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High sensitivity HEH monitor

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The LHC beam dumping system serves to safely abort 2 counter rotating proton beams each with energy of up to 360 MJ and its reliable operation is crucial for the accelerator safety. The system comprises 50 fast pulsed magnets and their associated pulse generators to fast extract and paint both beams on the surface of two 8 m long graphite blocks. The pulse generators operate at up to 29 kV and comprise 800 HV GTOs and 480 HV triggering IGBTs to deliver altogether more than 1 MA. All generators are installed underground in the galleries parallel to and shielded from LHC tunnel but some high energy hadrons (HEH) leak from the tunnel into the galleries via interconnecting cable ducts and can provoke Single Event Burnout (SEB) of HV semiconductors. This can lead to system malfunction and possible damage of the accelerator. In order to reduce the likelihood of SEB, the choice of HV semiconductors was based on their SEB cross-section and cable ducts shielding was improved by filling empty gaps with iron rods. To keep the probability of SEB failure low enough (< 0.1 per year), the requested HEH fluency in the galleries needs to be less than 5e4 HEH/cm2.year. The presently used HEH monitors are not sensitive enough subsequently the development of a new high sensitivity HEH monitor was necessary. It is based on protected SEB phenomenon in HV Si diodes. Depending on number of used diodes, it can be up to thousand fold more sensitive compared to present memory upset based instruments. It will allow confirming HEH fluency estimations used in failure rate evaluation and taking the most appropriate mitigation measures if necessary. The HEH monitor sensitivity measurement is ongoing under various conditions (cosmic rays at low and high altitudes, protons, neutrons, temperature variation).

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