



Development of a Dual-Purpose Laser Teststand – HGCAL SiPM Quality Control and Saturation Analysis

Wednesday 28 September 2022 14:15 (15 minutes)

For the approaching High-Luminosity-Upgrade of the Large Hadron Collider at CERN the development of the new detector systems will soon reach the production phase. This is also the case for the High Granularity Calorimeter (HGCAL), which will be applied in the endcaps of the Compact Muon Solenoid (CMS). The calorimeter uses silicon at the front and scintillators in the back, where the lower radiation level does allow it. It is specialized in the detection of showers of neutral hadrons. To increase the resolution of the detector systems the Particle Flow Algorithm (PFA) is to be utilized. On the hardware side this corresponds to the requirement of a highly granular calorimeter with over 200,000 individual scintillator tiles, where each light response is converted to an electrical signal by Silicon Photomultipliers (SiPMs). Besides the advantages of the PFA the high granularity also allows precise rejection of pile up events in the detector.

To guaranty high quality data and uniformity of the devices a fraction of the delivered SiPMs from Hamamatsu are to be tested for characteristics like the breakdown voltage, dark-count rate and gain. Besides the quality control, the behavior of the SiPMs at maximum illumination is to be investigated. Due to a recovery time in the range of tens of nanosecond after the detection of a first photon of one pixel of a SiPM, a second photon hitting this same pixel during the recovery time can not be detected. Therefore saturation will be reached for a high incident photon flux.

To analyze this behavior and also test SiPMs for high quality a laser test stand is under development. Two measurement modes are foreseen, one for quality assurance for large numbers of SiPMs, where the strong laser input is attenuated and split into 32 output optical fibers and a second, high intensity mode, where almost the full output is used in two channels to illuminate and saturate even the largest SiPMs with up to 40,000 pixel. As a read-out the ASIC “Kanäle für Ladungsauslese von SiPMs” (KLauS) is used.

A status of the described test stand development will be given as well as possible first test measurements.

Primary author: CHRISTIAN, Timo (FTX (FTX Fachgruppe DTA))

Presenter: CHRISTIAN, Timo (FTX (FTX Fachgruppe DTA))

Session Classification: Afternoon session