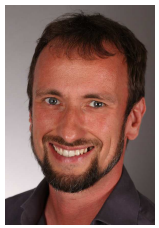
The SXP instrument

EuXFEL Call11 virtual information meeting
20 April 2023

Manuel Izquierdo on behalf of the SXP group



Patrik Grychtol
Laser specialist

David Doblas
Data Analyst

Vahagn Vardanyan
Mechanical Eng.

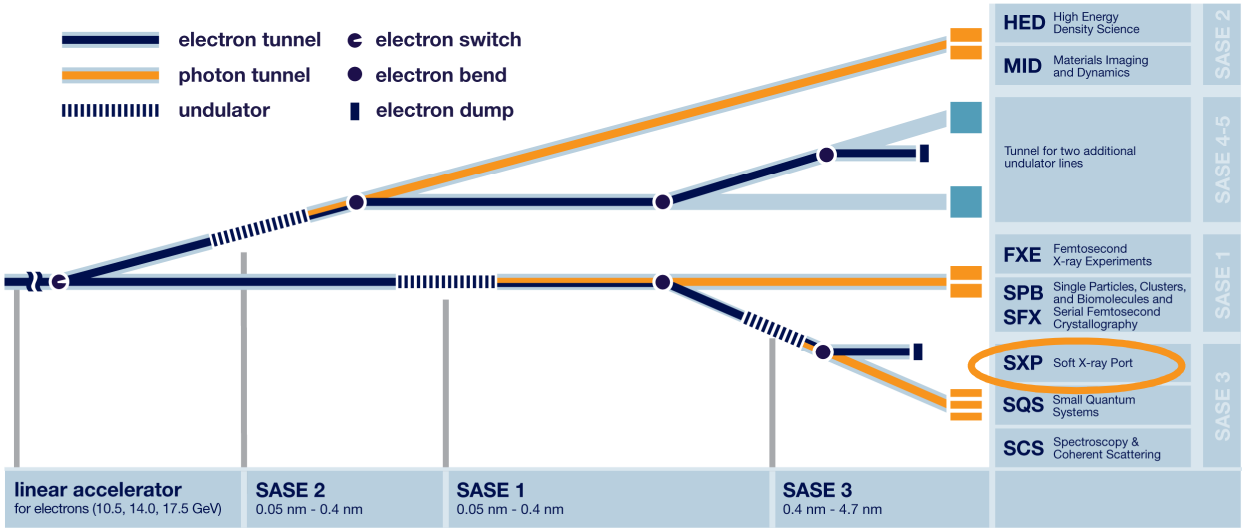
Ekaterina Tikhodeeva
PhD

Chris Bloem
EQP

Joshua Ohnesorge
Vacuum Eng. (1/3)

Maria Peter
Adm. Assistant

The Soft X-ray Port (SXP)

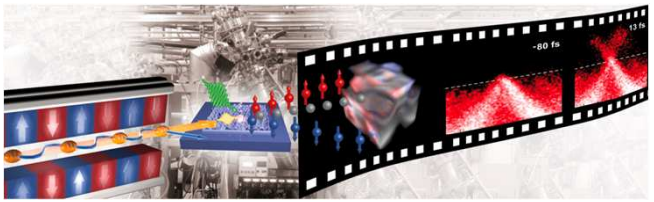


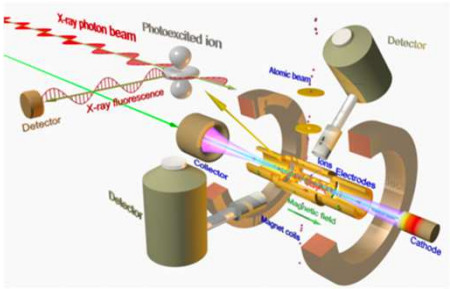
Complete Time-resolved X-ray Photoelectron spectroscopy

TR-XPES

K. Rossnagel (Uni-Kiel/DESY)

G. Schönhense (Uni. Mainz)





Laboratory for Astrophysics, atomic physics, fundamental research with highly charged ions

HCI

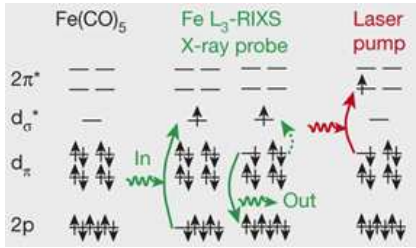
J. Crespo (MPI Heidelberg)

M. Meyer, T. Baumann (EuXFEL)

Understanding Catalysis and biochemistry by studying Chemical Bond Activation

CBA

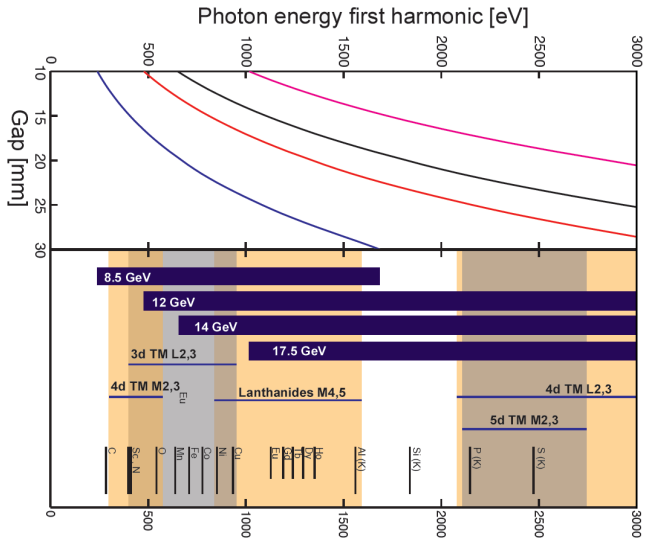
P. Wernet (Uni. Uppsala)

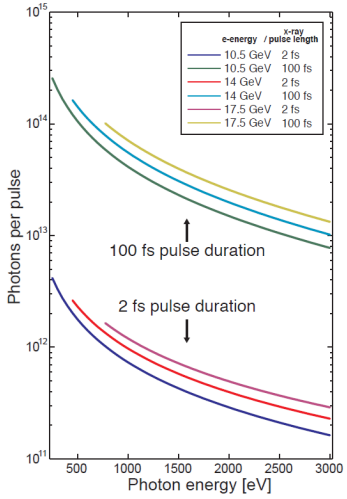


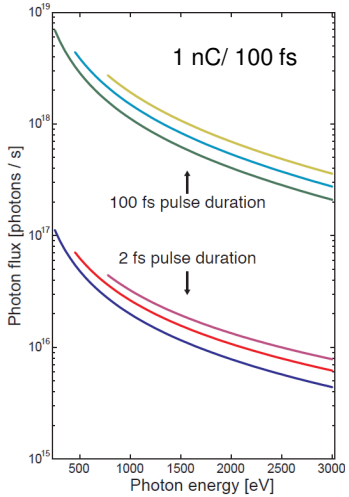
SXP in a nutshell

X-rays

- SASE 3 source (0.25 – 3 keV)
  - > 0.4 keV
  - Pulse energy up to 10 mJ
  - Pulse duration ~ 20 – 25 fs
  - 350 – 400 pulses @ 1.1 MHz
- Variable polarization
  - Linear for the moment
- Monochromatization
  - 50 l/mm RP 3000
  - 150 l/mm RP 10000





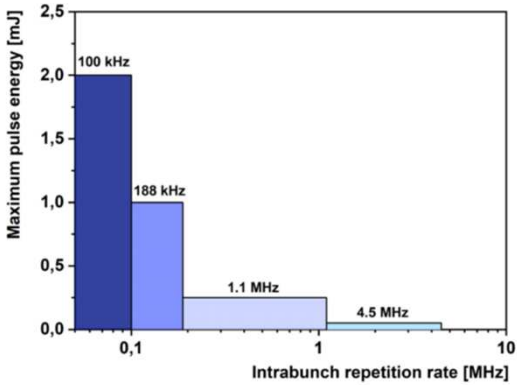


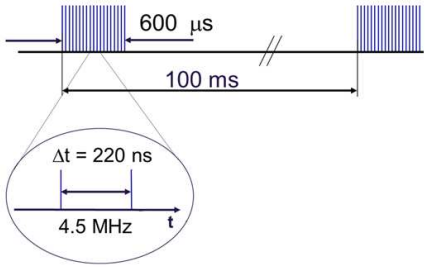
Adapted from the SCS Conceptual design report

Laser

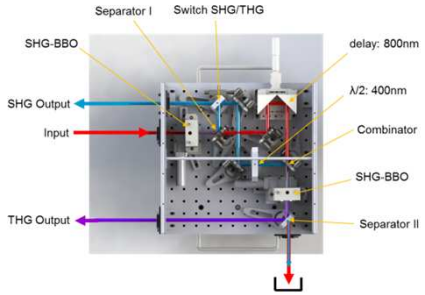
PP laser

- 800 nm = 2 mJ @ 15 – 300 fs
- 1030 nm = 40 mJ @ 1 ps – 500 ps





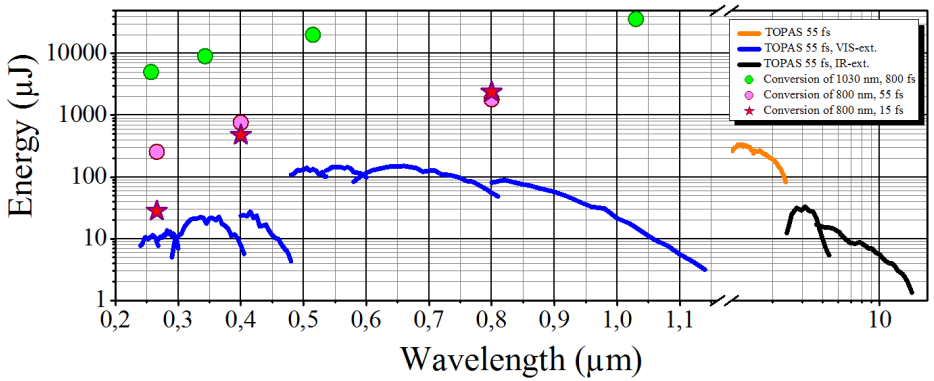
High Harmonic Generation (HHG)



Optical Parametric Amplifier (OPA)

TOPAS prime
Light Conversion
http://lightcon.com/

HHG and OPA at 100 kHz mode

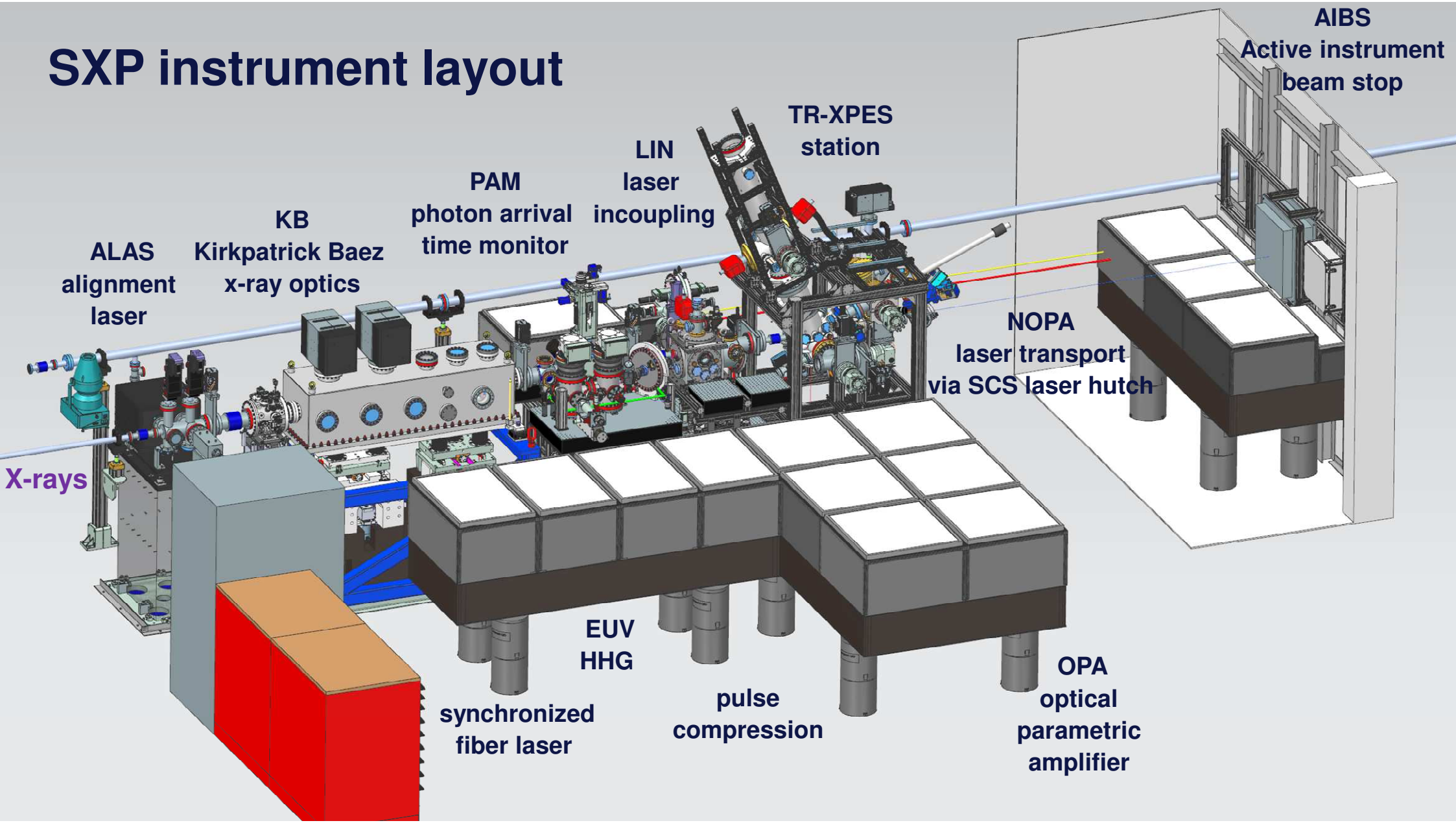


Laser Input Parameters:

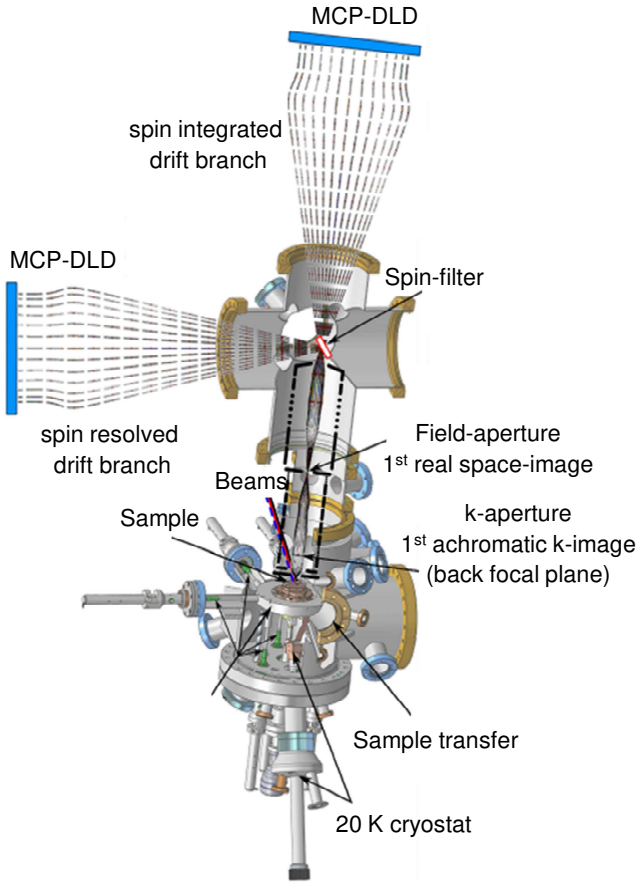
- OPA
  - 800 nm = 1.8 mJ @ 55 fs
- HHG
  - 800 nm = 1.8 mJ @ 55 fs
  - 2.4 mJ @ 15 fs
  - 1030 nm = 40 mJ @ 1 ps

Pergament *et al.*, Optics Express **22**, 22202 (2014) & **24**, 29349 (2016)

SXP instrument layout



SXP – Time-resolved photoelectron spectroscopy standard configuration



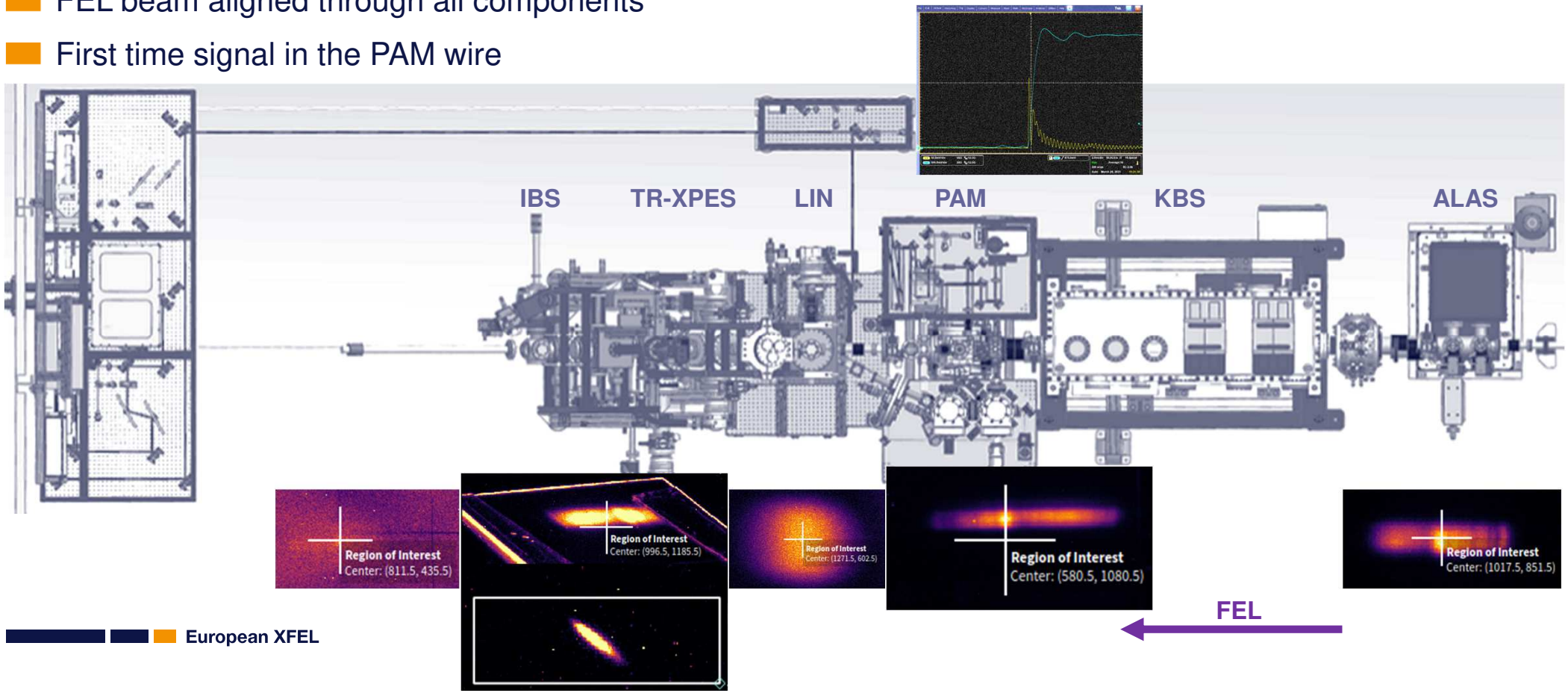
Review of Scientific Instruments **91**, 013109 (2020)

TR-XPES station

- Momentum microscope spectrometer
  - No spin
  - Large angular cone ~ 70º
  - Delay line detector
  - ΔE ~ 130 meV
  - Δk ~ 0.06 $Å^{-1}$
- Photon parameters
  - Energy: 0.4 – 3 keV
  - 400 pulses @ 1.1 MHz
  - 4.5 MHz
- Beam size on sample
  - 3 - 500 µm
  - default ~ 30 µm
- Omicron type mount for solid samples
- Load lock for fast sample insertion and preparation chamber

SXP updates: X-ray program

- FEL beam aligned through all components
- First time signal in the PAM wire

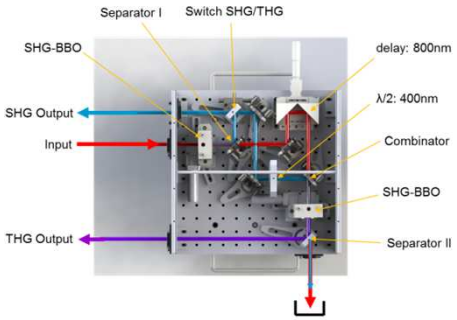


SXP updates: Laser program

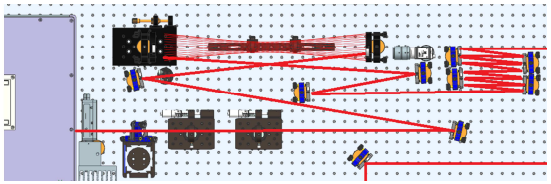
- Active Fiber Systems 60W laser amplifier

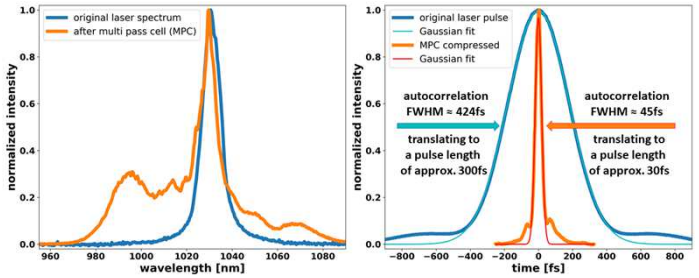
http://www.afs-jena.de/

4th harmonic generation
257.5 nm (4.8 eV)

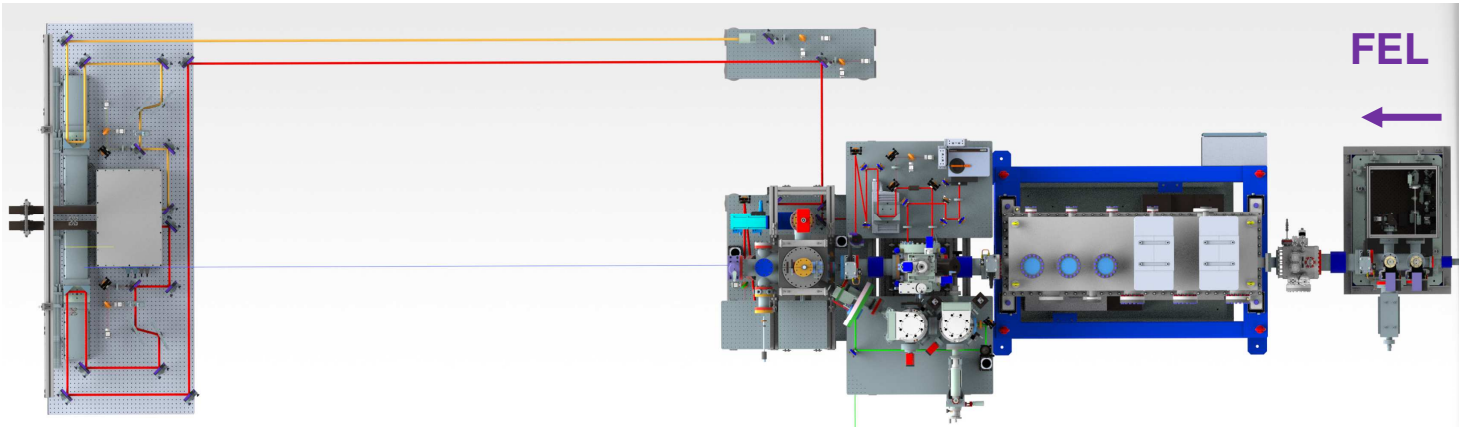


Pulse compression to 40 fs

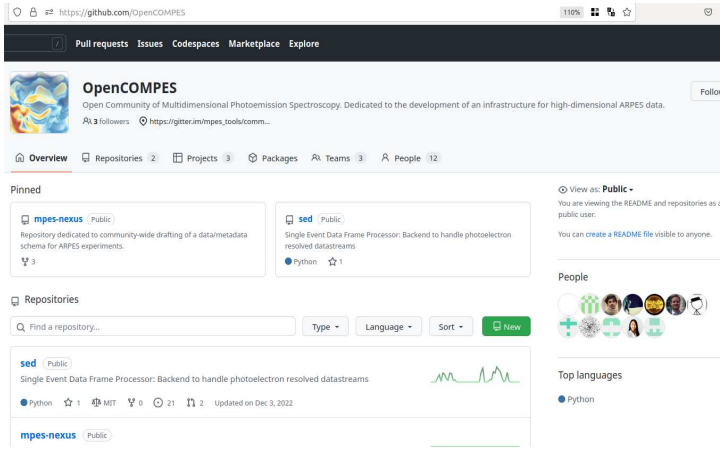




- PP laser



SXP updates: data analysis



Single **E**vent **D**ataframe Processor Library

mpes hextof

Implemented into XFEL data structure

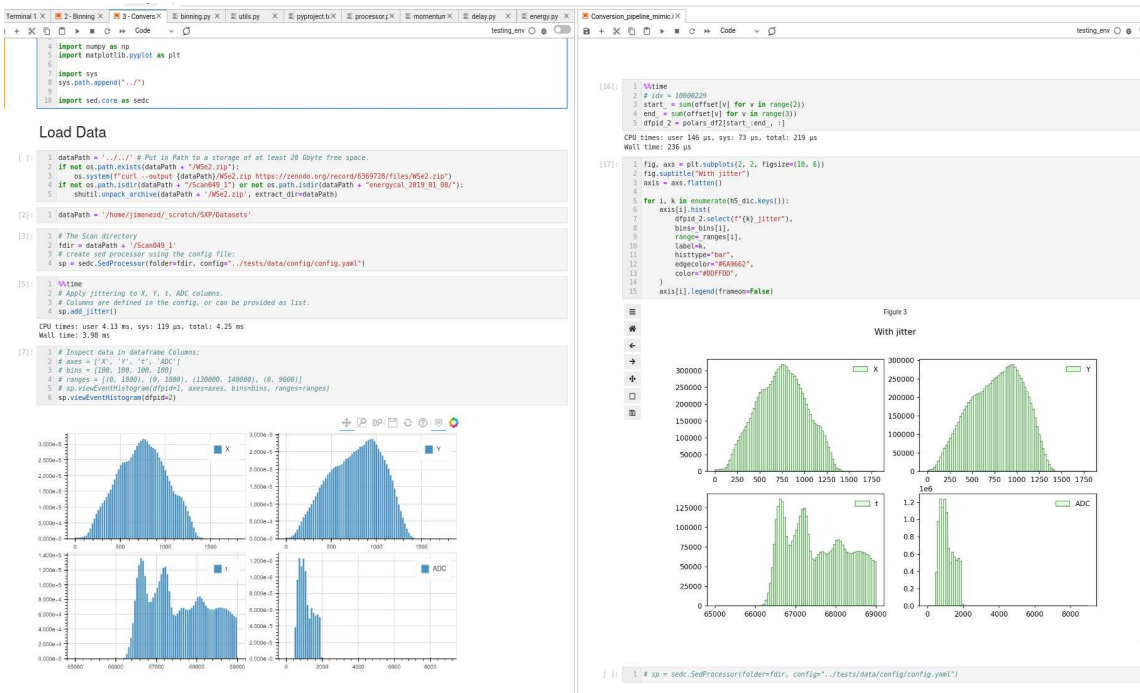
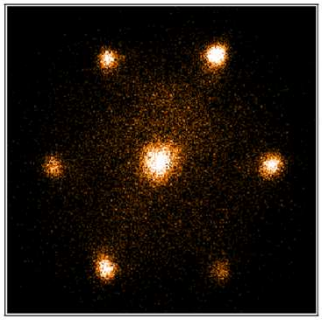
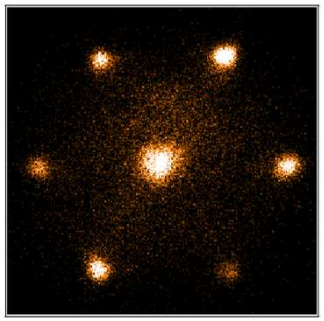
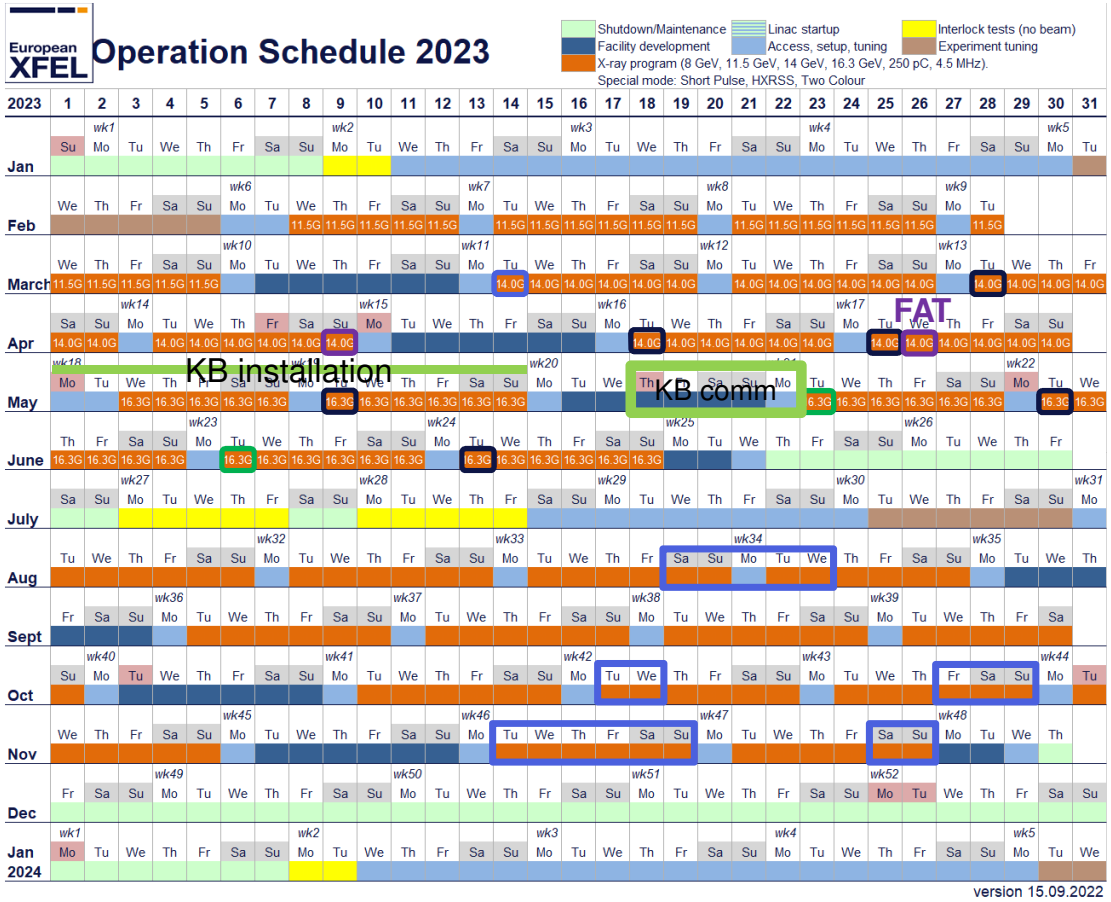


Image Corrections





Timeline


European XFEL
Operation Schedule 2023
Shutdown/Maintenance
Facility development
X-ray program (8 GeV, 11.5 GeV, 14 GeV, 16.3 GeV, 250 pC, 4.5 MHz).
Special mode: Short Pulse, HXRSS, Two Colour
Linac startup
Access, setup, tuning
Interlock tests (no beam)
Experiment tuning
KB installation
KB comm
FAT
version 15.09.2022

Thank you for your attention!

- Contact:
  - sxp@xfel.eu or manuel.izquierdo@xfel.eu
  - Webpage: Scientific Instrument SXP (xfel.eu) or browse for SXP XFEL