XPP capabilities for Run 23

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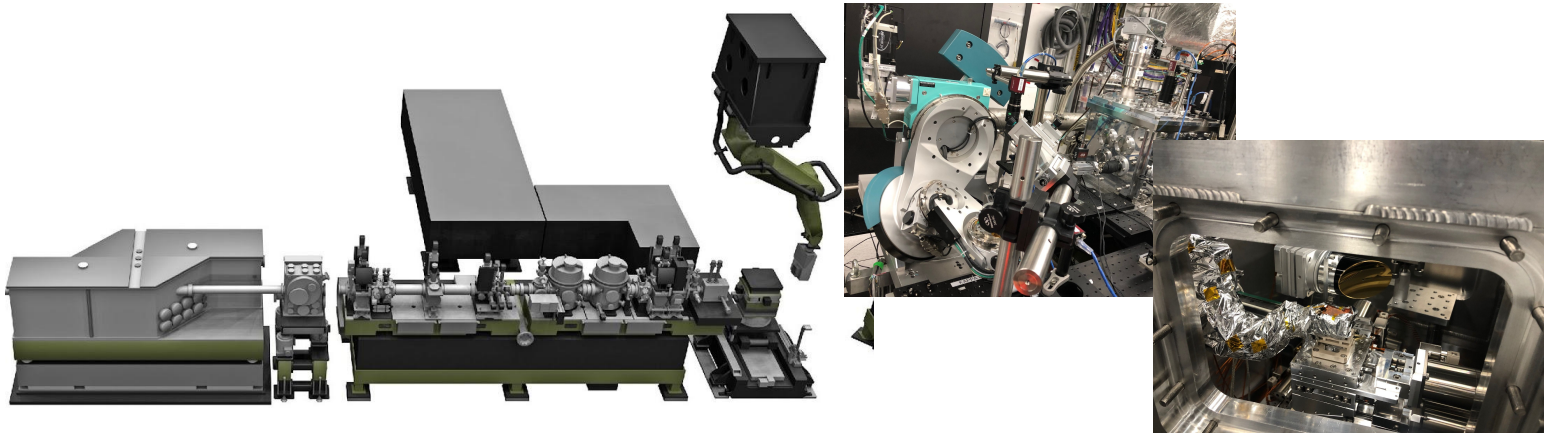
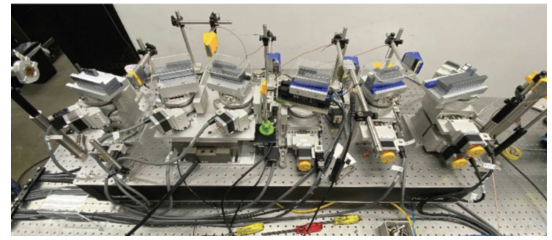
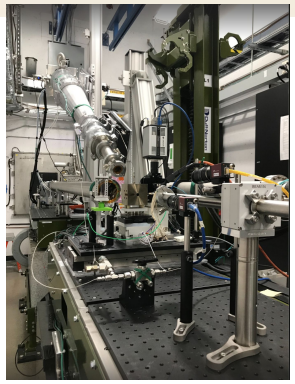
XPP status and configurations **30% more proposals were accepted for Run22!**

Short data collection proposal is offered for in-air diffraction combining Optical laser pump (needs to match other PRP proposals' parameter)







XPP alcove (SB4/5/6)

- **trWAX** for material science at 20keV+, vacuum environment supporting fixed target rapid replacement (appendix 3).
- **trXRD in-air 4-circle diffractometer,** (400K-100K with nitrogen cryojet) (appendix 3)
- **Hard x-ray polarization control** established to switch on a near pulse-to-pulse bases between circular and linear inside the new laser in coupling chamber(appendix 2).
- **High resolution mono** (<100meV) and **sub-micron focusing with AKB collaborative work with RIKEN/Osaka University (appendix 1)**.
- **Mini-split&delay** (delay range ~20ps) based on amplitude splitting(transmission grating)(appendix 4)
- **Special setup and experiments using "the secondary interaction points", high res. mono, tight focus. etc** on XPP alcove tables(appendix 4)
- **NO low-T chamber standard configuration. For low-T environment, please contact beamline scientists**

Detectors (on XPP robot arm or motion assembly)

ePix10k 2M, ePix100, and Jungfrau1M, Zyla, Alvium detectors are available for diffraction, spectroscopy and scattering measurement

X-ray parameters

Photon energy	4 keV – 26 keV (8-13 keV Std. config with Diamond(1 1 1) mono)
Mono Bandwidth	0.7 eV (Diamond (1 1 1) mono) – 20 meV(~sub meV):**appendix 1** Self seed is also available, factor of 3~4 more **average** spectral brightness
Pink beam Bandwidth	20 eV~
Pulse energy at 9.8 keV	Pink: 1 mJ at the sample location Mono with 0.7 eV bandwidth: ~10 uJ average
Pulse duration	Standard:30 ~50 fs, Special mode: attosecond, sub10 fs ~100 fs
Rep rate	Single shot ~120 Hz
Polarization	**Vertical(from undulator),** horizontal, and circular (from phase plate: appendix 2)
Focus	Sub-um ~ un-focus (350 um)+ diagnostic 1D focus is available

Optical laser parameters

Run run15-19

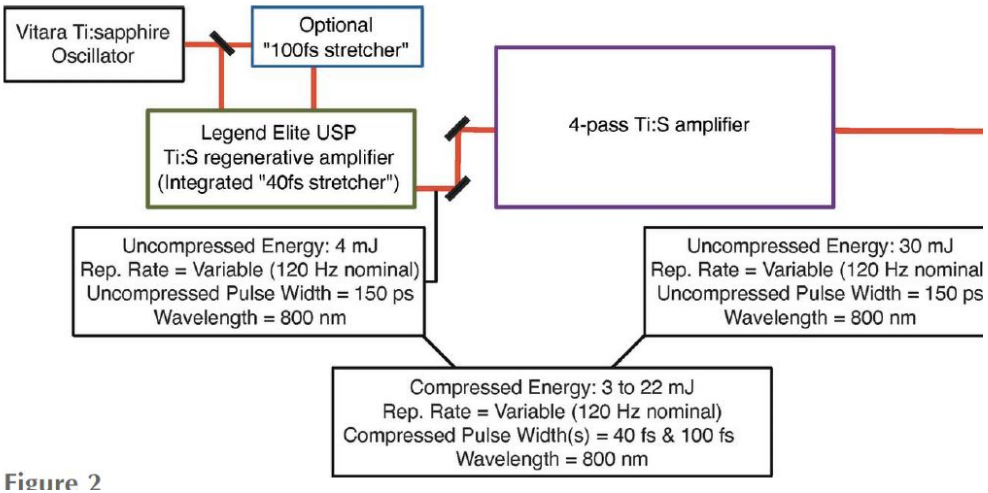
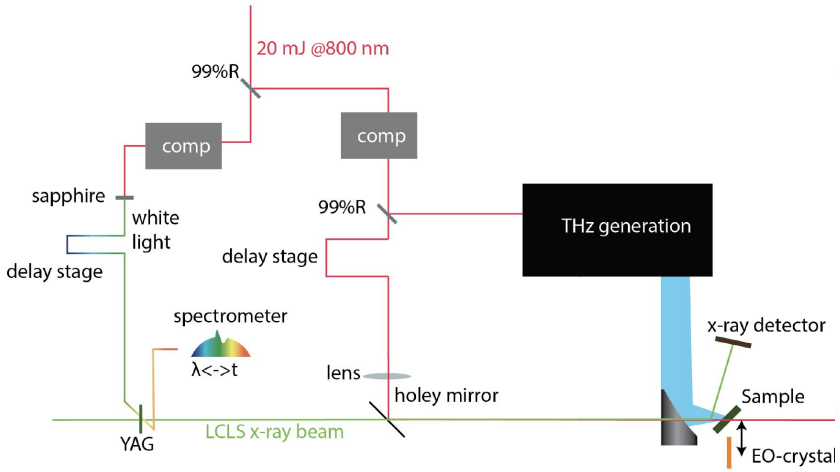
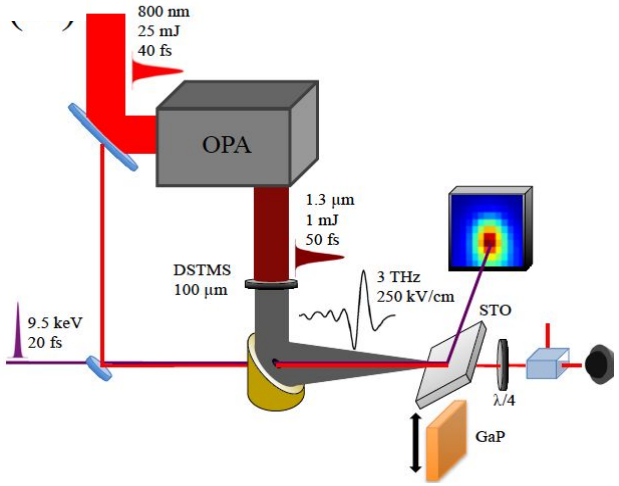


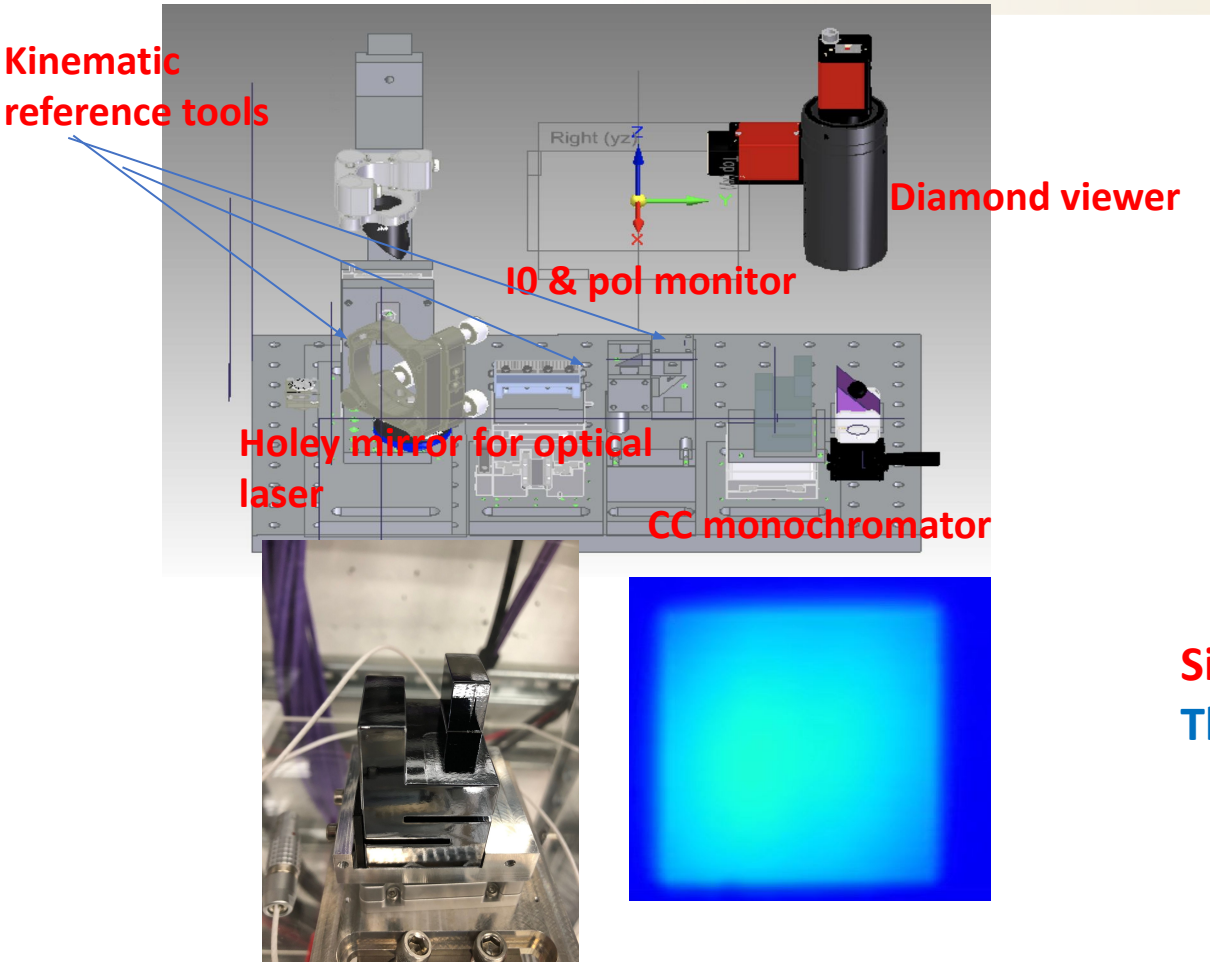
Figure 2

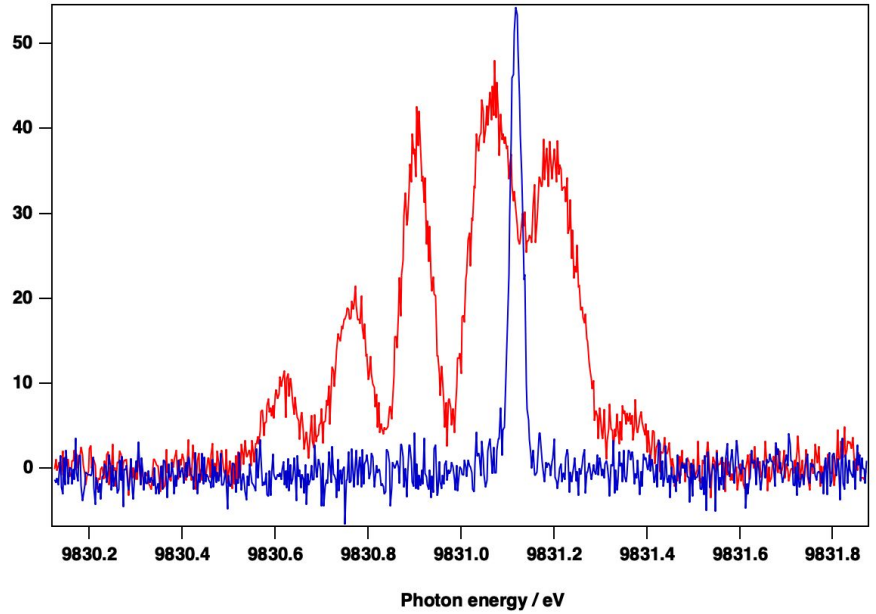




	Options	Pulse energy	Typical focal spot size	Comments	Standard Config?
OPA 1 degree collinear 5~10˚ non-collinear	290 nm ~ 2.4 um Mid-IR with DFG unit		150 um ~ 300 um (overfilling X-ray profile)	Please contact us for UV and Mid IR regions	**Yes**, for 480 nm ~ 2.4 um
THz + 800 nm EOS Only collinear	LiNbO3, DAST DSTMS	~15 uJ	~ 1mm		**Yes, for LiNbO3,**
800 nm 1 degree collinear 5~10˚ non-collinear		20 mJ	~150 um (overfilling X-ray profile)	Please contact us for “Sub 10 fs”	**Yes, for 50 fs**
SHG/THG/FHG 1 degree collinear 5~10˚ non-collinear				Please contact us for “Sub 10 fs”	**Yes, for SHG and THG**

Appendix 1: Bandwidth control with High quality channel-cut crystals





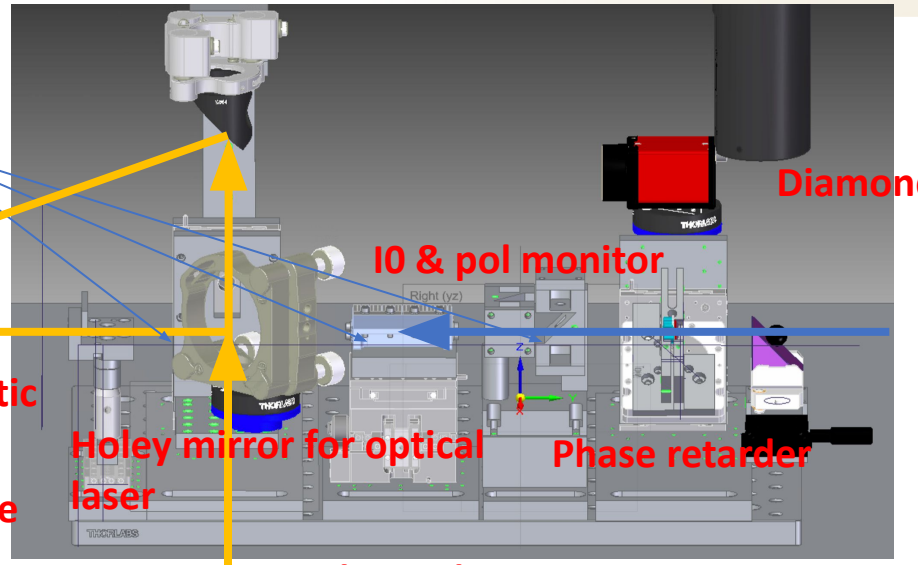
Single shot spectrum: Red Diamond(1 1 1), Blue Si(6 6 0)

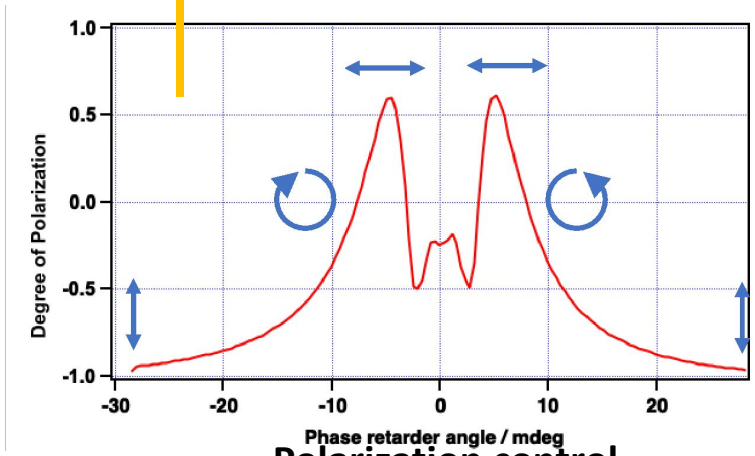
The average photon flux: ~2 x 10^8 Photon/pulse

2 bounces/4 bounces CC monochromator and downstream CRLs are available for SB4 and SB5

Si(3 3 3), Si(4 4 0), Si(4 4 4), Si(6 6 0), Si(5 5 5), (Si(3 1 1) available for Run22)

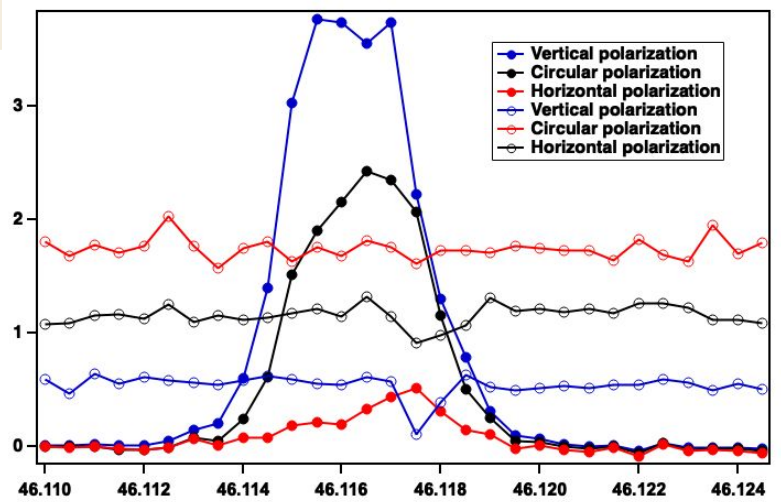
Appendix 2: Polarization control with phase retarder + polarization diagnostic



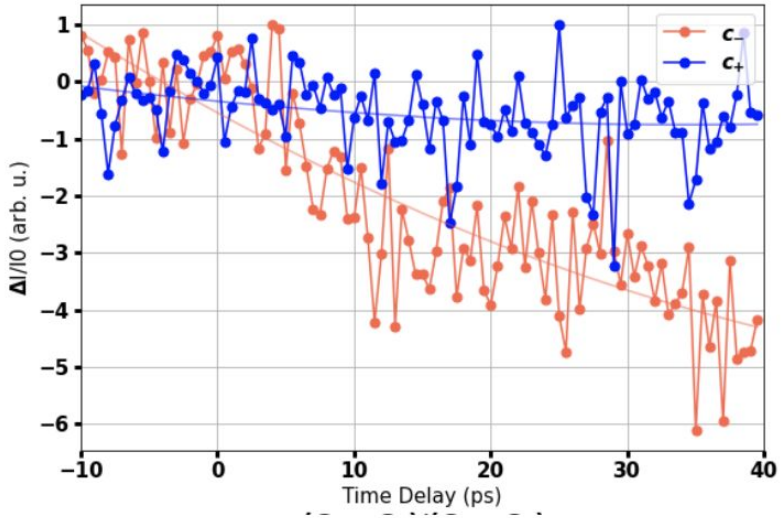


Polarization control

(more diamond crystals available for the parameter optimization)

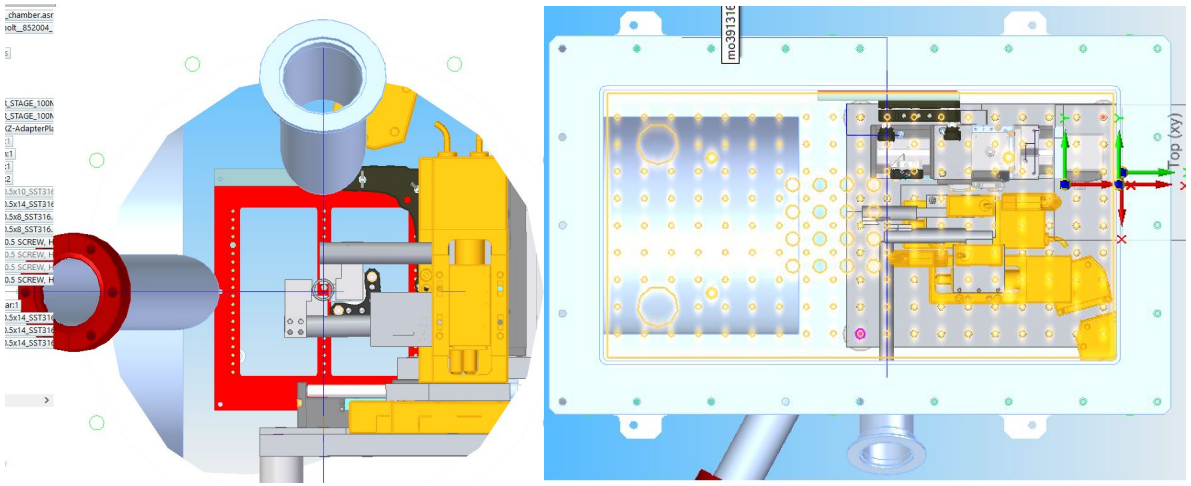


Single rocking curve scan with switching polarization (Diamond (4 0 0) at 9.831 keV)

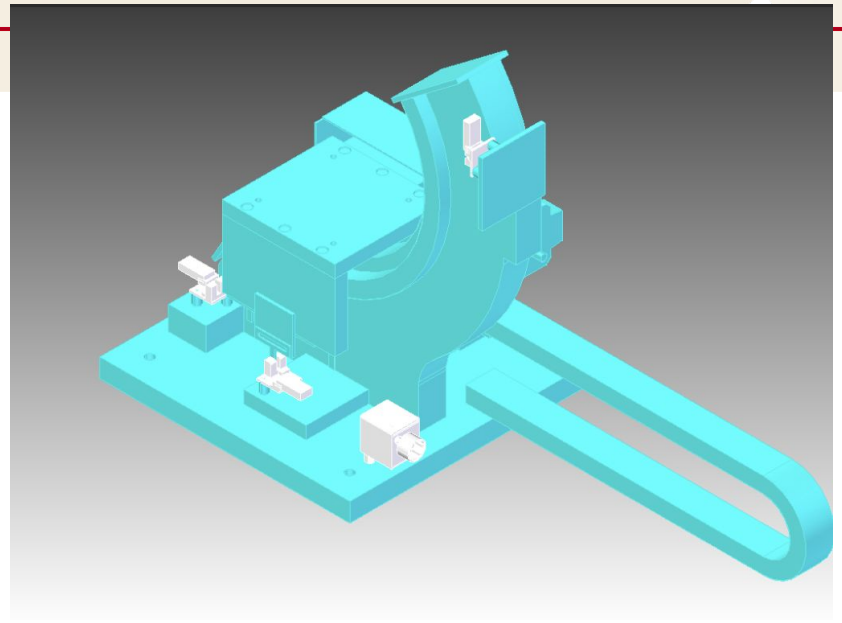


Time resolved X-ray dichroism(RXD)

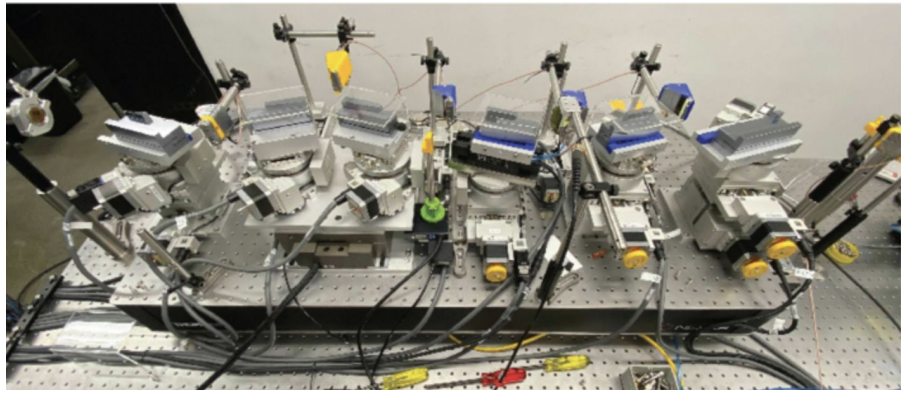
Appendix 3: **Standard configuration setup** at the primary interaction point (XPP goniometer)



Fixed target rapid scan platform (inline sample viewer, cleanup slits)



Theta-Chi(circle)-Phi Kappa diffractometer



Mini-Split&Delay optics
Yanwen et al

Standard configs (see the X-ray parameters for Std. Config)

1. **Flexible in-air diffractometer** for solid samples with cryojet cooling
2. **Low-T chamber** (some parameters are fixed for the Std.)
3. **tr-WAXS with Fixed target rapid scan platform**

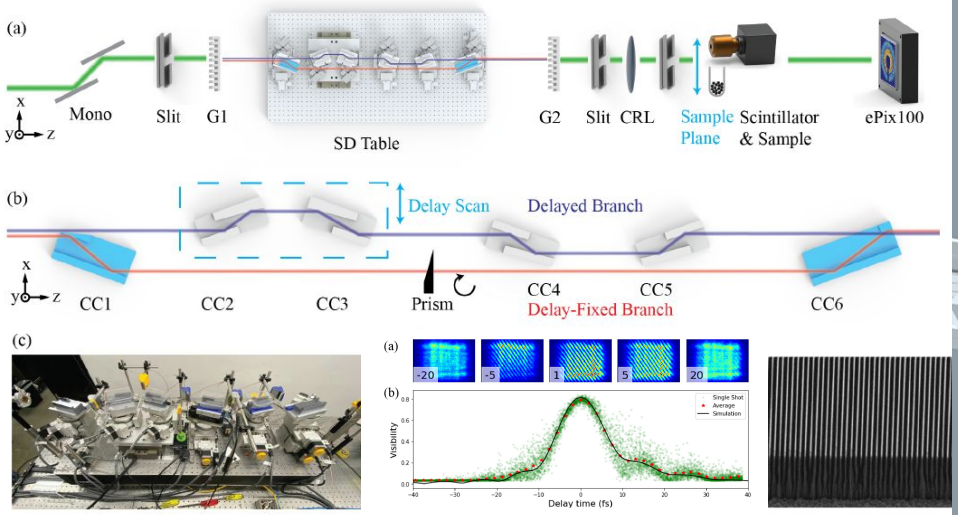
Laser parameter for Std configs

Flexible optical excitation capability from UV to **THz**.

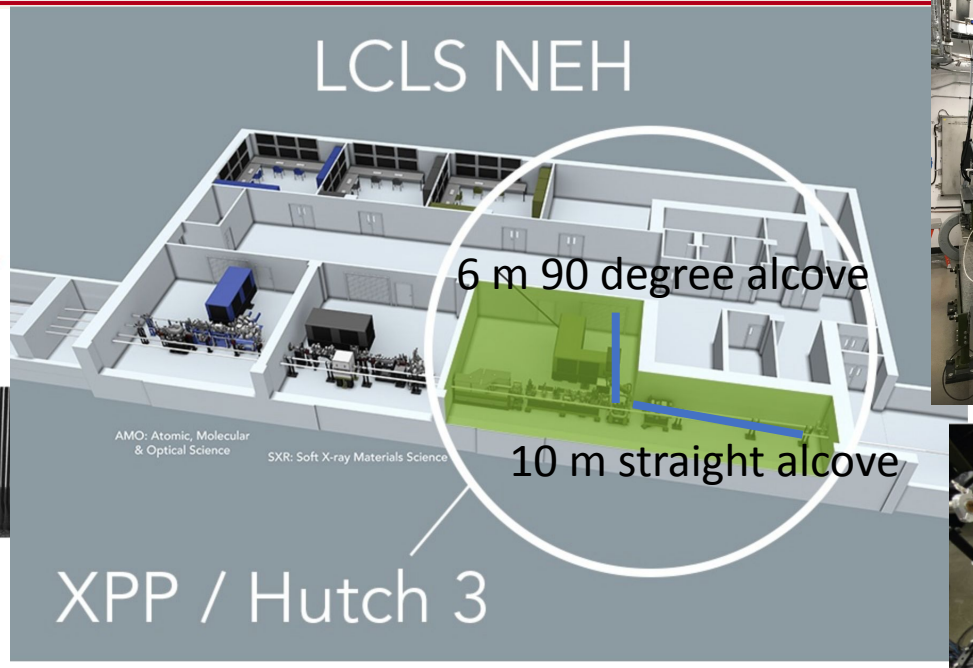
Detectors

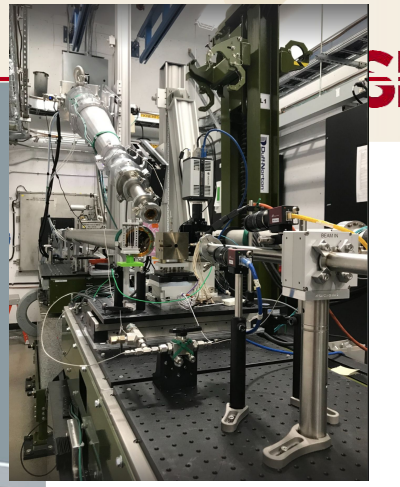
ePix10k, ePix100, and Jungfrau1M detectors available for diffraction and scattering measurement

Appendix 4: Secondary interaction points of XPP on alcove and potential applications

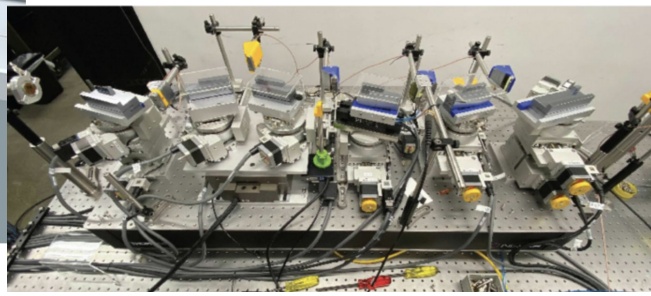


Mini split&delay
Li et al., Hard X-ray Pulse Pair with High Mutual Coherence Generated with Amplitude Split-Delay Optics





Secondary IP on SB5



Mini S&D on SB4

Potential experiments:

- Simple diffraction (theta + phi + small chi motion + 2theta-arm) experiment with **high resolution mono**
- Inelastic scattering(tr IXS/RIXS) with high resolution mono
- XMCD with X-ra polarization switching + monochromator scan
- Imaging type experiments
- Mini split&delay experiment
- **Specially designed experiments combining advanced X-ray optics and lasers (please contact us!!)**