



LMJ cryosystem

Overview of the cryosystem

Last results

New developments

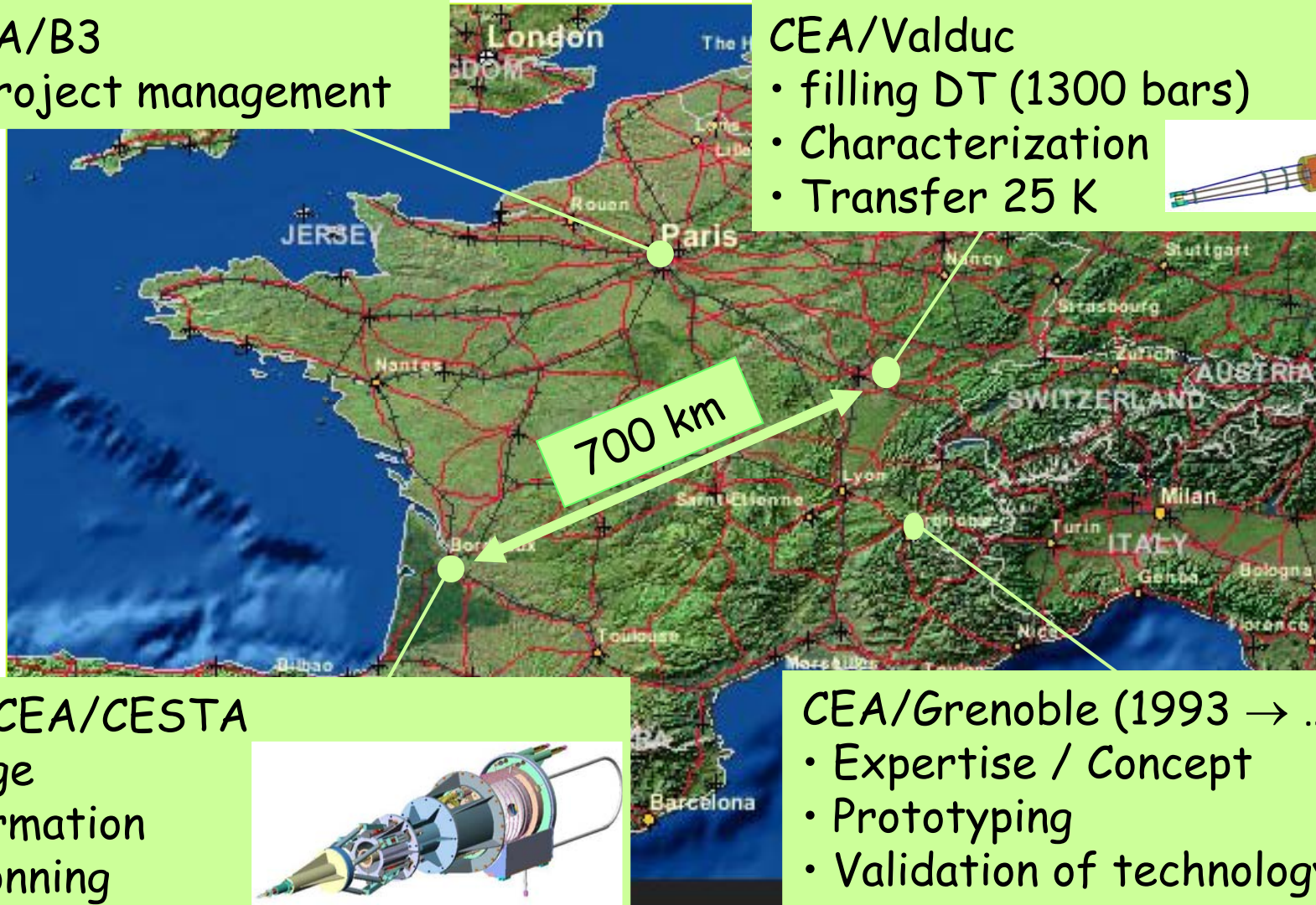
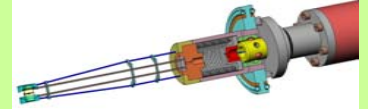
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CEA/B3

- project management

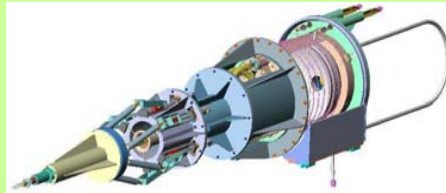
CEA/Valduc

- filling DT (1300 bars)
- Characterization
- Transfer 25 K



Pour le CEA/CESTA

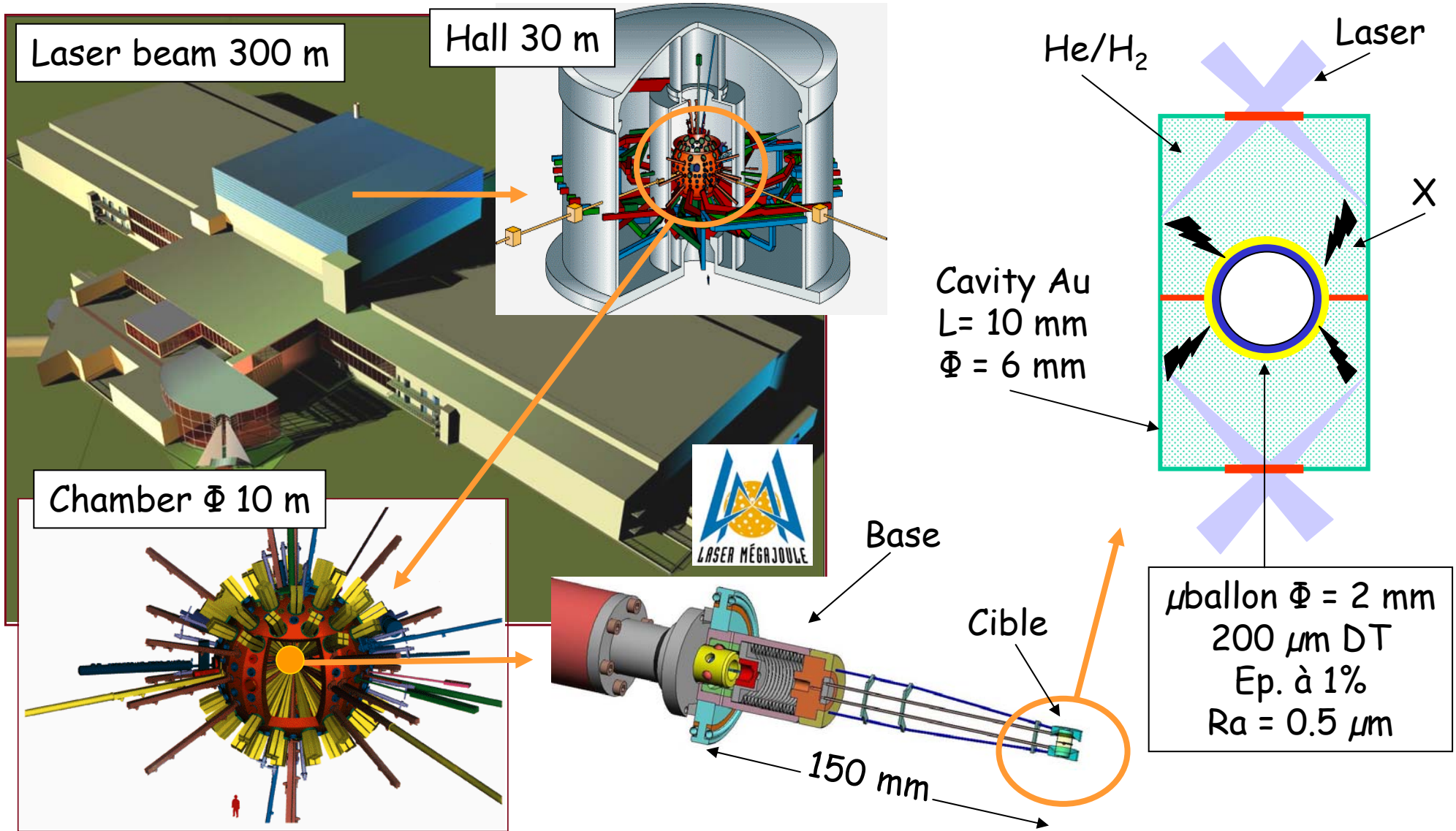
- Storage
- Conformation
- Positionning



CEA/Grenoble (1993 → ...)

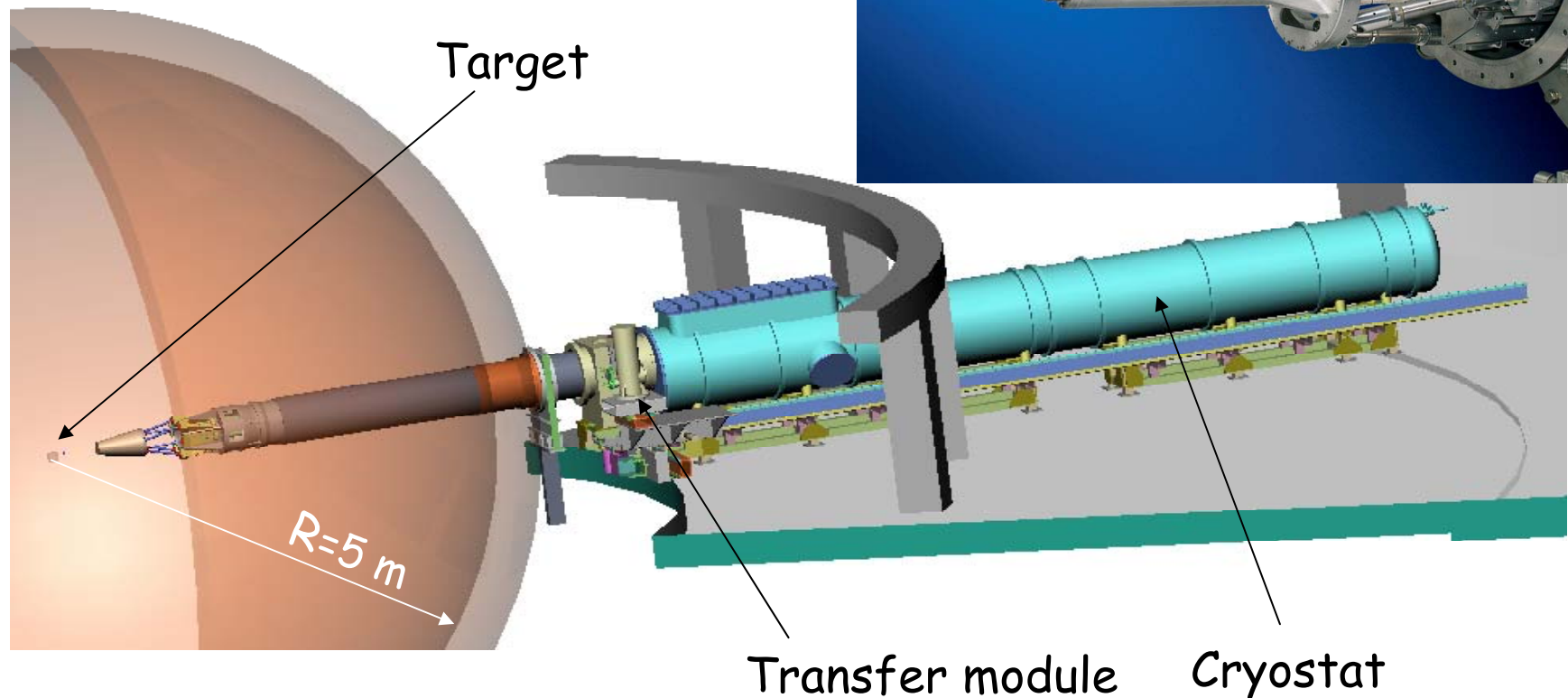
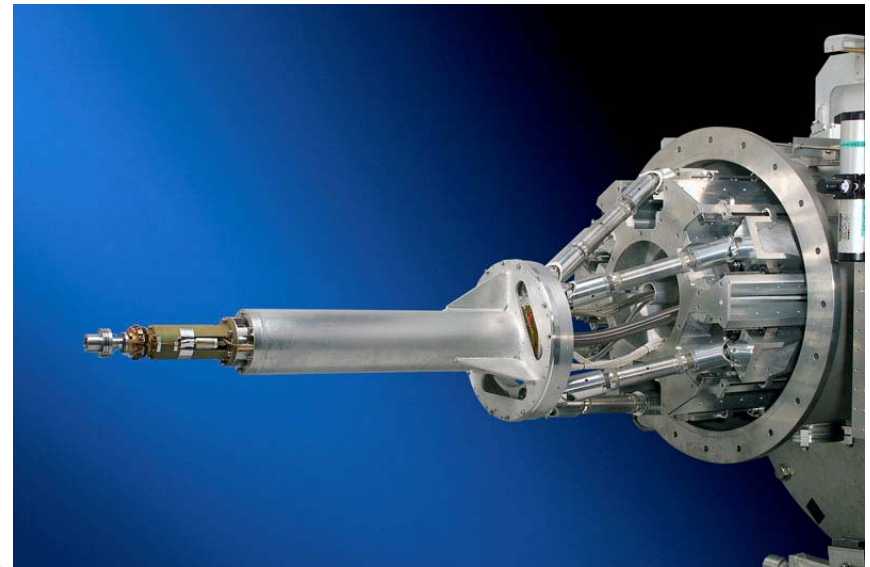
- Expertise / Concept
- Prototyping
- Validation of technology

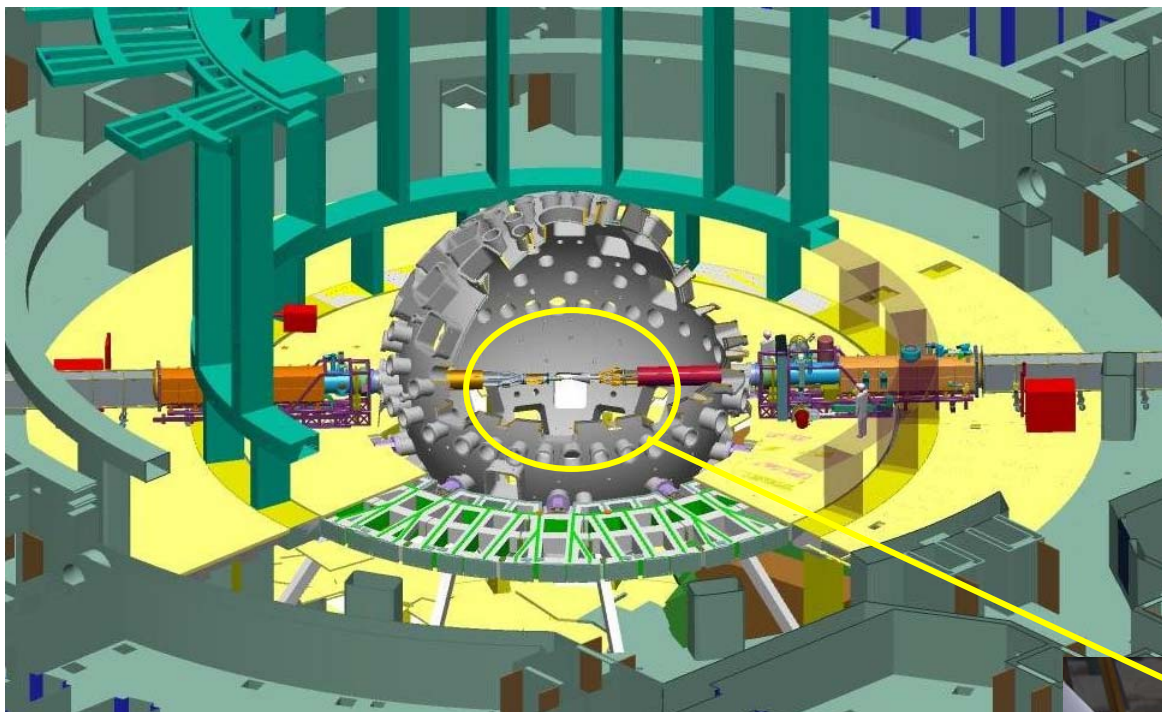
Laser MegaJoule project



Cryogenic target carrier (PCC)

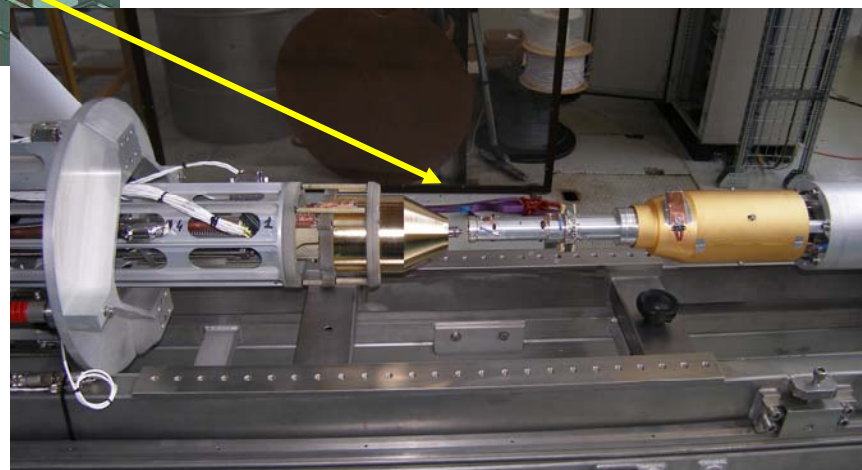
- Solidification ($18.2-19.72 \text{ K} \pm 1\text{mK}$)
- hexapode $10 \mu\text{m}$ accuracy
- Thermal gradient $< 75 \mu\text{K}$



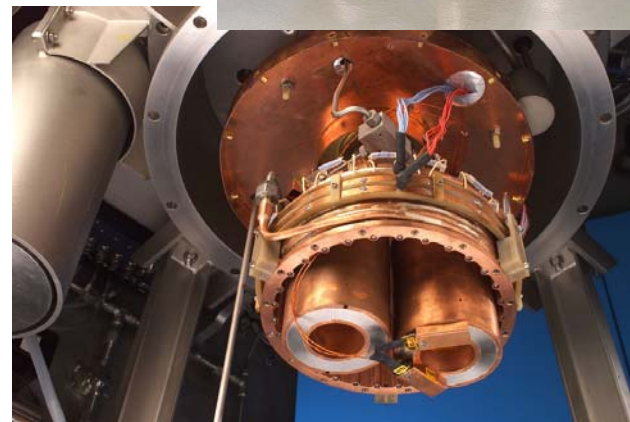
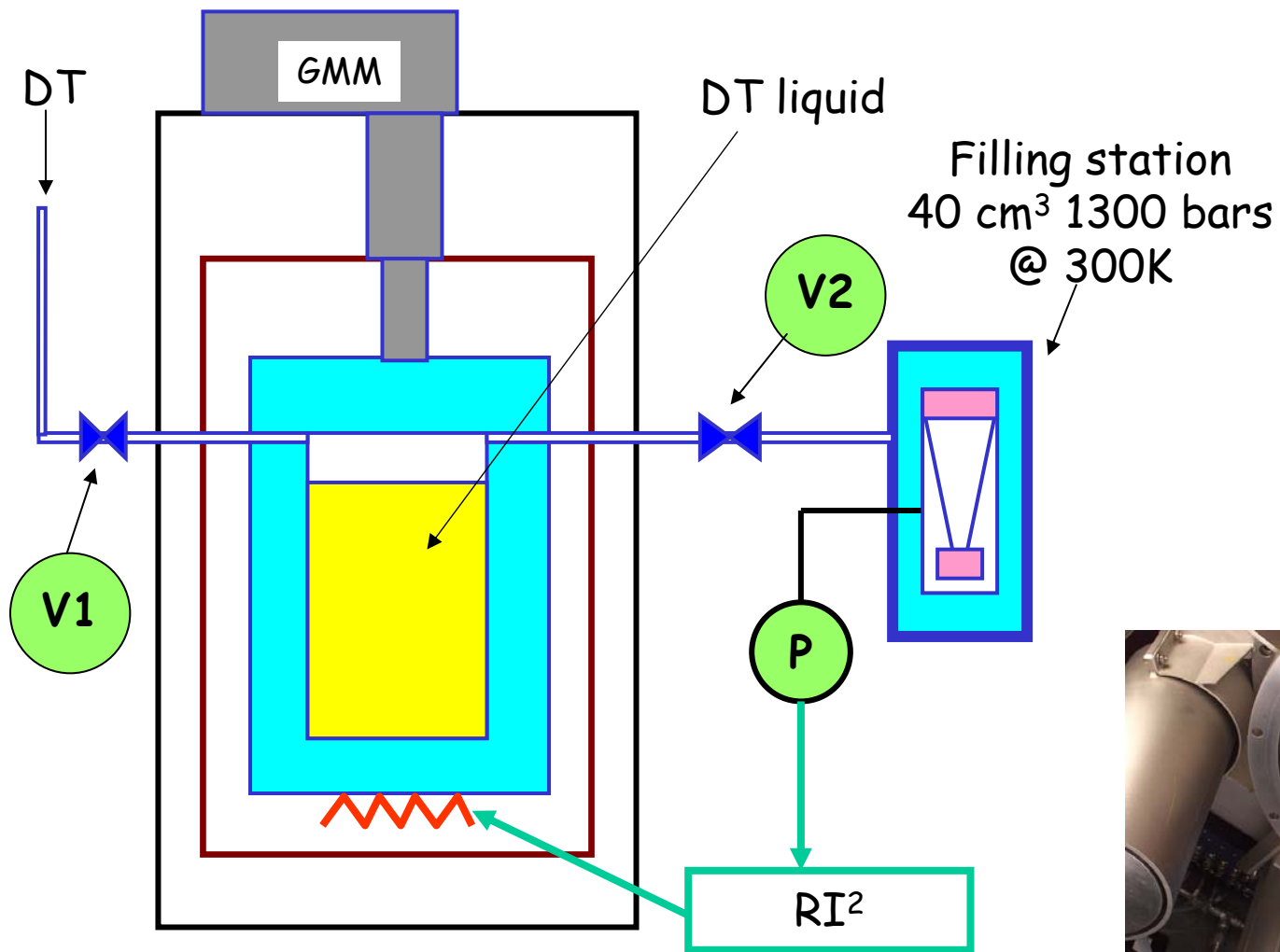


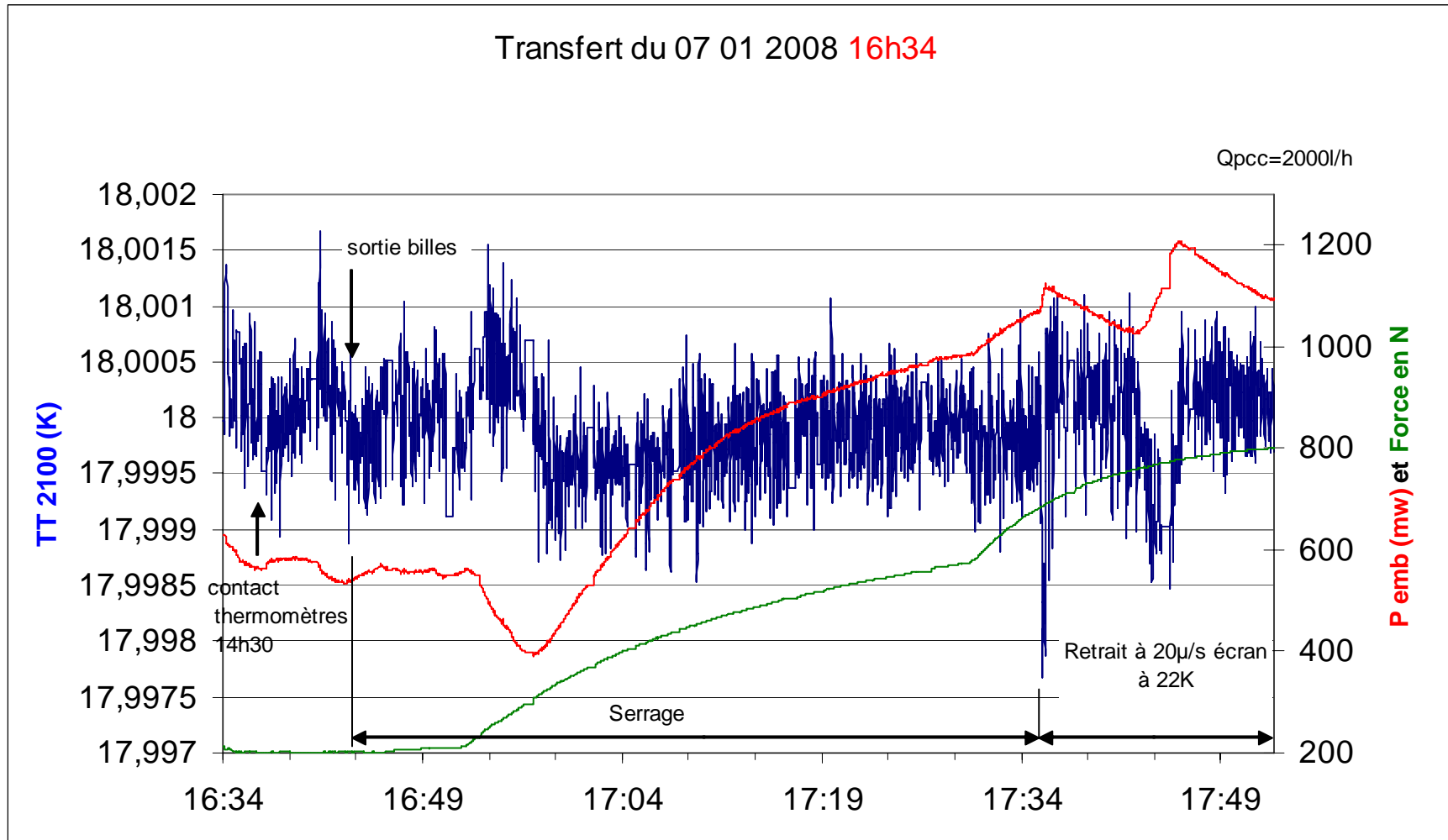
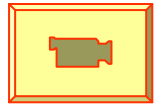
Target time life 180 ms
(numerical calculations)

Remove the thermal shroud less than 100 ms
and move away to a distance of 0.5 m
Linear motor from 20 to 40 kW
Acceleration 20 g

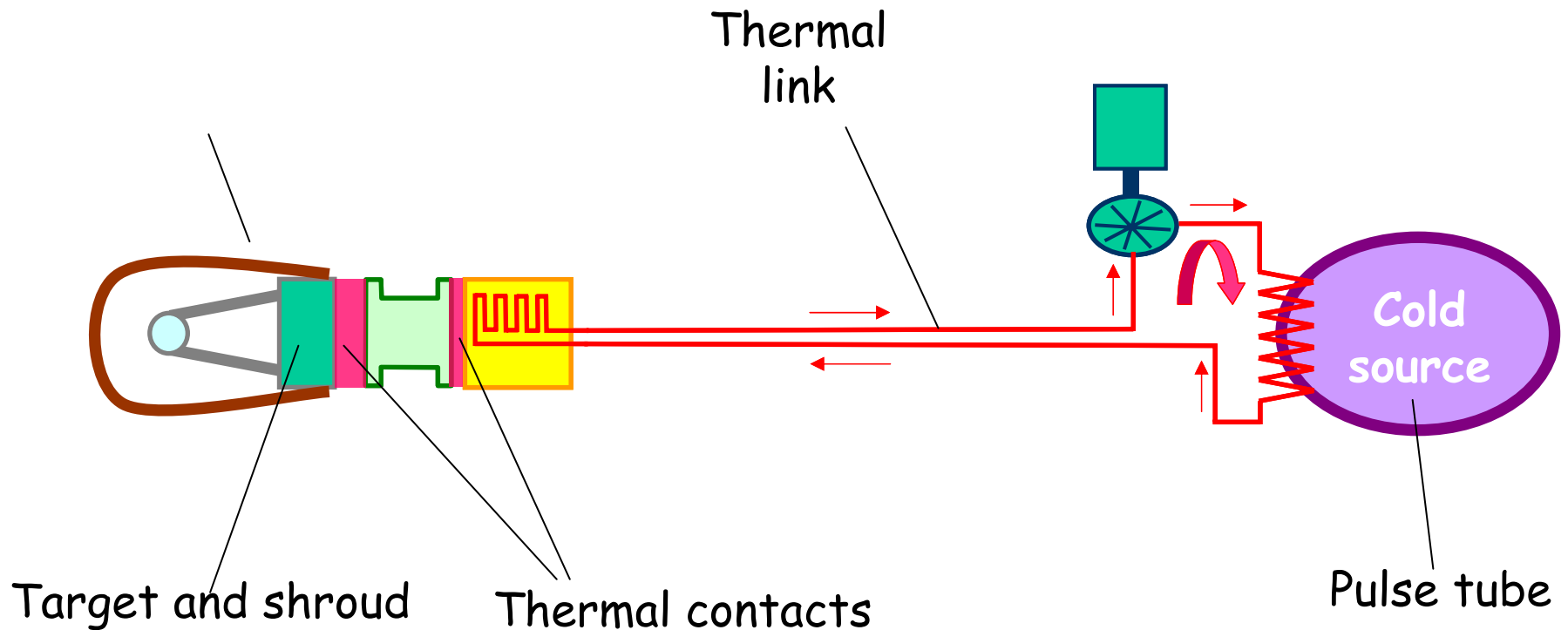


cea Cryocompressor

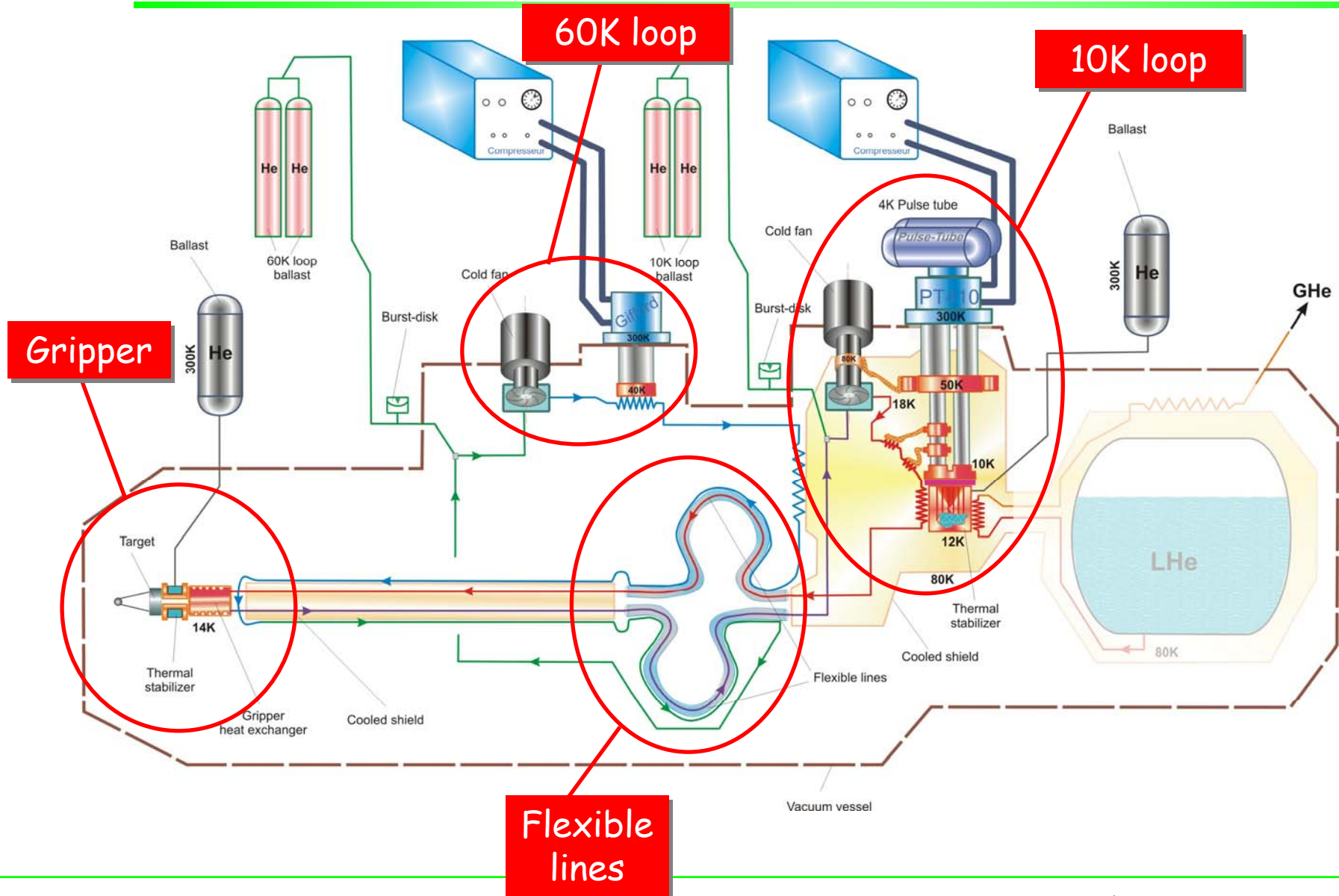




Cooling of the gripper: principle

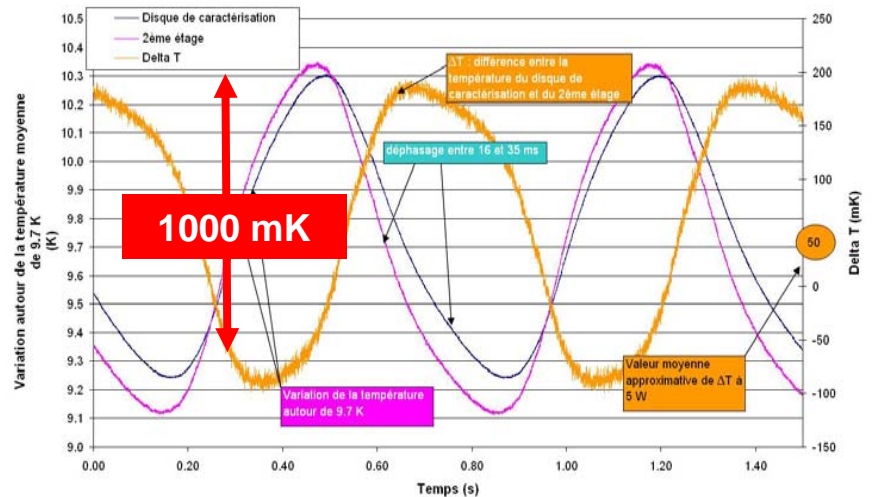


Cryogenic circuits : principle

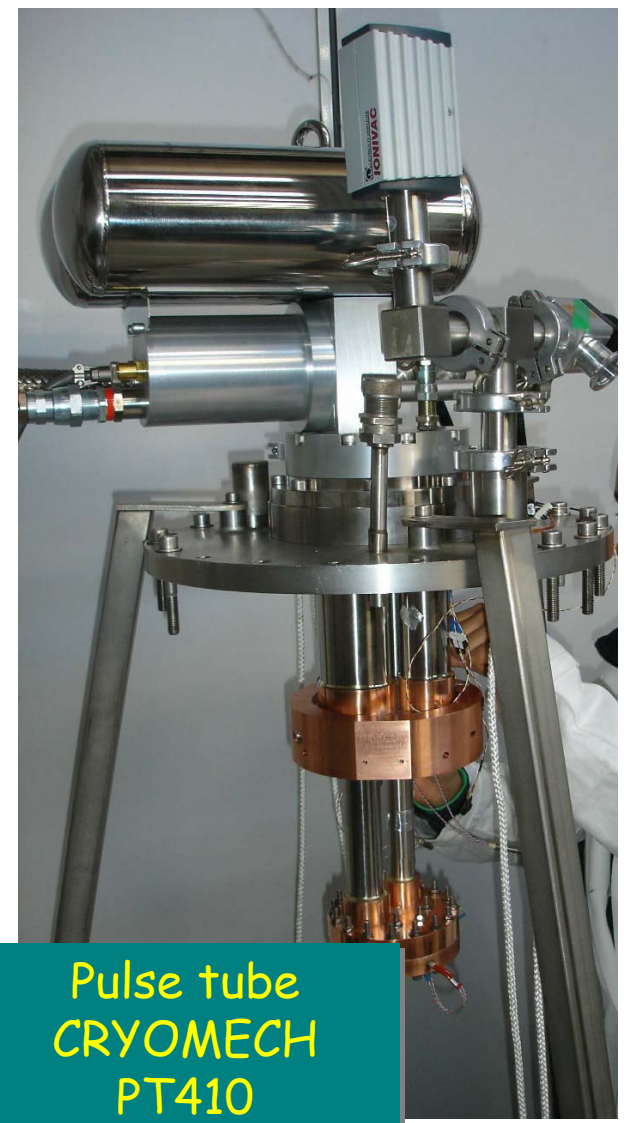
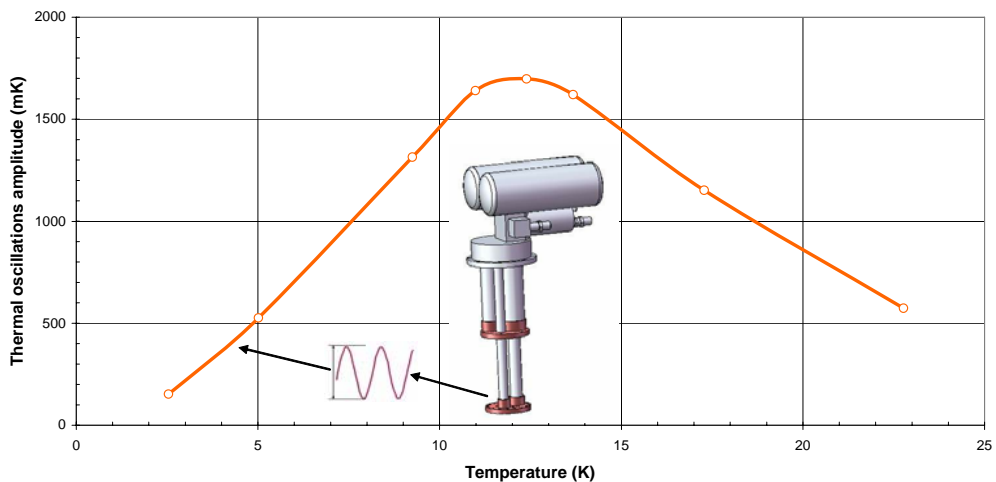


PT generates thermal oscillations

2nd stage temperature oscillates at 1.4 Hz



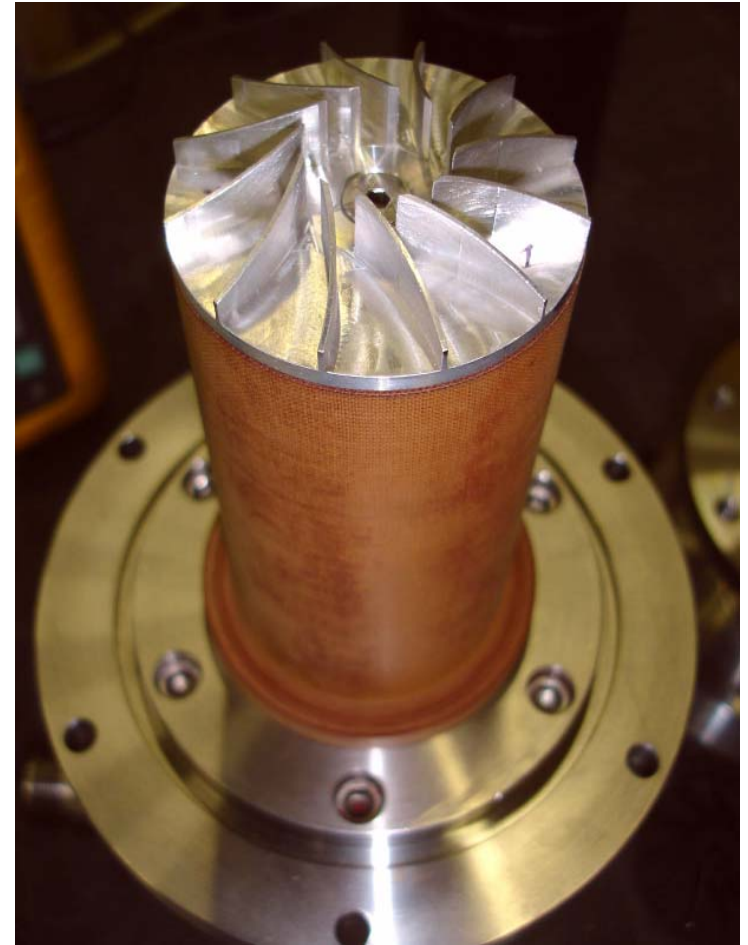
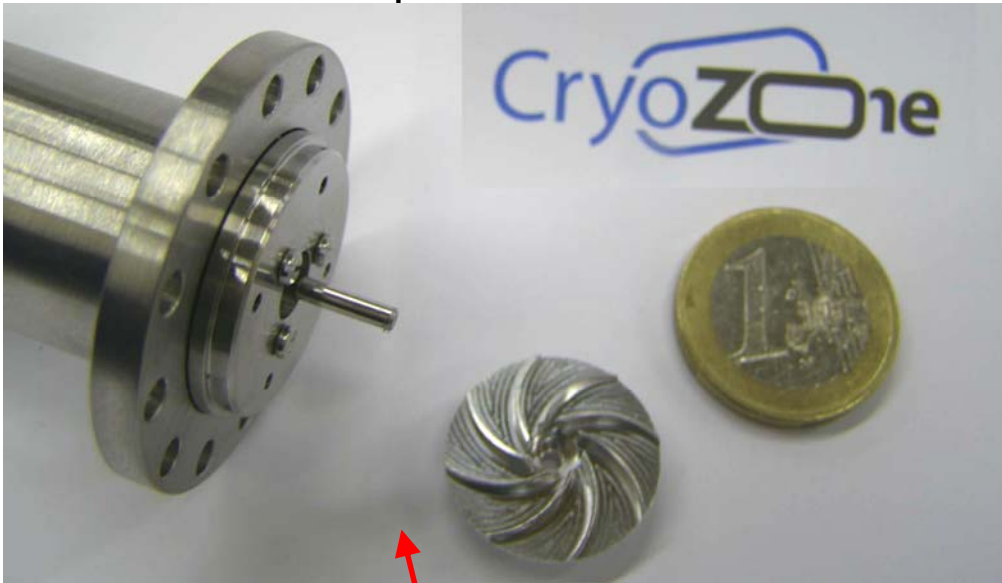
Thermal oscillations at the pulse tube second stage as a function of the temperature



**Pulse tube
CRYOMECH
PT410**

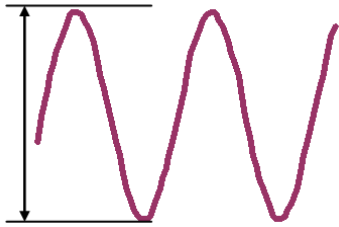
Small Cryogenic Fans

- One fan for the 10K loop, another for the 60K loop
- Working pressure : 20 bars
- Mass flow : 0.1 to 0.5 g.s⁻¹
- Delta P provided by the fan : up to 20 mbar
- The 10K fan has a thermal anchoring at 60K
- The critical point is the heat flow conducted

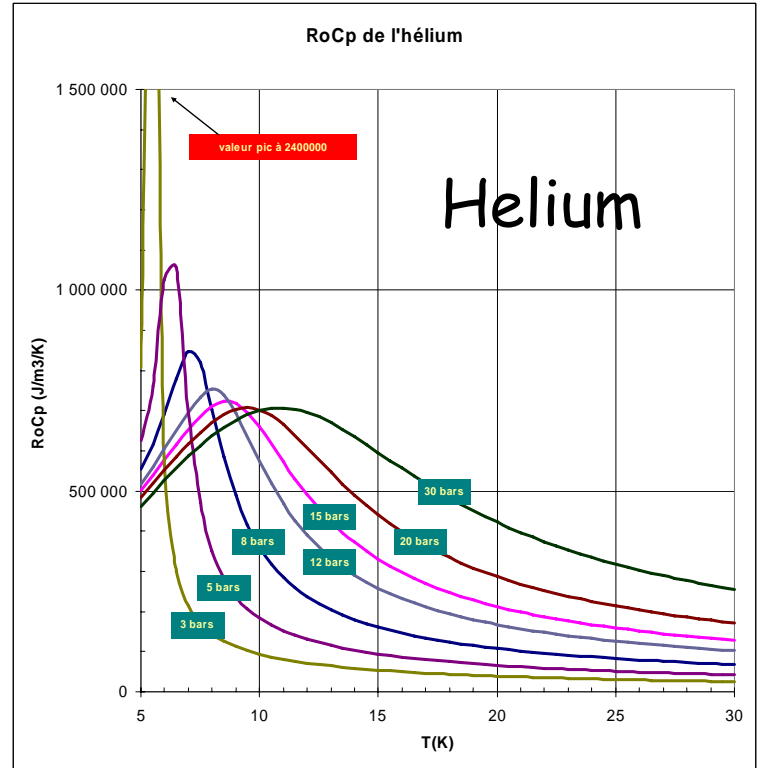
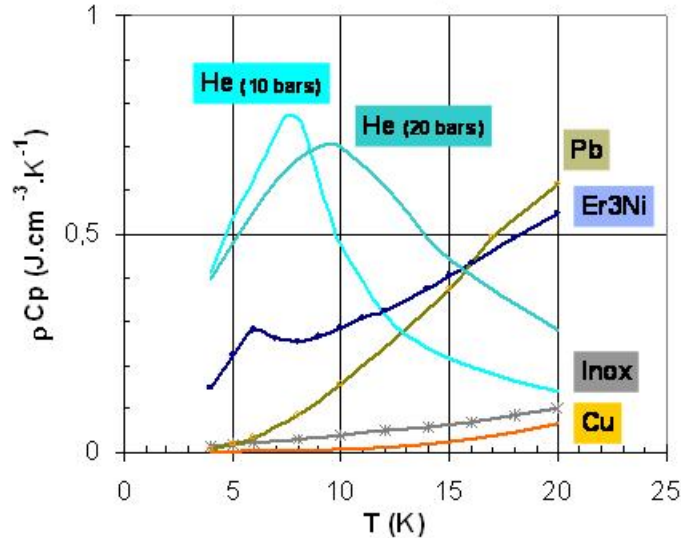


The fan "MISTRAL" : a brand new low heat input prototype designed and built by CRYOZONE

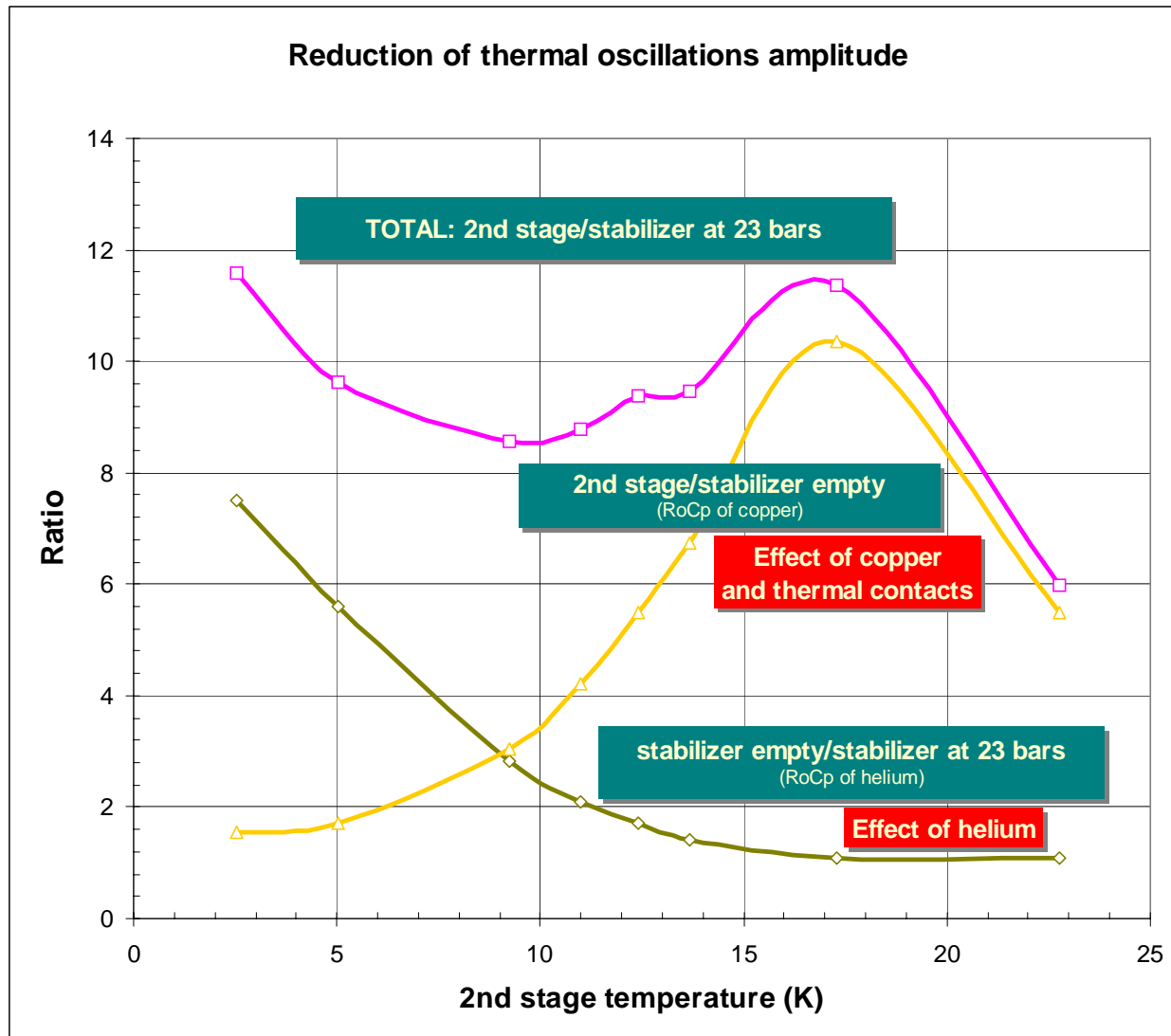
Damping the oscillations with a thermal mass



Oscillations have to be reduced by a factor 1000



With its high Cp Helium is a good candidate



It is expected from passive stabilizers to obtain a high damping.

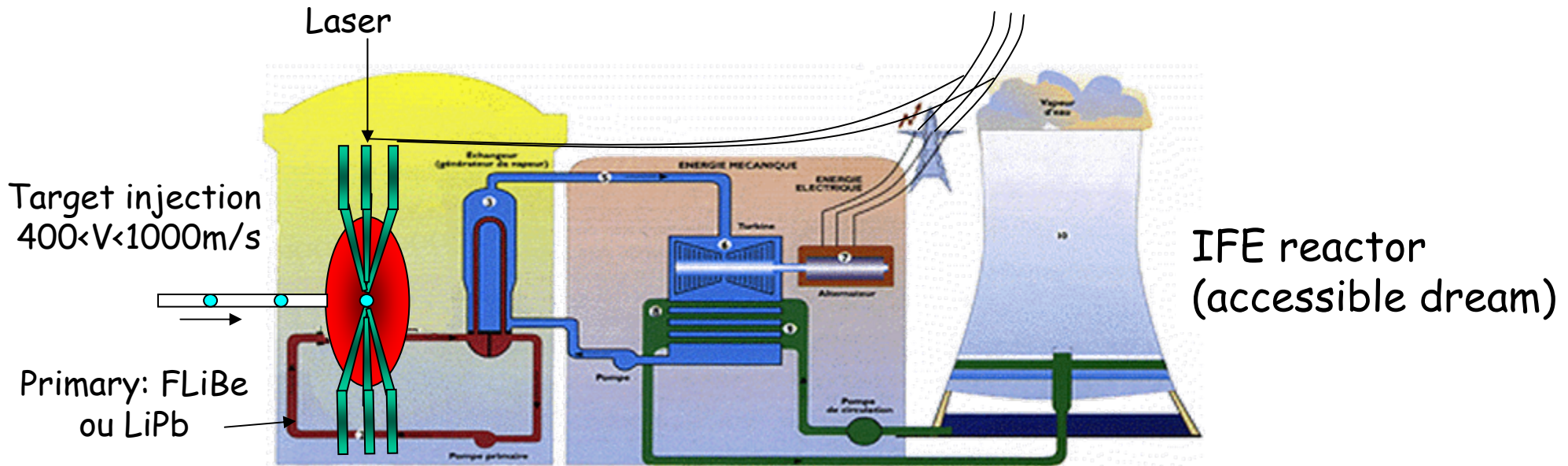
Many technologies are now available for cryotargets
(direct or indirect drive)

Regulation within a margin of 1 mK (LHe + GHe loop)

cold robotics with accuracy 10-15 microns,

With cryorefrigerator the margin is 20 mK.

Thanks for your attention



Do not ask yourselves what Hiper can do for you, ask yourselves what you can do for Hiper.

JFK

Copper and helium : a passive stabilizer

- Passive thermalizer : a cold helium volume (a few cc) connected to a ballast at 300K.
- A bulk copper part with numerous slots is used as thermal link.
- Copper helps the stabilization at 15K or above.
- The cold volume is thermally linked to the pulse tube.

