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Optical Measurements under Cryogenic Conditions on Superconducting Components without View Ports

A special task on superconducting magnets for FAIR is the determination of positional deviations of already built cryogenic components to its cryostat in different conditions (@ 293K and 4K) without the possibility of using view ports. Especially the almost non-existent opportunity to adapt the finished magnet design for measurement purposes is a challenge.

We are currently developing a method to perform multiple combined 1D interferometer measurements in a cryostat.

Using the Absolute Multiline System (AMS) from ETALON (group of HEXAGON), we made preliminary analyses regarding the reasonable configuration of the measurement lines to obtain 3D information. Modifications to the design of the cold mass or the surrounding cryostat to mount the AMS equipment are almost impossible. Furthermore, the AMS components were adapted to vacuum compatibility and cold conditions. The system tests were performed under nearly real operating conditions, i.e. the regular site acceptance tests for the superconducting quadrupole module of the future SIS100 synchrotron were running simultaneously. The achieved accuracy in cold condition was verified by comparing the results with Laser Tracker measurements. The poster shows both successes and failures in the development of the concept.

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