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## **The CERN SPS Low Level RF: embedded acquisition system for the Cavity-Controller and Beam-Control commissioning and diagnostics**

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The CERN SPS Low Level RF (LLRF) has undergone a major upgrade, including the complete redesign of the 200MHz Cavity-Controller and the Beam-Control during the Long Shutdown (2018-21). This upgrade was motivated by the required doubling of the beam intensity in the SPS for the High Luminosity LHC project (HL-LHC). This paper covers the embedded acquisition core used in both the 200MHz Cavity-Controllers (one per cavity) and the Beam-Control systems. These acquisitions measure the internal signals of the LLRF inside the Field Programmable Gate Array (FPGA) such as cavity voltages, amplifier power, beam phase and radial position, synchro loop error, all essential for the beam commissioning. The embedded acquisition core allows standard decimation or peak detection of any signal and can also provide a turn-per-turn decimation to track the evolution of selected bunches through a longer time scale. The latter can be used to study Coupled-Bunch Instability (CBI) growth rates or longitudinal diffusion.

The described embedded acquisition architecture and some advanced features accelerate the commissioning and offer new beam observation which greatly improves the operational efficiency of the accelerator.

### **Funding Agency**

### **Footnotes**

### **I have read and accept the Privacy Policy Statement**

Yes

**Primary author:** EGLI, Julien (European Organization for Nuclear Research)

**Co-authors:** BAUDRENGHIEN, Philippe (European Organization for Nuclear Research); HAGMANN, Gregoire (European Organization for Nuclear Research); SPIERER, Arthur (European Organization for Nuclear Research); SUMINSKI, Maciej (European Organization for Nuclear Research)

**Presenter:** EGLI, Julien (European Organization for Nuclear Research)

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