

# MICROROC: MICROMEsh Gaseous Structure Read-Out Chip

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MICRO MESH Gaseous Structure (MICROME GAS) and Gas Electron Multipliers (GEM) detectors are two candidates for the active part of a Digital Hadronic CALorimeter (DHCAL) as part of a high energy physics experiment at the International Linear Collider. Physics requirements lead to a highly granular hadronic calorimeter with up to thirty million channels with probably only hit information (digital calorimeter). To validate the concept of digital hadronic calorimetry, a cubic meter technological prototype, made of 40 planes of one square meter each, is compulsory. Such a technological prototype involves not less than 400 000 electronic channels, thus requiring the development of front-end ASIC. Based on the experience of previous ASICs (DIRAC and HARDROC) and on multiple testbeam results, a new ASIC, called MICROROC for MICRO mesh Gaseous Structure Read-Out Chip, has been recently developed at IN2P3 jointly by OMEGA/LAL and LAPP microelectronics groups. It was submitted to foundry in June 2010, and prototypes were delivered at the beginning of September, a low volume production has been tested in 2011 and the detector testbeams are scheduled in summer 2011.

## Summary 500 words

MICRO MESH Gaseous Structure (MICROME GAS) and Gas Electron Multipliers (GEM) detectors are two candidates for the active part of a Digital Hadronic CALorimeter (DHCAL) as part of a high energy physics experiment at the International Linear Collider. Physics requirements lead to a highly granular hadronic calorimeter with up to thirty million channels with probably only hit information (digital calorimeter).

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Based on the experience of previous ASICs (DIRAC and HARDROC) and on multiple testbeam results, a new ASIC, called MICROROC (MICRO mesh gaseous structure Read-Out Chip), is currently being jointly developed at IN2P3 by OMEGA/LAL and LAPP microelectronics groups. It should be submitted to foundry in June 2010, and prototypes are expected to be delivered at the beginning of September.

MICROROC is a 64 channel mixed-signal integrated circuit based on HARDROC manufactured in AMS 350 nm SiGe technology. Analog blocks and the whole digital part are reused from HARDROC, but the very front end\* part, ie the preamplifier and shapers, has been especially re-designed for one square meter MICROME GAS detectors, which require HV sparks robustness for the electronics and also very low noise performance to detect signals down to 2fC with an anode capacitance of. Each channel of the MICROROC chip is made of a fixed gain charge preamplifier, two different adjustable shapers, three comparators and a random access memory used as a digital buffer. Other blocks, like 12-bit DAC, configuration registers, bandgap voltage reference and LVDS receiver are included. All these blocks are power-pulsed, thus reaching a power consumption equal to zero in standby mode.

After characterisation of the MPW prototypes, a low volume production has been packaged in TQFP160 with the same pinout as the HARDROC. Therefore bulk MICROME GAS detectors with embedded MICROROC have been straightforward built, using HARDROC previously designed PCBs and the same data acquisition system. The testbeam of prototypes is scheduled in summer 2011.

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