Laser driven plasma based incoherent X-ray sources at PALS and ELI Beamlines

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Abstracts: *In this paper we report on development of incoherent secondary sources at the PALS Research Center and discuss the plan for the ELI Beamlines project. One of the approaches, how to generate ultrashort pulses of incoherent X-ray radiation, is based on interaction of femtosecond laser pulses with underdense plasma. This method, known as laser wakefield electron acceleration (LWFA), can produce up to GeV electron beams emitting radiation in collimated beam with a femtosecnond pulse duration. This approach was theoretically and experimentally examined at the PALS Center. The parameters of the PALS Ti:S laser interaction were studied by extensive particle-in-cell simulations with radiation post-processors in order to evaluate the capabilities of our system in this field. The compressed air, and mixture of helium and argon were used as accelerating medium. The accelerator was operated in the bubble regime with forced self-injection and resulted in the generation of stable relativistic electron beams with the energy between 10 and 80 MeV, hence the betatron X-ray radiation with critical energy in the keV range was generated. The extensions of this method to the ELI Beamlines facility will enable to generate much higher X-ray energies from 10 keV up to 1 MeV with 10 Hz repetition rate. Such source is suitable for various applications like phase contrast imaging or X-ray absorption experiments in single shot.*