EUROPEAN UNION

Structural Instruments 2014-2020

Project co-financed by the European Regional Development Fund through the Competitiveness Operational Programme
"Investing in Sustainable Development"

Extreme Light Infrastructure-Nuclear Physics
(ELI-NP) - Phase II

Extreme Light Infrastructure-Nuclear Physics

Ionel ANDREI
On behalf of ELI-NP Implementation Team

Extreme Light Infrastructure (ELI)

An ESFRI Landmark Project - A world leading scientific RI

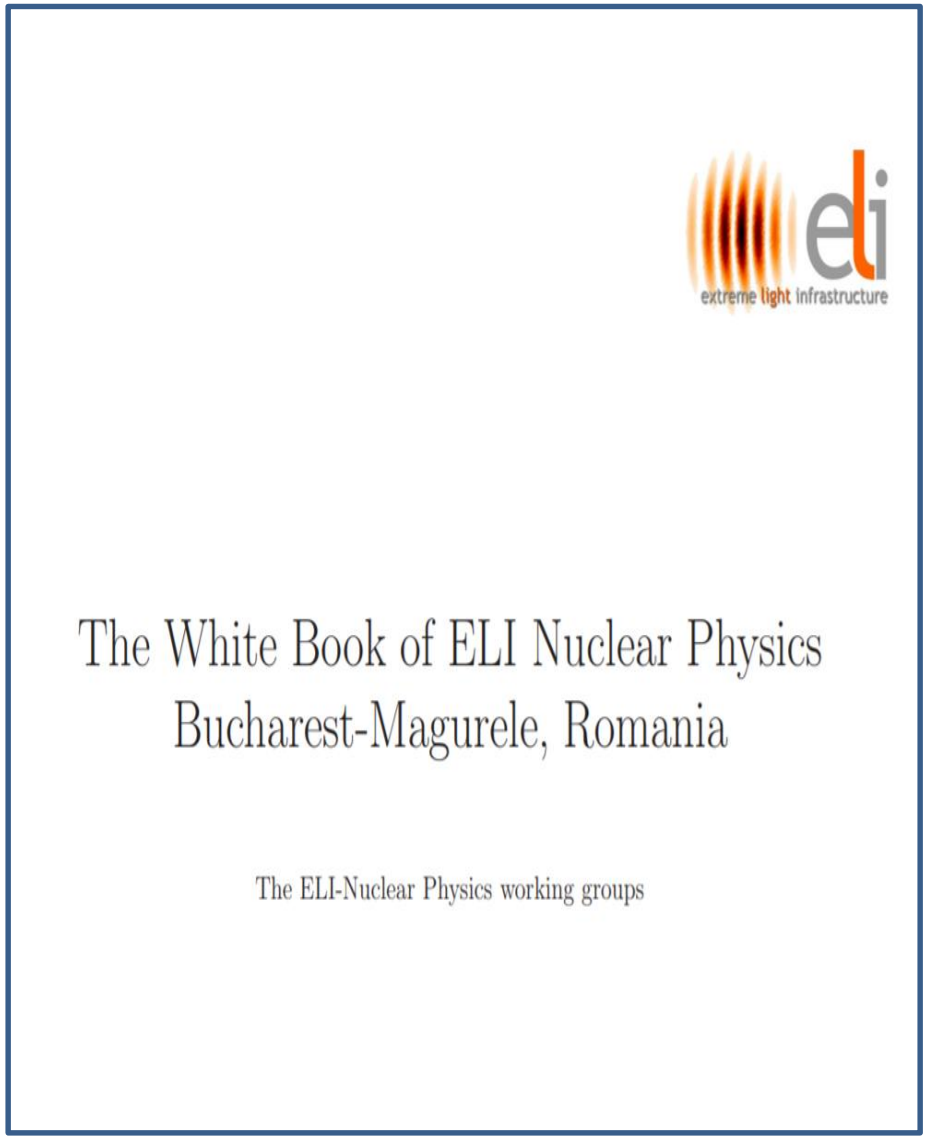
- 2006 ⟹ ESFRI Roadmap ⟹ 2008 ELI-PP

Romania's Embassy in Paris
Brain Circulation & Spreading the excellence within ERA

Extreme Light Infrastructure – Nuclear Physics (ELI - NP)

An enabling facility to support science

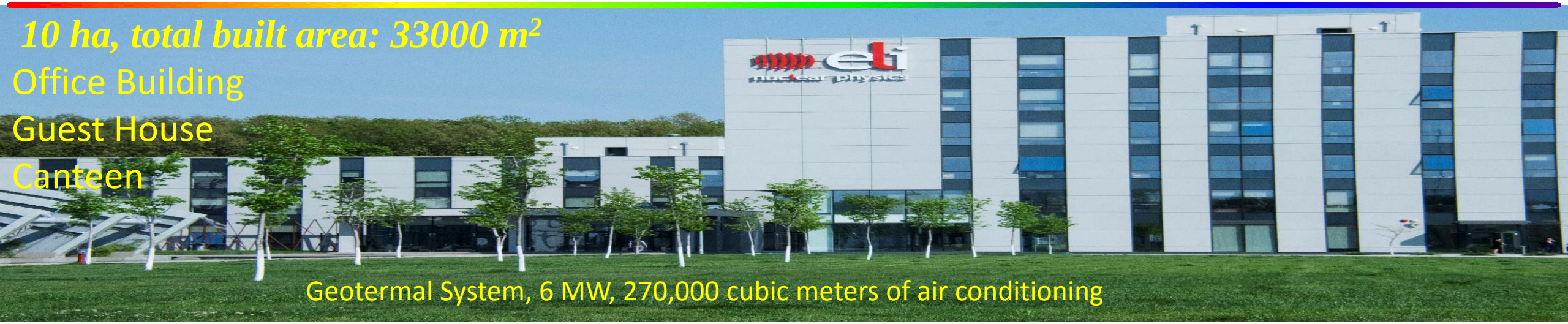
Exploratory workshops of nuclear and lasers communities: >200 renowned scientists from more than 50 universities and labs worldwide recognized

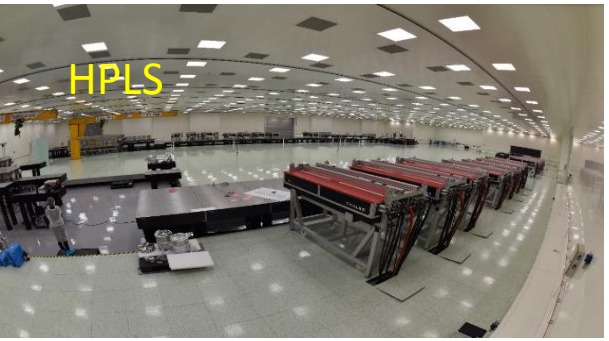


Impact Indicators e.g: Collaboration Excellence, Number of publications in high impact factor journals

SMART Facility, SMART Building
Special building and all infrastructures fully operational

+310 MEur



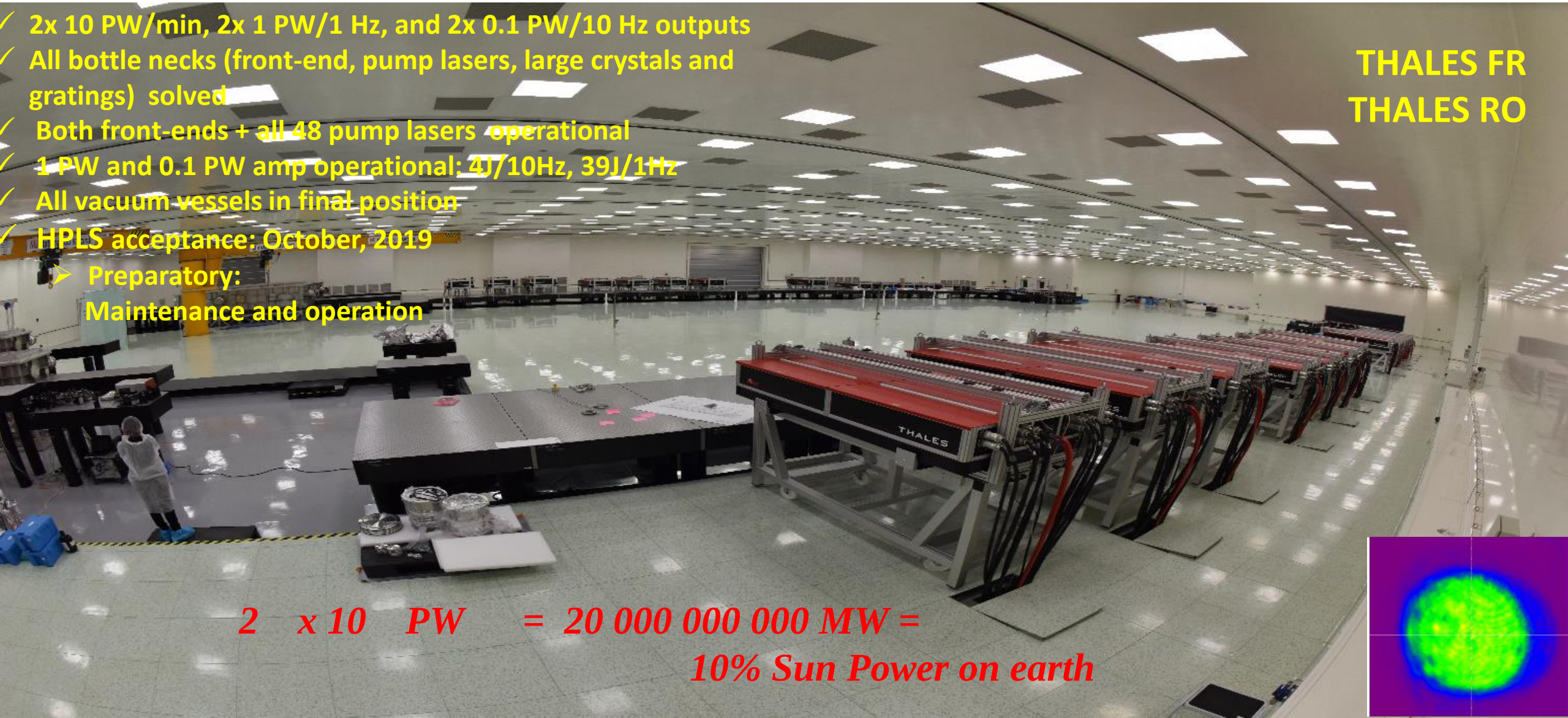


Laboratories
Experiments

ELI–NP High Power Laser System
Confirmed: May 2018 – 3 PW, 2019:February – 7 PW , March 10 PW

- ✓ 2x 10 PW/min, 2x 1 PW/1 Hz, and 2x 0.1 PW/10 Hz outputs
- ✓ All bottle necks (front-end, pump lasers, large crystals and gratings) solved
- ✓ Both front-ends + all 48 pump lasers operational
- ✓ 1 PW and 0.1 PW amp operational: 4J/10Hz, 39J/1Hz
- ✓ All vacuum vessels in final position
- ✓ HPLS acceptance: October, 2019
  - ➢ Preparatory:
    Maintenance and operation

THALES FR
THALES RO

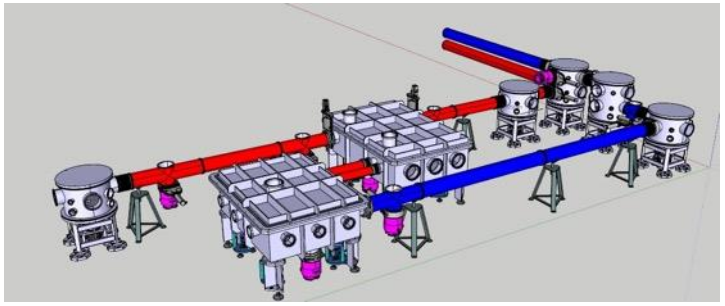


2 x 10 PW = 20 000 000 000 MW =
10% Sun Power on earth

2 x 10 PW Large Beam Transport System

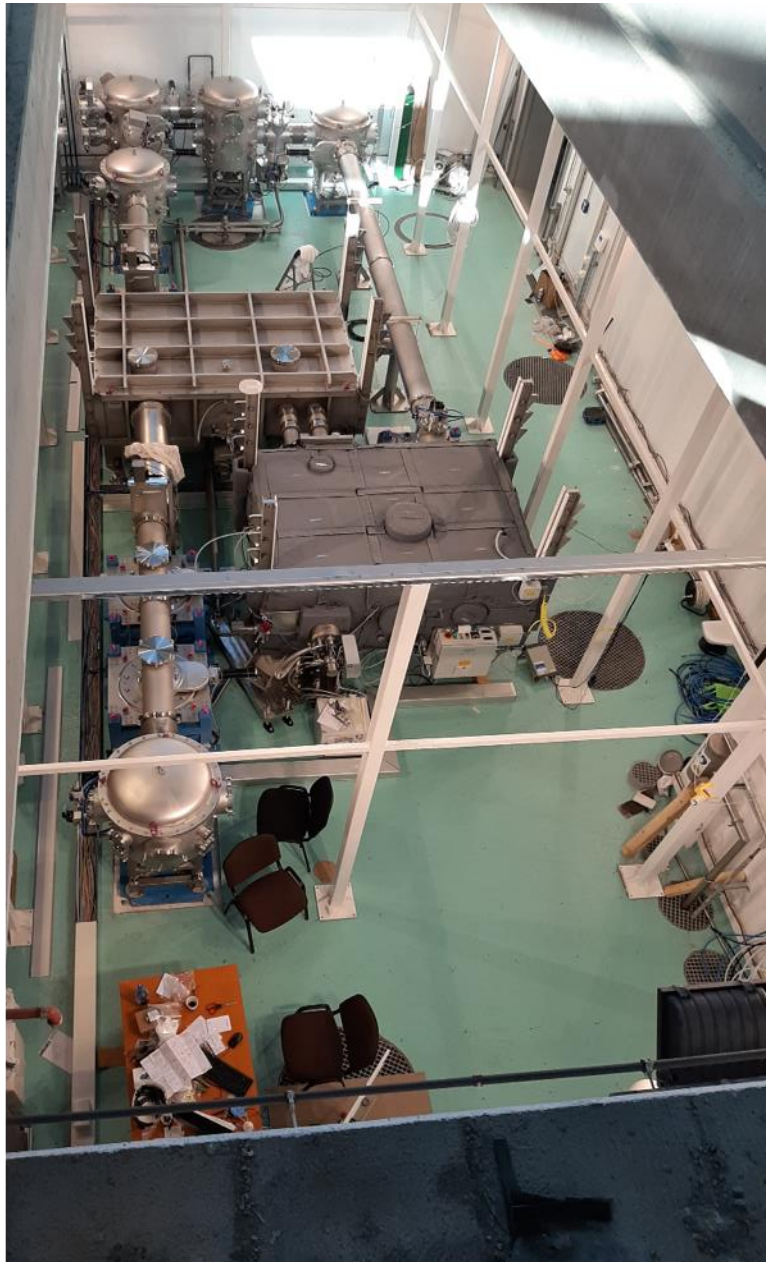
October 2019

ELI-NP 100 TW Experiments



E4 experimental area:

- 100 TW @ 10 Hz



Physics Case:

- high rep rate, four-wave mixing (dark matter), X-ray generation, gamma-gamma collider

Implementation status:

- Construction, installation and commissioning of the vacuum enclosures and the vacuum system – NTG GmbH - ongoing acceptance
- Commissioning of the experimental arrangement – November 2019
- **Start experiments in early 2020**

ELI-NP Laboratories

Target Laboratory – Operational

Deposition techniques
- UHV RF/DC sputtering
- UHV e-beam evaporation
- spin coating

Characterization
- SEM (EDS / EBSD / EBL)
- optical profilometer
- AFM
- XRD
- optical microscope

Structuring /patterning techniques
- reactive ion etching
- optical lithography
- Ar ion milling

Cleaning methods
- Plasma (O_2, Ar, SF_6)
- Ion beam (Ar)
- thermal treatments

Optics and Laser Laboratory – Operational

Spectroscopy Laboratory – Operational

Dosimetry Laboratory – Operational

ELI- NP VEGA System

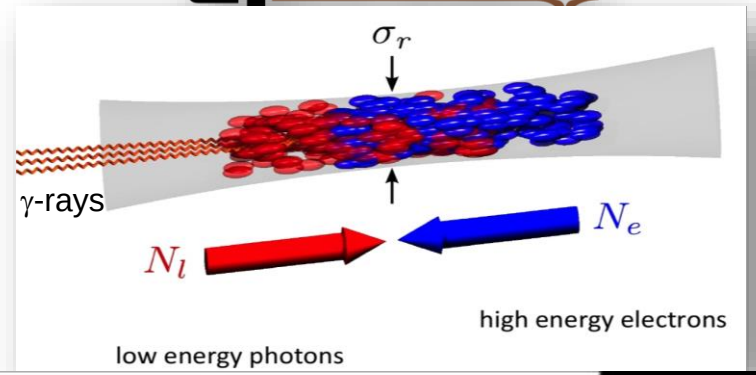
Signature of the VEGA System Contract

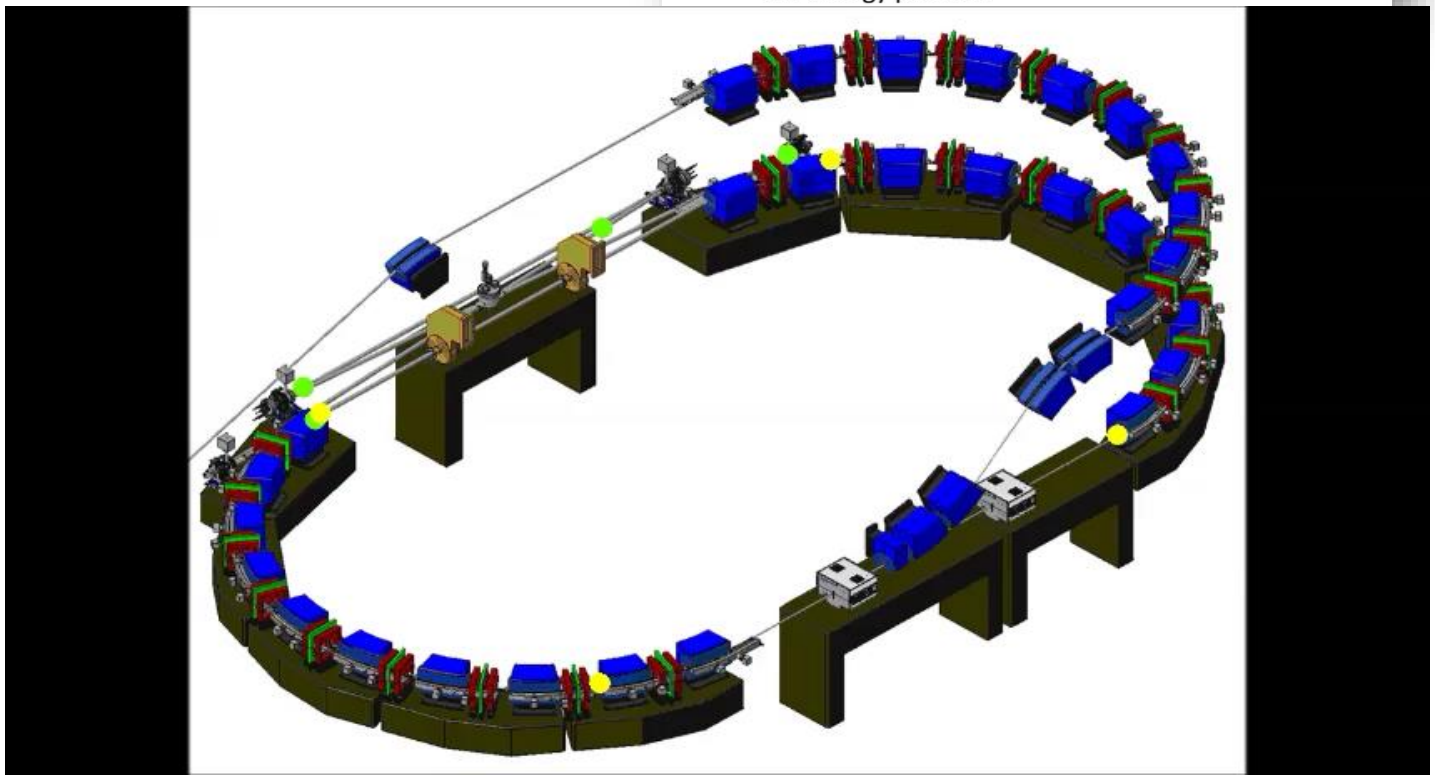
Commissioning – 2022
Early experiments - 2023

Variable Energy GAmma-ray (VEGA) System

Provider – Lyncean Technologies Inc.

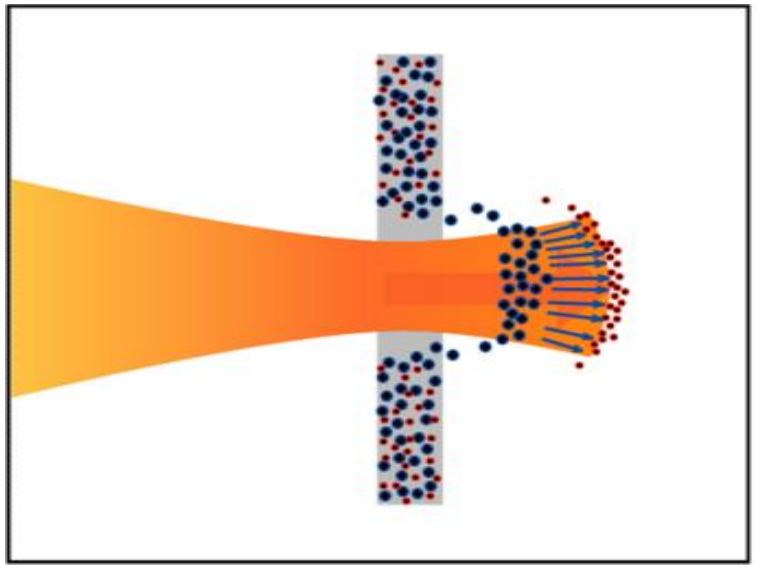
Gamma–rays from Inverse Compton Scattering





Extreme Light Infrastructure – Nuclear Physics (ELI - NP)

An enabling facility to support innovation



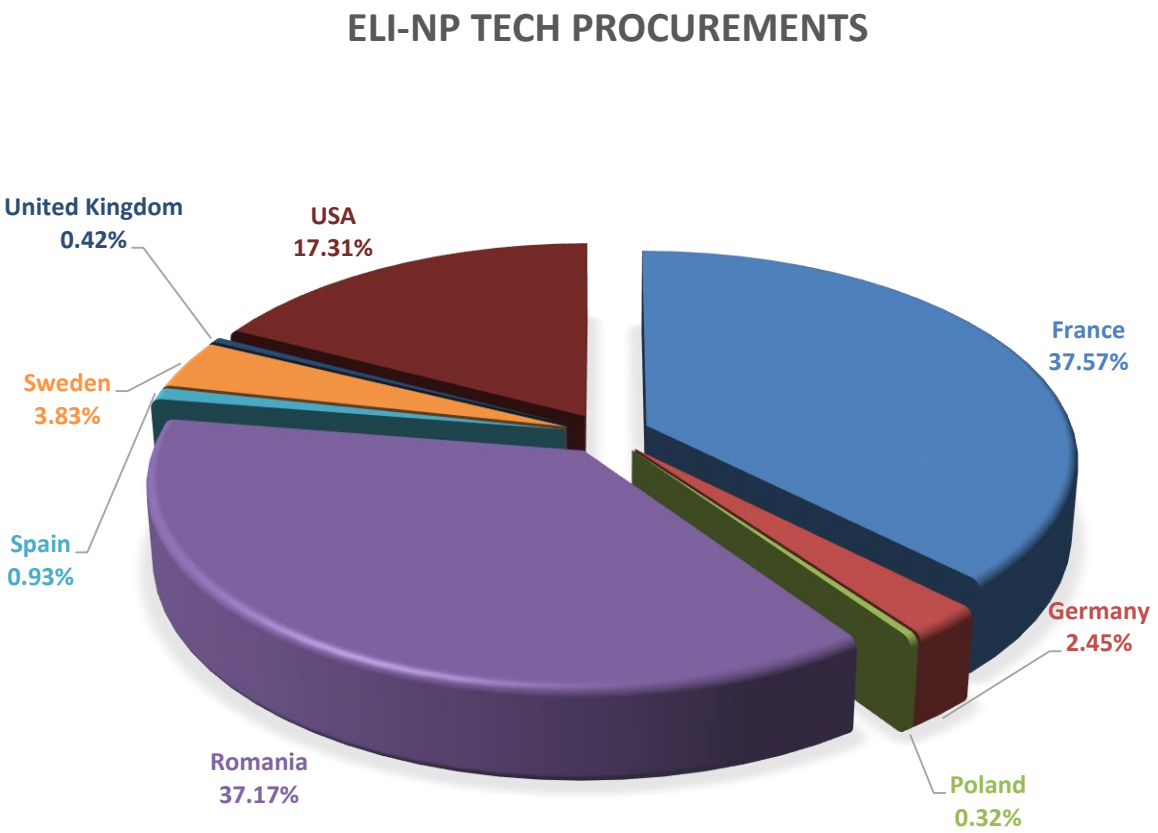
- *Studies of material behavior in extreme radiation intensities for Nuclear and Space Industries*
- *Management of Nuclear Materials, ex.: nuclear power plants*
- *Management of Nuclear Waste: Accelerator Driven System?*
- *Establish methods for production of radioisotopes: already commercial (ex. ^{99}Mo) or new radioisotopes for imaging and treatment (ex: ^{195m}Pt: In chemotherapy of tumors it can be used to exclude "non responding" patients from unnecessary chemotherapy and optimizing the dose of all chemotherapy)*

- ✓ ***Pushing the limits of technology in construction phase***
- ✓ ***Particle acceleration by laser a new paradigm…with a huge potential of developing civilian new/disruptive technologies and applications***
- ✓ ***Innovators(Companies): Suppliers/Beneficiary/User***

Impact Indicators e.g: Patents with a commercial use, Collaborative projects with industrial partners

Extreme Light Infrastructure – Nuclear Physics (ELI - NP)

Innovators(Companies): Suppliers/Beneficiary/Users



- **+ 300 commercial contracts – public procurements**
- **+25 Mil Eur research & technology development**

Challenges:

- **HPL market evolution – high demand, limited manufacturing capacity**
- **not enough mature TTI ecosystem**

User facility

Open acces

- **Facility: available gradually to the users 2019-2023**
- **Detailed description of the Machines and Experimental set-ups:**
  - **Commissioning is part of the Implementation (TDRs, internal) : 100 TW starts next Dec**
  - **Review of the equipment made available to users**
  - **Peer review access**
  - **Additional equipment for experiments(if recommended by PAC, only): if possible provided by the Facility; or provided by users themselves**
  - **Users (PAC only)**

Contractual acces

- **No peer review**
- **Proprietary results**

Impact Indicators e.g: -Data sharing, Commercial data use and data services

Extreme Light Infrastructure – Nuclear Physics (ELI - NP)

Integrated in a regional cluster – TTI oriented

Magurele High Tech Cluster (MHTC)
- An association of more than 90 organizations: companies, research institutes, foundations, associations, local public institutions, hospitals.

- It represents a significant potential in terms of financial, material, human, technological and scientific capabilities that are necessary to carry out ample projects (e.g. National Nuclear Medicine Centre)

1.Advanced Research:
- Nuclear Physics
- Lasers and plasma
- Materials Physics
- Earth Physic

2. Optoelectronics
3. Methods and nuclear technologies for health and environment
4. Preserving cultural heritage through nuclear technologies and lasers
5. Information and Communication Technologies, Energy, Security
6. Technologies for agriculture
7. Training & educational products & science promotion

Extreme Light Infrastructure – Nuclear Physics (ELI - NP)

Integrated in regional strategies

Laser Valley – Land of Lights

PWC 2016 Impact Study*:
Areas of development:

- ***Science***
- ***Technology***
- ***Social***

Impact:~6,ooo employees
~ EUR mil. 600 Turnover

*) Source: http://www.laservalley.ro/Home_files/directory/Studiu_de_Impact_ELI-NP_ro.pdf

Extreme Light Infrastructure – Nuclear Physics (ELI - NP)

A hub to facilitate regional collaborations

Magurele Science Park

Founders:
Ilfov County Council
ELI-NP
City of Magurele
University of Bucharest
Politehnica Univ. Bucharest

Impact indicator: e.g Number of local/regional suppliers

Collaboration:

- ✓ **With more than 60 internationally renowned universities and research institutions**
- ✓ **With Doctoral Schools of Politehnica University of Bucharest, University of Bucharest, West University from Timisoara, TU Darmstadt**

- ✓ **Member of ELI' family – Knowledge transfer - good practices and lessons learned**
  - ✓ **ELITRANS**
  - ✓ **IMPULSE,**

  projects funded by EC under H2020 RDI Programme
- ✓ **With local and international suppliers**

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