Informace o vědeckém a experimentálním programu ELI Beamlines v letech 2018-2020

Rada pro výzkum, vývoj a inovace
27. dubna 2017

Outline

ELI & scientific goals

Experimental programs

Research team

User community

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European Structural and Investing Funds
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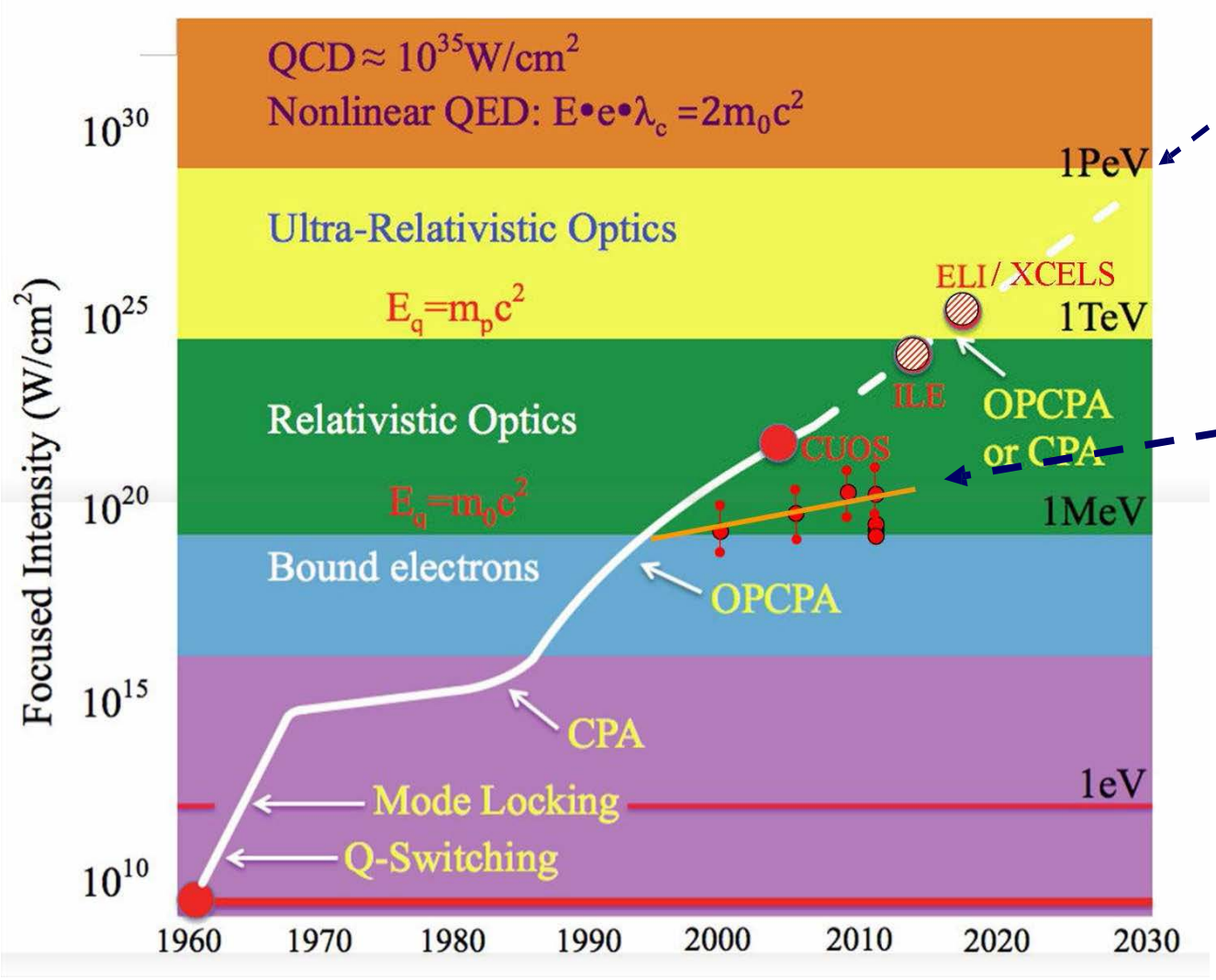
ELI – basic characteristics

- ELI will be the world's first international laser research infrastructure, pursuing unique science and research applications – "CERN of laser research"
- ELI is the first ESFRI project to be fully implemented in the newer EU Member States
- ELI will be operated as a distributed research infrastructure based on 3 specialised and complementary facilities located in the Czech Republic, Hungary and Romania
- ELI is pioneering a funding model combining the use of structural funds with national and EC funding and contributions in an ERIC for the operation phase

ELI Opportunity: the “facility challenge”



Top laser specifications

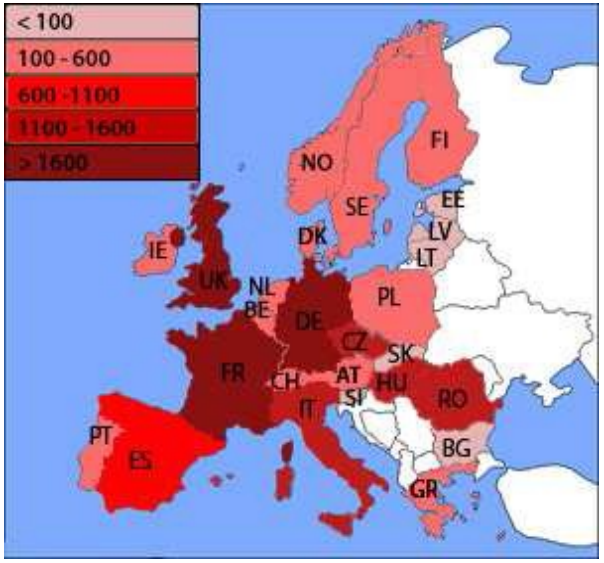
“Facility gap”

Highest reported intensities used in experiments (2012)

Lasers in Europe

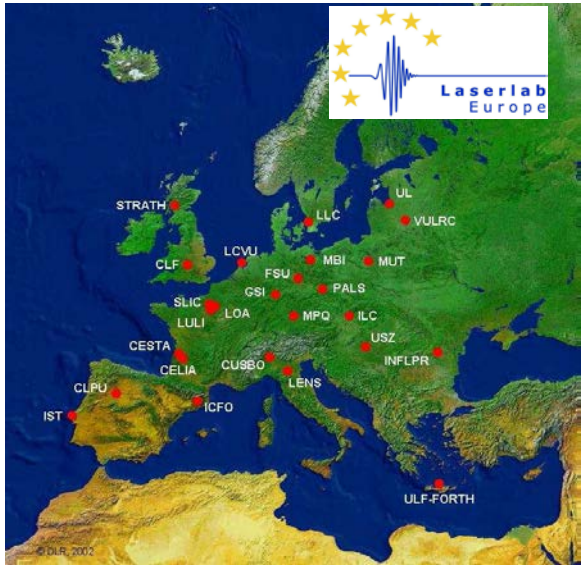
Scientific community in Europe is well organized.
Potential users know about ELI and are prepared to use it.

European Laser Community



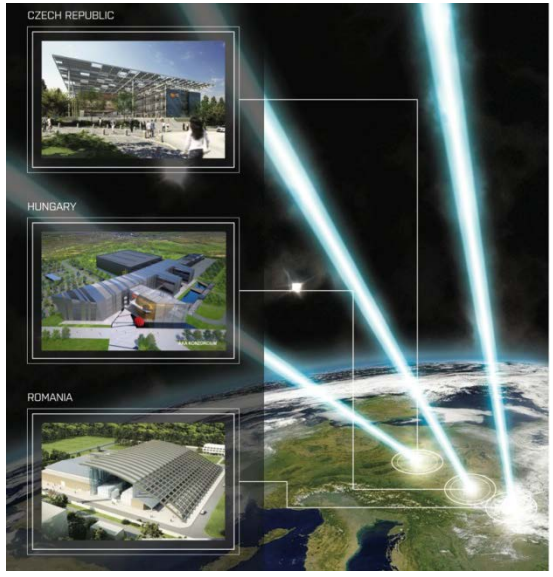
The basis

Existing Infrastructure Network: **Laserlab-Europe**



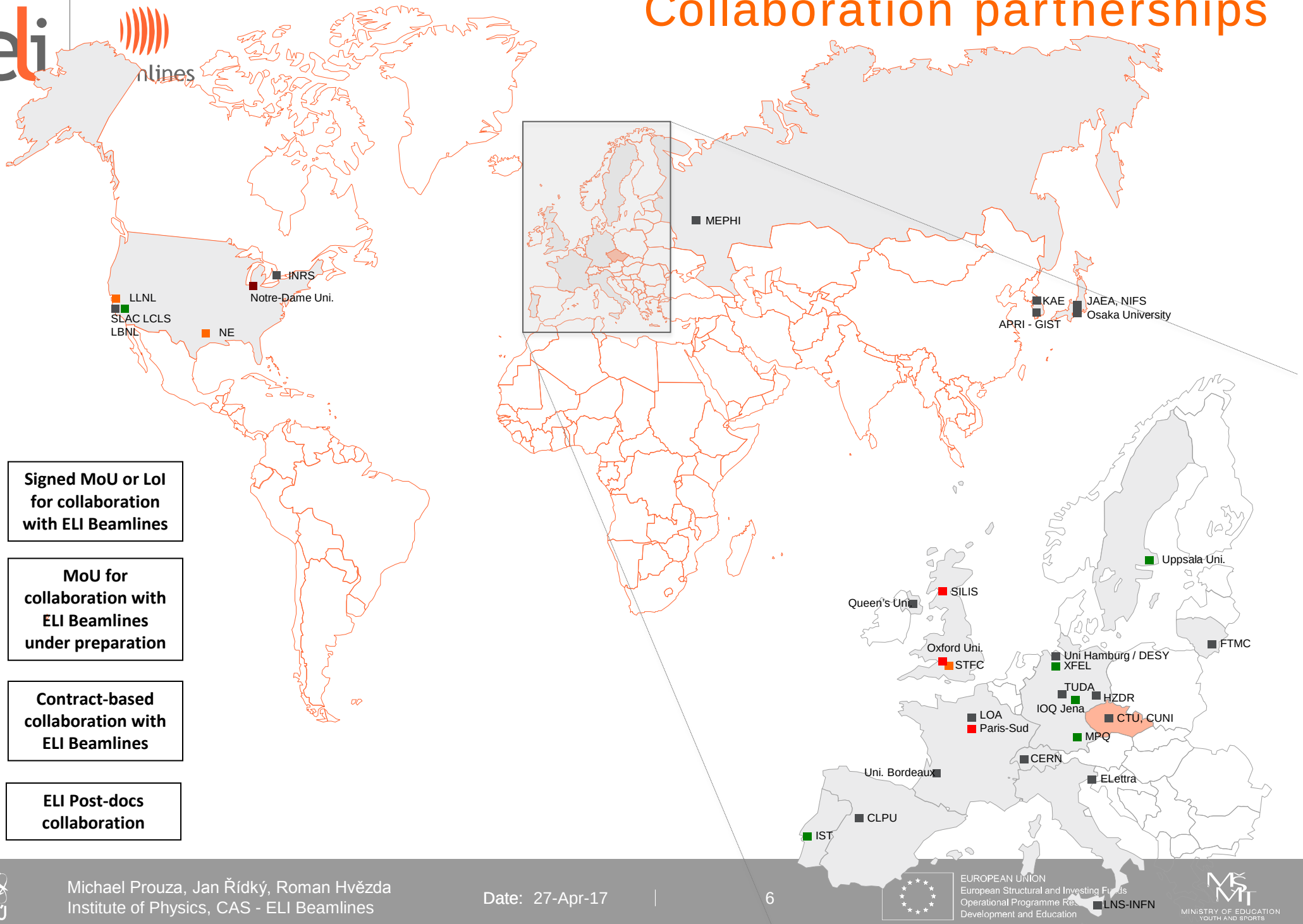
Flexible instrument to perform and initiate new science beyond the national scale

ESFRI Pan-European Research Infrastructures ELI



Mission-oriented single entities to meet global challenges

Collaboration partnerships



Signed MoU or LoI for collaboration with ELI Beamlines

MoU for collaboration with ELI Beamlines under preparation

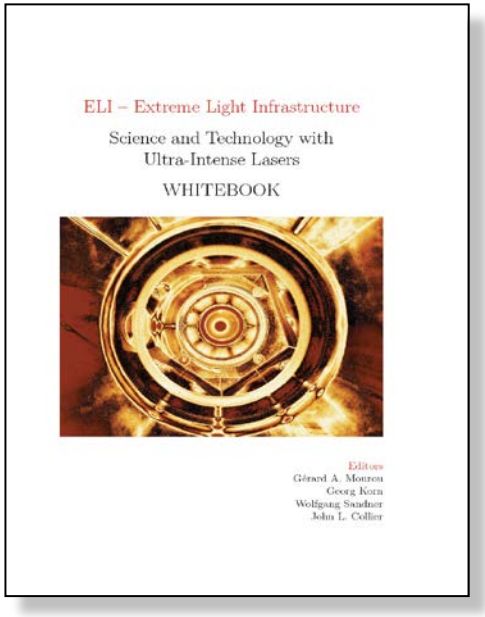
Contract-based collaboration with ELI Beamlines

ELI Post-docs collaboration

Science is the driver

- The **strong science case** is the main reason, why Europe has decided 11 years ago to build ELI

  The science case is described in detail in
  ELI WhiteBook,
  40 institutions, 13 countries



- The **applications potential** and **the socio-economic added value** is why Europe has decided to build ELI in three CE countries, using Structural Funds

Extreme Light for new science and variety of applications

- Investigation of vacuum structure
- Particle acceleration
- Ion sources
- Neutron sources
- Terahertz radiation sources
- Ultrafast-laser driven X-ray sources
- Attoscience: ultrafast dynamics
- Laser-based nuclear physics
- Physics of dense plasmas
- Laboratory astrophysics

- Material science
- Medicine
- Biology
- Environment
- Fusion research
- Space science
- Astrobiology
- Fundamental physics
- More will come

From "ELI White Book", 2011

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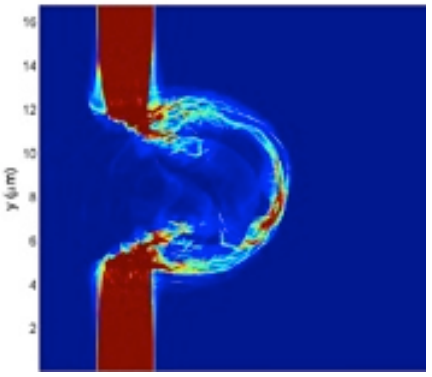
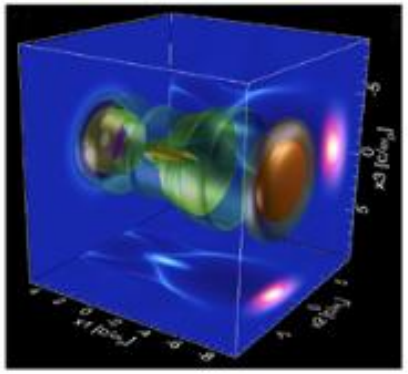
Research Areas

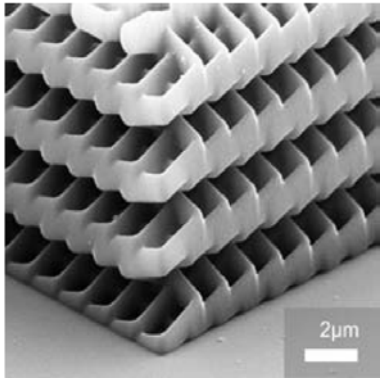
X-ray and gamma sources,
laboratory astrophysics



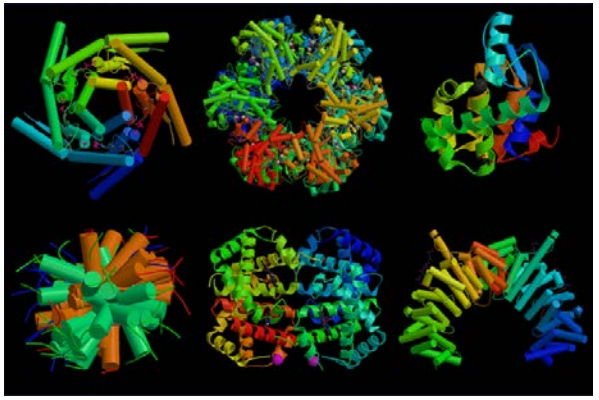
Proton acceleration



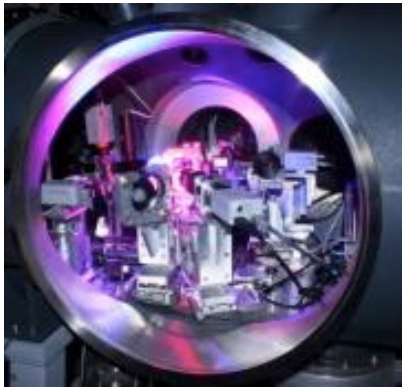
Electron acceleration



Nanotechnology
and advanced materials



Biology and biochemistry

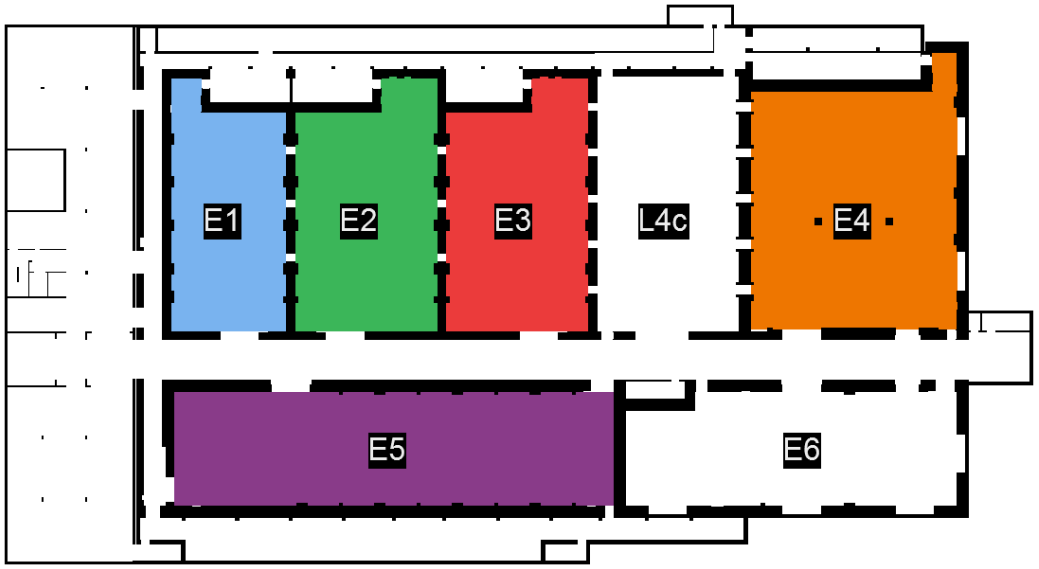


Medical diagnostics
and treatment technology

Scientific case of ELI Beamlines

- **Balance between fundamental science and applications**
- **Research Program 1**
  - Lasers generating rep-rate ultrashort pulses & multi-petawatt peak powers
- **Research Program 2**
  - X-ray sources driven by rep-rate ultrashort laser pulses
- **Research Program 3**
  - Particle acceleration by lasers
- **Research Program 4**
  - Applications in molecular, biomedical, and material sciences, strong cooperation with BIOCEV
- **Research Program 5**
  - Laser plasma and high-energy-density physics, lab astrophysics,
- **Research Program 6**
  - High-field physics and theory (steps to 10^{23}W/cm2, radiation reaction plays role)
  - 4th pillar contributions, 4th pillar ultra-relativistic intensities and above ($>10^{24}$W/cm2),
  - Protons become relativistic in the laser field

X-rays - What users get

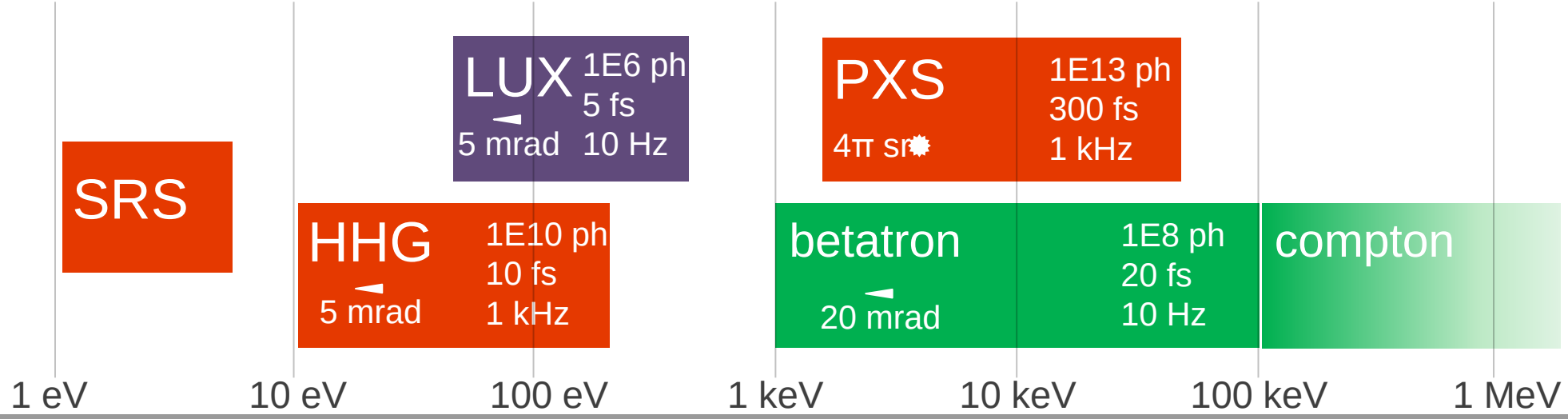


Secondary photon sources for users , short pulse

- Coherent Diffractive Imaging
- Atomic, Molecular and Optical Science
- Soft X-ray Materials Science
- X-ray phase contrast imaging
- X-ray Diffraction and spectroscopy
- Optical Spectroscopy and Molecular Dynamics

- X-ray Phase contrast imaging
- X-ray fluorescence/absorption spectroscopy

- Coherent Diffractive Imaging (concept)



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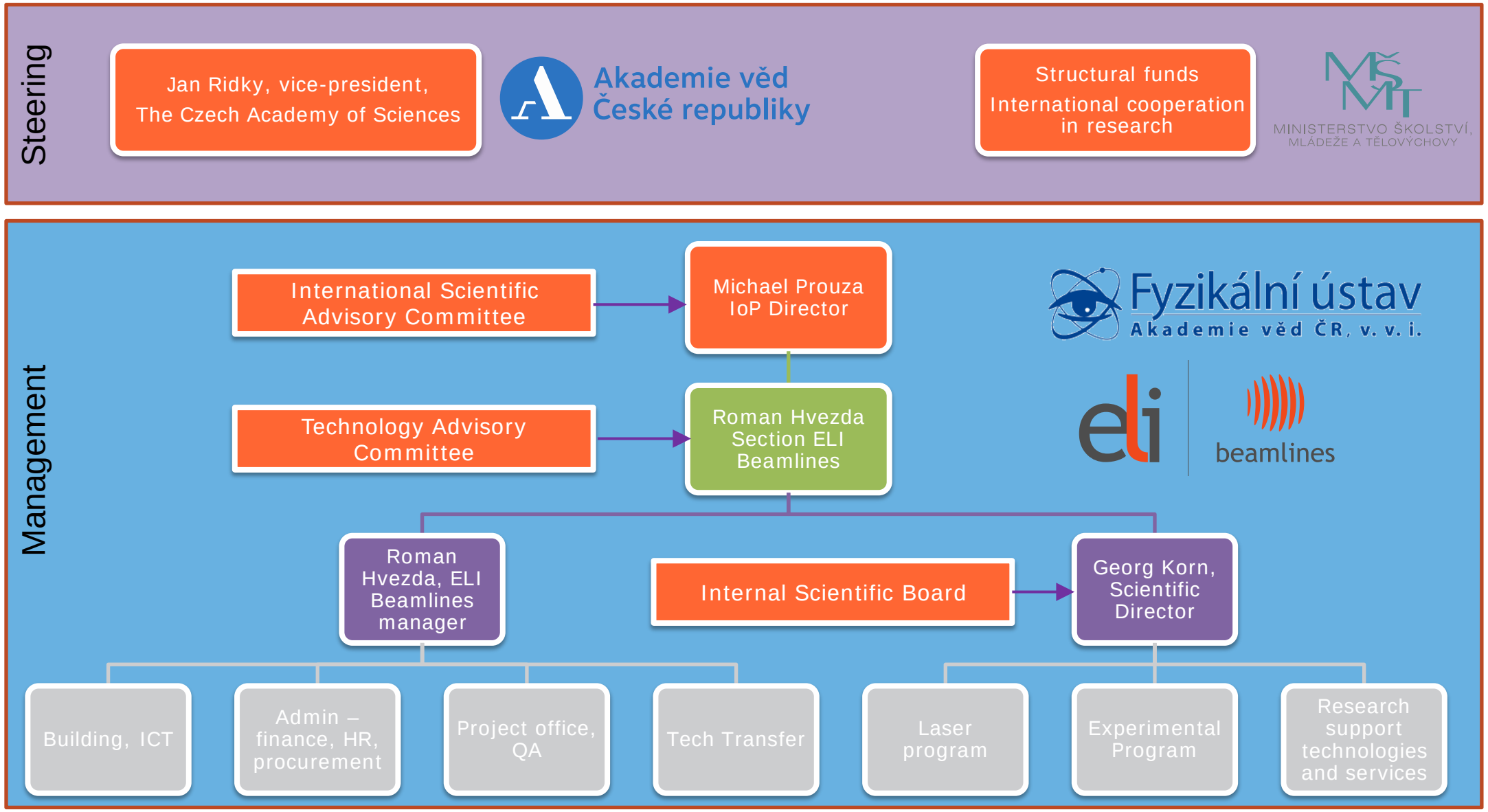
Governance / Management



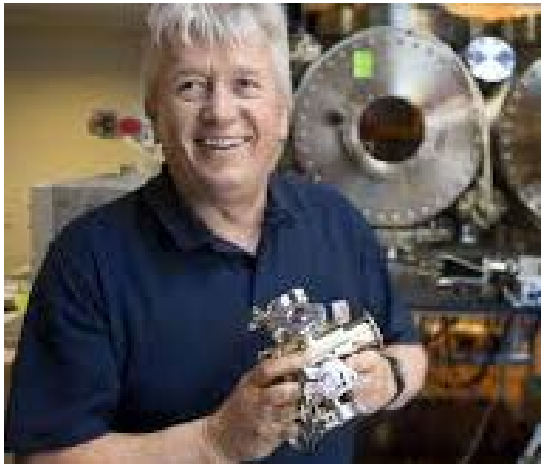
Scientific team

International Scientific Advisory Committee

HiFI project

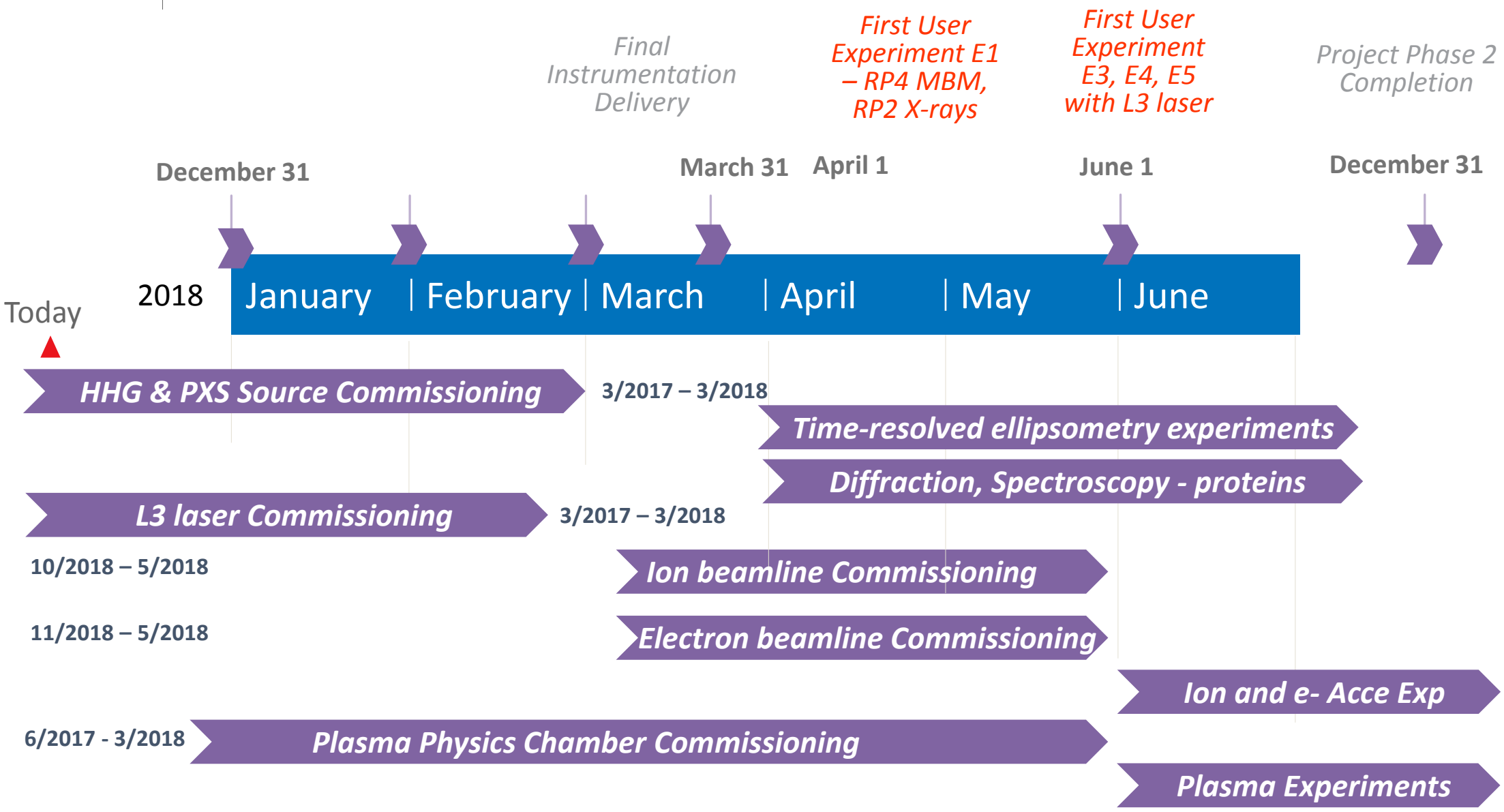
Sergei V. Bulanov

ELIBIO project



Janos Hajdu

Experimental Start-up Period



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Access Policy

- Necessity to attract excellent users
  - The access policy must ensure the attraction of the best scientific users and the best results in the facilities
- Standardized procedure
  - European Charter for Access to RI,
    Peer Review International Panel, Virtual User Office
- Excellence-driven access (*non-proprietary)*
  - accepted solely through independent peer review
- Market-driven access (proprietary)
  - shall be limited to 5-10%
- Specific access for training and testing
- Call “0” – 4Q 2017, Access mid 2018

ELI
lasers for
better future

Michael Prouza, Jan Řídký, Roman Hvězda
Institute of Physics, CAS - ELI Beamlines

Date: 27-Apr-17

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Backup slides

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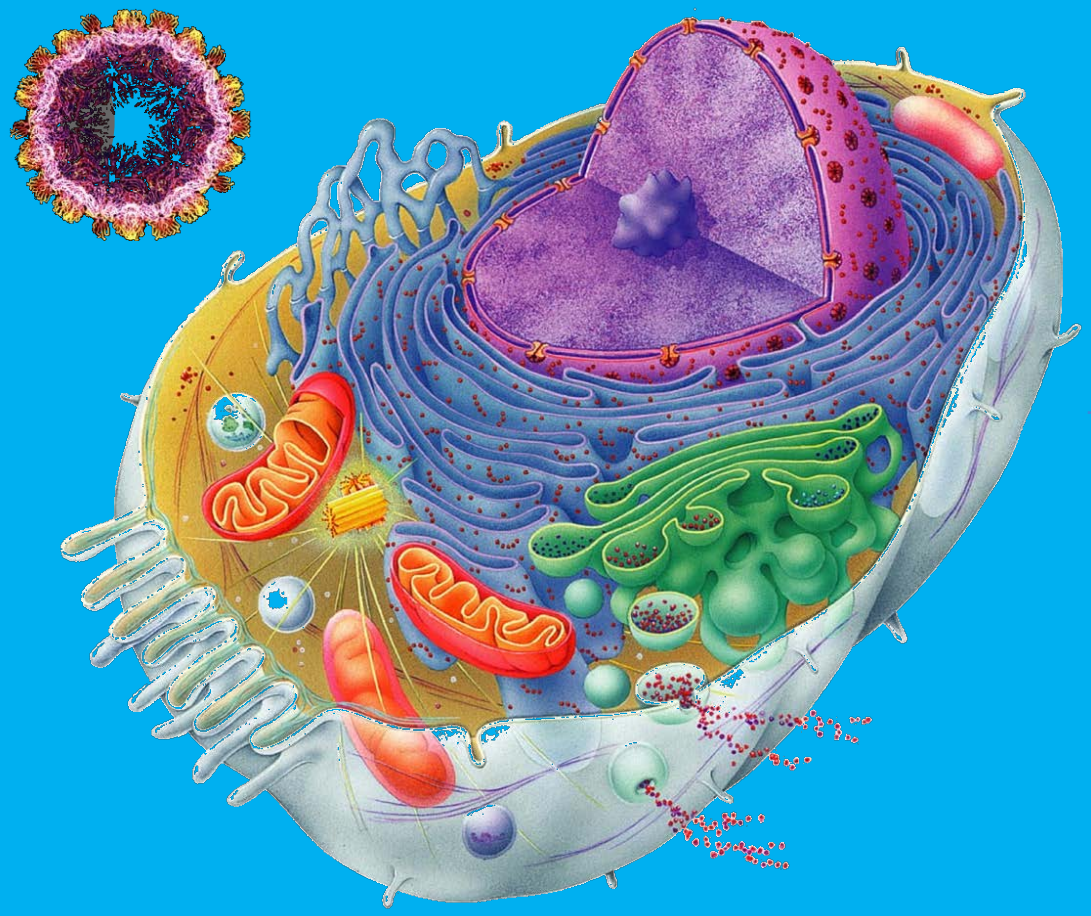
Financování 2016-2022

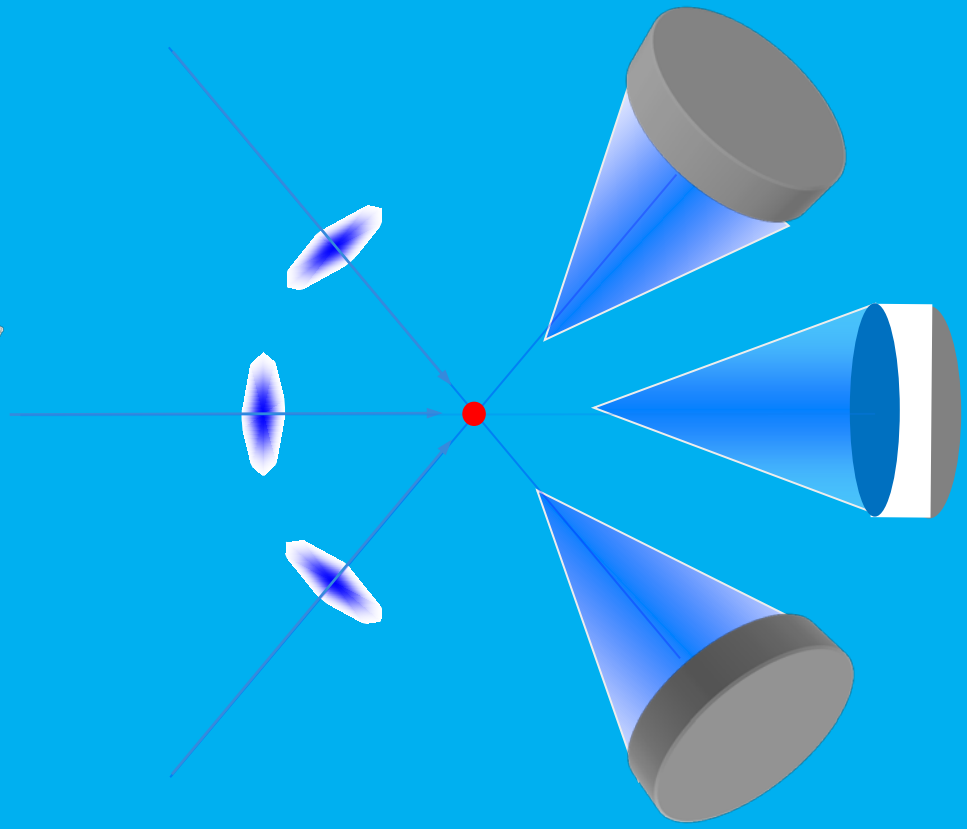
Projekt	Typ aktivity	Zdroj financování	Forma podpory	Období realizace	Rozpočet mil. Kč	Status
NPÚ II	R&D	MŠMT	účelová	2016-2020	685	v realizaci
VI 2016-2017	Access	MŠMT	účelová	2016-2017	103	v realizaci
ELI - Fáze 2	R&D	OP VVV	účelová	2016-2017	1 700	v realizaci
Excelentní týmy – ELIBIO	R&D	OP VVV	účelová	2017-2022	240	v realizaci
Excelentní týmy – HiFI	R&D	OP VVV	účelová	2017-2022	240	v realizaci
ELI – VI - ELITAS	R&D	OP VVV	účelová	2017-2019	20	v realizaci
ELI – excelentní výzkum - ADONIS	R&D	OP VVV	účelová	2018-2022	1 300	postoupil do 2. kola (5/2017)
Teaming - CHAMPP	R&D	H2020/OP VVV	účelová	2017-2018(22)	10 (1 500)	EK schválila 1. fázi
Rozvoj Kapacit pro VaV		OP VVV	účelová	2018-2020	60	v přípravě
VI 2018-2020 / ERIC	Access	MŠMT/ERIC	účelová/ institucionální	2018-2020	1 660	návrh předložen
CELKEM					**6 -7 000**	

User base


Imperial College London
University of Oxford
University of Potsdam
Technische Universität Berlin
DESY
CFEL
GSI
SCIENCE
Universität Leipzig
Otto von Guericke Universität Magdeburg
University of Strathclyde Glasgow
Queen's University Belfast
European XFEL
HZDR
Helmholtz Zentrum Dresden Rossendorf
FLASH.
Free-Electron Laser FLASH
TUM
UHH
Universität Hamburg
Der Forschung | Der Lehre | Der Bildung
Science & Technology Facilities Council
Rutherford Appleton Laboratory
Colorado State University
LMU
Ludwig-Maximilians-Universität München
LAOLA
Laboratory for Laser- and beam-driven plasma Acceleration
MBI
Berkeley Lab
Fermilab
Texas
Friedrich-Schiller-Universität
Lawrence Livermore National Laboratory
Chalmers
New Mexico State University
INFN LNS
TU Wien Photonics
University of Potsdam
PAN
Polish Academy of Sciences
cea
ELI
ESRF
cnrs
VU Vrije Universiteit Amsterdam
University of Gothenburg
Uppsala Universitet
Lund University
IFPiLM
Instytut Fizyki Plazmy i Laserowej Mikrosyntezy
UK
Uniwersytet
université de Bordeaux
CELIA
laboratoire d'optique appliquée
i3M
Instituto de Instrumentación para Imagen Molecular
Weizmann Institute of Science
Lund Laser Centre
CEITEC
Central European Institute of Technology
Brno | Czech Republic
BIOCEV
ELI Nuclear Physics
ELI attosecond
Rigaku
IST Técnico Lisboa
大阪大学
Osaka University
Jihočeská univerzita v Českých Budějovicích
University of South Bohemia in České Budějovice
ČVUT
České vysoké učení technické v Praze
Proton Therapy Center
SIGMAPHI
apri
Advanced Photonics Research Institute
SIOM
MEPhI

Multi-angle view of a cell





3 simultaneous views of a target

TO UNDERSTAND THE WHOLE YOU MUST LOOK AT THE WHOLE

Janos Hajdu

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What is ELI ?

ELI, the "Extreme Light Infrastructure", will be the first laser research infrastructure world-wide which is the result of a co-ordinated effort of a multi-national scientific laser community.

ELI White Book, 2011

A scientific community going global !

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ELI's vision

ELI, the "Extreme Light Infrastructure", will be the first laser research infrastructure world-wide which is the result of a co-ordinated effort of a multi-national scientific laser community.

True, as evident from ESFRI Roadmap process, and ELI-PP. But not a vision!

ELI needs to become the first international laser research infrastructure world-wide.

Still not sufficient.

ELI's must become the world's best user facility with the highest quality scientific output

How it came about

How it will be operated

Return of investment

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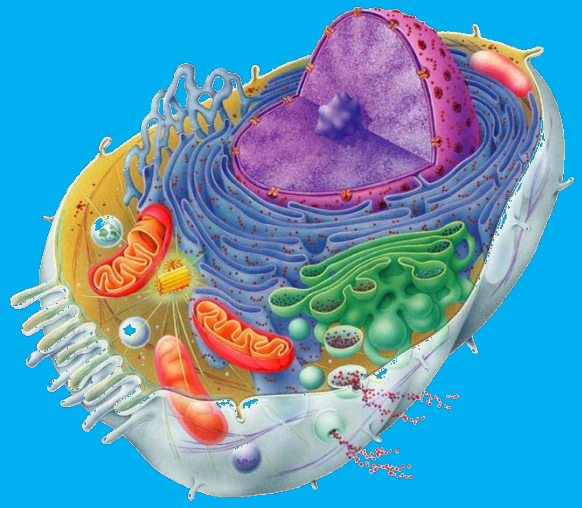
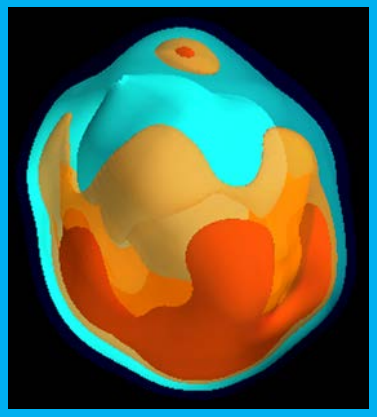
Where is the interest?

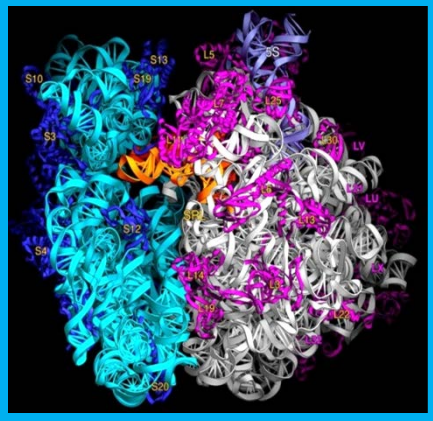
LIVING CELLS



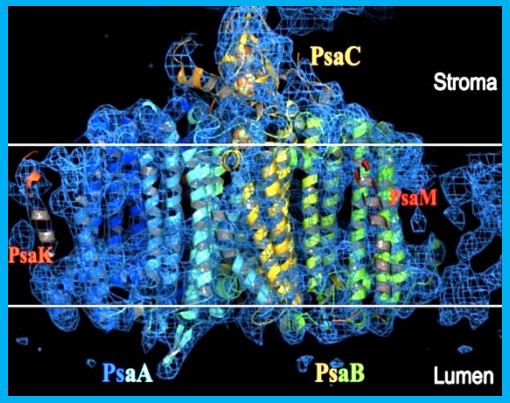
VIRUS PARTICLES



MACROMOLECULAR COMPLEXES

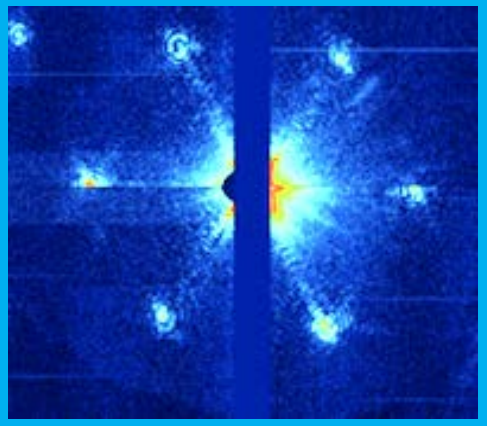


MEMBRANE PROTEINS



SINGLE MOLECULES

NANOCRYSTALS



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