CONTROL OF DIRECTION OF BEAM POLARIZATION

R. Schwitters

A number of ideas for controlling the direction of beam polarization in PEP have been explored during the Summer Study. The natural direction of polarization is positrons aligned parallel to the guide magnetic field and electrons antiparallel. Any arrangement of magnets which does not have time varying fields and operates on both beams will leave the beams polarized antiparallel to one another.

One practical method to circumvent this restriction has been proposed by W. Toner (Rutherford Laboratory Report RL-74-102). This method simply selectively depolarizes one beam thus giving a mixture of parallel and antiparallel spins. It can be used in conjunction with the longitudinal polarized discussed below to provide all possible spin alignments, parallel-antiparallel, longitudinal-transverse. It may be necessary to implement this depolarization technique at PEP to insure unpolarized beam for certain experiments.

The transformation of the normal transverse polarization to a longitudinal polarization seems most easily accomplished with the arrangement of vertical bending magnets proposed in PEP Note 87. A serious disadvantage of this method is the amount of synchrotron radiation power expended in the magnets. To minimize this power, it is necessary to have the longest possible drift space between the final interaction region quadrupoles (Q2-Q3). The present PEP design distance of 20 meters is marginal and depending on the particular experiments desiring longitudinally polarized beams, it may be desirable to lengthen this distance (at the expense of reduced luminosity) or reduce the degree of longitudinal polarization. A 20 meter drift distance is probably sufficient for any "first round" experiments using the longitudinal polarizer. Decisions on lengthening this distance should wait until we have experience operating polarized beams at PEP.