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Fri-Mo-Or1-04: Quench Protection for a Four-Layer Nb3Sn Cos-Theta Dipole in the CERN High Field Magnet R&D Program

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The High Field Magnet (HFM) R&D program at CERN aims to find technological solutions for the construction of accelerator magnets to be installed in future post-LHC colliders. The Italian Institute of Nuclear Physics (INFN) and CERN are collaborating to design and fabricate a new four-layer Nb3Sn cos-theta dipole able to achieve a bore field of 14 T with at least 20% of margin on the loadline. The magnet will be fabricated as a short model to demonstrate the feasibility of the technology, but the engineering solutions are thought to be adopted to a longer version as well, in view of the production of a full prototype ready to be installed in an accelerator. One of the main challenges of the long Nb3Sn accelerator magnets is the quench protection system. Usually, the high energy density cannot be extracted with standard solutions, therefore the quench protection system must be optimized properly considering all the fault scenarios.

In this paper, we describe different options for quench protection systems for the short model design, considering the impact of extrapolating the results for a longer version of the magnet. The efficiency of the protection systems presented will be discussed, considering the safe values for hot spot temperature and voltages chosen for this magnet.

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