# The orbital effects on time delay interferometry for TianQin

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The proposed space-borne gravitational wave (GW) detector TianQin owns a geocentric orbit with armlengths of $\approx 1.7 \times 10^5$ km. It is aimed to detect the GWs at 0.1 mHz – 1 Hz. For space-borne detectors, the armlengths are unequal and change continuously which results in that the laser phase noise is nearly $7 - 8$ orders of magnitude higher than the secondary noises (such as acceleration noise, optical path noise, etc.). The time delay interferometry (TDI) that synthesizes virtual interferometers with time-delayed one-way phase measurements has been proposed to suppress the laser phase noise to the level that is comparable or below the secondary noises. In this work, we evaluate the performance of various data combinations for both first and second generation TDI based on the five-year numerically optimized orbits of the TianQin's satellites which show the actual rotating and flexing of the constellation. We found that the time differences of symmetric interference paths of the data combinations are $\sim 10^{-8}$ sec for the first generation TDI and $\sim 10^{-12}$ sec for the second generation TDI, respectively. While the second generation TDI is guaranteed to be valid for TianQin, the first generation TDI is possible to be competent with improved stabilization of the laser phase noise in the concerned GW frequencies.

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