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Low-level RF consolidation of the CERN PS Complex machines

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The CERN PS complex comprises machines belonging to the Large Hadron Collider (LHC) injection chain, such as the Proton Synchrotron Booster (PSB), the Proton Synchrotron (PS) and the Low Energy Ion Ring (LEIR), as well as the Antiproton Decelerator (AD). These machines share several characteristics, such as a wide frequency swing between injection and extraction, mostly low-frequency cavities (few MHz) and large synchrotron tunes. In addition, a high dynamic range (over 60 dB) in the cavity voltage control loops is often required, as well as full system configurability to allow for complex RF gymnastics, whose requirements evolve with time. The RF group has chosen to consolidate the low-level RF (LLRF) systems of these machines to improve the machine operation whilst reducing the maintenance effort. To this aim, a dedicated LLRF family based upon digital technology and digital signal processing has been deployed in 2005 in the LEIR machine. A mightier version of the family is currently under development and will be deployed in the PSB from 2012 onwards. This will also allow test and control of new cavity types, included in the high-level RF consolidation program. Last but not least, it will be applied to the recently-approved Extra Low ENergy Antiproton (ELENA) ring. We describe here the main building blocks of this LLRF family. Beam results obtained over the years in the LEIR and PSB machines are also shown, together with hints on the future challenges and plans.

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