

# MAROC, a generic photomultiplier readout chip

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The MAROC ASICs family is dedicated to the readout of 64-channel Multi Anode PMT and similar detectors. Its main roles are to correct the gain spread of MAPMT channels thanks to an individual variable gain preamplifier and to discriminate the input signals (from 50fC i.e 1/3 photo-electron) in order to produce 64 trigger outputs.

A multiplexed analog charge output is also available with a dynamic range around 10 pe (~1.6 pC) and a 12 bit Wilkinson ADC is embedded.

Three versions of this chip have been submitted. MAROC 2 is the production version for the ATLAS luminometer and MAROC3 is a version with lower dissipation and significant improvements concerning the charge (30 pe: ~5 pC) and trigger (discrimination from 10fC).

This third version showed very good performances that are presented here.

## Summary

The 64 channel readout ASIC called MAROC for Multi Anode Read Out Chip is made in 0.35 $\mu$ m SiGe technology. It has been submitted in three successive versions.

Its main requirements are a 100% trigger rate for signal greater than 1/3 photoelectron, a charge measurement up to 30 photoelectrons (~5pC) with a linearity of 2% or better and a crosstalk less than 1%.

For each one of the 64 channels, the PM signal is first amplified thanks to an 8 bit variable gain preamplifier which has low noise and low input impedance to minimise crosstalk.

Then the amplified current feeds a slow shaper combined with two Sample and Hold capacitors: one to store the charge up to 5pC and a second one to measure the baseline as well as the maximum of the signal. The digital charge output is provided by a 8, 10 or 12 bit ADC Wilkinson.

In parallel, 64 trigger outputs are obtained by one bipolar or unipolar fast (15 ns) shaper followed by one discriminator for the photon counting or can be provided by another bipolar fast shaper (with lower gain) followed by its discriminator to trig at higher input charge (more than 1pe). The discriminator thresholds are set by two internal 10 bit DACs.

Three versions of this chip have been realized:

MAROC1 was the first prototype with 64 channels. The chip showed global good behavior despite a coupling problem through subtract which was introducing instability for gain greater than 1. MAROC2 which showed excellent performances on the photon counting aspect has been chosen to equip the ATLAS luminometer (~200 pieces). MAROC3 has been designed to fix bugs, improve charge measurement, dynamic range and global consumption.

MAROC3 has been tested and showed performances in good agreement with the requirements

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