

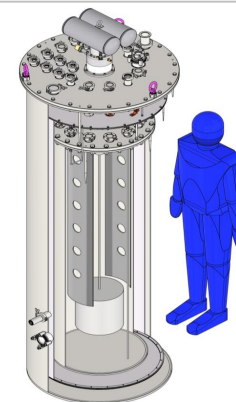
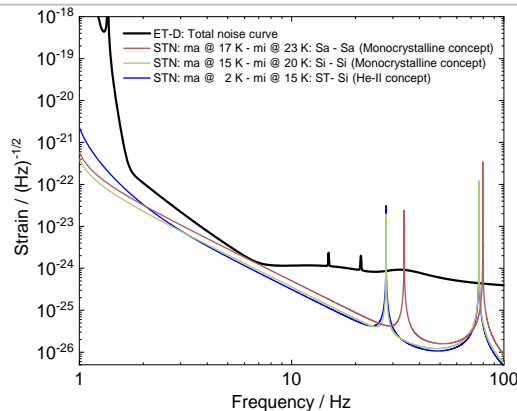
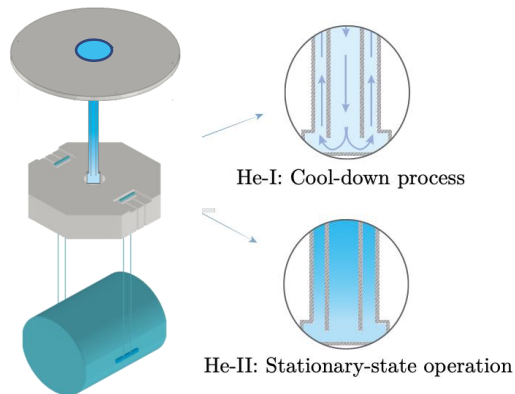
# Test facility for experimental investigations of the He-II based ET-LF payload cooling concept

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Piero Rapagnani, Valentina Mangano

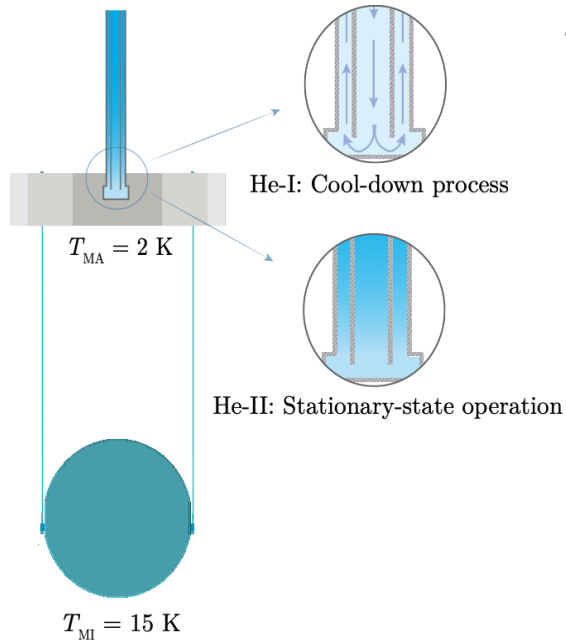


08 May 2023

XIII ET Symposium (Cagliari)

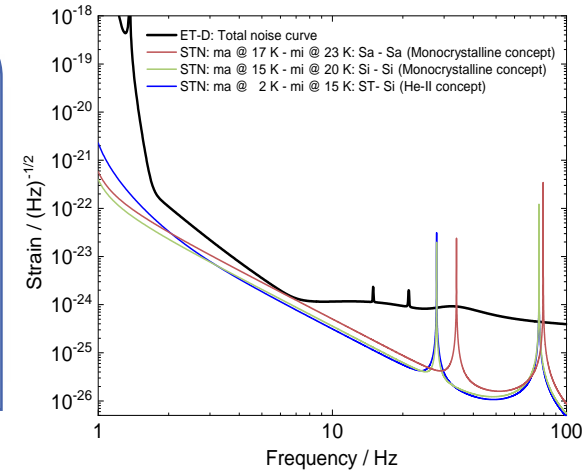


# He-II based cooling of ET-LF payload



## Potential of concept

- Properties of He-II = ultra-quiet, thermally efficient cooling
- Cool-down via He-I
- STN fulfills ET-D constraints
- Theoretical feasibility recently published in [1]



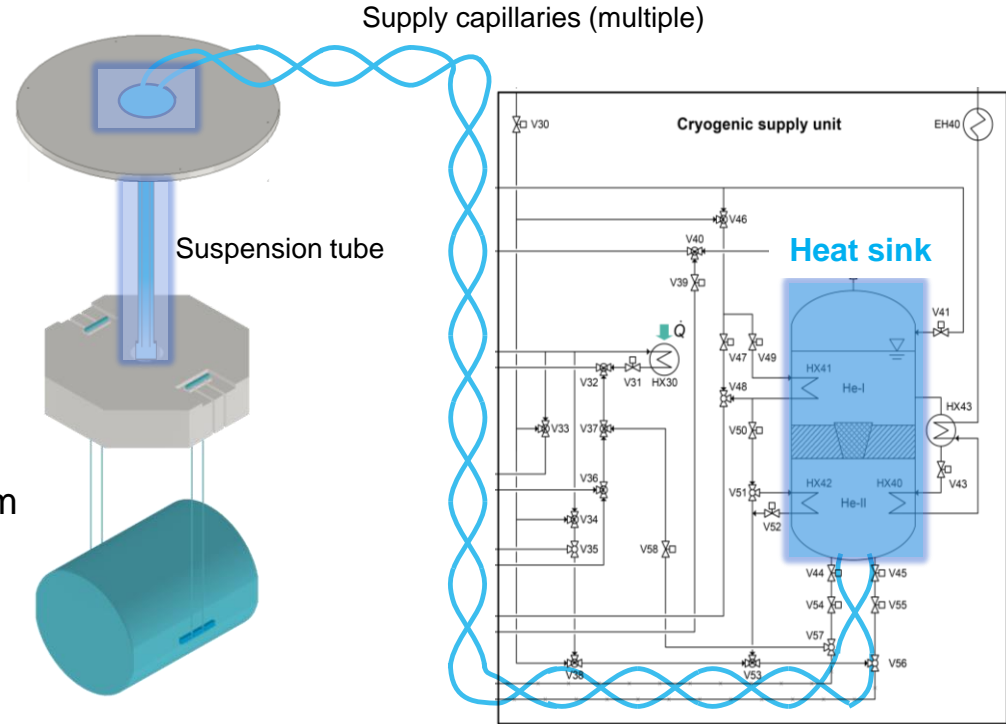
→ Experimental investigation of concept!

[1] X. Korovesi, L. Busch, E. Majorana, P. Puppo, P. Rapagnani, F. Ricci, P. Ruggi, S. Grohmann (2023), DOI: [10.48550/arXiv.2305.01419](https://doi.org/10.48550/arXiv.2305.01419)

# Experimental investigation

## ■ R&D to address open questions:

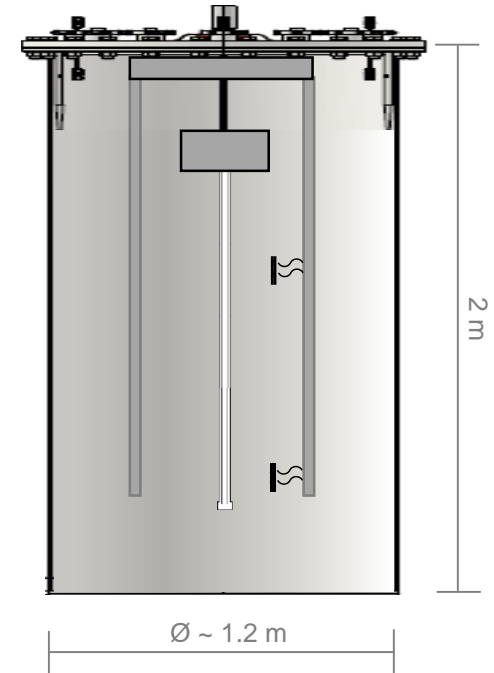
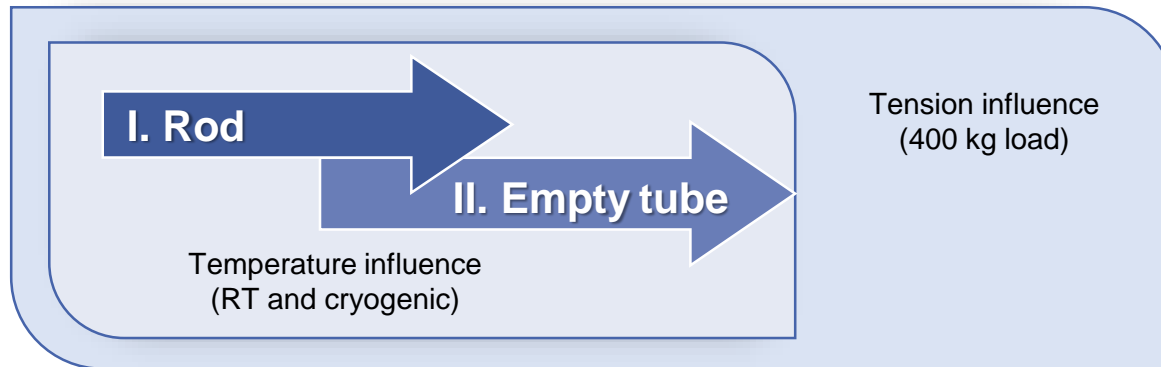
- Interface design, incl. noise isolation
  - Suspension tube ↔ Supply capillaries
- Validation of cooling procedure
- Vibration attenuation from helium cooling system
  - Transfer function of He-II cooling system
- He-II influence on dissipation
  - Q-factor of He-II filled suspension tube



Reference: L. Busch, S. Grohmann (2021), DOI: [10.1088/1757-899x/1240/1/012095](https://doi.org/10.1088/1757-899x/1240/1/012095)

# Experimental setup concept I

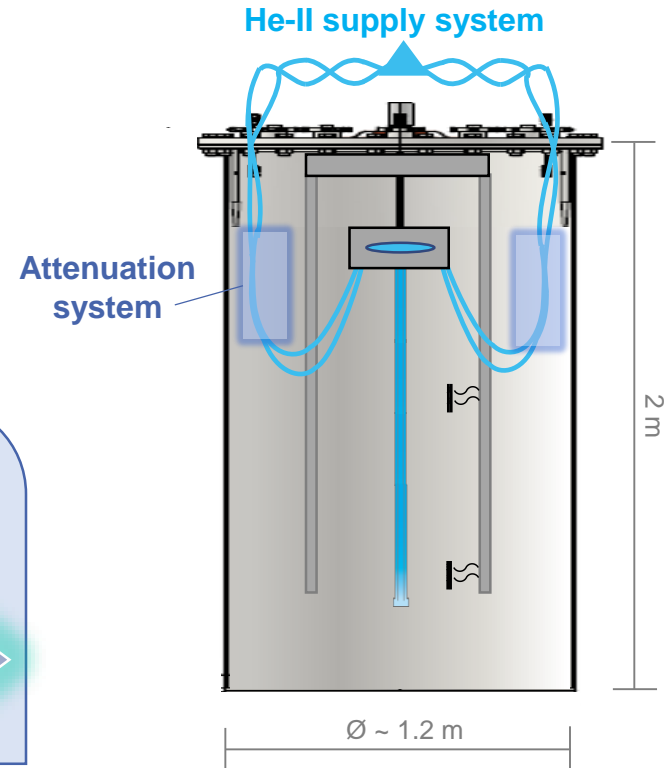
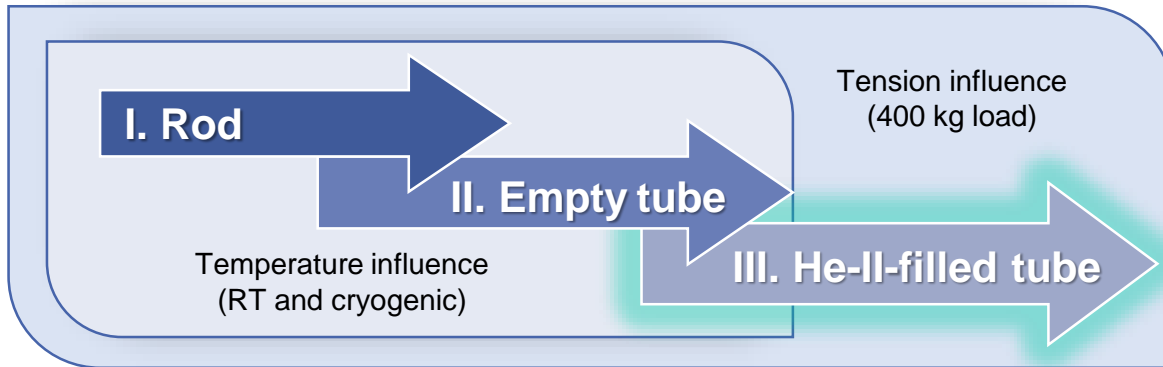
- **Q-factor measurement setup** to investigate losses in realistic suspensions:
  - Methodology: Ring-down procedure
    - Minimization of clamping losses via optimal sample support
    - Step-by-step **complexity increase** → 3 Stages



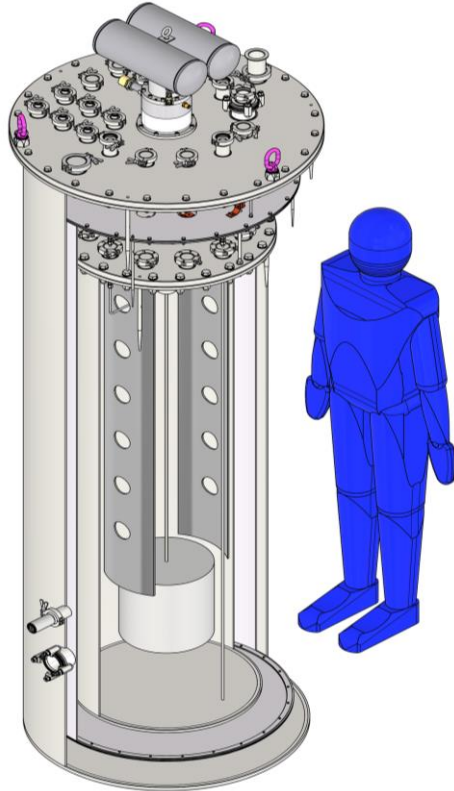
# Experimental setup concept II

## ■ Helium supply system:

- He-II supply to  $Q$ -measurement setup
- Design of He-II cooling interface on sample support
- Capillary noise attenuation system



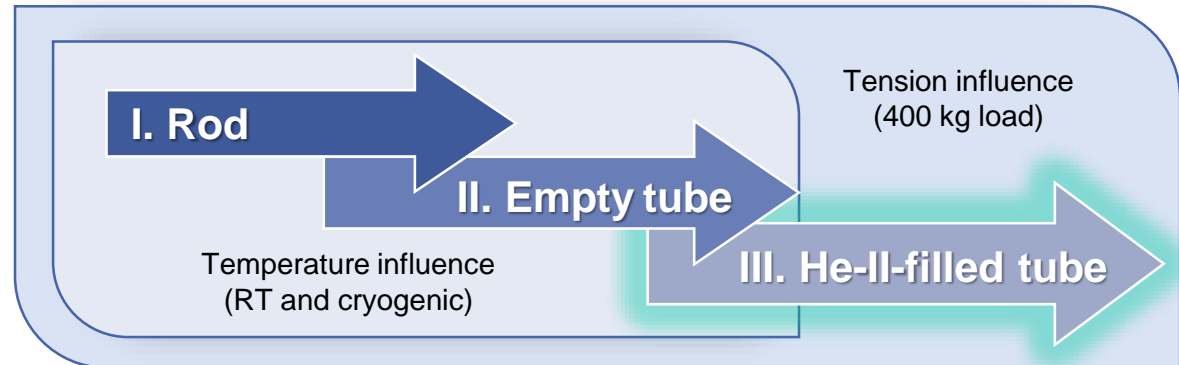
# Experimental scope of test facility



## ■ Q-factor measurement setup


- Realistic dimensions of suspension fibers and tubes
- Investigation of loss contributions in suspensions
- He-II integration in  $Q$ -measurements
- Proof of concept for He-II based payload cooling

Funding  
proposal  
pending!



# Thank you for your attention

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