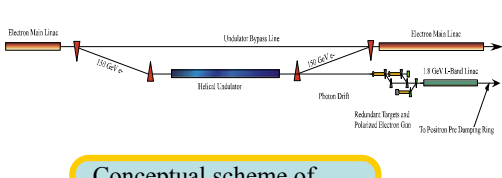


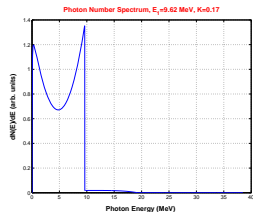
UNDULATOR-BASED PRODUCTION OF POLARIZED POSITRONS

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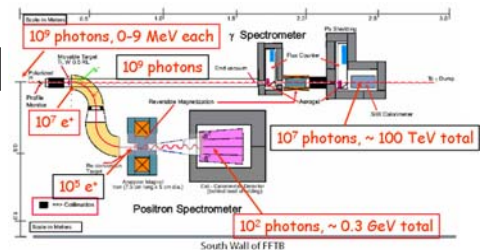
A proof-of-principle experiment (E-166) has been performed in the Final Focus Test Beam at SLAC to demonstrate production of polarized positrons in a manner suitable for implementation at the ILC. A helical undulator of 2.54-mm period and 1-m length produced longitudinally polarized photons of 1st-harmonic endpoint energy = 8.5 MeV when traversed by a 46.6-GeV electron beam. The polarized photons were converted to polarized positrons in a 0.2-radiation-length tungsten target. The polarization of these positrons was measured at several energies, with a peak value of ~ 80% according to a preliminary analysis of the transmission polarimetry of photons obtained on reconversion of the positrons in a second tungsten target.



Conceptual scheme of undulator-based production of polarized positrons.

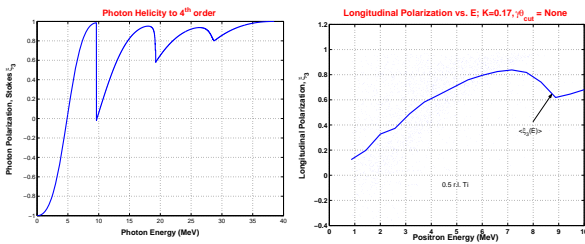


Conceptual layout E-166. 46.6-GeV electrons enter from the left and pass through an undulator to produce a beam of circularly polarized photons of ~ 10 MeV energy. Some of the photons are converted to electrons and positrons in a thin target. The polarization of the positrons, and of the photons, are measured in polarimeters based on Compton scattering of photons in magnetized iron.

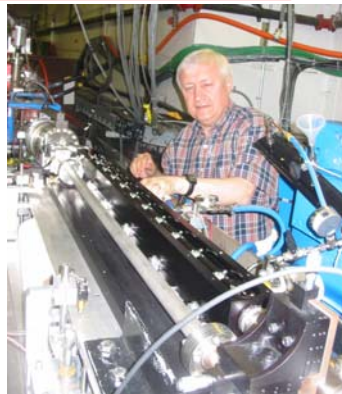


Layout of the E-166 positron generation and photon and positron diagnostic systems. Typical rates are shown at various locations in the apparatus.

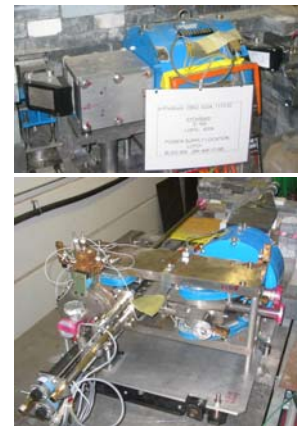
The photon number spectrum of undulator radiation, integrated over angle, for electron energy 50 GeV.



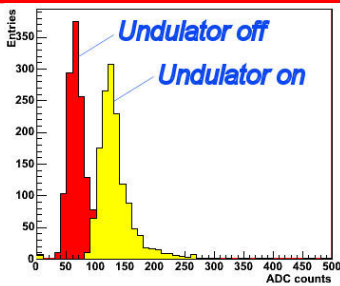
Left: The polarization of the undulator radiation as a function of energy. Right: Calculated positron longitudinal polarization as a function of energy. The solid lines are polarization averaged over a 0.5-MeV energy slice.



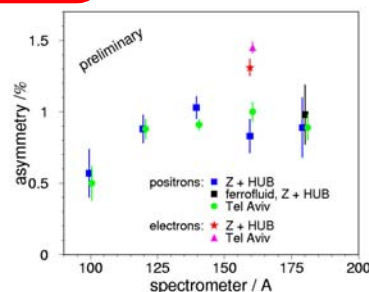
The helical undulator during installation. The undulator bore has an ID of 0.8 mm. Period = 2.54 mm, and K = 0.17.



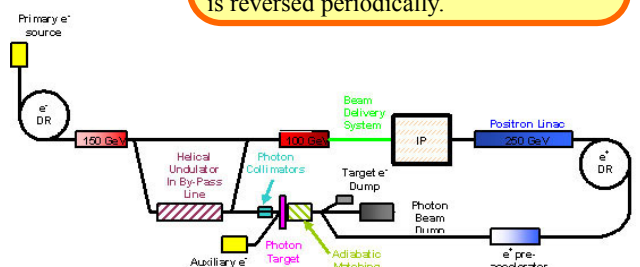
The photon transmission polarimeter (top) and the positron spectrometer and polarimeter (bottom) during installation. The blue objects are the iron-core solenoids whose magnetization is reversed periodically.



Comparison of the signal in the central CsI crystal for single electron beam pulses with undulator on and off. One ADC count is approximately 1.7 MeV.



Preliminary analysis of the positron asymmetry as a function of spectrometer current (100 A ~ 4.5 MeV)



Scheme of the undulator-based source of polarized positrons for the ILC