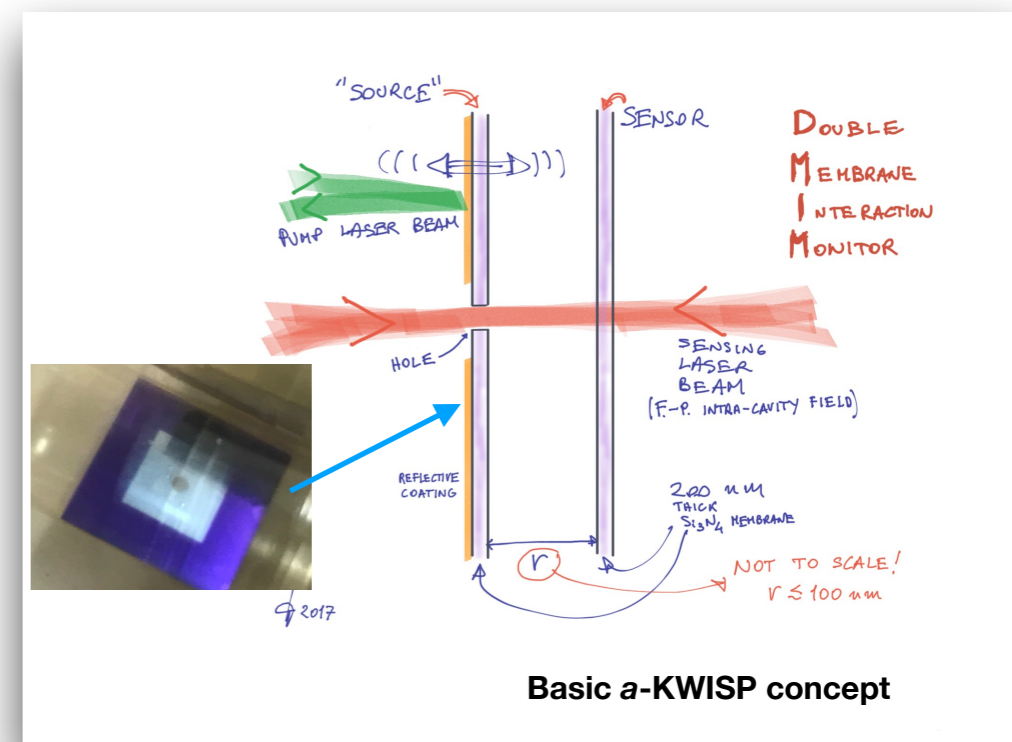


# Update on *advanced-KWISP*

G. Cantatore, M. Karuza  
PBC Tech WG meeting - 25/2/2021

# Summary

- The **advanced-KWISP** concept is based on the Fabry-Perot interferometric readout of a sensitive micro-mechanical resonator consisting of two parallel, ultrathin, membranes kept at a separation distance of the order of a micron. This apparatus would allow the investigation of novel microscopic interactions taking place when macroscopic bodies are kept at a short distance apart, and achieves its design performance at cryogenic temperatures.
- A key step towards this goal is building a compact Fabry-Perot resonator able to keep a stable lock for extended periods of time while reading the displacements of a micro-membrane placed inside it. This has been obtained by the KWISP opto-mechanical detector now operating at CAST, which features a **small-size, monolithic, Fabry-Perot** interferometer with full fiber optic beam transport, ready for cooling tests at liquid He temperatures.



# Main points

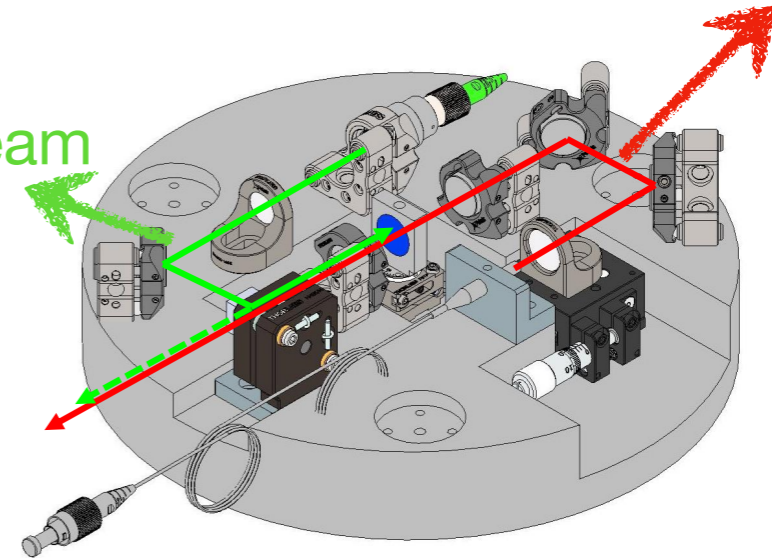
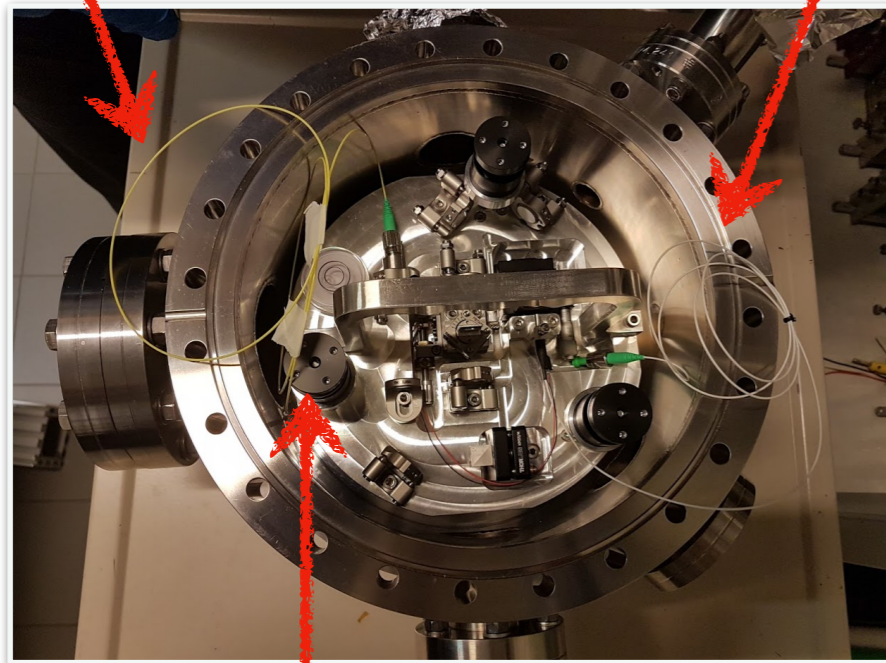
- **Key step towards a-KWISP: stably locked Fabry-Perot readout of micro-membrane displacements**
- **Achieved with KWISP version 3.5 now operating at CAST:**
  - small-size, monolithic, Fabry-Perot interferometric readout
  - full fiber optic beam transport
  - sandwich-type passive vibration isolation
  - force sensitivity in the pico-N range in “hostile” environment (CAST experimental hall) with on-board absolute force calibration
  - ready for cooling tests at liquid He temperatures
- **Ongoing laboratory work: resonance frequency measurements on metal coated membranes for the detection of static forces**

# KWISP 3.5 @ CAST

sensing beam

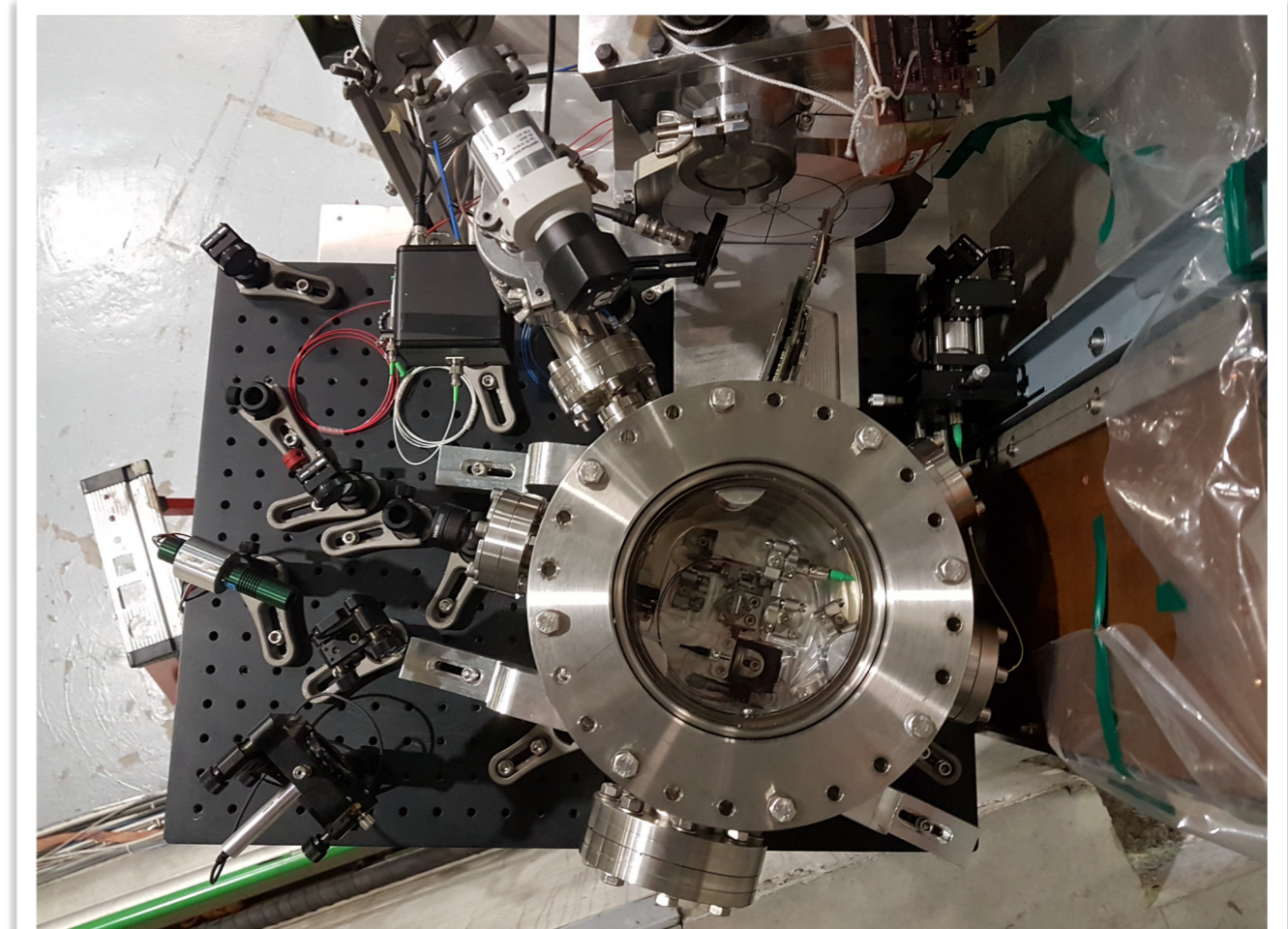
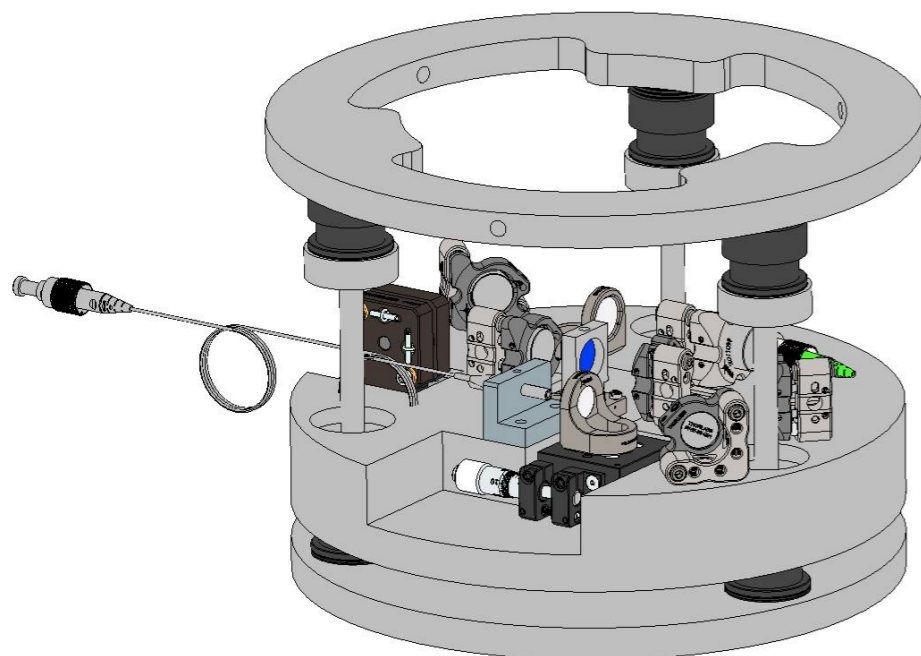
calibration beam

fiber optic beam transport



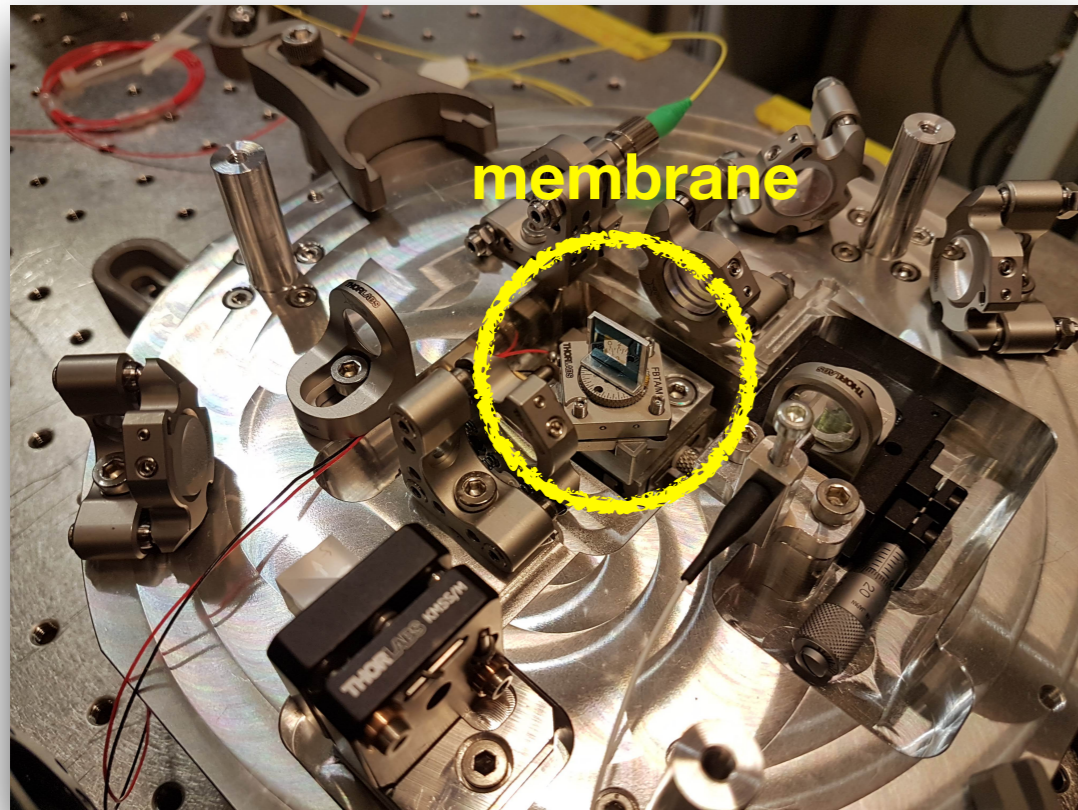
monolithic optical bench

sandwich-type vibration isolation

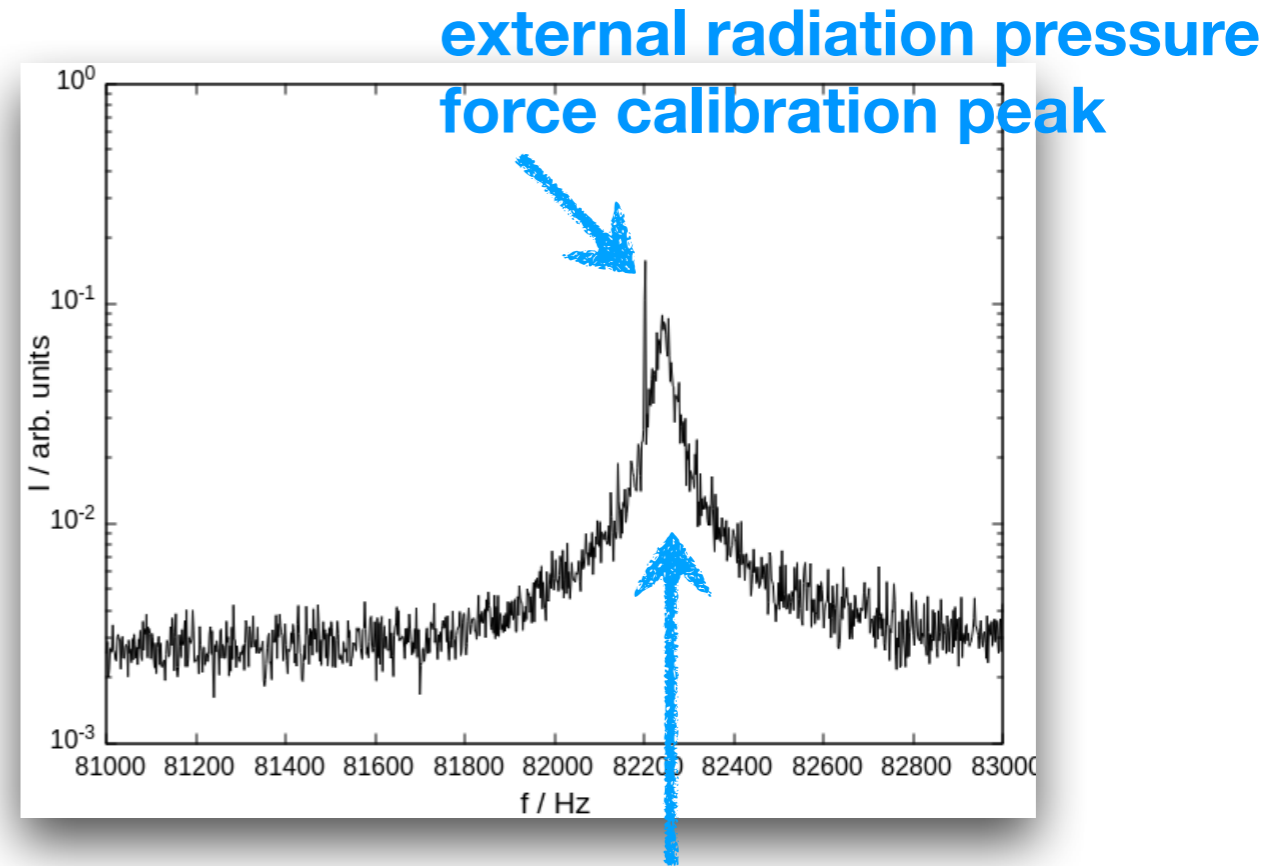


KWISP 3.5 on-beam at CAST

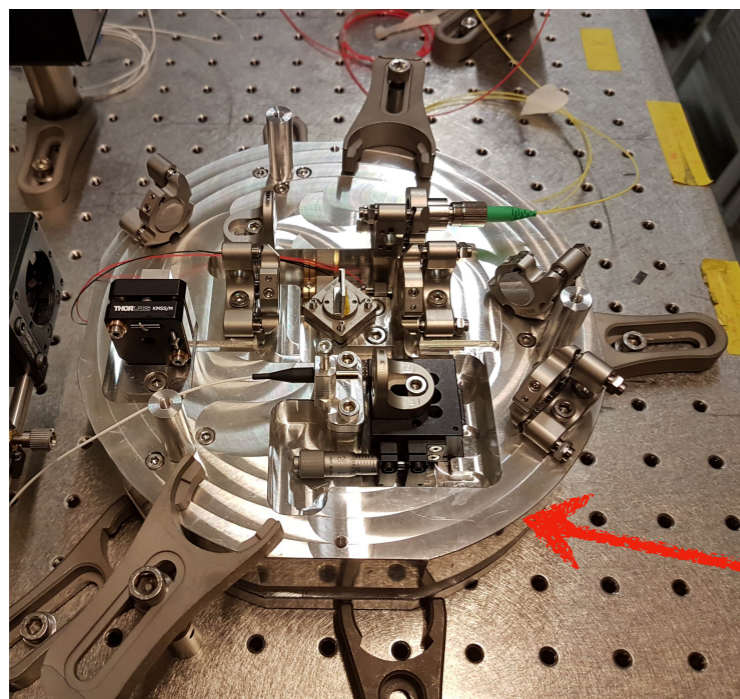
# Ongoing work



membrane



“thermal” mechanical resonance peak



- Pt-coated membrane used for frequency studies  $\Rightarrow$  detection of static forces
- monolithic optical bench ready for low temperature tests

