

## DESCRIPTION FOR THE GENERAL PUBLIC

The Large Hadron Collider (LHC) at CERN, the European Organization for Nuclear Research in Geneva, is the largest particle accelerator ever built. It allows us to study the structure of matter and interactions of its fundamental constituents with unprecedented precision. In July 2012 two experiments at LHC, ATLAS and CMS, announced the discovery of the Higgs boson. Existence of this particle was predicted over 50 years ago and its discovery proves the validity and consistency of the Standard Model – theory which was developed over the last 50 years to describe all known elementary particles and their interactions (except for gravity, which is not relevant on the microscopic scales). Still, we do believe that the Standard Model is not the ultimate “theory of everything”. Not everything can be explained and described in the Standard Model, as for example the existence of the Dark Matter, neutrino masses or the observed matter-antimatter asymmetry in the Universe.

There are many possible ways to improve, extend the Standard Model and many new theories were proposed, predicting existence of new particles or interactions. Many such theories, in particular the so called supersymmetric models suggest that new particles should have masses at the TeV scales (about thousand times heavier than the proton), within the kinematic reach of LHC. Unfortunately, no such state was observed at the LHC so far. They can be more massive, but it could also be that the new particles do not perceive the strong interaction, the interaction which bind quarks and gluons inside protons colliding at LHC. If this is the case, these states can not be easily produced in proton-proton collisions and we need to consider other options for discovering them.

Compact Linear Collider (CLIC) is considered as one of the most realistic and promising scenarios for the next large infrastructure at CERN. It is also complementary to the LHC, as it collides electrons with positrons, particles which interact with electromagnetic and weak forces only (contrary to the LHC, where strong interactions dominate). Therefore, there are many possible scenarios when new particles not accessible at LHC can be produced at CLIC. The main goal of the proposed project is to investigate such scenario and provide a detailed description of the CLIC potential to measure possible effects due to processes beyond the Standard Model (BSM). The detailed analysis of the BSM physics case for CLIC is crucial for the decision on the CERN future and we plan to prepare corresponding results for the next update of the European Strategy for Particle Physics, which is currently planned for 2020.

We plan to review available theoretical models and experimental constraints imposed on them, to select three models accessible at CLIC for detailed analysis. The analysis will be based on detailed computer simulation of the electron-positron scattering processes, particle interactions in the detector and detector response. Resulting data are then processed with dedicated event reconstruction procedure allowing us to reconstruct single particles in the detector, measure their momenta and energies, identify the particle type. Processing of large event samples require a lot of computer time, but can be performed efficiently using the distributed computer grid resources available for CERN users from the European Grid Infrastructure (EGI) and Open Science Grid (OSG) from US. Based on the reconstructed event information one can try to discriminate between the “signal” of “new physics” beyond the Standard Model and the known “background” (all processes predicted by the Standard Model). Most efficient discrimination can be obtained when using machine learning.