### Metrology procedure for the barrel SCT modules at KEK

### 1. Introduction

The ATLAS SCT barrel module is required to be assembled in high precision of a few micron meters particularly in x-y plane. Knowledge about z positions, such as deviation from the flatness, to individual module is also required to be as accurate as about 10 micron meters. It is, therefore, inevitable to perform detailed three dimensional metrology to all the assembled modules not only to verify the modules to meet assembly criteria but also to collect detailed knowledge of the module shape.

In this document, focusing on how to use jigs and how to handle the modules, we would briefly illustrate the procedure for the barrel module metrology at KEK.

#### 2. Jigs and tools

The metrology jigs and the relevant objects are pictured below.



A crab like tool shown at back right is a module picker with which the module inside the module box (right front) can be handled securely to transfer to the metrology jig (left front). Shown at left back is a guide frame which is to be attached on the metrology frame when the module held with the picker is positioned on the jig (The engineering drawing, A2-2002-06-06-4, is a new design of this jig).



The metrology jig consists of two almost identical frames, top and bottom frames, screwed on top of each other, in between the module is to be sandwiched.

The frame shown in back is just a guide for the module clutched with the picker to be properly positioned on the jig.

### 3. Module bringing out from the box



The module is placed inside the box, shown after removing the top cover and plastic fixtures.



The module picker with a positioning handle which could fit on the step structure of the box around the opening for the hybrid pig tail. The structure is shown in the previous picture.





Closing picker's arms by turning screws to clutch the module



Lifting up the module from the box by holding the positioning handle of the picker



## 4. Module setting on the metrology jig

The top frame (shown in back) is detached from the bottom frame, and instead the guide frame is attached for the preparation of positioning the module on the bottom frame. The guide frame provides the same step structure as the box frame, so that the module picked by the picker is unambiguously positioned on the jig by fitting the picker's support handle on top of the step structure of the guide frame.

Three tiny red circles are the gaskets to hold the module by means of vacuum chucking, thus the module could be held at these three points with minimal stress.



The module held with the picker is positioned on the bottom frame with a help of the guide frame.



The guide frame is being unscrewed to be detached from the bottom frame.



The guide frame has been removed, while the module is laid on the bottom frame. Partly shown above is the top frame to be overlaid on top of the bottom frame to sandwich the module.



The top frame is overlaid and screwed on top of the bottom frame. The module is sandwiched with the frames. The module is made sure, by slightly wiggling, to be properly positioned in the jig without stress.

# 5. The jig setting on Mitsutoyo Quick Vision Pro250



The base plate for the metrology jig is placed on the measuring table of Quick Vision Pro250



The base plate provides vacuum chucking to the module through the jig. The base plate is equipped with vacuum lines and a pair of valves.



The module held by the jig is set on the base plate. The module is, at first, fixed on the bottom frame by vacuum for the front side measurement.

### 6. Backside measurement



After finishing the front side measurement, in order to proceed to the backside measurement, the jig with the module is simply flipped over on the base plate. Shown above is the backside of the module. The active vacuum lines are changed by operating the valves such that the module is sucked on the top frame which is now placed at the bottom, attaching on the base plate

#### 7. Module returning to the box

After completing the metrology measurements, the module should be returned to the module box. The procedure of putting it back from the jig to the box is just the reverse process of bringing the module from the box to the jig. By reversing the steps explained in the sections 4 and 3 successively, the module can be returned safely back to the box.