



The ELI-ALPS research infrastructure – collaboration possibilities in the NKFIH-NKP program

Karoly OSVAY

Research Technology Director

30th January, 2018
Budapest



European Union
European Regional
Development Fund



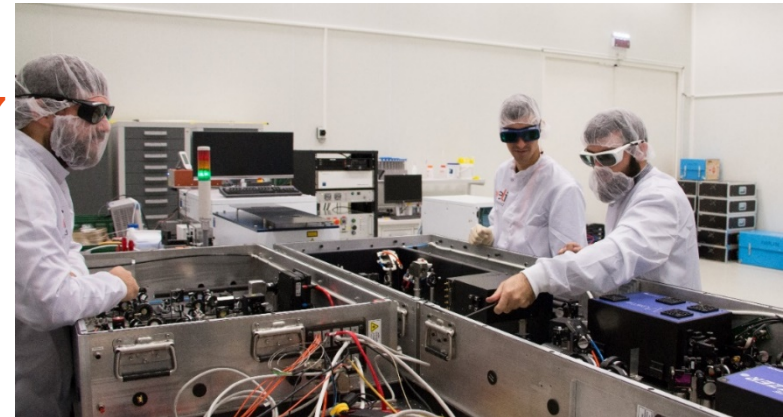
INVESTING IN YOUR FUTURE

Mid-Infrared Laser: *completed*

Site acceptance: 27th October, 2017

Friendly user ready: 30th November 2017

External user ready: February 2018



HR Laser: operational

Partial site acceptance: 15th December, 2017

Friendly user ready: 15th January 2018

External user ready: February 2018



THz spectroscopy lab: under installation.

Partial site acceptance: 24 January, 2018

Friendly user ready: March 2018

External user ready: April 2018



SYLOS1 Laser: **completed**

Factory acceptance: 8th March, 2017

Friendly user ready: NA

External user ready: NA



Arrived: 28th June, 2017



Most parts departed to LC, Vilnius, for SYLOS2A development: 10th August, 2017

Research Article

Vol. 25, No. 5 | 6 Mar 2017 | OPTICS EXPRESS 5797

Optics EXPRESS

53 W average power CEP-stabilized OPCPA system delivering 5.5 TW few cycle pulses at 1 kHz repetition rate

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Mechanical and electrical workshops are *operational*



Optical preparation laboratory is *operational*



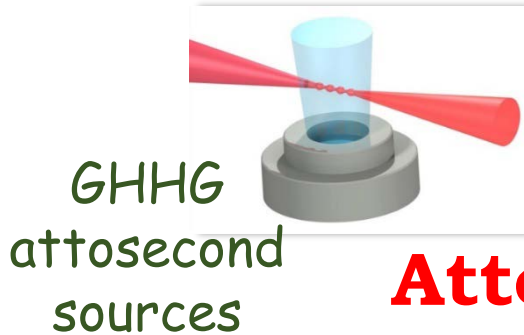
Optical workshop is *operational*.

Chemical, medical and radiobiological labs are under installation

- 1) To generate X-UV and X-ray **femtosecond and attosecond pulses**, for temporal investigation at the attosecond scale of electron dynamics in atoms, molecules, plasmas and solids.

**USER FACILITY offering access to
few cycle electromagnetic pulses
(atto- and THz beamlines)**

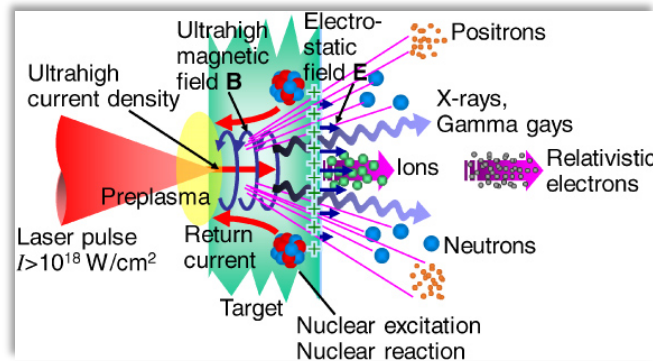
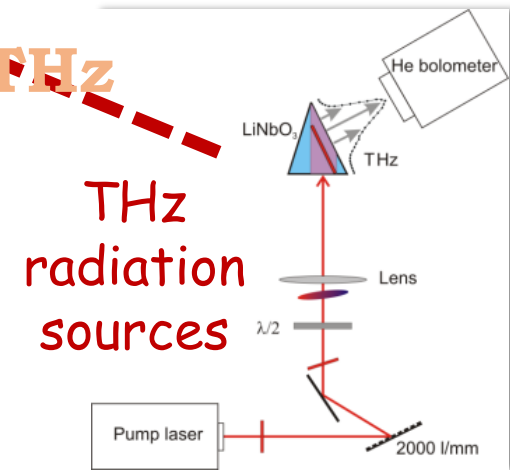
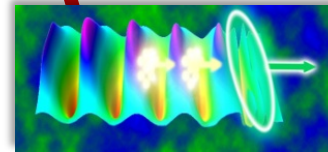
- 2) **Source developments**
(towards high average power, high peak intensity pulses)



Attosecond Sources



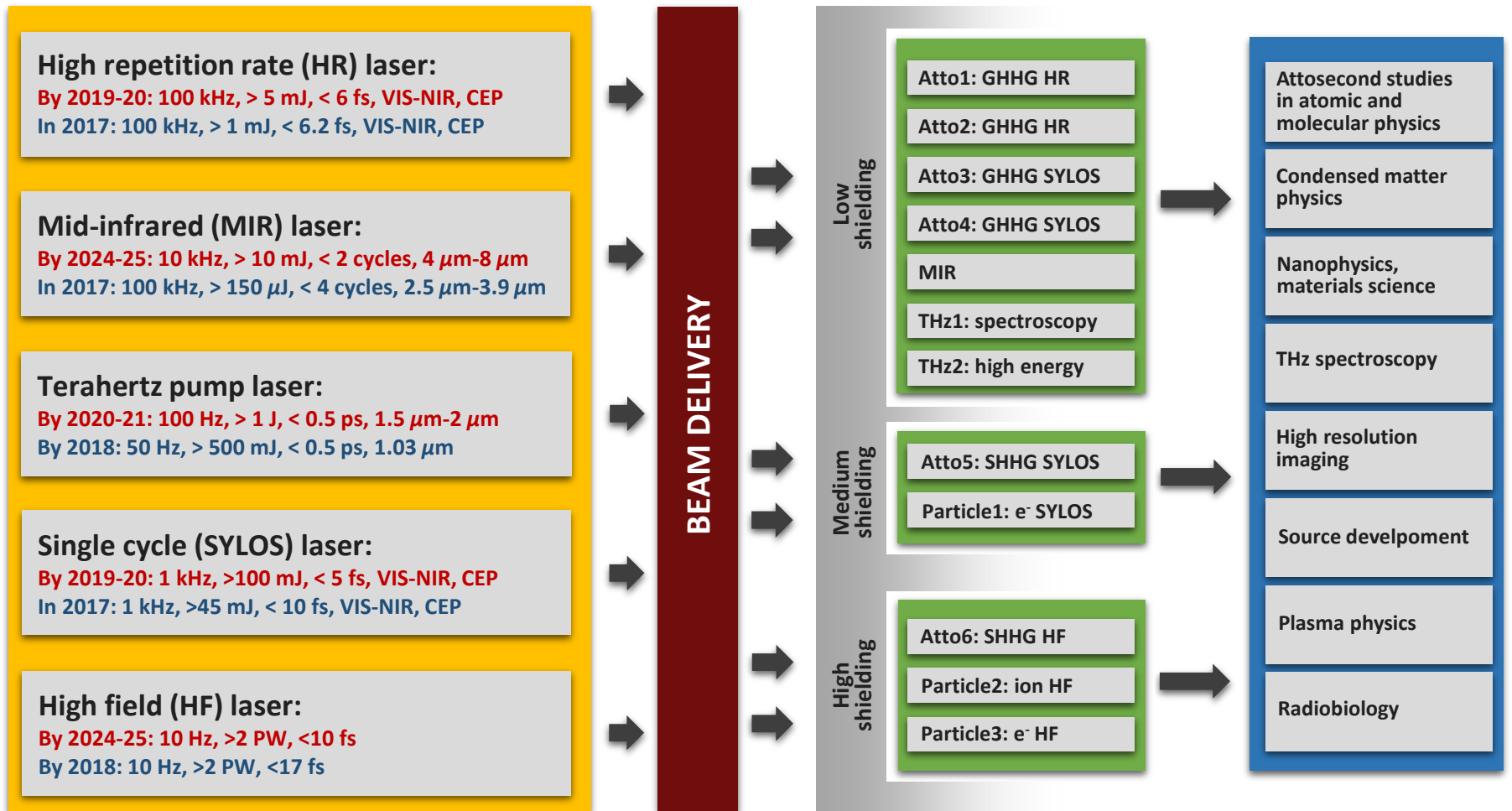
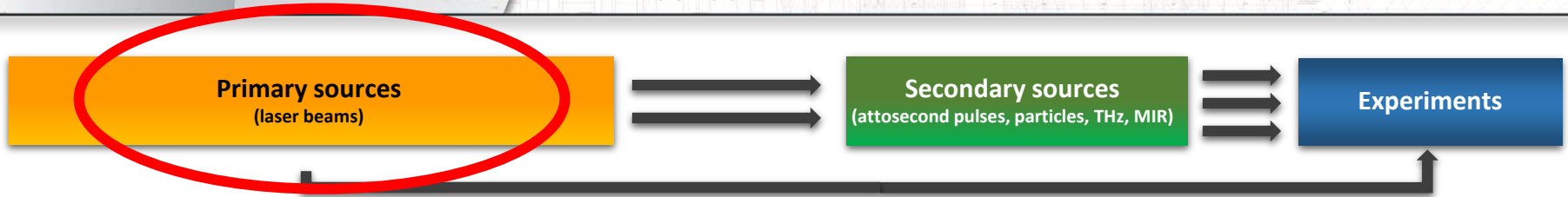
Particle and THz Sources



Electron, ion accelerators



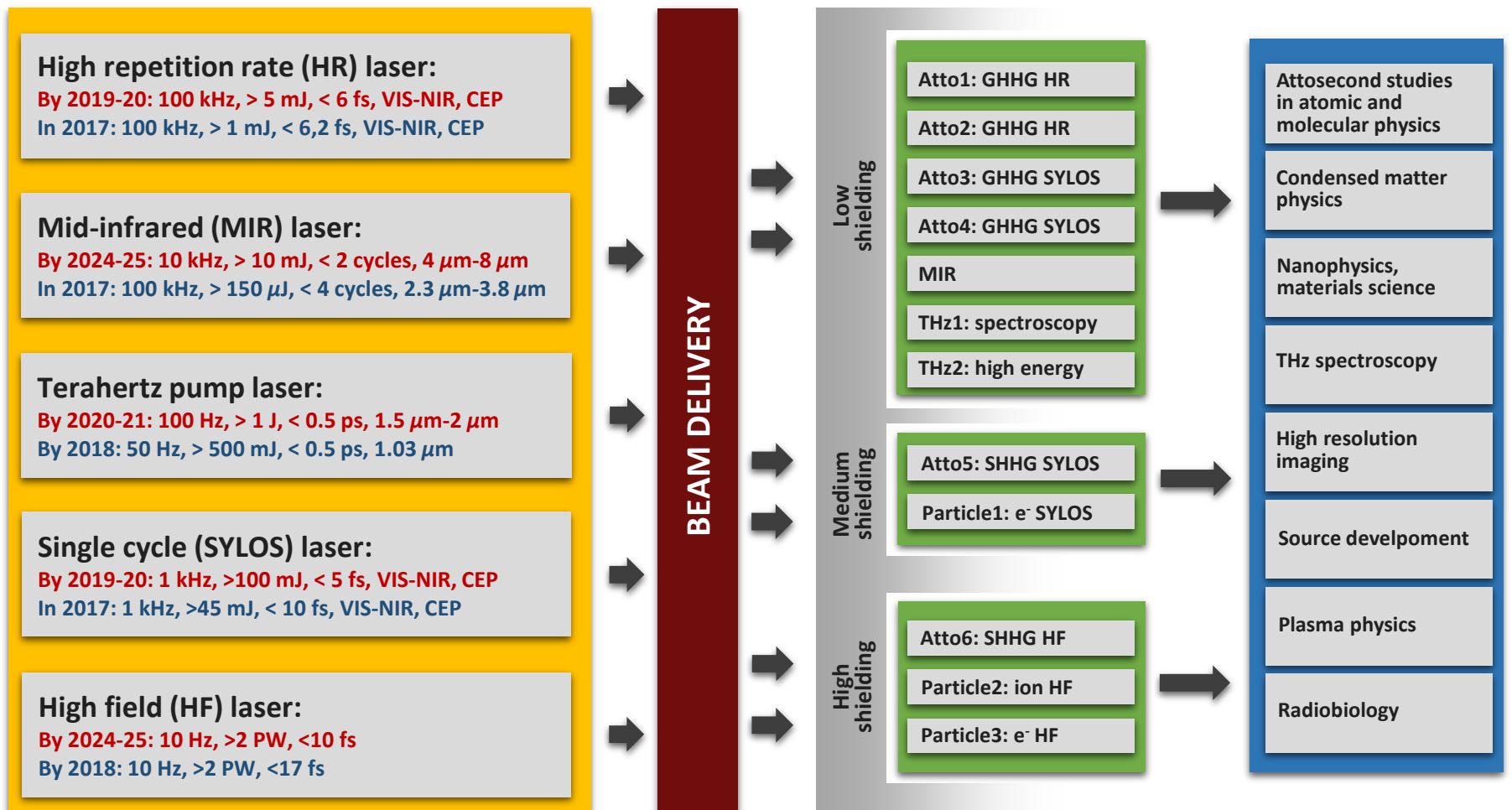
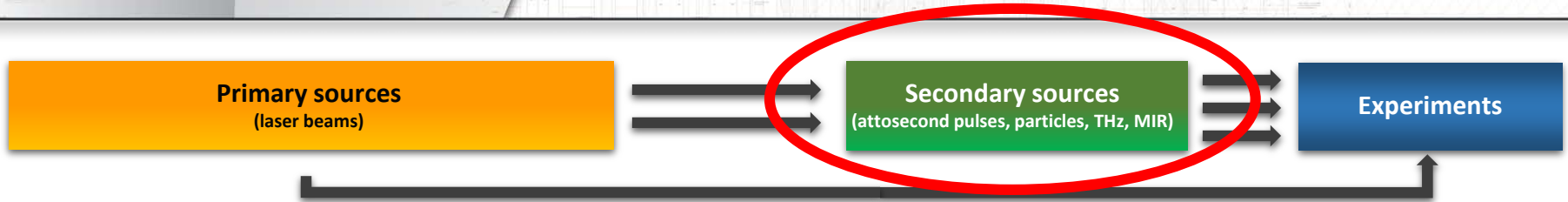
SCHEMATICS OF ELI-ALPS



SUMMARY- LASER IMPLEMENTATION STATUS

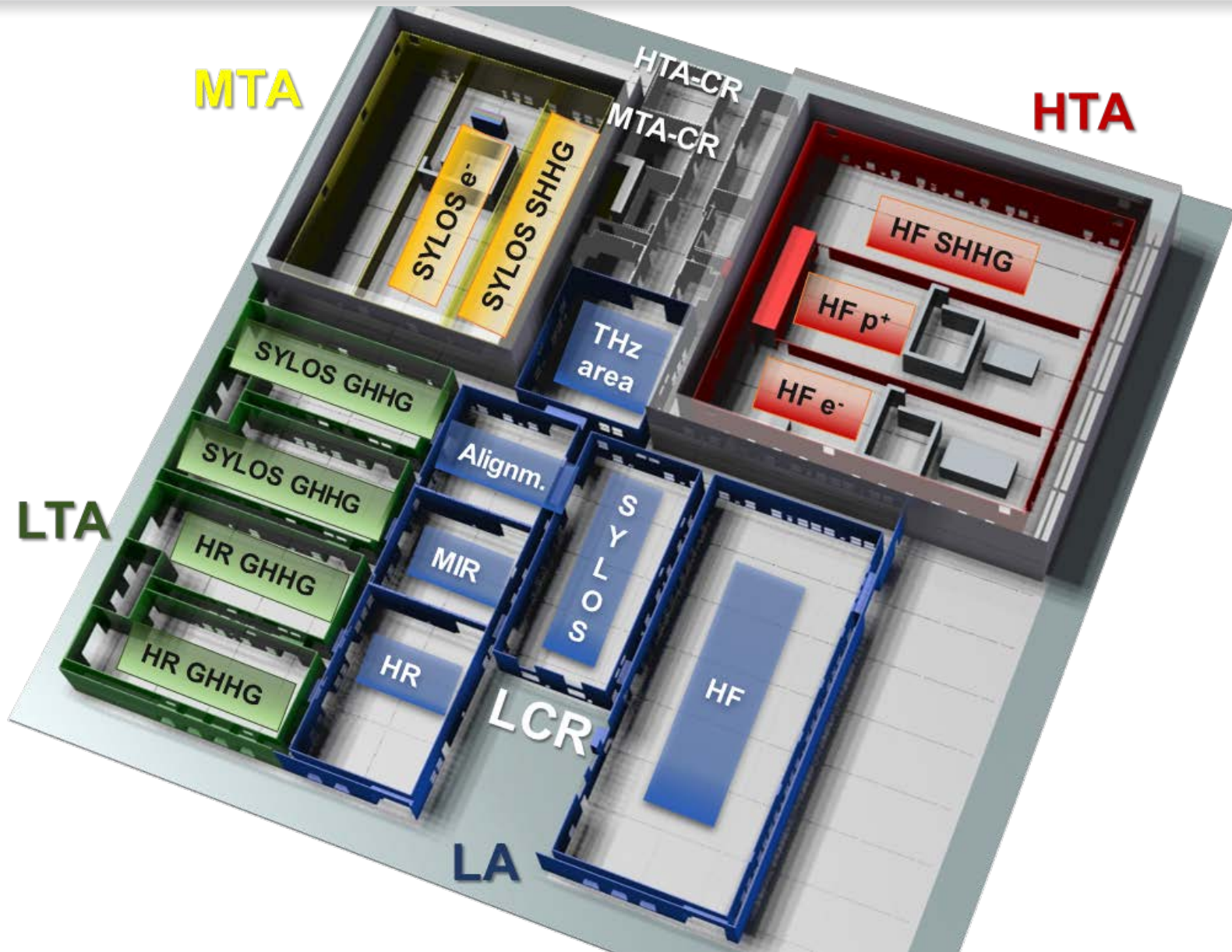
	Next DL	Due	Installation by
HR1	CEP SAT	June 2018	<i>LP Dec 2017</i>
HR2	Pre-amp	May 2018	April 2019
MIR	<i>Completed</i>		<i>October 2017</i>
Sylos 1	<i>Completed</i>		N/A
Sylos 2A	NOPCPA prototype	April 2018	April 2019
SylosAlign	Full FAT	July 2018	September 2018
HF PW	P60 pump	April 2018	November 2019
THzSp	<i>Completed</i>		<i>November 2017</i>
THzP	FAT full system	June 2018	September 2018

SCHEMATICS OF ELI-ALPS

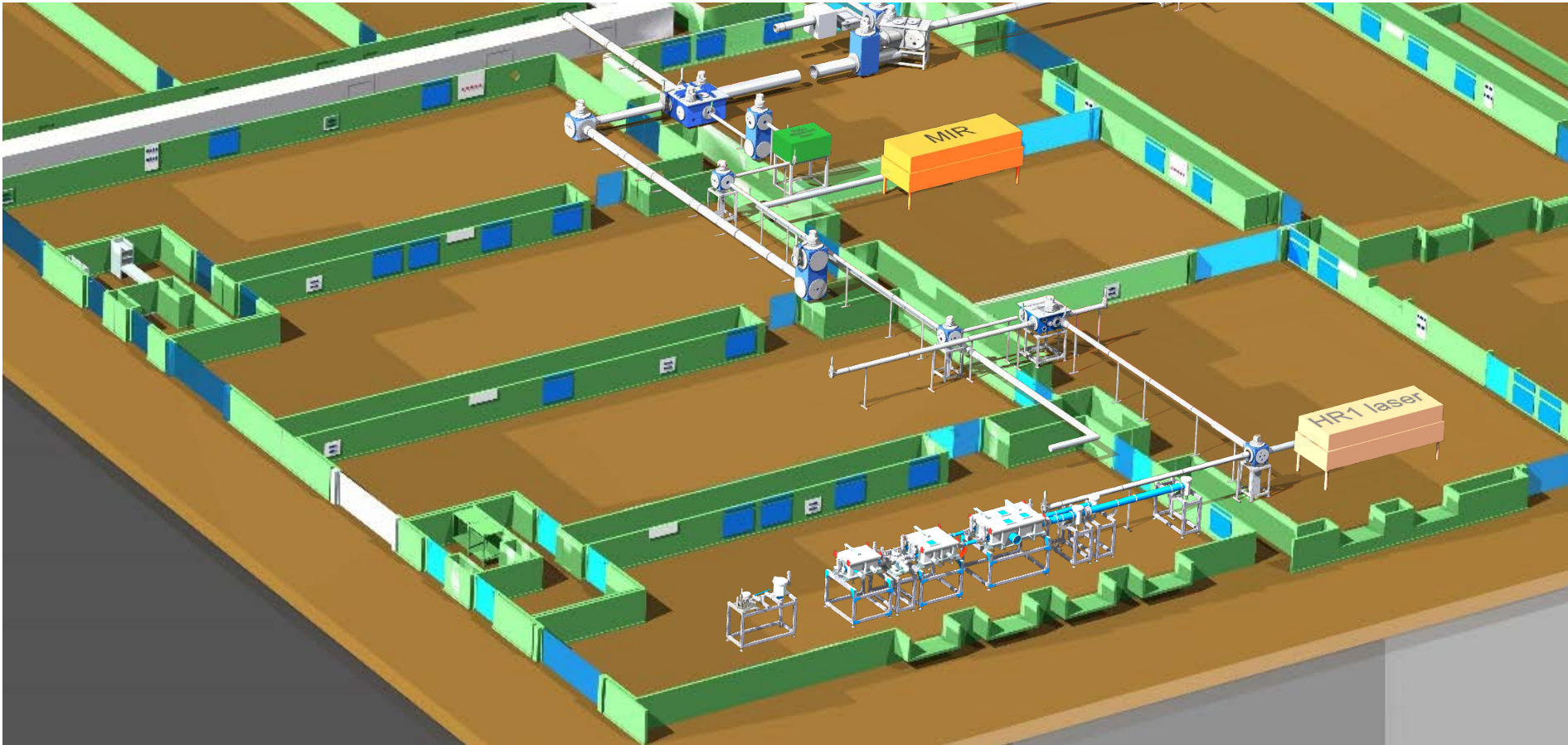


FLOOR PLAN

Main experimental building (A)



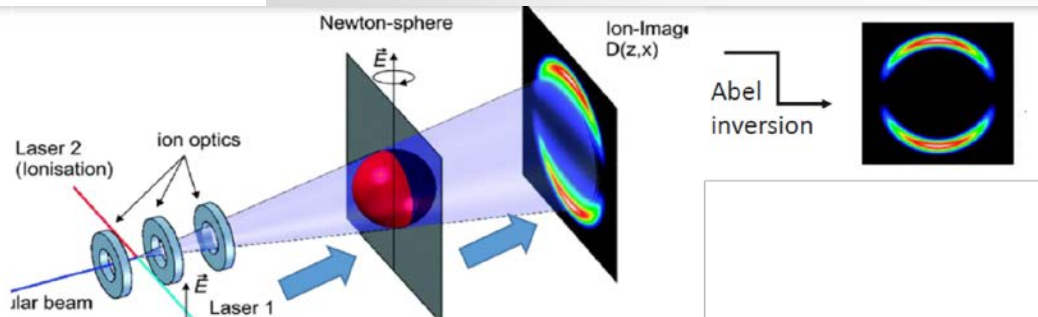
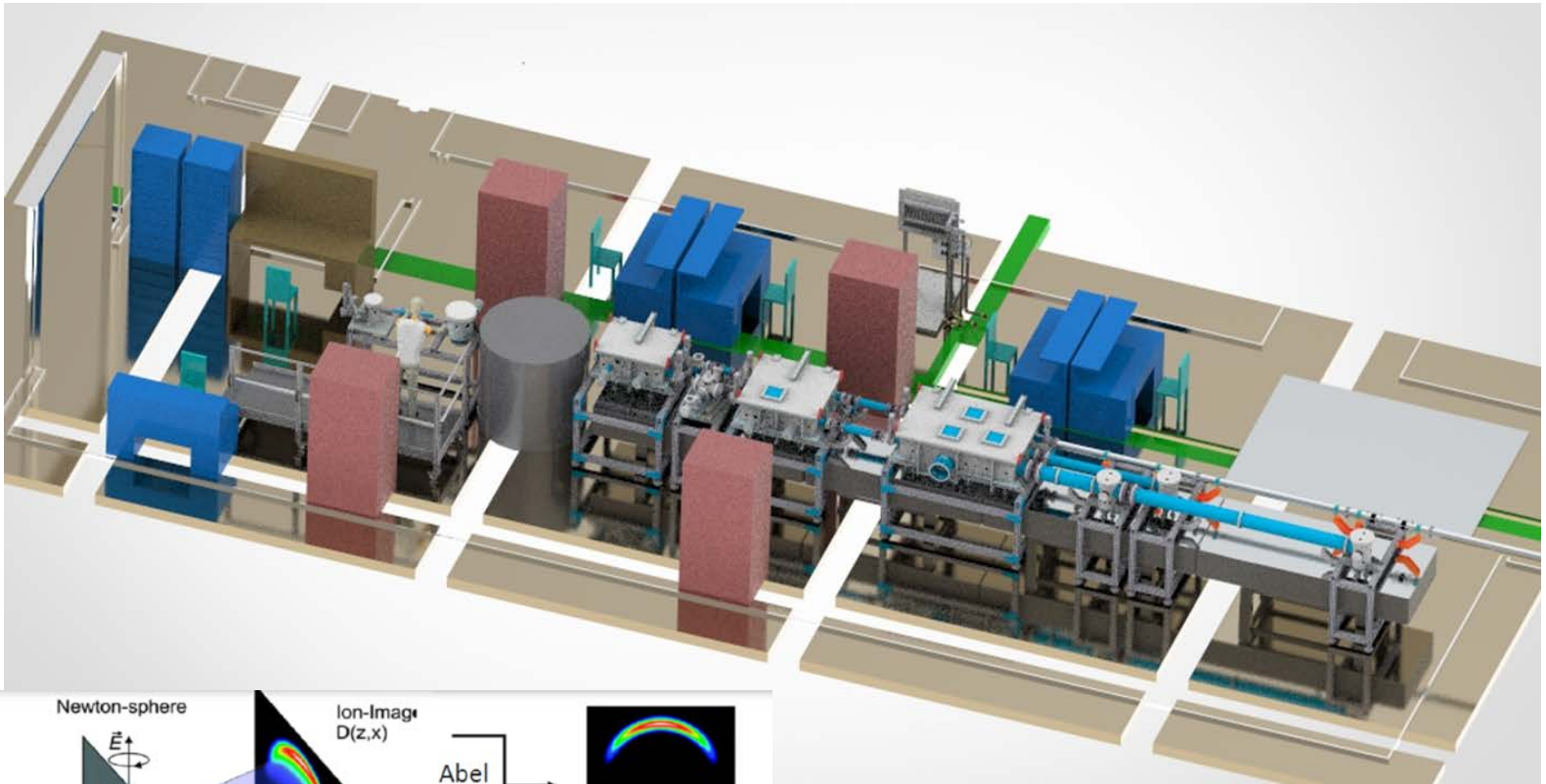
Assembly and Commissioning 2017



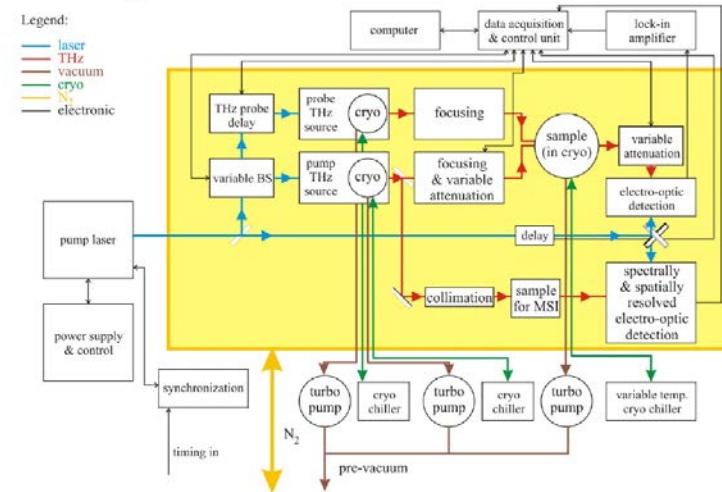
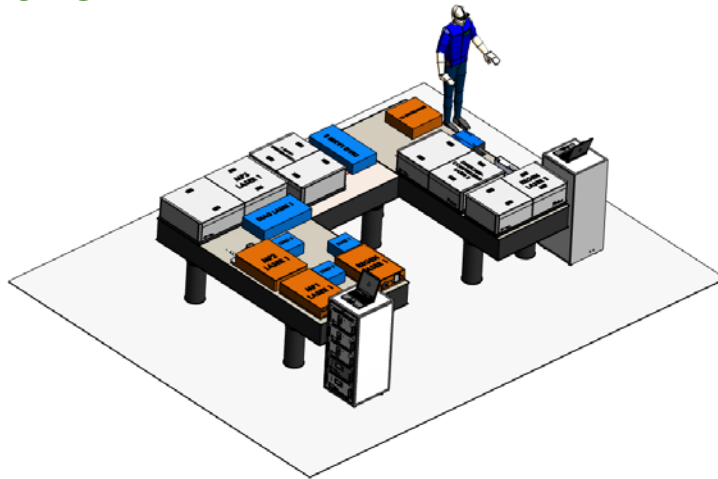
Assembly and Commissioning 2018



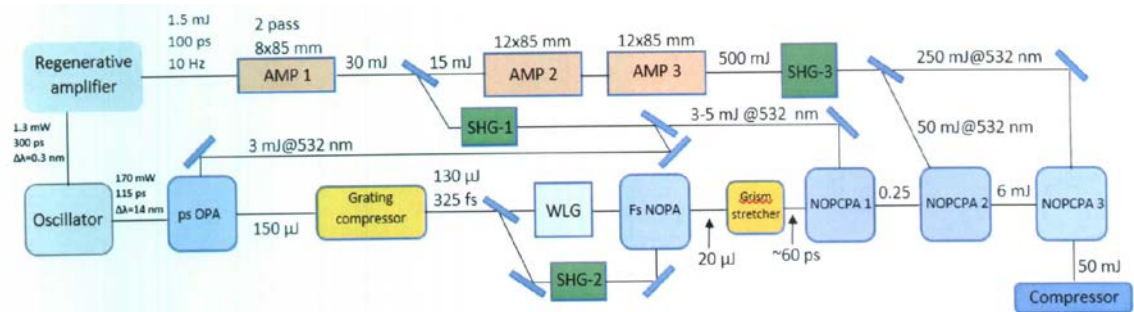
HR1 driven GHHG (gas interactions) beamline (with VMI: 2019) by November 2018



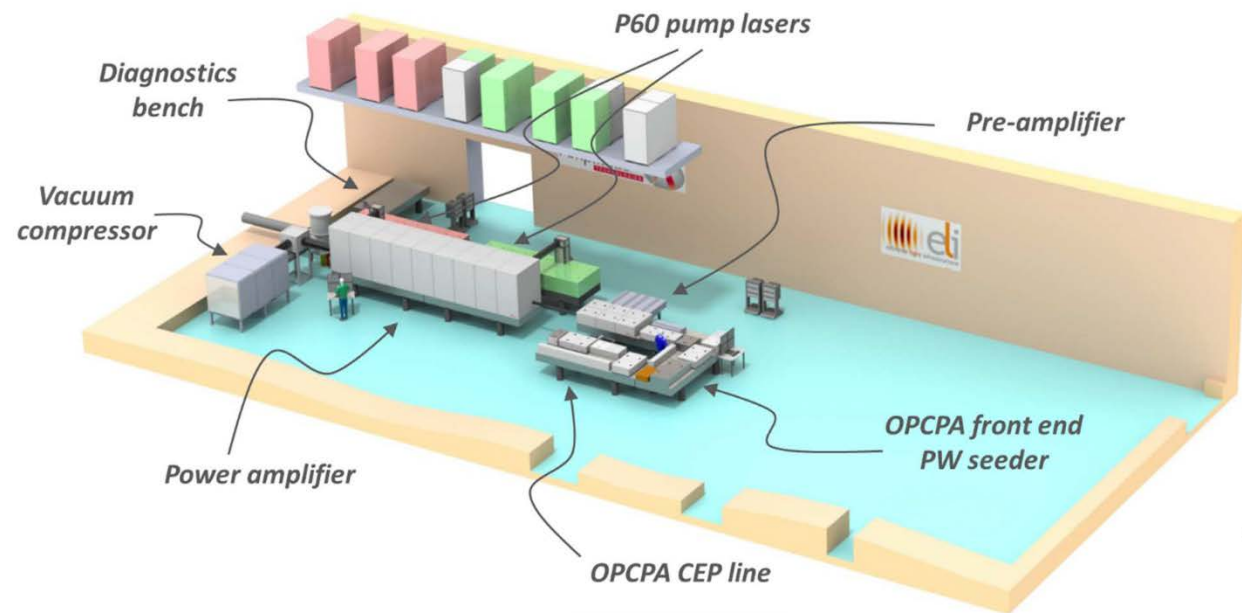
THz pump laser driven THz Nonlinear Lab by October 2018



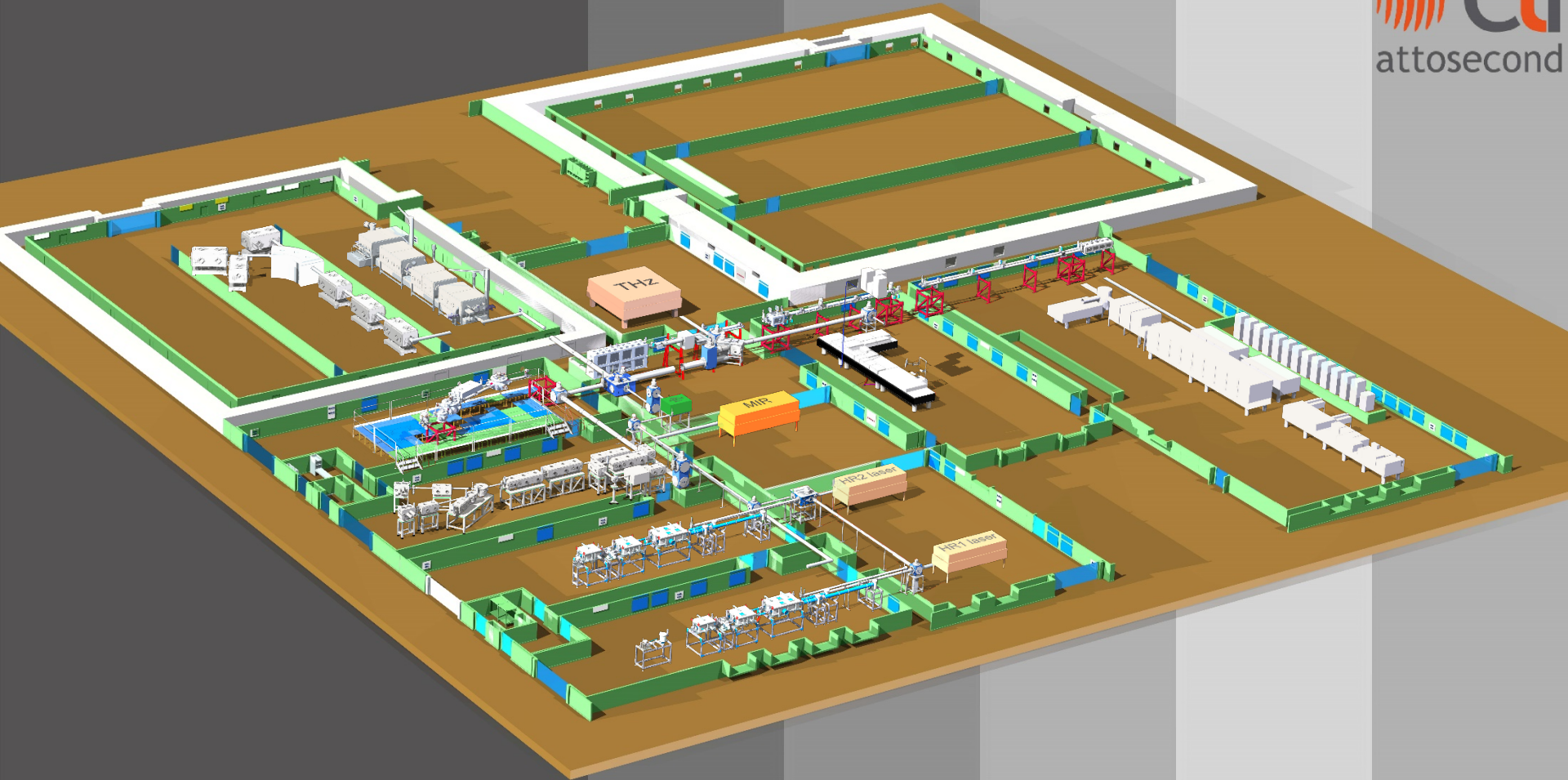
Experiment alignment laser for SYLOS beamlines by September 2018



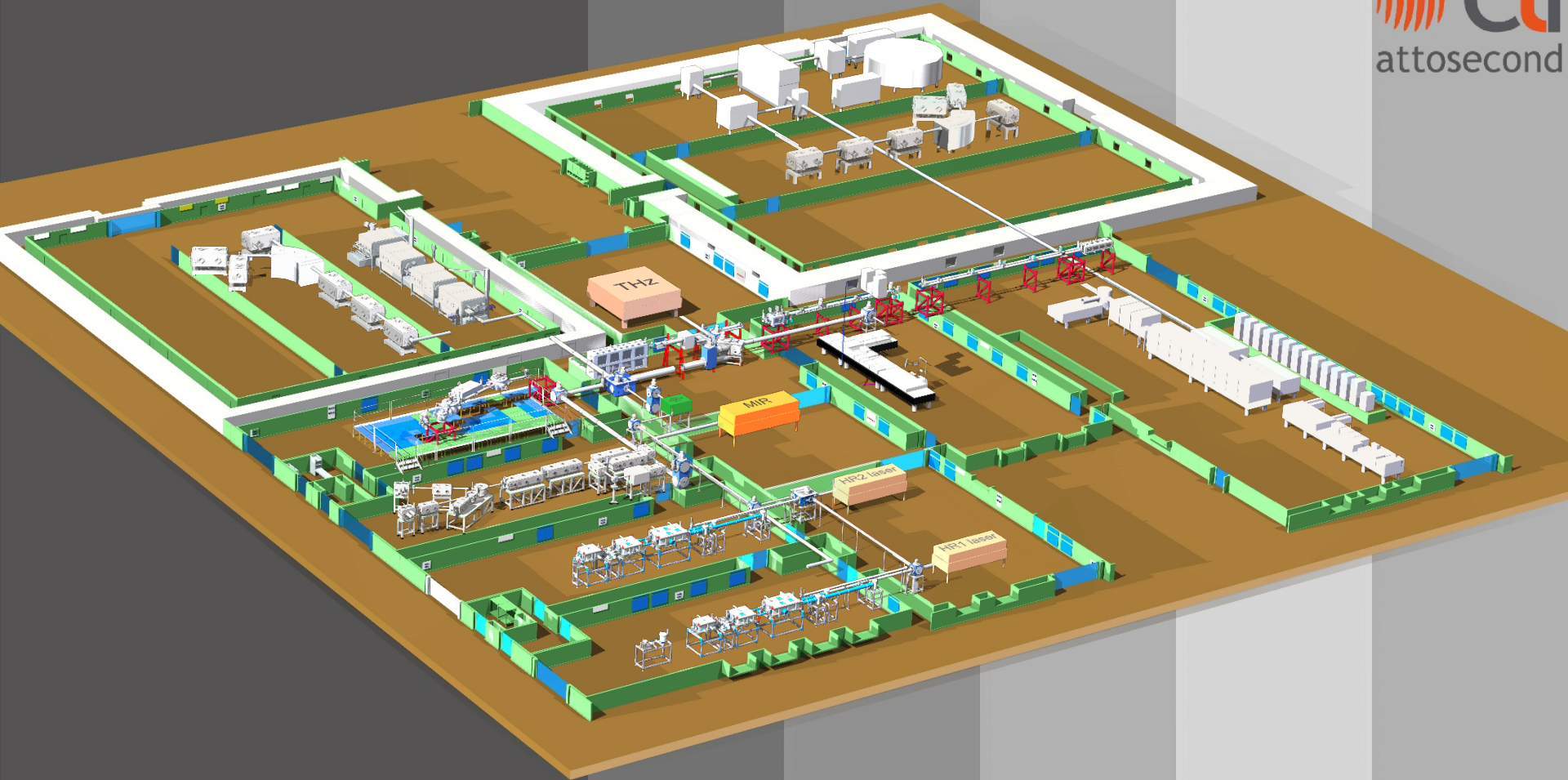
”Front end” of the PW laser
($>2.5\text{J}$, $<17\text{fs}$, 10Hz)
by September 2018



Assembly and Commissioning 2019

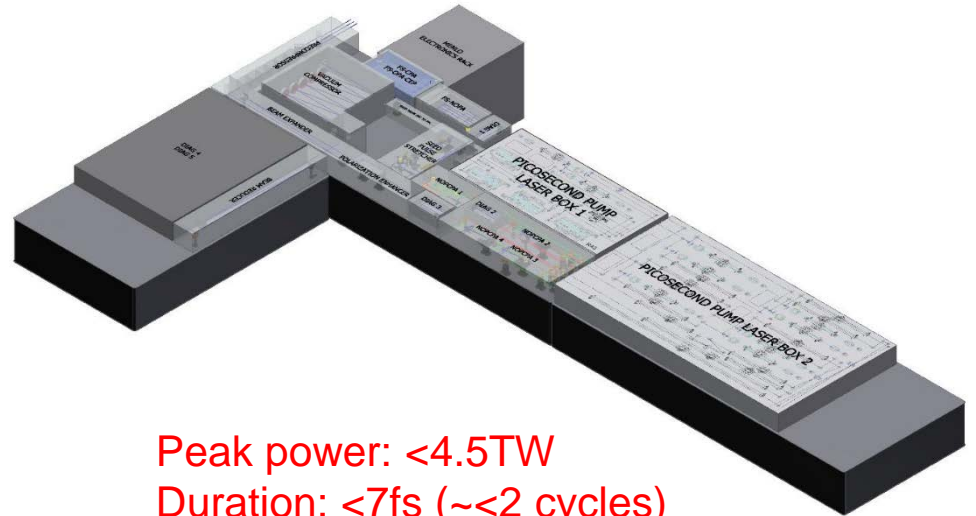


Assembly and Commissioning 2019



SYLOS 2A

Developed by October 2018
Installed in February 2019



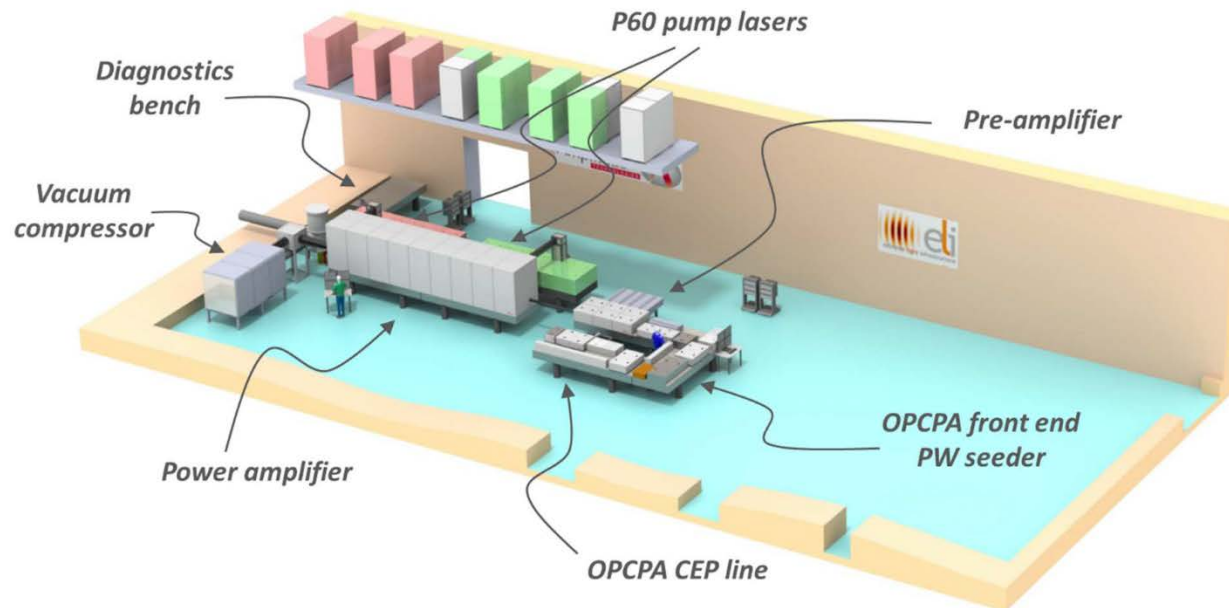
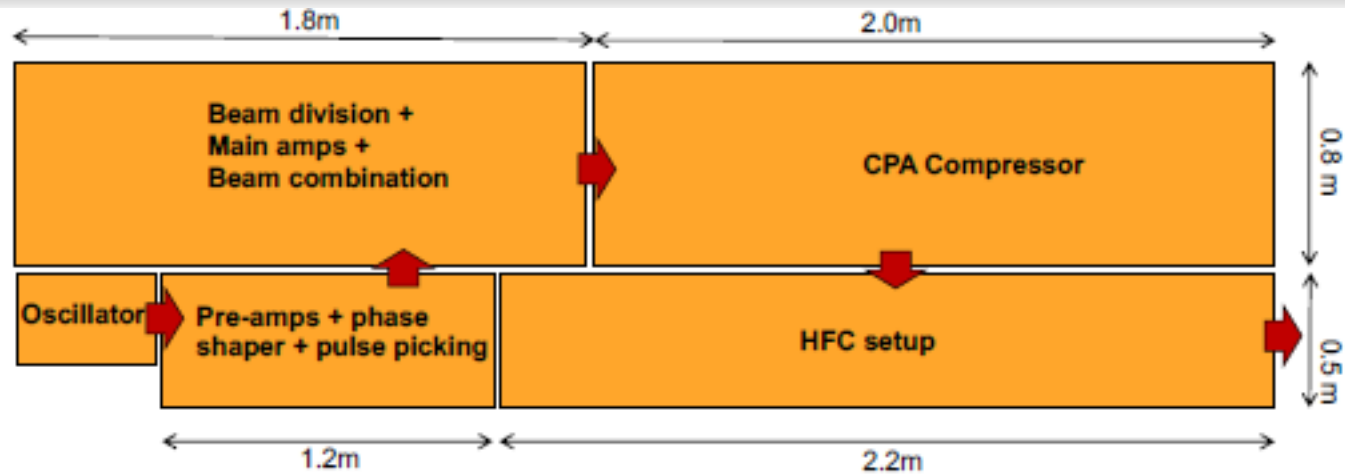
Peak power: <4.5TW
Duration: <7fs (~<2 cycles)
Energy stability: <1% rms
CEP stability: <250mrad
Wavelength range: 600-1400nm
 λ_0 : 850-975nm

SYLOS 2B

Enhance the energy by 4x at the sub- 2 cycle, CEP stable operation
New pump lasers

Expected to be completed by end 2019

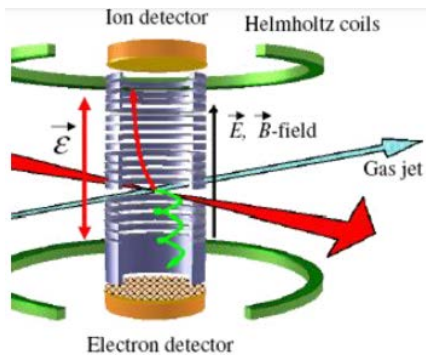
**HR 2 laser
by April 2019**



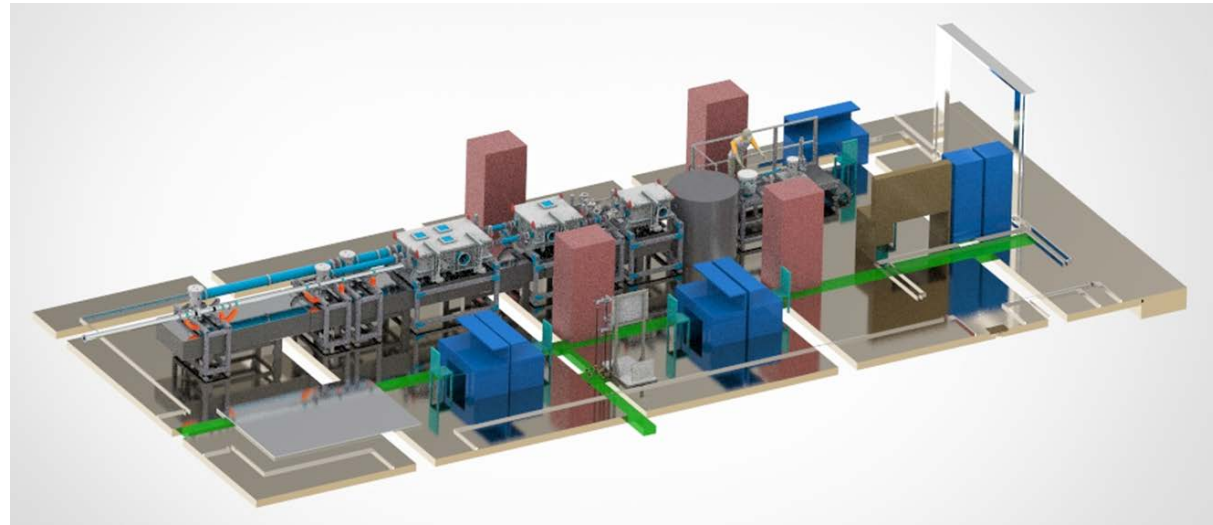
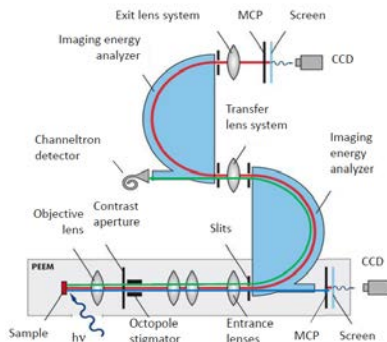
**PW laser
by November 2019**

HR2 driven GHHG (condensed) beamlines with... by November 2019

ReMi



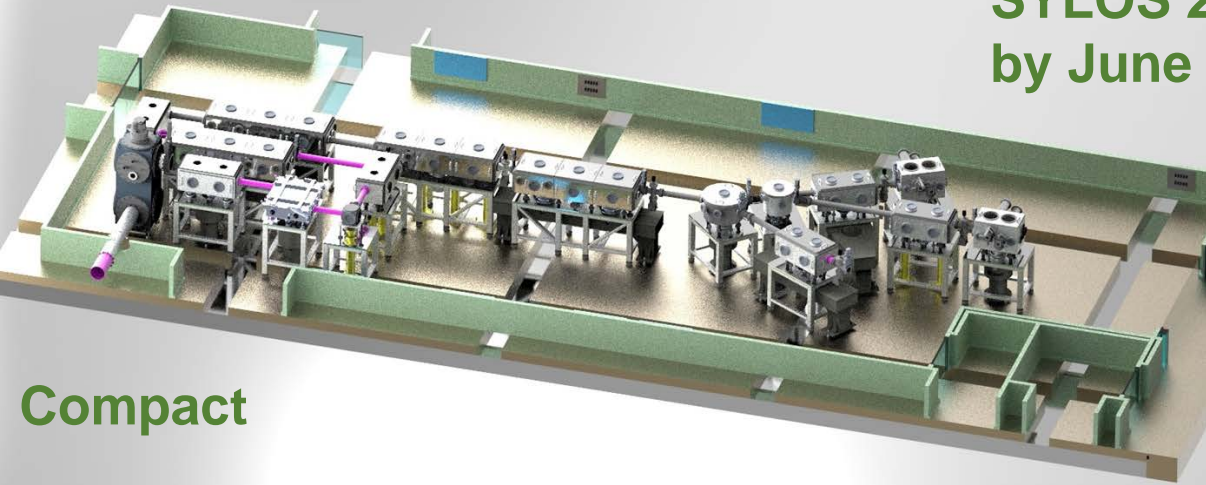
PEEM (Nanoesca)



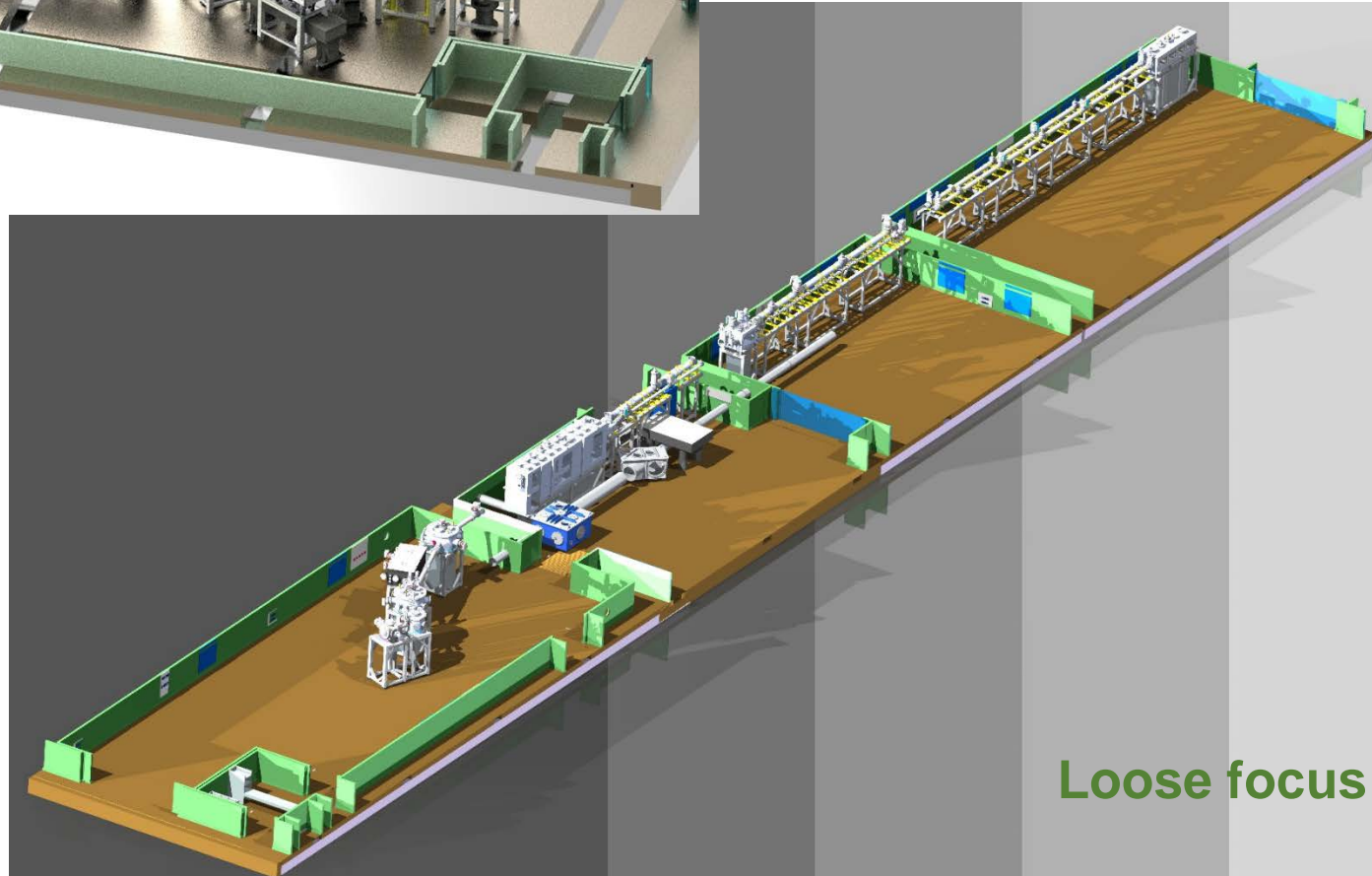


2020 – commissioned, user ready

**SYLOS 2A driven GHHG beamlines
by June 2020**



Compact



Loose focus



Divisions and groups in Scientific and Research Technology Directorates



Dimitris Charalambidis

Chief Scientific Advisor



Giuseppe Sansone

Scientific Advisor



Karoly Osvay

Research Technology Director

Attosecond and Strong Field Science Division



Franck Lepine
Division Head

Sandor Varro
Deputy Division Head

Scientific Application Division



Peter Dombi
Division Head

Particle and Terahertz Sources Division



Christos Kamperidis
Acting Division Head

Attosecond Sources Division



Katalin Varju
Division Head

Laser Infrastructure Division



Karoly Osvay
Division Head

Engineering and integration Division



Lajos Fulop
Division Head

Research Technology Service Unit



Gerger Meszaros
Division Head

Laser and Radiation Safety Group



Tamara Kecskes
Group Leader

Laser Plasma Group
Alexander Andreev

Strong Field and Quantum Optics Theory Group
Sandor Varro

Computational and Applied Materials Science Group
Mousumi Upadhyay Kahaly

Theoretical and Computational Group of Molecular Structure and Dynamics
Agnes Vibok

Attosecond and Strong Field Processes in Few-body Systems Group

Charge Dynamics in (Bio)materials Group
Sophie Canton

Biomedical Application Group
Katalin Hideghety

Ultrafast 4D Imaging Group
Laszlo Ovari

Ultrafast Nanoscience Group
Peter Dombi

Ultrafast Dynamics in Semiconductors Group
Csaba Janaky

THz Reaction Control Group
Viktor Chikan

Service Diagnostics Laboratories

Ion Acceleration Group
Patrizio Antici

Electron Acceleration Group
Christos Kamperidis

Terahertz Source and Applications Group
Jozsef Fulop

HR Attosource Group
Miklos Fule

SYLOS Gas Attosource Group
Sergei Kuehn

Surface Plasma Attosource Group
Subhendu Kahaly

Diagnostics of Attosources
Paraskevas Tzallas

Attosources R&D Group
Katalin Varju

Mid-Infrared Laser Group
Balint Kiss

High Field Laser Group
Mikhail Kalashnikov

Single Cycle Laser Group
Adam Borzsonyi

High Repetition Rate Laser Group
Zoltan Varallyay

Laser Research and Development Group
Mikhail Kalashnikov

Infrastructure Liaison Group
Imre Kiss

Beam Transport Group
Arpad Mohacsi

Software Engineering Group
Lajos Schrettnner

Electrical Engineering Group
Ferenc Horvath

Mechanical Engineering Group
Andras Makai

Optical Preparatory Workshops
Gerger Meszaros

Mechanical Workshop
Zoltan Vajna

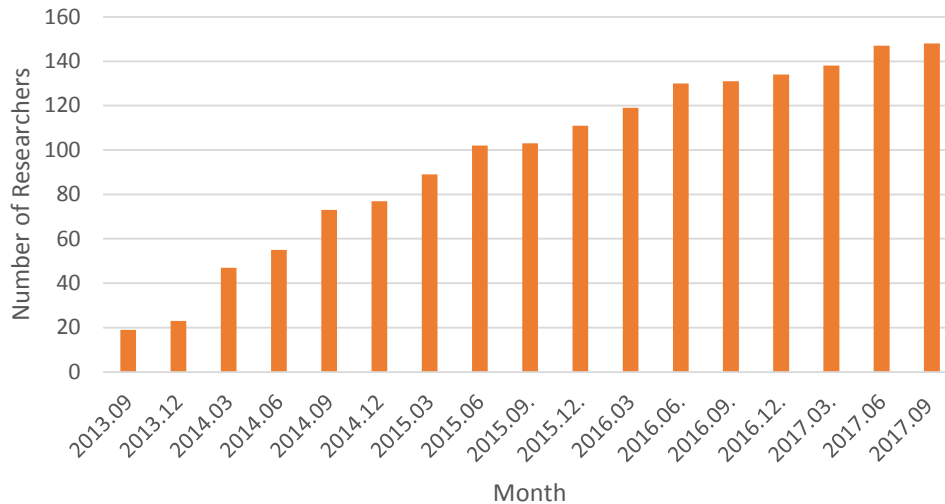
Electrical Workshop
Viktor Varkonyi

Cleanroom Group



Person power in SRD

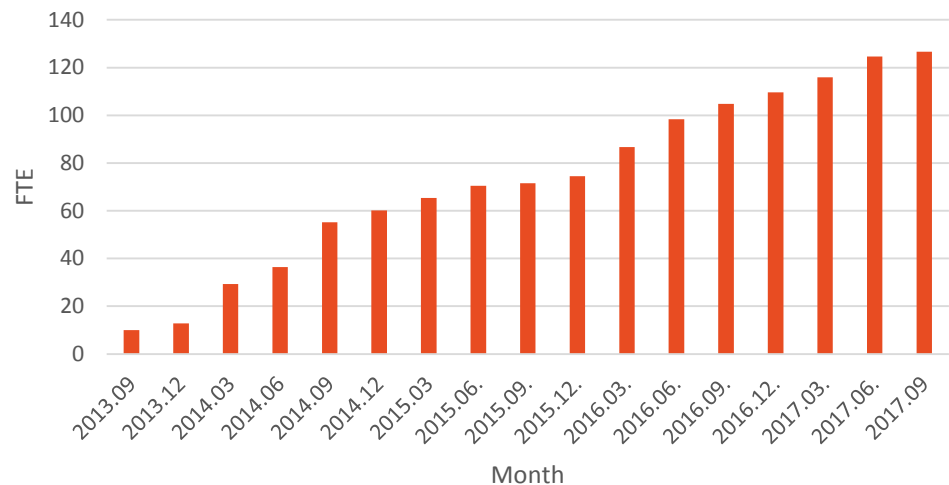
Number of Researchers



Number of researchers and research engineers in November, 2017: **148**

Full-time equivalent in November, 2017: **126**

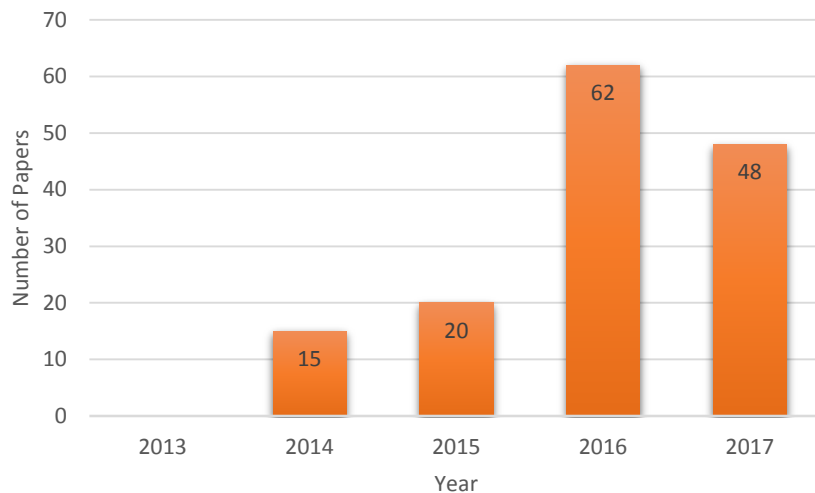
Full Time Equivalent



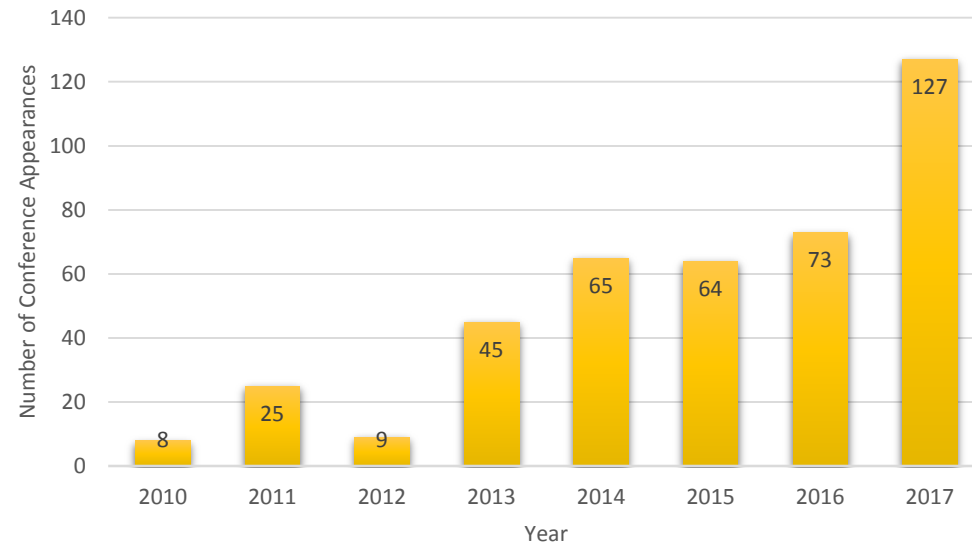
Scientific achievements by November 2017



ELI-ALPS Publications in Refereed Journals

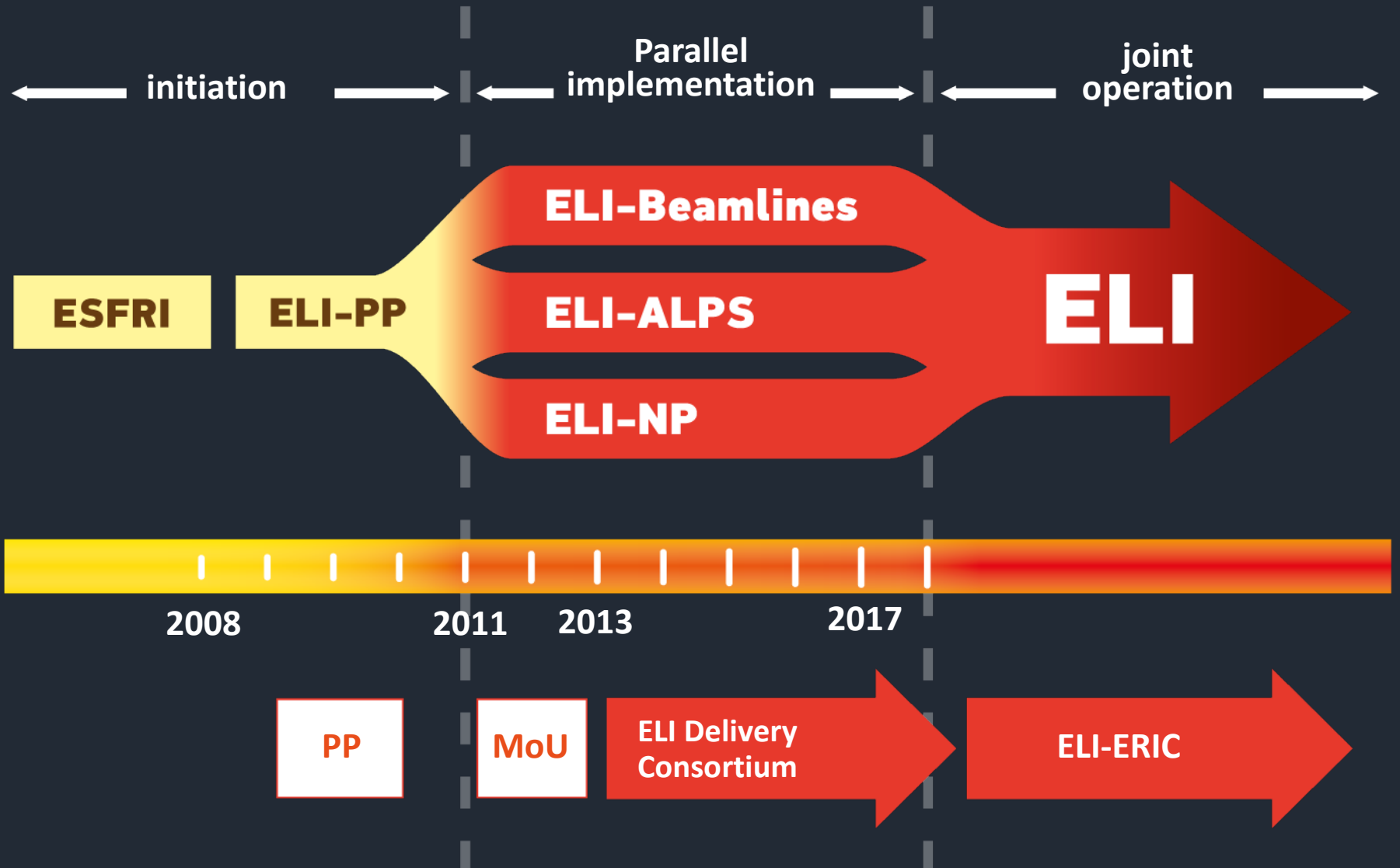


ELI-ALPS Conference Appearances



The first review paper on the facility:
The ELI-ALPS facility: the next generation of attosecond sources
J. Phys. B, **50**, 132002, 2017

ELI roadmap



Operation principles (for user ready beamlines)

Number of hours / days / week:

12 h / day, 5 days/ week

Number of months:

11 month operation,
1 month maintenance

Daily operation

2 hours warm-up time (lasers, BT)

9 hours operation – secondary sources (mind the lunch-time!)

1 hours cool-down time

Buildings are open/accessible

Weekdays 6-22h

Extend the operation beyond 5/12:

Upon request

Extra personnel

Commissioning users

Expert users in a field
 Part of commissioning, testing.
 For equipment has just been installed
 Full time operation is not guaranteed.
 Upon collaboration agreements
 Discretion of ELI-ALPS scientific management

"Zeroth call" users

(call to be launched in February 2018 by ELI-DC/ERIC)

For selected, user ready equipment (HR1, MIR, THzSp)
 Full time operation is on a best effort basis.
 Based on scientific merit – international peer-review committee

Regular users

For the user ready equipment
 Full time operation is guaranteed.
 Based on scientific merit – international peer-review committee

"National" users

As above, but a dedicated time slot up to 20% of the beam time.
 MUST go through peer review!

Summary for user operation



Name	Lasers and Beamlines				Facility experimental slot					Facility annual plan	
	Readiness				User experiment				Laser change of operation mode (weeks)	Annual maintenance (weeks)	Estimated total experiments / year
	Driver laser available, and 95% of components in the lab	Site Acceptance Test (lasers only), or Assembly completed and first tests are done	Friendly (commissioning) user ready	External user ready	Avg duration (weeks)	Assembly (weeks)	Measurement (weeks)	Disassembly (weeks)			
GHHG HR1 Gas	31.12.2017.	30.06.2018	31.10.2018	31.01.2019	4	1	2,5	0,5	1	4	9
GHHG HR1 Condensed	31.12.2017.	31.08.2018	28.02.2019	30.04.2019	4	1	2,5	0,5	1	4	9
GHHG HR2 Gas	06.10.2019.	06.12.2019	31.01.2020	31.03.2020	4	1	2,5	0,5	1	4	9*
GHHG HR2 Condensed	06.10.2019.	06.12.2019	31.01.2020	31.03.2020	4	1	2,5	0,5	1	4	9*
MIR beamline	13.11.2017.	15.02.2018.	15.04.2018	15.06.2018	3	0,5	2,25	0,25	1	4	12
SYLOS2A Compact	30.04.2019	30.06.2019.	31.10.2019.	31.12.2019.	4	1	2,5	0,5	1	4	9
SYLOS2A Long	30.04.2019	30.06.2019.	31.10.2019.	31.12.2019.	4	1	2,5	0,5	1	4	9
SYLOS2A SHHG	30.04.2019	30.06.2019.	31.12.2019	28.02.2020	6	2	3	1	1	4	6
SYLOS2A electron	30.04.2019	01.04.2020.	01.10.2020	31.01.2021	8	2	5	1	1	4	5
SYLOS2B Compact	15.10.2020	15.01.2021	15.03.2021	15.05.2021	4	1	2,5	0,5	1	4	9*
SYLOS2B Long	15.10.2020	15.01.2021	15.03.2021	15.05.2021	4	1	2,5	0,5	1	4	9*
SYLOS2B SHHG	15.10.2020	15.01.2021	15.03.2021	15.05.2021	6	2	3	1	1	4	6*
SYLOS2B electron	15.10.2020	15.01.2021	15.03.2021	15.05.2021	8	2	5	1	1	4	5*
Thz spectr	15.09.2017.	06.10.2017.	06.02.2018	06.04.2018	3	0,5	2,25	0,25	1	4	12
THz nonlinear opt	31.09.2018.	30.11.2018	31.03.2019	31.05.2019	5	1	3,5	0,5	1	4	8
HFPW ion	30.05.2019	30.12.2020	30.12.2021	30.12.2022	10	3	5,5	1,5	1	4	4
HFPW SHHG	01.02.2019.	01.02.2020	01.02.2021	01.02.2022	10	3	5,5	1,5	1	4	4
					ESTIMATED TOTAL NUMBER OF EXPERIMENTS PER YEAR					87	

Start of commissioning user operation

HR1 laser

H.J. Wörner (ETH Zürich)

From 29th January – 15th April 2018

Long pulse mode ($\sim 150\text{W}$, $< 40\text{fs}$)

HHG generation in gas and liquid jets



29th January, 2018

7 years after the

MIR laser

S.Manolis, D.Kapourzbas (FD RTN Crete)

From 5th February – 29th March 2018

HHG generation in solids

T. Rouschon (CEA Saclay)

From 15th April – 31th May 2018

HHG generation in gases

governmental decision!



Plan, design, and implementation of scientific experiments

The experimental campaign(s) shall be in ELI-ALPS.

National user experiments

(Mind the user policy and dates above!)

Welcome to establish long term "user end station" and / or experimental setups.

Fields of primary interest:

- Ultrafast measurements on biomaterials (charge dynamics, decay, etc)

- Ultrafast dynamics in solids

- Femtochemistry

- Nanoplasmonics

- Ultrafast material processing

- Attosecond / laser pulse characterisation

- ...

Development of large devices / end stations

The devices shall be in the core interest of ELI-ALPS.

The devices are expected to be available also for ELI users

Welcome to establish long term "user end station" and / or experimental setups

Examples:

- XUV spectrometer(s)

- Velocity map imager(s)

- Electron spectrometer(s) / diagnostics

- 4D imaging

- Large beam spatial characterisation / space-time couplings

- ...

Documents available

Scientific case – see www.eli-alps.hu

Planned implementation / user readiness roadmap of the lasers / beamlines



THANK YOU FOR
YOUR
ATTENTION!

SZÉCHENYI 2020

2020



HUNGARIAN
GOVERNMENT

European Union
European Regional
Development Fund



INVESTING IN YOUR FUTURE