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Performance measurements of a co-axial transfer line for 2-phase CO2 HEP detector cooling

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Phase-2 CMS particle detectors require an order-of-magnitude increase in evaporative CO2 (2PACL) cooling capacity while operating roughly 20 ℃ colder than legacy systems. This requires large co-axial transfer lines, whose performance has a non-negligible impact on detector temperature. The associated relatively low CO2 saturation temperatures (<-35 ℃), large transfer line diameters, and long routings –including about 20 m of vertical 2-phase up-flow –entail significant modelling uncertainties when relying on empirical correlations with limited validation in these ranges. We report preliminary measurements on a prototype Phase-2 CMS transfer line connected to the DEMO R&D CO2 cooling plant, and assesses the performance of 2-phase flow models used to size future CMS 2PACL cooling equipment.

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