LHC Beam Loss Monitors

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Content

Purpose and method of the system

Magnet coil quench levels

Beam loss and particle flux
outside the cryostat

Main system parameters

Purpose of Beam Loss Monitor System

- Protection and Prevention of magnets and other equipment against damage and magnet coil quenches by dump of the beam before thresholds are exceeded

- Beam diagnostic tool, beam loss monitors can be used to optimise the accelerator tuning

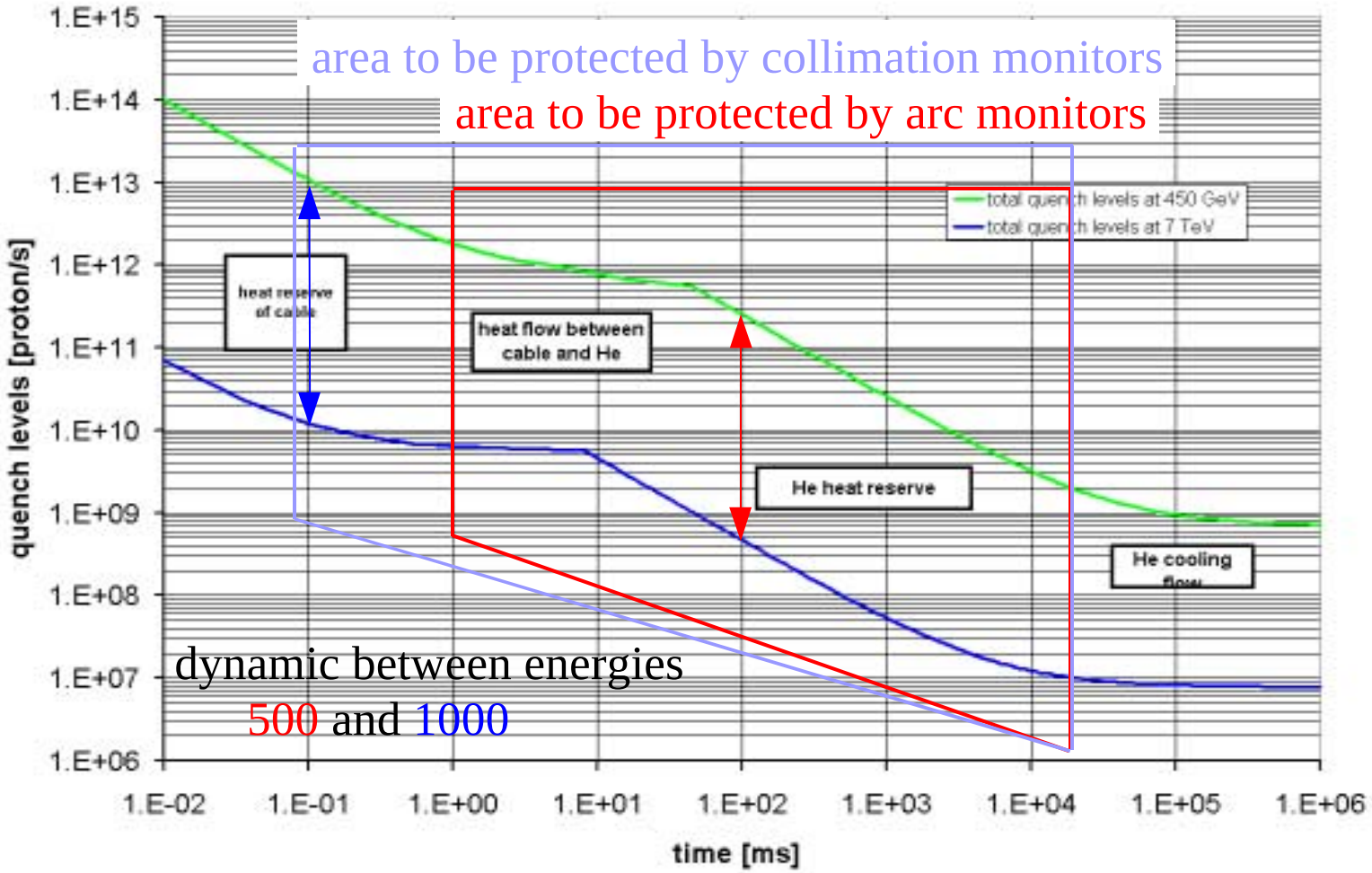
Method

Detection of shower particles outside the cryostat or near the collimators to determine the coil temperature increase due to particle losses

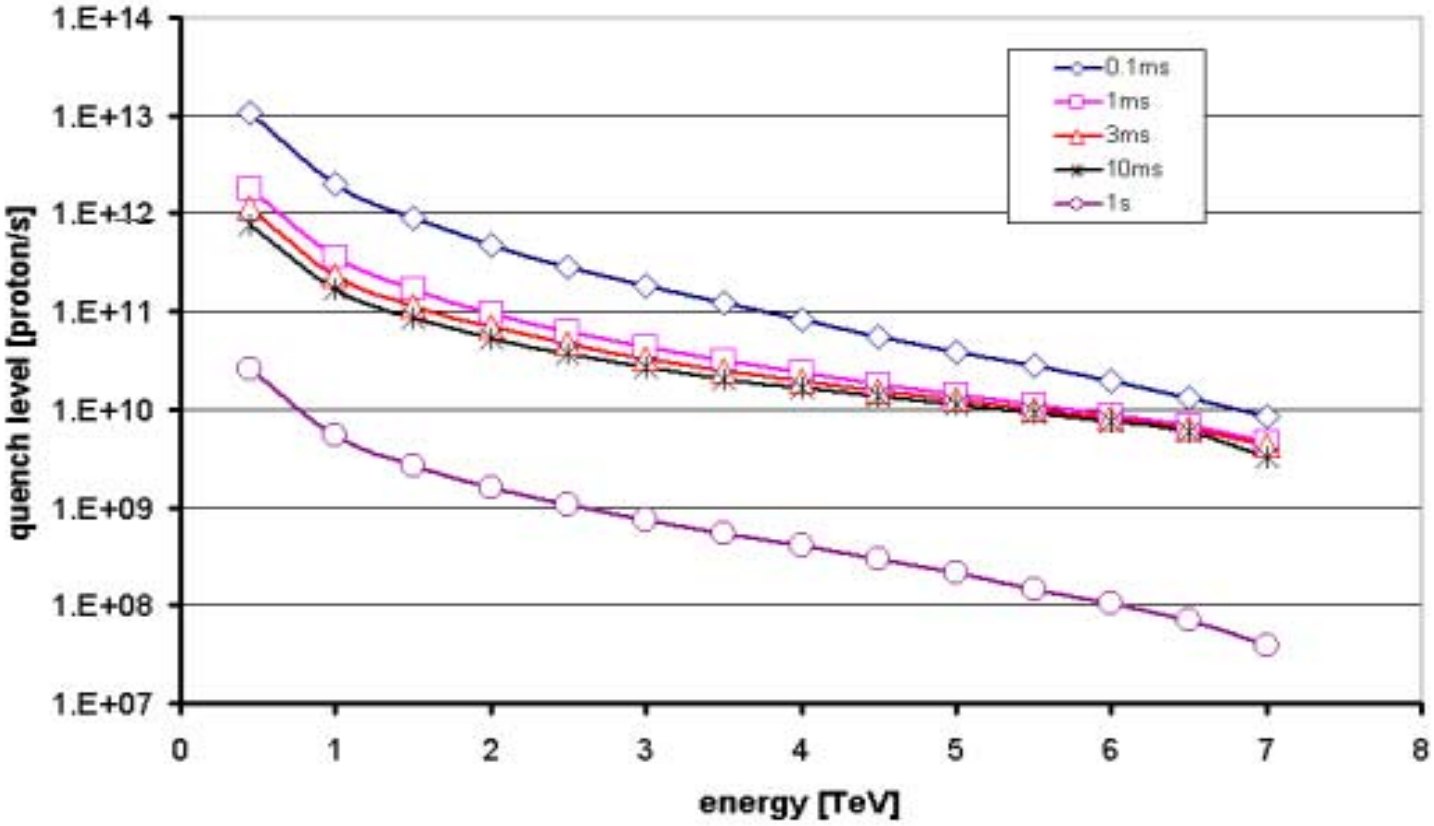
- Relation between loss rate and temperature increase
  quench levels:
  (J.B. Jeanneret et al. LHC Project Report 44)

- Relation between loss rate and particle flux outside the cryostat
  fluence:
  (A. Arauzo Garzia et al. LHC Project Note 238)

Quench levels

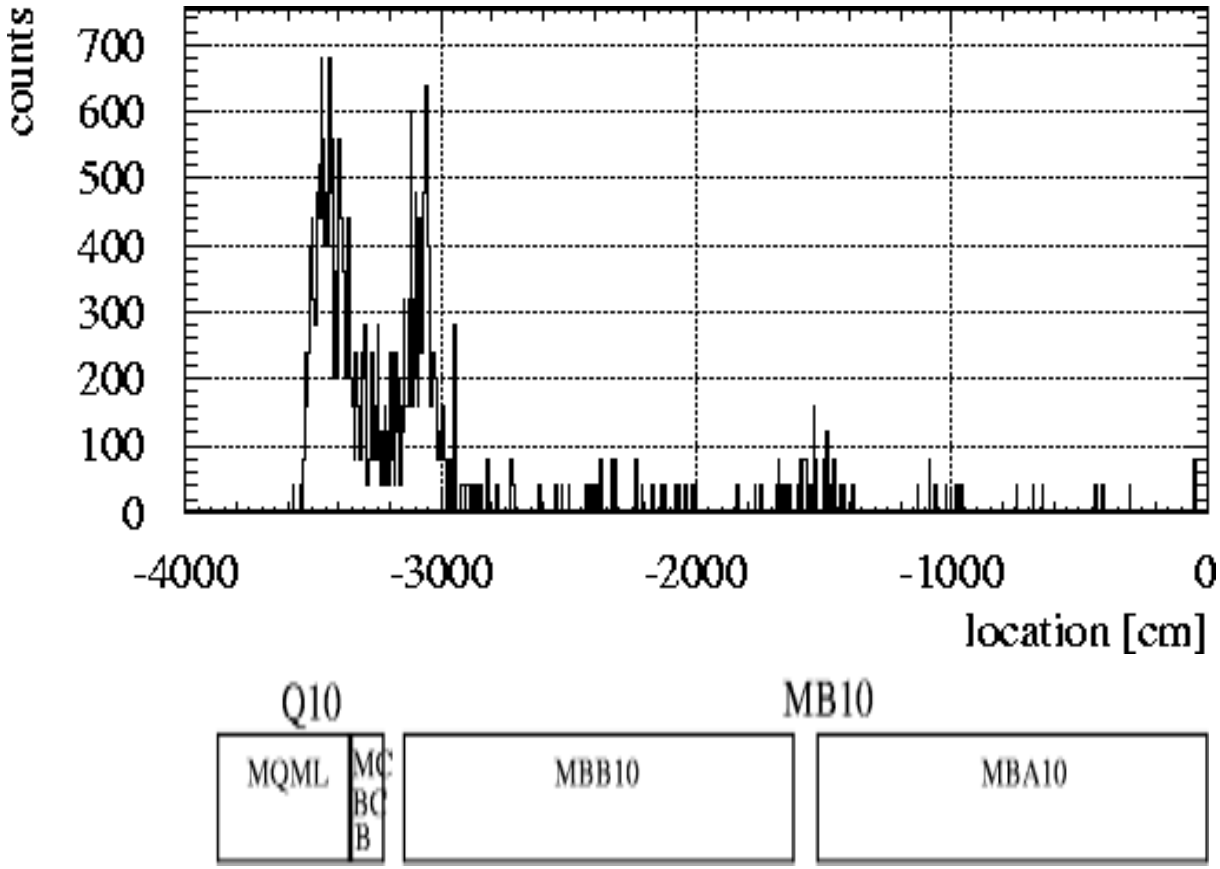


Quench Level Rate and Energy



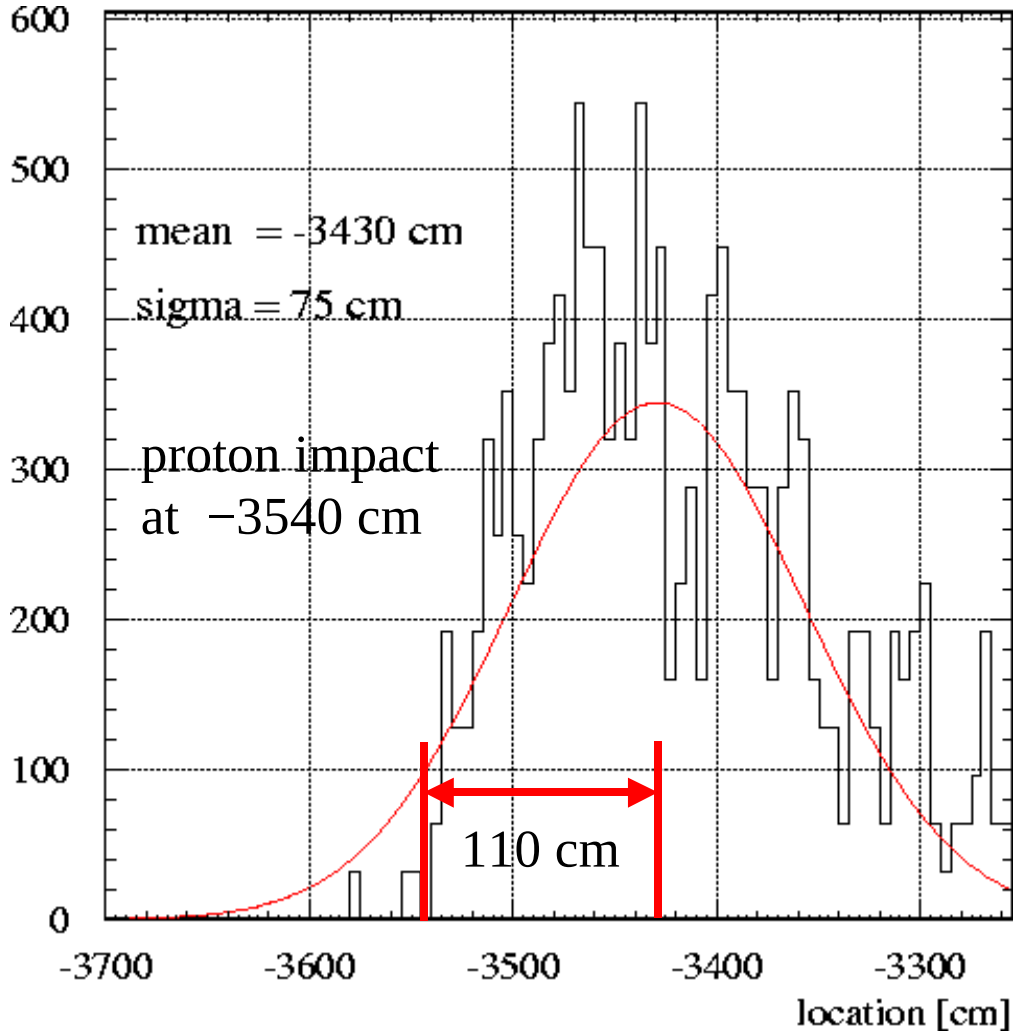
Factor 10 reduction between 0.45 and 1.5 TeV

Proton Shower Distribution (1)



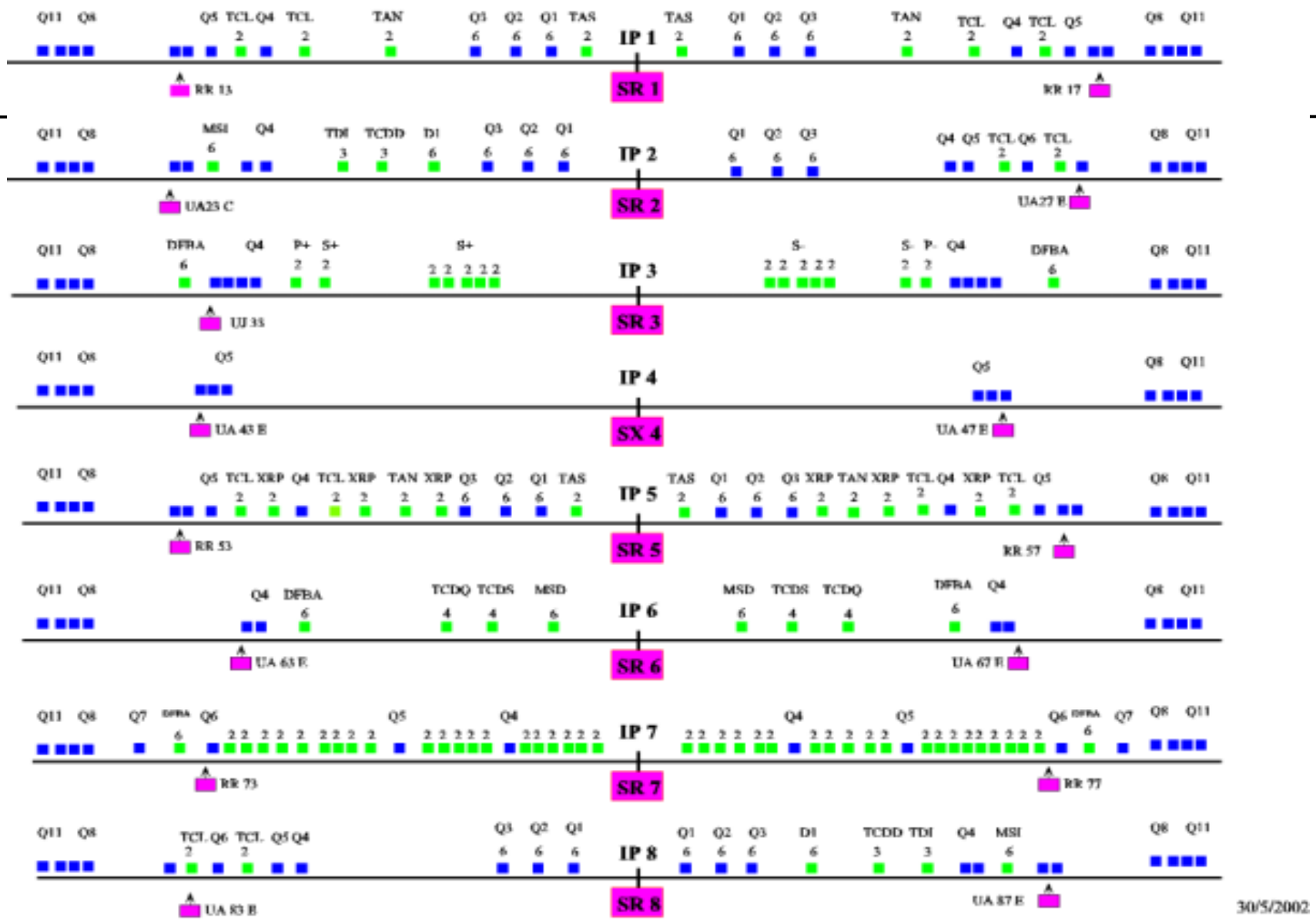
- impact of the protons at the centre of Q10
- first maximum due to shower in the cold mass
- second maximum due to gap between MQ and MB magnet
- third maximum due to gap between two MB magnets
- reduction of shower particles by a factor of over 100 after a few meters

Proton Shower Distribution (2)



- distance between proton impact and shower maximum 110 cm
- shower width σ = 75 cm
- longitudinal proton loss distribution will modify shower distribution significantly

Beam Loss: BLM (876), BLMC (240)



Main Monitor System Parameters

The monitor system dynamic range will be between 10^6 to several 10^7.

The update rate of the system will be 1 turn (89 us).

A threshold scaling during beam energy changes will be implemented

Several average loss values will be compared with the loss duration depending quench values

Each beam loss monitor channel will be connected to the beam abort system