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## Helium-based cooling concept of the ET-LF interferometer

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The low-frequency interferometer in the Einstein Telescope (ET-LF) shall be operated at test mass temperatures of 10 K to 20 K. Motivated by the potential of using superfluid helium (He-II) for cooling the test masses, we derive a general cooling concept for the ET-LF cryostats. This concept is based on a helium refrigerator at each ET corner station, providing cooling capacity with He-II for the test masses at 2 K, as well as cooling capacity with normal helium (He-I) for radiation screens at 5 K and thermal shielding at 50 K to 80 K. The heat extraction path of the 2 K system is implemented by means of long capillaries, where the heat transport takes place by steady-state heat conduction in He-II. The integration of He-II-filled capillary suspensions in the payload design may also offer a solution for achieving low temperatures of the test masses. This option will be investigated in terms of thermal dissipation and the propagation of vibrational noise from the helium cooling system into the payload.

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