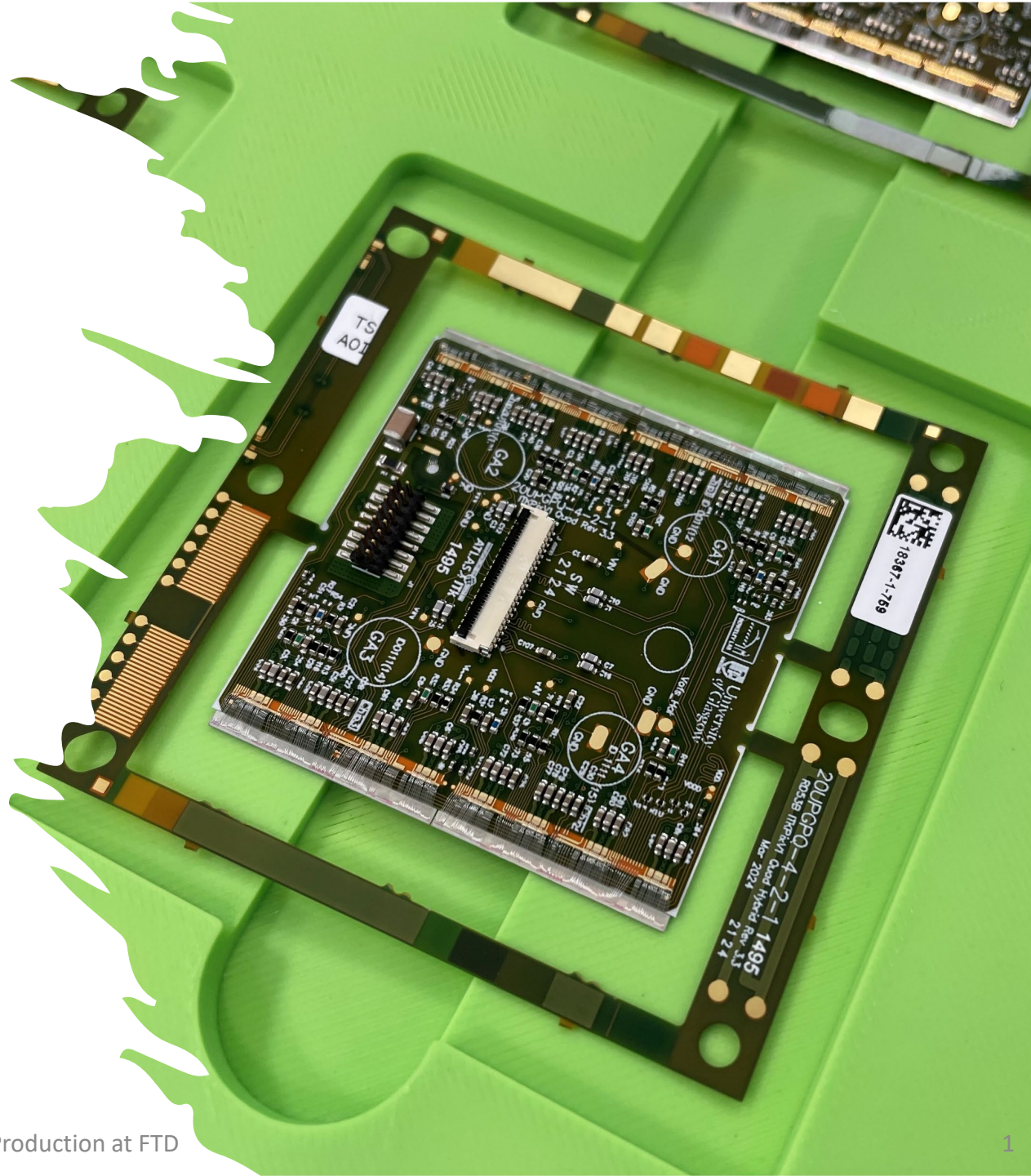
ATLAS ITk Module Production

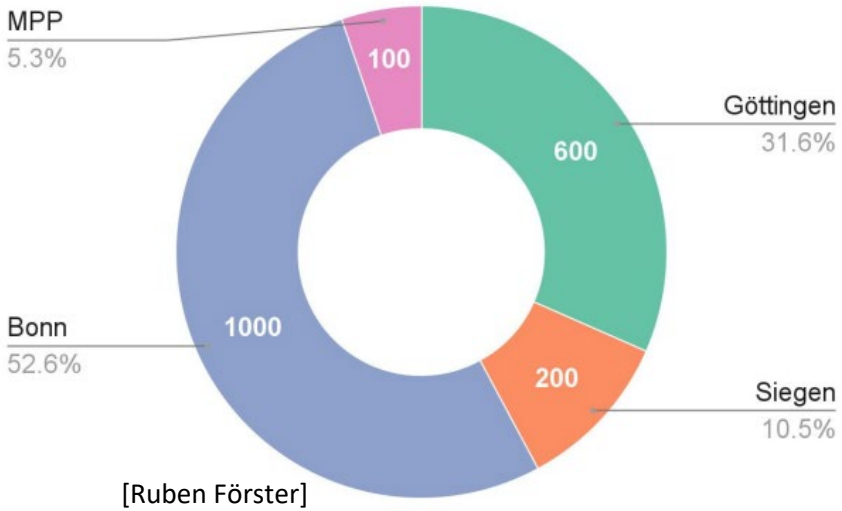
-

at FTD



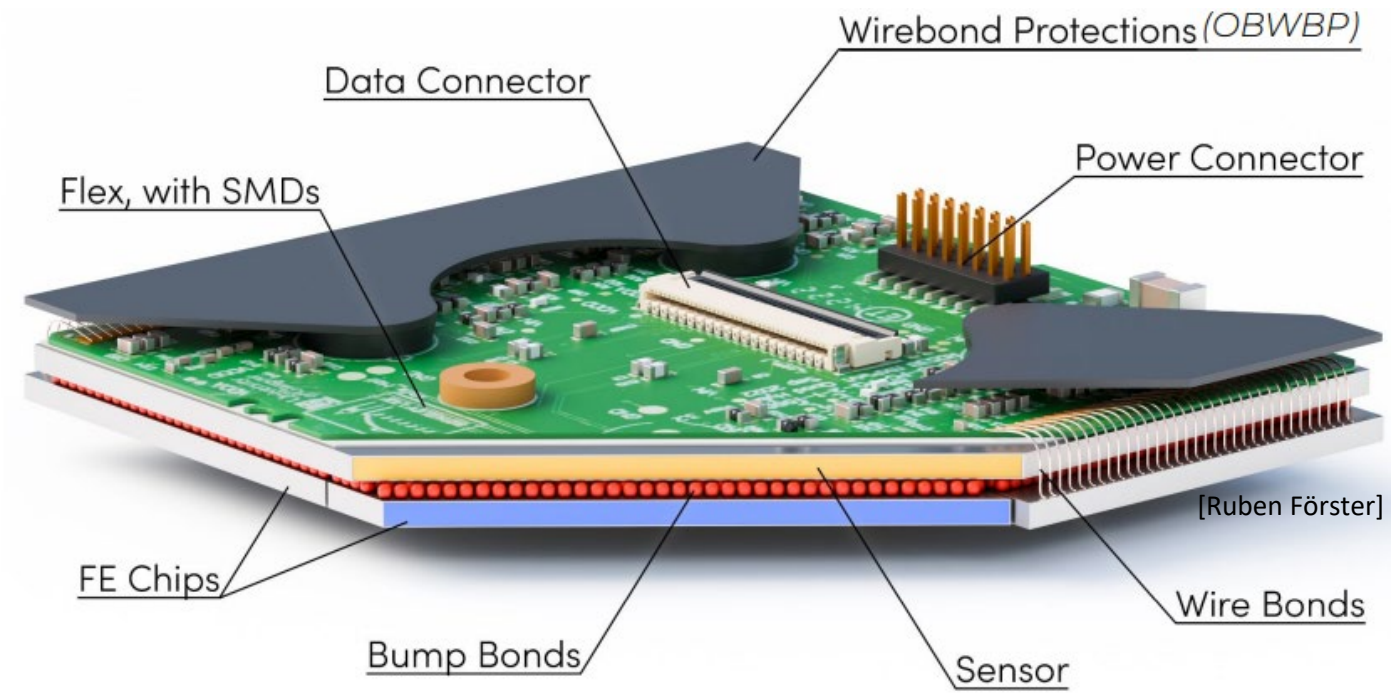
ATLAS Module Production

- In total, ~11 000 modules must be built (~8000 on-detector module
- World-wide effort amongst many different institutes
- Germany contributes to production with ~1900 modules
  - Munich: 100 modules
  - Siegen: 200 modules
  - Göttingen: 600 modules
  - **Bonn: 1000 modules (+600 assemblies from Göttingen)**



[Ruben Förster]

ATLAS ITk Modules

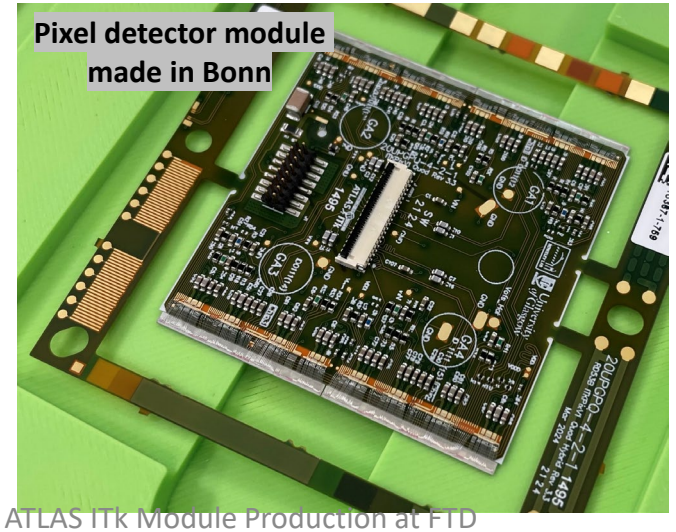


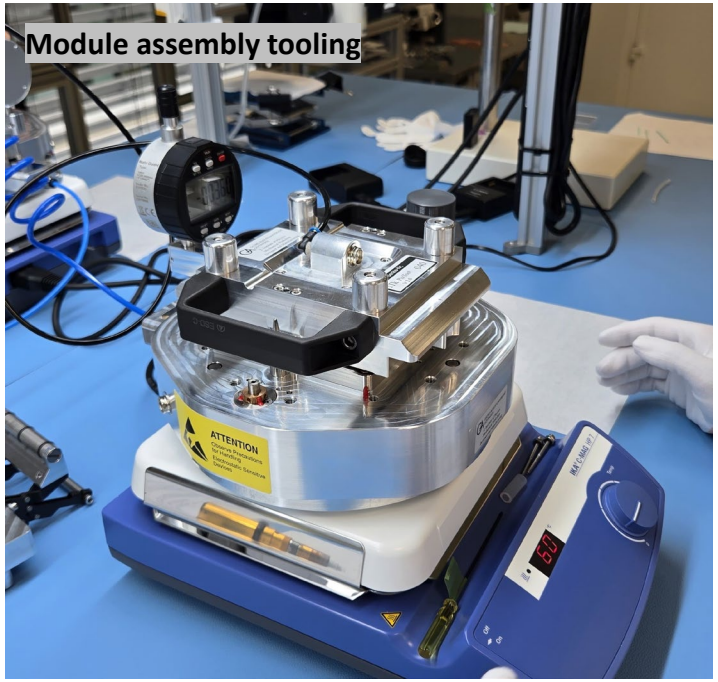
- Main components of hybrid pixel module:
  - Flexible PCB
  - Silicon sensor
  - Silicon readout chip
- A few facts
  - Module size: 4 x 4 cm²
  - Module thickness: 600 – 700 um
  - 4 R/O chips on a single sensor tile
  - 400 x 384 pixels on each R/O chip
  - Each pixel has a size of 50 x 50 um²
  - Very fast and radiation tolerant R/O chip
- To be used in the new ATLAS pixel detector
- Smallest unit of the detector

ATLAS Module Production (at FTD)

- Module production consists of many different production steps
- Extensive QC measurements after each production step are required to ensure good quality along the full chain of production
- Most of the production steps happen in the ISO7 clean room area
- So far, 450/1600 modules are assembled (flex-attach)
- Team effort: many technicians, working students, staff and PhD students…
  - more than 14 people are actively working on the module production in the clean room


Part of the whole team (not a one-man-show)


Pixel detector module made in Bonn



Module assembly tooling

Module Production Steps in Cleanroom

… Reception of flex and bare module

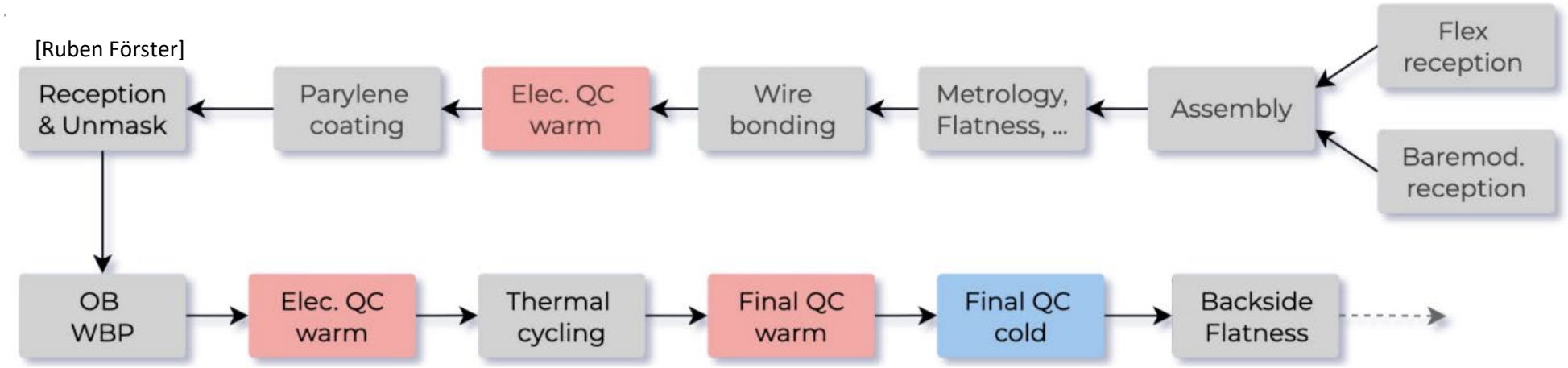
… Glue flex to bare module -> mechanical connection

… Wirebonding of module -> electrical connection

… Parylene masking/demasking -> parylene coating for HV protection

… Canopy attachment (OBWBP) -> protect wirebonds

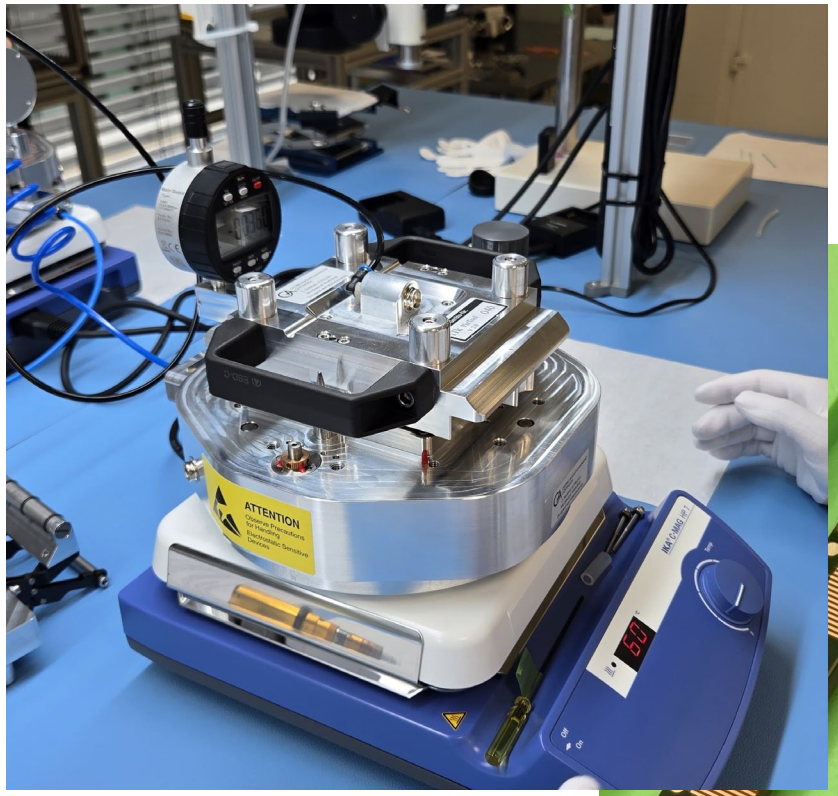
- Many QC steps and electrical testing in between steps

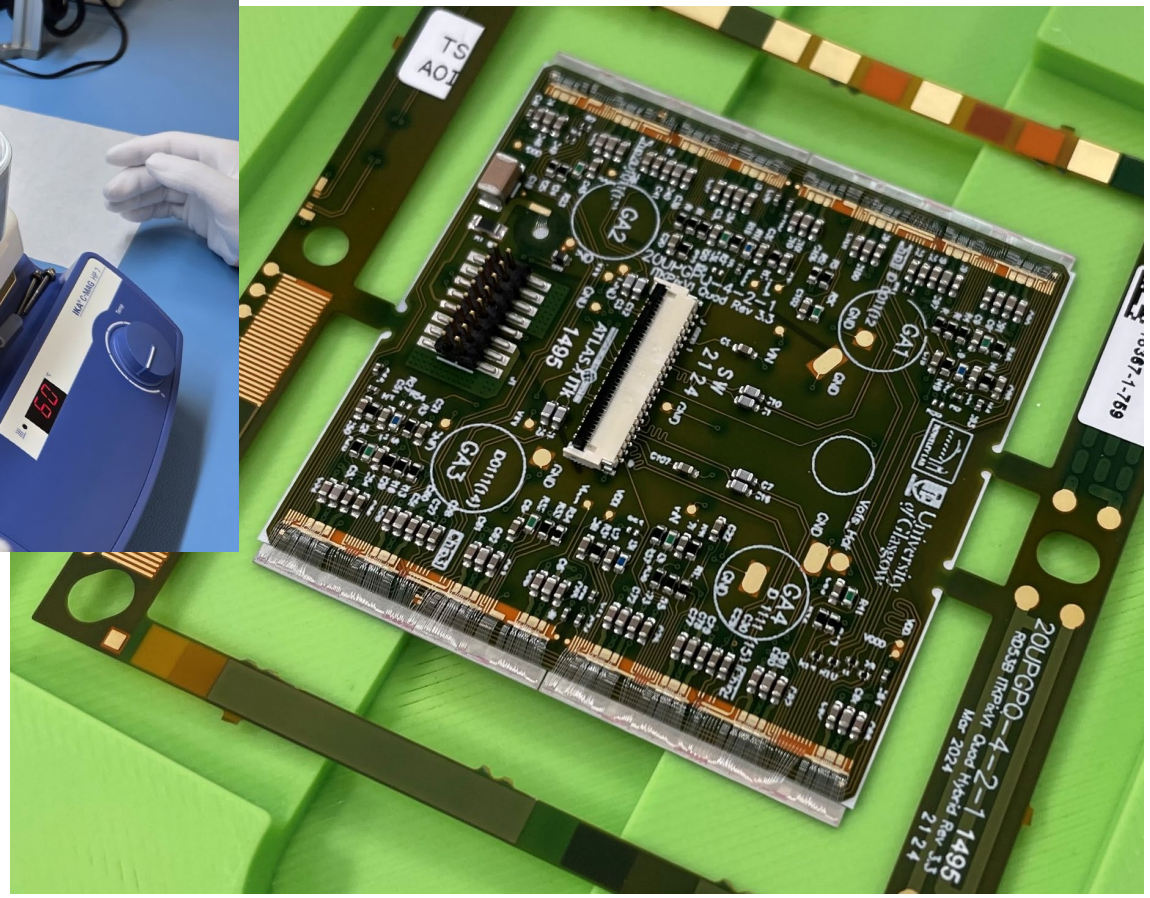


Assembly & Wirebonding

Assembly & Wirebonding

1. Glue flex to bare module
2. Metrology of module
3. Wirebonding
4. Pull tests





Assembly:
6 dedicated assembly tools

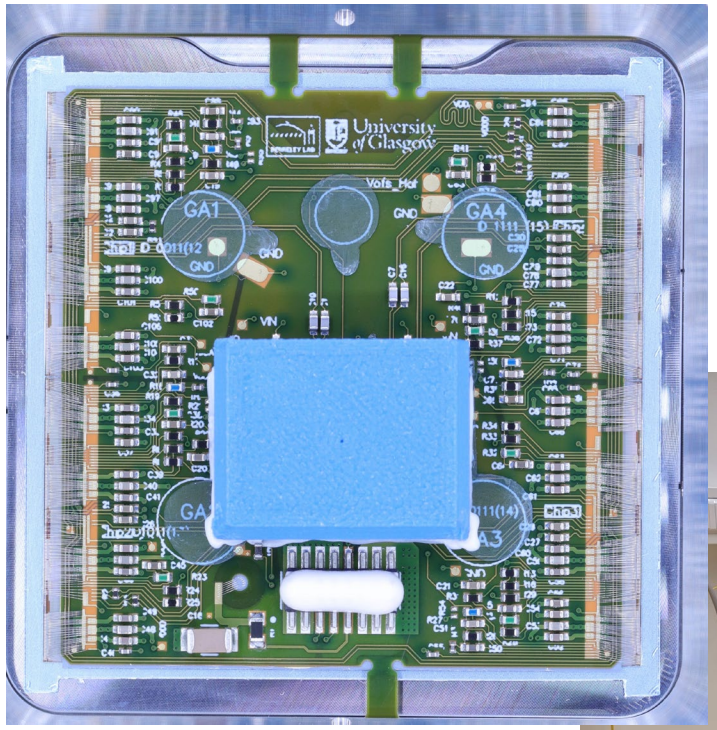
Wirebonding
2 wirebonding machines in operation

Pull tester for wirebonding QC

Parylene Coating

Parylene coating

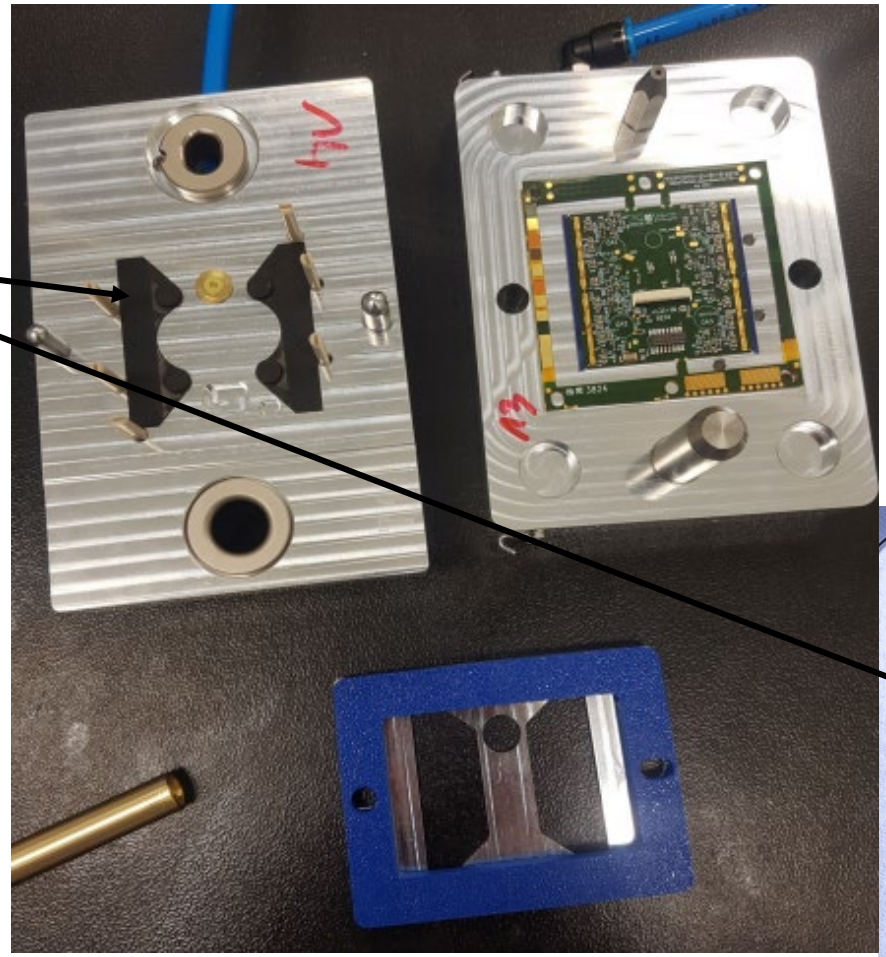
1. Masking of module
2. Parylene coating (done externally)
3. De-masking of module

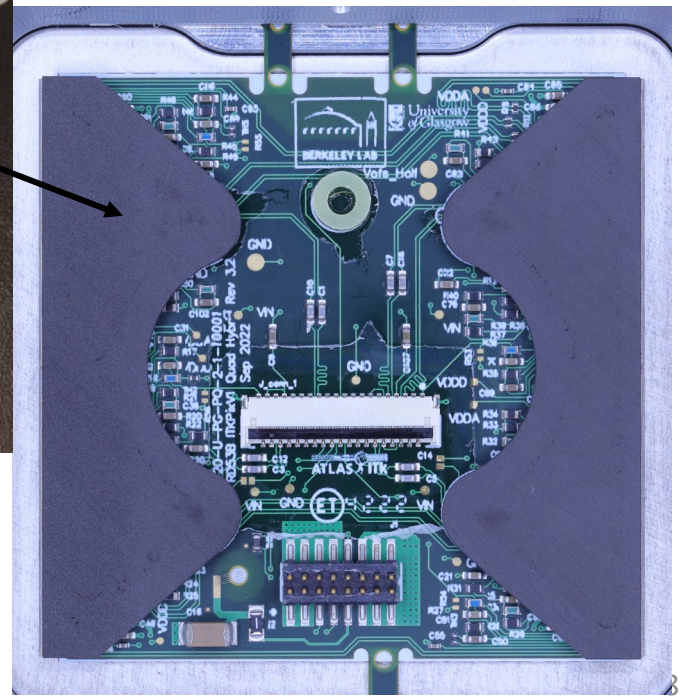


OBWBP

OBWBP (wirebond protection)

1. Attach wirebond protection
2. Final envelope measurement
3. Ready for final testing

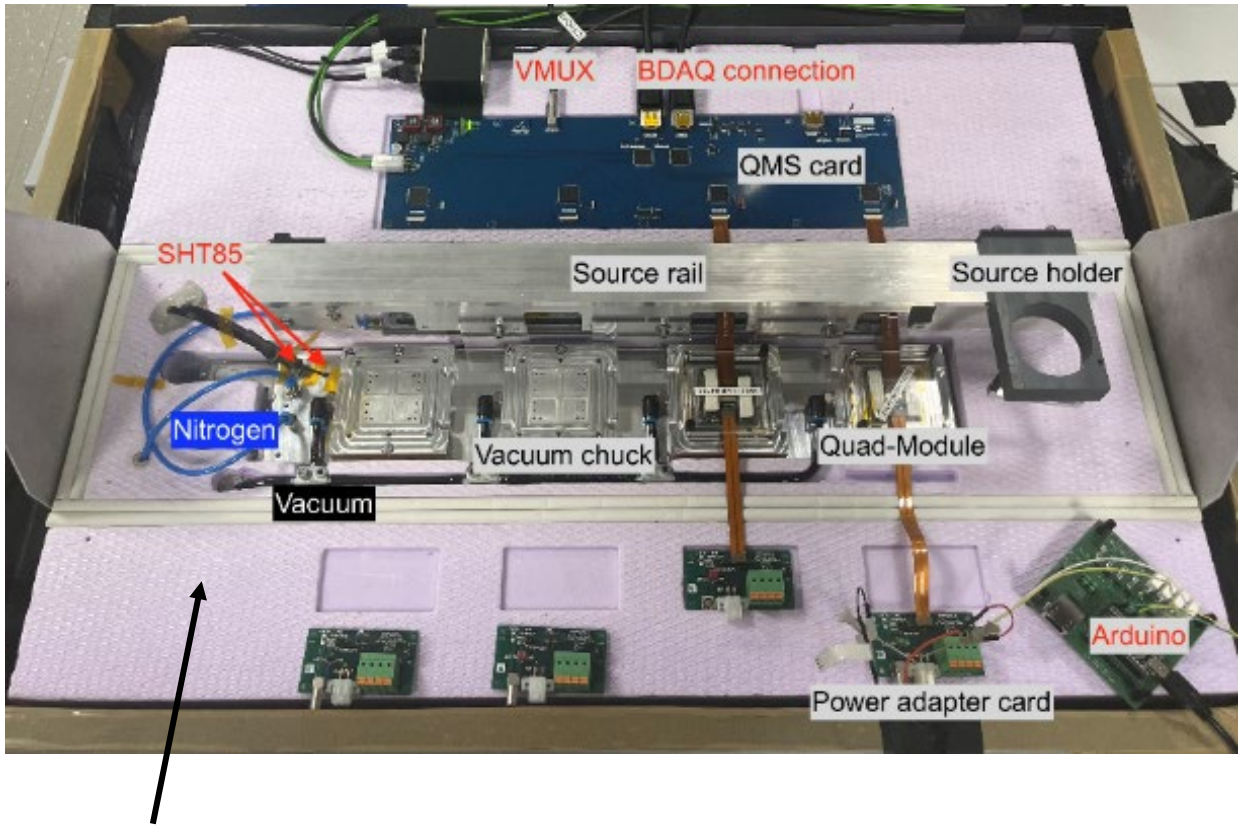




Module Testing

Module Testing

- Dedicated test stand(s) for electrical testing
- Warm and cold testing
- Test stand features DCS and interlock system for unsupervised testing
- Done at various stages during module production
- Two test stands during production -> currently only one in operation (still in our lab)
- **Preparation for re-location of setup is ongoing**
  - One setup will move into ISO7 (in preparation)
  - One setup is planned for ISO6 -> used for tests with radioactive source
  - Instead of N2, we will use dried, pressured air using dedicated adsorption dryer (ATLAS Copco CD5) -> Jerome installed tubing for ISO6/7
- **Everything will be properly cleaned to keep cleanroom clean**



Styrodur is covered with tape to make the test setup compatible with clean room environment