

STATUS OF THE GLUING LAB AT HIM



Ahmed Ali

On behalf of the HIM group

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Overview

The PANDA Barrel DIRC:

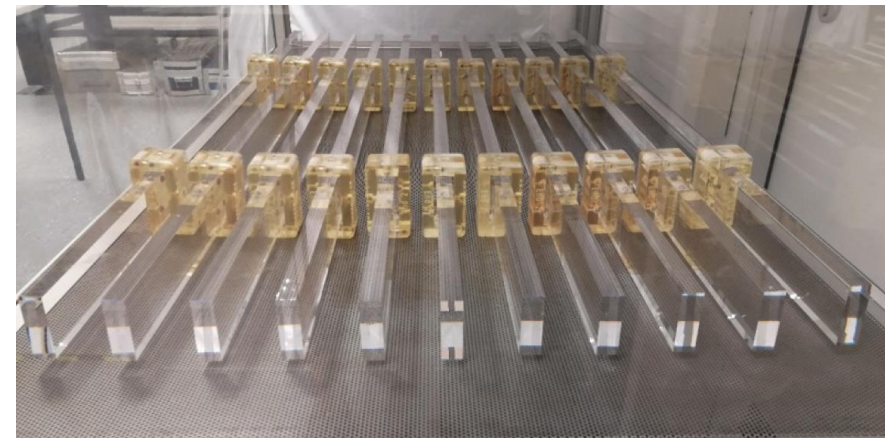
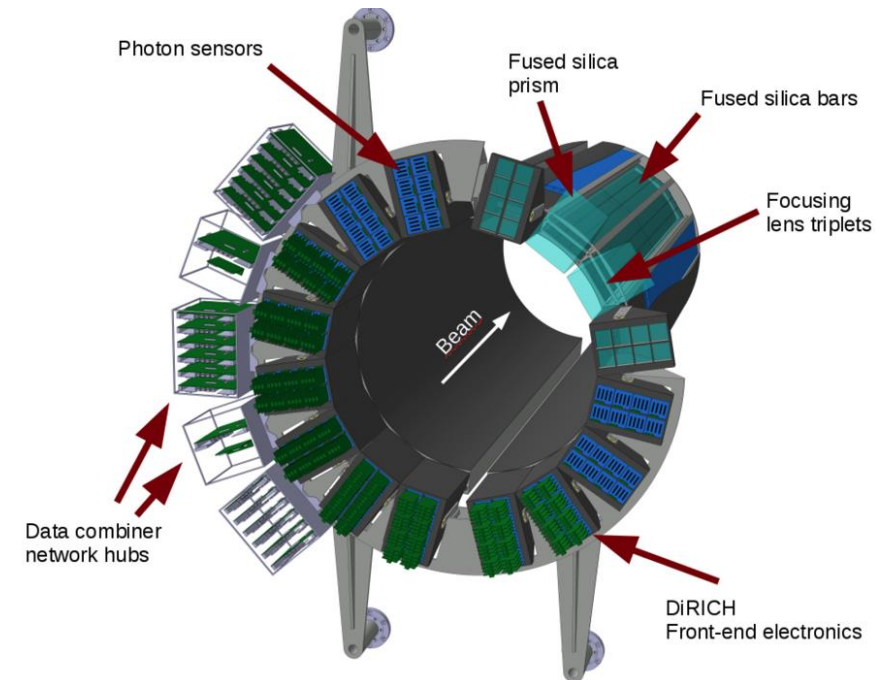
- Radiator: 48 bars (16 sectors)
- Compact expansion volume: 30cm-deep solid fused silical prisms
- Focusing optics: 3 layers spherical lens system

The bars:

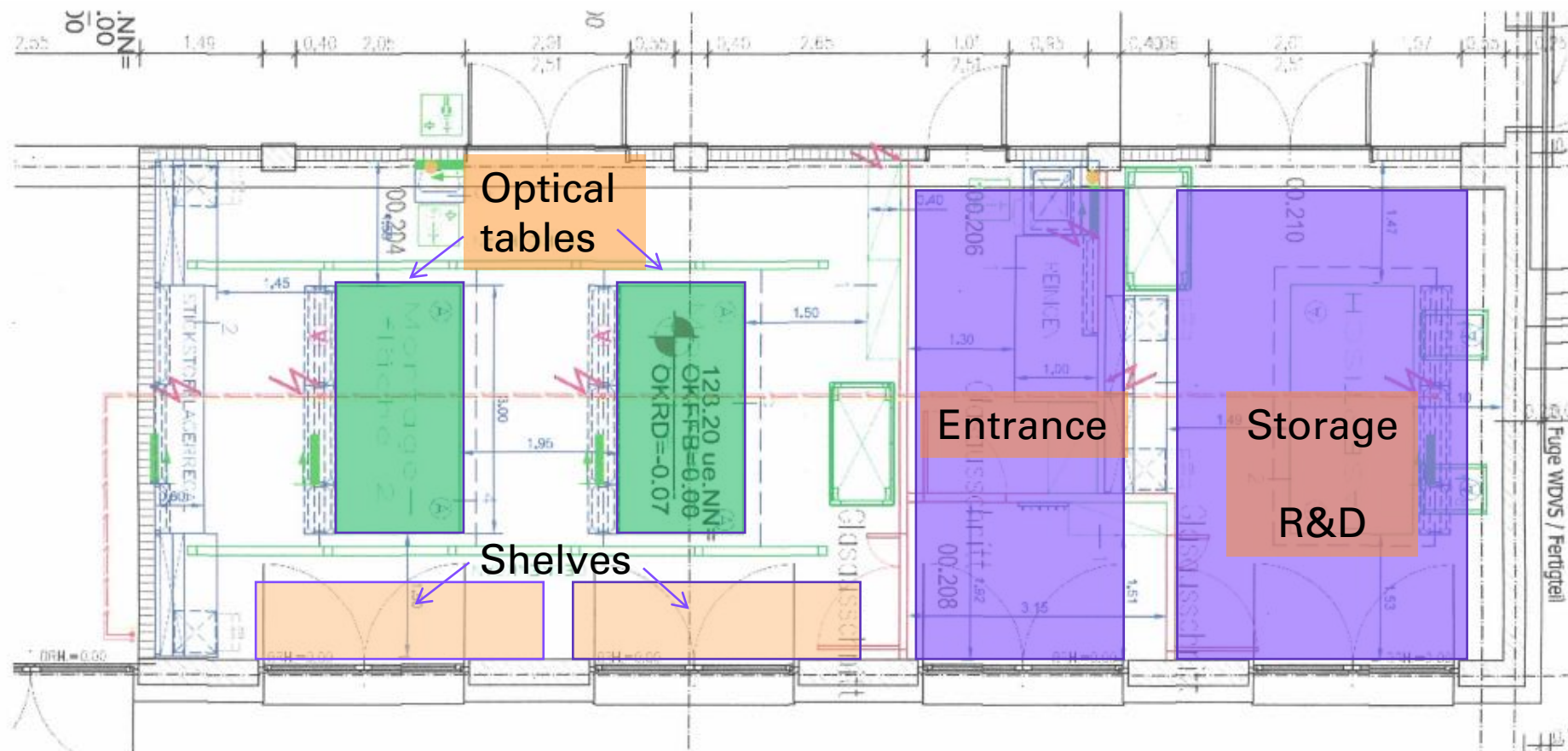
- Highly-polished bar made of synthetic fused silica
- The squareness of the side-to face angles is less than 0.25 mrad and the total thickness variation is less than 10 μm .

First task

- Two radiator pieces to be glued end-to-end to form a long bar, covering the full length of the Barrel DIRC 17mm (T) x 53mm (W) x 2400mm (L)



Gluing Lab at HIM



Optical Tables



Before installation



After installation

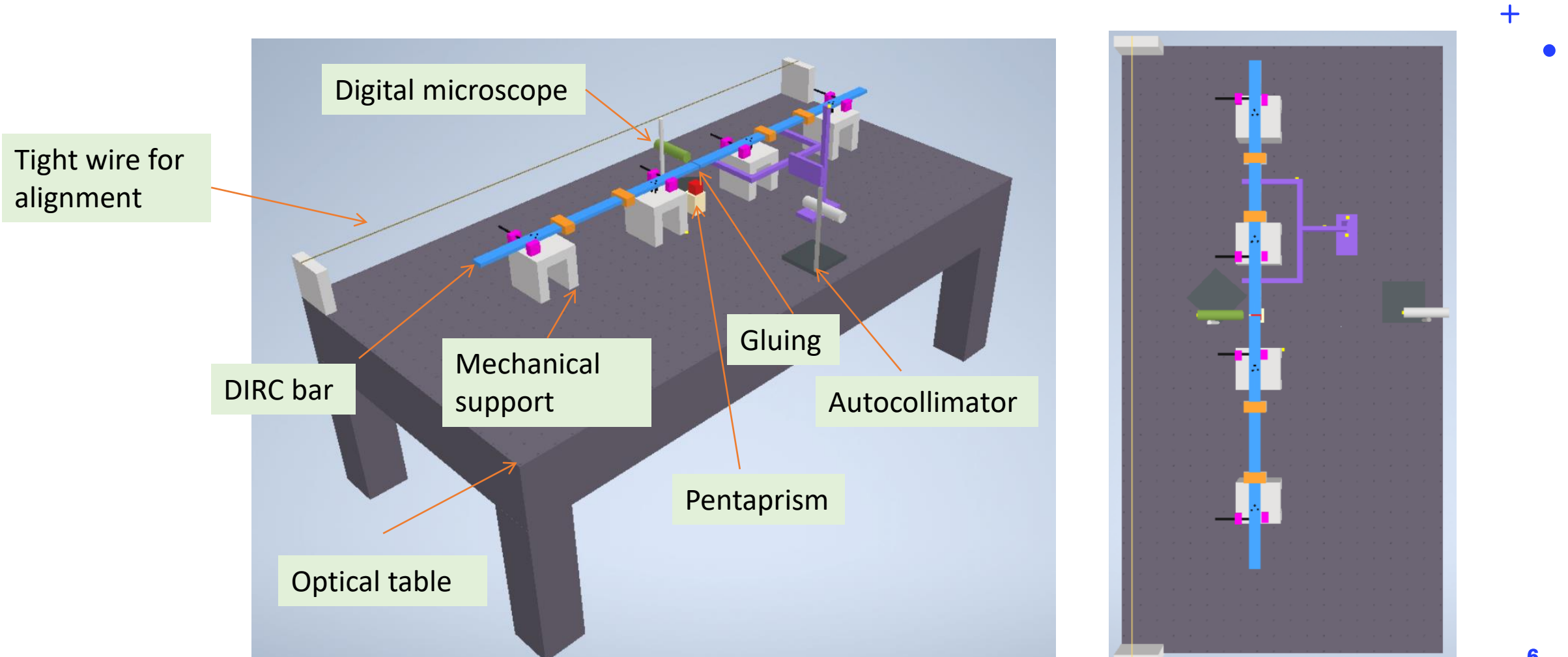


BaBar DIRC Gluing Setup

- PANDA Barrel DIRC gluing setup inspired by the BaBar DIRC gluing setup
- Photos of the bar gluing setup in the DIRC room at SLAC
- Large optical table and the DIRC bar support stations



Preliminary PANDA Barrel DIRC Gluing Setup



PANDA Barrel DIRC gluing setup inspired by the BaBar DIRC gluing setup

Bar Alignment

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- Develop a procedure to minimize mechanical stresses during the gluing process and to maintain the parallelism between the bar ends
- Angular alignment: Using Nikon Autocollimator 6D-LED with a measuring accuracy of 0.5 seconds of arc
- Position alignment: Using highly tight piano wire. The positioning precision will be measured by a precision machine at HIM with measuring accuracy 30 micron.

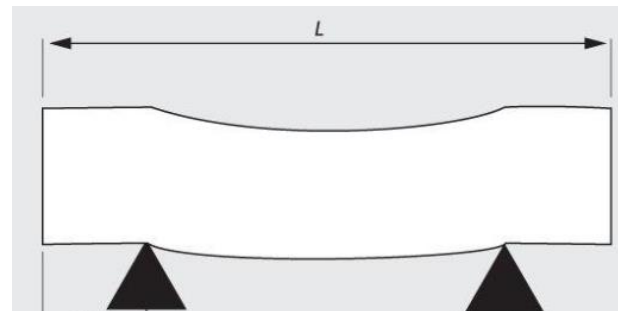
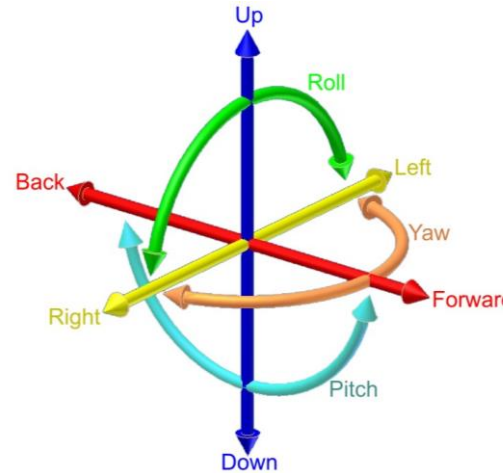
Bar Support Structure Prototype

Features:

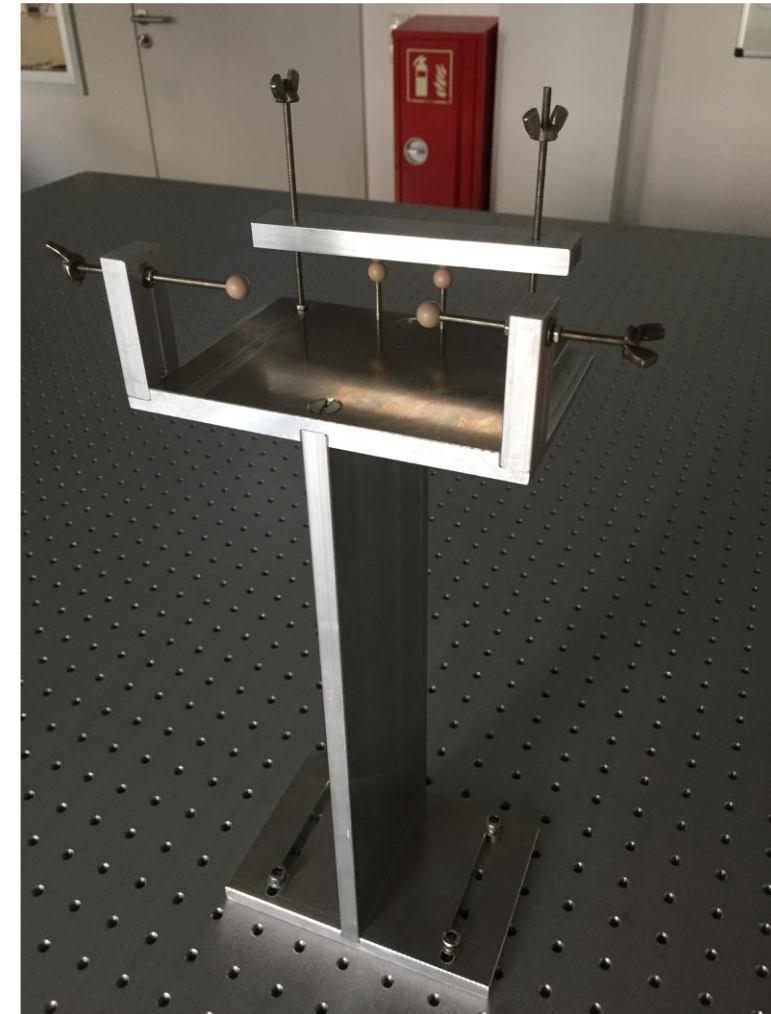
- Simple design, covers six degrees of freedom: forward/back, up/down, left/right, pitch, yaw, roll
- Support Bessel / Airy points positioning
- PEEK tips
- Vertical clamp

Future improvements:

- Add a vertical support column for more stability
- Improve the vertical clamp (pressure at the centre)
- Optimize the side opening, to be round instead of longitudinal opening
- Improve the accuracy of positioning screws



0.2113 L

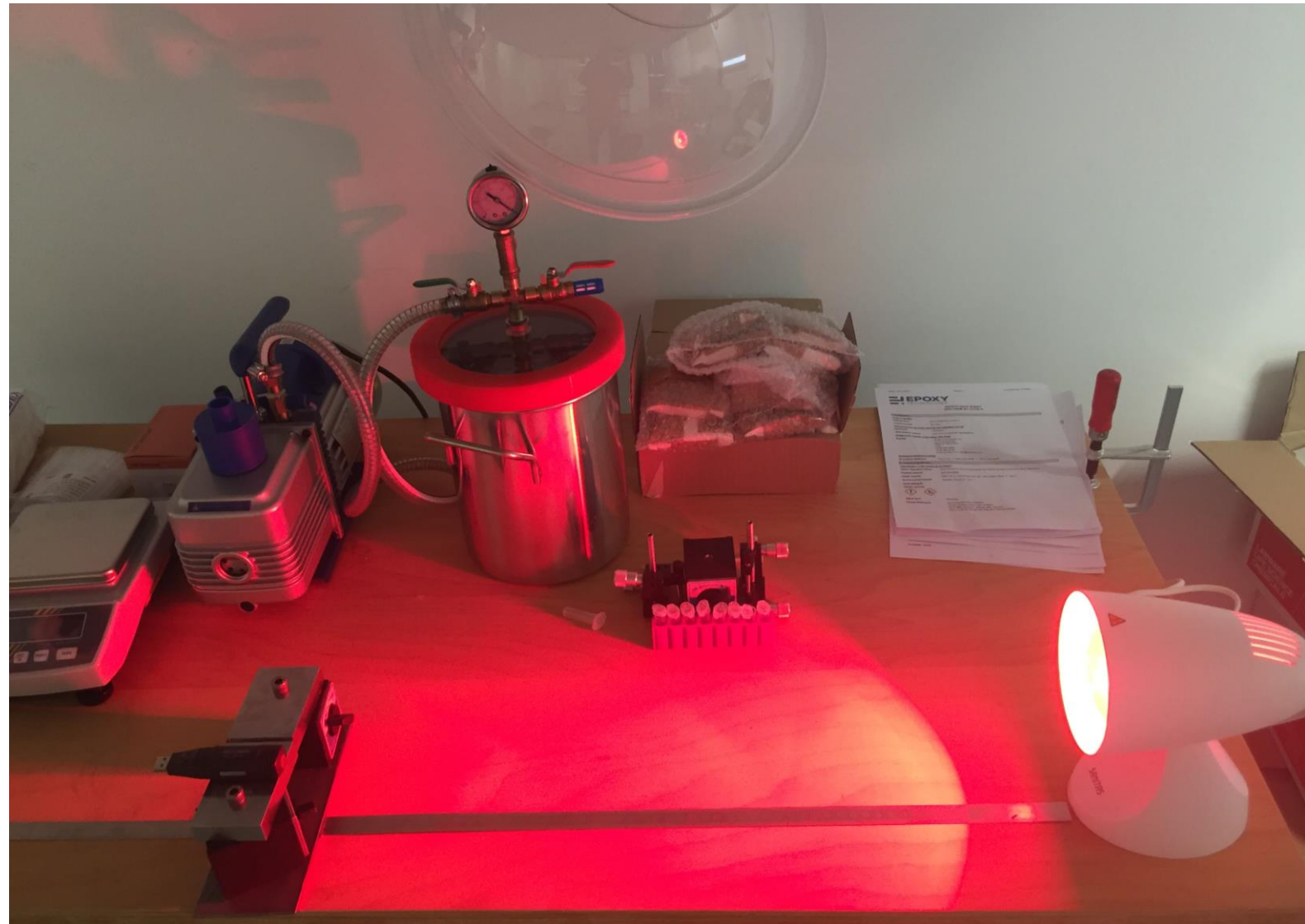


Mechanical support prototype

R&D Tests

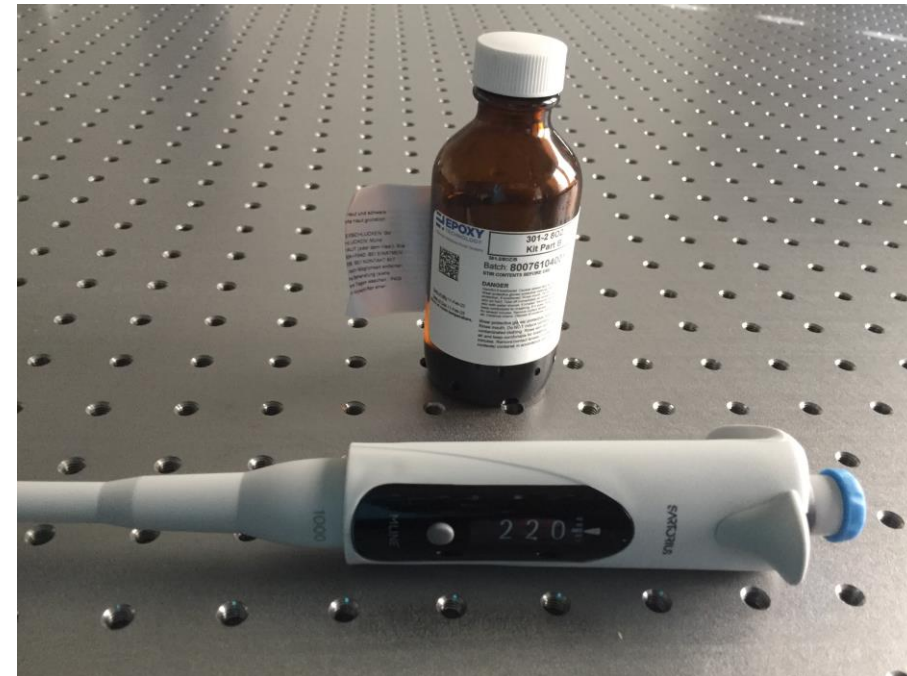
Several R&D glue tests are currently being performed using glass samples. The next phase will be using samples from Nikon bar after dicing.

- Glue materials mixing ratio
- Bubbles removal technique
- Gluing technique
- Temperature optimization
- Mechanical strength test
- Humidity scan
- Shim thickness scan
- Bar samples test

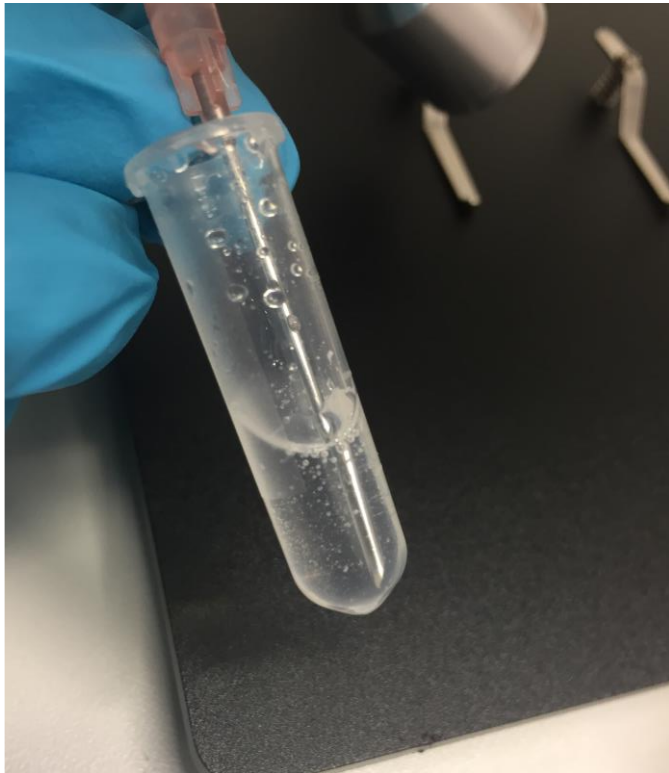


R&D Glue Materials Mixing Ratio

- Recommended mixing ratio by the manufacturer is 100:35 based on the weight, given the two glue materials has different densities.
- 65mg, 22.75mg , correspond to 500 μ l , 212 μ l.(The glue quantity should be optimized to reach 2g as minimum weight).
- The current R&D setup requires about 350 μ l of the mixture the rest of the mixture is left over.



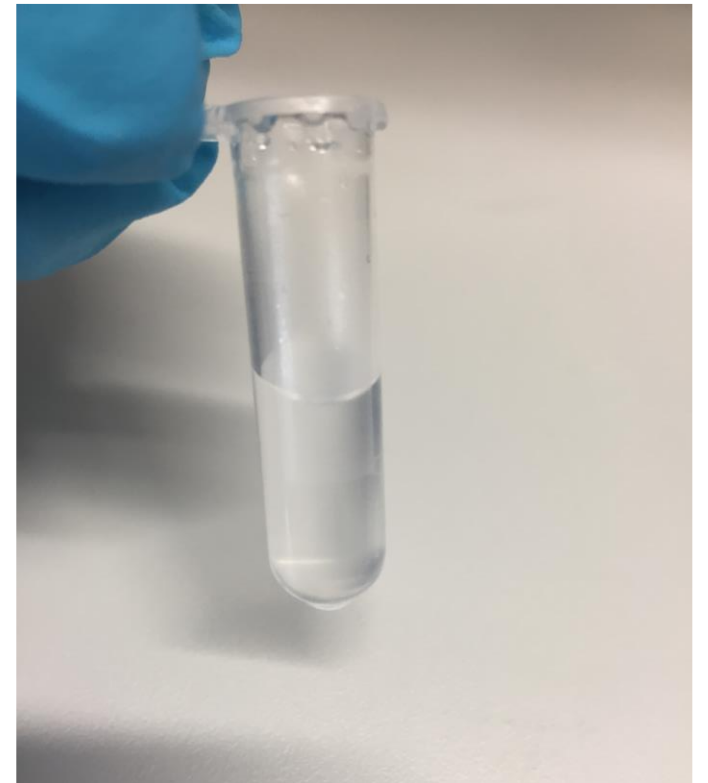
Bubble Removal Technique



Before Vacuum



Vacuum System



After Vacuum



R&D Gluing Technique

Conditions:

- Glass samples glued to the support structure using paper glue
- Glass samples separated using paper as a shim
- 100:35 in weight glue mixture corresponding to about 500 μ l , 220 μ l
- Glue material started from room temperature and clear
- Gluing process started from the top at the center
- Infrared lamp direct (d=0) for ½ an hour
- Clean all sides with non-absorbing tissue-propanol
- Applying glue for the second time
- Clean all sides with non-absorbing tissue-propanol
- Infrared lamp distance 20cm, corresponding to 34 C for one day

Results

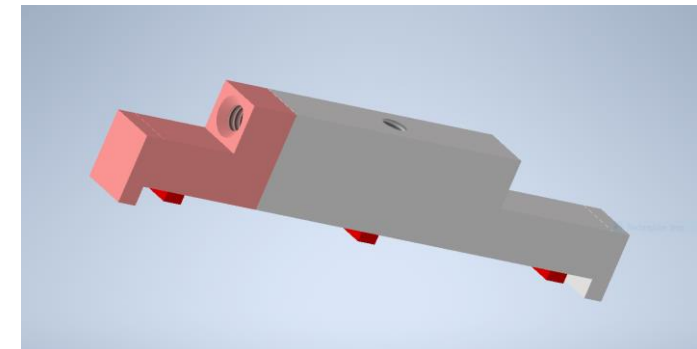
- **No bubbles were observed**
- Some outer cracks occurred while trying to remove the glass from the R&D mechanical support

Lessons learned

- Current technique is a good start (further optimization is required)
- Microliter pipette will be used for better gluing control
- Develop another R&D Mechanical support



Preliminary R&D support structure



Improved R&D support structure

R&D Temperature vs Curing Time

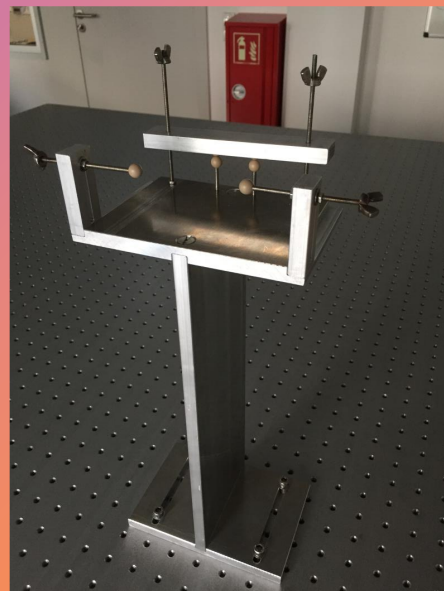
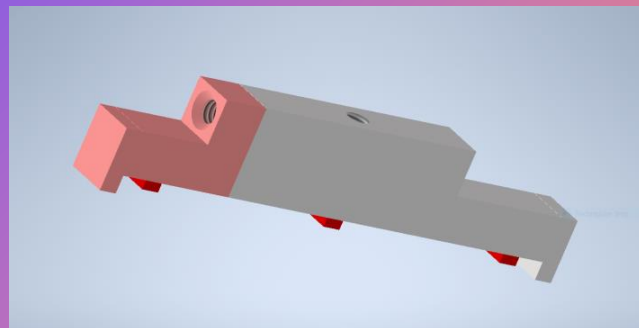
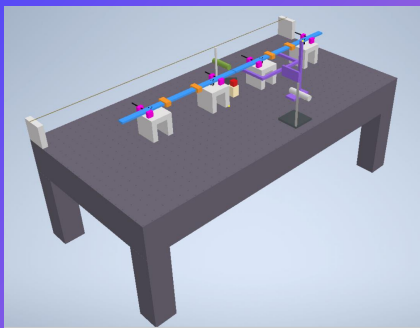
- The setup gives rough estimation for the required curing time at several temperature points
- Infrared lamp used as a heat source: 60cm/26C, 50cm/27C, 30cm/31C and 20cm /34C.
- One day curing time is roughly sufficient for 34C.
- Filter on the top of the optical table can provide homogenise air flow with temperature up to 24C (+2 above the nominal clean room temperature)
- Extensive gluing/curing studies will be performed at 24C, the ultimate temperature for the production phase



Infrared setup

Summary

- PANDA Barrel DIRC gluing setup inspired by the BaBar DIRC gluing setup
- Most of the required equipment is ready
- Several R&D glue tests were performed, the rest of the tests will be performed before the production phase
- Goal: Two radiator pieces to be glued end-to-end with high quality with less than 30 micron misalignment error



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THANK FOR YOUR ATTENTION