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Fs-Laser driven secondary sources of x-rays and particles within ELI-Beamlines

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We will be giving an overview on the development of the "ELI-beamline facility" built within the Extreme Light Infrastructure (ELI) project based on the European ESFRI (European Strategy Forum on Research Infrastructures) process.
The ELI project is constructing specialized branches (pillars) in several countries. ELI-Beamlines in the Czech Republic, which is a subject of this project, along with ELI-ALPS, the Attoseccond Laboratory (Szeged, Hungary) and ELI-NP, the Photonuclear Laboratory (Magurele, Romania). The Ultra High Field Science Laboratory as the fourth pillar (host country not yet determined) will be built later on. Individual pillars will be constructed and operated independently. After launching the individual pillars, it is proposed that the multi-sited infrastructure ELI will be managed and operated within central governance framework according to the model of ERIC (European Research Infrastructure Consortium). It is expected that the ELI-ERIC Consortium shall be established in 2018.

ELI-Beamlines will be 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 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 to 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.
In this talk we will concentrate on the development of short wavelength (20 eV-100 keV) short pulse high intensity laser driven sources and their practical implementation in the ELI-beamline user facility. The sources are either based on direct interaction of

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the laser beam with a gaseous or solid target (High order harmonics and x-ray lasers) or will first accelerate electrons which then will interact with laser produced wigglers (Betatron radiation) or directly injected into undulators (laser driven LUX or later X-FEL). The direct interaction (collision) of laser accelerated electrons with the laser again will lead to short pulse high energy radiation via Compton or Thomson scattering. The main planned short pulse laser driven x-ray sources and their parameters will be presented, together with the date of commissioning.

We will also touch the development and implementation of high energy laser driven electron (>1GeV) and proton (> 100 MeV) sources which are built as user beamlines for different applications like for instance in medical diagnostics or therapy.

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