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Prototyping cryogenics development for ET at the Amaldi Research Center.

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Einstein Telescope nominal sensitivity, below 20 Hz, implies innovative technologies associated to cryogenics and revised mechanical design for test mass suspension. It is foreseen to cool the main optics and their suspensions down to 10-20 K. The use of solid thermal conduction and pulse-tube technology appears suitable if properly designed. The reduction of technical noise is demanding and constrains the payload design. Though the performance of the existing techniques must be carefully validated in this context, significant developments must be further carried out. The heat extraction capability of pure and crystalline materials is extremely important, but to exploit it on a 1:1 scale payload, several intermediate steps must be validated and is strongly interlaced with mechanical issues.
A cryostat prototype meant to test the basic features of a full-scale cryogenic payload is under development at the Amaldi Research Center. The test mass in the payload will be dummy, but the main components involved in the heat extraction and last suspension stages will be realistic. A suitable thermal modelling is the key activity to guide the development of the cooling lines, the cryostat and, finally, the payload. FEM is being used to determine the overall design step by step, with the target of providing relevant solutions to be ported to ET-LF.

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