



# Sample Project: Detector thermal management through microstructured silicon devices

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## Title

Detector thermal management through microstructured silicon devices

## Description

Micro-channel cooling techniques are gaining considerable attention for the thermal management of the most challenging regions of the future generation of silicon detectors. Several studies have been performed at CERN and partner institutes in the recent years, demonstrating the great potential of these techniques in terms of cooling performance and mass reduction. Silicon micro-fabricated devices are in particular attractive because of their high potentiality of a perfect integration in a silicon-based detector. The tremendous progress in MEMS-derived techniques makes nowadays accessible also to small size productions several fabrication processes that were reserved to high-end microelectronics lines only a few years ago. This makes it possible to conceive and produce highly controlled and highly engineered devices for advanced thermal management of special detector electronics.

At CERN the matching of these advanced devices with the high thermal performance of evaporative CO<sub>2</sub> flows is presently under study. The technology has very high potential to overcome any other thermal management technique. However, several technical issues must be addressed in the next years in order to pass from the level of laboratory study to that of reliable engineered solution, required for implementation in an operational detector. A large Network has been just launched in the frame of the European project AIDA-2020, and this network - coordinated by CERN - will cover all such technological issues: from the problem of the "micro-to-macro" hydraulic connectivity, to optimization of the microfabrication techniques, to the detail analysis and modelling of the thermo-hydraulic performance of high pressure evaporating fluid at the micro-scale.

As all these aspects are studied in PH-DT (in collaboration with several European Universities) the Trainee will enter in contact with all the different engineering issues of this complex multi-discipline field. Depending of the specific skills and professional aspirations, he will be offered the possibility to specialize more on one specific aspect (2-phase micro-scale heat transfer; micro-fabrication techniques; device engineering), while always being immersed in a highly stimulating multi-cultural and international environment. Tutored by experts in the selected field, the trainee will have the rare opportunities to get in contact with all the different phases of a complex hi-tech process (measurement, modelling, design, production) while personally specializing in the specific subject selected.

## Skills

## Disciplines

Electrical Engineering, Mechanical Engineering

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