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

- **Ladder assembly tool:**
  - < 5 µm precision for horizontal and vertical placement
  - avg. vertical displacement: (9±3) µm → systematics from slide (can be produced multiple times, choose beste)
  - avg. gap size: (80±4) µm
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:

Glue thickness distribution for all ladders
Inner layer assembly

Gluing:

average glue thickness of ~5µm 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

Not satisfied with fixation of module handle. Similar attachment like for Layer 3/4 possible??
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)