# ROBUST TRACKING OF A TWO-FINGERED NANOMANIPULATION SYSTEM WORKING THROUGH THE FOCUS OF A X-RAY BEAM

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The main objectives of this work is to characterize intrinsic properties of materials through a X-ray beam. By nanorobotic manipulation, it is meant that nano-objects are localized, positioned, and placed by controlling external forces with sensorial feedback. The actual dual tele-nanomanipulation system is shown in Figure 1. Each atomic force microscope (AFM) probe is able to scan the surface in order to localize precisely the object before its manipulation but also to measure the nature and the intensity of the interaction between the tip and the object in order to tune the grabbing force to avoid sample damage. The force control is based on the measurement of the AFM cantilever due to the tip-surface interaction. In this presentation, we study the robust control issues of the dual AFM micro/nano manipulators motions to ensure tracking of the X-ray (or laser- ray) with micro/nanometric resolution. Robust control strategies for piezoelectric-stack actuated nanomanipulators are implemented to deal with uncertainties (modeling errors, sensor limitations…) and environment noise. Then, efficient robust algorithms are proposed to track the handling position variations due to beam exposition (electrostatic forces, Brownian motion, scattering…) based on Kalman filtering and particle filtering.

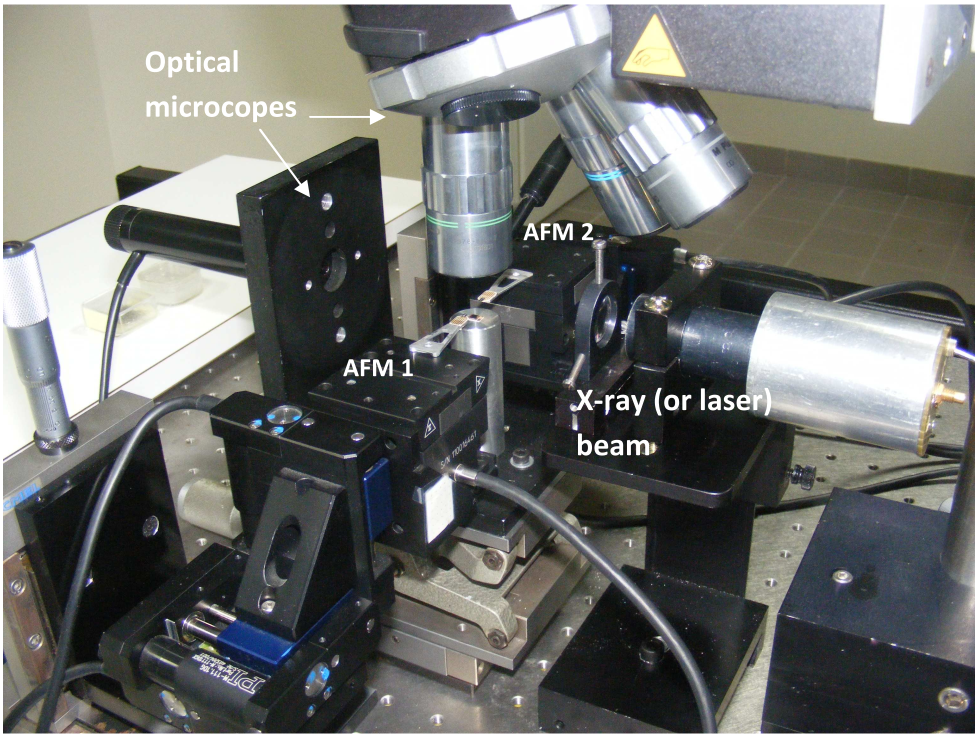

*Figure 1: Basic nanomanipulation setup with two independent atomic force microscope (AFM) tips working through the focus of a X-ray (or laser-ray) beam.*