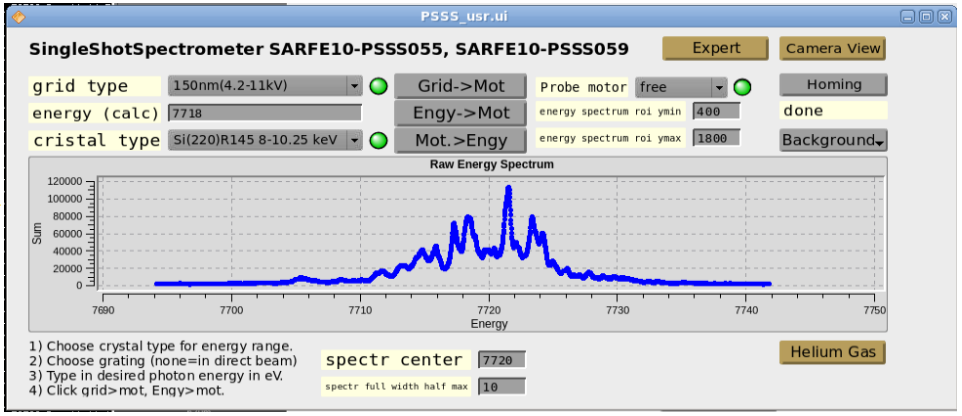
6 photon energy changes!

Feedback optimization

- Noticed oscillations at fixed energy and drift of the spectrum when changing the energy
- Florian and Simona optimized the feedback parameters to fix this
- It would be nice to have the PSSS following the requested photon energy (can be coupled also to the electron beam energy)

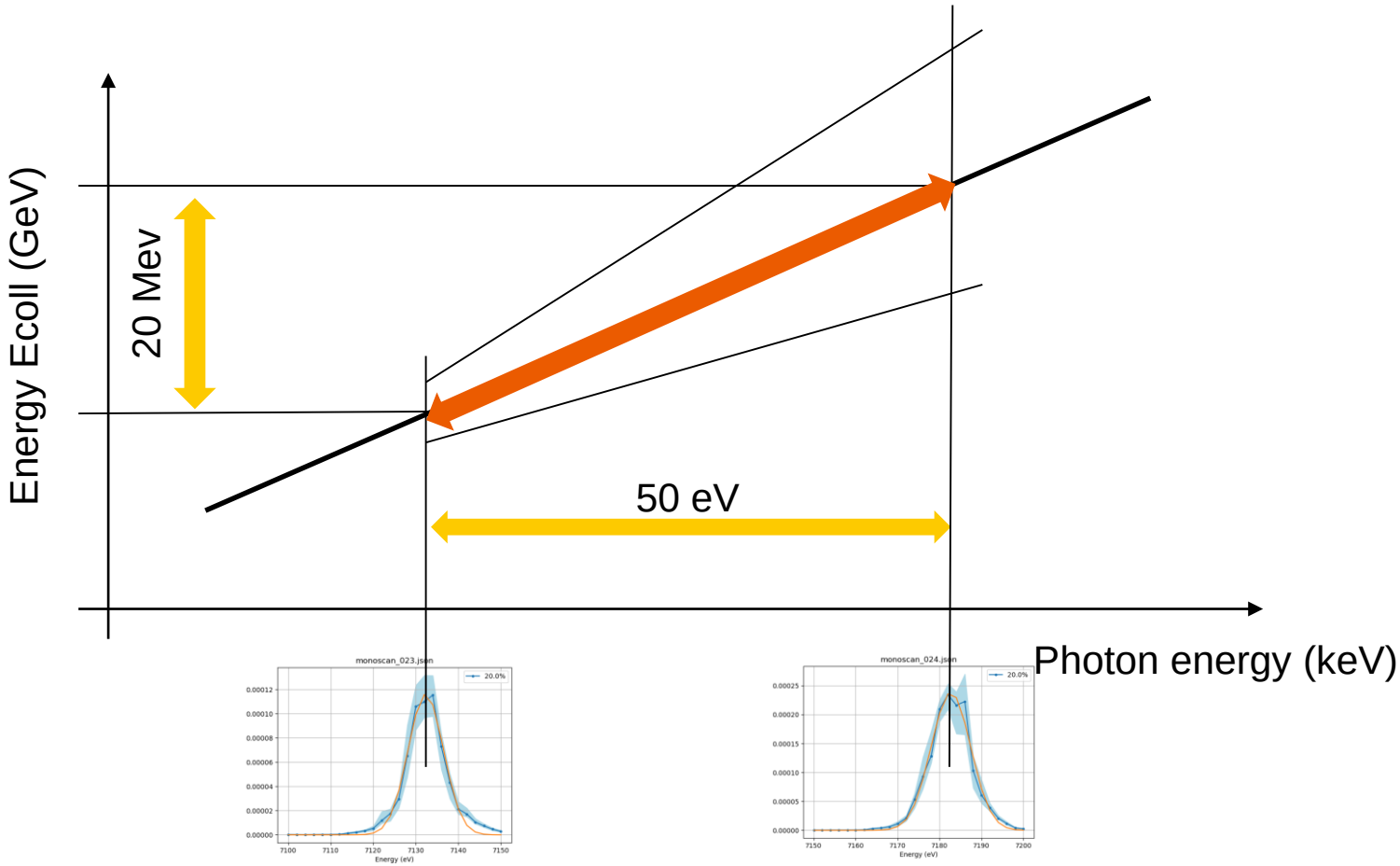




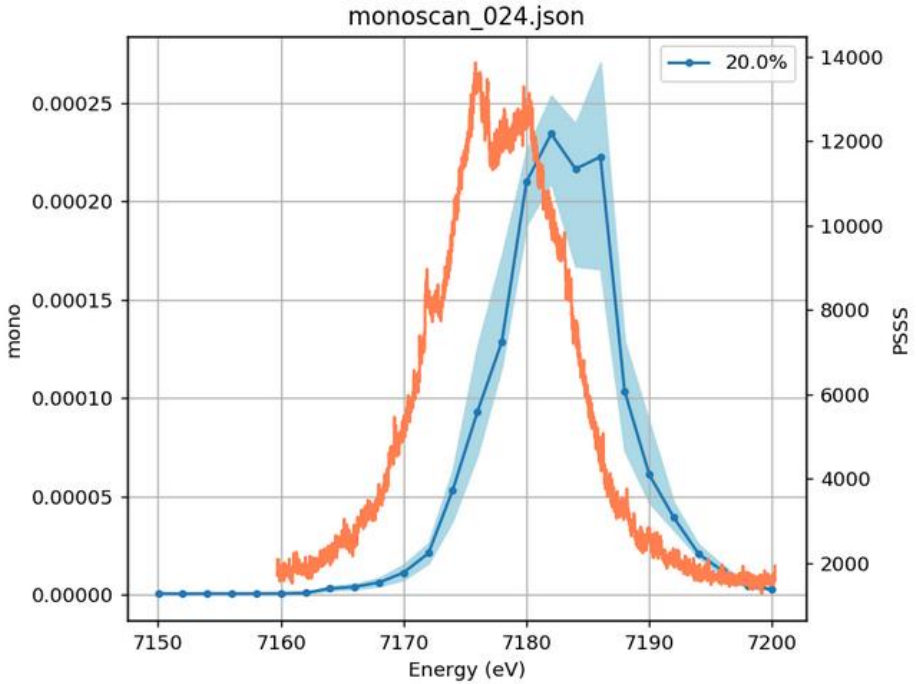


Long term drift

- Observed long term drifts, that required new calibration at two e-beam energies every few hours.
- In the past it helped to have PSICO optimizing on the monochromator throughput, but this time we had some problems with that sensor



Experiment



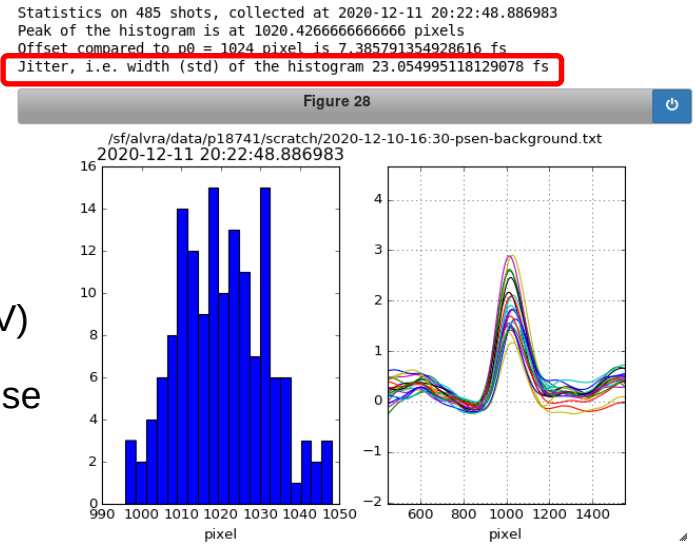
Noticed a larger offset between the reading of the PSSS and the monochromator (up 7 eV!)

- Can it be due to a different beam pointing?

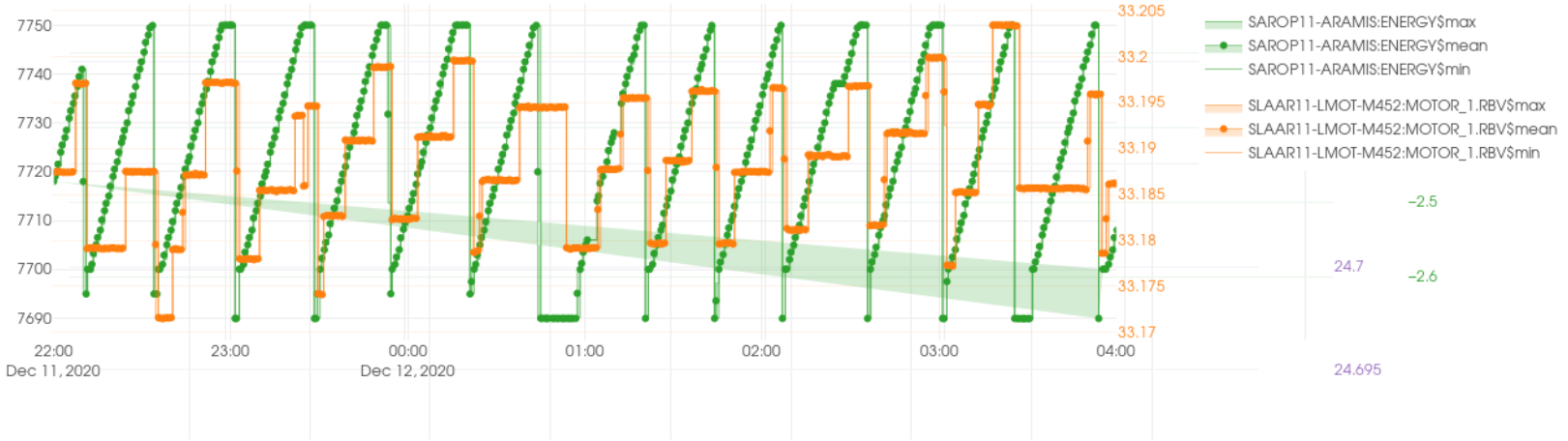
- First solid state experiment at Alvra
- JF used to detect TFY (XANES)
- A second stripsel JF for the von Hamos spectrometer for XES (in the end not used)

Timing tool (PSEN) for monochromatic beam

First demonstration of PSEN with monochromatic (unfocused) beam at Alvra



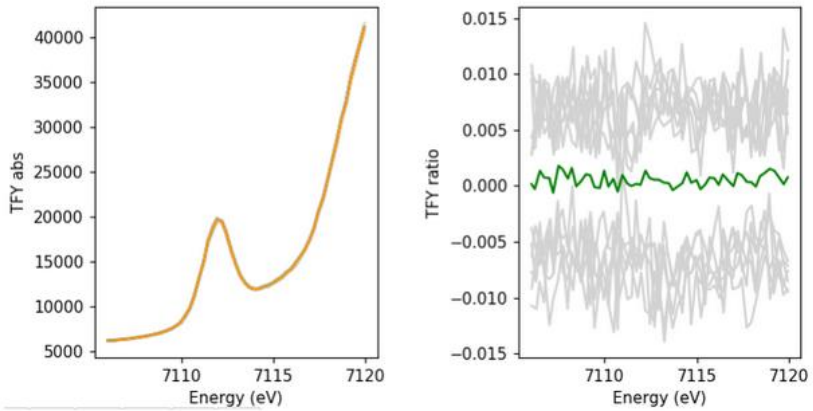
- 2% signal on 20 um thick YAG (~ 50% transmissive at 7.x keV)
- This is with unfocused FEL, possible thanks to the 600 uJ pulse energy and high monochromator throughput (0.15% spectral bandwidth)
- Philip set up the automatic feedback to correct drifts:



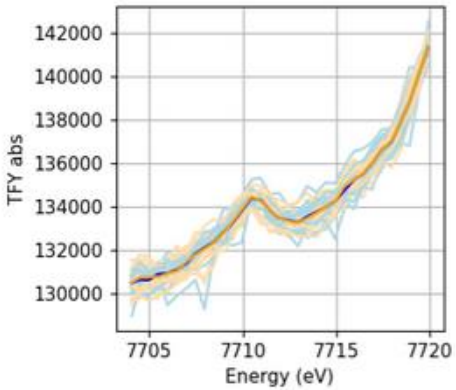
Results

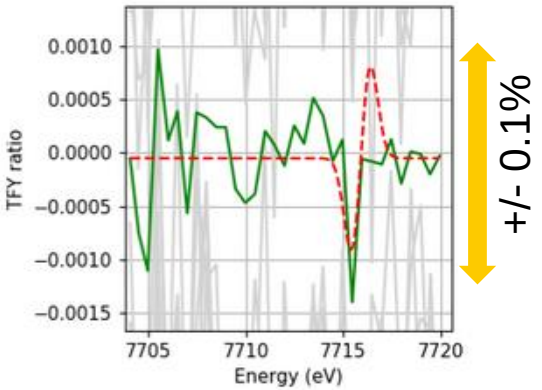
- Measured several energy and delay scans both at Co (7.7 keV) and Fe (7.1 keV) edges.
- Switched between two different laser pump wavelength (1300nm and 1160nm)
- Switched between different pump laser polarization (vertical and 45 deg)
- No evidence of pump probe effect

Fe edge



Co edge





Possible reason: pure magnetic effect (measured with XMCD), no contribution from electronic transitions