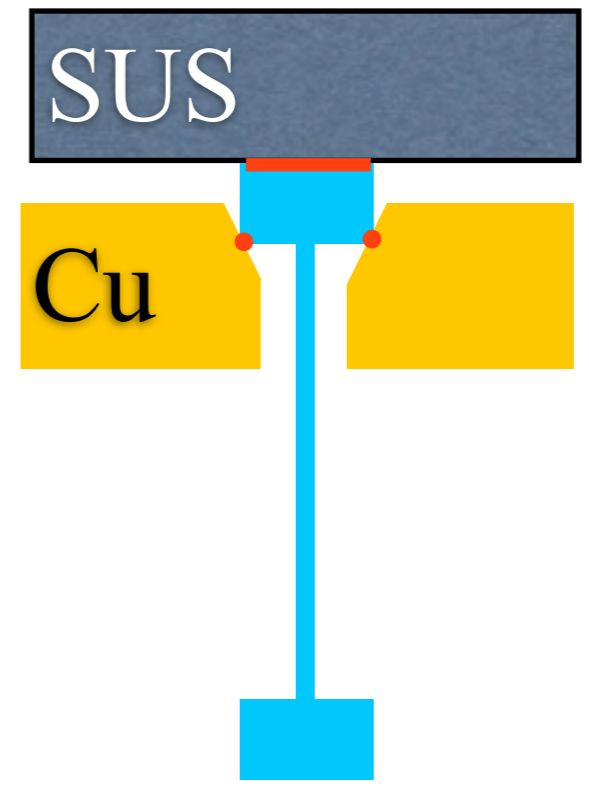
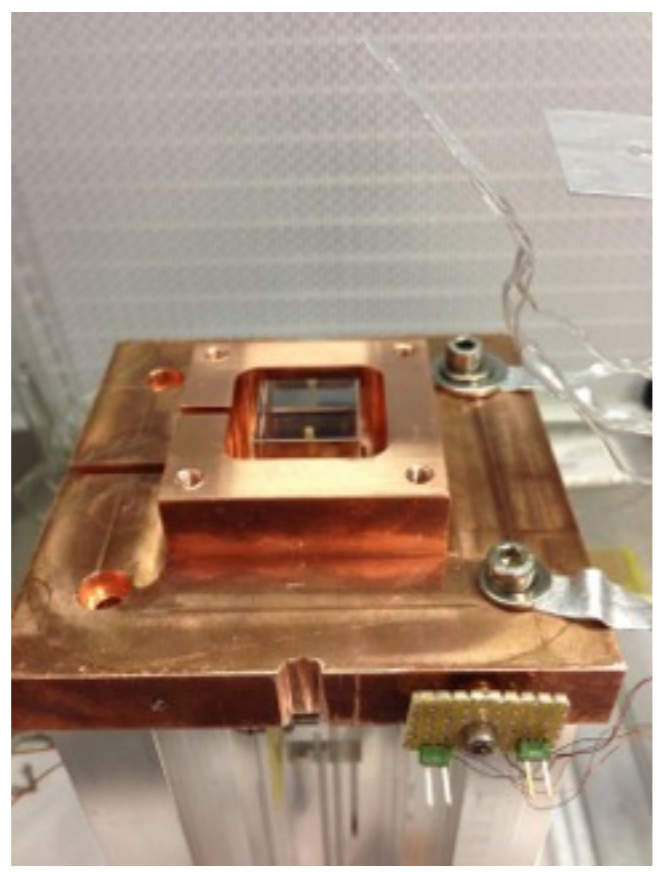
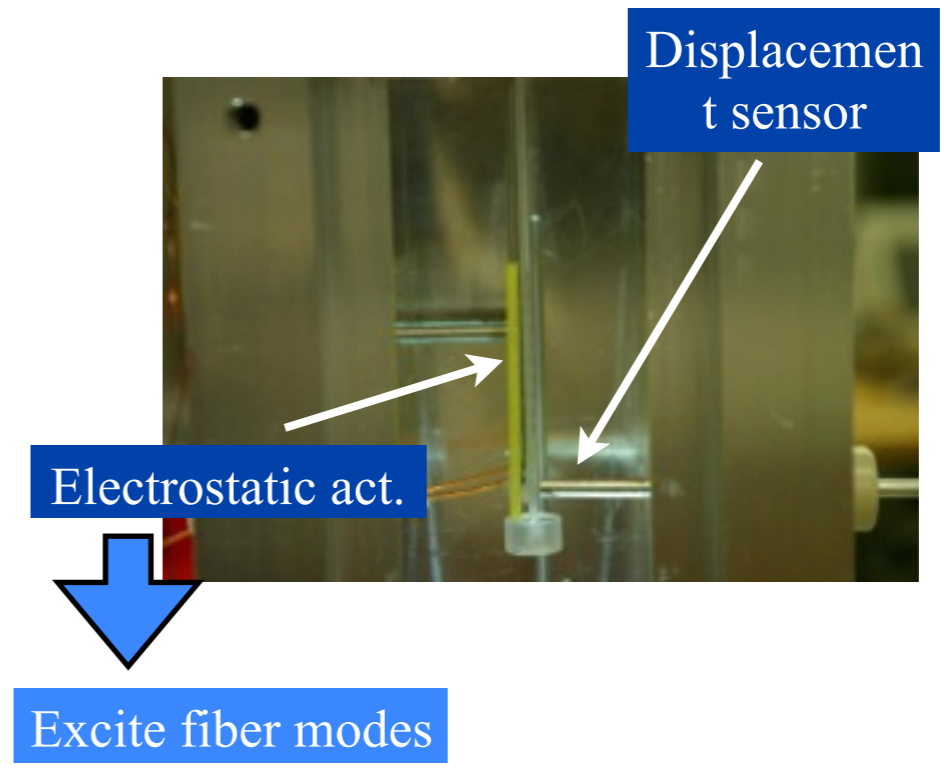
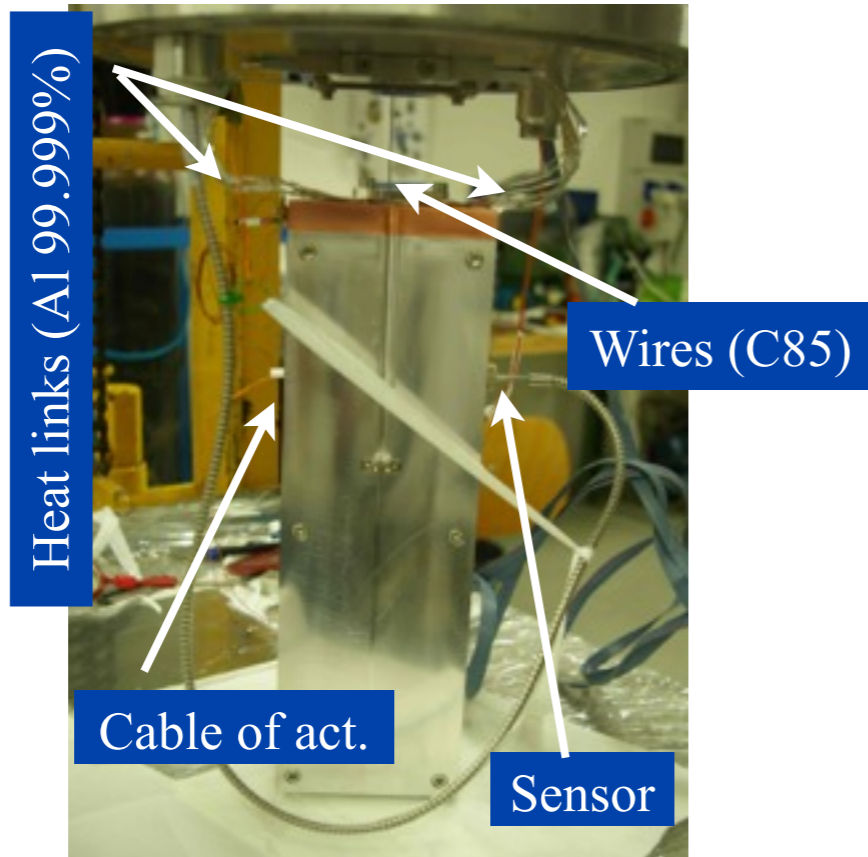


Q measurement of sapphire fibers (Rome)

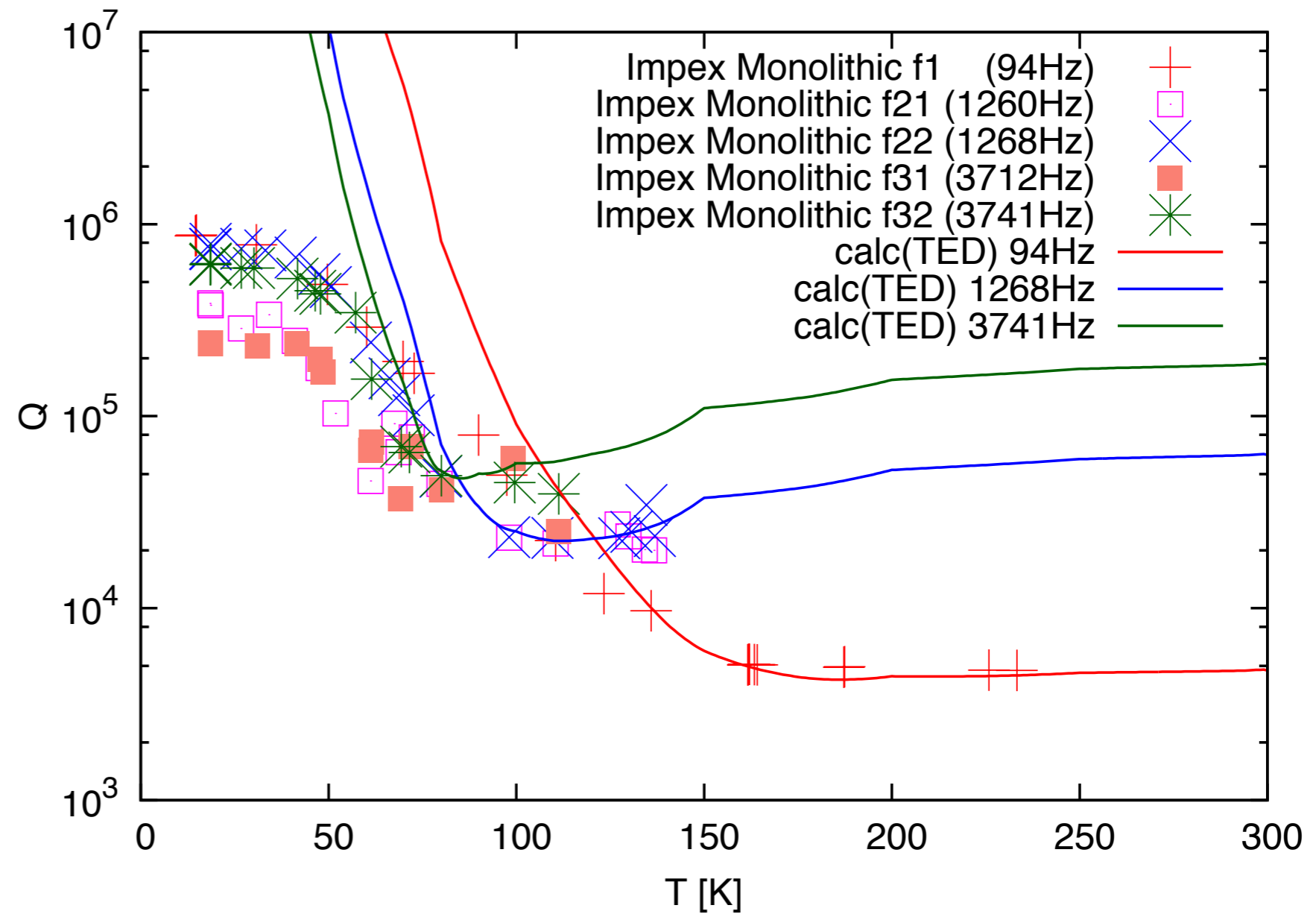
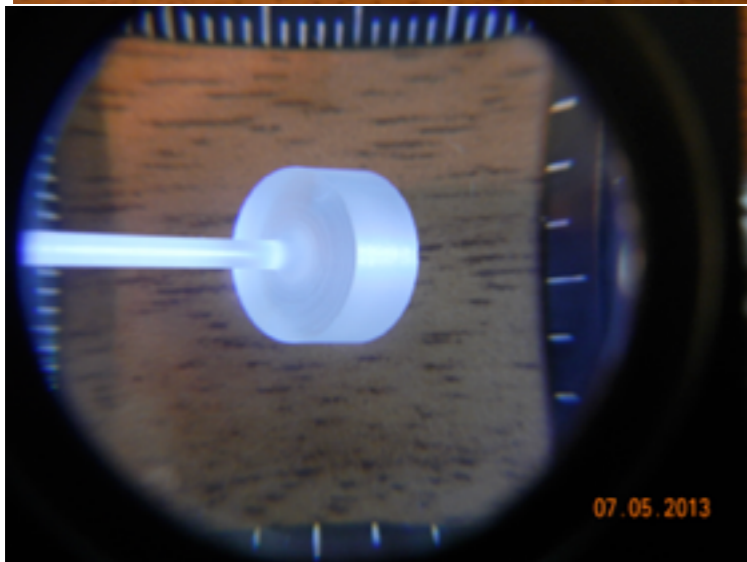
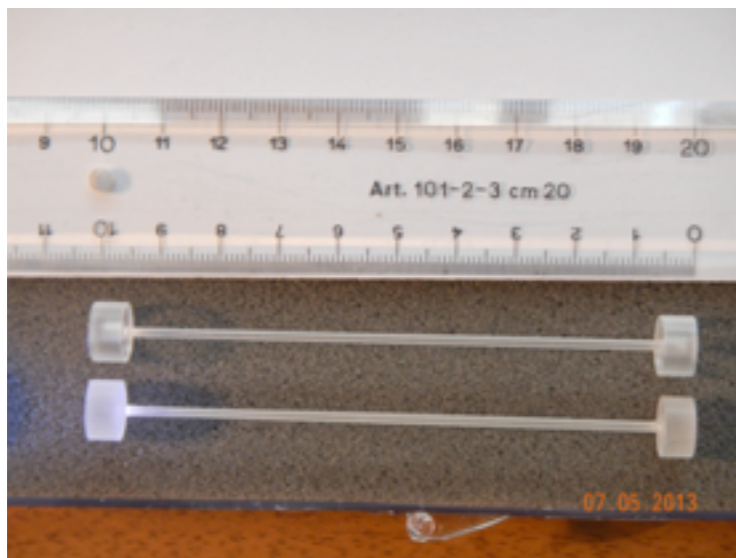
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Measurement setup



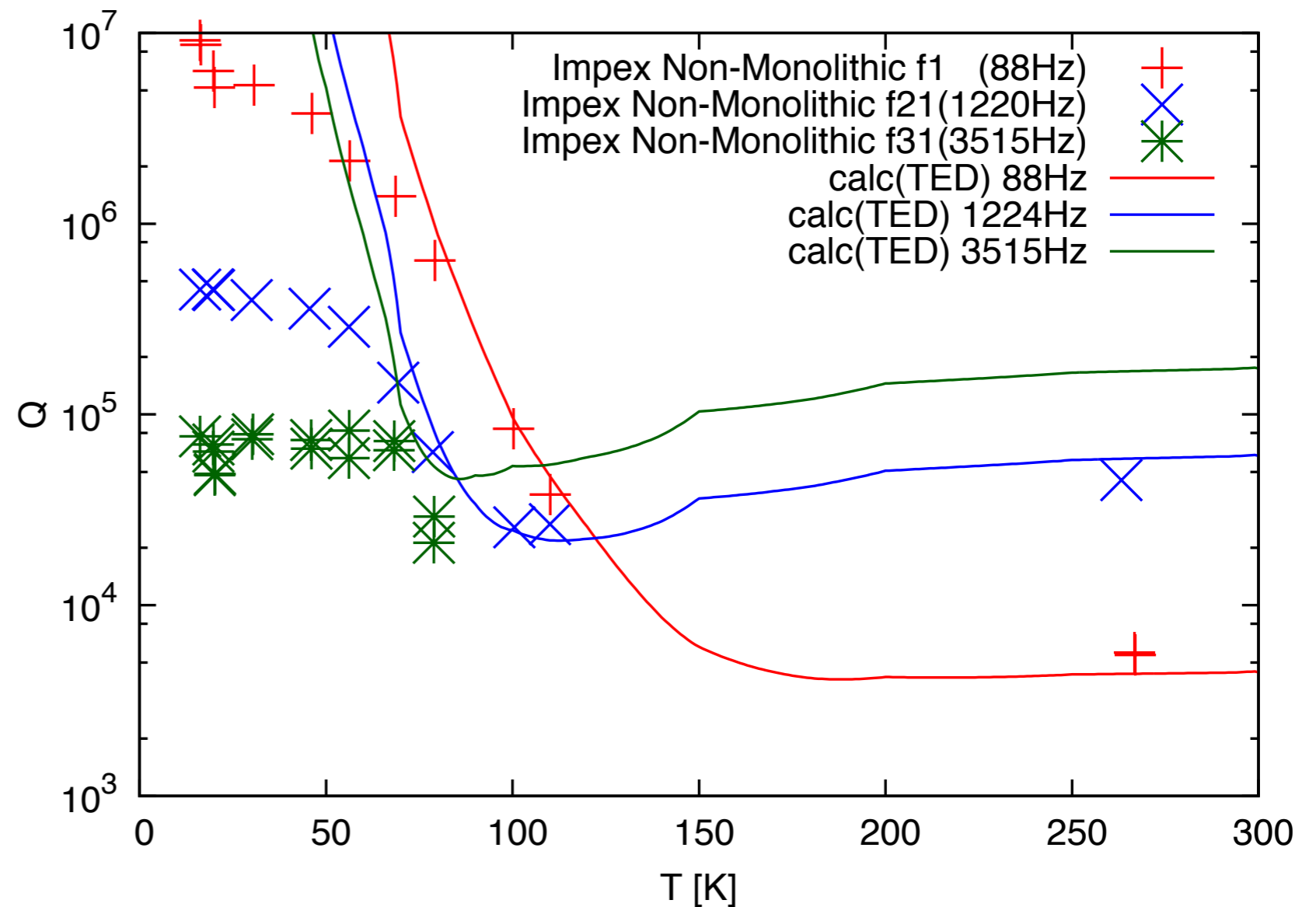
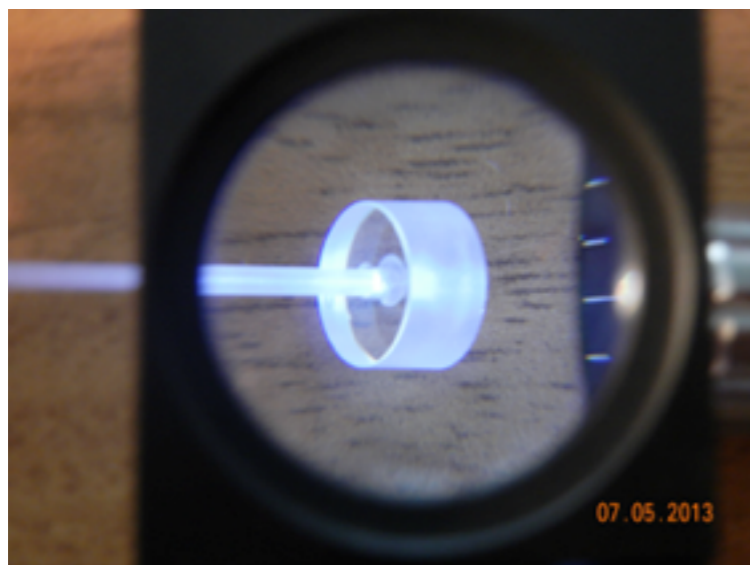
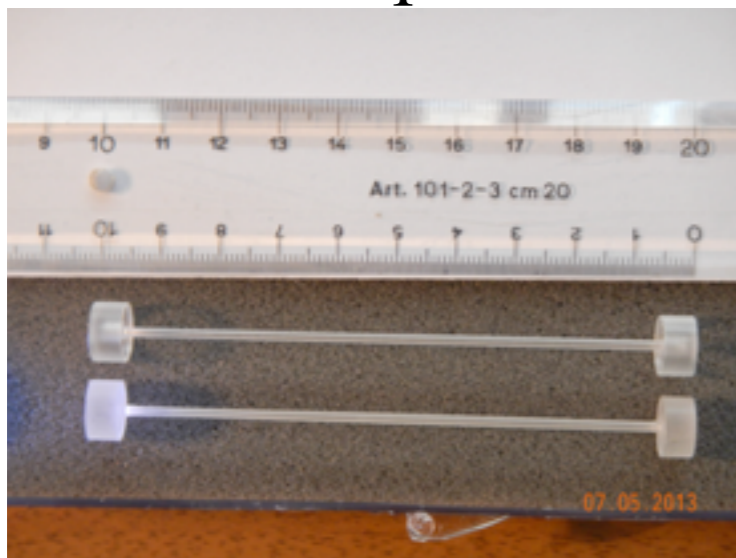
Fiber A (Sho, SH, Mo, NQ, NT)

- Short
- Small head
- Monolithic
- Normal quality
- No thermal polish



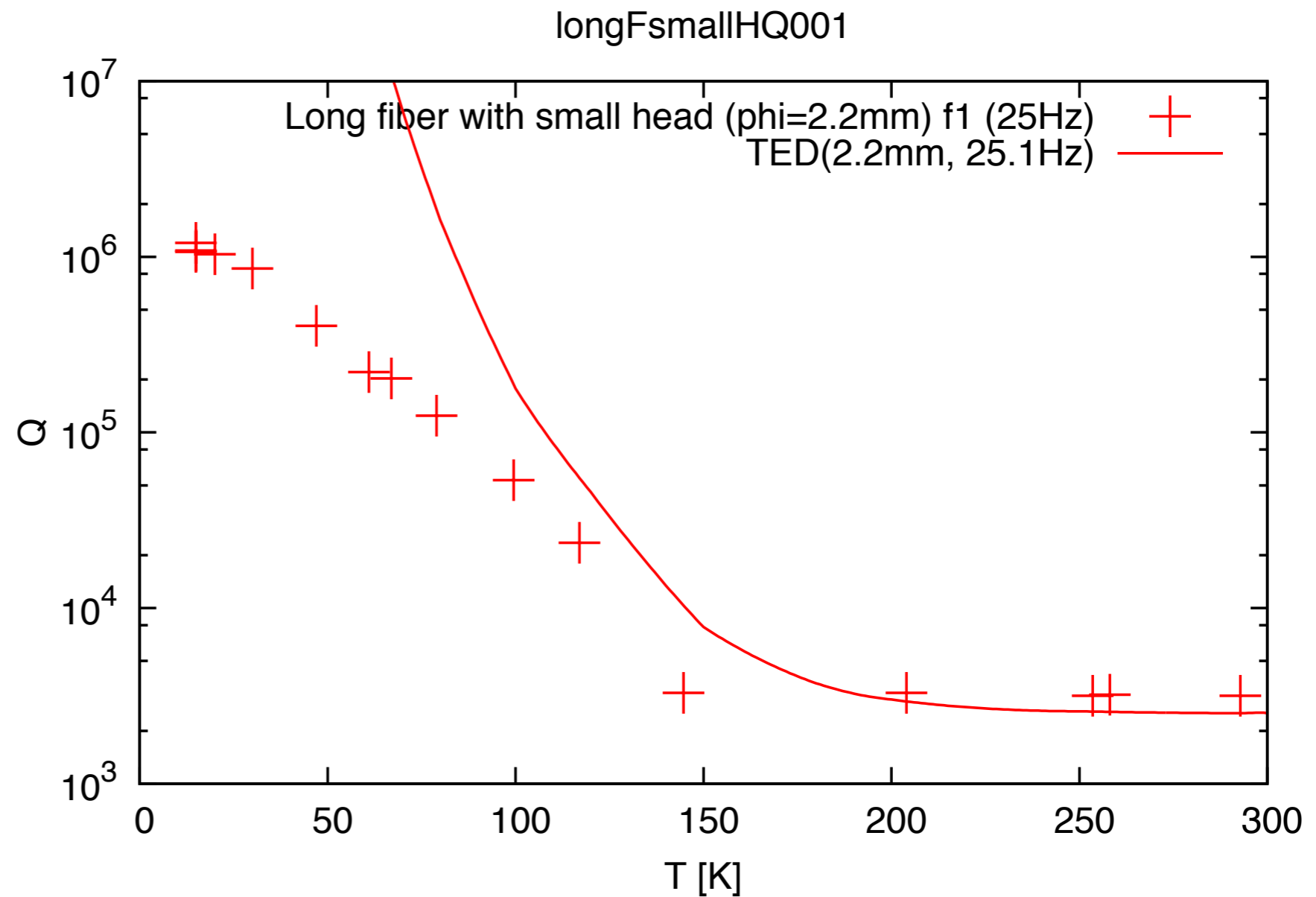
Fiber B (Sho, SH, NMo1, HQ, T)

- Short
- Small head
- Non-monolithic (Impex bonding 1)
- HEM quality
- Thermal polish



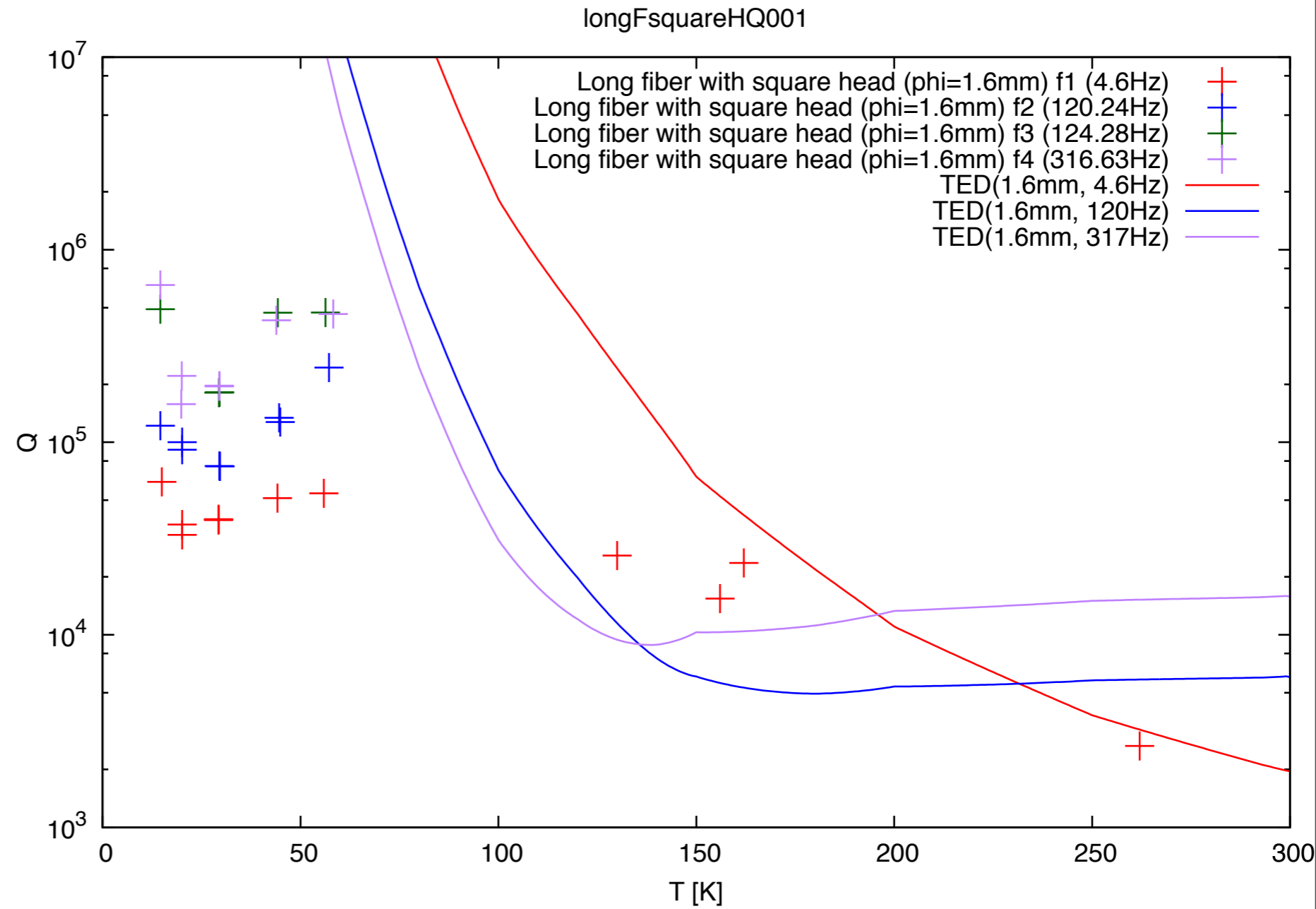
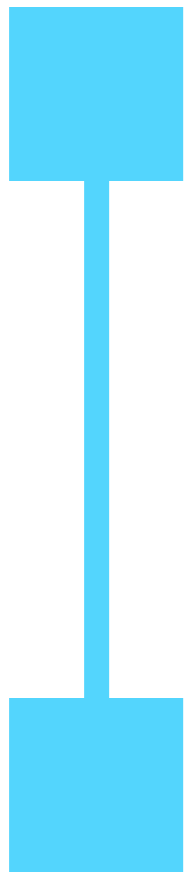
Fiber C (Lon, SH, Mo, NQ, NT)

- Long
- Small head
- Monolithic
- Normal quality
- No thermal polish



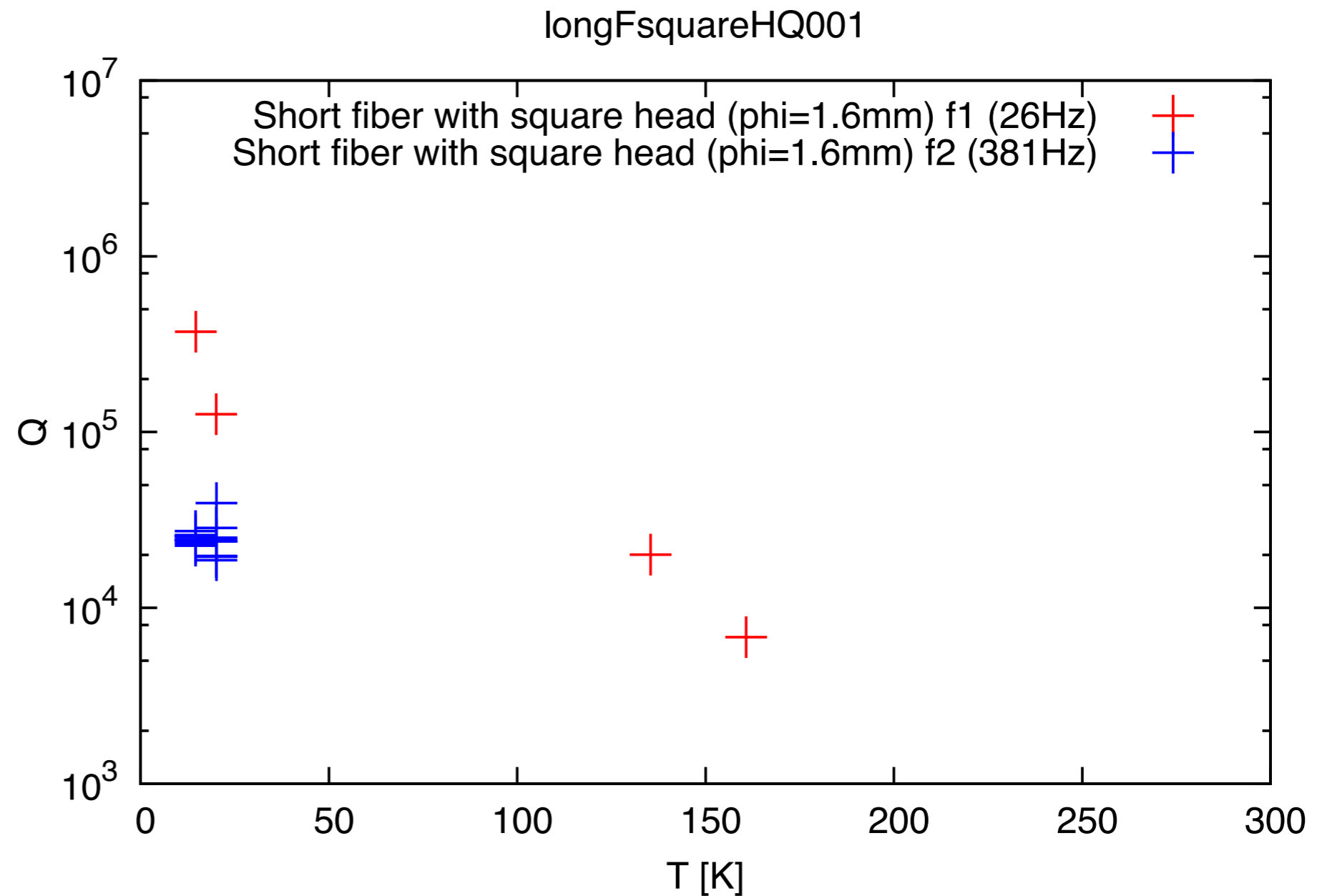
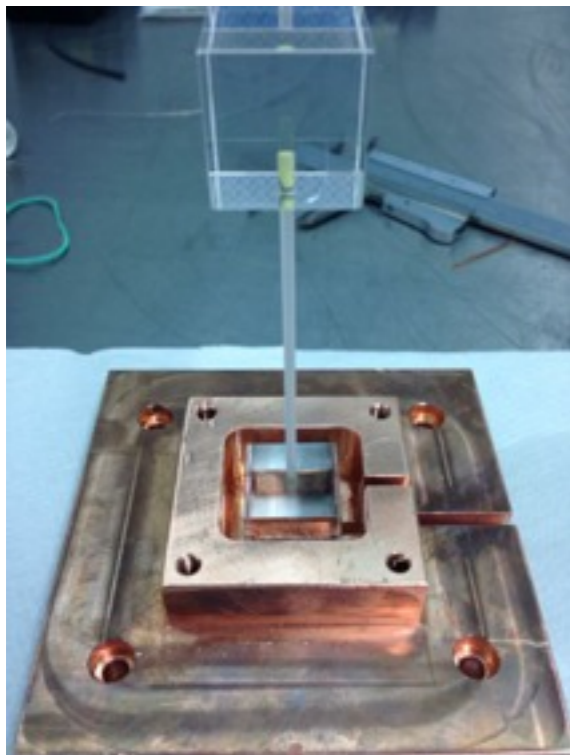
Fiber D (Lon, BH, NMo2, NQ, T)

- Long
- Big square head
- Non-monolithic Impex bonding2
- Normal quality
- Thermal polish



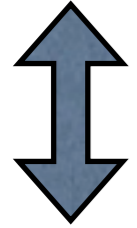
Fiber E (Sho, BH, NMo2, NQ, T)

- Short
- Big square head
- Non-monolithic
Impex bonding2
- Normal quality
- Thermal polish



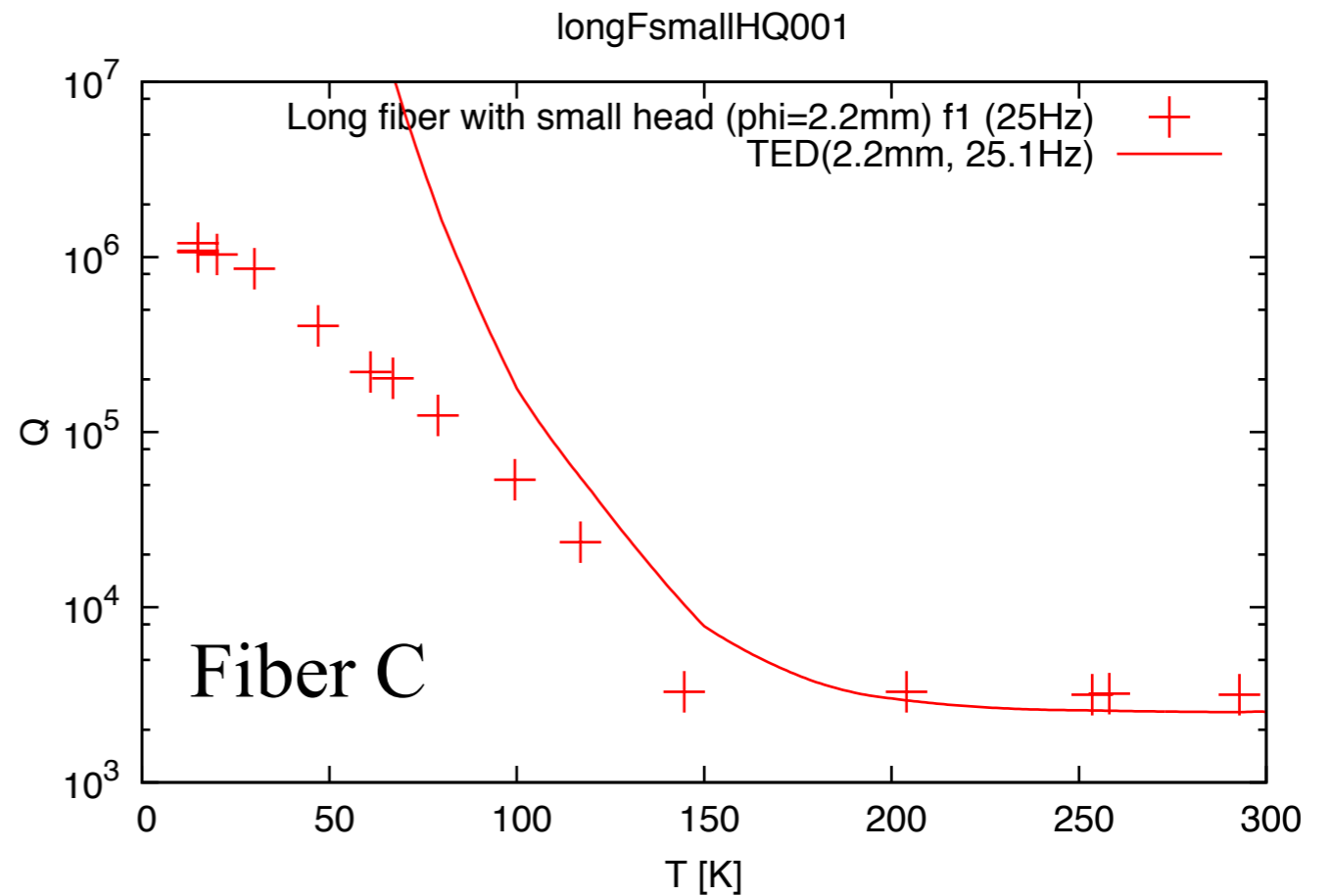
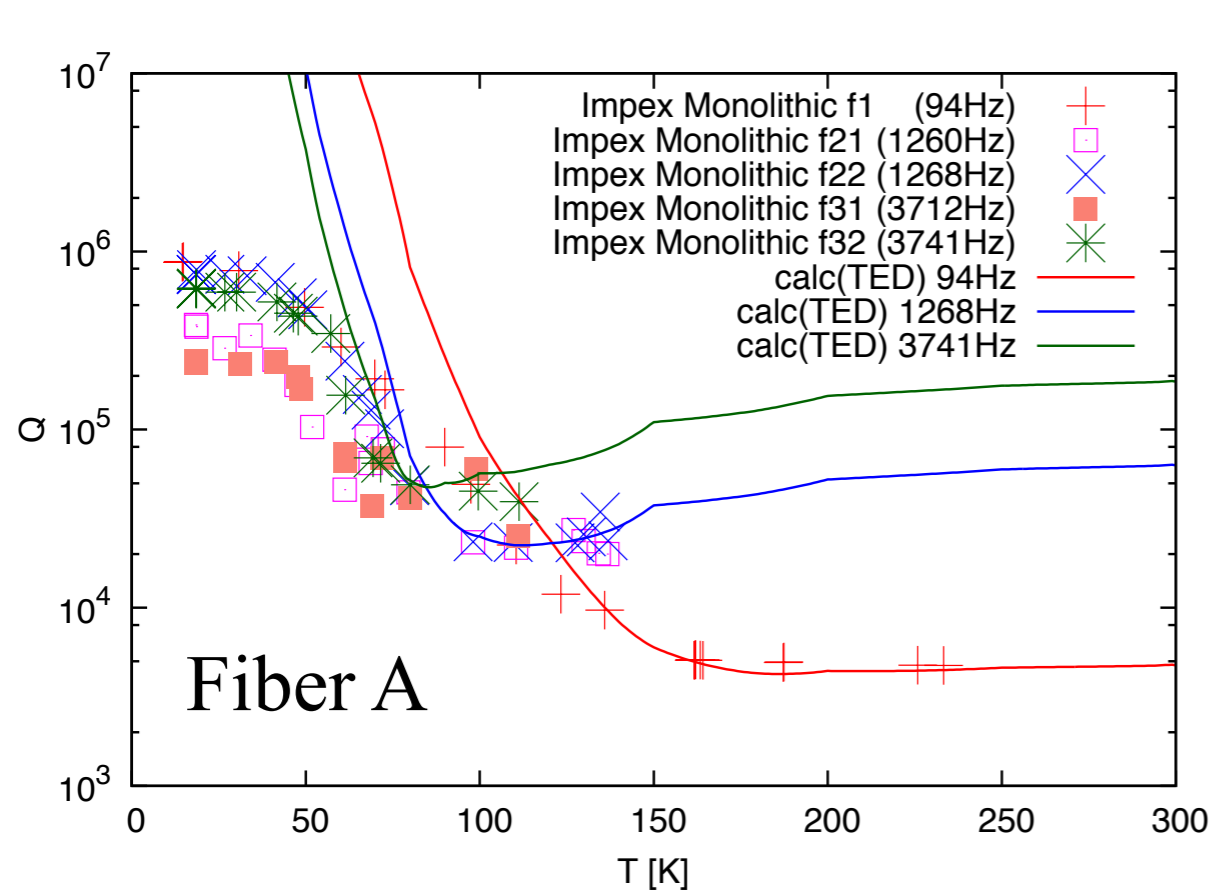
Compare 1

Fiber A (Sho, SH, Mo, NQ, NT)



Difference: length

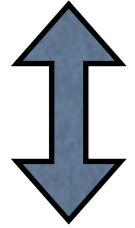
Fiber C (Lon, SH, Mo, NQ, NT)



Consistent.

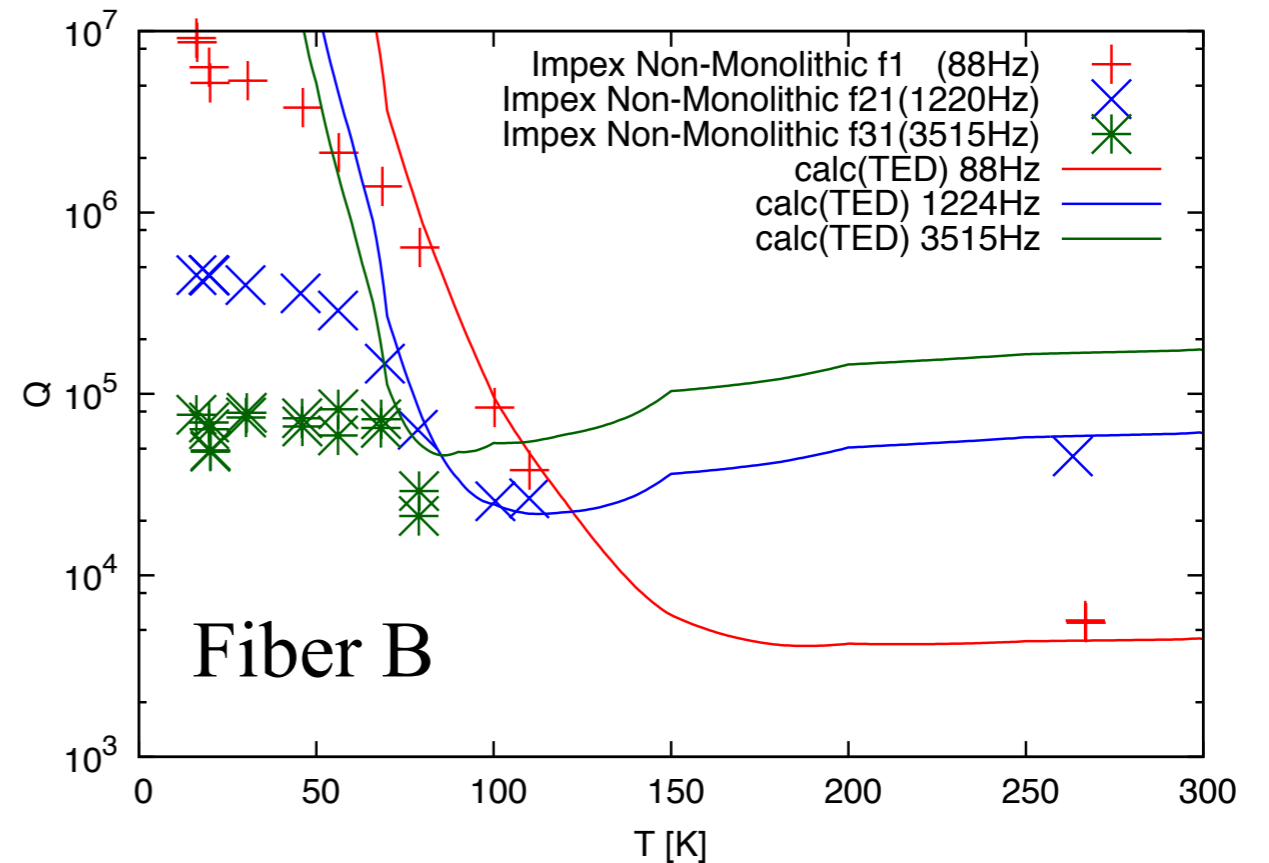
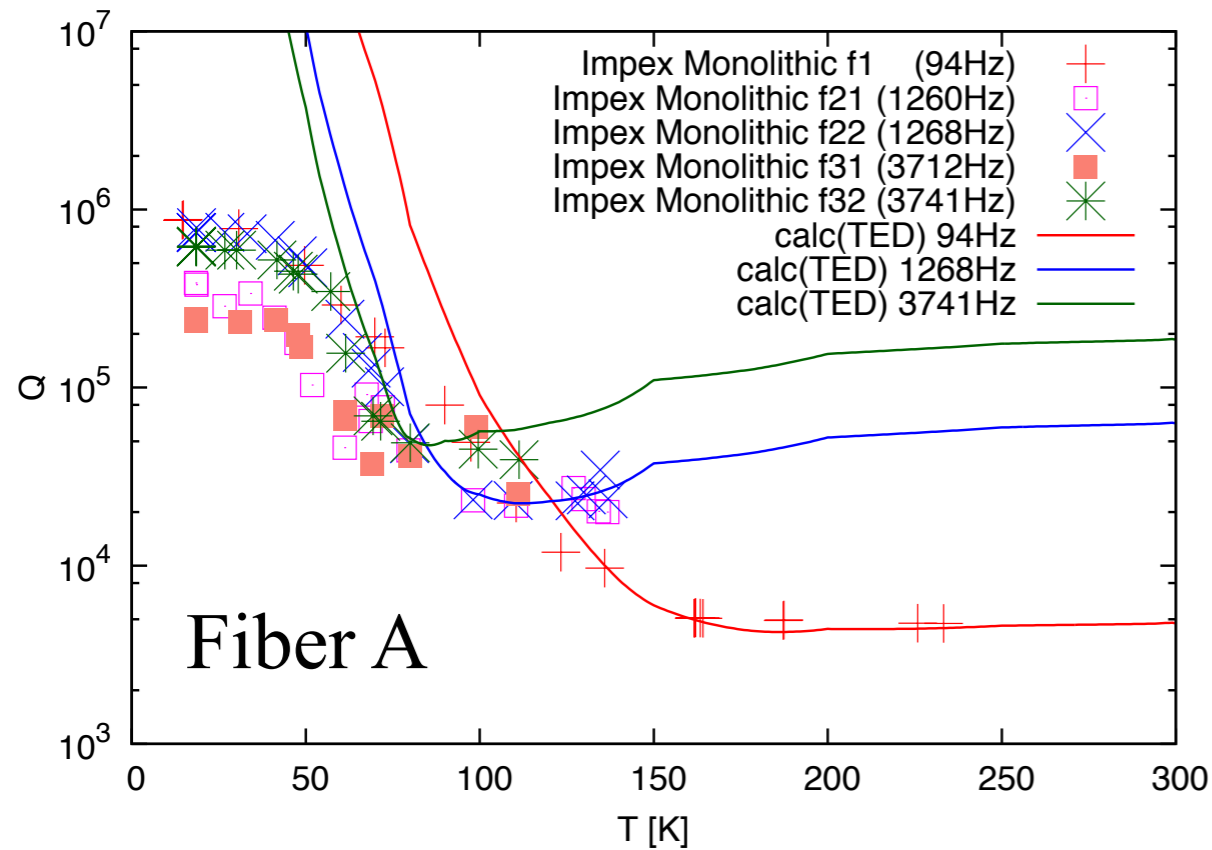
Compare 2

Fiber A (Sho, SH, Mo, NQ, NT)



Deference: Monolithic, Quality, Thermal polish

Fiber B (Sho, SH, NMo1, HQ, T)

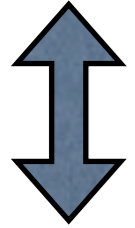


Quality or thermal polish can enhance Q value.

(The effect of thermal polish can not be so effective. ← rms change because of thermal polish is factor 3?)

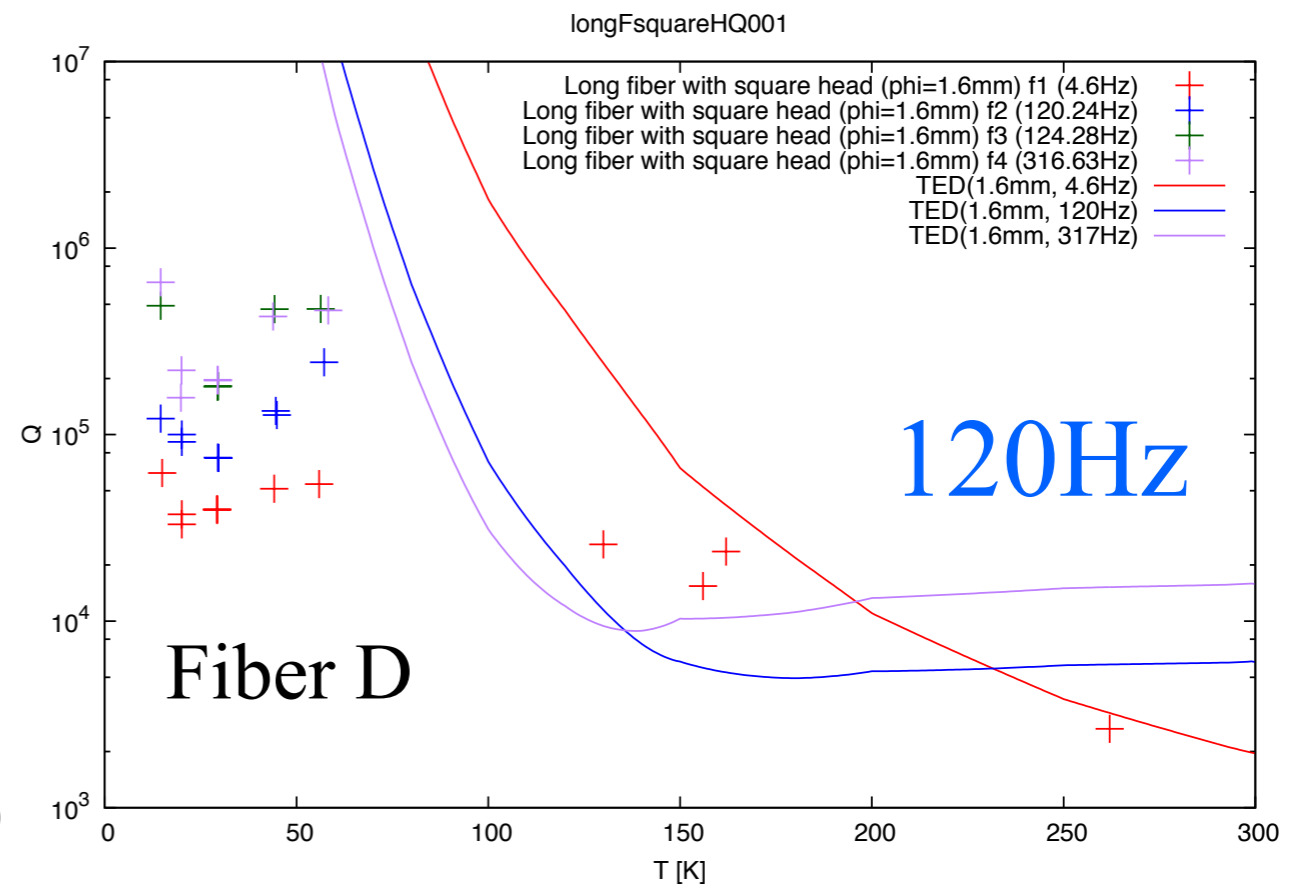
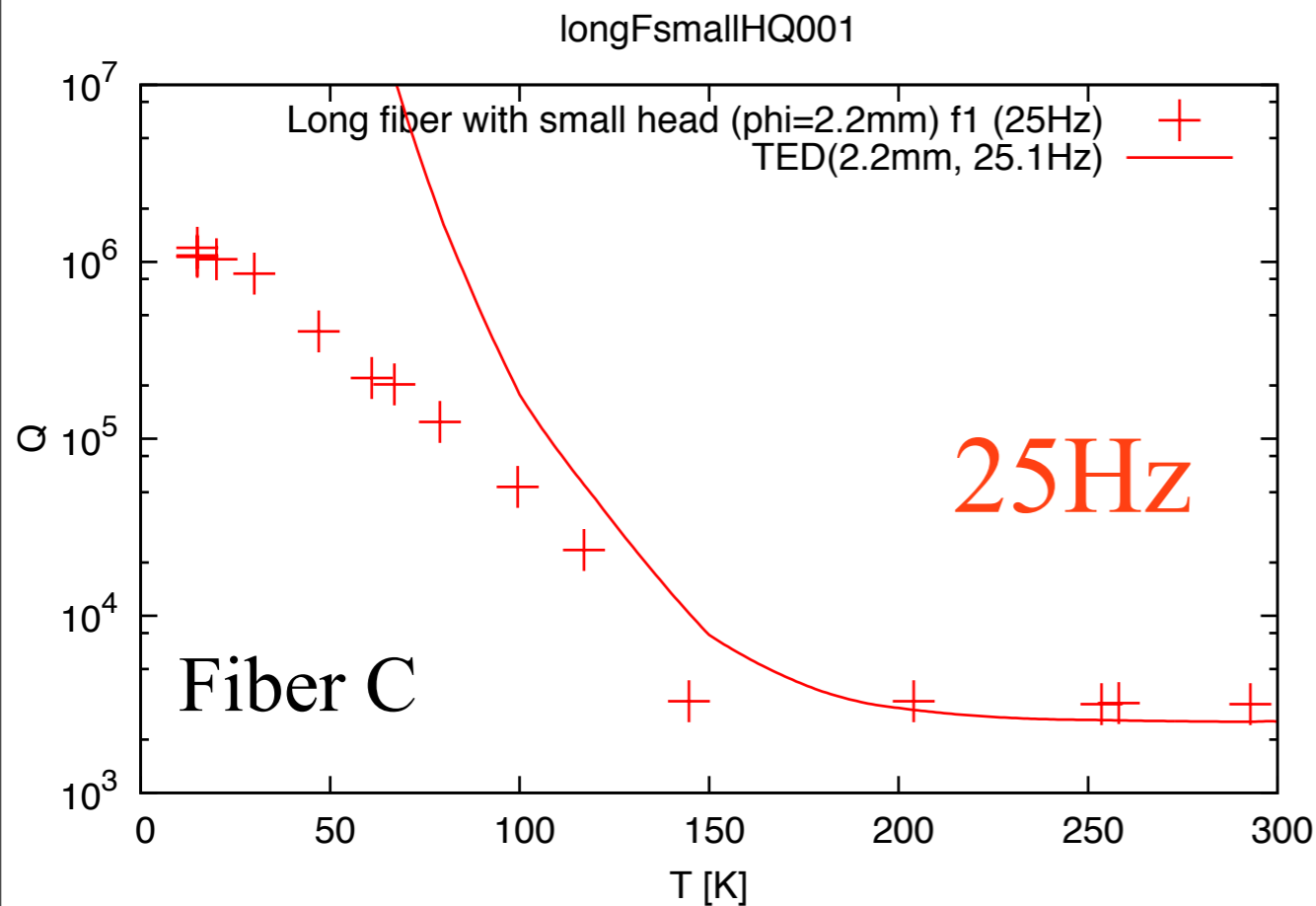
Compare 3

Fiber C (Sho, SH, Mo, NQ, NT)



Difference: Length, Head, Monolithic

Fiber D (Lon, BH, NMo2, NQ, T)



Recoil loss should be effective at low frequency.

→ Recoil loss does not limit the Q of fiber D at higher modes.

→ Impex bonding 2 can limit the Q of fiber D. (Same material)

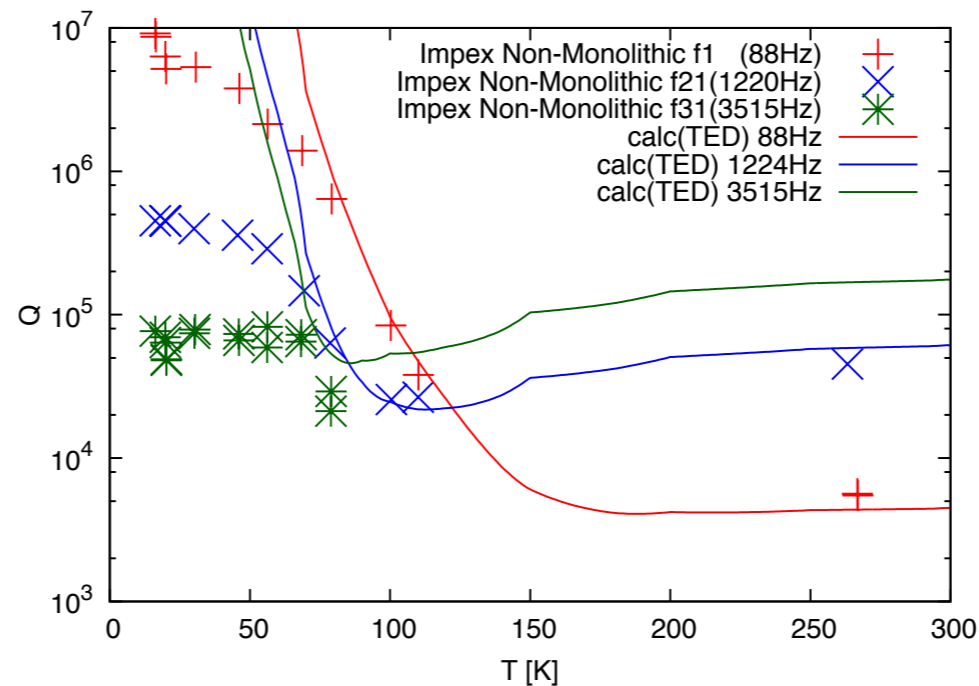
Thermal noise calculation

Which Q value do we use?

→ We can use the value of fiber B and fiber C

Fiber B

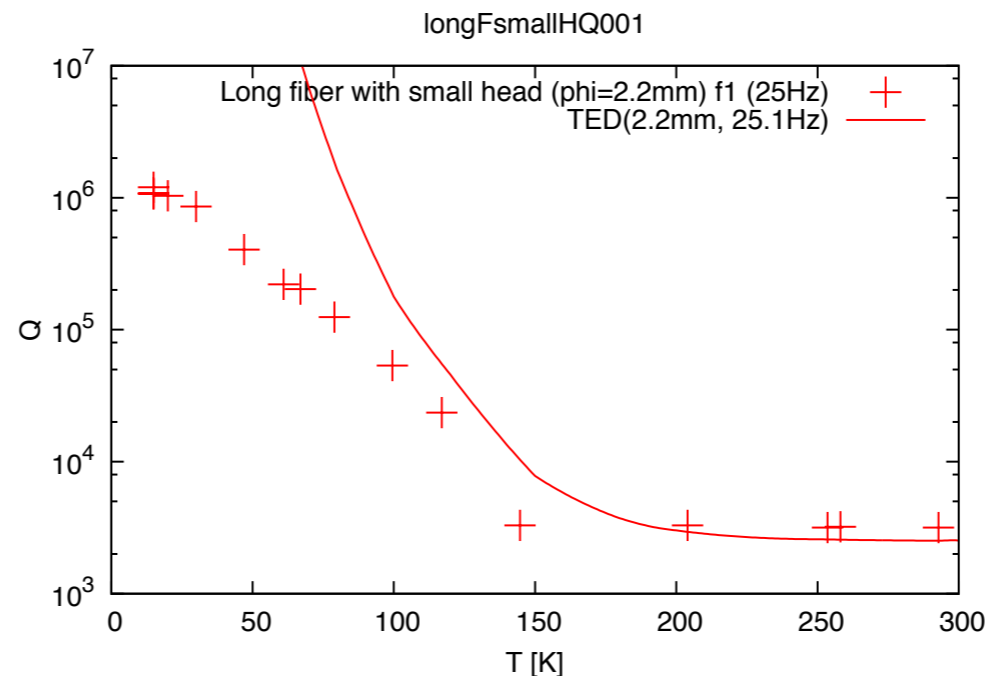
- Short
- Small head
- Non-monolithic (Impex bonding 1)
- HEM quality
- Thermal polish



The best value we know (With head)

Fiber C

- Long
- Small head
- Monolithic
- Normal quality
- No thermal polish



The fiber we can buy immediately.

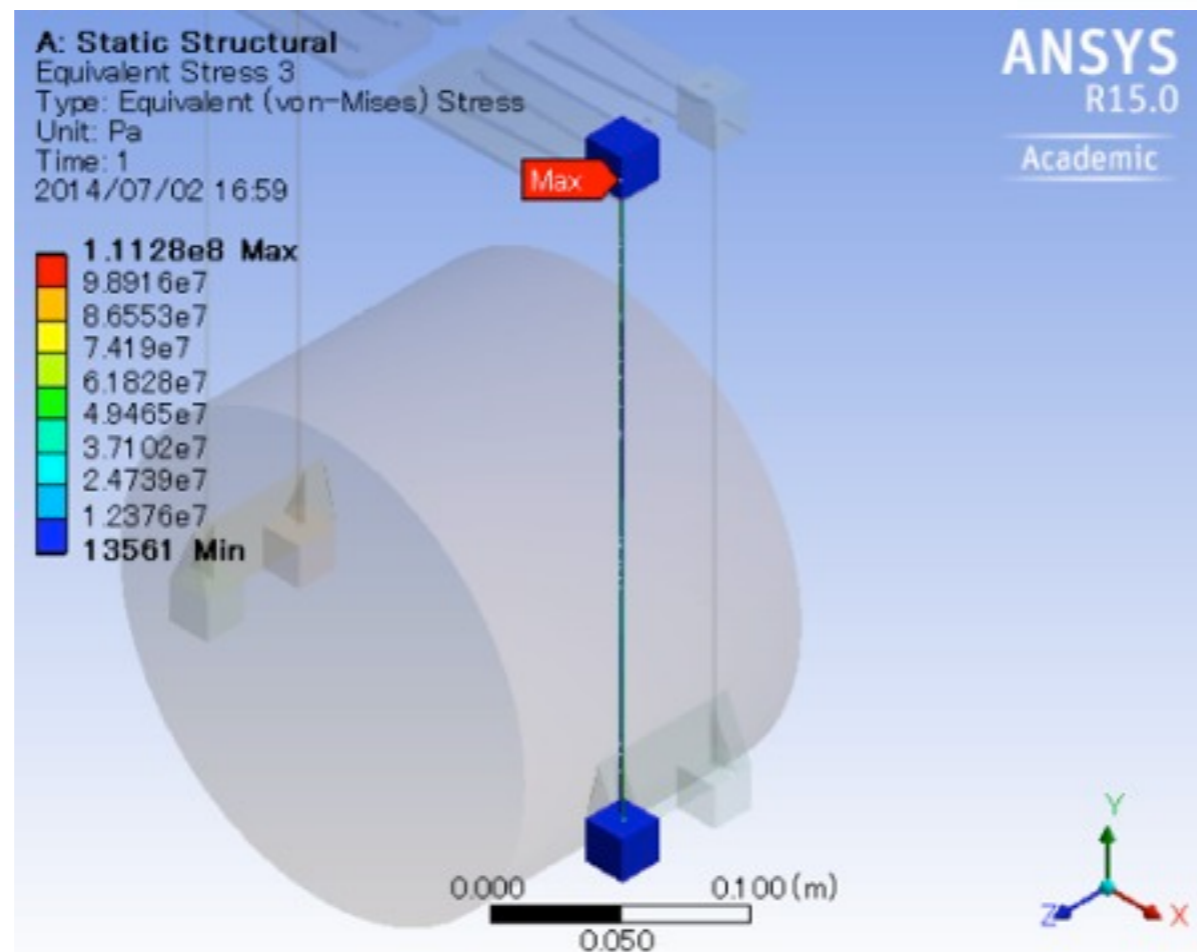
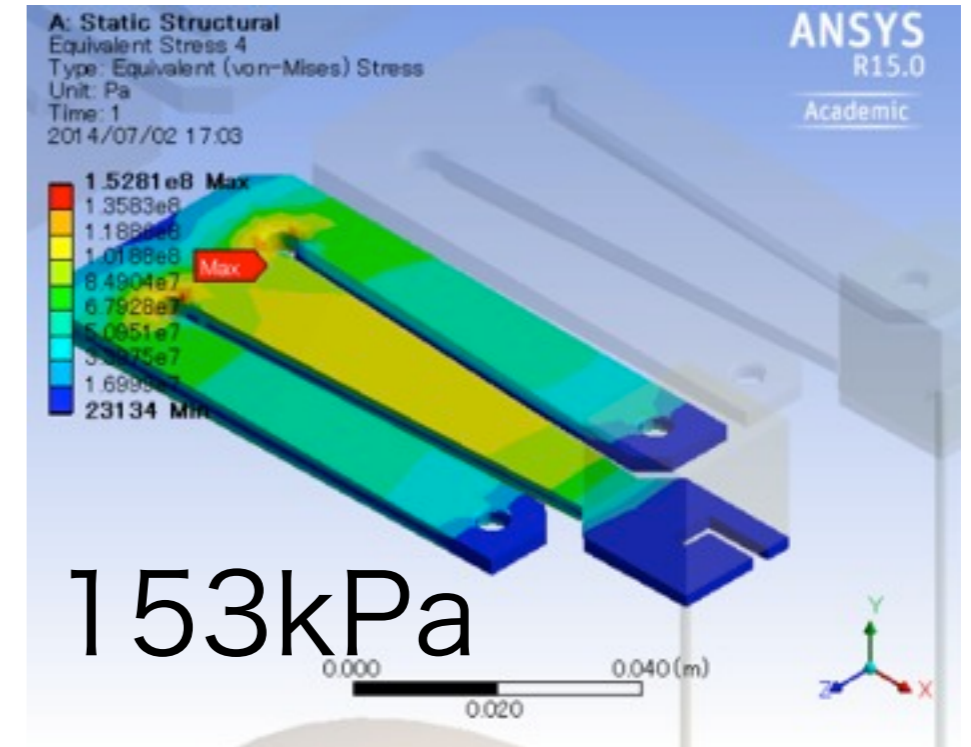
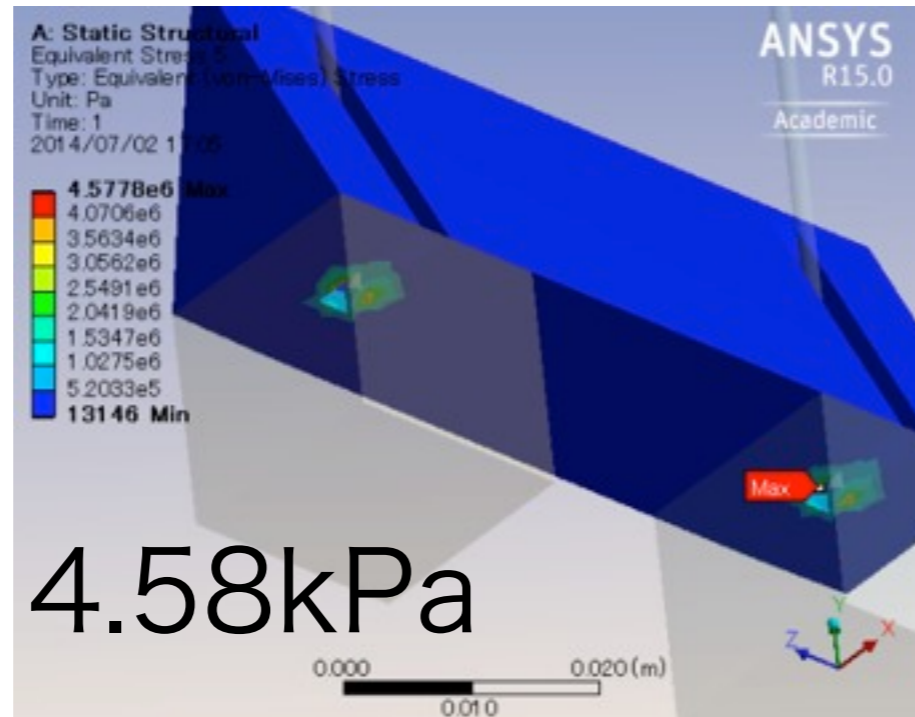
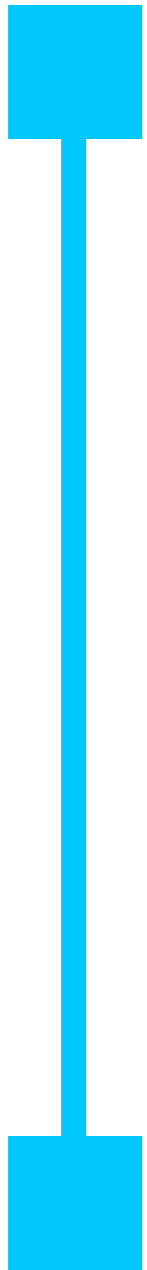
Different kind of fibers

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Fiber 1

20mm*20mm

20mm



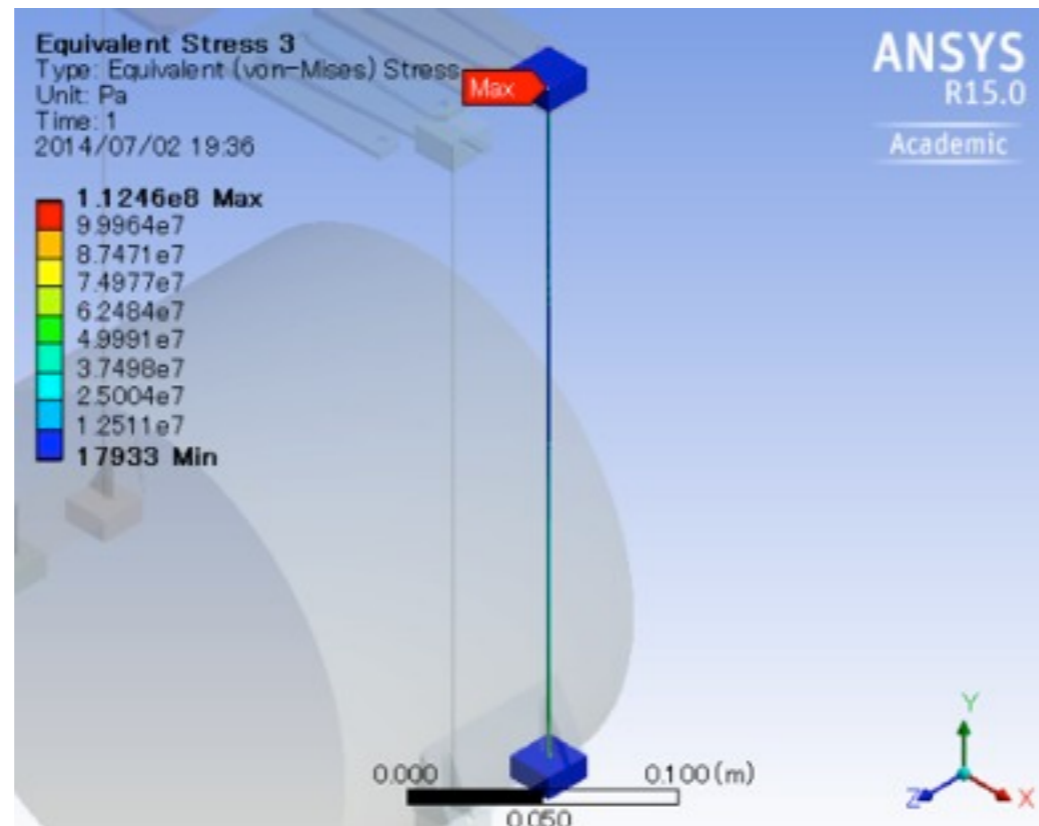
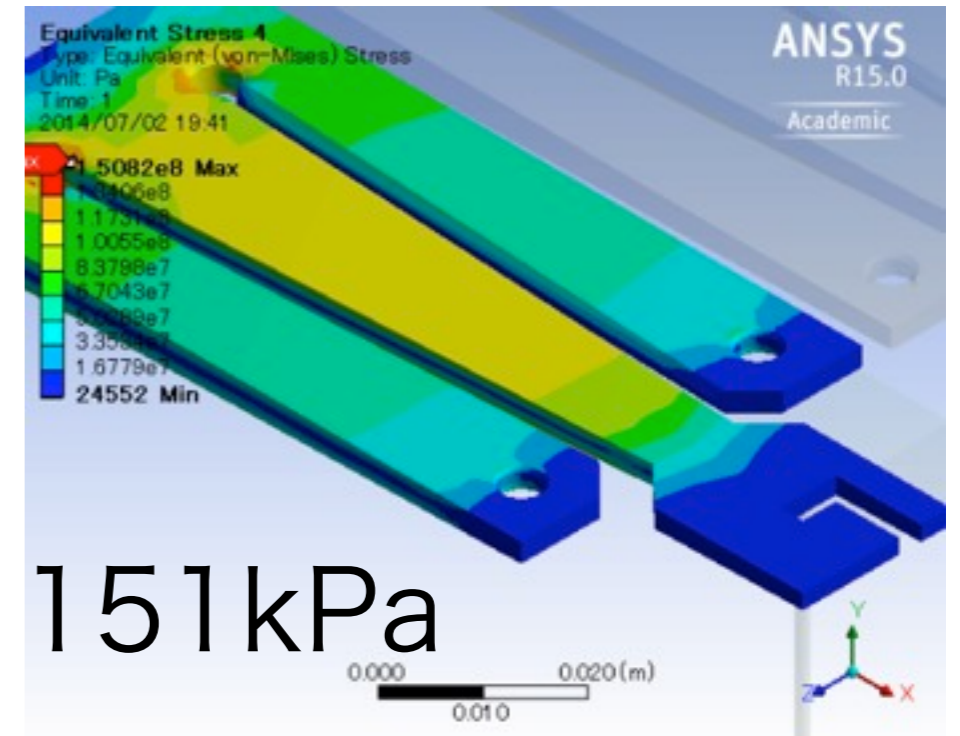
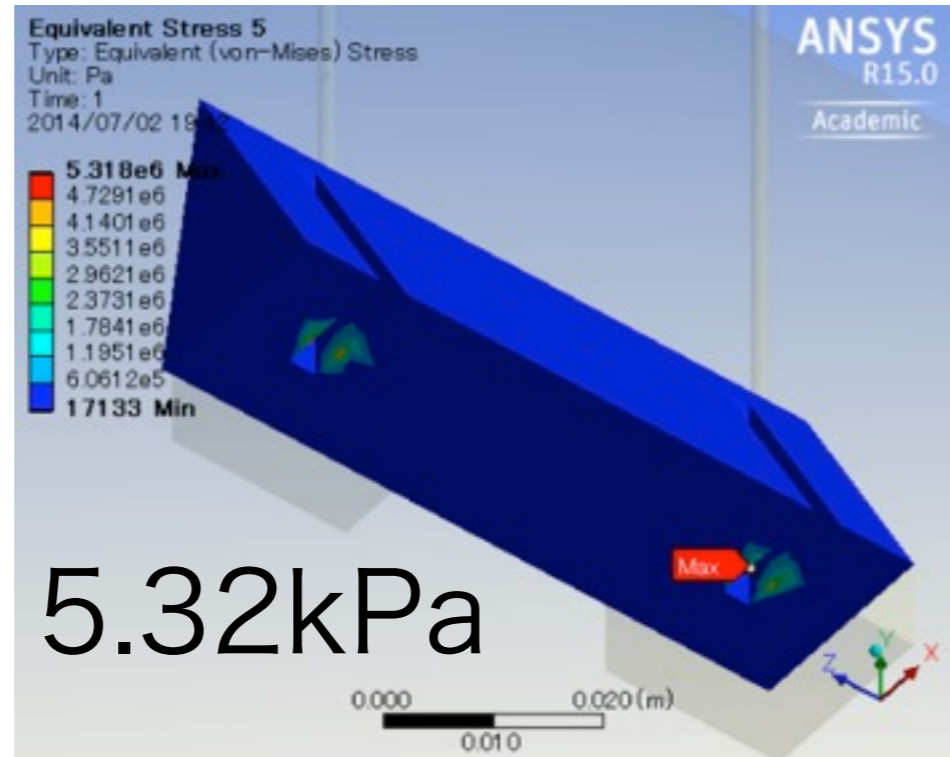
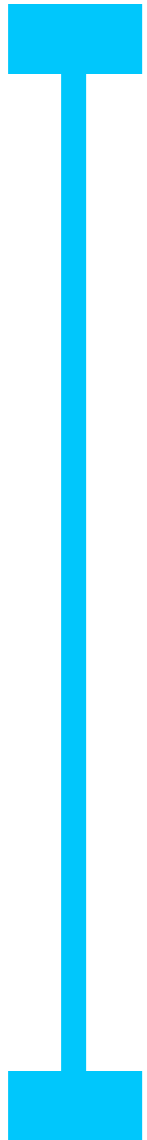
Max in fiber:

111kPa

Fiber 2

20mm*20mm

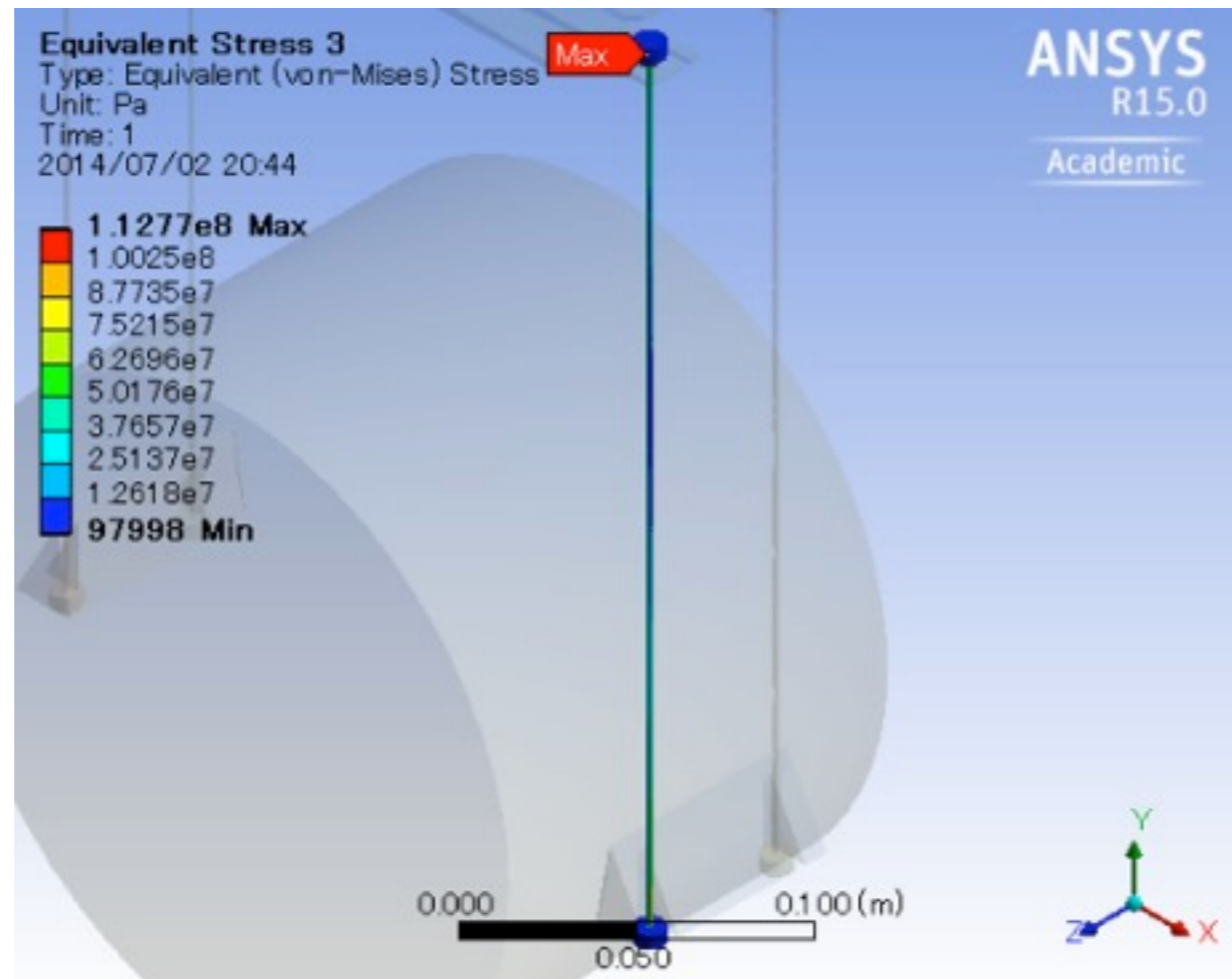
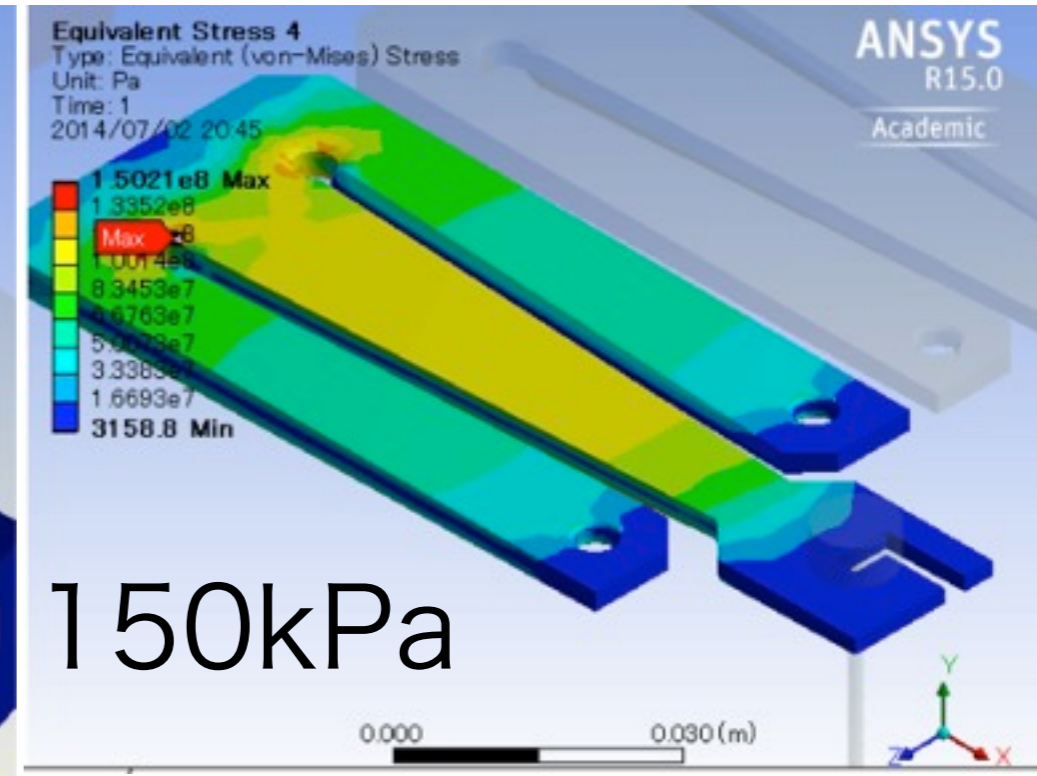
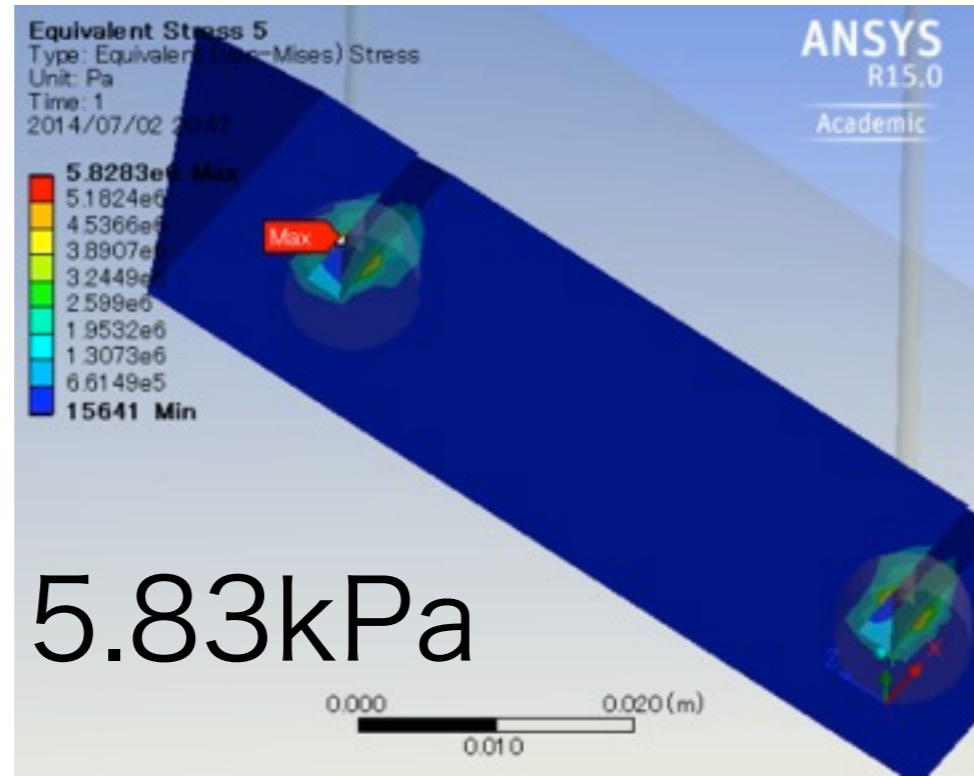
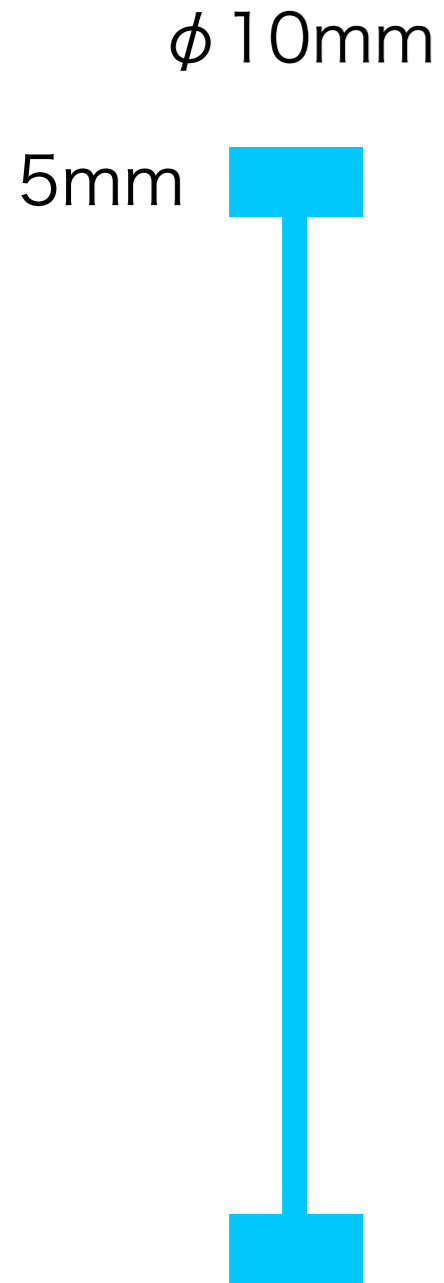
10mm



Max in fiber:

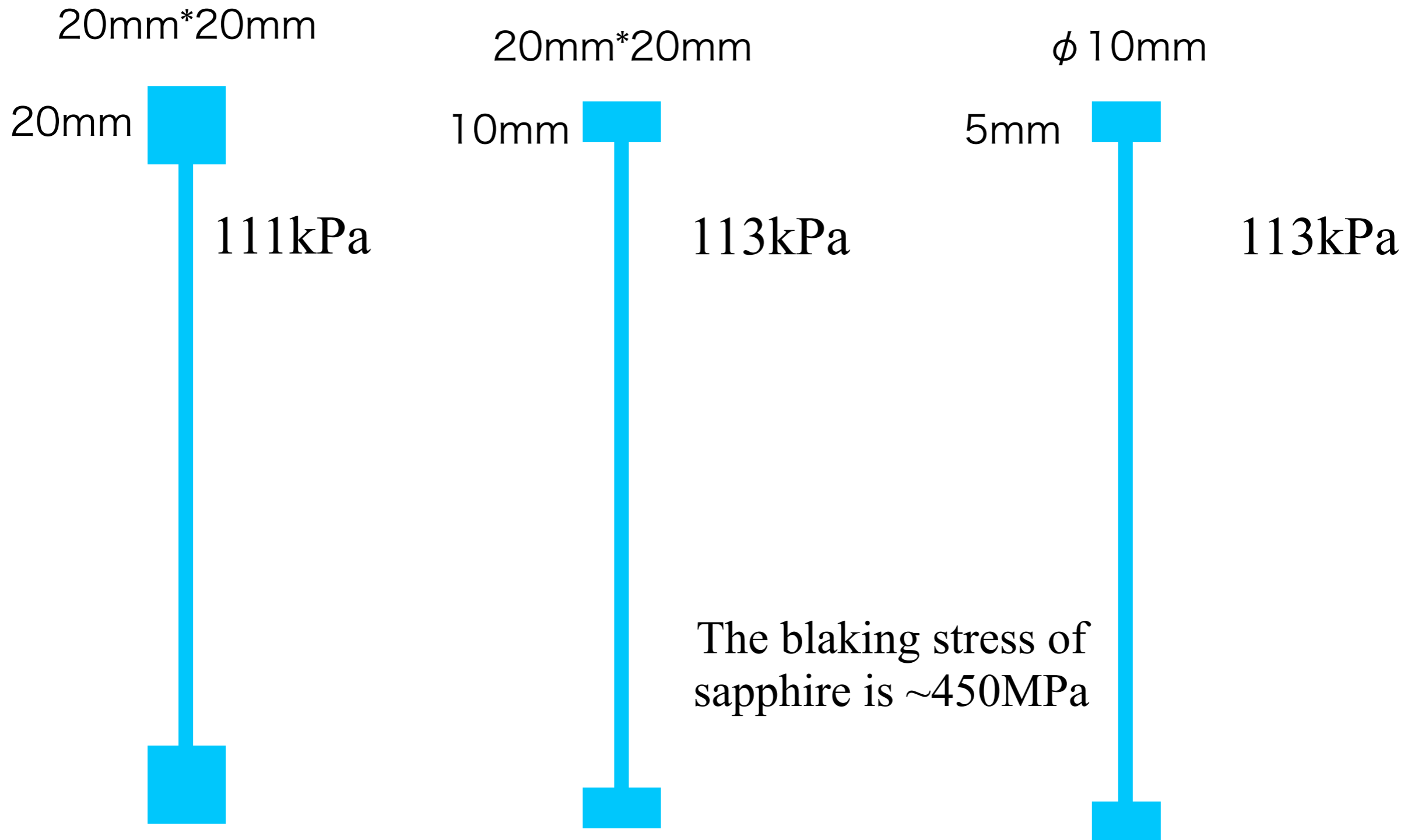
113kPa

Fiber 3



Max in fiber:
113kPa

Different kind of fibers



The breaking stress of sapphire is $\sim 450\text{MPa}$

There is no difference in terms of strength.
We can choose the fiber in terms of the thermal noise
(of indium and so on).