

LLRF system for the HIE-Isolde

Tuesday, 1 October 2013 14:50 (20 minutes)

The HIE-ISOLDE project is a major upgrade of the ISOLDE and REX-ISOLDE (radioactive nuclear beams) facilities at CERN. The most significant improvement will come from replacing most of the existing REX accelerating structure by a 40 MV superconducting linac based on 32 independently phased superconducting quarter-wave resonators (cavities). The new linac will raise the energy of post-accelerated beams from 3 MeV/u to over 10 MeV/u. The resonators operate at a frequency of 101.28 MHz and at a relatively high Q, providing an operational bandwidth of only a few Hertz. The resonators are tested and conditioned at their intrinsic Q providing bandwidth only of a fraction of a Hertz.

A new, fully digital LLRF system is being developed to operate the cavities at 0.2°/0.2% field accuracy. The very narrow resonator bandwidth introduces specific problems in cavity conditioning, measuring their parameters and the operation. A mechanical tuning system with a fraction of a Hz resolution and low microphonics is being developed to tune the cavity to the desired frequency. Lorentz force detuning of the tuning plate makes the cavity power up sequence, fast set point changes, as well as recovery from a sudden field loss very challenging. The cavity needs to be started up with a self-excited loop, undergo the mechanical resonant frequency tuning and be glitch-lessly handed over to the generator driven mode. The system design is presented along with the challenges and first results obtained on a cold cavity.

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Session Classification: Session 4 Systems