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Design and test plans of vacuum insulated transfer lines for the CO2 cooling systems of the phase II CMS detectors

The CMS Phase II upgrade program includes a new tracker, new timing layer detectors and high-granularity silicon-based calorimeter in the endcap region. All these detectors will be cooled with liquid pumped CO2. Besides the development of a cooling system with capacity for this order-of-magnitude increase in power over Phase I heritage, significant efforts are required to define the coolant distribution from the plants in USC55 to on-detector evaporator loops.

This poster describes ongoing activities to design the vacuum-insulated transfer lines routing coolant from the plants in USC55 to the sub-detector manifolds. These transfer lines must interface with both the on-detector cooling hardware and the plants in USC55, while respecting challenging integration constraints. Moreover, the transfer lines'decisive impact on return line pressure drops and system volume makes them a major driver of cooling system performance and cost.

The present study first formulated a grouping of cooling plants, manifolds and sub-detectors to respect operational requirements and integration constraints. Based on simulations of return-line pressure drops and system volume, optimal transfer line routings will then be proposed, with on-site verification of the routing foreseen during LS2. Planned research activities concerning vacuum insulation performance and 2-phase flow in flexible hoses and long vertical transfer lines are also presented.

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