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Design choices of the cryogenic system for the long-term operation of ATLAS and CMS detector magnets

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The design of detectors for High Energy Physic experiments is frequently based on large superconducting magnets generating the field for particle momentum measurements. The CMS experiment is built around a single large superconducting solenoid, whilst the magnetic configuration of ATLAS is based on a thin Central Solenoid surrounded by a large superconducting toroid consisting of three separate magnets, the Barrel and two End-Caps.
The cooling of all these magnets is achieved by an indirect method which greatly simplifies the cryostat design. For the two solenoids (CMS and ATLAS Central Solenoid), the simplest cryogenic principle to drive the helium flow into the cooling pipes has been adopted, i.e. the thermo-siphon which uses the hydrostatic pressure difference between the supplied liquid and the two-phase return. For the three ATLAS toroids, where the thermo-siphon could not be applied because of the unfavourable geometry and the complex helium internal distribution, a centrifugal pump was necessary to ensure the stability in the two-phase regime.
ATLAS magnets have the particularity to use two separate cryoplants; one unit to cool-down all magnets from 80K down and operate them at 4.5K and a second simple plant dedicated to the cooling of the thermal shields between 40K and 80K with minimized interruption for maintenance.
This talk presents the reasons of these design choices which should ensure the easiest - while still flexible - operation of these LHC detectors during the next 15 years.

Proposed for workshop session (see call for abstracts): 1- Operation 2- Maintenance 3 - Safety 4 - Control

Operation

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