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Modal analysis of Q-factor measurements of cryogenic suspensions for ET-LF in GRAVITHELIUM

The ERC project GRAVITHELIUM aims to investigate the dissipative behaviour of full-scale suspensions used to cool-down the cryogenic core optics in ET-LF. Two possible suspension concepts are currently considered, using either monocrystalline suspension fibres made of silicon or sapphire, or titanium suspension tubes filled with static He-II. The dissipative behaviour of these suspensions is characterized by the mechanical Q-factor. It can be measured by the ring-down method, exciting the suspensions to resonance vibrations on the nanometre scale and analysing the decay time. Modal analysis has concluded that the second and the third modes of the suspensions are measurable, which occur between 40 Hz and 160 Hz. In this frequency range, the experimental set-up is designed to keep the extrinsic dissipation below the intrinsic dissipation of the suspension. We present the design approach for the different types of suspensions.

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