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Tau polarization in Z to ditau decays

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Taus are third-generation leptons with a short lifetime, and their decay products offer a unique opportunity: by analyzing the kinematic distributions of these products, it is possible to reconstruct variables that reveal tau polarization. Polarization, which is directly linked to helicity, is a crucial observable that distinguishes between right- and left-handed particles. Moreover, with other observables, polarization information provides valuable insights into Z boson decays to ditau leptons. Through angular momentum conservation, where the Z boson has a spin of one, the two taus strongly correlate with specific helicity combinations. Therefore, studying tau decays allows us to explore the electroweak sector in greater detail.

Polarization variables take advantage of the asymmetry between left- and right-handed tau decays, and they can be used to increase sensitivity in searches for physics beyond the Standard Model, offering a window to study the possible properties of new particles.

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