PEPPo: A Low Energy Source of Highly Spin-Polarized Positrons

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Impressive endeavors over the past 20 years have produced or demonstrated polarized positron beams suitable for accelerator applications, but always dependent on the use of very high (GeV) beam energies to achieve a high-degree of positron spin-polarization. In contrast, this contribution describes the results of a proof-of-principle experiment at Jefferson Lab demonstrating a new method for producing highly spin-polarized positrons by using a low energy (<10 MeV/c) polarized electron beam. The method relies on the successive transfer of polarization from highly spin-polarized electrons first to bremsstrahlung and then to e+/e- pairs produced in a tungsten radiator.

The PEPPo (Polarized Electrons for Polarized Positrons) experiment obtained positrons with spin polarization exceeding 80% by using an 8.2 MeV/c, cw (continuous-wave) polarized electron beam from the CEBAF injector at Jefferson Lab and a 1 mm thick Tungsten radiator foil. Positrons from the resulting electro-magnetic shower in the range of 3.1 to 6.2 MeV/c were collected magnetically and analyzed with a Compton transmission polarimeter that had been calibrated using an electron beam with a known polarization. Details of the experiment, analysis, and Geant4 simulations of the apparatus and polarimeter are described. In addition, implications of this technique for both accelerator and industrial or academic purposes will be discussed.