

Experience with first full year of LHC operation

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The LHC produced first pp physics collisions at 7 TeV in March 2010, starting with a luminosity of about $8 \cdot 10^{26}$ Hz/cm² and finally reaching $2 \cdot 10^{32}$ Hz/cm² in October 2010; thus brilliantly surpassing the fixed target.

This paper reviews the 2010 and 2011 physic runs, highlighting the major achievements obtained during this period. Moreover, a summary of the dynamic vacuum observations detected during the physics runs is outlined. In particular, the impact of the synchrotron radiation during energy ramp, after accumulation of dose and along the LHC ring is reviewed. Furthermore, the detected electron cloud effect and a description of the pressure rise noticed in common and single vacuum beam pipes with beams of 50 and 75 ns bunch spacing at energy of 450 GeV are discussed. The effects of bunch intensity and different filling schemes on the vacuum levels are also compared. Simulations taking into account the effective pumping speed at the location of the vacuum gauge are introduced and, as a consequence, the different vacuum levels observed along the LHC ring are explained.

Finally, different kinds of interventions in NEG activated vacuum beam pipes are described and an innovative pure Neon venting system is discussed that enables venting the vacuum beam pipes to atmospheric pressure, without losing the NEG pumping speed performances.