Procedures for the Metrology of ATLAS SCT Endcap Modules at Liverpool

T.J.Jones

Scope

The purpose of this document is to define the procedures for the metrology of endcap modules built by the UK-N cluster. The QA of modules is meant to catch build related problems NOT to cause new ones due to unsafe handling. Therefore, in addition to the Operator instructions for the survey programmes used, a full description of the Metrology Work Area components and their routine maintenance regimes is given along with procedures for the handling of modules and their storage boxes.

The safe handling of modules and the maintenance of cleanliness is paramount.

Revision History

28/02/03	Draft 1	First version
03/03/03	Draft 2	Minor modifications to text and pictures
04/03/03	Draft 3	Incorporate feedback from JV

Operators

Name	**Responsibility**	**Scope**
T.Jones	Work Package Manager	Implement & maintain survey programmes. Diagnose & Fix survey programme failures. Work package procedures. Database Interface. Routine module surveying and cataloguing
P. Sutcliffe (?)	Deputy WPM	As above
A.N. Other 1	Operator	Routine module surveying and cataloguing
A.N. Other 2	Operator	Routine module surveying and cataloguing

Work Area Components

The Metrology Work Area is sited in a class 100 (FED 109/E) cleanroom and consists of the following constituents:-

- Work Zones: Granite metrology table,
  Operator work area,
  Work-in-progress (WIP) table.

- Hardware: OGP SmartScope™ Flash 200 Metrology Machine
  (including SmartScope PC, Printer, Joystick)
  Data handling PC (connected to LAN)
  Symbol COBRA LS/1900 bar-code reader
  Survey frame, Survey frame support plate

- Tools: 40mm x 6mm flat blade screwdriver
  20mm x 2mm flat blade screwdriver

- Consumables: AIS “Antistatic Solution Critical” Electronics cleanroom grade cleaning solution in 1l spray-gun
  Berkshire™ Class 100 cleanroom wipes

- Software: OGP MeasureX™ metrology software (SmartScope™ PC)
  Module-specific survey programmes
  AnalyseXY.vi and AnalyseZ.vi (Data handling PC)

Contamination Control

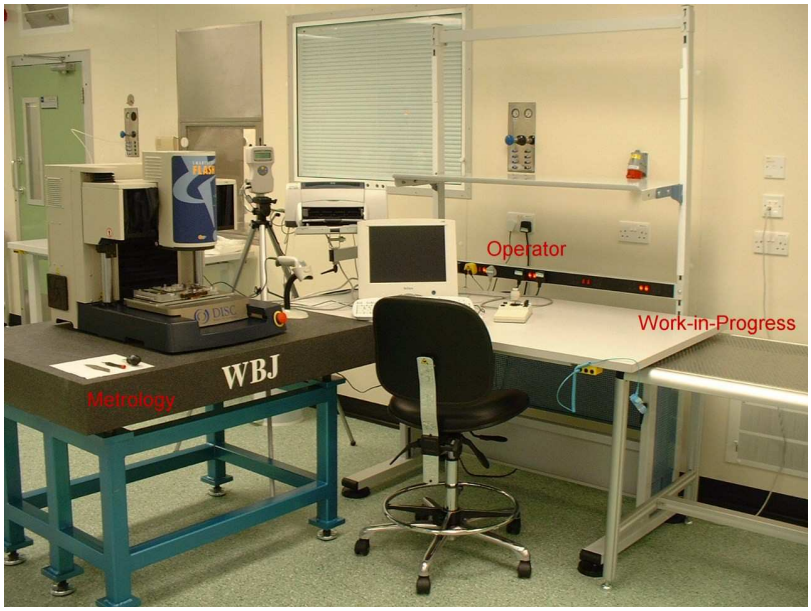
This section concerns the procedures that shall be adopted to control contamination within the Work Area.

Operator Apparel

Operators shall wear the approved Class 100 garments donned correctly.
ESD wrist-straps shall be worn.

Module Flow

The following figure shows a general view of the work area:-



Modules will be received in batches and placed on the WIP table. The WIP table is ONLY to be used for this purpose the temporary storage of a batch of modules during surveying. When a batch of modules has been surveyed the re-packaged modules will be transferred to the storage facility. At the end of the working day the batch of modules will be returned to the storage area and brought back again the next day for the completion of the survey if needed.

The WIP table is for the temporary placement of

module storage boxes and bags during the survey of a batch of modules.

It is not to be used for any other purpose.

Routine cleaning

Routine general cleaning shall be carried out as part of the standard regime for cleaning the class 100 room. Prior to routing cleaning the WIP table shall be clear of all modules, storage boxes and bags, the operator work table shall be tidy and all tools shall be in their proper place. The SmartScope shall be shut down and powered off.

Critical Surfaces & Components

The following list defines the task-specific areas that are possible sources of contamination during the metrology process.

- WIP table
- SmartScope Joy-pad
- SmartScope PC Mouse
- SmartScope PC Keyboard
- Hand Tools

General Procedures for the Maintenance of the Work Area

Prior to ANY modules being received into the work area the CRITICAL SURFACES shall be cleaned. Only the approved cleaning consumables shall be used.

WIP Table

Fold wipe in half and in half again. Moisten with anti-static cleaning solution. Clean half of table surface using smooth overlapping front-to-back strokes moving from left to right. Turn wipe over, moisten and repeat on other half of table. Un-fold wipe once and re-fold dirty-sides in. Repeat cleaning. Discard wipe.

SmartScope Joy-pad, Mouse and Keyboard

Fold wipe in half and in half again. Moisten with anti-static cleaning solution. Carefully clean joy-pad palm rest, joystick, START/STOP and ENTER buttons. Un-fold wipe once and re-fold dirty-sides in. Moisten and clean mouse and keyboard (pay particular attention to RETURN key). Discard wipe.

Tools

For each screwdriver, fold wipe in half and in half again. Moisten with anti-static cleaning solution. Clean blade with smooth drawing action from handle to blade tip. Repeat twice. Unfold wipe and re-fold dirty-sides in. Moisten wipe and clean handle. Discard wipe.

After cleaning has been completed, return to lobby,

discard gloves and don new pair

General Procedures for Module Handling

Module metrology will take place after thermal cycling has been completed and before the final electrical characterisations have been performed. Modules will be thermally cycled and electrically tested in batches. The batch size will vary from 1 to 6. It is expected that the survey of a complete batch can be undertaken in one working day.

Modules shall only be received into the work area when

the critical cleaning has been completed.

A batch of modules is placed on the WIP table. The operator shall connect their ESD wristband to the Operator Table. When required individual module storage boxes are removed from the batch container and placed on the WIP table. The storage box is removed from its anti-static bag. The three retaining screws are withdrawn and placed in a container. The top lid is removed and placed on the table. The frame + lower lid are transferred together to the Metrology Table. The module handling frame is then transferred to the Survey Jig. The lower lid is transferred to the WIP table.

Whilst the module is on the Survey Jig the lids of the storage box shall be cleaned as follows. Fold wipe in half and half again. Moisten with cleaning solution. For each lid draw wipe smoothly over the inner faces several times using overlapping strokes then proceed to the outer faces. Unfold wipe and re-fold dirty-sides in. Moisten wipe and repeat cleaning starting again on the inner faces. Finally run the wipe around the edges of the lids. Discard wipe.

Operator Procedures for Module Metrology

SmartScope Initialisation

The following initialisation sequences can be used:-

1. Cold Start.
    - Power on the SmartScope. The SmartScope PC executes the normal Windows™ type boot sequence. The MeasureX™ software is autostarted.
    - Follow the MeasureX™ initialisation dialogue.

2. PC On, MeasureX™ NOT running
    - Double-click on MeasureX™ icon.
    - Follow the MeasureX™ initialisation dialogue.

3. MeasureX™ running
    - Navigate through the SYSTEM pull down menu and select RESET.
    - Follow the MeasureX™ initialisation dialogue.

Module Survey Programmes

The module survey programmes are stored on the SmartScope (eg. C:\ModuleSurvey\Outer\Programmes) for the outer module.

There are four programmes for the outer module survey:-

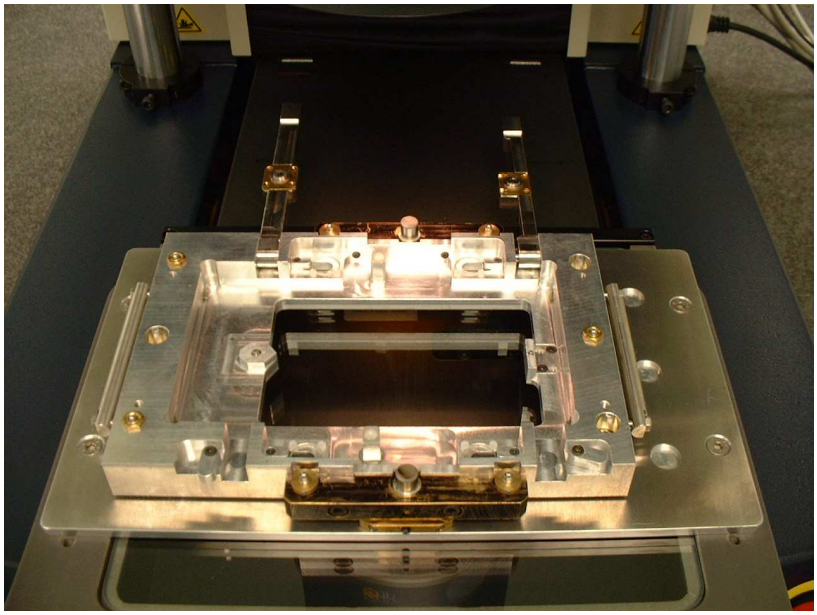
- fmOuterXY_top.MXI
- fmOuterXY_bot.MXI
- fmOuterZ_top.MXI
- fmOuterZ_bot.MXI

Each programme produces two output files. The first is a listing (.TXT) which lists the results of several key features which is used as a diagnostic to ensure that the acquisition of the survey data has been completed successfully. The second is the survey data (CSV format) that contains the survey data in the format specified in the document "How to Survey an SCT Module" (J. Greenhalgh and S.Snow) V2 1/6/01. (http://www.hep.man.ac.uk/groups/atlas/module/surv3.ps)

Module Mounting

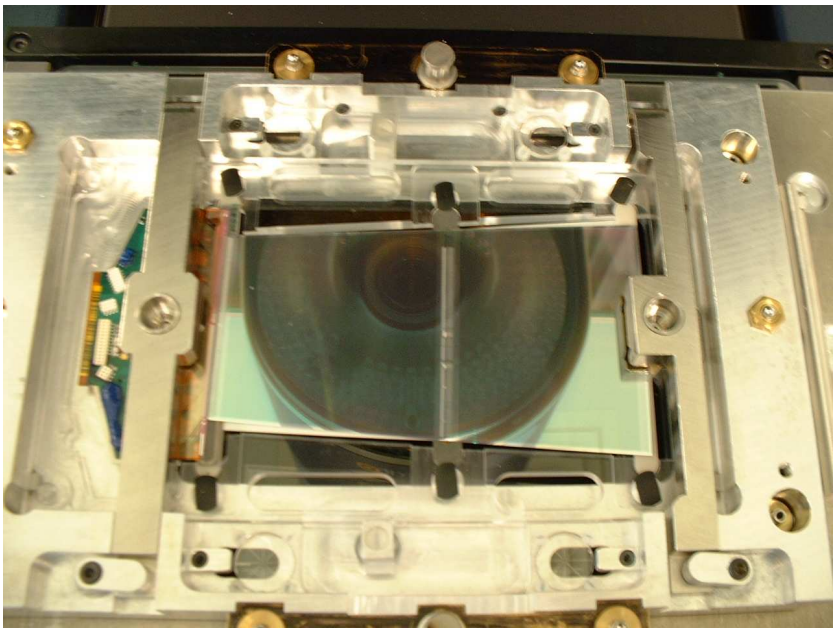
The module is mounted into the frame as follows.

1. Create working space
   - Use the joystick to bring the stage forwards.
   - Position the microscope in the middle of the horizontal axis.
   - Raise the microscope to maximum.

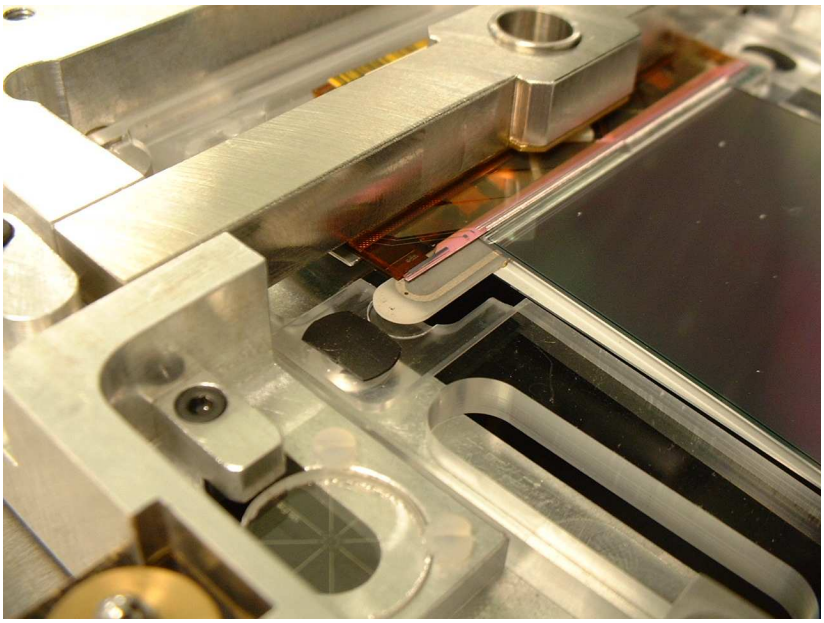


2. Clamp the Module
   - Rotate the horizontal arm retaining clamps and raise the two arms.
   - Check that the two frame support handles are pushed in and the two frame support clamps are correctly positioned.

- Offer the module frame onto the cooling block surfaces. Slowly lower the frame onto the cooling block surfaces so that the module's precision hole and slot pass over the survey jig location pins.
- Check that the module is sitting flat on the cooling block surfaces.
- Carefully lower the clamps onto the precision locators and retain them in position by rotating the two retaining clamps.



3. Drop and Retain the Frame
   - Rotate the six module to frame fixations using the small screwdriver.
   - Rotate the two frame support clamps.
   - Retract the two horizontal arm retaining clamps and allow the frame to drop.
   - Rotate the two frame support clamps to retain the frame.



XY Survey

The XY survey is performed by running the two programmes fmOuterXY_top.MXI and fmOuterXY_bot.MXI.

1. LOAD and RUN fmOuterXY_top.MXI.
2. Respond to prompts to manually locate:-
   - Top left transparent fiducial on survey frame
   - Bottom left transparent fiducial on survey frame.
   - Top right fiducial of left-hand wafer
   - Bottom right fiducial of left hand wafer.
3. Monitor the programme as it acquires the data.
4. Respond to the prompt for a file name.
5. Upon completion of the programme PRINT the listing
6. Use the joystick to move the stages to create space and turn the survey jig over.
7. Navigate via the SYSTEM drop-down menu and execute RESET.
8. LOAD and RUN fmOuterXY_bot.MXI.
9. Respond to prompts to manually locate:-
   - Top left transparent fiducial on survey frame
   - Bottom left transparent fiducial on survey frame.
   - Top right fiducial of left-hand wafer
   - Bottom right fiducial of left hand wafer.
10. Monitor the programme as it acquires the data.
11. Respond to the prompt for a file name using the same name as above.
12. Upon completion of the programme PRINT the listing
13. Use the joystick to move the stages to create space and turn the survey jig over.

Z Survey

1. Navigate via the SYSTEM drop-down menu and execute RESET.
2. LOAD and RUN fmOuterZ_top.MXI.
3. Respond to prompts to manually locate:-
   - Top left transparent fiducial on survey frame
   - Bottom left transparent fiducial on survey frame.
4. Monitor the programme as it acquires the data.
5. Respond to the prompt for a file name.
6. Upon completion of the programme PRINT the listing
7. Use the joystick to move the stages to create space and turn the survey jig over.
8. Navigate via the SYSTEM drop-down menu and execute RESET.
9. LOAD and RUN fmOuterZ_bot.MXI.
10. Respond to prompts to manually locate:-
    - Top left transparent fiducial on survey frame
    - Bottom left transparent fiducial on survey frame.
11. Monitor the programme as it acquires the data.
12. Respond to the prompt for the same file name as above.
13. Upon completion of the programme PRINT the listing
14. Use the joystick to move the stages to create space and turn the survey jig over.

Module Dis-mount & Re-pack

1. Raise the Frame
   - Rotate the two frame support clamps to the NULL position.
   - Gently raise the LH side of the frame and push home the LH frame support handle.
   - Gently raise the RH side of the frame and push home the RH frame support handle.
   - Rotate the frame support clamps to support the frame.
   - Rotate the six module to frame fixations using the small screwdriver.

2. Un-clamp the module
   - Remove module box plates from bag and take base to Metrology Table
   - Rotate the horizontal arm retaining clamps and raise the two arms.
   - Remove the module from the survey jig and transfer to module box base.
   - Lower the horizontal arms and rotate the clamps.
   - Transfer module frame / base to WIP table

3. Re-pack module
   - Locate lid on module storage box
   - Fasten 3 frame screws
   - Put module box in anti-static bag.
   - Put module into Batch Container

Failure to close the clamps may cause

serious damage to the SmartScope if the stages are moved.

Survey Data Handling

Once the whole batch of modules has been surveyed and put back into the storage unit, the data from the surveys are transferred to the Data handling PC for manipulation and subsequent up-load into the database.

The .CSV files produced by the survey programmes have to be coppied to a floppy disk. The disk is then transferred to the data handling PC where eash file is OPENed in EXCEL and SAVED AS tab-separated .TXT files to a directory on the hard disk (directory tbc). The individual module survey files are then processed using the AnalyseXY and AnalyseZ VI's running in LabView. The resulting output data files are in the required format for uploading to the database. The module ID field in the LabView analysis routines is filled in using the bar-code reader to scan the bar-code on the module storage box.

Once the data for the batch has been processed the modules are transferred to the storage facility.

Database Upload

To be added …