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. Developments of the LSA framework [1] are presented as part of the report on the development of the FAIR control system software [2].

Machine modeling

A major topic regarding machine modeling was the development of a generic model for longitudinal bunch manipulations in synchrotrons such as bunch merging and batch compression. These manipulations are implemented by operating the RF system at multiple harmonics, resulting in complex patterns of variation for frequency, amplitude, and phase of the individual cavities. An algorithm was implemented which allows the definition of any combination of merging and compression steps in any machine.

As an example, the proton stacking and compression scheme in SIS100 is described: The proton beam is accumulated by filling 4 out of 10 buckets with 4 injections from SIS18. After that, a combination of merging and compression steps is applied to gather the complete beam in a single bunch at harmonic number 5. The scheme uses two groups of RF cavities. Fig. 1 shows the temporal evolution of RF voltage and harmonic number h for one cavity of each group during this process.

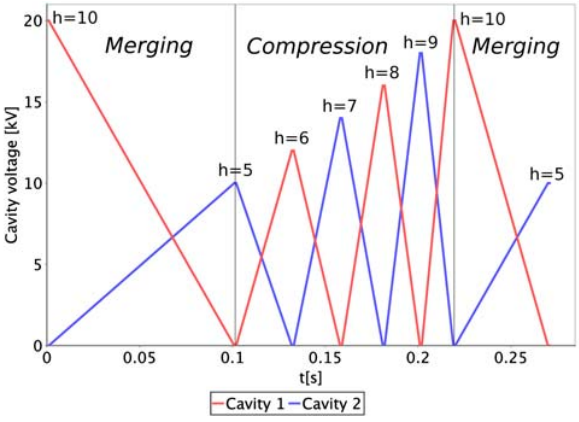

Figure 1: RF voltages for the creation of a single proton bunch in SIS100 at the injection level.

Another important topic concerned the implementation of a machine model for CRYRING, which will be controlled by a prototype of the new FAIR control system. In 2013 data on the ring hardware, such as power supply properties and magnet calibration data, and the ion optical layout, was imported into the LSA database and a hierarchy of relevant parameters created. Operational cycles were defined and corresponding set values calculated for all devices, starting from physics quantities like beam energy.

Fig. 2 displays the current in the main bending magnets for the acceleration of a proton beam from 300 keV to 30 MeV. In the second half the current is set back to the injection level again.

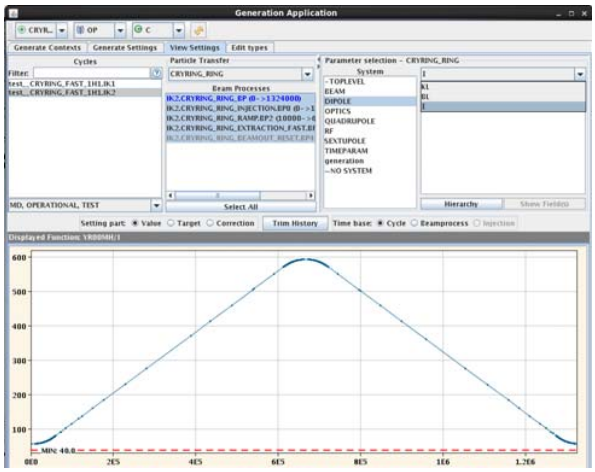

Figure 2: Control system application displaying the current in the main magnets for a CRYRING cycle.

Applications

The development of the Java version of MIRKO was continued. On the one hand, the functionality for its use as an online steering tool was implemented. On the other hand, significant effort was put into the further integration into the LSA development and build environment.

Another important activity concerned the adaptation of the application YASP from CERN for closed orbit correction in rings to the FAIR control system. This application is intended to become a standard tool in FAIR. This work will be continued in the coming year.

References

[1] G. Kruk et al., "LHC Software Architecture LSA – Evolution Toward LHC Beam Commissioning", ICALEPCS'07.

[2] J. Fitzek et al., "Status of the software development for the FAIR accelerator control system", this report.

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