# Project status of the new setting generation system for GSI and FAIR

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The progress made on the new setting generation system for FAIR and GSI regarding machine modeling and application development is reported.

In 2014, the main activities were related to benchmarking tests of the SIS18 machine model and support for other technical groups during machine experiments. In this context, the new settings generation system proved extremely useful. In fact, it was essential for the realization of several machine development studies, which required operation schemes impossible to achieve with the present settings generation software SISMODI. In particular, the following machine experiments depended on the use of the new settings generation system: (i) Commissioning of the first module of the new MA cavity with beam and (ii) bunch merging studies using different merging times and amplitudes (both conducted by PBRF); (iii) multi-turn injection studies using a variable angle of the orbit bump at the electrostatic septum and (iv) resonance compensation studies employing a tune ramp with captured beam on the injection or extraction plateau (latter two conducted by PBBP). In all cases, the settings generation system excelled in providing control over the machine as requested by the respective experimentators. Below, a detailed report is given about the bunch merging and resonance compensation experiments.

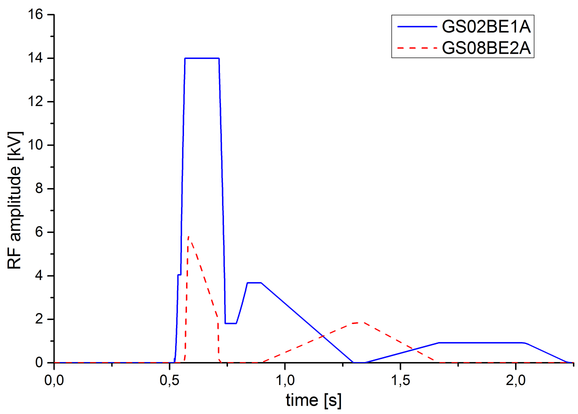


Figure 1: RF amplitudes of the two ferrite cavities in SIS18 for a cycle with two merging steps ($4 \rightarrow 2 \rightarrow 1$).

Because the cavities can be switched on and of sequentially with the new settings generation system, it is possible to combine ramping at full speed and bunch merging (see figure 1). Thus, at the end of the ramp one cavity is always available for the first bunch merging step. Also, the merging times are freely adjustable. This flexibility was extensively used to allow the RF department to test the performance of the bunch merging procedure as a function of the merging times.

The new system was also very helpful for resonance compensation measurements. Using the generic Java interface to the settings, it was possible to perform semi-automated parameter scans of tune and sextupole strengths. Up to 100 settings per hour were established. For each setting, the beam current was read out and saved for analysis. Figure 2 shows some of the recorded current readings, each curve corresponding to a different sextupole setting for a fixed tune. The current drop is a measure for the degree of compensation of the resonance.

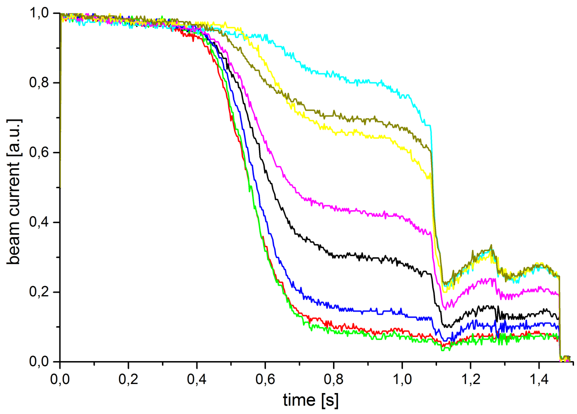


Figure 2: Beam current for different degrees of resonance compensation through variation of the sextupole strengths.

Besides the extensive support of the machine experiments, several development activities were pursued. Especially the work on the machine model for the CRYRING was continued with the main focus on the injector. Particular emphasis was put on modeling the RFQ structure, serving as a prototype for a generic cavity in linear accelerators.

Regarding applications, the development of the LSA version of the ion optics code MIRKO was continued. A satisfactory integration into the control system development environment was established. Concerning the steering and orbit correction program YASP, a collaboration with CERN was established to realize the integration into the FAIR control system.

## References

[1] G. Franchetti et al., “Recent development in mitigation of long term beam loss”, HB2014.

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