New Four Quadrant R2E ±600A ±10V for LHC
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ABSTRACT The LHC (Large Hadron Collider) particle accelerator makes extensive use of power converters, with a high precision regulated output current requirement. The level of radiation will increase, and higher availability is required for each system. High availability in 4-quadrant converters is crucial in LHC operation. To get this aim, a new redundant, modular and radiant tolerant 4-quadrant linear converter is developed modifying the control strategy of current converters in LHC. This poster introduces the R2E [±600A; ±10V] power converter, 162 units in the LHC are impacted.

CERN POWER CONVERTER ARCHITECTURE
CERN Power Converter Radiant Tolerant Validated
- A voltage power source unit
- Two high precision current transducers (DCCT)
- High Precision digital controller (FGC)

Radiant Tolerant Design
High – Energy Hadron Fluence

R2E-LHC600A-10V POWER CONVERTER TOPOLOGY

Modular & Redundant Design
Modular and redundant design achieve thanks to new control strategy.

LOW LEVEL OF OUTPUT NOISE

Very low level of output noise achieve thanks to the 4-Quadrant output stage.

SUPERCONDUCTIVE MAGNET PROTECTION
Crowbar System
The system is based on a 50 mΩ Power Resistance series back-to-back thyristors being fired at a given output voltage (∓15V), and then providing a safe path for magnet current.

Earth System
Detection system is an active system, since relying on a 100mA current source powering a 100 mΩ resistance in parallel, it is then possible to detect an earth fault even with converter being OFF (CPT, not condemned).

SUMMARY
A new topology and control strategy are developed to comply with nominal LHC requirements. These modifications have been successfully implemented in a new converter prototype. In next future, HL-LHC upgrade will demand new 4-quadrant converters, with a higher level of operating currents. It will be possible to feed these magnetic circuits with several power modules in parallel. A redesign could be done considering an undetermined number of power modules in parallel.