

Status of the Gluing Lab at HI Mainz

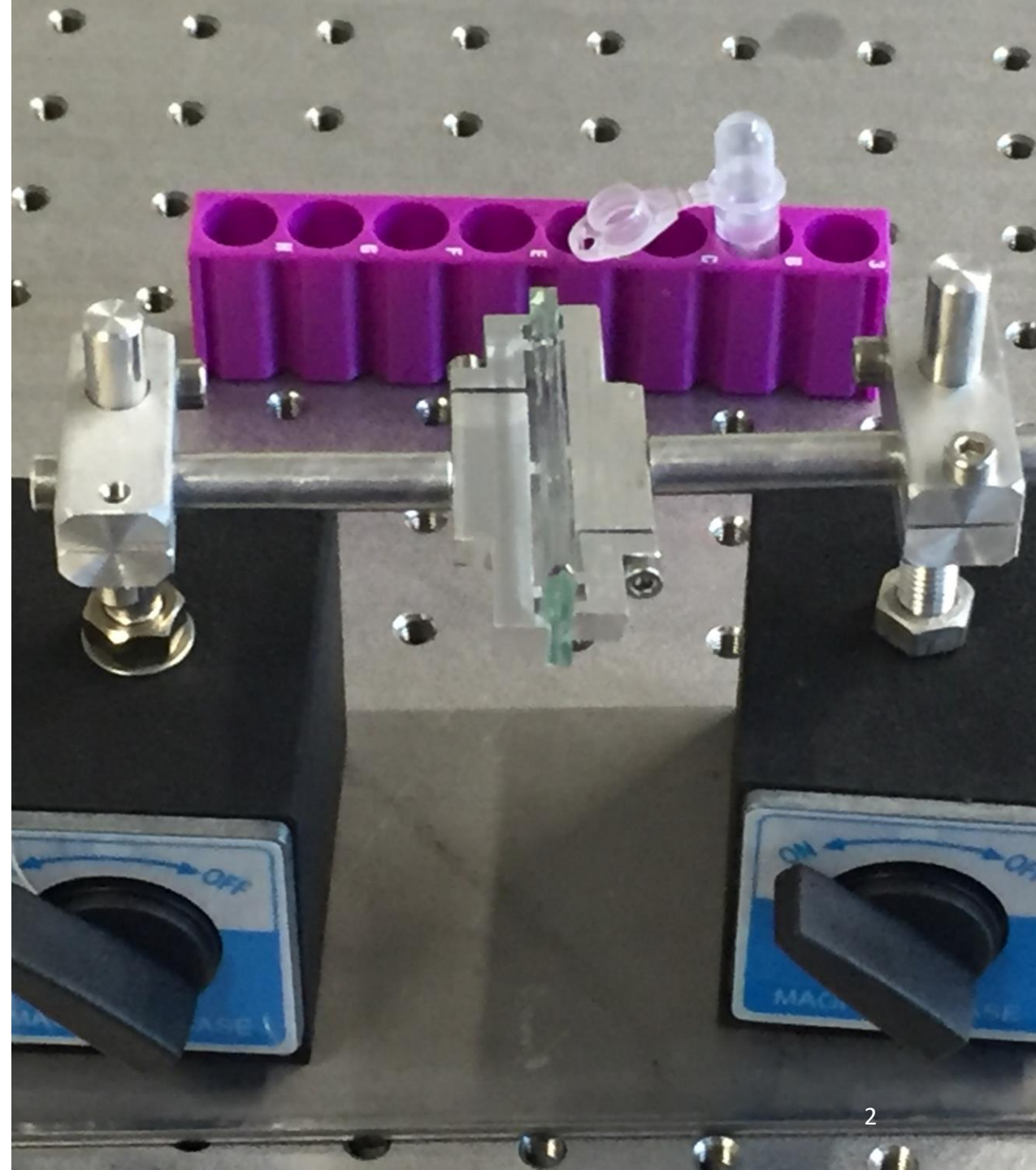
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On behalf of the HIM group

9/3/2023

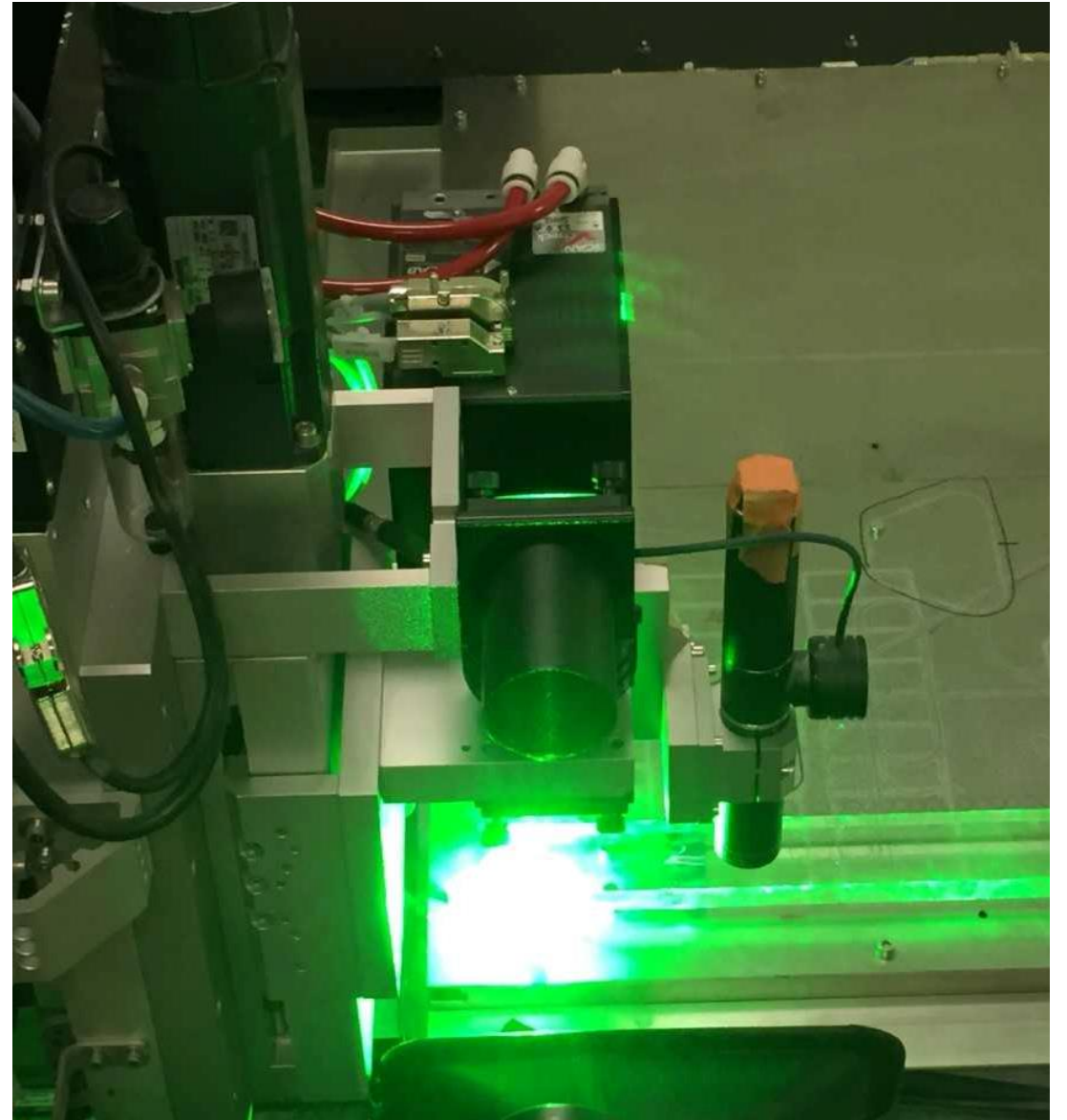
Motivation

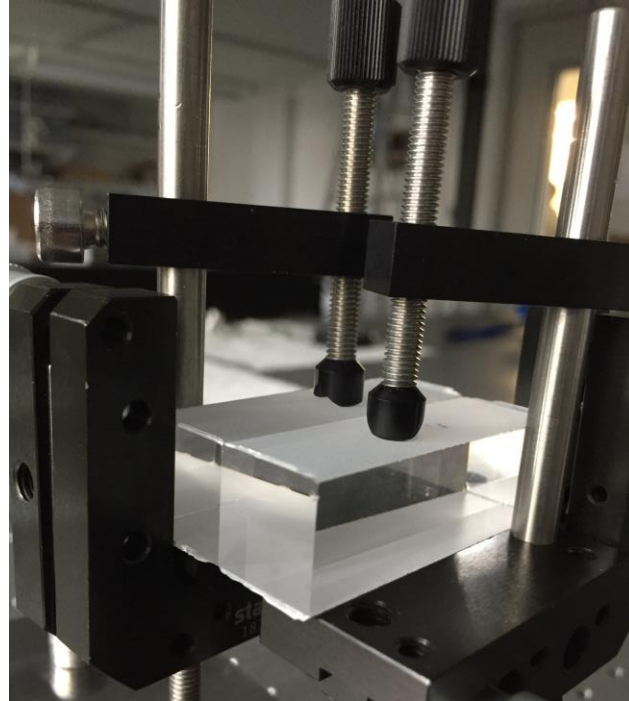
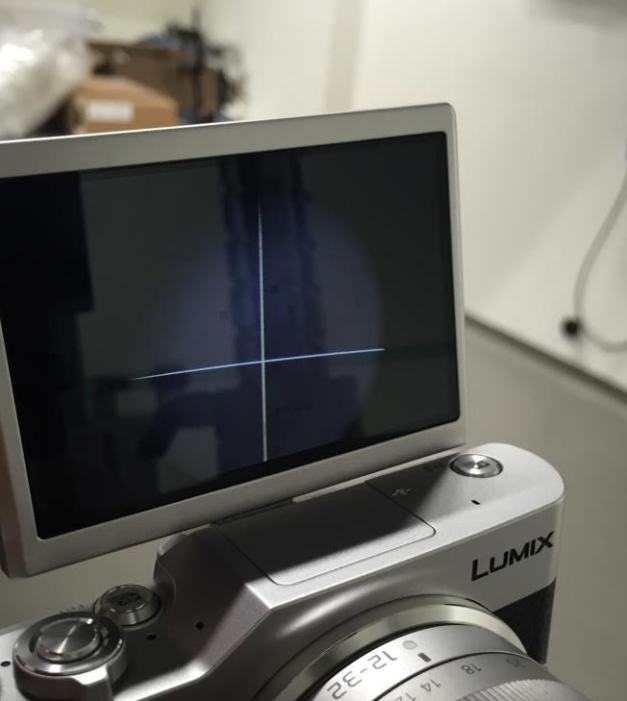
- To optimize the assembly of PANDA bars, the successful BaBar DIRC gluing procedures were used as a basis, with necessary modifications to account for the larger cross-section of the PANDA bars. These modifications will be experimentally validated.
- Initially, glass pieces were used to assess the quality of the glue joint. The quality tests were conducted by testing different ratios of glue components, curing conditions, and gap widths between the glass pieces to compare the glue uniformity and the number of air bubbles. The objective was to identify the optimal parameters that will result in the highest quality glue joint.



Laser Cutting

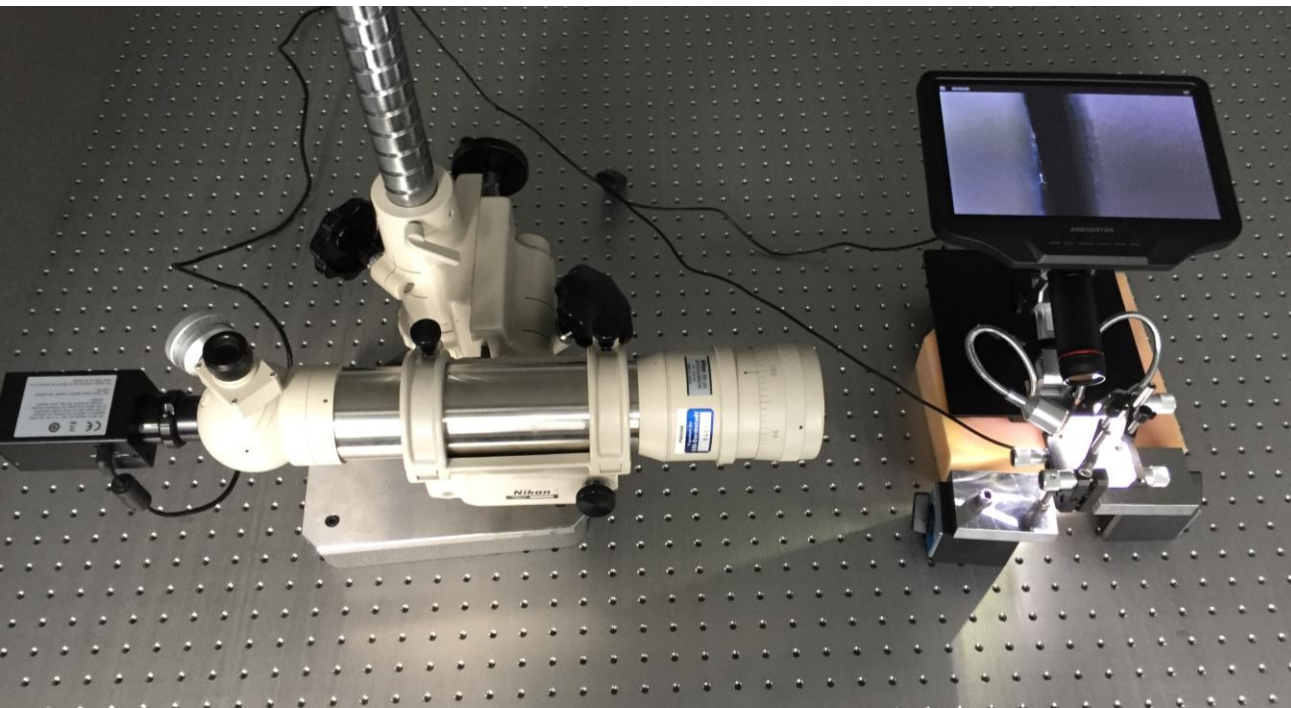
To conduct tests on the actual bars, a PANDA Barrel DIRC bar manufactured by Nikon Corp. was sliced into 53 mm-wide pieces using laser ablation at MDI Advanced Processing GmbH in Mainz.





Gluing Setup Prototype

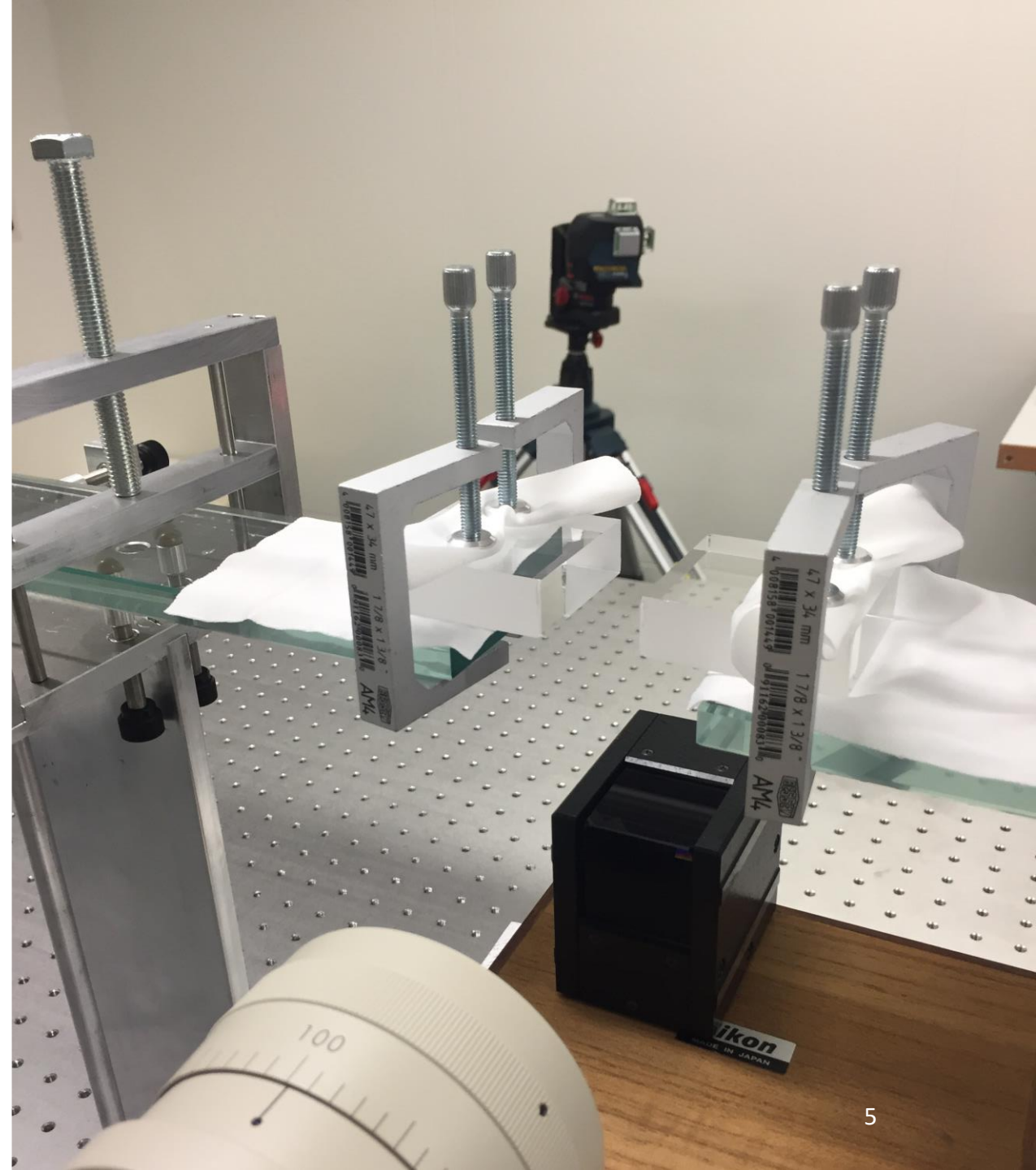
- The gluing results were highly dependent on the quality and alignment of the two surfaces.



- Two bar samples was secured by attaching them on top of a holder. The distances between the fused silica samples and the relative alignment can be controlled using micrometers, and an autocollimator.

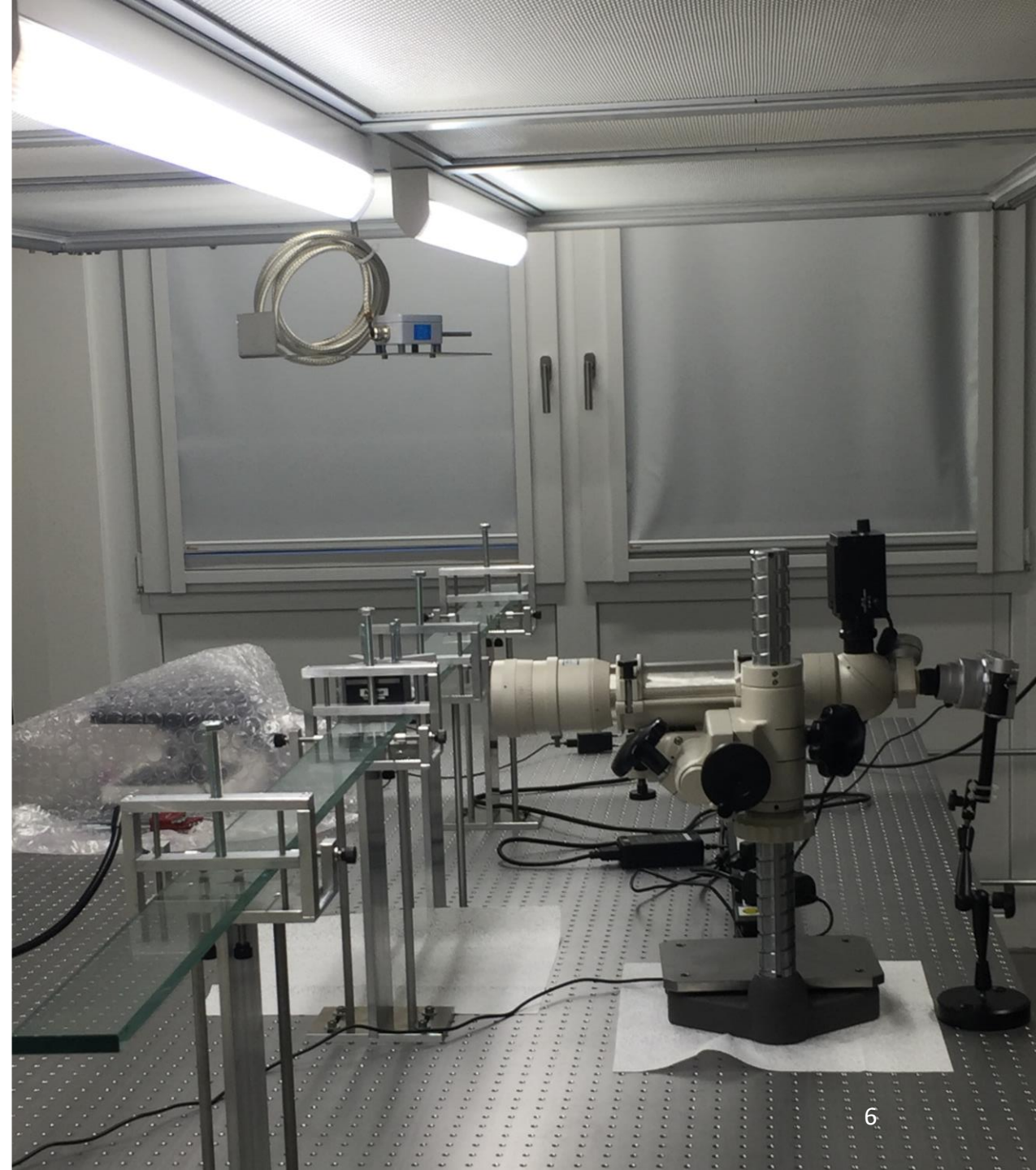
Pre-final Design of the Gluing Support Structure

- Each of the two bar samples was secured by attaching them on top of dummy glass bars using clamps. The dummy bars were placed on the mechanical gluing setup.
- The distances between the fused silica samples and the relative alignment can be controlled using micrometers, and an autocollimator.



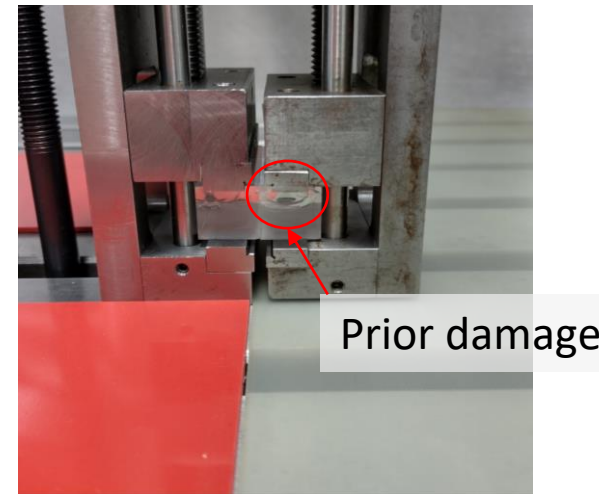
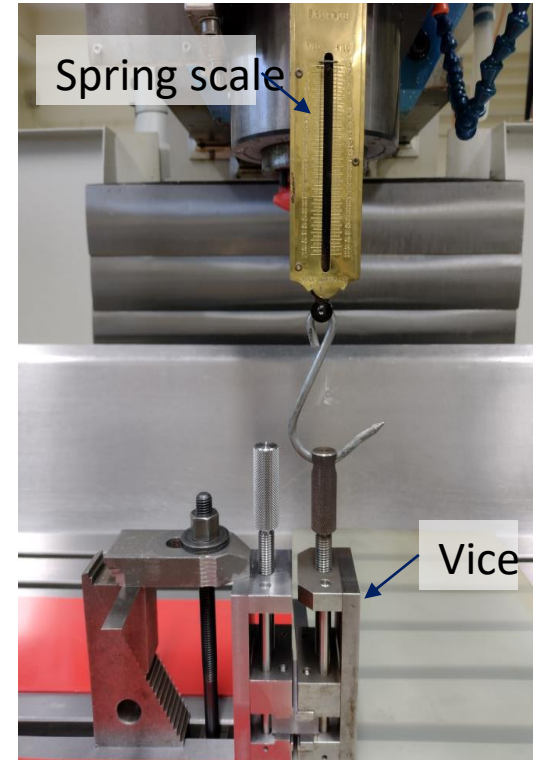
Pre-final Design of the Gluing Support Structure

- By varying the relative orientation of the samples as well as the environmental conditions, the optimum conditions for the production phase of the 48-long bars will be studied before the first full-size Nikon bars will be glued.
- A mechanical strength tests were conducted at the HI Mainz mechanical workshop. The tests confirmed the mechanical strength of the glue joints.



Strength Test Shear Force & Peeling

- Shear and peel testing are two common methods used to evaluate the mechanical strength of adhesives.
- Peel testing measures the force required to separate the two glued bar samples, by pulling the samples apart at 180-degree angle and measuring the force required to separate them
- In both cases, the results typically report the maximum force causing failure. However, it was observed that the failure did not occur on the glue joint but within the quartz itself. This confirms the successful mechanical strength of the glue.



Summary

- With 100% - 35% glue component A, B respectively mixing ratio Optimized
- Mechanical strength of the glue joint confirmed
- Installation of the pre-final design of the gluing setup
- Angular alignment controlled by the Autocollimator
- First bar sample, preliminary check with no evidence of air bubbles or gabs on the glue joints

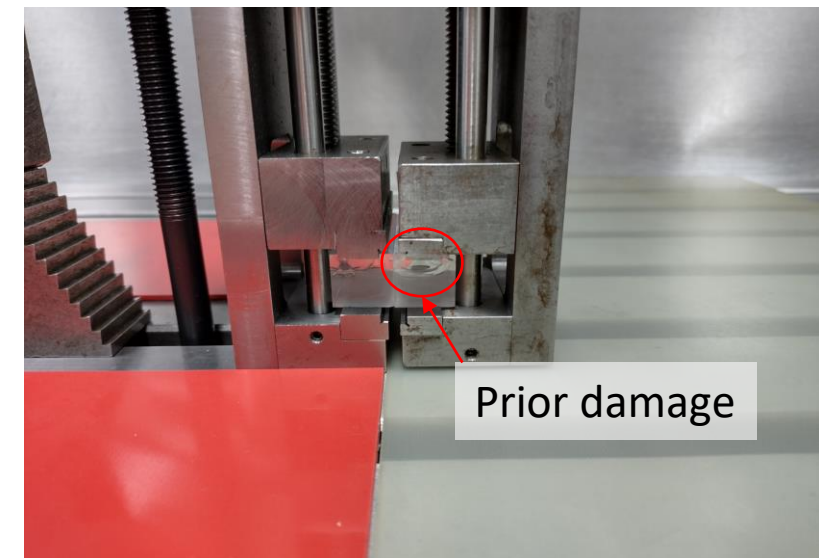
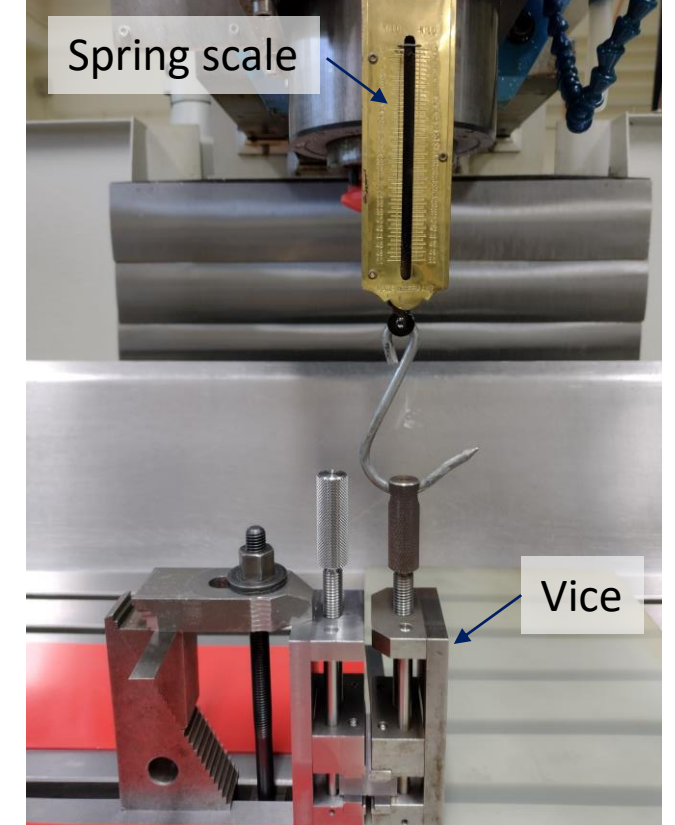
Next step

- Positioning alignment
- Photo spectrometer test ?
- Lab temperature control

Thanks for your attention

Strength Test – Shear Force

- Use milling machine
 - fused silica blocks clamped in vice
- Simple spring scale
- Sand down fused silica blocks
 - Remove ridge from laser cutting
- Prior damage from glueing jig
- Two attempts
 - 1st: 50 kg
 - 2nd: 38 kg
- One corner broke off in 2nd attempt
- Glue joint undamaged



Strength Test - Peeling

- Peel off fused silica block
 - Most likely case in bar box(?)
- Achieved 17 kg
- 2nd block disintegrated completely
 - Likely weakened by shear tests
- Glue joint undamaged



Glue joint