

Analogue Front-End tests with an Alpha Source:

To evaluate diamond detectors as beam profile monitors, it is required a radiation tolerant transimpedance amplifier (TIA) with fast slow rate, matched to 50 ohm to properly transmit the signal through long coaxial cables. For this, THS3001 has been chosen as operational amplifier in transimpedance configuration, using RF= 1K and 50 ohms input and output mpedance. The same configuration used on the operational beam scanners photomultiplier tubes (PMT) pre-amplifiers.

This amplifier was evaluated with a diamond detector and a ²⁴¹AM alpha source as shown on the pictures.

tector = Vo * 2 / RF

pCVD HV = -700V Vo : 4.5 mV Detector Current :9uA Charge: Q ~ 90 fC alogue Front-Enc for Detector Evaluation pCVD + TIA signal for Alpha particles on 50ohm

pCVD Diamond Detectors as beam profile monitors:

A pCVD Diamond detector and transimpedance amplifier were placed on the SPS complex, near an operational linear Beam Wire Scanner, in order to asses the detector performance for secondary particles detection and beam profile monitor. A nearby operational acquisition system, consisting on a scintillator attached to a photo-multiplier tube (PMT) and a pre-amplifier, was used for compa The measurements were collected on the surface with a LeCrov Scope at 2.5GSPS. Around 80m of CK50 cables were used for signal transmission.



References:

- rumentation (IIIVST) 10 C04016. aumbaugh et al. "Dizlito: on ewf cont- end custom integrated circuit for high-rate experiments". TWEPP13. Perugia, Italy. Septen oadhouser, Granssi et al. "The CMS HGLI FEE Control Module" TWEPP14. Nav-en-Provence, France. September 2014. arros, Shanor et al. "The GBT-PRO-Cone: Features and Nonlineger", ACESIDIA. CERN, Switzeriand, March 2014.

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Back-End System

Front-End St

A complete test set-up has been evaluated under laboratory conditions. The back-end system for prototype is based on an Igloo2 development kit.

lpha Source (²⁴¹Am)

Custom TIA (THS3001)

The set-up was used for the QIE10 front-end The set-up was used for the Quiz U mon-end evaluation. This charge integrator and digitalization ASIC reach a dynamic range of 1=5 (3.2fC-340pC) encoded with 8 bits by using a pseudo-logarithmic digitalization scheme. The charge encoding algorithm contains 16 sensitivity levels divided on 4 ranges.

The front-end was characterized in terms of linearity, difference with respect to the nominal response and sensitivities in each subrange. Linear sweeps with a Keithley current source were done. Each point on the following charts corresponde to the program poly detected corresponds to the average value detected during 25us with constant current.



Autonomous Front-Ends for QIE10 & ICECAL evaluation:

The readout system needs to be evaluated with two different integrator ASICs, for this, a modular design is used. Each readout ASIC candidate is hosted in a custom Radiation-Tolerant mezzanine with a SAMTEC connector that fits on a motherboard, the Igloo2 UMd board (designed by CMS) that drives the optical link.

Igloo2 UMd Board:

Acts as the front-end motherboard, equipped with a flash-based FPGA Igloo2, radiation tolerant components and a versatile link transceiver (VTRx) to drive the optical link with the GBT protocol QIE10p5 Mezzanine:

Equipped with two QIE10 ASICS, each, features one high dynamic range (1e5) channel. Radiation-tolerant linear regulators are used as POL regulators

ICECAL V3 Mezzanine: Contains an ICECAL integrator ASIC, with 4 input channels and 1e3 dynamic range on each. The ASIC output provides an analog voltage every 25ns, that is digitalized by an ADC. The mezzanine is powered with radiation hard FESTMP modules.





QIE10 Front-End configuration

Summary:

Diamond detectors have demonstrated to be a promising solution for secondary particle detection to determine the transverse beam intensity distribution and its width. Further investigations are required to understand the beam profile difference with respect to the scintillator/PMT system, a second set-up will be installed for more tests. The digital readout electronics systems have been fully tested under laboratory conditions showing the specified performance. The QIE10 front-end will be installed in the SPS tunnel and its performance tested under operational conditions.