

Low Level RF Workshop 2022



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Very Low Noise Receiver Technology for Digital Beam Position and Phase Detection

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Recent studies showed that the transverse feedback system noise floor in the Large Hadron Collider (LHC) must be reduced by at least factor of two in order to operate the machine with large beam-beam tune shift as foreseen in the High Luminosity (HL) LHC. Also, the future feedback system foreseen to suppress the LHC Crab Cavity noise relies on improved noise performance of the beam position measurement system. An upgrade program was launched to lower the LHC transverse feedback system noise floor mainly focusing on a new generation, very low noise beam position measurement module. Innovative methods in the RF receiver, digital signal processing, thorough optimization of every element in the signal chain from pickup to the kickers allowed to achieve a significant reduction of the system noise floor. This unprecedented noise performance opens also new possibilities for auxiliary instruments, using the position data from the transverse feedback. The contribution presents the new RF receiver architecture, with notable implementation details which allowed to lower the measurement noise floor by more than a factor 6 and obtain the required system noise performance.

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