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Analysis of the Training Behaviour of the MICE Spectrometer Solenoid

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Muon ionization cooling is theoretically well understood but has never been fully demonstrated experimentally. Ionization cooling is regarded as an important technology both in terms of cost and performance for a Neutrino Factory and is absolutely essential for a Muon Collider. The MICE experiment (Muon Ionization Cooling Experiment), based at the Rutherford Appleton Laboratory in the UK, is presently collecting data to prove the concept. Part of MICE are two spectrometer magnets, each consisting of five superconducting large bore solenoids. The spectrometer solenoid is designed for a peak field of 4T. Both spectrometer magnets required about 15 quenches to reach the design current. However, it was discovered that both spectrometers do not remember their training; after a warm-up the spectrometers have to be re-trained, following a very similar training curve. The MICE spectrometer was analyzed using 2D and 3D finite element software to understand the quench and training behaviour; the analysis revealed a clamping mechanism, leading to a stick-slip situation for one of the coils in its coil pocket. This paper summarizes the results and makes suggestions how to improve the design.

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