



Contribution ID: 61

Type: poster

Development of Visual Inspection System for Detecting Surface Defects on Sensor Chip

This study presents a visual inspection method based on image processing to detect surface defects found on pixel chip pad. Pixel chip is a particle detector used in Inner Tracking System (ITS) which is part of ALICE experiment (A Large Ion Collider Experiment). The quality of chip including the surface pad quality has to be well assessed in order to guarantee the successfulness of the overall experiments. A large number of pixel chips are used in ITS which demands both quick and accurate tests of the surface pad. Therefore, an effective inspection technique is needed to address such a problem. This paper proposes a design approach to assess the quality of surface pad by using image processing techniques. The design approach consists of three steps. Firstly, K- Means is employed to divide the surface pad into clean and defect areas. Secondly, defect area is extracted by using Gabor filter. Lastly, Canny Edge filter is executed to detect the defects of the defect area. Experimental results show that the proposed approach can achieve significantly high accuracy and recall probability which are by 84.9% and 77.9% respectively.

Summary

ALICE (A Large Ion Collider Experiment) is an experiment at CERN(Conseil Européen pour la Recherche Nucléaire), Switzerland that is designed to address the physics of strongly interacting matter and properties of the Quark-Gluon Plasma (QGP) using proton-proton, proton-nucleus and nucleus-nucleus collisions. In this experiment, a Large Hadron Collider (LHC) is used to accelerate two beams in opposite direction. The collision produces billion of particles with scattered trajectories, in which those particles need to be tracked and then identified..

The LHC apparatus consist of a central barrel, a forward muon spectrometer and a set of small detectors f

The pALPIDEfs design is used for particles detector. This design has dimension 15x30 mm/-2 for a single chip and 103 contact region with 200 μ m of diameter. As we can see in Figure, 103 contact area is aligned on the chip. According to its thickness, manual inspection is very hard to be done, because of light in weight, and small in size. These contact area are gold plated, and coated with other material (silicon). As mentioned before, during the production process damages may happen with unexpected condition. Figure shows the contamination process during placement activities using vacuum pick up tool.

In accordance with the pad area diameter, microscope used for visual inspection system needs to reach an appropriate view with certain magnification (500x). This system will be applied in mass production process to avoid several damages. Visual inspection for chip quality assessment is widely applied in industrial application by automated inspection system.

The study is focused in visual inspection for chip pad area. It aims to detect contaminated or defect ar

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