Electronic Supplementary Information

Magnetic-Field-Enabled Resolution Enhancement in Super-Resolution Imaging

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Typically it needs a careful design to apply a magnetic field onto the sample when recording the fluorescence emission spectra. As shown in Figure S1, we have opened a system for this experiment, which is different from the commercial spectrofluorometer (the commercial one has no space to set the magnetic plate at the side of a cuvette). The location and distance (Figure S1) are very important for a successful experiment. The Neodymium magnet (NdFeB) plate was used in our experiment. The magnet intensity should be measured by a magnetometer to accurately show the magnetic field intensity. A thin cuvette (about 1 mm thickness) would be better for the result. The design is very similar with our measurement by dSTORM imaging.

Figure S1. The scheme of the fluorescence emission spectroscopy experimental design (sample and magnet). The location and distance are important for a successful experiment. The cuvette can be rotated to control the angle of an incident light. The magnetic plate was set at the side of the cuvette.

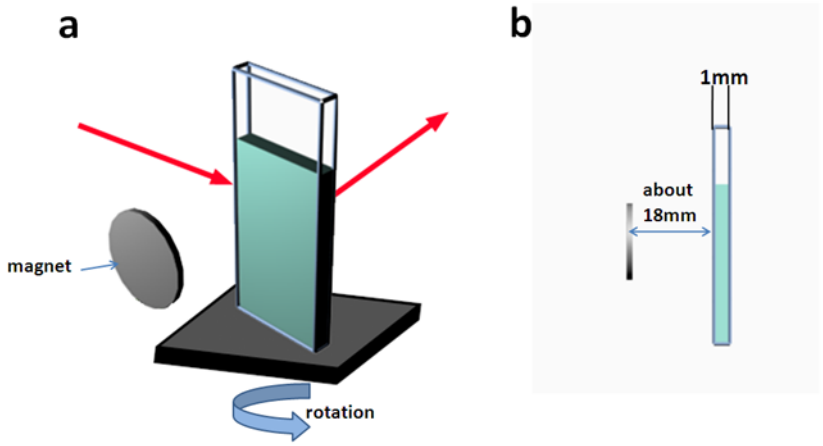
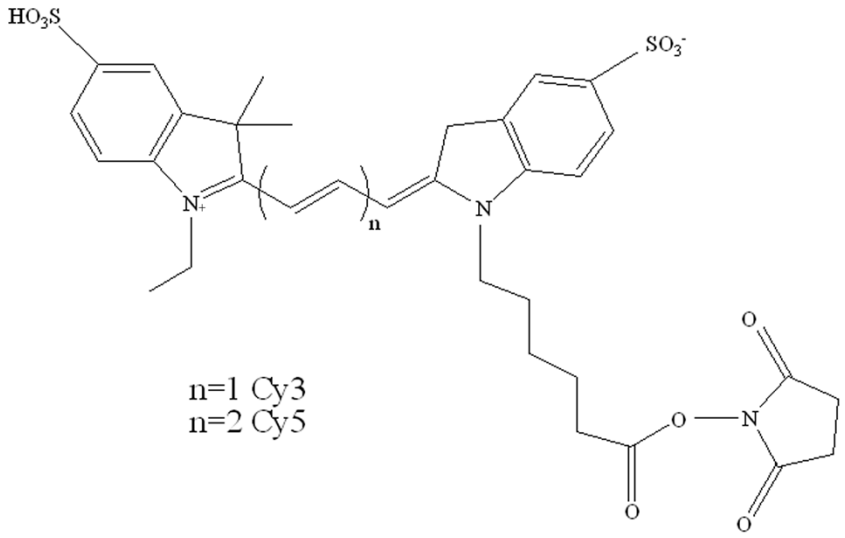


Figure S2. Molecule structures of Cy3, Cy5 (a) and Alexa Fluor 532 (b).

a



b

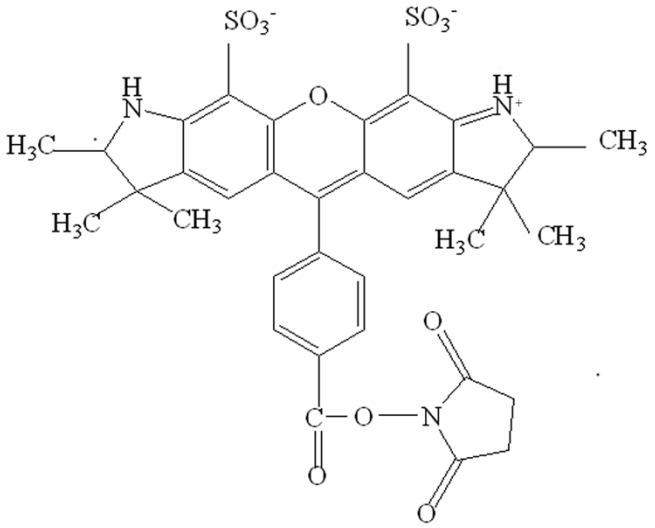


Figure S3. Fluorescence emission spectra of (a) Cy3, (b) Cy5 and (c) Alexa Fluor 532 acquired in a 1-mm quartz cuvette before applying the magnetic field (black), then with an 8-mT external magnetic field (red), and after removing the magnetic field (green) respectively. The fluorescence emission spectra before applying the magnetic field and after removing the magnetic field are virtually identical.

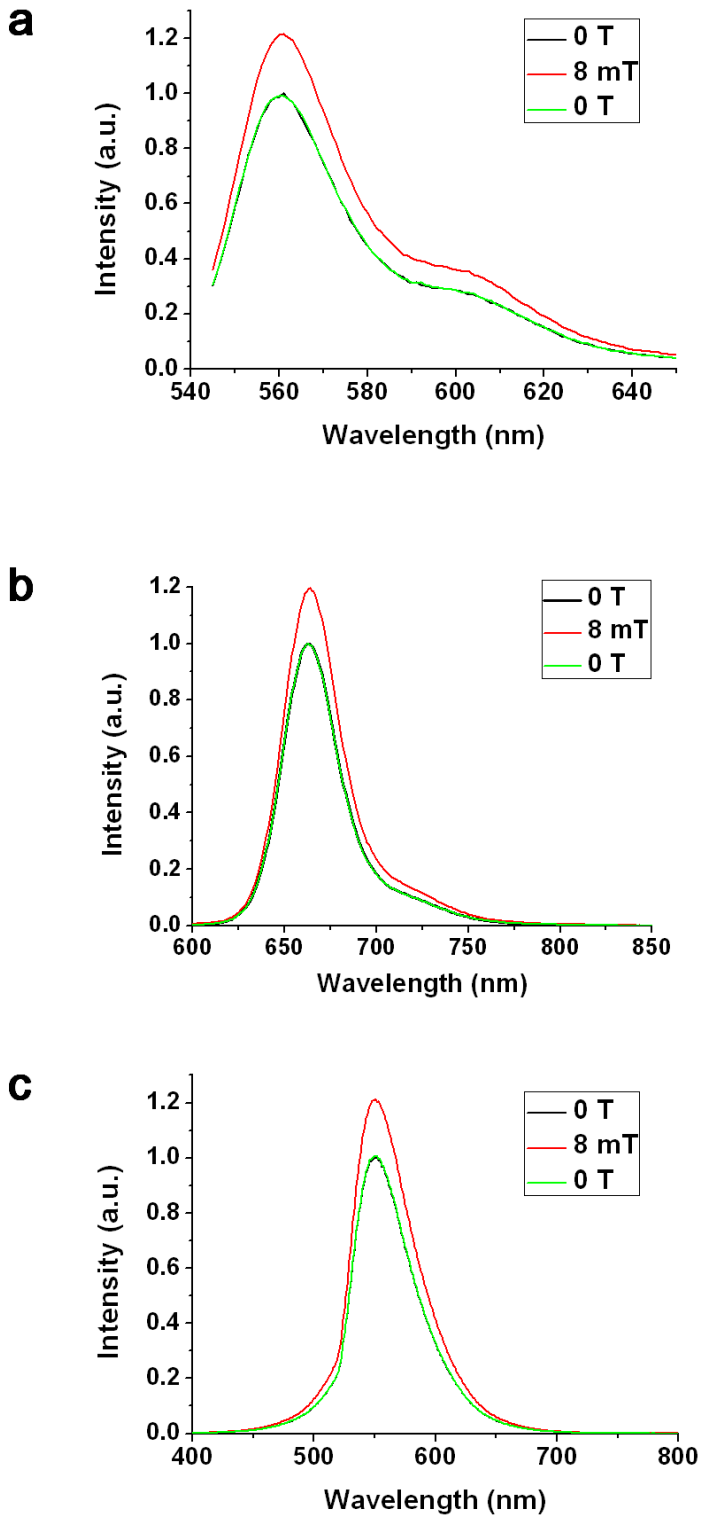


Figure S4. The background signals vs. frame number at different magnetic field conditions. The signals were obtained from blank samples (absence of fluorophores and only containing a standard imaging buffer in the slides). The experimental conditions (e.g. laser, exposure time, and frame number etc.) were the same as those in the dSTORM imaging of monodispersed dyes. The initial signal without magnetic field was normalized to be 1, and the error bars were the standard deviation.

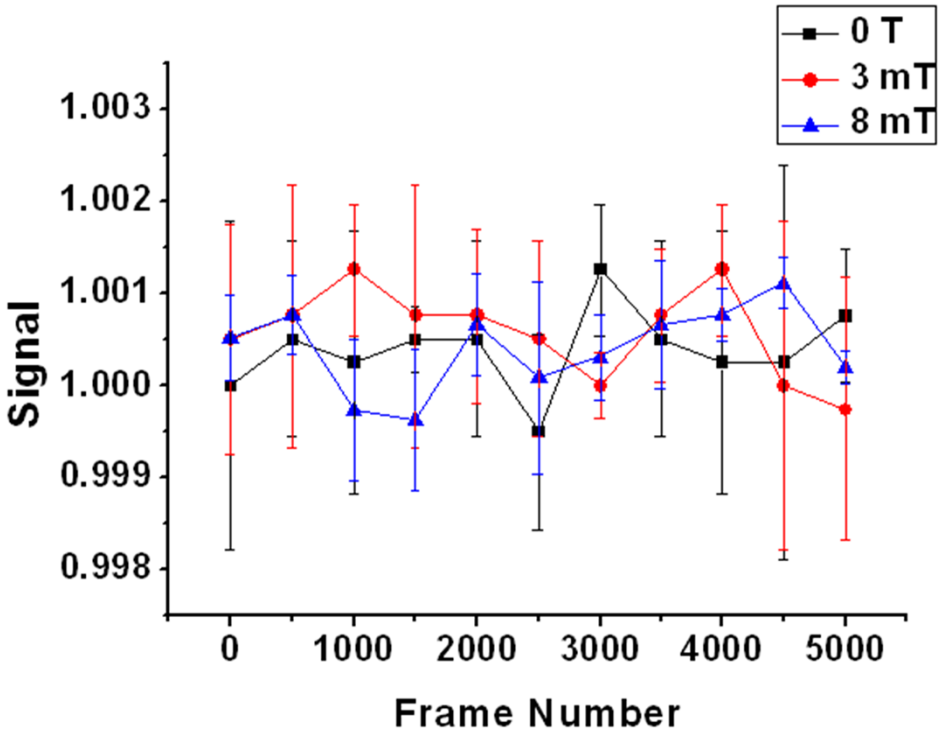


Figure S5. Left: Comparison of number of photons emitted per dye molecule immobilized on slides in the cases of magnetic field free (black) and the presence of an 8-mT external magnetic field (red), respectively. Right: Normalized the photon distribution shown in left; the insets show the difference of values by subtracting the frequency percentage without magnetic from that with an 8 mT magnetic field. (a, b) Cy3; (c, d) Cy5 and (e, f) Alexa Fluor 532. For each case, the histogram includes results from more than 60 groups of parallel experiments.

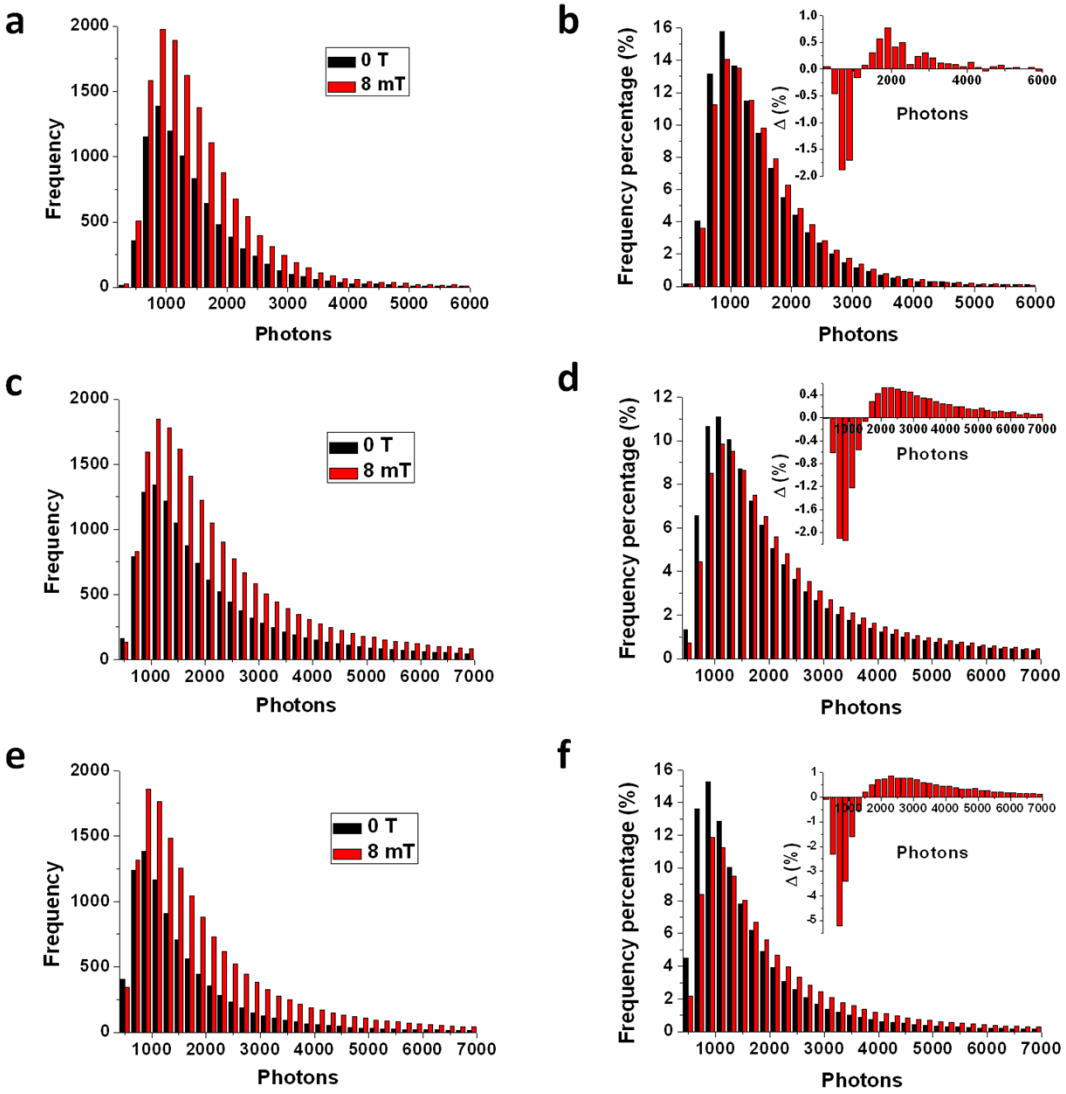


Figure S6. Super-resolution imaging of microtubules in Cos-7 cells at 0 T. (a) dSTORM imaging of microtubules. (b) Enlarged area of the ROI (yellow box) in (a), its length is 370 nm and the nmber of localizations is 1340. (c) Enlarged area of the ROI (green box) in (a), its length is 440 nm and the nmber of localizations is 1678. (d, e) The corresponding transverse profiles of the microtubule shown in (b) and (c), respectively. Scale bars: 1 μm for (a), 100 nm for (b) and (c).

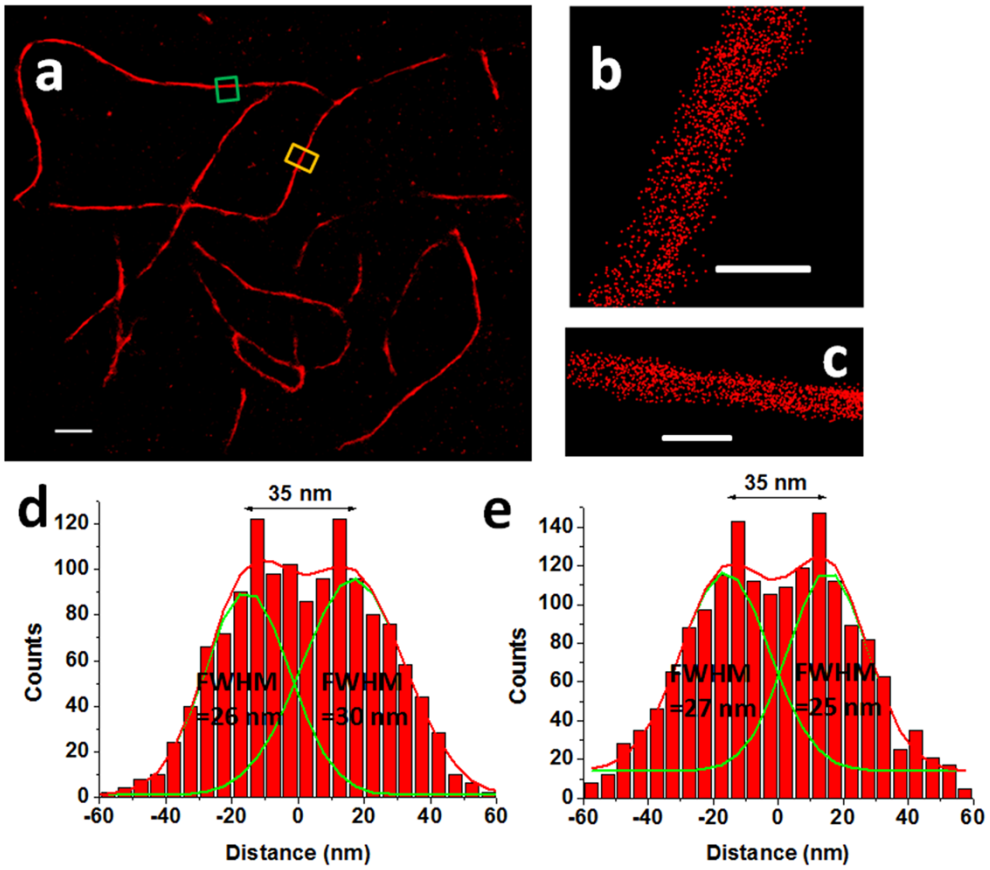


Figure S7. Super-resolution imaging of microtubules in Cos-7 cells at 8 mT. (a) dSTORM imaging of microtubules. (b) Enlarged area of the ROI (yellow box) in (a), its length is 700 nm and the nmber of localizations is 4190. (c) Enlarged area of the ROI (green box) in (a), its length is 400 nm and the nmber of localizations is 2179. (d, e) The corresponding transverse profiles of the microtubule shown in (b) and (c), respectively. Scale bars: 1 μm for (a), 100 nm for (b) and (c).

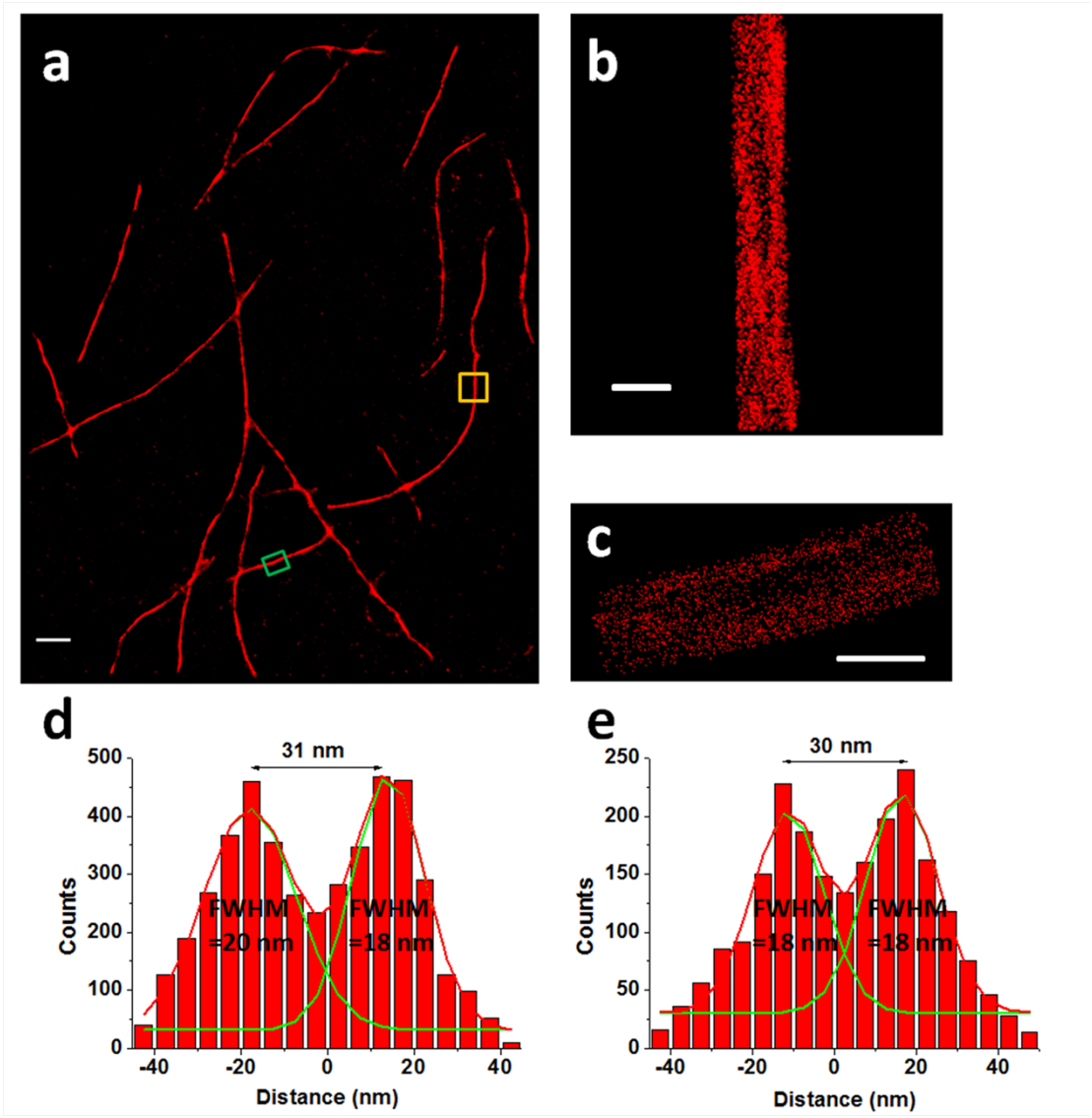


Figure S8. Fluorescence decays of Alexa Fluor 647 without magnetic field and with an 8 mT magnetic field, respectively. The excited-state lifetime was measured using the TCSPC technique.

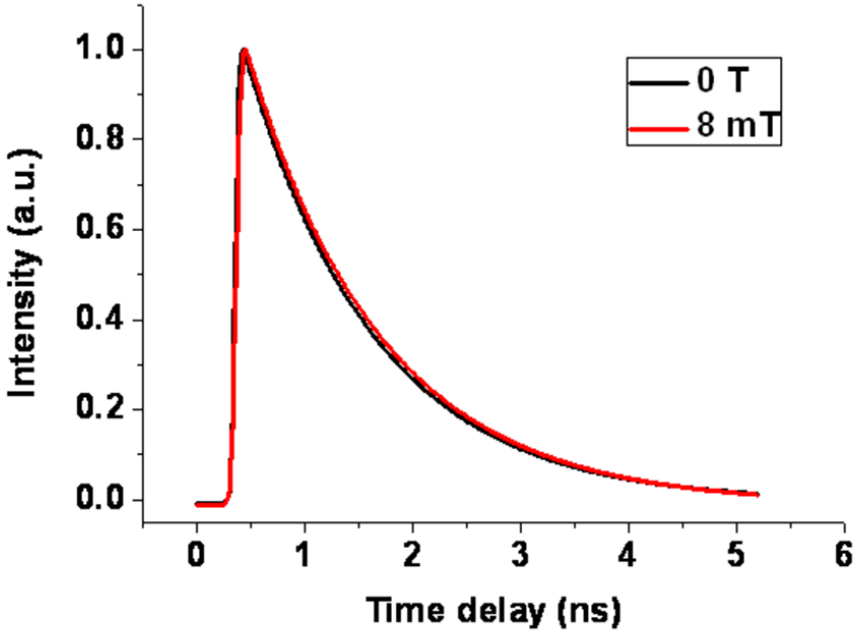


Figure S9. The on state lifetimes of Alexa Fluor 647 without magnetic field and with an 8 mT magnetic field, respectively. The on state lifetime was obtained by tracing single Alexa Fluor 647 molecule during 5000 frames. At each magnetic field condition, 30 groups of results were used to determine the on state lifetime.The boxes denote the standard deviation (SD), and the small panes in the boxes denote the mean values.