END TO END SIMULATION OF ILC HELICAL UNDULATOR BASEED POSITRON SOURCE*

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In order to produce high intenisty polarized positron source for the International Linear Collider (ILC), a helical undulator based positron source scheme has been chosen as the baseline design. The front end system has been outlined by Klaus Floettmann[1], as shown in Figure 1, which includes several hundred meters of helical undulator to produce polarized γ rays, a thin titanium target (0.4X) to produce e+, an adiabatic matching solenoid to collect and a pre-accelerator to accelerate the positrons to about 250 MeV. Then the positrons are separated by using a separation magnet set to select the positron with matched phase space for transport into the damping ring. For a complex system such as the ILC positron source, a detailed simulation including helical undulator length effect and drive beam profile, and photon polarization and its selection by a collimator must be considered.

The radiation of helical undulator as a circularly polarized photon source for polarized positron production was first proposed by Alexander Mikhailichenko[2] and then systematically studied by Klaus Floettmann. The scheme has also been investigated by Yuri K. Batygin[3] and John Sheppard[3,4] recently. The properties of helical undulator radiation from a single electron beam have been given analytically[1,4] and can be directly applied to the polarized photon production for idealized cases. But in order to have a better understanding of a real e+ source, there are many practical issues need to be addressed and these practical issues are mostly not suitable for being modeled analytically. Thus we need to perform a systematic numerical study that incorporate many practical issues such as the effect of the phase space distribution of drive electron beam, the effective length of the undulator, effect of a photon collimator and its location on the polarized positron production on the target. The final positron yield as function of these parameters are examined and discussed.

[1] Klaus Flottmann, Investigation toward the development of polarized and unpolarized high intensity positron sources for linear colliders, DESY 93-161

[2] V.Balakin, A. Mikhailichenko, Conversion system for obtaining highly polarized electrons and positrons at high energy, Budker INP 79-85, September 13, 1979

[3] Y.K.Batygin and J.C.Sheppard, Post-target beamline design for proposed FFTB experiment with polarized positrons, Linear Collider Collaboration Tech Note, lcc-0110, December 2002

[4] J. C. Sheppard, Helical Undulator Radiation, Linear Collider Collaboration Tech Note, lcc-0095, July 2002

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