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Azimuthal single- and double-spin asymmetries in semi-inclusive deep-inelastic lepton scattering by transversely polarized protons

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A comprehensive set of azimuthal single-spin and double-spin asymmetries in semi-inclusive leptoproduction of pions, charged kaons, protons, and antiprotons from transversely polarized protons is presented. These asymmetries include the previously published \hermes results on Collins and Sivers asymmetries, the analysis of which has been extended to include protons and antiprotons and also to an extraction in a three-dimensional kinematic binning and enlarged phase space. They are complemented by corresponding results for the remaining four single-spin and four double-spin asymmetries allowed in the one-photon-exchange approximation of the semi-inclusive deep-inelastic scattering process for target-polarization orientation perpendicular to the direction of the incoming lepton beam. Among those results, significant non-vanishing $\cos\phi - \phi_s$ modulations provide evidence for a sizable worm-gear (II) distribution, g_{1T}. Most of the other modulations are found to be consistent with zero with the notable exception of large $\sin\phi_s$ modulations for charged pions and K^+.

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