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Challenges in Instrumentation and Diagnostics for Nb3Sn magnets

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In the past 15 years accelerator magnet development focused on Nb3Sn magnet technology, reaching a mature state for 11T dipole magnets and MQXF quadruple magnets built at CERN and in the US LARP and AUP programs. Instrumentation and diagnostics methods reached maturity with state of art Quench Antenna, rotating coil magnetic measurements, high precision voltage measurement on full coils, strain measurements, fiber optics, etc. Quench localization methods have been improved strongly in Cosθ magnets using the harmonic quench antenna in the bore of the magnet. With a coil length of up to 7 meter long and reduced instrumentation when the magnets are in operation in the HL-LHC, it is important to be able to do diagnostics on only the few voltage signals that can be retrieved.
Through the past years, the HFM program has been launched and many model magnets use block coil technology, either in racetrack configuration or with flared ends. With the existing technology it has been very difficult to identify the location of a quench with high enough precision, since quench antenna seem less sensitive to quenches in the coil block and can sometimes not be deployed due to absence of a bore.
Repetitive flattop quenches were found in some magnets and it proves difficult to describe its exact origin and the diagnostics methods will be discussed.
In this presentation examples of recent challenges in Nb3Sn magnet diagnostics will be discussed, including a discussion on possible instrumentation and diagnostics solutions. This presentation is intended to start a fruitful workshop discussion.

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