

# Erratum: Quantum search for gravitational wave of massive black hole binaries [Phys. Rev. D **112**, 083004 (2025)]

Shifan Yu, Fangzhou Guo , and Jibo He 

(Received 7 September 2026; published 22 October 2026)

DOI: [10.1103/x3pz-ng9z](https://doi.org/10.1103/x3pz-ng9z)

In the numerical simulations used to generate the cost distributions in Figs. 3–6 of the original article, we identified an error in converting the measured quantum-counting outcome into the number of Grover iterations. Specifically, the counting-register outcome  $b$  was used directly as

$$k_{\text{old}} = \text{Round} \left[ \frac{\pi}{4} \sqrt{\frac{N}{b} - \frac{1}{2}} \right].$$

According to Algorithms 2 and 3 of the original article,  $b$  should first be converted into the estimated number of matching templates,

$$r^* = \text{Round} \left[ N \sin^2 \left( \frac{\pi b}{2^p} \right) \right], \quad (1)$$

and the number of Grover iteration should then be determined from  $r^*$  as

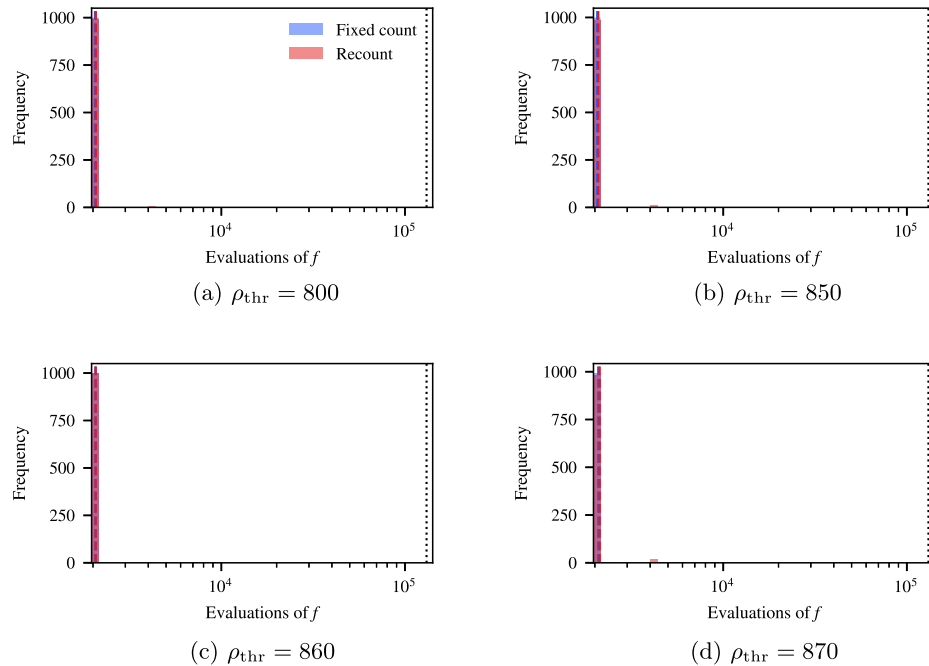


FIG. 3. Number of evaluations of the oracle function  $f$  required to retrieve a matching template in 1,000 simulations at different threshold levels  $\rho_{\text{thr}} = 800, 850, 860$ , and  $870$ . (a)–(d) Each subplot shows the distribution of function evaluations across trials. Blue histograms represent using a fixed  $k^*$ , estimated from a single SIGNAL DETECTION step; red histograms correspond to reestimating  $k^*$  for each failed retrieval. Dashed lines indicate mean values. The black dotted line shows the classical case where all  $2^{17}$  templates are evaluated.

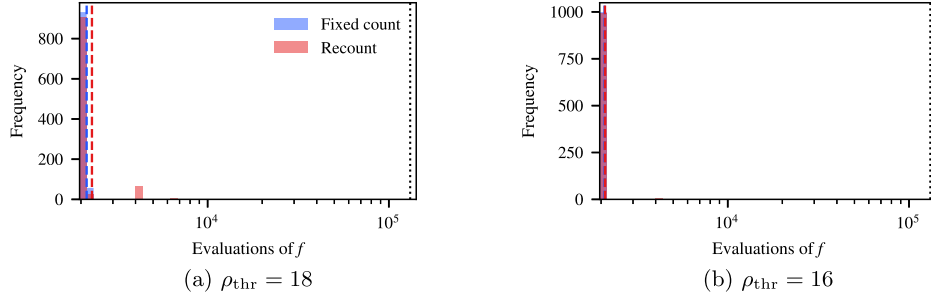


FIG. 4. Comparison of algorithm efficiency for detection thresholds  $\rho_{\text{thr}} = 16$  and  $\rho_{\text{thr}} = 18$  using 1,000 simulations for the GW150914 example.

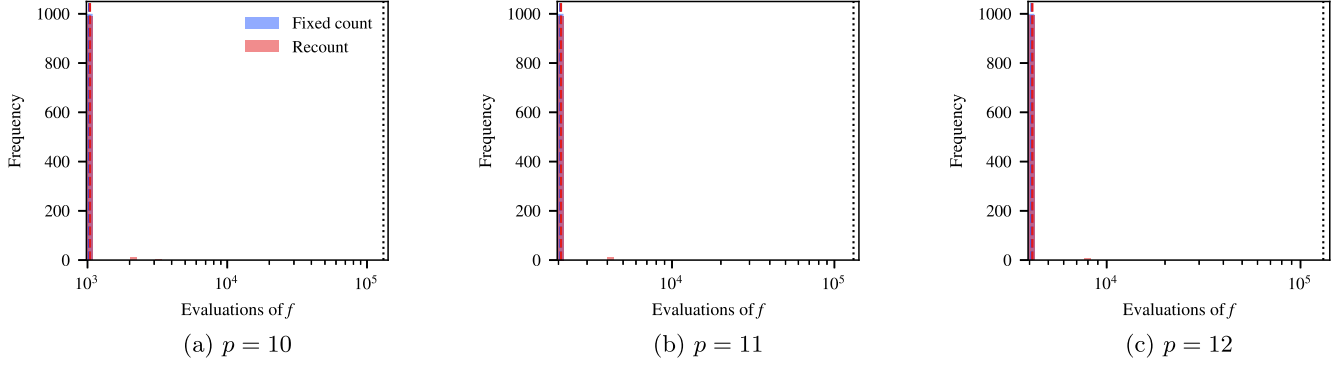


FIG. 5. Number of evaluations of the oracle function  $f$  required to retrieve a matching template in 1,000 simulations for precision values  $p = 10, 11$ , and  $12$ , with the threshold set to  $\rho_{\text{thr}} = 800$ .

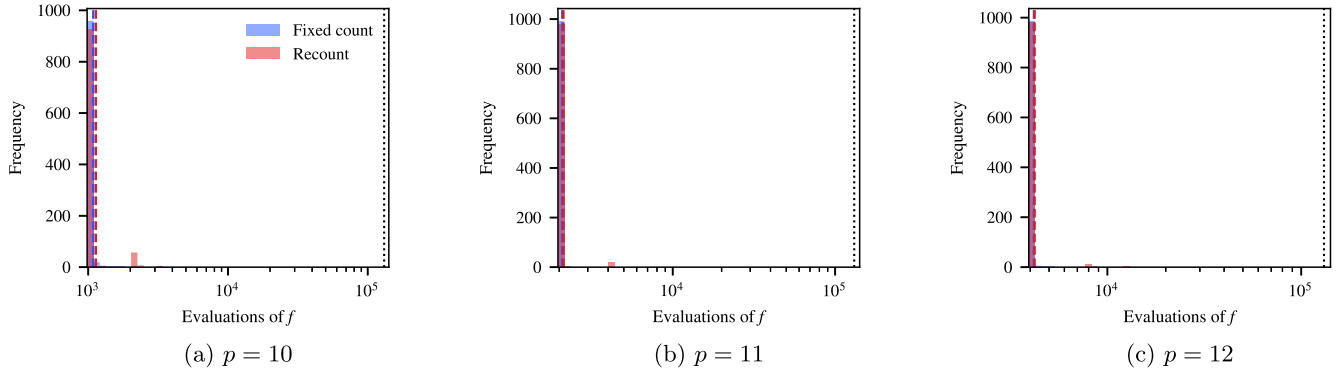


FIG. 6. Number of evaluations of the oracle function  $f$  required to retrieve a matching template in 1,000 simulations for precision values  $p = 10, 11$ , and  $12$ , with the threshold set to  $\rho_{\text{thr}} = 870$ .

$$k^* = \text{Round} \left[ \frac{\pi}{4} \sqrt{\frac{N}{r^*}} - \frac{1}{2} \right]. \quad (2)$$

Corrected versions of Figs. 3–6 of the original article are presented. With all the other simulation conditions fixed, only the mapping used to select the Grover iteration number was changed.

After correction, the cost distributions become substantially more concentrated, and the pronounced right tails in the original simulations are greatly reduced. Small residual tails remain because finite-precision quantum counting and the integer-valued Grover iteration number can still produce low-probability suboptimal outcomes, but their contribution is significantly diminished.