Contribution ID: **332** Type: **Oral**

Prospects for an optical Re-Triggering System for the LHC Beam Dumping System at CERN

Wednesday 21 June 2017 16:15 (15 minutes)

The LHC beam extraction kicker system, composed of 15 fast kicker magnets per beam, is used to extract the particles in one turn from the collider and to dispose of them, after dilution, on an external absorber. Each of the 15 magnets is powered by a separate pulse generator, all of which are simultaneously triggered when a beam extraction from the machine is requested. Spontaneous firing of a single generator will create undamped beam oscillations that are likely to exceed the accelerator aperture resulting in beam losses and potential damage to the machine. In order to protect against occurrence of such events, a Re-Triggering System (RTS) has been implemented to redistribute, as fast as possible, a trigger request issued from the spontaneous-firing generator to the remaining 14 generators. Due to the architecture of the system an avalanche mechanism is started after a detection of a spontaneous firing. Since there is no stored energy in the system itself it is difficult to create spurious triggers; neither a disconnected cable nor a defective trigger source could cause triggers. Nevertheless, such a system has demonstrated potential electro-magnetic immunity weaknesses due to common coupling between generators.
A prospect for a RTS based on passively generated and transmitted optical power to all others generators has been studied in order to overcome this limitation. This can be accomplished by coupling light from a number of diode laser bars at re-trigger sources of one generator to bundles of optical fibres subsequently dispatched the remaining 14 generators. At each generator control stage we foresee a photoconductive semiconductor switch which ensure the conversion of the light signal into isolated electrical triggering pulse. The system can provide electrical power to the generator stacks of switching circuits through an optical link and therefore excluding common mode failures of interconnected re-triggering segments.

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Session Classification: Oral session 16 - Solid State Modulators and Pulsed Magnets for Accelerators, Electromagnetic Launchers - Session Chair : Michael John Barnes

Track Classification: Pulsed Power Industrial and Bio-Medical Applications