



LEAPS League of European
Accelerator-based
Photon Sources

LEAPS: Advancing Science and Technology in Europe

*Mirjam van Daalen, Paul Scherrer Institut
Vice chair LEAPS coordination board*

LEAPS Information
Institute of Physics Belgrade
28th of May 2019



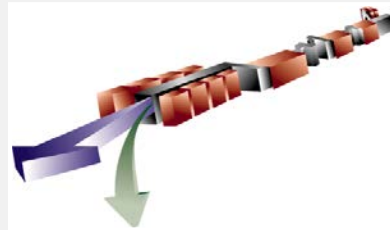


LEAPS

League of European
Accelerator-based
Photon Sources

Europe's highly advanced community has devised a transformative level of cooperation, coordination and integration for boosting science and innovation in Europe

European Synchrotron Radiation and FEL Facilities



are joining forces
to master
the challenges of the next decades

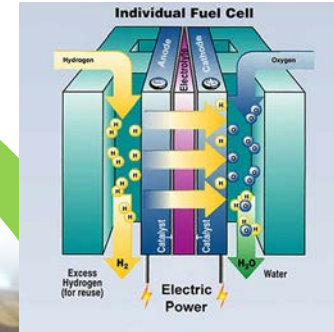


LEAPS 21st Century - Era of Complexity

Aerospace Technologies

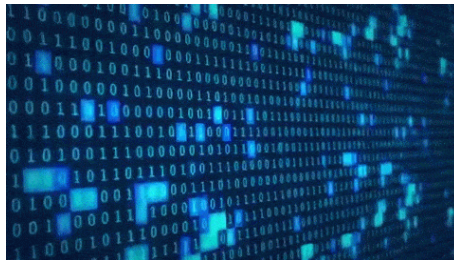


Energy Technologies



**Materials
Made to Measure**

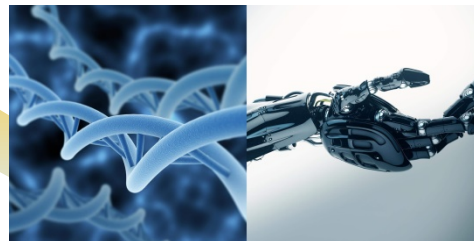
Digital Future **EOSC**



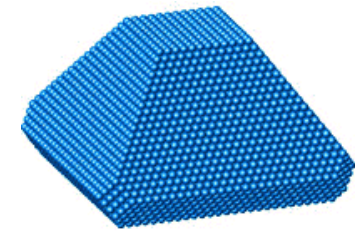
IT Technologies



Biomedical Technologies



“When the going gets tough”



© A. Stierle, DESY

21st Century - Era of Complexity

- **Answers to the Grand Challenges require new materials solutions for**
 - sustainable energy and transport concepts
 - better drugs
 - digital future
- **Challenge**
 - design of multifunctional materials with molecular control
 - operando/ in vivo analytic with highest precision
- **European Synchrotron and FEL facilities** getting prepared for shaping the future:

Joining forces for Science and Technology in Europe

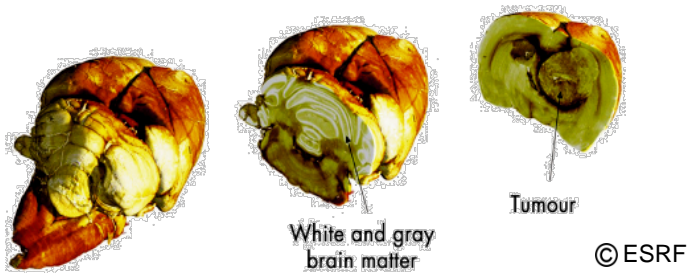


X-rays for better Materials

„A lot in mind - A lot behind“

Pushing scientific excellence

Serving and integrating **24.000** users from all scientific disciplines



Over **23.000** unique articles published in peer reviewed journals in the last **5** Years

5 Nobel Prices linked to LEAPS facilities

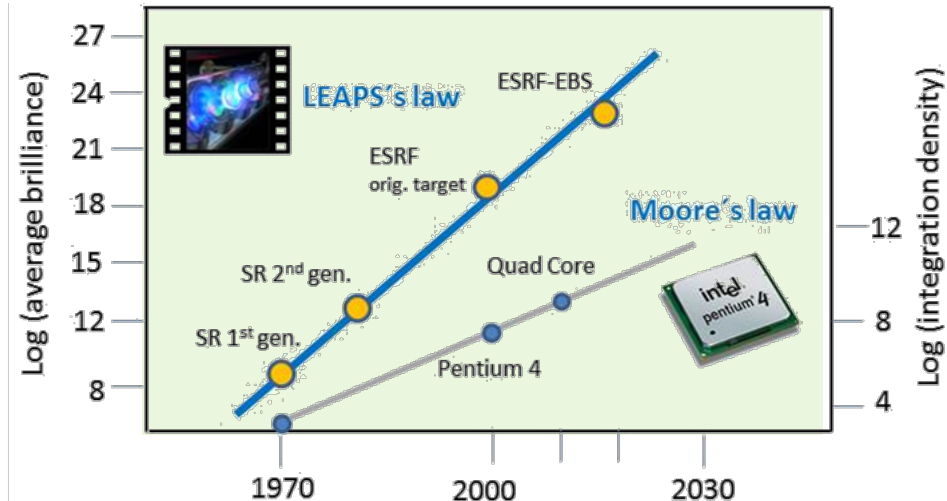
In 2016 more than **500.000** hours of beamtime

More than **300** operational experimental stations

Pushing technology limits

Storage Rings as Ultimate Microscopes:
Breakthrough HMBA Technology

Free Electron Lasers as High Speed Cameras
Merging Laser Tech with X-ray Tech



LEAPS Members and Aims

16 Members: all SR and FELs operating in EU agree to work coherently to:

1. Shape future science & technology at accelerator-based light sources
 - **Collective landscape document and strategy** across European facilities
 - Periodical update of **roadmaps and action plans for key technologies**
 - **Develop future policies with stakeholders** (e.g. European Commission)
2. Engage more effectively with industry and **boost innovation**
3. Improve and broaden user access and **enhance European integration**
4. Promote **Open Science, education, training and exchange of staff, common indicators, communication and outreach**

LEAPS Meetings

Frankfurt
November

Brainstorming
and Analysis
of challenges
After DESY
call

ESRF

Initiative
analysis and
WG reports

SOLARIS

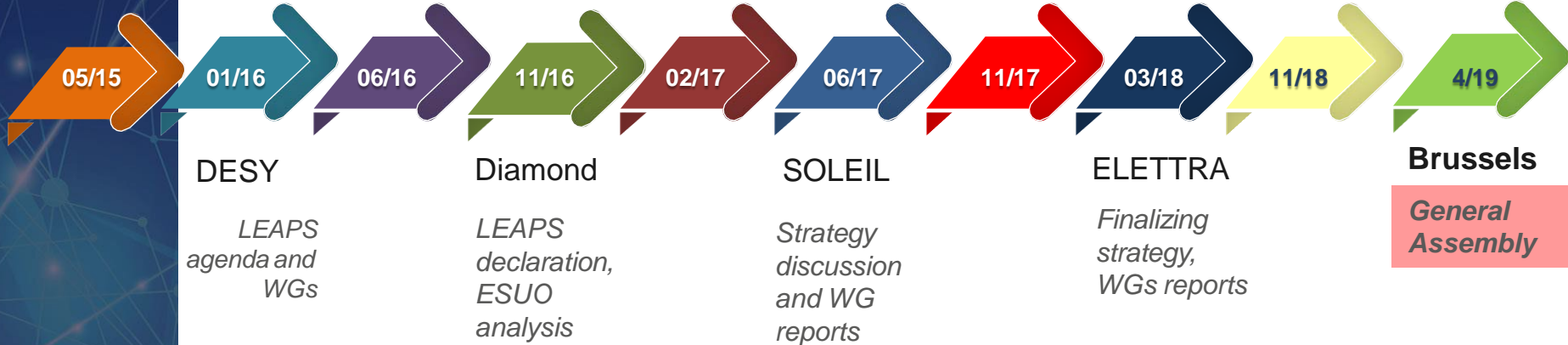
WG
reports.

Brussels

Launch event
and
Coordination
Board
constitution

DESY

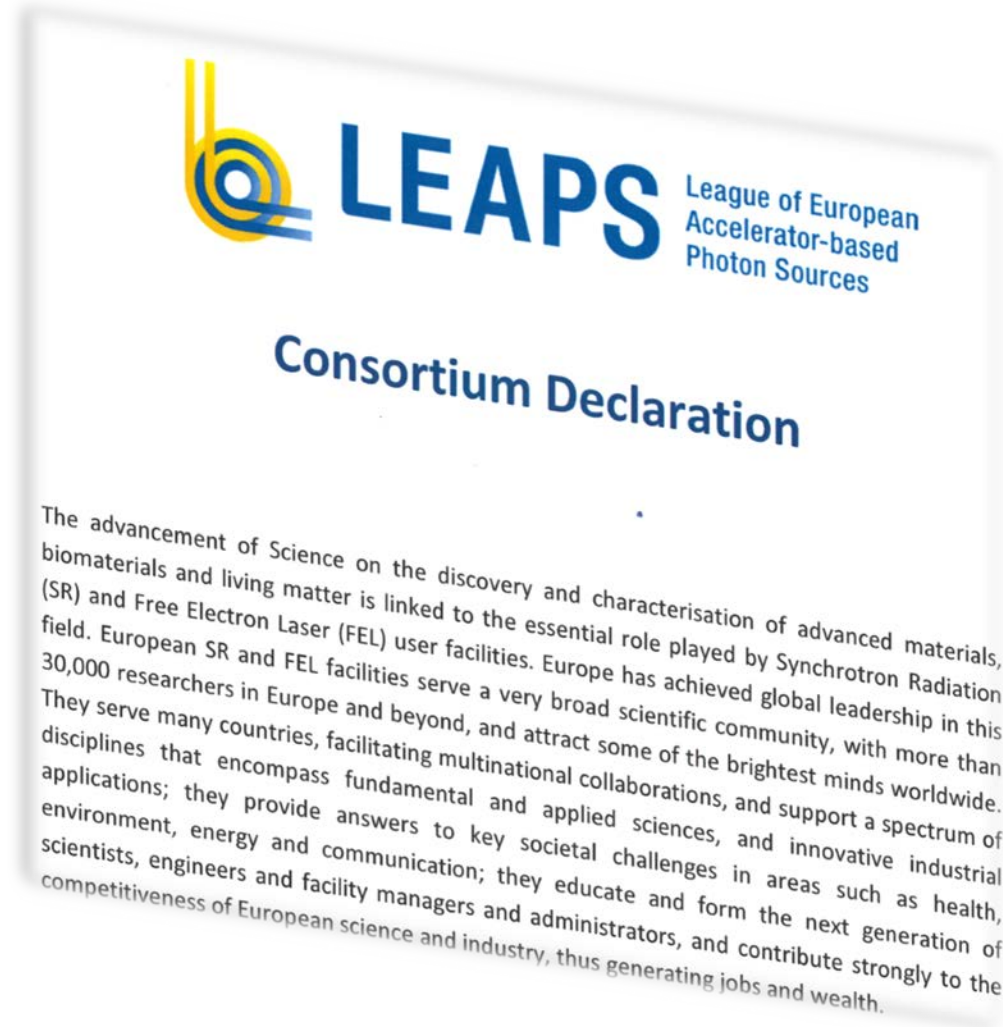
1st
Plenary
meeting



1st official document

**Signed by 16
member facilities
on the 13-11-17
at the Brussels
Launch Event**

First GA Meeting



LEAPS international presence



10-16
ICRI 2016
SouthAfrica

03-18
DOE/BESAC
Washington

03-18
RI conference
Sofia

29-05-18
Lightsources
Berlin

06-18
SRI2018
Taipei

05-19
Inst. Phys
Belgrade

12-18
ESFRI
Brussels

09-18
ICRI 2018
Vienna

03-19
LENS
Liblice

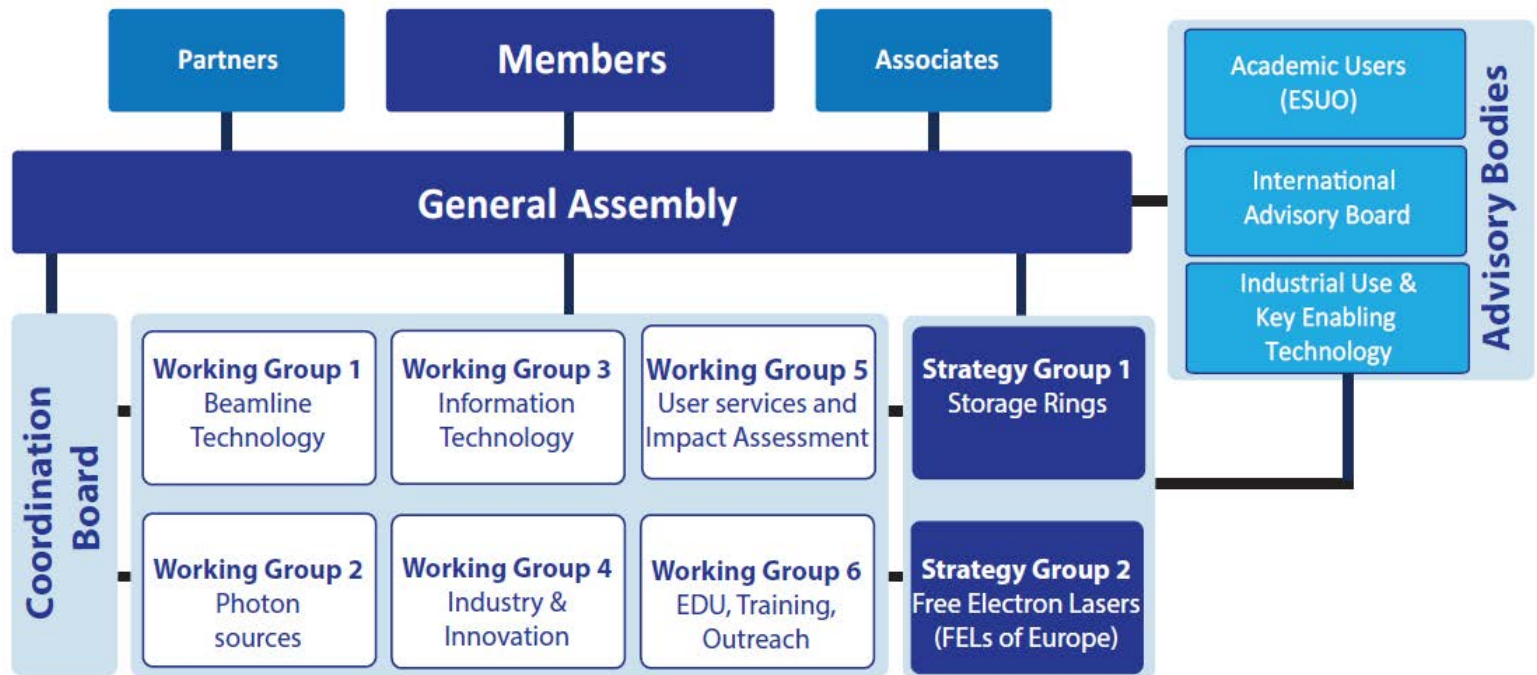
18-12-18
UNESCO/
Sesame
Paris

10-18
ISCS 2018
Beijing



Organisation

Operational since Nov 2017

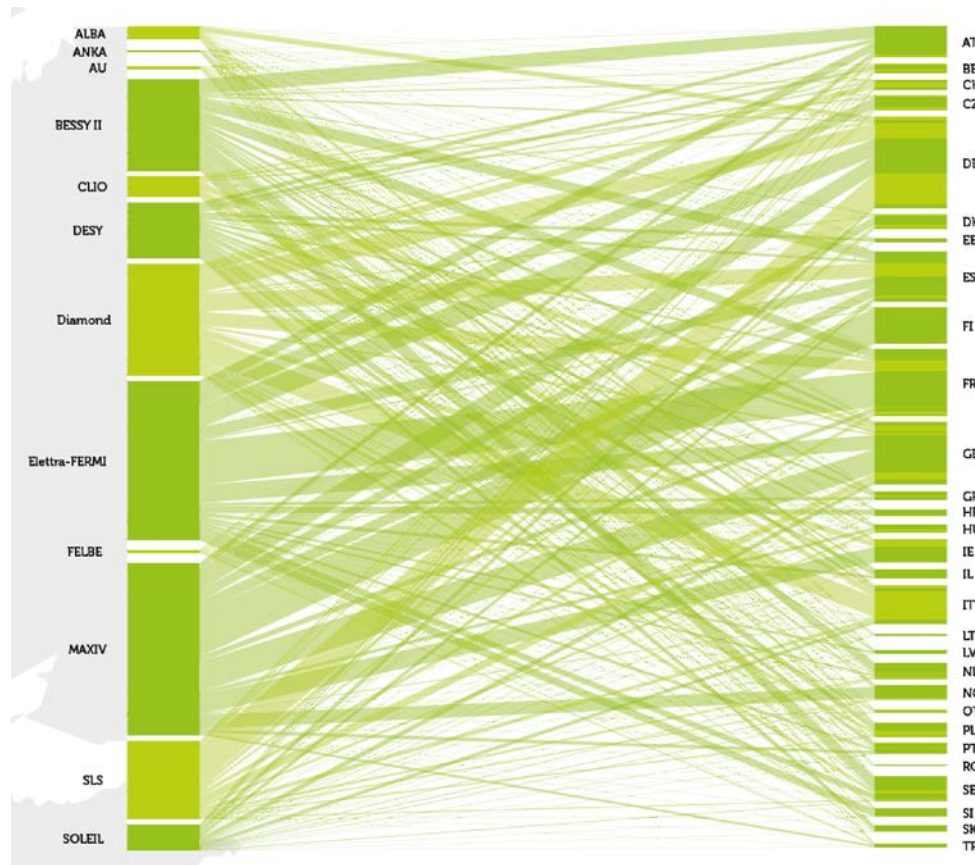


Integration

“New strategic partnerships in Europe and beyond”



25000 users in Europe



Synchrotron/FEL community is fully transnational.

Facilities, through LEAPS, are taking over from users and further developing the already fruitful collaboration

From ESUO, 2016

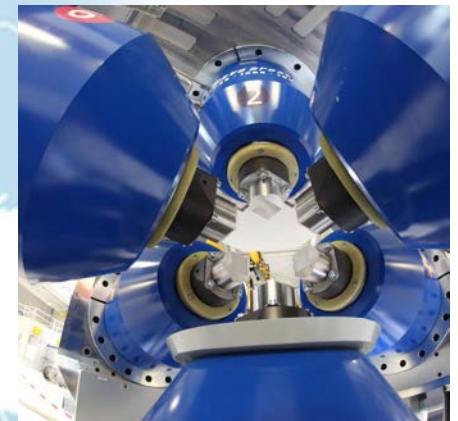
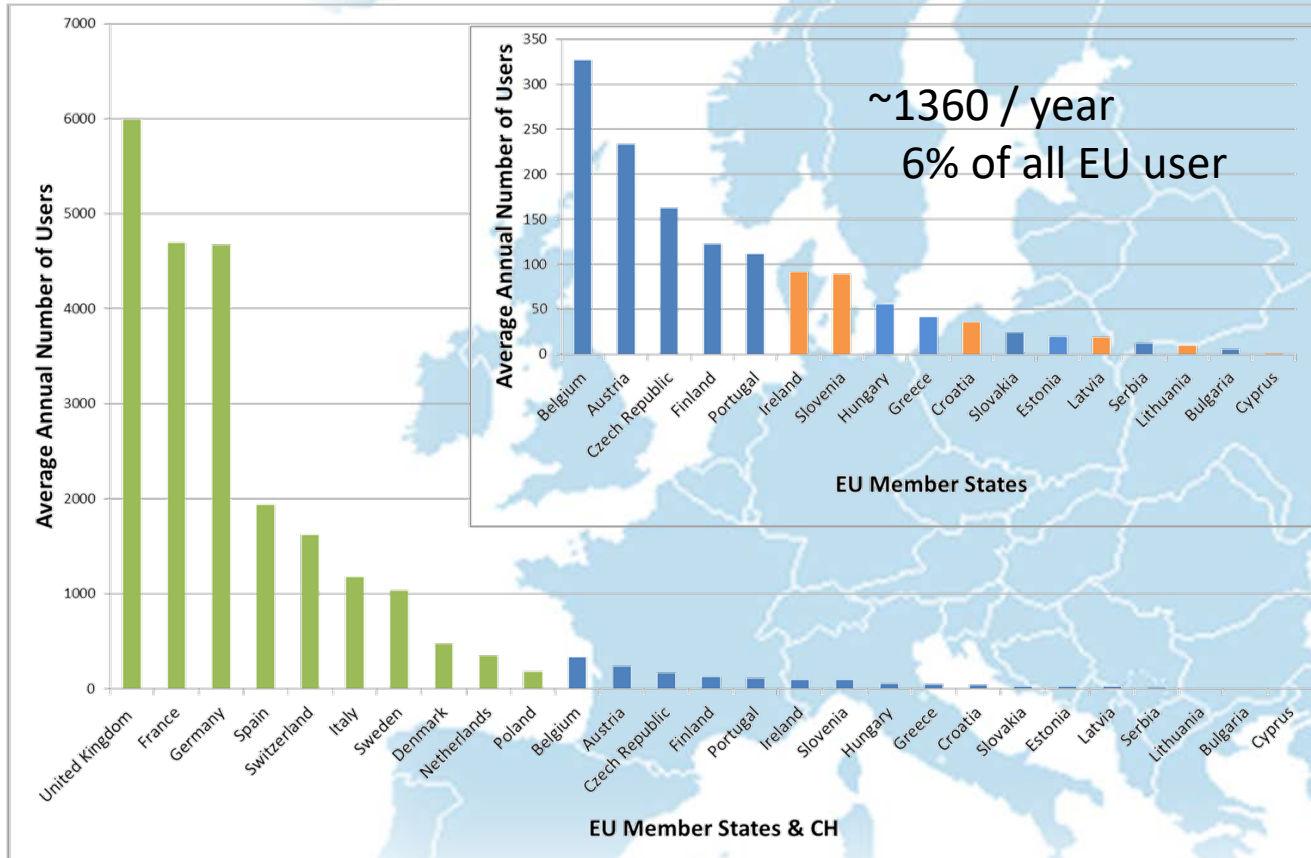
The diagram shows the national interweaving of research at European light sources. The left side displays selected light sources and their respective beamline hours used for transnational access. These hours are correlated to the group leaders' home institution countries (right side).



LEAPS Offering Transnational Access to all European researchers

“Gateway for Discovery Science”

- EU Member States :
- Hosting LEAPS facilities (10)
- Financially contributing to LEAPS facilities (19)
- Not financially contributing to LEAPS facilities (6 of 7)



“Gateway for Discovery Science”

- **Beamtime for non-national EU users**
 - ~ 60 000 hrs per year
 - ~ 32 M€ beamtime free of charge
- **Publications of non-national EU users**
 - ~ 690 per year
 - ~ 14.5% of LEAPS user publications

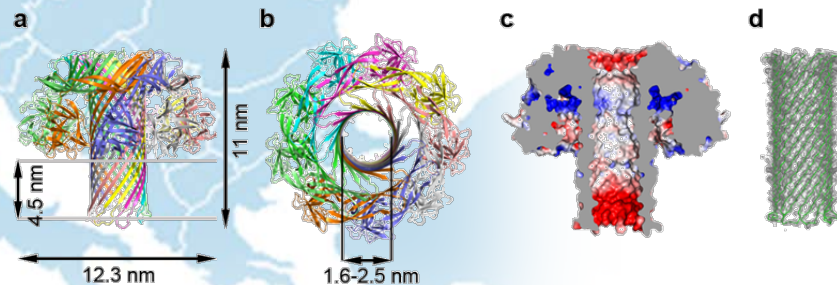


- **21 member states are investing into LEAPS Facilities through**
 - **Membership in ESRF, EU.XFEL**
 - **Investments in National Facilities**

e.g.: BESSY II, ELETTRA, FELIX, MAX IV, PETRA III, SOLARIS

Example Slovenia @Elettra

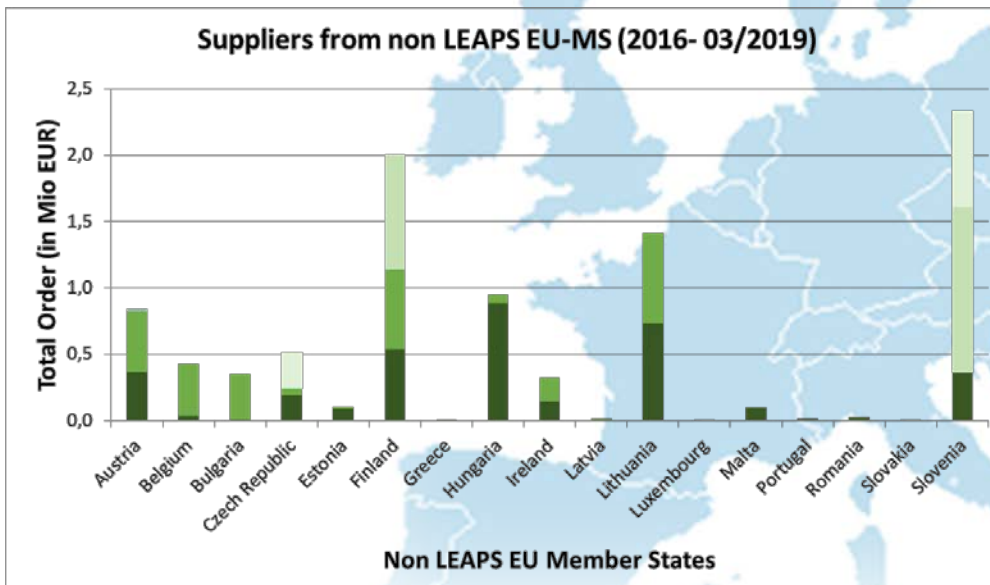
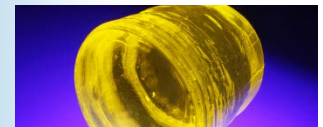
Molecular Structure of Toxin Complex



M. Podobnik et.al. *Nature Comm.*, **7**,(2016); DOI: 10.1038/ncomms11598

“Opportunities for European Industry”

- **National Investments made**
~ 9 Bn €
- **Future National High Technology Investments**
~ 2.3 Bn € for approved & planned upgrades (2020-30)
- **Procurement info from 6 LEAPS facilities**

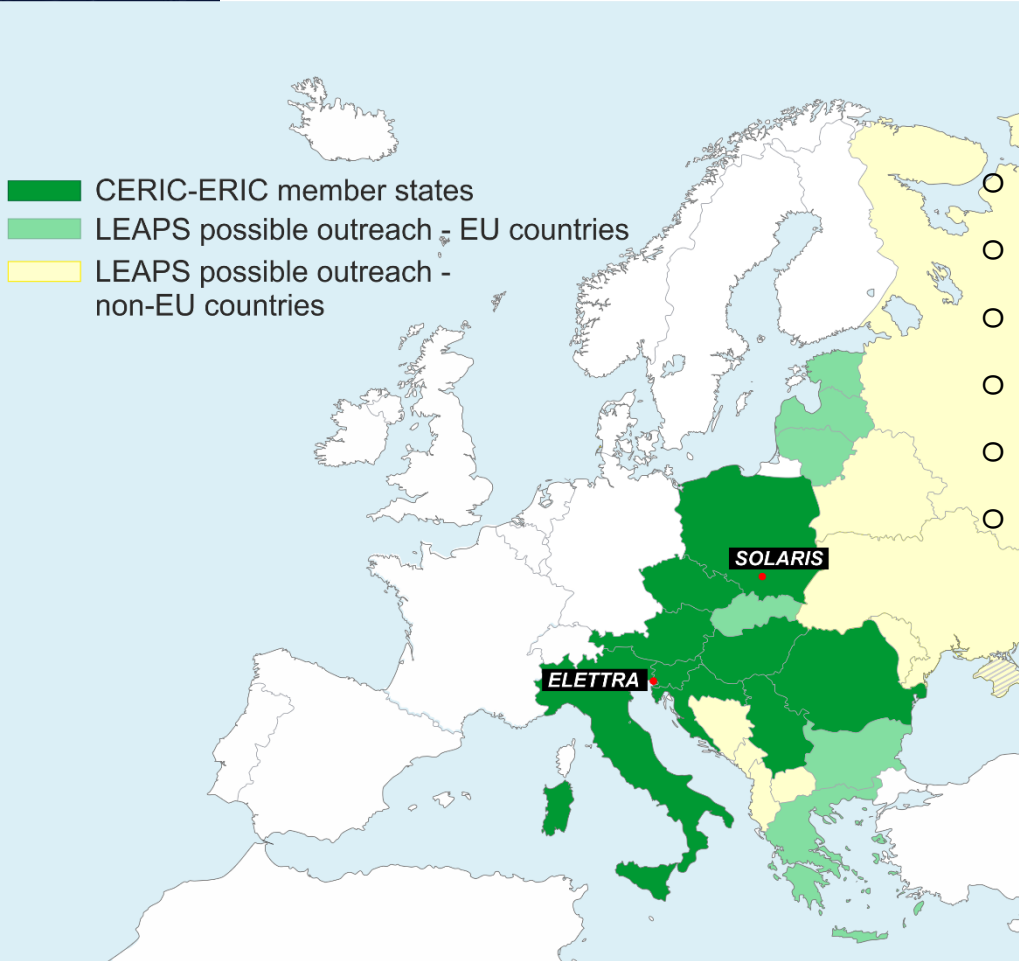


Examples:

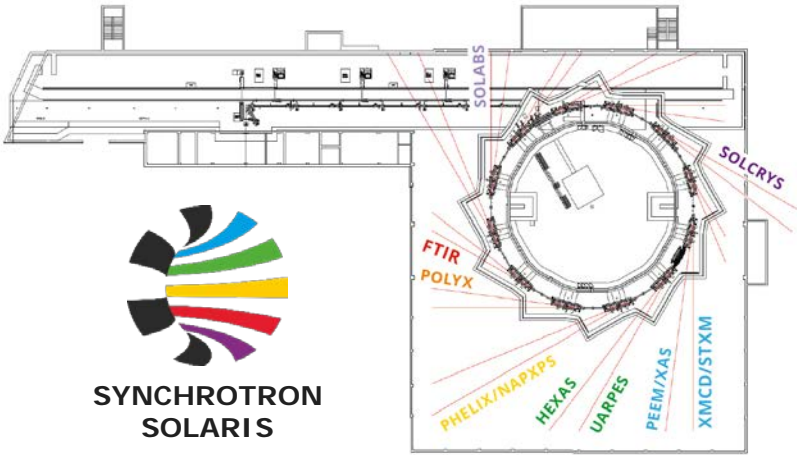
- Czech Republic
- Finland, Bulgaria
- Hungaria
- Ireland
- Lithuania
- Slovenia

- Detectors
- Printed Circuit Board
- Multilayer Devices
- Software
- Laser Technology
- RF and Digital Electronic
- Undulator Systems

SOLARIS – research and industrial gateway to LEAPS RI's for Central and Eastern Europe



- modern, medium size, tailor made RI
- geographical and cultural proximity
- similar economic environment
- reasonable travel and subsistence costs
- investment and participation opportunities
- CERIC-ERIC experience



LEAPS first Plenary Meeting

12-13 November DESY, Hamburg



SESAME welcomed as
1st LEAPS Associate

13 pilot research projects have been presented

Open session with European Commission and national funding agencies to discuss different possibilities for funding common research projects

Vision and Goals

Longterm Vision

- to establish itself in Europe as a **new force** shaping the future strategy in Photon Science.
- to have a lasting impact on the Europe **research agenda**.
- to contribute a critical **added value** for all its members.
- to lobby for Photon Science and develop **proposals** in EU FPs and beyond.

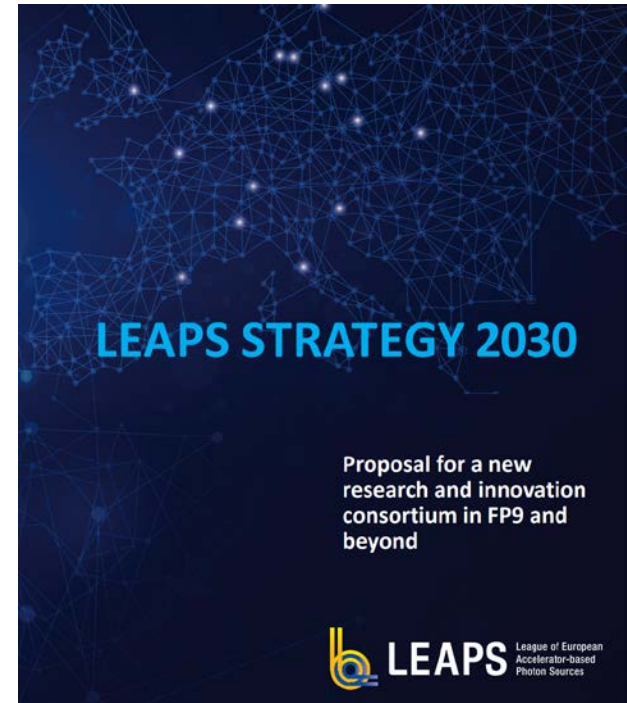
Midterm Vision

- to establish a **co-fund action HZ Europe**
- to develop an action and business plan/organisation ("LEAPS Project Agency").
- to implement the complex **national upgrade projects** of LEAPS facilities in a coordinated plan.
- to enable the development and implementation of **new technologies** in a concerted effort far superior to fragmented national efforts leading to better and more cost-efficient technologies.

Shortterm Plan

- to prepare for H2020 INFRAINNNOV-4-2020, innovation pilots
- The application will consist of two parts:
- Part a) Preparation of the details of the LEAPS Project Agency
 - Part b) Launch of first key technology projects within LEAPS.
- to pursue and coordinate other on-going collaborations

- Addresses the key issues of the European Long-Term Sustainability action plan
- Ensuring excellence of the services and solutions provided by LEAPS RIs
- Ensuring that the LEAPS RIs have the right people in the right place at the right time
- Optimisation of data life cycle management for data generated by LEAPS RIs
- Exploiting the potential of LEAPS RIs as innovation hubs
- Assessing the economic and wider societal value of LEAPS RI
- Establishing adequate framework conditions for effective governance and sustainable long-term funding of the LEAPS consortium



Working together – 100s in 6 Working Groups

Technological

WG1 – Beamline technology

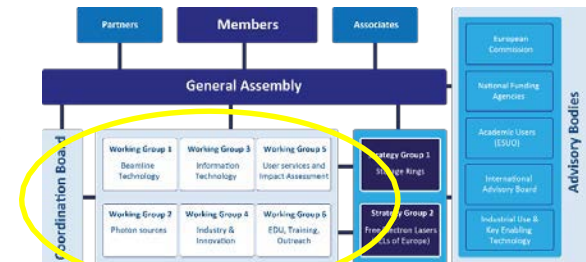
- Detectors
- Optics and BL Instrumentation
- Sample Environment

WG2 – Photon Sources

- Compact Sources
- FEL Developments
- Storage Rings

WG3 – DATA management and software

More efficient and more cost-effective technology development with smart specialisation of European expertise and benefitting European industry



Networking & services to users and society

WG4 – Industry & innovation

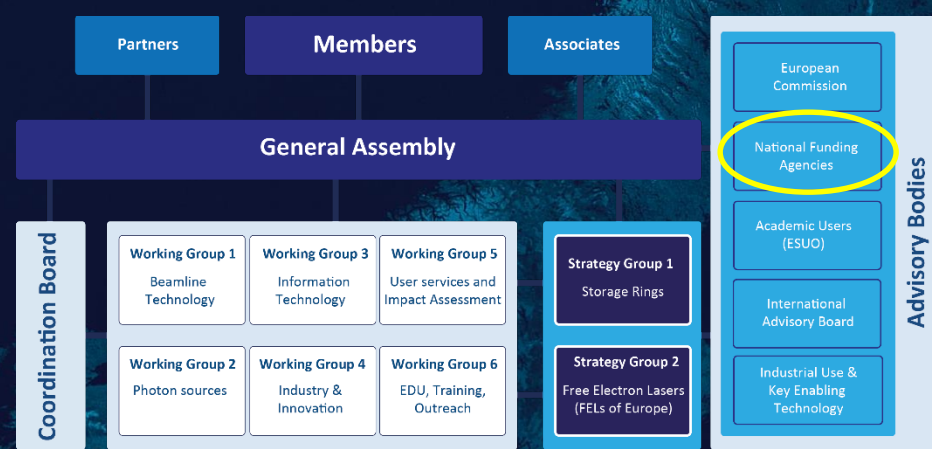
WG5 – User Services & Impact

WG6 – Education, Training & Outreach

Countries

Denmark
 France
 Germany
 Italy
 Netherlands
 Poland
 Spain
 Sweden
 Switzerland
 UK

+ those participating to
 ESRF and EU XFEL

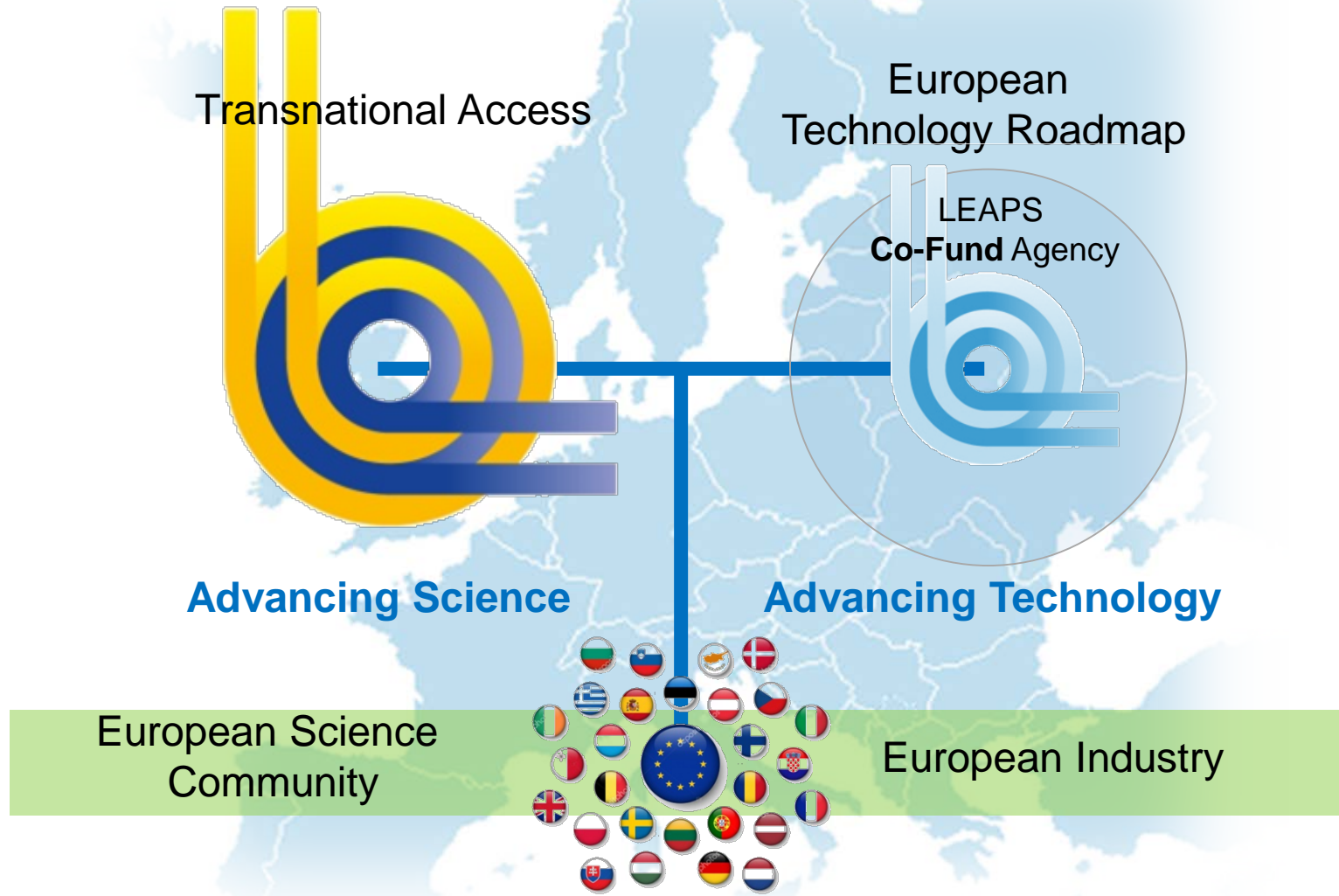


NFA will participate in LEAPS projects as co-funding agencies:

- 1st information meeting of National Funding Agencies at the 1st LEAPS plenary meeting on 12th of November 2018.
- Participation to a round table, stating their interest in supporting the initiative through their facilities 4th of April 2019
- Presentation of LEAPS at the H2020 programme committee 7th of May 2019

A New European Handshake

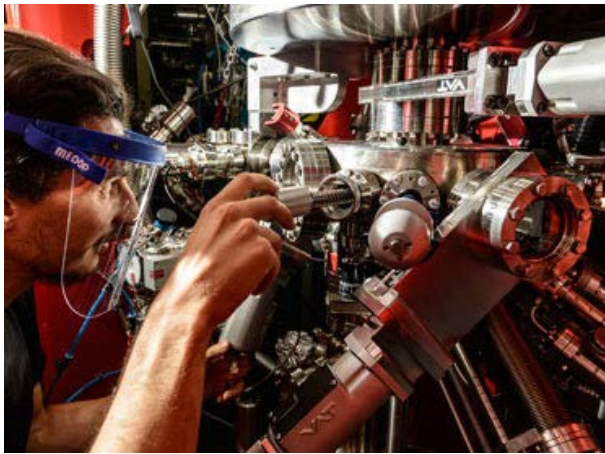
„A World Leading Science and Technology Consortium“



WG1 Beamline Technology

Sub WG's

- Detectors (2)
- Optics and instrumentation (2)
- Sample environment (1)



Five Pilot Projects presented:

- High Throughput X-ray Spectroscopy Detector System
- Detector Toolbox
- Superflat - industrial production of flat X-ray mirror and grating substrates
- NeXtgrating – Next generation diffraction gratings
- Positioning and scanning systems for speed and accuracy

WG 2 Photon Sources (accelerator technology)



1 Pilot Project:

LEAPS R&D Topic Insertion Devices (LIDs):

R&D on novel undulator technology pushing the parameters for

- high field / short period
- advanced schemes for EPU (elliptically polarizing undulator)
- optimize production cost

WG 3 Information Technology

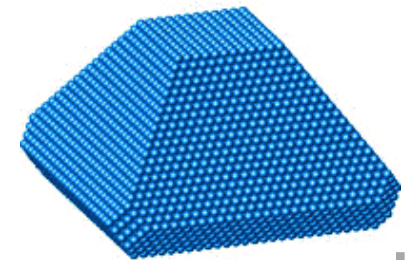


Facing explosion of data volumes with new detector technologies

Open data policies, FAIR data
Connection to EOSC
Aiming at user services and infrastructure optimisation

2 Pilot projects:

- Data reduction and compression
- IT strategic blueprint



A. Stierle, DESY
P. Vashishta, USC

WG4 Industry as provider and as user

2 Pilot Projects

- Industrial Innovation through Light Sources (IILS)
- SME Innovation through Light Sources Services



WG 5 User service & impact

2 Pilot Projects

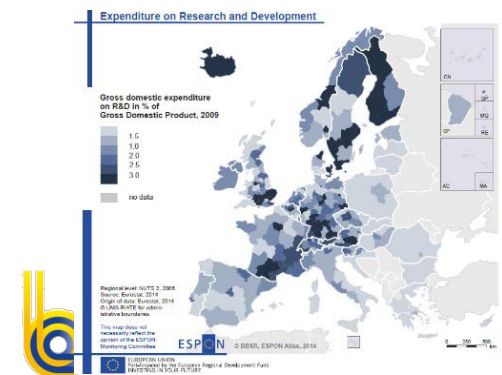
- Wayforlight as a new e-infrastructure serving the user community
- Impact assessment and standardized metrics for LEAPS



WG 6 Education, training & outreach

1 Pilot Project

- Scientific focal points for new countries, new communities, new users, SMEs and industry



Facility Roadmap

- upgrades („4th Gen“)
- new facilities

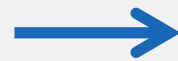
Technology Roadmap

- nextGen detectors
- advanced optics
- future data management
LEAPS - EOSC
- nextGen accelerators

Joining efforts and
sharing resources

National – European

„a good business plan“



Coordination

Availability

- state-of-the-art analysis for academia & industry

Standardisation

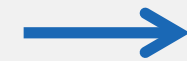
- environments
- data formats
- access

Integration I

- High-Tech Industry

Integration II

- emerging communities
- strategic partners
- all member states



Specialisation

Complementary solutions

- for high-end applications

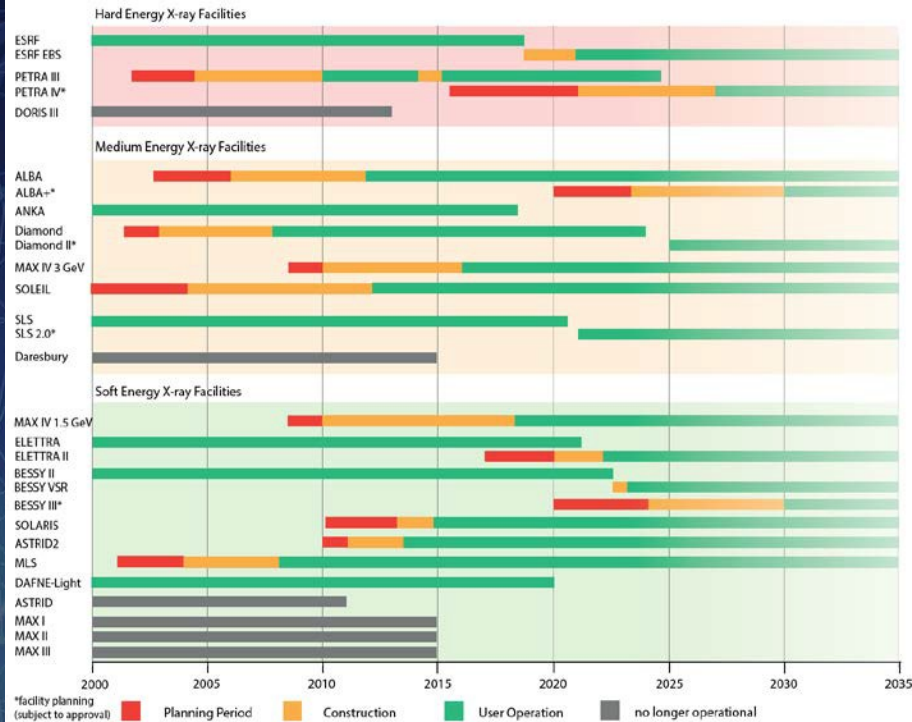
Specialized consortia

- technology developments
- advanced detectors
- novel optics
- data management systems
- nextgen accelerators

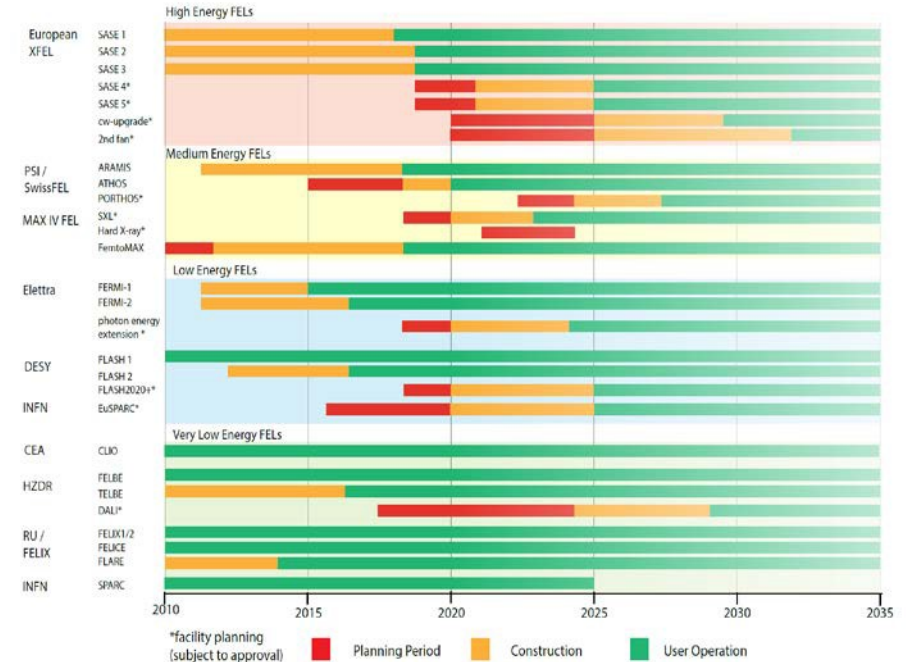
- training and education scientists, engineers, future leaders
- mobility programs

Landscapes and roadmaps

Storage Rings



Free Electron Lasers



Timeline of the existing storage ring and FEL facilities, approved upgrades and plans for upgrades not yet approved (*)

„A new vision for Europe“

LEAPS will be the world's most advanced science consortium

- boosting **science and innovation** in Europe
 - **integrating all European member states** in the development of **novel materials** and **state-of-the-art technologies**
 - enabling **new ways of cooperation** with industry
 - **sharing expertise and resources** for technology developments (incl. EOSC)
 - offering a European **platform for the education** of the next generations of scientists and engineer
 - devising **robust roadmaps** for the further development of European RIS
 - offering **one voice for advice** to European and national decision makers
 - **International cooperation** with
- **providing the maximum return on the substantial investments made**



LEAPS

Future collaboration possibilities with LEAPS

- LEAPS will invite a representative of the Serbian delegation to the LEAPS plenary meeting 18-20 November 2019 at PSI.
- LEAPS aims at integrating, user communities in instrumentation development.
- LEAPS aims at integrating competence teams for smart specialisation.
- Support from countries using LEAPS facilities, even if not hosting a LEAPS facility, is welcome.
- Example: CERIC-ERIC and SOLARIS as research and industrial gateway to LEAPS RI's for Central and Eastern Europe.

Better Science and Advanced Technologies for Europe

<https://www.leaps-initiative.eu/>



Coming together is a beginning,
Staying together is progress,
Working together is success.

(Henry Ford)