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Status of realising and testing compact local test mass displacement sensors using DFMI

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A key technology to achieve the exquiste low-frequency sensitivity of the Einstein Telescope is to reduce the noise of local displacement sensors in the test mass suspension chains. We are developing a sensing infrastrcuture for this purpose based on the interferometer technique Deep Frequency Modulation Interferometry (DFMI) that enables us to realize compact sensors that can provide sub-picometer displacement sensitivity and absolute ranging. To realise this we are investigating the realisation of compact sensing heads, so called compact balanced readout interferometers (COBRIs) and we are developing advanced phase readout algorithms and are implementing them with FPGAs in the scalable MicroTCA infrastrcuture to realize the readout of dozens of sensors. Furthermore, we are also comissioning a test bed, an active seismic isolation vacuum facility, to probe the sensor usage and performance in vacuum on triple-suspensions borrowed from ET Pathfinder. We will present the status of these developments and our test bed, as well as results from our efforts to use machine-learning to predict the motion of our seismically isolated platform.

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