

**Table S3:** Comparison between phototransformation yields retrieved from simulated data sets with tumbling molecules and fixed molecules (circularly polarized laser and linearly polarized laser).

	True	Tumbling	Fixed (Circular)		Fixed (Linear)	
			Circular model	Tumbling model	Linear model	Tumbling model
$\phi_{bleach}$	$2 \times 10^{-5}$	$(2.01 \pm 0.05) \times 10^{-5}$	$(2.17 \pm 0.06) 10^{-5}$	$(2.31 \pm 0.05) \times 10^{-5}$	$(2.92 \pm 0.11) \times 10^{-5}$	$(3.65 \pm 0.19) \times 10^{-5}$
$\phi_{on-off}$	$5 \times 10^{-6}$	$(3.61 \pm 0.07) \times 10^{-6}$	$(3.13 \pm 0.20) 10^{-6}$	$(3.36 \pm 0.17) \times 10^{-6}$ #	$(2.53 \pm 0.32) \times 10^{-6}$	$(3.18 \pm 0.49) \times 10^{-6}$ #
$k_{off-on} [s^{-1}]$	20	$21.9 \pm 0.66$	$23.9 \pm 0.79$	$23.9 \pm 0.83$	$26.2 \pm 1.20$	$26.4 \pm 1.10$
$N_{mol}$	26272	$24029 \pm 96$	$23308 \pm 140$	$19940 \pm 120$	$26098 \pm 130$	$16022 \pm 128$
$\Phi_A$	$4.28 \times 10^{-4}$	$(4.10 \pm 0.004) \times 10^{-4}$	$(4.21 \pm 0.006) \times 10^{-4}$	$(4.89 \pm 0.006) \times 10^{-4}$	$(3.67 \pm 0.005) \times 10^{-4}$	$(6.03 \pm 0.008) \times 10^{-4}$

Given standard deviations correspond to histogram fitting errors.

# When the model corresponding to tumbling molecules is applied to data sets generated with fixed molecules,  $\phi_{on-off}$  yields values are retrieved that are closer to the true values than when the correct model is used due to compensating errors.