# Supporting information for:

# Calibrating and Controlling the Quantum Efficiency Distribution of Inhomogeneously Broadened Quantum Rods Using a Mirror Ball

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## Quantum rod spectra

We measured emission spectra on several single quantum rods, using a Acton f=25 cm spectrometer and a PIXIS:100B back illuminated Si CCD detector by Princeton Instruments, Figure S1 presents an example of the normalized emission spectrum from three individual QRods together with the ensemble emission spectrum. The ensemble emission spectrum shows a center emission wavelength near 610 nm.

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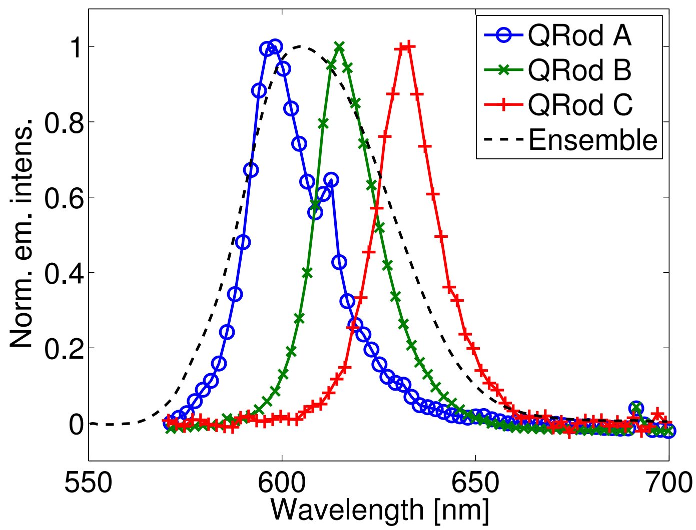


Figure S1: Solid lines: Normalized emission spectra of three single QRods measured on a glass substrate. each spectrum has been integrated over 40 s. Dashed line: Average ensemble emission spectrum using 10 s integrated ensemble spectra measured at 5 different locations on the glass substrate.

# Decay rate of single quantum rods

In order to relate the uncertainty of the extracted decay rates at each pixel (see figure fig. 3) relative to a more conventional determination of the decay rate of a single quantum rod, integrating over many seconds, we carried out time-correlated single-photon counting (TCSPC) measurements on a single QRod without a spherical mirror. Using two avalanche detectors (APDs) in a Hanbury Brown-Twiss setup allows for simultaneous acquisition of a PL decay curve and an intensity trace over hundreds of seconds as well as the photon-photon correlation function $g^2$ to verify if a single emitter is probed. Figure S2 presents a TCSPC measurement carried out over 150 s. Firstly, we note that measured photon-photon correlation $g^2(t)$ is clearly vanishing near $t = 0$, thus verifying that indeed we are probing a single QRod. The detected arrival times on each detector are divided into time bins of 20 ms and by counting the total photon number in each bin, we plot the intensity trace over the entire duration of the measurement, see figure S2 (right). For each 20 ms bin, we histogram the photon arrival-times in bins of 1.32 ns (similar to the confocal scanning measurement

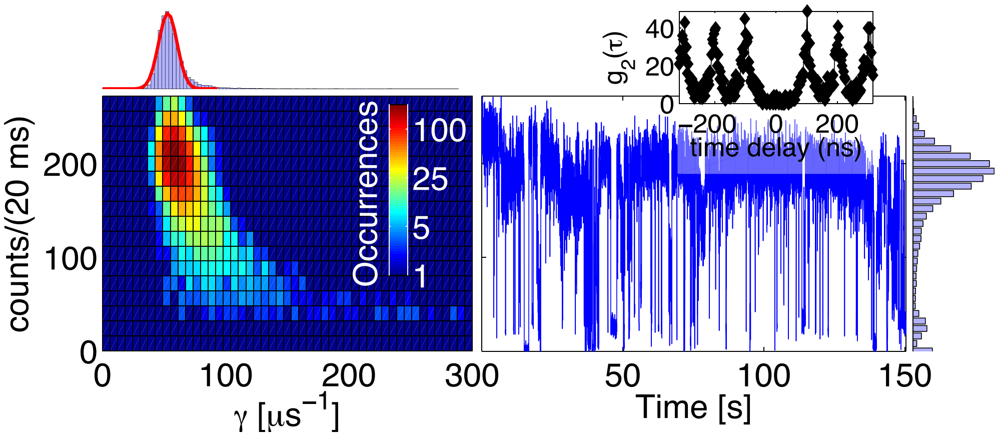


Figure S2: Decay rate fluorescence imaging on a single QRod. Left: Histogrammed fitted decay rates versus counts per 20 ms bin. The histogrammed rates is shown on top (blue bars) together with a with a fit using a normal distribution (red line) with an estimated mean of 55.1 $\mu s^{-1}$ and standard deviation 7.8 $\mu s^{-1}$. Right: Intensity trace over the measured 150 s. The inset shows the measured second order correlation $g^2$, verifying that a single QRod is probed.

with the spherical mirror), and extract a decay rate using a single exponential function with a background offset.

The extracted decay rates versus intensity were subsequently histogrammed to obtain the decayrate-intensity distribution, as presented in fig. S2 left. We notice a clear correlation between decay-rate and intensity, with a concentration of occurrences near a rate 55 $\mu s^{-1}$ and 200 counts per ms and and few occurrence with large decay rates for low intensities. A histogram of the total counts versus the fitted decay rate is plotted on top, and is reasonably well fitted with a normal distribution with mean 55.1 $\mu s^{-1}$ and standard deviation 7.8 $\mu s^{-1}$. The decay curve of the entire dataset, excluding data from 20 ms time bins with less than 40 counts, is plotted as a function of arrival time in figure S3. The decay curve is very well fitted with a single-exponential function resulting in an extracted decay-rate of $56.37 \pm 0.03$ $\mu s^{-1}$ in good agreement with the mean extracted decay-rate based on the decay-intensity histogram in fig. S2. While the accuracy of the extracted decay-rate is far superior for the long integration time it is evident that decay-rate estimates may be extracted from data with counts of $\sim 200$ with an uncertainty on the order of 10%, i.e., much more precisely than the

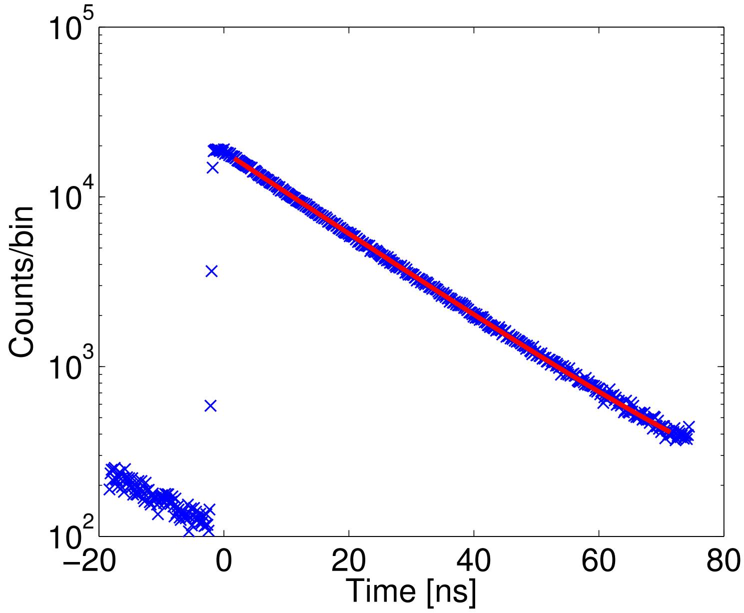


Figure S3: Total measured decay trace extracted from the measurement in figure S2 over the entire 150 s. Counts occurring during periods with occurences below 40 per 20 ms time bin where excluded from the histogram. A fit using a single-exponential fit is show on top (red solid) with an estimated decay rate of $56.37 \pm 0.03\ \mu s^{-1}$.

spread in rates that we uncover for the ensemble of quantum dots.