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## 2P45 - High performance triggering transformer for stack of series connected thyristors

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Large Hadron Collider (LHC) - the world biggest and highest energy proton accelerator/collider is built on Switzerland/France border at ~100 m underground. Its circumference is 27 km and it will accelerate up to  $4 \times 10^{14}$  protons per beam to a peak energy of 7 TeV. Under these conditions energy of each beam will be 360 MJ. Safe dumping of the beam with such energy is crucial for the safety of the LHC.

LHC beam dumping system (LBDS) consists of 30 extraction and 20 dilution generators delivering altogether ~1MA. Extraction generator operates at up to 29 kV and delivers up to 18 kA peak current with pulse duration of 91  $\mu$ s. It employs 2 parallel stacks of 10 series connected fast thyristors with 80 kA rating. Thyristor commutation speed depends on the triggering pulse performance with recommend triggering current peak value 2 kA with slew rate of 5kA/ $\mu$ s. Triggering is ensured by a triggering transformer (TT) with a primary driven by two triggering generators operating at 3.5 kV and with multiple floating secondaries individually supplying each thyristors within the stack. Presently used TT (custom designed) limits the triggering current to 500 A peak with slew rate of 400A/ $\mu$ s. Ongoing upgrade of LHC calls for increasing of the whole LBDS reliability including triggering system. Main modifications target reduction of TT and cabling inductances. The new TT has fully coaxial design with common primary and ten single turn secondaries with independent magnetic circuits. HV triggering cables are made of 12 parallel twisted pairs with common shielding. Significantly reduced total stray inductance resulted in more than 3x higher peak current and 10x higher dI/dt (1.8kA, 4kA/ $\mu$ s respectively) with the same trigger generator voltage. The whole thyristors stack turn-on delay and rise time were reduced by more than 200 ns with proportionally reduced turn-on losses.

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