ITS Assembly System at PNU

Status @ CERN

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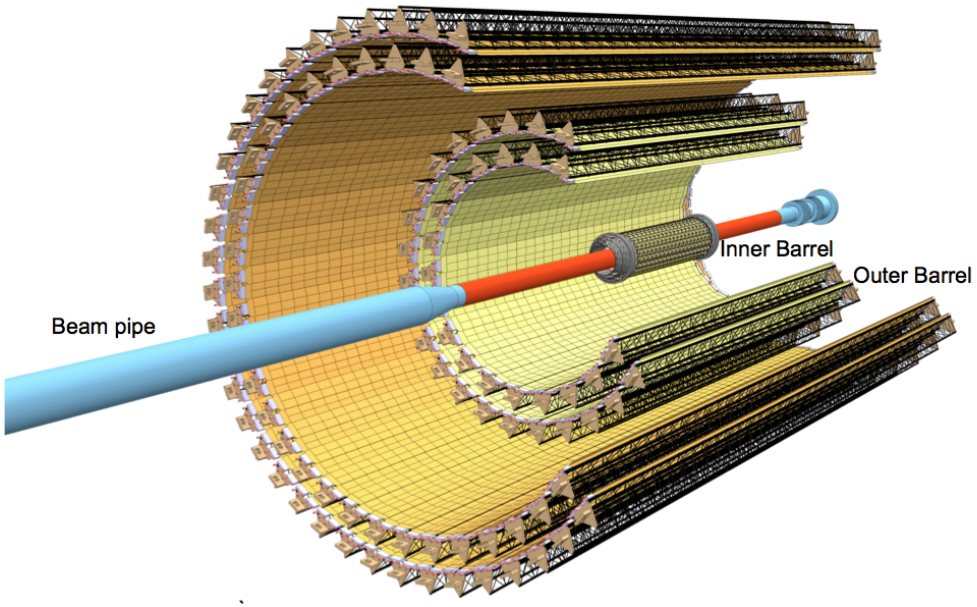
PUSAN NATIONAL UNIVERSITY

ITS Upgrade



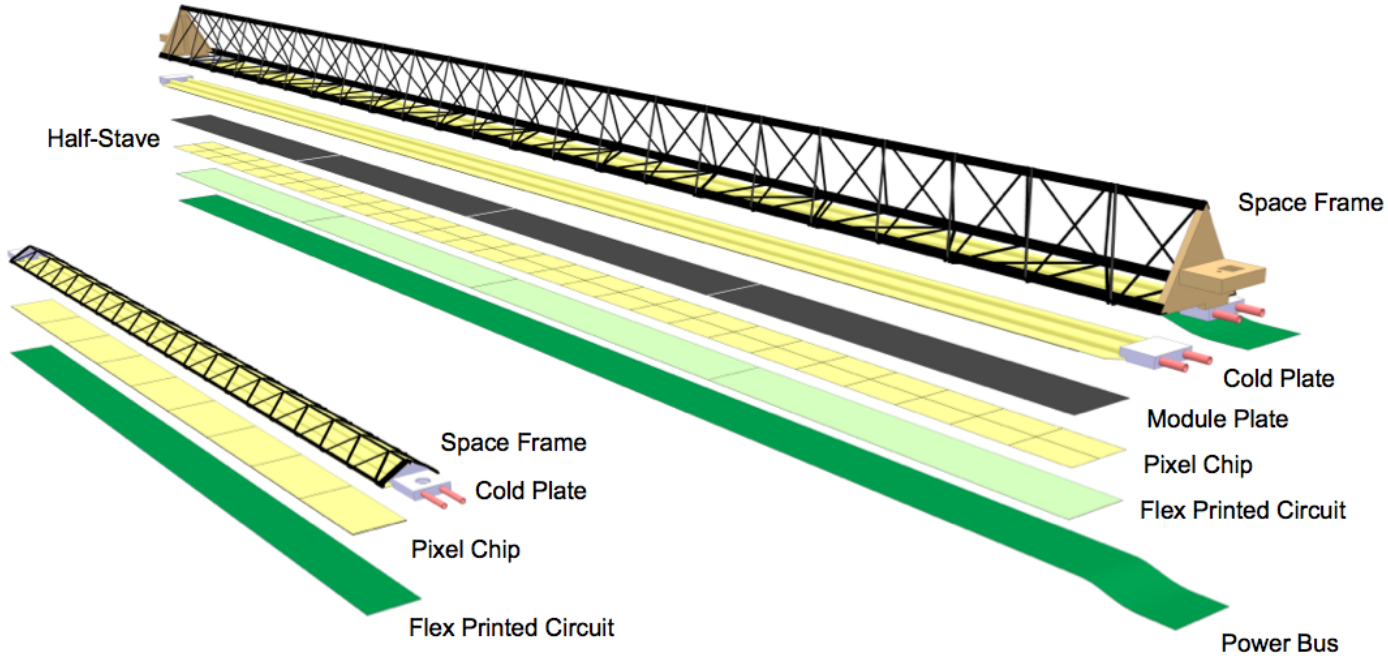
Layout:

- 10 m^2 of silicon
- 25 Gigapixels
- 7 layers of Monolithic Active Pixel Sensors (MAPS)

Specifications:

- Impact parameter improvement by factor of 3:
  - Closer first layer: 39 mm $\rightarrow$ 22 mm
  - Less material budget: 1.14 $\rightarrow$ 0.3 % (inner layers)
  - Smaller pixel size: 50 $\times$ 425 μm $\rightarrow$ 30 $\times$ 30 μm
- Tracking efficiency and transverse momentum resolution improvement for low mass momenta:
  - 6 layers $\rightarrow$ 7 layers
  - only pixel layers
- Faster readout:
  - heavy ions: 50 kHz
  - protons: several 100 kHz

ITS Components: Stave

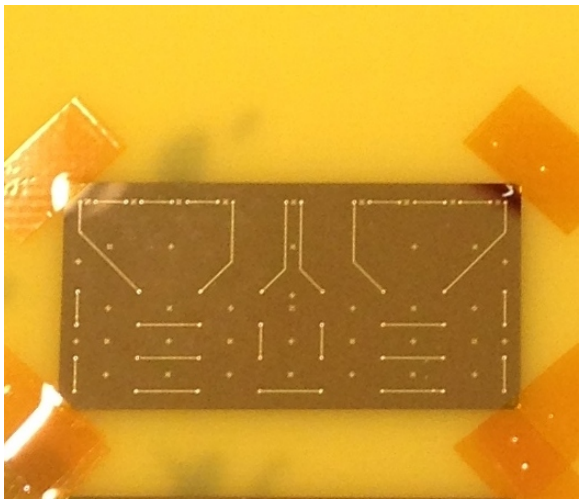


- The ITS layers are segmented in units named Staves, which are mechanically independent.
- The Inner Barrel Stave (left) has 4 components and the Outer Barrel Stave (right) has 5 components.
- **The task of PNU:**
  1. Mass production test of the Pixel chips
  2. Assembly of module: Flex Printed Circuit + Pixel Chip + Module Plate (under discussion)

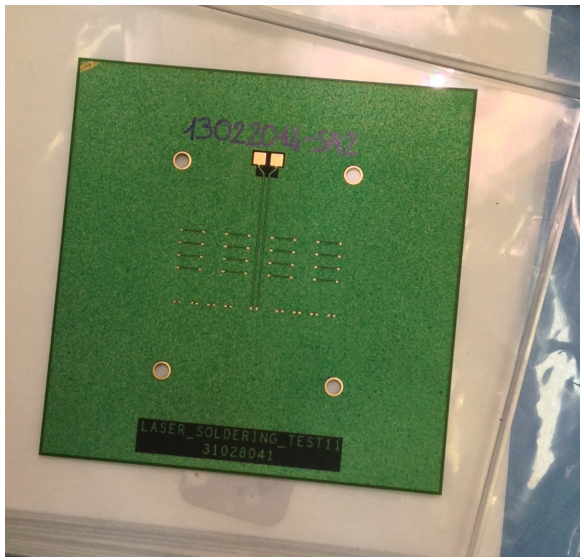
Current assembly system @ CERN

Components:

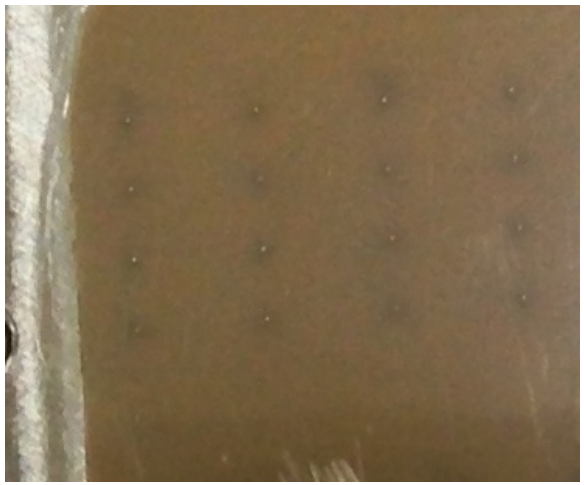
- Pad chip: 15 mm $\times$ 30 mm, 50 μm thick (identical to the TDR)
- FPC: 50 contacts
- Soldering ball: 200 μm diameter (tin-silver, SnAg)



Pad chip



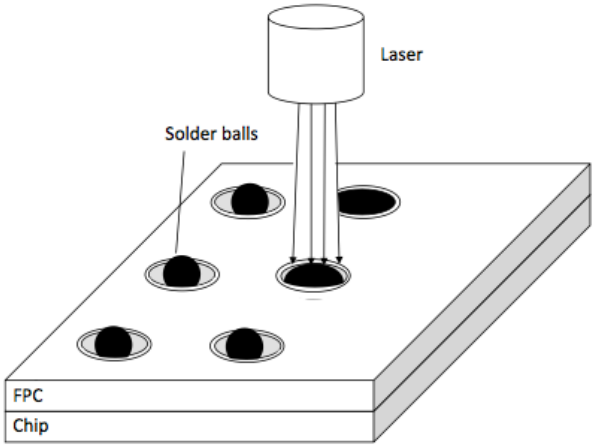
FPC

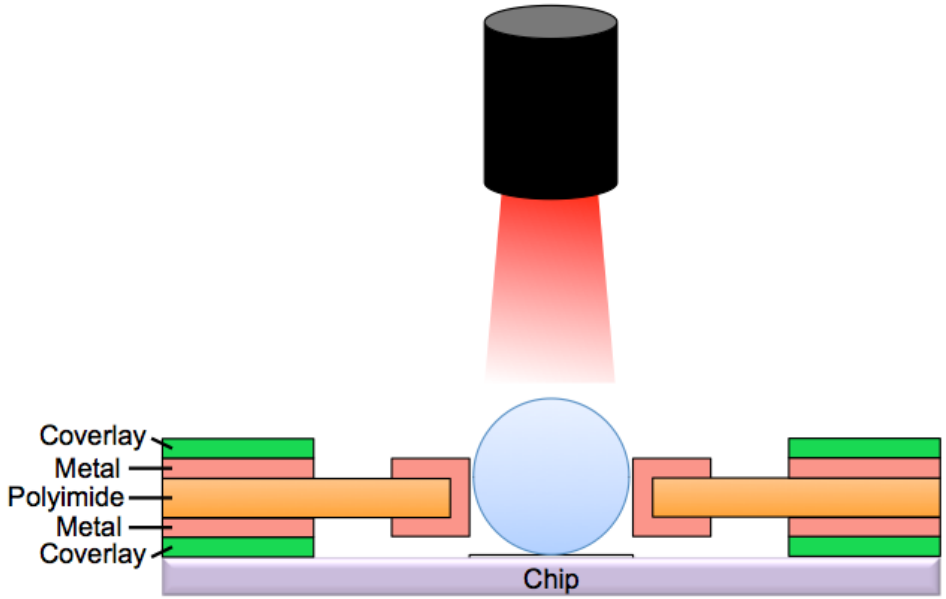


Soldering balls

Current assembly system @ CERN

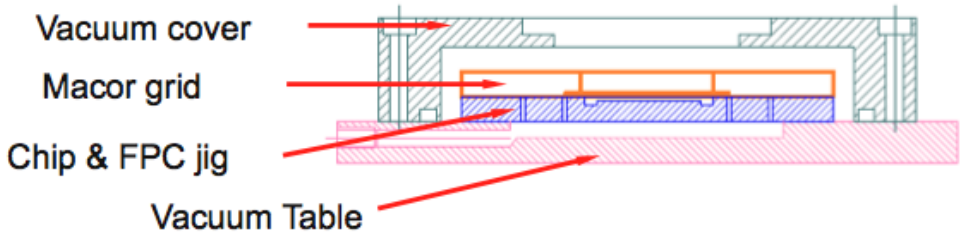
- Solder the Pixel Chip with the FPC by the laser soldering technique.

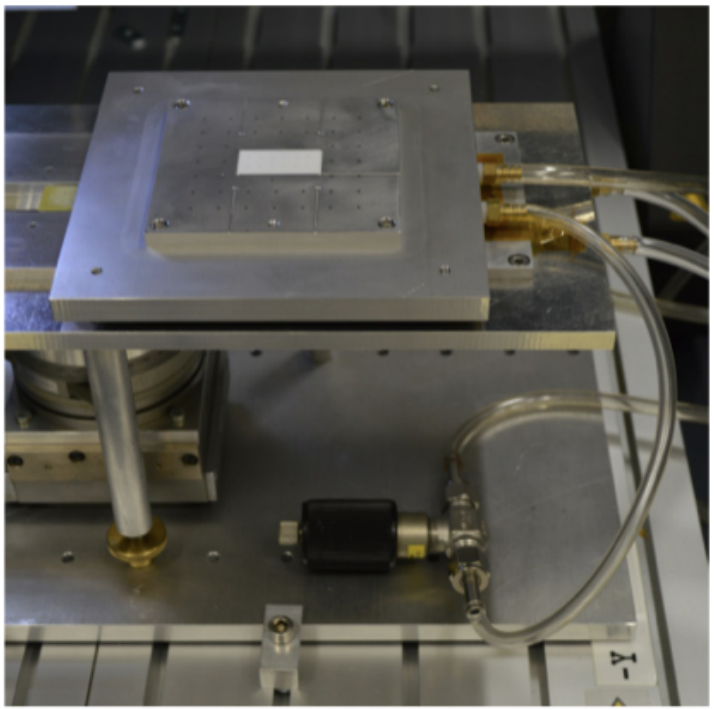


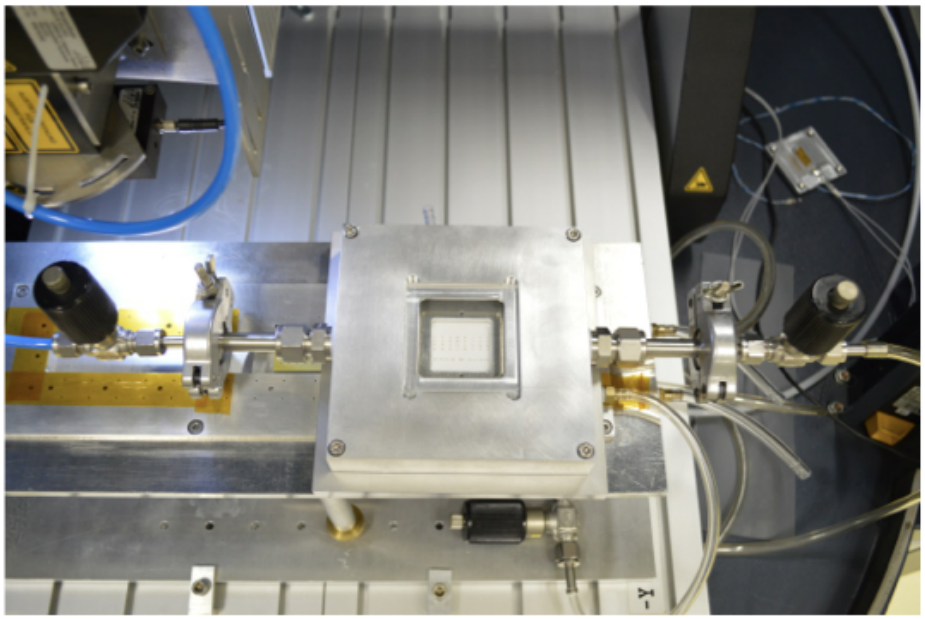


Current assembly system @ CERN

- Laser soldering under vaccum



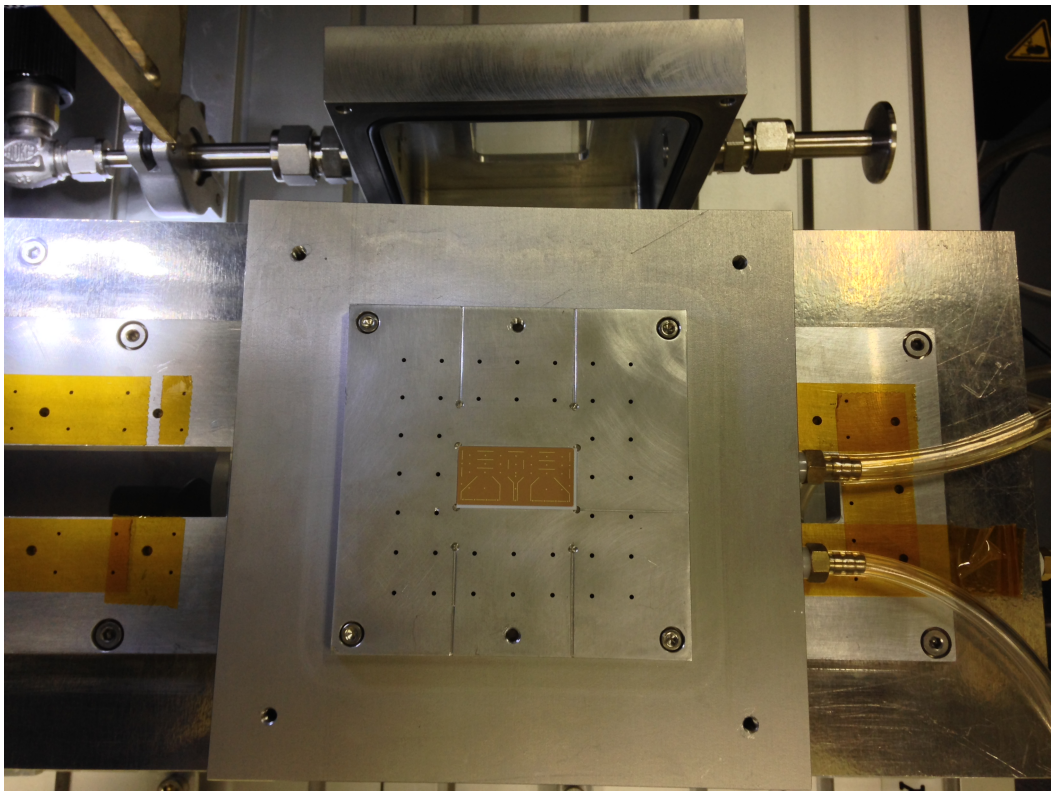




New vacuum table prepared by Jaap

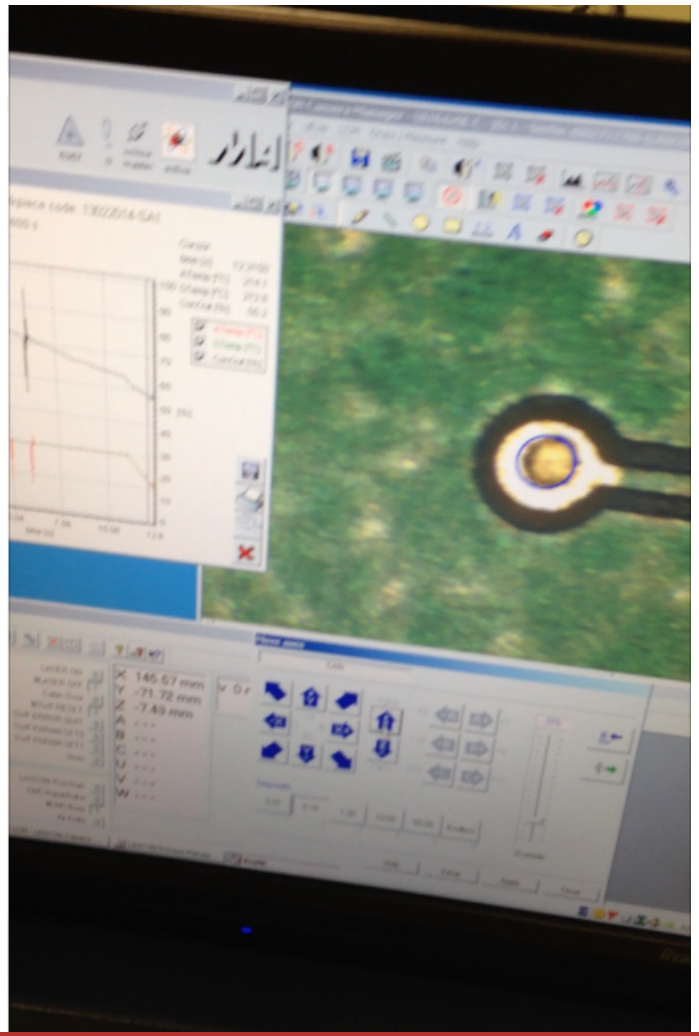
Current assembly system @ CERN

- Procedure of the laser soldering:
  1. Prepare a Pad chip
  2. Mount on the bench



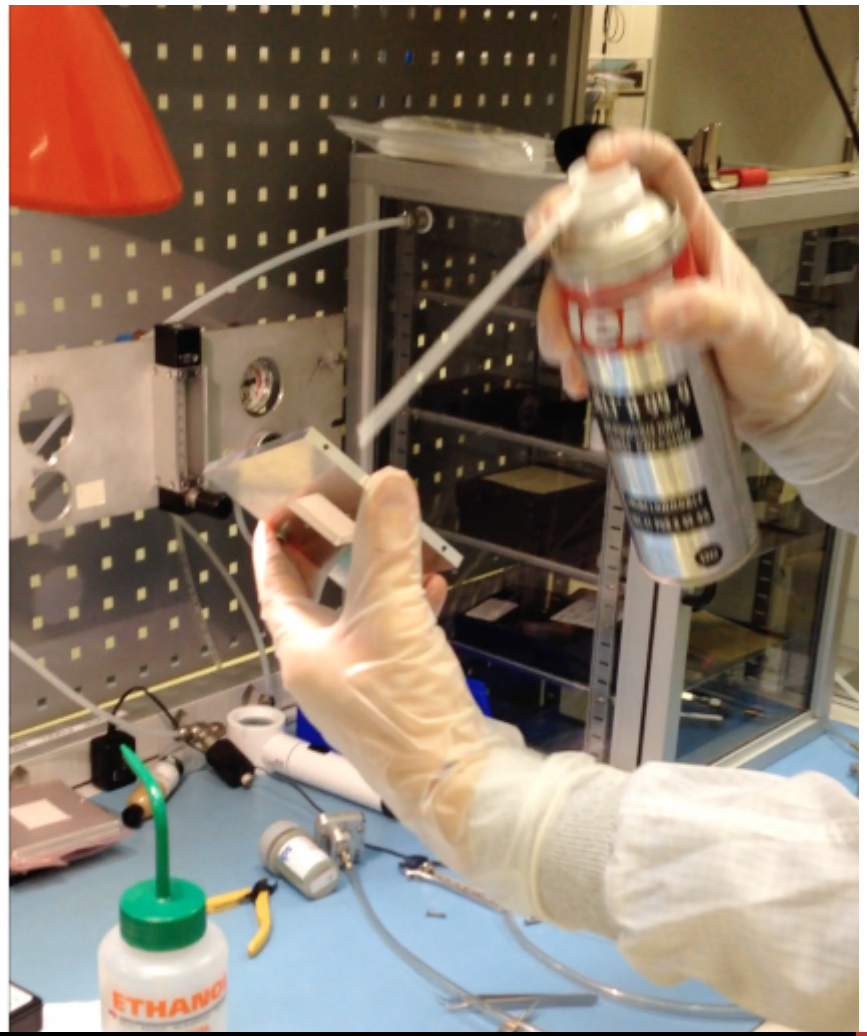
Current assembly system @ CERN

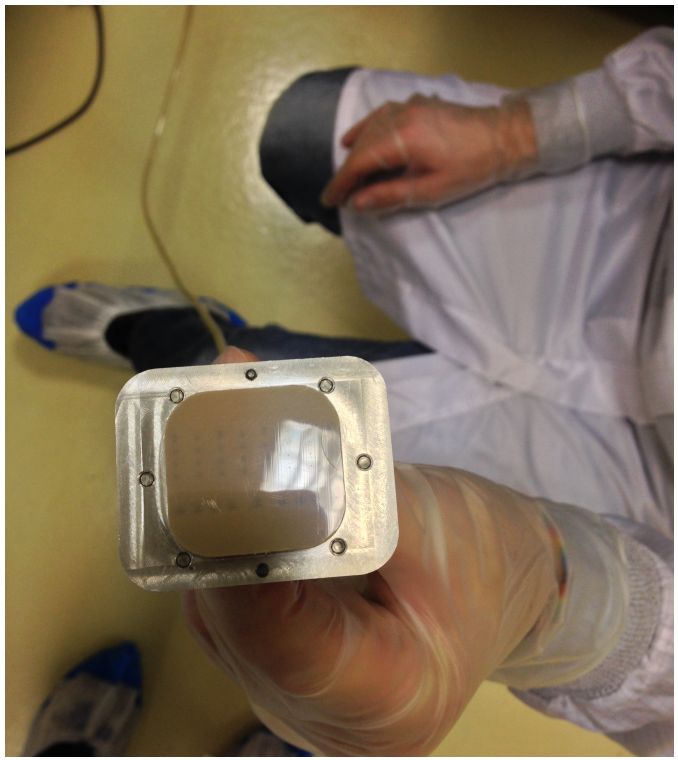
- Procedure of the laser soldering:
  3. Prepare a FPC
  4. Mount and check the alingment between the Pad chip and the FPC



Current assembly system @ CERN

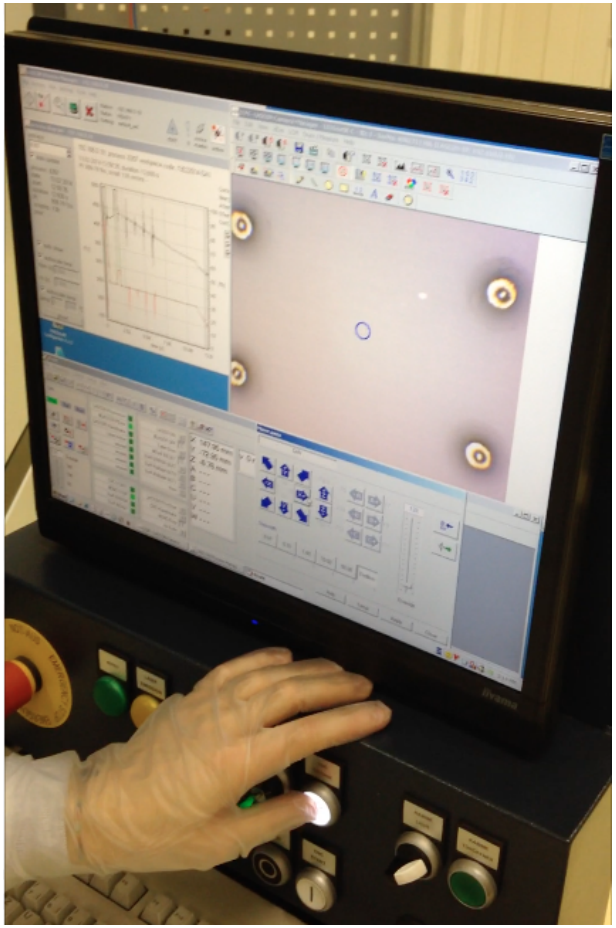
- Procedure of the laser soldering:
  5. Cover a soldering grid on top of FPC
  6. Distribute soldering balls on the holes of FPC

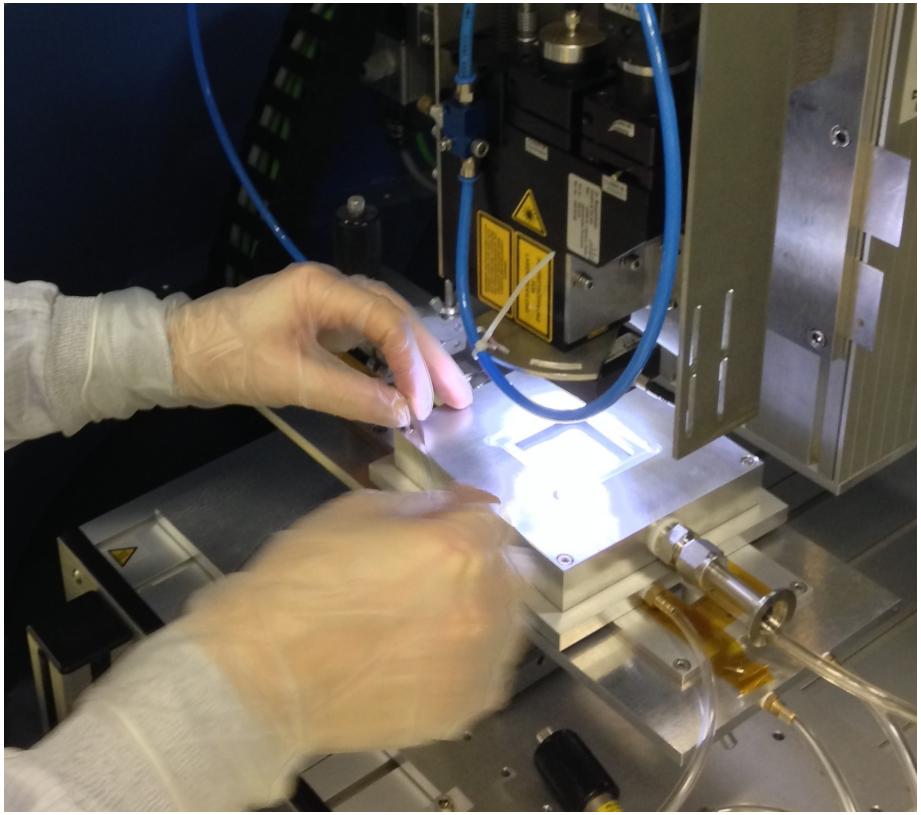




Current assembly system @ CERN

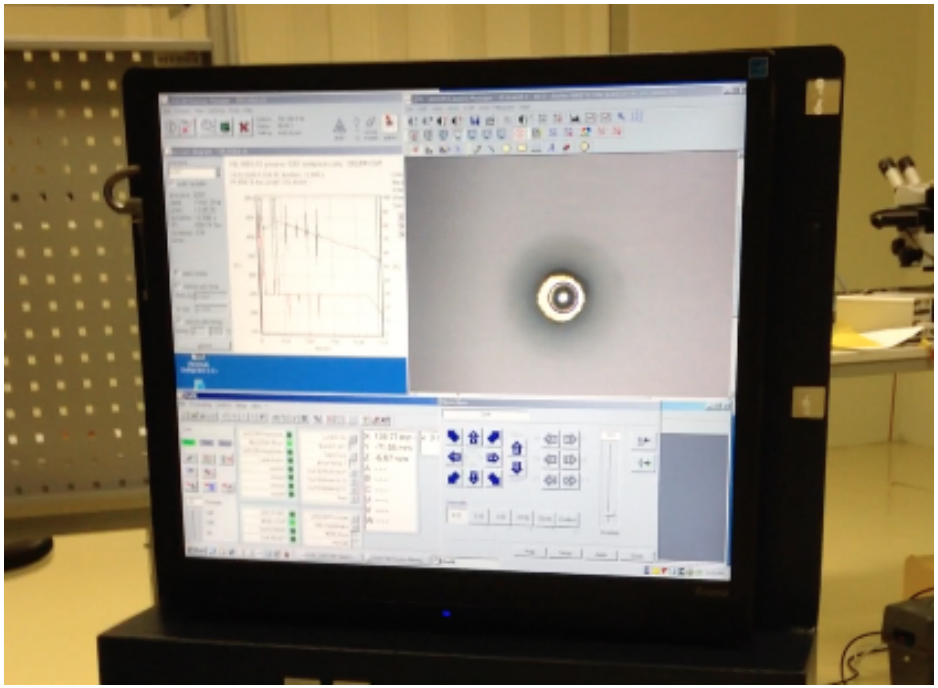
- Procedure of the laser soldering:
  7. Check soldering balls
  8. Seal the vacuum cover

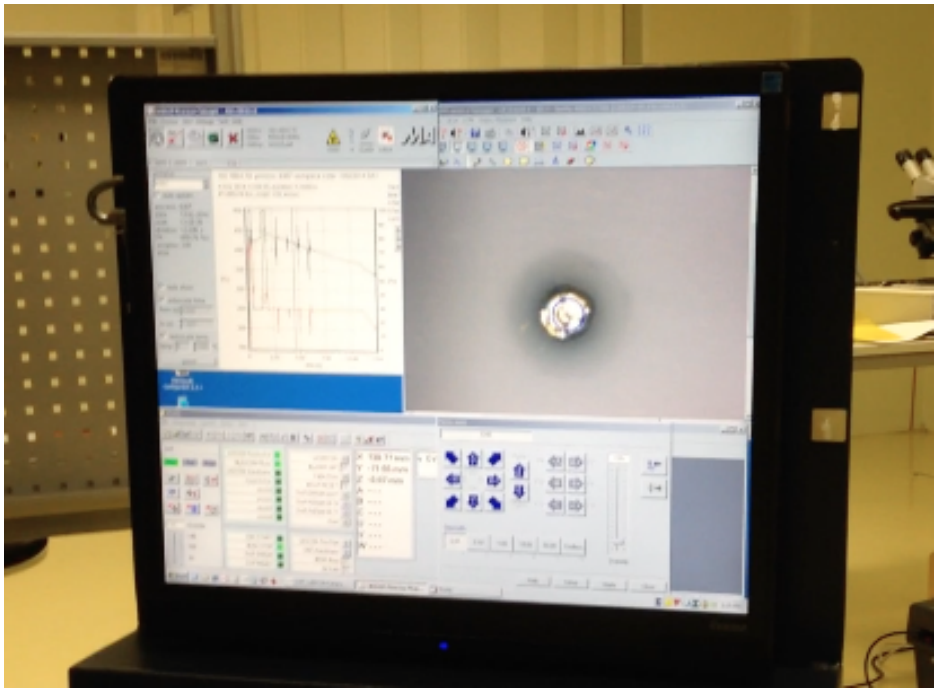




Current assembly system @ CERN

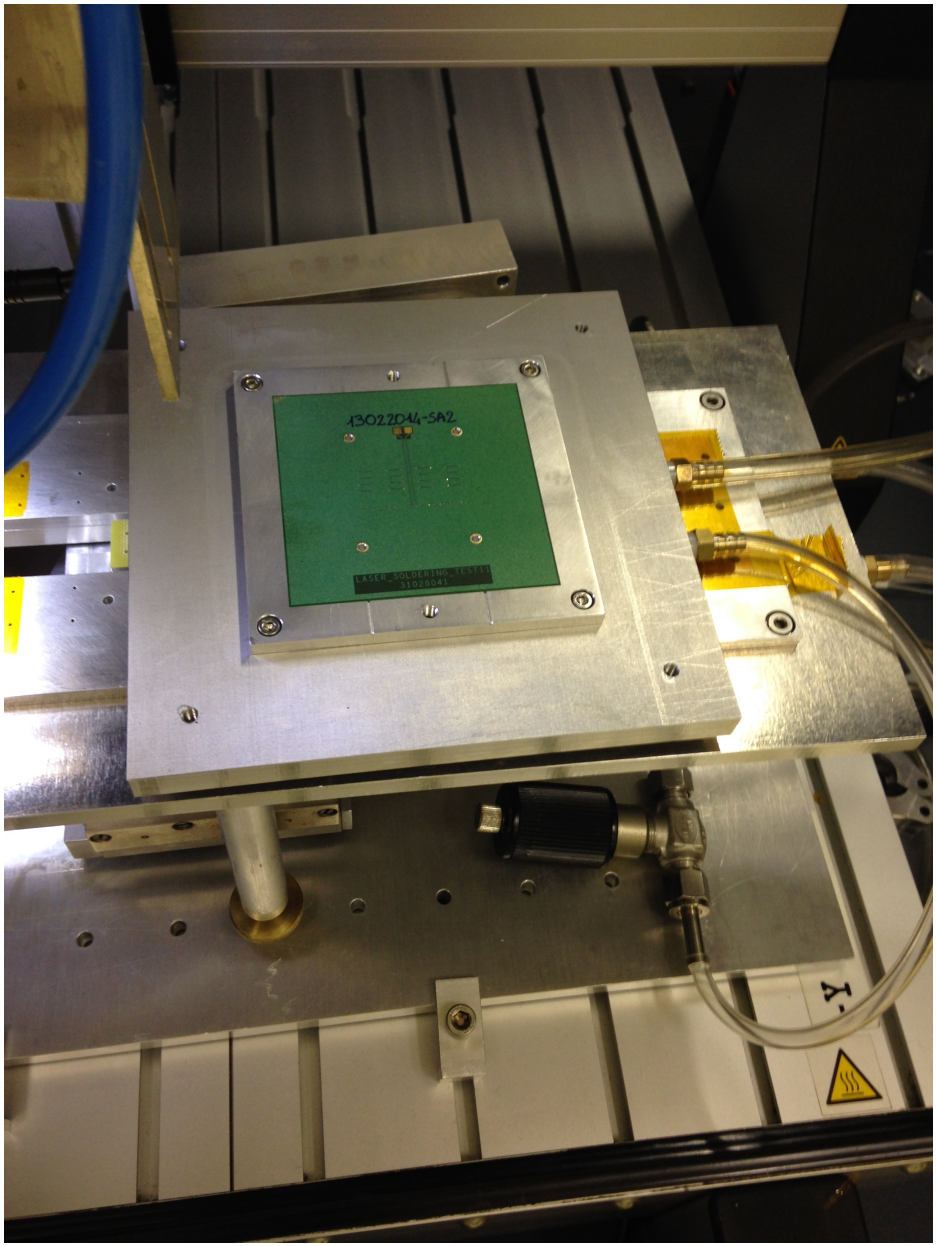
- Procedure of the laser soldering:
  9. Make it vacuum and close the door for laser
  10. Solder 50 soldering balls



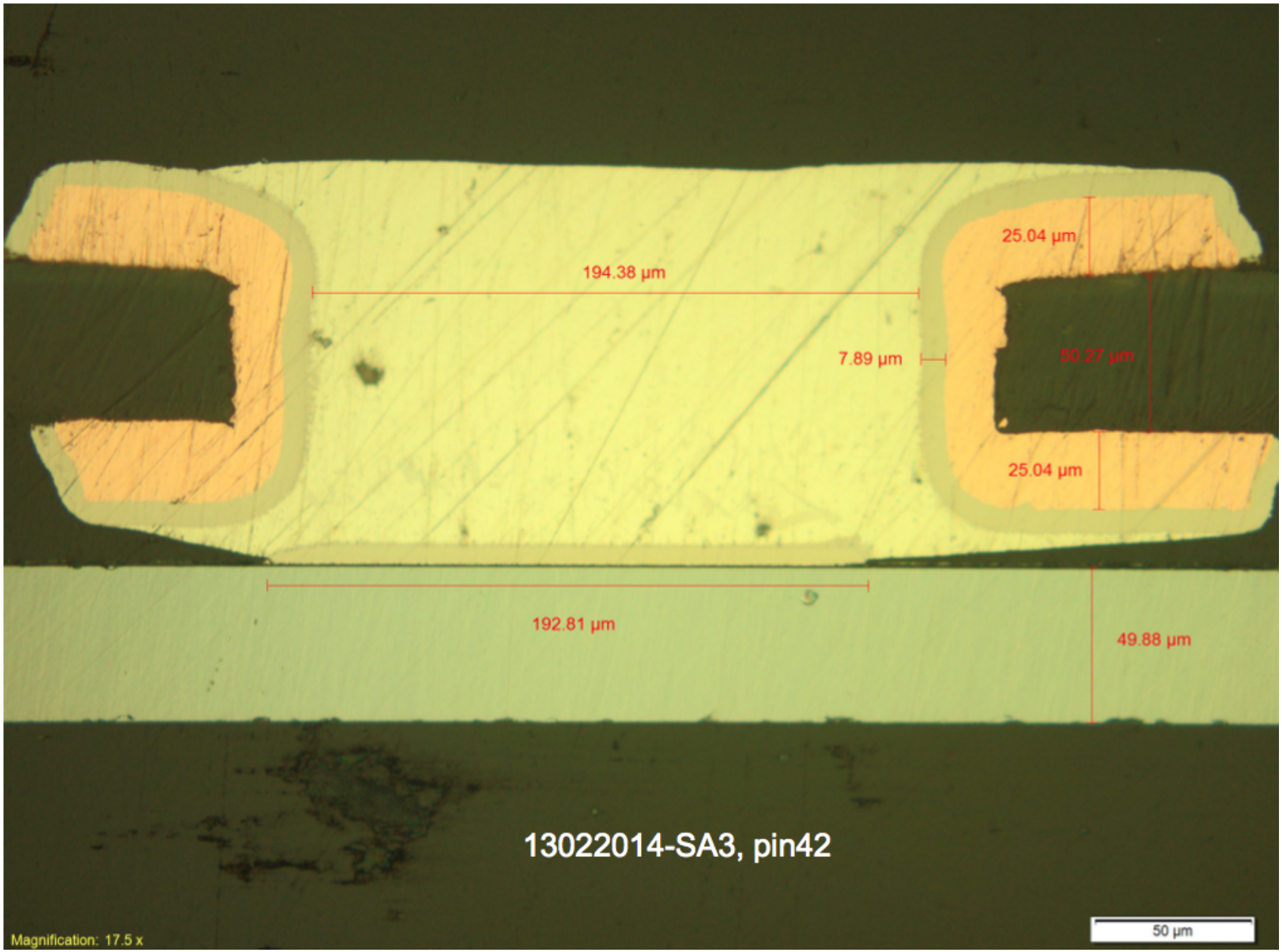


Current assembly system @ CERN

- Laser soldering of Pixel Chip and FPC is finished!
- Two QA methods are currently available: daisy-chain resistance and cross section view



Current assembly system @ CERN



Summary

- Laser soldering system for the assembly of the Pixel Chip and FPC is preparing.
- Many steps are done manually for the moment, but under development of full automatic system.
- 1 Ph.D student and 2 undergraduate student are working on this.