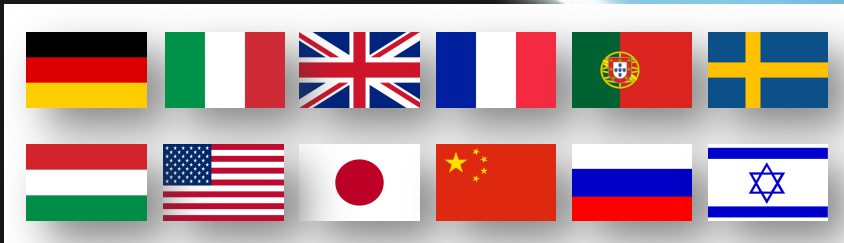


EUROPEAN
PLASMA RESEARCH
ACCELERATOR WITH
EXCELLENCE IN
APPLICATIONS



Additional funding opportunity status, LEAPS & TIARA (R. Assmann)

R. Assmann, 22. June 2017



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 653782.



Test Infrastructure and Accelerator Research Area Preparatory Phase

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The main objective of TIARA is the integration of national and international accelerator R&D infrastructures into a **single distributed European accelerator R&D facility** with the goal of developing and strengthening state-of-the-art research, competitiveness and innovation in a sustainable way in the field of accelerator Science and Technologies in Europe.



Besides maximizing the benefits for the owners of the infrastructures and their users, TIARA aims at establishing a framework for developing and supporting strong joint European programmes:

- › for accelerator Research and Development
- › for education and training
- › for enhancing innovation in collaboration with industry

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The consortium includes 11 participants from 8 countries



Number	Full name	Short name	Country	Homepage
1	Commissariat à l'Energie Atomique et aux Energies Alternatives	CEA	France	www.cea.fr
2	European Organization for Nuclear Research	CERN	International	www.cern.ch
3	Centre National de la Recherche Scientifique	CNRS	France	www.cnrs.fr
4	Centro de Investigaciones Energeticas, Mediambientales y Tecnoloicas	CIEMAT	Spain	www.ciemat.es
5	Stiftung Deutsches Elektronen-Synchrotron Helmholtzzentrum für Schwerionenforschung GmbH	DESY	Germany	www.desy.de
6	Stiftung Deutsches Elektronen-Synchrotron Helmholtzzentrum für Schwerionenforschung GmbH	GSI	Germany	www.gsi.de
7	Istituto Nazionale di Fisica Nucleare	INFN	Italy	www.infn.it
8	Paul Scherrer Institut	PSI	Switzerland	www.psi.ch
9	Science and Technology Facilities Council	STFC	UK	www.stfc.ac.uk
10	Uppsala Universitet	UU	Sweden	www.uu.se
11	Instytut Fizyki Jadrowej - Krakow	IFJ PAN	Poland	www.ifj.edu.pl



Accelerator R&D covers many domains, from the concepts of acceleration themselves to the study and realization of sub-elements, with a large effort put on the two basic elements of any accelerator, the accelerating radio-frequency cavities, and the bending magnets. The main goals are to increase the intensity and/or the energy of the particle beams.

Non limiting list of accelerator R&D

- **Innovative acceleration concepts**
 - Laser plasma, and electron laser accelerations, enabling ultra high accelerating field
- **Beam phase space optimization**
 - development of beam sources, and injectors
 - beam cooling techniques
 - development of RFQ (Radio Frequency Quadrupole), with both an accelerating and focusing effect
 - development of crab cavities
- **Beam control and beam loss reduction**
 - advanced beam diagnostics and analysis methods
- **High field magnets**
 - both high field dipoles (for energy increase) and high field quadrupoles (final focus systems)
- **Superconducting radio frequency technologies**
 - allowing continuous wave operation, limiting the accelerator length and its operation cost
- **High gradient normal conducting radio frequency structures**
 - operated in pulsed modes, but capable of producing very high accelerating fields
- **High power radio frequency and pulsed power generators**
 - necessary to power the cavities described above

The programs **CARE** and **EuCARD**, partly financed through the funding of the 6th and 7th Framework Programmes of the European Community are examples of coordinated accelerator R&D programs..See **FP6-FP7 accelerator R&D projects**.

Forum through which we discussed and lobbied for EuPRAXIA

- EuPRAXIA: **3M€ total for 4 years, 38 institutes. CDR ONLY!**
- Collecting funding needs to move ahead and build a serious accelerator
- Thanks to Roy and DESY EU office for December discussion
- Survey from 38 institutes (EU, Russia, Israel only)
 - 18 institutes provided requests (2018 – 2022)
 - At the moment: 50-60 M€ total for four years → about 15 M€/year
- Investigating possible sources
 - Talk again to EU DG research
 - TIARA
 - LEAPS (photon science)
- Unique chance for Europe here: **we work out the option to make a quantum leap for accelerator technology** – needs sufficient funding from some source

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



Home About Partners Synchrotrons FELs Partner Initiatives

Welcome

LEAPS - the League of European Accelerator-based Photon Sources - is a joint initiative of the Directors of the Synchrotron Radiation and Free Electron Laser (FEL) user facilities in Europe. Its primary goal is to actively and constructively ensure and promote the quality and impact of the fundamental, applied and industrial research carried out at their respective facility to the greater benefit of European science and society.



LEAPS PARTNERS





LEAPS: devising a new era of accelerator-based photon science in Europe

By [Carolin Hahn](#). Published on [22 May 2017](#) in: [May 2017](#), [News](#), [Europe](#), [League of European Accelerator-based Light Sources](#), [LEAPS](#), [Light source](#), [Particle Accelerator](#)

The Directors of the European Synchrotron and FEL user facilities have decided to establish a strategic partnership – the League of European Accelerator based-Photon Sources (LEAPS)– which aims for an unprecedented level of cooperation and development and outreach to academic and industrial users as well as to the general public.

So far, 16 facilities have joined this initiative which is strongly encouraged by policy makers such as Robert-Jan Smits, the Director-General for Research and Innovation of the European Commission, who met with LEAPS representatives in Brussels on April 26, 2017.

The primary goal of LEAPS is to ensure the quality and impact of fundamental, applied and industrial research carried out at their facilities. The Partnership deploys its substantial collective knowledge, experience and expertise in Synchrotron and FEL science and technology, Research Infrastructure management, and service to scientific users to the greater benefit of European science and society. It also aims to play an integrating role for countries with less developed communities and infrastructure for research and innovation, in Europe and beyond.

The Partnership is currently preparing a roadmap document outlining the future of accelerator-based photon science in Europe, which will be handed over to DG research and innovation at the big international LEAPS roll-out meeting in November 2017.

LEAPS is aiming to get substantial funding from the EU in the 9th framework program based on its track record of more than three decades of accelerator based light sources and a community exceeding 30,000 users across Europe.

LEAPS is supported by ALBA, DESY, Diamond Light Source, Elettra, ESRF, European XFEL, FELIX, HZB, HZDR, INFN, ISA, MAX IV, PSI, SOLARIS, SOLEIL, and most recently PTB, and is collaborating with the European Synchrotron User Organization ESUO.

Find more information at www.leaps-initiative.eu

LEAPS at Diamond Light Source in November 2016



Partners (PTB just joined and is still missing here)



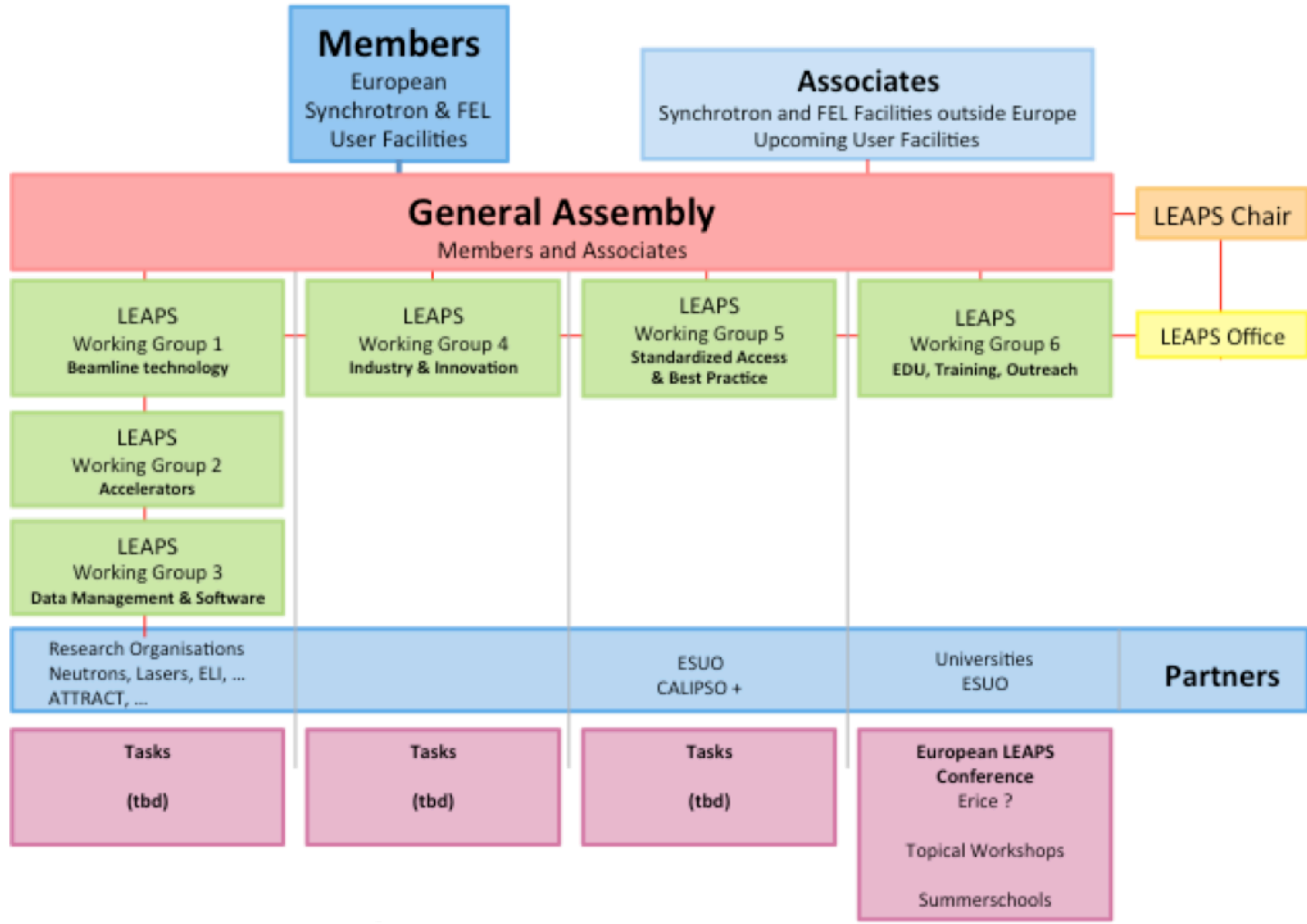
<http://www.epsnews.eu/2017/05/leaps-devising-a-new-era-of-accelerator-based-photon-science-in-europe/>

LEAPS: devising a new era of accelerator-based photon science in Europe

The Directors of the European Synchrotron and FEL user facilities have decided to establish a strategic partnership – the League of European Accelerator based-Photon Sources (LEAPS)– which aims for an unprecedented level of cooperation and development and outreach to academic and industrial users as well as to the general public.

- ALBA
- **DESY**
- Diamond Light Source
- Elettra
- ESRF
- European XFEL
- FELIX
- HZB
- **HZDR**
- **INFN**
- ISA
- MAX IV
- PSI
- SOLARIS
- **SOLEIL**
- PTB
- collaborating with the European Synchrotron User Organization ESUO.

LEAPS governance



The accelerator WG2 is coordinated by **Hans Braun** (PSI). Three topics have been defined with topic leaders:

- **Future compact sources / Ralph Assmann**
- **FEL developments / Thomas Tschentscher and Simone Di Mitri**
- **Storage rings / Andreas Jankowiak**

But: most R&D topics discussed are of interest for several topics \Rightarrow ?no easy sorting but combined table

TOPICS	Technology	Tech sub category	coord. Person (from FEL or COMPACT)	DESY person	INFN person	FERMI person	SOLEIL person	HZDR person	MAX IV person	Cooperation partners outside LEAPS (from EuPRAXIA et al)
General (master) contact				R. Assmann	M. Ferrario	S. Di Mitri	M.E. Couprie	U. Schramm	S. Thorin	
COMPACT	accelerating techniques	high gradient (plasma & dielectric)	R. Assmann	R. Assmann	M. Ferrario			A. Irman		EuPRAXIA Consortium
COMPACT	test stands for compact sources	test stands for compact sources	U. Dorda	U. Dorda	E. Chiadroni					
COMPACT	beam combination & separation	distribution systems	R. Assmann	R. Assmann	R. Pompili					
COMPACT	Laser for accelerators	laser accelerator drivers	A. Walker	A. Walker	M. P. Anania			U. Schramm		
FEL + COMPACT	high gradient/field magnets	permanent magnet	P. Tavares	U. Dorda						
FEL + COMPACT	Insertion devices	small period, high K undulator (SC or perm.)	T. Schmidt, M.-E. Couprie	???	DESY-FS	G. Dattoli	S. Di Mitri	M.E. Couprie		ENEA, Kyma
FEL + COMPACT		APU, EPU	T. Schmidt, M.-E. Couprie	???	DESY-FS	G. Dattoli	S. Di Mitri	M.E. Couprie		ENEA, Kyma
FEL + COMPACT		TGU	T. Schmidt, M.-E. Couprie	???	DESY-FS	G. Dattoli	S. Di Mitri	M.E. Couprie		ENEA, Kyma
FEL + COMPACT		electron bunch control	bunch compression	S. Dimitri	U. Dorda	E. Chiadroni	S. Di Mitri			
FEL + COMPACT		collimation	S. Dimitri	U. Dorda	R. Pompili	S. Di Mitri				
FEL + COMPACT	FEL architecture(s)	fs -to-as pulse generation (CPA, ...)	E. Allaria, S. Sverin	J. Bödeewadt, C. Lechner	M. Ferrario	E. Allaria		A. Debus		
FEL + COMPACT	precision timing&synchronisation		H. Braun	???	H. Schlarb	M. Bellaveglia	S. Di Mitri		M. Kuntzsch	
FEL + COMPACT	Laser for accelerators	cathode	S. Dimitri	???	I. Hartl	F. Villa	S. Di Mitri			
FEL + COMPACT	accelerating techniques	application of X-band for TDS	???	B. Marchetti	D. Alesini					
FEL + COMPACT	low emittance photo-injectors	nc	T. Kamps	B. Marchetti	M. Ferrario	S. Di Mitri		P. Michel		
FEL + COMPACT	diagnostics	electron	???	???	E. Chiadroni	S. Di Mitri		P. Evtushenko		
FEL + COMPACT		sub-fs capability	???	B. Marchetti	R. Pompili	S. Di Mitri		A. Irman		

R&D items with short (2p) proposal text already available

Proposal	Submitting Authors	Labs interested in R&D	Total cost estimate M€	Topic S=synchrotron F=FEL C=compact source
Short period insertion devices	M.E. Couprie (SOLEIL) T. Schmidt (PSI)	SOLEIL, PSI, DESY, ELETTRA, ESRF, HZB, Diamond, Maxlab, ALBA, ANKA	33.4	S,F,C
High Gradient/Field magnets with very small aperture	P. Tavares (MAXLAB)	ALBA, ASTRID, HZB, Elettra, DESY, ESRF, MAX IV, PSI, SOLEIL	10.6	S,C
Seed laser systems	M. Danailov (ELETTRA)	DESY, ELETTRA, EU-XFEL,HZDR, LNF, PSI	3.5	F
Electron bunch control (advanced bunch compressor, Laser heater, collimation)	S. Di Mitri (ELETTRA)	DESY, ELETTRA, EU-XFEL, MAXLAB, PSI	2.9	F,C
Advanced schemes for tailoring FEL pulses	S. Werin (MAXLAB) E. Allaria (ELETTRA)	ELETTRA, PSI, DESY, SOLEIL, MAXLAB, Eu-XFEL, DESY	14	F, C
Low emittance Photo-injectors (cw/sc and pulsed/nc)	T. Kamps (HZB)	HZB, DESY, HZDR, PSI, ELETTRA, LNF, MAXLAB	12	F,C
LEAPS accelerating techniques cwRF	H. Weise (DESY)	DESY, EUuXFEL, NCNR (Poland)	6.1	F
FEL tests stand (either stand-alone or attached to existing FEL)	M.E. Couprie (SOLEIL), B. Faatz (DESY)	SOLEIL, DESY, ELETTRA, PSI	24-41	F
Tunable high power THz source for Eu-XFEL	Frank Stephan (DESY Zeuthen)	DESY, EU-XFEL (+ large number of potentially collaborating universities)	5	F
Very small aperture vacuum chamber	T. Schmidt (PSI) C. Herbeoux (SOLEIL)	ALBA, DESY, PSI, ANKA, SOLEIL, DIAMOND, MAXLAB	10	S,F

More R&D items

Proposal	Submitting Authors	Labs interested in R&D	Cost estimate M€	Topic S=synchrotron F=FEL C=compact source
Injection systems for low dynamic aperture rings (kicker and pulser)	R. Bartolini (DIAMOND)	ALBA, Elettra, DESY, HZB, ESRF, MAXLAB, PSI, SOLEIL	6.5	S
sc / nc cavities for bunch length control + RF systems	Jens Knobloch, Andreas Jankowiak (HZB)	ALBA, DESY, HZB, MAX IV, SOLEIL	15.9	S,F
Diagnostics and Feedback for advanced photon beam stability	G. Rehm (DIAMOND) R. De Monte (ELETTRA)	DIAMOND, Elettra, HZB, MAX IV, ESRF, PSI, SOLEIL	8.9	S,F
Sub femtosecond timing and synchronization	S. Hunziker (PSI)	PSI, DESY, ELETTRA	2.5	F,C
Joint R&D on compact plasma accelerator for photon science (context EU design study EuPRAXIA)	R. Assmann (DESY), M. Ferrario (INFN), U. Schramm (HZDR)	DESY, INFN, HZDR, ..., EuPRAXIA (EU) Consortium (38 institutes)	45	C

Total sum both tables 200-217 M€

Pilot projects in FP8 as preparation for LEAPS what s possible / reasonable?

Ideas for Pilot Projects

- Comparative study of undulator technologies and future requirements towards a coherent R&D program for short period devices
- Survey of injector technologies and future requirements towards a coherent R&D program for low emittance/high brightness injectors
- Laser systems as power drivers for plasma acceleration/industry involvement
- Define R&D roadmap towards a PM magnet only demo storage ring
- Design-assessment of plasma accelerators for photon science

- Funding is ongoing or being applied for:
 - **National funding:**
Base. Set up facilities. Accelerator R&D basic infrastructure. National priorities. (order of 30 M€)
 - **EuPRAXIA Design Study:**
CDR type of work. (3M€)
 - **EU/LEAPS and others funding:**
use for TDR type of work – prototyping towards a European EuPRAXIA facility (50 M€)
- Construction:
 - Another order of 50 - 150 M€ to come from host country and EU facility partner labs.
 - Model: Particle physics detector. Budget to all for constructing components – assemble in one site.

- Assume FP9 (2021 – 2027) Accelerator R&D: 194 M€
- Assume Horizon2020 Accelerator R&D: 6 M€
- To do by July 8 (split FET and material cost):
 1. Input to common proposals (no individual project financing, common activities, R&D) for a total of **2 M€ EuPRAXIA-related work 2018 – 2020**.
 1. Lasers for plasma accelerators (1.25 M€) → Leo/Francois/Andi W.
 2. Design assessment plasma acc. for photon science (0.75 M€) → R. Assmann
 2. Input to common proposal for **45 M€ EuPRAXIA-related funding** during FP9 (2021 – 2027) → organize through EuPRAXIA
 3. Input to other WP's with relevance for Compact Sources (C in table)
- How? Deadline July 8 (split FET and material cost):
 - Scope: design, critical issues, **technical R&D and/or prototypes required for EuPRAXIA construction.**
 - Update your ideas/numbers and send input to Andreas Walker: **technical description (1/2 page), involved LEAPS partner, involved partners from EuPRAXIA, involved EuPRAXIA WP's, schedule of work, required budget versus year** (EU plus Russia plus Israel, include UK for now) – will be public