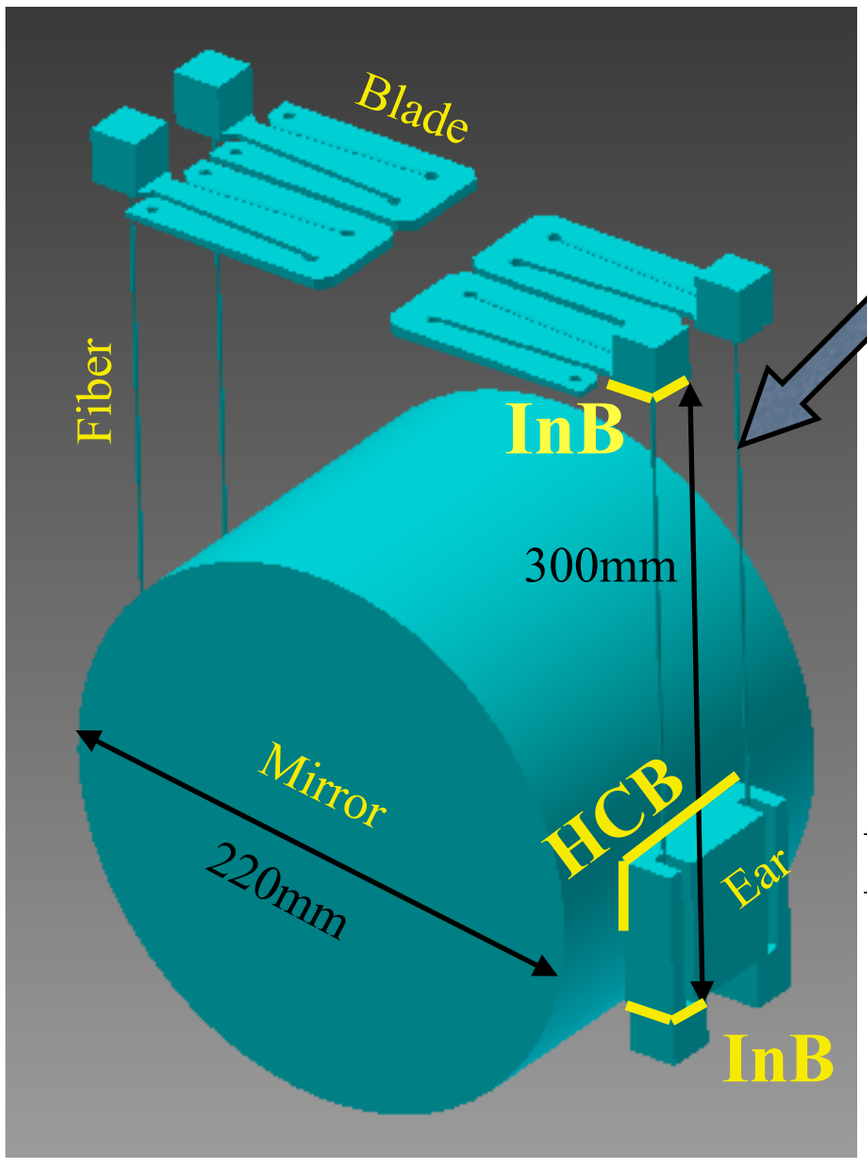
- The lop-eared suspension
- Status of the single R&D items
  - Heat conductivity measurements on fibers
  - Heat extraction through the weld **„nail** head – **fiber“**
  - **Heat conductivity through hydroxide catalysis and indium bonds**
  - Fiber Q measurements
  - Indium and HCB Q measurements
  - HCB strength test after thermal cycling
- Prototype experiments planned

Heat conductivity through hydroxide catalysis and indium bonds

- Purpose and requirement -

To know whether bondings can limit the heat extraction



Requirement for heat conductivity of a fiber(φ1.6mm) is 5000W/m/K

+

Bonding surface has 1cm^2 at least.

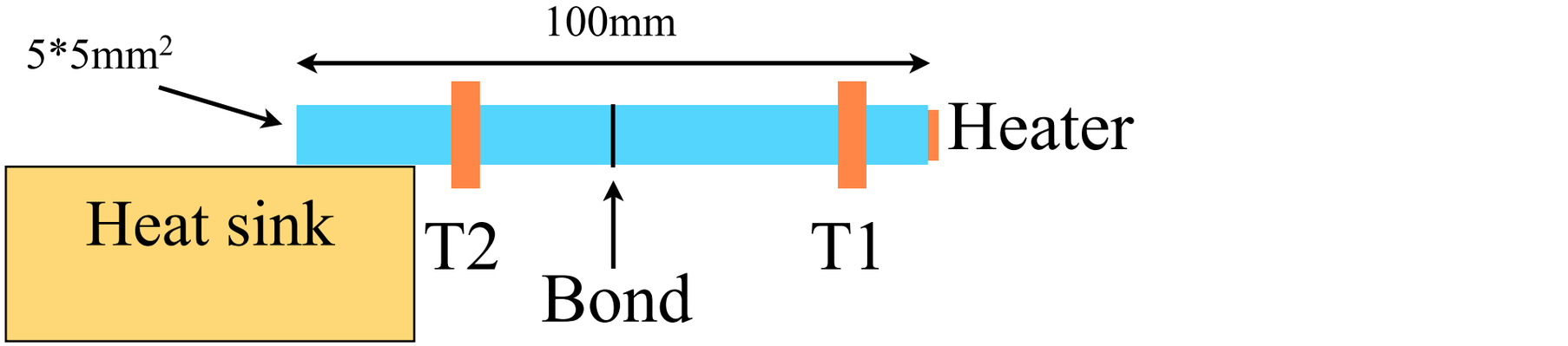
If bonded sapphire has more than **100W/m/K**, bondings don't limit the heat extraction.

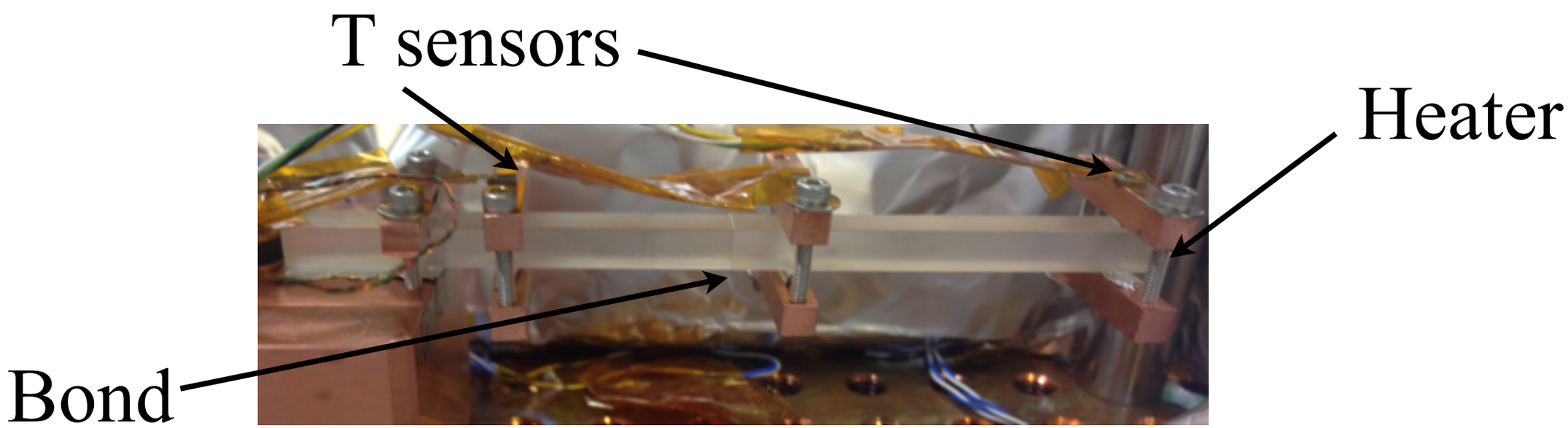
Bond

Heat conductivity through hydroxide catalysis and indium bonds

- Measurement -

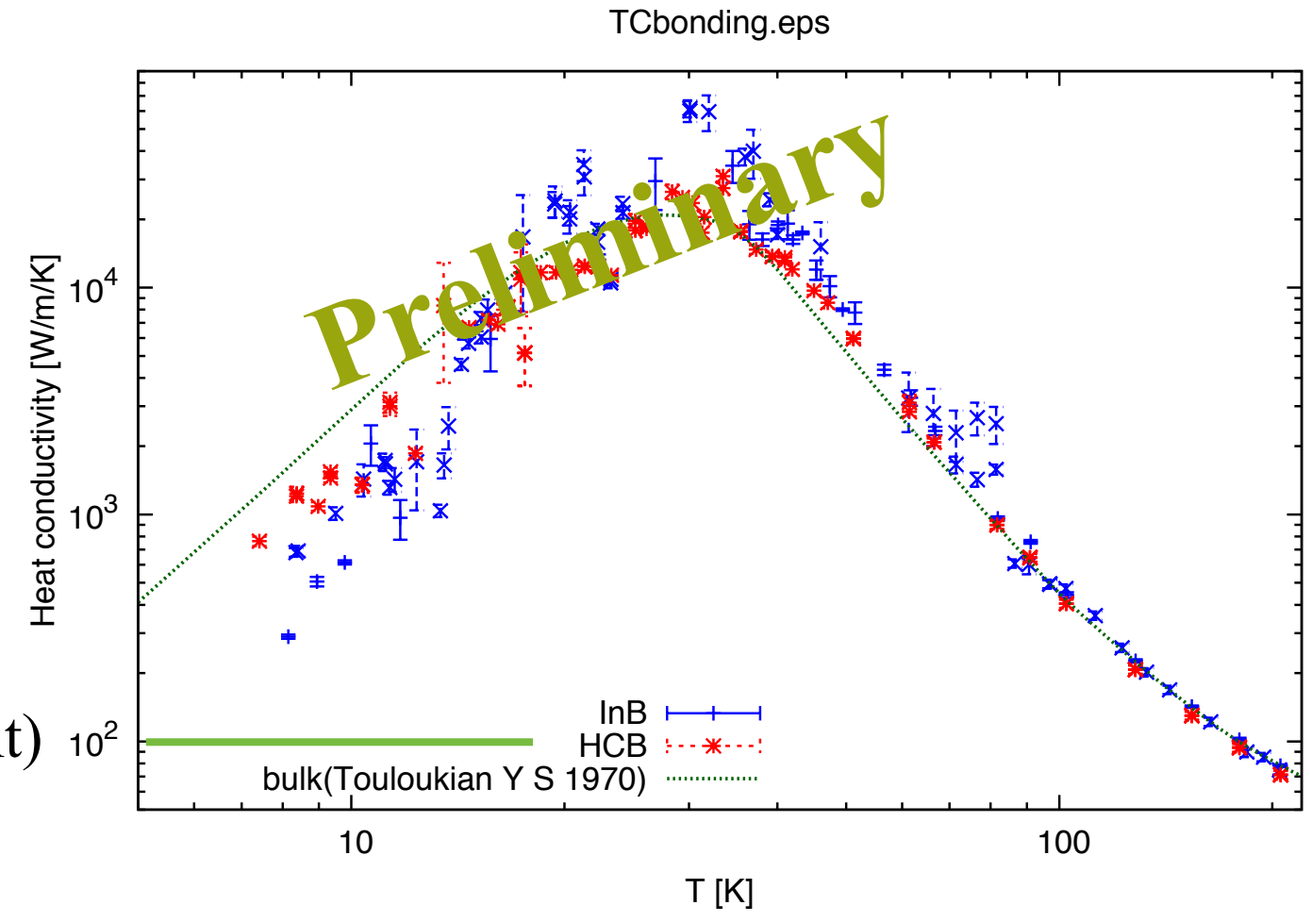
We did experiments in the same setup that was used to measure the heat conductivity of a fiber





Heat conductivity through hydroxide catalysis and indium bonds

- Result -



(Requirement)

The thermal conductivity of bonded samples seems to be sufficient for KAGRA, analysis in progress.

- The lop-eared suspension
- Status of the single R&D items
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  - Heat extraction through the weld „nail head – fiber“
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  - Indium and HCB Q measurements
  - HCB strength test after thermal cycling
- Prototype experiments planned

Fiber Q measurements

Purpose: measurement of sapphire Q for KAGRA mirror suspension.

We will use sapphire fibers (ϕ 1.6 mm) to suspend cooled sapphire mirrors(20K).

High thermal conductivity → keeping mirror temperature low

High Q value → lower thermal noise

Requirements

Thermal conductivity: 5000 W/m/K

Q value: 5×10^6

etc...

In Rome, we tested two samples with good thermal conductivity.

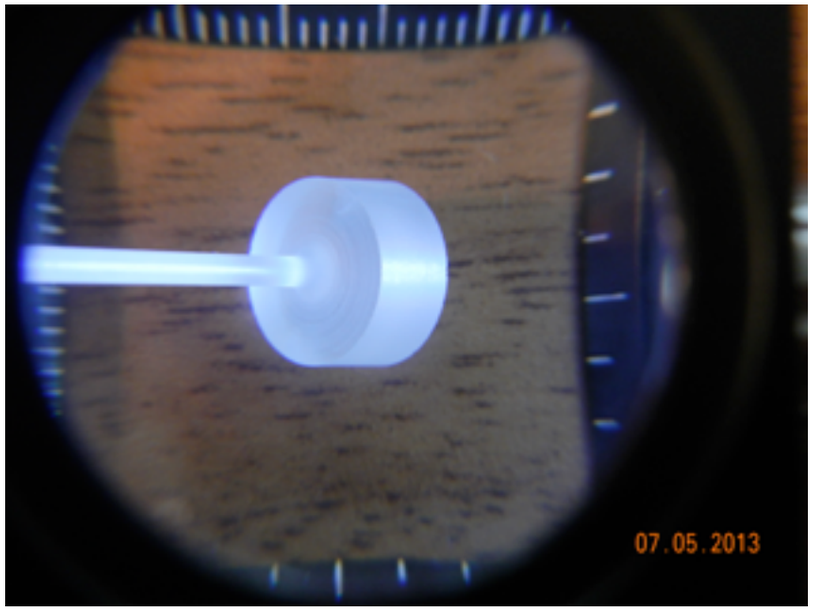
Fiber 1: 5000 W/m/K @20K

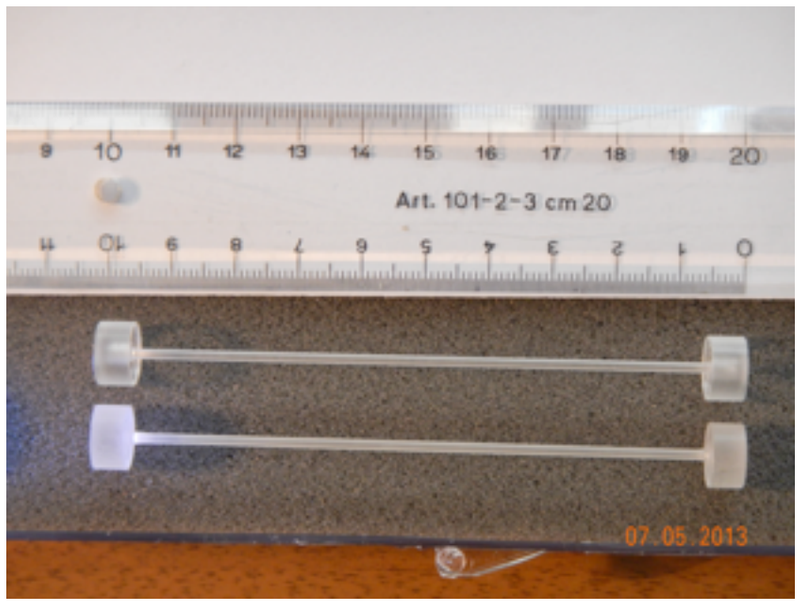
Fiber 2: 6000 W/m/K @20K

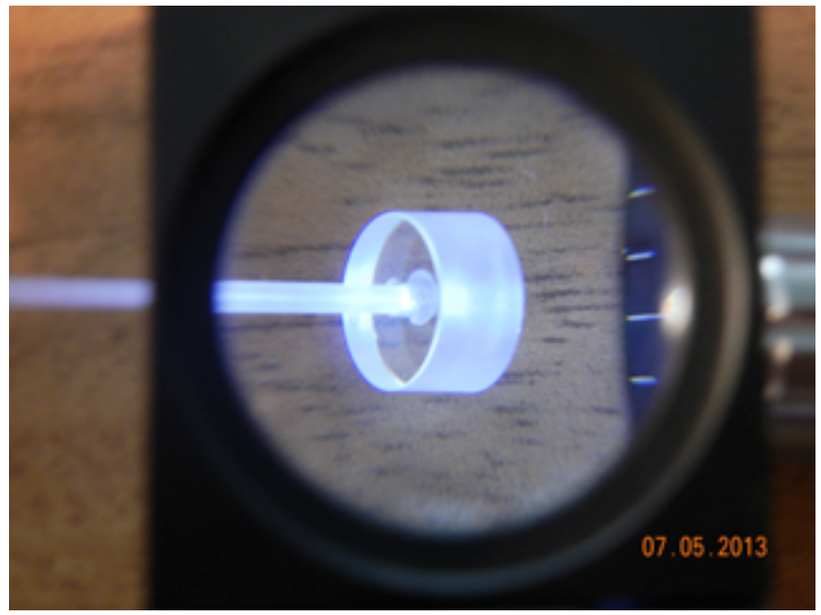
Already explained before

Our purpose is measuring the Q value of these fibers @ 20K

Sapphire fibers for Q measurement







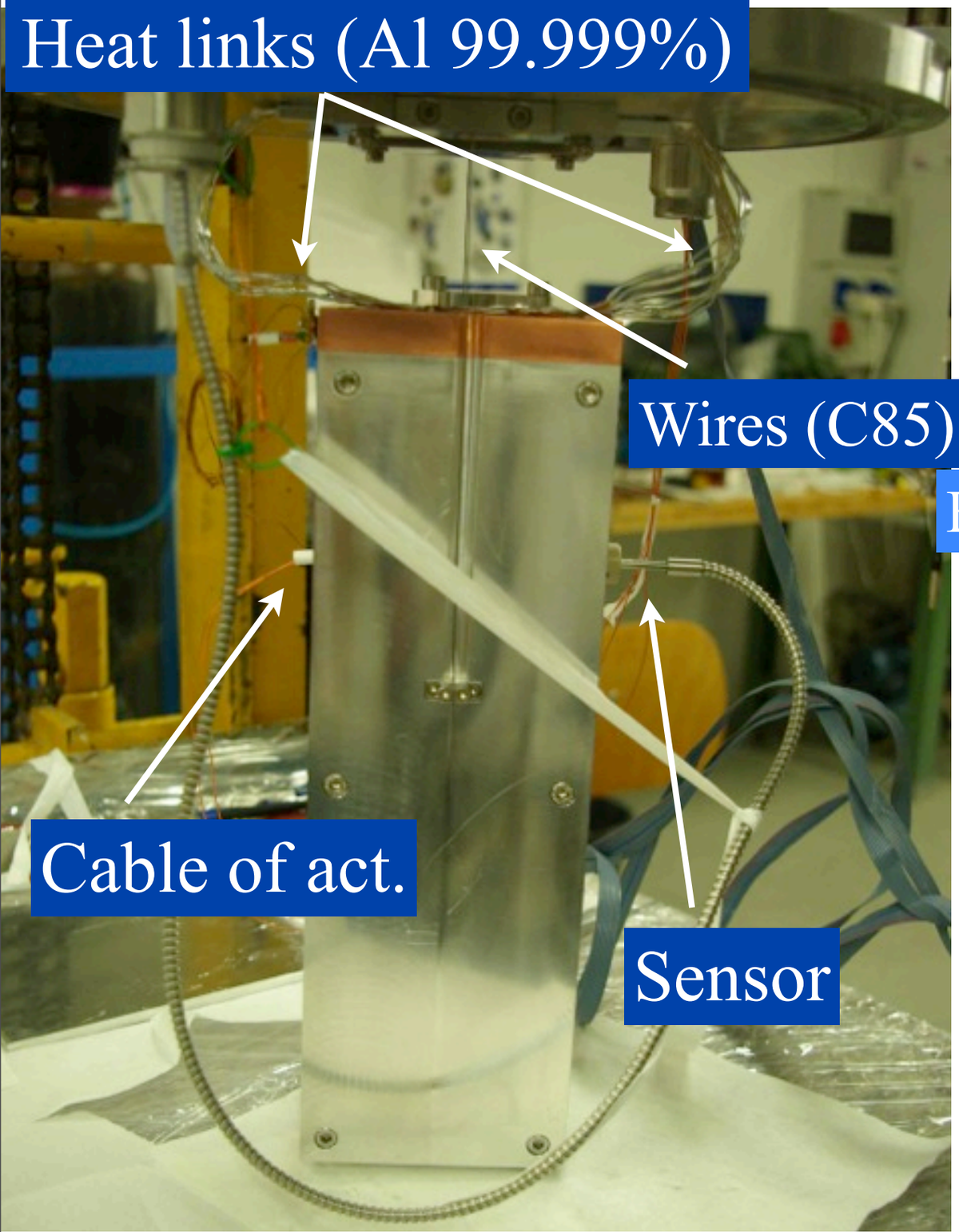
Fiber 1:

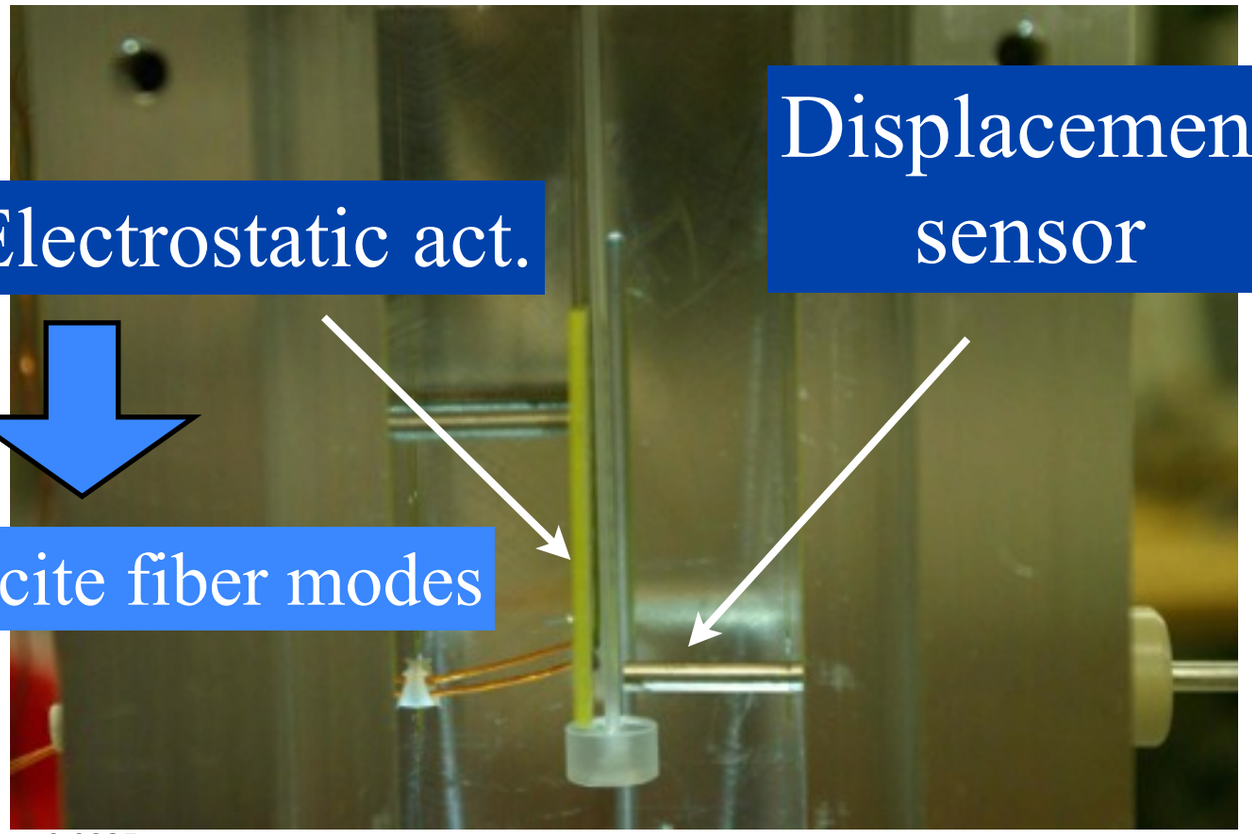
- 5000 W/m/K @20K
- Monolithic

Fiber 2:

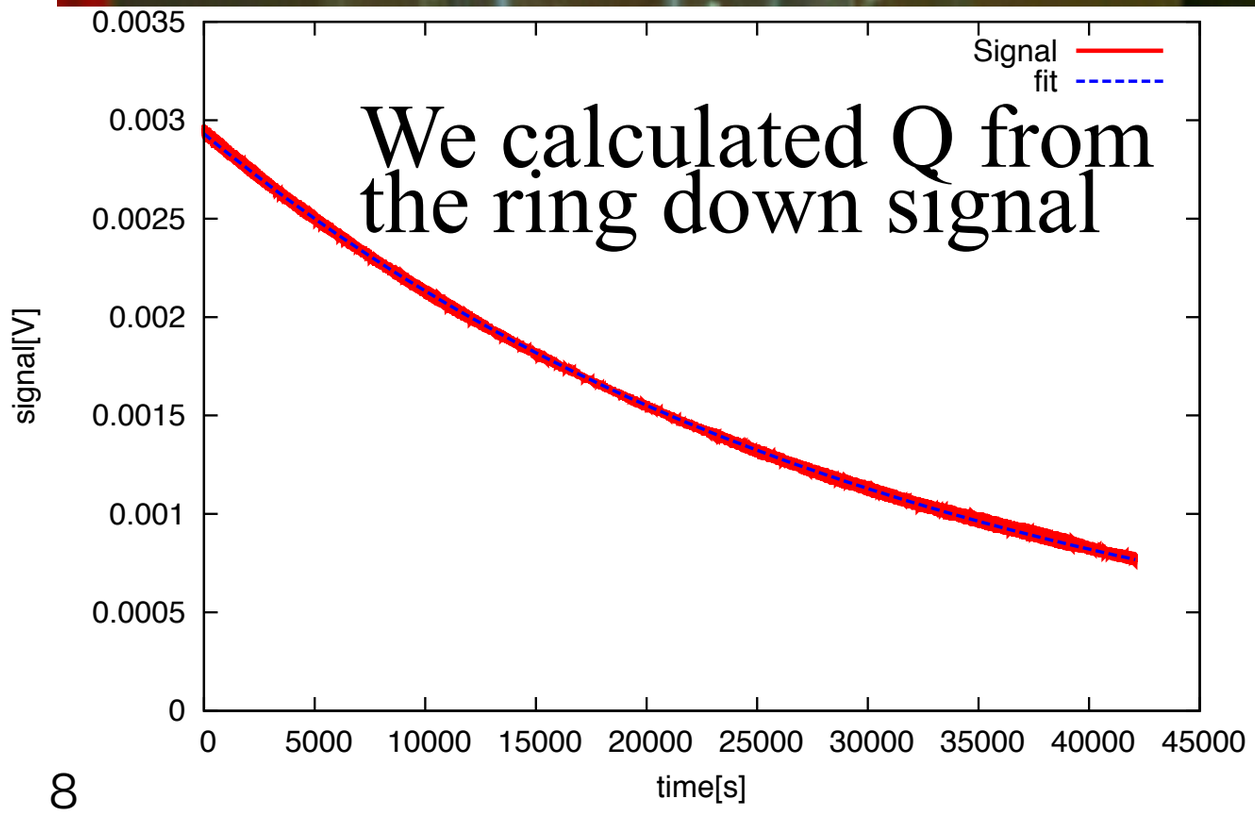
- 6000 W/m/K @20K
- Non-monolithic
- Brazed
- HEM sapphire
- Thermopolished

Measurement setup



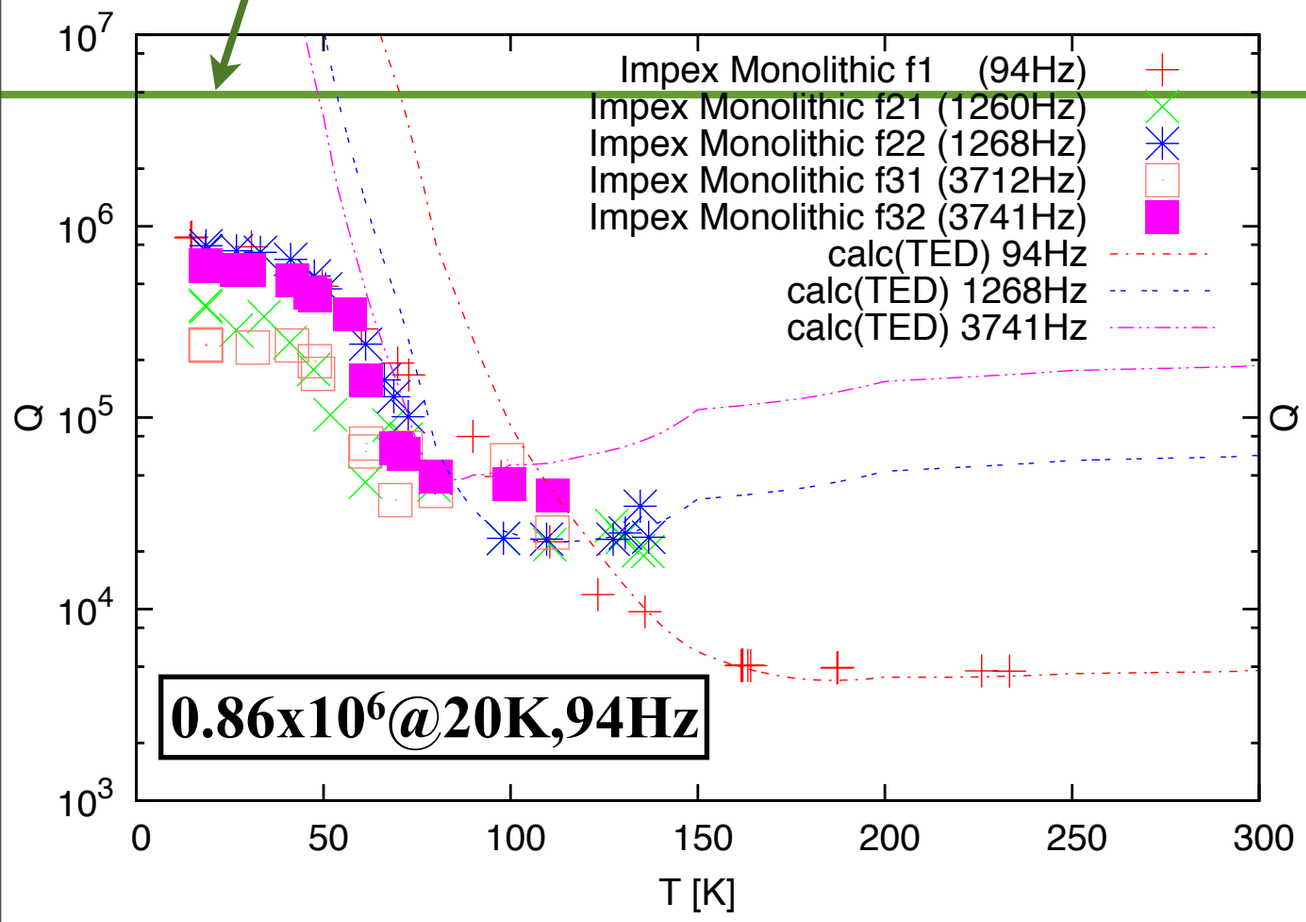


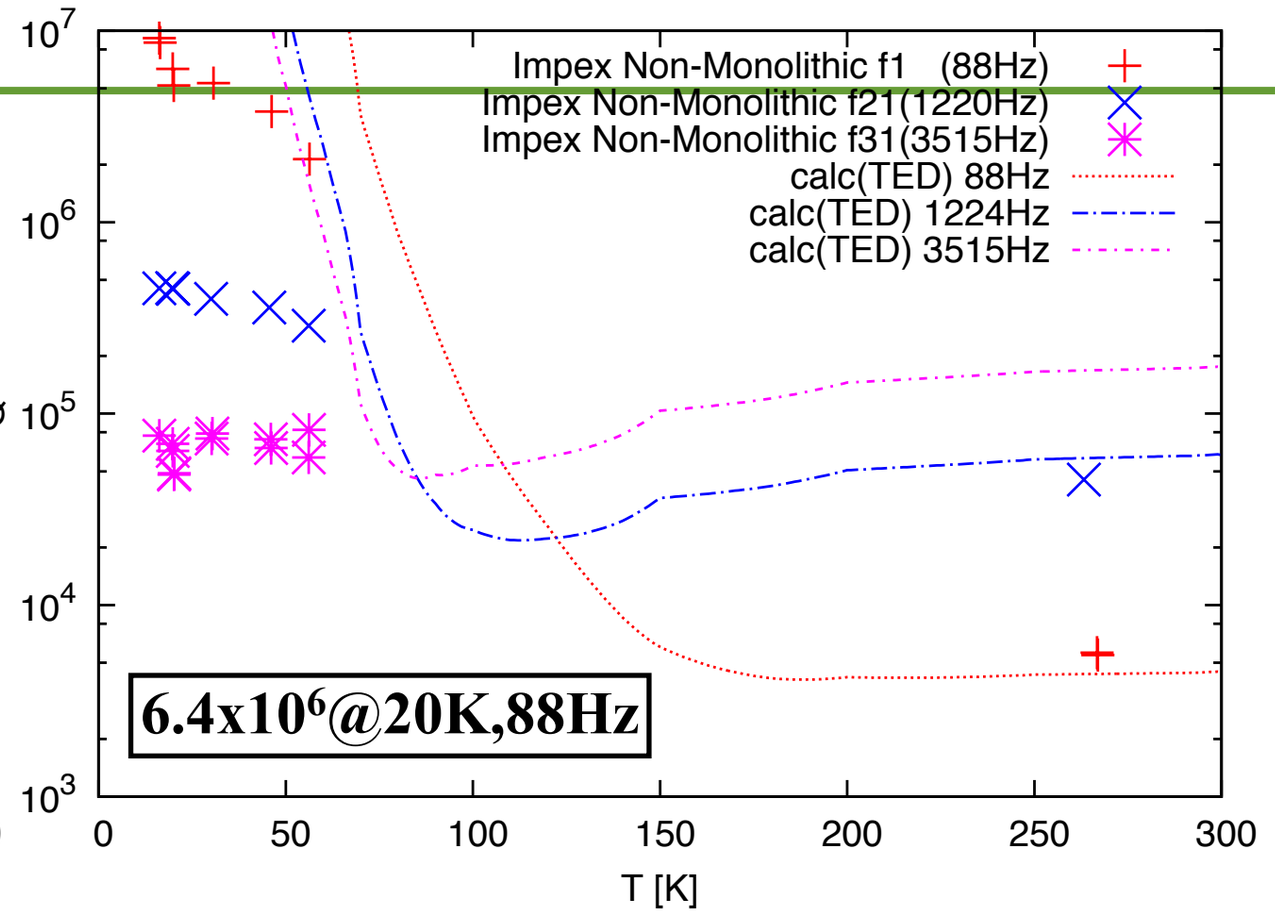
Excite fiber modes



Result

Requirement (5x10⁶@20K)



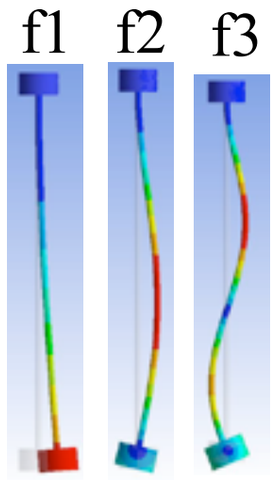


Fiber 1:

- 5000 W/m/K @20K
- Monolithic

Low Q

Modal simulation

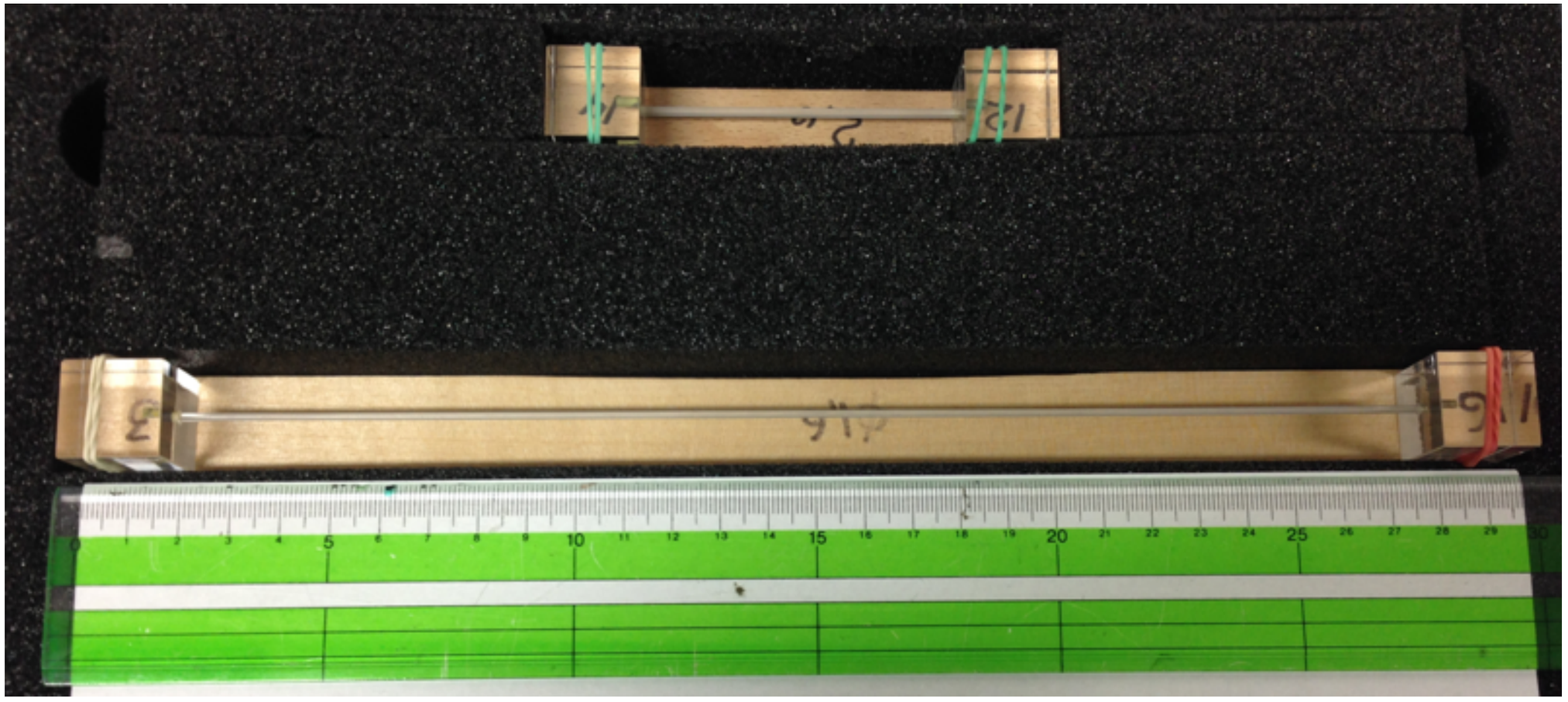


Fiber 2:

- 6000 W/m/K @20K
- Non-monolithic
- Brazed throu
- HEM
- Thermopolish

High Q
Higher than requirement

Next Q measurement



Q measurements of long fibers (KAGRA-like) will start in 2 weeks

- The lop-eared suspension
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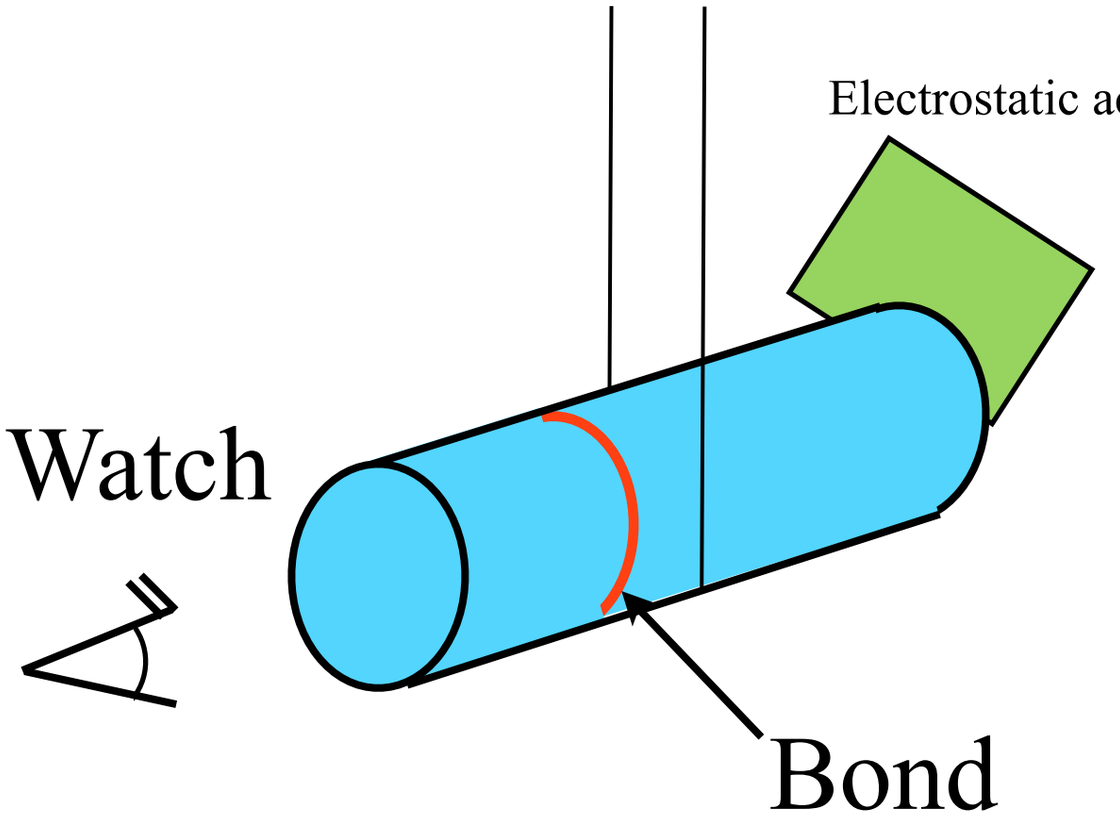
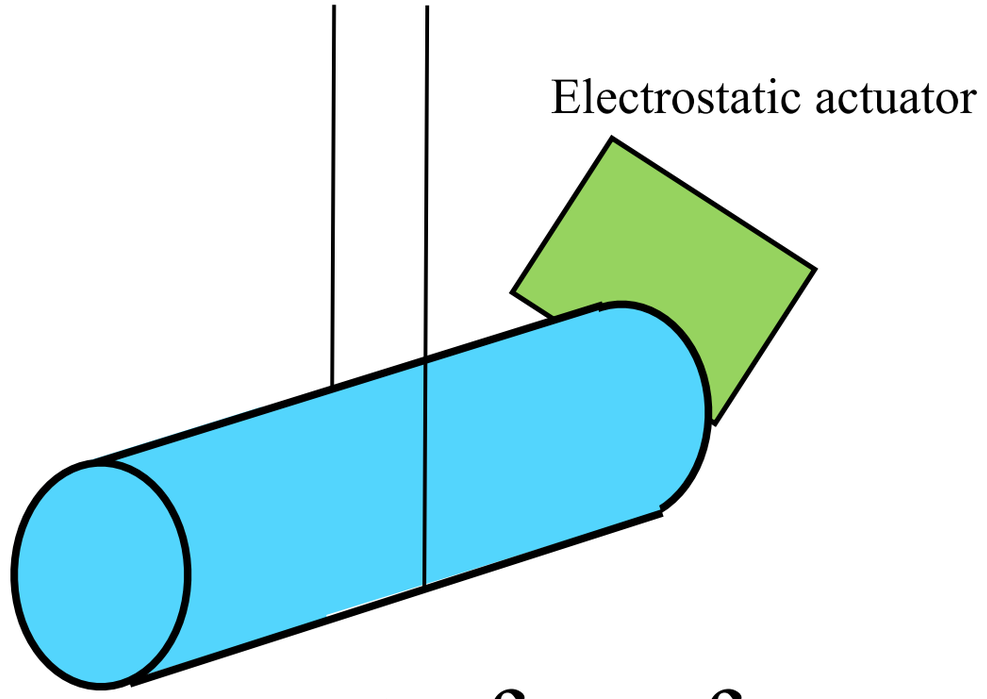
  - **Indium and HCB Q measurements**
  - **HCB strength test after thermal cycling**
- **Prototype experiments planned**

Q measurement of bond

To estimate thermal noise from the bond, the Q of bonds will be measured in Jena and Glasgow from the next month on

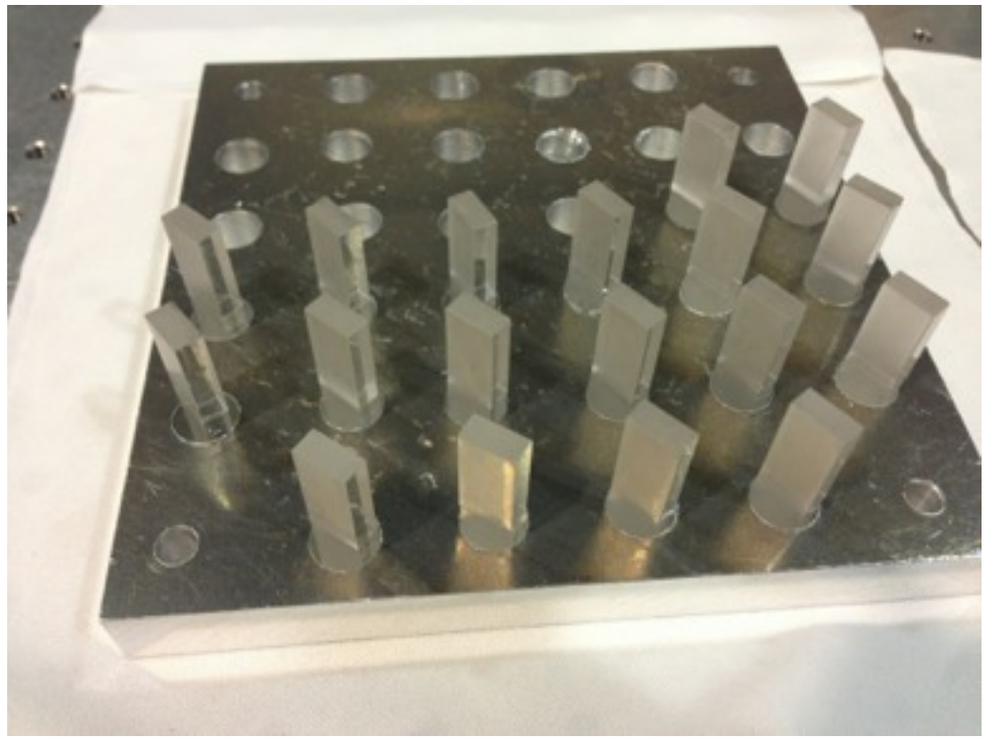


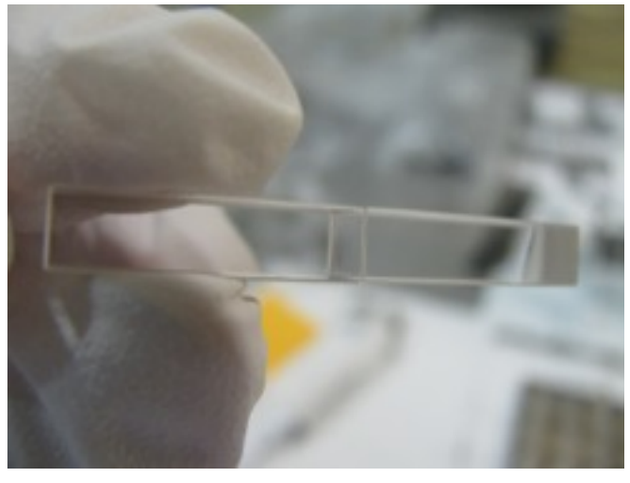


Measurement of a reference sapphire bulk sample already completed in Jena

HCB strength test after thermal cycling

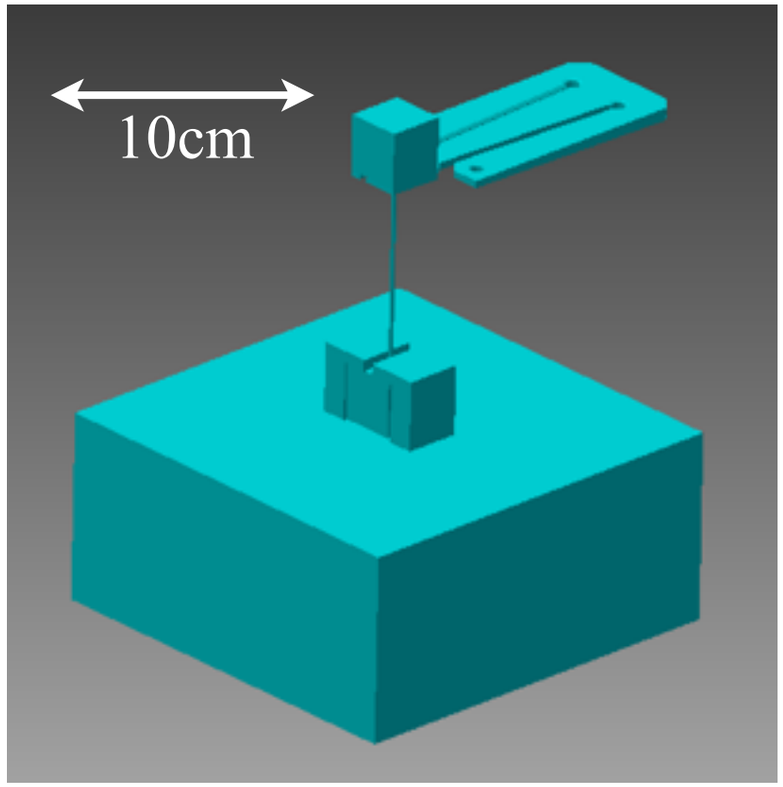
A strength test of HCB after 10 and 20 thermal cycles will be done in August
For this experiment, we made HCB samples last Friday (many thanks to Marielle).



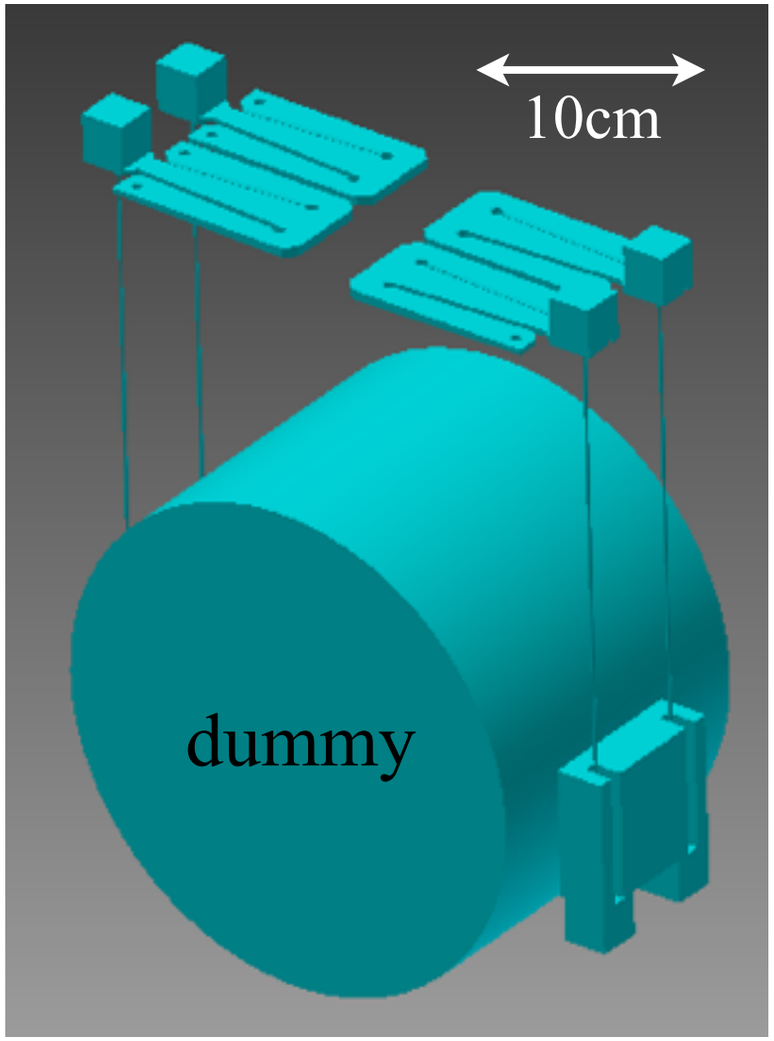


Prototype experiments

Two prototype experiments are planned in the near future.



Heat extraction
Q of fiber
Blade spring
Assembly



Assembly
Ear