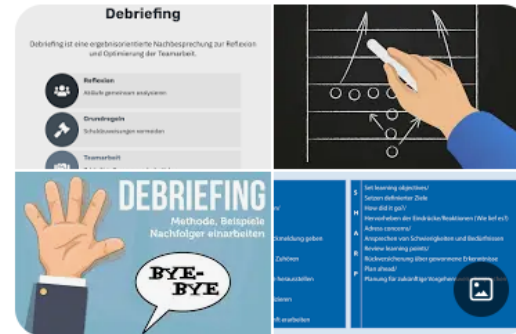# 2S Module Production – Debriefing

**ETP 2S Module Production Meeting – 27.03.2025**
●**Stefan Maier**

Debriefing

Die Nachbesprechung ist ein Bericht über eine Mission oder ein Projekt oder die so erhaltenen Informationen. Es ist ein strukturierter Prozess nach einer Übung oder einem Ereignis, der die ergriffenen Maßnahmen überprüft.
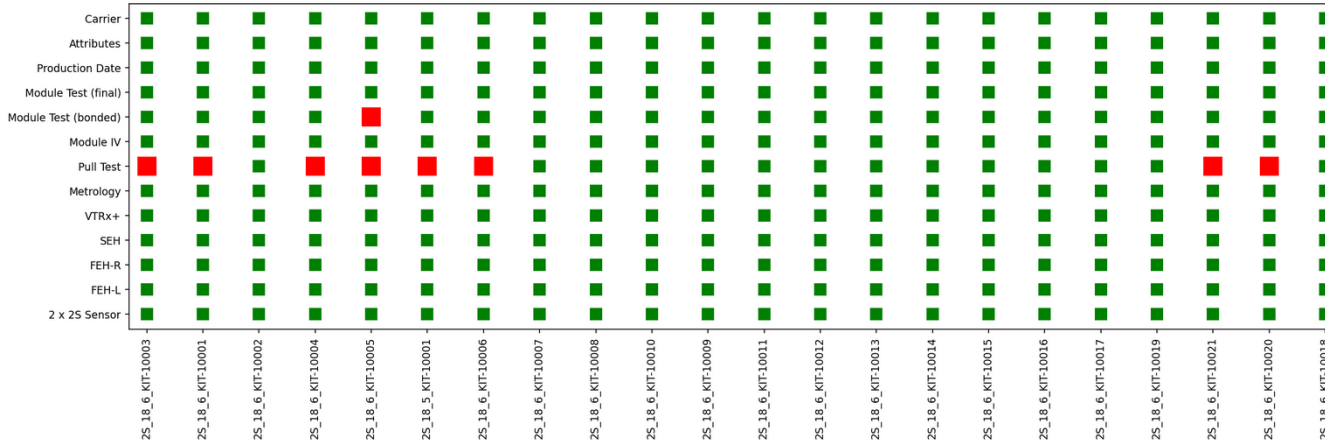
Source: Wikipedia (Englisch)

15 Modules in 16 Days

2S Module History (Cumulative)

- ◼ Long story short: Success!
  - ◼ We took the lead! ;)
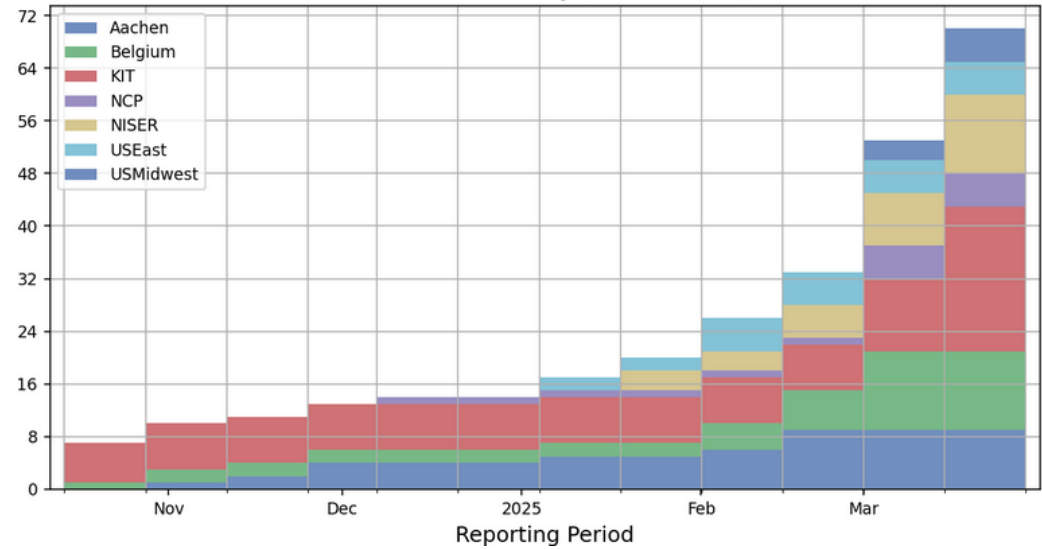
KIT - 2S Module DB Status (Last 60 Modules)

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Shift Scheduling

- As already stated in the kick-off meeting the high granular scheduling of shifts and task is not feasible for a full scale production scenario
- We will change from 8 time slots to 4 time slots
  - 2 in the morning 2 in the afternoon
  - One "major" gluing task per 2 shifts
- Try to keep HiWis busy
  - Dicing test
  - VI hybrids
  - Skeleton assembly and test
  - VI Bridges
  - Assemble carriers
  - Register parts on arrival → Logistics room ;)
- We remove starting and end times as we will drop constraints in the pipeline

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Pipeline in general

- Currently: 7 days
  - Kapton gluing
  - O.I. & Wire-bonding & encapsulation
  - HV / IV test & Bare module assembly
  - O.I. & Metrology & Hybrid gluing
  - O.I. & Wire-bonding & quick test & encapsulation
  - Encapsulation
  - Full test
  - 7 days

- In future: 13 days
  - Kapton gluing
  - O.I. & Wire-bonding & Encapsulation
  - HV / IV test
  - Bare module assembly
  - O.I. Bare Modules
  - Metrology
  - Hybrid gluing
  - O.I. Hybrid gluing
  - Wire-bonding
  - Quick test
  - Encapsulation
  - Encapsulation
  - Full test

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In future: 13 days
- Kapton gluing
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- HV / IV test
- Bare module assembly
- O.I. Bare Modules
- Metrology   Time constraint in our pipeline
- Hybrid gluing
- O.I. Hybrid gluing
- Wire-bonding
- Quick test
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- Encapsulation
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  - Hybrid gluing
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  - Wire-bonding
  - Quick test
  - Encapsulation
  - Encapsulation
  - Full test

- Constraint
  - Limited by #of jigs
  - Constrains us to do O.I. immediately followed by HV tail bonding
  - Kapton gluing in the afternoon not feasible as the glue will not harden enough
  - Module bonding schedule must account for this:
    - Start only one module in the morning
    - Wire-bond tails
    - Bond remaining modules

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Front-End

- Basic functionalities given by the software
  - Login problems solved
- Improvements mandatory
  - Better overview pages
  - Display of part history (comments)
  - Edit tasks already done

Lets hope our HiWis are good with JavaScript!

- Please use the comment field!
  - Unify way of giving comments?

Skeleton Assembly and Test

- Hybrid VI:
    - Leander identified 3 FEHs with scratches on the antenna and GND bond pads
    - We concluded that we identify such hybrids with a <mark>red sticker</mark> to make clear that wire-bonding might be problematic
        - Could also be done via the front-end but given the severity this is more straight forward and indicative
- Skeleton assembly is a time consuming step
    - We will try to stick and let it be done by HiWis, but this might not fully work out
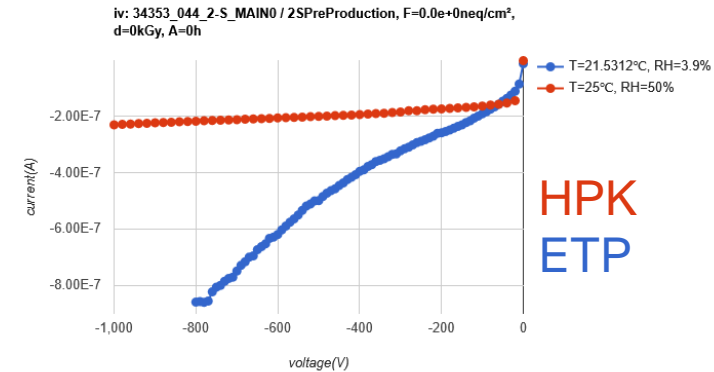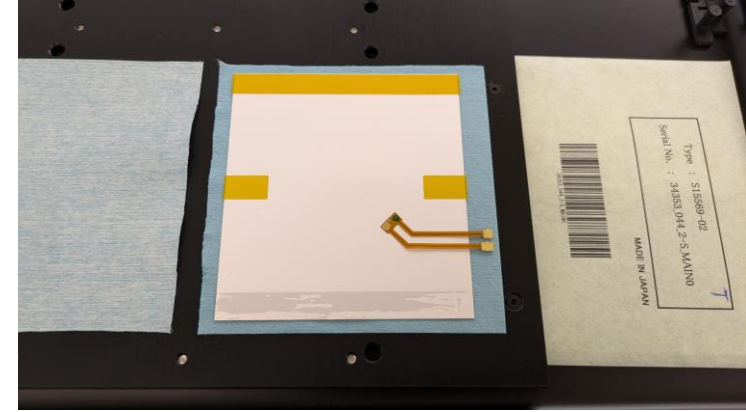- Skeleton test can be run while another one is assembled
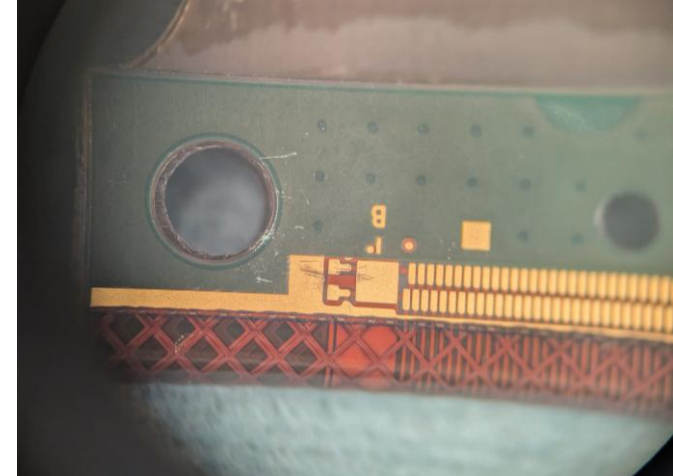
Al-CF Bridges

- With new no-go pins all "newer" bridges passed hole QC test
- Thickness gauges machined by brown questionable
  - Results in 10% dropout rate, contacted conveners
  - We were told to measure bridges manually to crosscheck their gauges…

05.03.2025	Lorena	1.8 Stump	Tray 4	72				too thin		17	5486_22		
								too thin		18	5486_22		
								too thin		24	5486_18		
								too thin		29	5486_18		
								too thin		51	5488_05		
								too thin		68	5488_06		
05.03.2025	Lorena	1.8 Stump	Tray 3	72				too thin		1	5443_04		
								too thin		5	5443_05		
								too thin		6	5443_05		
								too thin		10	5443_05		
								too thin		12	5443_05		
								too thin		44	5486_19		
								too thin		58	5486_24		
								too thin		70	5486_27		
11.03.2025	Lorena	1.8 Main	Tray 26	16	missing	2	5514_18_2						
11.03.2025	Lorena	1.8 Main	Tray 27	16								slot too large	2 5486_4_1
				broken	13	5409_10_2							
11.03.2025	Lorena	1.8 Main	Tray 28	16	Stufe	7	5409_18_2						

Kapton Gluing

- Incident: Pickup tool stuck to sensor
  - Repairable
  - Increased IV curve. Not severe
  - Amount of glue in the pattern was reduced by 10%
- We try and stick to do the gluing in the morning shift
  - Keep 24h of curing as we need to wire-bond this in the morning
- Recheck of gluing in the afternoon
- Sensor showed some scratches during/after bare module assembly
  - Assumption:
    They come from the repair
- Buy dedicated dropper/pipette to apply isopropanol

iv: 34353_044_2-S_MAIN0 / 2SPreProduction, F=0.0e+0neq/cm²,
d=0kGy, A=0h

HPK
ETP

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Sensor handling / Sensor Dicing

■ Now: Sensor processes is started after dicing test

HV Tail Bonding and Encapsulation

- Bonding went flawless
  - Pattern recognition even better with new tails
- Ease front-end usage: We skip the location scan, implemented

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HV / IV Test

- Sensor tablets are now tagged:
  - One caveat: First person in the morning must change tags from curing to untested. Error Prone How does one know he /she is the first one? Ideas?
- Current recipe for measurement: 20 mins if everything goes well
  - Place sensor, attach HV tail
  - Place ion blower for 3-5 minutes
  - Place bias needle
  - Wait for 5% RH
  - Measure
- Problem sensors do charge up / are charged up after the HV test
  - We had >500V on the jig after the measurement!
  - Check relay setting and investigate
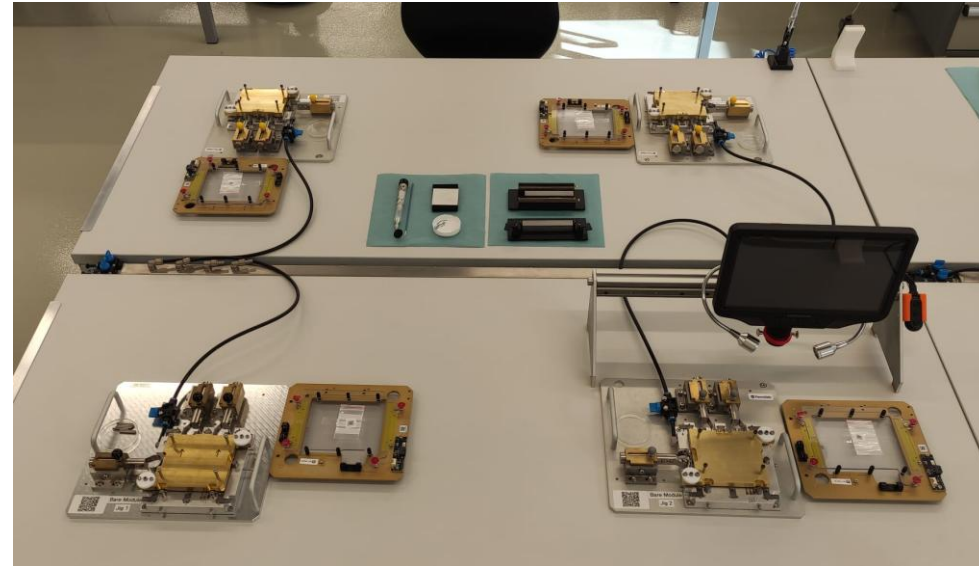 - Possible damage on sensors? (See later damaged channels)

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Microscopes on Gluing Stations

- Looking forward for their upgrade
- Should be done before we re-start
- Experience with batteries?

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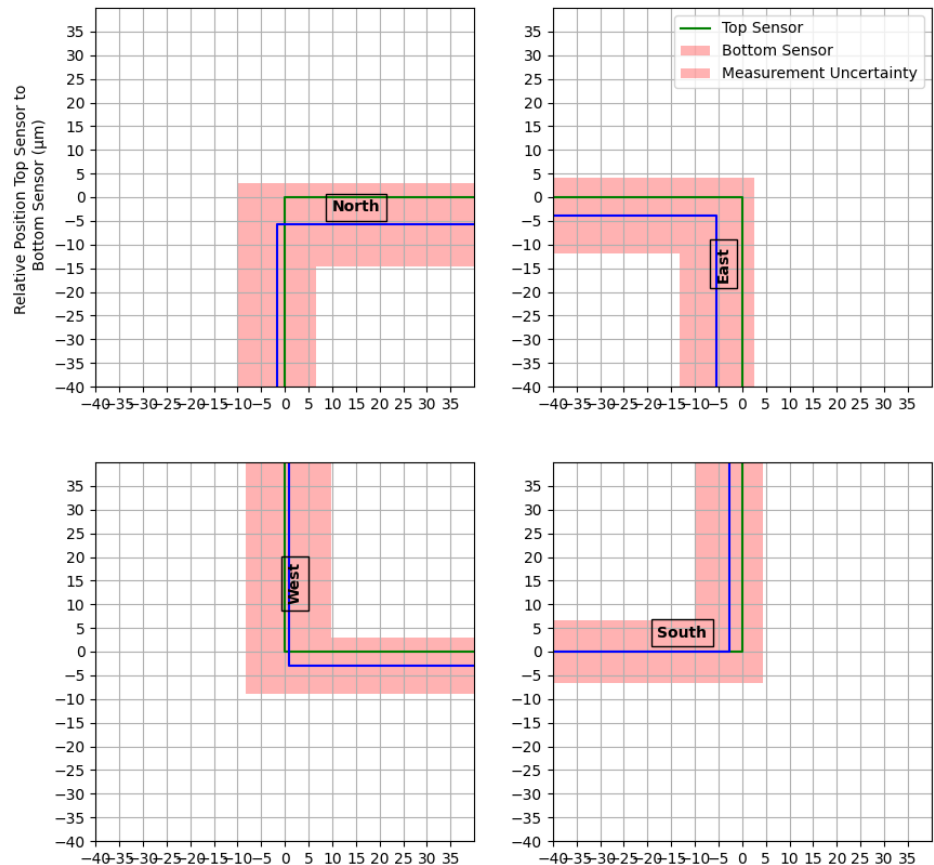
Bare Module Assembly / Metrology

- Space sufficient for 2 jigs/table?
- Different jigs yield slightly different alignment results
  - Eager to see trends
  - Recheck alignment pins
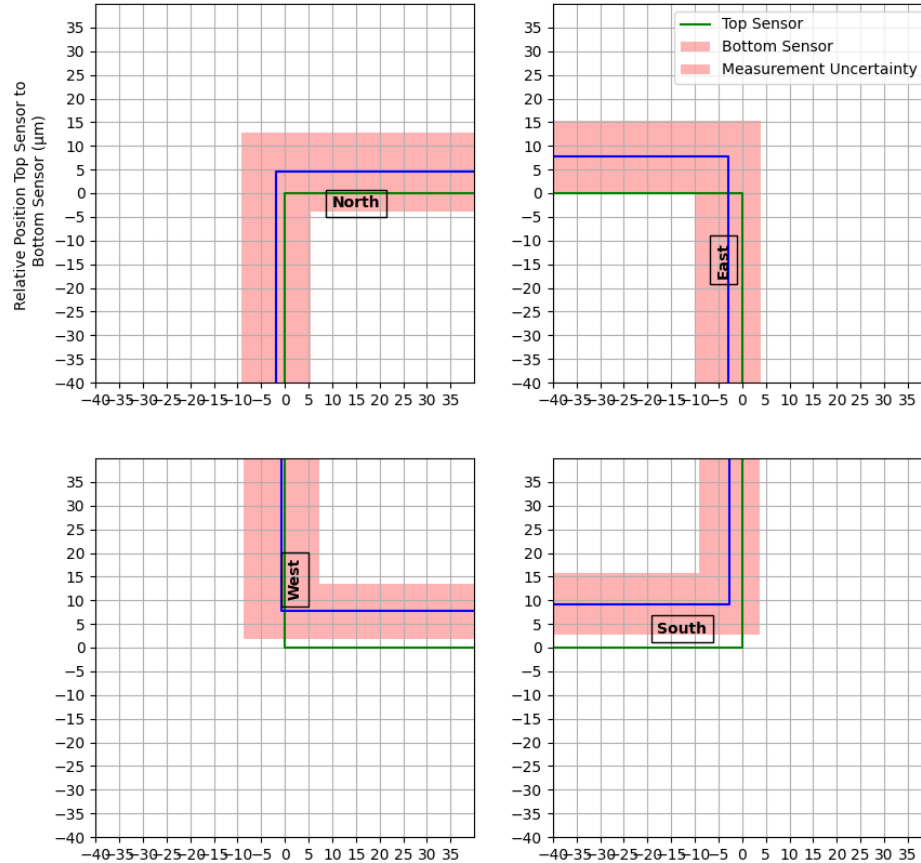- Jig #3 base plate uneven?

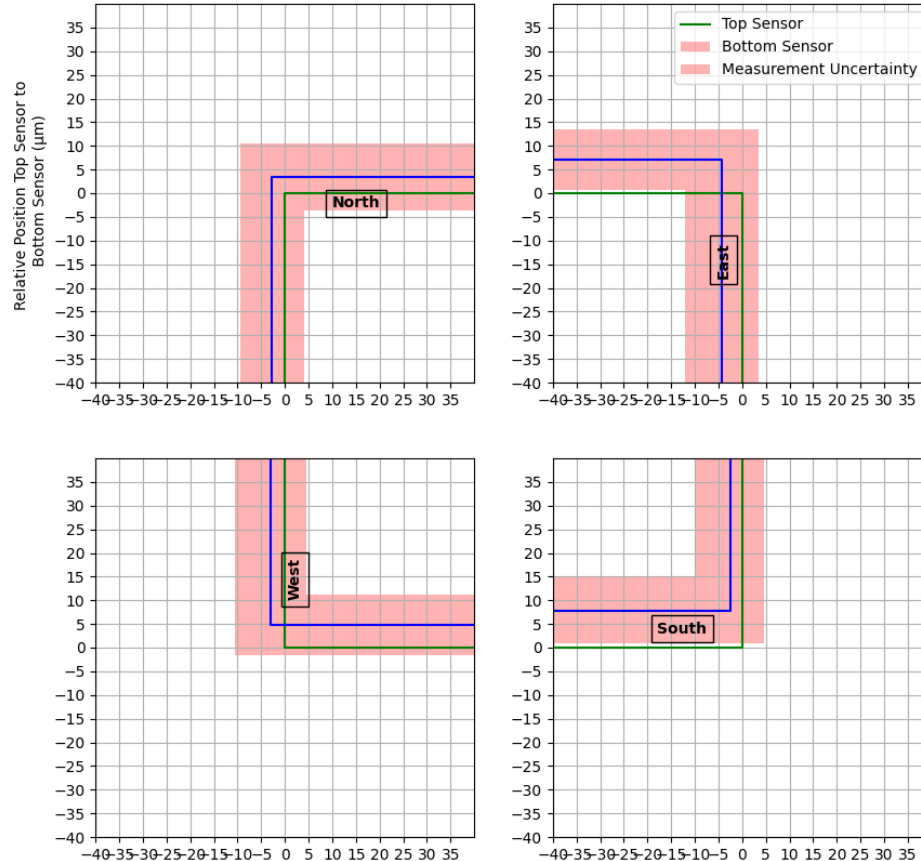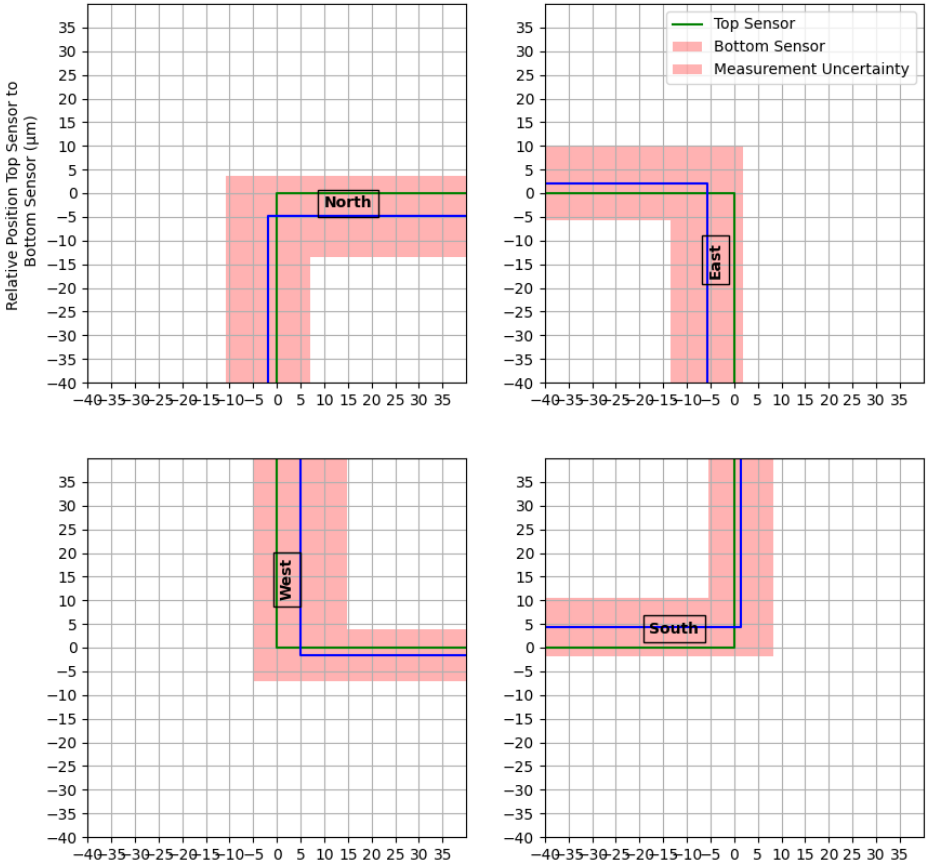Guideline 2S Module Production at ETP   Stefan Maier   s.maier@kit.edu

er@kit.edu

Modul 15
Jig 1

er@kit.edu

er@kit.edu

Modul 1
Jig 2

Modul 21
Jig 2

er@kit.edu

Modul 16
Jig 3

er@kit.edu

Modul 19
Jig 3

er@kit.edu

Modul 17
Jig 4

er@kit.edu
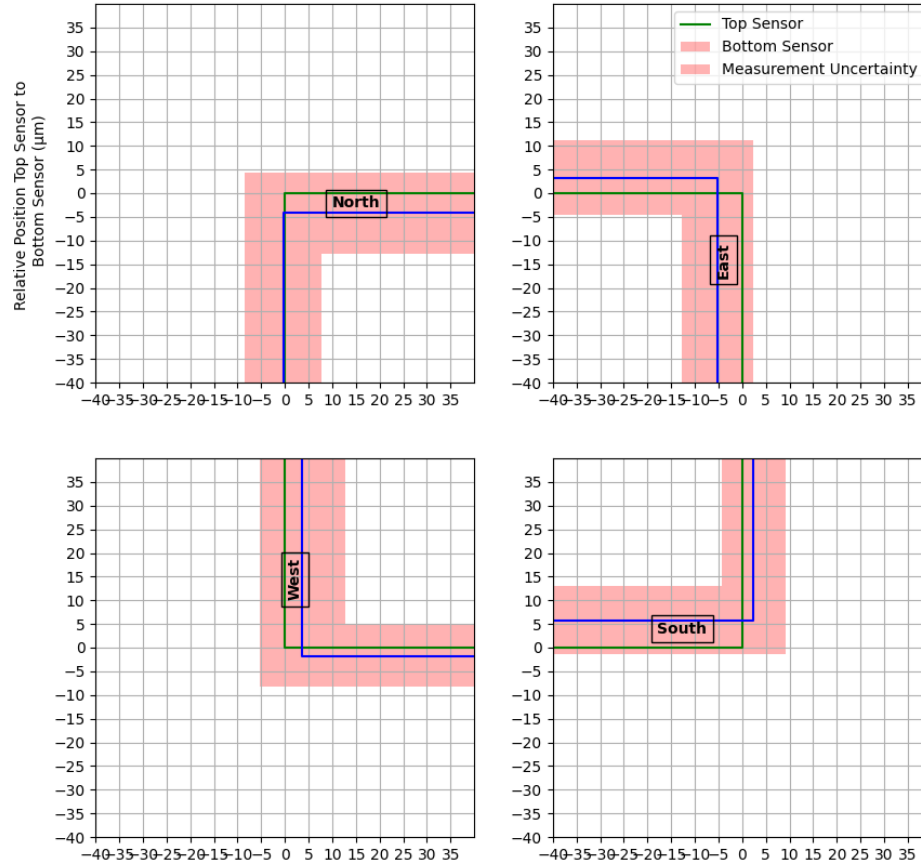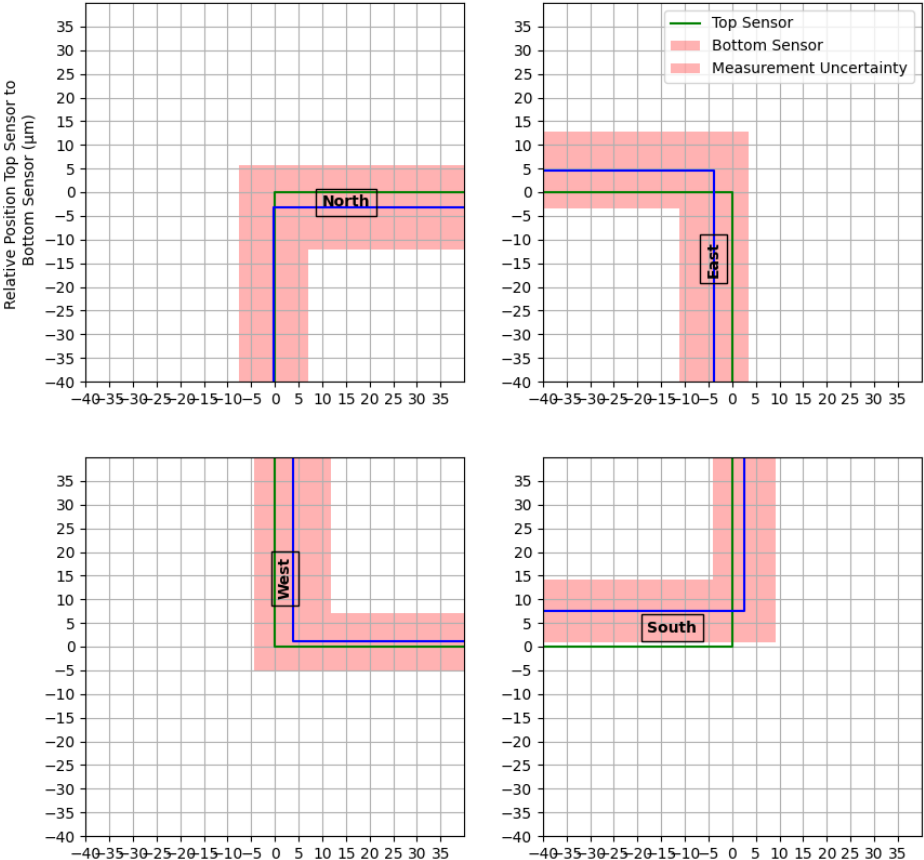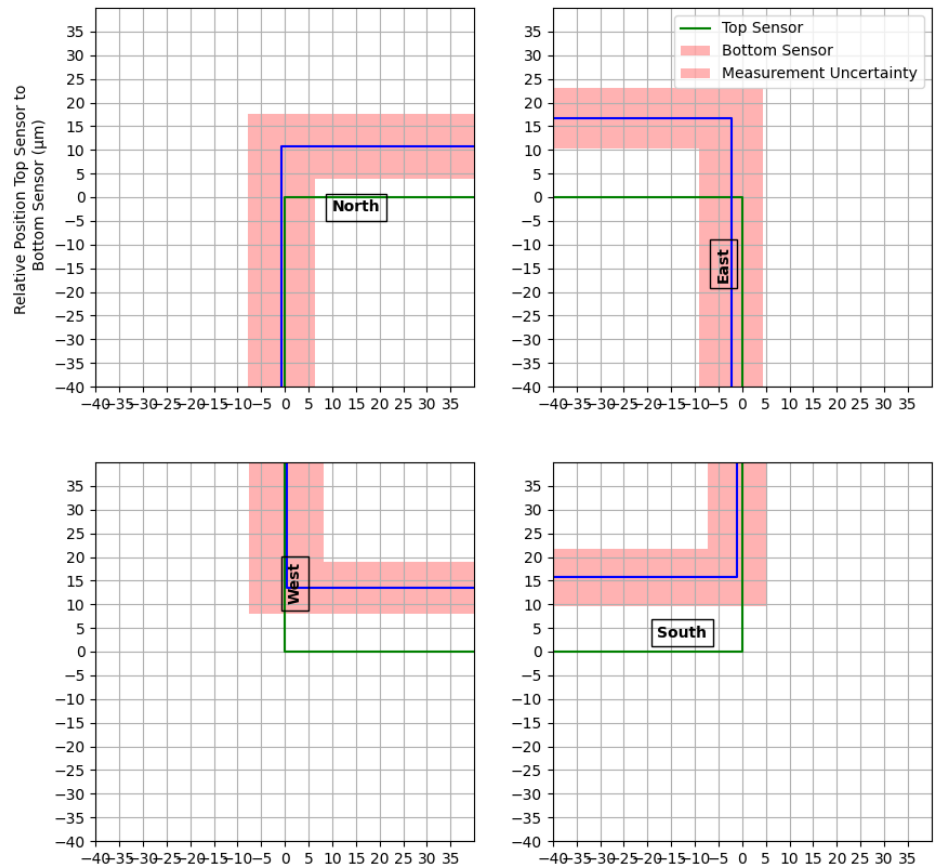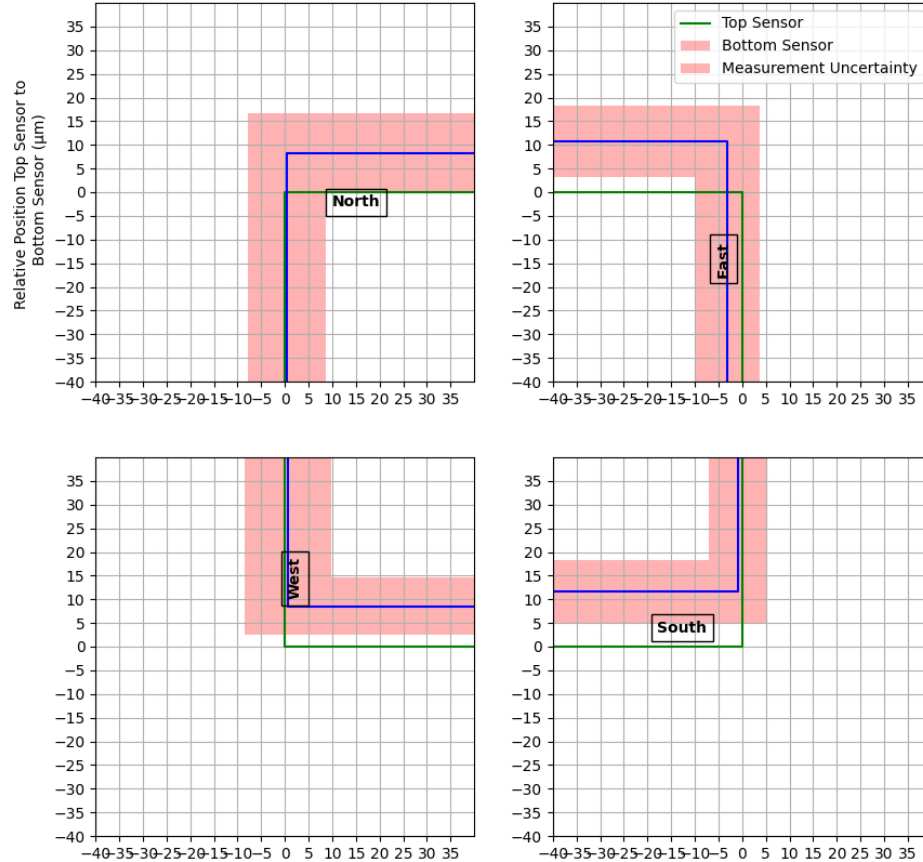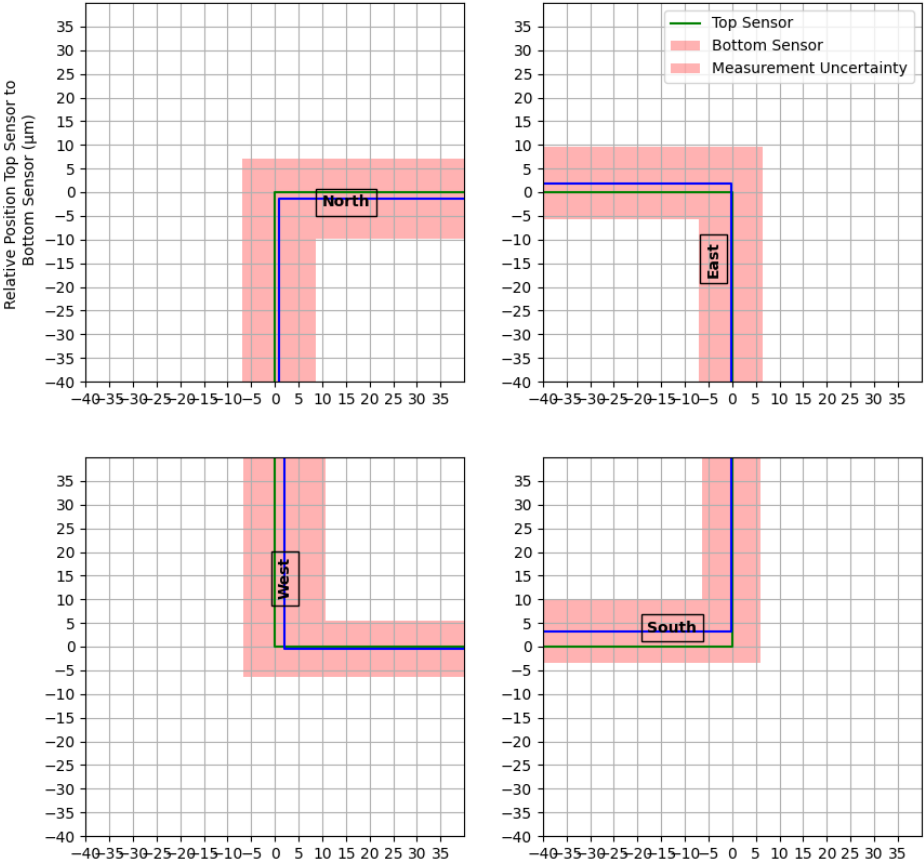
Modul 18
Jig 4
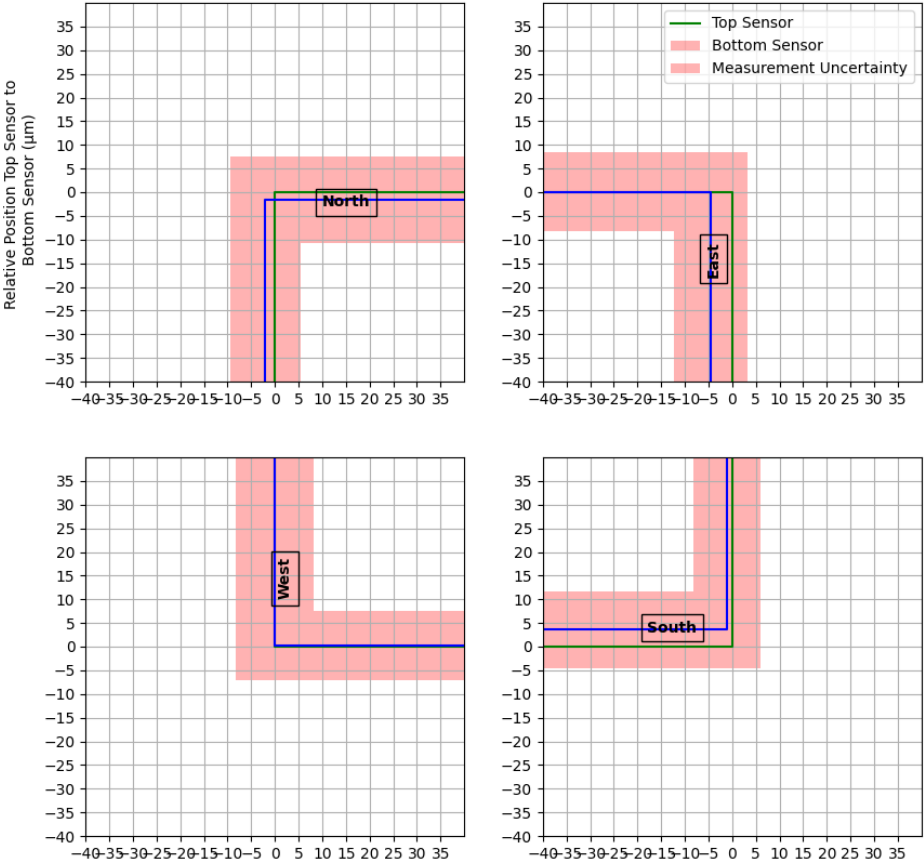
Hybrid Assembly

- Sufficient space for 2 jigs/table?
- Further comments?

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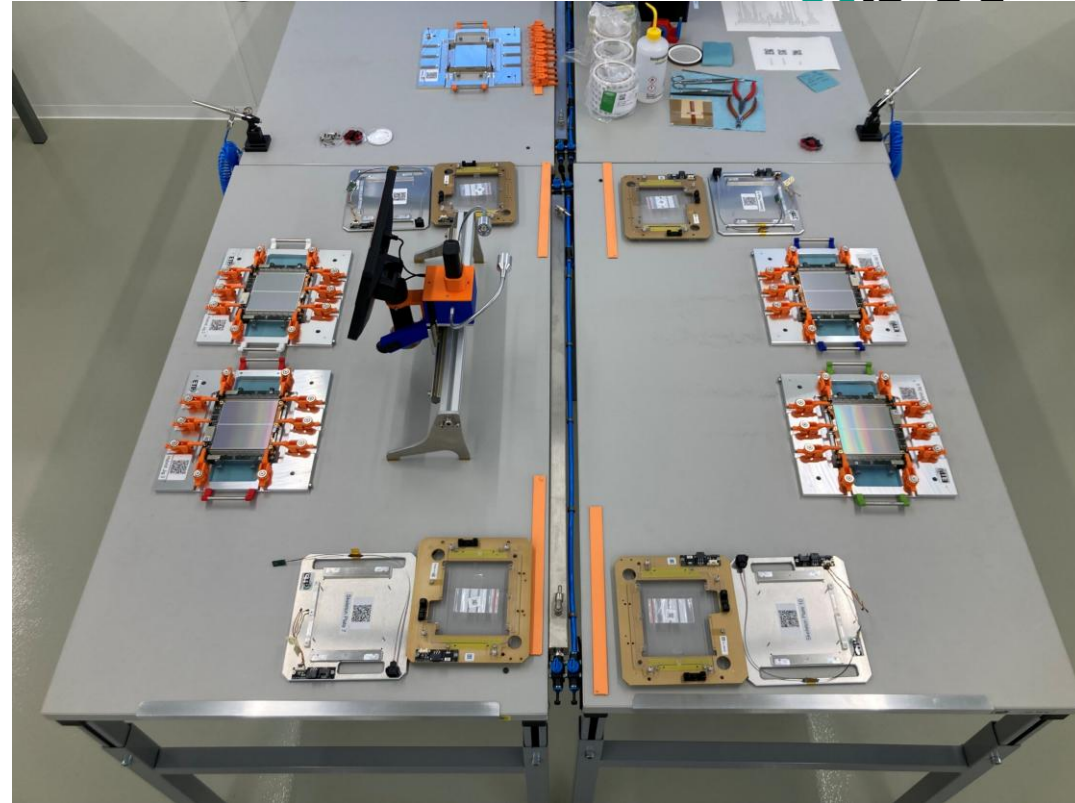
Wire-bonding

- In general even smoother than in October
- 4 modules and 20 pull test wire-bonds: 4 hours and 30 minutes
- Where is the bottleneck?
  - → PARTS
- All pull test values between 6 and 13 g
- Add dedicated microscope to make these pull tests and to inspect modules (?)

pull_test: T=null°C, F=0.0e+0neq/cm², d=0kGy, A=0h

Legend:
- 2S_18_6_KIT-10018
- 2S_18_6_KIT-10019
- 2S_18_6_KIT-10017
- 2S_18_6_KIT-10016
- 2S_18_6_KIT-10014
- 2S_18_6_KIT-10015
- 2S_18_6_KIT-10013
- 2S_18_6_KIT-10012
- 2S_18_6_KIT-10012
- 2S_18_6_KIT-10011

1/2

y-axis: corr_pull_force(gr)
x-axis: pull_position(#)
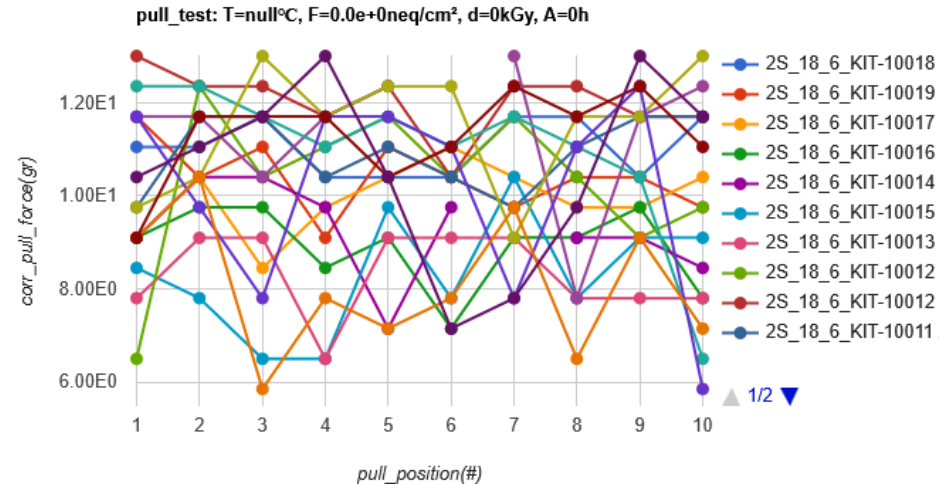
Channel outliers

```
7/Results.root
                        71 noisy
                        73 noisy

8/Results.root
9/Results.root
10/Results.root
11/Results.root
12/Results.root
                        714 noisy
                        715 unconnected
                        716 noisy
13/Results.root
                        1014 unconnected
14/Results.root
                        692 unconnected
                        693 noisy
                        954 noisy
                        955 noisy
                        956 noisy
                        962 noisy
                        963 noisy
                        964 unconnected
                        969 noisy
                        970 unconnected
15/Results.root
16/Results.root
17/Results.root
                        578 unconnected
18/Results.root
19/Results.root
                        606 noisy
                        607 unconnected
20/Results.root
21/Results.root
```

?

"Leaky strip effect"

?

Scratched area

?

Most likely scratch

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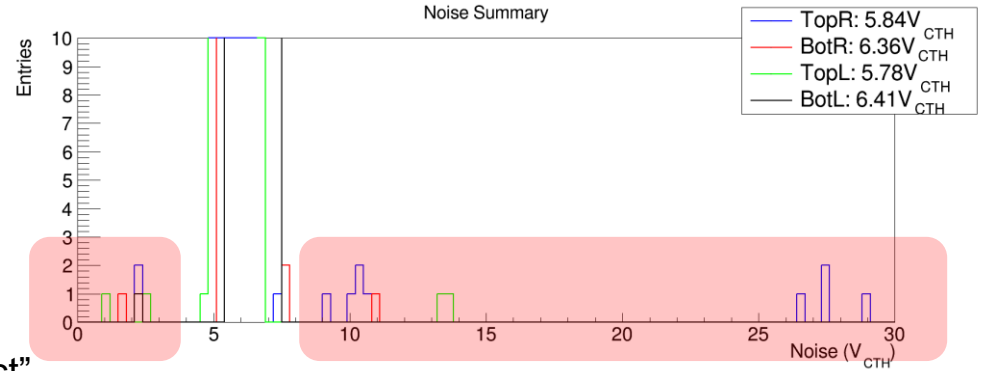
Encapsulation

- Clash of MT / MPO connector (Zip tie) with module adapter
  - Already modified, might need to reprint plastic piece
- 5cc and 30cc usage exercised
  - Both run smooth
  - Might need to adapt the 30cc program slightly
    - Did not 100% hit the wire-bond feet on last modules, to be investigated
    - Change dispensing height
- 6 modules tested with WBE height tool. All passed (<1mm above bottom sensor)
  - 9 more (incl 30cc modules) to do…

Module Test

- New failure mode (1 Module in October and one this time)
- Single channel increases global leakage current significantly
- Until we do not understand the cause and the impact on operation we must identify these channels and pull the corresponding channel
  - We will start testing how this is triggered and its impact

D_B(0)_O(0)_HybridNoiseTop_Hybrid(1)

iv: 2S_18_6_KIT-10012 / 2S_module, T=null°C, F=0.0e+0neq/cm², d=0kGy, A=0h
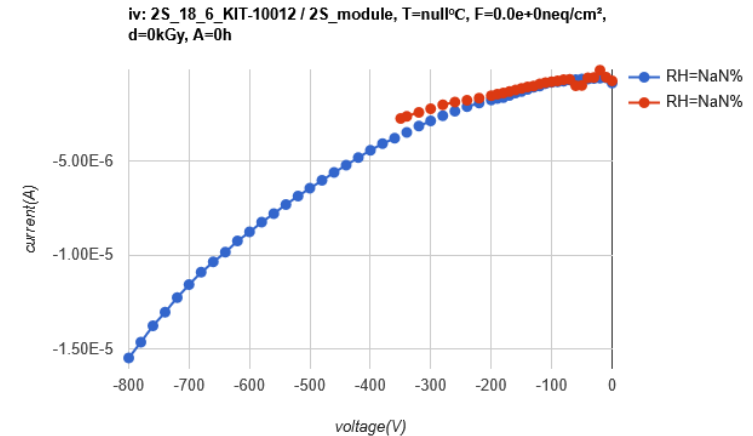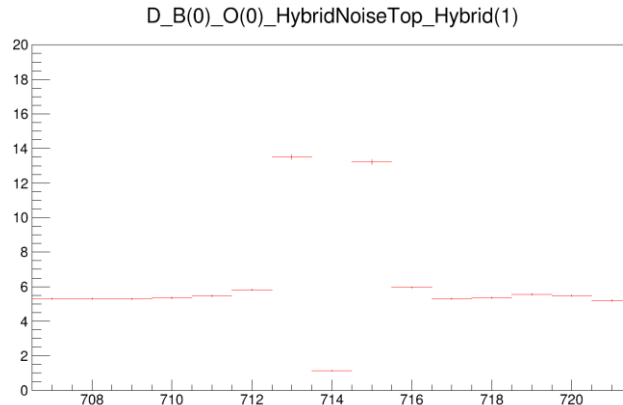
Module Test (2) - Noise

Module Test (3) - IV

iv: T=null°C, F=0.0e+0neq/cm², d=0kGy, A=0h

Legend:
- 2S_18_6_KIT-10018 / 2S_module, RH=...
- 2S_18_6_KIT-10019 / 2S_module, RH=...
- 2S_18_6_KIT-10020 / 2S_module, RH=...
- 2S_18_6_KIT-10021 / 2S_module, RH=...
- 2S_18_6_KIT-10017 / 2S_module, RH=...
- 2S_18_6_KIT-10016 / 2S_module, RH=...
- 2S_18_6_KIT-10015 / 2S_module, RH=...
- 2S_18_6_KIT-10014 / 2S_module, RH=...
- 2S_18_6_KIT-10013 / 2S_module, RH=...
- 2S_18_6_KIT-10011 / 2S_module, RH=...

1/2
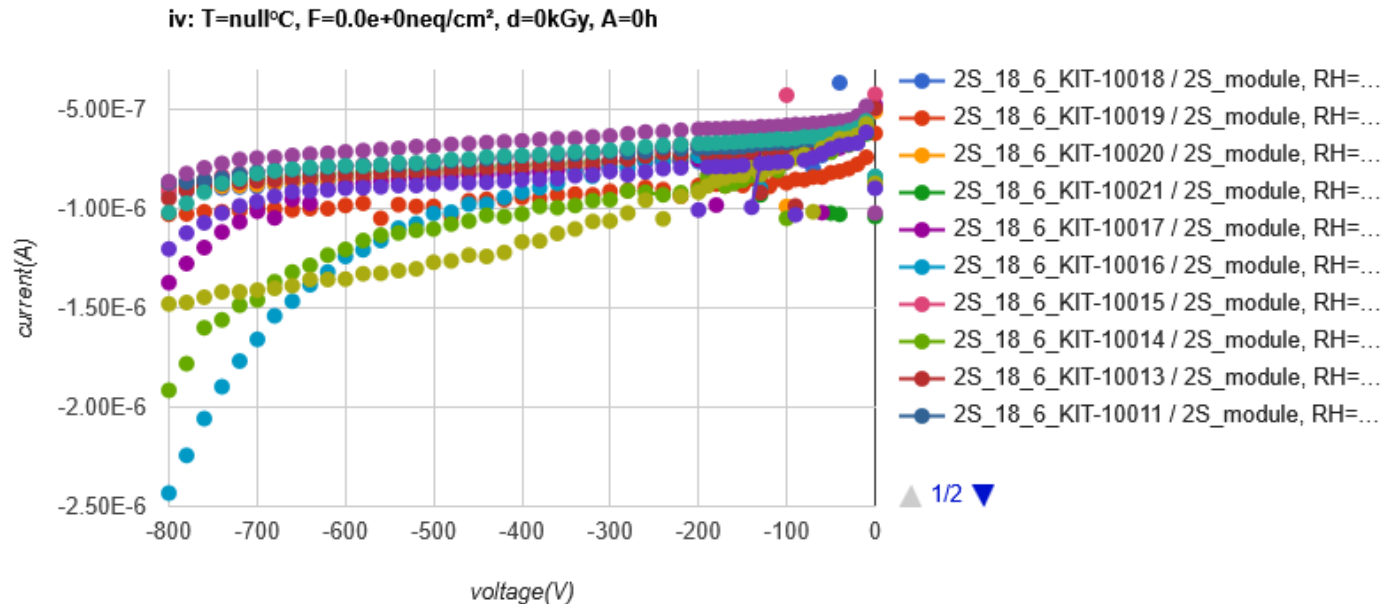
Organization

- Vacation / sickness leave etc: How to run the assembly line?
- Need to come up with some knowledge transfer
  - At the moment a lot of things happen "in the background" using custom scripts and manual work

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Outlook

- Soon, we will get more FEHs
  - They will have blocked alignment holes. Assembly without pins
- New HV Tails are currently prepared at CERN.
  - Update expected tomorrow in the electronics meeting
  - IF they are good we can expect them mid of April
- We expect ~120 or more carriers "soon"
  - Assembly time should not to be underestimated
- New type of SEH will be build "soon", we do not expect that we need to build too much incomplete modules anymore
- Soon: New modules must be finalized with another SEH
  - Hybrid gluing
  - Light shield attachment (encapsulant)
  - Single module full test
  - Burn in
- Once we ramp again we will again start only doing one module per day, increasing towards 4 modules per day, depending on how much material we get. We will try to enter in a continuous production.

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structure	Count	Assembled	Available
2S_carrier	25	12	13
2S Sensor	3522	84	3438
2S_Skeleton	38	31	7
Al_cf_bridge_long_18	270	66	181
Al_cf_bridge_long_40	198	2	181
Al_cf_bridge_short_18	339	58	251
Al_cf_bridge_short_40	178	2	176
fehybrid_left	64	40	24
fehybrid_right	69	42	27
gnd_balancer	119	24	95
hvtail_bottom	46	46	0
hvtail_top	45	45	0
kapton_long	556	150	401
kapton_short	540	133	407
service_hybrid	101	40	61
VTRxPlus	118	25	93

Vacation

April	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Barvich				1										1	1	1	1					1	1	1	1					
Siemens																														
Krämer																														
Rehm											1								Ostern											
Berger														1	1	1	1													
Simonis																														
Maier																												1	1	1
Dierlamm																														

Mai	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Barvich				1								1	1	1	1	1														1	
Siemens																															
Krämer				1																										1	
Rehm																														1	
Berger			1.Mai	1																										1	
Simonis																															
Maier				1			1	1	1	1																					
Dierlamm																															

| Juni | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |

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