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## RF synchronization and phase recovery using a White Rabbit network for the Large Hadron Collider (LHC) at CERN

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During LHC operations, RF signals are crucial not only for accelerating cavities but also as a clock for experiments, beam instrumentation and the new Crab cavities. We propose a highly scalable method for synchronizing RF generation across the LHC complex, enabling automatic phase recovery.

In the upcoming long shutdown (LS3), scheduled in the period 2026-2028, the analog RF distribution will be replaced by a White Rabbit (WR) network. This network will provide sub-nanosecond clock synchronization, temperature compensation and the RF over Ethernet (RoE) protocol, which facilitates the transmission of Frequency Tuning Words (FTW) and phase information.

In this presentation, we will explore the system architecture and the mechanism used for generating and recovering the RF phase in distributed nodes.

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