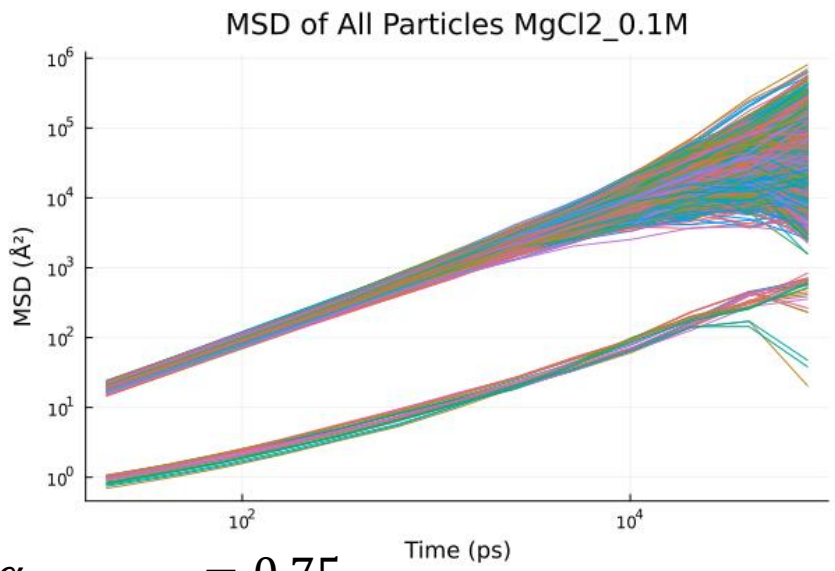
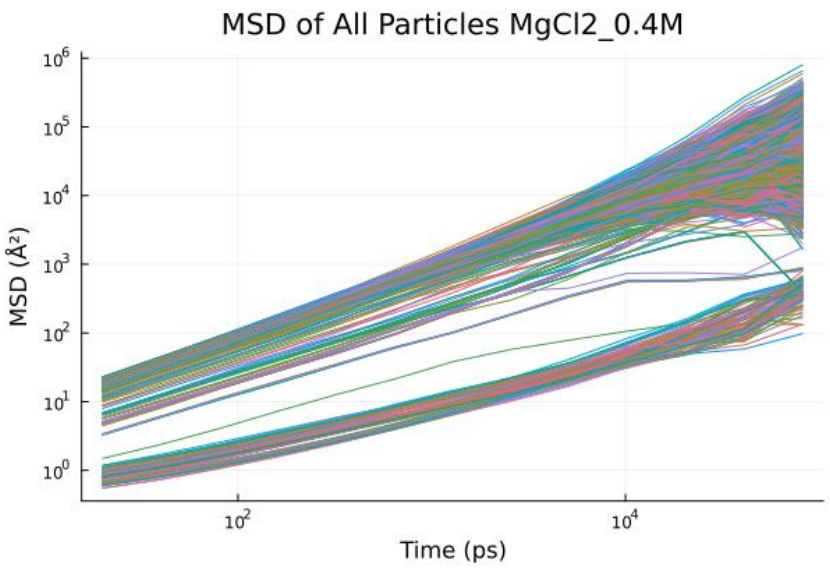
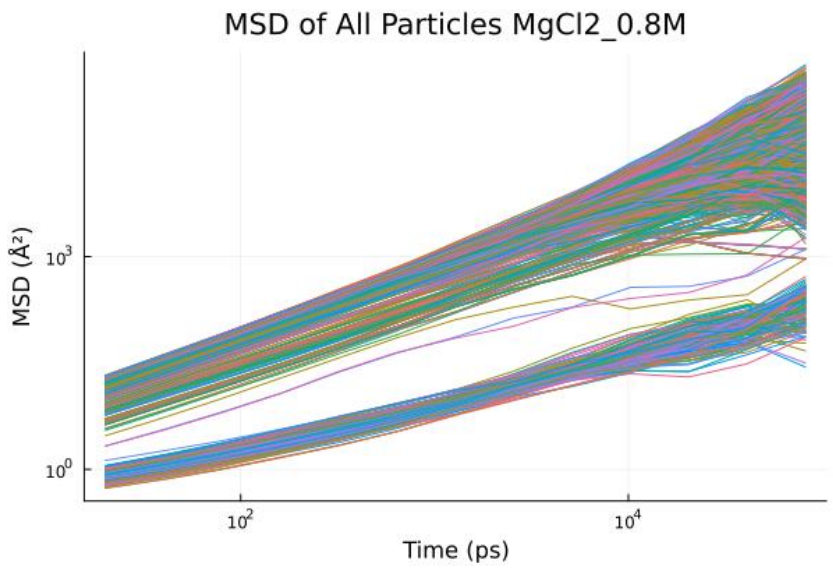
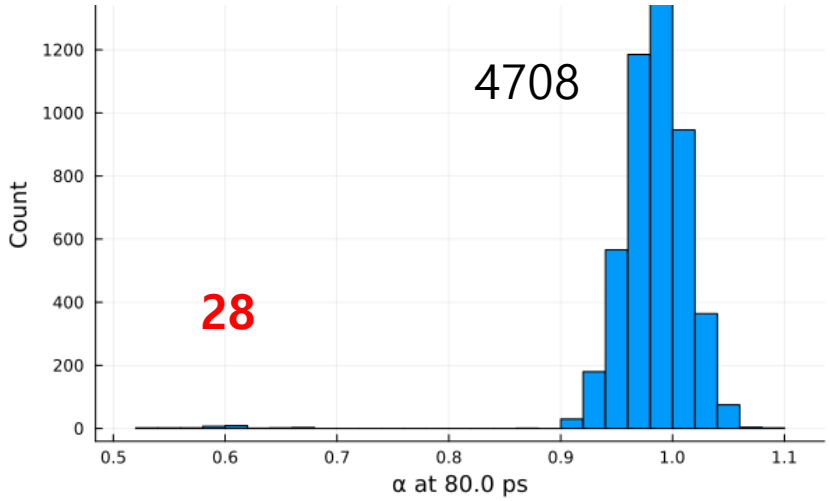
SI Result 1. MSD of individual water molecules.

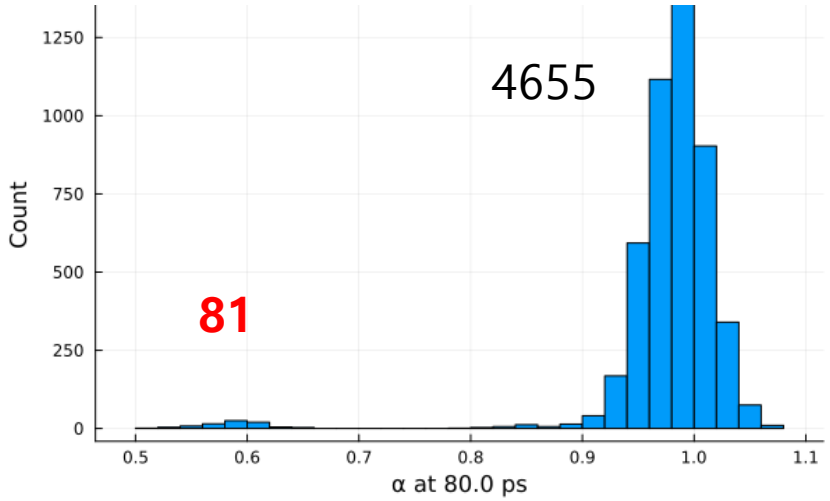


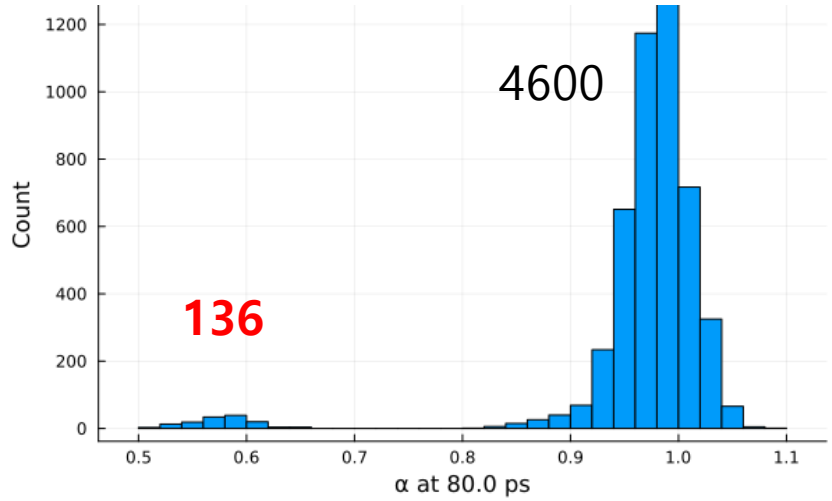




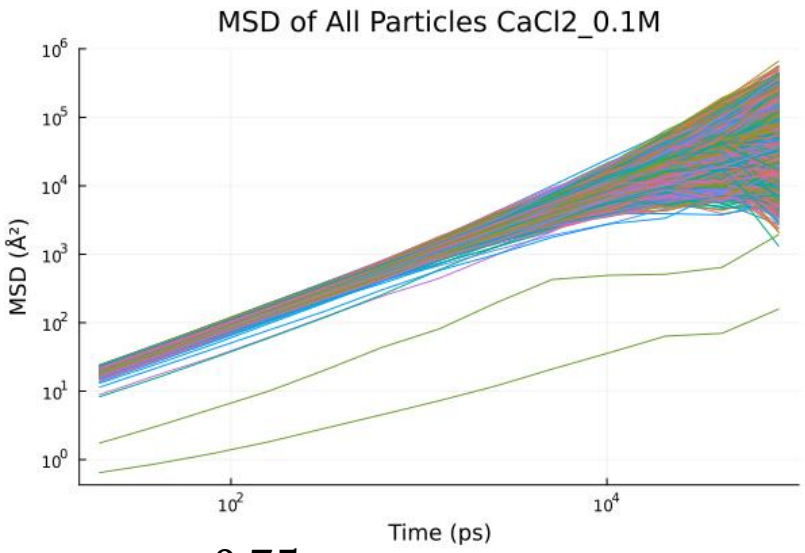
$\alpha_{\text{threshold}} = 0.75$

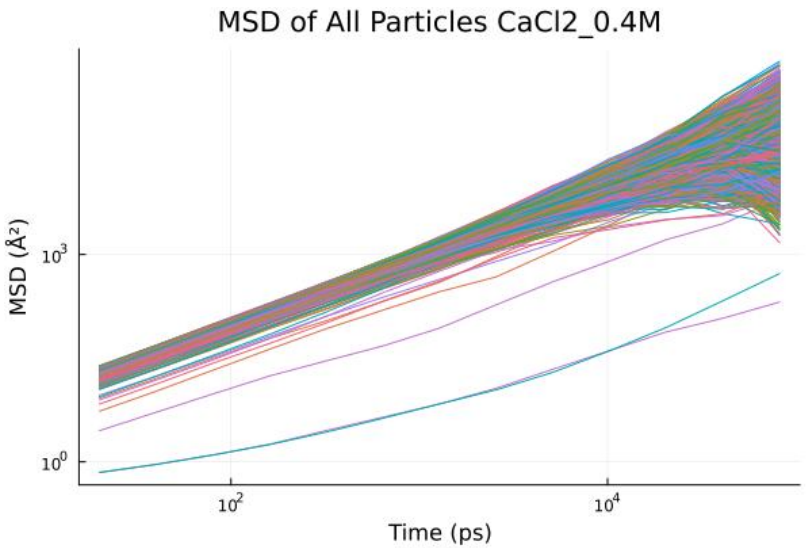


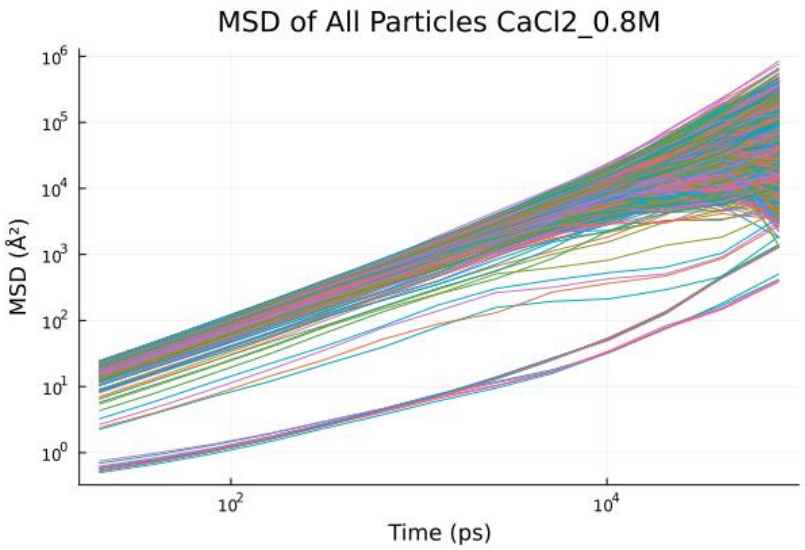




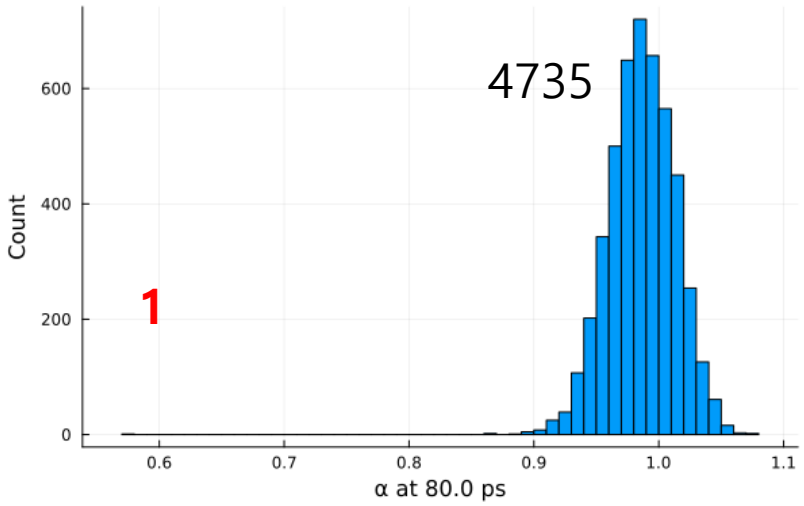
SI Result 1. MSD of individual water molecules.

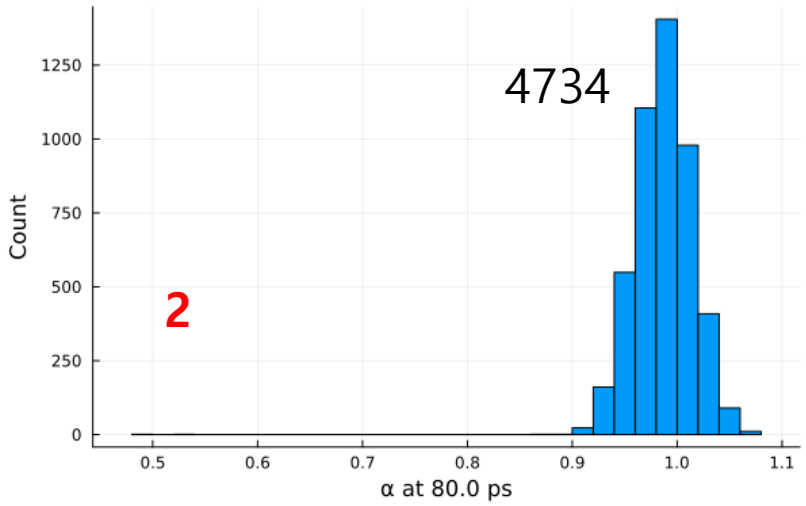


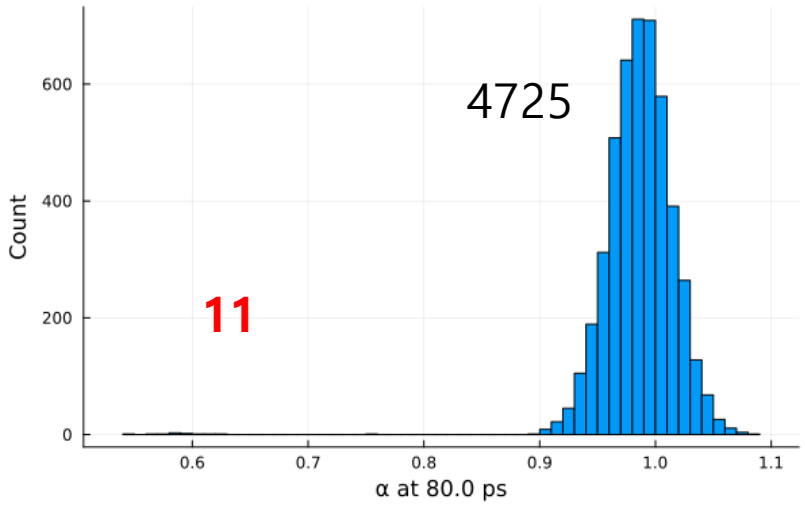




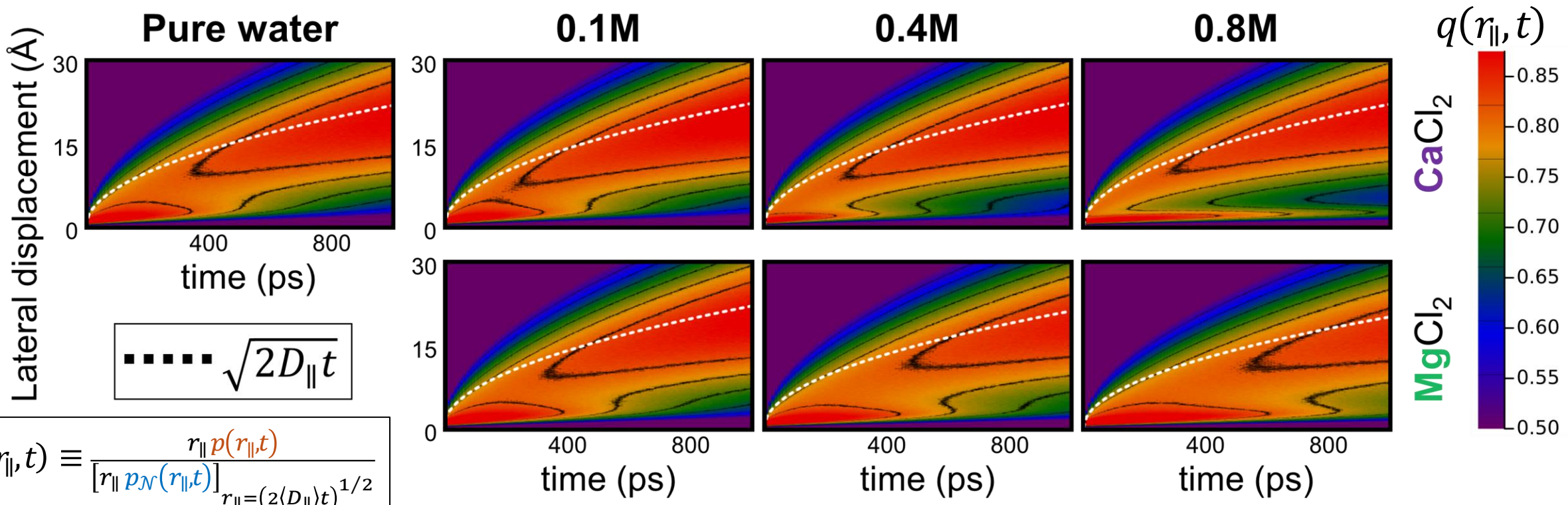
$\alpha_{\text{threshold}} = 0.75$







SI Result 2. Lateral Displacement Distribution



$$q(r_\parallel, t) \equiv \frac{r_\parallel\, p(r_\parallel, t)}{\left[r_\parallel\, p_{\mathcal{N}}(r_\parallel, t)\right]_{r_\parallel = (2\langle D_\parallel \rangle t)^{1/2}}}$$

$p(r_\parallel, t)$: **Radial distribution (simulation result)** $\quad p_{\mathcal{N}}(r_\parallel, t) \equiv \left(4\pi\langle D_\parallel \rangle t\right)^{-1} e^{-r_\parallel^2 / 4\langle D_\parallel \rangle t}$: **Radial Gaussian distribution**

- The peak position (**red**) = where the displacement ($r_\parallel$) is biased.
- At long times, peak position of $q(r_\parallel, t)$ converges to $\sqrt{2D_\parallel t}$. = At long times, $p(r_\parallel, t) \cong p_{\mathcal{N}}(r_\parallel, t)$.
- **Ca**Cl2: As Conc. Increases, short $r_\parallel$ region expands along the x-axis, while it shrinks along the y-axis.
- **Mg**Cl2: As Conc. Increases, short $r_\parallel$ region expands along the x-axis.
- **Both**: As Conc. Increases, the appearance of the peak at long $r_\parallel$ is retarded in time.