

The consolidation program of the cryogenic systems of the ATLAS and CMS experiments

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The CMS and ATLAS experiments and their superconducting magnetic and calorimetric systems, installed in the LHC (Large Hadron Collider) at CERN, have both been equipped with cryogenic installations. The CMS experiment is making use of a large superconducting solenoid magnet, while the ATLAS experiment combines a large superconducting toroid magnetic system, a superconducting solenoid and three liquid argon calorimeters.

The respective and associated cryogenic installations have all been in continuous operation during the LHC physics run started in 2009. Although these systems have been performing with high reliability, specific consolidations have been proposed to improve their reliability. The consolidations have been mainly implemented during the LHC long shutdown periods of 2013-2014 and 2019-2020. For the CMS experiment, hot-spare helium compressors were installed to allow full redundancy in case of failure. For ATLAS one redundant high-pressure helium compressor and two of the booster helium compressors have been upgraded with new and increased capacity units. A unit of 10'000 litres liquid helium storage was integrated into the cooling process of the ATLAS solenoid allowing significantly improved operation autonomy and recovery in case of a resistive transition of the magnetic toroid system. The CMS oil removal system was upgraded to overcome oil problems that were impairing the performance of the helium refrigerator. Finally, for both ATLAS and CMS infrastructure, an upgraded full flow dryer scheme was added in the global process of helium systems.

This paper describes the consolidation program made to these cryogenic systems towards their availability improvement.

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