

THE EXTREME LIGHT INFRASTRUCTURE – NUCLEAR PHYSICS FACILITY (ELI-NP): Project implementation and overview of the scientific program

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The European Strategic Forum for Research Infrastructures (ESFRI) has selected in 2006 a proposal based on ultra-intense laser fields with intensities reaching up to 10^{22-23} W/cm² called “ELI” for Extreme Light Infrastructure. The construction of a large-scale laser-centred, distributed pan-European research infrastructure, involving beyond the state-of-the-art ultra-short and ultra-intense laser technologies, received the approval for funding in 2011-2012.

The three pillars of the ELI facility are being built in Czech Republic, Hungary and Romania. The Romanian pillar is ELI-Nuclear Physics (ELI-NP). The new facility is intended to serve a broad national, European and International science community. Its mission covers scientific research at the frontier of knowledge involving two domains. The first one is laser-driven experiments related to nuclear physics, strong-field quantum electrodynamics and associated vacuum effects. The second is based on a Compton–backscattering high-brilliance and intense low-energy gamma beam (<20 MeV), a marriage of laser and accelerator technology which will allow us to investigate nuclear structure and reactions as well as nuclear astrophysics with unprecedented resolution and accuracy. In addition to fundamental themes, a large number of applications with significant societal impact are being developed. These applications extend from nuclear power plant waste management to new radio-isotopes for medicine and cancer therapy and from space science to material and nanoscience using for example new powerful probes like a brilliant positron beam.

The ELI-NP research centre will be located in Magurele near Bucharest, Romania. The project is implemented by “Horia Hulubei” National Institute for Physics and Nuclear Engineering (IFIN-HH). The project started in January 2013 and the new facility will be operational by the end of 2018.

During the last three years, a significant fraction of the international scientific community contributed to the shaping of the ELI-NP facility science program through a series of international workshops. The ELI-NP Whitebook and the Technical Design Reports (TDRs) for the proposed experiments envisage a very wide range of experiments in 8 experimental areas. A gradual approach in terms of complexity was adopted for each experiment, in order to ensure successful implementation in the preparatory and intermediary phase of this highly challenging project. A description of the present status of the implementation of the ELI-NP project and an overview of the proposed experiments will be presented.