INAUGURAL 10 PW LASER AND USERS SYMPOSIUM:
MOVING INTO UNCHARTERED TERRITORIES

10 PW
- The first 10 PW laser pulse was shot through the entire ELI-NP laser system

- E4 Experimental Hall 100 TW
- E5 Experimental Hall 1 PW
- E1 Experimental Hall 2x 10 PW
- E6 Experimental Hall 2x 10 PW

www.eli-np.ro
ELI-NP, the Nuclear Physics pillar of the European distributed infrastructure ELI, is going to be the most advanced research facility in the world focusing on the study of photonuclear physics and its applications, comprising a very high intensity laser of two 10 PW ultra-short pulse lasers.

This unique experimental combination will enable ELI-NP to tackle a wide range of research topics in fundamental physics, nuclear physics, and astrophysics, and also applied research in materials science, management of nuclear materials and life sciences.

ELI-NP has been selected by the most important scientific committees in Nuclear Physics in Europe – NUPECC – in the Nuclear Physics Long Range Plan in Europe as a major facility.
ELI-NP Experimental Building

Building layout

02

HPLS, 2 x 10 PW

10 PW Laser Experiments Area
Laser & Gamma Beam Experiments Area
Gamma Beam Experiments Area

Dosimetry Laboratory
Laser Experiments Diagnostics Laboratory

Target Laboratory Area
Laser and Optics Laboratory Area
Biophysics and Biomedical Applications Laboratory

Mechanical and Vacuum Workshop
User Room
DAQ Room
Spectroscopy Laboratory

1 PW Laser Experiments Area
TW Laser Experiments Area
On the 19th of August 2020, the first 10 PW laser pulse was shot through the entire ELI-NP laser system, namely all the amplifiers, the final compressor, the 30 m of the beam transport system and finally into a beam dump. During this test the High Power Laser System (HPLS) fired 10 shots at 3 PW, 10 shots at 7 PW, 3 shots at 8 PW, and 10 shots at 10 PW; so one shot/minute over a period of about 40 minutes, thus demonstrating the robustness of the laser system. The energy fluctuation between shots was less than 2% and there was good pointing stability, namely an average fluctuation of the beam direction corresponding to less than 3 mm after one kilometer of propagation.

Preliminary experiments have begun in March 2020 for the 100 TW arm of the laser system and for the 1 PW energy pulses, plans to test proton acceleration are scheduled to take place before the end of 2020. The more challenging 10 PW beams commissioning experiments are planned to take place in 2021, where the laser beams are focused down to several microns, thus putting more than $10^{22}$ W/cm$^2$ on target.
E4 Experimental Hall
100 TW

► Designed Specifications:
- Shot rate: 10 shot/second
- Energy: 3 mJ-2.5 J
- Focusing optic: f/8, f/25
- Intensity on target: $10^{19}$ W/cm²
- Central Wavelength: 814-825 nm
- Pulse Duration: 25 fs

Probe Beam:
- Energy: to be determined

► Available Diagnostics & Equipment
- Electron Spectrometers
- Optical Spectrometers
- X-ray imaging

► Status:

- Installation:
- Commissioning: ✔
- Open to Users: ✗
E5 Experimental Hall
1 PetaWatt

- Designed Specifications:
  - Shot rate: 1 shot/second
  - Energy: 15-25 J each beam
  - Focusing optic: f/3.5, f/24
  - Intensity on target: $10^{21}$ W/cm$^2$
  - Central wavelength: 814-825 nm
  - Pulse Duration: 24 fs
  - Frequency double: Yes

- Probe Beam:
  - Energy: 1-50 mJ
  - Frequency double: Yes

- Available Diagnostics & Equipment
  - Thomson Parabola (up to 100 MeV)
  - Electron & Positron Spectrometers (up to 100 MeV)
  - Gamma Spectrometer (5-50 MeV)
  - Streak Cameras (visible, NIR)
  - CsI(Tl) spectrometer (up to 20 MeV)
  - Activation with coincidence counters

- Status:
  - Installation: 
  - Commissioning: 
  - Open to Users:
## E1 Experimental Hall
2 x 10 PetaWatt

### Designed Specifications:
- **Shot rate:** 1 shot/minute
- **Energy:** 230 J each beam
- **Focusing Optic:** f/2.7
- **Intensity on target:** $10^{23}$ W/cm²
- **Central wavelength:** 814-825 nm
- **Pulse Duration:** 23 fs
- **Frequency double:** Yes

**Probe Beam:**
- **Energy:** 1-50 mJ
- **Frequency double:** Yes

### Available Diagnostics & Equipment
- Thomson Parabola (up to 250 MeV)
- Electron & Positron Spectrometers (up to 100 MeV)
- Gamma Spectrometer (5-50 MeV)
- Spectrometers (wavelength?)
- CsI(Tl) spectrometer (up to 20 MeV)
- Activation with coincidence counters

### Status:
- **Installation:**
- **Commissioning:**
- **Open to Users:**

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E6 Experimental Hall
2 x 10 PetaWatt

► Designed Specifications:
- Shot rate: 1 shot/minute
- Energy: 230 J each beam
- Focusing Optic: f/54
- Intensity on target: $10^{20}$ W/cm²
- Wavelength: 814-825 nm
- Pulse Duration: 15-22.5
- Frequency double: Yes

▶ Probe Beam:
- Energy: 1-50 mJ
- Frequency double: Yes

► Available Diagnostics & Equipment
- Electron Spectrometers (up to 5 GeV)
- Optical Spectrometers

► Status:

Installation: 

Commissioning: ✔

Open to Users: 

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Participants

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SLAC Stanford Accelerator Laboratory, USA
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