

A custom front-end ASIC and readout board for cosmic-ray charge identifiers and imaging Cherenkov devices.

ABSTRACT

A new class of instruments – based on SiPM photosensors – are currently under development for the next generation of Astroparticle Physics experiments in future space missions. A custom front-end ASIC for the readout of 64 SiPM sensors was specified in collaboration with GM-IDEAS (Norway) that designed and manufactured the ASIC. Our group developed a custom readout board equipped with a 16 bit ADC for the digitization of both pulse height and time information.

A time stamp, generated by the ASIC in correspondence of the threshold crossing time, is digitized and recorded for each channel. This allows to define a narrow time window around the physics event that reduces the background due to the SiPM dark count rate in low-light-level imaging applications (e.g.: Ring Cherenkov, DIRC).

TECHNOLOGY STAGE

- ASIC available from GM-IDEAS (0.35 μ m)
- epitaxial protection against SEE effects
- board output : 64 P.H. + 64 time-stamps
- USB-2 interface
- active control of the SiPM gain

POSSIBLE APPLICATIONS

- High-Energy Physics.
- High Energy Astrophysics.

EXISTING APPLICATIONS

- Proximity focussed Ring Cherenkov
- Scintillator + WLS readout
- Integral Cherenkov + WLS readout
- FDIRC for isotopes identification in space



GSI beam test (Oct 2010)



SPECIFICATIONS

- 64 channels (< 15 mW/chan)
- adjustable threshold for self-triggering
- programmable shaping time (50-300 ns)
- individual adjustment of input potentials
- noise ~ 1 fC ENC
- 40 ps LSB at board level

ADVANTAGES

- single photon sensitivity
- magnetic field tolerant
- compact, rugged

LIMITATIONS

- small sensitive area of the array
- needs active gain control

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