Abstract

The High Luminosity Large Hadron Collider (HL-LHC) is an upgrade to the Large Hadron Collider (LHC) aimed at improving performance and achieving high instantaneous luminosity. As part of the HL-LHC program, High Granularity Calorimeter (HGCAL) is constructed by Compact Muon Solenoid (CMS) experiment at LHC to replace the existing endcap calorimeters. HGCAL has two main compartments known as electromagnetic (ECAL) and hadronic (HCAL) calorimeter and featuring a previously unrealized transverse and longitudinal segmentation. The ECAL and part of HCAL will be based on robust and cost-effective hexagonal silicon sensors. The rest of HCAL will be based on highly segmented plastic scintillator with on detector SiPM readout. Prototype hexagonal silicon modules have been tested in beams at CERN. The setup has 28 layers with single module per layer represents a full slice of ECAL. We present part of the results which is the noise study of the module using electrons, pions and muons.

Introduction

The Large Hadron Collider (LHC) is the world’s largest and most powerful particle accelerator. Currently, it can provide proton-proton collisions at centre-of-mass energy of \( \sqrt{s} = 13\, \text{TeV} \) and the instantaneous luminosity of \( 1.7 \times 10^{34} \, \text{cm}^{-2} \, \text{s}^{-1} \). The Compact Muon Solenoid (CMS) is one of the general-purpose detector at the LHC. It is built around a huge solenoid magnet which provides a magnetic field of 3.8 T. Detailed studies are being carried out to the Higgs boson and standard model (SM) processes as well as searches for physics beyond the SM.

HGCAL

The high luminosity phase of the LHC (HL-LHC) is an upgrade of LHC and is scheduled to start its operation in 2026. It will integrate 10 times more luminosity than LHC. As part of HL-LHC upgrade program, the CMS Collaboration is proposing to build a high granularity calorimeter (HGCAL) to replace the existing endcap calorimeters. HGCAL has two main compartments known as electromagnetic (ECAL) and hadronic (HCAL) calorimeter and featuring a previously unrealized transverse and longitudinal segmentation. The ECAL and part of HCAL will be based on robust and cost-effective hexagonal silicon sensors. The rest of HCAL will be based on highly segmented plastic scintillator with on detector SiPM readout.

Test Beam Setup

In HGCAL June 2018 test beam setup, 28 Si modules are mounted in 14 double-sided “cassettes”, represent the one side of whole EE part.

- Each cassette consist of absorber(Pb), module(Si/Cu/W), cooling-plate(Cu), module(Si/Cu/W) and frame.

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References


[3] 25 years of Large Hadron Collider experimental programme
https://home.cern/about/updates/2017/12/25-years-large-hadron-collider-experimental-programme

[4] ITB analysis team, ANALYSIS STATUS OF JUNE 2018 TEST BEAM DATA