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Analyzing qPlus sensor assemblies for optimized simultaneous scanning tunneling and non-contact atomic force microscopy operation using finite element method OMUR DAGDEVIREN, UDO SCHWARZ, Yale University — Scanning tunneling microscopy (STM) and non-contact atomic force microscopy (NC-AFM) are powerful methods that can not only visualize a surface's atomic structure, but also probe its electronic and chemical properties with picoampere, piconewton, and picometer resolution. Quartz tuning forks in qPlus configuration that have a metallic probe tip attached to the end of the free prong have gained considerable popularity in recent years for simultaneous high-resolution STM/NC-AFM experiments. Due to the small size of the tuning forks and the complexity of the sensor architecture, it is, however, not intuitive to judge how variations in the execution of the individual assembly steps affect the completed sensor's performance. In this presentation, we analyze the influence of each assembly step on the sensor's final performance using finite element method. The results show that when the tunneling current is collected using a separate wire, the exact realization of this wire connection has major effect on the sensor's performance. In addition, we show how other design choices such as the exact amount of epoxy used at key interfaces affects parameters such as spring constant, Q-factor, and resonance frequency.

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