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Noise on photon correlation data: I. Autocorrelation

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Upon comparison with experimental noise data, we discovered an error in the computer routine used to generate figure 5 and 6 of our recent paper on noise on photon correlation data. Starting from equation (41) and (50), we overlooked the fact that those equations must be slightly modified for sample times comparable with or larger than the coherence time. The first term of order $1/n$ in these equations originates from the $|z_{k-1}|^2$ term in (39) which yields 1 in the limit of short sample times, only. For large sample times, which are important in the 'multiple tau' case, triangular averaging of $|z_0|^2$ must be taken into account, as given in (58). Consequently, we obtain a significant reduction of the $1/n$ term and the large lag time behaviour of the normalized autocorrelation estimator shows an even more pronounced noise decay (figure 1 and 2) towards zero rather than a finite limit. This fact lends even stronger support to our previous statement, that an increase of the sample time in proportion with the lag time is of extreme practical importance in order to obtain an optimum signal-to-noise ratio at large lag times.

![Figure 1. Corrected standard deviation for a 'multiple tau' correlator operating at lag times between 200 ns and 100 s, for $\beta = 1$ and count rates per coherence time of 0.01, 0.1, 1, 10, 100 and 1000 (from top to bottom).](image-url)
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Figure 2. Corrected standard deviation for a 'multiple tau' correlator operating at lag times between 200 ns and 10 s, for $\beta = 1, 0.5, 0.25$ and 0.125 and corresponding count rates per coherence time of 10, 20, 40 and 80 (from top to bottom).