

Microchannel cooling for the LHCb VELO Upgrade

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The upgraded VELO modules will each host 12 VeloPix ASICs with a total power consumption of up to 30 W. To mitigate the radiation damage an efficient cooling system is to keep the sensors below -20 C. The solution created is to use a cooling substrate composed of thin silicon plates with embedded micro-channels that allow the circulation of boiling CO₂. The advantages of this technique are: low material contribution, same CTE as the sensor-ASIC tiles, radiation hardness of CO₂ and high heat transfer capacity.

A leak-tight fluidic connector soldered with a flux-free solution was developed maintaining the planarity and the correct positioning required for the subsequent construction of a precise tracking system.

Two back-up alternatives were designed, with small impact on physics performance. This talk will cover the key points of the microchannels R&D including fabrication, robustness tests, performance and the comparison with the backup options.

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