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Designing a Magnetic Measurement Data Acquisition and Control System with Reuse in Mind: A Rotating Coil System Example

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Accelerator magnet test facilities frequently need to measure different magnets on differently equipped test stands and with different instrumentation. Designing a modular and highly reusable system that combines flexibility built-in at the architectural level as well as on the component level addresses this need. Specification of the backbone of the system- the interfaces and dataflow for software components and core hardware modules - serves as a basis for building such a system. The design process and implementation of an extensible magnetic measurement data acquisition and control system are described, including techniques for maximizing the reuse of software. The discussion is supported by showing the application of this methodology to constructing two dissimilar systems for rotating coil measurements, based on the same architecture and sharing core hardware modules and many software components. The first system is for production testing 10 m long cryo-assemblies containing two MQXFA quadrupole magnets for the High Luminosity LHC (HL-LHC) upgrade and the second for testing one-of-a-kind conventional chicane magnets built for the ORNL Proton Power Upgrade project.

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