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Novel positron beam generation based on Shanghai Laser Electron Gamma Source

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The Shanghai Light Source has been operated since 2009 to provide synchrotron radiation to 40 beamlines of the electron storage ring at a fixed electron energy of 3.5 GeV. The Shanghai Laser Electron Gamma Source (SLEGS) is approved to produce energy-tunable gamma rays in the inverse Compton slant-scattering of 100 W CO₂ laser on the 3.5 GeV electrons as well as in the back-scattering. SLEGS can produce gamma rays in the energy range of 0.66 –21.7 MeV with flux of $1e+5$ – $1e+7$ photons/s*.

A positron source based on SLEGS is designed to produce positron beams in the energy range of 3 –16 MeV with a flux of $1e+5$ /s and energy resolution of ~7% with an aperture of 10 mm collimator. The positron generated has been simulated by GEANT4, uses a SLEGS gamma injected into a single-layer target, and a dipole magnet deflect positrons. Based on the energy-tunable SLEGS gamma rays, the optimized parameters at each gamma energy were simulated to obtain an energy-tunable positron source.

We have confirmed positron generation in the commissioning. We plan to construct the positron source in the summer of 2024. We present the positron source based on results of simulation and test measurements.

Footnotes

- H. H. Xu, G. T. Fan, H. W. Wang, H. Utsunomiya, L. X. Liu, Z. R. Hao, et al. Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 2022 Vol. 1033 Pages 166742. & Wang, HW., Fan, GT., Liu, LX. et al. Commissioning of laser electron gamma beamline SLEGS at SSRF. NUCL SCI TECH 33, 87 (2022).

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