An ASIC for fast single photon counting in the LHCb RICH upgrade


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The CLARO is an 8-channel front-end ASIC for fast single photon counting with multi-anode photomultipliers (MaPMT). It was designed to sustain hit rates up to 40 MHz on each pixel, while consuming less than 1 mW per channel. The peaking time of the front-end amplifier is a few ns, and return to baseline is faster than 25 ns. The low input impedance (<200 ohm) prevents crosstalk between neighbouring channels in closely packed arrays. Low noise (2 ke- RMS typical) results in a timing resolution down to 10 ps RMS for input signals in the Me- range.

The specifications of the CLARO were tailored to the requirements of the upgrade of the LHCb RICH detectors. In about 10 years of operation, a total integrated luminosity of 50 fb^-1 is assumed. The chips will have to withstand radiation up to a total ionising dose of 200 krad and neutron and hadron fluences up to 3 x 10^12 cm^-2.

The CLARO was designed in 0.35 um CMOS technology from AMS, and includes several radiation hardening techniques. The radiation tolerance of the CLARO prototypes was ascertained with a safety factor of 10 beyond the radiation levels foreseen in the upgraded LHCb RICH detectors.