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Alvra user beamtime, proposal number 20200756

Clarifying the microscopic mechanism of all optical magnetization switching

December 8th to 13th, 2020



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



SARFE10-PBPG050:PHOTON-ENERGY-PER-PULSE-AVG\$max
SARFE10-PBPG050:PHOTON-ENERGY-PER-PULSE-AVG\$mean
SARFE10-PBPG050:PHOTON-ENERGY-PER-PULSE-AVG\$min

SARUN03-UIND030:FELPHOTENE\$max

- SARUN03-UIND030:FELPHOTENE\$mean
 - SARUN03-UIND030:FELPHOTENE\$min



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





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)







- 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







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

Statistics on 485 shots, collected at 2020-12-11 20:22:48.886983 Peak of the histogram is at 1020.4266666666666 pixels Offset compared to p0 = 1024 pixel is 7.385791354928616 fs Jitter, i.e. width (std) of the histogram 23.054995118129078 fs

2020-12-11 20:22:48.886983

990 1000 1010 1020 1030 1040 1050

pixel

14 12 10

Figure 28 /sf/alvra/data/p18741/scratch/2020-12-10-16:30-psen-background.txt

600

800 1000 1200 1400

pixel

2% signal on 20 um thick YAG (~ 50% transmissive at 7.x keV) ٠

monochromatic (unfocused) beam at Alvra

First demonstration of PSEN with

- This is with unfocused FEL, possible thanks to the 600 uJ pulse ٠ energy and high monochromator throughput (0.15% spectral bandwidth)
- Philip set up the automatic feedback to correct drifts: •





- 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



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