Contribution ID: **318** Type: **Poster**

Fast and low power SiPM amplifier operating in a wide temperature range

Friday, 31 May 2024 08:56 (1 minute)

The next generation of RICH detectors in high energy physics experiments may use SiPMs as photon sensing elements. This upgrade is necessary to achieve greater detector granularity and speed. Thanks to their small dimensions and performance, SiPMs have also been identified as best candidates for photon sensing in neutrino studies based on liquid Argon time projection chambers (TPC). However, one downside of using such devices is that they need to be cooled down to cryogenic temperatures to detect single photons and avoid being overwhelmed by the presence of 'dark signals' due to radiation damage. It is therefore necessary to study and characterise SiPM models in dedicated campaigns, using a custom-built amplifying chain that can also operate in an extended temperature range, between 100 K and 300 K, for detector characterisation purposes. The proposed amplifier configuration consists of a hetero-junction bipolar transistor (HBT) in common emitter configuration, followed by a current-feedback operational amplifier (CFOA). The HBT was chosen as input element for its low voltage noise. The signal is fed into the base of the HBT and is picked up by the CFOA at the collector. The CFOA is operated in an unconventional open-loop mode. Feedback is closed between the output of the CFOA and the base of the HBT. The circuit behaviour has been computed and simulated to achieve a signal bandwidth of several hundred megahertz (400 MHz $< BW <$ 800 MHz), a phase margin of approximately $45°$ and a power consumption of around 115 mW. The amplifier prototype unit, which is currently under test, can be adjusted to cover the considered temperature range and still operate at full speed. The measurements, performed at both ambient and cryogenic temperatures, are compared to the simulations and calculations of the overall feedback circuit.

Collaboration

Role of Submitter

I am the presenter

Primary authors: Mr GOTTI, Claudio (Istituto Nazionale di Fisica Nucleare); TROTTA, Davide (INFN - Milano Bicocca); Mr PESSINA, Gianluigi Ezio (Istituto Nazionale di Fisica Nucleare); Mr CARNITI, Paolo (Istituto Nazionale di Fisica Nucleare)

Presenter: TROTTA, Davide (INFN - Milano Bicocca)

Session Classification: Electronics and On-Detector Processing - Poster session

Track Classification: T7 - Electronics and On-Detector Processing