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The interplay between noise budget and scientific return for the Einstein Telescope

In the planning of a third-generation detector such as the Einstein Telescope, it is crucial to study the impact of technological limitations on the sensitivity, and in turn on the scientific output. In this study, we analyze a set of sensitivity curves corresponding to different technological choices, including worst-case scenarios where each limiting factor is individually considered. We evaluate infrastructural and technological constraints by examining their scientific return relative to the baseline sensitivity.

To this end, we consider a broad range of metrics to quantify the performance across the diverse sources it will observe, thanks to its extended bandwidth. These sources include binary black holes, binary neutron stars, core-collapse supernovae, primordial black holes, intermediate-mass black holes, and astrophysical backgrounds. Our analysis is based on fast, efficient metrics, such as detection capabilities, horizon calculations, and Fisher matrix-based parameter estimation.

We present our findings for both the baseline triangular configuration and the 2L geometries, offering insights into how different design choices impact the Einstein Telescope's scientific potential.

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