LCLS Run 25 Users Town Hall

February 6th 2025

SLAC NATIONAL ACCELERATOR LABORATORY

Stanford University | U.S. DEPARTMENT OF ENERGY

Agenda

Time (PST)	Topic	Presenter
Plenary Session - Join via Zoom >>		
9:00 am	Current LCLS Status & Plans	**Mike Dunne** Director, LCLS
9:15 am	Universal Proposal System	**Leilani Conradson / Paul Jones** LCLS User Office
9:23 am	User Executive Committee Update	**Silvia Pandolfi** LCLS UEC Vice Chair
9:26 am	Short Proposal Program Update	**Sandra Mous** LCLS Scientist
9:31 am	Accelerator Plans for Run 25	**Axel Brachmann / Tim Maxwell** Accelerator Dept. Head
9:40 am	Soft X-ray Instrument Capabilities (Introduce breakouts)	**James Cryan / Kristjan Kunnus /Georgi Dakovski** TMO/chemRIXS/qRIXS Instrument Leads
9:50 am	Hard X-ray Instrument Capabilities (Introduce Breakouts)	**Sebastien Boutet** Director of Operations
9:55 am	Data systems	**Jana Thayer** Data Systems Dept. Head
Breakout Sessions/Office Hours by Instrument		
10:10 am - 11:00am	Session 1	
	•TMO Join via Zoom >>	James Cryan
	•MEC Join via Zoom >>	Eric Galtier
	•MFX Join via Zoom >>	Sebastian Dehe for Leland Gee
	•qRIXS Join via Zoom >>	Georgi Dakovski
	•XCS/XPP Join via Zoom >>	Matthieu Chollet & Takahiro Sato
	•chemRIXS Join via Zoom >>	Kristjan Kunnus
	•CXI Join via Zoom >>	Meng Liang

Current LCLS Status & Plans

Mike Dunne

LCLS Director

February 6th 2025

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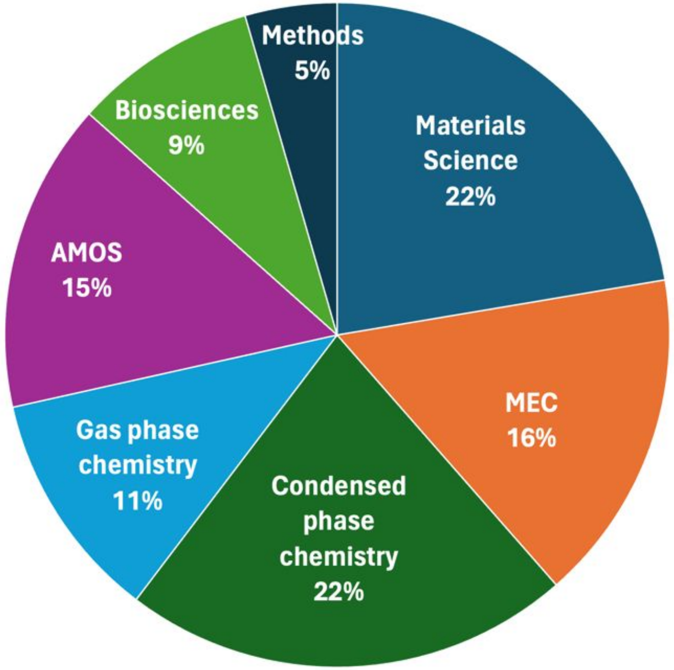
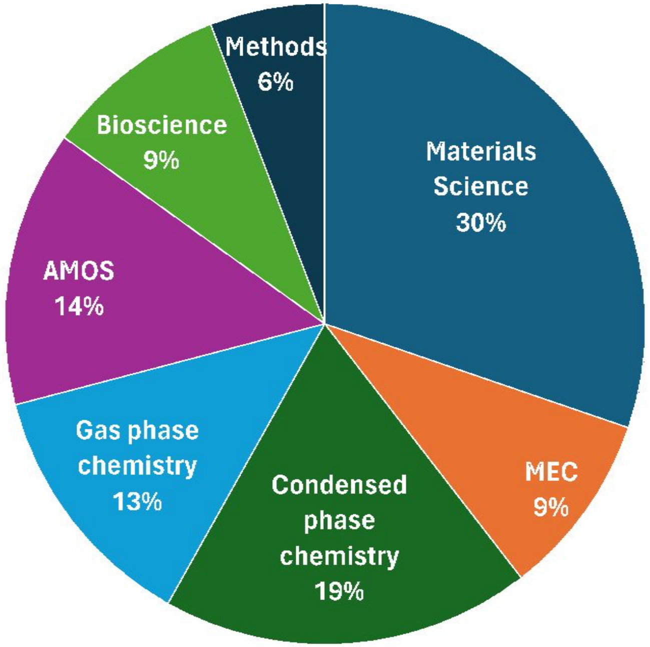
Recent proposal statistics

Split by science area

Run 23

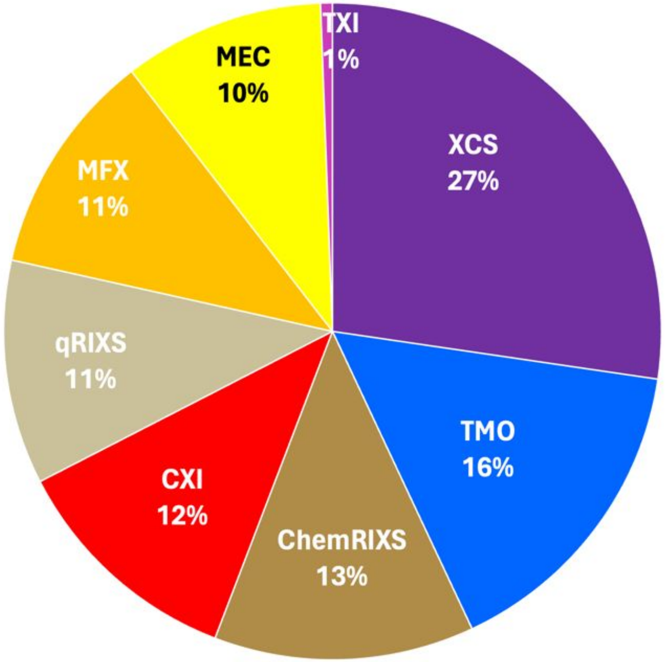


Run 24



Split by instrument

Run 24



158 proposals for Run 24 (March – July 2025)

152 proposals for Run 23 (Aug 24 – Mar 25)
177 proposals for Run 22 (Jan – July 2024)

Note:
XPP upgrade for LCLS-II-HE started in December!

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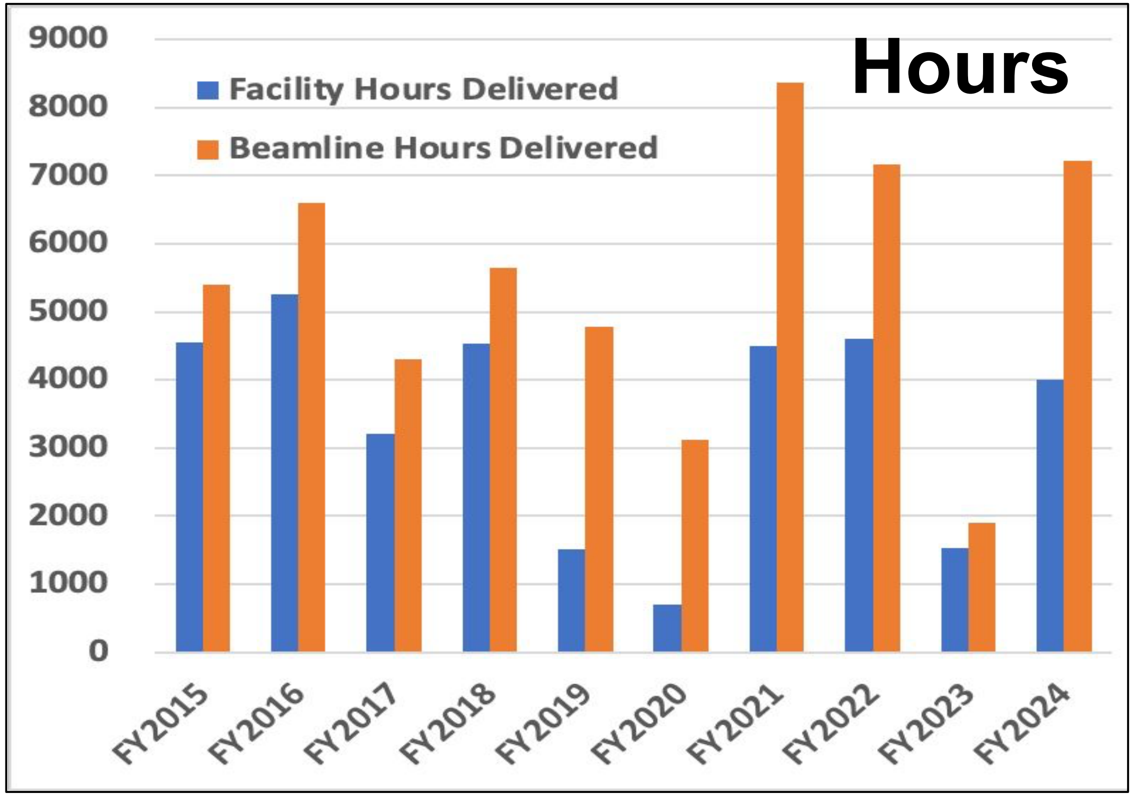
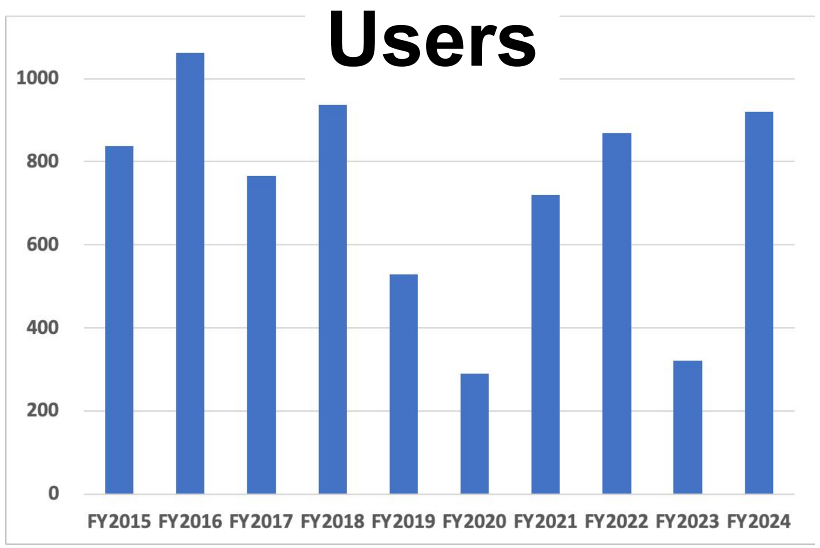
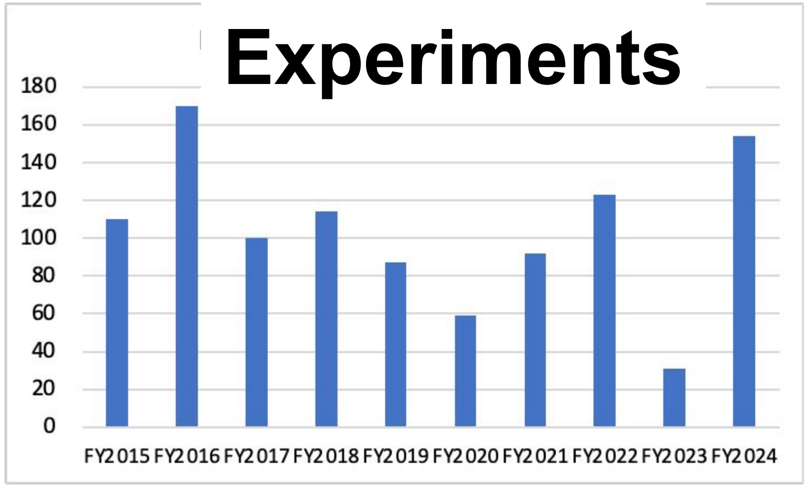
Growing chemistry and materials science, and continuing lower rate from biosciences

FY2024 was a productive year, with a return to the high levels of delivered hours and users seen in our peak historical years







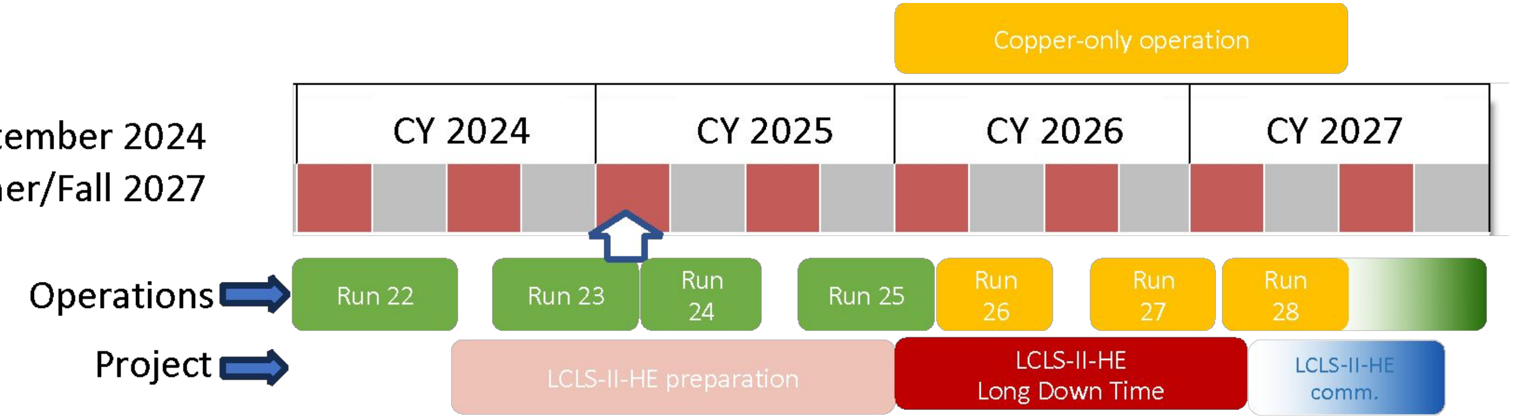
- FY24: **920** unique users (37% remote) for **154** experiments
- FY24 estimated annual publications at a high level (**203**)
- FY24 facility hours (**4005** = 3834 Cu + 171 SC)
- **FY25 planned** facility hours rises to **~7000** (4600 Cu + 2400 SC)

Facility status – SC-based FEL

- Highlights in Run 23 include sustained 8 kHz and sub-fs pulses (XLEAP)
- Increase of beam power limit **from 5 kW to 16 kW** for Run 24
  - Allows beam repetition-rate increase to 33 kHz and/or increased beam charge
  - Ongoing work to increase linac energy and improve beam emittance
- **Had to delay the restart of Run 23 in CY2025 due to vacuum leak in the SC linac gun**
  - Curtailed the final set of experiments in December
  - Invasive repair needed (multi-week) to replace a ceramic RF window
  - Restart is now underway
  - User science from 1 March to 17 March
- Recovered some beamtime by starting Run 24 early and finishing later
  - Run 24 (SC) 24 March to 20 July
  - Run 24 (NC) 27 March to 20 July

Update on LCLS-II-HE downtimes, and impact on LCLS operations

LCLS-II-HE Project Baseline: September 2024
First Light: Summer/Fall 2027



An extended shutdown of the SC linac is needed (12 to 15 months)

- **Timing** of the Long Down Time (LDT) is driven by :
  1. LCLS-II-HE **Project readiness** for construction and installation work
  2. LCLS-SC **beam commissioning** to meet pre-determined performance goals (to reduce risk to HE)
  3. Delivery of LCLS-SC **user science program** (TMO, ChemRIXS, qRIXS)
- **Start of LDT deferred to January 2026** to allow additional time for beam ramping and user science
- **Run 25**
  - Cu linac (hard X-ray) users: 2 Sept 2025 to 31 Jan 2026
  - SC linac (soft X-ray) users: 15 Sept 2025 to 19 Dec 2025
  - With the limited beamtime to SC users, we will ask the PRP to provide particular attention to "*issues of programmatic and community diversity, access to new instruments*" to help ensure overall balance

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Summary of highlights for Run 25

- Operation of **SC linac** at nominal 33 kHz (potential for higher rep-rate at constant power)
  - TMO-MRCO/MBES <u>and</u> TMO-DREAM
  - ChemRIXS with new high throughput SVLS spectrometer and upgraded detectors
  - qRIXS
- Performance of **Cu linac** expected to enable 20-25 keV (previously 18keV limit)
  - XCS, MFX, CXI, MEC
  - XPP not available due to upgrade for LCLS-II-HE
    - Transition of user science to XCS: please consult with the instrument science team!
- New Dataset and Screening (DC&S) proposal mechanism (1-2 shifts) to be treated separately to full-scale proposals

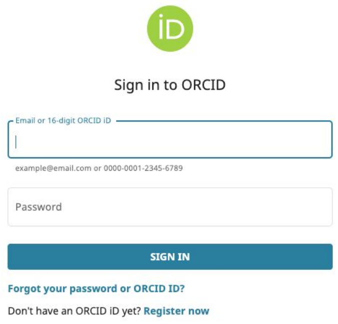
Universal Proposal System (UPS)

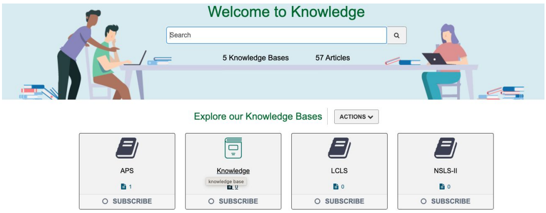
Paul Jones https://orcid.org/0000-0001-7538-4238

Leilani Conradson https://orcid.org/0000-0002-4261-7135

February 6th 2025

What To Expect





Logging In

Authenticate into the system via your ORCiD credentials

Do not request a new ORCiD if you already have one - please use your existing ORCiD

Profile

Your UPS profile data is private and protected

Demographic data will only be used in aggregate

You decide how much info to share

Knowledge Base

Under development - over time this will provide answers to FAQs

Fully searchable resources at your fingertips

Dashboards

Configurability to put information from your most-used facilities front and center

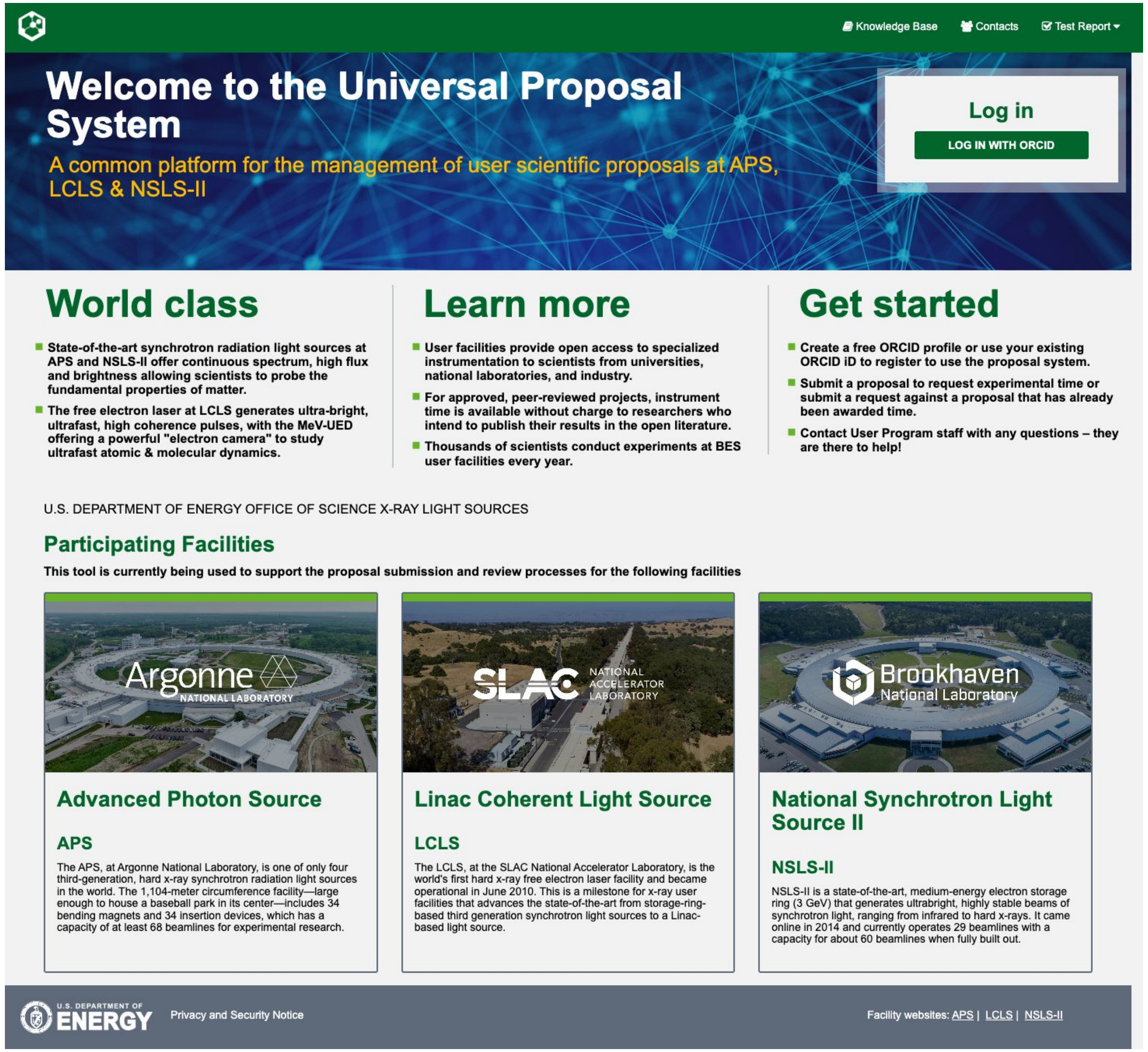
Important Notes

- **<u>ALL members of the proposal team PIs, Co-PIs and Co-Proposers must register in UPS</u>**
- Members of the proposal team can collaborate on draft proposals - once submitted, proposals cannot be edited
- Proposals not submitted by the submission deadline will be archived - they can be viewed, but not edited or re-used

Useful Resources:

- Register / Login to UPS: https://ups.servicenowservices.com/ups
- Further information and tutorial video: https://lcls.slac.stanford.edu/user-resources/proposals/universal-proposal-system-ups
- Contact the User Office with questions: lcls-user-office@slac.stanford.edu

Do not wait until the last minute to submit!



Need Help?

Universal Proposal System “Office Hours”

Date	Time
February 12, 2025	9:30 am Pacific Time
February 19, 2025	9:30 am Pacific Time
February 25, 2025	9:30 am Pacific Time
March 3, 2025	9:00 am Pacific Time
March 3, 2025	12:00 pm Pacific Time

Zoom links at: https://lcls.slac.stanford.edu/news/lcls-run-25-call-proposals

LCLS UEC (User Executive Committee)

Silvia Pandolfi, UEC Vice Chair

February 6th, 2025

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LCLS UEC (what is the role of UEC?)

UEC is here to represent you!

UEC meets monthly with LCLS Management

UEC communicates the needs and desires of users regarding:

- LCLS operating policies and use of LCLS
- user support
- other issues of concern to users

UEC assigns LCLS awards during the User Meeting

Current Members of UEC & meeting Minutes: https://lcls.slac.stanford.edu/lclsuo

Upcoming user meeting

2025 LCLS/SSRL Users' Meeting: 22nd-26th September

Call for User Meeting Workshops is open (until March 28th)!

https://forms.gle/qdUjAWTWynLLQ5sE6

Please feel free to contact the LCLS UEC members with any suggestions or questions!

E-mail suggestions to

LCLS UEC lcls-uec@slac.stanford.edu

or

User Office (lcls-user-office@slac.stanford.edu)

LCLS Run 25 Users Town Hall
Dataset Collection & Screening

Sandra Mous

February 6th, 2025

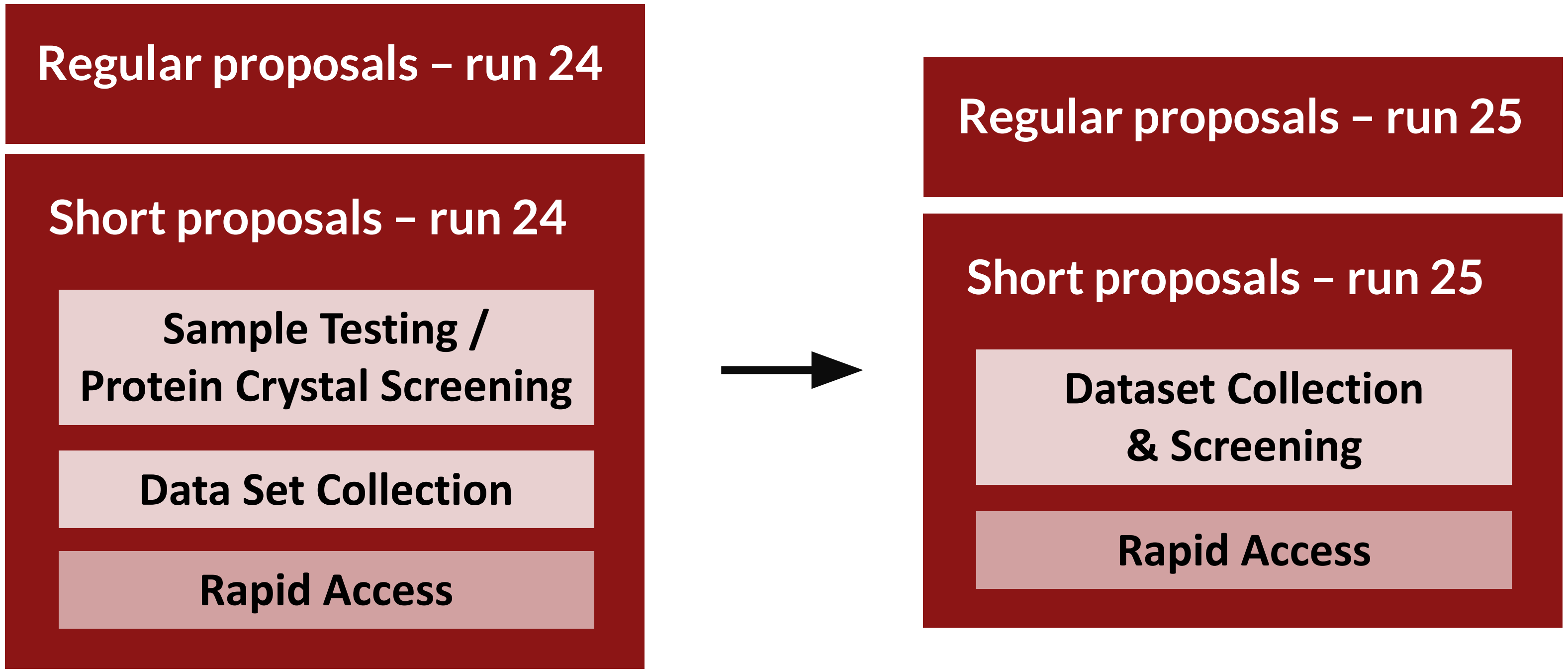
LCLS Short Proposal Program

- Offered alongside regular LCLS proposals

- Access mechanisms offered in the LCLS Run 24 Short Proposal Program:
  - **Sample Testing** (or Protein Crystal Screening - PCS): ideal for new user groups to gain first experience with XFEL beamtime and obtain preliminary results
  - **Data Set Collection**: enables user groups to complete data collection or test mature projects with a limited amount of beamtime (up to 24 hours)
  - **Rapid Access**: for time-sensitive experiments, provides short-term scheduling and rapid turnaround

Unifying modes of access to LCLS

- Merging some of the short proposal programs simplifies the modes of access to LCLS
  - **Dataset Collection & Screening**: short beamtime for testing or collecting a dataset using standard configuration
  - **Rapid Access**: rolling review and short-term scheduling



Overview of changes to the program

- **Experimental requirements**: DC&S proposals will need to make use of a standard configuration already in place for a regular LCLS experiment to maximize the throughput of an existing set-up
  - A list of select hard X-ray configurations has been made available in the call for proposals
  - DC&S proposals will not be carried over if a suitable configuration is not available
  - To apply for a short amount of beamtime using a non-standard configuration (or configurations not listed in the call for DC&S proposals), users will be asked to submit a regular proposal
- **Proposal templates**: user groups are asked to make use of the templates provided in the proposal call
  - The template addresses key review criteria
- **Alignment of submission deadline**: DC&S proposals are due at the same time as regular proposals
- **Concurrent review**: DC&S proposals are reviewed by the PRP at the same time as regular proposals
  - This helps ensure proposals are reviewed on time for scheduling considerations
- **Ranking**: DC&S proposals will be ranked separately from regular proposals
  - Acceptance is dependent on the available shifts and set-ups and may not strictly reflect the PRP ranking

Availability

- Scientific areas
  - Biology
  - Materials Science
  - Solution Phase Chemistry and Biochemistry
  - Gas Phase Photochemistry
  - Matter in Extreme Conditions
- Frequently deployed configurations <u>only</u>
  - XCS: horizontal liquid jet for solution scattering and hard X-ray spectroscopy
  - MFX: horizontal liquid jet for solution scattering or crystallography
  - MFX: droplet-on-tape for crystallography
  - MFX: fixed targets in air
  - CXI: liquid jet in the micron-focus chamber (no pump laser)
  - CXI: gas phase scattering in the micron-focus chamber with 200 nm or 266 nm pump laser
  - MEC: X-ray diffraction with uniaxial compression
  - MEC: X-ray imaging with long pulse laser side irradiation

Contact information

- Questions or feedback?

    → Please reach out to Sandra Mous (smous@slac.stanford.edu) or respective instrument lead

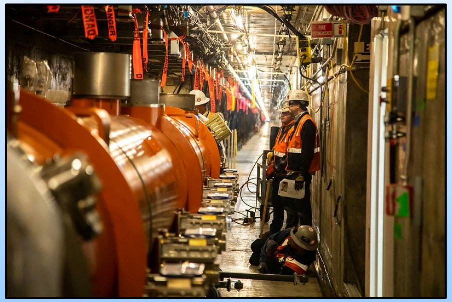
LCLS Run 25 Users Town Hall
Accelerator Update

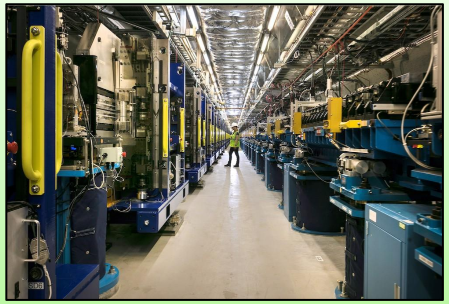
Axel Brachmann, Tim Maxwell, Yuantao Ding

February 6th, 2025

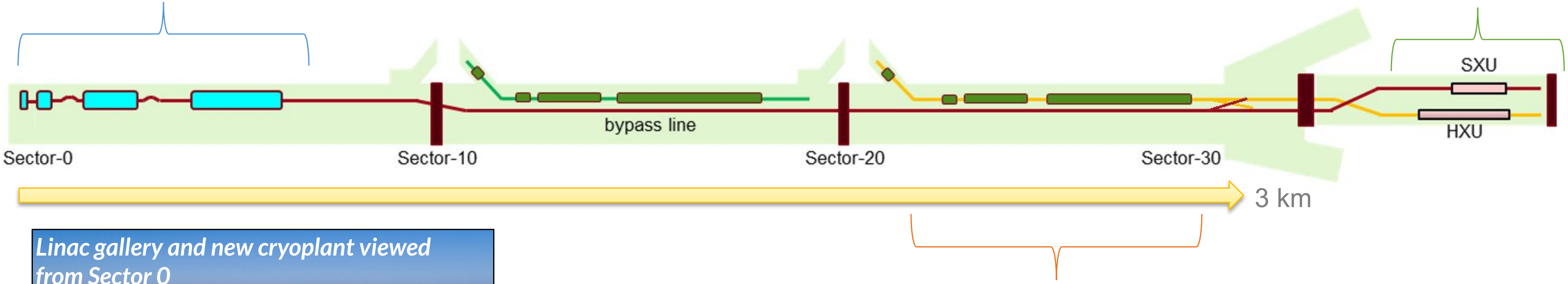
LCLS NC/SC Linac FEL Complex

Superconducting Linac
4 GeV,
High rep rate, CW RF



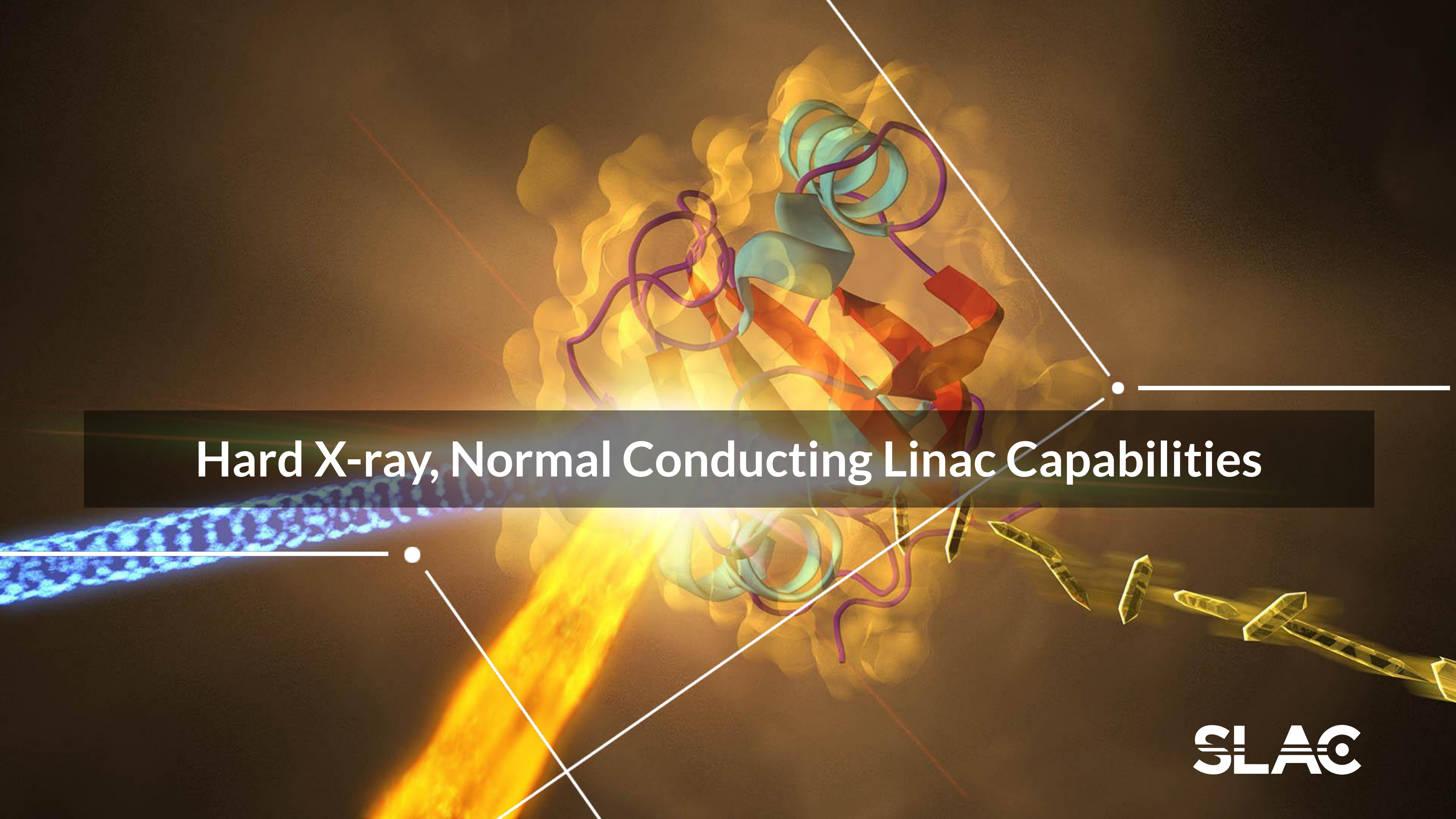


Soft and Hard X-ray Variable Gap Undulators (VGUs)



Normal Conducting Linac
3.5-17 GeV,
120 Hz Pulsed RF

Hard X-ray, Normal Conducting Linac Capabilities



HXR single-pulse SASE w/ NC Linac

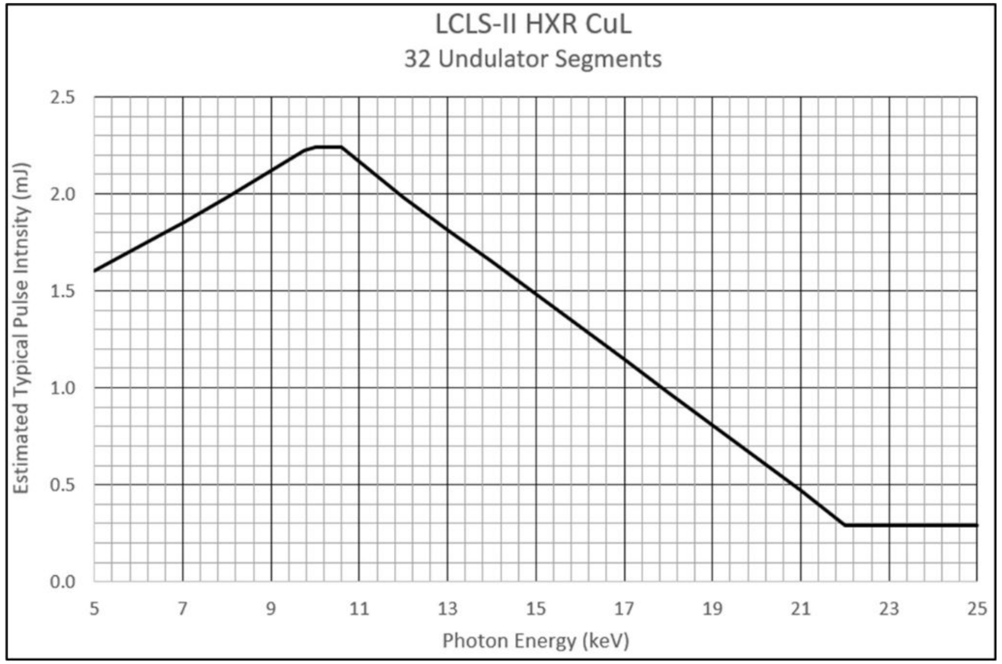
Beam Parameters	Symbol	Cu-HXU x-rays		Unit
		ω_{max}	ω_{min}	
Photon Energy	$\hbar\omega$	**25000**	**1000**	**eV**
Fundamental wavelength	λ_r	0.5	12.4	Å
Final linac e- energy	γmc^2	16.5	3.5	GeV
FEL 3-D gain length	L_G	4	1	m
Peak power	P	20	80	GW
Pulse duration range (FWHM)		10 – 50		fs
Nominal pulse duration (FWHM)	$\Delta\tau_f$	**~30**		**fs**
Max Pulse Energy*	U	**0.6**	**2**	**mJ**
Photons per pulse*	$N\gamma$	0.15	14	10^{12}
Peak brightness*	$B_{pk,\ SASE}$	7800	425	10^{30} §
Average brightness (120Hz)*	$\langle B\rangle$	280	16	10^{20} §
SASE bandwidth (FWHM)	$\Delta\omega/\omega$	30	2	eV
Photon source size (rms)	σ_s	8	20	µm
Photon far field divergence (FWHM)	$\Theta_{FWHM,x,\infty}$	1	12	µrad
Max. Beam Rate	φ_{FEL}	**120**		**Hz**
Avg. x-ray beam power	P_x	0.07	0.24	W
Linear Polarization (100%)	$\langle P\rangle$	Vertical		

*Assuming nominal duration and undulator strength

§Brightness units are photons/sec/mm^2/mrad^2/0.1%-BW

High photon energy (to 25 keV) and pulse energy (0.5-2mJ)

Varies w/ duration, energy, beamline transmission, etc.



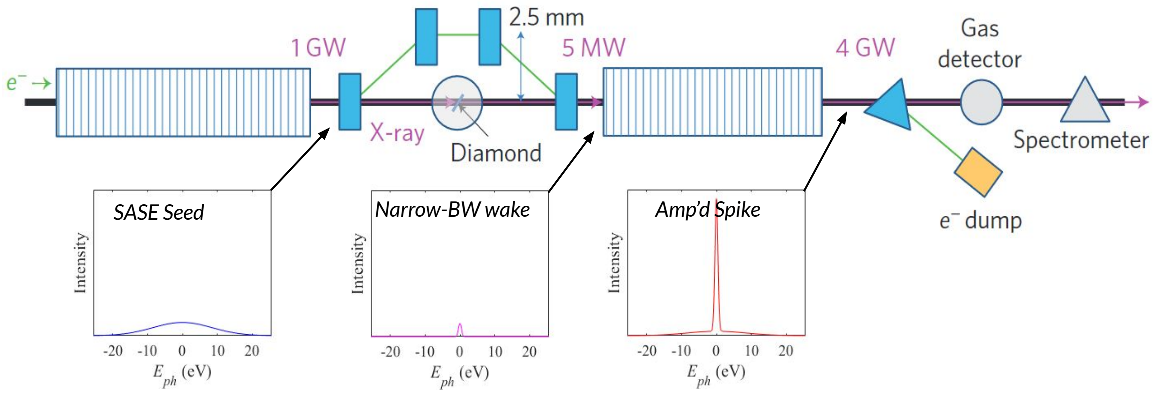
https://lcls.slac.stanford.edu/machine/parameters

Hard X-ray Self-Seeding (HXRSS)

Spectral brightness enhancement for narrow bandwidth experiments

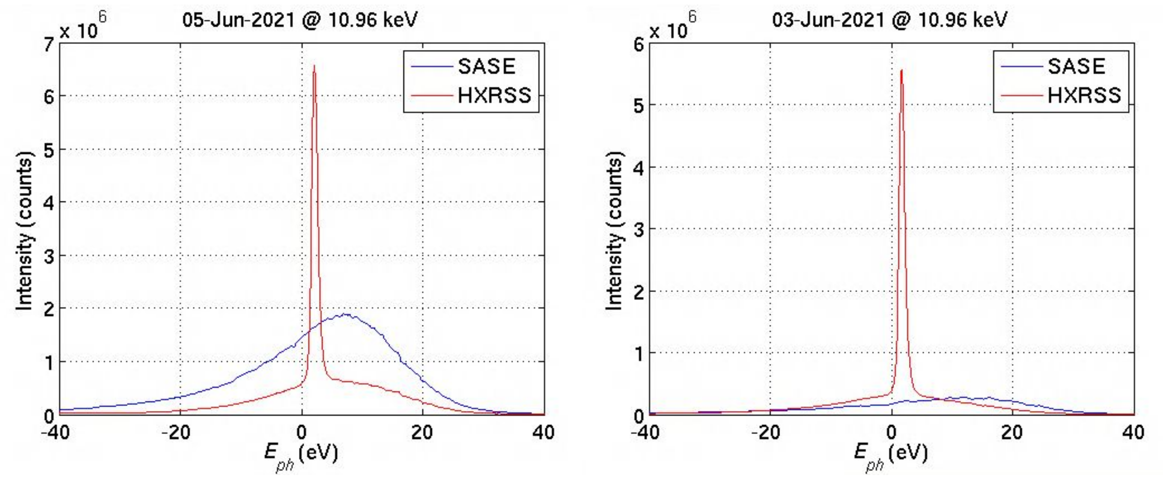
- Updated for LCLS-II *vertically* polarized HXU (90° rotation of crystal optics)
- 3-6x spectral brightness at sample vs. SASE

Photon energy	4.5 – 11 keV
Bandwidth (FWHM)	**0.35 – 1.5 eV**
Max pulse energy	0.2 – 0.5 mJ
Duration	30 fs



Initial SASE passes diamond wake monochromator, narrow BW amplified in 2nd half of undulator

Full SASE vs. HXRSS average spectra at 11 keV

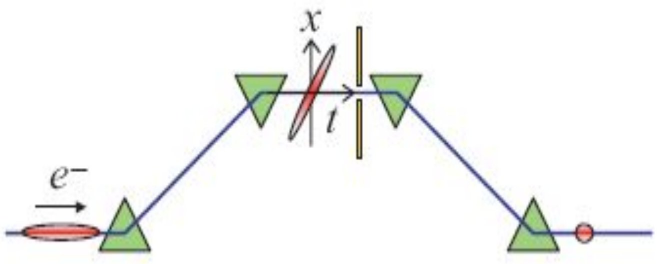


Short Pulses

- **~5-10 fs HXR pulses readily achievable** with corresponding reduction in pulse energy (change of charge, use of "slotted foil")

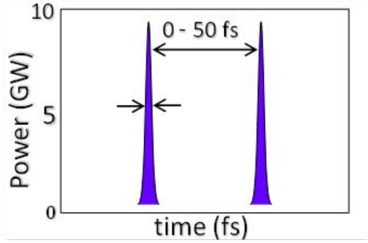
- Methods are available for **< 1 fs HXR pulses**, approaching single SASE spike limit

Technique	Min Pulse Duration	Energy/Pulse	single-spike rate
Slotted foil / optics / taper	400 as	5 uJ (76% fluct.)	65%
Non-linear bunch compression	200 as	10 uJ	45%
HXR XLEAP (experimental)			



Slotted foil inserted in beam to spoil lasing in time

Make short single or double pulses



Discuss special requirements with your LCLS POC

Advanced Multi-Pulse/Color Modes

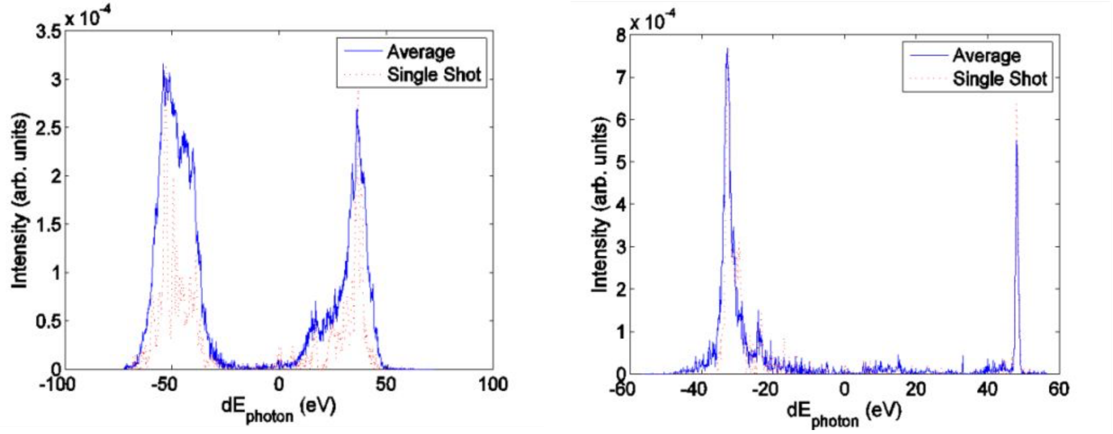
Multiple accelerator-based means for x-ray pump, x-ray probe on variety of time scales

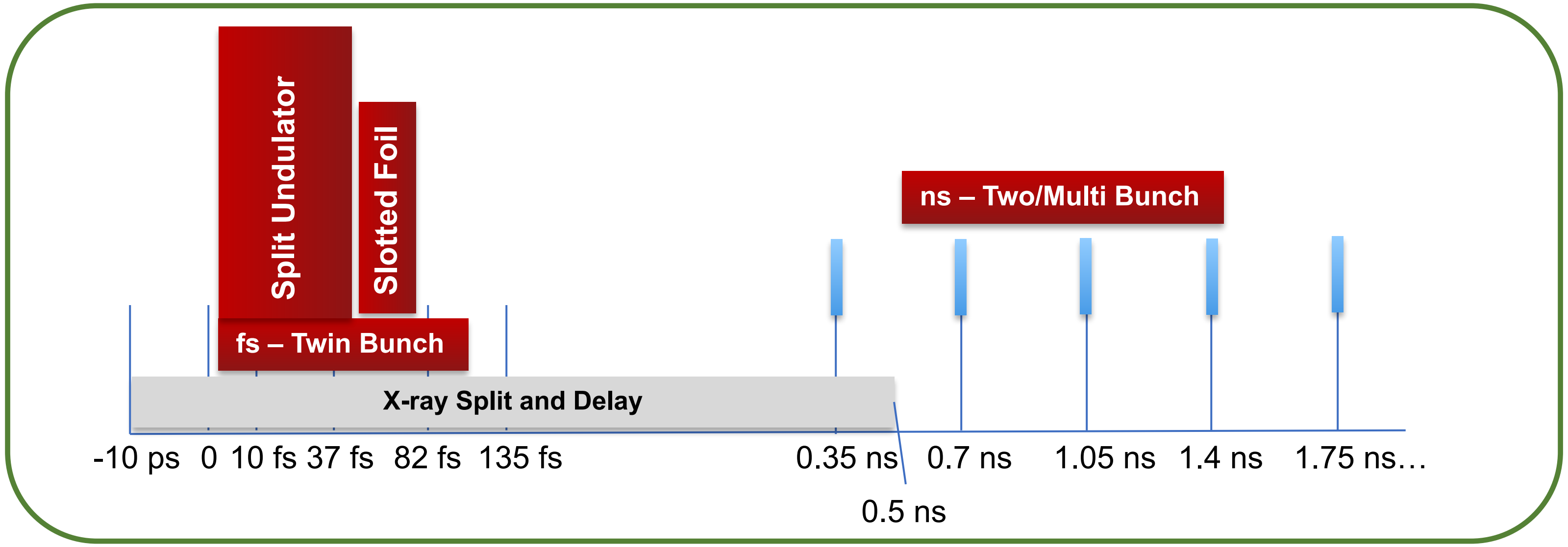
One electron bunch:

- Double slotted foil

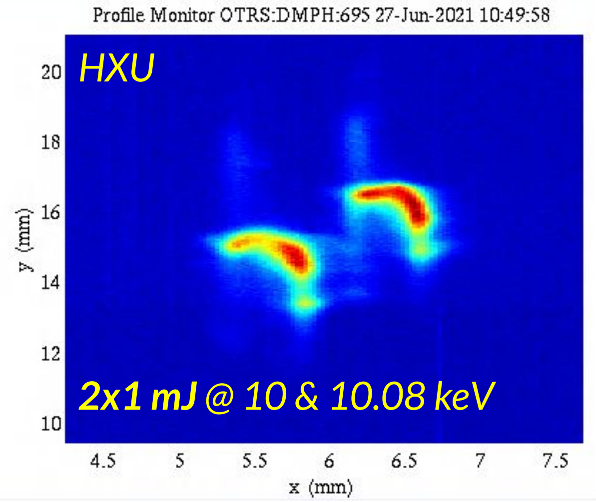
Two electron bunches:

- fs spacing: Injector laser pulse splitting ("twin bunches")
- ns spacing: Multiple laser pulses at cathode ("two/multi bunches")





Two-bunch XTCAV Images (ns spacing)



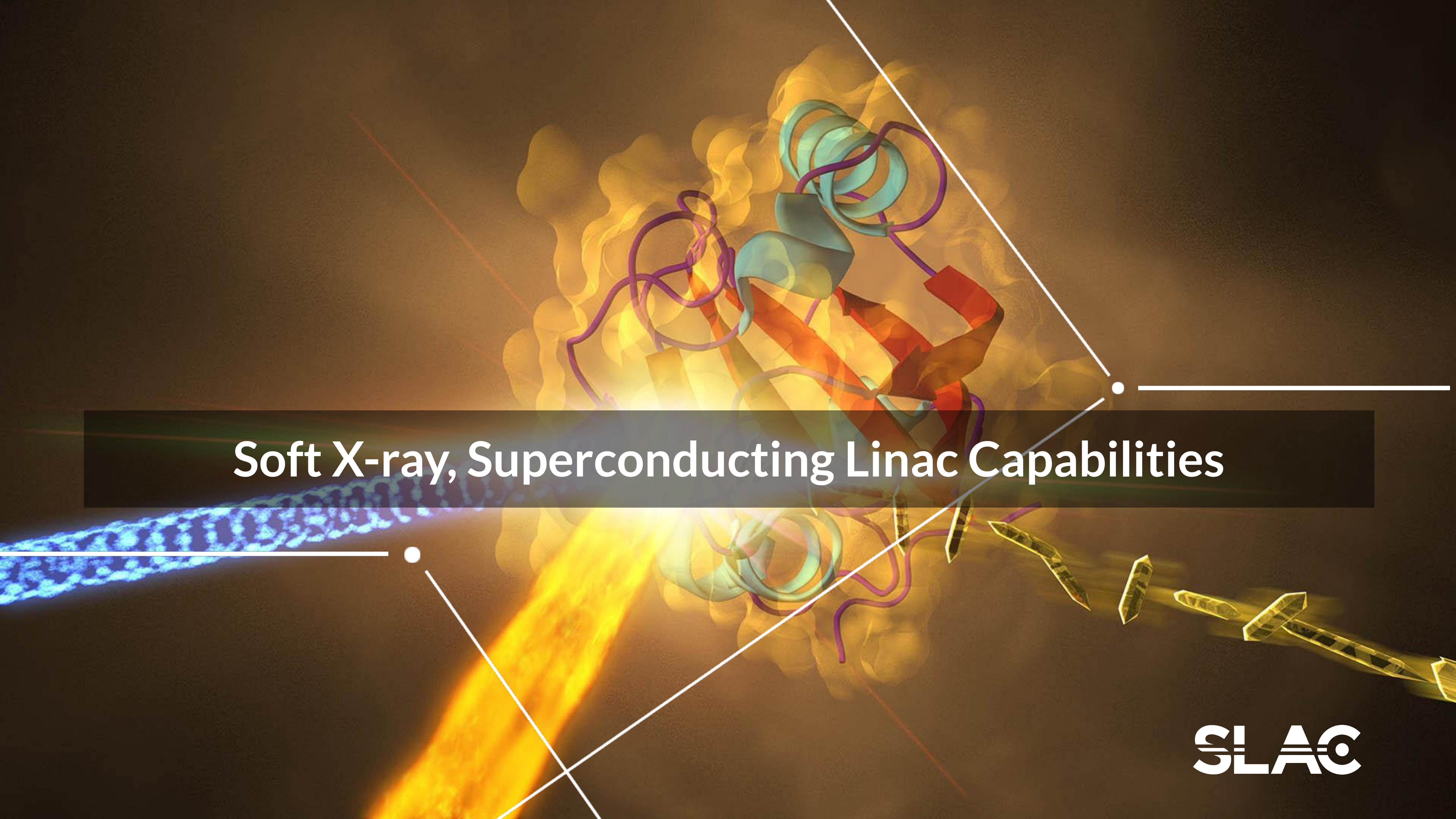
Advanced Multi-Pulse/Color Modes

Multiple accelerator-based means for x-ray pump, x-ray probe on variety of time scales

Technique	Pulse Separation	Pulse Duration	Energy Separation	Max Energy/Pulse
Split Undulator SASE	0 - 30 fs	15 fs	Up to factor 1.2 ratio in photon energies	40 uJ (25 fs pulse duration)
Double Slotted Foil	7-20 fs	~ 10 fs	+/-1.5%	100-200 uJ
Twin Bunches				
Two SASE Pulses	20 - 125 fs	~ 10 fs	0.2-2%	0.3 mJ (20 fs duration)
With slotted foil (shorter pulses)	+/- 50 fs	~5-10 fs	~2%	40 uJ
Two-(multiple) bunch				
Two bucket	350 ps increments, up to 120 ns	20 fs	~ 1%	0.5-1 mJ (30 fs duration SASE)
Multi bucket (4 or 8 bunches)	Two trains of 4 pulses. 700 ps between each pulse in the same train.	20 fs	~ 1%	To be tested

Discuss special requirements with your LCLS POC

Soft X-ray, Superconducting Linac Capabilities



SXR single-pulse SASE w/ SC Linac

Beam Parameters	Symbol	SC-SXU x-rays			Unit
		$h\omega_{max}$	$h\omega_{nominal}$	$h\omega_{min}$	
Photon Energy	$h\omega$	**1300**	**800**	**200**	**eV**
Fundamental wavelength	λ_r	9.5	15.5	62.0	Å
Final linac e- energy	γmc^2	3.5-4.0			GeV
FEL 3-D gain length	L_G	TBD			m
Peak power	P	3	2.5 - 7	8	GW
Pulse duration range (FWHM)		20 – 40			fs
Nominal pulse duration (FWHM)	$\Delta\tau_f$	**20**			**fs**
Max Pulse Energy*	U	**0.06**	**0.05 - 0.14**	**0.16**	**mJ**
Photons per pulse*	$N\gamma$	0.28	0.4 - 1.1	5.0	10^{12}
Peak brightness*	$B_{pk, SASE}$	20	8.6 - 24	1.7	10^{30} §
Average brightness* **(@33 kHz)**	$\langle B \rangle$	137	57 – 161	12	10^{20} §
SASE bandwidth (FWHM)	$\Delta\omega/\omega$	4	3	3	eV
Photon source size (rms)	σ_s	TBD			µm
Far field divergence (FWHM)	$\Theta_{FWHM,x,\infty}$	TBD			µrad
Max. Beam Rate	φ_{FEL}	1,000 – 40,000 **			Hz
Avg. x-ray beam power **(@33kHz)**	P_x	2.0	1.7-4.6	5.3	W
Linear Polarization (100%)	$\langle P \rangle$	**Horizontal**			

*Assuming nominal duration and undulator strength

§Brightness units are photons/sec/mm²/mrad²/0.1%-BW

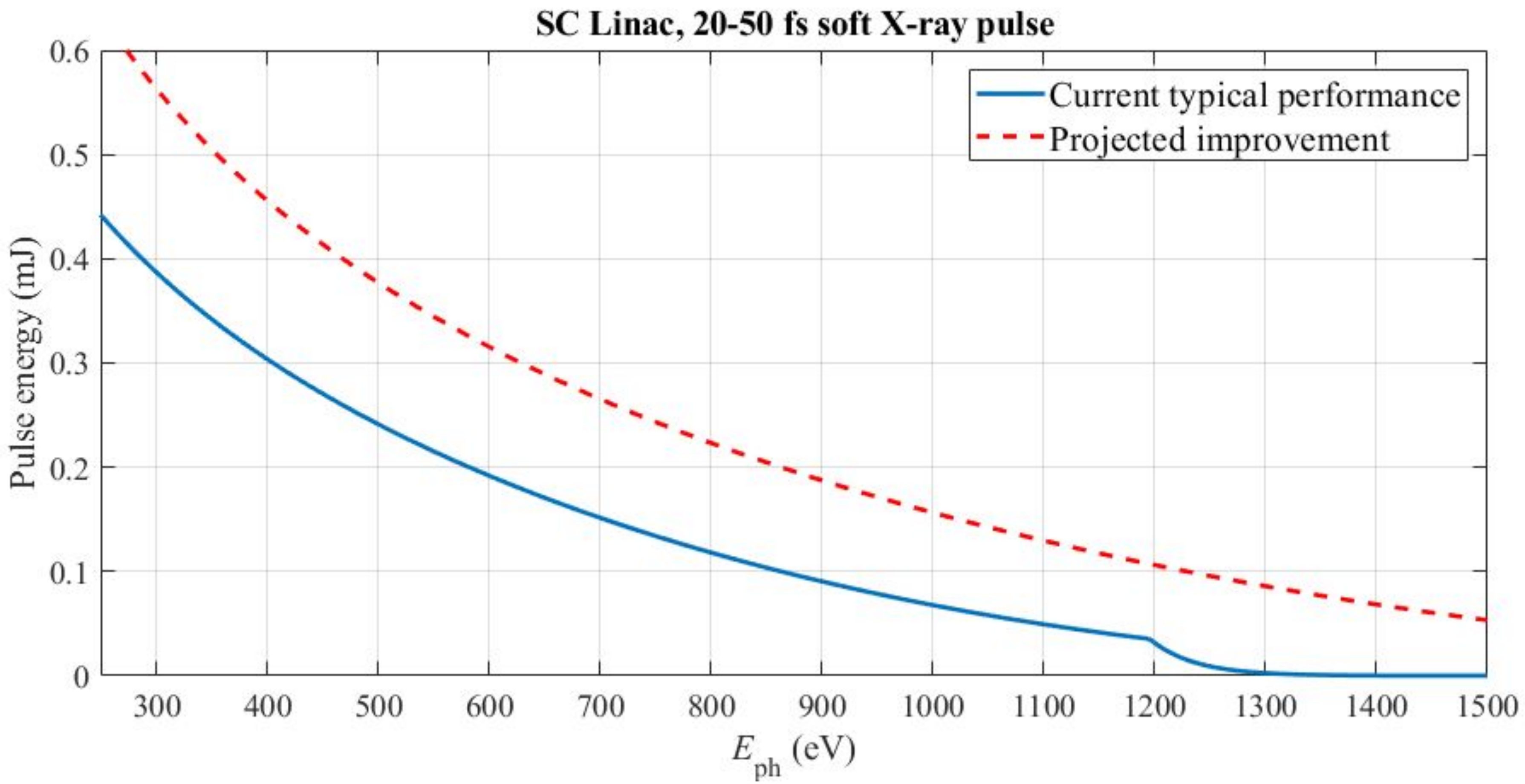
**** Highest rate will depend on accelerator protection and beamline acceptance**

Pulse energies of >100 µJ in <40 fs

https://lcls.slac.stanford.edu/machine/parameters

SC Linac Beam Quality Ramp Up

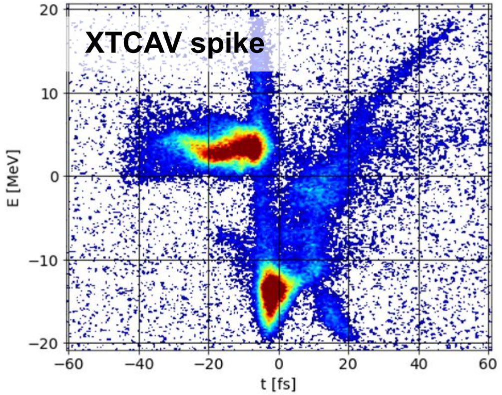
- Projected intensity has been achieved at *70 pC* in Run 23

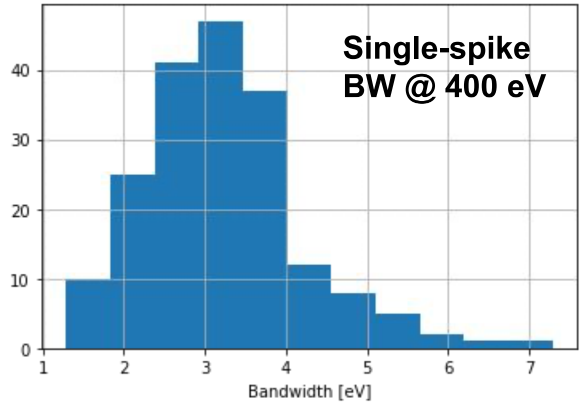


*** Projected SC linac parameters depend on optimization of initial demonstrated performance

Shorter Pulses

- Laser heater shaping (few fs pulses) and XLEAP (sub-fs pulses) demonstrated with NC Linac
- XLEAP capability *demonstrated* to 1 fs and better w/ SC linac





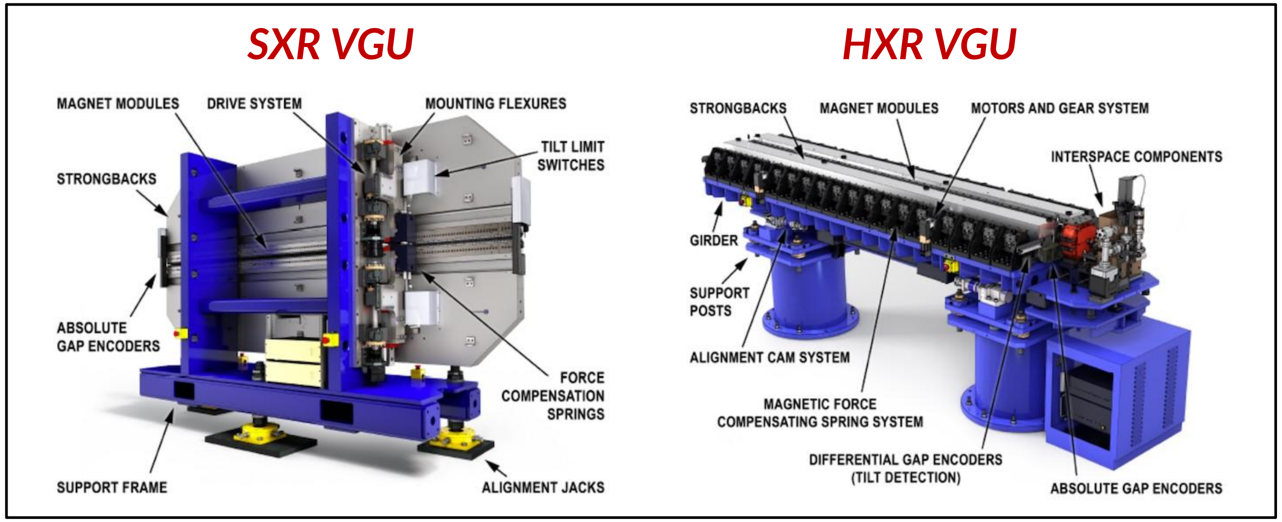
Technique	Min Pulse Duration	Linac (Max Rate)	Energy range	Energy/Pulse	Single Spike rate
Laser Heater Shaping	< 8 fs	SC (1 kHz+)	SXR	10-20 uJ	TBD
XLEAP	< 1 fs (TBD)	SC (1 kHz+)	SXR	TBD	TBD

fs and sub-fs pulses demonstrated w/ SC linac in Run 23

Photon Energy Scanning

Linac+Und	Mode	Energy delta	Speed/step	Notes
NC + HXR	Und Gap (coarse)	20%	seconds	Range is performance limited
	Vernier (fine)	1-2%	milliseconds	
SC + SXR	Und Gap (coarse)	50-100%	seconds	Range is performance limited
	Vernier (fine)	1-2%	milliseconds	(Tested, affects performance)

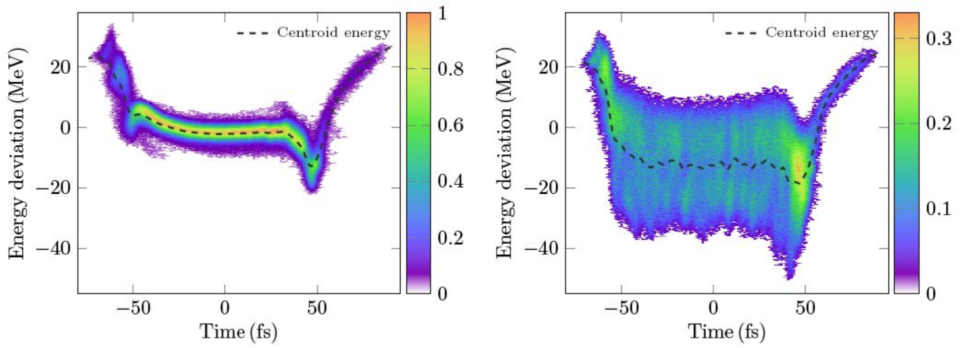
User control of photon energy scans ready and available via new variable gap undulators

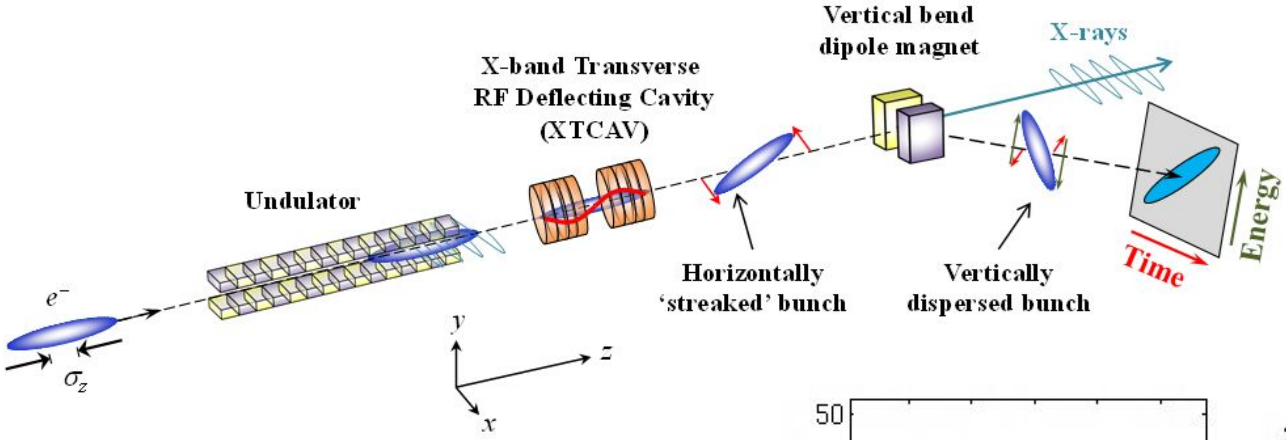


XTCAV: Femtosecond "streak camera" for e^- beam

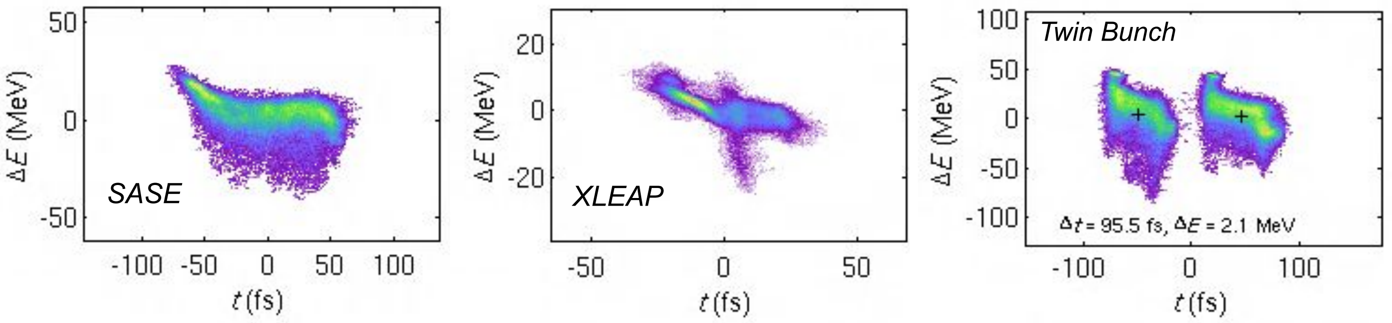
- 120 Hz images of e^- beam time-energy distribution
- Observe energy loss due to FEL, **calculate x-ray temporal profile shot-by-shot w/ fs resolution**
- Available for recording/analysis at beamlines in coordination with ACR

Lasing Off **Lasing On**





XTCAV available for both undulators *and* linacs in Run 25 (120 Hz max)



SLAC

SC Linac Summary

- **Rate:** Up to 33 kHz delivery over Run 25
- **Intensity/quality:** Continued improvement for lower charge/duration
- Special capabilities for Run 25:
  - **Photon energy scans**
  - **Short pulses** (fs to sub-fs)

Communication with the Accelerator Team

- Weekly 'User Meeting' with the ACR team:

  Wednesday before your experiment starts, share experiment background and summarize key x-ray parameters: photon energy, pulse energy, pulse length, other special conditions/requests important for FEL source requirements. (~10 min presentation each)

- LCLS POC is the conduit for communication with the Accelerator teams

Thank you and Good Luck

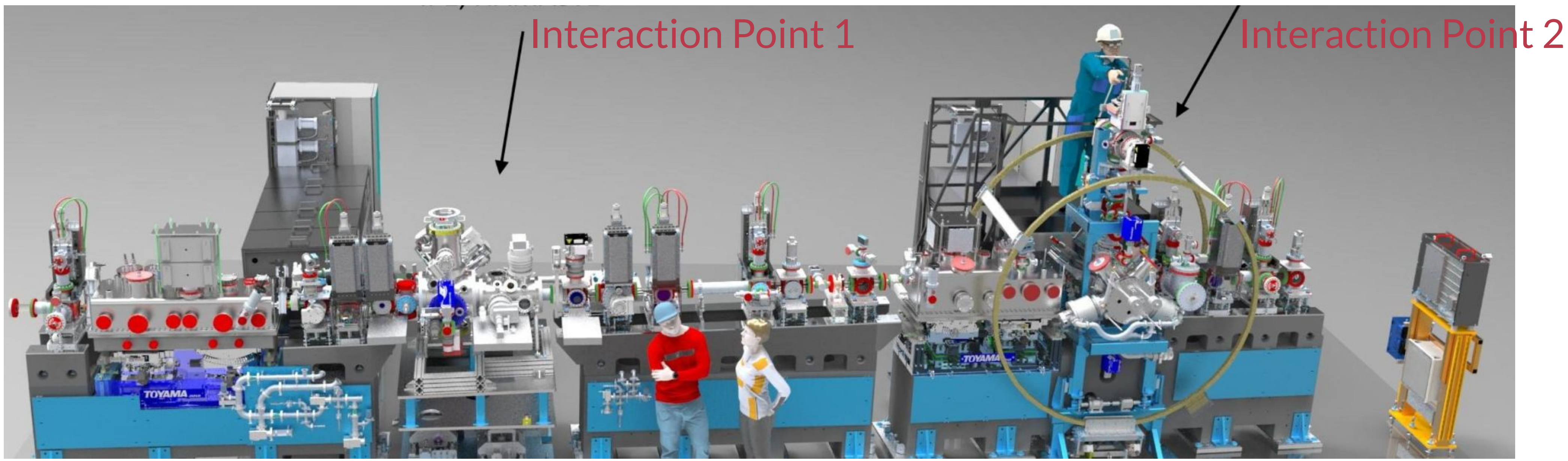
TMO in Run 25

LCLS Run 25 Users Town Hall

February 6th 2025

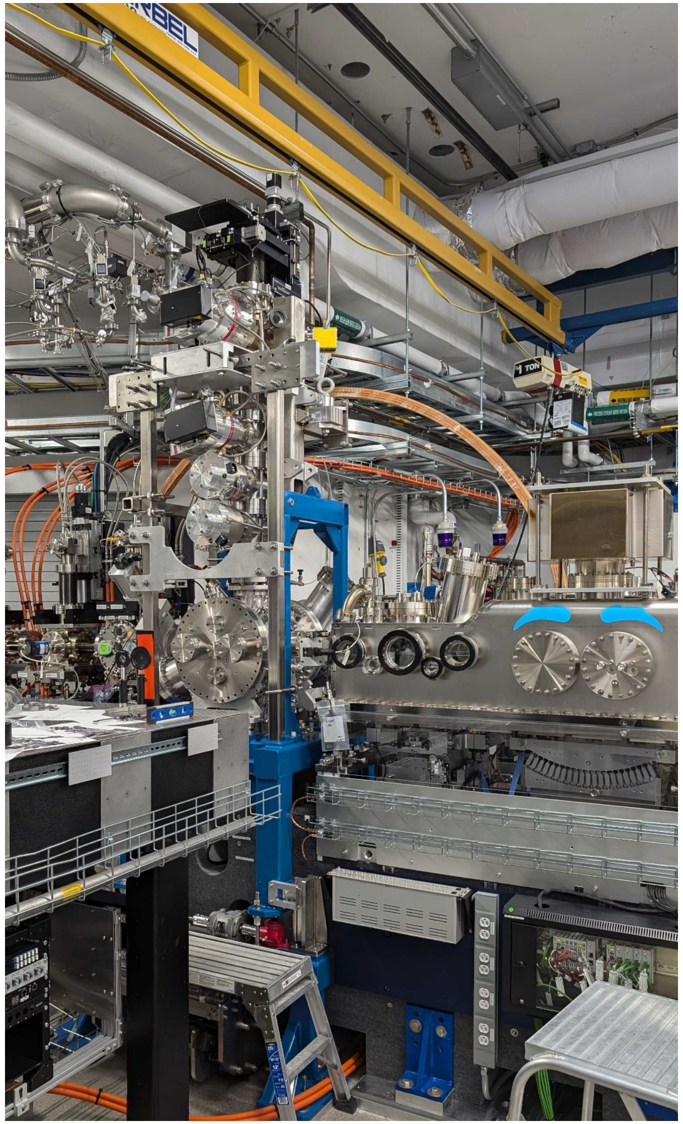
James Cryan and the TMO Team

TMO in Run 25



- We will offer a standard configuration for both IP1 (MRCO/MBES) and IP2 (DREAM)
    - Interaction points can not be operated simultaneously at this point.
    - We hope to develop this capability.
- Expect X-ray repetition rates up to 33 kHz (possibility to exceed)
- Atto/atto capabilities

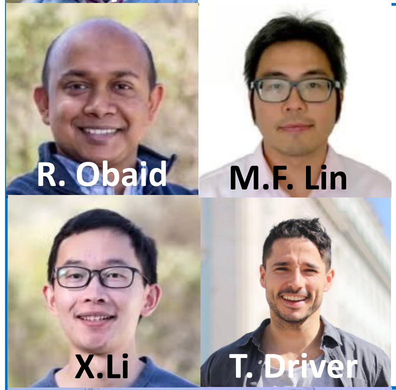
Dynamic REAction Microscope (DREAM)



- Assembly almost complete
- Plan for laser-only commissioning during remainder of Run 23.
- Bulk of X-ray commissioning during Run 24
- Early Science experiments at end of Run 24:
- Following Early Science, we will move into PRP experiments

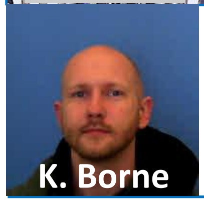
TMO Instrument Team @ LCLS

TMO Instrument Lead



TMO Instrument Scientists

TMO Laser Scientists



TMO Research Associates

TMO Engineering Team

TMO Area Manager and Support Team

TMO Controls Team

Graduate Students

SLAC

ChemRIXS in Run 25

LCLS Run 25 Users Town Hall

February 6th 2025

Kristjan Kunnus and the ChemRIXS Team

SLAC NATIONAL ACCELERATOR LABORATORY

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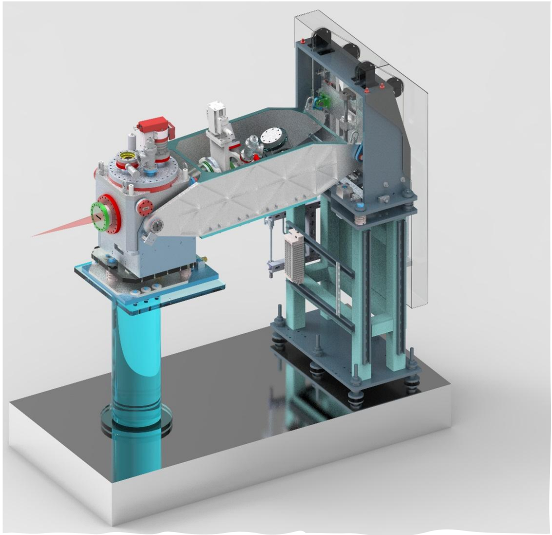
ChemRIXS Run 25 call

Liquid standard configuration

Liquid samples, sheet or round jets.

- Time-resolved XAS with monochromatic beam (scanning)
  - Transmission experiments (sheet jets)
  - Total Fluorescence Yield (TFY) mode
  - Partial Fluorescence Yield (PFY) mode
- Time-resolved RIXS/XES

Spectrometer upgrade:



Upgrades

We are planning to commission during Run 24:

- High throughput RIXS spectrometer.
- Improved transmission XAS capabilities (new detectors, dual-beam).

Non-standard configurations

- Please contact beamline scientist for:
  - Zero-order operation at high rep-rate (e.g. attosecond XLEAP experiments).
  - Solid samples or special sample delivery requirements.

ChemRIXS Run 25 key parameters

X-ray

Repetition rate (Hz)	Up to 33 kHz
Energy Range (eV)	250 - 1600 eV
Pulse Duration (fs)	20 fs (nominal, SASE)
Energy per pulse at the IP (monochromatic)	>100 nJ (250 - 1000 eV) >10 nJ (1000 - 1300 eV) >1 nJ (1300 - 1600 eV)
Beamline Resolving Power	>2000
Spot Size, FWHM (range)	10 - 1000 (um) diameter
Polarization	Linear, Horizontal

Laser

Repetition rate (Hz)	Synchronized up to 33 kHz				
Wavelength (fs)	800	400	266	480 - 600	600 - 900
Pulse Duration (fs)	20	30	35	<50	<50
Energy per pulse (μJ) (on target)	500	50	5	>15	>5
Spot Size, FWHM (800 nm)	50 to 100 μm				
Polarization	Variable: linear, circular				
Angle	~0.5 deg angle with x-ray beam				
Arrival Time Monitor	< 20 fs accuracy in x-ray/laser arrival time tagging should be available. Overall temporal resolution will be dependent on machine and instrument configuration.				

Please contact us for any questions
K. Kunnus
kristjan@slac.stanford.edu

qRIXS in Run 25

LCLS Run 25 Users Town Hall

February 6 2025

Georgi Dakovski and the qRIXS Team

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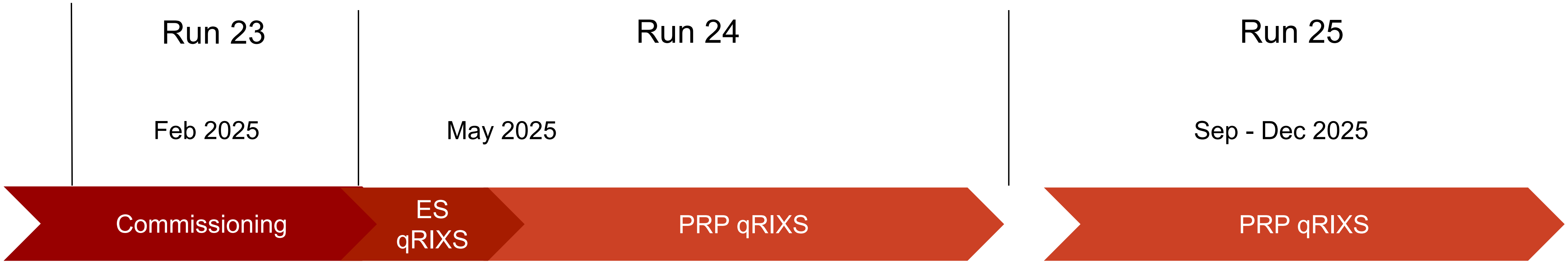
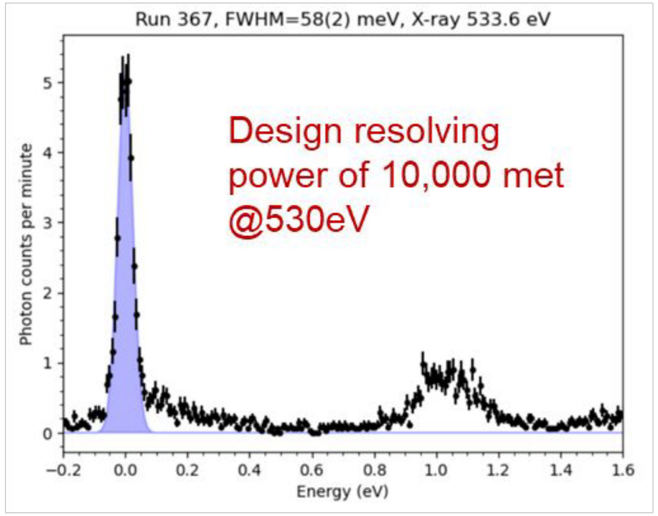
qRIXS Instrument: Notional timeline

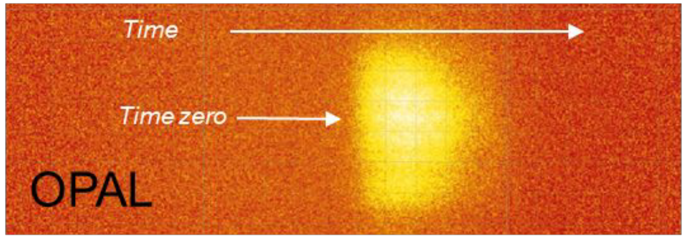


- qRIXS is installed; vacuum, motion and detectors are functioning
- Commissioning in Run 23 is underway
- Early Science phase will be scheduled for the beginning of Run 24, based on commissioning progress
  - For Users community engagement, please contact Apurva Mehta, mehta@slac.stanford.edu (Materials Science Department Head)
- The remainder of Run 24 and Run 25 will be for PRP experiments

qRIXS commissioning is underway

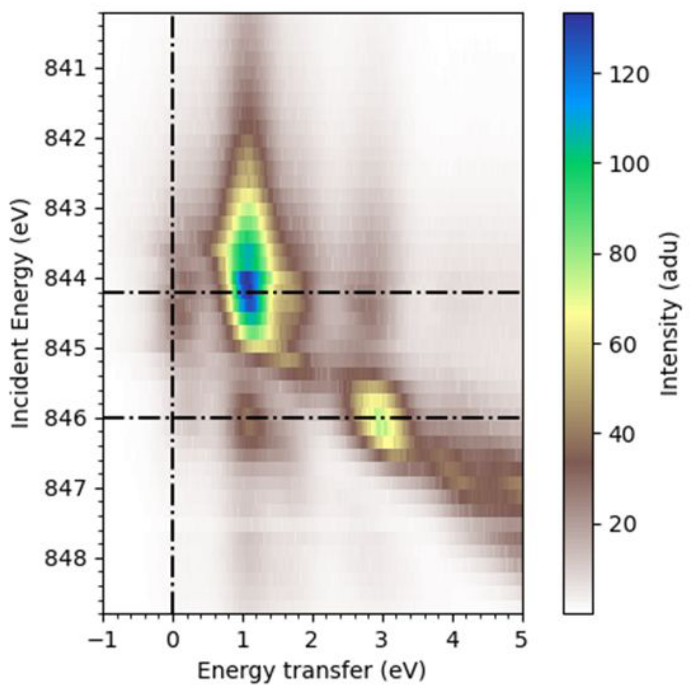


First Arrival Time Monitor results using SC & 1030nm beams



qRIXS began commissioning @8.3kHz, 400 – 930eV

Fast RIXS map of NiO at the Ni L_3 edge



Hard X-ray Instruments in Run 25

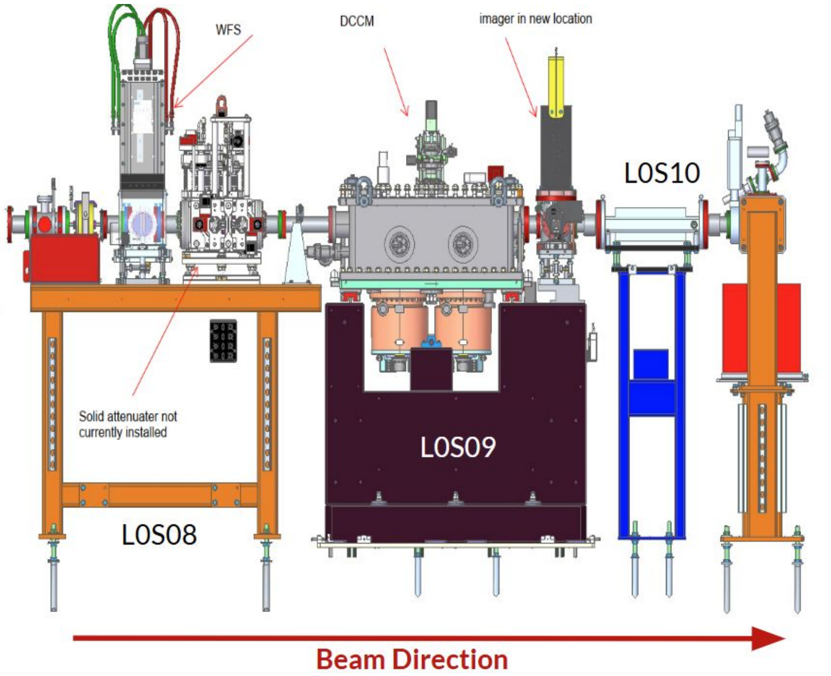
LCLS Run 25 Town Hall

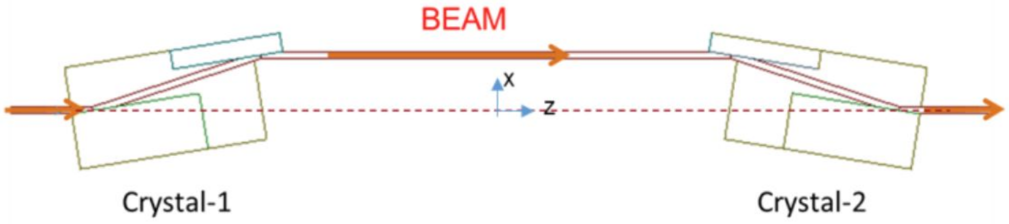
February 6 2025

Sebastien Boutet for all LCLS Hard X-ray
Instrument Team Members

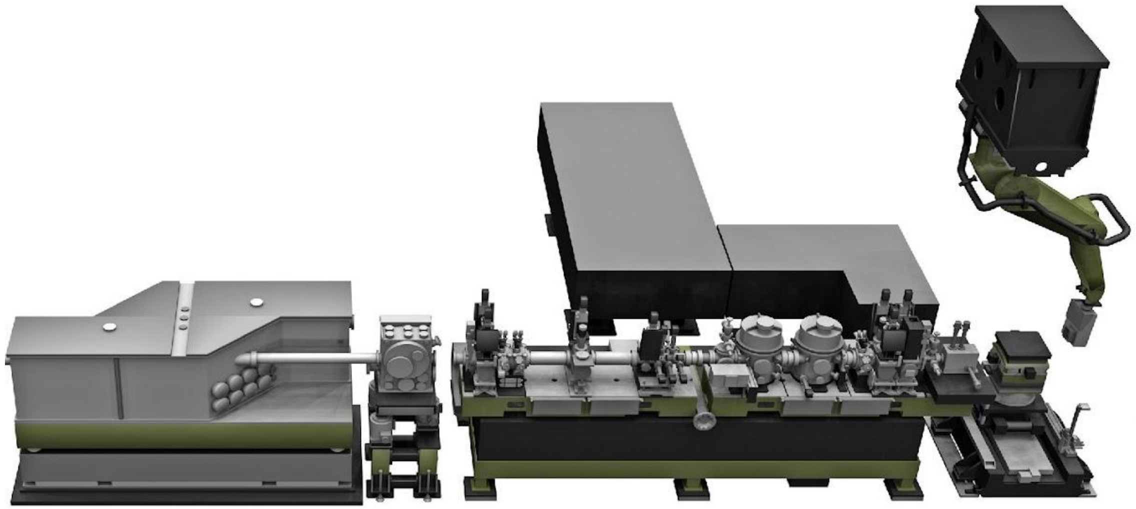
New Capability: DCCM in The FEE Will Be Available

- The Double channel-cut crystal monochromator (DCCM) is currently installed in the Front End Enclosure (FEE).
- Will be commissioned in Run 23 & 24
- Will be available to users for run 25.
- Can send monochromatic beam to the far hall.
    - ΔE/E of 1E-4
- Can be used to calibrate XRT spectrometer.
- **Can be used for XAS experiments.**





XPP (Not Available in Run 25)



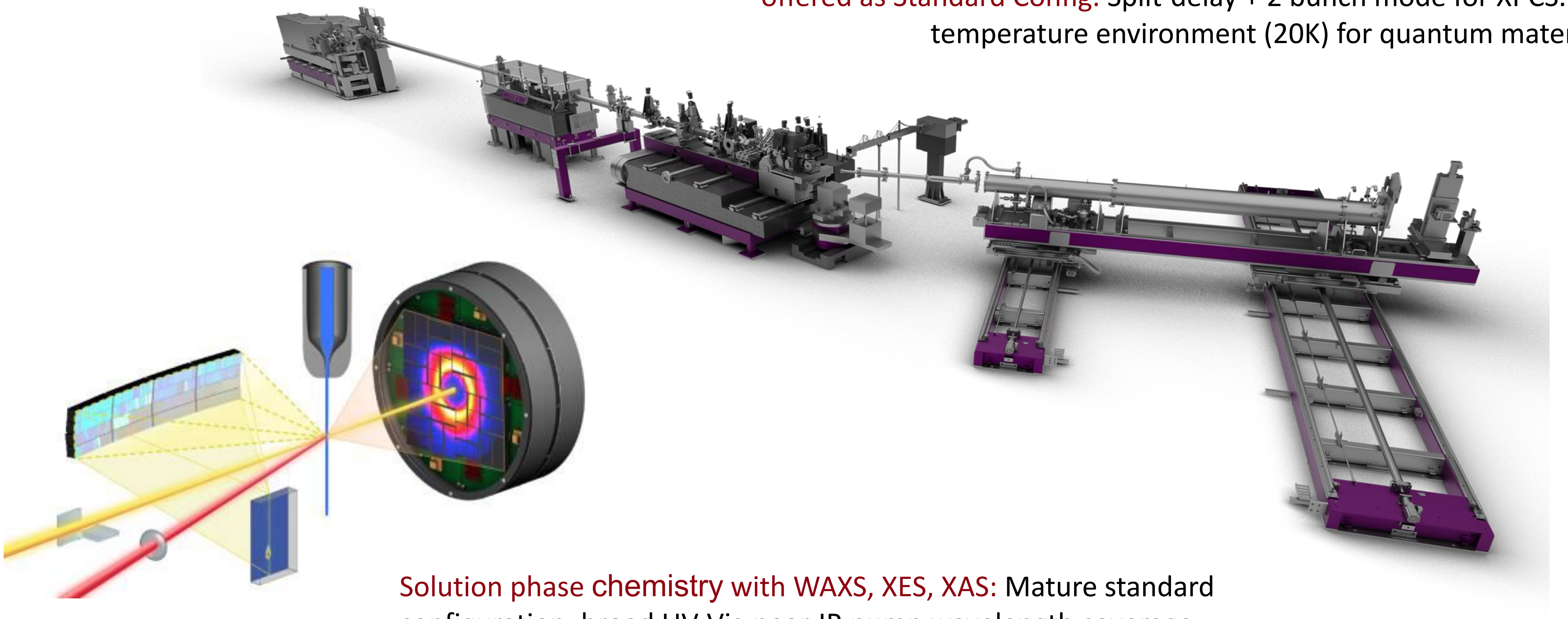
LCLS-II-HE Upgrade

- The XPP Instrument is not available for beamtime in Run 25
- It will be undergoing a rebuild for LCLS-II-HE
- Much of the capabilities of XPP are available at other Hard X-ray Instruments
- Please contact LCLS scientists to discuss how to best support your needs at other instruments

Instrument Lead: Takahiro Sato

XCS

Time-resolved coherent diffraction and small angle coherent scattering offered as Standard Config. Split-delay + 2 bunch mode for XPCS. Low temperature environment (20K) for quantum materials.

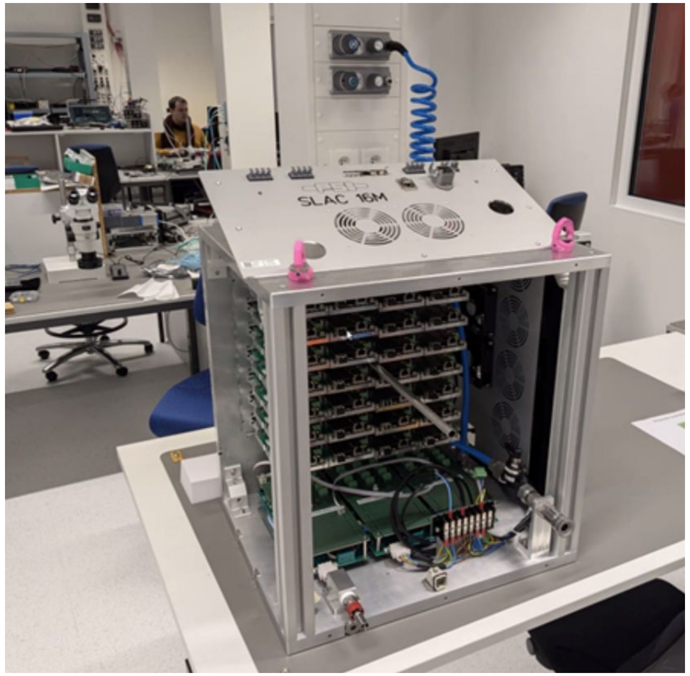


Solution phase chemistry with WAXS, XES, XAS: Mature standard configuration, broad UV-Vis-near-IR pump wavelength coverage. Enhanced suite of multi-crystal spectrometers.

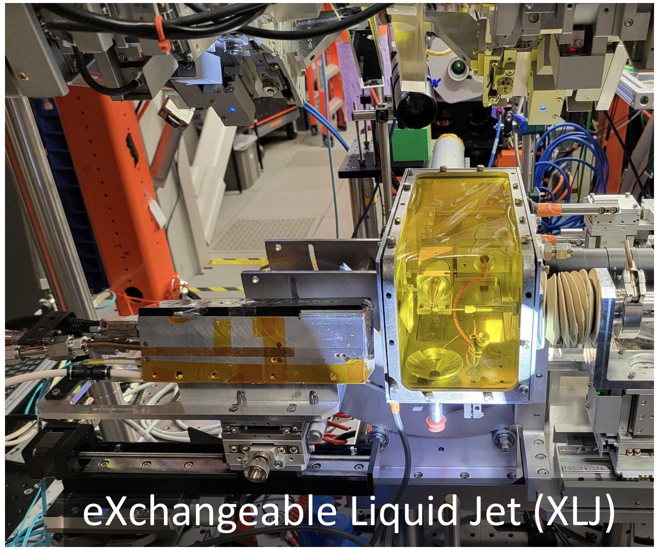
Instrument Lead: Matthieu Chollet

MFX

- **Key Capabilities**: Femtosecond Crystallography and time-resolved forward scattering (WAXS/SAXS).
- Femtosecond Pump Laser: Collinear incoupling geometry with wavelength coverage from UV to near IR.
- Jungfrau 15M: Fast large area detector to be commissioned in Run 24
- eXchangeable Liquid Jet Endstation: Helium environment horizontal and vertical jet sample delivery compatible with emission spectroscopy and forward scattering. Dedicated mutli crystal spectrometer. Compatible with collinear optical pump.
- Droplet on Demand: Semi-automated droplet delivery system with low sample consumption



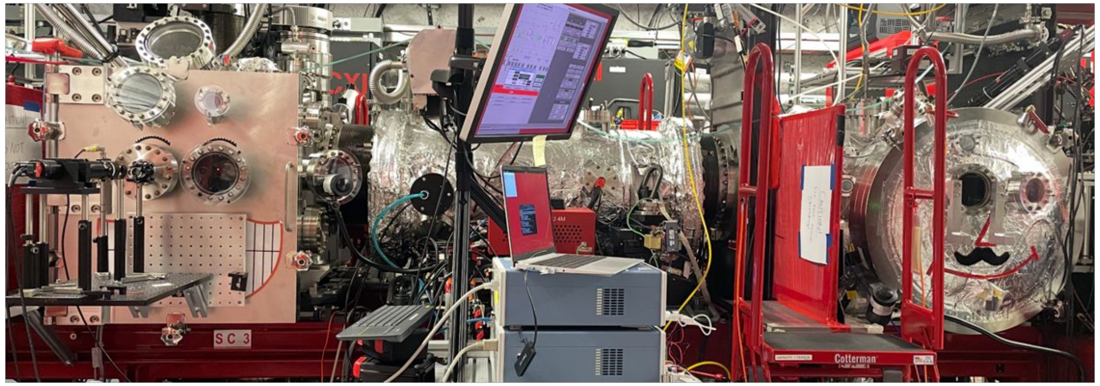
Jungfrau 15M

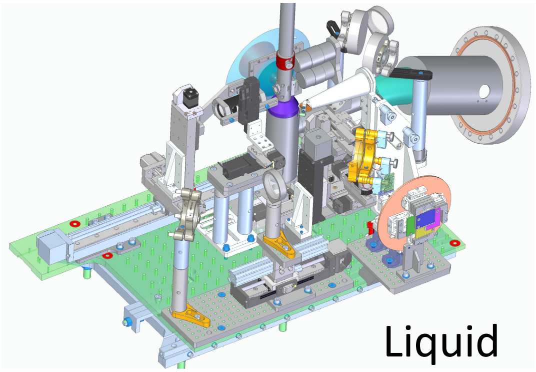


eXchangeable Liquid Jet (XLJ)

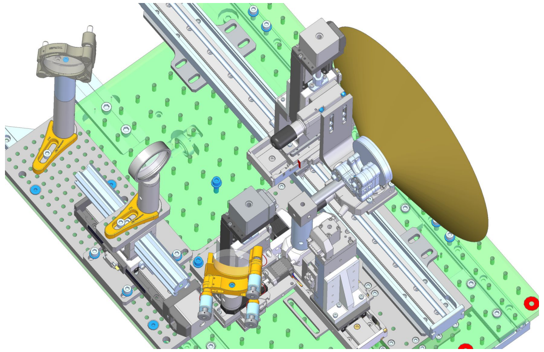
Instrument Lead: Leland Gee

CXI





Liquid jet



Gas cell

Serial Femtosecond Crystallography: variety of sample injection options from jets (GDVN, high-viscosity, MESH, mixing) to fixed target. High photon energy (18 keV) available for 0.8 Å resolution.

Gas Phase Photochemistry: In vacuum gas cell, short-pulse UV pump (<50fs), multisample gas exchange manifold.

Nanofocus for high field physics and nonlinear x-ray science: 100nm KB system allows reaching power density of 10^{20} W/cm^{2}. Improved nanofocus monitoring with wavefront sensor.

SLAC

Instrument Lead: Meng Liang

MEC

Discuss with the staff to evaluate the use of these capabilities for your experiment!

Long Pulse Laser

- Delivery of up to 100J in 10 ns on target
- Peak power of 10 GW for any temporal configuration
- Pulse shaping (e.g. flat top, ramp)
- CPP: 150, 300 and 600 μm

Short Pulse Laser

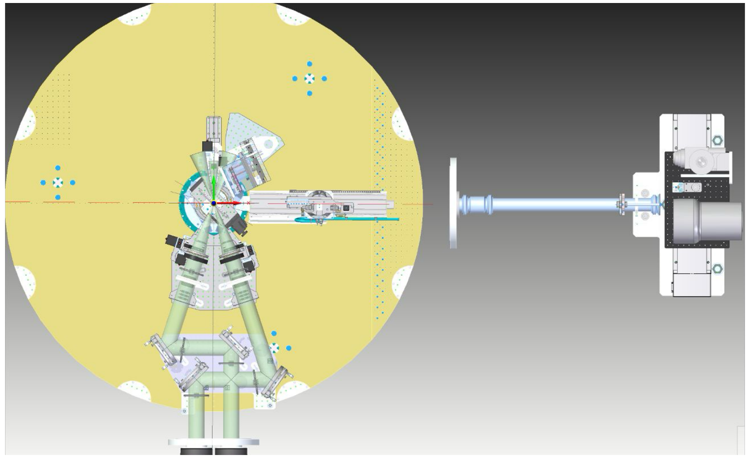
- Delivery of up to 1J in 45 fs at 800 nm, or 0.54J at 400 nm
- high intensity platform: peak intensity > 10^{19} W/cm^2
- at 800 nm, 45° angle of incidence allowed between high intensity mode and FEL
- low intensity platform: peak intensity << 10^{16} W/cm^2

Multiple submission avenues

- Regular PRP proposal
  - up to 50% towards Inertial Fusion Energy
  - about 50% standard configuration
- Data Set Collection
  - 1-2 shifts
  - no requirement for previous X-rays beamtimes
  - reviewed by PRP
- Rapid Access
  - VISAR only shots
  - can be submitted at any time during the year
  - reviewed by the MEC team

Std configurations

1. X-Ray Diffraction configuration with long pulse laser in collinear geometry (vs the FEL)
2. X-Ray Imaging geometry with Long Pulse Laser perpendicular to the FEL, X-Ray Diffraction with 1x ePix10k



Instrument Lead: Eric Galtier

TXI

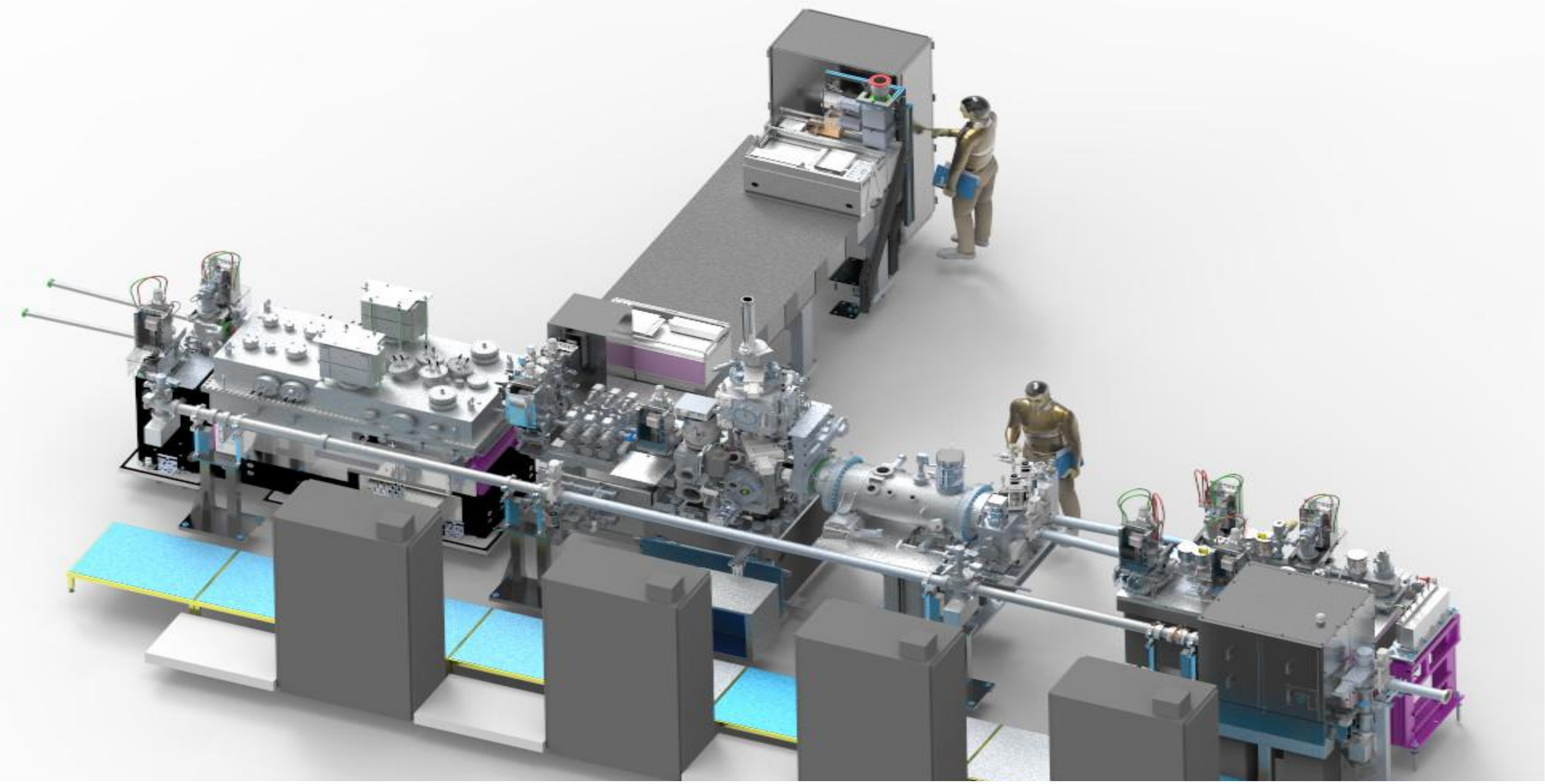
Run 25 | Run 26

~Nov 2025 | ~Feb 2026 | ~Mar 2026

Commissioning → ES TES → PRP TES

TXI commissioning: We will commission the Tender Spectroscopy Endstation as the first TXI capability, with Early Science planned for run 26.

Visit the breakout sessions/office hours for more details.



Instrument Lead: Andy Aquila

Data Systems

February 6th 2025

SLAC NATIONAL ACCELERATOR LABORATORY

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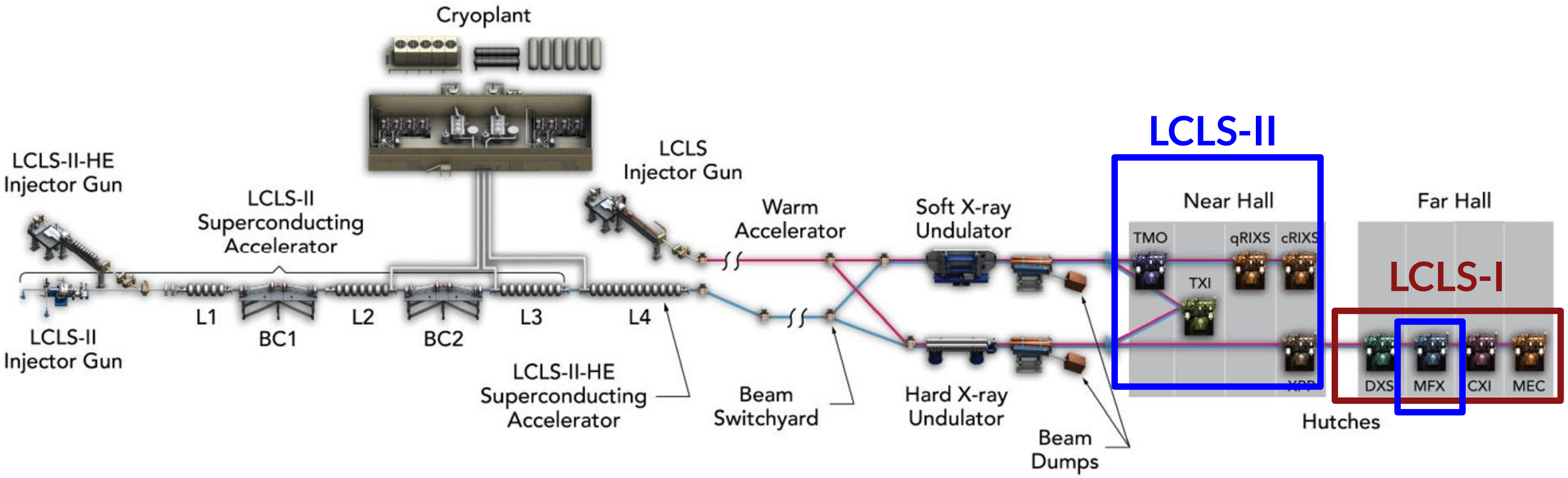
Reminder: LCLS-I and LCLS-II Use Different Data Systems

LCLS-I and LCLS-II have different DAQ, psana analysis framework, and AMI



LCLS-I is used for hard x-ray instruments **XCS, CXI, and MEC** - limited to 120 Hz and ~10 GB/s

LCLS-I psana analysis framework (psana) documentation: https://confluence.slac.stanford.edu/display/PSDM/LCLS+Data+Analysis

LCLS-II is used for the new instruments in **TMO, RIX, XPP, MFX** - up to 1 MHz and ~TB/s

LCLS-II psana analysis framework (psana2), documentation:

https://confluence.slac.stanford.edu/display/LCLSIIData/LCLS-II+Data+Acquisition+and+Analysis.

AMI2 available in TMO, RIX, XPP, and MFX: https://confluence.slac.stanford.edu/display/LCLSIIData/ami

What's new?

- MFX is moving to LCLS-II DAQ/analysis
- LCLS-I will begin supporting AMI2 to allow users to acclimate to the new online monitoring system, designed to handle the high rate demands of LCLS-II. Users can start to use AMI2 in MFX.
- TMO and RIX data reduction: High Speed Digitizers are emitting both reduced (Feature Extracted, or FEX, data) and non-reduced (non-FEX) data.
  - Data Reduction in TMO/RIX digitizers is zero suppression; it is recommended that users analyze both FEX and non-FEX data in parallel to verify that they agree to within statistical errors
  - Please contact pcds-ana-l@slac.stanford.edu or your POC with questions.
- Data center (S3DF) outages announcements: https://confluence.slac.stanford.edu/display/PCDS/Outages

How is S3DF Different From psana?

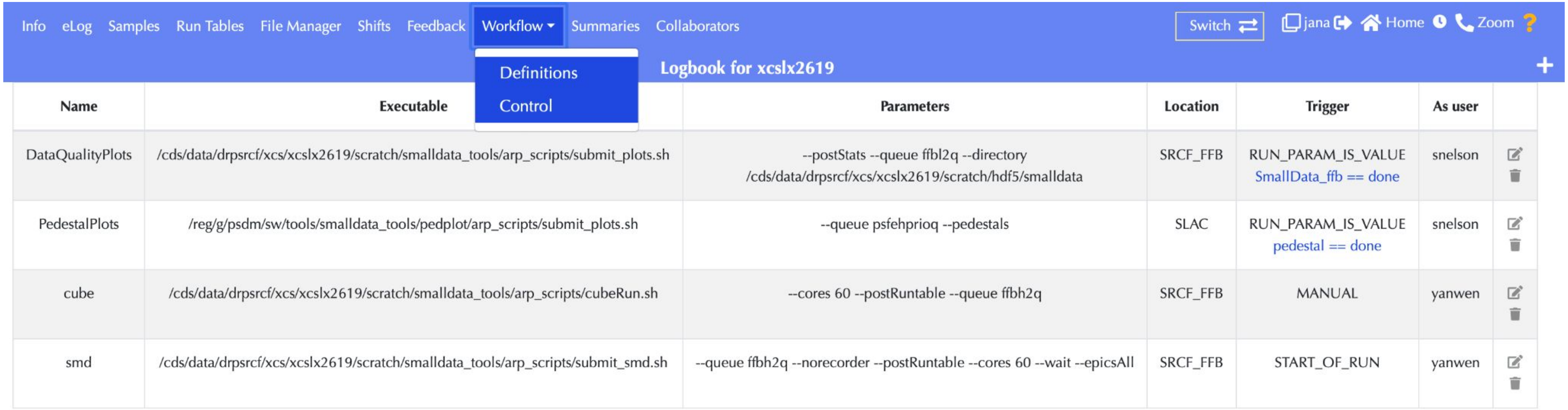
Changes to expect when migrating from psana to S3DF

- ***All*** users/experiments, including old experiments, will use S3DF as a replacement for psana
- By October 2024, legacy systems will be retired.
- Changes from psana to S3DF:
    - Home directory (backed up) is now be in weka (/sdf/home/<first letter of username>/<username>)
    - Shared software packages and tools are in /sdf/group/lcls/ds
        - /sdf/group/lcls/ds/ana psana1/psana2 releases, detector calibration, etc.
        - /sdf/group/lcls/ds/tools smalldata-tools, cctbx, crystfel, om, …
        - /sdf/group/lcls/ds/dm data-management releases and tools
    - LCLS experimental data is accessible on the interactive and batch nodes (but not the login nodes)
        - Offline storage: /sdf/data/lcls/ds/<instr>/<expt>/<expt-folders>
        - FFB storage /sdf/data/lcls/drpsrcf/ffb/<instr>/<expt>/<expt-folders>
    - S3DF batch compute uses Slurm batch processing and requires a Slurm account to submit a job in order to track resource usage per experiment. The slurm account is lcls:<experiment-name>
        - Contact your POC if you require a reservation with a certain number of nodes.
        - We are investigating on-shift/off-shift priority mechanisms; keep an eye on confluence as our policies and recommendations may be in flux as we learn which techniques provide users with the best performance.

Try out Automated Run Processing (ARP)

Automated Run Processing (ARP) capabilities are available via eLog →Workflow → Definitions

- The Automatic Run Processor (ARP) is a web service that allows for automatic workflows and for the easier submission of batch jobs via a web interface: see eLog →Workflow → Definitions
- A script that submits the batch job is all that is needed for this system to work.
- ARP will automatically launch the configured workflow and return status and results to eLog.
- Examples and documentation: https://confluence.slac.stanford.edu/pages/viewpage.action?pageId=219269619
- Working on some standardized workflows for complex analysis tasks.
- For more information on using this resource, reach out to Silke Nelson (snelson@slac.stanford.edu)



Name	Executable	Parameters	Location	Trigger	As user
DataQualityPlots	/cds/data/drpsrcf/xcs/xcslx2619/scratch/smalldata_tools/arp_scripts/submit_plots.sh	--postStats --queue ffbl2q --directory /cds/data/drpsrcf/xcs/xcslx2619/scratch/hdf5/smalldata	SRCF_FFB	RUN_PARAM_IS_VALUE SmallData_ffb == done	snelson
PedestalPlots	/reg/g/psdm/sw/tools/smalldata_tools/pedplot/arp_scripts/submit_plots.sh	--queue psfehprioq --pedestals	SLAC	RUN_PARAM_IS_VALUE pedestal == done	snelson
cube	/cds/data/drpsrcf/xcs/xcslx2619/scratch/smalldata_tools/arp_scripts/cubeRun.sh	--cores 60 --postRuntable --queue ffbh2q	SRCF_FFB	MANUAL	yanwen
smd	/cds/data/drpsrcf/xcs/xcslx2619/scratch/smalldata_tools/arp_scripts/submit_smd.sh	--queue ffbh2q --norecorder --postRuntable --cores 60 --wait --epicsAll	SRCF_FFB	START_OF_RUN	yanwen

S3DF Quick Reference

S3DF Quick Reference: https://s3df.slac.stanford.edu/public/doc/#/

SSH	s3dflogin.slac.stanford.edu
NoMachine	s3dfnx.slac.stanford.edu
OnDemand	https://s3df.slac.stanford.edu/ondemand
Globus Endpoint	slac#s3df
Help (slack channel)	slac.slack.com#comp-sdf
Help (email)	s3df-help@slac.stanford.edu
Banking & Accounting	https://s3df.slac.stanford.edu/coact
S3DF Dashboard & Monitoring	https://s3df.slac.stanford.edu/monitoring

Questions?

Agenda

Time (PST)	Topic	Presenter
Plenary Session - Join via Zoom >>		
9:00 am	Current LCLS Status & Plans	**Mike Dunne** Director, LCLS
9:15 am	Universal Proposal System	**Leilani Conradson / Paul Jones** LCLS User Office
9:23 am	User Executive Committee Update	**Silvia Pandolfi** LCLS UEC Vice Chair
9:26 am	Short Proposal Program Update	**Sandra Mous** LCLS Scientist
9:31 am	Accelerator Plans for Run 25	**Axel Brachmann / Tim Maxwell** Accelerator Dept. Head
9:40 am	Soft X-ray Instrument Capabilities (Introduce breakouts)	**James Cryan / Kristjan Kunnus /Georgi Dakovski** TMO/chemRIXS/qRIXS Instrument Leads
9:50 am	Hard X-ray Instrument Capabilities (Introduce Breakouts)	**Sebastien Boutet** Director of Operations
9:55 am	Data systems	**Jana Thayer** Data Systems Dept. Head
Breakout Sessions/Office Hours by Instrument		
10:10 am - 11:00am	Session 1	
	•TMO Join via Zoom >>	James Cryan
	•MEC Join via Zoom >>	Eric Galtier
	•MFX Join via Zoom >>	Sebastian Dehe for Leland Gee
	•qRIXS Join via Zoom >>	Georgi Dakovski
	•XCS/XPP Join via Zoom >>	Matthieu Chollet & Takahiro Sato
	•chemRIXS Join via Zoom >>	Kristjan Kunnus
	•CXI Join via Zoom >>	Meng Liang