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Magnetic resilience studies for power supplies

Tuesday 3 October 2023 15:00 (20 minutes)

In this poster we present our approach to design power supplies that are resilient to magnetic field that can reach up to 1 T, we will illustrate the engineering challenge to have a power supply that can safely operate in radiation and magnetic fields. We will summarize the test we have performed starting from basic components like inductors, then sub-parts and complete modules. We will illustrate the use case of the BRIC1 used by ATLAS-NSW as DC-DC intermediate converter stage and summarize its performance.

Summary (500 words)

It's well known that modern physics experiments require higher LV power to be delivered to the front-end electronics with respect to the past, this is efficiently done by placing the LV power supplies as close as possible to the detector. Unfortunately, this means that they must be robust against radiation and resilient to the magnetic fields often present to measure particles properties.
Experimental caverns place restraints on the design of the power supplies and various standards must be respected, bust most important are the functionalities needed to properly operate the detectors during their lifecycle.
Designing a power supply for such specific needs it is not a trivial task, once the contour conditions are well understood the executive design can start, but before even drawing a circuit it is mandatory to decide the design approach to the power supply and what components to use. Since the peculiar environment, the components have to be carefully selected and tested, like measuring the magnetic properties of inductors and how they change according to an external magnetic field.
Once this step is completed and the design has started then some sub-part can be tested, the circuits should efficiently work at B = 0 T and to cope with increasing magnetic fields up to 1 T, to assure this we have performed also tests at this phase. The last phase is, of course, the testing of a whole power supply in an operational environment.
In this work we will explain the engineering challenge to have a power supply that can safely operate in radiation and magnetic fields, and how we have tackled it. We will summarize the results we have obtained during the tests we have performed during the three abovementioned phases, in order to give a complete picture of the development of the CAEN EASY BRIC1, an intermediate convertor now used by ATLAS-NSW to power the front-end electronics with 12 V starting from 300 V.

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