Strips module update

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LBL

08/27/20

Outline

- Status

- Metrology
  - Redesigned routines
  - Glue Height study

- Electronic test
  - Module noise test in Climate chamber

4 modules so far this year

Our Simpsons family:

EL-11-HOMER: March

EL-12-MARGE: June

EL-13-BART: June

EL-14-LISA: July

All of them are measured by smart scope and

electronic tested.

New Room for Test

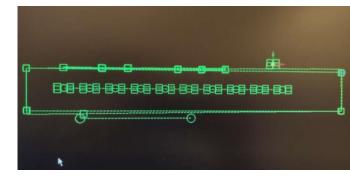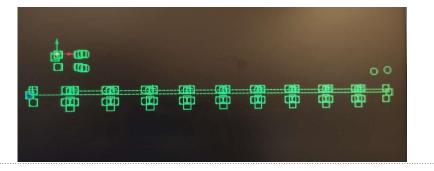Now moving to 6040 to do tests!
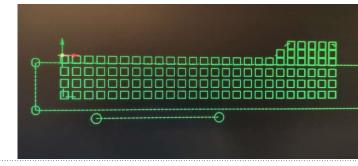
Metrology routines

Many test routines are re-designed to test more specifically.

Main idea is to make sure the reference point/plane, to make results repeatable and comparable.
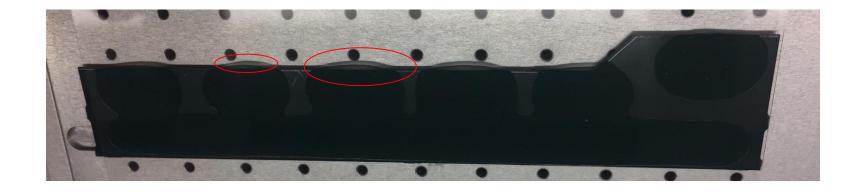
Hybrid flatness issue

In BNL, in the past 4 modules, we all saw there are glues between hybrid and sensor squeezed out:

It usually happen in the center region of hybrid. Would be better to understand.
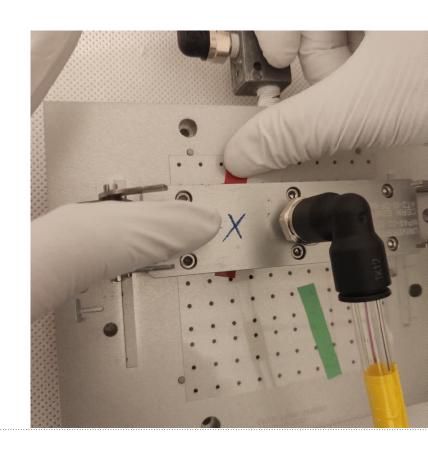
Shim: Glue height non-uniformed?

When gluing the hybrid to sensor, usually we use the shim, with varied thickness to determine the distance.

While the required glue height is 120±40um, it would be difficult to let the 100um shim through the center region of the hybrid.

Also it indicates that the glue height may be not enough.

Existing glue height measurement

As QC required, LBL has the measurement for the glue height.

It is measured by:
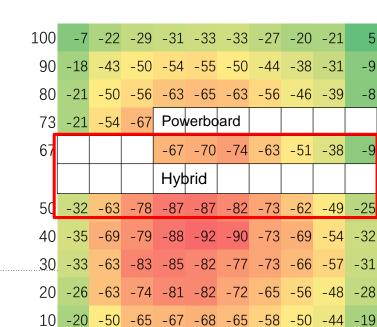
1. Make a module scan; like right:

2. Using the 20 points close to hybrid to construct the reference zero plane.

3. Measure the 11 fiducial cross height on the hybrid. Minus 380um.

With this method, however, the glue height for all 10 chips are in the limit 120$\pm$40um.

Chip: ~300um
Glue: ~120um
Hybrid: ~380um
Glue: ~120um
Sensor

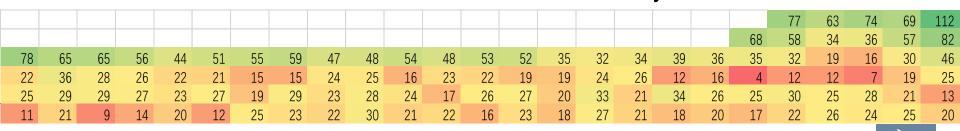|										
100	-7	-22	-29	-31	-33	-33	-27	-20	-21	5
90	-18	-43	-50	-54	-55	-50	-44	-38	-31	-9
80	-21	-50	-56	-63	-65	-63	-56	-46	-39	-8
73	-21	-54	-67	Powerboard						
67				-67	-70	-74	-63	-51	-38	-9
				Hybrid						
50	-32	-63	-78	-87	-87	-82	-73	-62	-49	-25
40	-35	-69	-79	-88	-92	-90	-73	-69	-54	-32
30	-33	-63	-83	-85	-82	-77	-73	-66	-57	-31
20	-26	-63	-74	-81	-82	-72	-65	-56	-48	-28
10	-20	-50	-65	-67	-68	-65	-58	-50	-44	-19
0	-6	-28	-32	-41	-40	-34	-31	-26	-23	-1

Scan of the hybrid backside

The hybrid plane is higher than the reference ground point.
Esp. for edge of the HCC chips.

HCC edge is higher, and the bottom left is lower. Difference could be 100um. (112-11)

And, in the short side(78-11), the deviation is more serious.
This is also seen in other hybrids.
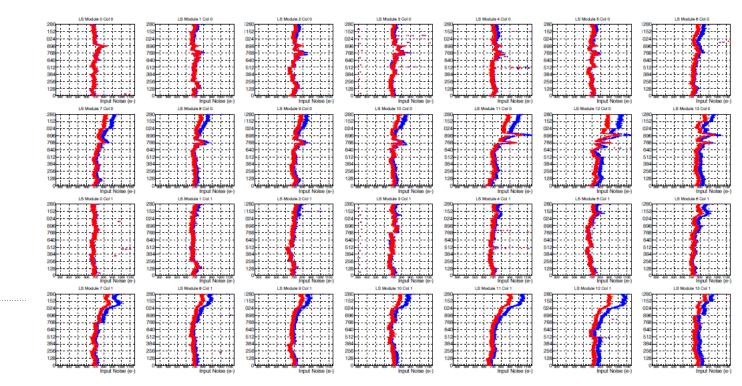

Hybrid: GPC1938-18C-H1

																				77	63	74	69	112
																			68	58	34	36	57	82
78	65	65	56	44	51	55	59	47	48	54	48	53	52	35	32	34	39	36	35	32	19	16	30	46
22	36	28	26	22	21	15	15	24	25	16	23	22	19	19	24	26	12	16	4	12	12	7	19	25
25	29	29	27	23	27	19	29	23	28	24	17	26	27	20	33	21	34	26	25	30	25	28	21	13
11	21	9	14	20	12	25	23	22	30	21	22	16	23	18	27	21	18	20	17	22	26	24	25	20

This issue has been reported to ITK group and under study.

Module Noise study Motivation

Module electronic performance matter, especially for noise control.

It is known that in the previous <u>test</u>, with lower temperature, abnormal higher noise is observed. Need further study.

Kaili

Test Environment

Module: HOMER, LBL-ES-0011. Built in February.
FW: Latest ITSDAQ.

NeXys, LV, HV;

Climate Chamber

Use foam to keep light-tight.
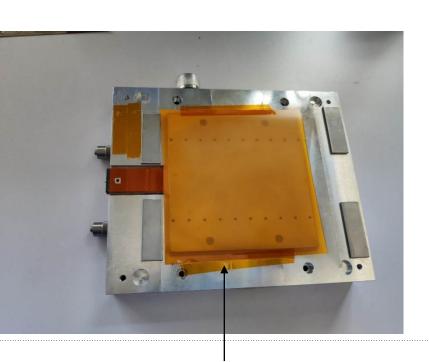
Insulation during the test
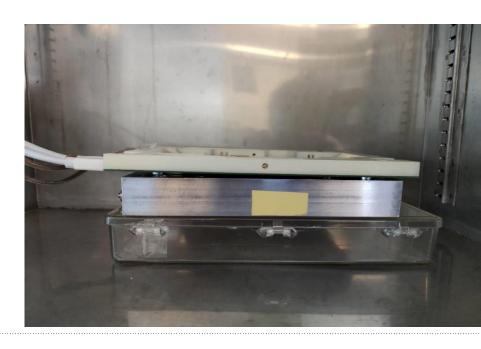
Jig to support module cannot be directly used.
The surface is all connected, which leads to early break down and very high noise.

Need to do insulation with Kapton sheet.

Surface touching with copper pad, where HV added.
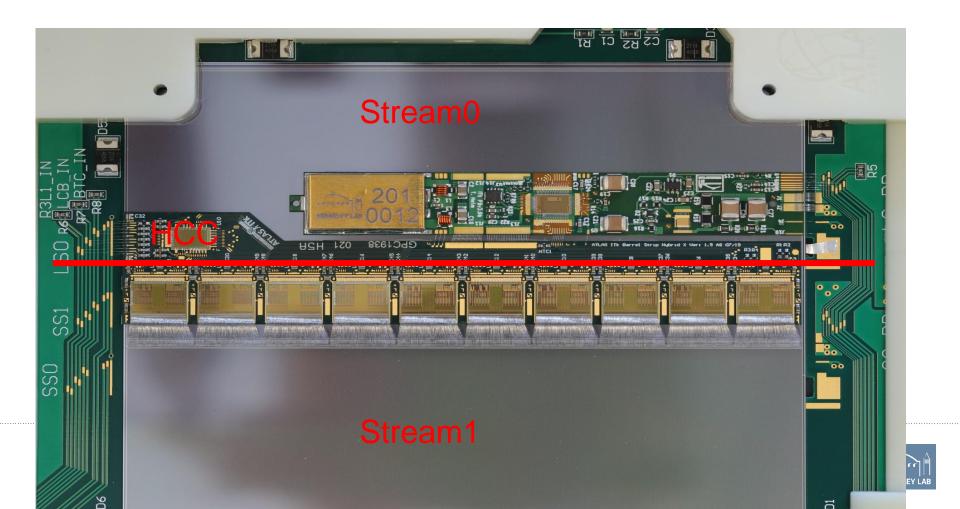
Module Layout

Here channels are ordered as physical order from chip0 to 9.

Stream0: the side with PB, and HCC. Channel 0-1280;

Stream1, the side without PB, Channel 1280-2560;

Grafana
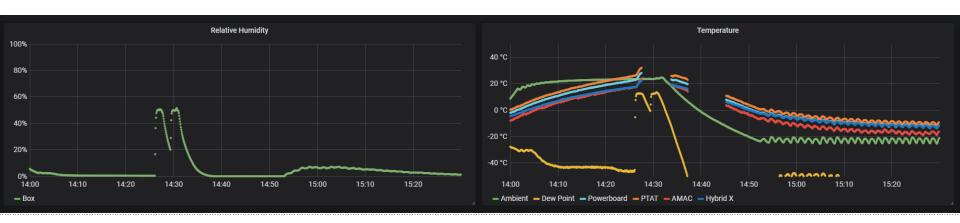
Humidity and Temperature are monitored with Grafana.

also for volts and current read from AMAC.

The temperature of sensor usually 3~7℃ higher than the chamber setting. (-23 ℃ for -30 ℃ chamber, 23 ℃ for 20 ℃ chamber)

For humidity, ~0% in zoom temperature.

For -30 ℃, a bit higher but still <10%.
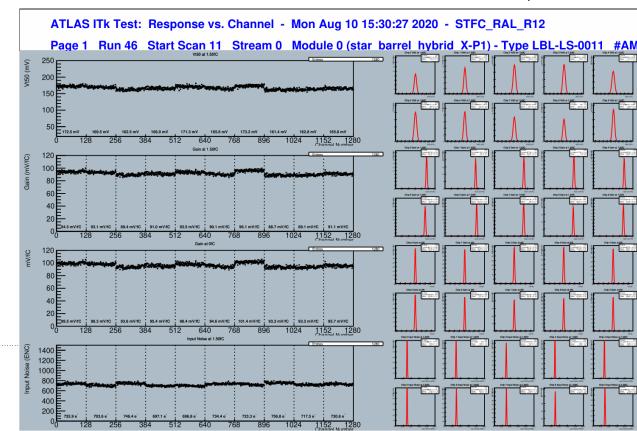
Tests

On August 10th, tests are done

- HV 50V, Chamber temperature 20 ℃

- 50V, -30 ℃

- 350V, 20 ℃

- 350V, -30℃

350V, -30℃

ATLAS ITk Test: Response vs. Channel - Mon Aug 10 15:30:27 2020 - STFC_RAL_R12

Page 1   Run 46   Start Scan 11   Stream 0   Module 0 (star_barrel_hybrid_X-P1) - Type LBL-LS-0011   #AM
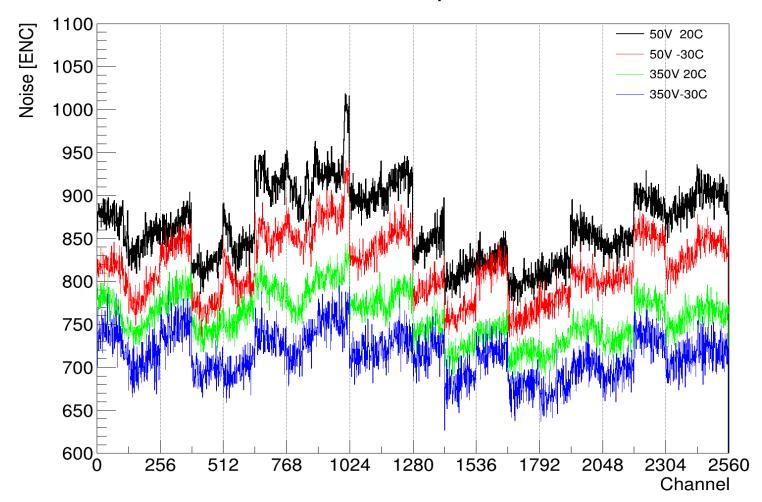
Noise level in 4 tests

Module HOMER: Input Noise 1.5fc

Legend:
- 50V 20C
- 50V -30C
- 350V 20C
- 350V-30C

Generally:

HV↑, Noise↓; Temperature↓, Noise↓.

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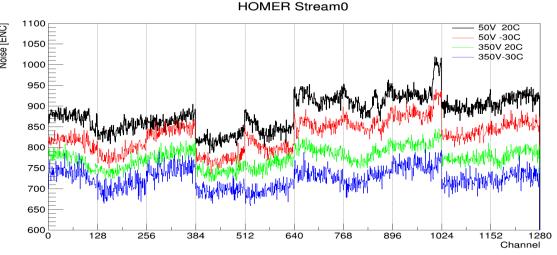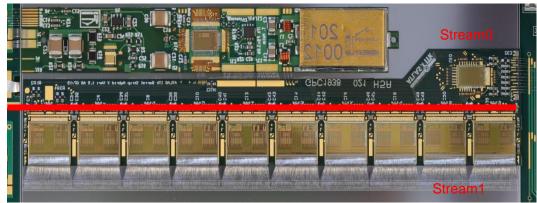
Noise Layout

Generally, Stream1 4% better than stream0.
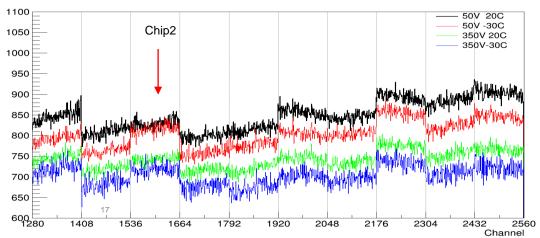
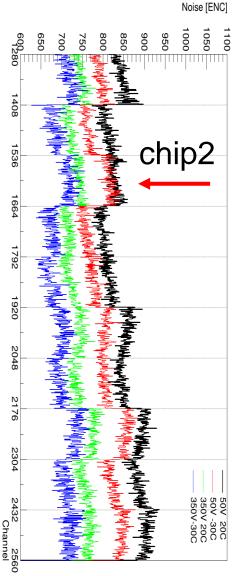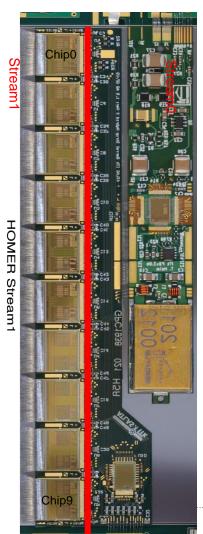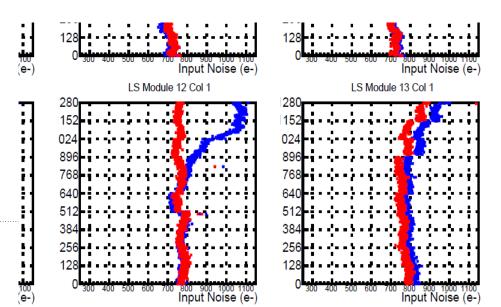Noise for chip2 is comparable in different temperature.

AC GND?

Previous study showed, maybe related to the AC GND, the chips near HCC suffer more exterior, temperature independent noise. So the noise is a bit higher.
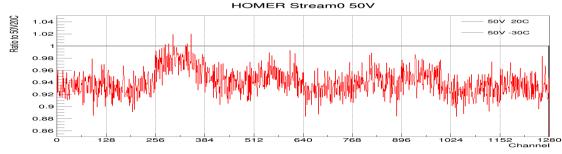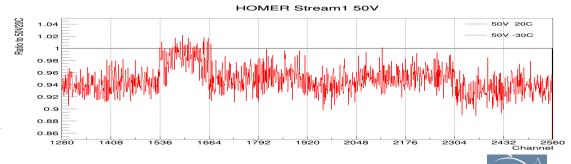
Ratio plot: 50V

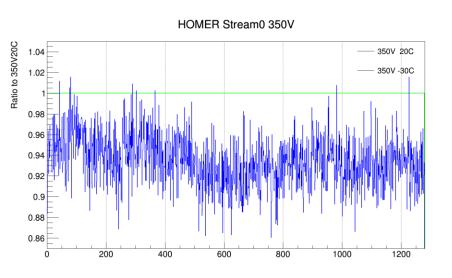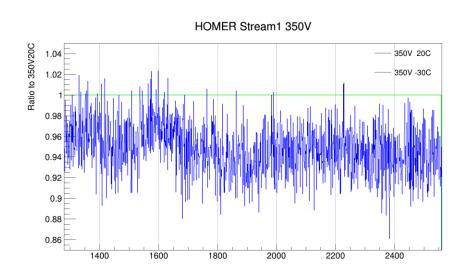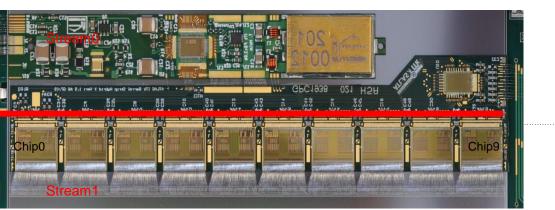Generally, for 50V, -30℃ would be 6% better than 20 ℃.
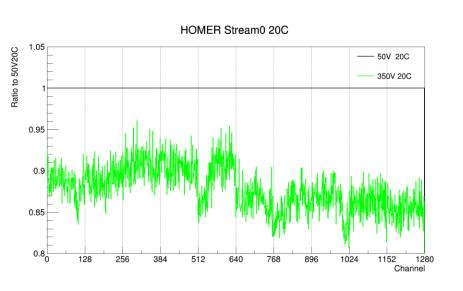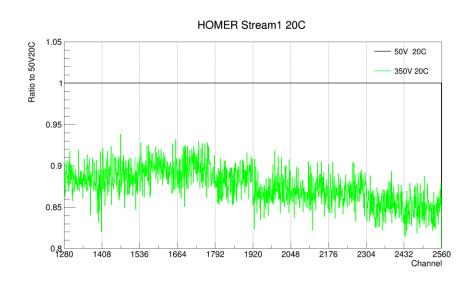
Ratio plot: 350V
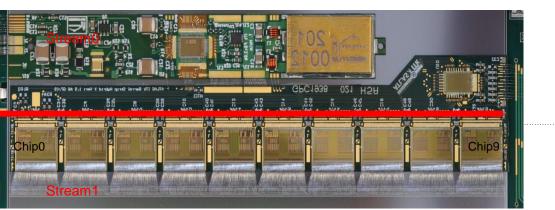
For 350V, -30℃ is 5% better than 20 ℃.
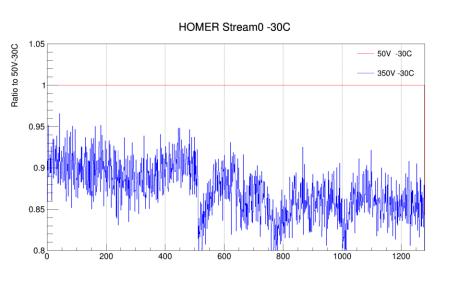
Ratio plot: 20C

350V is 15% better than 50V in 20C.
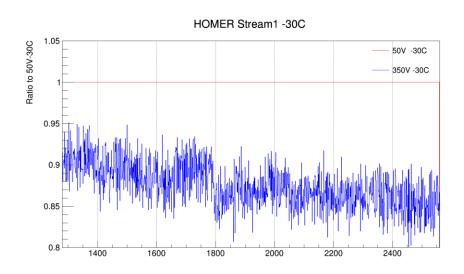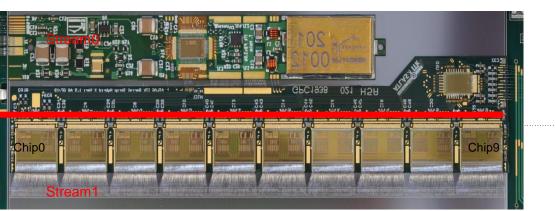
Ratio plot: -30C

350V is 14% better than 50V in -30C.

Noise level table

	50V20C			50V-30C			350V20C			350V-30C		
Stream 0	883	±	41	830	±	37	775	±	23	724	±	25
chip 0	873	±	15	815	±	13	771	±	16	736	±	17
chip 1	845	±	15	787	±	16	751	±	15	704	±	18
chip 2	866	±	14	843	±	12	785	±	14	746	±	17
chip 3	820	±	12	772	±	12	742	±	12	697	±	13
chip 4	847	±	18	803	±	15	758	±	14	697	±	15
chip 5	919	±	15	854	±	14	794	±	12	734	±	14
chip 6	909	±	22	855	±	16	779	±	16	723	±	18
chip 7	938	±	29	887	±	20	809	±	12	757	±	16
chip 8	897	±	12	831	±	12	773	±	10	718	±	14
chip 9	916	±	15	855	±	13	783	±	14	731	±	16

	50V20C			50V-30C			350V20C			350V-30C		
Stream 1	848	±	37	804	±	33	742	±	22	704	±	25
chip 0	846	±	16	794	±	13	747	±	11	719	±	16
chip 1	809	±	13	763	±	11	718	±	11	684	±	16
chip 2	829	±	12	816	±	12	743	±	9	719	±	13
chip 3	798	±	11	757	±	12	715	±	11	679	±	14
chip 4	815	±	11	779	±	12	720	±	13	673	±	16
chip 5	858	±	12	806	±	11	746	±	10	703	±	13
chip 6	845	±	10	804	±	10	734	±	11	694	±	13
chip 7	894	±	12	855	±	11	777	±	10	736	±	14
chip 8	884	±	14	821	±	13	754	±	13	708	±	15
chip 9	904	±	12	847	±	11	767	±	11	722	±	16

Noise study summary

Noise level in different HV and temperature tested.

No big defects found for this module HOMER.

Generally the performance is in our expectation.

For some specific channels and chips, the noise level in lower temperature would be comparable with zoom temperature.

One possible reason is AC GND. Need further study.

Under Pb3.0C, Performance at -10V would also be tested in the following run.