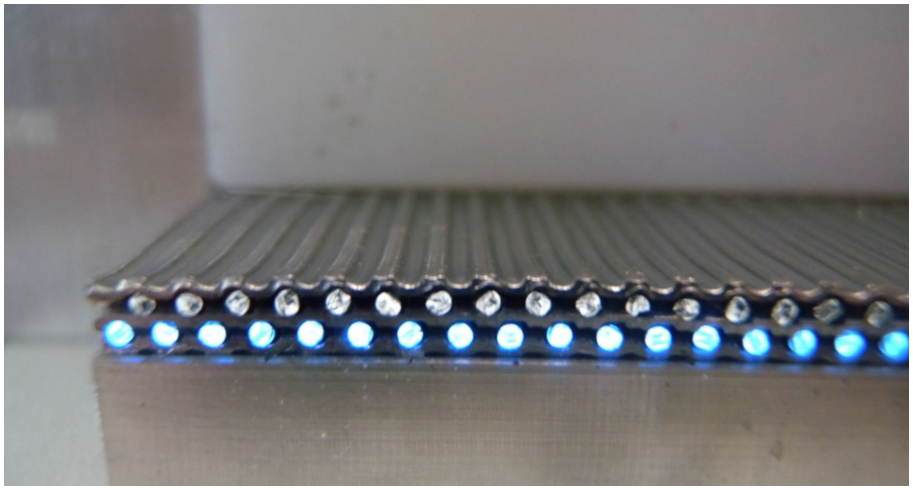
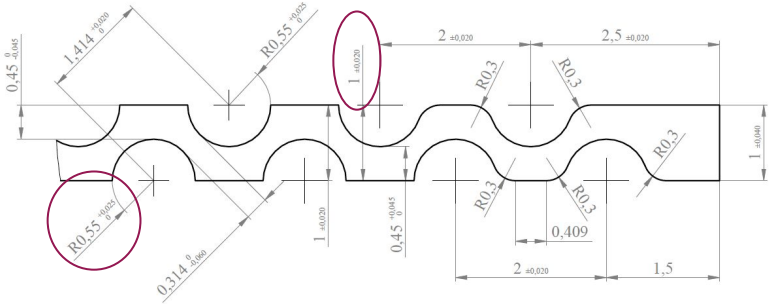
Experience from NewDream module construction

Pavia, Sep. 11th 2019

RD52 lead module

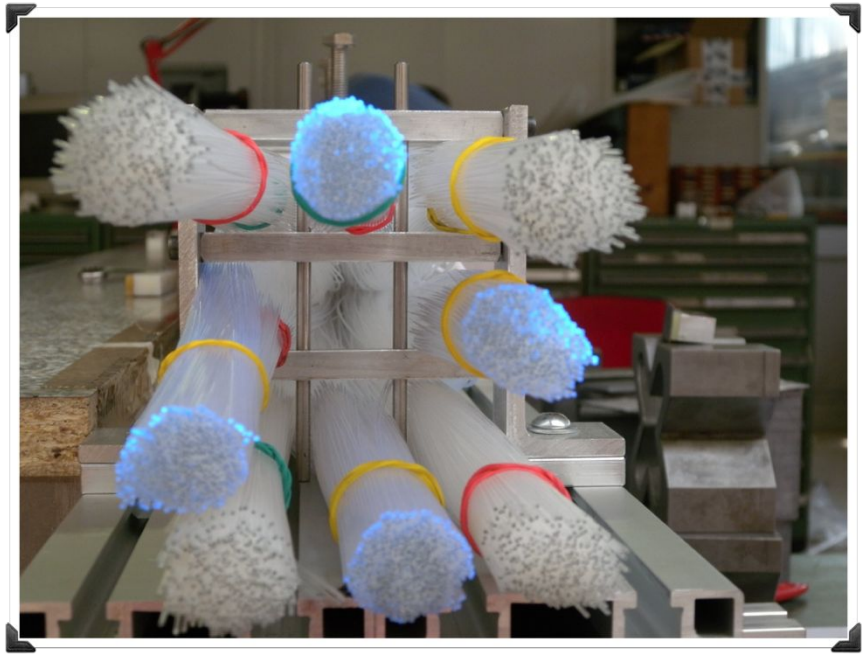




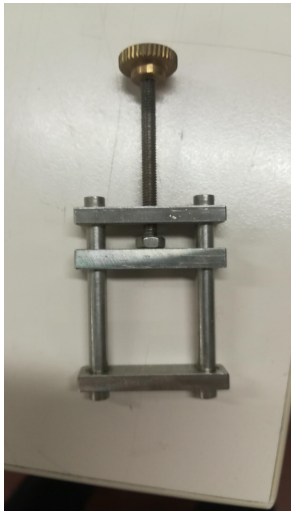
DETTAGLIO A
SCALA 20 : 1

- Made by superposition of 1mm thick lead plates, with groves both sides.
- Clear and scintillating fibers interleaved in the plates
- All positioning done by hand
  - Plates coming in roll, need to be flatened
  - Fibers come in bags, need to be correctly positioned in the groves
- We could assembly about 10 layer max in a "shift", then need to be pressed to consolidate structure
  - 92 layers each module
  - Out of specs of few tenth of microns results in macroscopic effect in the module height

Fiber separation



- Each module 93x93 mm is divide in 4 towers
- In each tower clear and scintillating fibers are divided at the back of the module.
- Number of fibers were optimized to match the PMT active window size.



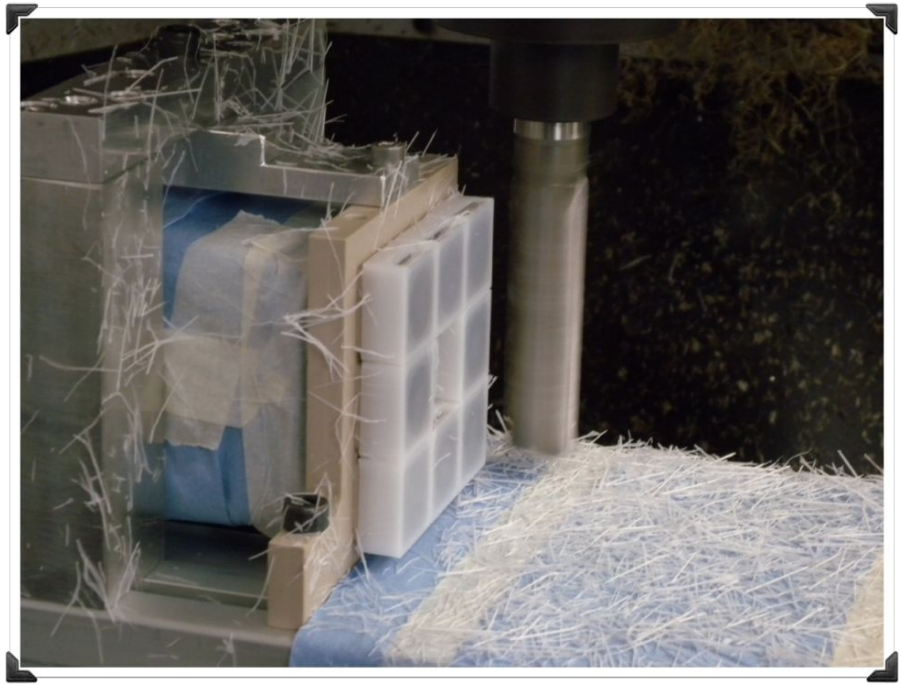
Coupling to PM

- A structure to interface fiber to PM was designed and built
  - No fiber order in each channel were needed (different from SiPM)
- Positioned about 30cm far from the back surface
- Excess of fiber cut away

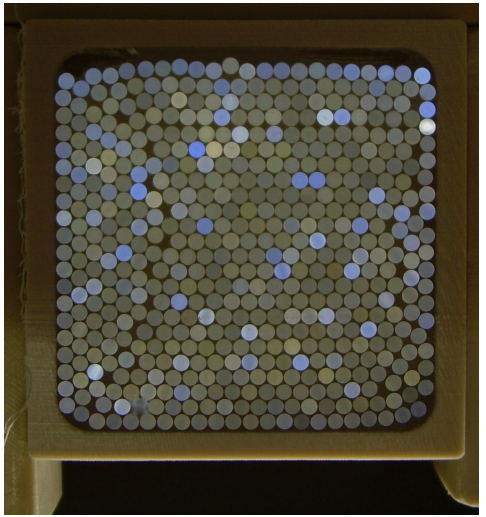
Fiber glueing

- Optical glue was used to glue fibers in the structure holes.
  - Glue were poured until glue holder were full (some glue lost along fibers)

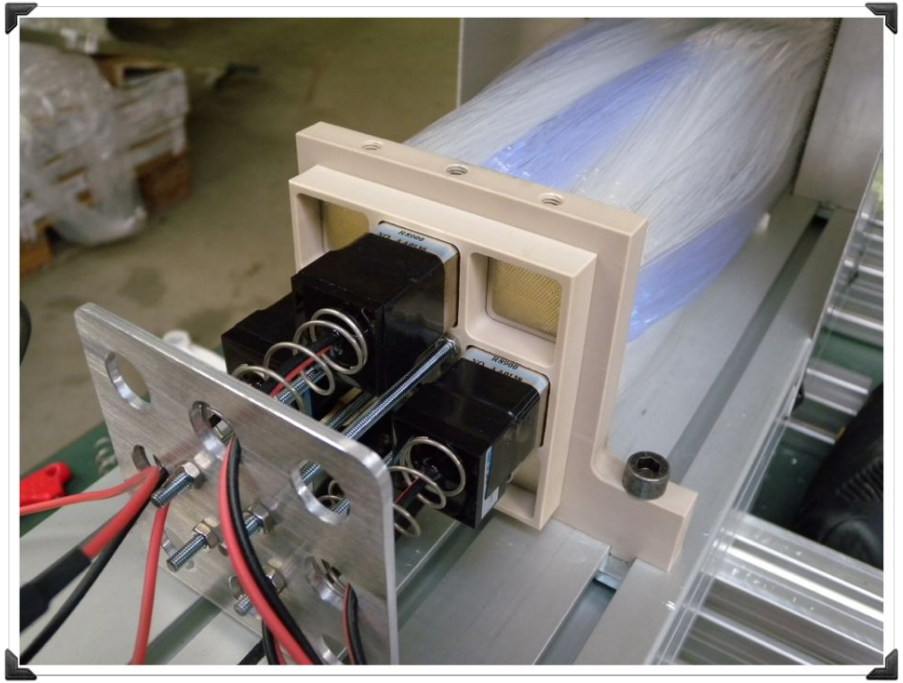
Fiber milling

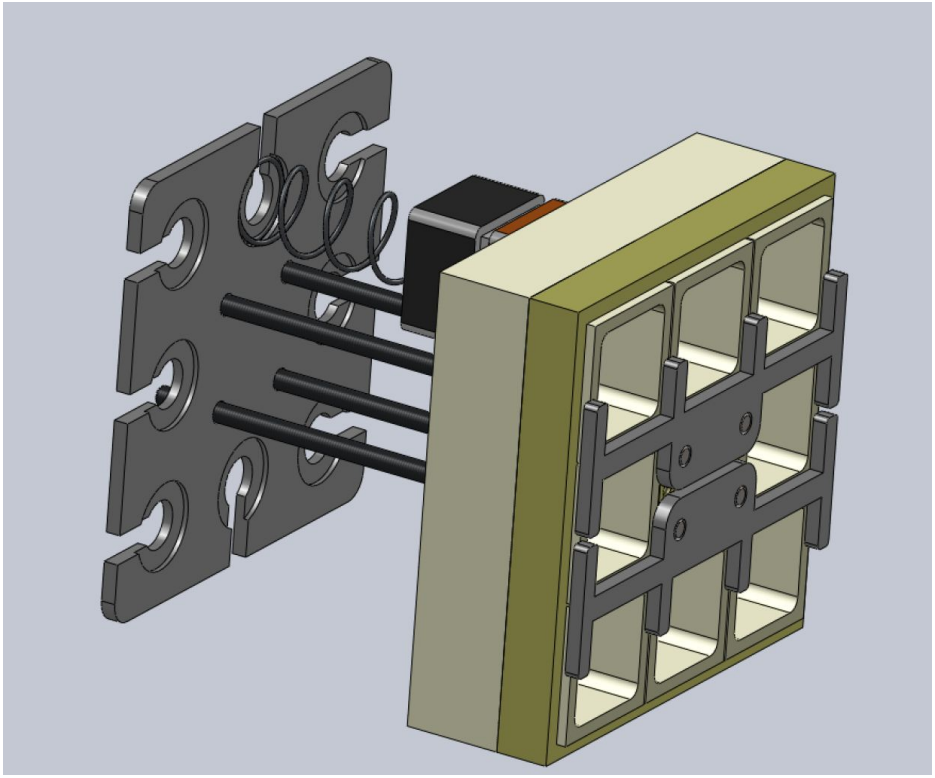


- Once glued the plastic glue holder was milled to reveal fibers and to have a very uniform and smooth surface

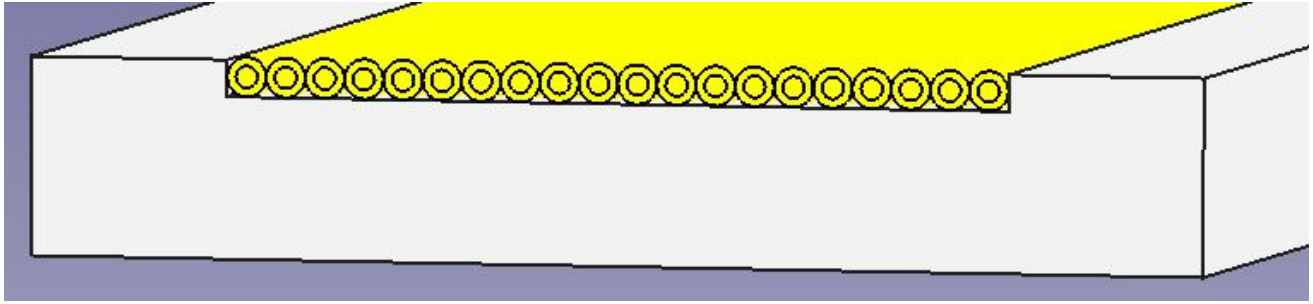


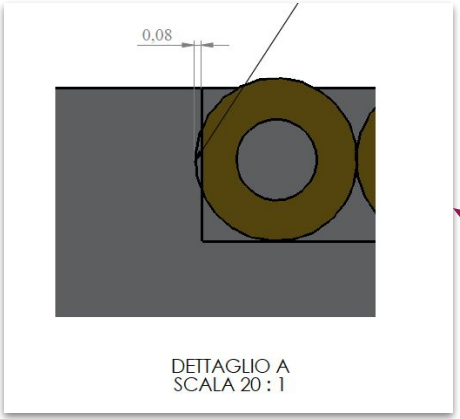
PMT holder

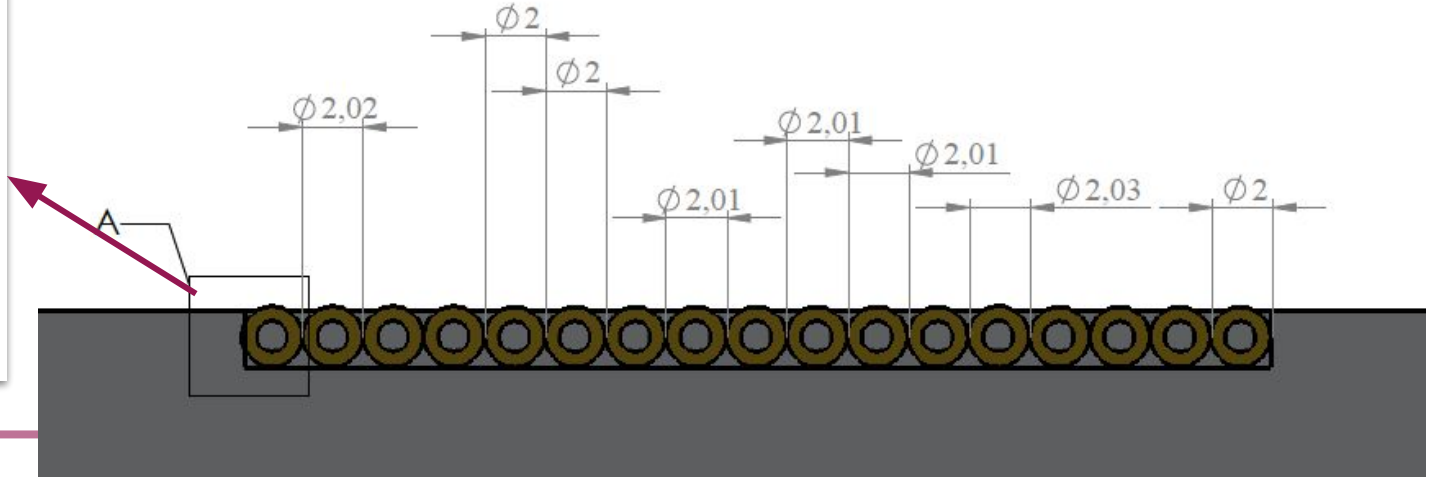




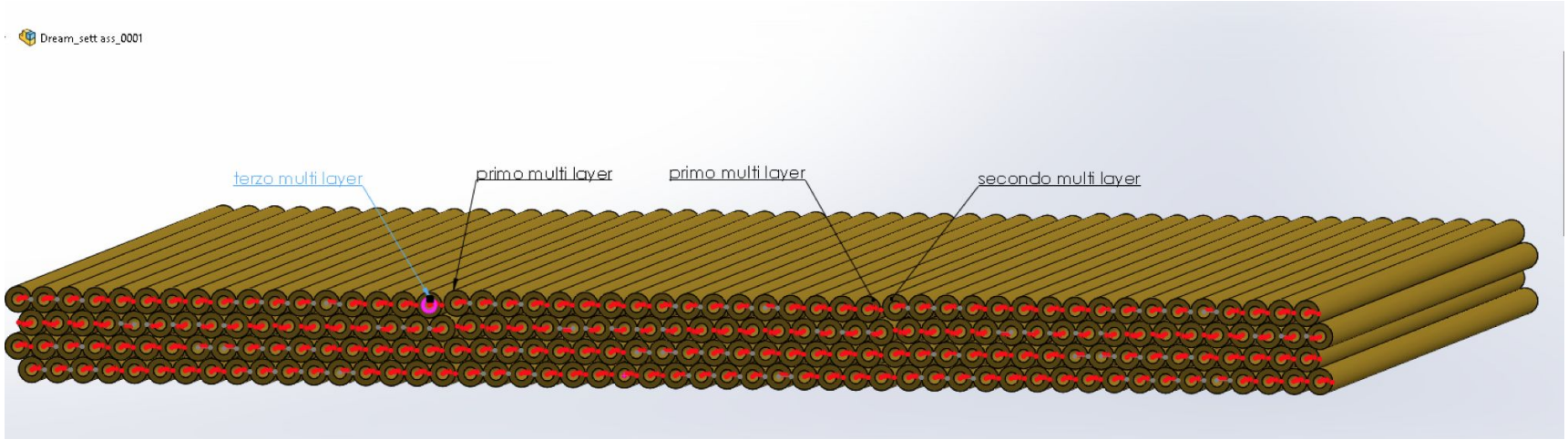
On mechanical tolerance - horizontal







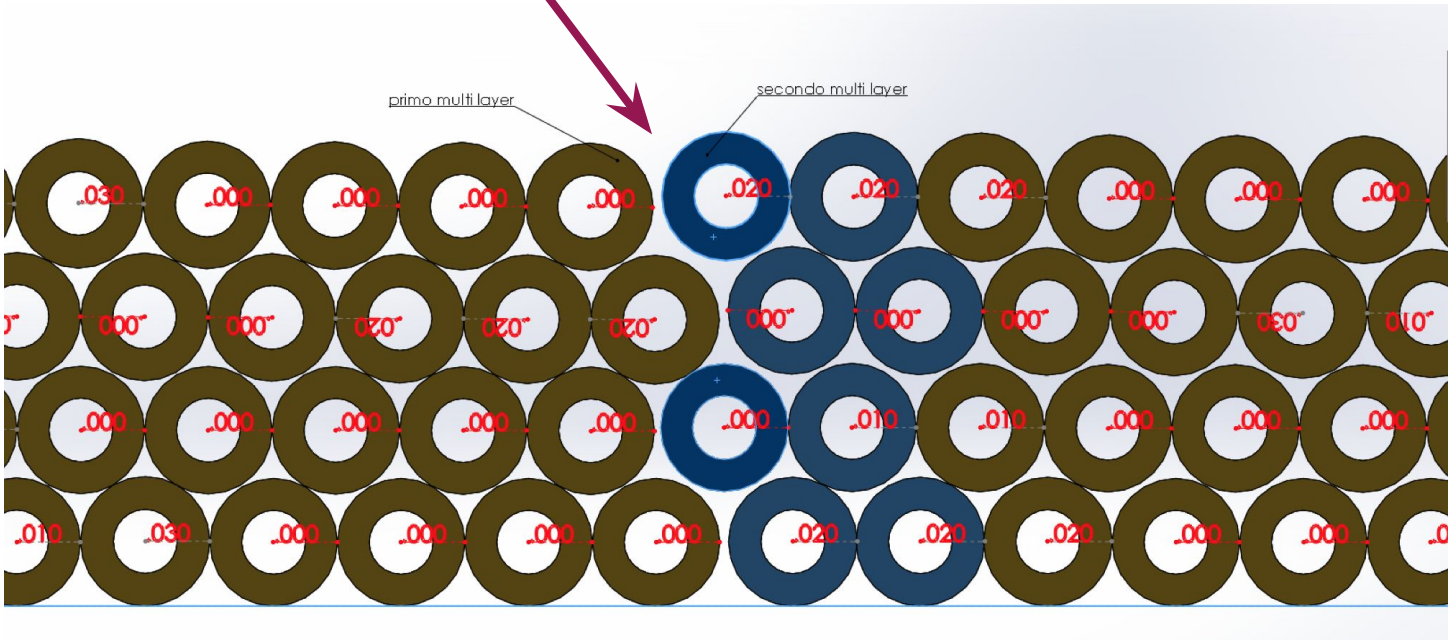
On mechanical tolerance - vertical



Simulation:
Adding 0-30 um tolerance on tubelet diameter (no straightness effect considered)
Coupling 4 layers with this characteristic (17 tube each)
Coupling 3 modules on a plane

On mechanical tolerance - vertical

Displacement of the tubelets from nominal position up to 200um found

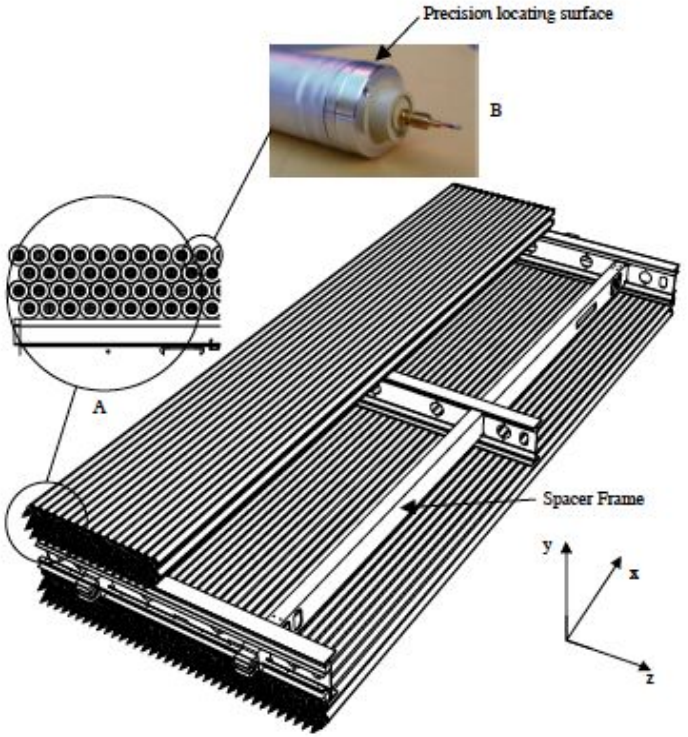


Coping with tube tolerance

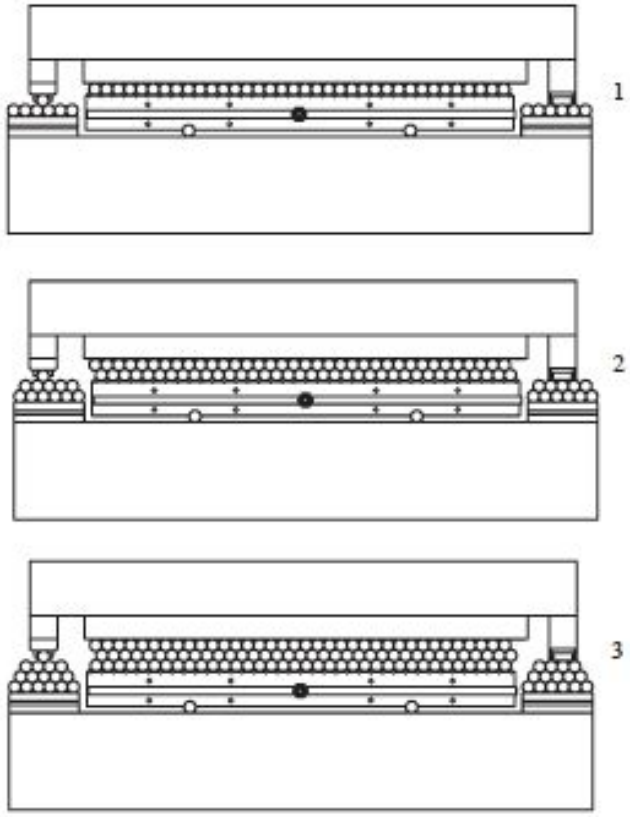
MDT experience:

- 30mm diameter Al tubes with 50um W-Re wire
- 10 um positioning required

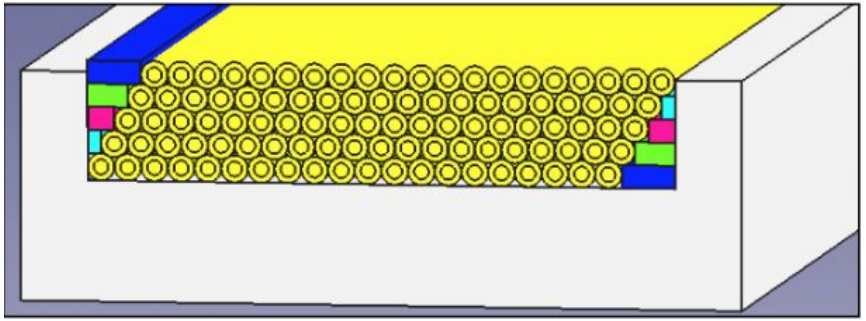
Different size and different tolerance… but may be interesting starting point



Coping with tube tolerance



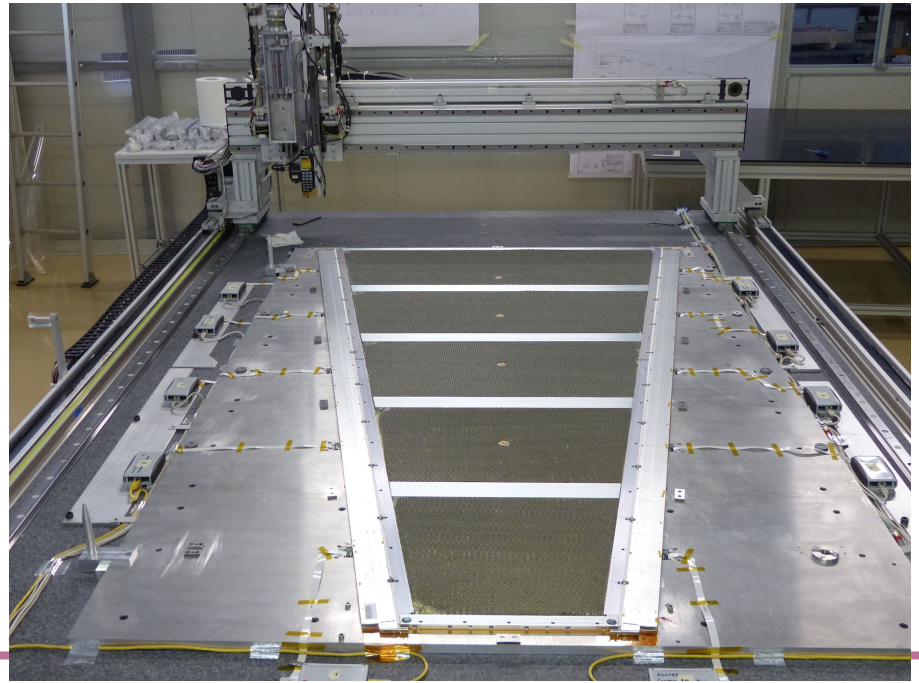
- We used combs to correctly position the tubes
- Comb step larger than tube diameter
  - No interference of tube
  - Coping with tolerance on diameter and straitghness
- Once a layer was glued, it was removed with a stiffback
- Second layer glued
  - Vertical distance guaranteed by external reference

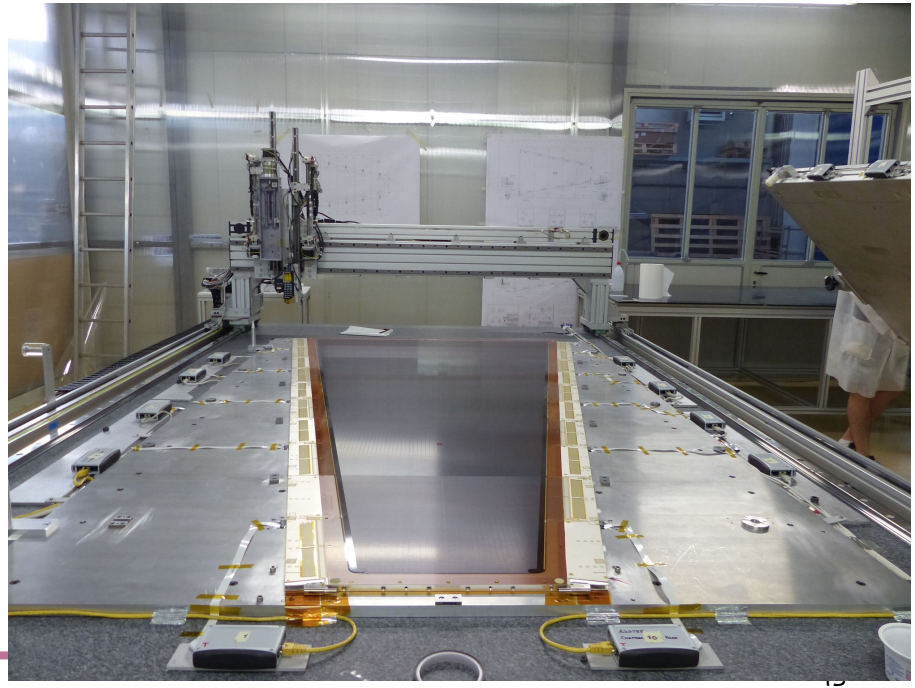


Micromegas - Example

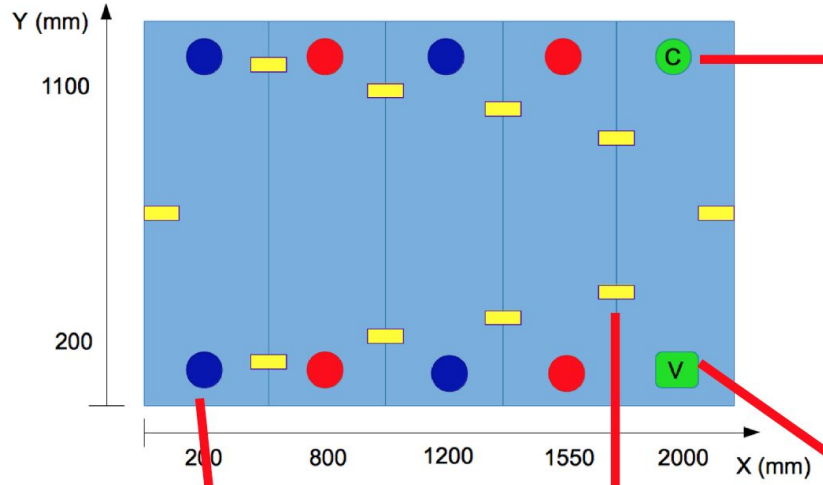
50um tolerance on PCB and honeycomb thickness
60um tolerance on frame thickness
100um tolerance on cooling channel thickness

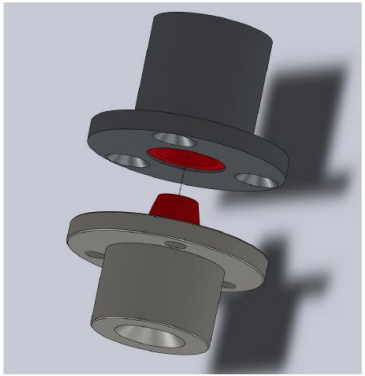
→ Must results in 100um tolerance thickness on panel



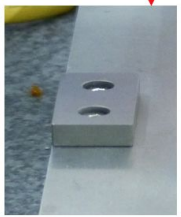


Micromegas -example

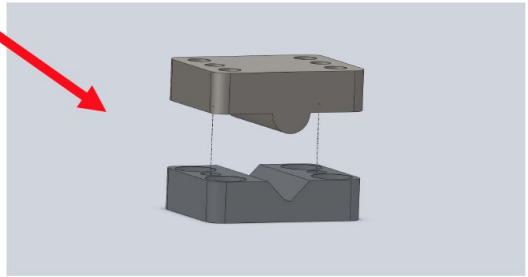




Conical interlock (x and y)



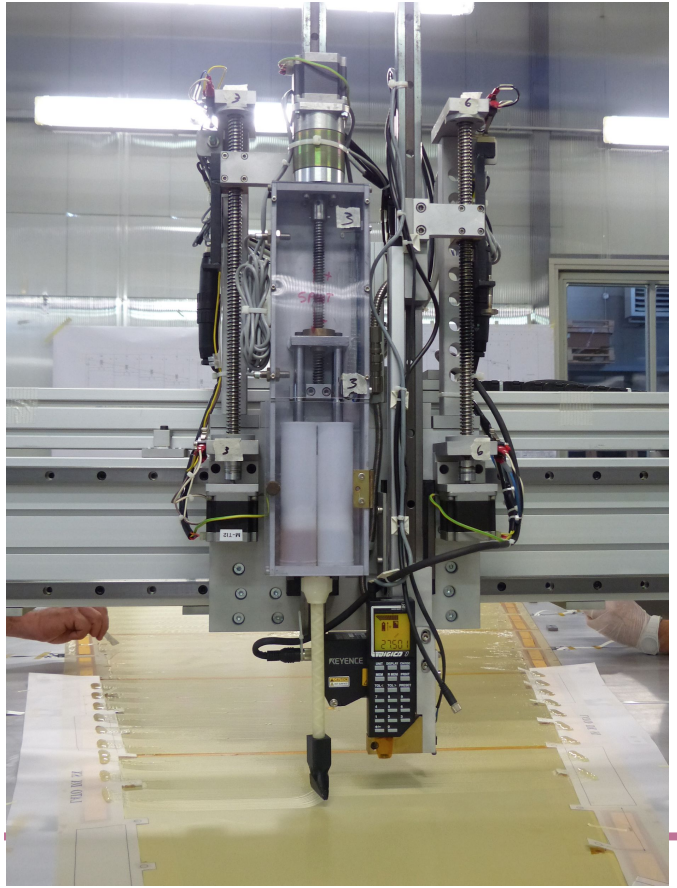
Shims (z)



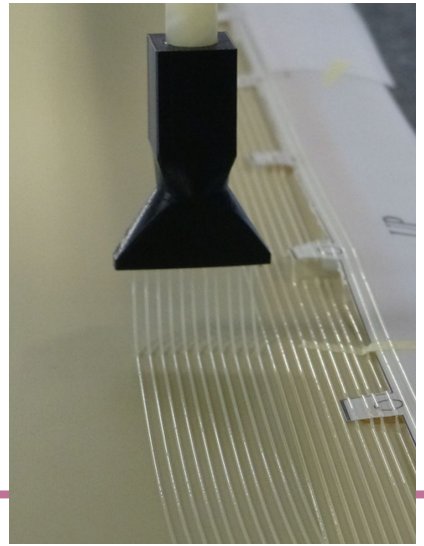
V-shape interlock
(rotation in the plane)

Also in this case we decided to rely on external reference to avoid problems with component tolerances

Gluing automatic system



- 200+200 ml Araldite 2011 cartridges
- Remote controlled step motors for glue pressing and distribution
- Glue dispenser designed and produced in Pavia



Glue dispenser and step motors parameters where chosen to deposit the wanted quantity of glue