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Computer simulation on homogeneity testing for weighted data sets used in HEP

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We introduce several modifications of classical statistical tests applicable to weighted data sets in order to test homogeneity of weighted and unweighted samples, e.g. Monte Carlo simulations compared to the real data measurements. Specifically, we deal with the Kolmogorov-Smirnov, Anderson-Darling and f-divergence homogeneity tests. The asymptotic approximation of p-value and power of our weighted variants of homogeneity tests are investigated by means of simulation experiments. The simulation is performed for various sample sizes and statistical distributions of samples and weights. Finally, our methods of homogeneity testing are applied to Monte Carlo samples and real DATA sets measured at the particle accelerator Tevatron in Fermilab at DZero experiment originating from top-antitop quark pair production in two decay channels (electron, muon) with 2, 3, or 4+ jets detected. Consequently, the final variable selection for these 6 variants of decay channels is carried out and the resulting subsets chosen from 46 dimensional physical parameters are recommended for further top quark cross section analysis. Our variable selections differ from the ROOT TMVA based selection for the top-antitop (electron and muon) decay channels.

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