PAUL SCHERRER INSTITUT

PSI

GFA & SwissFEL Accelerator Seminar

Analysis of losses in superconducting magnets based on the Nb_3Sn Rutherford cable configuration for future gantries

Monday, 13 February 2017, 16.00 h, WBGB/019

Prof. Dr. Marco Breschi
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The electrodynamic transients in superconducting strands and cables generate losses that must be calculated for a proper design of the magnet cryogenic system. Two main types of losses must be accounted for when dealing with multistrand superconducting cables, related to the magnetization of the superconducting wires (hysteresis losses) and to the current loops induced between different strands during electrodynamic transients (coupling losses). The presentation describes the methodologies and numerical codes adopted to compute the hysteresis and coupling losses in a magnet designed by PSI for future superconducting gantries. The design analyzed is the one based on Nb_3Sn Rutherford cables. The validation of the numerical tools versus analytical results is presented for simplified cases with uniform magnetic flux density applied to the conductor. The results of the loss calculation and the impact of the different contributions are then presented for the proposed magnet geometry. The implementation of these results in a 3D FEM thermal model of the gantry magnet system allows one to compute the resulting temperature distribution during its typical working cycle, and therefore determine the temperature margin available for the magnet operation.

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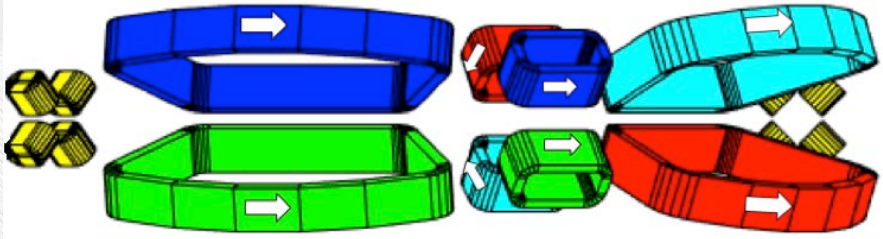

Proposed gantry magnet system geometry

Geometry of the Rutherford cable used to wind the coils