

Safety Challenges of Biological Applications at High Power Laser Accelerators

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ELI-Beamlines is the Czech Republic based pillar of the Extreme Light Infrastructure, a European Research Infrastructure Consortia, which exploits the next generation of high energy and high intensity lasers. Among others, it aims at the development of high-brightness sources of X-rays to be used for various research and practical applications such as biological and biomedical.

One of the most promising projects hosted by ELI Beamlines is ELIBIO that explores new frontiers in light and optics to create breakthrough science in biology, chemistry and physics. The main goal is to utilize laser driven X-Ray sources to investigate biological and biochemical processes, especially to observe them in the real time. This goal constitutes considerable technological and scientific challenges, and last but not least specific safety demands. The combination of laser, ionizing radiation, and biological hazards imposes requirements on building, installed technology, and operational safety. Dedicated laboratory facilities enabling to control the hazards and conduct the research efficiently and in a safe manner.

Design of the experimental laboratories providing beams of ionizing radiation to the users has to comply with the principles of the biosafety management and keep the operation efficient. ELI Beamlines already operates a bio-laboratory and aims to enhance its capabilities by implementation of biocontainment facilities enabling to control combined hazards, such as laser or ionizing radiation.

Additionally, utilizing lasers and X-Rays for biological experiments results in further challenges, such as adopting suitable cleaning and disinfection procedures that would be careful to sensitive optics (minimize its destruction) while preventing biological contamination and avoiding cross-contamination of the research.

This contribution introduces safety approaches taken to support this ambitious project and to enable its further upgrades.

Email

petr.prochazka@eli-beams.eu

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ELI Beamlines, Institute of Physics ASCR

Primary author: Mr PROCHAZKA, Petr (ELI Beamlines)

Co-authors: Dr PRIBYL, Lukas (ELI Beamlines, Institute of Physics ASRC); Mr BIZDRA, Marek (ELI Beamlines, Institute of Physics ASCR); Dr PRECEK, Martin (ELI Beamlines, Institute of Physics ASCR)

Presenter: Mr PROCHAZKA, Petr (ELI Beamlines)

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