Abstract Submitted
for the TS4CF08 Meeting of
The American Physical Society

Inferring kinetic pathways, rates, and force dependence from non-processive optical tweezers experiments: a maximum likelihood approach
BENNETT KALAFUT, KOEN VISSCHER, University of Arizona — Optical tweezers experiments allow us to probe the role of force and mechanical work in a variety of biochemical processes. However, observable states do not usually correspond in a one-to-one fashion with the internal state of an enzyme or enzyme-substrate complex. Different kinetic pathways yield different distributions for the dwells in the observable states. Furthermore, the dwell-time distribution will be dependent upon force, and upon where in the biochemical pathway force acts. I will present a maximum-likelihood method for identifying rate constants and the locations of force-dependent transitions in transcription initiation by T7 RNA Polymerase. This method is generalizable to systems with more complicated kinetic pathways in which there are two observable states (e.g. bound and unbound) and an irreversible final transition.

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Date submitted: 11 Sep 2008 Electronic form version 1.4