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ELI-Beamlines: scientific and societal applications of ultra intense lasers

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ELI-Beamlines is the high-energy, repetition-rate laser pillar of the ELI (Extreme Light Infrastructure) project. It will be an international facility for both academic and applied research, slated to provide first user capability since the beginning of 2018. The main objective of the ELI-Beamlines Project is delivery of ultra-short high-energy pulses for the generation and applications of high-brightness X-ray sources and accelerated particles. The laser system will be delivering pulses with length ranging between 15 and 150 fs and will provide high-energy Petawatt (10Hz) and 10-PW peak powers. For high-field physics experiments it will be able to provide focused intensities attaining 1024 Wcm-2, while this value can be increased in a later phase without the need to upgrade the building infrastructure to go beyond the ultra-relativistic interaction regime in which protons are accelerated to energies comparable to their rest mass energy on the length of one wavelength of the driving laser.

We will introduce the different experimental user areas with the emphasis of applications of secondary sources of x-rays and laser accelerated particles and the extreme field science area.

We discuss new approaches for efficient proton acceleration with higher repetition rate targets based on a solid Hydrogen ribbon for possible medical applications in the energy range above 60 MeV. The ion acceleration beamline ELIMAIA and the ELIMED concepts will be highlighted for their use in different fields including medicine.

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