Review on Thermal Stability of Accelerator Superconducting Magnets

CARE 3-4 March 05

"Beam Generated heat Deposition and Quench Levels for LHC Magnets"

Needs expressed :

Calculate energy deposited by beam in "any magnet"

(not this review)

Estimate how to adjust the BLM based triggers [B. Dehning]

N.B. : Hera Experience [Kay Wittenburg]

L.T. Needs : *(from Wamdo April 06 & Valencia meeting – Oct 06)*

Improve design & predict thermal stability for future magnets (Low Beta, Cycled)

This Review (Internal) :

Progress since Care 05

Goals & Resources for following ab. 6 months

Subjects to be Studied? [B. Dehning, Care 05]

3700 monitors need threshold values (11 time slots and 30 energy slots)

- **Loss locations and their variations**
- **Quench levels as function of time and energy for the different magnet types**
  - **Transient loss values**
  - **Quench levels between few ms to 10 s (heat flow in magnet)**
  - **Steady state values (heat flow)**
- **Identification of error margins**

Conclusions [Kay Wittenburg, Care 05]

- **Threshold of Quenches is about factor 5 below calculated critical beam loss (count) rate (response of BLM). All safety margins were eaten up.**

  Edep = 2.1 mJ/cm3 is needed for a temperature increase of DTc = 0.8 K (at 820 GeV/c)

  - **Possible Reasons:**
    - **Simulations (no magnetic field)**
    - **Loss position inside Quadrupole**
    - **Inaccurate parameters in calculation**
    - **…**
- **Quench probability depends on beam losses, not on weak magnets.**
- **Threshold of 4 BLMs is to rigid, sometimes only 1 BML is affected.**
- **Very fast losses (< 5 ms) can occur.**

  (BLMs cannot protect against instantaneous losses!)