Tooling with modules for ATLAS ITk strip upgrade

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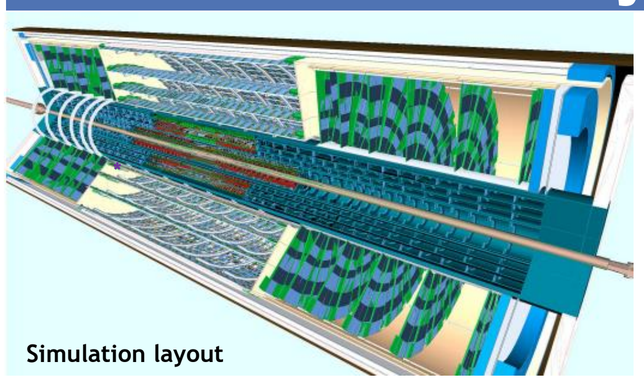
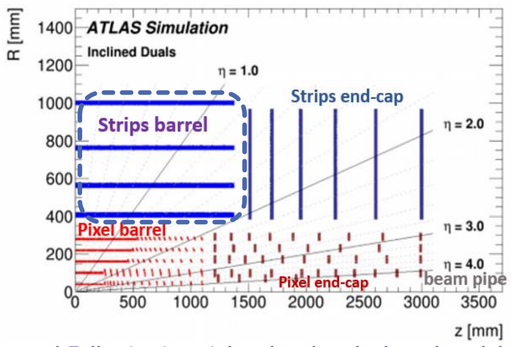
Introduction & Motivation

- The ATLAS experiment is planning a complete replacement of its inner detector(ID) with a new all-silicon inner tracker(ITk) for the **HL-LHC**
- The ITk is designed to cope with the increased pile-up, data rates and radiation levels, maintaining or improving the tracking performance
- The ITk design and technology R&D have been completed and pre-production of the detector modules is starting
- This work presents the ITk layout, tooling with modules for ATLAS ITk strip upgrade

ITk layout



Simulation layout

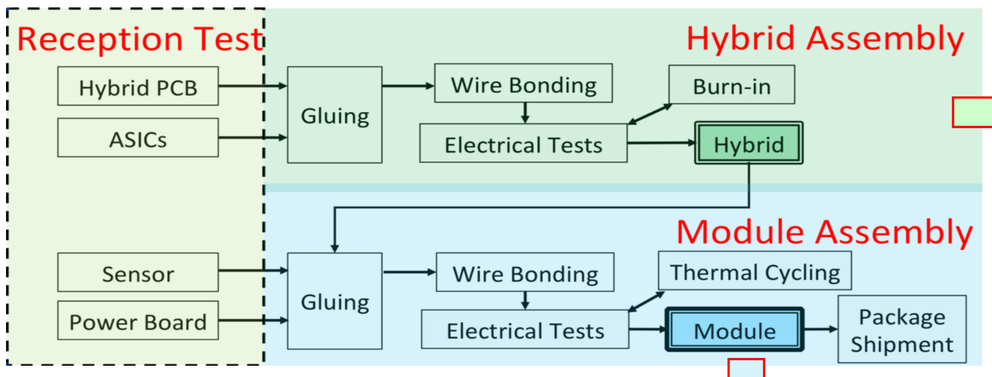


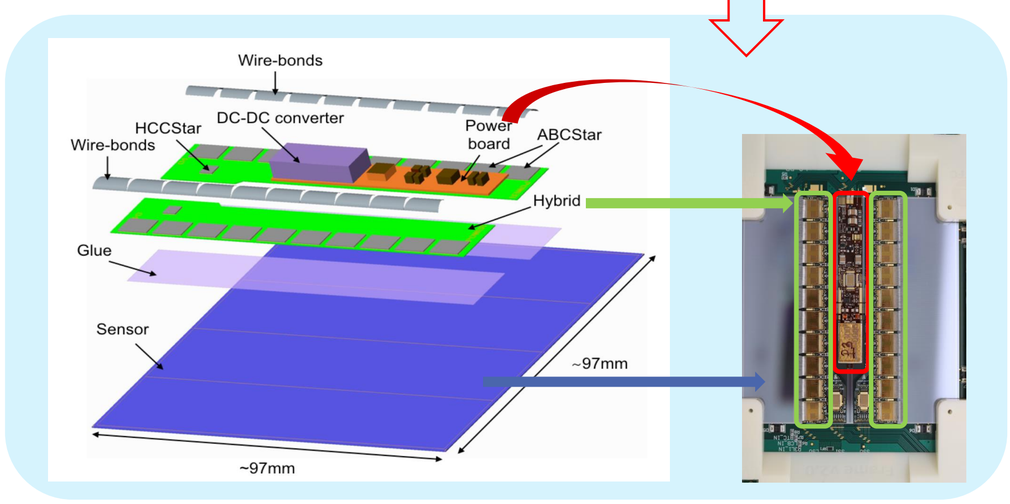
* Following is mainly related to the barrel module

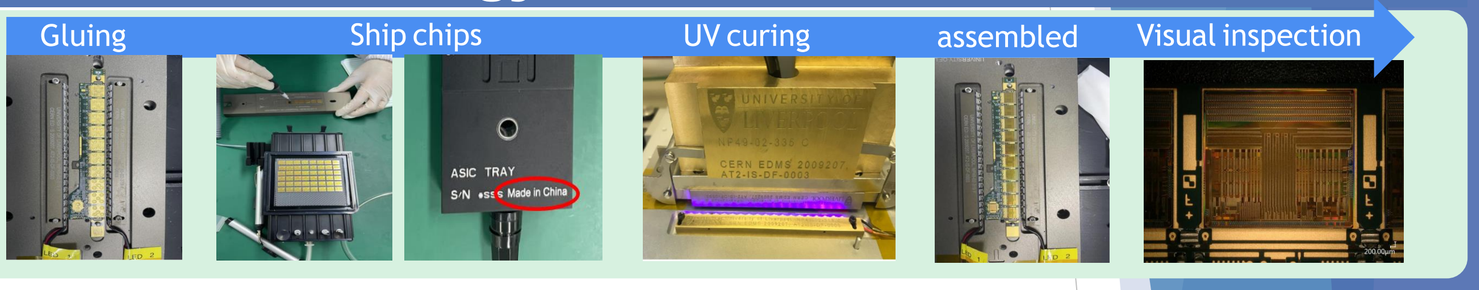
Experimental environment

- ISO Class 7(Clean room)
- Temperature: ~20℃
- Humidity: ~45%
- Equipment: OGP

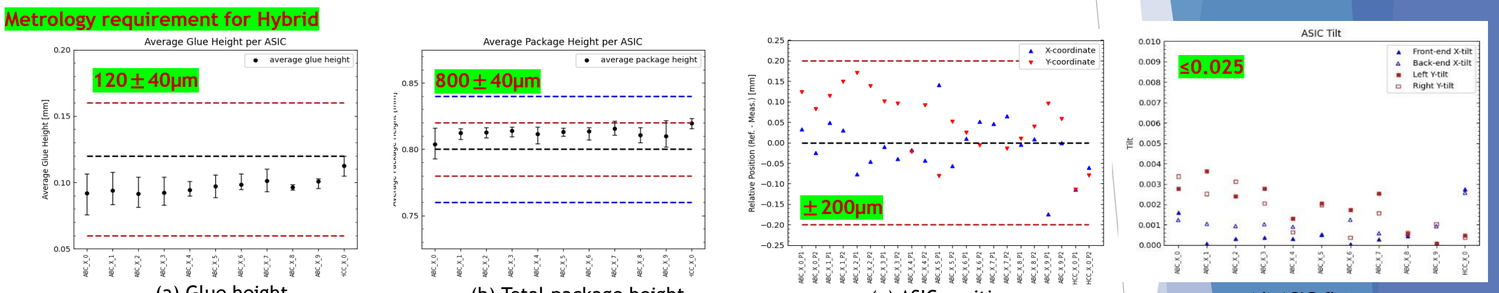
Module production & Metrology results





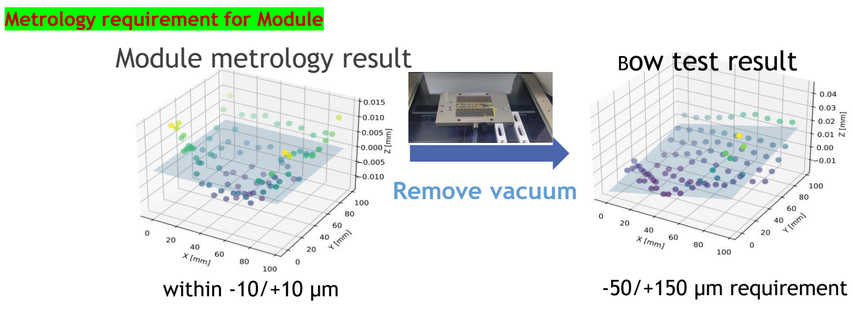


Metrology requirement for Hybrid



(a) Glue height (b) Total package height (c) ASIC position (d) ASIC flatness

Metrology requirement for Module



within -10/+10 μm -50/+150 μm requirement (e) Relative Position for Hybrid and PB

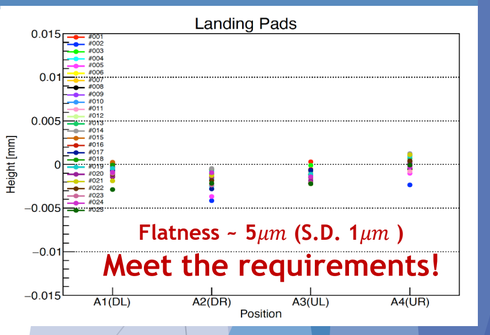
Conclusion: All of results meet the requirements!

Tooling

- A set of new tools
  - ① Hybrid assembly jig
  - ② Module test jig
  - ③ Module bonding jig
  - ④ Module assembly jig
  - ⑤ Pickup tool
  - ⑥ ASIC tray
  - ⑦ Hybrid panel

Partial results

- Landing pad flatness check
  - Coordinate system: based the point on "DL" to establish a Right-hand coordinate system
  - Datum plane: each landing pad takes a point and automatically fits a plane
  - Test point selection: 5x5 points for each landing pad
  - Tolerance requirement: **0.02 mm**



Summary & Outlook

- This work presents the ITk layout, tooling with modules for ATLAS ITk strip upgrade
- IHEP has officially passed the requirement for production
- The inspection of tooling has not found any problems so far
- The official production of tooling for modules will be promoted

Ref. Link

- The ATLAS ITk detector system for the Phase-II LHC upgrade https://doi.org/10.1016/j.nima.2022.167597
- ATLAS inner tracker strip detector: Technical design report https://cds.cern.ch/record/2257755
- Expected tracking and related performance with the updated ATLAS inner tracker layout at the high-luminosity LHC https://cds.cern.ch/record/2776651

THANKS FOR YOUR ATTENTION!