Lateral Magnetic Tweezers

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Combining single-molecule techniques with fluorescence microscopy has attracted much interest because mechanical measurements can eventually be correlated with directly visualized DNA:protein interactions. Lateral Magnetic Tweezers (MT) is an advantageous technique because it permits applying an accurate constant force to several tethered DNA molecules tracked in parallel, while fluorescence on the surface can be monitored. In this work, we propose an implementation of a laterally pulling MT modulus and its subsequent calibration in commonly employed microfluidic devices such as flow cells and capillaries using micrometer size superparamagnetic beads. Resulting forces and consistency of results with the Worm Like Chain (WLC) model are discussed for the different scenarios. Finally, a method for estimating forces in flow-stretch experiments is proposed, and the results of the method are compared with those of lateral MT, confirming its validity and superior suitability for performing fluorescence experiments on DNA molecules stretched on a surface.