Facility Update & Information about 12th Call for Proposals

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Scientific Director, European XFEL

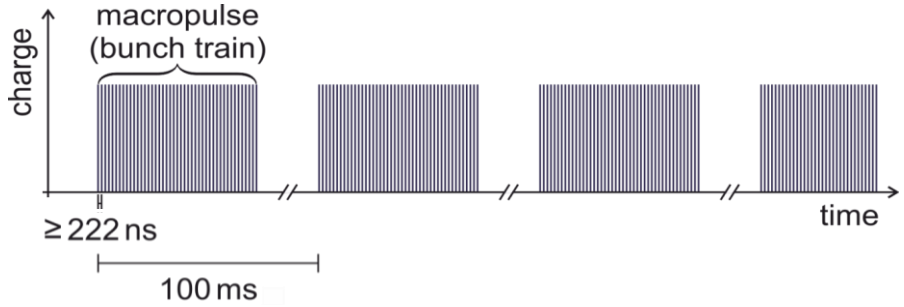
Virtual user information meeting -12th call for proposals
Virtual meeting, Schenefeld/Zoom
10 October, 2023

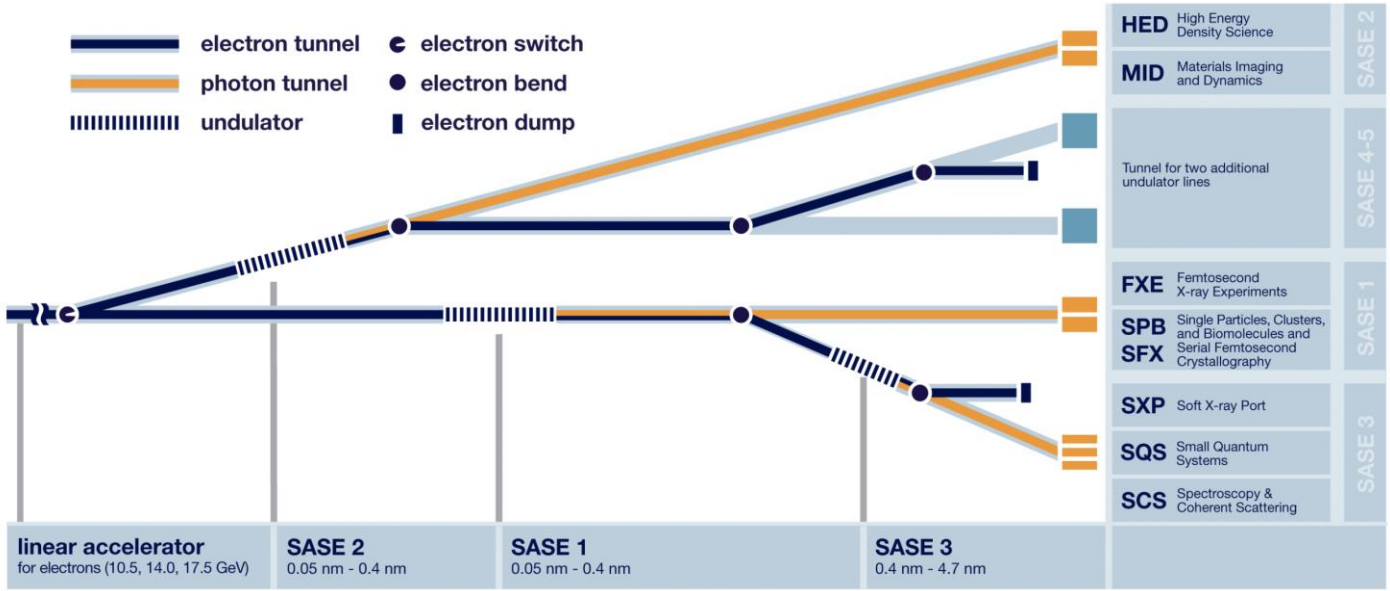
Outline

- Brief introduction to EuXFEL and Instruments
- Overview and update of Access Modes
- Operation
- Update on developments

About the European XFEL

- International user facility for FEL research
  - World's longest SC RF electron accelerator
  - MHz repetition rates, high pulse energies, $0.28 \geq h\omega \geq 20$ keV
  - Provides soft & hard X-ray FEL radiation
- Multi-disciplinary science community
  - Physics
  - Chemistry
  - Biology
  - Geosciences
  - Materials
- Status
  - Construction 2009-2017
  - First experiments 2017
  - 6 instruments operating since 2019 (+ 1 in 2023)
  - Enter now "Harvesting" phase

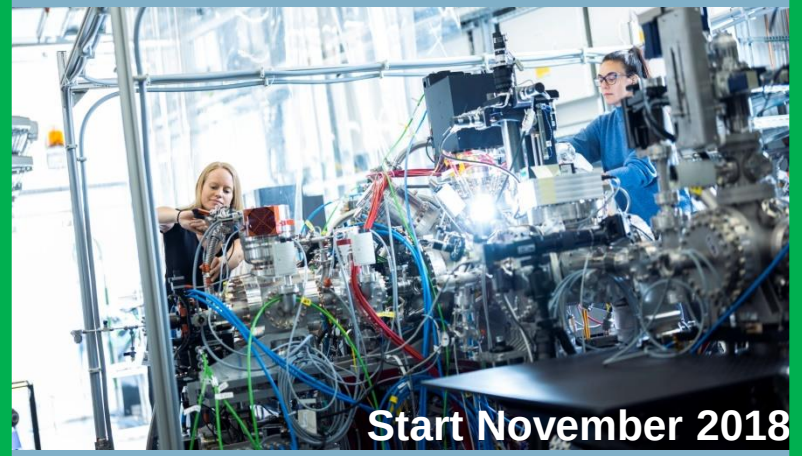




Six Instruments in User Operation since 2019

SPB/SFX (Richard Bean)

SQS (Michael Meyer)



MID (Anders Madsen)

FXE (Chris Milne)

SCS (Andreas Scherz)

HED (Ulf Zastrau)

Six Instruments in User Operation since 2019

SPB/SFX (Richard Bean)

Single Part., Bioimaging, & SFX

- Coherent diffraction imaging from single part.
- Serial fs nano-crystallography

SQS (Michael Meyer)

Small Quantum Systems

- Ultrafast dynamics of atoms, ions & clusters
- Combination of spec. & coh. scat. techniques

MID (Anders Madsen)

Materials Imaging & Dynamics

- CDI from nano-structured samples
- XPCS of nanoscale dynamics

FXE (Chris Milne)

Femtosecond X-ray Experiments

- Ultrafast dynamics of liquids and solid matter
- Combination of spec. & scat.

SCS (Andreas Scherz)

Spectroscopy & Coherent Scatt

- Ultrafast dynamics of complex solids
- Combination of hr-inelastic spec. & coh.scattering

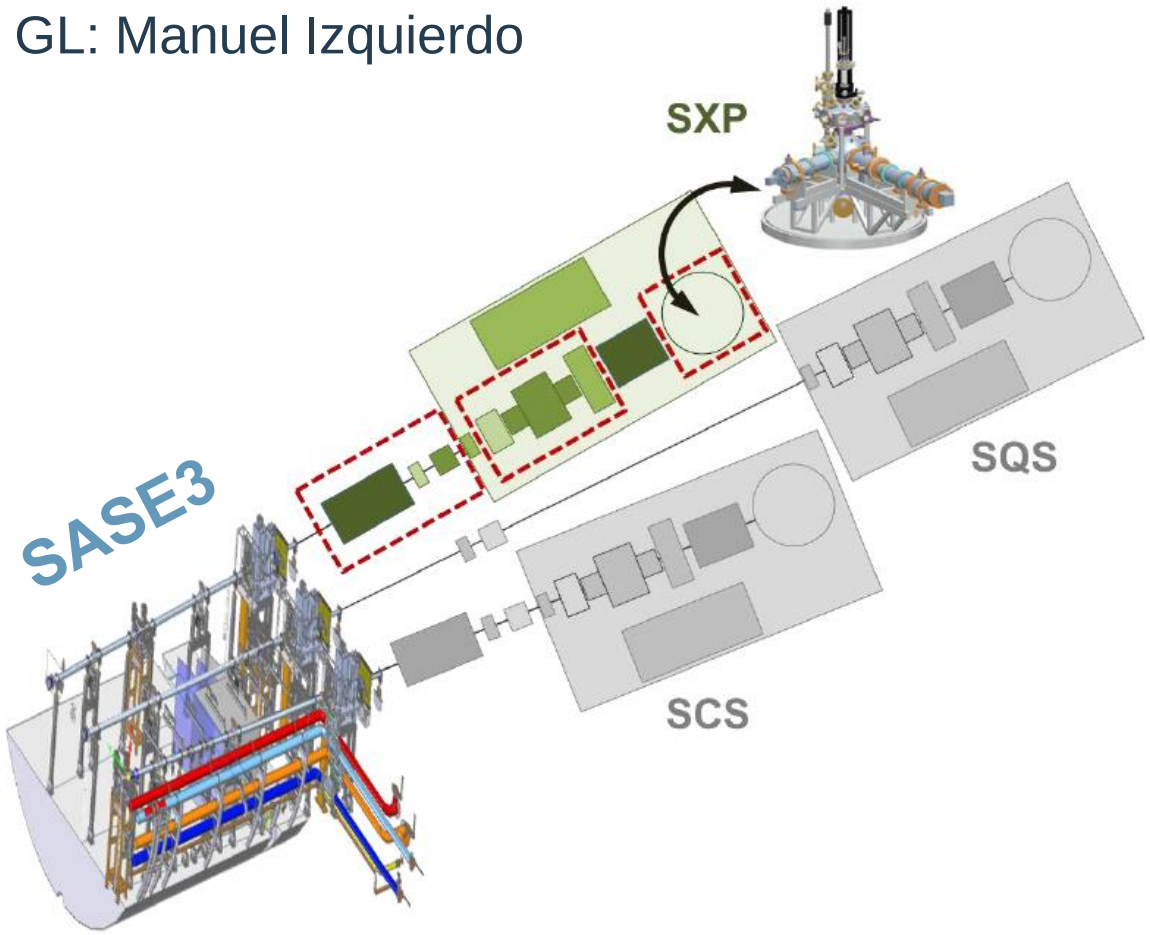
HED (Ulf Zastrau)

High Energy Density science

- Ultrafast dynamics of highly excited matter
- Combinations of scattering, diff. & spectroscopy

The 7th instrument SXP

GL: Manuel Izquierdo

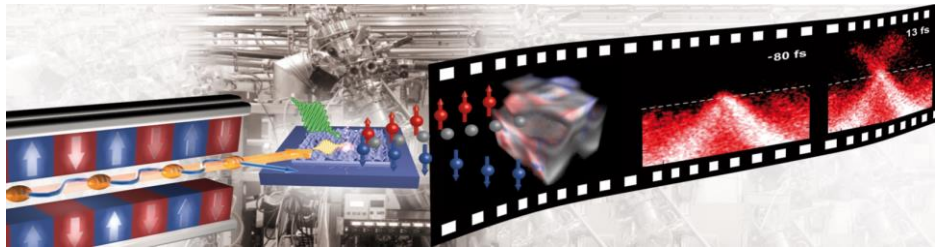


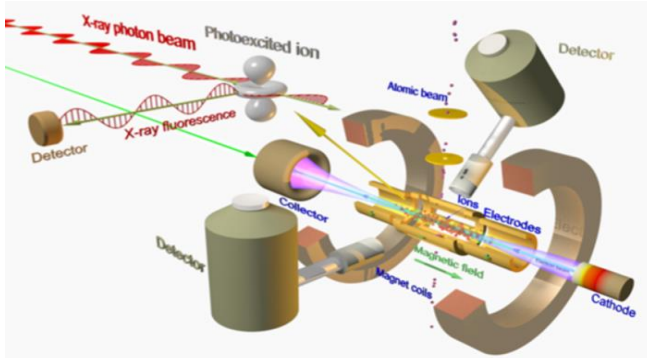
Complete Time-resolved X-ray Photoelectron spectroscopy

TR-XPES

K. Rossnagel (Uni-Kiel/DESY)

G. Schönhense (Uni. Mainz)





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

HCI

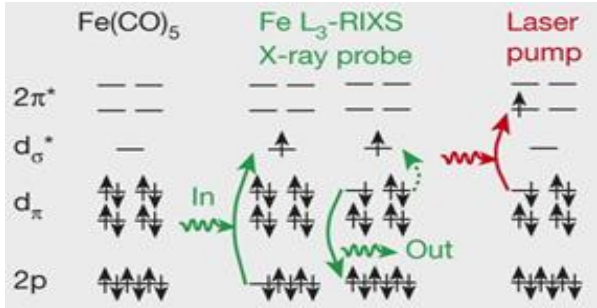
J. Crespo (MPI Heidelberg)

M. Meyer, T. Baumann (EuXFEL)

Understanding Catalysis and biochemistry by studying Chemical Bond Activation

CBA

P. Wernet (Uni. Uppsala)



Access Modes - I

Regular Proposals

- From start of operation: bi-annual Calls (May, November)
- 6 Peer Review Panels (by instrument), meetings in Feb→Jan and Sept→June
- Average Oversubscription (Calls 9 – 11) ~ 3.5

Sample Screening

- First campaign Call 8 (Protein Crystal Screening, SPB/SFX)
- Extended to generic samples studied by SFX in Call 9
- Considering extending to other instruments

Access Modes - II

Topical Calls

- Two step process (w/Expression of Interest)
- 2 Calls: COVID-19 (Summer 2020) and Molecular H_2O Research (Spring 2022)
  - ► COVID-19: 20 EoI, 3 proposals scheduled 2021, remote users (OS: 6.7)
  - ► Molecular H_2O Research: 30 EoI, 8 proposals scheduled 2023 (OS: 3.8)
- **2nd H_2O Call to be launched soon**: open workshop Satellite to UM2024
- Working on a process to select future Topics for Topical Calls

Long Term Proposals

- Two step process (w/ Expression of Interest)
- First campaign Call 9
- 10 EoI, 9 submitted proposals, 3 scheduled 2023-2025
- Template and reviewing process to be refined
- Next Call 2025 (start 2026-I) ?

Access Modes - III

Update beamtime shares

- Open port SXP on SASE3 started user operation in 2023-II
- SASE3 (SQS/SCS/SXP): 40/40/20% for 2024-I
- SASE1/2: 50/50

Priority Access HIBEF proposals at HED

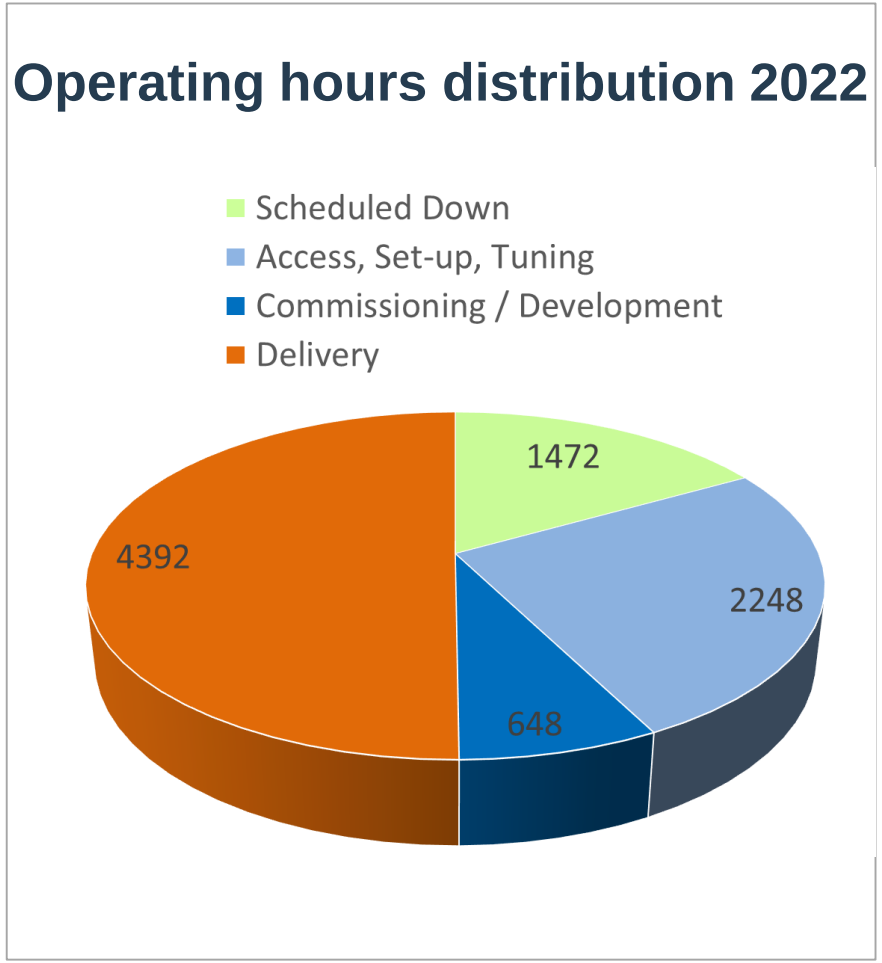
- Proposals evaluated by HED PRP, no ranking
- Max 30% of user beamtime
- 3 PA proposals scheduled in 2024-I

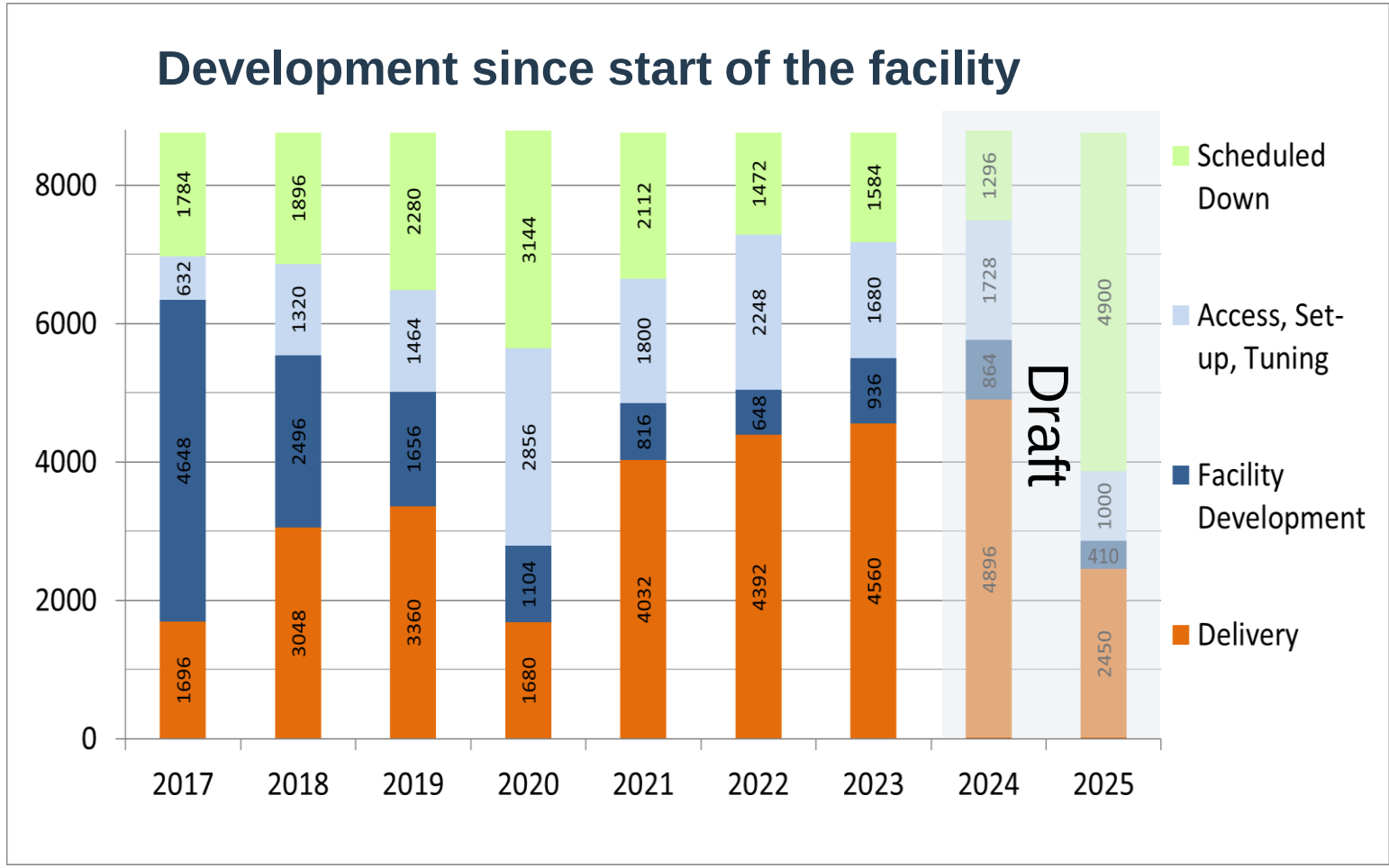
Pilot Block Allocation Group (BAG) Access

- Community access proposal grouping together a number of independent Principal Investigators (PIs) working in the same scientific field, who apply together as a consortium.
- Aim: produce the most impactful science in that field by allowing the community to share the beamtime and decide itself on measurement priorities, made easier by regular beamtime allocation.
- Start with Pilot BAG for the SFX User Consortium on SPB/SFX

Over 4000 hours of scheduled X-ray delivery

Annual operation leveled at about 7000 hours, delivery hours still increased (+4% in 2023)





2022: The first year really close to full user operation

	2018 (FXE/SBP/SCS/ SQS only)	2019	2020	2021	2022
Instrument Hours	1 356	3 348	1 908	4664	**8080**
No. of experiments	25	56	23	44	**95**
User Publications	2	4	15	16	**18**

- 8 080 instrument hours to users in 2022, closer to our mid-term target of 10 500
- Strong increase in number of user experiments (incl screening experiments)
- Slow increase in user publications – delayed by ~2 years?
  - *Stronger focus on user publications in the beamtime review process*

Previous runs - allocation

	Call 8	Call 9	Call 10	Call 11
Allocation period	2022-II	2023-I	2023-II	2024-I
Total proposals submitted	167	156	157	122
Allocated	49	46	44	50(*)
Success rate	29%	29%	28%	41%

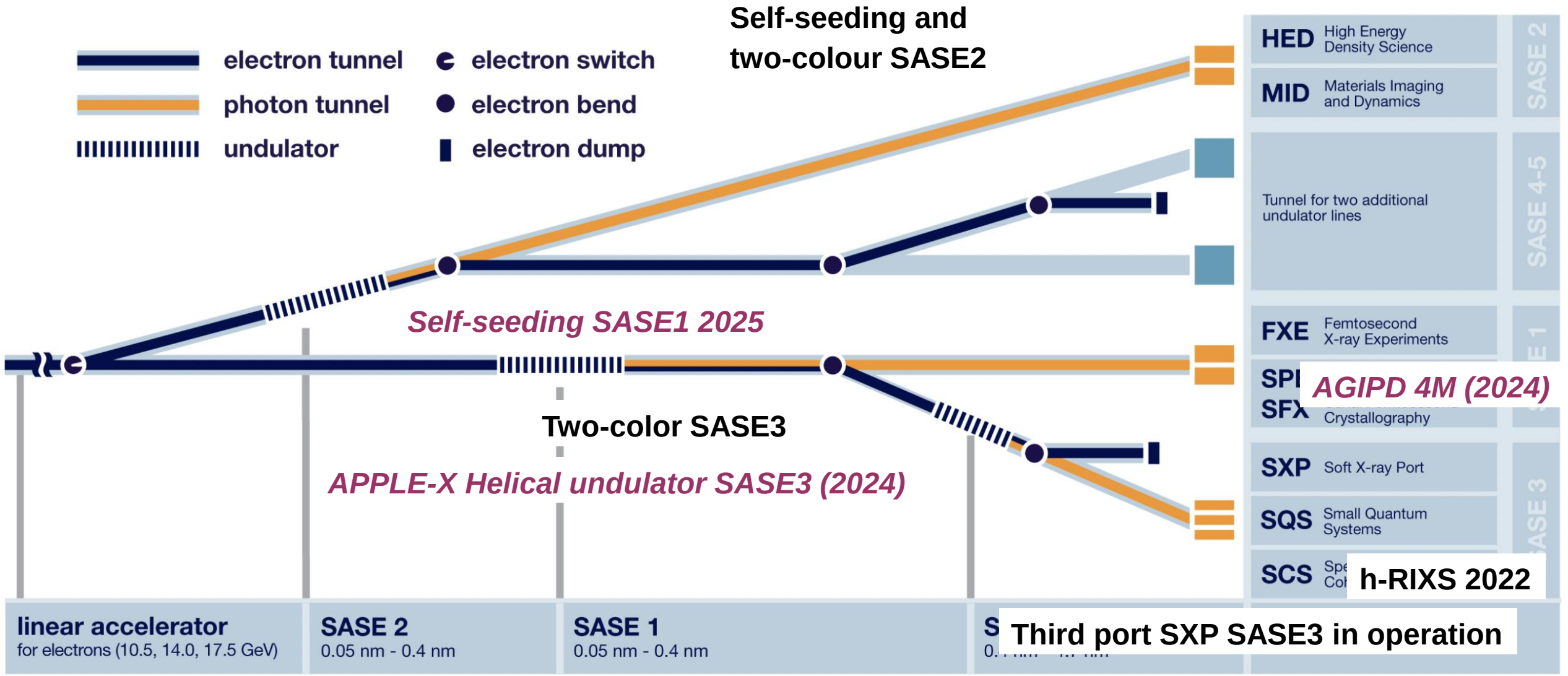
(*) including 6 Screening experiments @ SPB/SFX/user labs & 3 Priority Access proposals @ HED/HIBEF

Operation in fall 2023

- Due to low performance of the accelerator, the first user week in 2023-II was cancelled
  - Expectation : Accelerator must be able to deliver ~2 mJ at SASE1 and ~1 mJ at SASE2
  - Re-scheduling of user experiments nearly completed
- Three cryo failures in the fall
  - Cryo failures were of new origin and not related directly to ball bearings issues
  - The failures led to cancellation of user experiments
  - Magnetic ball bearings will be installed on all cryo compressors in the summer 2024 (delayed)
- Users experiments have in general been going well in spring **but not in the fall 2023**
  - Lower performance on self-seeding at SASE2 than in the spring
  - In addition to the cryo failures we had a power glitch
  - No successful experiment so far in fall 2023 on HED. SCS and FXE have also had several failed experiments
- We might have to introduce a “buffer” and schedule less experiments.
  - User run 2024-I is already scheduled

On-going and recently completed new developments

Construction of third hutch on SASE2 (starts 2024)

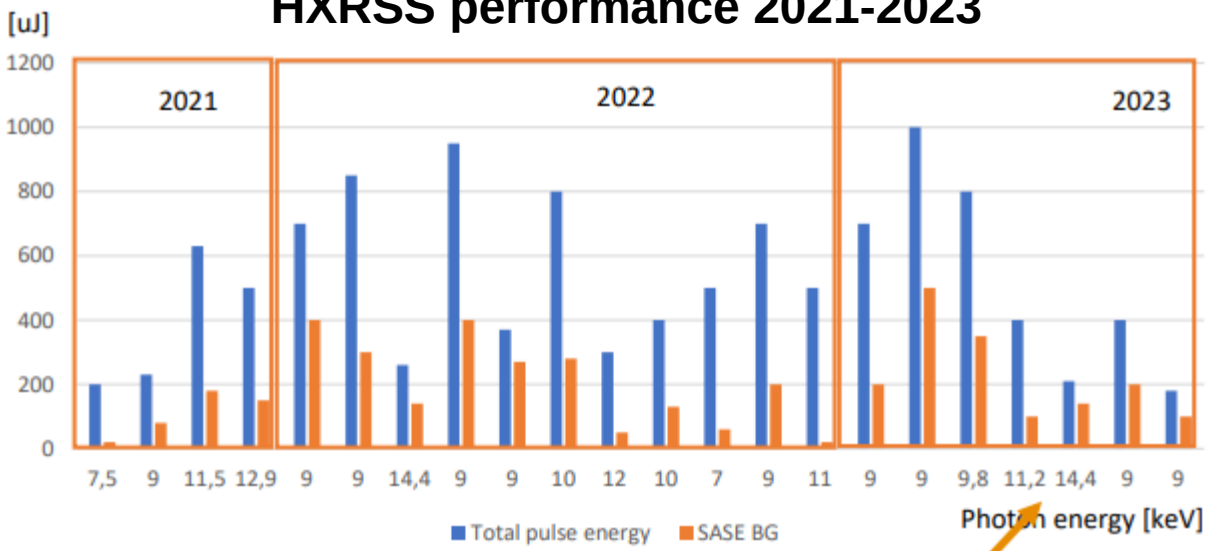


Update HXRSS, Apple X, attosecond pulse generation

APPLE- X undulators

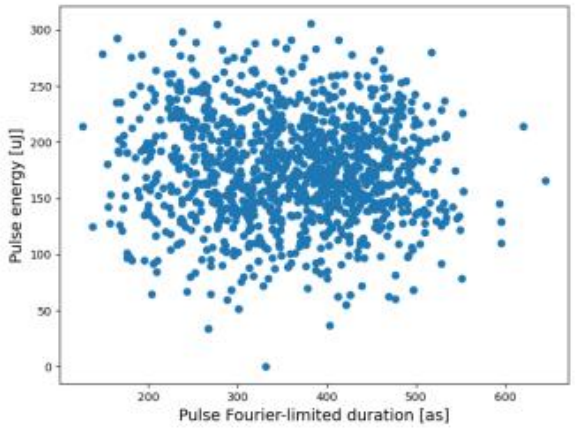
- Installed Winter 21/22
- Lasing April 2022
- Errors in Control System
- Removed Summer 2022
- Successful repair & shielding
- Re-installation Winter 23/24

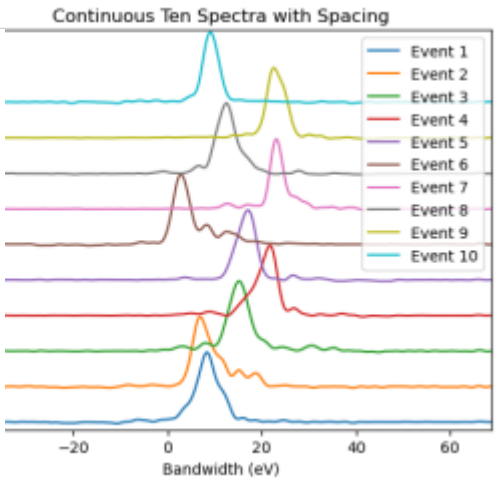
HXRSS performance 2021-2023



- Ongoing work to improve our understanding of HXRSS performance

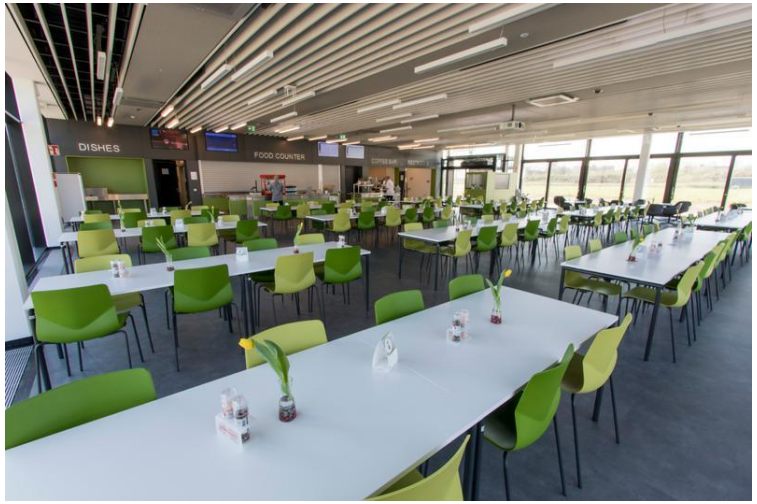
Generation of intense attosecond pulses (R&D)





- Self-chirping enabled
- ~30% single spike at 9 keV
- Pulse energy of 172 ± 44 µJ
- Puser FT-limited ~ 350 as

Updates about on-site food options



- BeamStop restaurant **weekend 'pilot' openings** Sat/Sun 08:00-13:00
  - 11 selected weekends in user run 2023-II
    - ► Financial assessment still ongoing but regular demand exists
- Meal options outside opening hours of the on-site restaurant:
  - "BeamStop freshly made" meals to microwave
    - ► from BeamStop (opening hours - Mo-Fr 07:00-15:00) and
    - ► from the freezer in XHQ foyer - at any time
  - Pizza-baking machine installed on the plaza still in testing phase (in front of main building XHQ)
  - Under discussion: concept and number of vending machines

Call 12 and user access

Event	Dates / deadlines
User run 2023-II	Aug-Nov 2023
Call for Proposals 12 - deadline	**08 November 2023 16:00 CET**
Experiment reports due	12 November 2023
Proposal Review Panel Meetings Call 12	**11-12 January 2024**
User run 2024-I	Feb-June 2024
Outcome Call 12	**Feb/March 2024**
User run 2024-II	**Aug-Dec 2024**

Next call 13 (run 2025-I): Early Spring 2024

Call 12 additional information

- Standard configurations (HED & MID)
- Specific set-ups (SCS)
- Sample and Protein Crystal Screening at SPB/SFX
- Cross-instrument proposals
- Please refer to the breakout sessions for more

Thank you for your attention!