

SCS instrument



European XFEL Virtual User Information Meeting 11th Call for Proposals

Andreas Scherz
Spectroscopy and Coherent Scattering
(SCS instrument)

20. April 2023


[Home](#) > [Facility](#) > [Instruments](#) > **SCS**

Scientific Instrument SCS

11th Call for User Proposals

We are happy to accept proposals, scheduled for the first half of 2024, for solid samples using the FFT station in forward-scattering geometries and for the CHEM station providing liquid jet sample environments. In order to support experiment proposals from the chemistry RIXS community, the lower photon energy range at SASE3 will be adapted in this allocation period, so as to include the N K-edge. Detailed parameters can be found below. Please note that the XRD experiment station is NOT included in this call.

contact us:
scs@xfel.eu



Go to the SCS instrument web page

11th-Call-for-Proposals: **FFT & CHEM**



SCS instrument and beam parameters

11th Call-for-Proposals, scheduled for the first half of 2024

[DOWNLOAD](#)

Online hRIXS Seminar: Information about hRIXS instrumentation



Online seminar slides for download

Provides more information about hRIXS instrumentation, performance and parameters

[DOWNLOAD](#)

Report (2022)

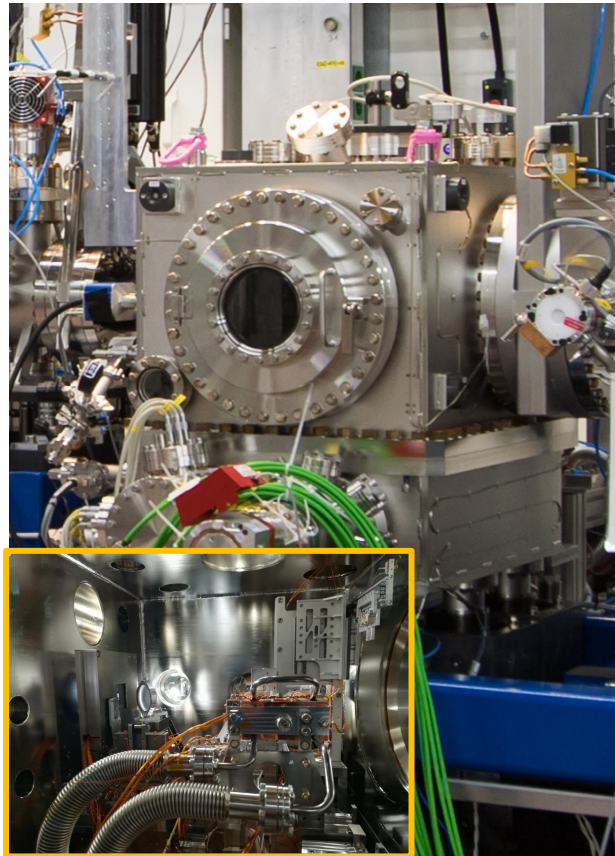
SCS Instrument Review Report

R. Carley, B. Van Kuiken, L. Le Guyader, G. Mercurio, A. Scherz

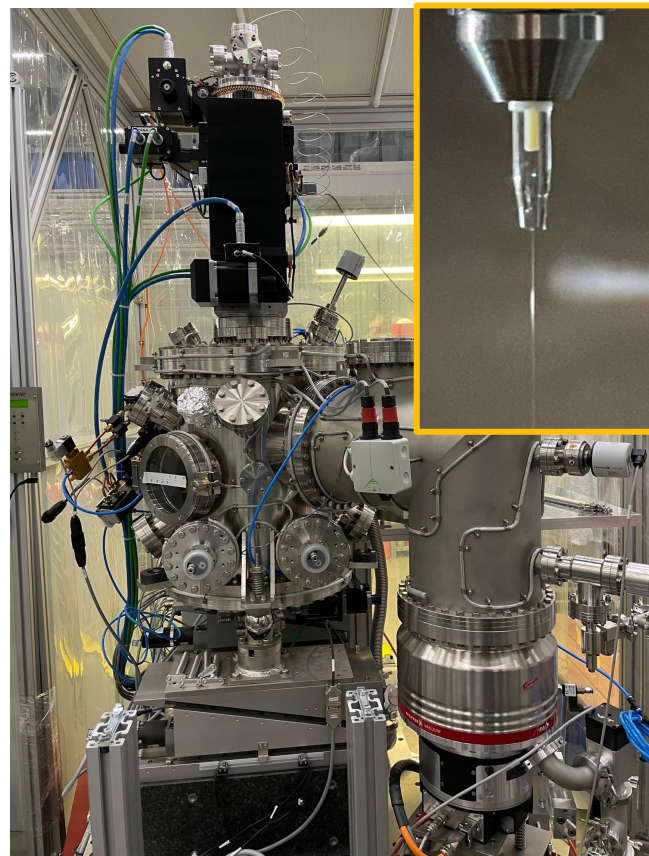
[doi:10.22003/XFEL.EU-TR-2022-003](https://doi.org/10.22003/XFEL.EU-TR-2022-003)

SCS experiment stations

FFT experiment station Since Oct 2018



CHEM experiment station Feb 2022

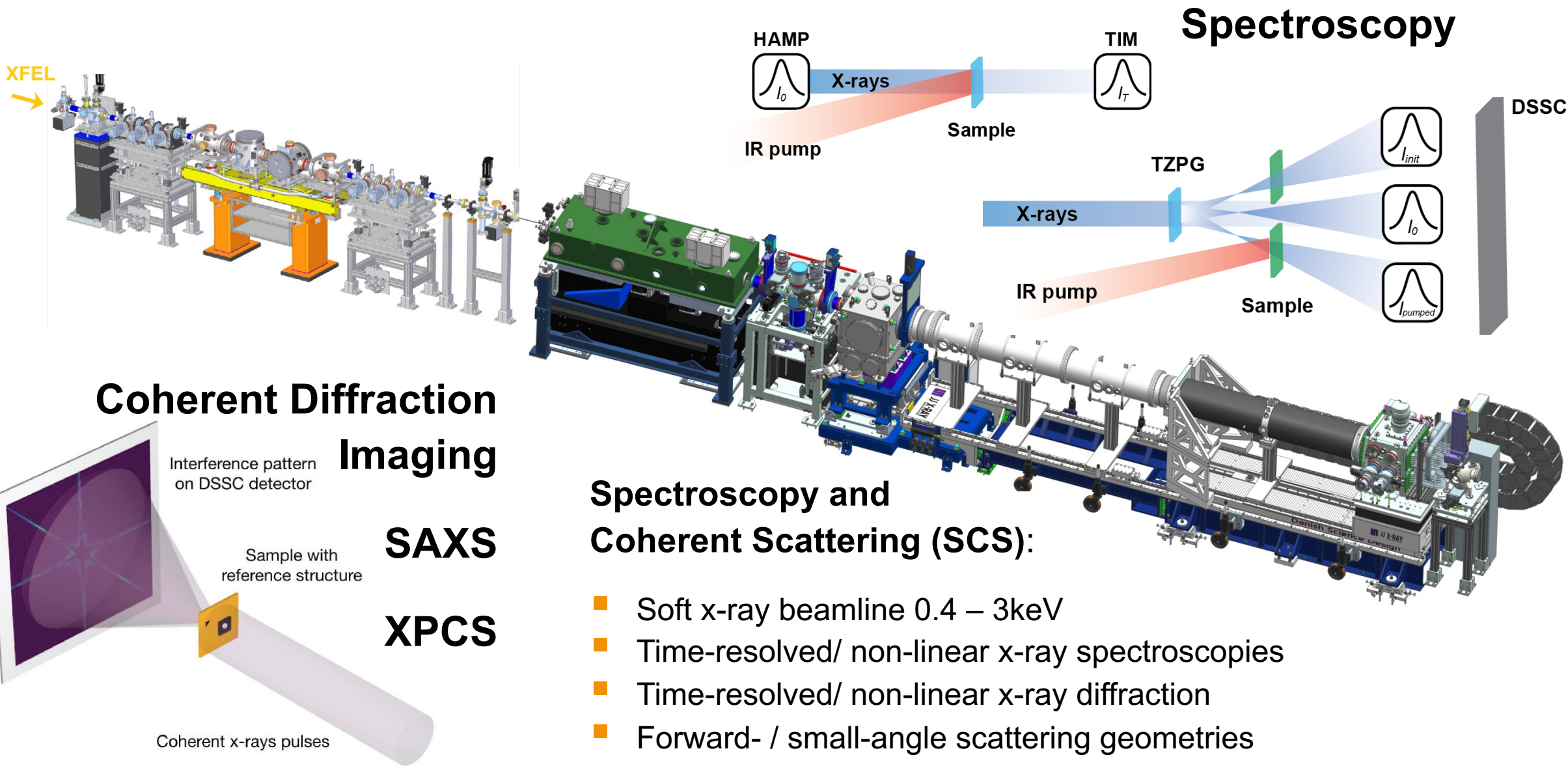


XRD experiment station Sep 2022

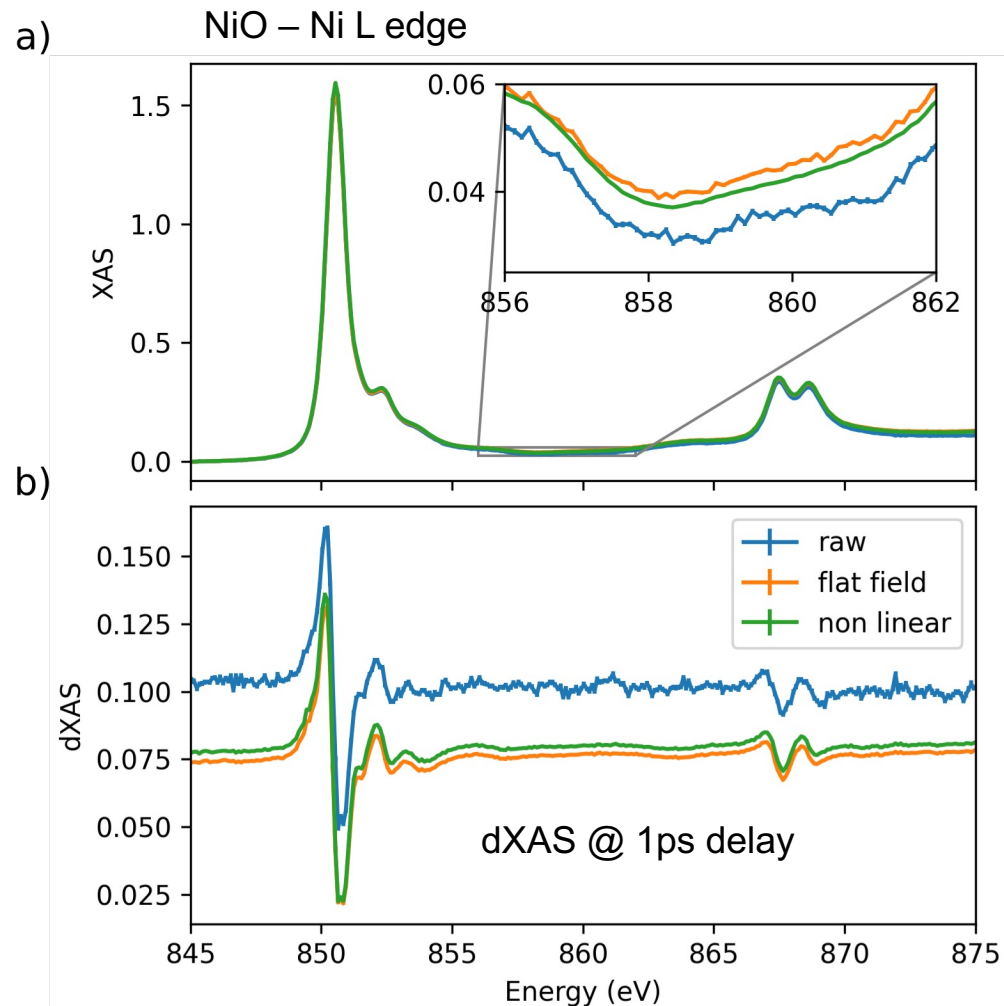
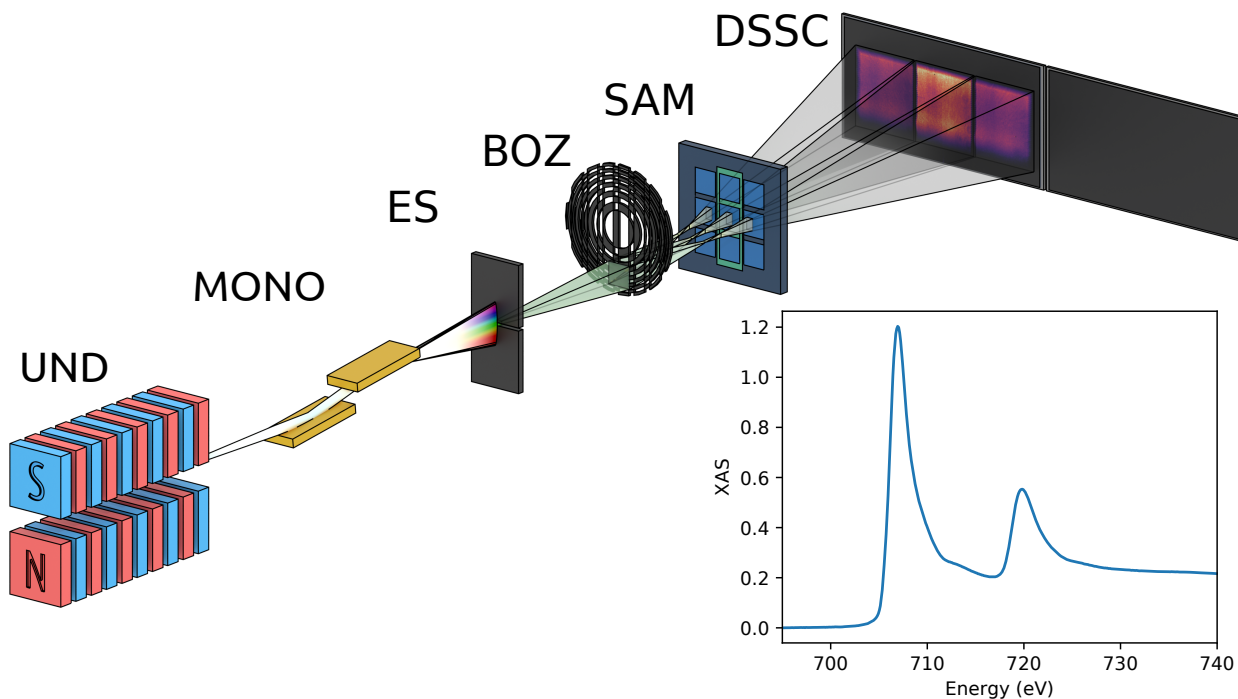


next call for proposals opens later this year

SCS instrumentation for forward scattering geometries



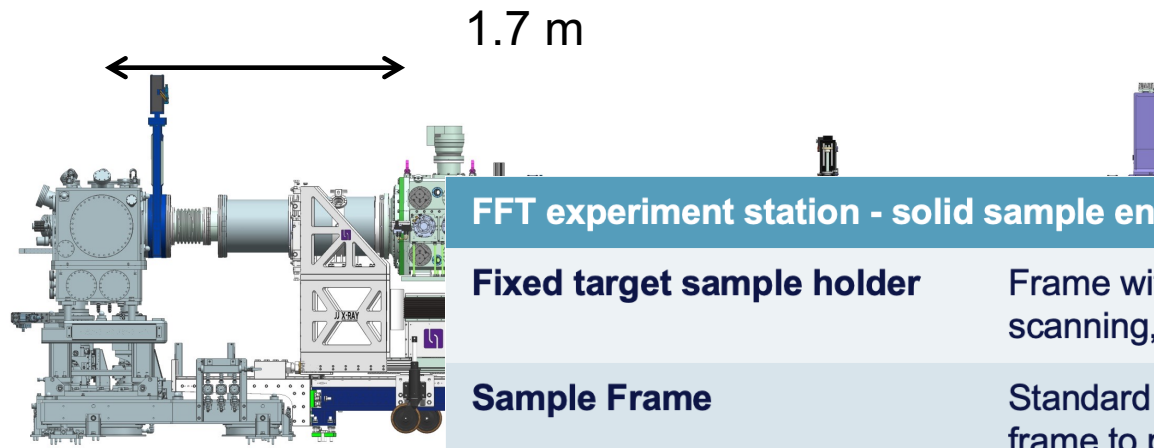
Beam-splitting off-axis zone plate for shot-noise limited MHz transient absorption spectroscopy with the DSSC detector



Le Guyader & al., J. Synchrotron Rad. (2023). 30, 284
 Lojewski et al., arXiv:2210.13162 (2022)
 Engel et al., arXiv:2211.17008 (2022)

UP 2589, Eschenlohr et al., in preparation

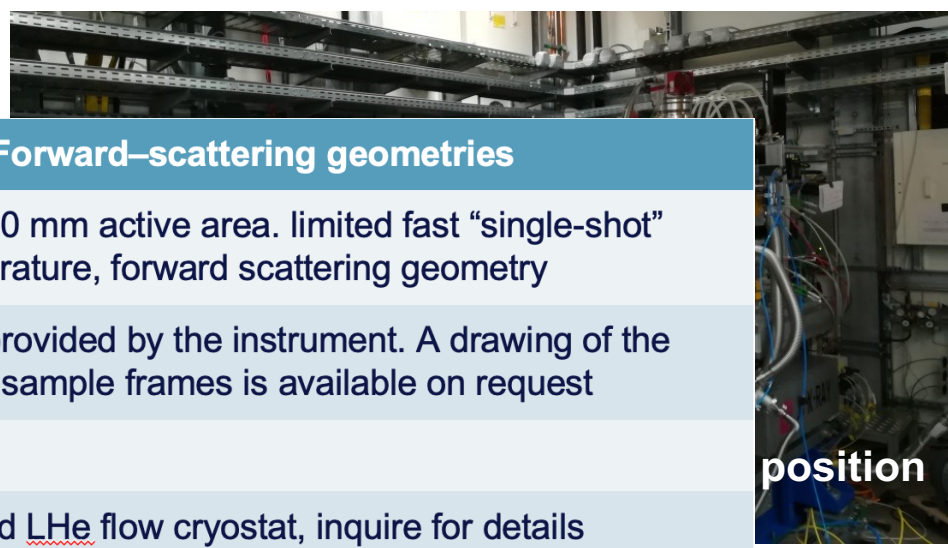
FFT Experimental apparatus for XAS and SAXS / CDI




1.7 m

FFT experiment station - solid sample environment, Forward-scattering geometries

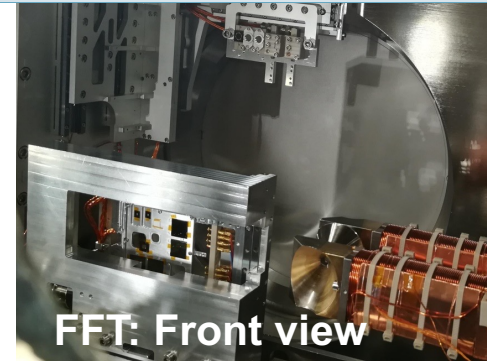
Fixed target sample holder	Frame with 50 mm x 50 mm active area. limited fast "single-shot" scanning, room temperature, forward scattering geometry
Sample Frame	Standard frames are provided by the instrument. A drawing of the frame to produce own sample frames is available on request
DC electromagnet	≤ 0.35 T
Cryostat sample holder	15 – 300K, top-inserted <u>LHe</u> flow cryostat, inquire for details



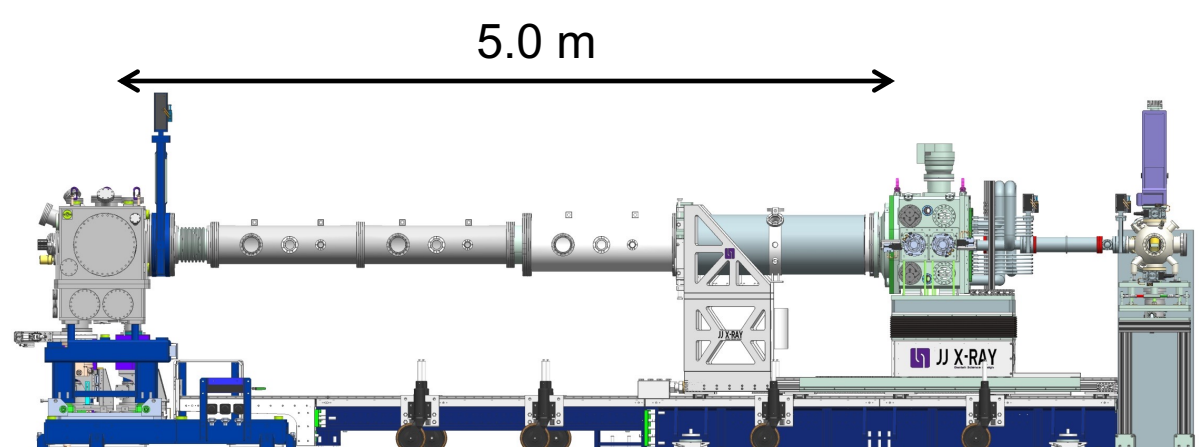
position




FFT: Side view



FFT: Front view

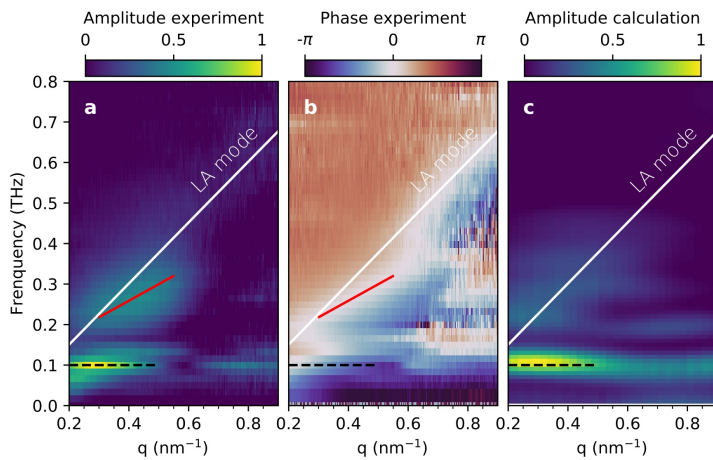


5.0 m

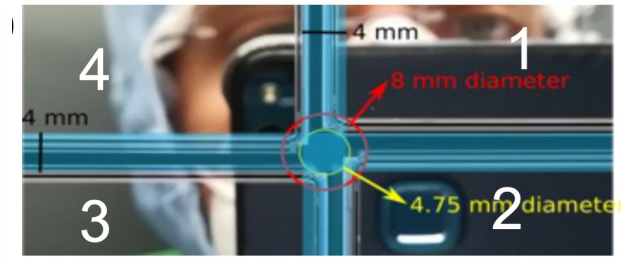
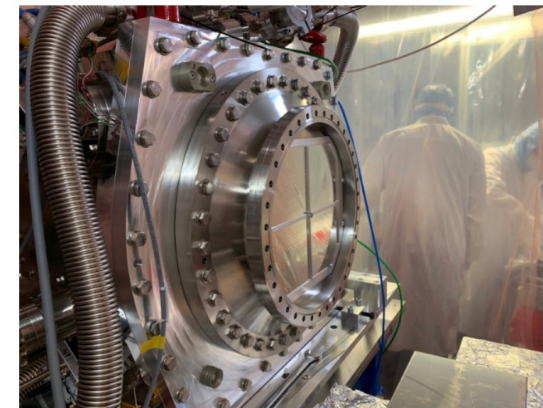
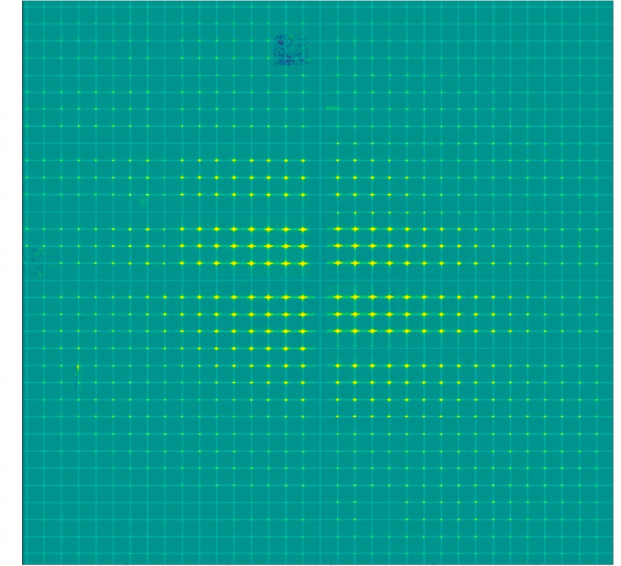
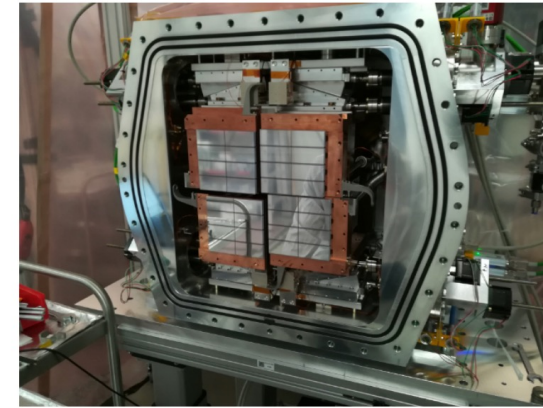


DSSC Detector for CDI, SAXS, XPCS

DSSC detector	SAXS, CDI, BOZ-XAS, XPCS	
Number of pixels	1024 x 1024	
Pixel coordinates	Hexagonal	Detector quadrants in windmill configuration
Pixel size	204 μm x 236 μm	
Max frame rate	4.5 MHz	
Beam hole size	Default: 4.75 mm (windmill)	The diameter of the central dead area is 8mm.
Standard detector-to-sample distance	Min: 1.02 m Max: 5.40 m Travel range: 1.5 m (under vacuum)	



Turenne et al.,
Science Advances
(2022)



Büttner, et al., Nature materials **20**, 30 (2021)

Turenne et al., Science Advances, **8**, 1–11 (2022)

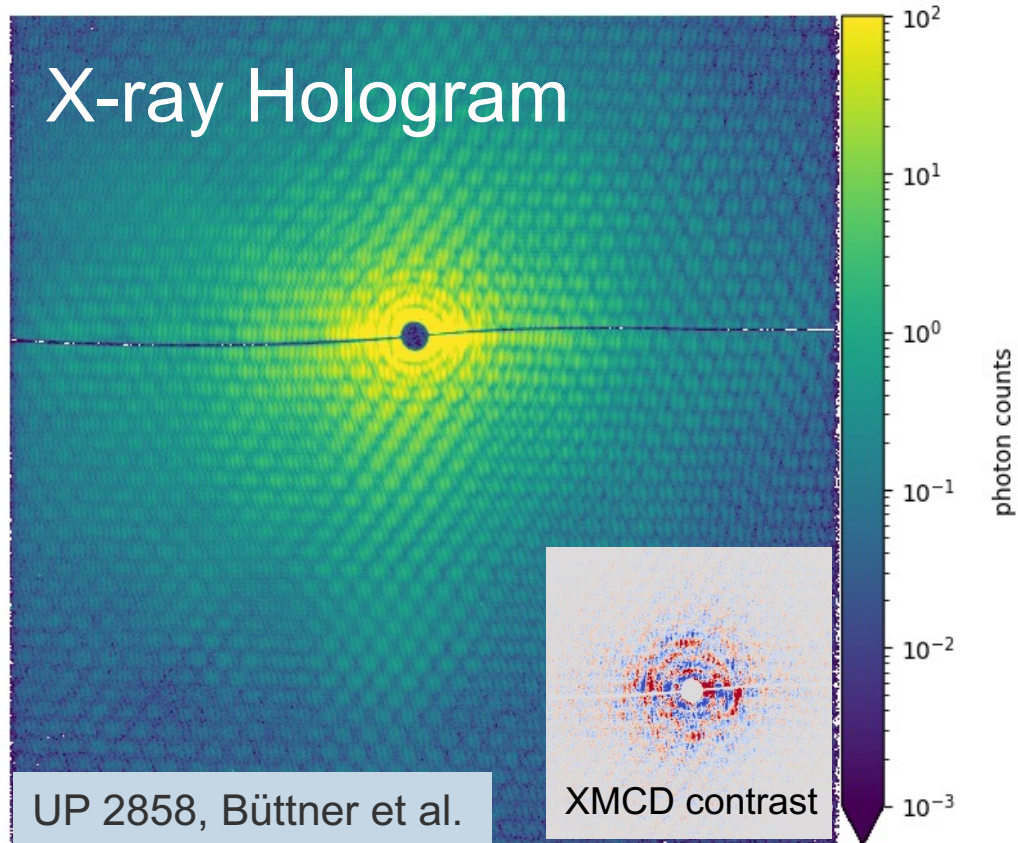
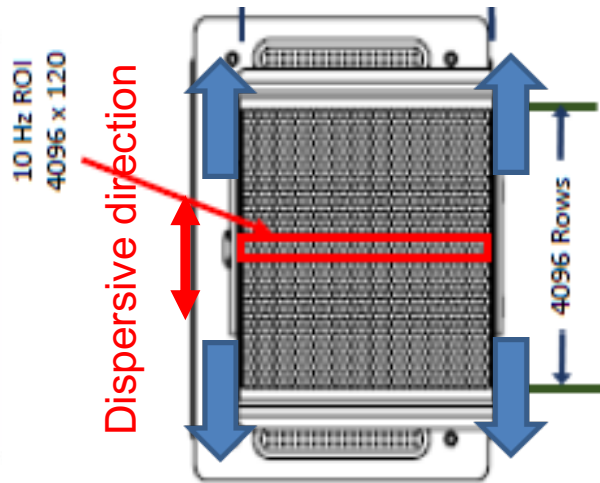
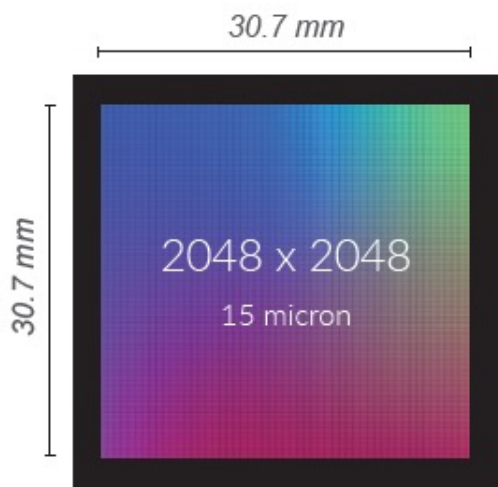
Hagström, et al., J. Synchrotron Rad. **29**, 1454 (2022)

Hagström, et al. Phys Rev B, **106**, 224424 (2022).

Pi-MTE3 commercial detector option



PI-MTE3 Detector		
Number Pixels / Size	2048 x 2048, 15µm x 15µm	Cartesian coordinates, 30.7 x 30.7 mm imaging area
Frame rate	up to 1Hz	4 port readout, inquire for details
detector-sample distance	55 - 820 mm	

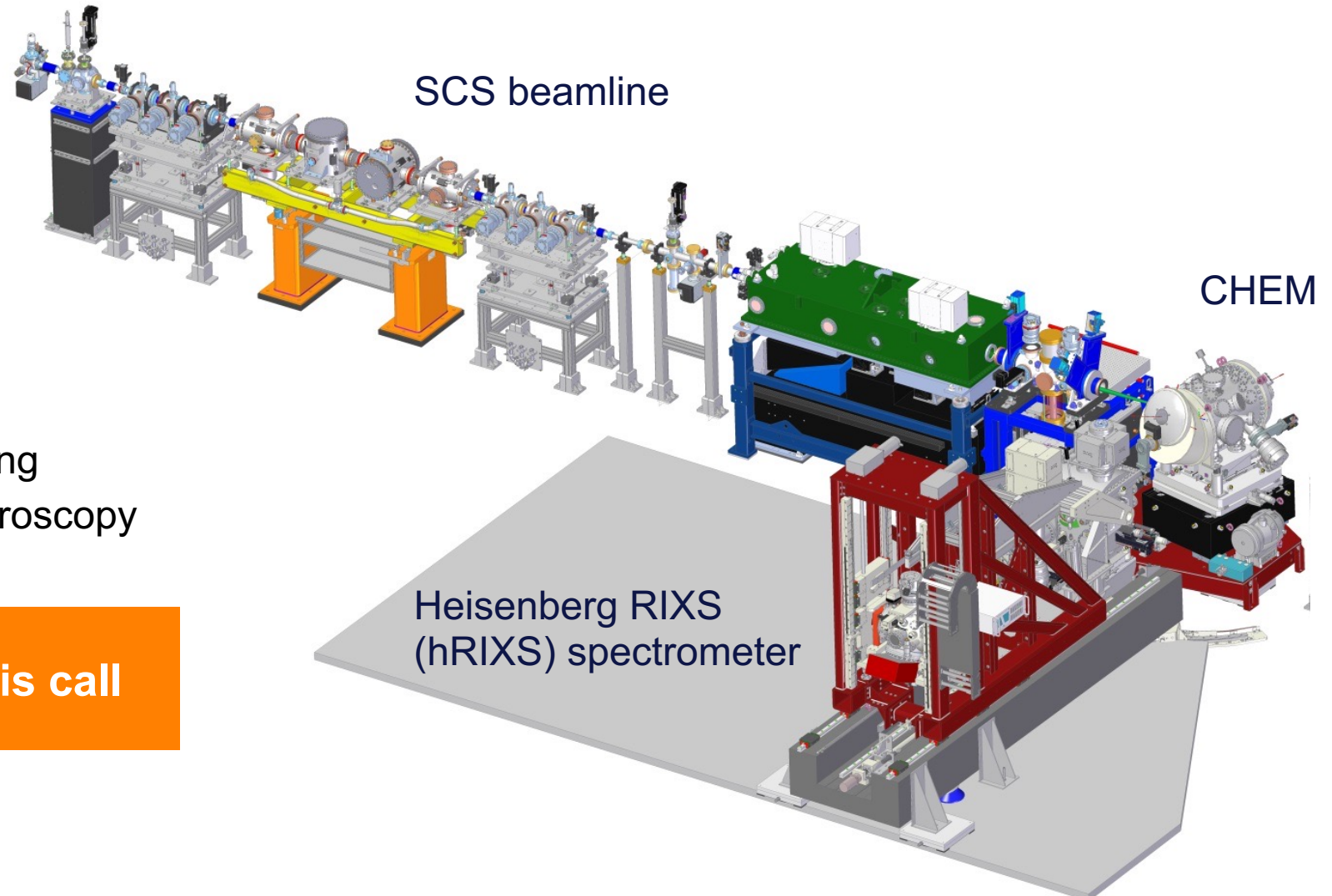


CHEM station at the SCS Instrument, 11th Call for Proposals

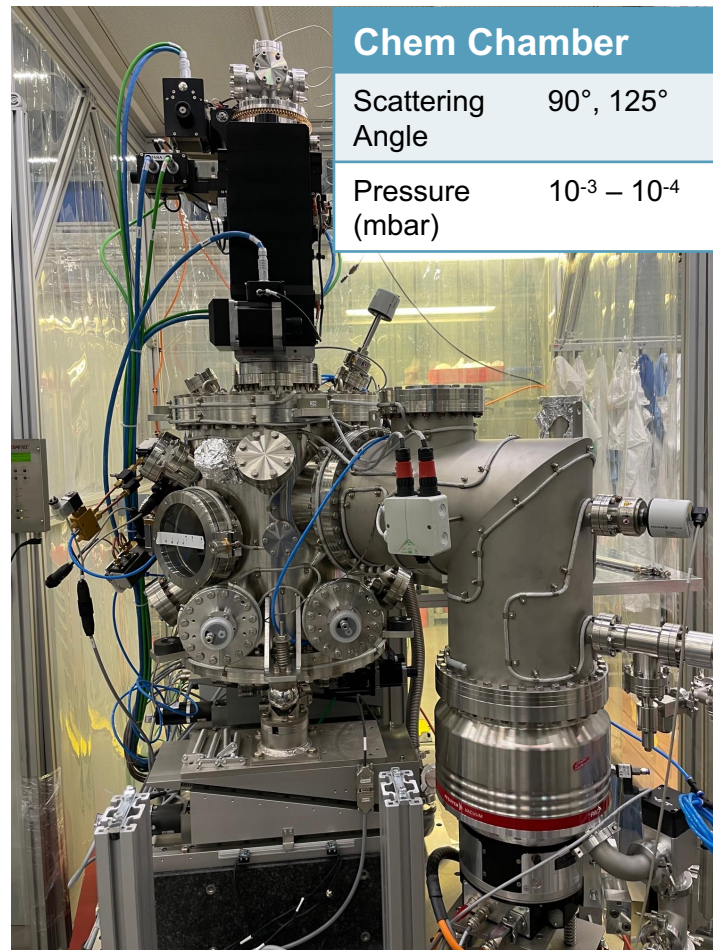
Spectroscopy and Coherent Scattering (SCS):

- Soft x-ray beamline 0.4 – 3keV
- Liquid jet samples
- Resonant inelastic X-ray scattering
- Transient X-ray absorption spectroscopy

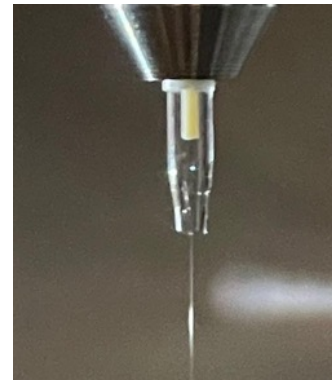
Includes the N K edge this call



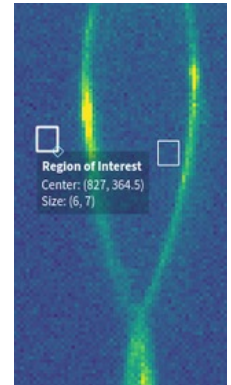
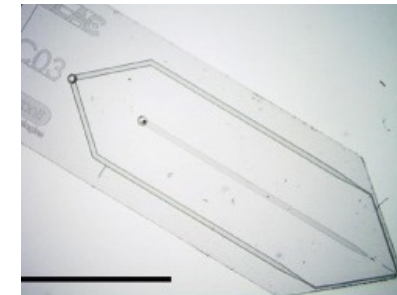
CHEM experiment station with liquid-jet sample environment



Cylindrical Jet for RIXS+PFY XAS



Flat Jet for transmission XAS

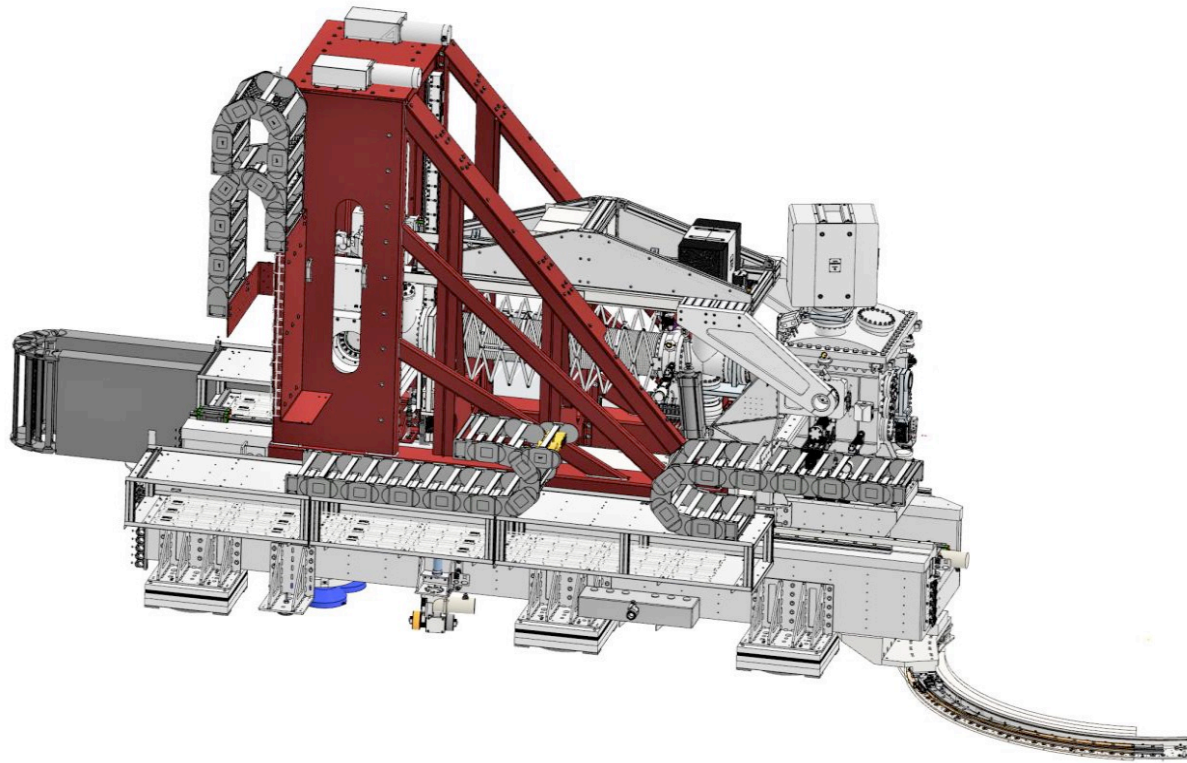


Korelek et al. Nat Commun. (2018) 9. 1353

	Cylindrical Nozzle (RIXS)	Flat Jet (BOEZ)
Jet Dimension	20 – 50 μm diameter	1 – 4 μm thick
Solvents*	Water, Ethanol, Octane	Water
Flow Rate	~1 ml/min	~3 ml/min
X-ray Spot Size	Tunable 200 μm – < 10 μm	line focus (200 x 10 μm H x V)

*Contact SCS staff to discuss additional solvents and sample details (recirculation, cooling, etc.)

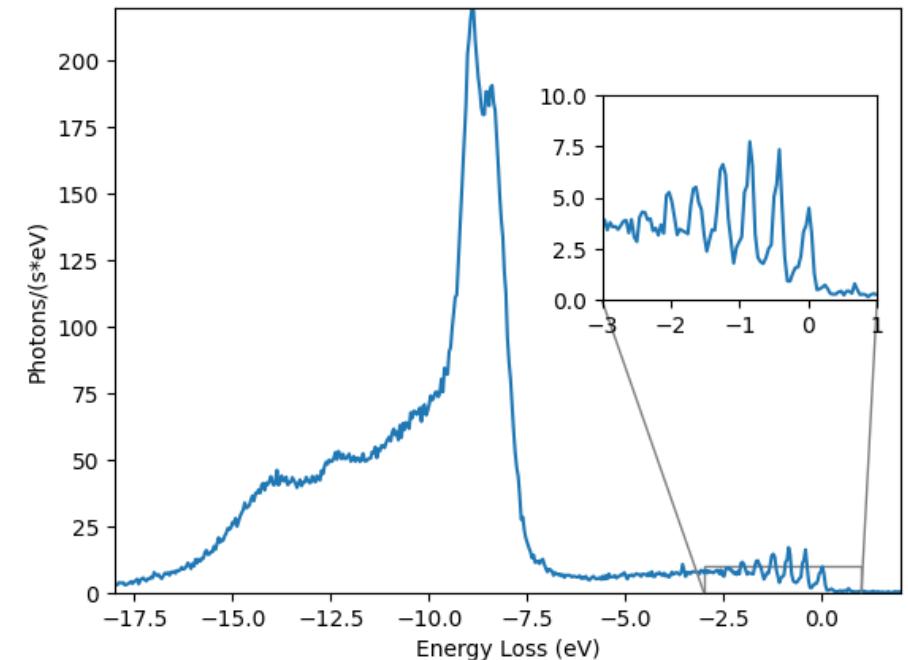
hRIXS parameters for run 11



hRIXS parameters

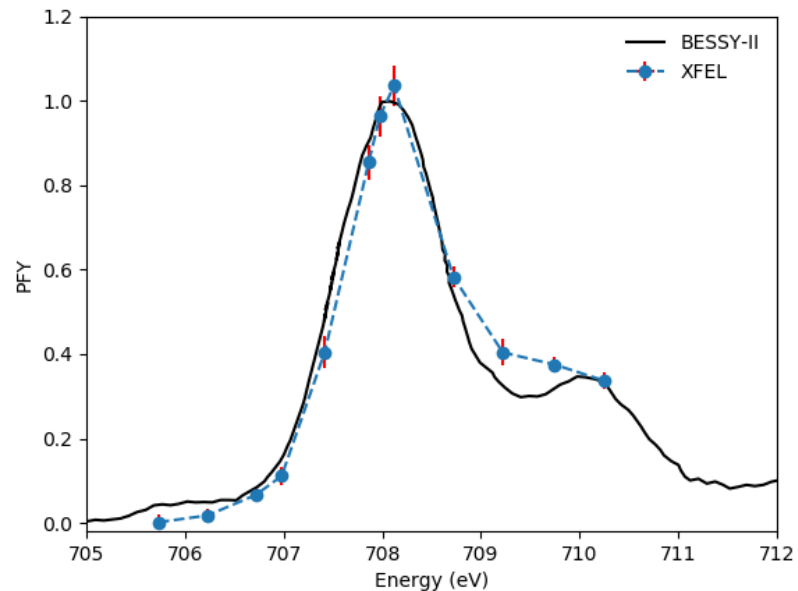
Photon energy	0.5 – 1.5 keV
Combined resolving power	Up to 10.000 (mono HR) 3.000 (mono LR)
Transmission	$\sim 10^{-6}$
Time resolution	Limited by mono: 80-150 fs (mono HR) 30-50 fs (mono LR)
Scattering angle -> CHEM	90 deg, 125 deg

O K-edge RIXS of Liquid Water

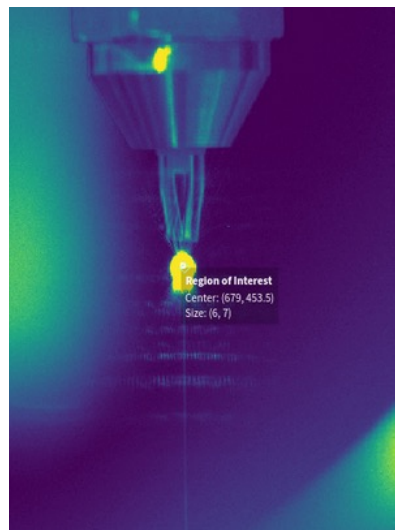


RIXS of Solution Samples

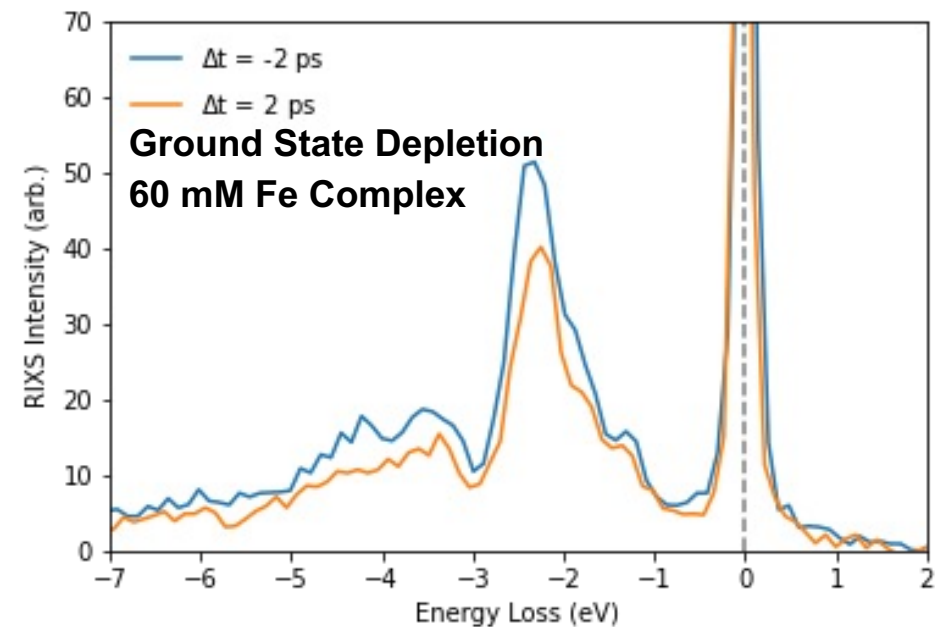
XAS Measured by PFY



Optical Laser for trRIXS

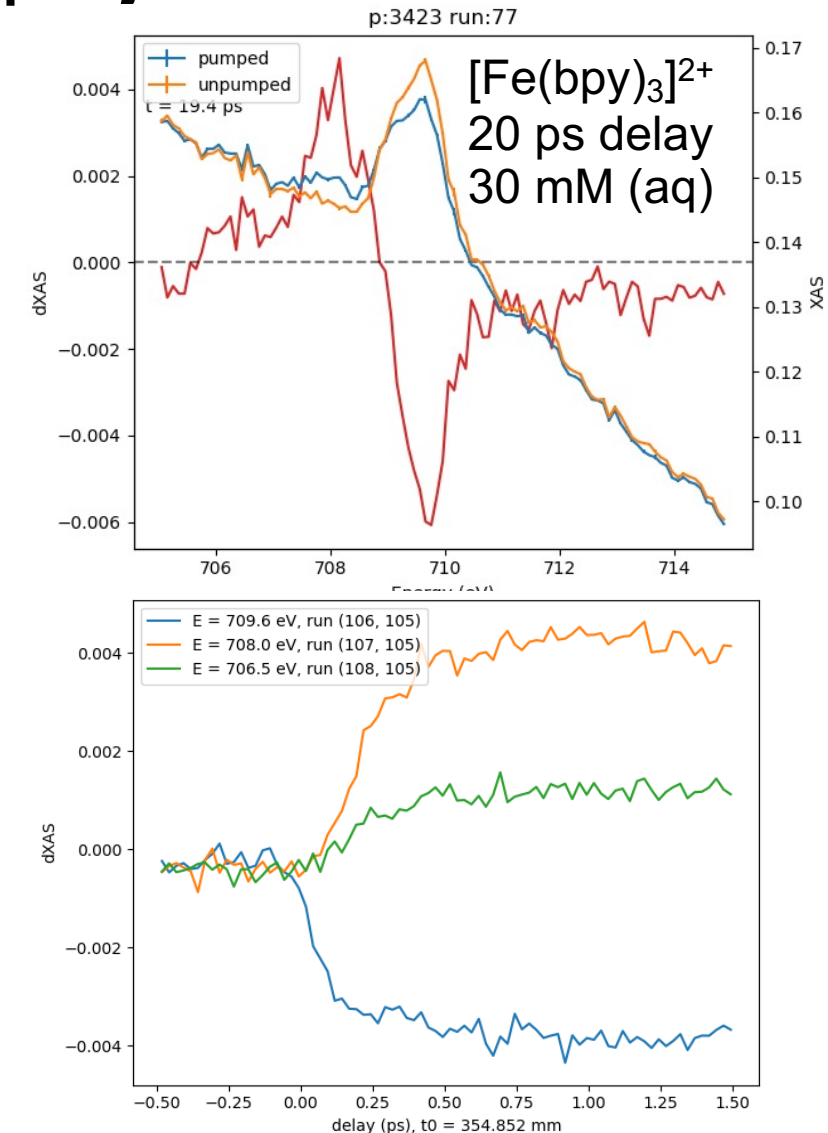
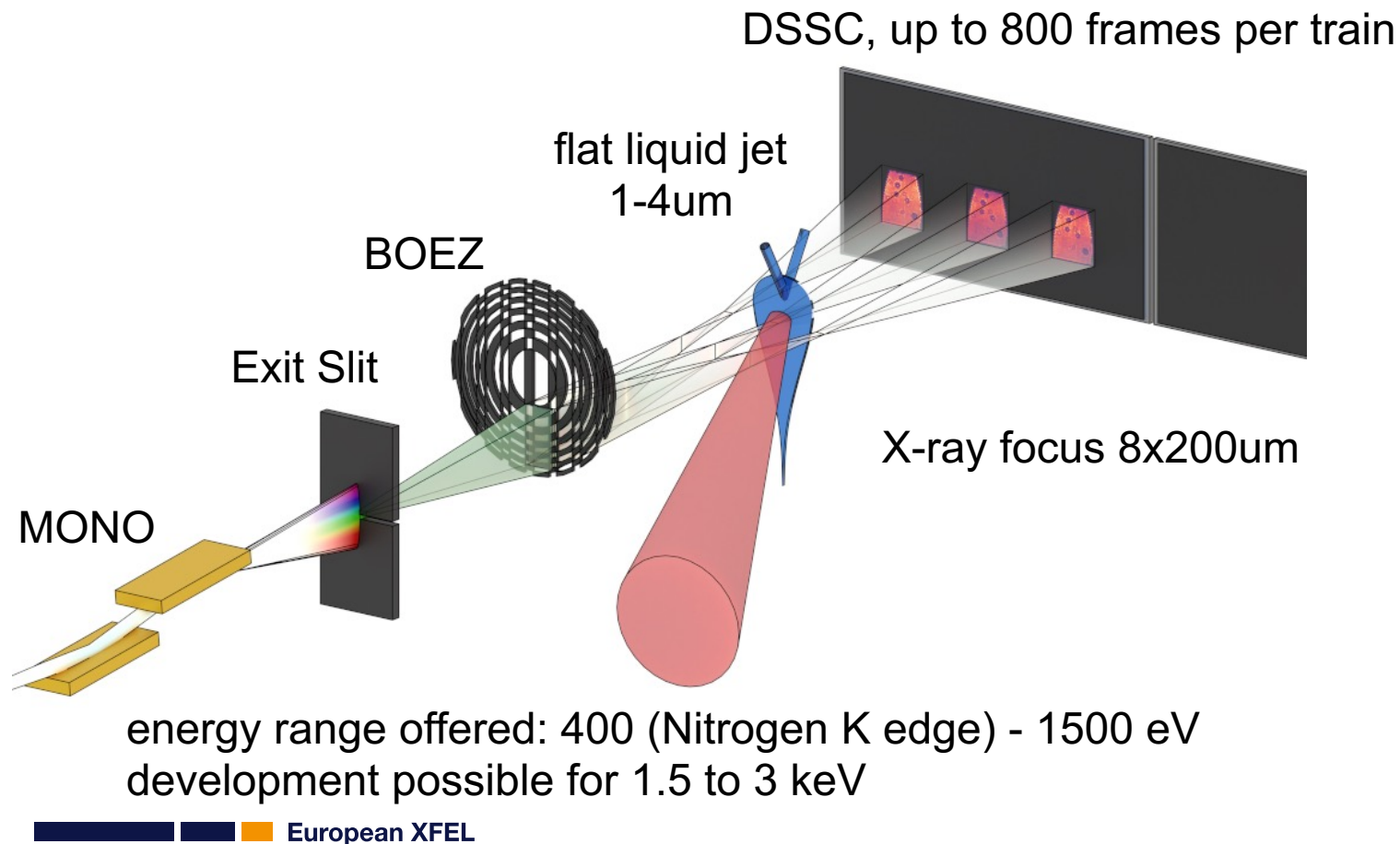


RIXS on Samples ≥ 10 mM



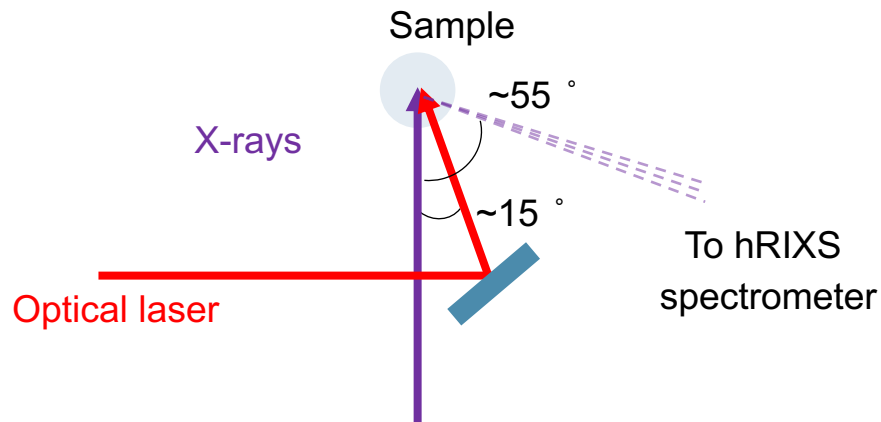
User-assisted commissioning (2022)

Beam-splitting off-axis elliptical zone plate for shot-noise limited MHz transient absorption spectroscopy with the DSSC detector with liquid jet



Optical delivery to FFT and CHEM

Laser in-coupling geometry for
FFT and CHEM



Optical laser system	SASE3 PP laser	
Center wavelength	800 nm	
Pulse duration	15 or 50 fs	
Repetition rate and Pulse energy	2 mJ @ 113 kHz, 800 nm 0.2 mJ @ 1.13 MHz, 800 nm	Other working points exist. Inquire for details
Wavelength tunability	Conversions from 800 nm / 50 fs: SHG (400 nm) , THG (266 nm), OPA: wavelength between 350 nm and 2.5 microns Please inquire for details on pulse energies	
Spot size	$\sim 100 \mu\text{m}$	
Polarization	Linear and circular	
Operation	Burst mode synchronized to FEL with jitter <50 fs	

