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# Experimental and numerical investigation on losses in electrodynamic transients in a Nb3Sn prototype race-track coil

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The detailed calculation of the current and losses distribution during the electrodynamic transients is of great importance for the design of superconducting accelerator magnets made of Rutherford cable. On the one hand, the current distribution affects the field harmonics generated by the superconducting magnet; on the other hand, the loss computation is necessary for the design of the cryogenic system. This paper presents the analysis of current distribution and losses in a prototype race-track coil configuration, the so-called Short Model Coil (SMC), developed at CERN in the frame of a test campaign of possible cable candidates for the HL-LHC project of CERN. The SMC 11 T was wound with a 40 Nb3Sn strand Rutherford cable in two layers, with 35 turns per layer. The loss measurements were performed at CERN by means of an electrical approach to analyse different transport current cycles. The THELMA model of the Rutherford cable, which represents the conductor at the strand level, was used for the analysis of the current distribution and losses in the coil during the transport current ramps. In this way, the inter-strand current diffusion and the corresponding time constants could be analysed in detail. In the paper, the comparison between the numerical and the experimental results is presented, together with the relevant information on contact conductances between strands, current distribution and losses.

## Submitters Country

Italy

**Primary authors:** Prof. BRESCHI, Marco (University of Bologna, Italy); Prof. RIBANI, Pier Luigi (University of Bologna, Italy); Prof. BELLINA, Fabrizio (University of Udine); Mr STACCHI, Francesco (University of Udine, Bologna)

**Presenter:** Prof. BRESCHI, Marco (University of Bologna, Italy)

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