Instruction for IST production testing at UIC

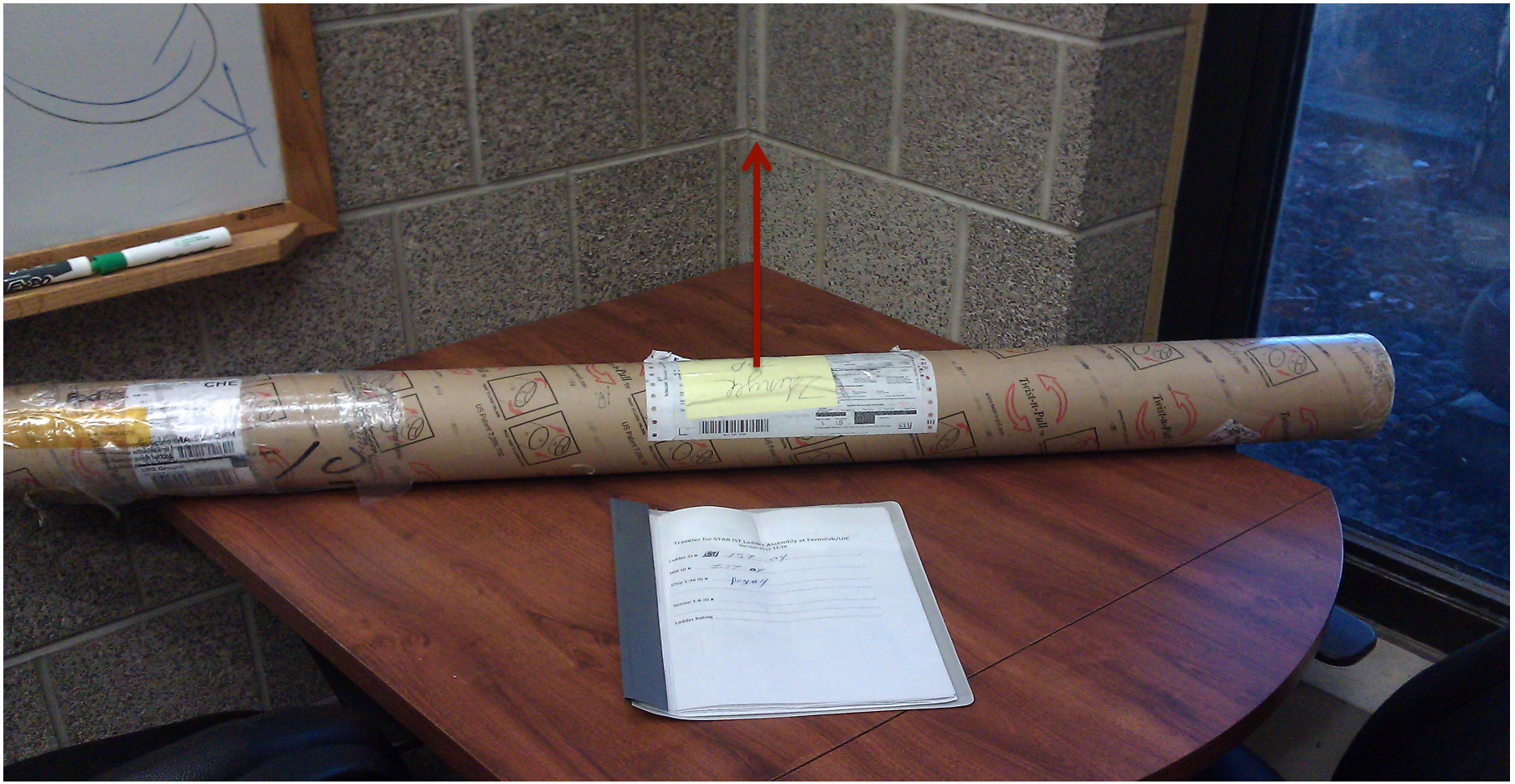
Yaping Wang (UIC)

Step 1: Stave preparation
Step 2: Visual inspection
Step 3: Set up test chain
Step 4: Start testing
(1) Testing after APV chips placement and wire bonds
(2) Testing after sensors placement and wire bonds
---- Switch on slow control firstly
Step 5: Record testing results
Step 6: Upload testing results to database
Step 7: Put stave back into transportation box

Keep in mind: If you have any doubt for your step or are not clear what's the next step, please stop! Please contact Dr. Zhenyu Ye or corresponding person.

Stave preparation

1. Take out IST stave from transportation box (keeping stave upward).

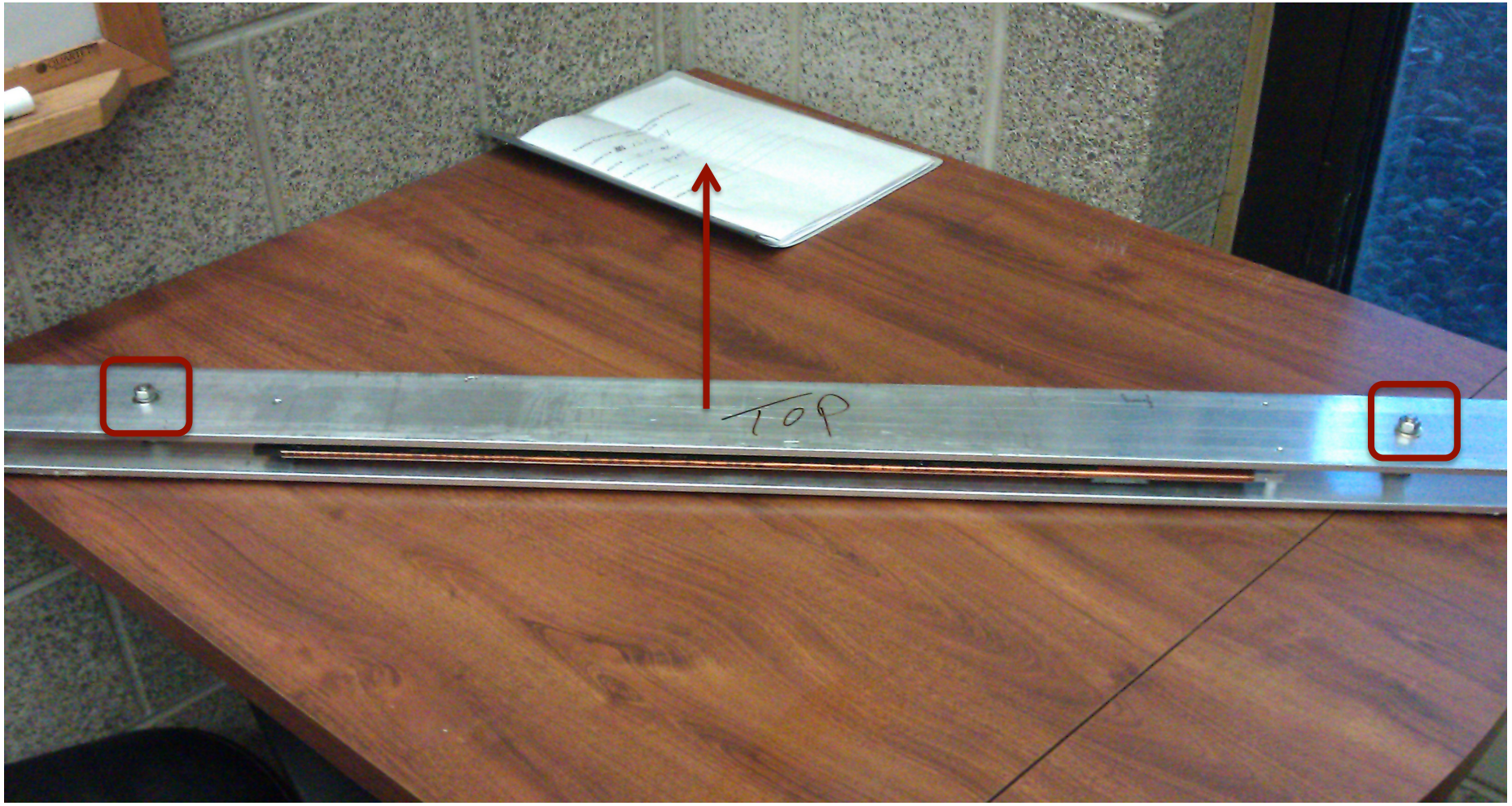


Stave preparation

2. Take the stave from the bag (keeping stave upward)

Stave preparation

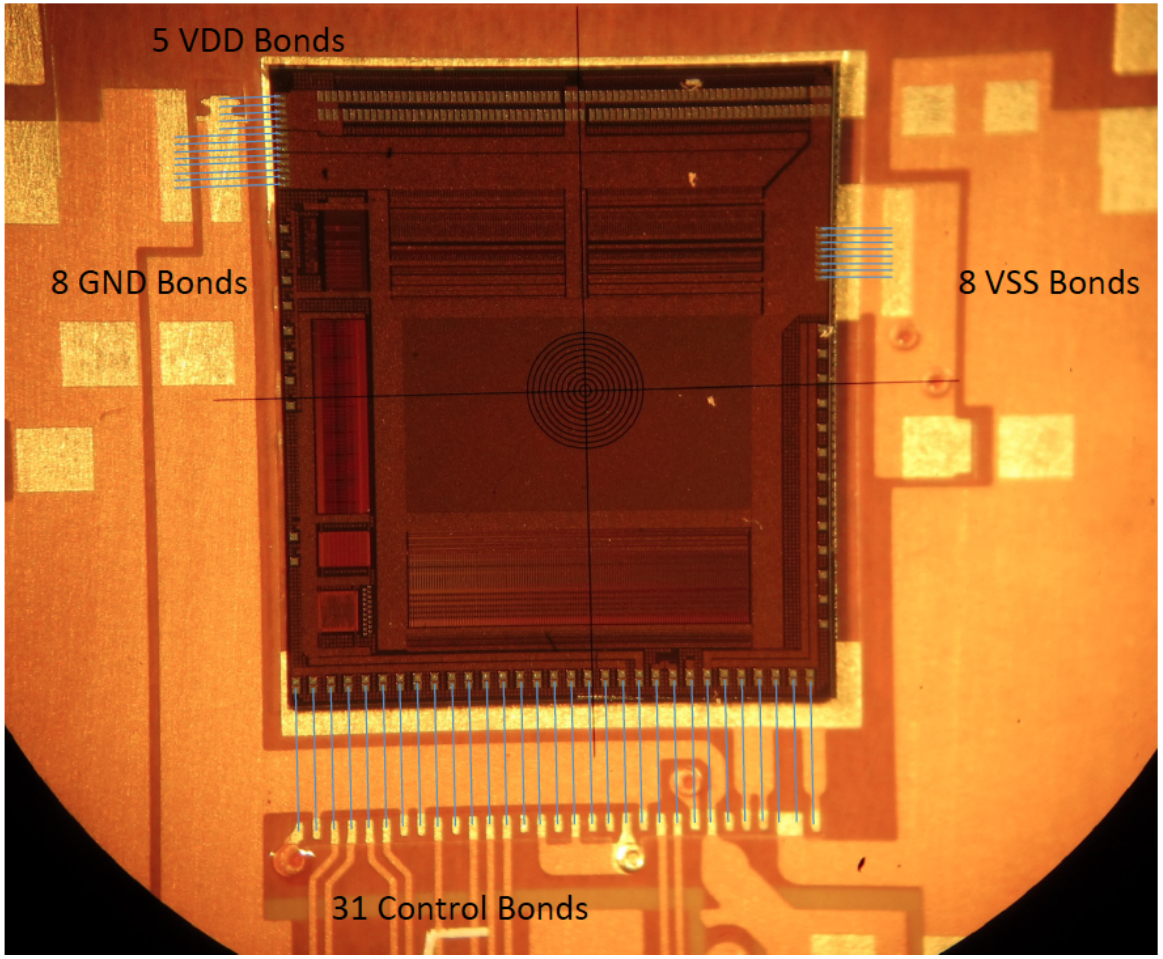
3. Place the stave on a stable table (keeping stave upward) and remove the top plate
(1) Screw off the two big nuts
(2) Take out the top aluminum plate



Visual inspection

1. Place the uncovered stave under the lens of microscope (Please wear gloves and dust cap!!) and check the APV to hybrid bonds.

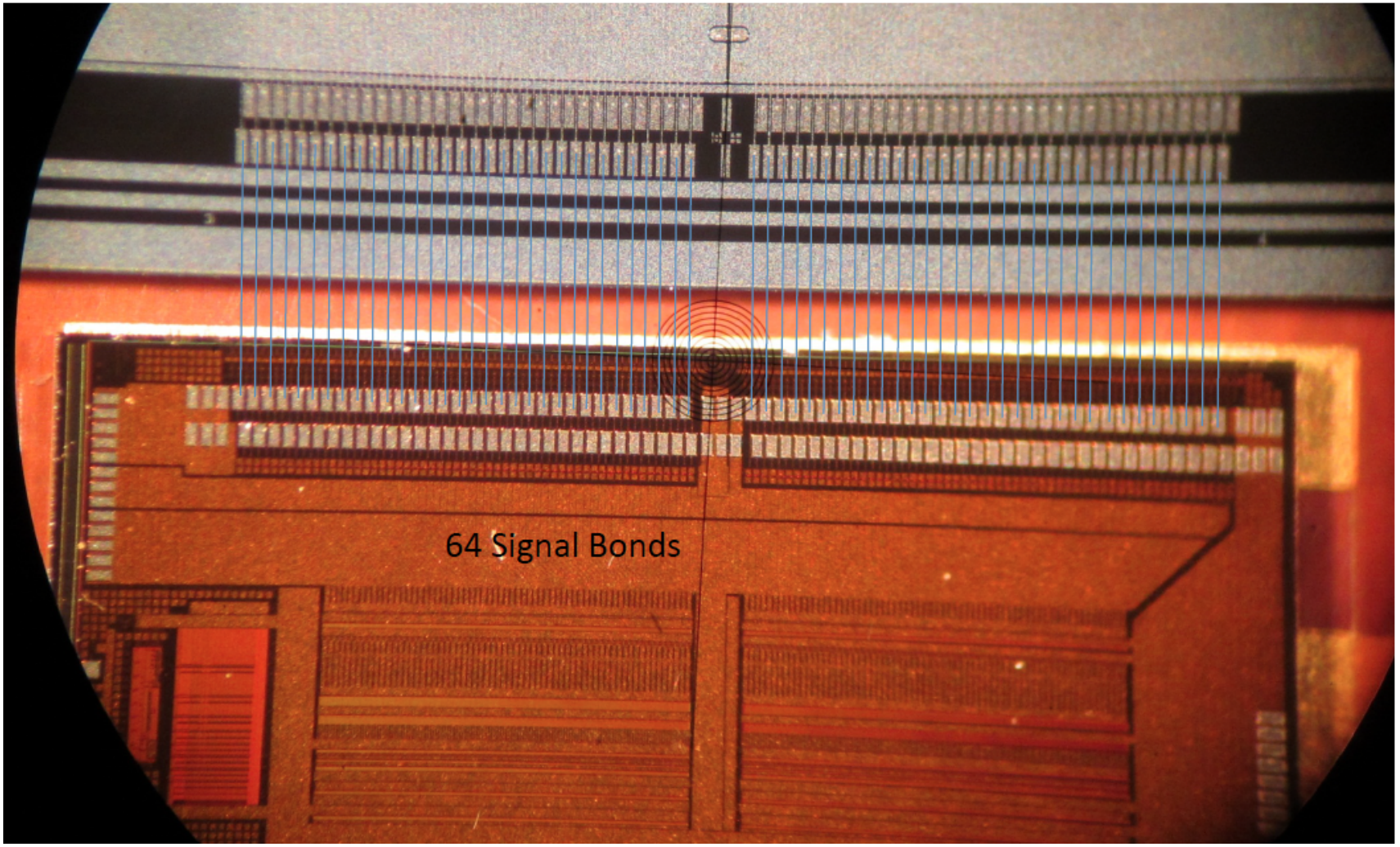
If bonds missing/broken or bonds touched each other, please write it down in the traveler.



Visual inspection

2. Check the APV to sensor bonds (Inner row) once the sensors placement is done.

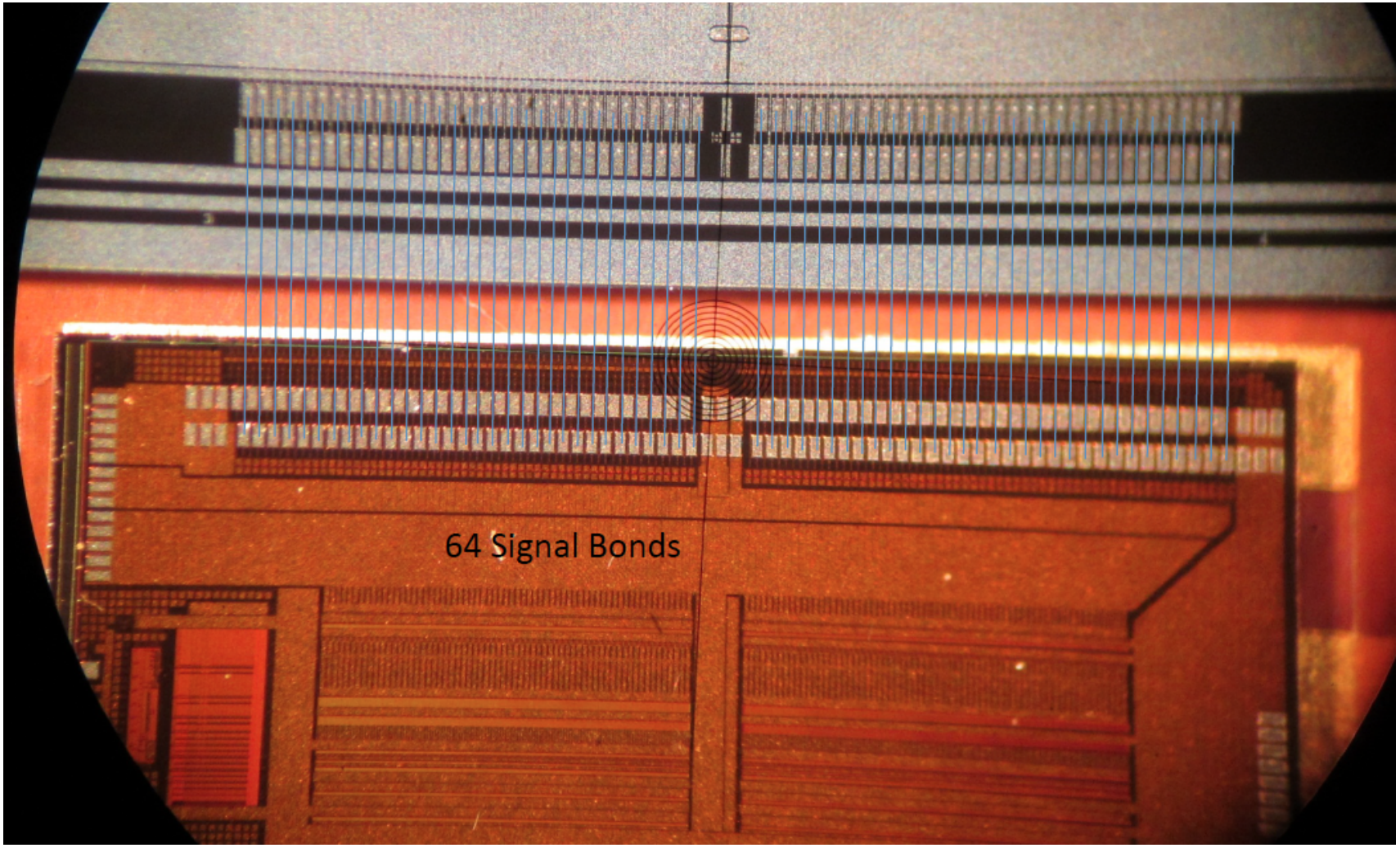
If bonds missing/broken or bonds touched each other, please write it down in the traveler.



Visual inspection

3. Check the APV to sensor bonds (Outer row).

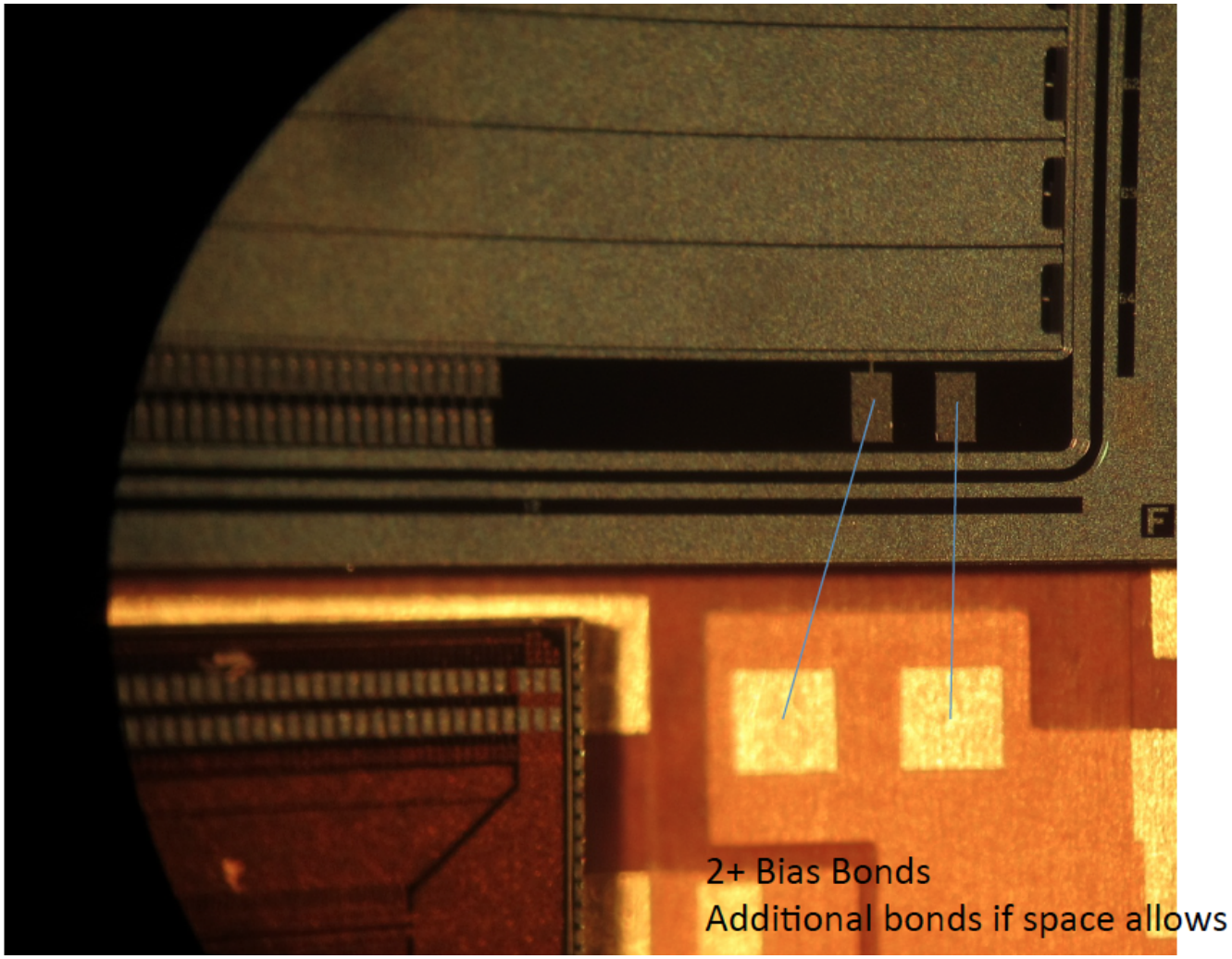
If bonds missing/broken or bonds touched each other, please write it down in the traveler.



Visual inspection

4. Check the sensor to hybrid (bias HV connection).

If bonds missing/broken, please write it down in the traveler.



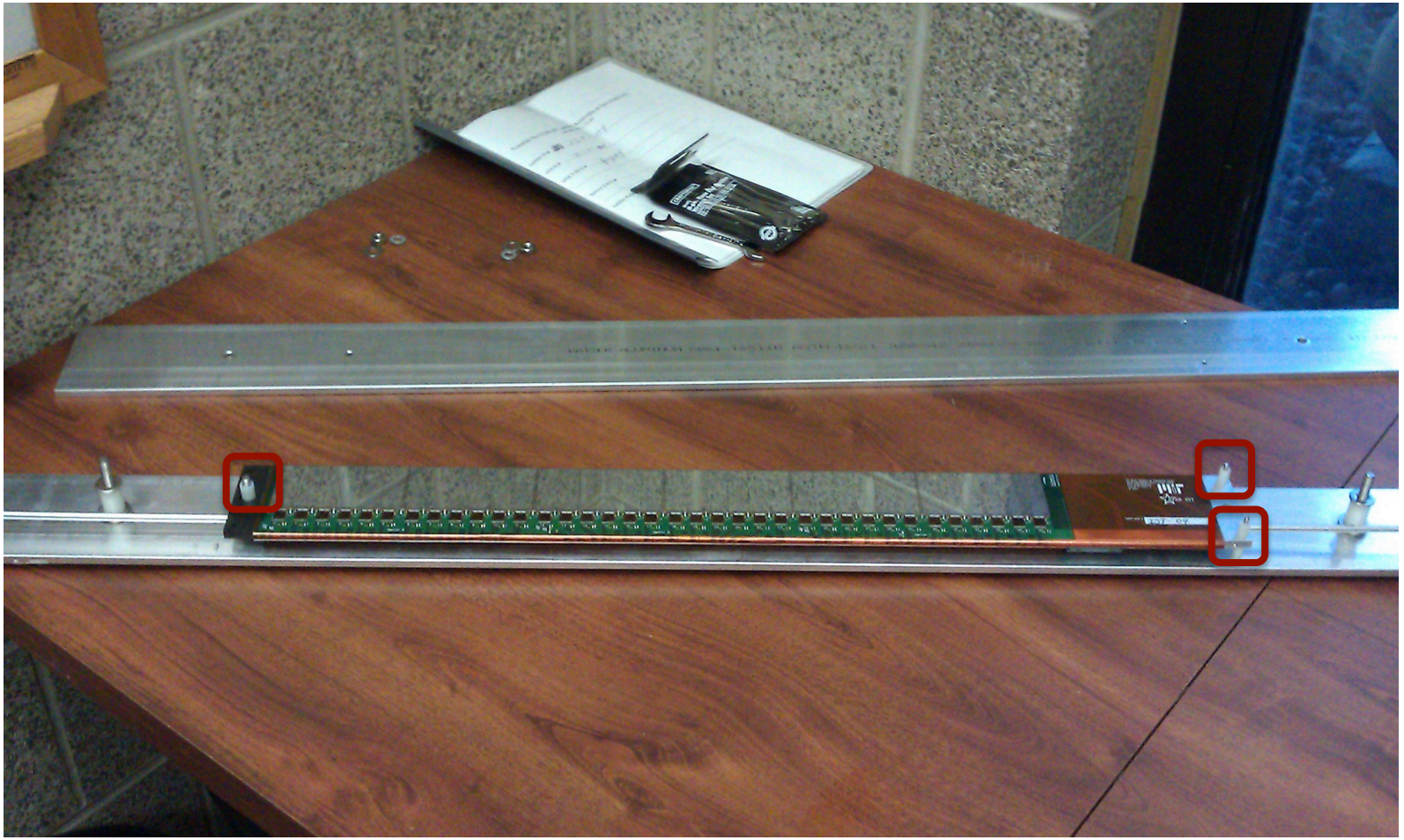
Visual inspection

5. Move the stave to the testing lab once the visual inspection done and no serious errors found (please keep gloves and cap on!).

Be sure of that the top plate is covered (but not screwing up) while moving.

Set up test chain

1. **Keep gloves and dust cap on.**
2. **Place the stave on table and remove the top aluminum plate.**
3. **Remove the three spacers**



Set up test chain

4. Open the front door of testing frame

5. Place the stave into the testing frame (three screw studs of ~ 20cm fixed on bottom side of the frame which are used to fix the stave).

(1) Keeping the three studs are threading corresponding holes (two on east end-cap and one on west end-cap) of the stave.

(2) During the placement, please keep your hand on the stave's two end-caps, and low the stave very carefully and slowly. Once you feel the placement a little tight, please loosen one stud (east side) and then continue.

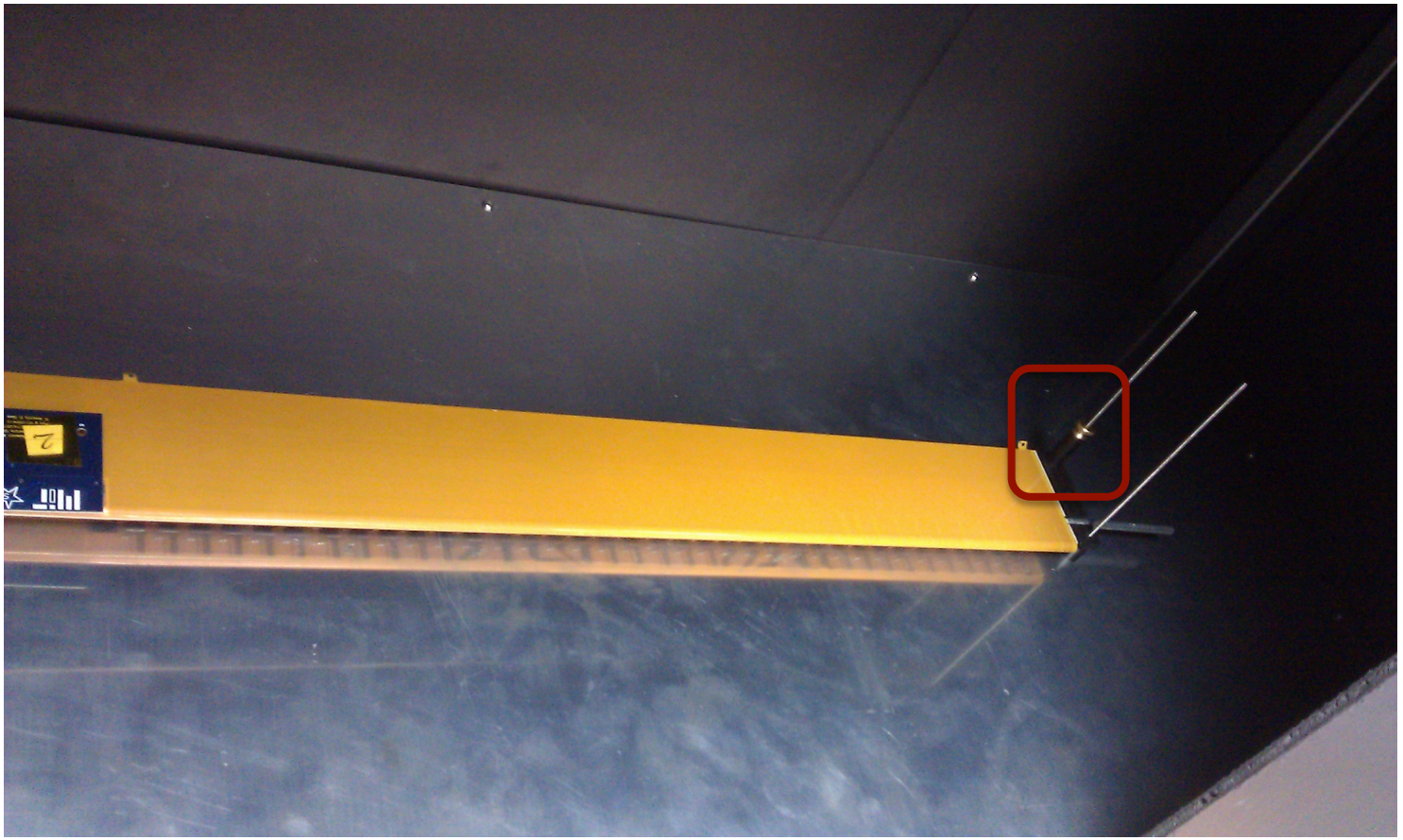
(3) Do not touch the hybrid area and do not press the stave during placement.

Set up test chain

6. Connect the transition board to the PPB board (T-Board #2 used for full sections testing).

Set up test chain

7. Place the stave into the frame. On the east side, there are two studs to fix the stave, and please screw up the inner one with a spacer and a nut.



Set up test chain

8. Place the T-Board to to the stave (markers have been available on both sides).

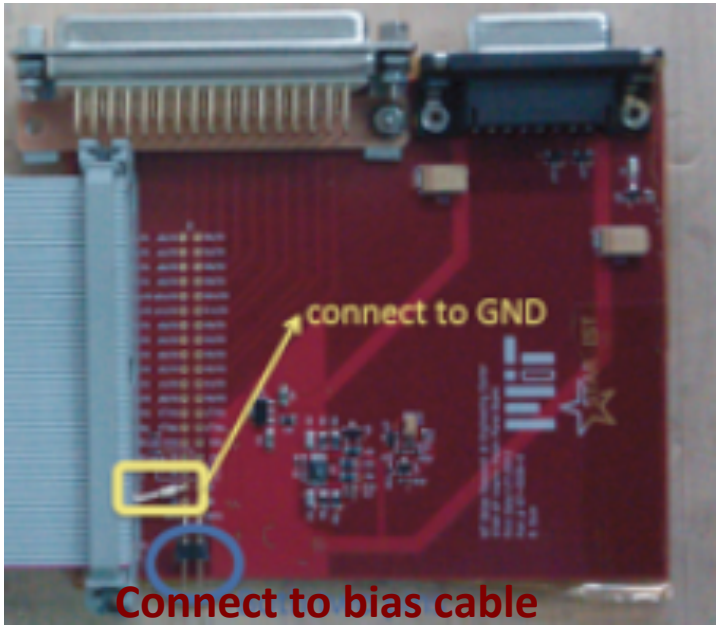
ARM0_PORT0 ---------- Power/Signal cables A ---------- PPB # 1 ----------T-Board Bus A
ARM0_PORT1 ---------- Power/Signal cables B ---------- PPB # 3 ----------T-Board Bus B
ARM1_PORT0 ---------- Power/Signal cables C ---------- PPB # 2 ----------T-Board Bus C

Set up test chain

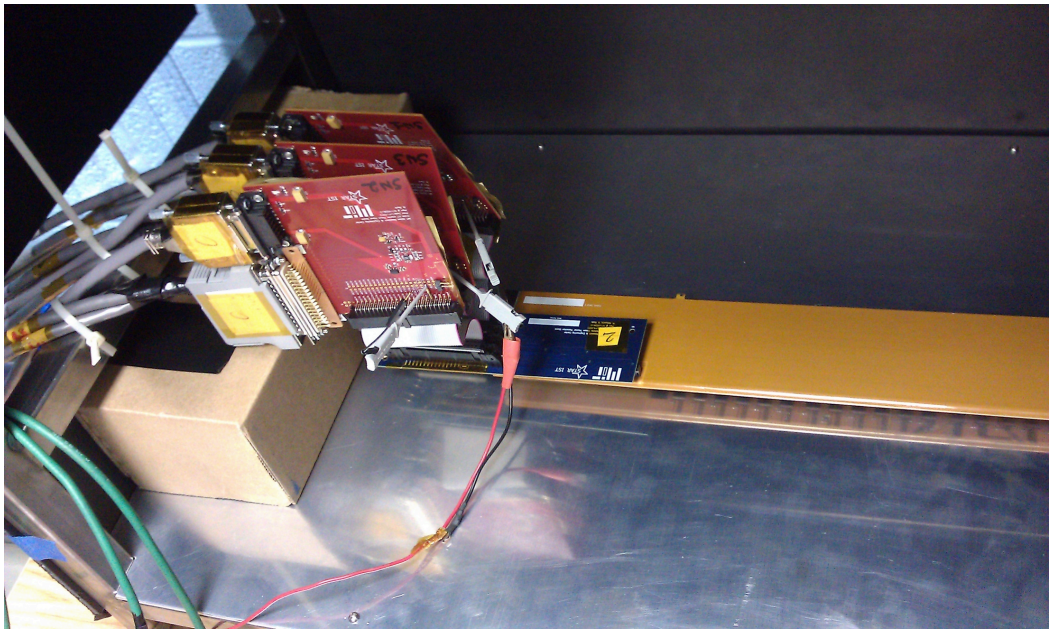
9. Connect bias and earth ground to the inputs on PPB side once the sensors placement is done.

suggest all the bias GND should be connected to a common earth ground.

Bias cable A ---------- PPB # 0 ----------T-Board Bus A
Bias cable B ---------- PPB # 3 ----------T-Board Bus B
Bias cable C ---------- PPB # 2 ----------T-Board Bus C



Connect to bias cable of 70 Volts



No bias needed for the testing after APV chips placed and skip it.

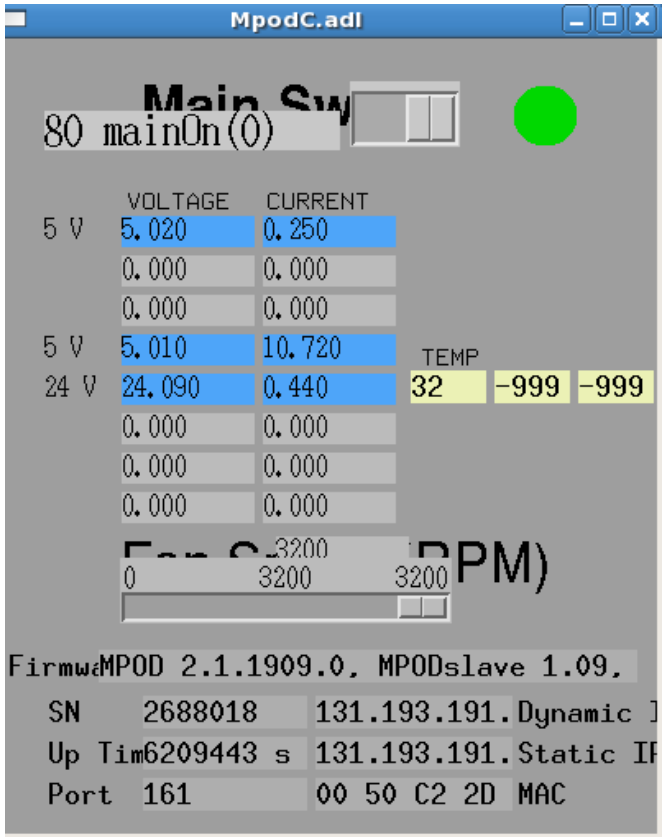
Set up test chain

10. Check the connection again and make sure all connections are correct (including cosmic trigger is connected. Do not adjust/power off the cosmic trigger system).
11. Close the front door of testing frame.

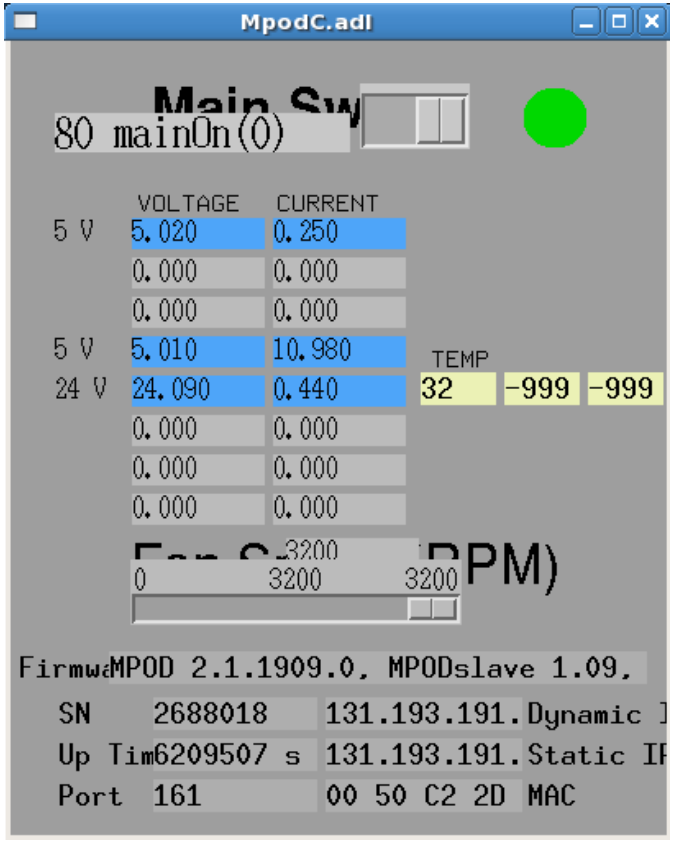
Start testing -- Testing after APV chips placement and wire bonds

1. Log in DAQ PC (account: ist password: ist4hft@UIC)
2. Switch to home directory
3. Switch to "FGT_TEST" directory
   "daqman" or "cd /home/ist/cvs/online/RTS/src/FGT_TEST"
4. Start DAQ program
   stardev
   ./fgt_run_daq –L –c ist_rdo_conf_YPW_for_Test.txt –C 0x03 –n 1000 –S /scratch/data/IST_04/COSMIC_STAVE04_SensorBias0_VPSP43_VFS70_PosPol_1000evts_YYYYMMDD_UIC_##.sfs
   Here YYYYMMDD is the date like 20121216, ## means data number.
5. Start analysis program
   cd /home/ist/ARMdisplay
   stardev
   ARMdisplay –f /scratch/data/IST_04/COSMIC_STAVE04_SensorBias70_VPSP43_VFS70_PosPol_1000evts_YYYYMMDD_UIC_##.sfs
   press "p" to save analysis results as png files once the analysis loop is over.

Record testing results – currents of staves with 36 APV chips



Initial power up

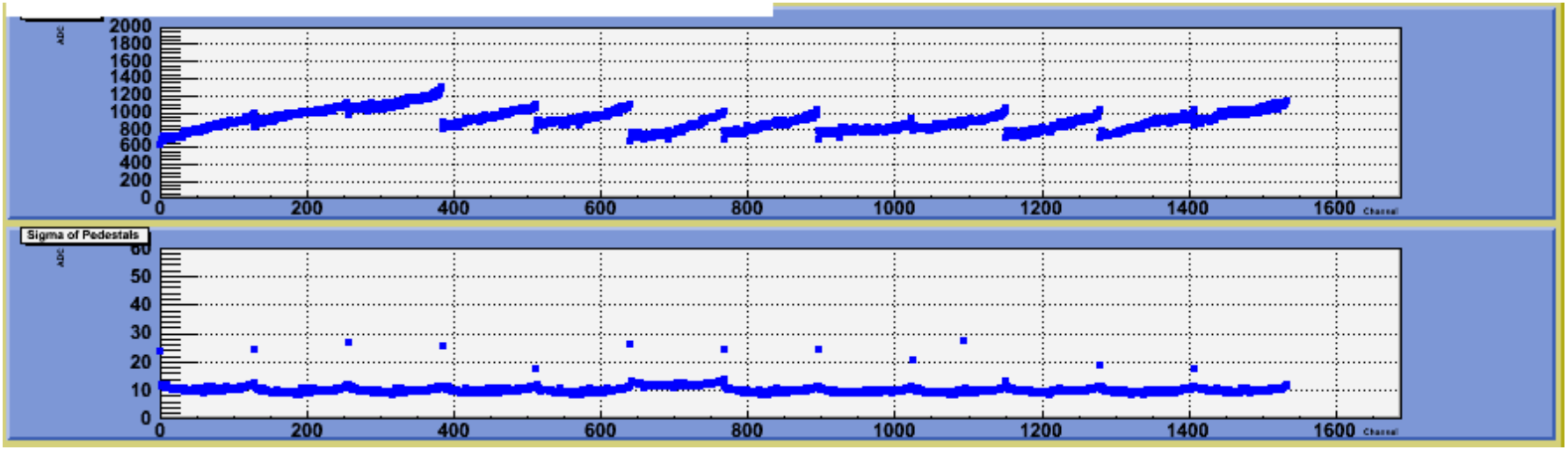


Taking data = configured

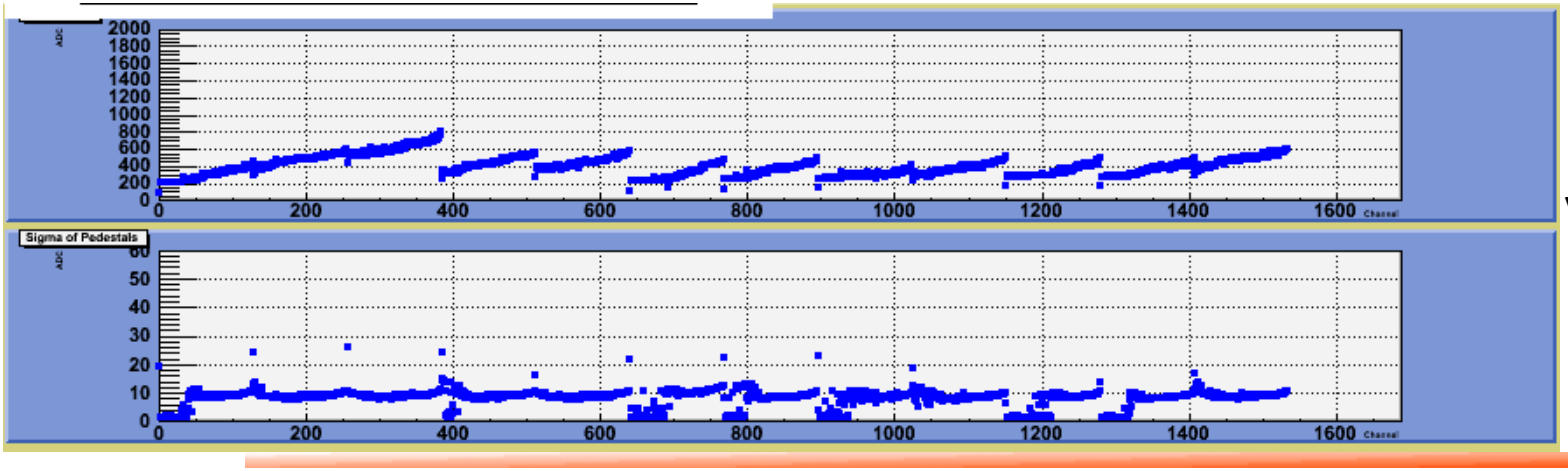
Power consumption is different when the chips are configured by the DAQ than just after initial power on of the readout crate!

-record the currents by making screenshots of the slow controls window or by writing down the currents for 5V and 24V

Record testing results – Pedestals of section A

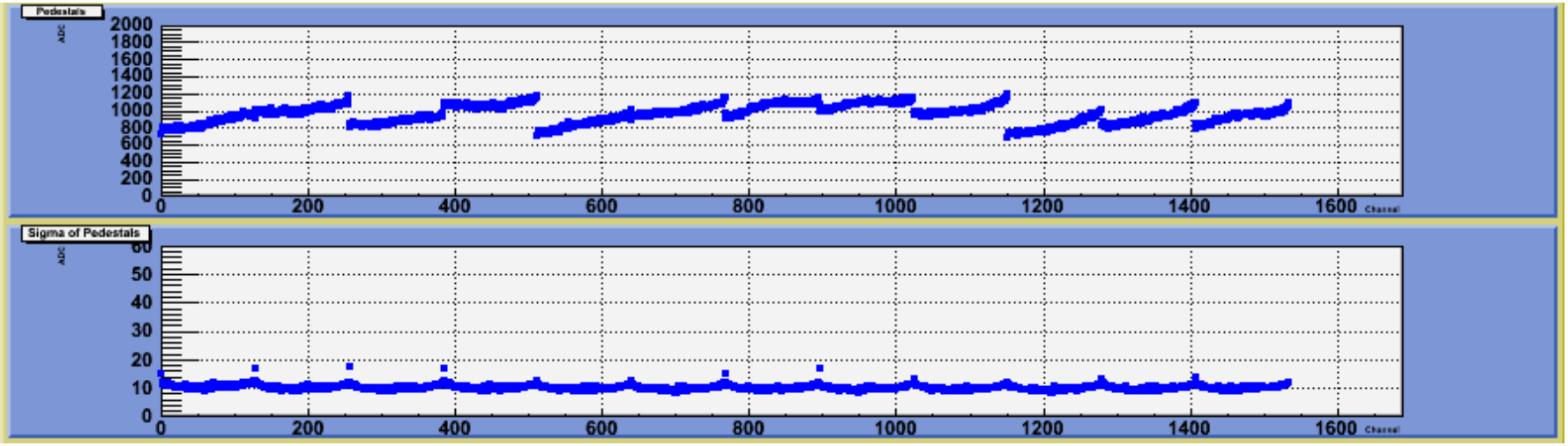


- record pedestals and noise by making screenshot
- record presence and sanity of the 12 APVs
  - with VPSP=43 the pedestals should look roughly as in plot
  - take a run with VPSP=48, the pedestals should go down
  - noise should be around 10

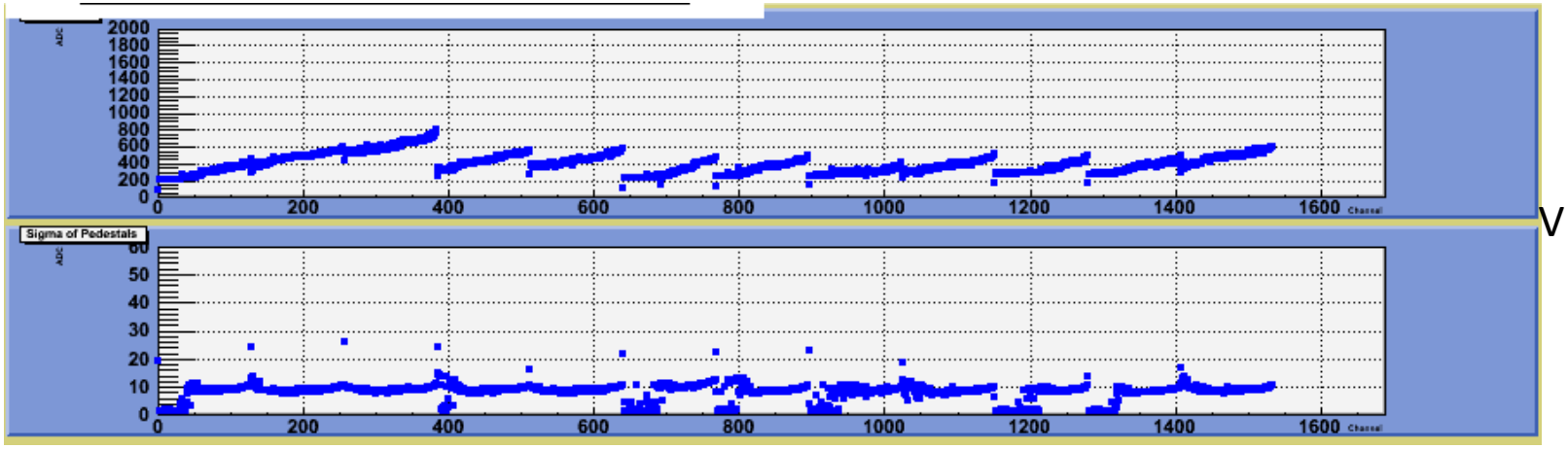


VPSP=48

Record testing results – Pedestals of section B

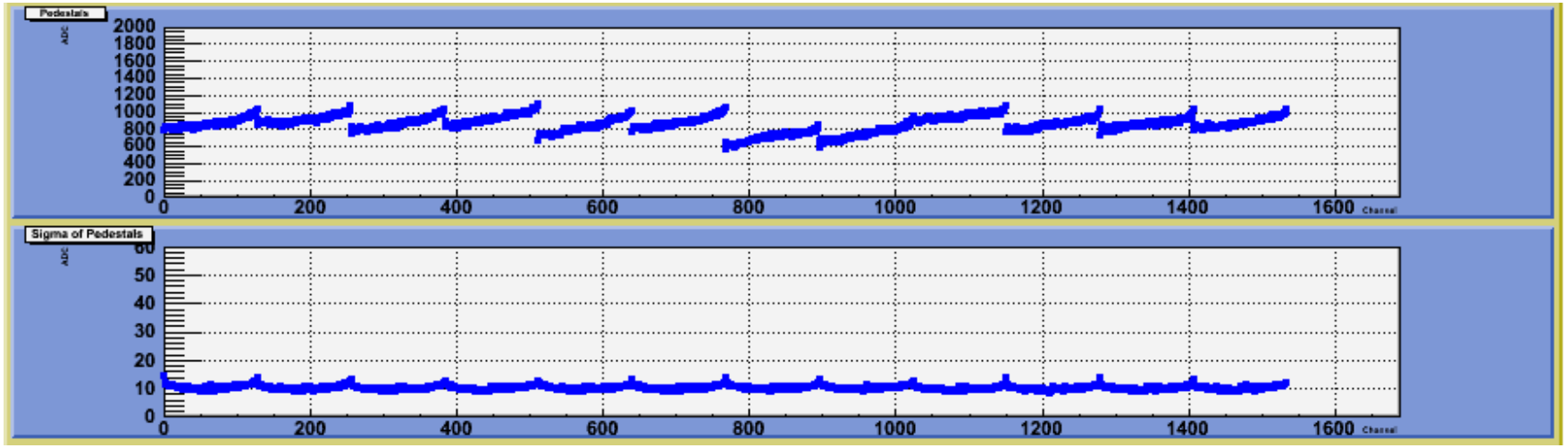


- record pedestals and noise by making screenshot
- record presence and sanity of the 12 APVs
  - with VPSP=43 the pedestals should look roughly as in plot
  - take a run with VPSP=48, the pedestals should go down
  - noise should be around 10

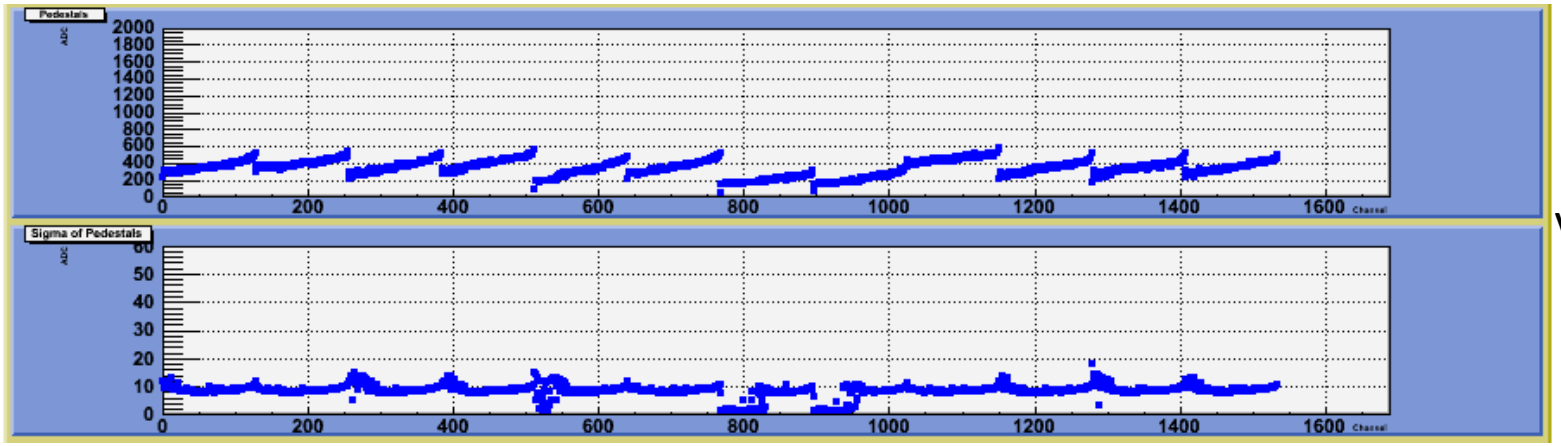


VPSP=48

Record testing results – Pedestals of section C

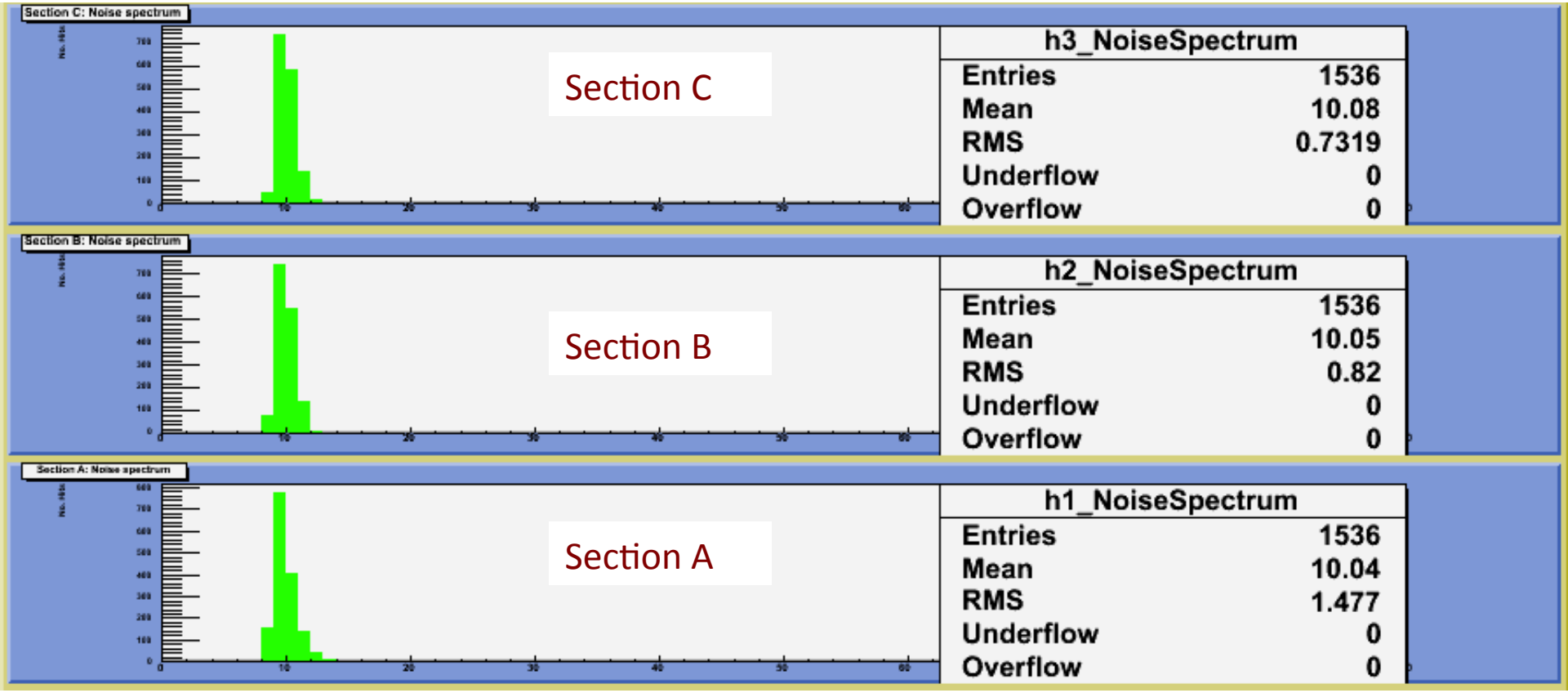


- record pedestals and noise by making screenshot
- record presence and sanity of the 12 APVs
  - with VPSP=43 the pedestals should look roughly as in plot
  - take a run with VPSP=48, the pedestals should go down
  - noise should be around 10

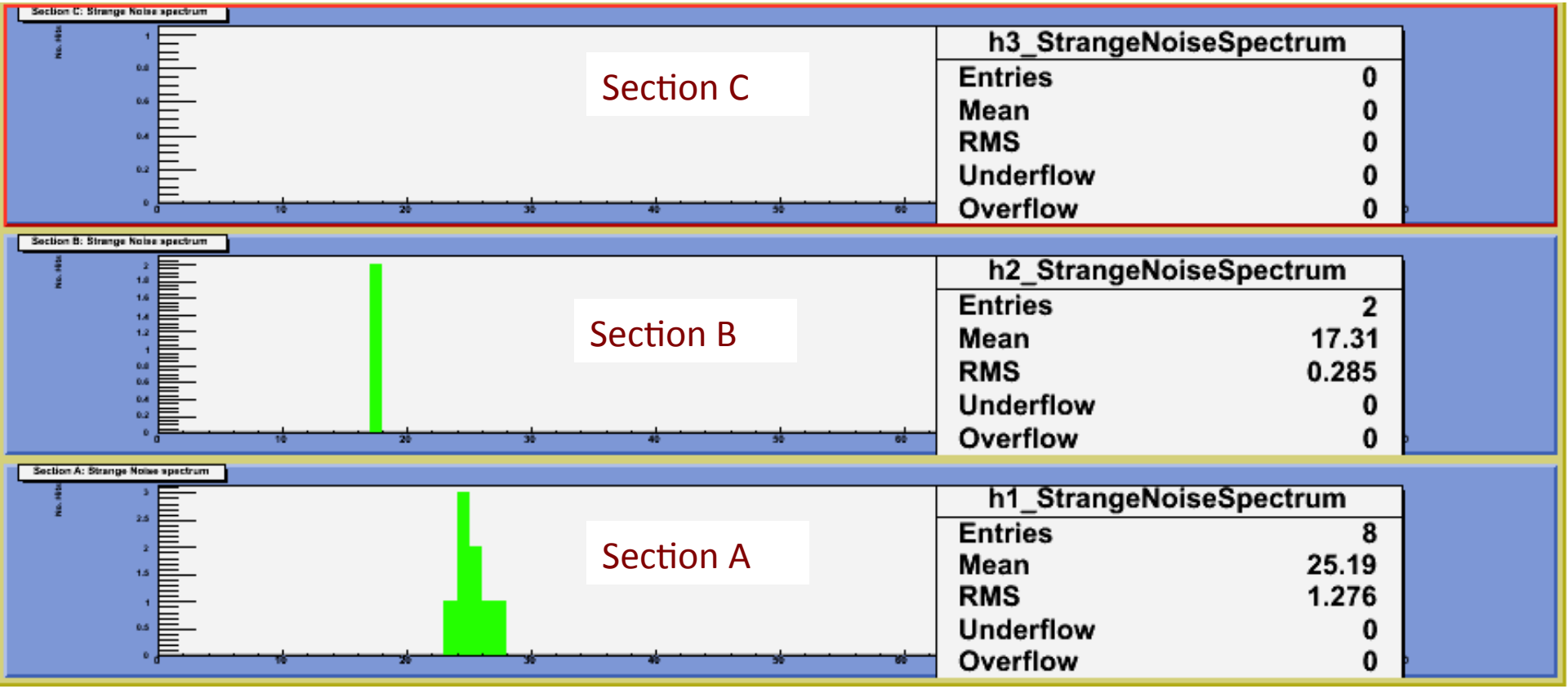


VPSP=48

Record testing results – Noise for all sections



Record testing results – Strange Noise for all sections



Record testing results – Broken channels list

```
##########List of broken channels##########
###Section A - APV 0 - Chan 0 ###
###Section A - APV 1 - Chan 0 ###
###Section B - APV 1 - Chan 0 ###
###Section A - APV 2 - Chan 0 ###
###Section B - APV 2 - Chan 0 ###
###Section A - APV 3 - Chan 0 ###
###Section A - APV 5 - Chan 0 ###
###Section A - APV 6 - Chan 0 ###
###Section A - APV 7 - Chan 0 ###
###Section A - APV 8 - Chan 71 ###
##########################################
```

- **record broken channels by copying the relevant output of the analysis program**

Record testing results – File name format

- <StaveID>_WithSensors_Measurement_YYMMDD-HHMM.<ext>

IST-04_Currents_Configured_121210-1250.png
IST-04_Currents_Initial_121210-1240.png
IST-04_QA_BrokenChannels_121210-1250.txt
IST-04_QA_Noise_121210-1250
IST-04_QA_StrangeNoise_121210-1250
IST-04_SectionA_Pedestals_121210-1250
IST-04_SectionA_Pedestals_VPSP48_121210-1250
IST-04_SectionB_Pedestals_121210-1250
IST-04_SectionB_Pedestals_VPSP48_121210-1250
IST-04_SectionC_Pedestals_121210-1250
IST-04_SectionC_Pedestals_VPSP48_121210-1250

All files should be save as png file except for broken channels list as a txt file.

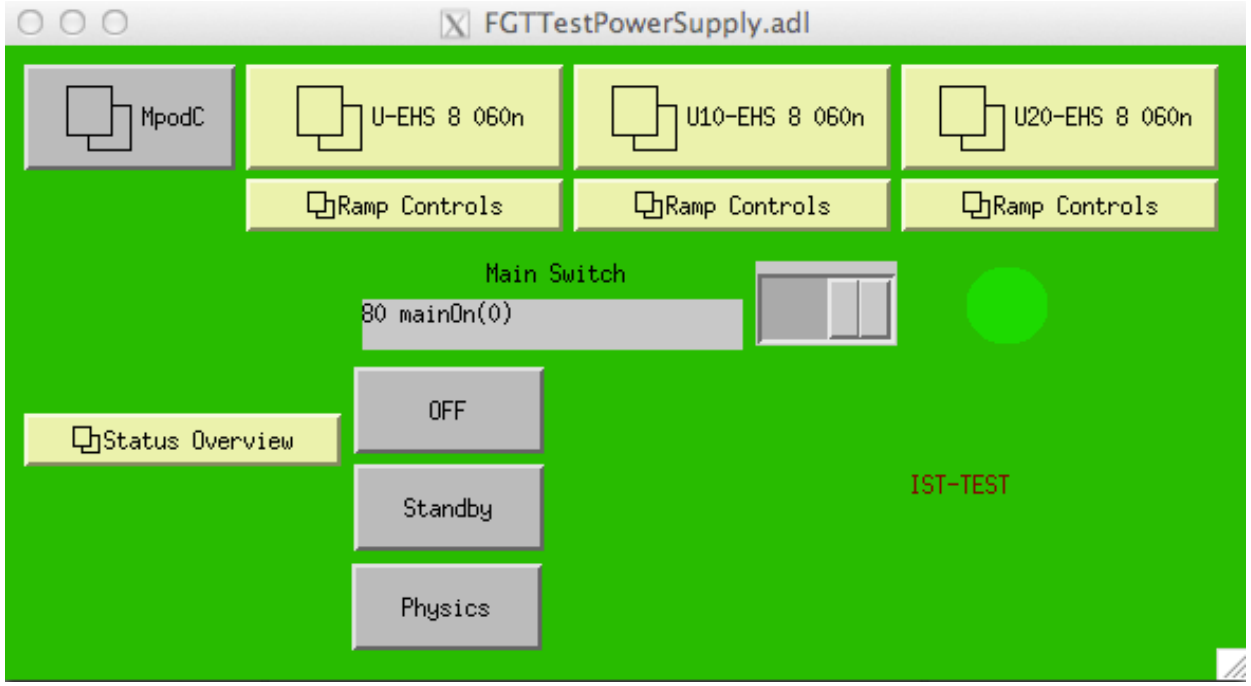
Record testing results – requirements

- All chips should be configuring and working properly
    - I2C configuring should work, easy check is to ride the pedestals up and down through VSPS
    - the chips pedestals should be sane
    - the chips average noise should be less than 14 with an RMS less than 2
- There should be no more than 50 randomly distributed channels not functioning
    - this is about 1% of the total channels
    - we can then afford to loose another 1% after sensor mounting and bonding for a total of 2% not functioning channels

Start testing -- Testing after sensors placement and wire bonds

Slow control should be available for bias HV supply to sensors.

1. **Log in DAQ PC (account: ist password: ist4hft@UIC)**
2. **Switch to "ist_hv_devel" directory**
   cd /home/ist/ist_hv_devel
3. **Start IOC service**
   cd iocBoot/iocsnmp
   ./iocstart
4. **Start slow control GUI (a GUI is popup as shown below)**
   cd /home/ist/ist_hv_devel
   ./ist-test_display

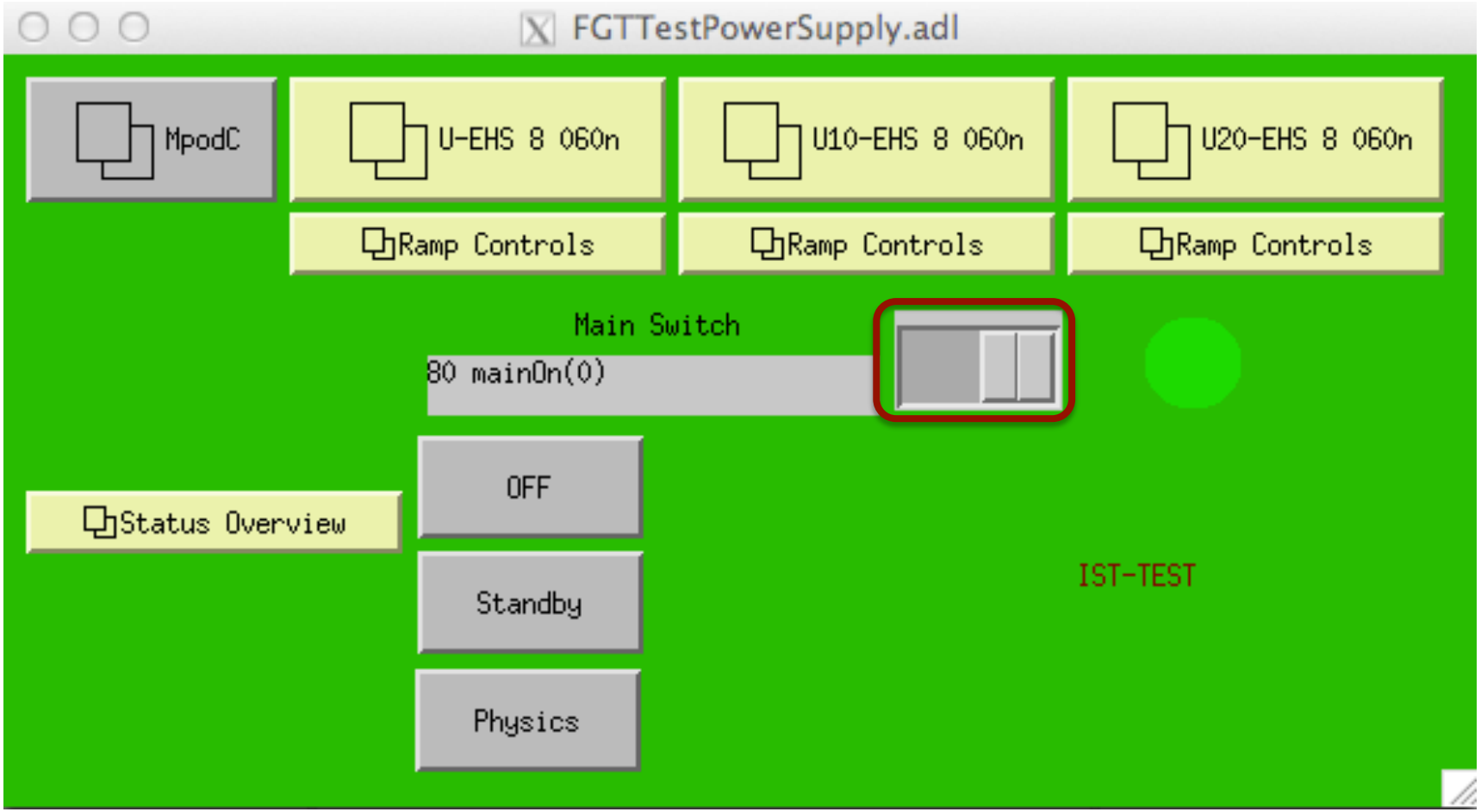


Button is controlled by click or dragging;
Parameters setting is done by keyboard input.

Start testing -- switch on slow control

5. Power on the readout crate by Main Switch controller

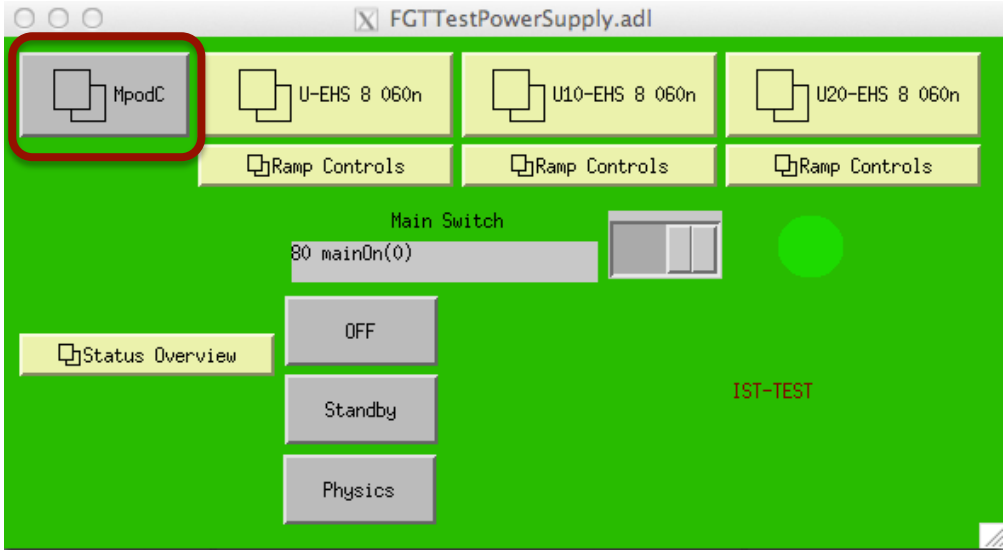
Dragging the main switch to right side is to switch on the readout crate (indicator turns green), or to left side is to power off the crate (indicator turns red).

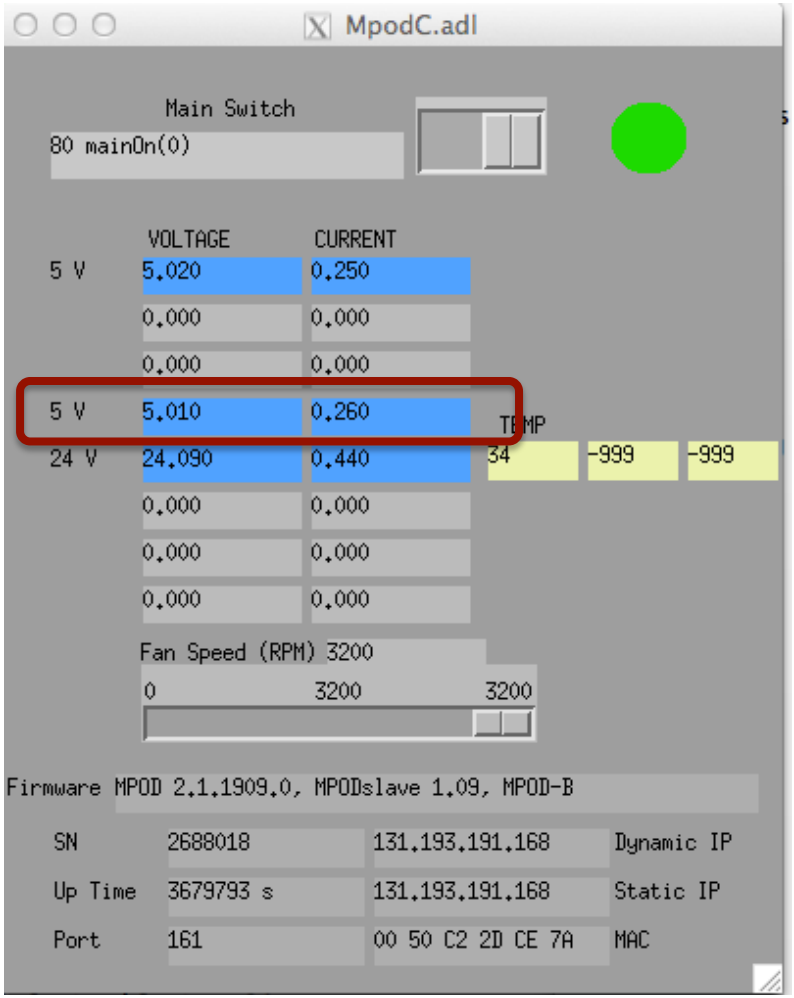


Start testing -- switch on slow control

6. Monitor the low voltage status and record it by screenshot.

Click top-left button “MpodC” and then a GUI is pop up.



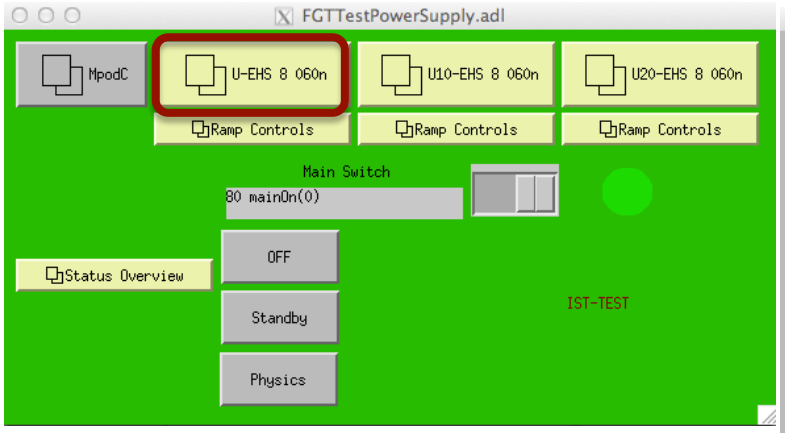


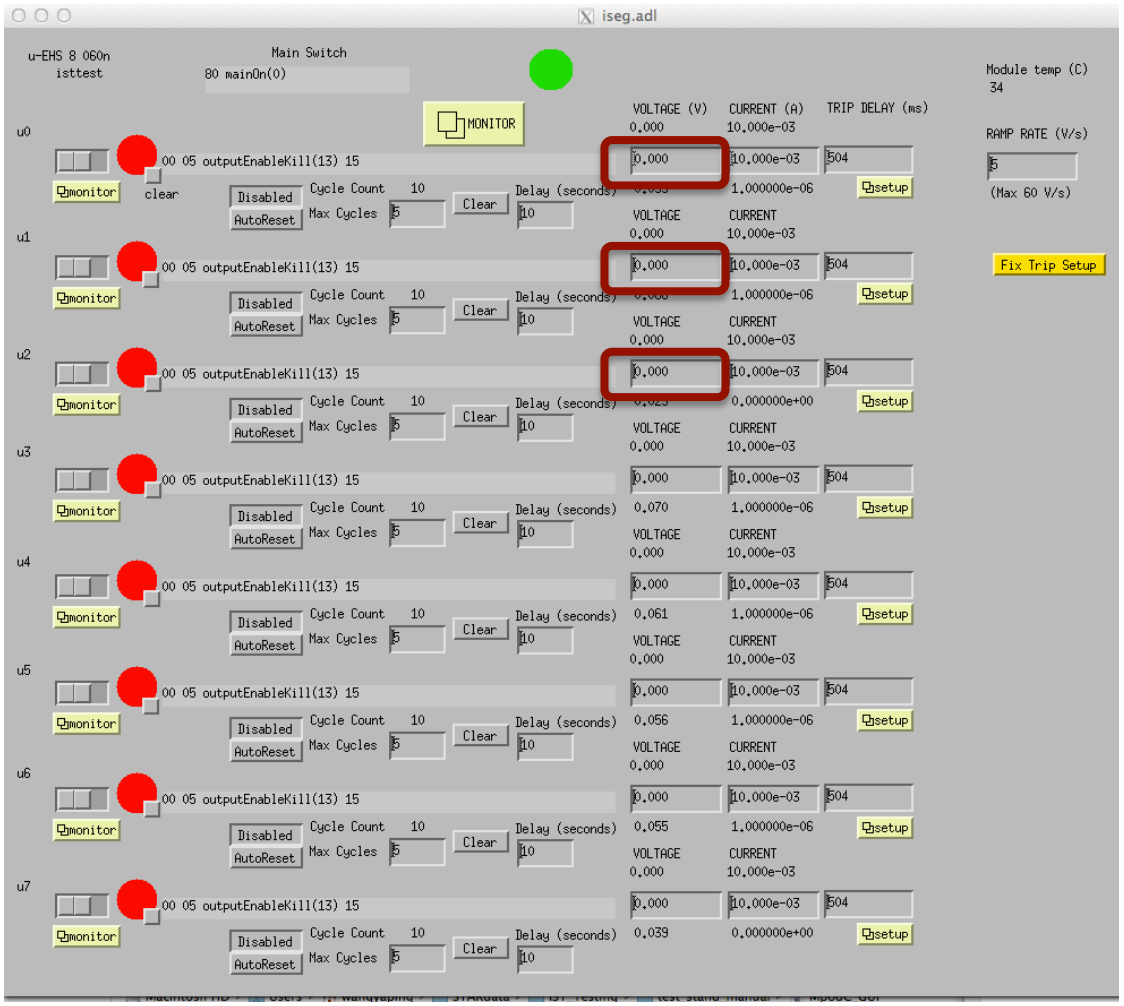
We are interested in current changes of 5 volts between initial (power on) and data taking (APVs are configured).

Start testing -- switch on slow control

7. Setting up the bias voltage for sensors (nominal value is 70 Volts).

Click button “U-EHS 8 060n” and then a GUI is pop up.



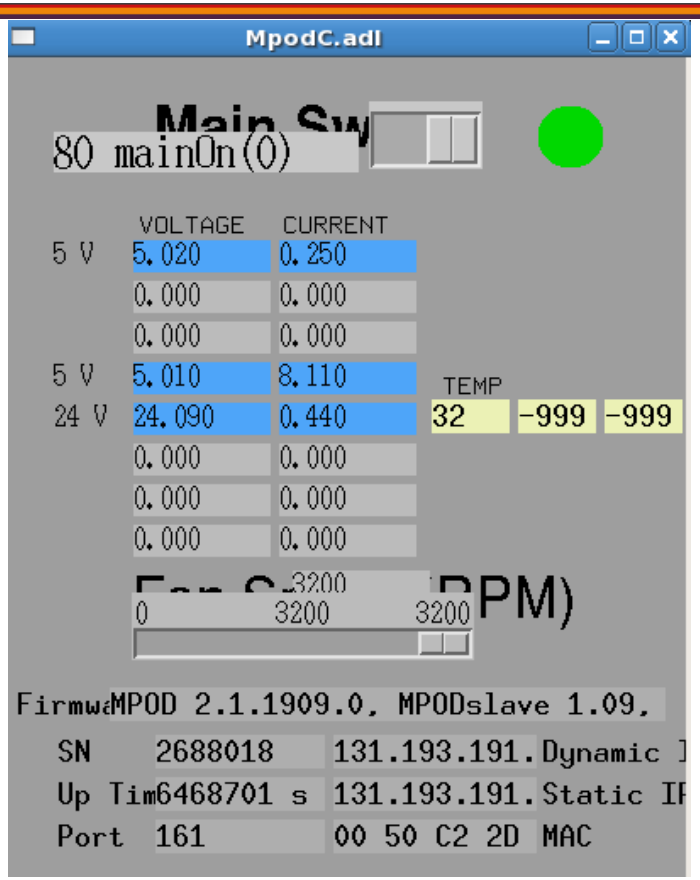


(0) Enable U0, U1 and U2 output and wait till the indicators turn green.
(1) Setting 70 Volts (please check the value is 70 Volts before you press enter to confirm!) for three channels one by one.
(2) The voltage will be ramping up in a step of 5 Volts/step.
(3) Switch to new linux window

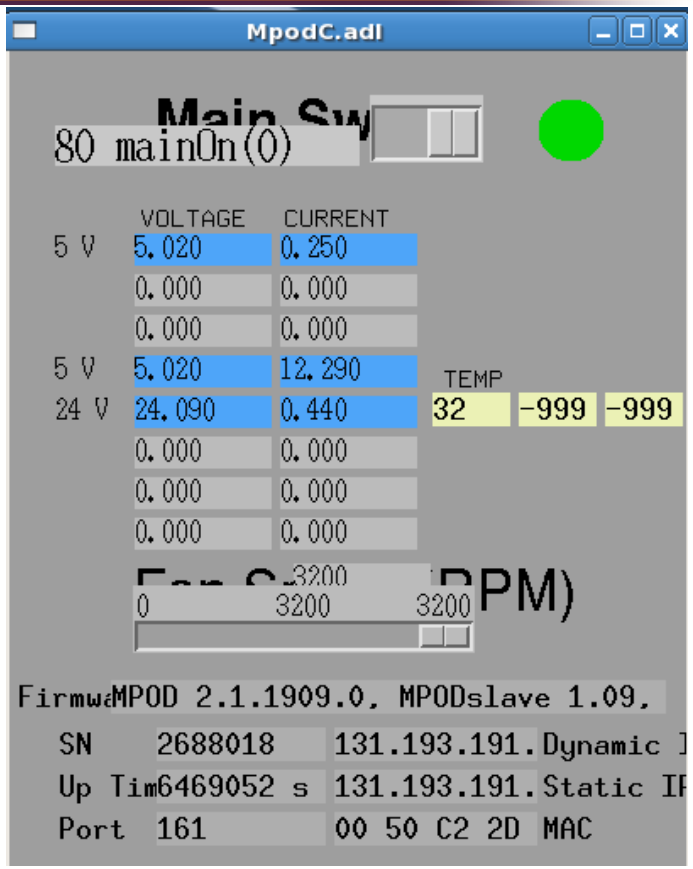
Start testing -- Testing after sensors placement and wire bonds

8. Switch to home directory
9. Switch to "FGT_TEST" directory
   "daqman" or "cd /home/ist/cvs/online/RTS/src/FGT_TEST"
10. Start DAQ program
   stardev
   ./fgt_run_daq –L –c ist_rdo_conf_YPW_for_Test.txt –C 0x03 –n 1000 –S /scratch/data/IST_04/COSMIC_STAVE04_WithSensors_SensorBias70_VPSP43_VFS70_PosPol_1000evts_YYYYMMDD_UIC_##.sfs
   Here YYYYMMDD is the date like 20121216, ## means data number.
11. Start analysis program
   cd /home/ist/ARMdisplay
   stardev
   ARMdisplay –f /scratch/data/IST_04/COSMIC_STAVE04_WithSensors_SensorBias70_VPSP43_VFS70_PosPol_1000evts_YYYYMMDD_UIC_##.sfs
   press "p" to save analysis results as png files once the analysis loop is over.

Record testing results – currents of staves with bias = 0



Initial power up

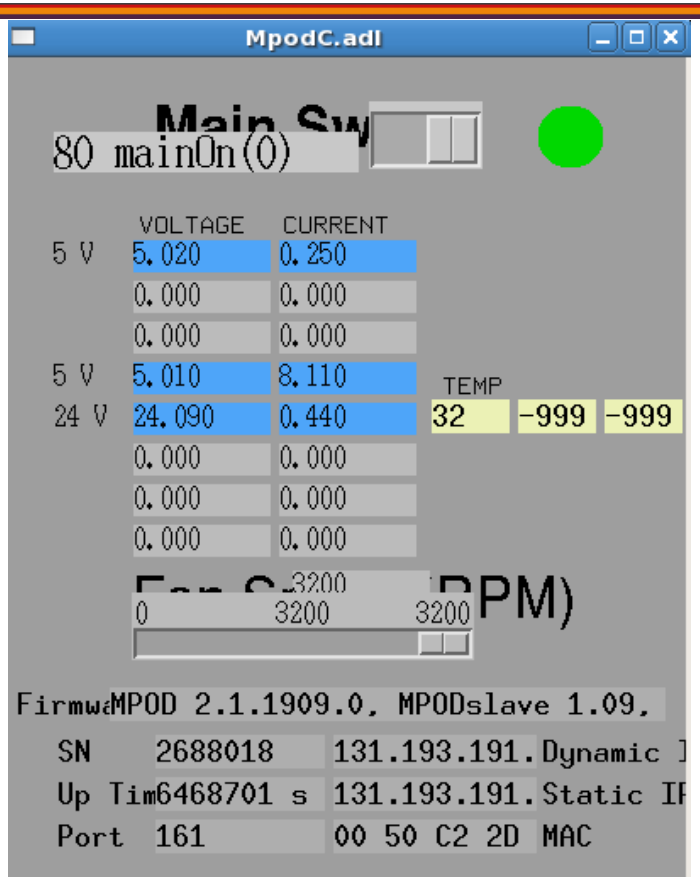


Taking data = configured

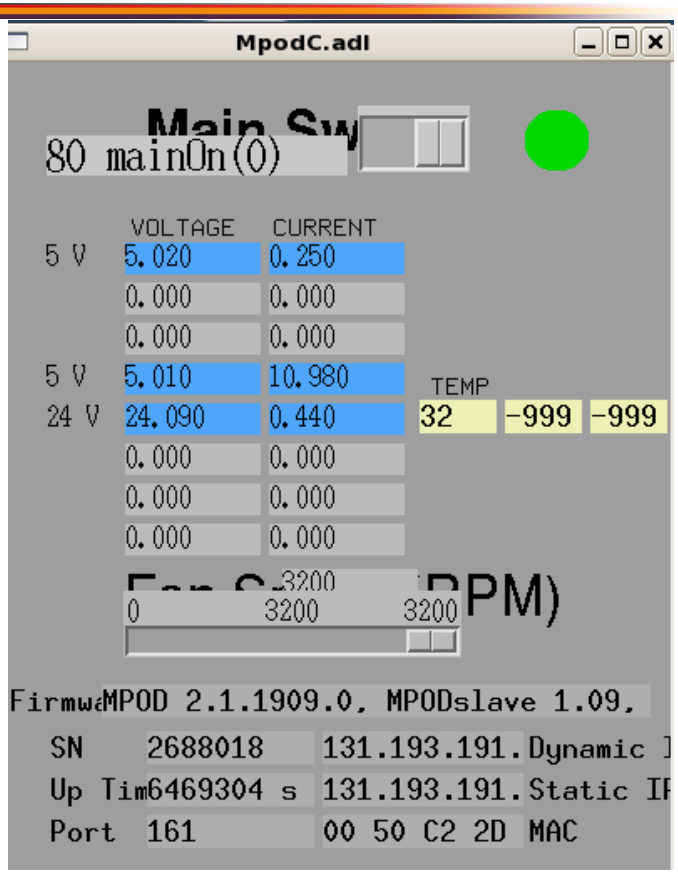
Power consumption is different when the chips are configured by the DAQ than just after initial power on of the readout crate!

-record the currents by making screenshots of the slow controls window or by writing down the currents for 5V and 24V

Record testing results – currents of staves with bias = 70 Volts



Initial power up

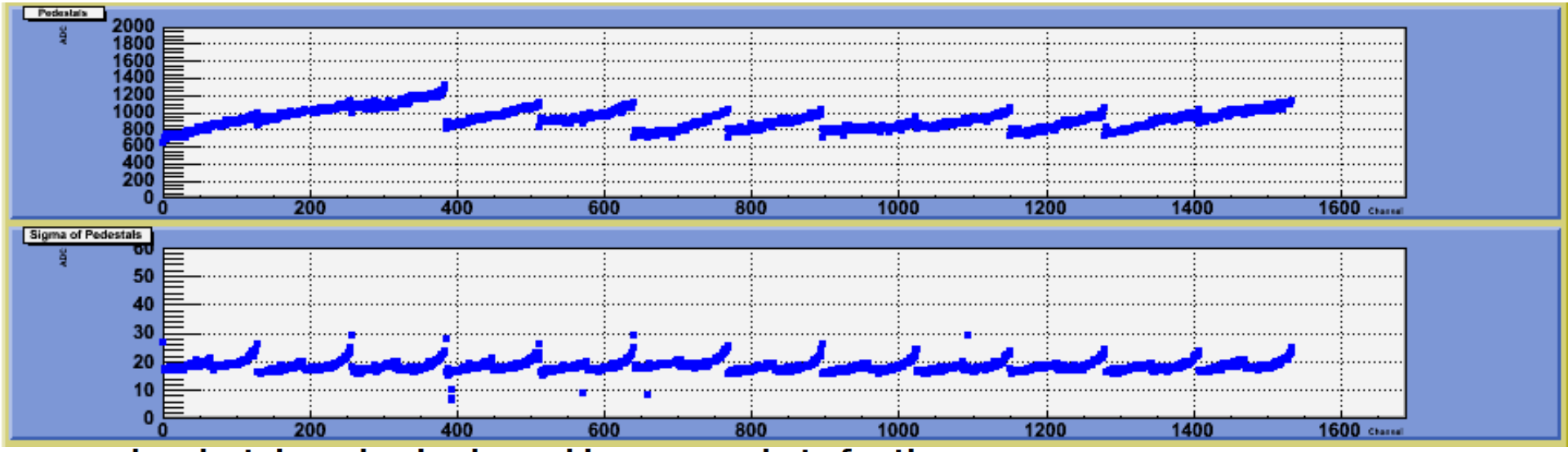


Taking data = configured

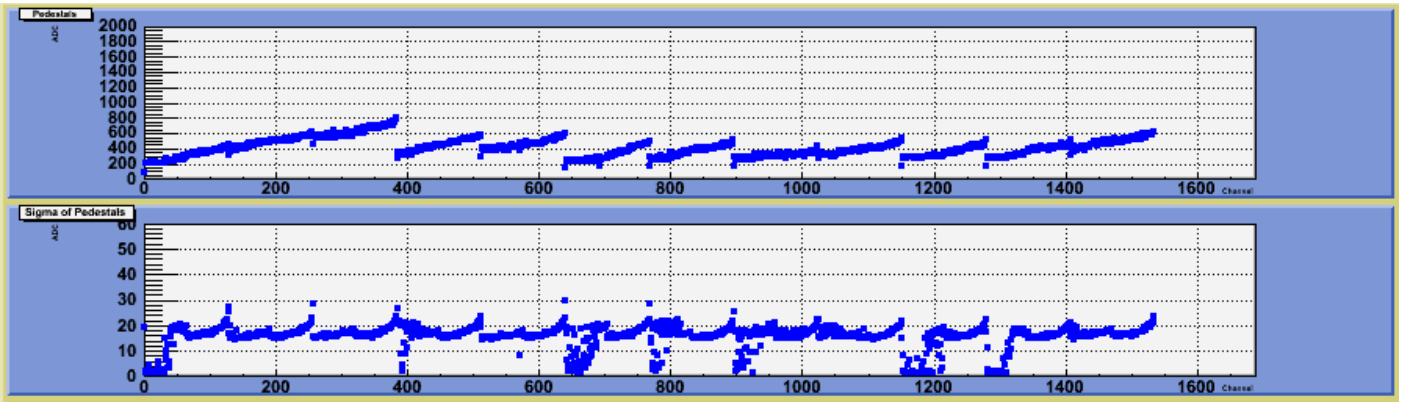
Power consumption is different when the chips are configured by the DAQ than just after initial power on of the readout crate!

-record the currents by making screenshots of the slow controls window or by writing down the currents for 5V and 24V

Record testing results – Pedestals for section A

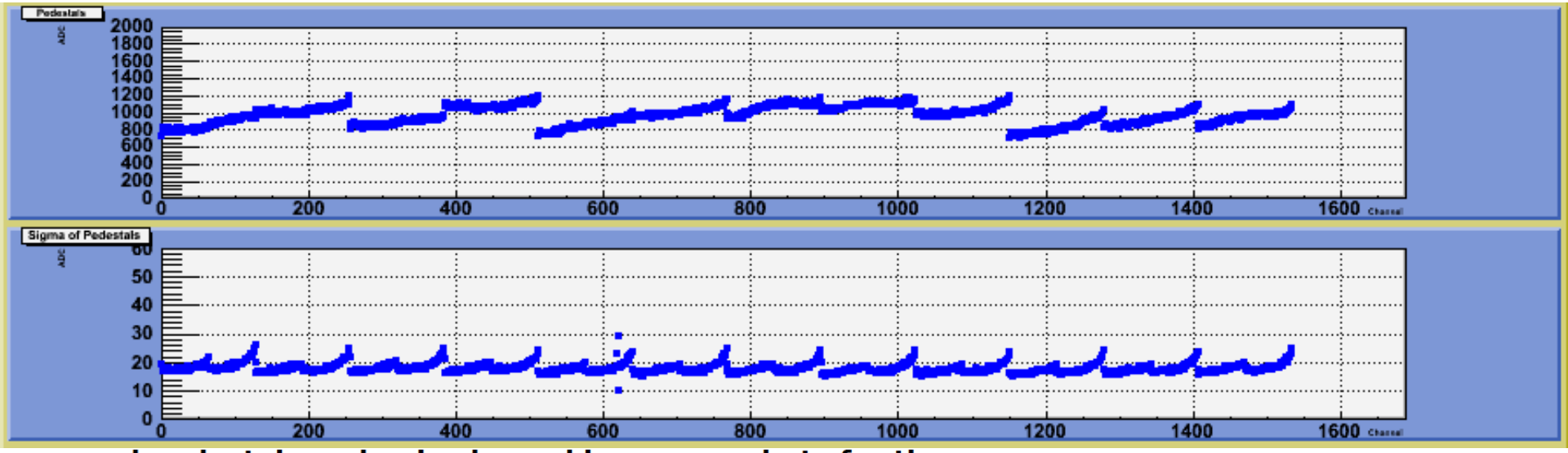


- record pedestals and noise by making screenshots for the 3 sections
- record presence and sanity of the 36 APVs
  - with VPSP=43 the pedestals should look roughly as in plot
  - take a run with VPSP=48, the pedestals should go down
  - noise should be around 15 to 30

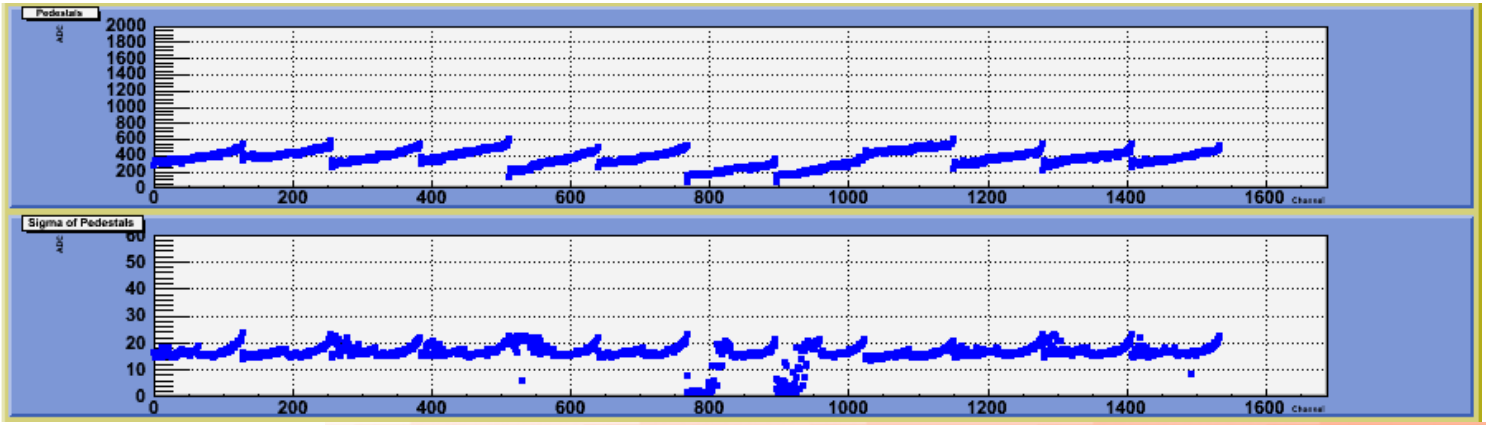


VPSP=48

Record testing results – Pedestals for section B

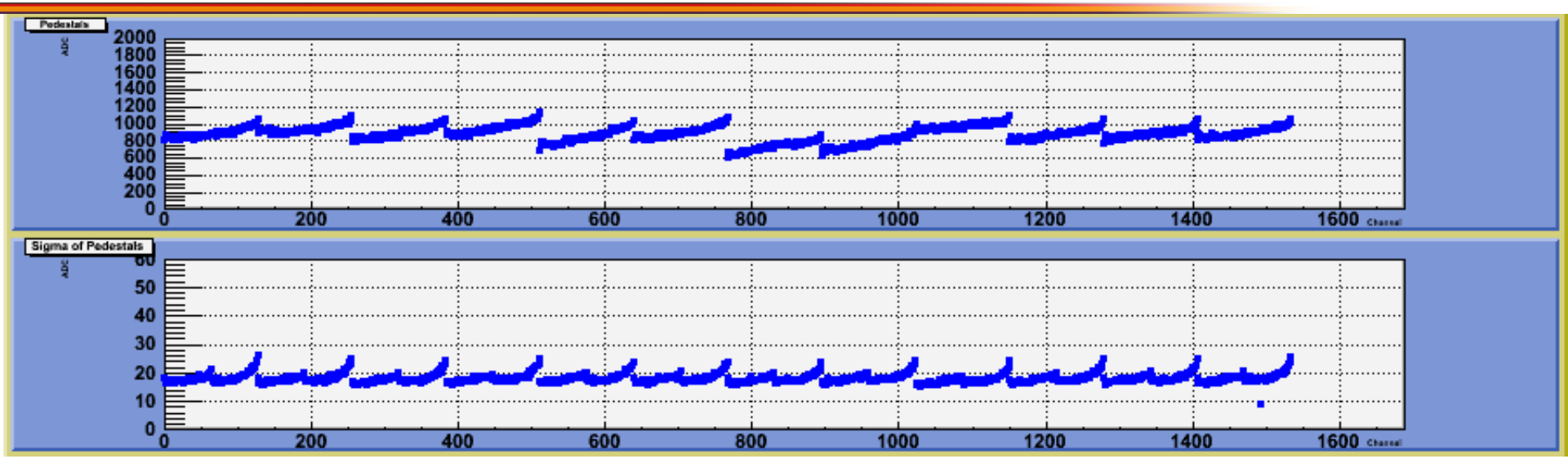


- record pedestals and noise by making screenshots for the 3 sections
- record presence and sanity of the 36 APVs
  - with VPSP=43 the pedestals should look roughly as in plot
  - take a run with VPSP=48, the pedestals should go down
  - noise should be around 15 to 30

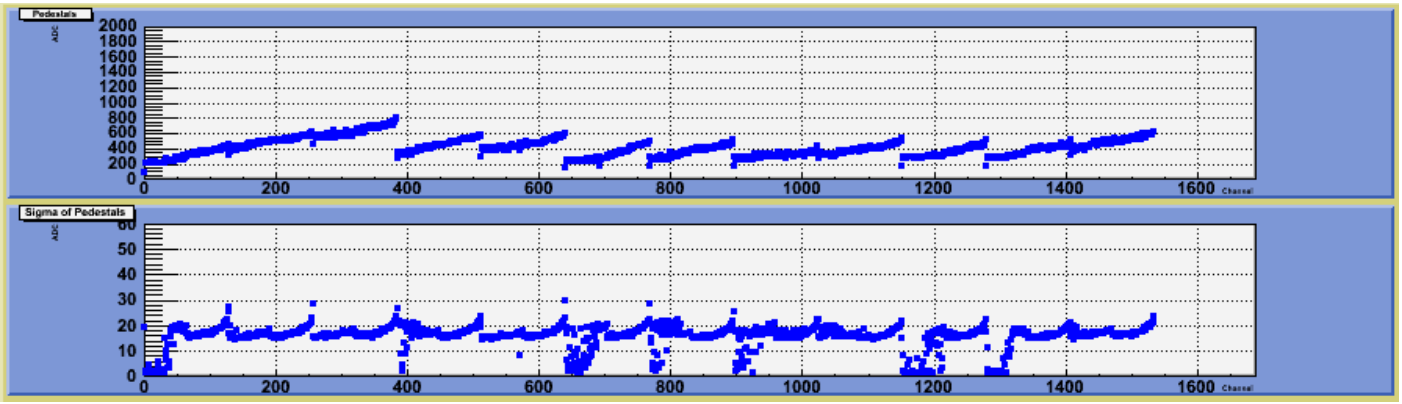


VPSP=48

Record testing results – Pedestals for section C

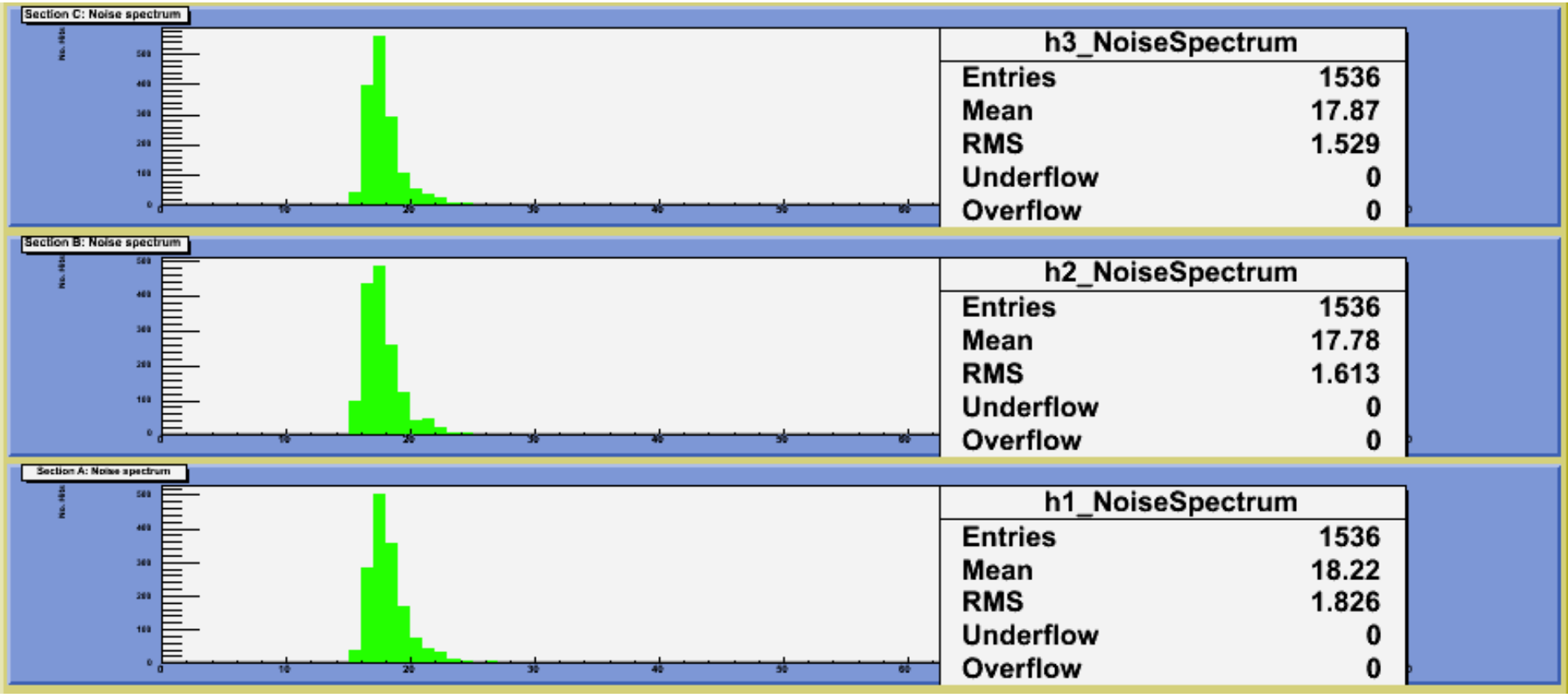


- record pedestals and noise by making screenshots for the 3 sections
- record presence and sanity of the 36 APVs
  - with VPSP=43 the pedestals should look roughly as in plot
  - take a run with VPSP=48, the pedestals should go down
  - noise should be around 15 to 30

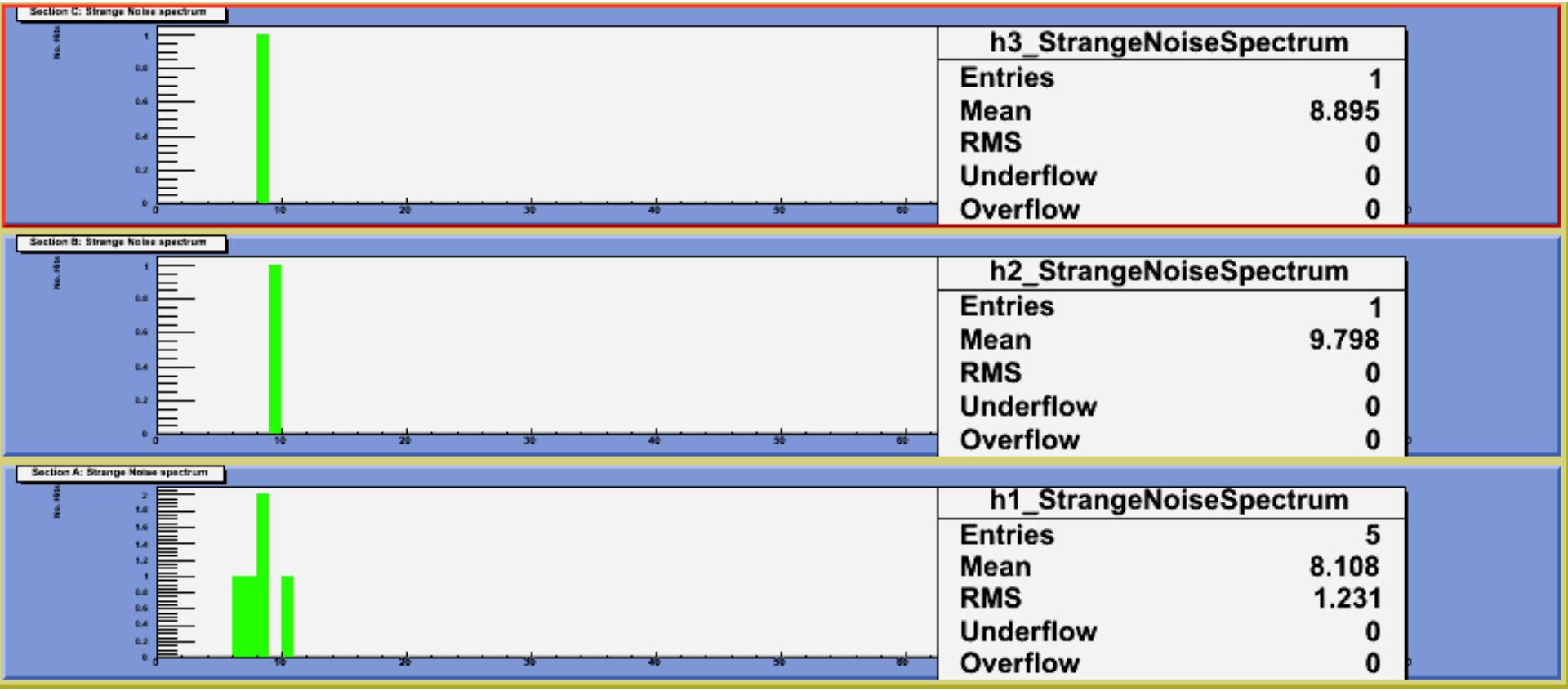


VPSP=48

Record testing results – Noise with sensors for section A, B and C



Record testing results – Strange Noise for section A, B and C



Record testing results – Broken channels list

```
##########List of broken channels##########
###Section A - APV 3 - Chan 7 ###
###Section A - APV 3 - Chan 8 ###
###Section A - APV 3 - Chan 9 ###
###Section A - APV 4 - Chan 58 ###
###Section B - APV 4 - Chan 109 ###
###Section A - APV 5 - Chan 19 ###
###Section C - APV 11 - Chan 86 ###
##########################################
```

- **record broken channels by copying the relevant output of the analysis program**

Record testing results – File name format

- <StaveID>_WithSensors_Measurement_YYMMDD-HHMM.<ext>

IST-04_WithSensors_Currents_Configured_SensorBias70_121213-1350.png
IST-04_WithSensors_Currents_Initial_121213-1350.png
IST-04_WithSensors_QA_BrokenChannels_121213-1350.txt
IST-04_WithSensors_QA_Noise_121213-1350.png
IST-04_WithSensors_QA_StrangeNoise_121213-1350.png
IST-04_WithSensors_SectionA_Pedestals_121213-1350.png
IST-04_WithSensors_SectionB_Pedestals_121213-1350.png
IST-04_WithSensors_SectionC_Pedestals_121213-1350.png

All files should be save as png file except for broken channels list as a txt file.

Record testing results – requirements

1) - All chips should be configuring and working properly
   - I2C configuring should work, easy check is to ride the pedestals up and down through VSPS
   - the pedestals should be sane
   - the average noise should be less than 30
2) - The analysis program gives the number of non-functional channels according to 'strange' noise levels

If 1) is not true then the stave gets grade -1, meaning 'do not install'

If 1) is true, but according to 2) there are 25 or more consecutive broken channels (=not random distributed) then the stave gets grade -1

If 1) is true and the broken channels are randomly distributed then the stave gets graded according to the number of broken channels.
So staves with grade 0 are the best with no broken channels, grade 1 is almost perfect and so on.

Upload testing results to database

Upload the files to the eLog database:
http://leto.phy.uic.edu:8080

leto.phy.uic.edu:8080 Reader

Personal Info ▾ Webmail ▾ CCNU ▾

Several logbooks are defined on this host.
Please select the one to connect to:

Logbook	Entries	Last submission
IST04 STAR IST Stave Assembly Database	9	Thu Dec 13 15:00:37 2012 by Yaping
IST05 STAR IST Stave Assembly Database	0	-

After each test, please upload testing results to the eLog database as done for IST-04.

leto.phy.uic.edu:8080/IST04/ Reader

Personal Info ▾ Webmail ▾ CCNU ▾ UIC ▾ STAR ▾ IST ▾ Workshop ▾ HepData search SPIRES-HEP Search Apple iCloud Wikipedia News ▾

IST04 IST05

STAR IST Stave Assembly Database, Page 1 of 1 ELOG

New | Find | Select | Import | Config | Last day | Help

Full | Summary | Threaded -- Author -- -- Location -- -- Operator -- 9 Entries

ID	Date	Author	Location	Operation	Operator	Start Time	End Time	Weight Before Operation	Weight After Operation	Visual Insepction Before Operation	Additional Comment	Text	
9	Thu Dec 13 15:00:37 2012	Yaping	UIC	chip readout test after front-end bonding	Yaping	12/13/2012 11:00	12/13/2012 13:50			confirm two missing wire bonds on chips 16 (channel 109) and 35 (channel 86). two outer wires could touch each other on chip 22.	7 channels marked as bad channels	Attachment 1:	18x
8	Thu Dec 13 11:28:49 2012	Zhenyu	FNAL	chip front-end bonding	Tammy, Michelle	12/12/2012 12:00	12/13/2012 9:00		143.55		chip 16 and 35 have one missing wire-bond each		
7	Thu Dec 13 11:27:31 2012	Zhenyu	FNAL	sensor placement	Burt	12/11/2012 14:00	12/11/2012 17:00	128.80	143.64				
6	Mon Dec 10 13:44:43 2012	Yaping	UIC	chip readout test after back-end bonding	Yaping	12/10/2012 11:00	12/10/2012 13:00				After repair, all 36 chips are working now.	Attachment 1:	11x
5	Mon Dec 10 11:15:18 2012	Zhenyu	FNAL	repair	Bert, Tammy	12/10/2012 8:00	12/10/2012 9:00	128.75	128.82	confirmed observation from UIC, and in addition found a missing wire-bond (backend 3rd from the right) on chip #33	add back the missing wire-bonds on chip 9, 17, 33, remove broken wire beneath wire-bonds of chip 25		
4	Fri Dec 7 11:03:05 2012	Zhenyu, Yaping	UIC	chip readout test after back-end bonding	Yaping, Zhenyu	12/6/2012 11:30	12/7/2012 12:00			Wire-bondings for pull tests are not completely removed. Both chip 9 and 17 have a missing VSS wire-bonding. One broken wire under wire-bonds of chip 25.	Removed remaing wire-bondings from pull tests. Chip 33 has fluctuating pedestals. Will replace it with another chip.	Attachment 1: Initial currents while Power Up	12x
3	Fri Dec 7 10:58:59 2012	Zhenyu	FNAL	chip back-end bonding	Tammy, Michelle	12/5/2012 12:00	12/5/2012 14:10	128.68	128.82	OK	Take 5 hours to set up the bonding fixures		
2	Fri Dec 7 10:21:51 2012	Zhenyu	FNAL	chip placement	Bert	12/4/2012 13:00	12:4/2012 16:30	127.17	128.68	OK	NONE		
1	Fri Dec 7 10:18:38 2012	Zhenyu	FNAL	wire-bonding pull test	Tammy	12/4/2012 08:00	12/4/2012 10:00	127.27	127.27	OK	NONE		

ELOG V2.9.2-2455

Put stave back into transportation box

1. Switch off the bias channel by slow control GUI
   (1)Set the Voltage to 0.0 and press enter
   (2)The voltage will be ramping down to 0.0
2. Switch off main power for the crate by slow control GUI
3. Remove the GND connection and bias connections on PPB side
4. Remove the connections between PPB and T-Board (Wearing gloves and cap!)
5. Take out the stave from the testing frame
6. Place the stave on the transport frame (keeping sensor side upward)
7. Remove the T-Board from the stave (carefully and softly)
8. Screw off the three nuts
9. Place the three spacers back
10. Cover the top aluminum plate.
11. Screw up the two big nuts.
12. Put it back to the bag.
13. Put it back to transport box.