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Polarimetry at the ILC

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In order to fully exploit the physics potential of the International Linear Collider (ILC), it is important to provide a precise determination of the actual beam polarization at the permille-level. This can only be achieved by combining the fast time-resolved measurements of the laser-Compton polarimeters with an absolute scale calibration of the luminosity-weighted average polarization at the interaction point (IP) calculated from collision data.
The time-resolved polarization is measured by two polarimeters per beam from the differential Compton cross section of a particle bunch with a circular polarized laser. However, those polarimeters are 1.65km before and 150m after the IP. Thus, the measurement has to be extrapolated from the polarimeters to the IP via spin tracking, considering all uncertainties including beam collision effects. In the past, the absolute scale calibration has been studied for different, well known standard model processes individually.
In this study, a unified approach will be presented for the first time, which combines the total and differential cross section measurements from all suitable processes, as well as the expected constraints from the polarimeters considering effects of the spin tracking. Hereby, the statistical and systematical uncertainties are taken into account, including their correlations.
This study shows that a fast spin flip frequency is desired even with a non-perfect helicity reversal because a fast spin flip frequency reduces the systematic uncertainty, while a non-perfect helicity reversal is now compensated within the unified approach. The final goal is to provide a realistic estimated of the luminosity-weighted average polarization at the IP to be used in the physic analyses.

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