

The upgrade program of the major experiments at LHC

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After a successful data taking period at the CERN LHC by the major physics experiments (ALICE, ATLAS and CMS) since 2009, a long-term plan is already envisaged to fully exploit the vast physics potential of the Large Hadron Collider (LHC) within the next two decades. The CERN accelerator complex will undergo a series of upgrades leading ultimately to increase both the collision energy and the luminosity, thus maximizing the amount of data delivered to all experiments.

As a consequence, the experiments have also to cope with very high detector occupancies and operate in the hard radiation environment caused by a huge multiplicity of particles produced in each beam crossing. In parallel to the accelerator upgrades, the LHC experiments are planning various upgrades to their detector, trigger, and data acquisition (DAQ) systems. The main motivation for the upgrades is to extend and to improve their physics program also in the increasingly challenging LHC environment. For such reason, the LHC experiments are currently involved in an intense R&D activity aimed at developing new technologies, to replace part of the existing detectors by new devices, or to implement entirely new detector systems with higher performance.

The upgrade program is planned in three phases, which correspond to the three long, technical shutdowns of the LHC accelerator. Phase-0 (~ 24 months) will take place in 2013 and 2014, the Phase-I (~ 12 months) will be during 2018, and finally, the Phase-II (~ 24 months) is scheduled for 2022-2023.

Running proton and heavy ion beams with a higher luminosity is a great challenge for all the LHC experiments. This task will require significant detector optimizations, changes and improvements, which are the subject of this contribution. A general overview of the upgrade program of the major experiments at LHC will be given, with some additional details concerning specifications and physics program of specific new detector subsystems.