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CO_2 evaporative cooling system for the LHCb UT Detector

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The LHCb Upgrade requires a new Silicon Strip Tracker detector with improved performance.
The Front-End read-out electronics will be in the active area, close to the sensors: this is a key feature driving the mechanical and cooling detector design, together with the requirement to mantain the maximum temperature of the Silicon Sensor below −5℃ during data-taking, to withstand radiation damage and thermal runaway effects.
The design of the detector implements an integrated cooling system exploiting CO2 evaporation and a cooling plant based on the 2-Phases Accumulator Control Loop cycle.
CO2 evaporation temperatures will be in a range from ambient temperature to −30℃, the working point being set after measuring and controlling the real detector components temperatures (i.e. read-out ASICs hybrid).
The support structure for the sensor modules is a lightweight carbon fiber mechanical structure embedding a cooling pipe, designed to pass underneath the read-out ASICs, which are the main thermal power sources to be cooled down.
The poster gives a technical description of the LHCb UT detector cooling system and CO2 flow control and distribution, with a focus on the “first time use of snake pipes” and “first time use of calibrated orifices (200 micron diameter)” inlet flow restrictors for the control of the flow ditribution into the 68 parallel detector local supports called “staves” (each one with a snake pipe cooling inside).

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