**Motivation:**
- Beam Wire Scanners Upgrade
- New detector used (pCVD)
- High dynamic range needed
- Low noise measurements
- One single system for LHC, SPS, PS & PSB
- Avoid the need of tuneable parameters

**Analogue Front-end scanners**

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 $R_F = 1k$ and 50 ohm input and output impedance. The same configuration was used on the operational beam wire scanners photomultiplier tubes (PMT) pre-amplifiers.

This amplifier was evaluated with a diamond detector and a $\alpha$-source as alpha particles on Si/SiBor.

**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 assess the detector performance for secondary particle detection and beam profile monitoring. A nearby operational acquisition system, consisting of a scintillator attached to a photomultiplier tube (PMT) and a pre-amplifier, was used for comparison. The measurements were collected on the surface with a LeCroy Scope at 2.5GSPS. Around 80M of CSO cables were used for signal transmission.

**Proposed System Architecture Overview:**

A front-end will be placed near the detector for digitalization to avoid transmission over long coaxial cables and maintain the pCVD signal dynamic and quality. Once digitalized, the data will be sent through an optical link at 4.8 Gbps following the GBT protocol. The optical link provides data transmission, front-end slow control and systems synchronization. The Back-End solution envisaged is based on the new VFC board developed by the CERN’s Bi-8i group.

The development of a custom radiation-hard and high dynamic range acquisition front-end is needed. To provide a reliable solution, the evaluation of diamond detectors as beam profile monitor and the test of different readout ASICs are required.

**Reference:**

1. J. Sirvent et al., “Radiation-tolerant particle detector system for the CERN’s beam wire scanners upgrade”, 2015 JINST 10 P10005. DOI: 10.1088/1748-0221/10/10/P10005.

2. F. Breit et al., “Beam instrumentation for the CERN’s beam wire scanners upgrade”, 2015 JINST 10 P10001. DOI: 10.1088/1748-0221/10/10/P10001.


4. A. Emery, N. Ballesta et al., “Towards a 1 k channel read-out and VFL with the VFL for the operation of the CERN’s linear colliders”, 2013 JINST 8 P04007.


**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.

**ICCAL_V3 Front-end configuration**

QIE10 Front-end configuration

**References:**

1. J. Sirvent et al., “Radiation-tolerant particle detector system for the CERN’s beam wire scanners upgrade”, 2015 JINST 10 P10005. DOI: 10.1088/1748-0221/10/10/P10005.

2. F. Breit et al., “Beam instrumentation for the CERN’s beam wire scanners upgrade”, 2015 JINST 10 P10001. DOI: 10.1088/1748-0221/10/10/P10001.


4. A. Emery, N. Ballesta et al., “Towards a 1 k channel read-out and VFL with the VFL for the operation of the CERN’s linear colliders”, 2013 JINST 8 P04007.


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