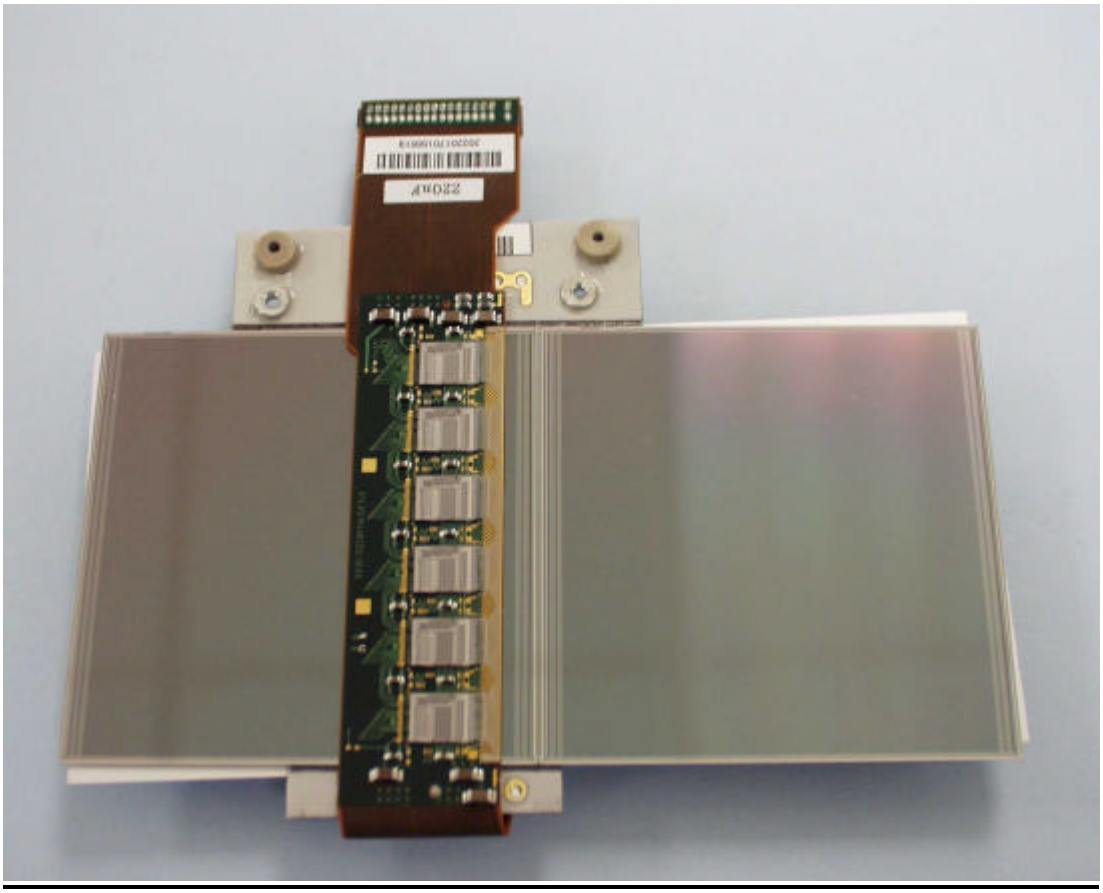
ATLAS SCT
The ATLAS Semiconductor Tracker
RAL PPD

INSTRUMENTATION Department

# ASSEMBLY OF HYBRIDS AND WIREBONDING OF ATLAS SCT BARREL HYBRIDS AND MODULES



# ESD PROTECTION INSTRUCTIONS.

**WEAR WRIST-STRAP CONNECTED TO GROUND-GUARD.**

**ENSURE GROUND GUARD SHOWS GREEN LED ILLUMINATED.**

**UNPACK DEVICES ON DISSIPATIVE SURFACE.**

**ENSURE "VISITORS" OBSERVE THE SAME INSTRUCTIONS.**

# GENERAL OVERVIEW

STAGE 1: Solder the surface mount components onto the bare hybrid and attach the ABCD3T die at the appropriate locations.

STAGE 2: Wirebond the control and power wires between the hybrid pads and the ABCD3T pads.

STAGE 3: Wirebond the inputs of the twelve ABCD3T ASICs to the fanin (1536 channels).

STAGE 4: QA Requirements.

STAGE 5: Wirebond.

5.1 Ht and Bias from hybrid fanin to detector.

5.2 The 768 top face channels from the fanin to the detector.

5.3 The 768 top face detector to detector channels.

5.4 The 768 bottom face channels from fanin to detector.

5.5 The 768 bottom face detector to detector channels.

STAGE 6: Dispatch.

STAGE 1: *Solder the surface mount components onto the bare hybrid and attach the ABCD3T die at the appropriate locations.*

This is now the responsibility of the hybrid manufacture controlled by KEK, Japan.

STAGE 2: *Wirebond the control and power wires between the hybrid pads and the ABCD3T pads.*

This is now the responsibility of the University of Birmingham, UK.

STAGE 3: *Wirebond the inputs of the twelve ABCD3T chips to the fanin (1536 channels)*

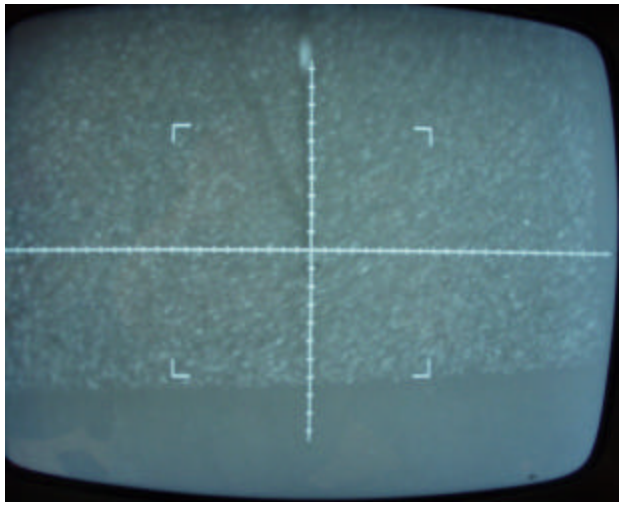
This is now the responsibility of the University of Birmingham, UK.

STAGE 4: *Module acceptance and QA requirements prior to and during wirebonding.*

The documentation for the identification of the correct module, also recording wire bonding parameters and detector channel errors must be adhered to.

STAGE 5: *Wirebonding of module.*

This is the responsibility of RAL and the following operating procedure is written assuming a K&S 1470 wire bonding machine is to be used. The calibration of the bonder is assumed to be such that the crosshairs are at the bondfoot. Any deviation from this should be taken into consideration when aligning the reference points.



STAGE 6: *Packaging and delivery for test after wirebonding.*

## Stage 4 QA Requirements.

### 4.1 Module identification.

1. Documentation relating to module construction (i.e. which hybrid on which baseboard and individual detector relative position) is the responsibility of the module assembly team.

2. Ensure that the module is the correct one to be wire bonded by checking the barcode on the hybrid.

3. Download from [*dir*.*filename*] the information relating to the module.

4. Using the agreed relative detector layout plan identify and record on the wire bonding route card the channels which are not to be bonded.

5. Record all other relavent information on the route card and tick off sections as completed. Note the mean and standard deviations of bond quality obtained from the machine statistics via the keypad.

# ATLAS BARREL MODULE WIRE BONDING

## FRONT

### FANIN TO DETECTOR

**Power: 1st bond: ____ 2nd bond: _____**

**Bond left HT (4 wires)** ☐

**Bond right HT (4 wires)** ☐

**Power: 1st bond: ____ 2nd bond: _____**

**Bond left bias (2 wires)** ☐

**Bond right bias (2 wires)** ☐

**Channels not bonded:** _____

_____

***Channel numbering 1st row=***

$$\frac{n+1}{2}$$ *where n = wire number taken from the wire bonder display*

***Channel numbering 2nd row=***

$$\frac{n}{2}$$ *where n = wire number taken from the wire bonder display*

### DETECTOR TO DETECTOR

**Power: 1st bond: ____ 2nd bond: _____**

**Bond left bias (2 wires)** ☐

**Bond right bias (2 wires)** ☐

**Channels not bonded:** _____

_____

| **Bond Quality:** | **Ref. 1** | **Ref. 2** | **Bond Quality:** | **Ref. 1** | **Ref. 2** |
|---|---|---|---|---|---|
| **Mean** | | | **Mean** | | |
| **Standard deviation** | | | **Standard deviation** | | |
| **Comments:** | | | **Comments:** | | |

**Completed by:** _____

**Date:** _____

**Completed by:** _____

**Date:** _____

# ATLAS BARREL MODULE WIRE BONDING

## BACK

### FANIN TO DETECTOR

**Power: 1st bond: ____ 2nd bond: _____**

**Bond left bias (2 wires)** ☐

**Bond right bias (2 wires)** ☐

**Channels not bonded:** _____

### DETECTOR TO DETECTOR

**Power: 1st bond: ____ 2nd bond: _____**

**Bond left bias (2 wires)** ☐

**Bond right bias (2 wires)** ☐

**Channels not bonded:** _____

***Channel numbering 1st row=***

$$\frac{n+1}{2} \text{ where } n = \text{wire number taken from the wire bonder display}$$

***Channel numbering 2nd row=***

$$\frac{n}{2} \text{ where } n = \text{wire number taken from the wire bonder display}$$

| **Bond quality** | **Ref. 1** | **Ref. 2** | **Bond Quality** | **Ref. 1** | **Ref. 2** |
|---|---|---|---|---|---|
| **Mean** | | | **Mean** | | |
| **Standard deviation** | | | **Standard deviation** | | |
| **Comments:** | | | **Comments:** | | |

**Completed by:** _____

**Date:** _____

**Completed by:** _____

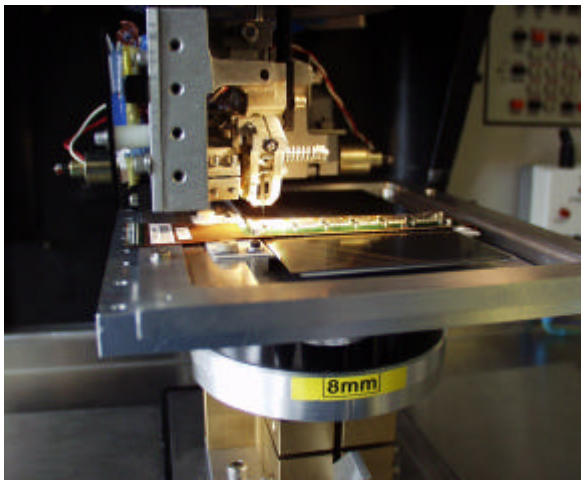
**Date:** _____

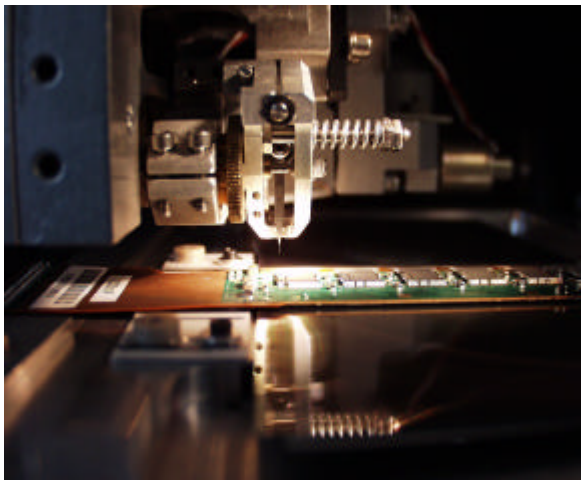
# Stage 5 Wire Bonding.

## 5.1 Wirebond Ht and Bias from hybrid fanin to detector.

1. Mount the module on the bonding jig (top face up) and fix to the 1470 stage using the fixture plate, rotational stage and 8mm spacer.

2. In MAN Mode set loop height to 120 in LHT mode, CVL1 and CVL2 to 8.

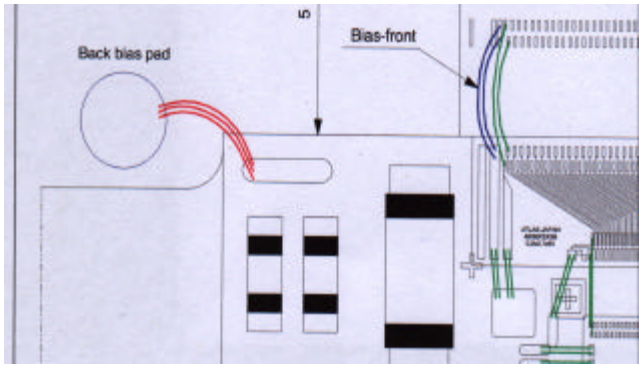


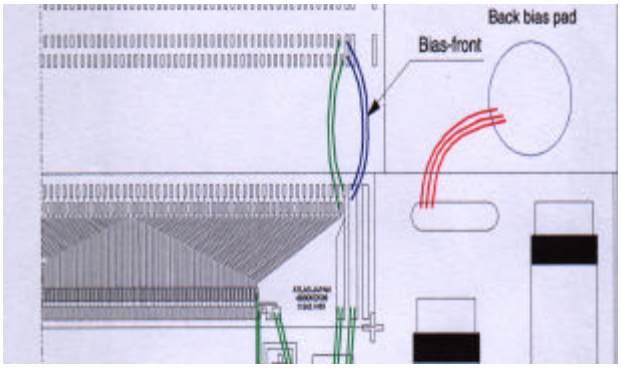



3. Set 1 on the presettable focus depth. Position the fanin under the wedge and, using the Theta/Z option, put the Z drive to 230 counts. Raise the workholder so that the fanin makes contact at this focus and Z height. This should ensure the focal planes for the fanin and detector are 1 and 6 respectively.

4. Set 1st bond and 2nd bond power to 2.8

5. Wirebond three wires from the HT pad on the hybrid to the BACK BIAS pad on the baseboard at both the left and right edges of the module.



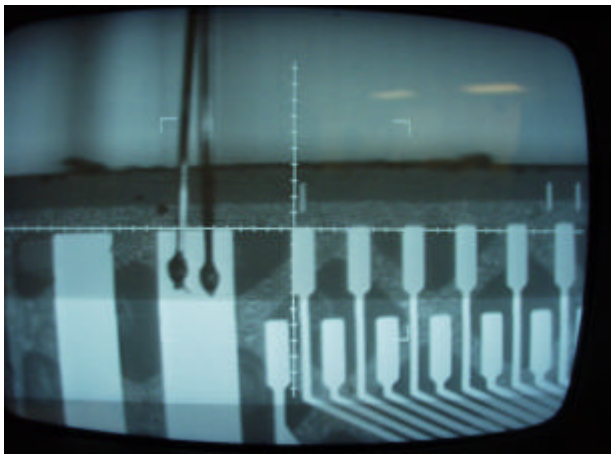

6. Still in MANUAL Mode, leave loop height and CVL settings.

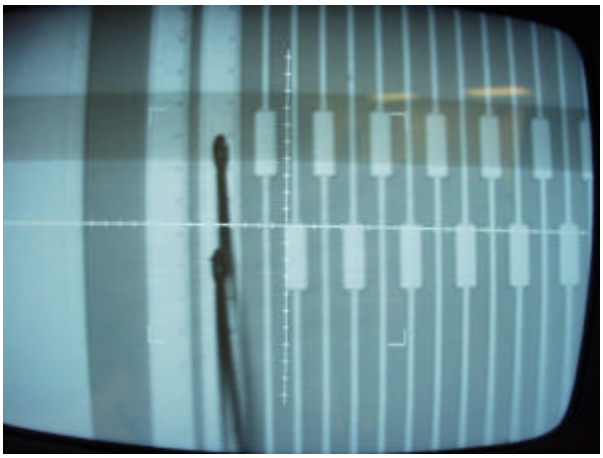
7. Change 1st bond power to 2.4 and 2nd bond power to 2.1.

8. Wirebond two wires from the FRONT BIAS rail on the fanin to the BIAS rail on the detector again at both the left and right edges of the module.

## 5.2 Bond 768 top face channels from the fanin to the detector.

1. Load program ATLAS 20.
2. Check detector information for channels to be missed.
3. Set 1st bond power to 2.4 and 2nd bond power at 2.1.
4. In MAN mode set XY0.
5. Select SEMI-AUTO mode.
6. Set XY0 and align crosshairs to reference points as per the following images.



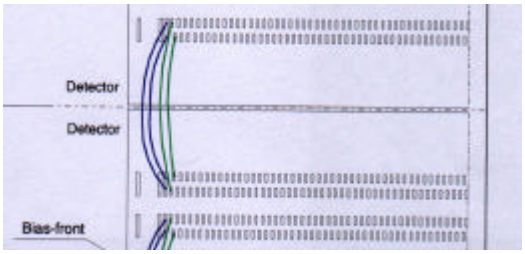


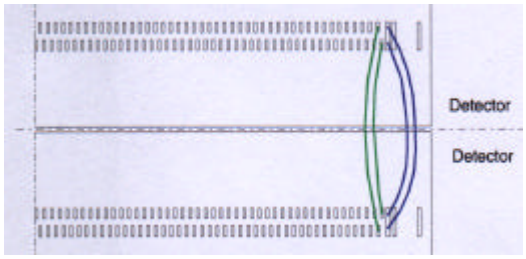
7. Set LOOP Ht to 120, 1st bond power to 2.4 and 2nd bond power to 2.1.
5. Commence bonding, checking on placement of bond foot and clearance of wire over front edge of the hybrid.
6. When satisfied AUTO bond the full fanin to detector array.
7. Record SIGMA and STD DEV for 1st and 2nd bonds.
8. Record intentionally and unintentionally missed bonds.
9. When 1st row is finished return to XY0 and align for the 2nd row bonding.
10. Set XY0 and align crosshairs to reference points as above but aligning to the second row.
11. Set LOOP Ht to 150, 1st bond power to 2.4 and 2nd bond power to 2.1.
12. Commence bonding, checking on placement of bond foot and clearance of wire over 1st row bonding.
13. When satisfied AUTO bond the full fanin to detector array.
14. Record SIGMA and STD DEV for 1st and 2nd bonds.
15. Record intentionally and unintentionally missed bonds.

## 5.3 Bond 768 top face channels from detector to detector.

1. Move the 1470 stage such that the detector/detector joint is positioned below the wedge

2. Do not adjust the height of the workholder but change the programmable focus point to focus the image on the monitor.




3. Load program ATLAS 21.

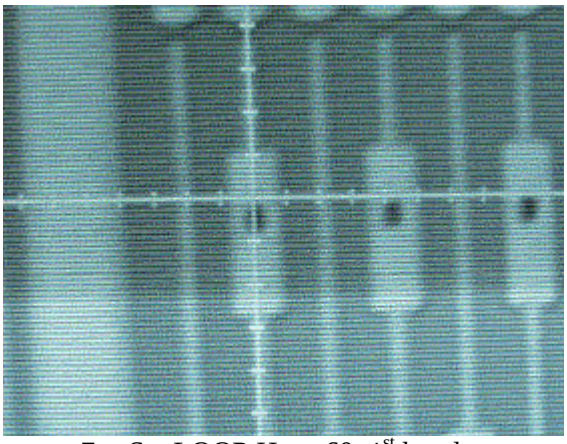
4. Check detector information for channels to be missed.

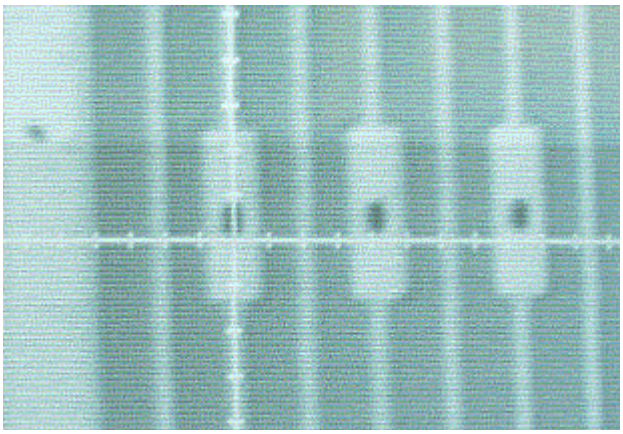
5. Set 1st bond power to 2.1 and 2nd bond power at 2.1.

6. In MAN mode and loop at 60 LHT mode bond BIAS between the two detectors at both edges of the detector. The pad is a window in line with the channel bonding pads.

8. Select SEMI-AUTO mode.

9. Set XY0 and align crosshairs to reference points as per the following images.





7. Set LOOP Ht to 60, 1st bond power to 2.1 and 2nd bond power to 2.1.

8. Commence bonding, checking on placement of bond foot.

9. When satisfied AUTO bond the full detector to detector array.

10. Record SIGMA and STD DEV for 1st and 2nd bonds.

11. Record intentionally and unintentionally missed bonds.

12. When 1st row is finished return to XY0 and align for the 2nd row bonding.

13. In MAN mode and loop at 80 LHT mode bond BIAS between the two detectors at both edges of the detector. The pad is a window in line with the channel bonding pads.

14. Set XY0 and align crosshairs to reference points as above but for the second row.

15. Set LOOP Ht to 80, 1st bond power to 2.1 and 2nd bond power to 2.1.

16. Commence bonding, checking on placement of bond foot and clearance of wire over 1st row bonding.

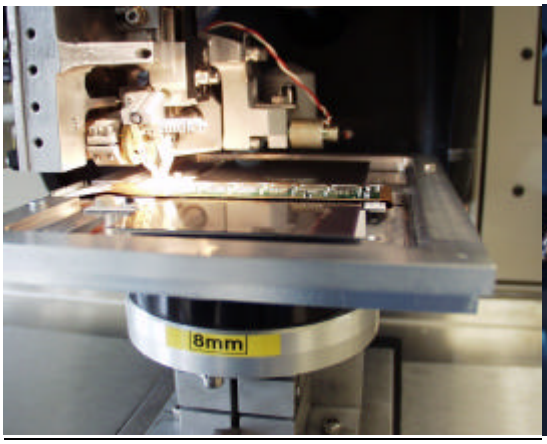
16. When satisfied AUTO bond the full fanin to detector array.

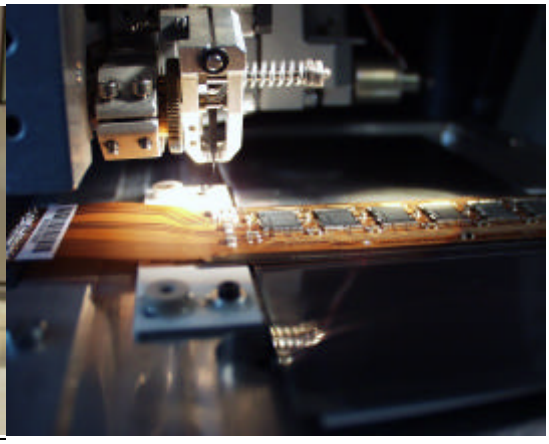
17. Record SIGMA and STD DEV for 1st and 2nd bonds.

18. Record intentionally and unintentionally missed bonds.

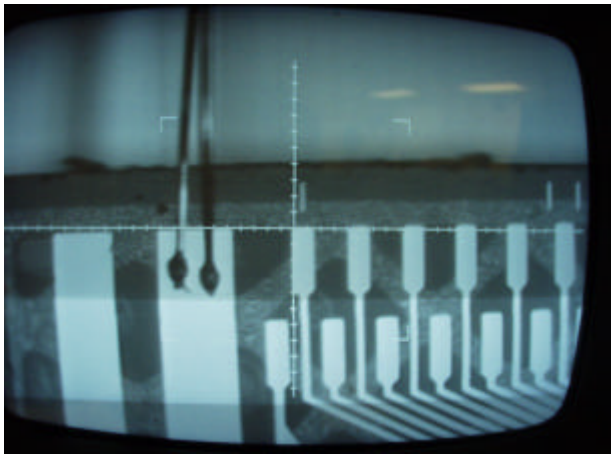
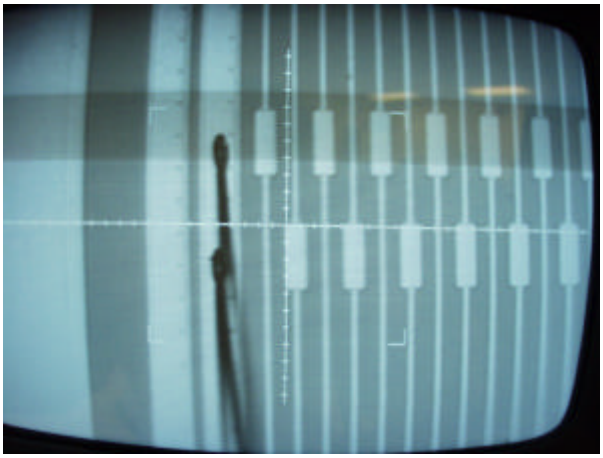
## 5.4 Bond 768 bottom face channels from the fanin to the detector.

1. Mount the module on the bonding jig (bottom face up) and fix to the 1470 stage using the fixture plate, rotational stage but no spacer.





2. There are no Ht connections between hybrid and detector on the bottom face.
3. Load program ATLAS 20.
4. Check detector information for channels to be missed.
5. Set 1st bond power to 2.4 and 2nd bond power at 2.1.
6. In MAN mode set XY0.
7. Select SEMI-AUTO mode.
8. Set XY0 and align crosshairs to reference points as per the following images.

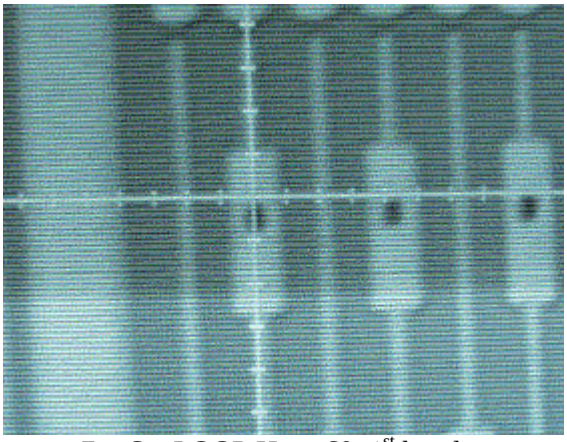



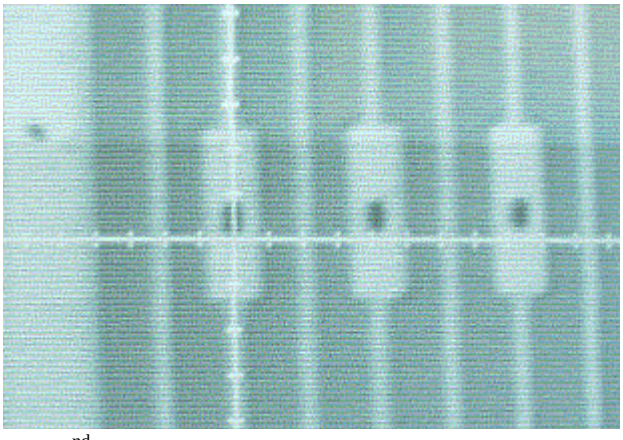
9. Set LOOP Ht to 120, 1st bond power to 2.4 and 2nd bond power to 2.1.
10. Commence bonding, checking on placement of bond foot and clearance of wire over front edge of the hybrid.
11. When satisfied AUTO bond the full fanin to detector array.
12. Record SIGMA and STD DEV for 1st and 2nd bonds.

13. Record intentionally and unintentionally missed bonds.
14. When 1st row is finished return to XY0 and align for the 2nd row bonding.
15. Set XY0 and align crosshairs to reference points as above but aligning to the second row.
16. Set LOOP Ht to 150, 1st bond power to 2.4 and 2nd bond power to 2.1.
17. Commence bonding, checking on placement of bond foot and clearance of wire over 1st row bonding.
18. When satisfied AUTO bond the full fanin to detector array.
19. Record SIGMA and STD DEV for 1st and 2nd bonds.
20. Record intentionally and unintentionally missed bonds.

## 5.5 Bond 768 bottom face detector to detector channels.

1. Move the 1470 stage such that the detector/detector joint is positioned below the wedge.
2. Do not adjust the height of the workholder but change the programmable focus point to focus the image on the monitor.
3. Load program ATLAS 21.
4. Check detector information for channels to be missed.
5. Set 1st bond power to 2.1 and 2nd bond power at 2.1.
6. In MAN mode and loop at 60 LHT mode bond BIAS between the two detectors at both edges of the detector. The pad is a window in line with the channel bonding pads.
10. Select SEMI-AUTO mode.
11. Set XY0 and align crosshairs to reference points as per the following images.





7. Set LOOP Ht to 60, 1st bond power to 2.1 and 2nd bond power to 2.1.
8. Commence bonding, checking on placement of bond foot.

9. When satisfied AUTO bond the full detector to detector array.

10. Record SIGMA and STD DEV for 1st and 2nd bonds.

11. Record intentionally and unintentionally missed bonds.

12. When 1st row is finished return to XY0 and align for the 2nd row bonding.

13. In MAN mode and loop at 80 LHT mode bond BIAS between the two detectors at both edges of the detector. The pad is a window in line with the channel bonding pads.

14. Set XY0 and align crosshairs to reference points as above but for the second row.

15. Set LOOP Ht to 80, 1st bond power to 2.1 and 2nd bond power to 2.1.

16. Commence bonding, checking on placement of bond foot and clearance of wire over 1st row bonding.

19. When satisfied AUTO bond the full fanin to detector array.

20. Record SIGMA and STD DEV for 1st and 2nd bonds.

21. Record intentionally and unintentionally missed bonds.

## Stage 6. Dispatch.

### 6.1 Record storage of module.

1. On completion of wirebonding transfer the module to the storage box and record [*dir:filename*] the storage location so that the correct module can be identified by the test team.