Contribution ID: **9** Type: **not specified**

Electro-thermal simulations of the 13kA shunted LHC joints

Wednesday 12 October 2011 15:00 (30 minutes)

A defective bus connection between two dipole magnets was the primary cause of the 2008 September incident in the LHC. This led to the decision that all ten thousand dipole and quadropole bus joints will be improved to avoid the reoccurrence of such an event. The purpose of the present work is to support the design choices and quality control of the shunts.
In order to achieve high reliability of the implemented solution, worst case conditions are assumed for the supporting simulations. Adiabatic thermal boundaries and conservative RRR values of the copper elements of the bus are used. Variation of the soldering and thus of the electrical and thermal contacts in the interconnect is the most important design parameter. Partial soldering to the bus is presumed, and the condition that the shunt needs to carry the full current of the circuit during a discharge of the circuit through a dump resistor is applied. The time constant, tau, of the discharge is determined by the inductance of the circuit and the value of the dump resistor. For the dipole circuits tau equals 100 seconds and for the quadropole circuits 30 seconds. Safe current as a function of the shunt design parameters is analyzed in this work. Also the influence of a partly soldered shunt is analyzed, where the percentage of soldered area is a function for the quality control. Safe operating current is defined by the condition that during the discharge of the circuit the temperature of the bus remains below 300K.
For the calculations finite element analysis (FEA) is used, with a commercial software Comsol Multiphysics. Comparisons were also performed with a one dimensional model, called QP3.

Author: MOLNAR, Daniel (CERN)

Co-authors: VERWEIJ, Arjan (CERN); BIELERT, Erwin (CERN)

Presenter: MOLNAR, Daniel (CERN)

Session Classification: Session 2 - Stability and Quench