Contribution ID : **2** Type : **not specified**

Challenges and advantages of an e-LINAC based positron beam facility

The Helmholtz-Center Dresden - Rossendorf operates the superconducting electron linear accelerator ELBE (short for Electron LINAC with high Brilliance low Emittance) as a high-power driver for various types of secondary radiation. Running in a 24/7 mode of operation, ELBE serves as user facility which attracts several hundreds of national and international users per year. Secondary beam lines focus on research in fundamental and applied nuclear physics with MeV X-rays from bremsstrahlung production for nuclear photon scattering, photo-activation, nuclear astrophysics, and energy-selective neutron interactions employing time-of-flight techniques. Electron beams are further used for secondary IR radiation by means of free-electron lasers and sub-ps superradiant THz radiation for materials research at high electric field strengths. Finally, intense secondary beams including hard X-ray production from electron-bremsstrahlung serve as an intense source of positrons by means of pair production. The Mono-energetic Positron Source MePS [1] utilizes positrons with variable kinetic energies for depth profiling of atomic defects and porosities on nm- to µm-scales in thin films. High timing resolutions ($\sigma_t \approx$100 ps) at high average rates ($10^5 s^{-1}$) and adjustable beam repetition rates allow performing high-throughput experiments.
In the presentation, special emphasis will be given on the challenges of this high power radiation source and the advantages for state-of-the-art materials research and other applications.
The MePS facility has partly been funded by the Federal Ministry of Education and Research (BMBF) with the grant PosiAnalyse (05K2013). AIDA was funded by the Impulse- und Networking fund of the Helmholtz-Association (FKZ VH-VI-442 Memriox) and by the Helmholtz Energy Materials Characterization Platform.
[1] A. Wagner, et al., AIP Conference Proceedings, 1970, 040003 (2018).

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