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Hidden Magnets Measurement and Alignment System for a High Radiation Area at FAIR –Part I: Requirements, Concept and General Overview

The Super-FRS, one part of the accelerator beamlines of the new Facility for Antiproton and Ion Research FAIR, presents an enormous challenge in terms of alignment maintenance: its magnets environment will be completely enclosed after the initial adjustment of the machine. In future the magnets will not be accessible anymore because of high radiation. For this reason, the positions of the magnetic structure must be checked and realigned “blindly”, using only a few 110 mm diameter holes on the ceiling. Fiducials on the magnets will be reached only indirectly from a working tunnel above the accelerator tunnel. To that end, a novel hidden point measurement system, called Fiducial Bars System (FiBS), has been created that meets the absolute requirement on radiation resistance too. Besides the hardware, a number of customized carbon fiber rods, the system is also intended to comprise software, which would perform fast calculations of the hidden magnet point coordinates based on the reference points on each bar. Dedicated algorithms will include an estimation of the 3D position and orientation of the magnet itself, outputting directly the amount of movement that needs to be executed by specially developed adjustment rods also handled from the working tunnel above. This work will detail its specifications, the general measurement procedure, all the still necessary steps until it is operational, and finally, some ideas regarding system maintenance. The project has passed a prototyping phase and is currently being tested, with all bars and counterparts already manufactured and calibrated.

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