Abstract:

This report will be devoted to methods of statistical treatment, by which a typical experiment in high energy physics can be analyzed.The result of the experiment is assumed to be a histogram consisting of bins or channels with numbers of corresponding registered events. Events in each channel are expected to be produced either by background processes or by a studied process called a signal. The expected background and expected signal shape or acceptance for a certain full signal rate are measured in a separated auxiliary experiments, or calculated by the Monte Carlo method with finite statistics, and hence with finite precision. The task of the main experiment is to determine the most probable full signal rate, the confidence interval for it and also the significance of the signal+background hypothesis versus the pure background hypothesis. Especially interesting situation arises when some of the expected background channels in the auxiliary background experiment happen to be zero due to either fluctuation of auxiliary measurement or because they are truly zero. It is then unclear both conceptually and numerically how to interpret a non-zero result of the main experiment in this channel. I will show how well this task can be solved by different methods of statistical analysis. A wide range of methods will be discussed, starting from the known Bayesian analysis and ending with the recently proposed CLs techniques. The latter is today used in HEP for search of the Higgs boson and other rare processes.