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## Hidden Magnets Measurement and Alignment System for a High Radiation Area at FAIR –Part III: Photogrammetric Approach

The FAIR project, as already introduced in other works, will demand the proposition of new alignment solutions to overcome issues such as limited working space around magnets and very restricted access to accelerator tunnels. For the Super-FRS machine, for example, the FiBS measurement scheme was envisaged to allow one to estimate the pose of the obstructed components and perform the necessary adjustments. In terms of the metrology apparatus and the technology involved, a few alternatives have been tested and compared, especially the use of laser trackers to estimate the obstructed lines-of-sight points. This could be achieved indirectly, observing fiducials on long bars, or using a more direct approach, by using a handheld probe. A third technique is investigated in the present work, which consists of using photogrammetry to measure the calibrated bars. This methodology requires additional calibration steps and a few adaptations on the working environment, but could potentially lead to a faster procedure. Additionally, the measuring principle may represent a suitable routine to perform health checks and intermediate periodic verifications on the FiBS. This last application is also studied experimentally within this work.

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