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LHC experience with different bunch spacings in 2011 (25 , 50 & 75 ns)

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LHC operation in 2011 had a smooth start in March with 75ns beams and only one month later moved to 50ns beam, after a successful dedicated scrubbing run. Several observables, such as pressure rise, heat load in the arcs, beam instability, emittance growth and synchronous phase shift, clearly pointed to the presence of an electron cloud inside the machine during the first days of operation with 50ns beams. The gradual reduction of all these effects, and their eventual disappearance, over the days of the scrubbing run, indicated electron cloud mitigation and allowed physics production to shift to 50ns beams. Up to the end of the run the quality of the 50ns beams was increased by regular stages (first lower transverse emittances, then higher intensities) and they could provide steadily improving peak luminosities. Furthermore, 4 MD sessions with 25ns beams took place in the period June-October, but the quality of these beams was always deteriorated by severe electron cloud effects. However, a clear improvement was noticed also with the 25ns runs. An estimation of the present state of conditioning of the machine and the required scrubbing time can be inferred from electron cloud simulations compared with measured data.

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