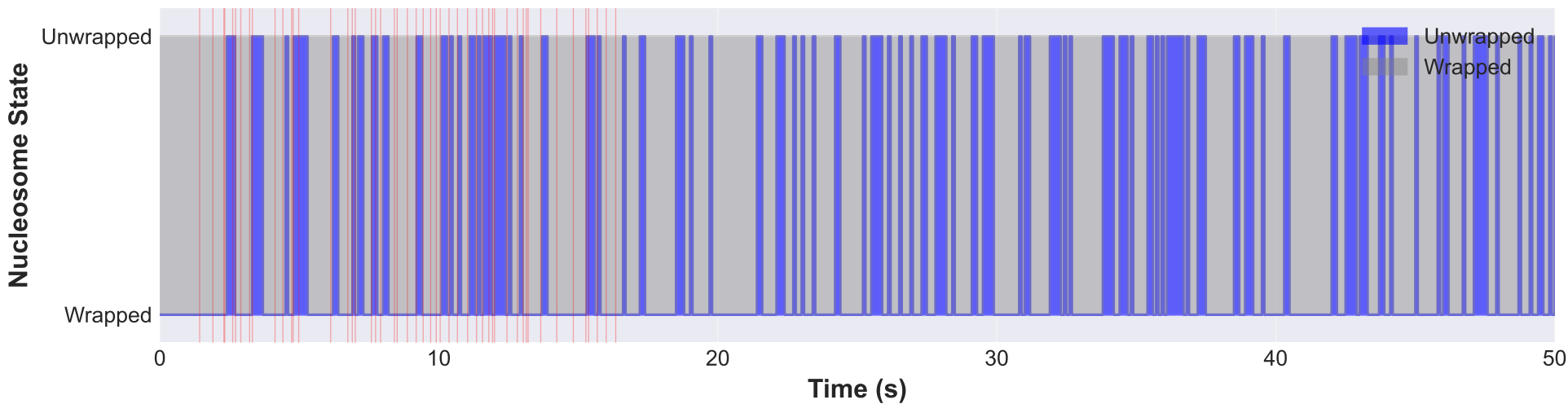
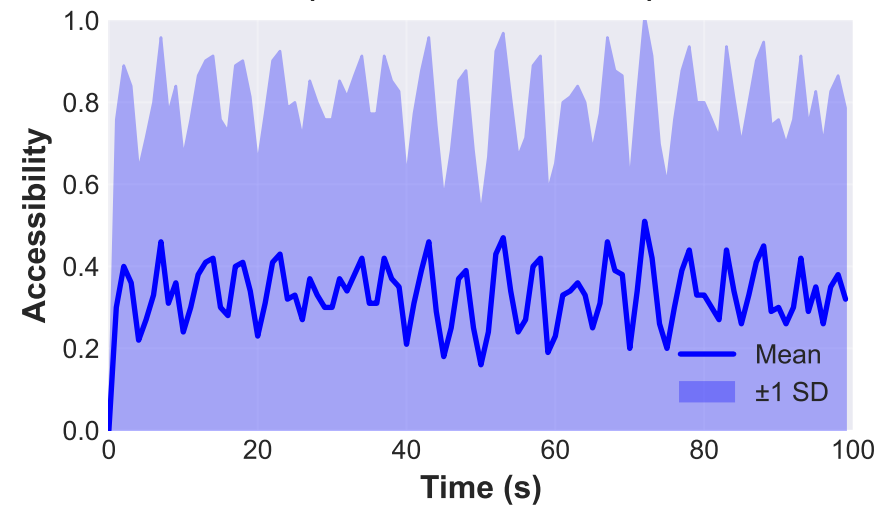


Chromatin Breathing and Nucleosome Dynamics: Charge-Dependent Accessibility

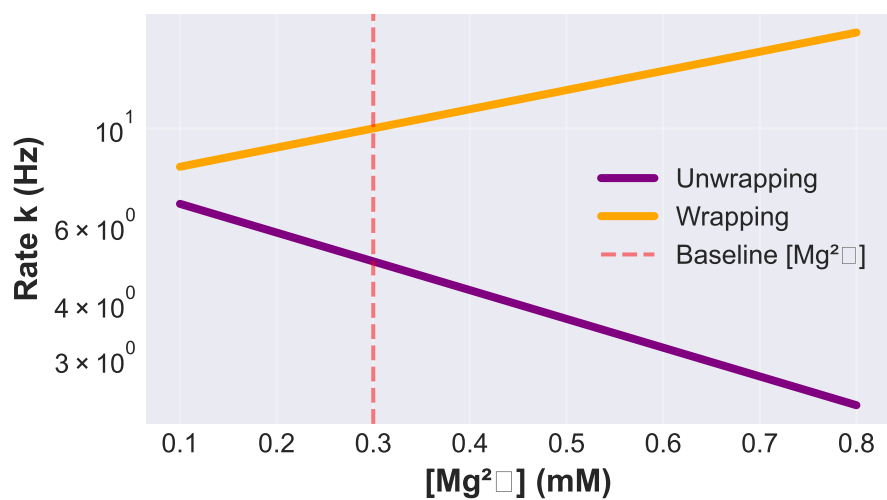
A. Single Nucleosome Breathing Dynamics



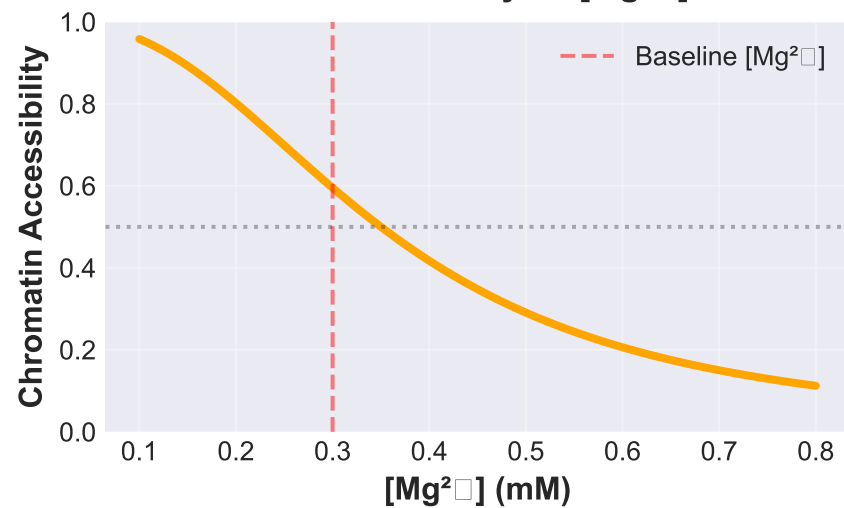
B. Ensemble Average (n=100 nucleosomes)



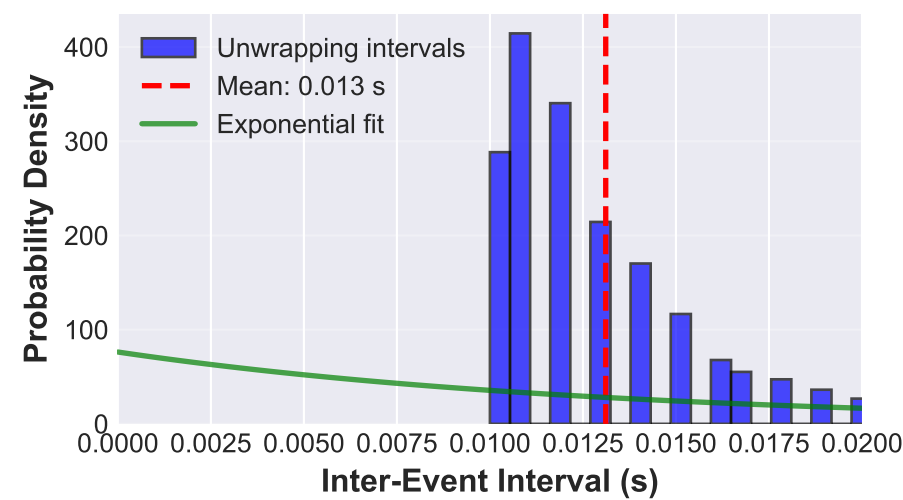
C. Transition Rates vs $[Mg^{2+}]$



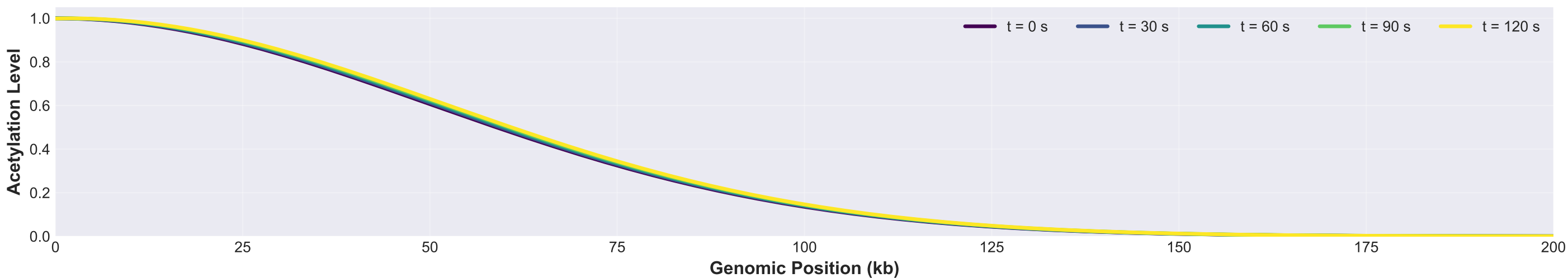
D. Accessibility vs $[Mg^{2+}]$



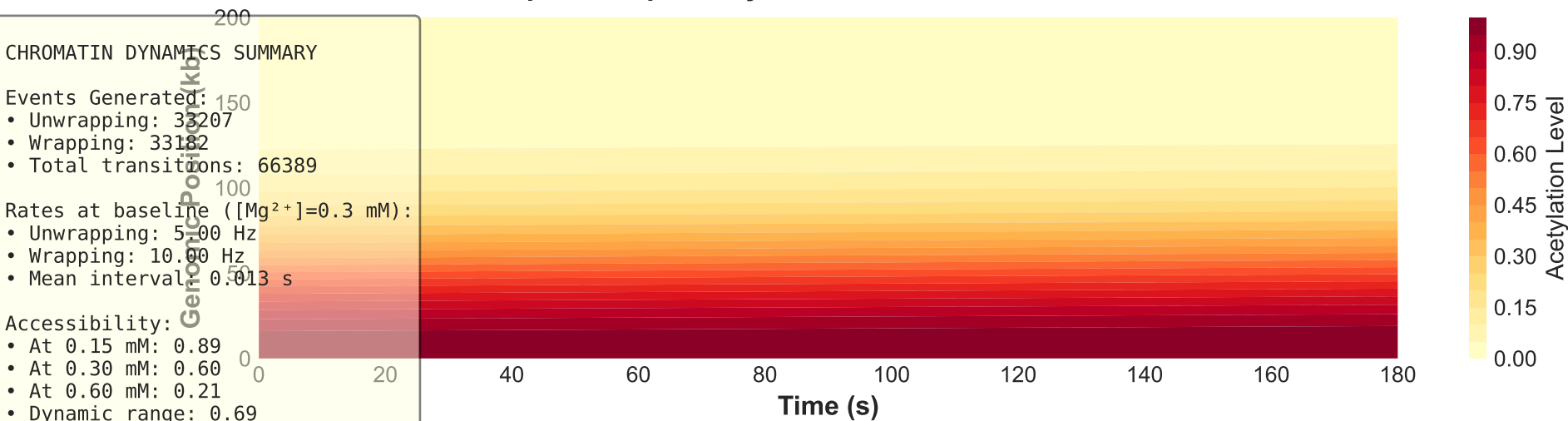
E. Breathing Event Statistics



F. Histone Acetylation Wave Propagation ($v = 1$ kb/min)



G. Spatiotemporal Dynamics of Histone Modification



CHROMATIN DYNAMICS SUMMARY

Events Generated: 150
• Unwrapping: 33207
• Wrapping: 33182
• Total transitions: 66389

Rates at baseline ($[Mg^{2+}] = 0.3$ mM):

• Unwrapping: 5.00 Hz
• Wrapping: 10.00 Hz
• Mean interval: 0.013 s

Accessibility:

• At 0.15 mM: 0.89
• At 0.30 mM: 0.60
• At 0.60 mM: 0.21
• Dynamic range: 0.69

Wave Dynamics:

• Velocity: 1.0 kb/min
• Width: 50 kb
• Period: ~120 s (200 kb)

H. Breathing Frequency vs $[Mg^{2+}]$

