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Automated GTO Measurement, Validation and Stack Selection System for the LHC Beam Dumping System

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The LHC Beam Dumping System (LBDS) is a safety critical system ensuring extraction and safe deposition of LHC beams on their respective dump blocks. It consists of 15 extraction and 10 dilution generators per beam and generates up to 1 MA total current at 7 TeV beam energy.
Both extraction and dilution generators employ similar stacks with 10 series connected GTO like thyristors as the main switches. To ensure safe operation of the GTO stack, the individual GTOs within the stack have voltage-sharing resistors and are continuously monitored with the goal to detect failure of an individual GTO. The monitoring system compares the full stack to the lowest potential GTO voltage and generates an alarm/interlock in case of abnormal behaviour. The accuracy of the voltage surveillance system can be compromised by individual GTO leakage current variations if the latter is too high, compared to the current in the voltage sharing resistors. In order to minimise this risk the Automated GTO Measurement and Stack Selection System (AMSSYS) was developed. It is based on simultaneous leakage current measurements of 5 GTOs at multiple (6) voltage levels within our dynamic range (100 V –3 kV). AMSSYS selects automatically a set of 10 GTOs with best fitting parameters for one stack with very similar behaviour over the whole voltage range at our operational temperature. This minimizes forward blocking voltage (VDS) variations within the stack. The risk of a false detection of a GTO failure was significantly reduced, the sensitivity and reliability of the LBDS stack monitoring was improved. The turn on time of the individual GTOs is dependent on VDS. AMSSYS optimizes the turn on time spread by minimizing VDS variations. The development and design of AMSSYS is outlined. Different test programs for the GTOs are presented and compared.

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