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LLRF and Longitudinal Diagnostics Implementation for CERN's ELENA Ring

CERN's Extra Low ENergy Antiproton (ELENA) ring is a new synchrotron that will be commissioned in 2016 to further decelerate the antiprotons coming from CERN's Antiproton Decelerator.

ELENA's LLRF will implement beam phase, radial and extraction synchronisation loops. A cavity voltage and phase loop will also be implemented.
Essential longitudinal diagnostics include the intensity measurement for bunched and debunched beams and the measurement of Dp/p for debunched beams to assess the electron cooling performance. Two approaches are envisaged to satisfy the longitudinal diagnostics needs. The baseline system for providing the required beam parameters is based upon ultra-low-noise AC beam transformers, adapted from those successfully used in CERN's AD, and associated digital signal processing. The beam signal needed by the LLRF to implement its phase loop will also be generated by these ultra-low-noise AC beam transformers. A novel method for calculating the required beam parameters is also envisaged; this includes combining signals from the twenty electrostatic pick-ups (PU) used for orbit measurements to improve the signal-to-noise ratio, so that the many electrostatic PUs will function as a single, distributed PU from the processing system viewpoint. For both approaches the digital signal processing will be carried out with the leading-edge hardware family used for ELENA's low-level RF system.

This poster provides an overview of ELENA's LLRF system and of the two longitudinal diagnostics approaches.

Author: Mrs ANGOLETTA, Maria Elena (CERN)

Co-authors: Mr MOLENDIJK, John (CERN); Mr SANCHEZ-QUESADA, Jorge (CERN)

Presenter: Mrs ANGOLETTA, Maria Elena (CERN)