

Superfluid Helium Heat Pipes

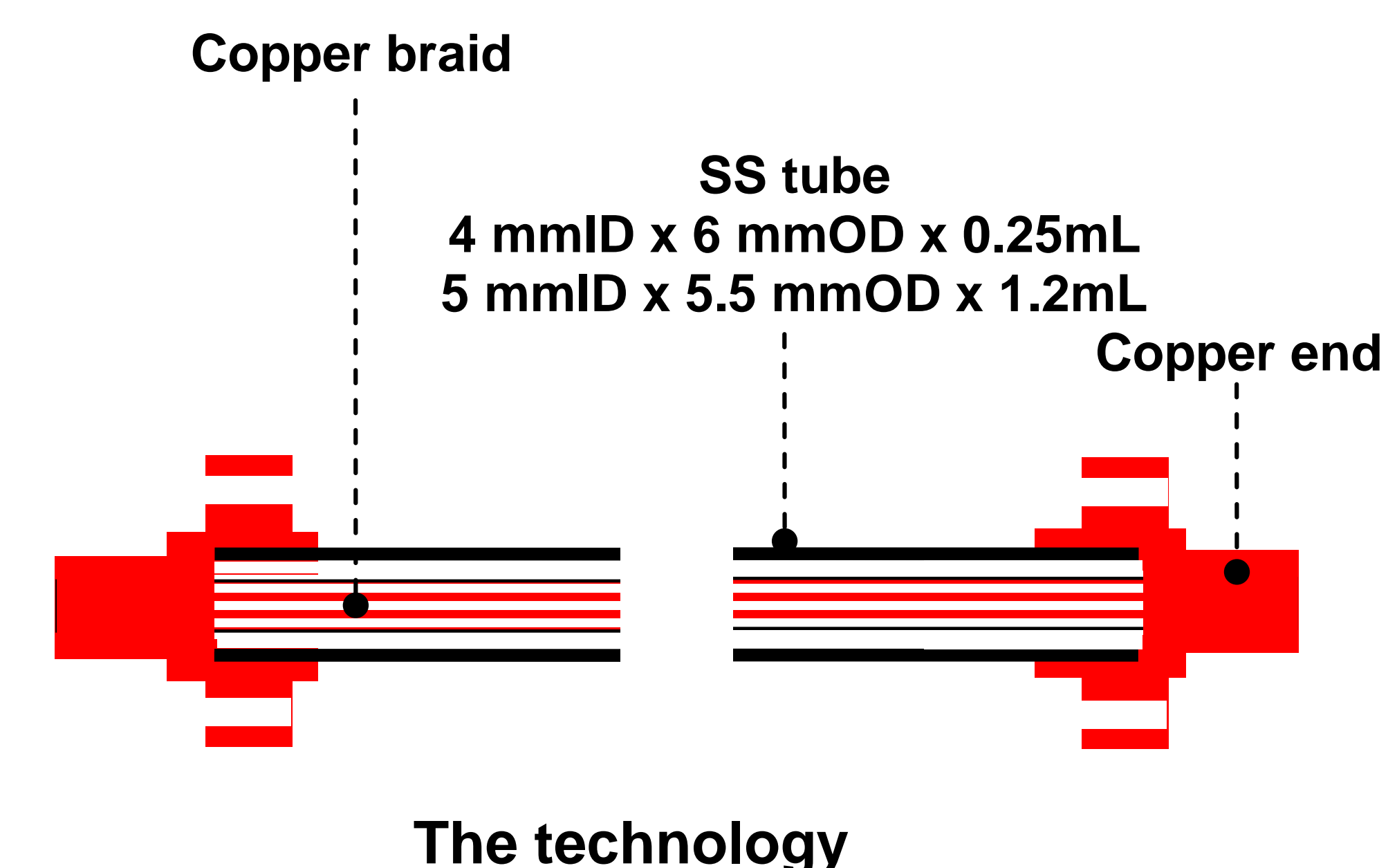
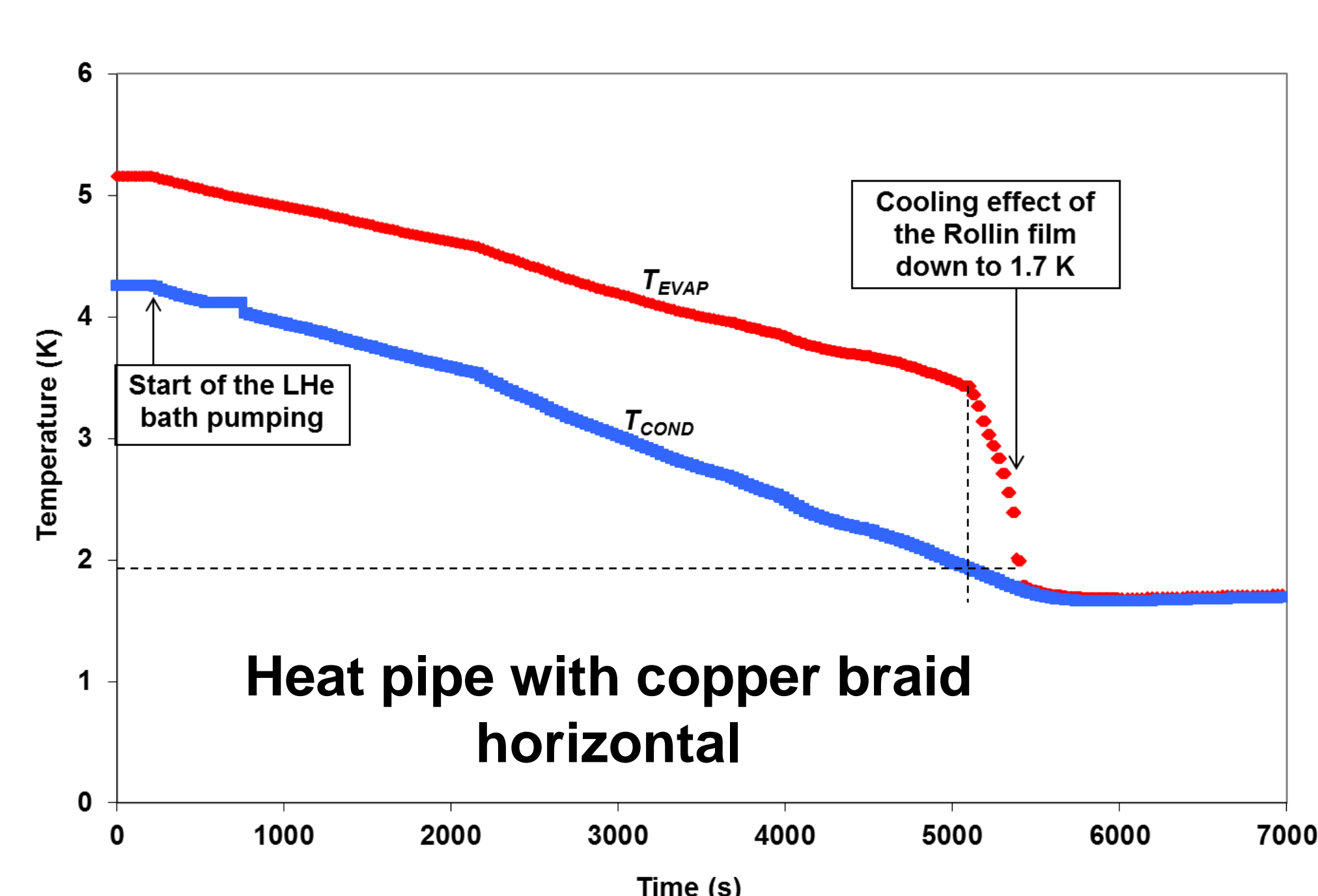
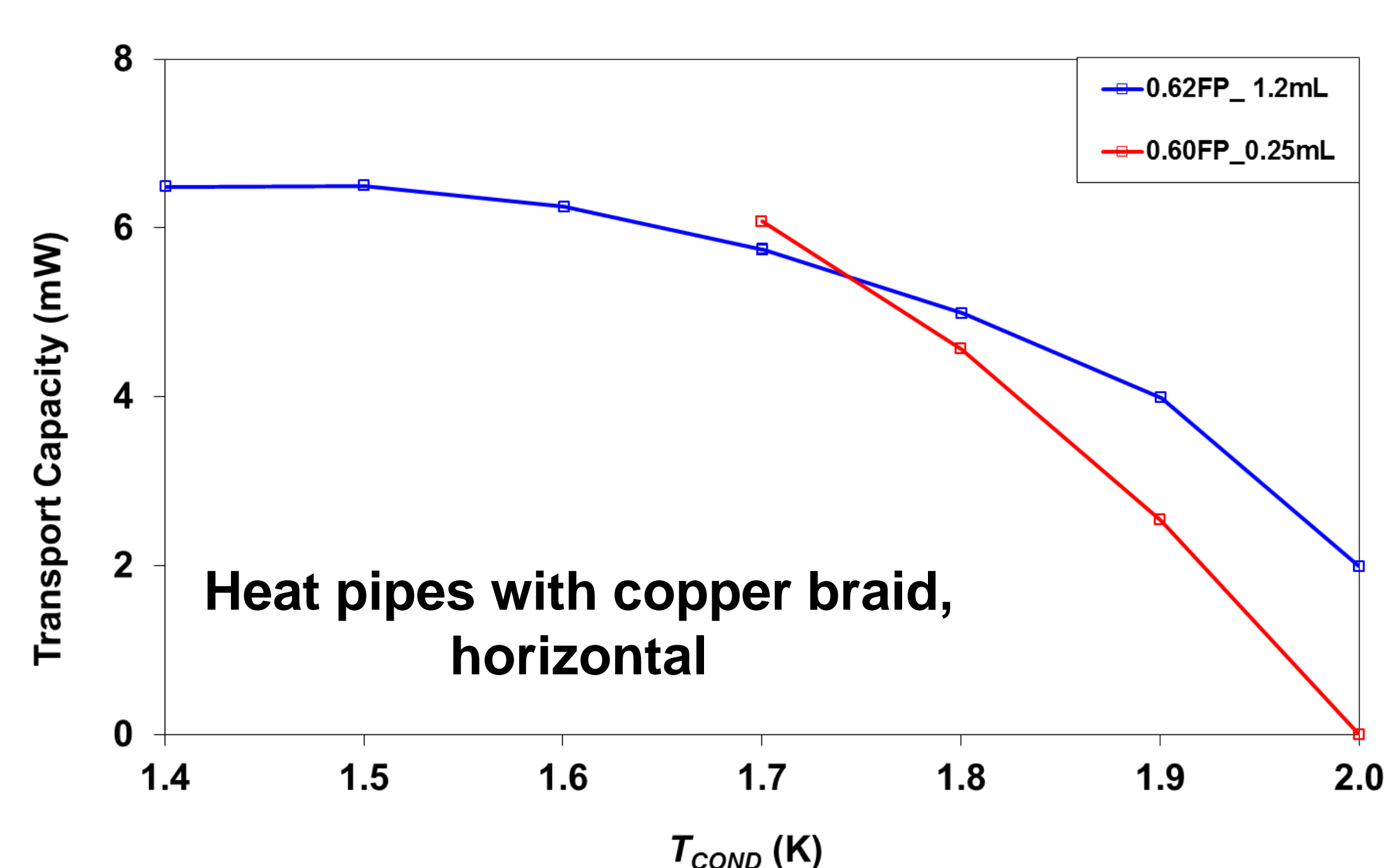
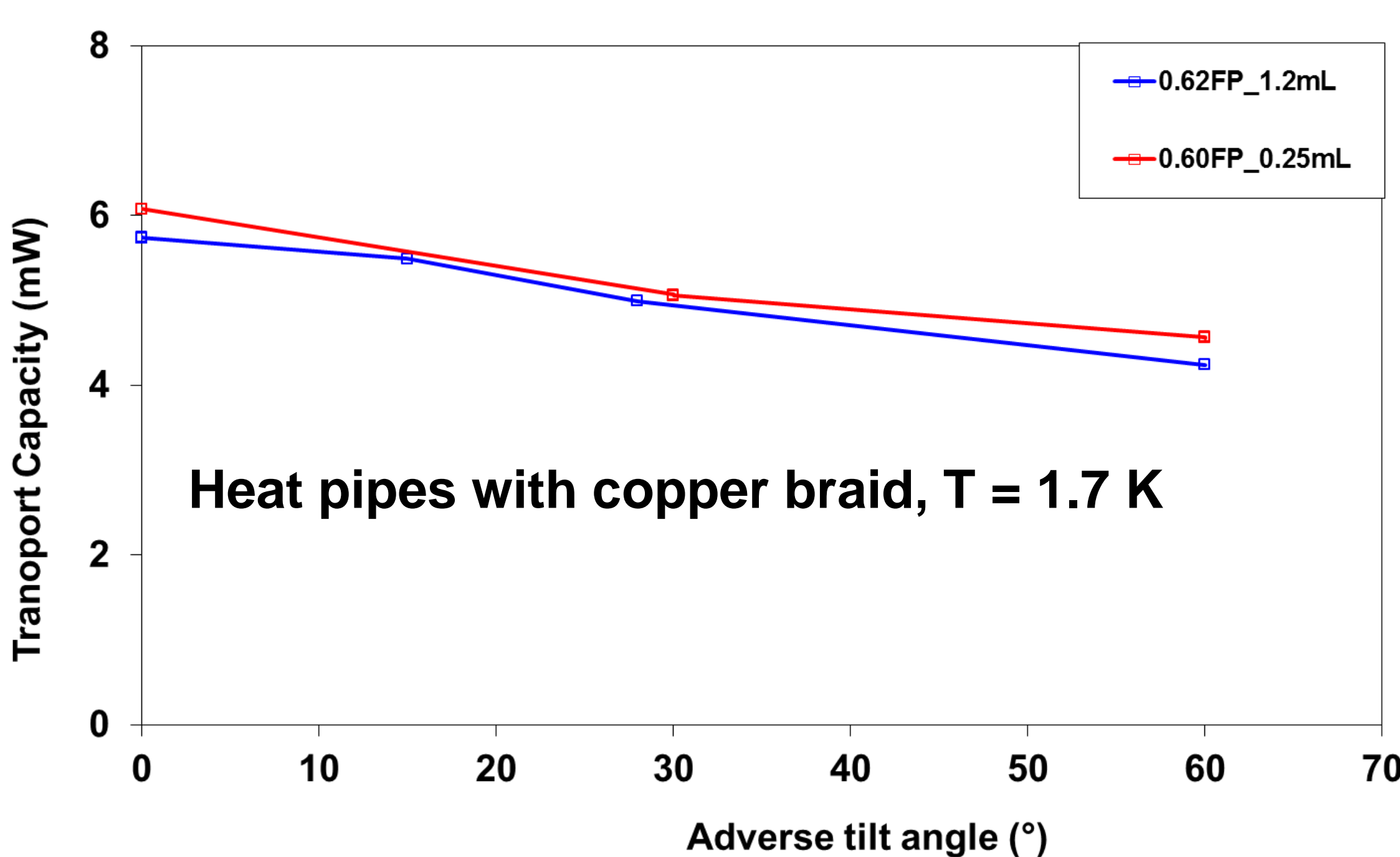
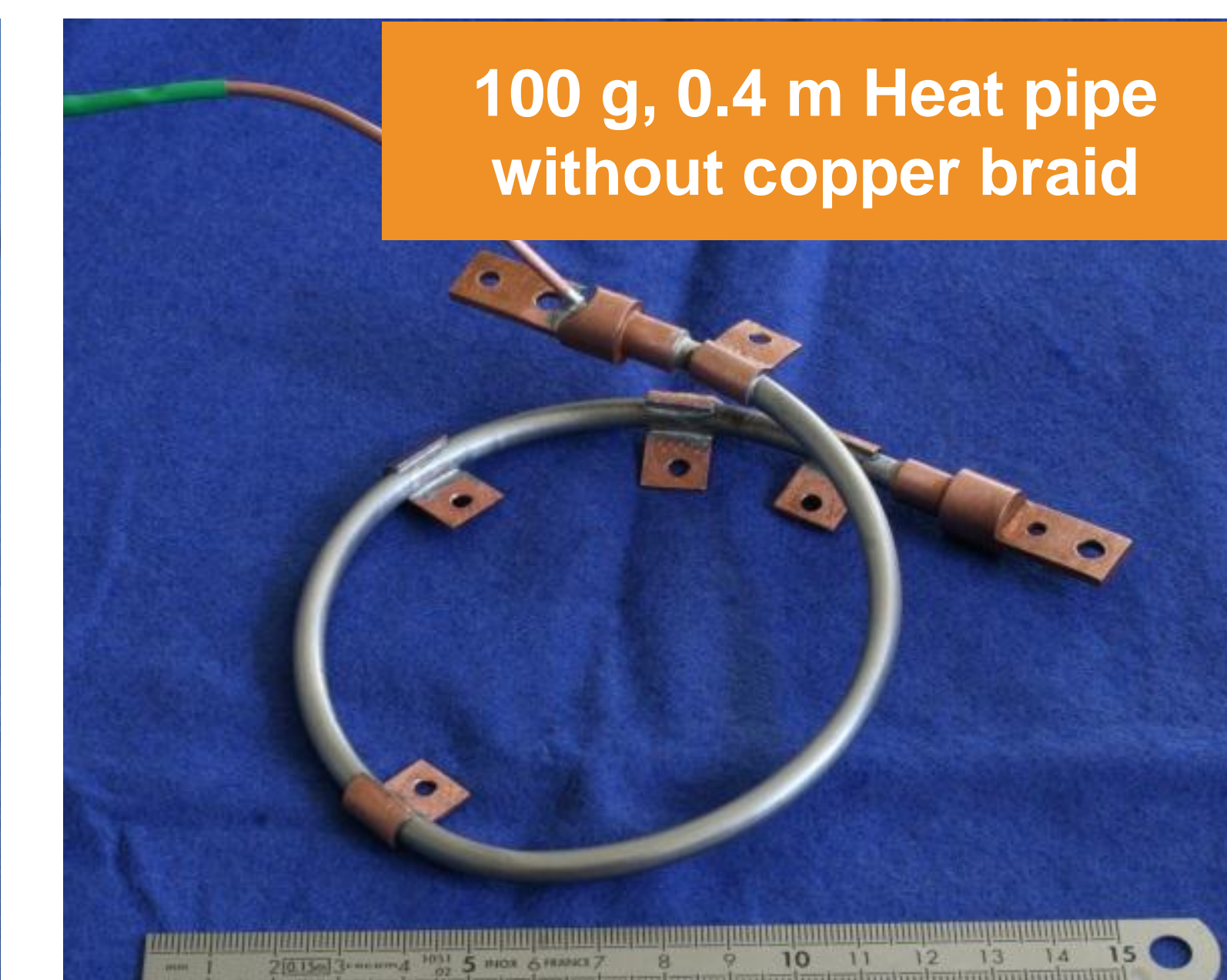
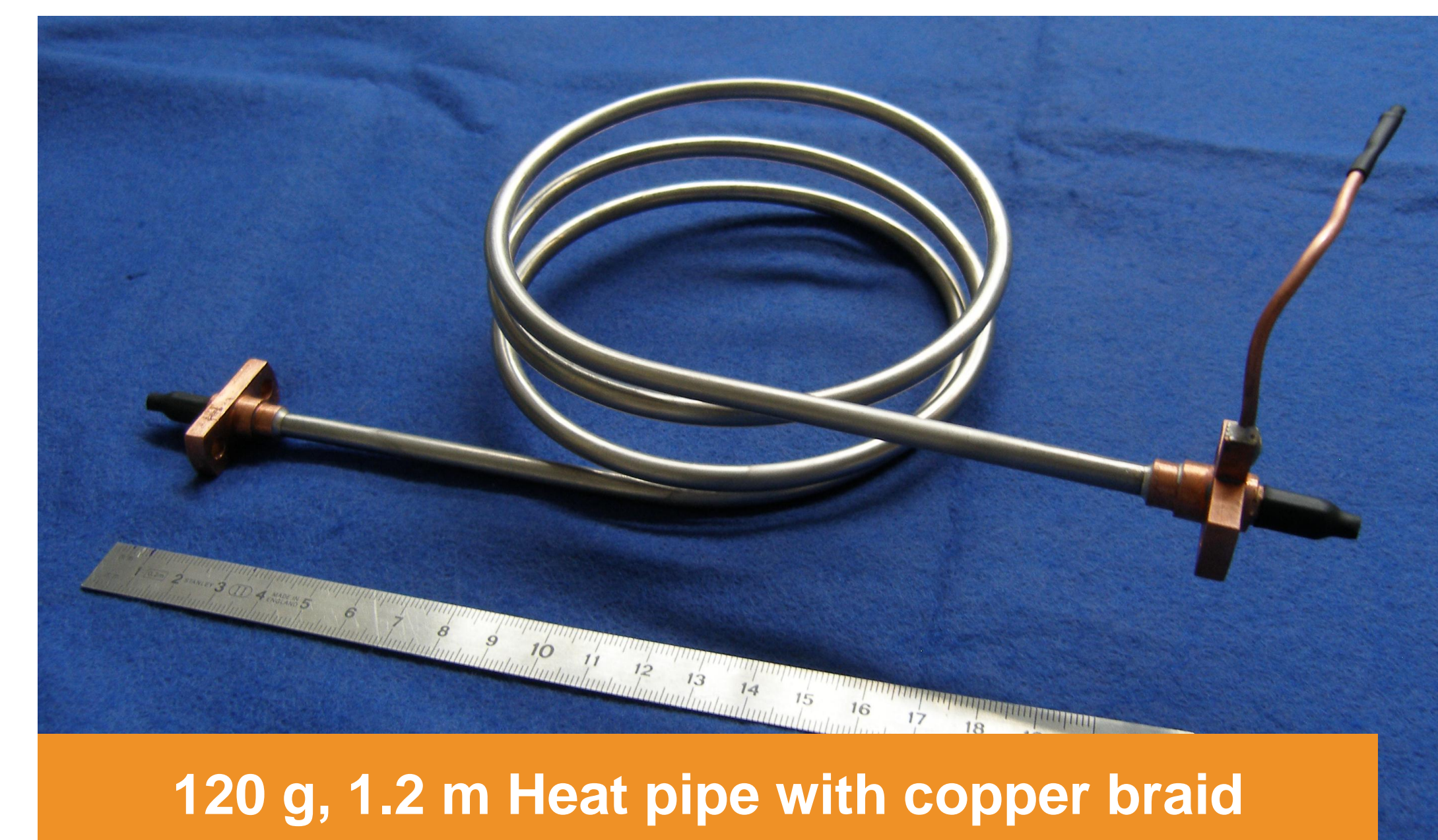
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Jointed CEA/CNES research technology programs

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Abstract:

- Over a small thermal gradient and below T_λ a mass flow rate occurs in the Rollin film, a very thin liquid film which covers any surface
- Design, manufacturing and thermal tests of 3 heat pipes
- The technology is very simple : a single 6 mm SS tube with or without copper braid as support of the film
- 2 heat pipes (0.25 m and 1.2 m) with copper braid for large transport capacity : 6.2 mW and 600 mW/K at 1.7 K
- 1 heat pipe (0.4 m) without copper braid for low transport capacity K) : 3.8 mW/K at 0.7 K
- The cool down of one heat pipe below T_λ is also presented.



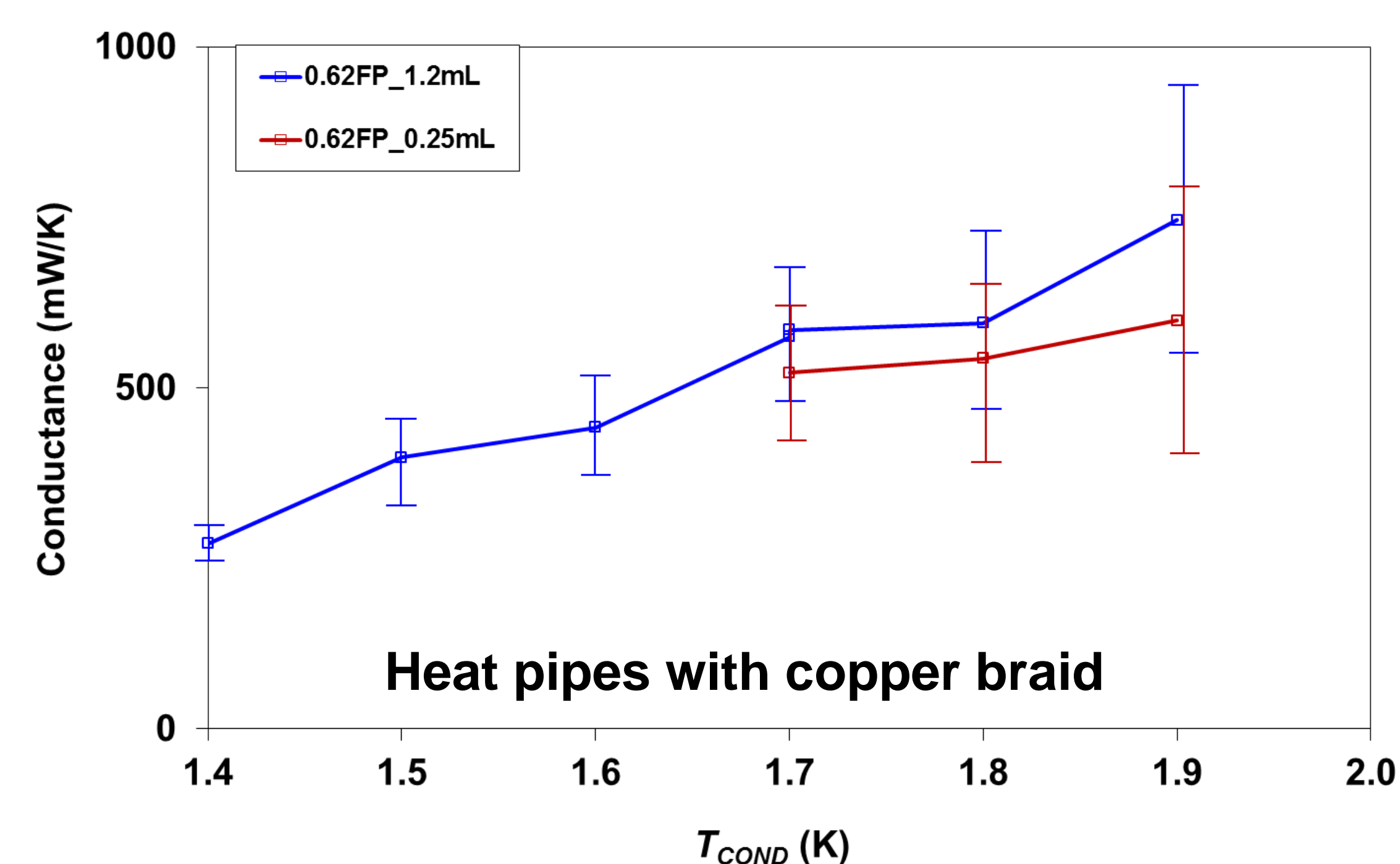
Small dependence on the adverse tilt angle
The transport capacity remains significant

The transport capacity depends on working T
Same trend than in literature

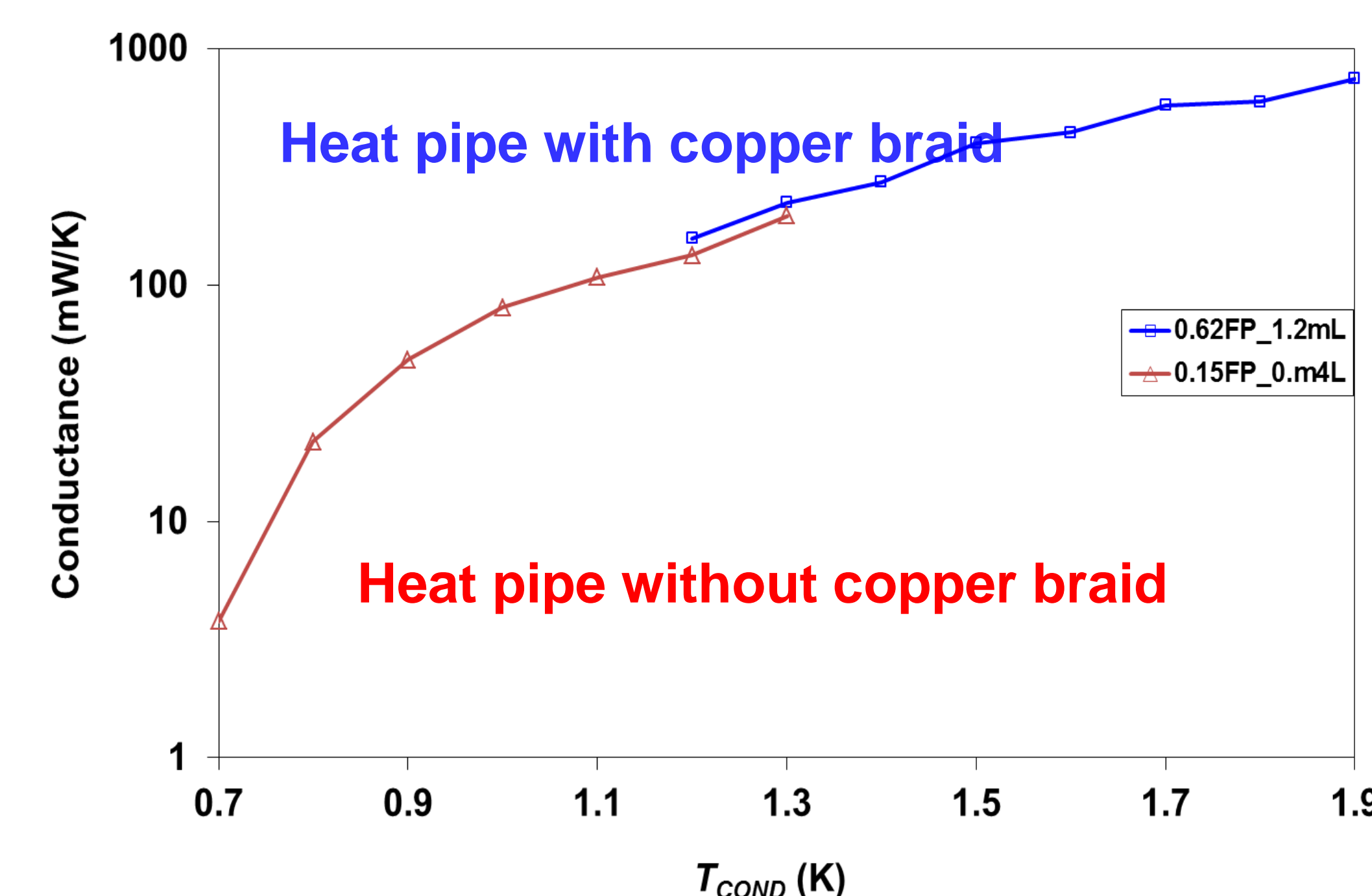
Cooldown of the 1.2 m heat pipe is achieved
with $Q_{evap} = 6$ mW

Conclusion :

- 3 helium heat pipes of different lengths (0.25 m, 0.4 m and 1.2 m) with and without copper braid (support of the Rollin film to reach high transport capacity)
- The technology is very simple
- Heat pipes with copper braid:
 - High transport capacity achieved : At 1.7 K, 4.5 mW / 60° and 6 mW / 0°. The transport capacity depends on the working temperature and follows the trend of the literature.
 - Large thermal conductance achieved : 600 mW/K at 1.7 K.
 - The Rollin film eases the cool down of the evaporator down to 1.7 K with a heating power applied to the evaporator
- Heat pipe without copper braid:
 - Thermal conductance : 200mW/K at 1.3 K and 4 mW/K at 0.7 K
 - Thermal conductance depends on the working temperature



High conductance achieved in the 1.4 – 1.9 K range.
C depends on the working T



C without copper braid ~ Cwith copper braid (1.3 K)
C depends dramatically on the working T

