Project Status of the New Setting Generation System for GSI and FAIR

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Introduction

Since 2008, a project group at GSI is developing a setting generation system for the accelerators of GSI and FAIR using the CERN LSA (LHC Software Architecture) framework [1]. This report summarizes the development progress during the year 2012.

LSA Framework

There were no major changes to the LSA framework. However, a strategy was devised within the LSA collaboration for the design and implementation of the pattern concept required for modeling the parallel operation modes of the FAIR facility. It was agreed that the implementation of this eminently important extension will take place during the long shutdown of the LHC this year.

Also, a first step was made towards a better separation of the FAIR specific resources and the common LSA framework. While the latter will remain hosted at CERN, all FAIR specific resources are now located in a repository of the GSI controls group.

Machine Modeling

The generic synchrotron model was adapted to make use of the recently implemented LSA support for flexible cycle lengths. The models for SIS18 and SIS100 were revised and improved.

The SIS18 machine model was used to perform machine experiments with and without beam for the planned booster operation mode. One experiment was devoted to the dual harmonic operation. Dual harmonic buckets could be successfully established at injection level. Acceleration was, however, not possible due to an insufficient phase calibration of the acceleration cavities.

A second experiment was performed to test a new parametrization of the optics change from triplet to doublet during the ramp. At the ramping speed of $10\,\mathrm{T/s}$ for the booster operation, the voltage of the triplet power supply would exceed its limit by fifty per cent. The booster parametrization escapes this limit by reducing the triplet strength faster (see figure 1). However, this scheme implies larger beam radii during the ramp, potentially leading to beam loss. Therefore, the number of particles as a function of time was measured with a U^{28+} beam of high intensity at $3\,\mathrm{T/s}$, for both the standard and the booster parametrization. No excess beam loss was observed, proving the feasibility of the booster parametrization (see figure 2).

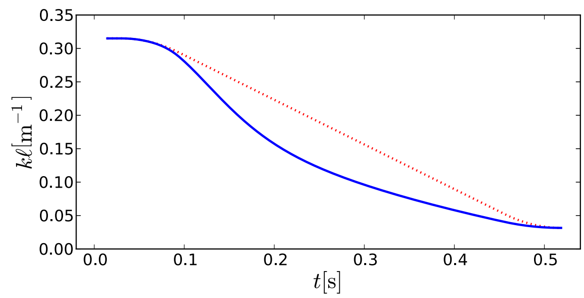

Figure 1: Triplet strength for the standard (dotted line) and booster (solid line) parametrization.

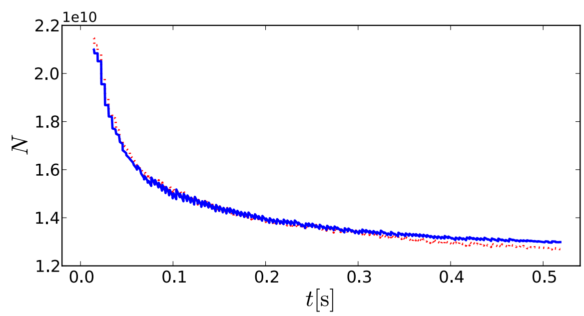

Figure 2: Normalized number of particles for the standard (dotted line) and booster (solid line) parametrization.

An experiment without beam was concerned with the capabilities of the power supplies at $10\,\mathrm{T/s}$. As a result, the supplies for the triplet and for the bump at the magnetic septum will be upgraded to sustain the booster operation.

Besides the work for SIS18, a minimal model of the ESR ring (without cooler yet) was implemented and the first settings have been generated.

Apart from the machine models, applications were further developed. The first one, ParamModi, was used extensively during the machine experiments for controlling SIS18. The second one, a Java version of the ion optics program MIRKO, was successfully converted into an application interacting with the LSA system.

In 2013, the main focus will be on the extension of LSA to support the pattern concept for parallel operation.

References

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