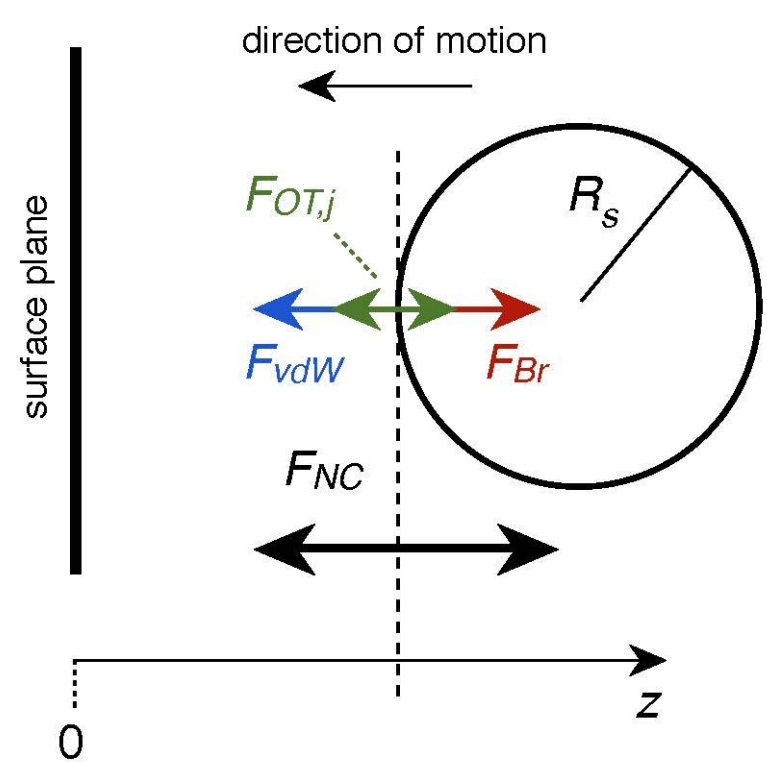


Accuracy and Precision in Force-Distance Curves

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PURPOSE

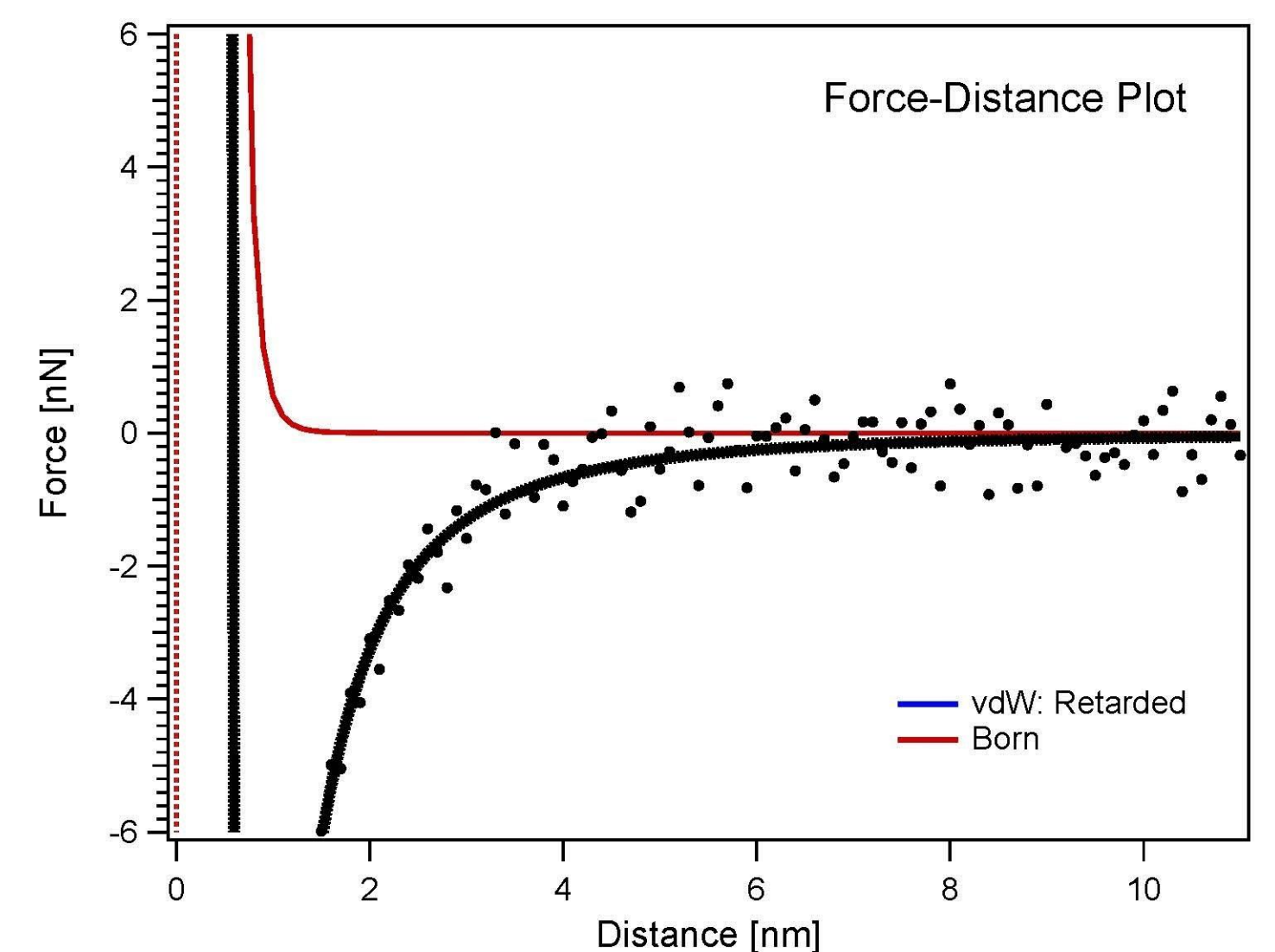
In atomic force microscopy (AFM), ongoing projects are studying the effect noise has on producing reliable force-distance curves. The goal of this project is to replicate previous results, and to use the Hamaker constant and theoretical force equations to model force-distance curves. The confidence levels for the accuracy and precision of these curves, and any possible trends will be examined using various parameters.



A sphere approaching the surface [1].

METHODS

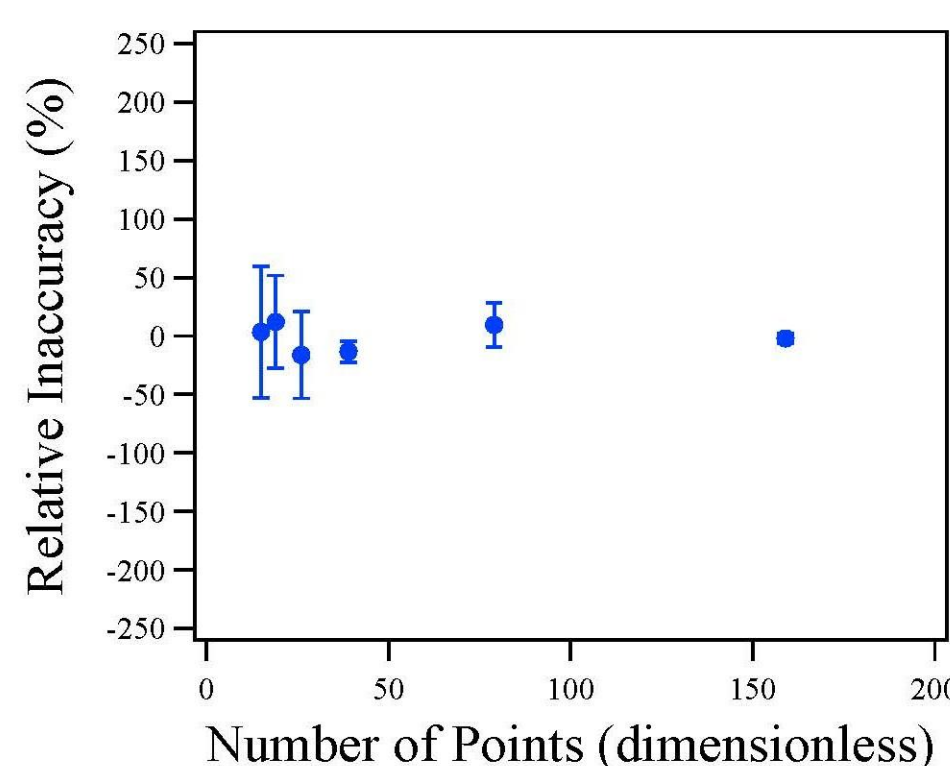
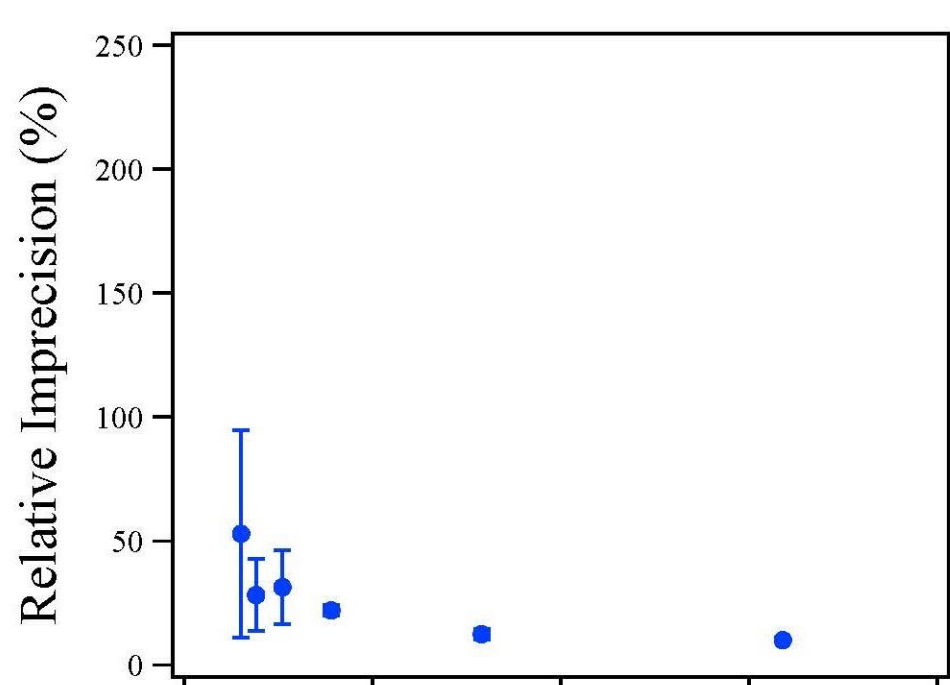
Force equations were first modeled in MathCad and Excel to confirm and replicate the findings in Igor Pro. Simulations were conducted in Igor Pro based on codes from theoretical force equations. The relative imprecision and inaccuracy were measured against range, sphere radius size, and the number of data points generated. This data was then analyzed for any possible trends.



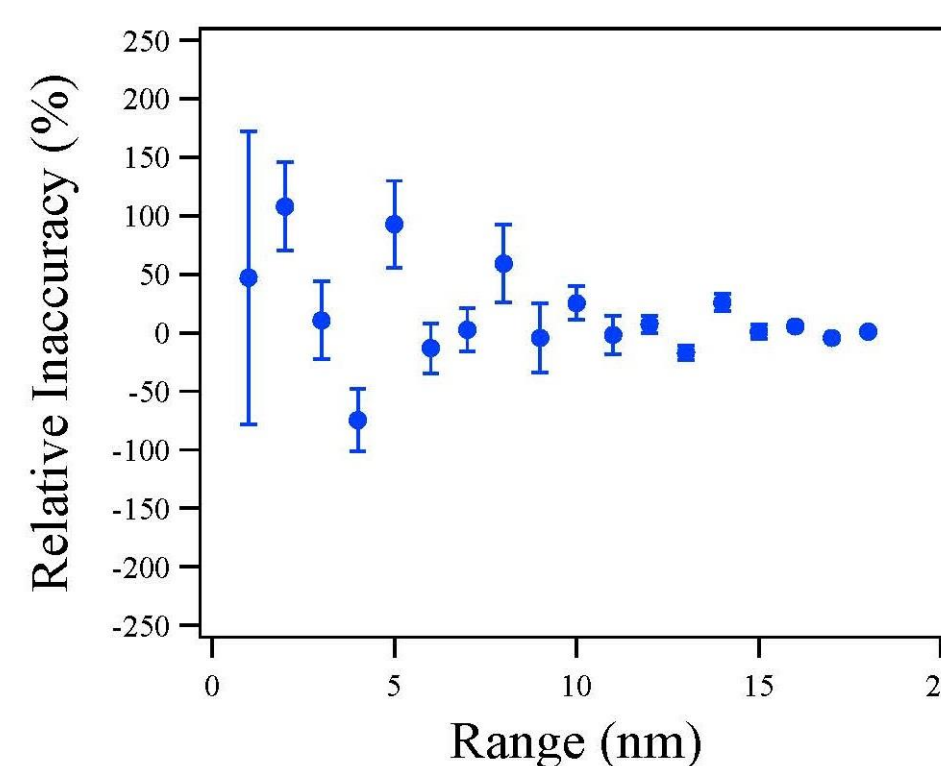
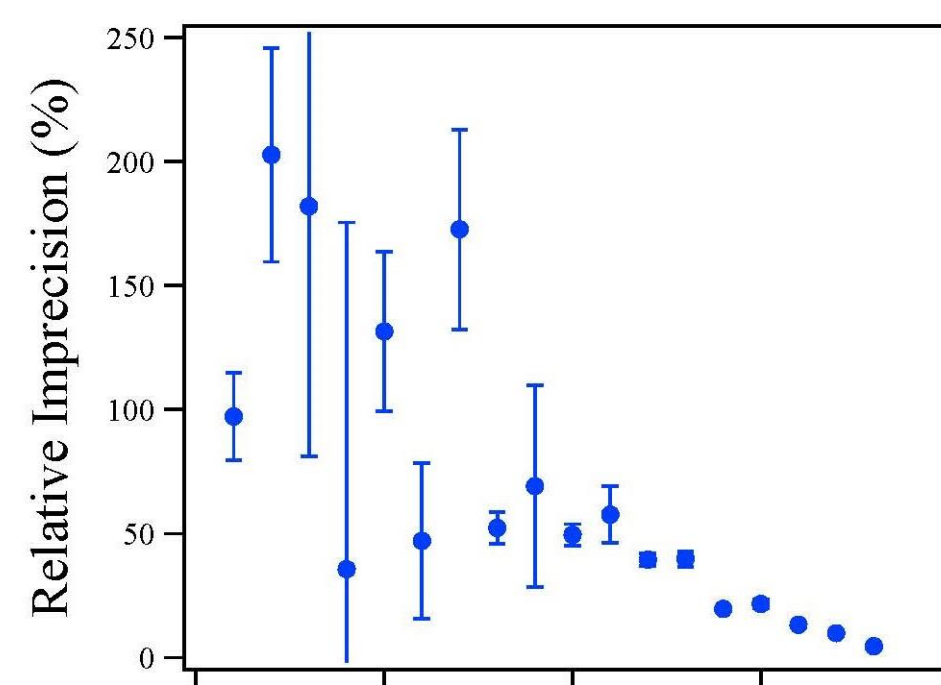
A force-distance curve with a noise of 0.50 nN [2].

RESULTS

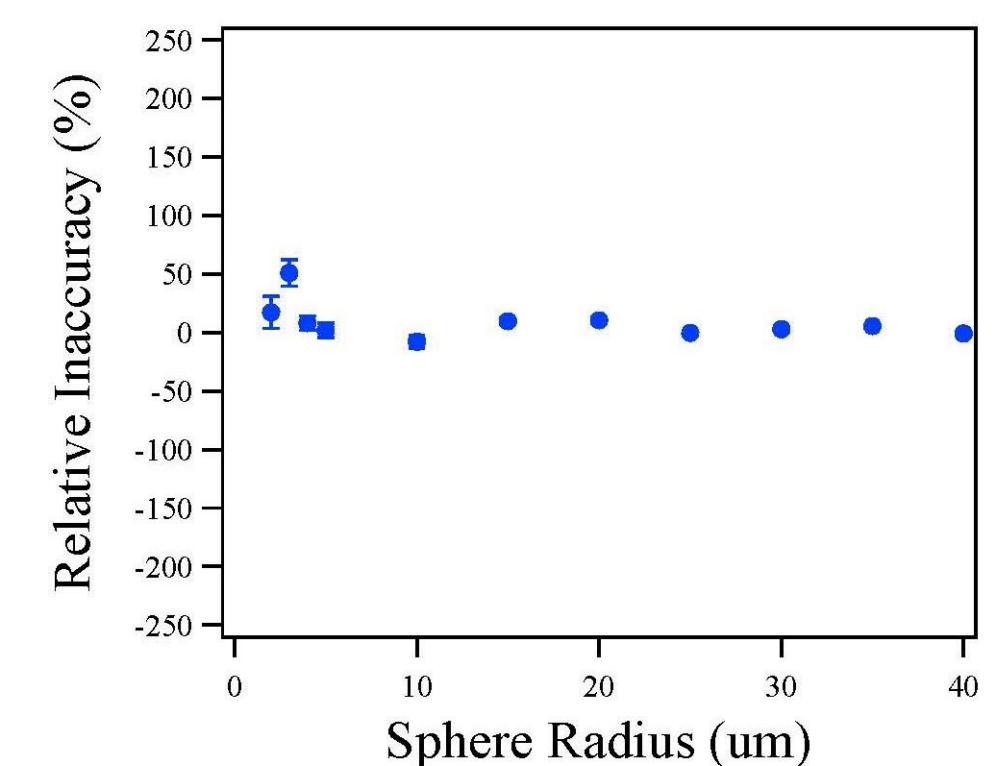
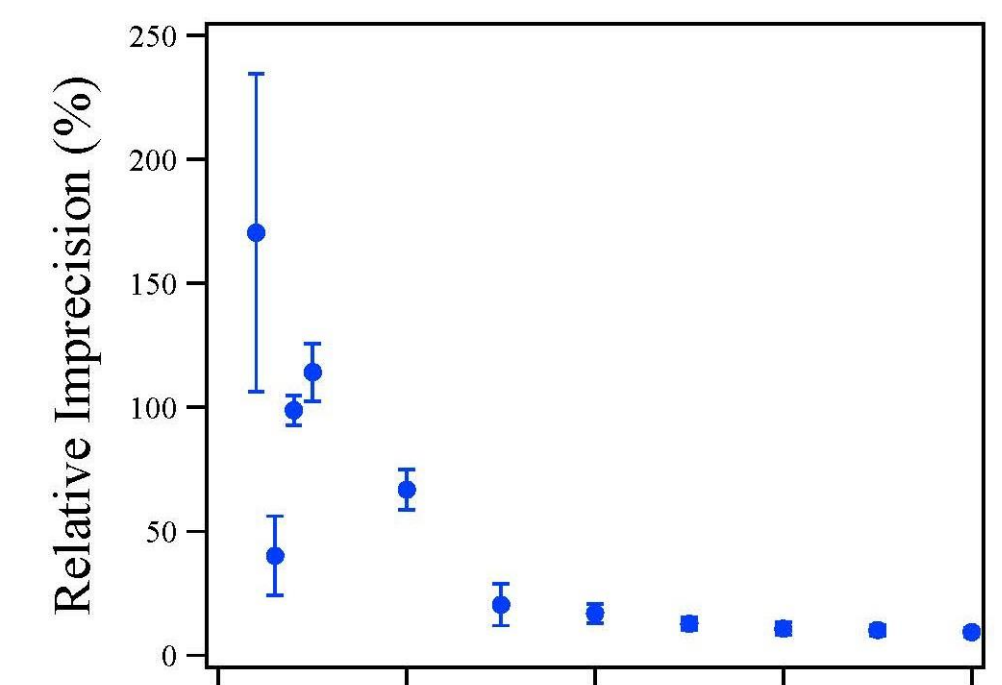
The Effects of the Number of Points



The Effects of Fitting Range



The Effects of Changing the Sphere Radius



FUTURE DIRECTIONS

Moving forward, we will continue to analyze these parameters in more depth. We will also observe how adding additional theoretical force equations will impact the uncertainty budget.

References:

1. Weimer, J.J., An Uncertainty Budget Analysis on the Hamaker Constant Determined When Fitting Force Distance Curves for a Sphere-Plate System. Alabama-Huntsville: Huntsville AL, 2017 Measurement (submitted June 2017)
2. Weimer, J.J., AFM Force Curves v100b2, Igor Pro, ver. 7.0, WaveMetrics Inc.: 2007 (accessed Aug. 7, 2017)

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