Programme / Sub-programme / Module	5/5.1/ELI-RO
Project type	RDI
ELI-NP thematic	RA35/III.5; RA35/III.2; RA1/III.3
Project title / Acronym	**On-line measurement of laser-driven proton beams effect on human cells / ONLINEBIORAD**
Project duration	26.5 month

PROJECT SUMMARY

The goal of this research project is to contribute/boost the activities of the E5 experimental area of the Extreme Light Infrastructure-Nuclear Physics (ELI-NP) by implementing scientific research in the areas of Biophysics and Biochemistry through initial investigation for the development of an on-line measurement system of laser-driven proton beams effect on epithelial and endothelial human cells.

The project uses the capabilities of the Centre For Advanced Laser Technologies (CETAL) at the National Institute for Laser, Plasma and Radiation Physics (INFLPR) to operate a 1 PW at 0.1 Hz laser beams which can be directed toward solid targets to provide proton beams with energies up to 70 MeV and of the Research Innovation and Technology Center for New Materials (RITecC) at the National Institute of Materials Physics (INCDFM) in developing new materials and architectures for sensors and biosensors.

In order to prove the working principle, secondary proton beams derived from high power laser irradiation of solid or gas targets will be directed toward an epithelial cellular culture grown onto the surface of the EC/ncFET detection device formed by a classical 3-electrodes electrochemical (EC) sensor in parallel with a field effect transistor (FET) with nanowire channel (nc) for detection of ROS and RNS. The activities proposed within the working plan involve: i) the development, characterization and optimization of the EC/ncFET detection device; ii) development, characterization and optimization of the secondary proton sources obtained after the interaction of the high-power laser beam with solid targets; iii) assembling the experimental set-up by integrating the EC/ncFET sensor with immobilized cellular cultures within the irradiation chamber; iv) characterization of radiation effect on cellular cultures.

Contributions of the present project are scientific and institutional. First, it contributes to development of new strategies for real-time biological monitoring with direct applications to aeronautics for continuous monitoring of crews' health and/or physiological parameters and also to radiobiology for treatment of various diseases especially cancer. From institutional point of view, it is an excellent opportunity to bring together researchers specialized in different fields and to broaden their scientific expertise by working in a multidisciplinary field. It is proposed by a Romanian multidisciplinary consortium made of four national institutions: National Institute of Materials Physics (INCDFM) as coordinator, National Institute for Laser, Plasma and Radiation Physics (INFLPR), Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH) and the Institute of Cellular Biology and Pathology "Nicolae Simionescu" (IBCPNS).

The project is in line with the domain 5.6.15 "Materials research in high intensity radiation fields" and S275 "Materials in extreme environments for energy, accelerators and space applications" at ELI-NP White Book and TDRs. Nevertheless, a successful implementation of the project opens the possibility for preparing of new applications for funding in order to undergo research on cell interaction with accelerated microbeams of protons or heavy ions at *ELI-NP* or other international institutions such as *Ruđer Bošković Institute in Zagreb* and *GSI Helmholtzzentrum für Schwerionenforschung*.