Depolarisation Effects At The ILC

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Spin polarisation will play an important role in the International Linear Collider (ILC) physics program. A polarised electron beam with a polarisation of at least 80% is already foreseen for the baseline machine design. However, in order to fulfill the full physics potential of the ILC, polarised positrons will also be required, and can be provided by a simple upgrade to the baseline positron source. It is important to ensure that no significant polarisation is lost during the transport of electron and positron beams from the sources to the interaction region(s). Therefore all sources of depolarisation between the polarised sources and the interaction region(s) have to be fully understood. Transport elements downstream of the sources which can contribute to a loss of polarization include the initial accelerating structures, the damping rings, the spin rotators, the main linac and the high energy beam delivery system.

The 'heLiCal' collaboration aims to provide a full analysis of all depolarisation effects at the ILC. In recent studies, the depolarisation in the ILC damping rings and in the beam delivery system has been analyzed by using a Monte-Carlo tracking algorithm which simulates the stochastic emission of radiation: namely the code SLICKTRACK. As expected intuitively, the depolarisation in damping rings with carefully corrected orbits is shown to be negligible. However, contrary to popular opinion, it is clear that if the incoming polarisation vector is tilted from the vertical, there is very little decoherence of the horizontal components of the spins during the damping process. This important finding is confirmed by a simple mathematical model.

No noticeable depolarisation is observed in the beam delivery system if good alignment of the magnets is assumed. However the effects of misalignments will require further careful studies.

Depolarisation effects are also expected from the beam-beam interaction. These effects have been evaluated by 'heLiCal' collaboration for a range of the ILC parameter sets.