DESCRIPTION FOR THE GENERAL PUBLIC

The discovery of the Higgs boson, a major milestone in the quest to understand the fundamental nature of the Universe, required one of humankind's most ambitious scientific projects, the Large Hadron Collider (LHC). However, our ambition does not stop there. The primary reason for this is that the Standard Model (SM) of Particle Physics, which describes the fundamental components of ordinary matter and their interactions, is not yet a "Theory of Everything". Despite its great success in predicting many experimental results, including existence of the Higgs boson, the SM fails to account for a number of interesting phenomena. Among them: it cannot explain the observed matter-antimatter asymmetry of the Universe, it does not give an explanation for the large hierarchy between the weak scale and the Planck scale and does not provide a good candidate for dark mater. New physics Beyond the Standard Model (BSM) is needed to solve these and other open questions. However, because there is no clear signal of BSM physics at the LHC and we do not have solid theoretical guidance where to look for it we need a sort of *deus ex machina* which according to the Oxford dictionary is "an unexpected power or event that saves a situation that is very difficult or even seems to be impossible to solve". More precisely, we need a QCD ex-Machina since the current precision of our predictions for the LHC is limited by our understanding of the theory of strong interactions: Quantum Chromodynamics (QCD). This fascinating theory has many unresolved problems which will be the topics of the project. Let me stress that in order to study the complex final states of hadron-hadron collisions, numerical computer simulations using Monte Carlo techniques are the only realistic approach. It is because in practice, there is a huge gap between a one-line formula of a fundamental theory, like the Lagrangian of the SM, and the experimental reality that it implies. Genera Purpose Monte Carlo (GPMC) event generators are designed to bridge that gap. One can think of a GPMC as a "Virtual Collider" that produces simulated collisions similar to those that are produced in the actual LHC experiments, and therefore its results can be directly compared against the experimental data. This is the reason why the GPMC event generators are central to high energy physics (HEP) and are an indispensable part of HEP experiments. Almost all measurements and discoveries in the modern era have relied on GPMC generators. Therefore, it is very important to improve the precision of these "Virtual Colliders" which is the aim of the project.