

Christian Bressler, *Femtosecond X-ray Experiments (FXE) Instrument*
European XFEL

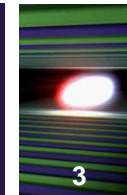
XFEL User Meeting, Hamburg, Jan 28, 2015

Experiment Hall Integration



FXE





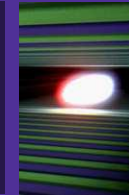
Parameter	Monochromatic	Pink beam
Energy range	5-20(25) keV	5-20(25) keV
Beam position	Sampl (fixed)	Sampl (fixed)
Energy bandwidth	1.4×10^{-4} Si(111) 3×10^{-5} Si(311)	0.3-1 %
Bunch charge	≤ 250 pC	≤ 250 pC
X-ray pulse duration	< 25 fs	< 25 fs
Optical pulse duration	15 fs	15 fs
Sample delivery: Liquid flat-sheet jets	Up to 15 m/s (sapphire nozzles) Up to 100 m/s (colliding μ jets)	Up to 15 m/s (sapphire nozzles) Up to 100 m/s (colliding μ jets)
X-ray beam spot	1-10 μ m in focus Up to 0.1 mm out of focus	1-10 μ m in focus Up to 0.1 mm out of focus
Energy resolution	ca. 1 eV (cylindrical) 0.3 - <1 eV (spherical)	ca. 1 eV (cylindrical) 0.3 - <1 eV(spherical)
Q range (XDS)	0.7 – 13 \AA^{-1}	0.7 – 13 \AA^{-1}

FXE Overview Specifications

- FXE will offer world-wide unique and versatile end station for dynamical studies of guest-host interactions
- It will exploit the high repetition rate, x-ray photon flux and ultrashort pulse duration of the European XFEL
- FXE will offer a flexible sample environment optimized for liquid-phase photochemistry using a suite of complementary x-ray spectroscopic and scattering techniques in pump-probe arrangement.
- Simultaneous measurements of several observables deliver a more complete picture of the dynamics both of the solute (guest) and solvent molecules (host).

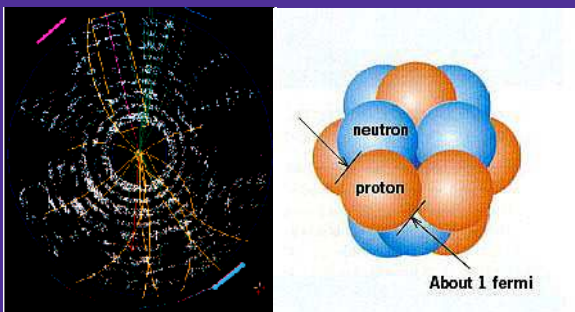
Coupled electronic, spin and nuclear changes of solute and solvent molecules can be resolved in “real-time”

What are the fundamental timescales?



Femtochemistry, Photosynthesis and
Catalysis

Solid State Dynamics

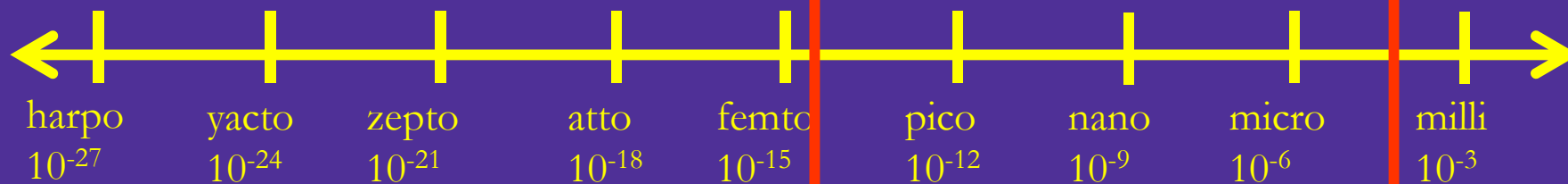
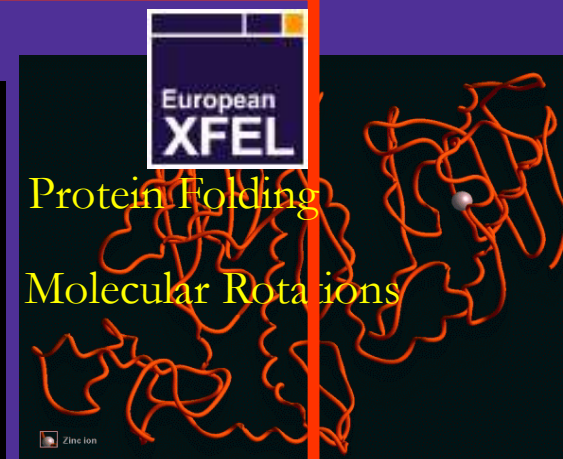
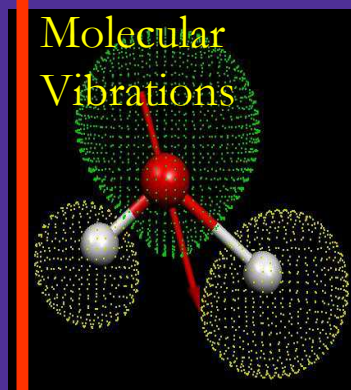


Strings,
Cosmology

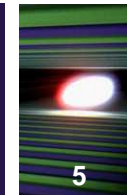
Particle
Collisions

Electron dynamics

Vision



Time / seconds



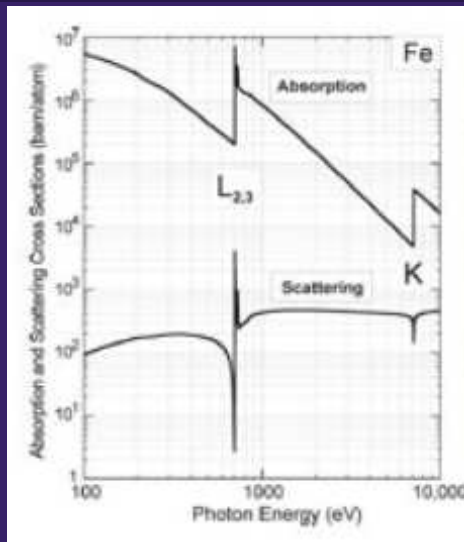
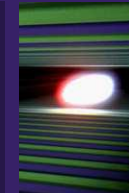
See Afternoon Talk in this Auditorium:

■ Wojciech Gawelda, 17:00

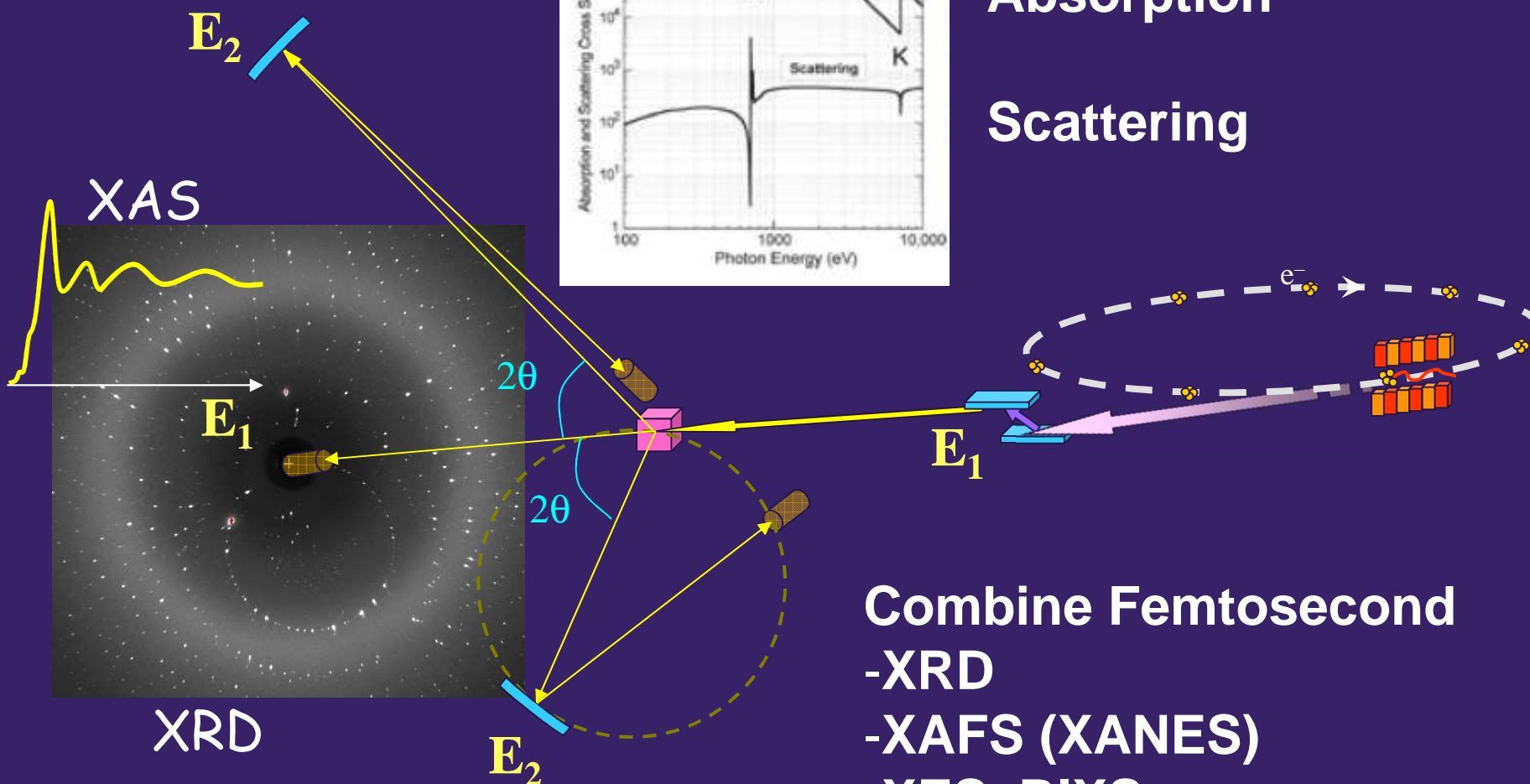
**“Tracking Chemical Reactions with
Ultrafast X-Ray Spectroscopies and
Scattering”**

**Visit our posters on Friday:
Posters # 90 and #219**

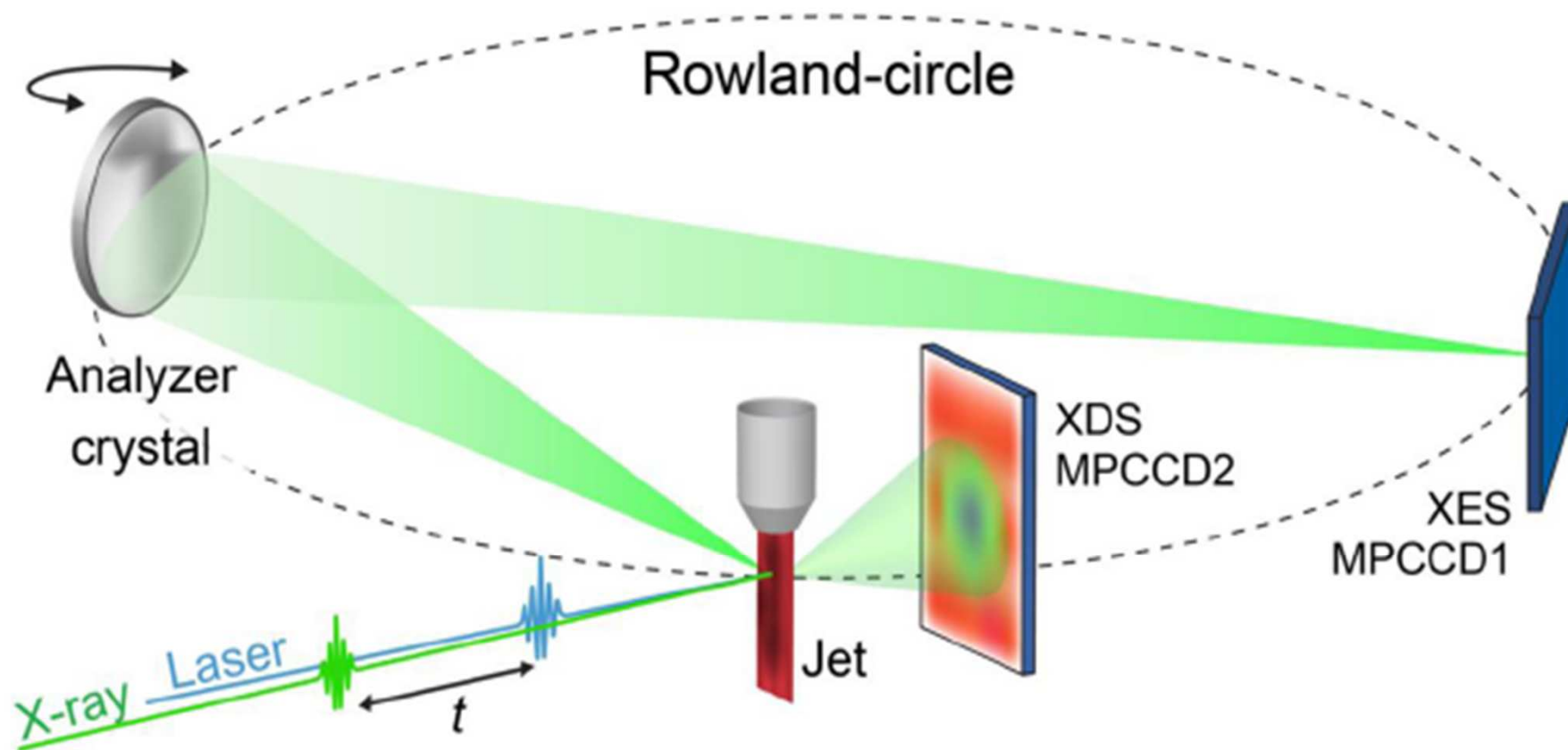
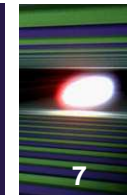
FXE: Make use of all incident x-ray photons



Absorption
Scattering



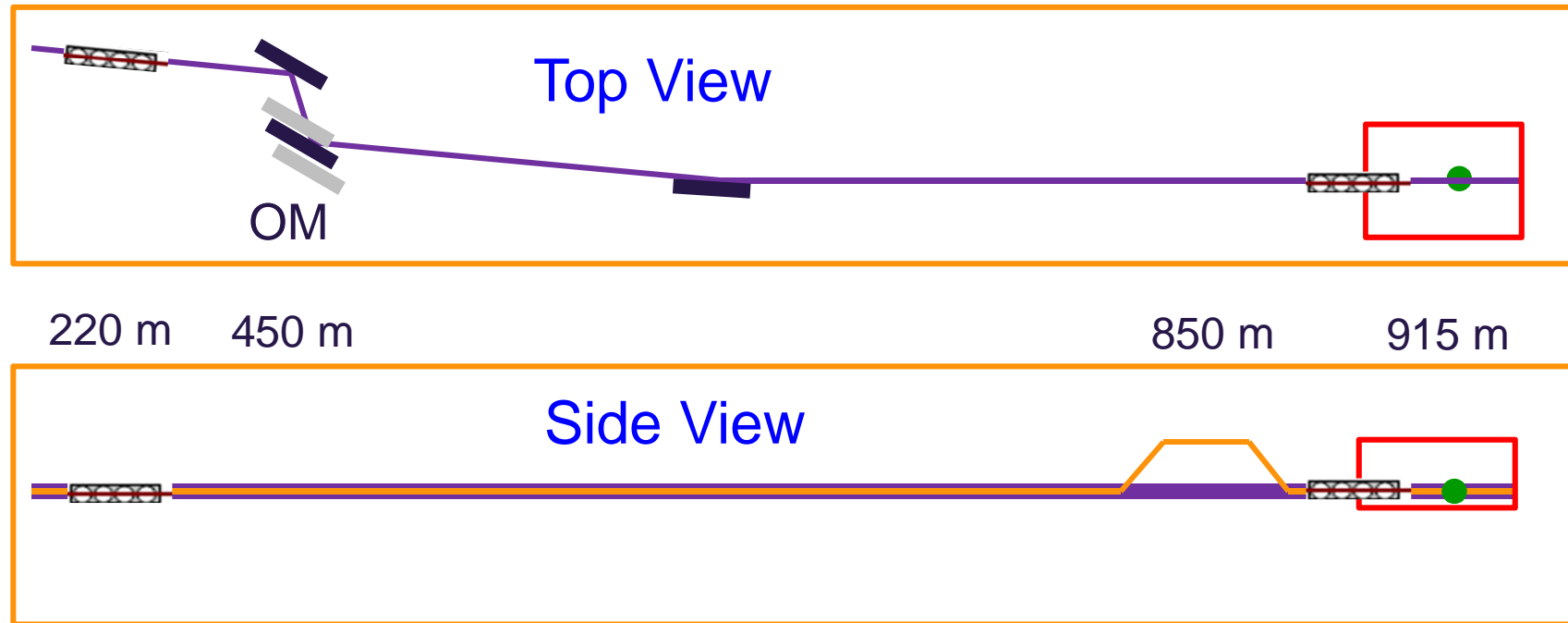
Combine Femtosecond
-XRD
-XAFS (XANES)
-XES, RIXS, ...





- **X-Ray Absorption Spectroscopy**
XANES: oxidation state changes, valence orbitals, DOS...
EXAFS: coordination shells (geometric)
- **X-Ray Emission Spectroscopy**
spin momentum of the absorber, charge state, molecular orbitals,...
- **Resonant Inelastic X-Ray Scattering (RIXS)**
Low energy excitations (d-d, charge transfer, even phonons), tunable to different final states, i.e. 3d orbitals (dipole-forbidden for 1s → nd excitation)
- **X-Ray Raman Spectroscopy**
Access K-edges of light elements (N, O, C...) constituting solvent molecules
- **X-Ray Diffuse Scattering**
Short- and medium-range geometric environment, solute + solvent (cage) contributions to the structural factor

On Axis Strategy (pink AND monochromatic)

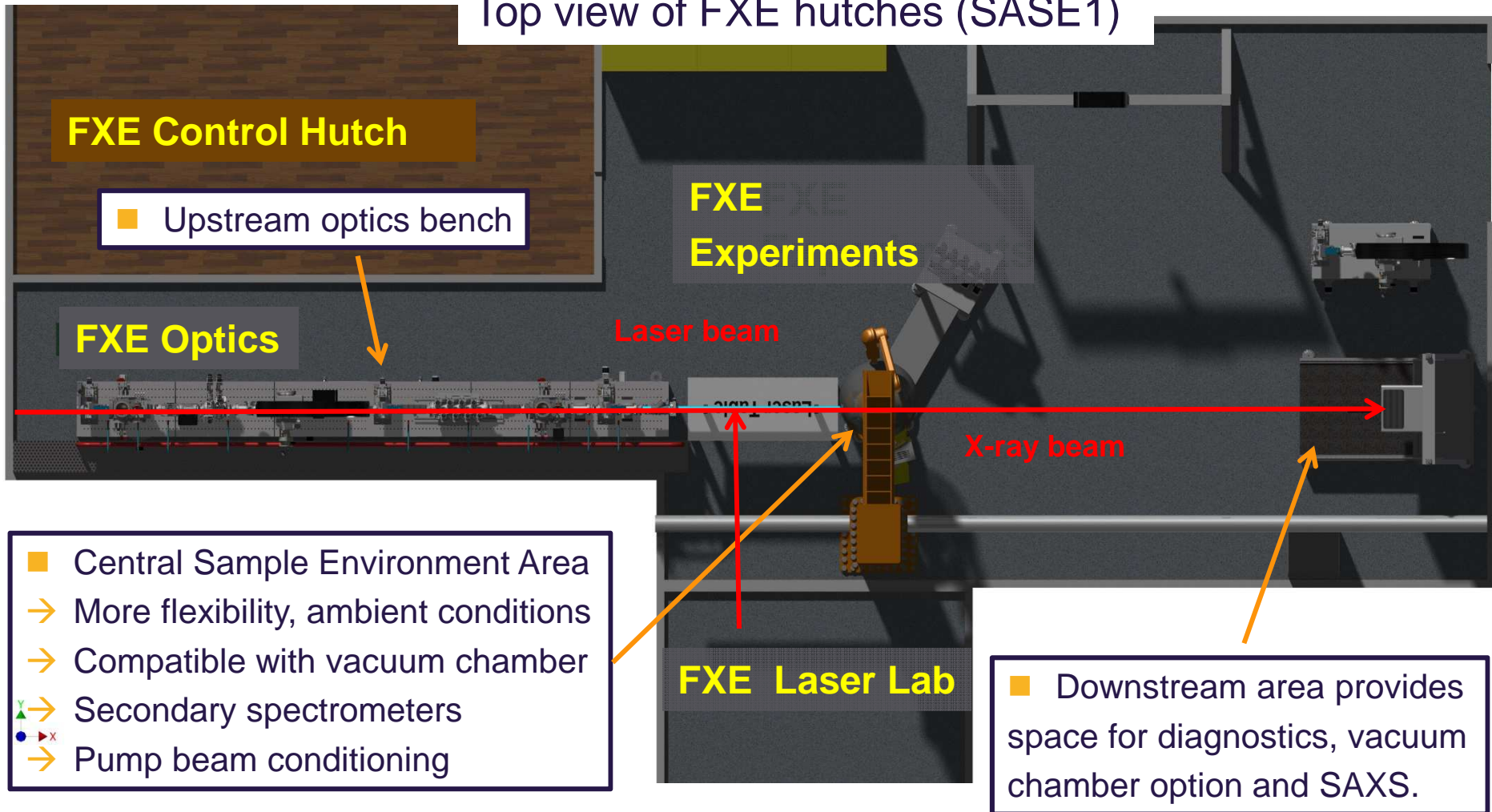


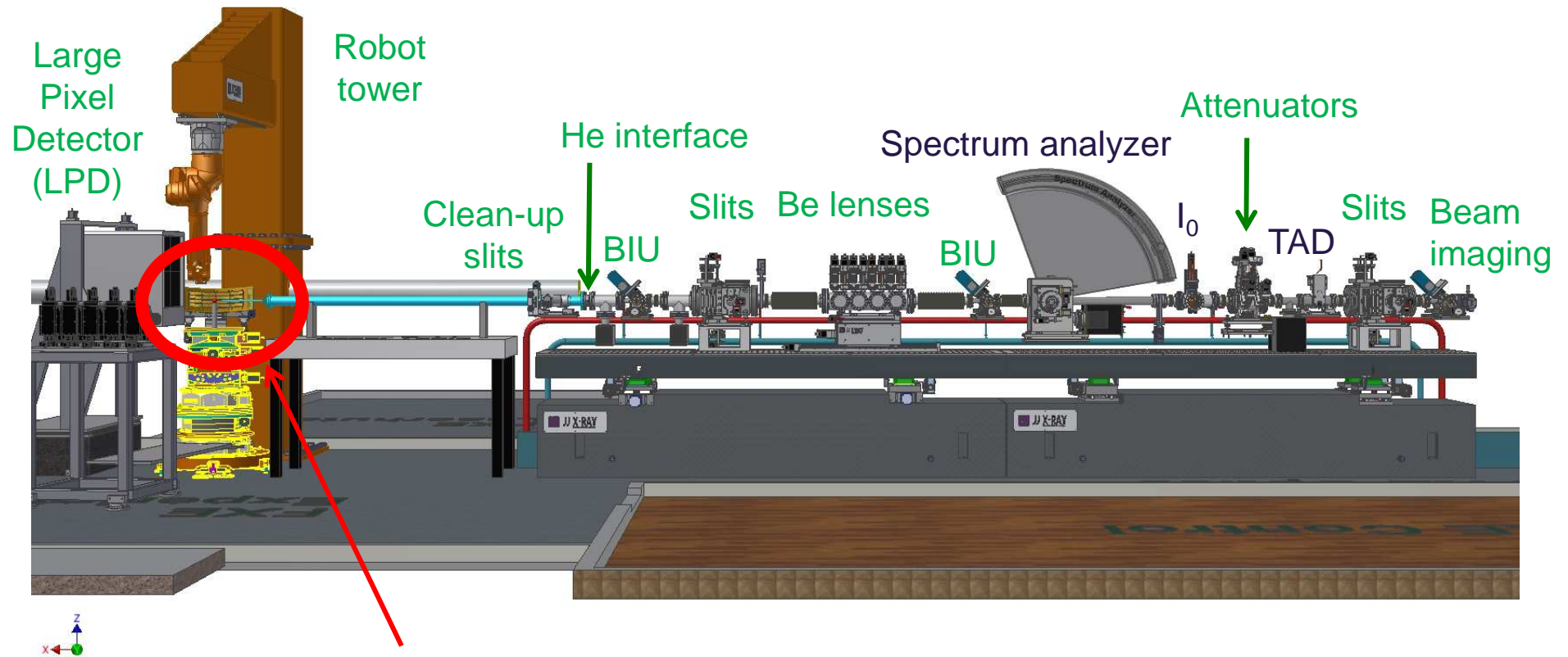
→ Emphasis for „on-axis“ configuration (pink, mono, 5-20 keV)

- single OM position/angle (5 – 20 keV)
- Si(111) 4-bounce for startup (upgrade possible)

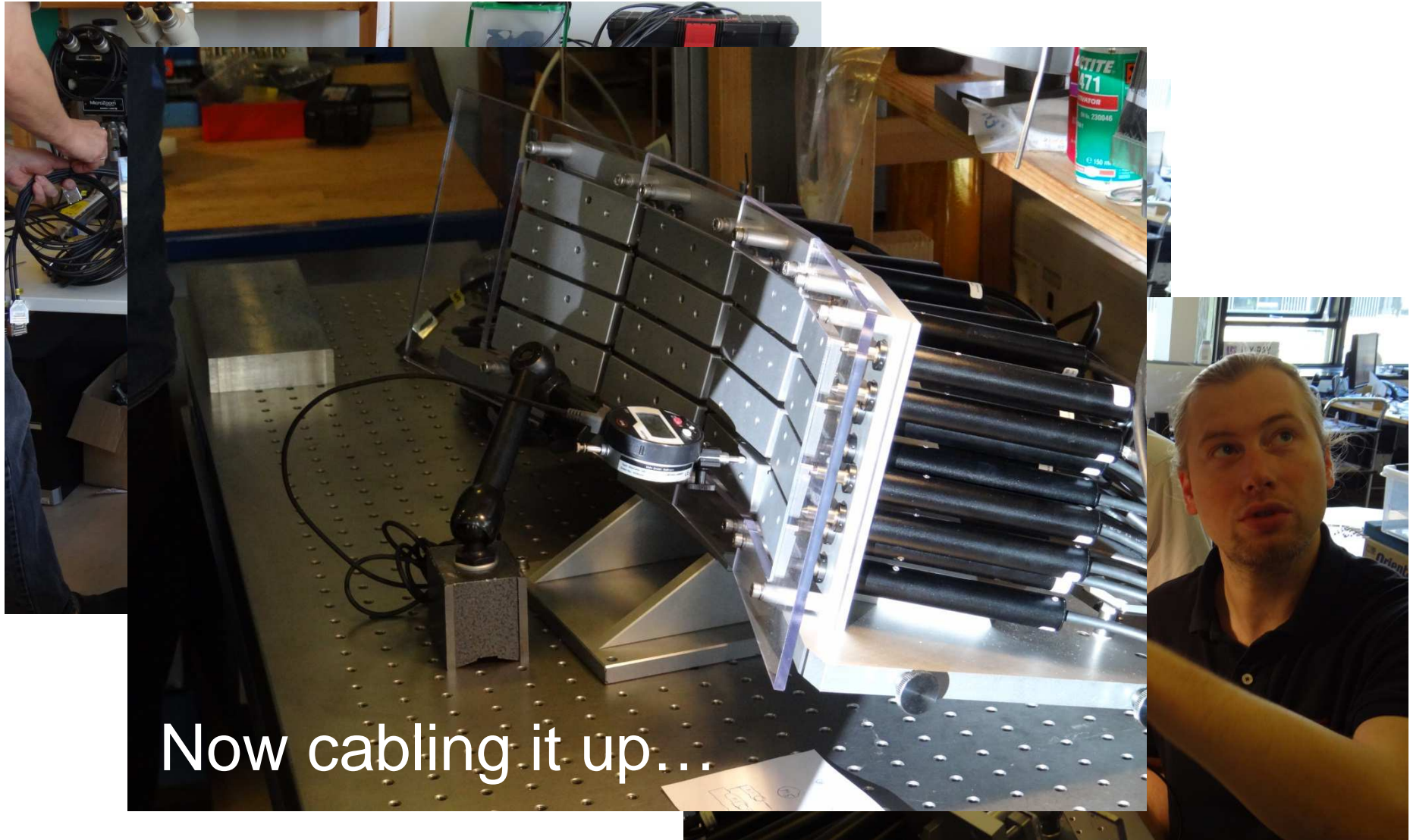
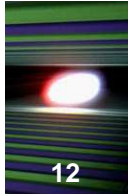


Top view of FXE hutches (SASE1)





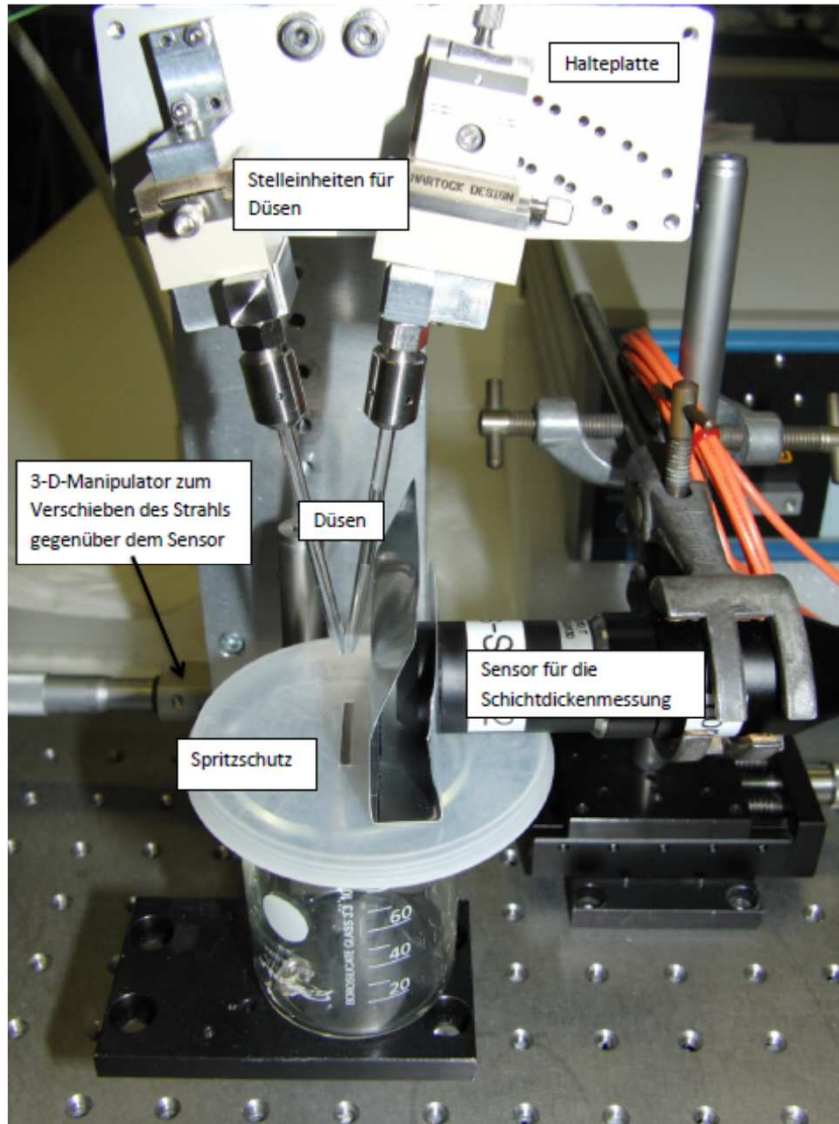
Our first Component Arrived!



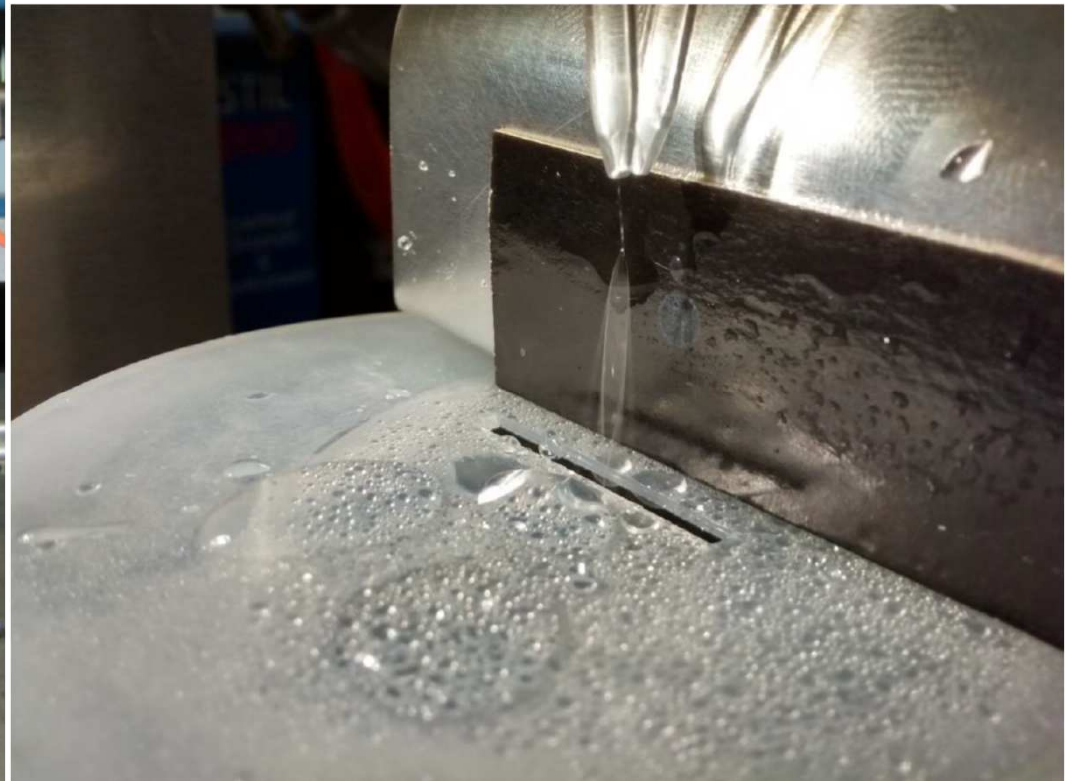
Next Component: Flat Sheet Jet (1-100 μm)

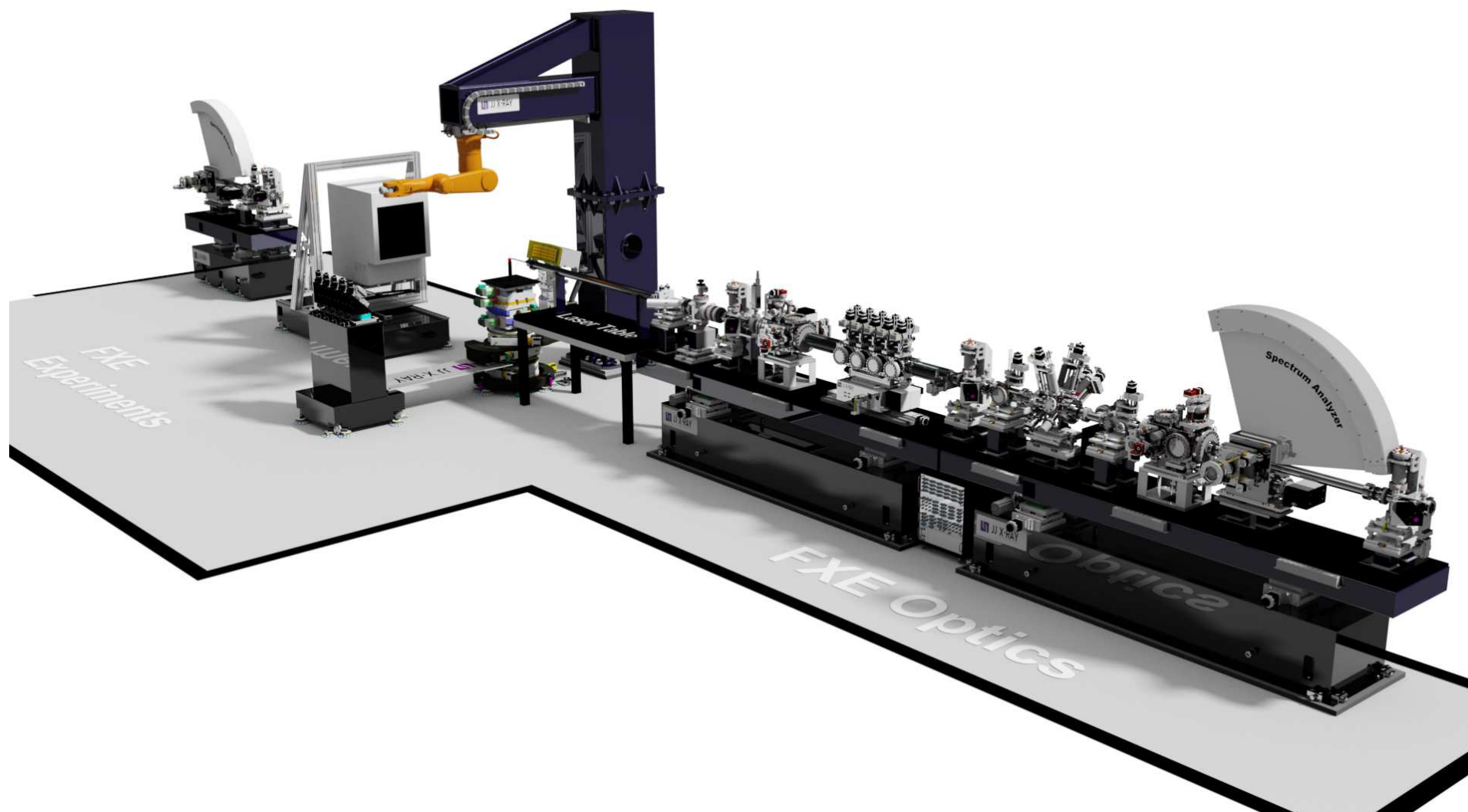
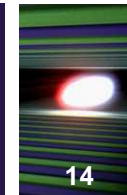


13

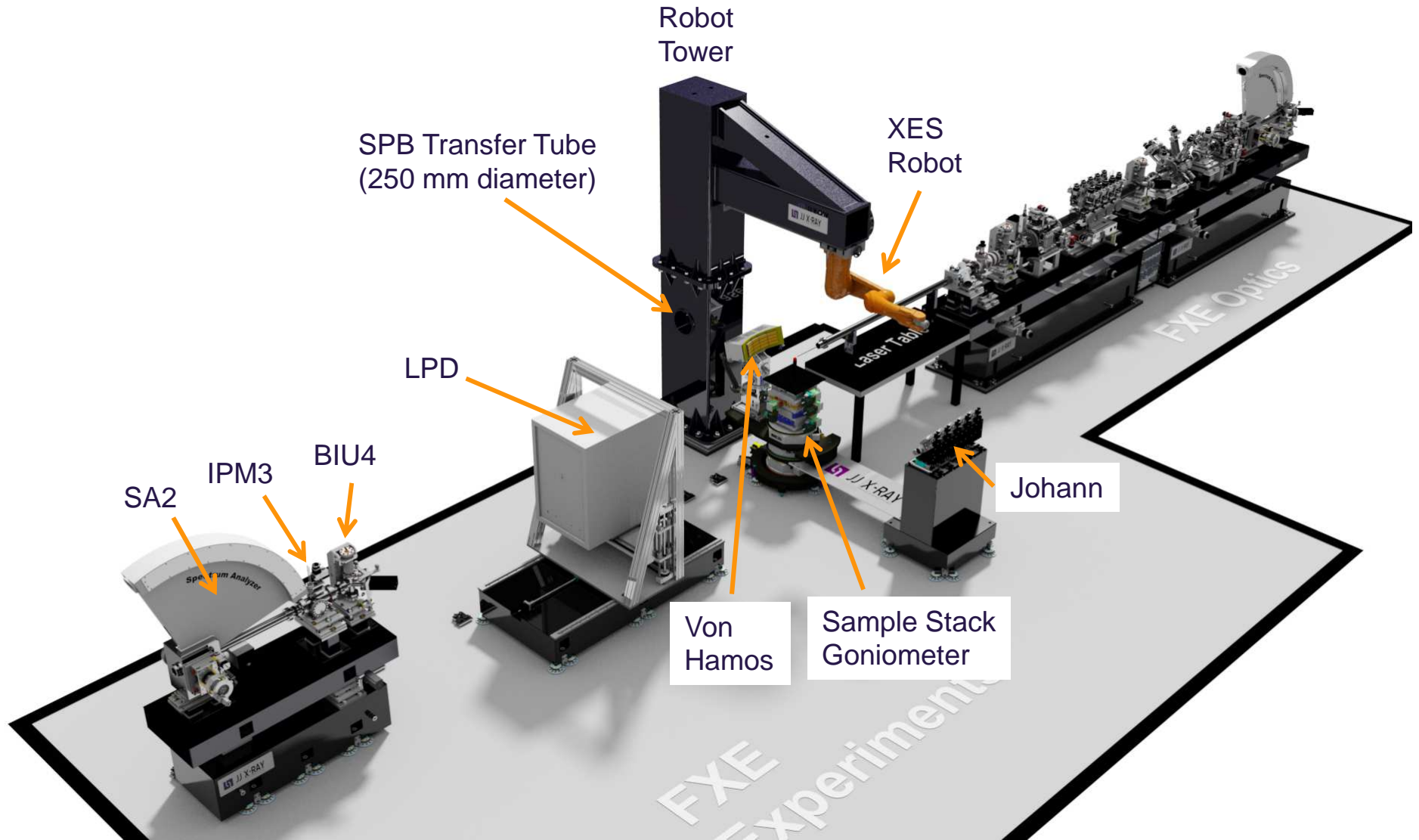


- Delivery Feb 2015:
thin flat sheet jet
(adjustable thickness)





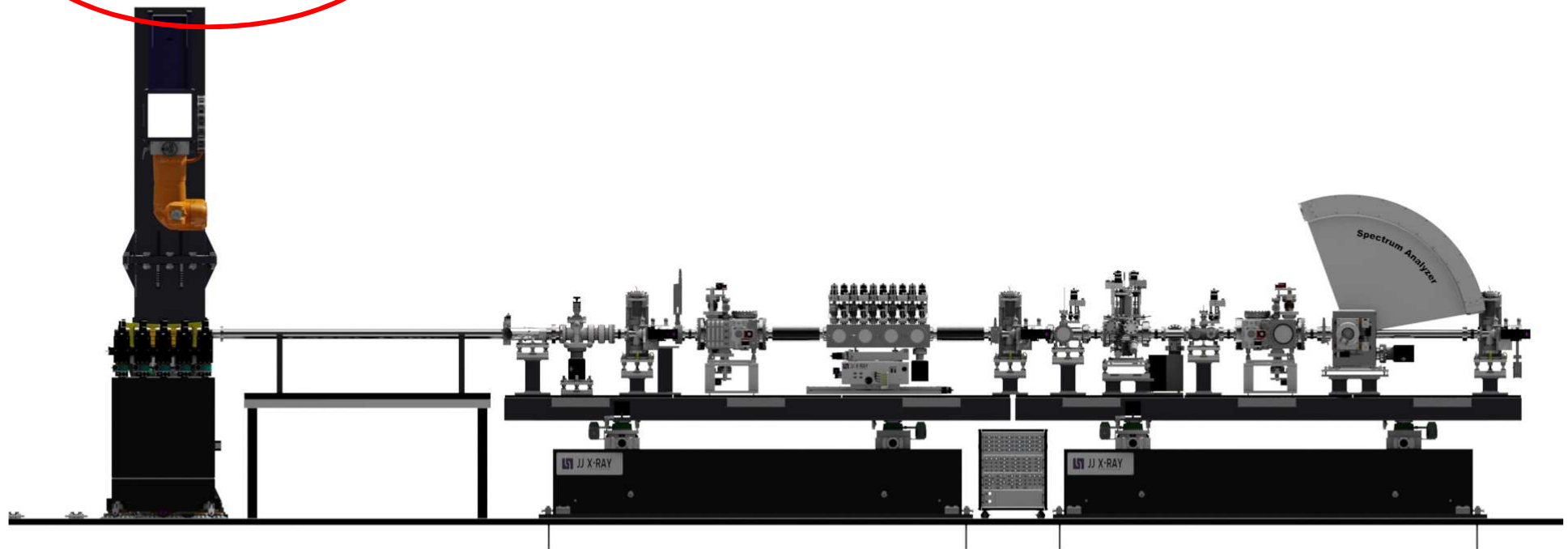
FXE Instrument



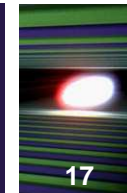


Sample
Environment

Optics Branch



- He Environment (ambient conditions, liquid jets)
- Solid State Chamber



FXE Instrument User Workshop

Featuring: Solid State Options

Tomorrow, Jan 29, 13:30

CFEL Seminar Room III

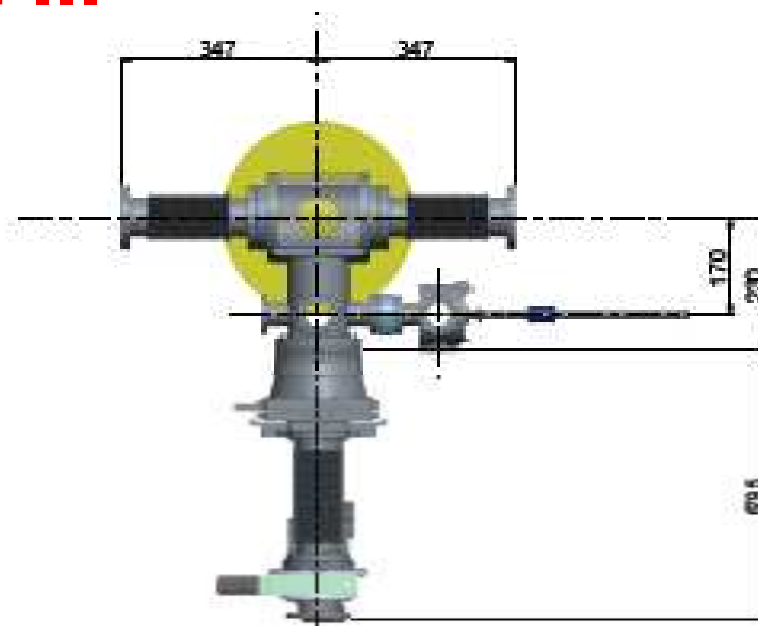
Organizers: F. Boscherini, C. Bressler

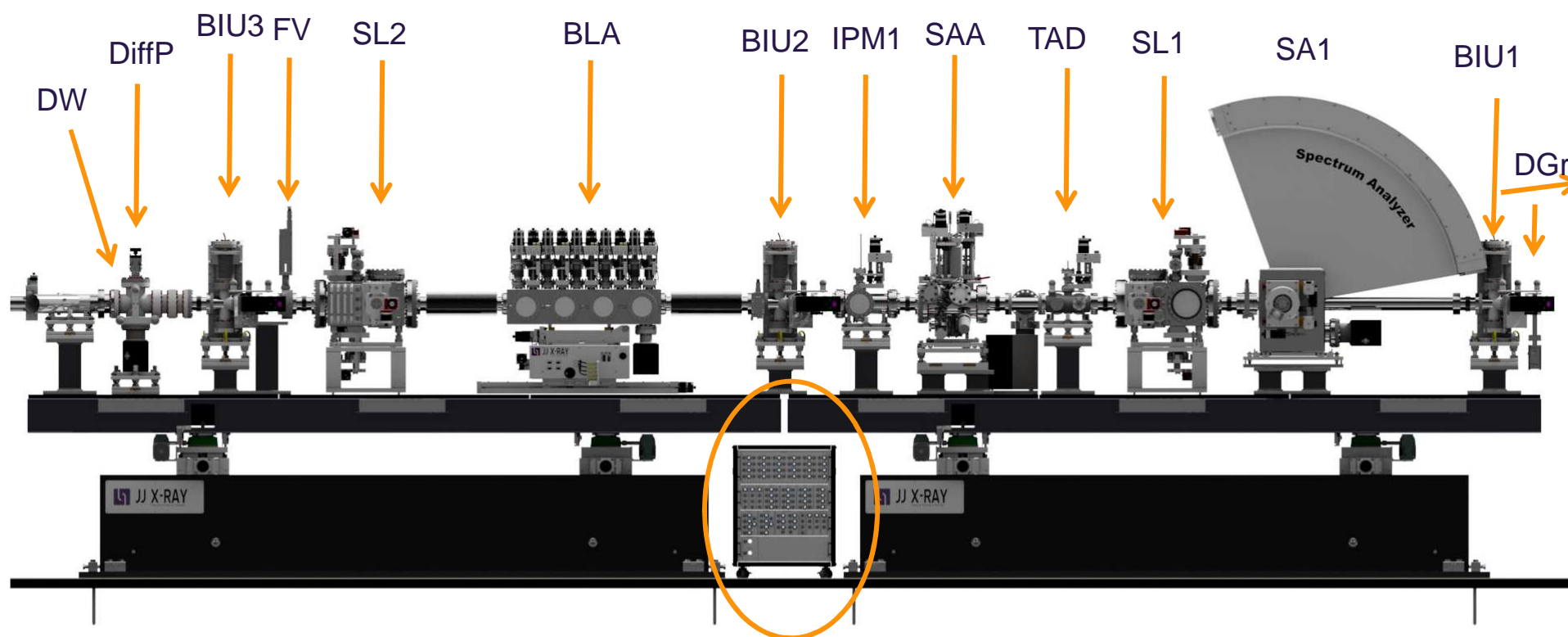
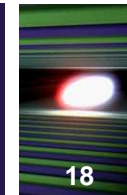
Invited speakers:

S. L. Johnson

M. M. Nielsen

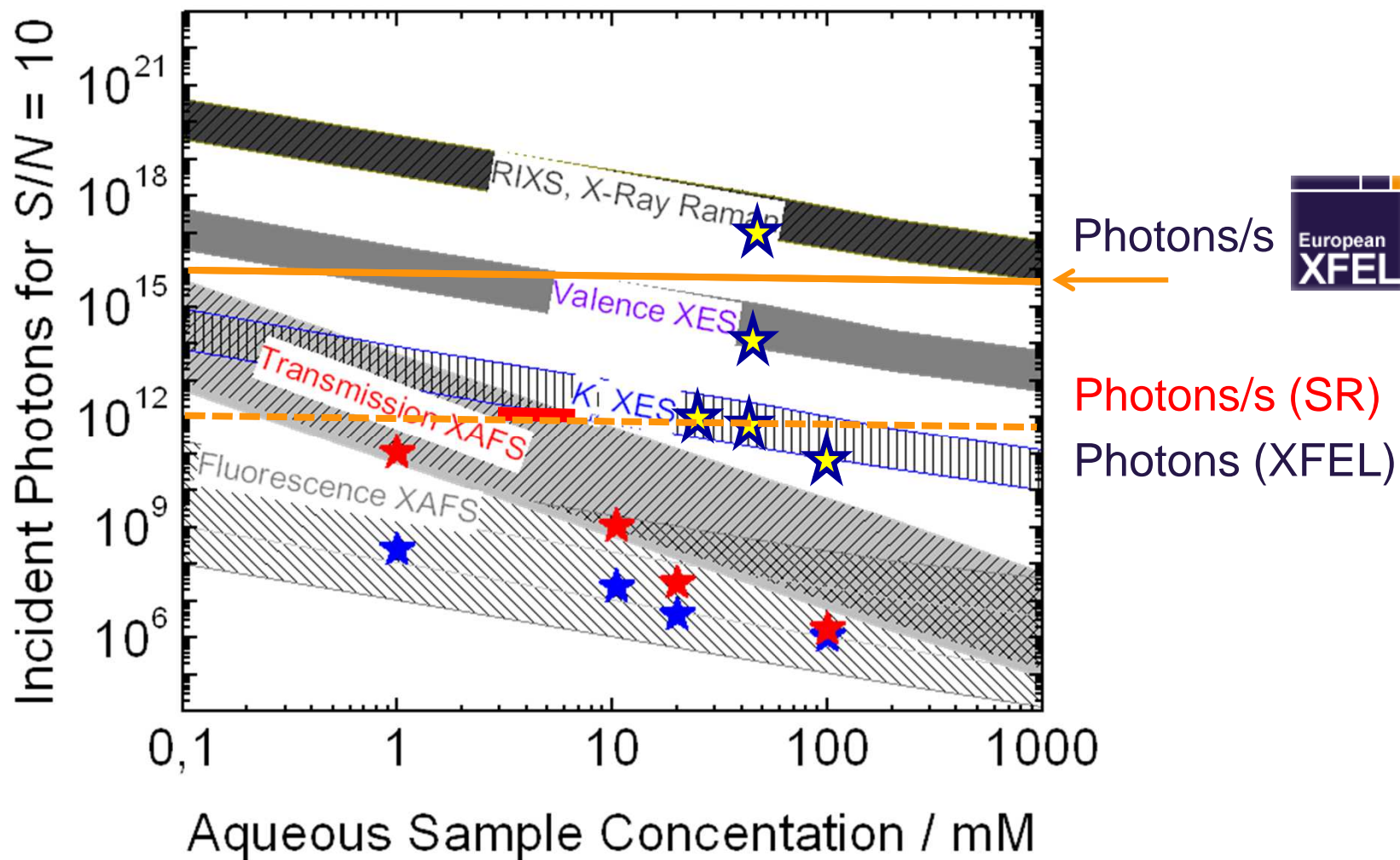
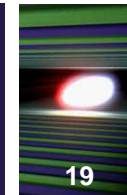
...





■ Patch Panel with Lemo Connectors

Feasibility: solvated molecules (here: H₂O)





- Provide a Suite of Complimentary Tools
 - X-Ray Spectroscopies (XAS, XES, Raman, ...)
 - Forward Scattering (1 MPx, WAXS, ...)
 - Ambient Conditions (He atmosphere)
 - < 50 fs time resolution
 - Solid State Vacuum Chamber
- FXE Instrument well underway...
- ...and fully on schedule
- 2015: freeze design, 2016: Install Instrument
- Come to the FXE Workshop tomorrow for more details



- Wojciech Gawelda (FXE)
- Andreas Galler (FXE)
- Dmitry Khakhulin (FXE)
- Tadesse Assefa (FXE)
- Alexander Britz (FXE)
- Thomas Tschentscher (European XFEL)
- Martin M Nielsen (DTU)
- Christian Mammen et al. (JJ X-Ray)

FXE instrument Workshop: Tomorrow, 13:30-18:00 CFEL SemRoom III (Bldg. 99)
Please visit our posters on Friday: Poster # 90 and #219

Feb 04, 2015

Feb 15, 2015



■The European X-Ray Free-Electron Laser Facility GmbH (European XFEL GmbH) is a multi-national non-profit company. It will make available X-rays of unique quality for studies in physics, chemistry, the life sciences, materials research and other disciplines. Located in the Hamburg area, Germany, it will comprise scientific instruments for a wide range of experimental techniques. Construction of the European XFEL is underway; user operation starts in 2017. For the Femtosecond X-Ray Experiments (FXE) instrument we are looking for a

■Scientific Instrument Support Scientist (f/m)

The Position

- participates in planning, installation, commissioning and maintenance of the FXE scientific instrument infrastructure
- acts as an interface between XFEL internal groups (detector, data management,...), the FXE scientific instrument group and users
- supports and consults instrument users during user operation
- participates in scientific user experiments, but also leads own research efforts at European XFEL

Requirements

- PhD in physics or an equivalent academic degree
- experience in operation of X-ray detectors (1D, 2D)
- beam line experience at a large scale light source facility (SR, FEL)
- knowledge of a programming language like Matlab, C++ or Python is an asset
- good communication skills and ability to work in a multi-lingual, multi-disciplinary team

For additional information, please contact Christian Bressler (christian.bressler@xfel.eu).

General information on working in Germany, Hamburg and the European XFEL can be found at <http://www.xfel.eu/careers>.

■Reference number

- S-107

Duration

■This appointment is initially limited to 3 years. The conversion into a permanent contract is possible. Salary and benefits are similar to those of public service organizations in Germany. In addition European XFEL provides a non-contributory company pension scheme, as well as broad relocation benefits. The European XFEL GmbH intends to achieve a widely international staff. Non-German candidates hired from abroad receive an international allowance.

Handicapped persons will be given preference to other equally qualified applicants. The European XFEL GmbH is an equal opportunity and affirmative action employer and encourages applications from women.

■English is working language, knowledge of German is considered an asset.

Application deadline: 15th Jan 28-30, 2015
Christian Albert Faust, Postfach 10 15 19, 22761 Hamburg, Germany
Please apply online via www.xfel.eu (job offer S-107) and provide a motivation letter next to a CV in English. Mailing address: Notkestr. 85, 22607 Hamburg, Germany.

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■Instrument Engineer (f/m)

The Position

- mechanical integration of FXE Instrument components in collaboration with the experimental team and external suppliers
- planning and construction of FXE experimental infrastructure
- interface with scientists and other technical staff
- construction of the European XFEL

Requirements

- degree

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Application

Current FXE Openings
www.xfel.eu/careers/open_positions/