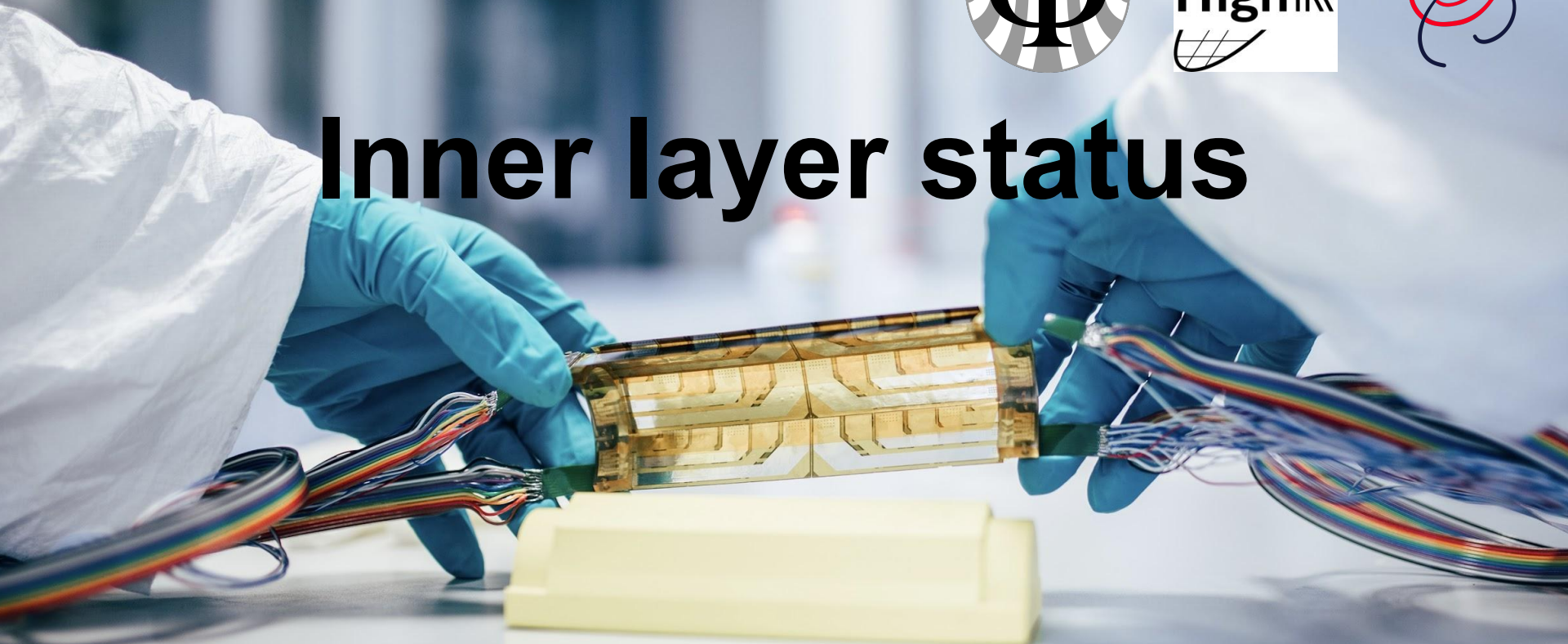




Inner layer status



Thomas Rudzki - Pixel construction meeting - Oxford 2021

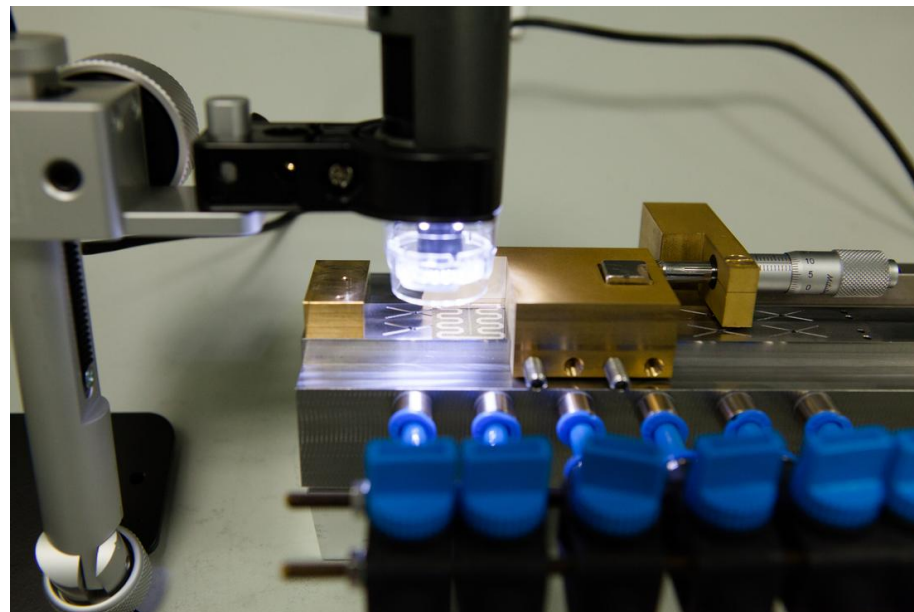


Inner layer assembly

- Tooling tested and verified for silicon heater project

Inner layer assembly

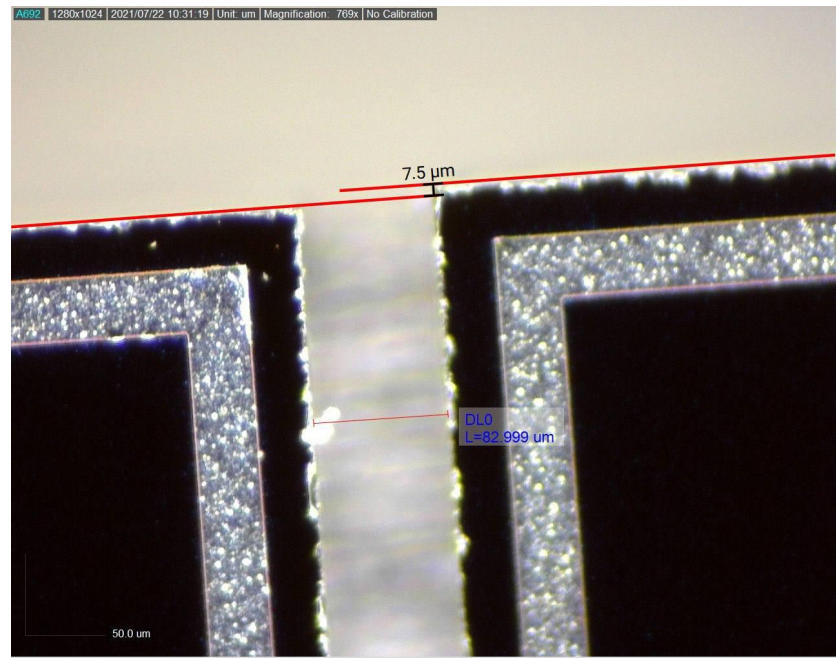
- Ladder assembly tool:





Inner layer assembly

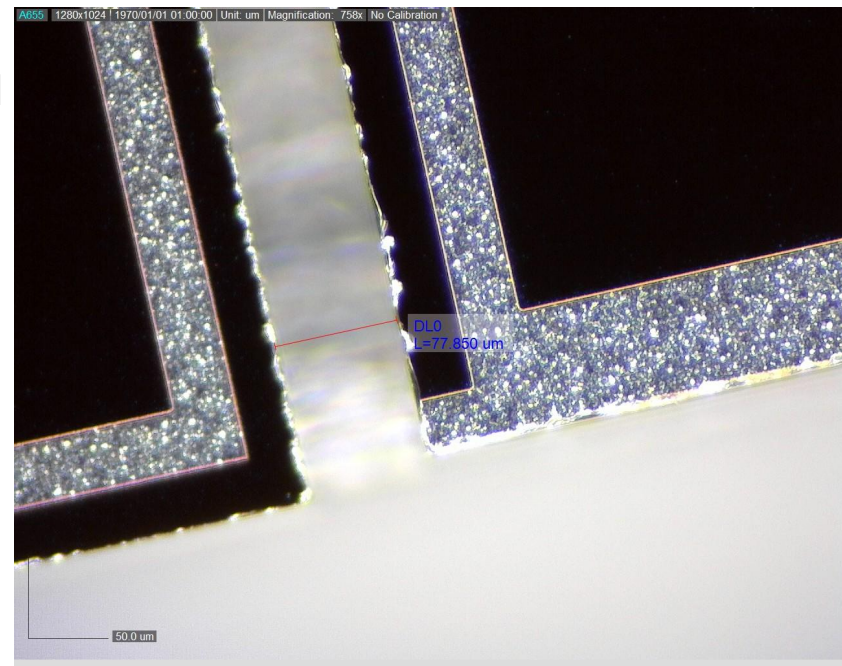
- Ladder assembly tool:
 - $< 5 \mu\text{m}$ precision for horizontal and vertical placement
 - avg. vertical displacement: $(9 \pm 3) \mu\text{m}$
→ systematics from slide
(can be produced multiple times, choose beste)





Inner layer assembly

- Ladder assembly tool:
 - $< 5 \mu\text{m}$ precision for horizontal and vertical placement
 - avg. vertical displacement: $(9 \pm 3) \mu\text{m}$
→ systematics from slide
(can be produced multiple times, choose beste)
 - avg. gap size: $(80 \pm 4) \mu\text{m}$





Inner layer assembly

Ladder assembly tool - Status:

- Tool for MuPix10 existing, should fit MuPix11 (same dimensions)
- Precision will be proved in spring 2022
→ MuPix10 ladder production

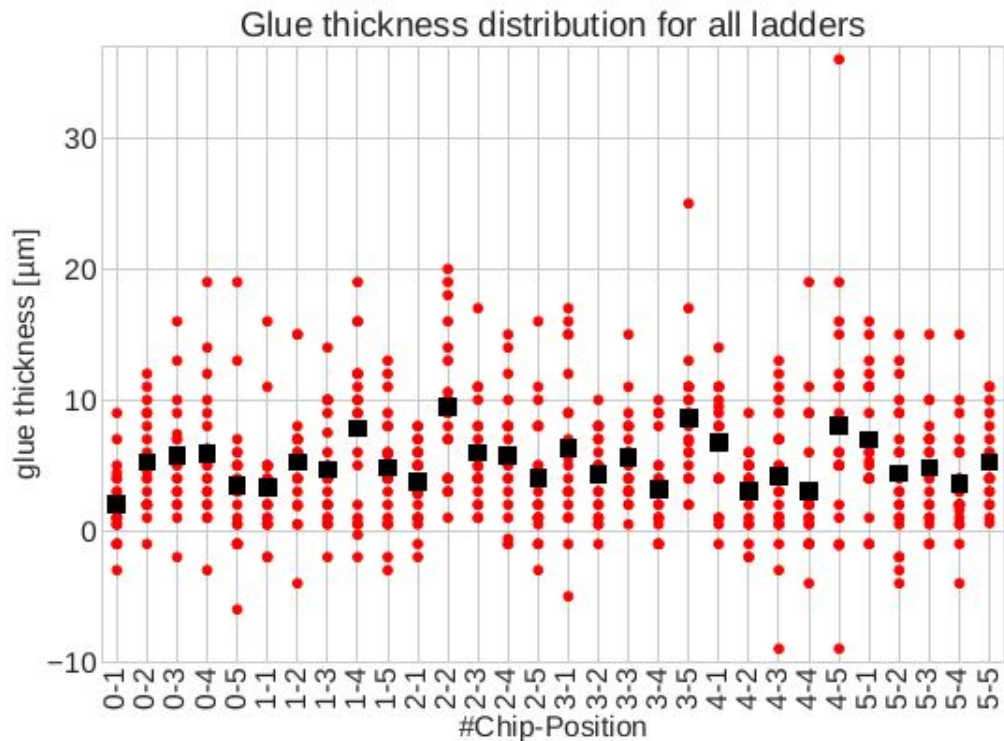
Open question:

- Per hand alignment of HDI and chips precise enough for HV pad?
- Chip bending of MuPix chips compared to Si heaters an issue?



Inner layer assembly

Gluing:

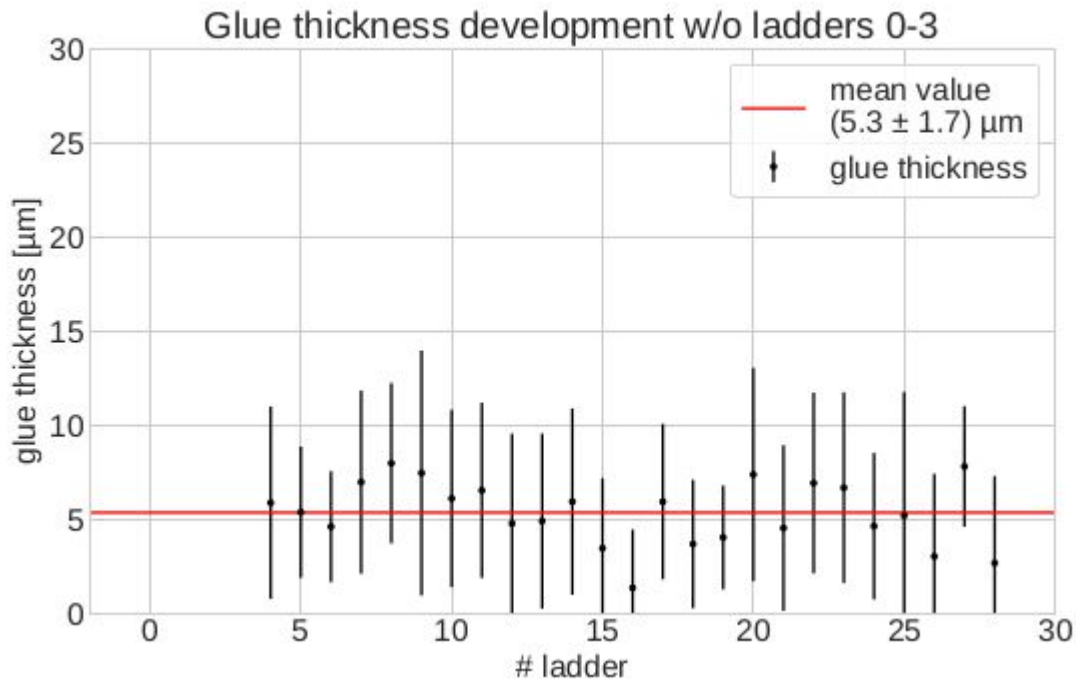




Inner layer assembly

Gluing:

average glue thickness of
~5 μm by hand achieved





Inner layer assembly

Module assembly:

- Tooling worked fine
- Have to be produced for final length
- Production foreseen until summer 2022



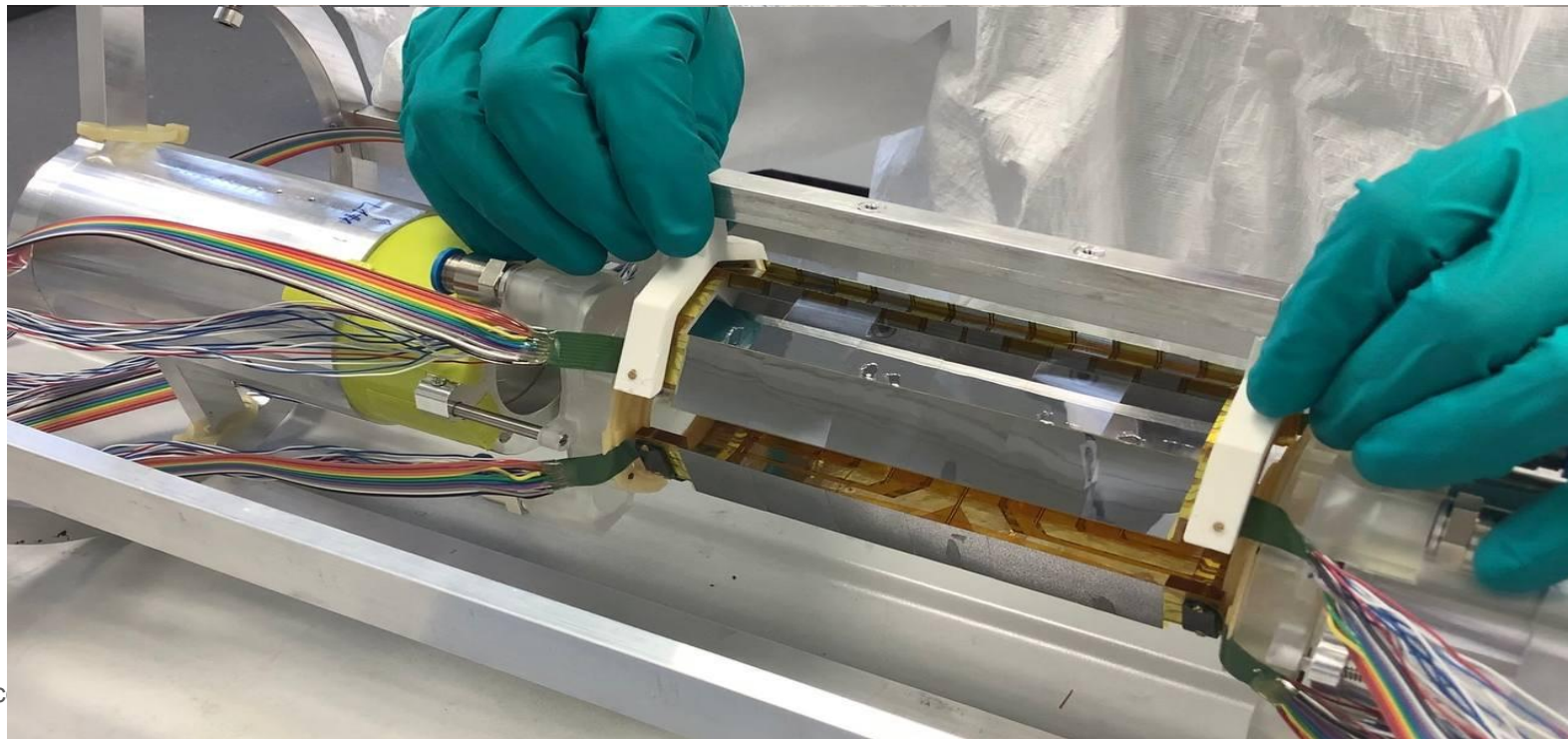


Handling lessons

- Precautions during manufacturing
 - small PVC weights shielding outermost chip while mounting interposer stack and while testing
- Gluing of module
 - Careful to not spill glue → highest risk to directly lose 4/5 ladders!!

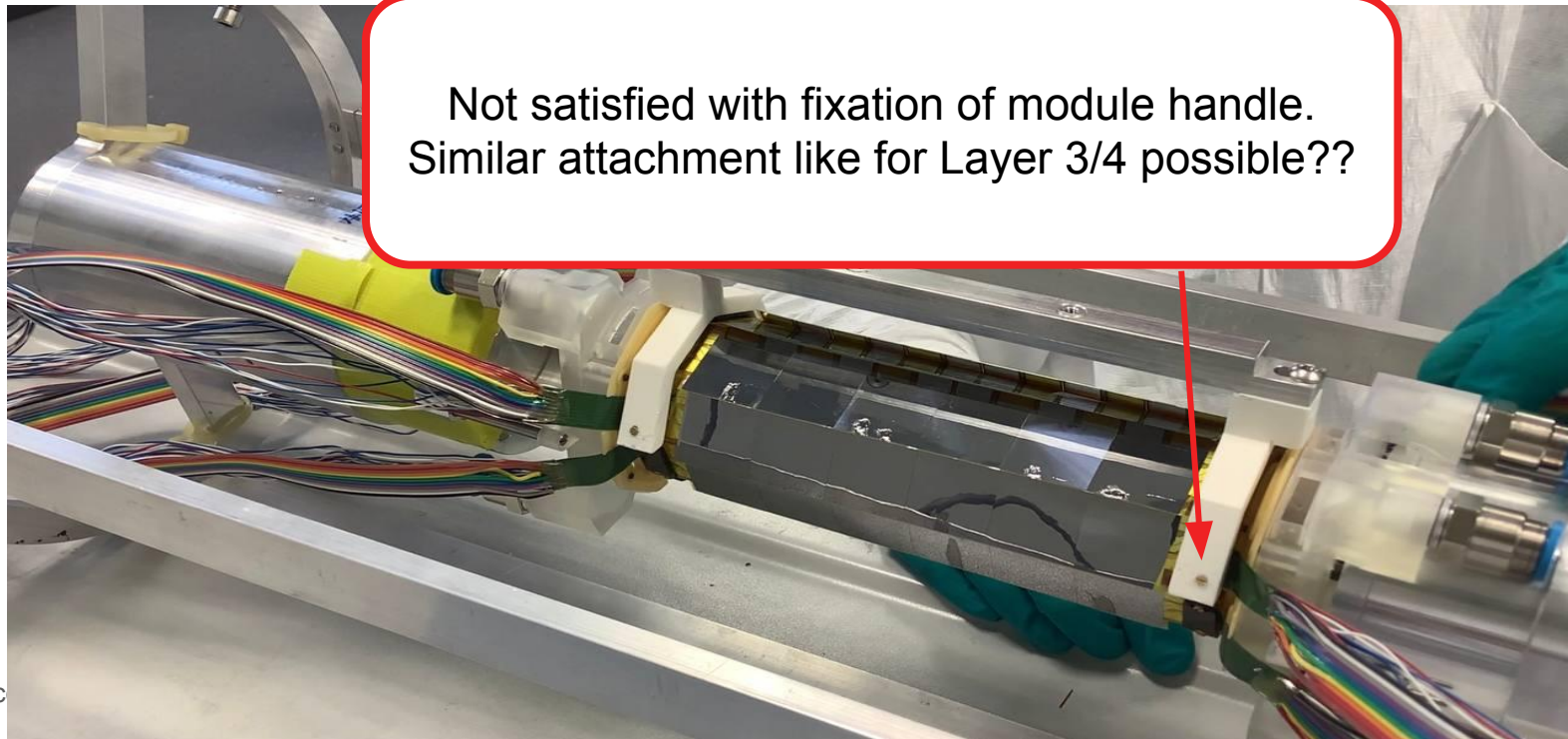
Handling lessons

- Barrel assembly



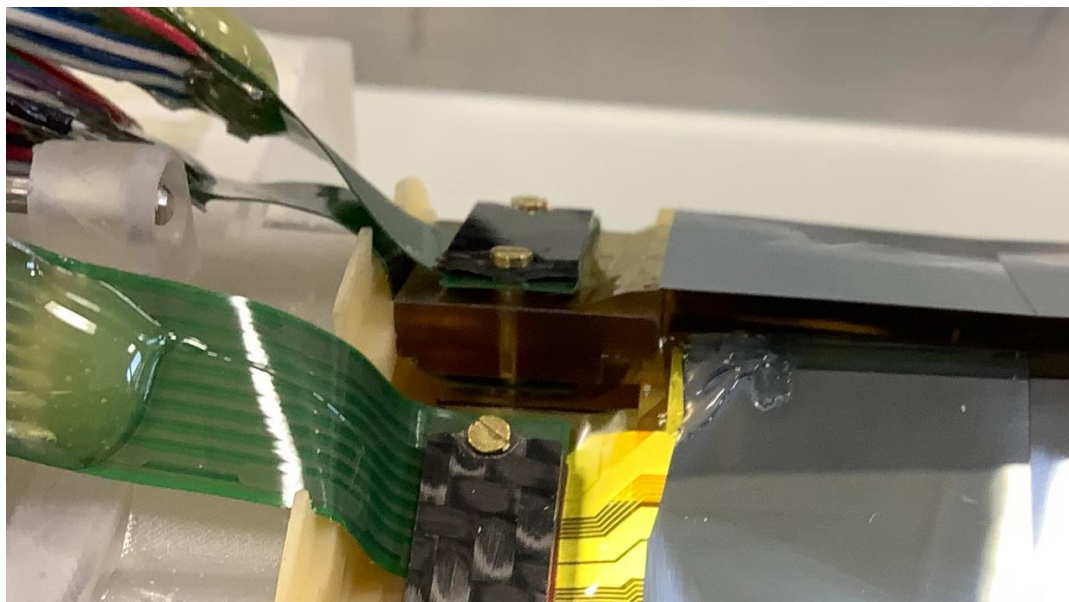
Handling lessons

- Barrel assembly



Handling lessons

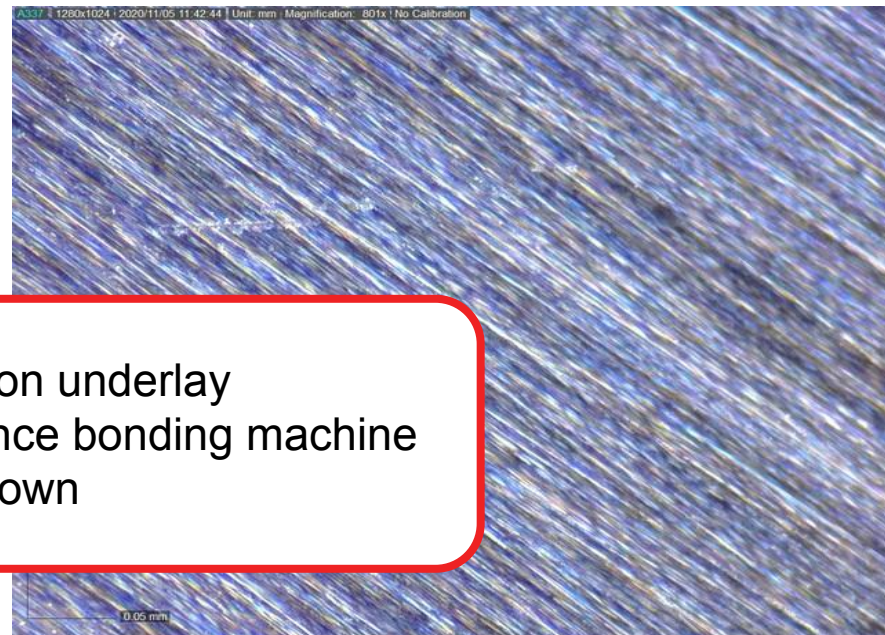
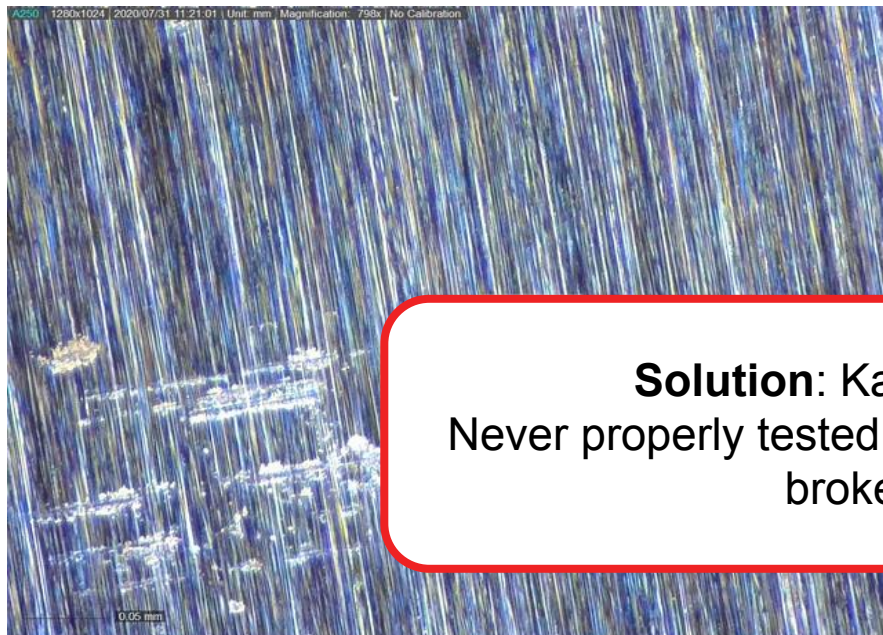
- Barrel assembly
- Clearance between chips and end pieces while mounting (when not spring loaded)





spTAB experiences

Backside scratches for chips on aluminum chuck

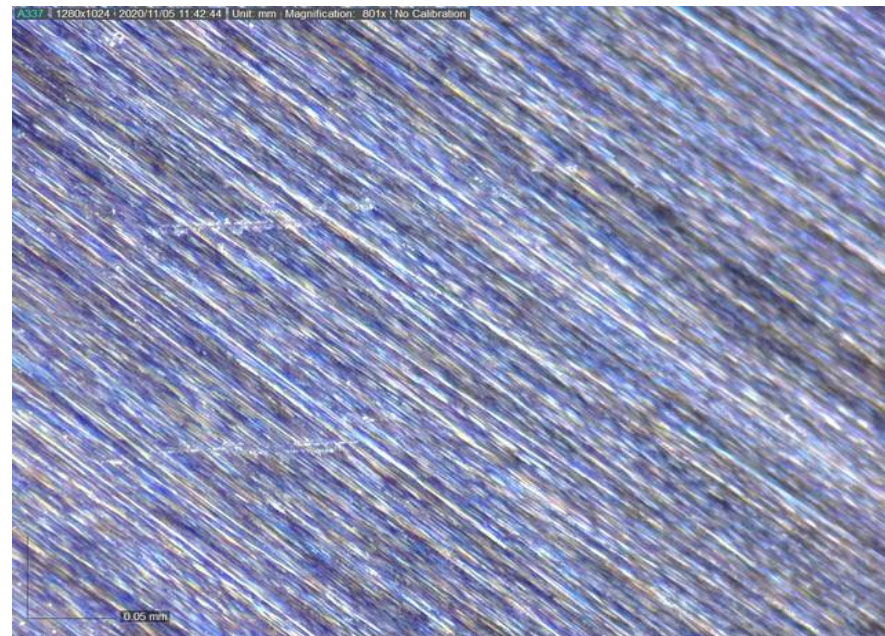
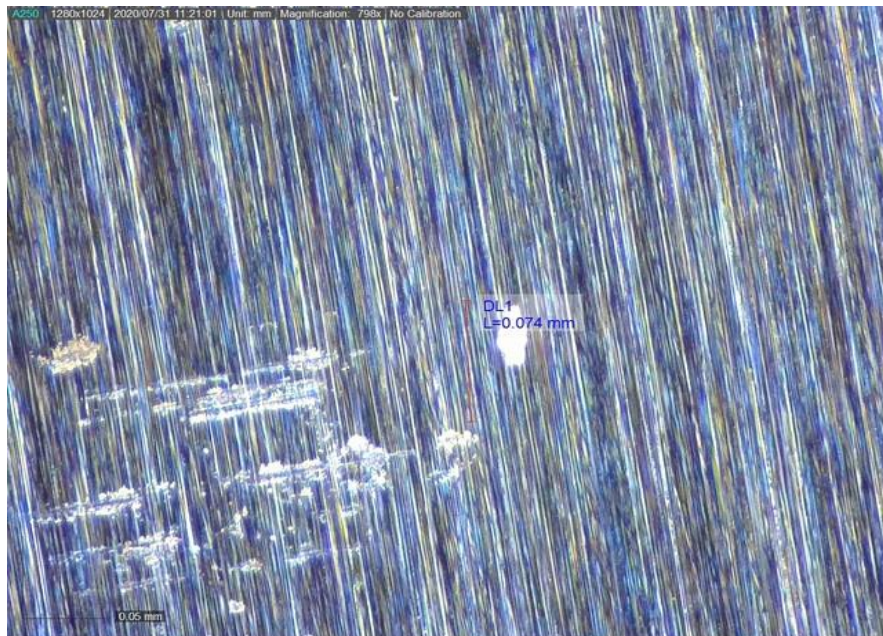


Solution: Kapton underlay
Never properly tested since bonding machine
broke down



spTAB experiences

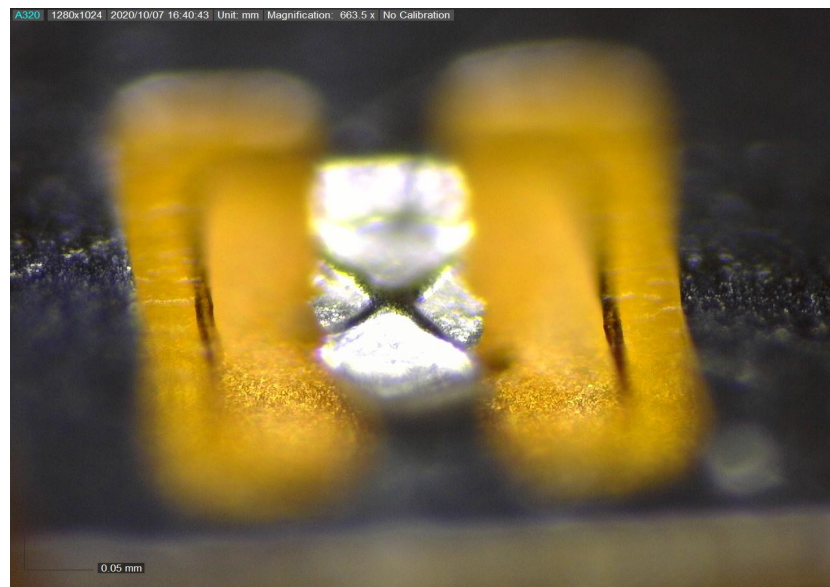
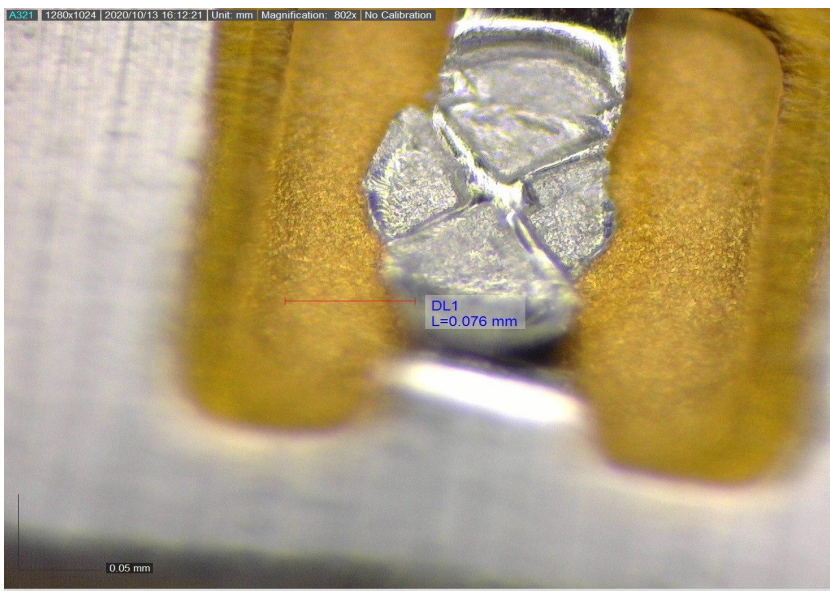
Backside scratches for chips on aluminum chuck





spTAB experiences

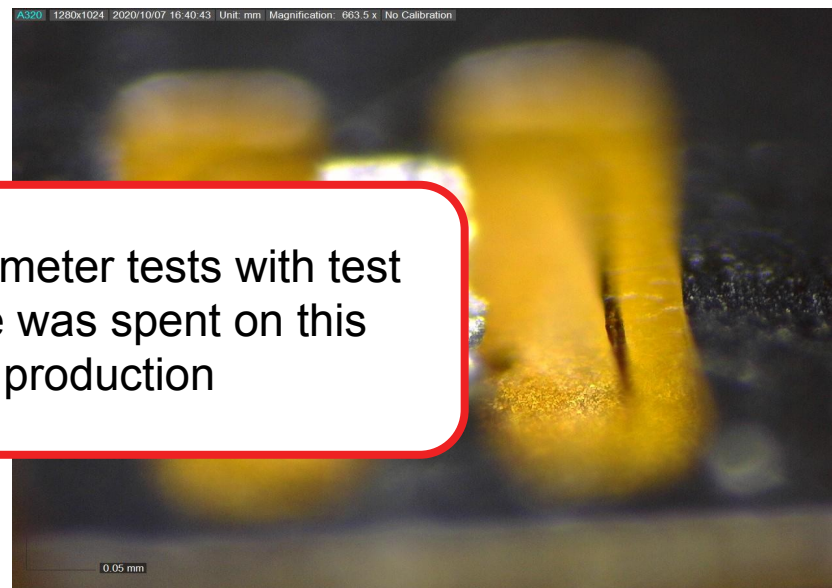
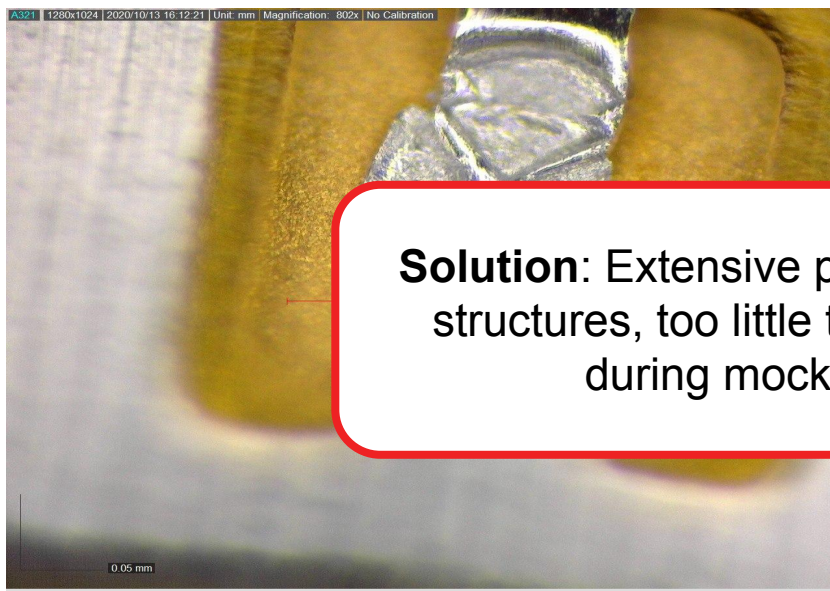
Loose bonds after time for improper settings





spTAB experiences

Loose bonds after time for improper settings



Solution: Extensive parameter tests with test structures, too little time was spent on this during mock-up production



Main takeaways (production)

- Assembly works nicely
 - Module assembly tools need to be produced
 - Test hardware for MuPix11 ladders need to be designed yet
- Handling:
 - barrel assembly on beam pipe has to be refined to be more reliable
 - Silicon heater mock-up can be used to test this in 2022
- spTAB:
 - more systematic tests of parameters



MuPix10 & MuPix11 program

- MuPix10:
 - 12 HDIs in Heidelberg
 - production in spring 2022
 - no modules due to SPI lines
- MuPix11
 - HDI design ready
 - interposer & end-piece flexes in design process (Luigi's talk)
 - ladder & module production in autumn 2022 (pre-production)
 - best case: full two-layered barrel for a potential “integration run” in autumn
- Final detector components:
 - 2023 (but pre-production already in final shape)
 - 2 or 3 sets of vertex detectors



Schedule

- Spring 2022: MuPix10 ladders
- Summer 2022: 1st LTU MuPix11 ladders arrive
Tooling for MuPix11 modules
Start of MuPix11 ladder production
- Autumn 2022: MuPix11 module production
- Final detector: 3 month production time (whenever requested, production can start from December 2022)