



Digital LEAPS

A European Strategy on
the Digital Transformation
of Accelerator-based
Photon Sources towards
a resilient and sustainable
European Research Area



LEAPS

League of European
Accelerator-based
Photon Sources

The new Pathway of LEAPS Facilities into the Post-Corona Era

Europe faces enormous political, social and technological challenges in the coming decade, such as the man-made climate change which threatens the existence of our future generations. Reliable concepts in energy production, energy storage and energy saving as well as new concepts for enabling a circular European economy are urgently needed. Breakthroughs in all these critical areas will not be possible by evolutionary improvements of the properties of existing material systems, but rather by tailoring the functions of novel materials at the molecular level.

In 2020, the COVID-19 pandemic has revealed a further future life-threatening enemy and in parallel exposed, like in a burning glass, the weaknesses in Europe. Within the COVID-19 pandemic, the European Union has decided on a large recovery plan by the initiative NextGenerationEU¹. As significant deficits in digitalization compared to the U.S. and Asia became evident, an analysis where technology sovereignty is of paramount importance to be better prepared for future crises in Europe.

2

The LEAPS consortium - together with its more than 30.000 academic and industrial users from worldwide across all disciplines - has faced these challenges and its future role in the European Research Area.

It is well understood by now that the design of disruptive new materials with sustainable properties and functions cannot be accomplished without the non-destructive analytics provided by LEAPS facilities, recent example: the “Battery 2030+” endeavor. In the past months of the pandemic, it has now become evident to everyone how system relevant LEAPS technologies are for a groundbreaking understanding of the pathogen and its interaction with the host, and consequently of vaccine and drug design: large pan-European consortia from academia, the pharmaceutical industry and hospitals have extensively used the LEAPS facilities to obtain the necessary non-destructive microscopic information on viral components of the virus and on drugs, as well as 3D tomographic insights into damaged human tissues.²

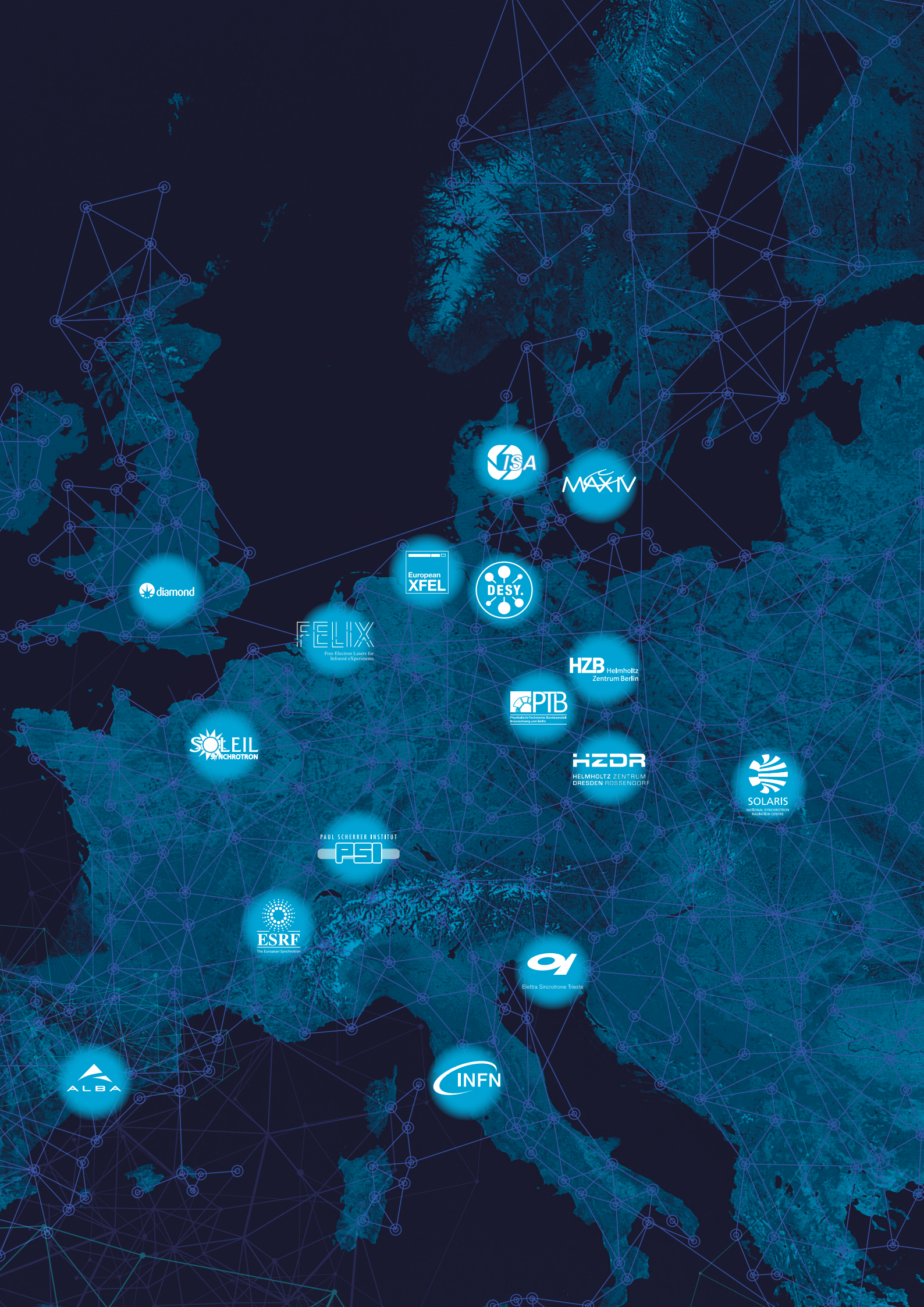
For the future, LEAPS facilities need to ensure to become even more resilient to times of crisis, where massive constraints on operations and mobility are taking place. This requires a fundamental reconsideration of user operation including remote operation tools and artificial intelligence concepts in the entire power train of the experimental installations from the accelerator to big data handling. The pan-European DIGITAL LEAPS project is currently developing the digital technologies required for this, with European standardization being considered from the outset.

With its green “Digital LEAPS” project, LEAPS sees itself as a pioneer and pacesetter in the European Research Area in devising the post-Corona era.

¹ https://ec.europa.eu/info/strategy/recovery-plan-europe_de

² [LEAPS and COVID-19: one year later \(leaps-initiative.eu\)](https://leaps-initiative.eu)





diamond

LSA

MAX IV

European XFEL

DESY

FELIX
Free Electron Lasers for
Infrared Experiments

HZB
Helmholtz
Zentrum Berlin

PTB
Physikalisch-Technisches Bundesamt
Bundesmetrologie und Berlin

SOLEIL
SYNCHROTRON

HZDR
HELMHOLTZ ZENTRUM
DRESDEN ROSSENDORF

SOLARIS
NATIONAL SYNCHROTRON
RACIBÓRZ CENTRE

PAUL SCHERRER INSTITUT
PSI

ESRF
The European Synchrotron

SI
Elettra Sincrotrone Trieste

ALBA

INFN

Strategic Pathway to a Green DIGITAL LEAPS

In order to transform LEAPS research infrastructures to more resilient ones towards pandemic crisis situations or disasters, support the European society in infection fight and in developing a circular economy within the scope of the European Green Deal and Missions of Horizon Europe, LEAPS has identified the strategic elements for a transition to a Green DIGITAL LEAPS, to be implemented via the three pillars STARS, HR⁴ and LIP, as described in the figure below.

Impact to ERA and societal challenges

LEAPS facilities become more resilient and more green & serve better the scope of European Green Deal and resilience to future pandemics & serve Missions of Horizon Europe

4

DIGITAL LEAPS pillars

STARS HR⁴ LIP

Strategic elements for a transition to a green DIGITAL LEAPS

- Remote User Operation
- Digital Communication
- Digital Training
- Resilient & energy saving operation
- AI-assisted molecular infection fight
- Advanced materials for digital transformation & circular economy



The DIGITAL LEAPS pillars

The Pillars are in the design phase, further details can be followed on leaps-initiative.eu

STARS: “Enhanced remote access for users” will strive at more standardised procedures on sample mail-in and remote user access across facilities, and provide an extensive overview on information on technology tools useful to facilitate the remote access and the digital sample handling.

HR⁴: “Enhanced digital platforms for networking & training” will establish a digital collaborative platform such as Innovation Mall, or for remote training of staff and hybrid training for users both using also the new tools developed by the other pillars, and a collaborative platform to create a smart user network, with tight connection to industry.

LIP: “More resilient green sources & beamlines” will speed up the development of a digital interface system to access and autonomously operate green facilities, via digital twin, artificial intelligence and machine learning, virtual diagnostic, androids for remote access, the design of further photon instruments for remote access and standards for fully automated user beamlines and exploiting the use of permanent magnets for the new generation diffraction limited storage rings.

DIGITAL LEAPS preserve GREEN DEAL goals

In addition to the research done at the LEAPS facilities, the guideline of the Digital LEAPS pillars is persevering audaciously the Green Deal goals and Europe’s ambition to become climate neutral by 2050.

- Digital Remote User Operation is going in the direction to rationalize the movements of the people and its negative impact on the environment. At the same time, it will open up new access possibilities from geographically far countries e.g. Africa.
- Smart user network and digital collaboration platforms will multiply the possibilities with common developments in the areas of environmental and neutral climate challenges.
- Specific technology development, e.g., the permanent magnets or the energy saving in the big data management, will pursue the goal of improving the energy efficiency of the LEAPS facilities.
- These target areas identify improved services enabling the development of materials for circular economy in the future.

LEAPS

the League of European Accelerator-based Photon Sources is a strategic consortium initiated by the Directors of the Synchrotron Radiation and Free Electron Laser user facilities in Europe. Its primary goal is to actively and constructively ensure and promote the quality and impact of fundamental, applied and industrial research carried out at each facility to the greater benefit of European science and society.

**+30000 USERS FROM ALL
OVER EU AND BEYOND**

**OFFERING
+800000 H/YEAR**

**25000 PUBLICATIONS
IN THE LAST 5 YEARS**

**+300 OPERATING
END STATION**

www.leaps-initiative.eu



DIGITAL  **LEAPS**