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Using Integral and Differential Charge Asymmetries for BSM Searches at the LHC

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Contrarily to past high energy colliders, the LHC is a charge asymmetric machine. Therefore most of the hard scattering processes producing electrically charged final states have a positive integral charge asymmetry. The latter quantity, denoted AC, is easily measurable in event topologies bearing an odd number of hard and isolated charged leptons. We have brought to light the strong correlation between AC and the mass of the charged final state. This enabled us to setup a new method of indirect mass measurement [1]. For example, this method enables to measure the mass of the W boson with a 1% accuracy. Obviously this is not competitive with respect to the standard technique based on the W transverse mass. However for other processes where more final state particles escape detection, we've demonstrated the integral charge asymmetry method to be much more effective. We illustrate this in a search for a supersymmetric production of chargino-neutralino pairs decaying in the trilepton inclusive topology. Nevertheless, in order to apply the integral charge asymmetry method, one needs to have a significant excess of signal events over the event yield of the corresponding background processes. We are currently extending this indirect mass measurement method using differential charge asymmetries. In addition to their sensitivity to the mass, the shape of these observables can also be exploited to improve the separation between a signal and its background processes. Our main physics case under study is the production of an heavy W' boson which decays into a single charged lepton. [1] S. Muanza and T. Serre, "A New Method for Indirect Mass Measurements using the Integral Charge Asymmetry at the LHC", JHEP 1604 (2016) 179, arXiv:1412.6695 [hep-ph].

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