Status of module glueing and mechanical design

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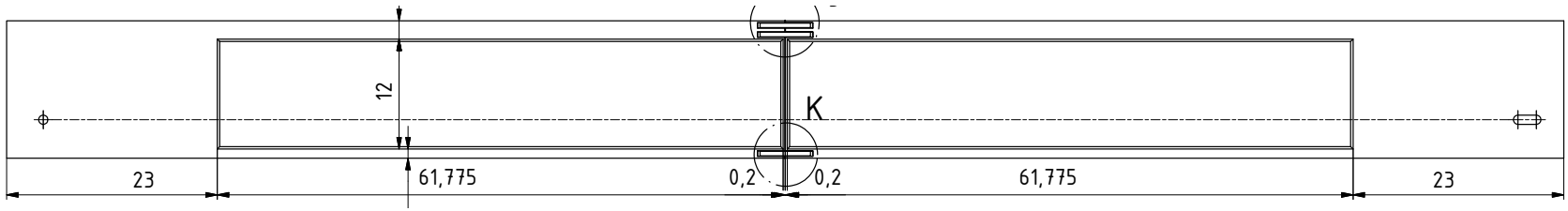
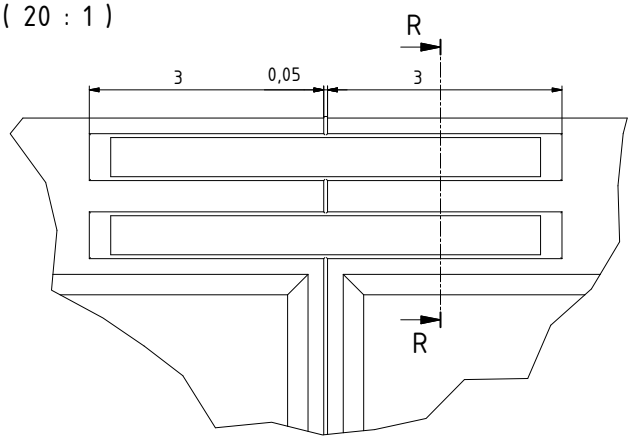
Module Glueing
Mechanical Tests
Mechanical Design

Glueing Scheme



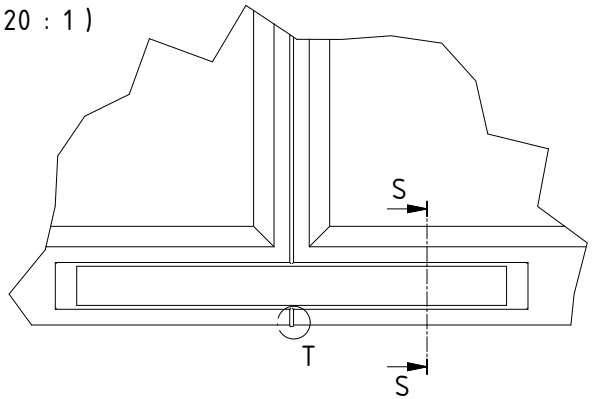
J (20 : 1)

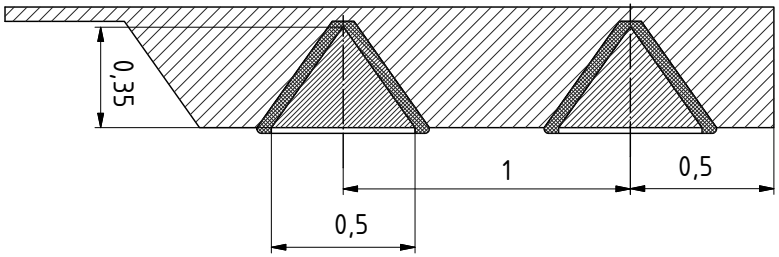


Scheme from Laci:

- front face glueing with minimal additional material
- dead area: 500 μm + glue
- reinforce glueing with ceramic reinforcement

K (20 : 1)

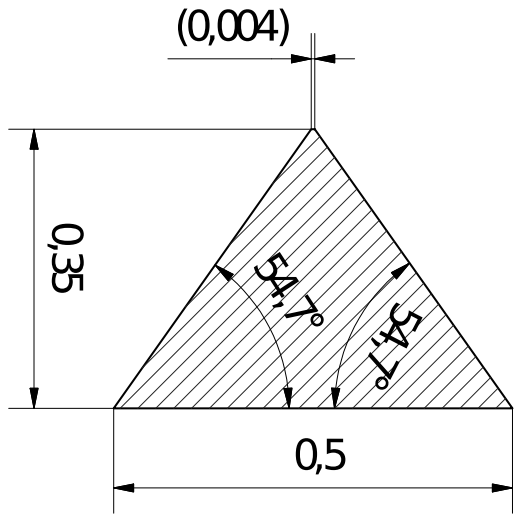


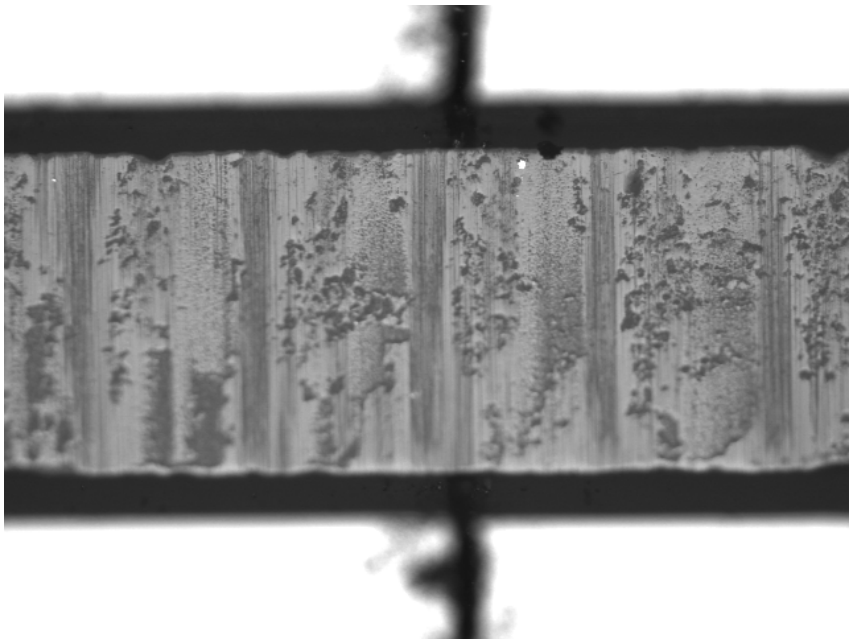


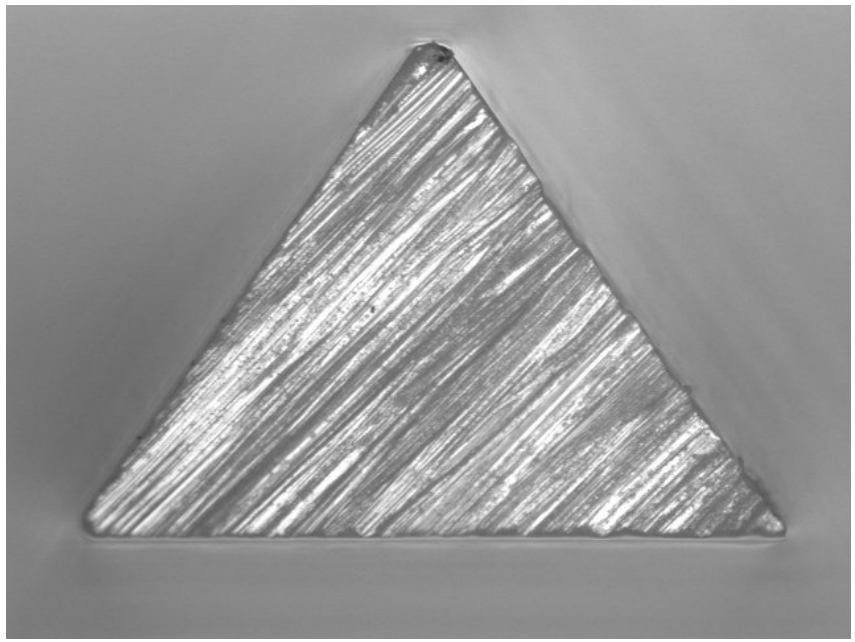
Ceramic Reinforcements

Initial batch of ceramic reinforcements received

- fitting very well into grooves

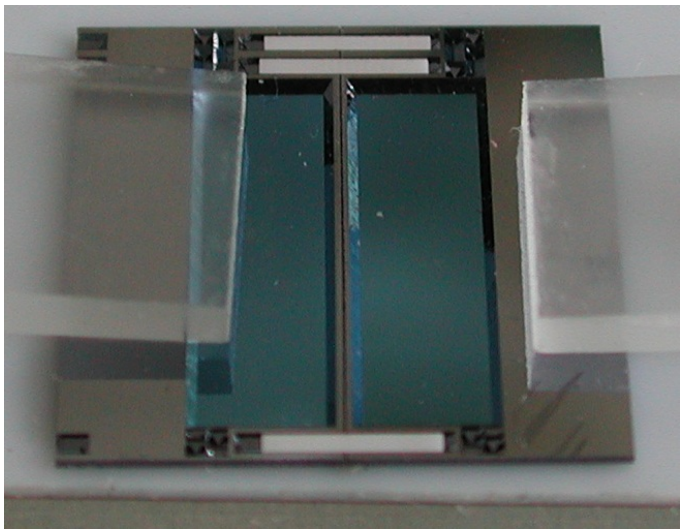


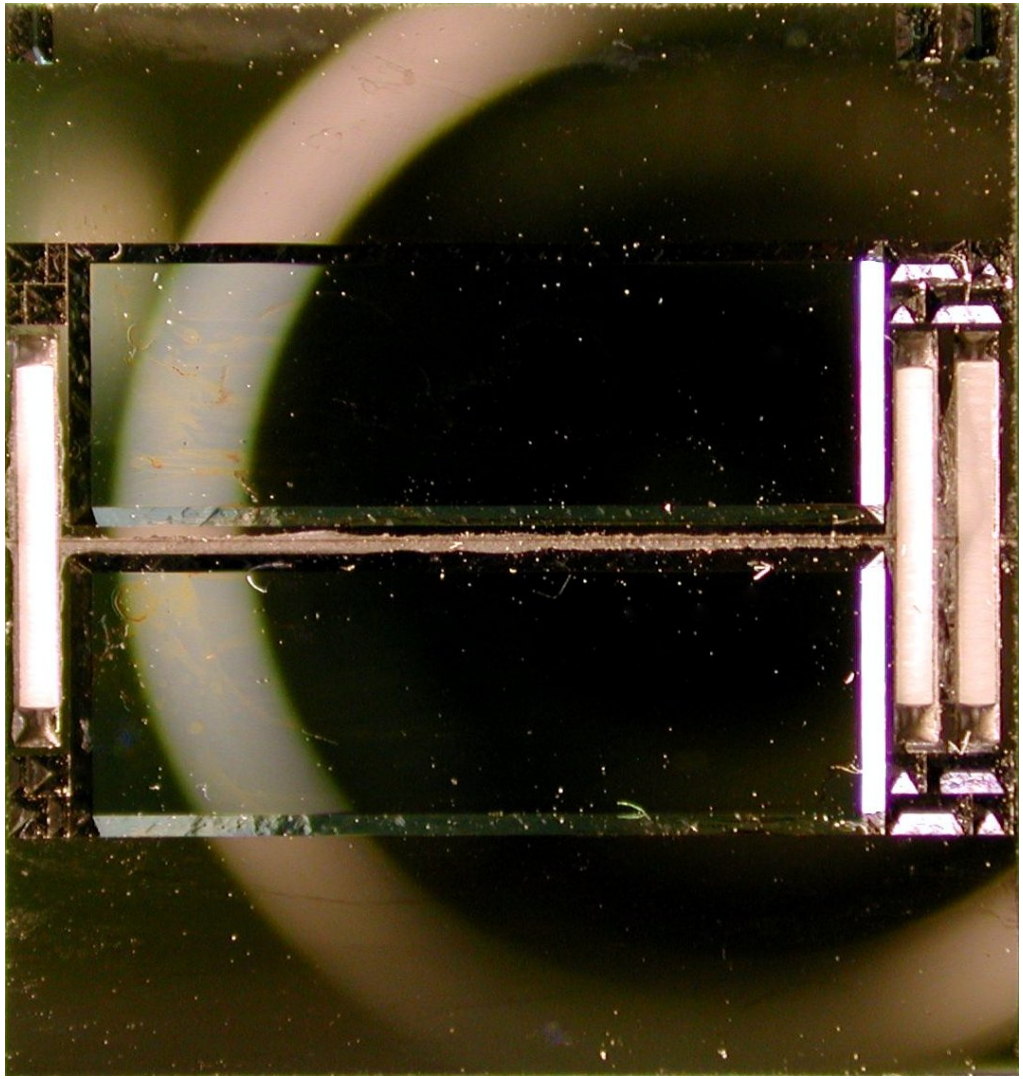




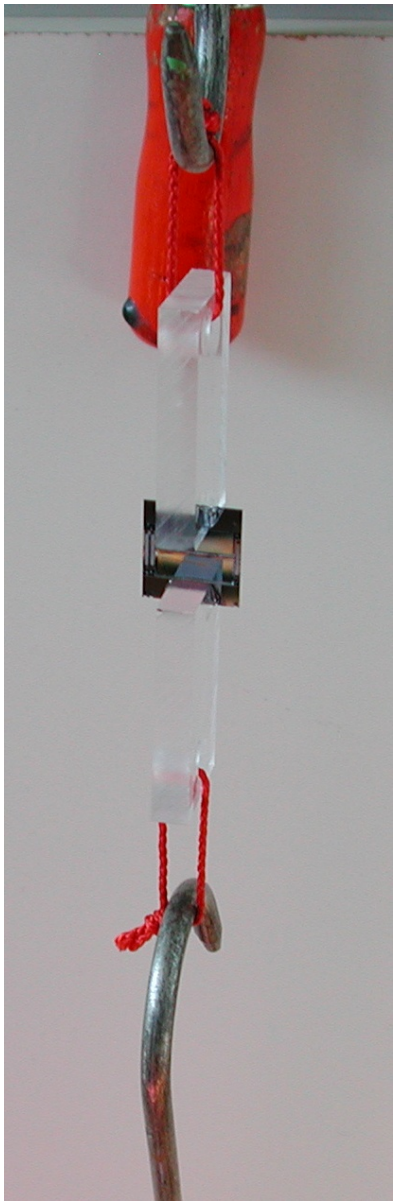
First Glueing

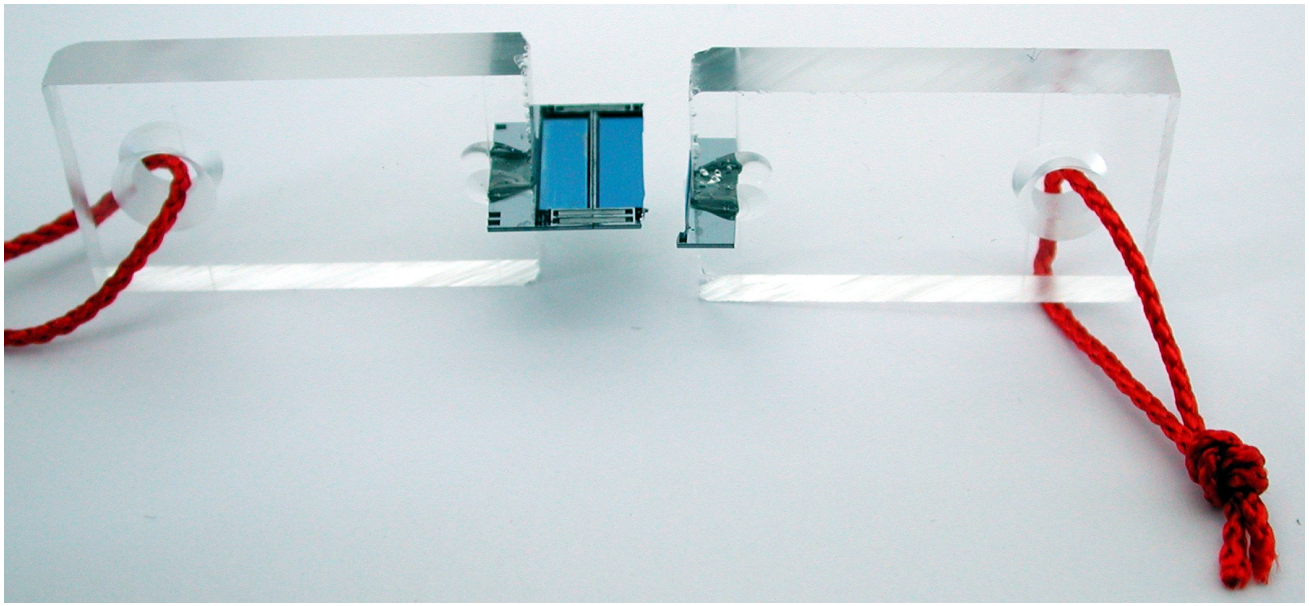
- first glueing of thinned down dummies (50 μm) done





Tensile Strength Test





First tensile strength test carried out:

- ends of the module fixated
- increasing force applied to pull the pieces apart
- solid 450 μm silicon tested to 7 kg
- unthinned front face glueing achieved $\sim$ 6 kg

Long time test (unthinned, 3 kg) still ongoing: 2 weeks already achieved

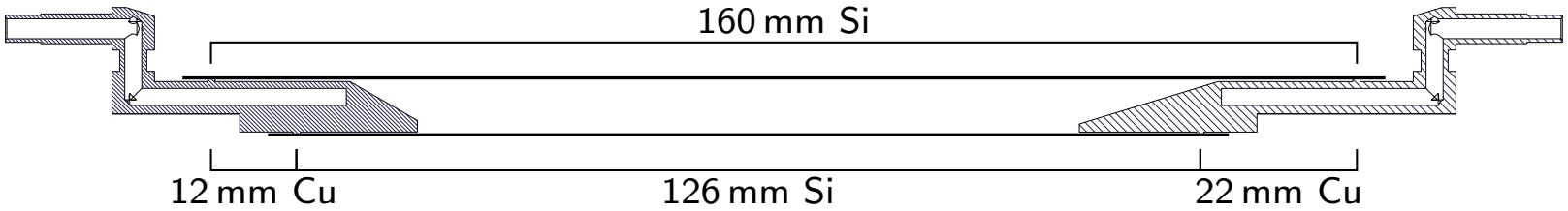
Strengh Test Results

- module broke just above 5 kg
- glue more or less still intact
- silicon seems to be weaker then glue (for 50 μm)
- additional tests scheduled

Mechanical Module Tests

Goal: Verify Mechanical Design

Baseline: Screwing of Modules

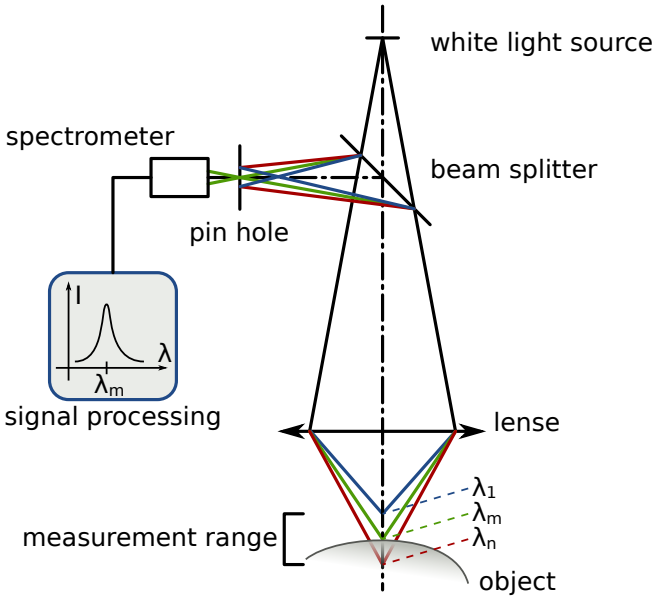


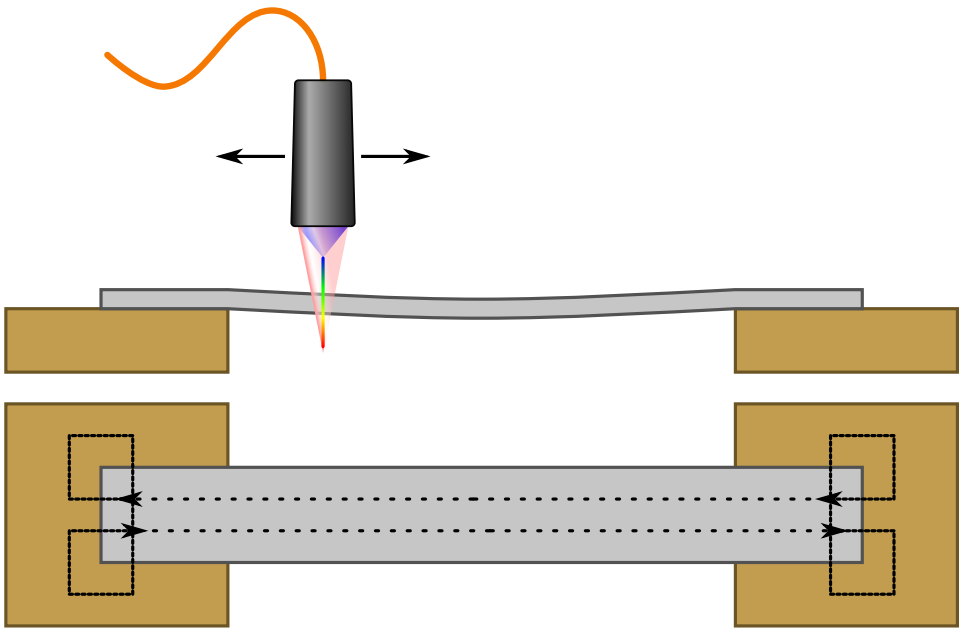
Difference between expansion of inner and outer layer $\sim 20\,\mu$m for $\Delta T = 40\,^{\circ}$C

we need to make sure that modules and glue remain stable over the whole temperature range

Precise position/distance measurement over "large" temperature range needed.

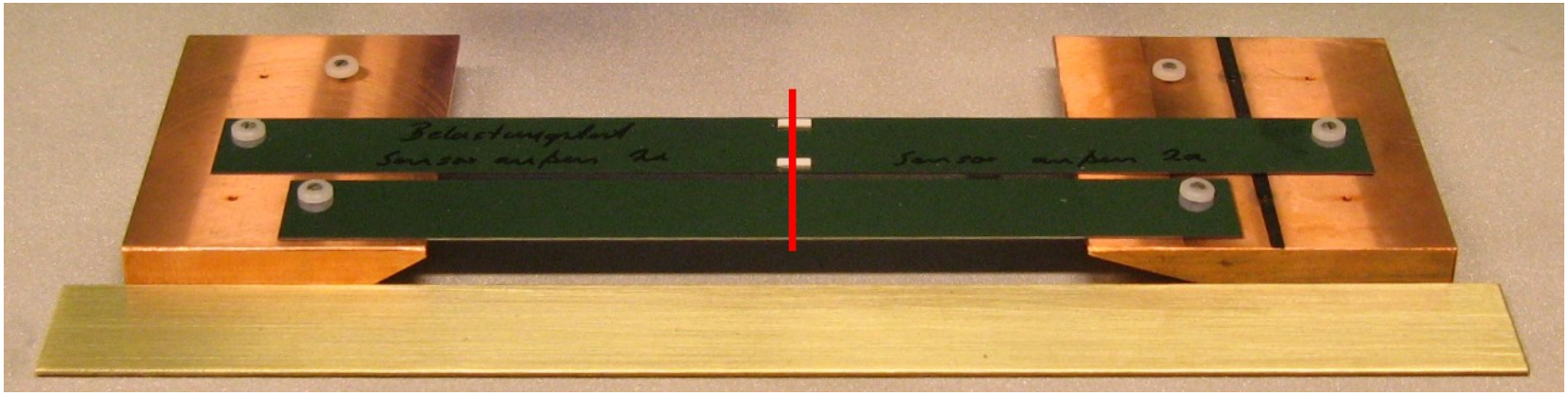
Confocal Chromatic Distance Sensor





- high resolution ($\sim 1\,\mu$m axial, $\sim 10\,\mu$m lateral)
- contact free measurement
- almost independent of material (max. slope depends on reflectivity)
- passive sensor: large temperature range possible
- high measurement rate up to 2 kHz

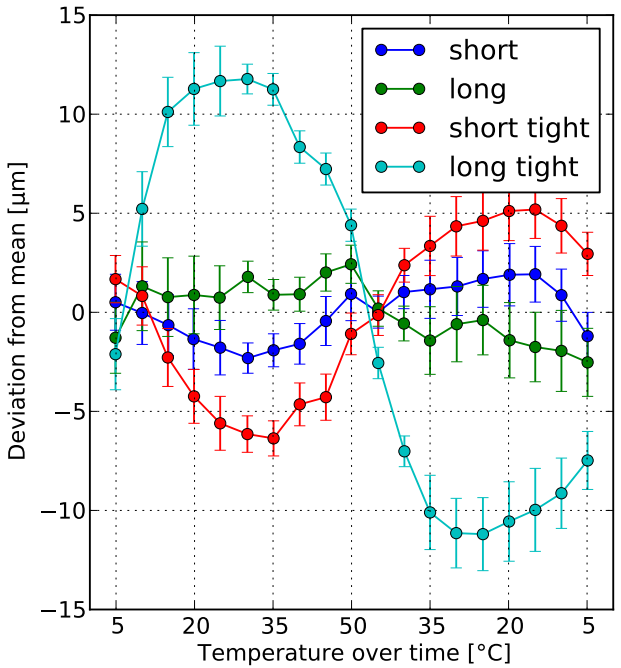
First tests



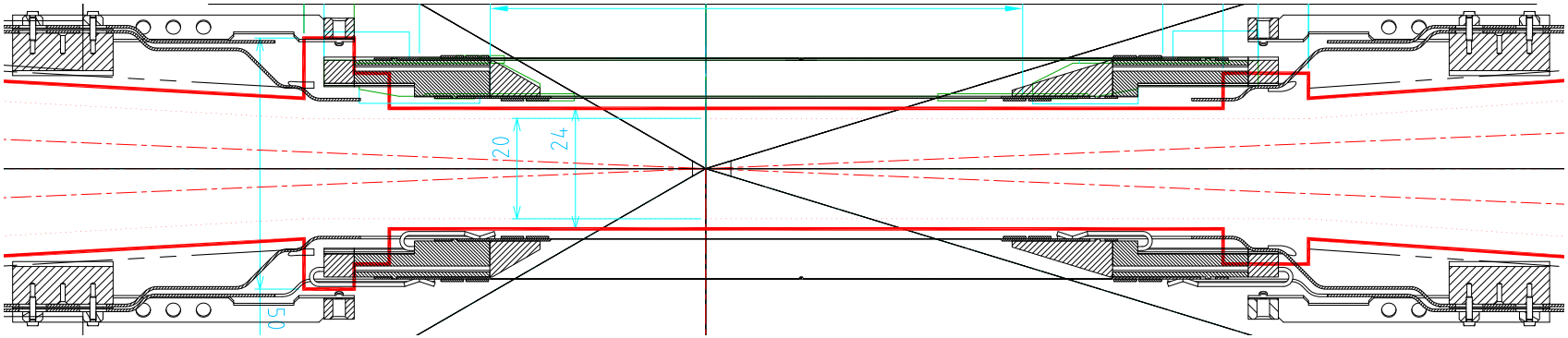
Obtained test system to check performance.
But: only measurement in one direction

- measured height of module surface
- covered $\Delta T = 45\,^{\circ}\mathrm{C}$
- first results: most changes are from movement of the stage
- no significant movement after preliminary calibration

⇨ additional run with tightened screws
  - movement visible, but not yet understood
  - silicon damaged due to high torque



Mechanical Design



Definition of length changed

We assumed the straight part to be 200 mm **excluding** cooling manifold
⇨ now including cooling

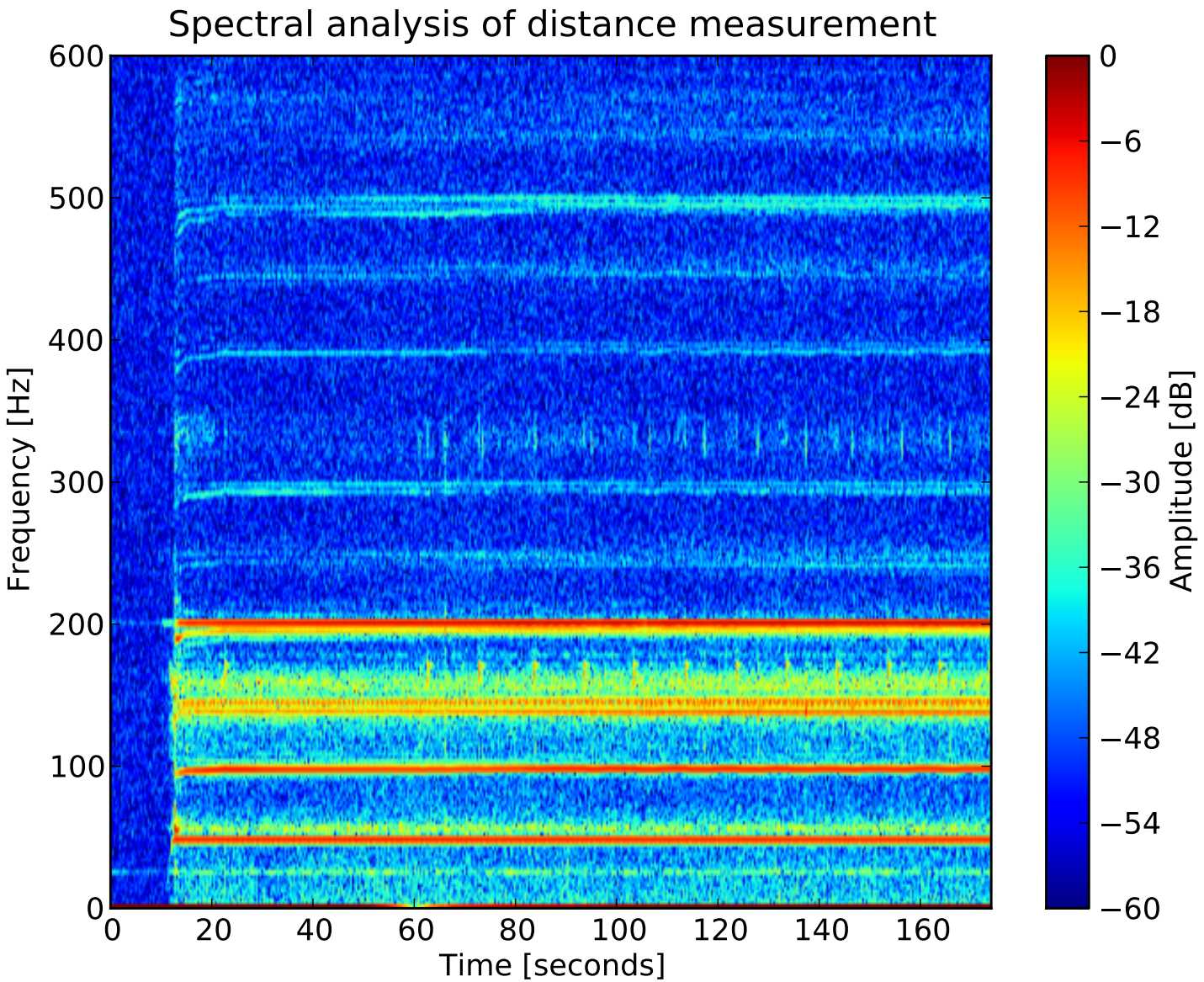
- "old" design not feasible
- currently estimating how to adapt existing design
- precise beam pipe layout needed

Conclusions

- first glueing of thinned modules successful
  - silicon showed tensile strength of $\sim 5\,\mathrm{kg}$
  - additional tests scheduled to verify
  - bowing test scheduled
- first temperature tests started
  - confocal measuring very promising
  - complete calibration of setup required
  - preliminary results show screwing to be feasible
- Mechanical design currently under redesign to adapt to new beampipe

Backup

Spectrogram of climate chamber



Movement of stage