



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Photon Science in Europe Landscape and Future Strategy

LEAPS – League of European Accelerator-Based Photon Sources

BESAC

July 13, 2018

Helmut Dosch

DESY, Hamburg

Facility	Location	Energy	N° BL	Current Plans	Comments
Storage Rings					
ESRF	Grenoble	6 GeV	45	Upgrade HMBA 2015+	
PETRA III incl extensions	Hamburg	6 GeV	24	Upgrade HMBA PETRA IV 2025	
Diamond	Didcot	3,0 GeV	32	Upgrade plans HMBA	
MAXIV	Lund	3,0 GeV 1,5 GeV	25	under construction 7BA	
SOLEIL	Paris-Saclay	2,75 GeV	29	Upgrade plans HMBA	
ANKA	Karlsruhe	2,5 GeV	----	closes user operation	
ELETTRA	Trieste	2,0-2,4 GeV	24	Upgrade approved	Soft X-ray Facilities
BESSY II	Berlin	1,7 GeV	35	Upgrade VSR (2017+ operational)	
X-ray/FEL Lasers					
FLASH I and II	Hamburg	1,25 GeV	5 (2)	Upgrade 2018 FLASH II	Soft x-ray laser
EU.XFEL	Hamburg	17,5 GeV	10	Upgrade 2 nd fan 2030+	Europ. X-ray Laser
SwissFEL	Zürich	2,1-5,8 GeV	2	in operation	Hard and soft FEL beamline
FERMI (-II)	Trieste	HGHG			$\lambda = 100\text{nm}-10\text{nm}-4\text{nm}$
ELBE	Dresden	IR-Laser		Upgrade ELBE II 2020	



European Landscape X-ray/Laser facilities

- European Facilities ESRF and EU.XFEL
serving the European user community
operated with funding of shareholders
- 15 National Facilities Serving their national user communities (<60%>
+ European user community (<40%>
operated with national funding
- National Facilities (so far) not/never part of a European strategy
→ little European financial support for TNA
- National funding agencies increasingly request that new national facilities and facility upgrades
must take the European landscape into account.
- Insufficient standards in software, sampe environment, data formats,
- Insufficient cooperation in enabling technologies: detectors, optics, data systems,
- No common x-ray voice in Europe

**There has been an urgent need for establishing a European consortium of all
accelerator-baseds photon sources !**

A new voice in Europe



May 11	Frankfurt	Airport	Analysis of Challenges and need for LEAPS
Jan 14-15 2015	Hamburg	DESY	Setting the LEAPS agenda: Working groups
Jun 10-11 2016	Grenoble	ESRF	Analysis of existing initiatives and Reports WG
Nov 14-16 2016	Didcot	Diamond	LEAPS Declaration, Analysis ESUO Questionnaire
Feb 01-03 2017	Krakow	SOLARIS	Reports WGs
Jun 14-15 2017	Paris	SOLEIL	Finalizing Strategy, WGs, Docs
Nov 13 2017	Brussels	5:30 pm	Constitutional Meeting of LEAPS GA



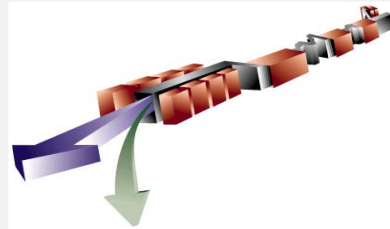


LEAPS

League of European
Accelerator-based
Photon Sources

A new consortium of excellence in Europe
devising a transformative level of coordination and integration

European Synchrotron Radiation and FEL Facilities



are joining forces
to master
the challenges of the next decades





European Flagship ESRF Advancing science since 1992

ALBA BESSY II DIAMOND ELETTRA ISA MAX IV MLS PETRA III SLS SOLARIS SOLEIL

Pushing scientific excellence

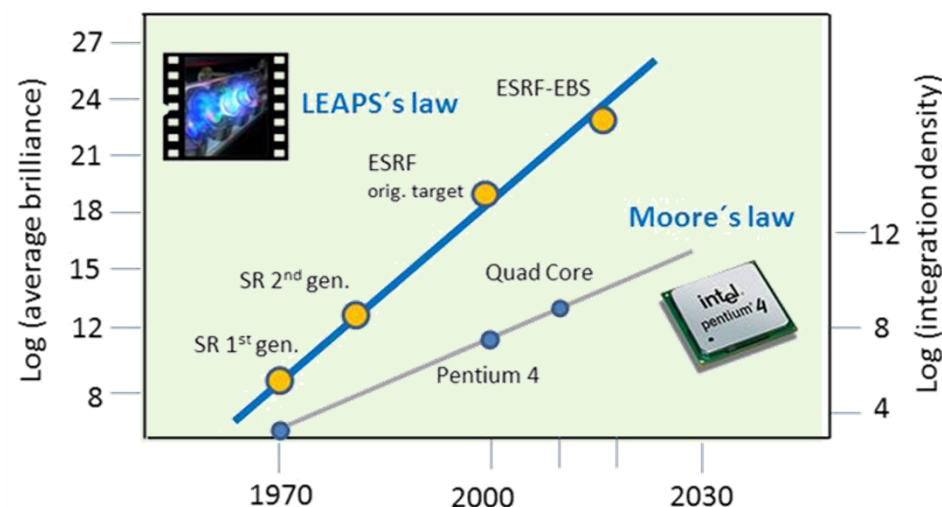
In 2016 more than **500 000** hours of beamtime

More than **200** operational Beamlines

Over **23 000** unique articles published in peer reviewed journals in the last **5** Years

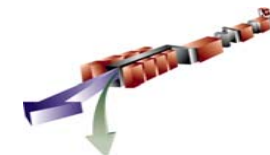
More than **25.000** users

Pushing technology limits



Serving users of all scientific disciplines

Partnering with industry



European Flagship

European XFEL

most powerful XFEL worldwide

FLASH

ELBE

FELIX

FERMI

SwissFEL

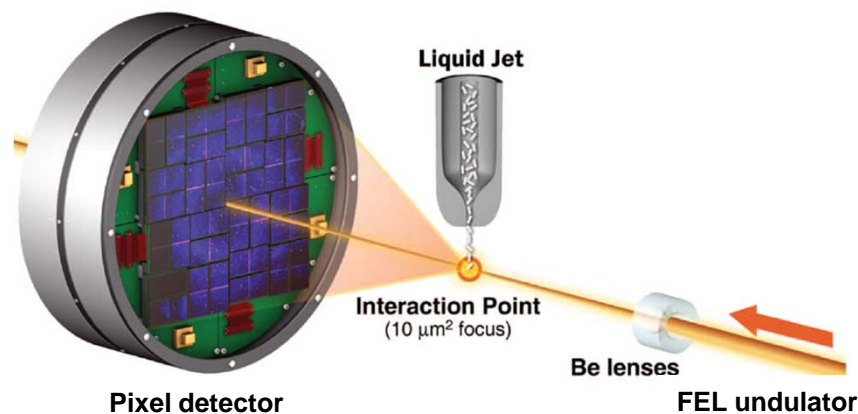
CLIO

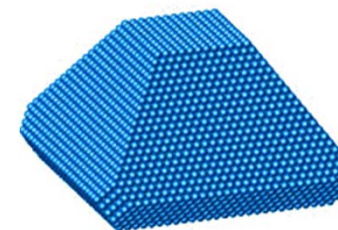
- **New science - „Discovery Channel“**

- > New avenues in macromolecular crystallography
- > New disruptive schemes for X-ray sciences

- **Pushing the technology limits**

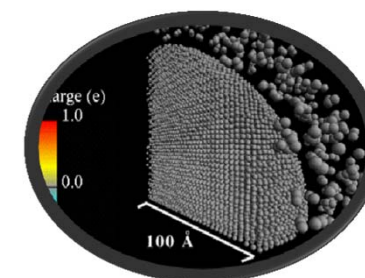
- > Advanced linear accelerators
Superconducting technology
- > Laser femto technology
- > Novel pixel detectors
- > Novel sample delivery systems
- > Information technology
Advanced computational methods





21st Century Era of Complexity

- Answers to the Grand Challenges in **energy systems · information · health care · transport technologies** require new complex materials solutions
- European Synchrotron and FEL facilities must provide **dedicated high-resolution technologies** for researcher and industry to enable the design of tailored (bio-) materials architectures.
- The **smart transformation** of the existing storage rings into **nextGen facilities** requires a new level of coordination, specialisation and cooperation.
- In order to develop a **sustainable RI ecosystem**, European Synchrotron and FEL facilities must 
 - provide the most **advanced technologies** and a state-of-the-art **user infrastructure**,
 - enable **mobility** among researchers,
 - train future **managers**,
 - master the data **challenge**,
 - develop new partnerships with **industry**.
- All above efforts must **integrate** emerging communities and benefit all of Europe and beyond





Ambition

„Devising a common European strategy“



European Synchrotron Radiation and FEL Facilities

Preparing the next era of science and innovation in Europe



Upgrading existing Synchrotron facilities

Next generation storage ring technologies:

MBA- and **HMBA-technologies**

Expanding FEL infrastructure

New facilities with different concepts and energy range

Science Vision

Ultimate in-situ X-ray microscopes
for materials and drug design

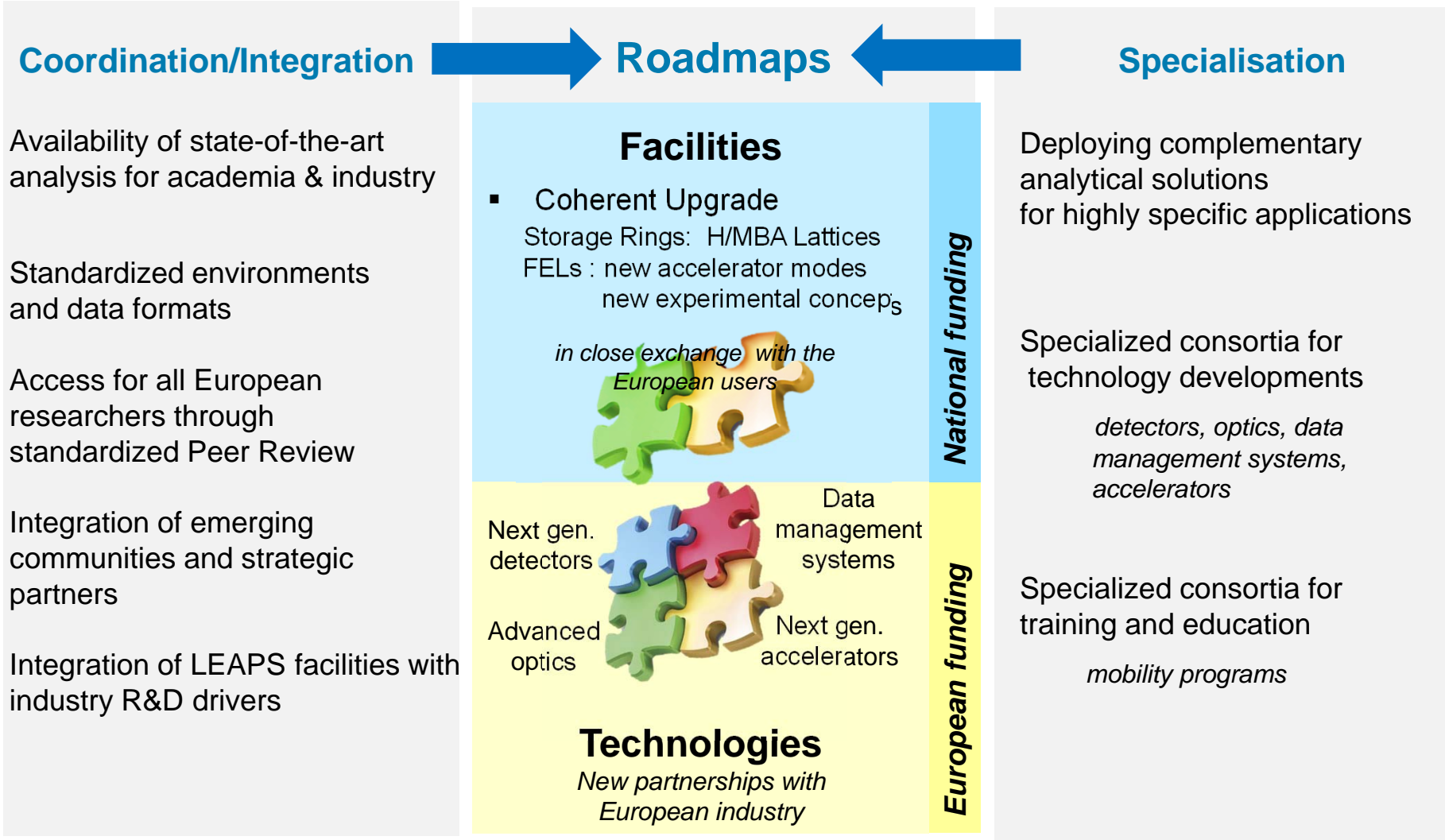
Accessing all length and time scales of
nano-bio-science and -technology

Technology Vision

Novel concepts in

- Accelerators
- Detectors
- Optics
- Sample environments
- Data handling policies

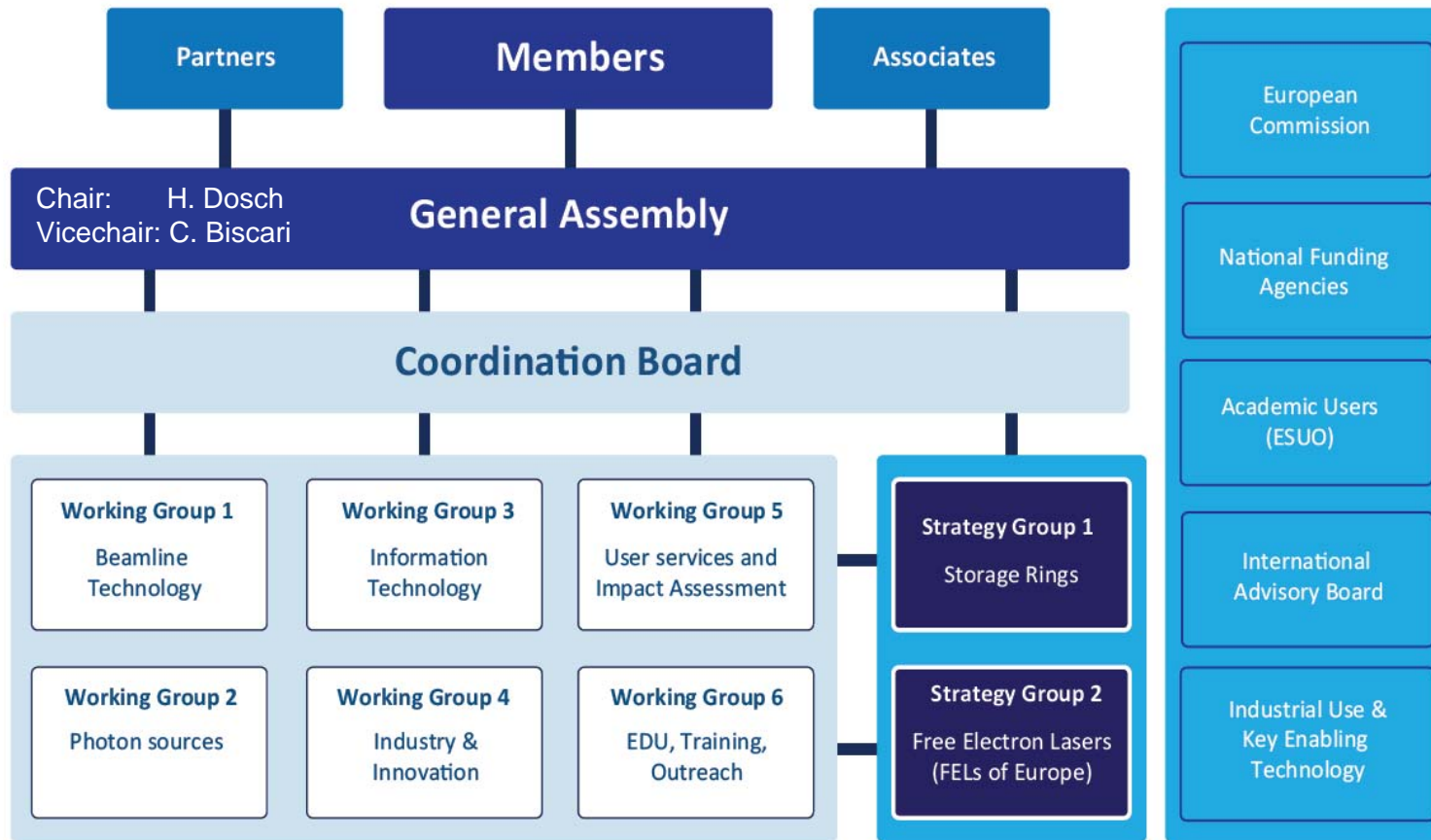






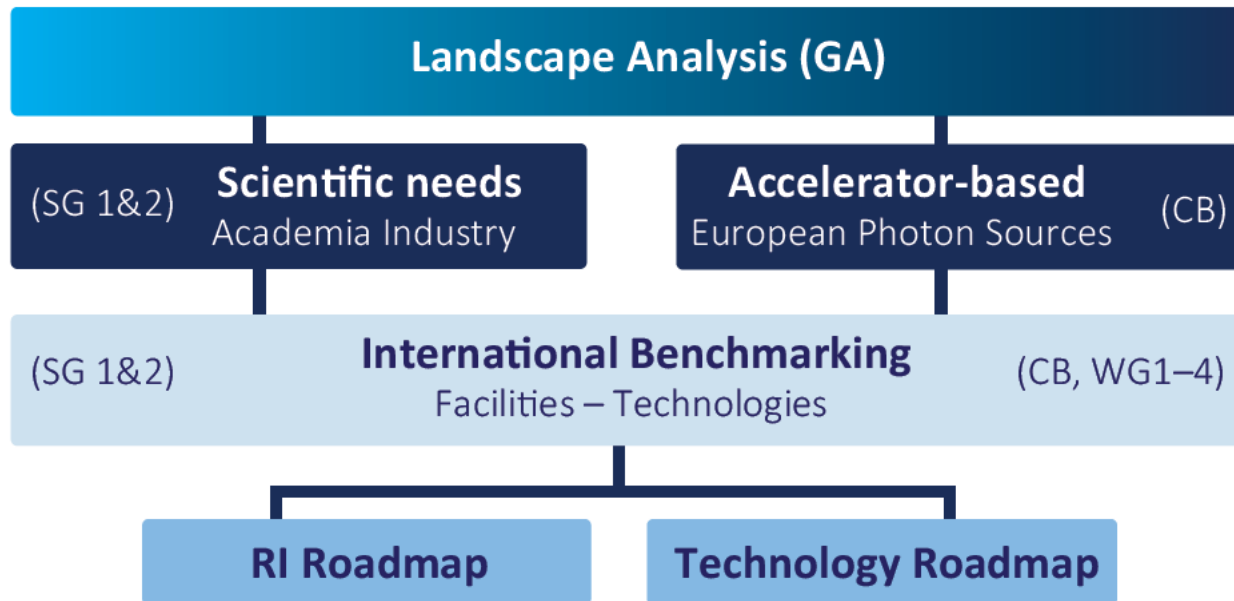
LEAPS

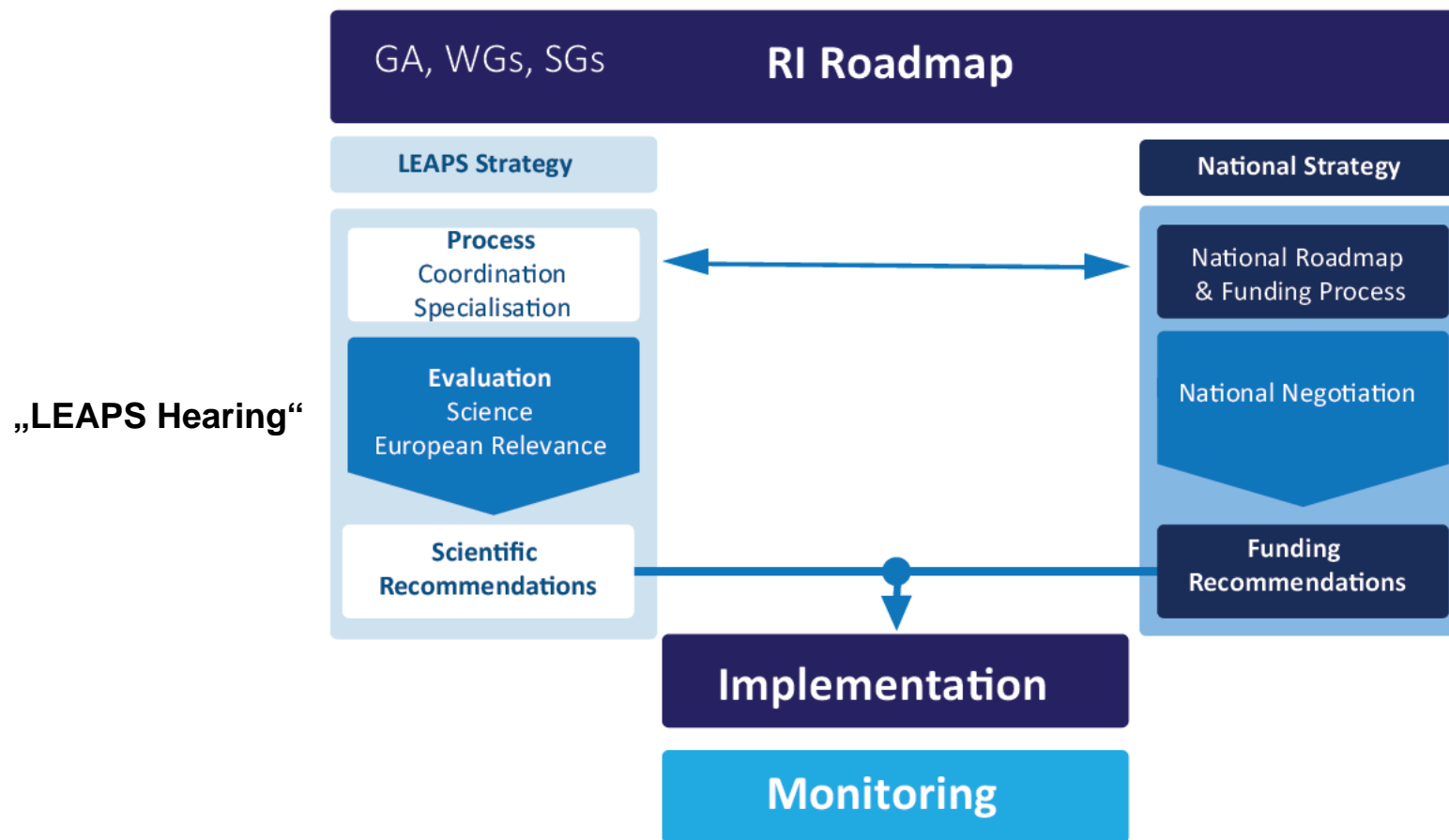
Organisation





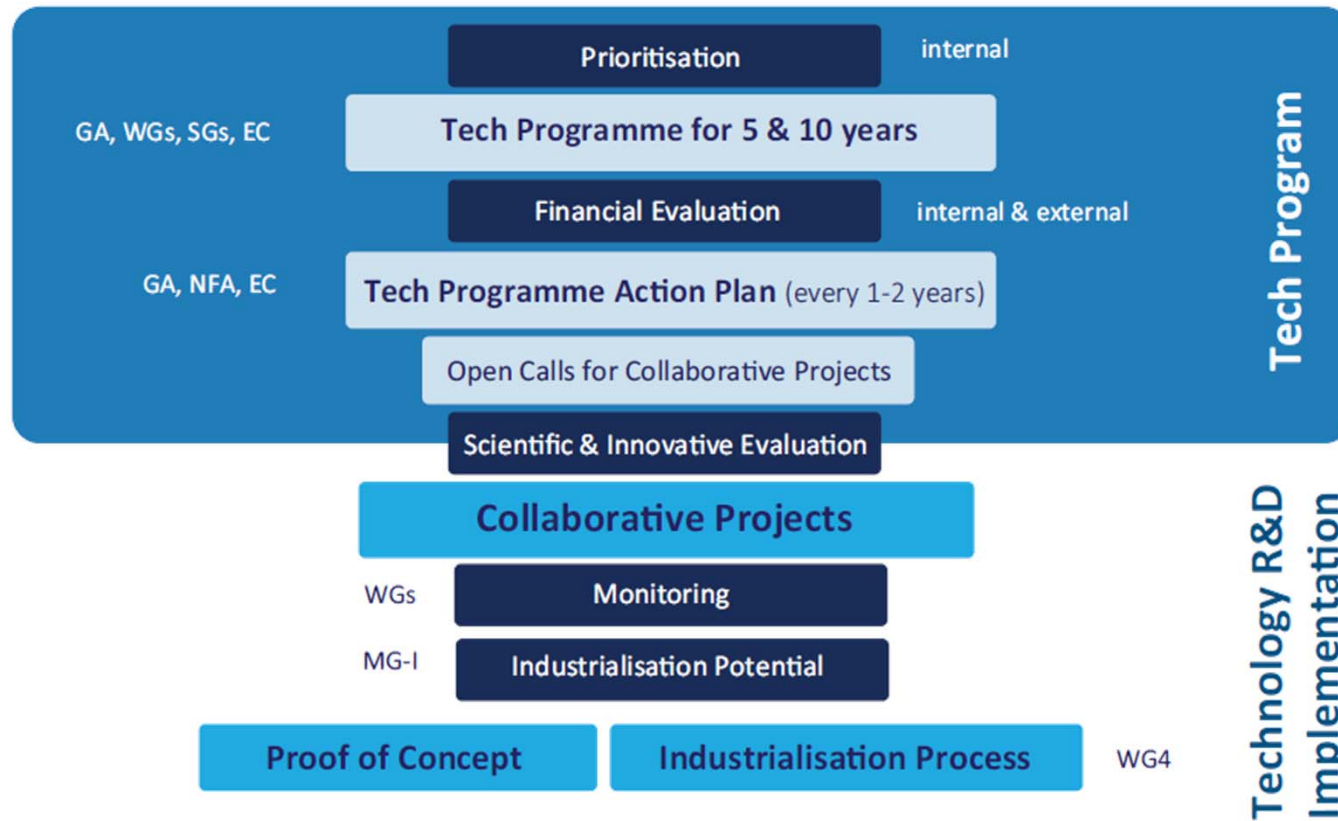
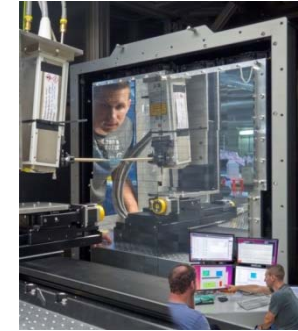
LEAPS roadmap process





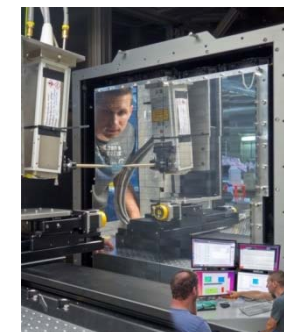
Technology Roadmaps

„Offering the most advanced technology for academia and industry“



Technology Roadmaps

„Offering the most advanced technology for academia and industry“



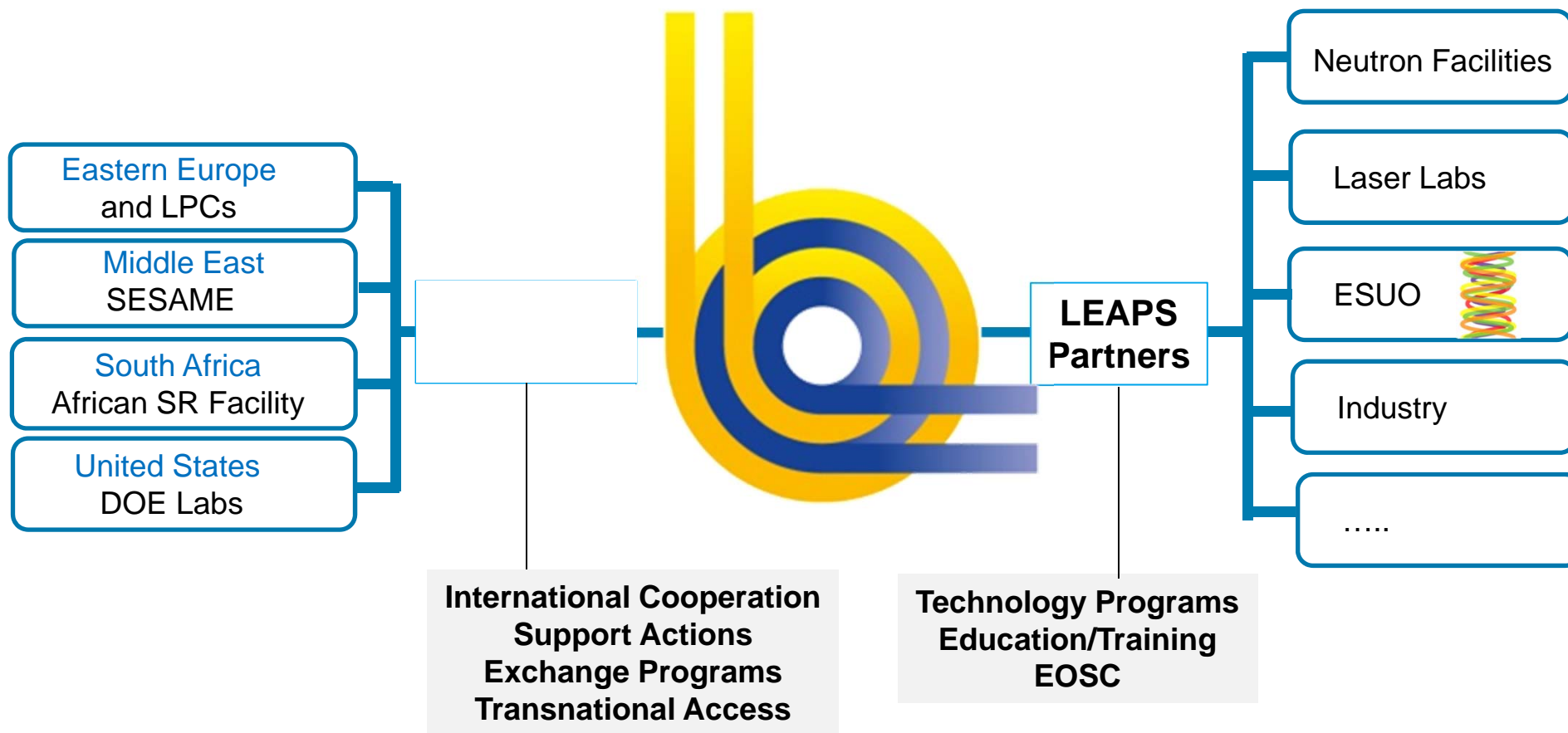
Technology 2018-2028		requires / Mio €
Beamline technology	Detectors, optics, sample environment	170
Photon Sources	(novel accelerators)	200
Information technology / Data		140
Integration 2018-2028		requires / Mio €
Innovation & industry		90
User Services and Impact Assessment		15
Education, training & outreach		30
Governance		10

~ 650 Mio €



Integration

“New strategic partnerships in Europe and beyond”



Summary

“Developing the future RI Ecosystem”

Pushing X-Ray Science in Europe to the next level Building a new RI Consortium for FP 9 and beyond

New Cooperation between European Facilities in close interaction with national authorities and the European Commission

- **Coordinated transformation** of Europe’s facilities towards the nextGen facilities
- **Smart specialisation** strategy among LEAPS facilities
LEAPS roadmaps for facility developments and new technologies
- Most **advanced technologies** to academia and industry
- New European **training platform** for nextGen scientists, industry and future managers
- Development of LEAPS as a contact point of the future **EOSC**
- **Integration** of emerging communities and strategic partners of Europe