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Revolution frequency invariant reconstruction of bunch profiles in fixed frequency clock systems

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During the last few years, the LLRF systems of all CERN small synchrotrons (PSB, LEIR, AD, ELENA) have been upgraded to a fixed frequency clock scheme. As a result, the beam profiles obtained from the digitization of pick-up signals will have a different number of samples as the revolution frequency varies. In this work, we present a method to reconstruct the time-domain signal of the bunch profile by using the demodulated values of 16 harmonics of the revolution frequency. This method uses a digital Multi Harmonic Local Oscillator (MHLO) efficiently using the FPGA resources and individual demodulators with out-of-band filtering. The constant number of samples for the bunch profiles allows a better visualization of the evolution of the bunch shapes during the cycle.

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