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Simulations of electron-cloud heat load for the cold arcs of the CERN Large Hadron Collider and comparison with measured data

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Abstract content

The CERN Large Hadron Collider (LHC) has become a very successful discovery machine. On 4 July 2012 the discovery of a new particle was announced, a candidate to be the famous Higgs boson. This extraordinary discovery was possible due to the excellent performance of the machine. However, an electron cloud and related effects have been detected in the LHC and have proven to be a problem for the optimal performance of the LHC and a limitation to reach its nominal design operation. Inside the LHC vacuum chamber, either by ionization of residual gas or photoemission due to the beam synchrotron radiation, a collection of electrons are created and after amplification via secondary emission a substantial electron cloud may be generated along with its undesirable effects. A large concern, for the safe LHC operation is the additional heat load due to the electron cloud because it can overcome the limited cooling capacity and provoke a loss of the superconducting state in the bending magnets of the cold arcs of the LHC (a so-called “quench"). This work presents simulations of the electron-cloud heat load in the LHC. I discuss the heat load for the nominal design operation parameters. A comparison with measured data from 2010 to 2012 is also presented.

Summary

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