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High banwidth commercial digitizer for hostile environment

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The Mu2E collaboration has developed a digitizer board that samples
up to 20 signals with a sampling frequency of 200 MHz on 12 bits.
The digitizer has been qualified to operate in the hostile environment of Mu2E.
The qualification levels are Total Ionizing Dose (TID) of 12 Krad and Neutron
fluence of 5x1010 n / cm2 @ 1 MeVeq (Si) / y, 1T magnetic field, level of vacuum of 10-4 Torr.

The digitizer has aroused considerable commercial interest,
as there are currently no digitizers with similar characteristics on the market.
Possible applications are related to the aeronautical industry,
the medical sector and that of accelerators.

The Mu2e board requires both hardware and firmware changes related to
the use of custom electronic components and communication protocols related to the Mu2e collaboration,
which were funded by INFN through a specific research and development project called HAMLET.

As an example of application of the electronics developed in the HAMLET field,
a demonstrator based on an array of SiPM coupled to a sparkling crystal and connected
to the digitizer was created.
The demonstrator constitutes a complete and scalable qualified hardware platform
that can be used in hostile environments.

Each single channel of the demonstrator is made up of a CsI crystal c
oupled through a SiPM array of 8 Broadcom® SiPMs to a front end chip called
MUSIC developed by ICCUB (University of Barcelona spin-off) which adds,
forms and amplifies the signals of up to 8 SiPM. An interface card connects
the front end with the digitizer, manages 20 independent and programmable HV channels,
20 I2C interfaces to the Music chip and one I2C / SPI interface to the digitizer.
The system is thermostated in such a way as to keep the SiPM gain stable.

Collaboration

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