Opportunities for users & collaborators @ ELI facilities

Dimitris Charalambidis

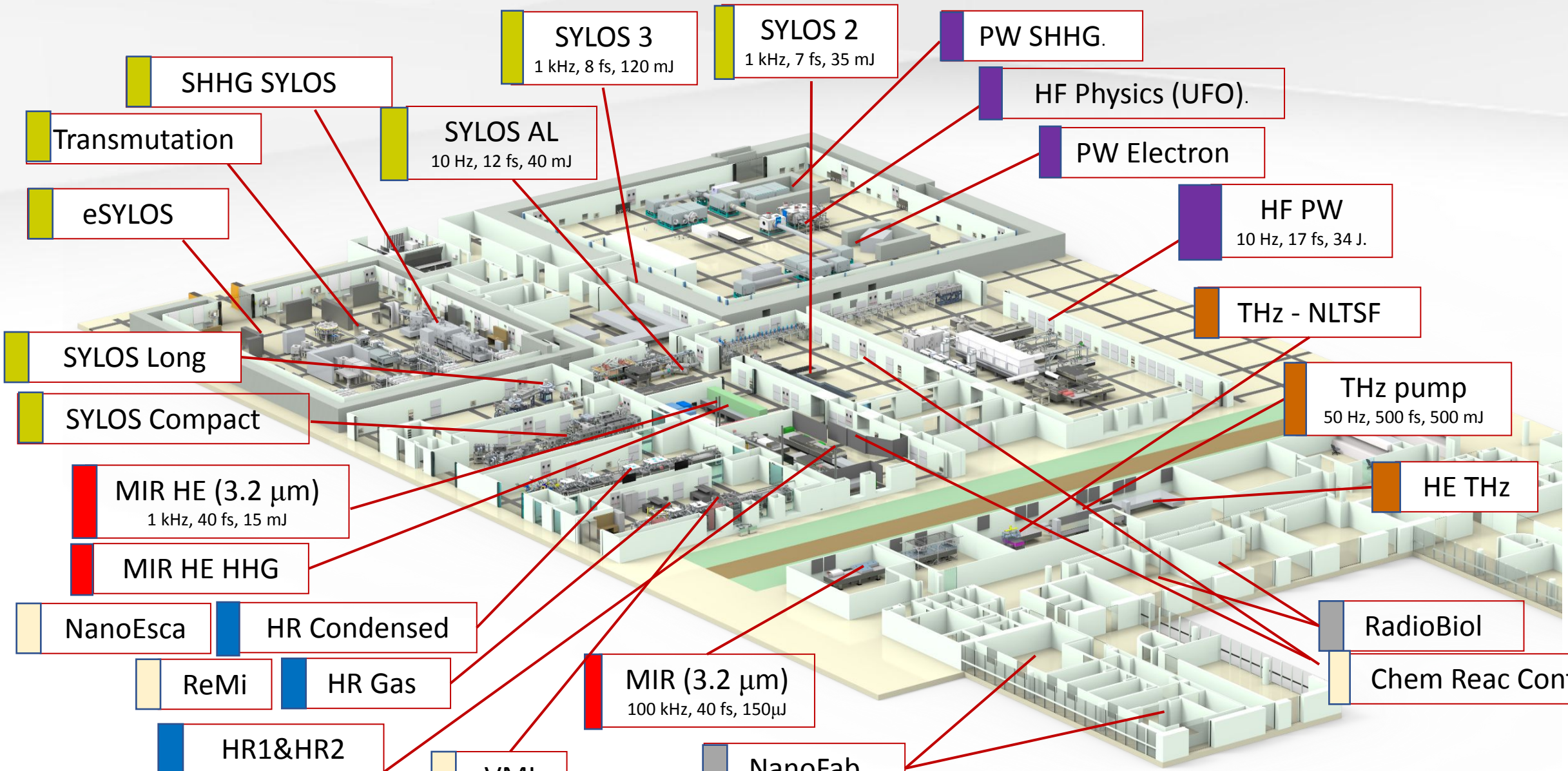
Chief Scientific Advisor, ELI ALPS

ELI ERIC Iberian Information Day

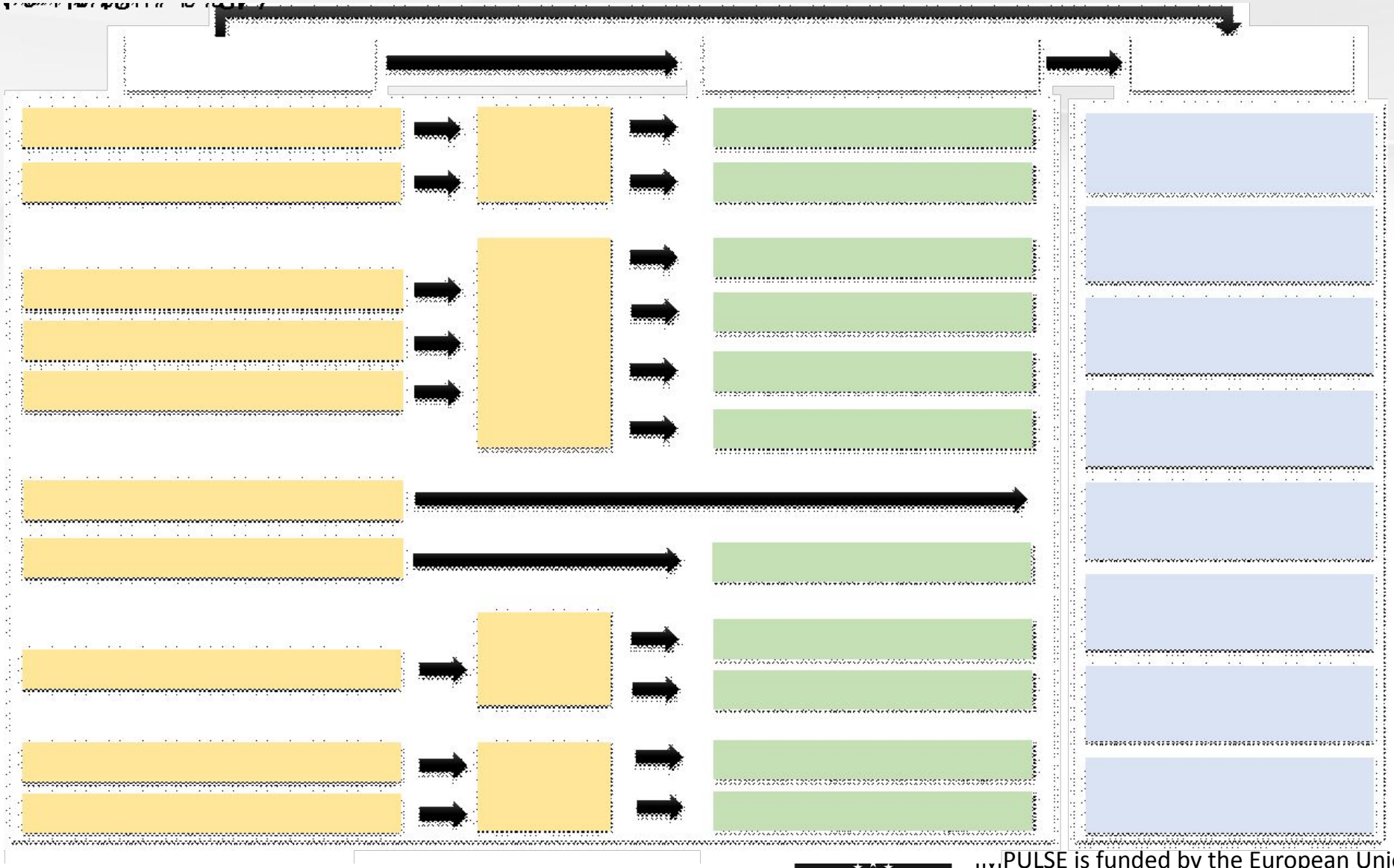
Madrid, 1 June 2022

IMPULSE is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871161

Facility overview



Research potential offered @ ELI ALPS

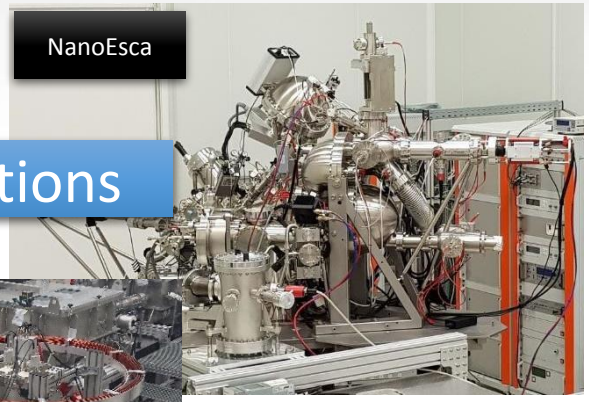


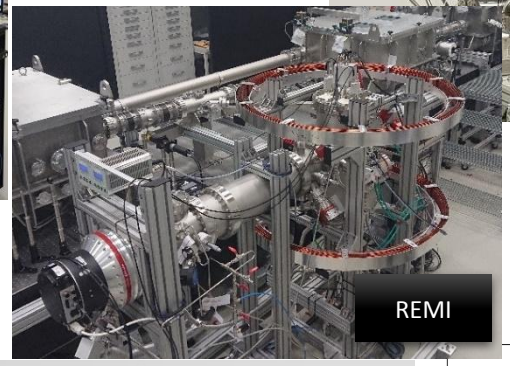
...PULSE is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871161

Portfolio of research opportunities
Capacity, Capability and Uniqueness

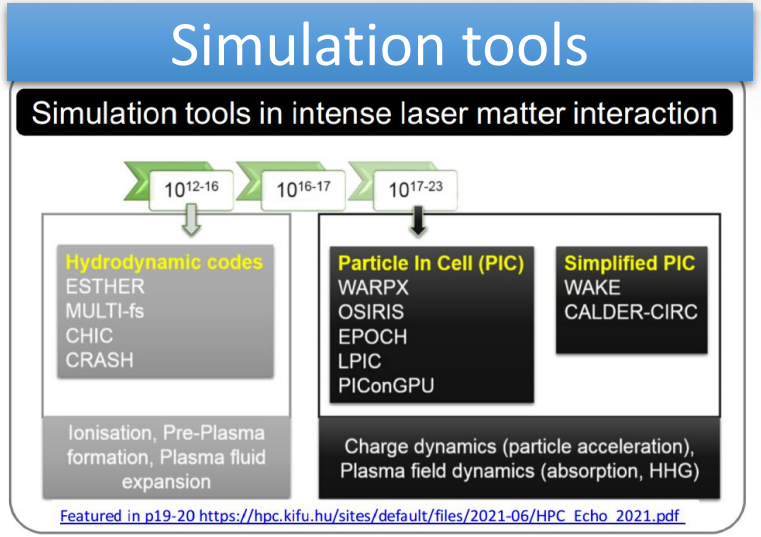
Lasers

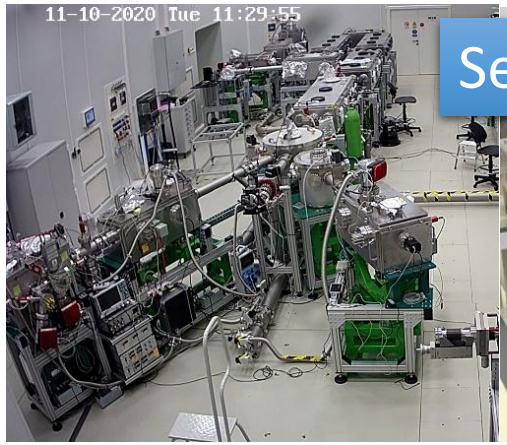
Endstations



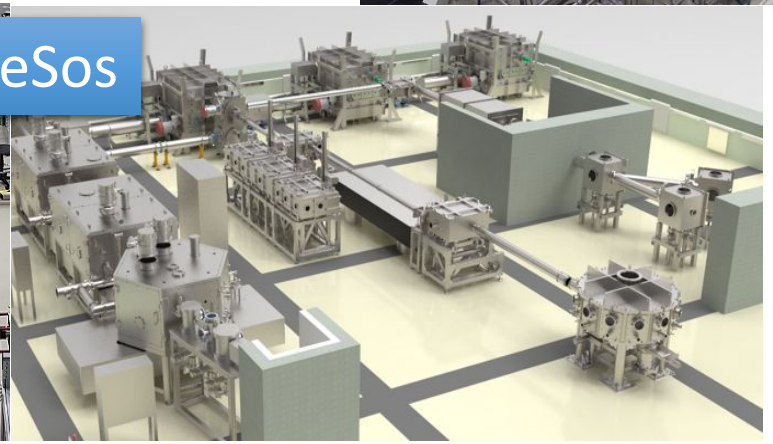


Simulation tools

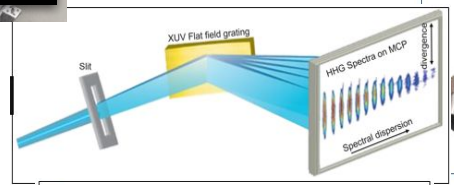


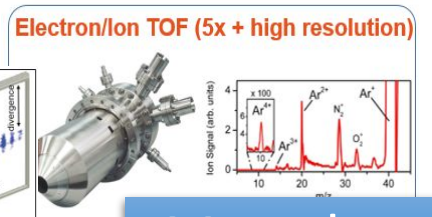


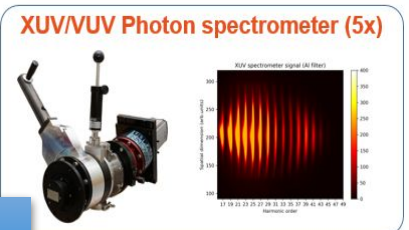
SeSos

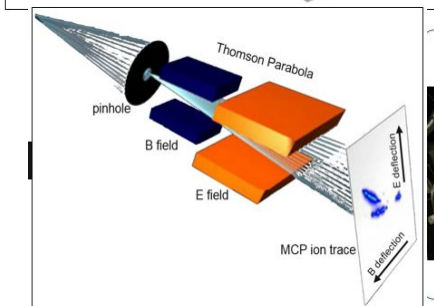


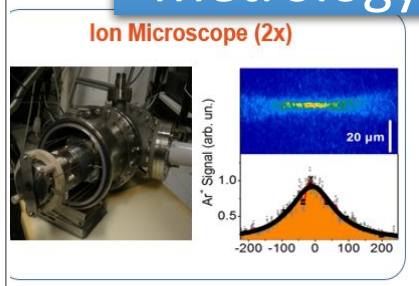
Metrology

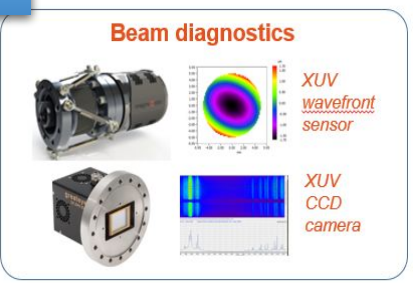








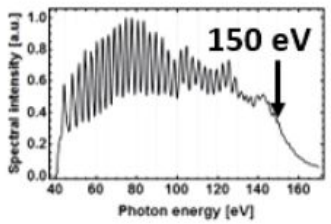




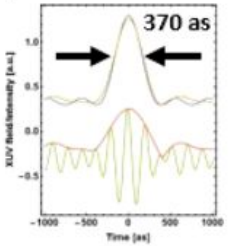
Examples of research opportunities

1kHz atto + ReMi. Kinematicaly complete experiments of ultrafast dynamics

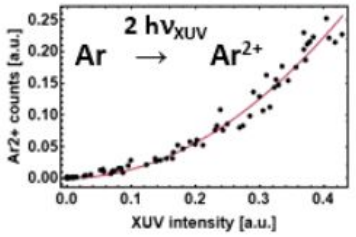
High-harmonic spectrum of Neon

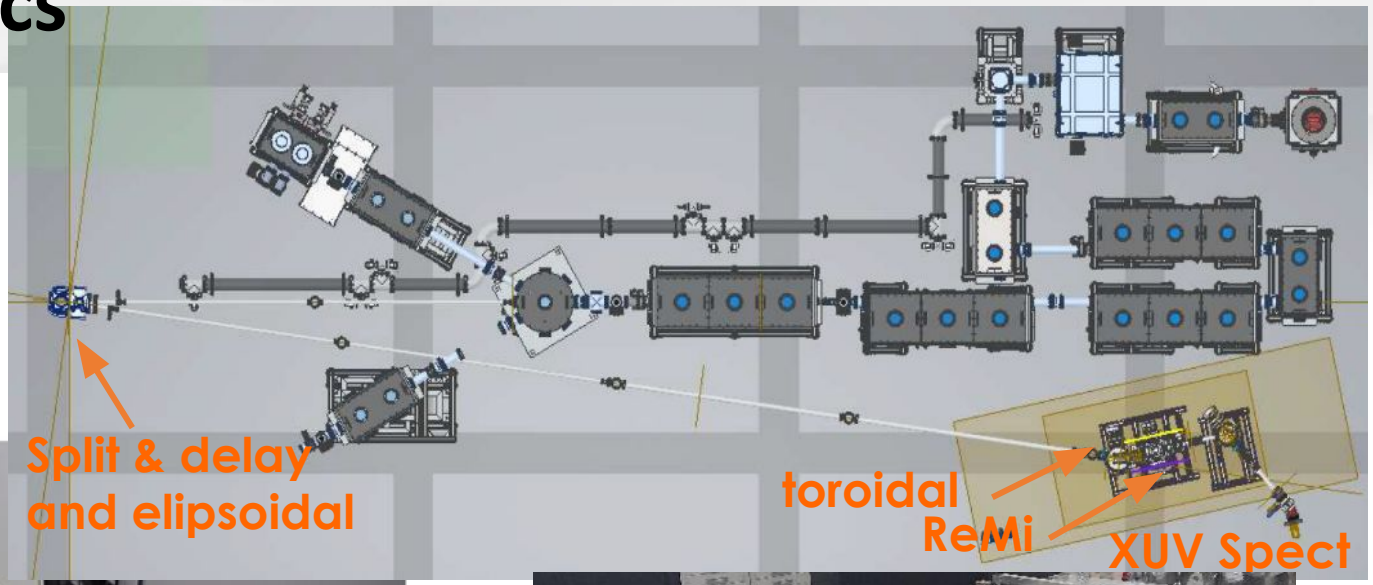


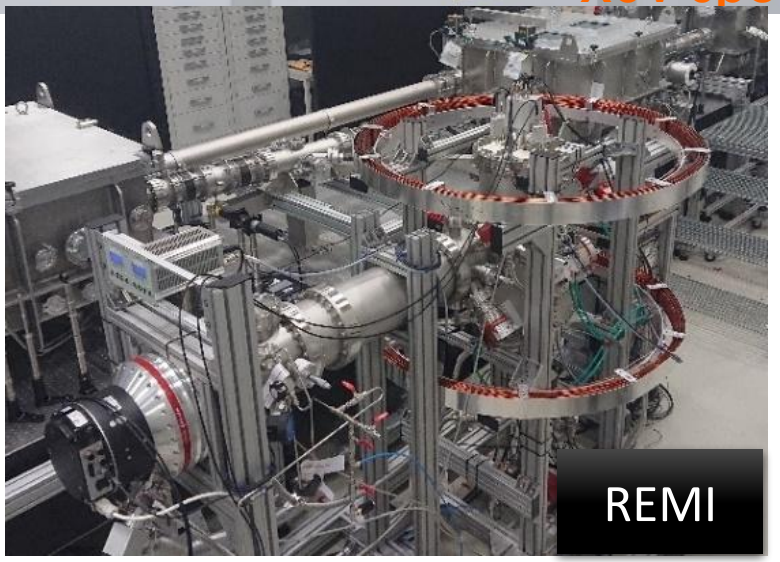
Attosecond pulse transient



Nonlinear XUV process



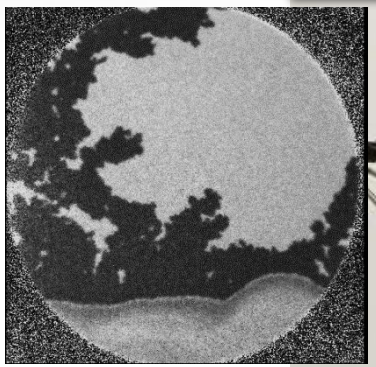


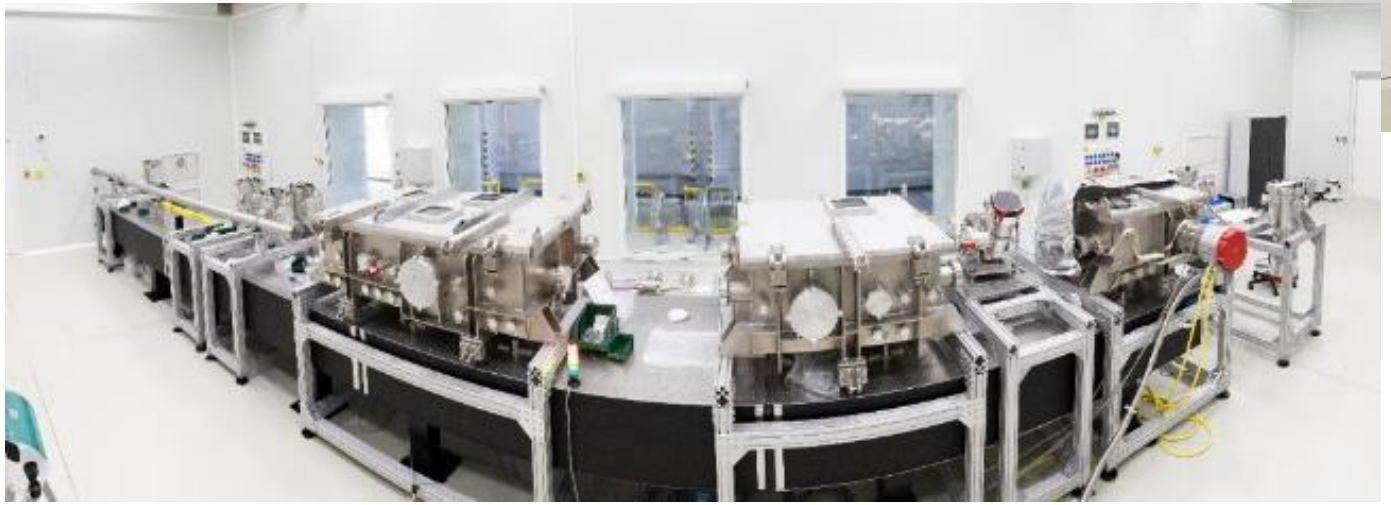


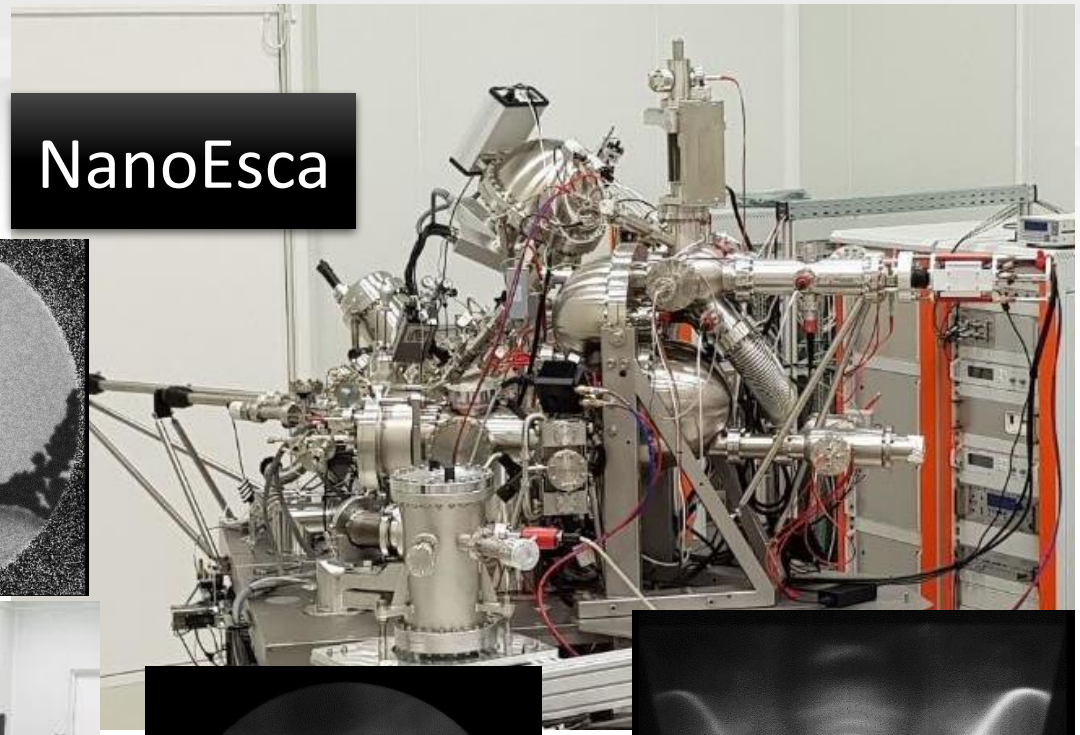
Examples of research opportunities:

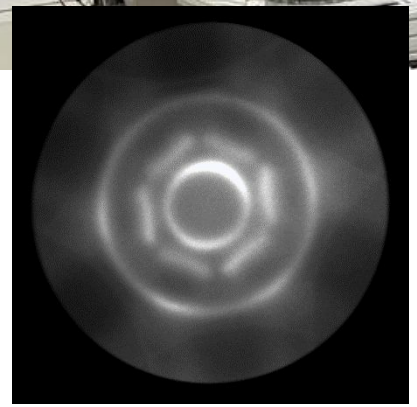
100kHz atto + NanoEsca
Band structure dynamics during phase transitions.

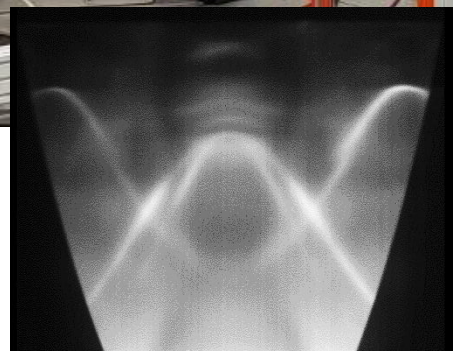
Energy & spin resolved real & k-space measurements











IMPULSE is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871161

Examples of research opportunities

Mid IR: Coupling strong field physics with quantum optics

1st User paper from ELI-ALPS

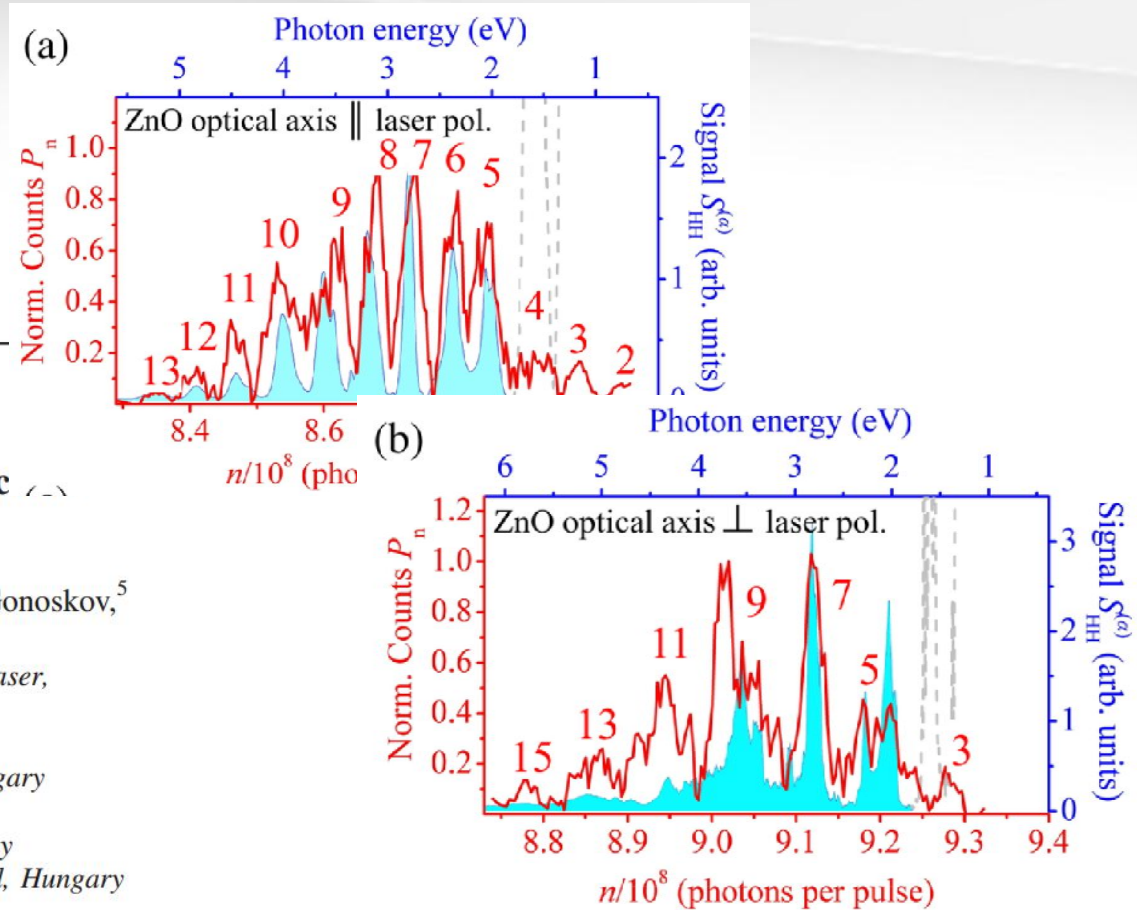
PHYSICAL REVIEW LETTERS **122,** 193602 (2019)

Quantum Optical Signatures in a Strong Laser Pulse after Interac … with Semiconductors

N. Tsatrafyllis,[1] S. Kühn,[2] M. Dumergue,[2] P. Foldi,[2,3] S. Kahaly,[2] E. Cormier,[2,4] I. A. Gonoskov,[5] B. Kiss,[2] K. Varju,[2,6] S. Varro,[2,7] and P. Tzallas[1,2,*]

[1]*Foundation for Research and Technology-Hellas, Institute of Electronic Structure and Laser, PO Box 1527, GR-71110 Heraklion, Greece*
[2]*ELI-ALPS, ELI-Hu Non-Profit Ltd., Dugonics tér 13, H-6720 Szeged, Hungary*
[3]*Department of Theoretical Physics, University of Szeged, Dom ter 9, 6720 Szeged, Hungary*
[4]*Univ Bordeaux, CNRS, CELIA, CEA, F-33405 Talence, France*
[5]*Max Planck Institute of Microstructure Physics, Weinberg 2, D-06120 Halle, Germany*
[6]*Department of Optics and Quantum Electronics, University of Szeged, Dom ter 9, 6720 Szeged, Hungary*
[7]*Wigner Research Center for Physics, 1121 Budapest, Hungary*

(Received 28 September 2018; published 14 May 2019)



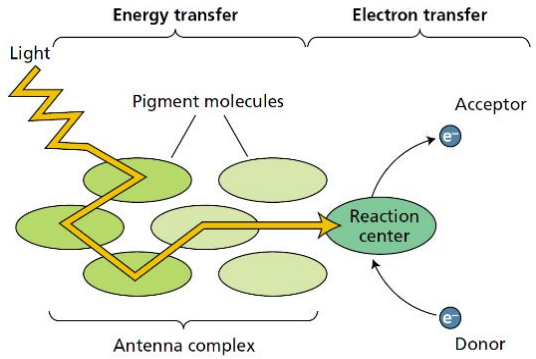
IMPULSE is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871161

Examples of research opportunities

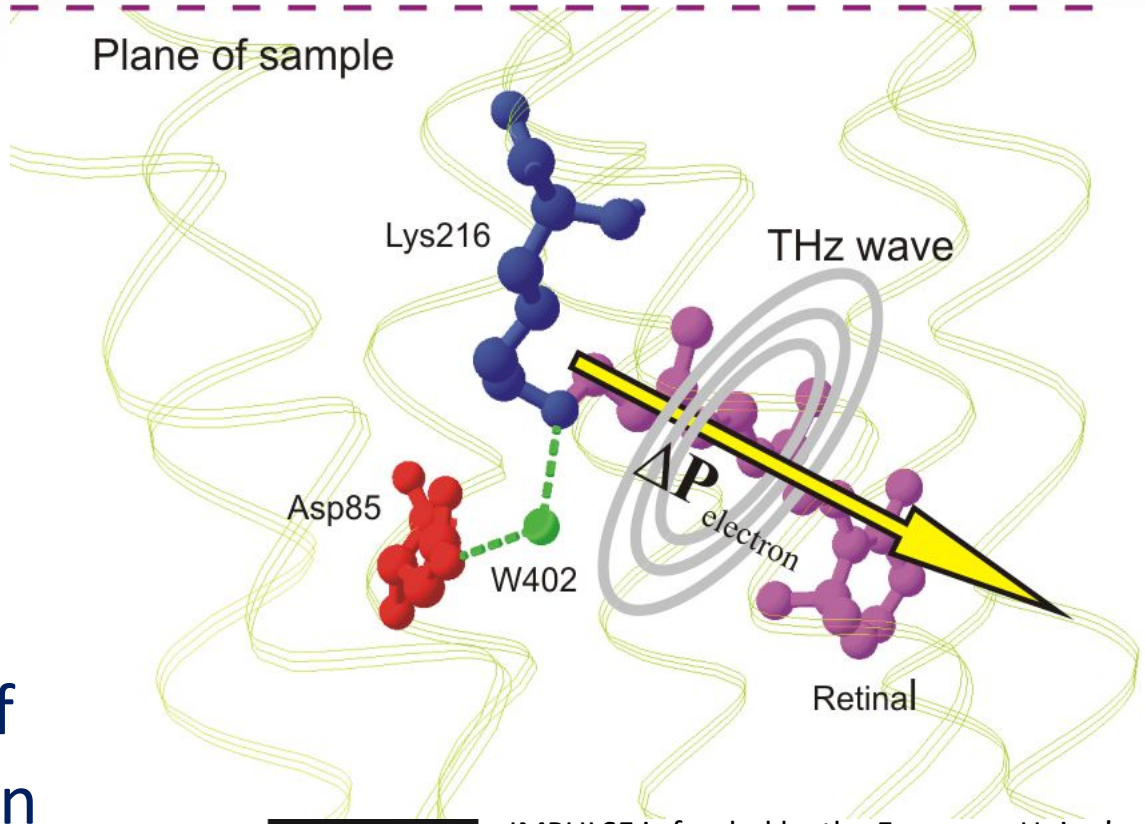
Tackling biological challenges using THz radiation

BRC-Szeged research plans @ ELI-ALPS

Photosynthetic Light Reactions



Ultrafast charge separation generates EM radiation



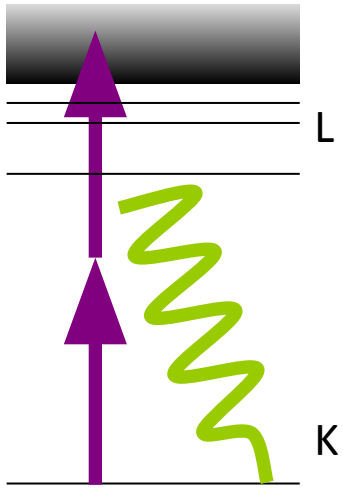
- Direct observation & control of charge separation by EM radiation

IMPULSE is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871161

Examples of research opportunities

PW SHHG: intense x-ray attosecond pulses

Inaugurating the era of MP inner-shell processes or just a dream?

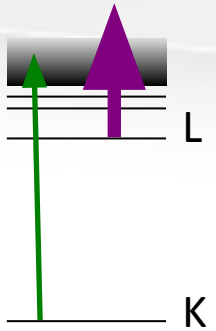


ω = 110eV (e.g. Be^{3+})

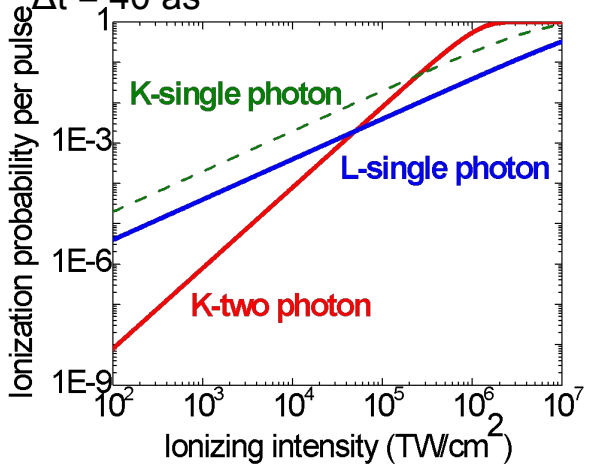
$\sigma^{(2)}_K = 5 \cdot 10^{-54}$ cm^4·s

$\sigma^{(1)}_L \sim 10$ kb (10^{-20} cm^2)

$\sigma^{(1)}_k \sim 10^{-19}$ cm^2 (220eV)



Δt = 40 as



@ ~$5 \cdot 10^{16}$ W/cm^2 the TPI becomes the dominant ionization process!!

2-photon ionization of inner-shells in solid targets
→ high atomic density → higher signal
Spatial selectivity

IMPULSE is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871161

Opportunities in education

- Several PhD students participate user campaigns at ELI-ALPS receiving training and producing outstanding results for their dissertation

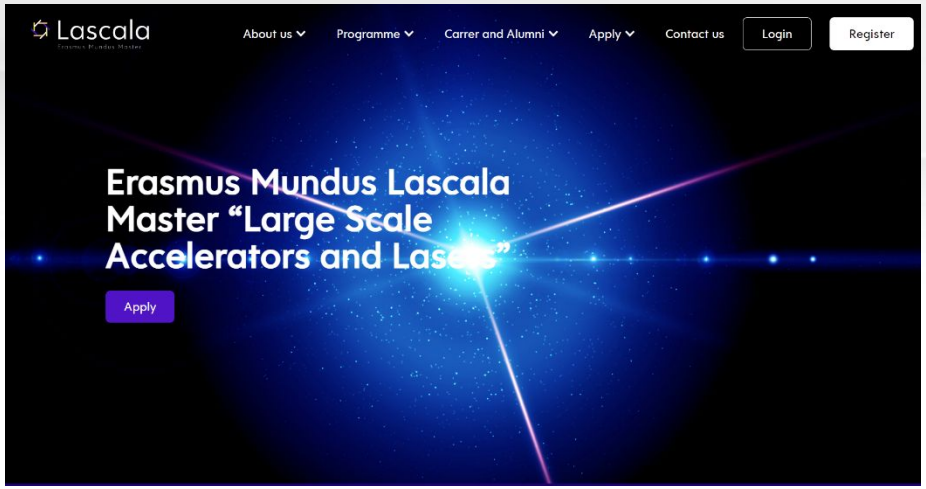
- Several post-doctoral fellows participate in user campaigns at ELI-ALPS receiving training and producing high quality publications

- ELI is organizing an annual Summer School (ELISS)

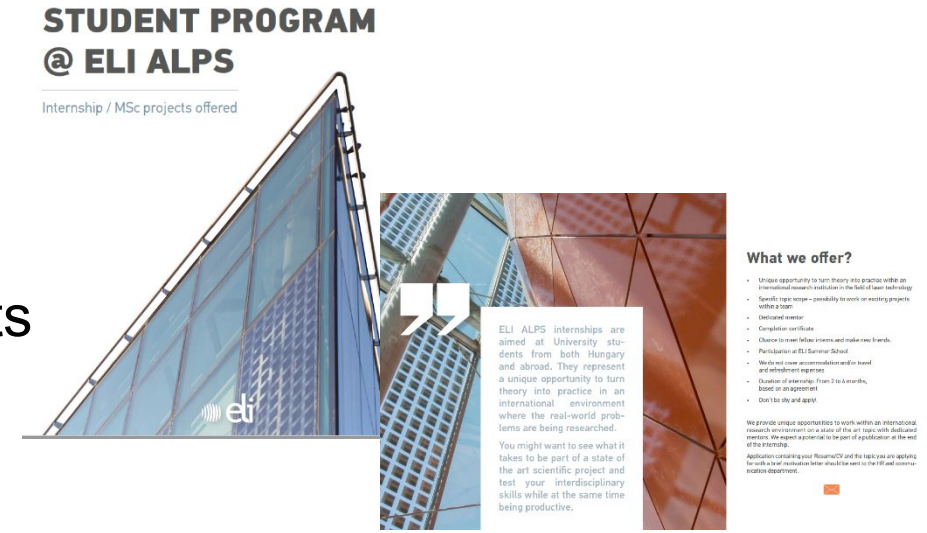
IMPULSE is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871161

Opportunities in education

- ELI-ALPS is offering courses in the LASCALA masters program of ERASMUS MUNDUS. LASCALA aims at training experts in the most advanced experimental and theoretical tools and concepts of high power lasers and associated advanced sources, as well as in their applications for science and society.



- ELI-ALPS is offering 2-6 months internships for training in specific laser related research and technology topics and participation in exciting projects



IMPULSE is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871161

Opportunities for the industry

- Exploit the large variety of the laser systems of ELI in evaluating which system/parameters would better serve their needs
- Testing new methods and/or materials candidates for being adopted in a production line
- Use of the analytical facilities offered
- In the area of ELI-ALPS a science park is planed to be build companies of which will have immediate access to the facilities of the RI
- Museums and galleries can exploit laser based analytical and treatment techniques in the sector of cultural heritage

IMPULSE is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871161

Instead of an epilogue

- be creative
- work out new ideas
- turn them to reality at ELI
- and return successful and happy to the Iberian Peninsula

We, ELI, will provide the means and host you with pleasure

IMPULSE is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871161

Thank you !

IMPULSE is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871161