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New design concepts for suppressing erratic triggering of solid state switch stacks

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The proposed FCC Beam Dump architecture consists of a large number of kicker magnets to assure a fast and safe beam deflection. The High Voltage (HV) pulse generators will produce fast controlled capacitor discharges through HV power switches into lumped inductance magnets. As for the LHC Beam Dump System (LBDS), an erratic triggering (i.e. self-trigger) of one or more of the 300 generator switches cannot be avoided and will deflect the circulating beam and could significantly damage the machine. The standard mitigation is a retrigger mechanism that ensures the triggering of the remaining generators, but the kicker rise time is then unsynchronised with the beam abort gap(s) and hence several bunches will be steered on the machine extraction and downstream equipment.
Two alternative generator topologies for tackling the problem of erratic triggers at the source are studied: the use of additional shorting crowbar or series blocking switches. Both topologies can limit the current in the kicker magnet with the aim to reduce or eradicate the impact on the beam. This can result in a higher system reliability but the impact on availability needs to be acceptable. The results of electrical simulation models are presented in addition to topology advantages and disadvantages. A low-voltage test-bench has been built and the results of the associated tests are discussed.

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