

A LLRF implementation to Extend the Present LHC RF System to High-Lumi Beam Currents

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The LHC RF/LLRF system is currently setup to achieve extremely stable RF voltage (in amplitude and phase) to minimize transient beam loading effects. The available klystron forward power would limit the LHC performance to nominal beam current with the present operational scheme. For beam currents above nominal (and possibly earlier), the cavity phase modulation by the beam (transient beam loading) will not be corrected, but the strong RF feedback and One-Turn Delay feedback will still be active for RF loop and beam stability in physics. To achieve this, the voltage set point should be adapted for each bunch. This work presents the theoretical background, simulation studies, test-bench evaluation, and measurements with beam in the LHC of a new iterative algorithm that adjusts the voltage set point to achieve the optimal cavity phase modulation which minimizes klystron forward power requirements.

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