LEAPS League of European Accelerator-based Photon Sources

BSBF 2022

ESAPS2022,
Boosting LEAPS connection to industry

Caterina Biscari
ALBA Synchrotron

LEAPS outgoing chair

https://www.bsbf2020.org/

5th October 2022

LEAPS

BSRF 2022

at a glance

LEAPS is the largest consortium of analytical facilities world-wide and further expanding its service to an interdisciplinary European user community

19 facilities - **16** institutions - **10** countries

> 300 operating End Stations

> 1.000.000 h beamtime /year

> 5.000 publications/year

> 15 spin off companies

> 35.000 users from all EU & beyond researchers from all research area

Construction and Operation (~ 800 M€/year) through national funding

LEAPS League of European Accelerator-based Photon Sources

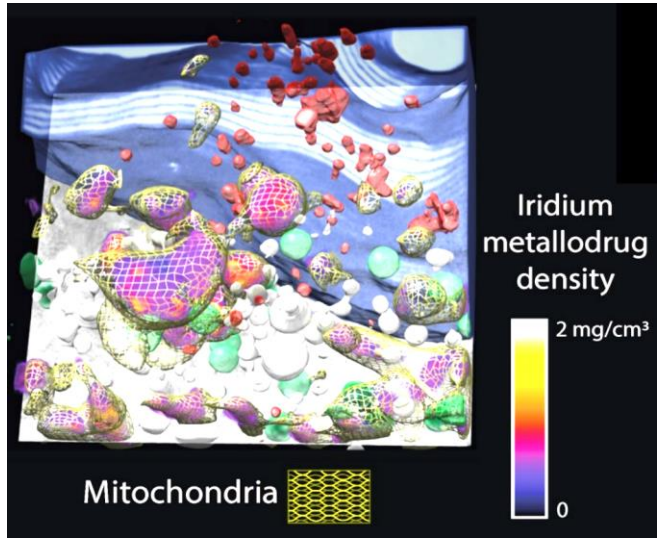
LEAPS

BSRF 2022

at a glance

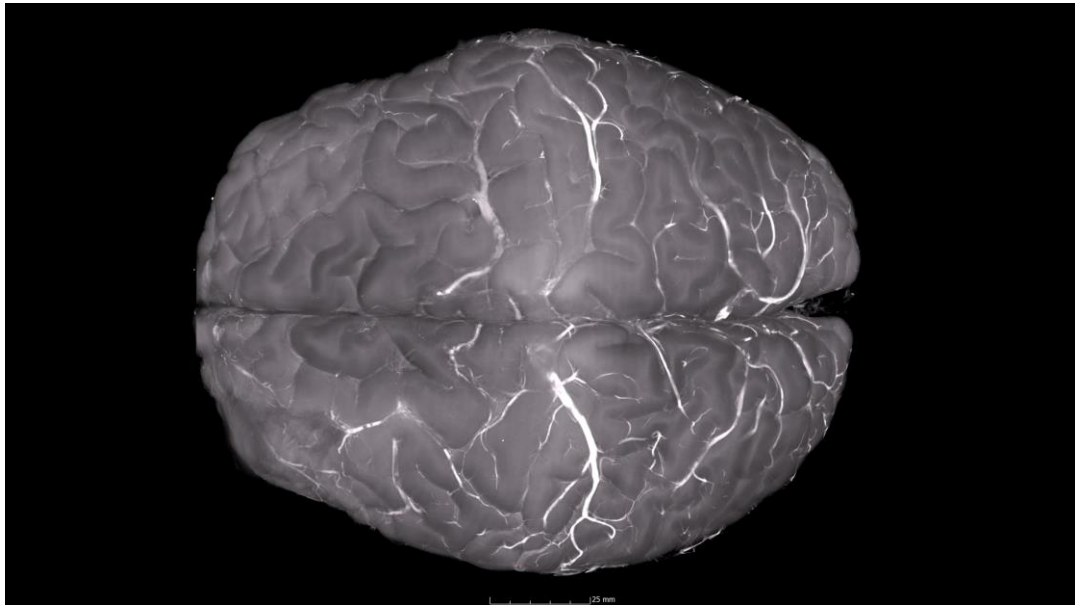
LEAPS provides unique solutions to broad scientific areas
Life Sciences – Health

From proteins, through cells, tissues up to massive high resolution tomography



Credit CNB-CSIC/ALBA/ESRF

Credit ALBA



Human Atlas, credit ESRF

Collaboration with research institutions, universities, medical centers, pharma industry

LEAPS

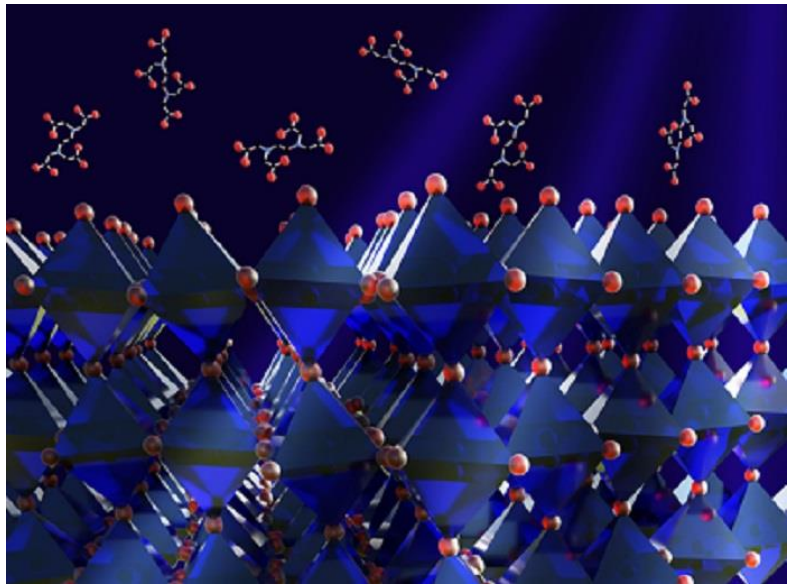
BSRF 2022

at a glance

LEAPS provides unique solutions to broad scientific areas

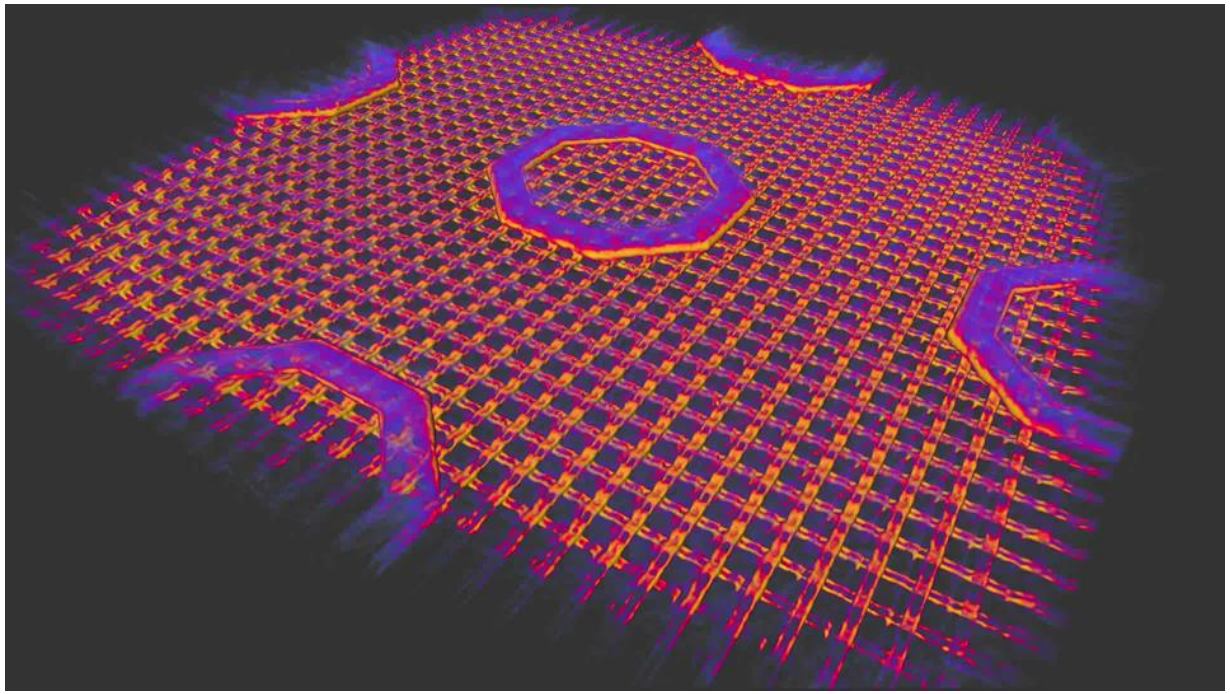
Material science

Electronic and magnetic properties of matter
Quantum materials
Atom and molecule physics
Energy materials
Surface science
Catalysis
Environmental sciences
Information technologies
Cultural Heritage



Perovskite research - Diamond

[Microchip Structure - PSI]



Collaboration with research institutions, universities, advanced material industry, strategic projects

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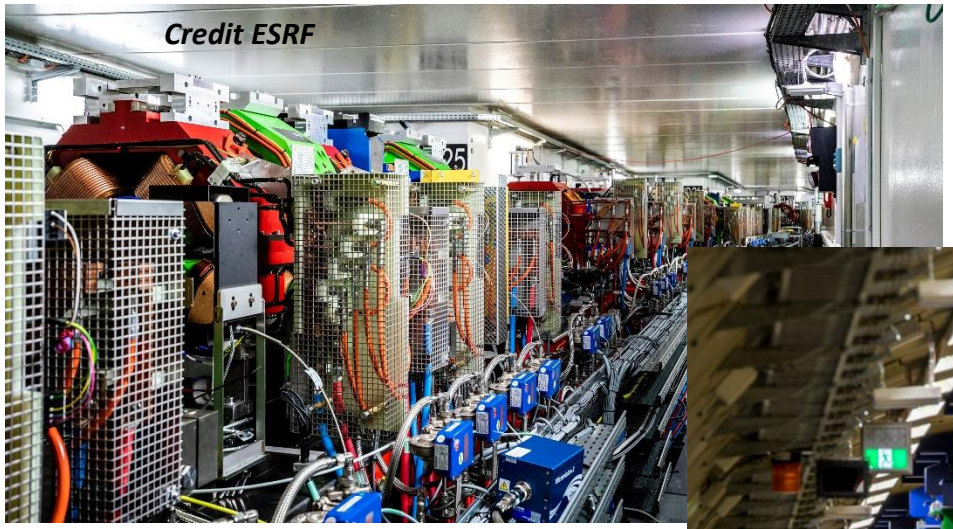
LEAPS

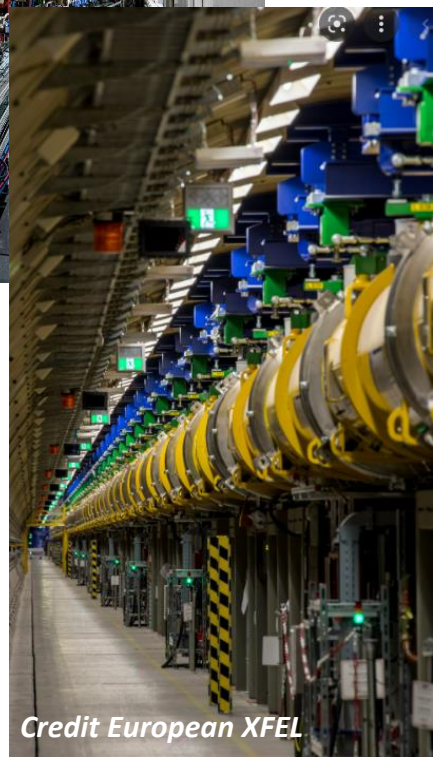
BSRF 2022

at a glance

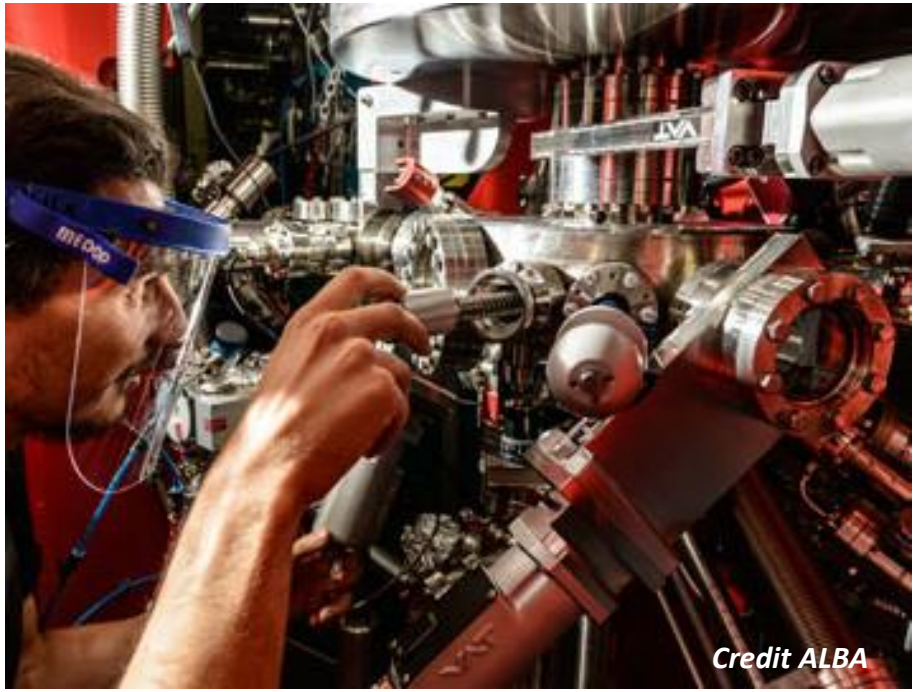
LEAPS and Industry

Leading evolution from 3rd to 4th generation synchrotrons and FEL technologies





Innovation hubs
Industry as provider and Industry as a research collaborator



World leadership in technologies

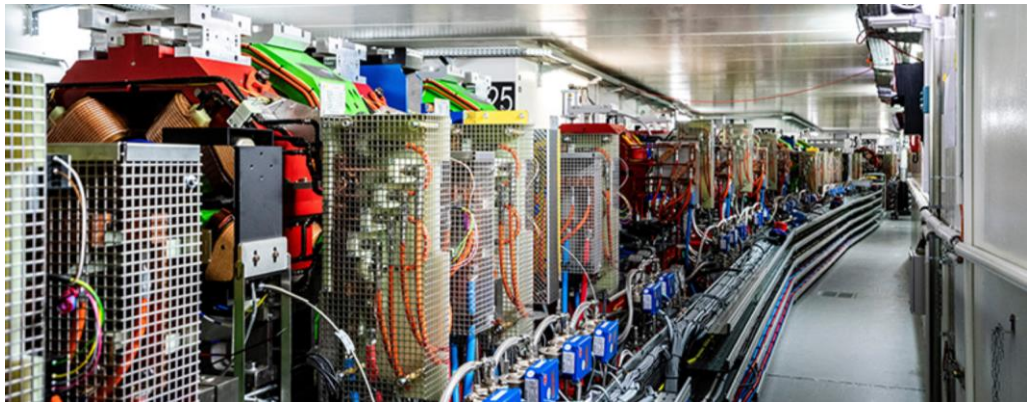
MAX IV

***MAX IV*, the first 4th gen Synchrotron**

https://www.maxiv.lu.se/

ESRF
The European Synchrotron

***ESRF-EBS*, the first upgraded from 3rd to 4th**



European Synchrotron Radiation Facility (ESRF)

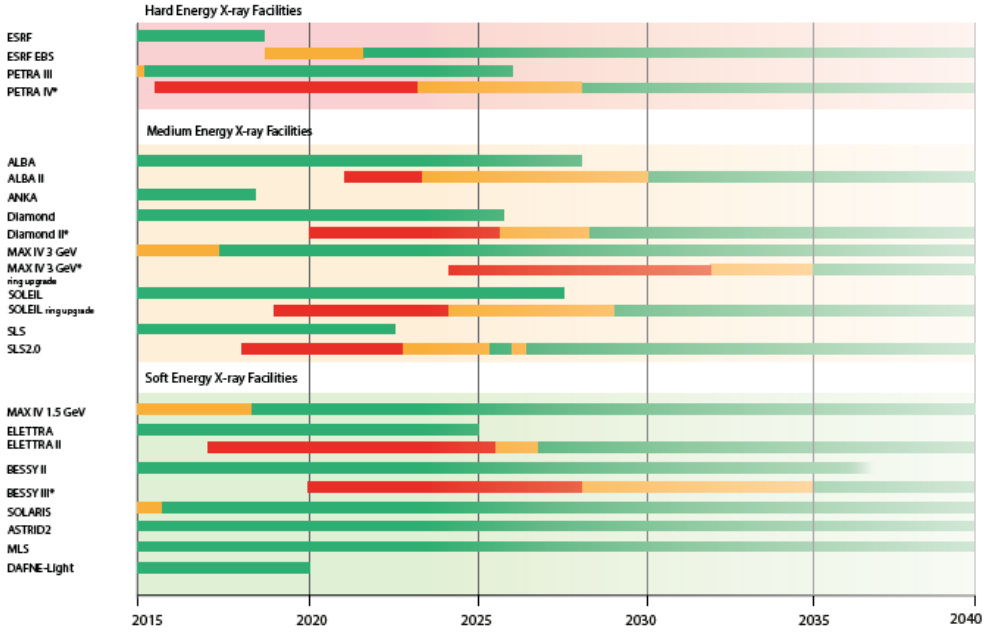
The LEAPS example is being followed all over the world.

@ LEAPS: ALBA II, BESSY III, Diamond2, Elettra2, Petra IV, Soleil2, SLS2

LEAPS Facilities approved upgrades and plans for upgrades

at a glance

Storage Rings



Free Electron Lasers

*facility planning (subject to approval)

Planning Period | Construction | User Operation | Upgrade programs of existing facilities

LEAPS League of European Accelerator-based Photon Sources

LEAPS Facilities Investment Plans 2022-2026

Investment Plans

- **Estimation of total investment**

Activity (2022-2026)	Approximate numbers
No. of new beamlines being constructed or refurbished	70
Yearly/Total operational budget	800/4000 M€
Budget for investments	450 M€
Budget for the upgrade programs (partly already funded)	550 M€

Larger investments foreseen for the period 2027-2030

LEAPS Facilities Investment Plans 2022-2026

Investment Plans

ESRF – The European Synchrotron

In August 2020, the ESRF opened its completely rebuilt X-ray source, **ESRF-EBS (Extremely Brilliant Source)**, the world's first fourth-generation high-energy synchrotron.

- **Beamline works**

4 beamlines under construction,
6 beamlines under refurbishment

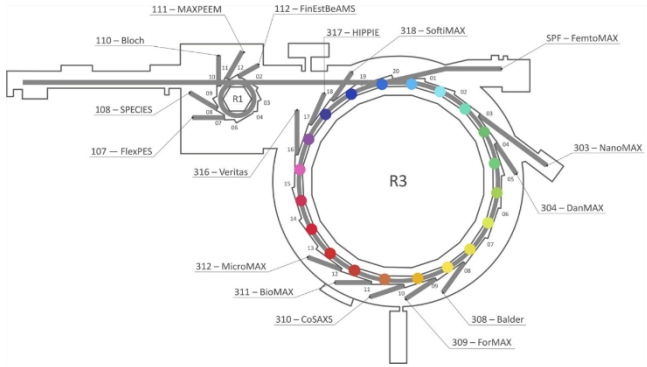
ESRF
The European Synchrotron

MAX IV

- **New beamlines:**
  - 2 beamlines currently under commissioning
  - Capacity to host up to 10 more beamlines

- **Accelerator Upgrades (after 2026):**

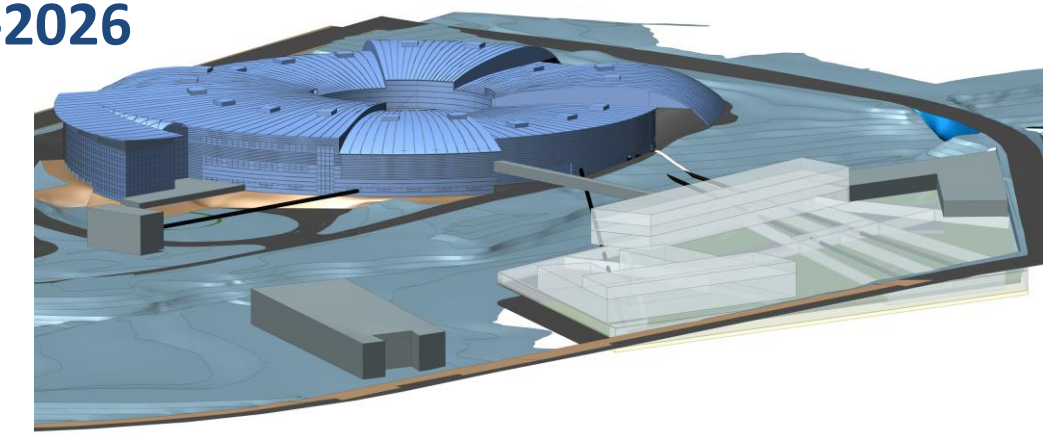
In the long term, an upgrade of the MAX IV 3 GeV storage ring into a diffraction-limited source for 10 keV photons is foreseen.



LEAPS League of European Accelerator-based Photon Sources

LEAPS Facilities Investment Plans 2022-2026

ALBA synchrotron



PLANNED investments:

***ALBA II Enabling technologies (2022-2025*):**

- Prototyping a full arc of the ALBA II Storage Ring including magnets, power supplies, vacuum chamber, diagnostics, girder
- Superconducting undulator
- Set-up of a Nanopositioning laboratory, including civil infrastructure
- TEM, AFM, STM Microscopes – *Planes Complementarios*

Beamline and experimental technologies

Visit ICTS stand

- Last calls for tender for Hard X-ray tomography and MX beamlines being placed
- New beamline on surface spectroscopy starting now
- Upgrades of several beamline detectors, end-stations, sample environments
- Set-up of laboratories for batteries, catalysis, bio
- Data infrastructures upgrades

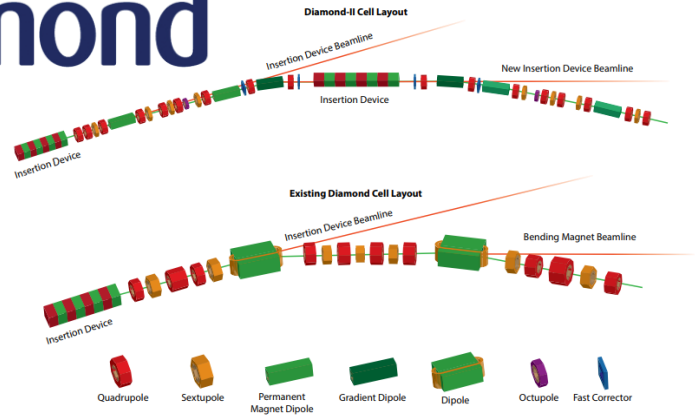
FUTURE investments after 2026 (being secured)

- Upgrade of the storage ring, construction on new long beamlines

https://www.cells.es/en/science-at-alba/alba-ii-upgrade

LEAPS Facilities Investment Plans 2022-2026

diamond



https://www.diamond.ac.uk/Home/About/Vision/Diamond-II.html

PLANNED upgrades:

- Diamond II: 4th generation upgrade of Diamond's accelerators,
- "dark period" foreseen in 2026-2028

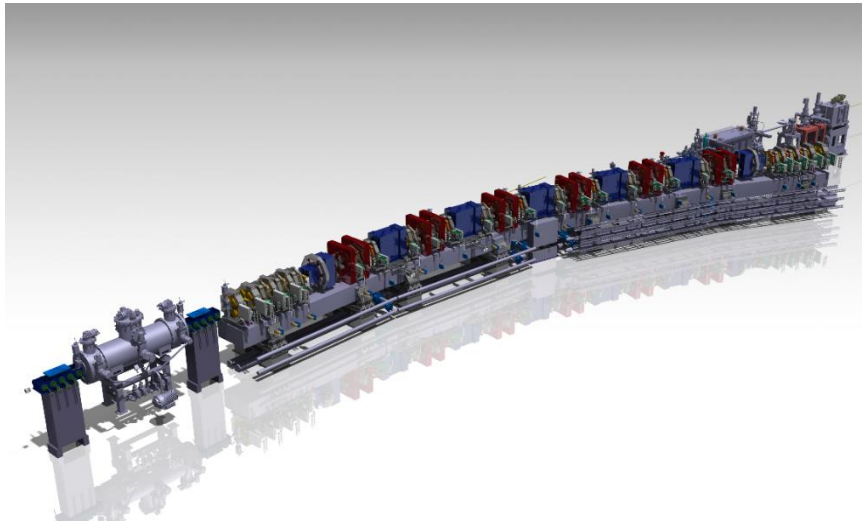
NEW beamlines:

- 3 new beamlines will be built alongside the implementation of 2 major beamline upgrades.

SWISS LIGHT SOURCE SLS

SLS 2.0 synchrotron

7-MBA upgrade - Upgrade to 4th generation



https://www.psi.ch/en/sls2-0

LEAPS Facilities Investment Plans 2022-2026

Investment Plans

Elettra Sincrotrone Trieste

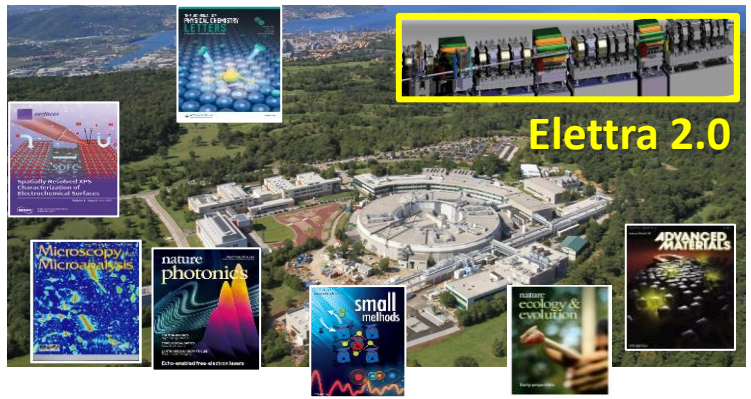
[Elettra Sincrotrone Trieste]

Elettra 2.0 (upgrade project ongoing)

- Upgrade of the Storage ring: 2025-2026 installation of the new DLSR;
- Upgrade of 22 beamlines and end-stations;
- Construction of 9 new beamlines;
- Timeline for phase 1 & 2: 2022–2026.

FERMI FEL

- Upgrade planned after ELETTRA 2.0 UPGRADE.



INFN
Istituto Nazionale di Fisica Nucleare

EuPRAXIA

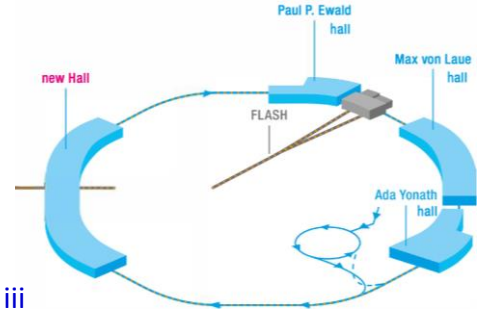
http://www.eupraxia-project.eu/

EuPRAXIA – Frascati: New Plasma acceleration FEL infrastructure (ESFRI Roadmap)
Timeline 2020 – 2028 (TDR R&D 2022-2025)

EuAPS PNRR: 3 Betatron radiation sources for users Timeline 2022-2026

SABINA@SPARC: THZ-IR beam line
Timeline 2020 - 2023

LEAPS Facilities Investment Plans 2022-2026



https://photon-science.desy.de/facilities/petra_iii
https://photon-science.desy.de/facilities/flash2020_project

PLANNED upgrades:

PETRA III:

- refurbishment of beamline instrumentation
- construction of two new beamlines
- preparation of the funding proposal and TDR for PETRA IV upgrade project

(6 GeV, 20 pmrad)

FLASH2020+ project:

Energy upgrade of the super conducting linac to 1.35 GeV, external seeding at high repetition rate, new injector and pump-probe lasers, helical, variable gap-undulators, new photon diagnostics and user beamlines.

Solaris - SOLARIS National Synchrotron Radiation Centre - Jagiellonian University (uj.edu.pl)

PLANNED upgrades:

- experimental hall extension to accommodate 4 new beamlines and cryoTEM facility

Beamlines upgrades:

- 3 beamlines under construction,
- 8 BL to be designed.

Investment Plans

LEAPS Facilities Investment Plans 2022-2026

Investment Plans

HZB Helmholtz Zentrum Berlin

Helmholtz-Zentrum Berlin (HZB) - Mainpage (helmholtz-berlin.de)

Ensure reliable and stable operation until 2035+, new, unique opportunities for *operando* studies

- **Accelerator & Infrastructure**
  - Replacement / upgrade of critical components like power supplies, magnets, cavities, undulators etc.
- **Beamlines:**
  - 2 dipole beamlines for *operando* studies of electrochemical interfaces;
  - 1 undulator beamline for *operando* battery research;
  - 1 undulator microARPES beamline branch.

PTB, Metrology Light Source

Physikalisch-Technische Bundesanstalt
National Metrology Institute

https://www.ptb.de/cms/en/ptb/fachabteilungen/abt7/ptb-sr.html

NEW beamlines:

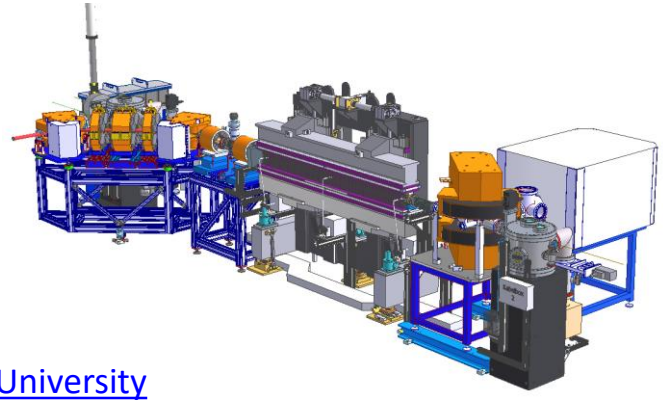
- vacuum-ultraviolet radiometry (VUVR) characterisation 3 eV to 30 eV range
- VUV irradiance calibration

Instrument upgrades:

- new EUV reflectometry facility for large industrial optics (operational 2022);
- new primary detector standard (radiometer) 3 eV to 300 eV (operational 2025).

LEAPS Facilities Investment Plans 2022-2026

Investment Plans



FELIX laboratory – Radboud University

ISA - ASTRID2 – the ultimate synchrotron radiation source (au.dk)

PLANNED upgrades:

- FEL-2, undulator and cavity,
- upgrade RF system,
- two-color operation, variable pulsing schemes,
- optical switchyards.

New endstations:

- 3 endstations under construction;
- connection FELs to high field magnets (up to 45 T)

- **Beamlines:** Construction of the new micro-focus beamline will continue.
- **Instruments:** New Apple-2 undulator with upgraded beamline and end-station is planned

LEAPS Facilities Investment Plans 2022-2026 and beyond 2026

European XFEL

European XFEL

- **Mid-term development (2022-2026)**
  - Develop and build a superconducting afterburner (SCU)
  - Build the 8th scientific instrument for hard x-Rays
  - Provide sub-femtosecond pulse duration capability (ASPECT)
  - Initiate the design and construction of a 2nd generation of pixel detectors (DET, R&D) -> available 2028-2030
  - Prepare to build new insertion devices, photon transport systems and instruments at empty tunnels.

Potential upgrade options for European XFEL +2026

- Accelerator upgrade
  - Burst mode
  - CW mode: implement new injector and RF system
    - Continuous delivery
    - Long pulse mode
- Beam distribution and science instruments

Investment Plans

Investment Plans

LEAPS Facilities Investment Plans beyond 2026

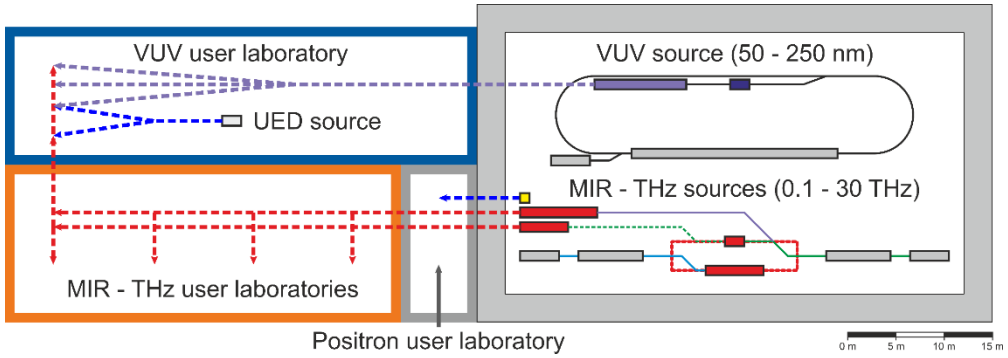
HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF

https://www.hzdr.de/DALI

PLANNED upgrade:

A successor facility for ***ELBE***,

- ***DALI:*** Dresden Advanced Light Infrastructure
- Detailed technical planning 2025 – 2026
- Construction is envisioned between 2027 and 2031

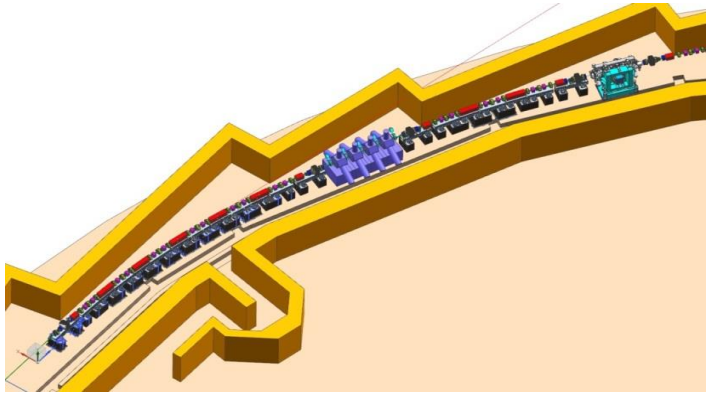


SOLEIL SYNCHROTRON

French national synchrotron facility (synchrotron-soleil.fr)

PLANNING of the upgrade:

- First stage: upgrade of accelerators and adaptation and/or reconstruction of several beamlines.
- Total upgrade envisioned in **2024-2033**



LEAPS Facilities Investment Plans

- **TECHNOLOGY FOCUS**

  ✓ Accelerator technology as a whole (magnets, vacuum, rf, control, diagnostics, civil infrastructure)

  ✓Advanced X-ray technique use with wide range of beamline end-stations

  ✓Stability & Nano-positioning instrumentation

  ✓X-Ray Detectors & Optics

  ✓Beamline Control & Data Management

  ✓High-throughput Data Acquisition & Online Data Analysis

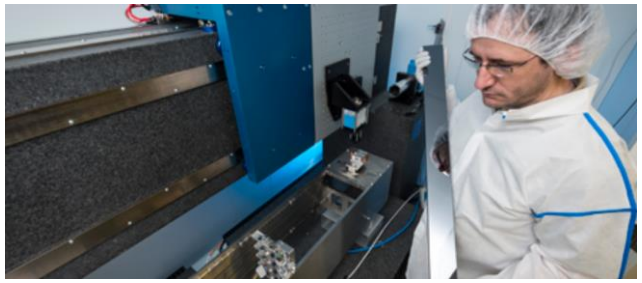
LEAPS Facilities Investment Plans

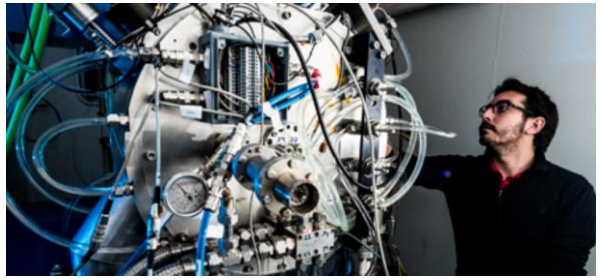
- **TECHNOLOGY & KNOWLEDGE TRANSFER**

  ✓ Commercial access for testing instrumentation with dedicated laboratories (magnetic measurements, rf systems, optics, vacuum,…)

  ✓ Expert tender support

  ✓ Technology transfer and instrumentation design licences



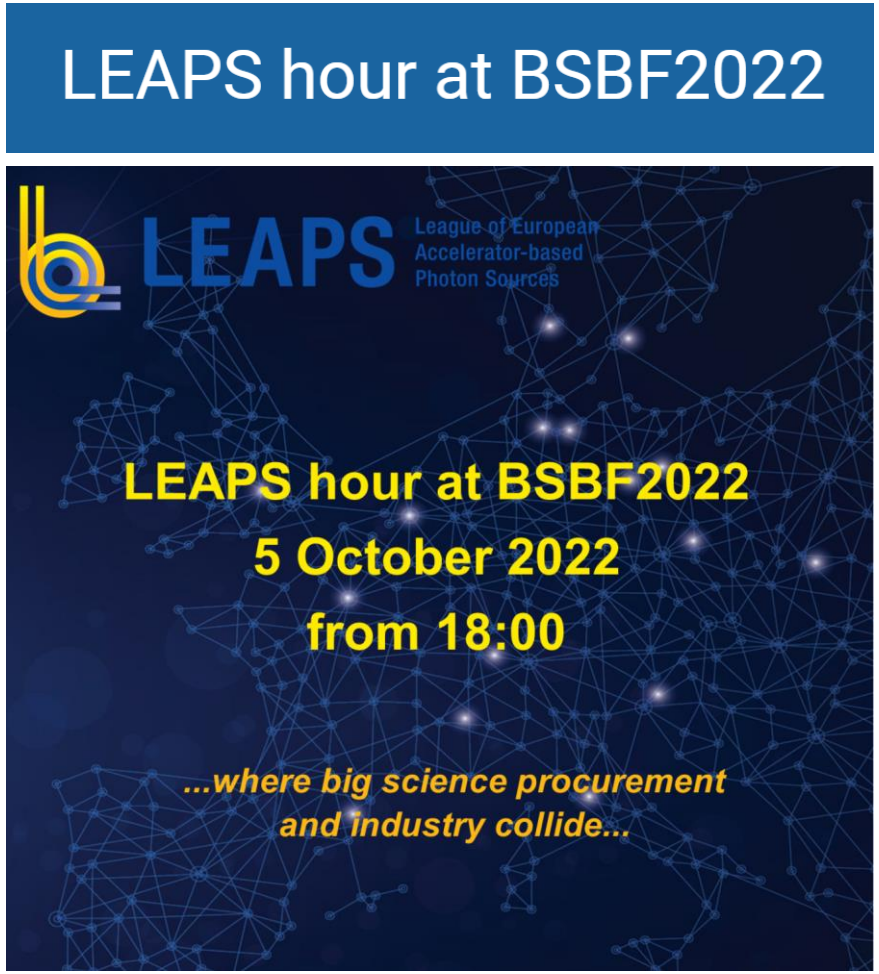


LEAPS at BSBF2022

Next two talks by

- Michele Svandrlik on DIGITAL LEAPS

- Elke Plönjes-Palm on LEAPS-INNOV



LEAPS

BSRF 2022

LEAPS

League of European Accelerator-based Photon Sources

Tool for European inclusiveness

"The strength of LEAPS lies in its staff and users, hailing from all European countries, beyond those which host the facilities."

Tak

Tack

Thanks

Bedankt

Danke

Dziękuję

Merci

Grazie

Gracias

شكك

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https://leaps-initiative.eu