

Beamline Optics Design and Simulation Workshop

19 May 2025, 09:00 → 22 May 2025, 19:00 Europe/Berlin

Building 1b, Room 4ab (DESY)

Kai Bagschik (FS-PETRA-BO (Beamline Optics Simulation)) , Nazanin Samadi (DESY)

Description This workshop offers a comprehensive, hands-on introduction to the design, modeling, and optimization of optical systems for synchrotron and X-ray beamlines. Participants will explore fundamental principles, advanced design strategies, analytical methods, and cutting-edge simulation techniques essential for modern beamline development.

Through a combination of lectures and practical sessions, attendees will gain experience using simulation tools inside OASYS, a powerful simulation environment, alongside analytical calculations to characterize and optimize beamline components. Key topics include:

- **Synchrotron source properties** – coherence, power, flux, and spectral characteristics
- **Optical system design** – mirrors, monochromators, lenses, and other key beamline elements
- **Simulation techniques** – ray tracing, wavefront propagation, and hybrid methods

Designed for scientists, engineers, and beamline professionals, this workshop provides the essential knowledge and skills needed to effectively simulate and optimize synchrotron optics. Whether you are new to beamline design or looking to enhance your expertise, this interactive training will offer valuable insights, practical techniques, and expert guidance to help you advance your work in X-ray optics, beamline and experiment design.

This workshop is organised by DESY Photon Science in the framework of the PETRA IV project.

Contact ✉ bl-optics-workshop@desy.de

MONDAY 19 MAY

14:00	→ 17:00	Registration
-------	---------	--------------

TUESDAY 20 MAY

08:30	→ 09:00	Registration
-------	---------	--------------

09:00	→ 10:45	Beamline design basics and software
-------	---------	-------------------------------------

09:00	Course Introduction and Welcome ⌚ 15m Speakers: Nazanin Samadi (DESY), Kai Bagschik (FS-PETRA-BO (Beamline Optics Simulation))
09:15	Introduction to SR and Light Sources (IDs, BMs) ⌚ 30m Speaker: Manuel Sanchez del Rio (ESRF)
09:45	Hard X-ray beamline design and optics consideration ⌚ 30m Speaker: Xianbo Shi (Argonne National Laboratory)
10:15	Soft X-ray beamline design and optics consideration ⌚ 30m Speaker: Rafael Celestre (SOLEIL)

10:45	→ 11:05	Coffee Break & Posters ⌚ 20m
-------	---------	------------------------------

11:05	→ 12:30	Beamline design basics and software
-------	---------	-------------------------------------

11:05	Methods for beamline simulations (Ray tracing/ Wave optics/HYBRID) ⌚ 30m Speakers: Luca Rebuffi (Argonne National Laboratory), Xianbo Shi (Argonne National Laboratory)
11:35	Introduction to Oasys ⌚ 15m Speaker: Luca Rebuffi (Argonne National Laboratory)

11:50		Introduction to Shadow4 ⌚ 40m Speaker: Manuel Sanchez del Rio (ESRF)
12:30	→ 13:30	Lunch ⌚ 1h
13:30	→ 15:00	Live Demo: XOPPY, SHADOW4
13:30		Live demo of SHADOW4 simulation of a SXR beamline ⌚ 45m Speakers: Manuel Sanchez del Rio (ESRF), Luca Rebuffi (Argonne National Laboratory)
14:15		Live demo of SHADOW4 simulation of a HXR beamline ⌚ 45m Speakers: Luca Rebuffi (Argonne National Laboratory), Xianbo Shi (Argonne National Laboratory)
15:00	→ 15:20	Coffee Break & Posters ⌚ 20m
15:20	→ 16:10	Live Demo: XOPPY, SHADOW4
15:20		Power transport and management in synchrotron beamlines & Live demo ⌚ 50m Speakers: Manuel Sanchez del Rio (ESRF), Philipp Brumund (European Synchrotron Radiation Facility, 38043 Grenoble, France)
16:10	→ 18:00	Problem Solving and Practice

WEDNESDAY 21 MAY

09:00	→ 10:30	SRW
09:00		SR source related calculations with SRW ⌚ 45m Speakers: Luca Rebuffi (Argonne National Laboratory), Rafael Celestre (SOLEIL)
09:45		Wavefront propagation for X-ray beamlines with SRW ⌚ 45m Speakers: Luca Rebuffi (Argonne National Laboratory), Rafael Celestre (SOLEIL)
10:30	→ 10:50	Coffee Break & Posters ⌚ 20m
10:50	→ 12:00	Live Demo: SRW
10:50		Live demo of OASYS-SRW simulation of beamlines ⌚ 1h 10m Speakers: Luca Rebuffi (Argonne National Laboratory), Manuel Sanchez del Rio (ESRF)
12:00	→ 13:00	Lunch ⌚ 1h
13:00	→ 14:30	Special topic: Mirrors, lenses
13:00		X-ray mirror system design and specification ⌚ 45m Speaker: Xianbo Shi (Argonne National Laboratory)
13:45		CRL design and phase correctors ⌚ 45m Speaker: Frank Seiboth (FS-PETRA (PETRA III))
14:30	→ 14:50	Coffee Break & Posters ⌚ 20m
14:50	→ 15:35	Live Demo: CRL
14:50		CRL ray tracing, error simulations, wavefront propagation (SRW, HYBRID) ⌚ 45m Speaker: Rafael Celestre (SOLEIL)

15:35 → 16:50 **Live Demo: Heatload, power transport**

15:35 | **Introduction to XOPPY & Live demo** ⌚ 45m
Speaker: Manuel Sanchez del Rio (ESRF)

16:20 | **Thermal load calculation through beamline** ⌚ 30m
Speaker: Luca Rebuffi (Argonne National Laboratory)

16:50 → 18:00 **Problem Solving and Practice**

THURSDAY 22 MAY

09:00 → 10:30 **Methods on transverse coherence**

09:00 | **Basics of coherence** ⌚ 30m
Speaker: Ruslan Khubbutdinov (None)

09:30 | **Introduction to Wofry & coherent mode decomposition** ⌚ 1h
Speaker: Manuel Sanchez del Rio (ESRF)

10:30 → 10:50 **Coffee Break & Posters** ⌚ 20m

10:50 → 12:00 **Live Demo: Partial coherence & OASYS scripting**

10:50 | **Multi electron simulations with SRW - partial coherence** ⌚ 30m
Speakers: Manuel Sanchez del Rio (ESRF), Luca Rebuffi (Argonne National Laboratory)

11:20 | **OASYS scripting & extensions** ⌚ 40m
Speaker: Luca Rebuffi (Argonne National Laboratory)

12:00 → 13:00 **Lunch** ⌚ 1h

13:00 → 13:40 **Special topic: Grating monochromators**

13:00 | **Grating design** ⌚ 40m
Speaker: TBA

13:40 → 14:10 **Live Demo: Gratings**

13:40 | **Grating simulations** ⌚ 30m
Speaker: Manuel Sanchez del Rio (ESRF)

14:10 → 14:30 **Coffee Break & Posters** ⌚ 20m

14:30 → 16:50 **Special topic: Crystal monochromators, analyzers & other optics**

14:30 | **Laue crystals - flat and bent** ⌚ 30m
Speaker: Manuel Sanchez del Rio (ESRF)

15:00 | **Multi-layer monochromators** ⌚ 20m
Speaker: Manuel Sanchez del Rio (ESRF)

15:20 | **Phase shifters and polarizers** ⌚ 20m
Speaker: Manuel Sanchez del Rio (ESRF)

15:40 | **Curved analyzers** ⌚ 20m
Speaker: Xianbo Shi (Argonne National Laboratory)

16:00

Multilayer Laue Lenses (MLLs)

🕒 30m

Speaker: Margarita Zakharova (FS-ML (Multilayer))

16:30

Other simulation softwares

🕒 20m

16:50

→ 18:20

Problem Solving and Practice
