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Experimental results on longitudinal RF beam phase feedback in the heavy-ion synchrotron SIS18

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In the SIS18 heavy-ion synchrotron at GSI, RF beam phase feedback systems are developed and tested with beam for the damping of coherent longitudinal bunch oscillations. In particular, a beam phase control system is currently commissioned for the damping of longitudinal dipole oscillations. The feedback system has to cope with both, a large RF frequency span (400 kHz to 5.4 MHz) and synchrotron frequencies of up to 6 kHz. It has to be compatible with several beam manipulation schemes such as dual-harmonic, bunch merging, and bunch compression. The system relies on recent upgrades of the SIS18 LLRF topology including a newly developed multi-purpose DSP system that is used for the RF cavity synchronization as well as for RF beam feedback. This paper describes the LLRF concept of the RF beam phase feedback at SIS18 and presents results from machine experiments with beam where an adaptive feedback filter for damping longitudinal dipole oscillations during the whole SIS18 machine cycle was realized and successfully applied. Finally, an outlook will be given towards the full integration into the central control system and towards the SIS100 bunch-by-bunch longitudinal feedback system.

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