

Supplementary Information

Parameters for label mobility simulations

For all simulations of spin label mobility, a spin label g-tensor $g = [2.0078 \ 2.0050 \ 2.0023]$ and hyperfine coupling matrix $a = [16.8$
5 $16.8 \ 103.7]$ MHz were used. The resulting rotation correlation times are given in supplementary table S1.

Table S1 rotation correlation times of the investigated labels as simulated in EasySpin

Label	$t_{\text{corr}} / \text{ns}$
T54C	2.51
T80C	2.51
T117C	4.47
T179C	11.22
free spinlabel	0.01
