Quench Limit Simulations and Measurements for Steady State Heat Deposits in LHC Magnets

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A quench, transition of a conductor from the superconducting to the normal conducting state, occurs irreversibly in accelerator magnets if one of the three parameters: temperature, magnetic field or current density, exceeds a critical value. Energy deposited in the superconductor by the particles lost from the beams, provoke quenches detrimental for the accelerator operation.

A Network Model is used to study of the thermodynamic behavior of the LHC magnets. The results of the heat flow simulation in the magnets with the network model were validated with measurements performed in the CERN magnet test facility. A steady state heat flow was introduced in the coil by using both the quench heaters implemented in the LHC magnets and a dedicated internal heating apparatus installed inside cold bore. The heat loads from these heat sources needed to initiate quenches as a function of the coil current are calculated from the Network Model and compared to the settings leading to quench occurrence.