



Supporting Information

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Comparison and Validation of Different Magnetic Force Microscopy Calibration Schemes

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Supporting Information

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1. Probes geometry

Scanning electron microscopy (SEM), images of the probes used have been taken and are shown in Figures S1 to S7. Note that distance and angular uncertainties depend on the magnification used on each image.

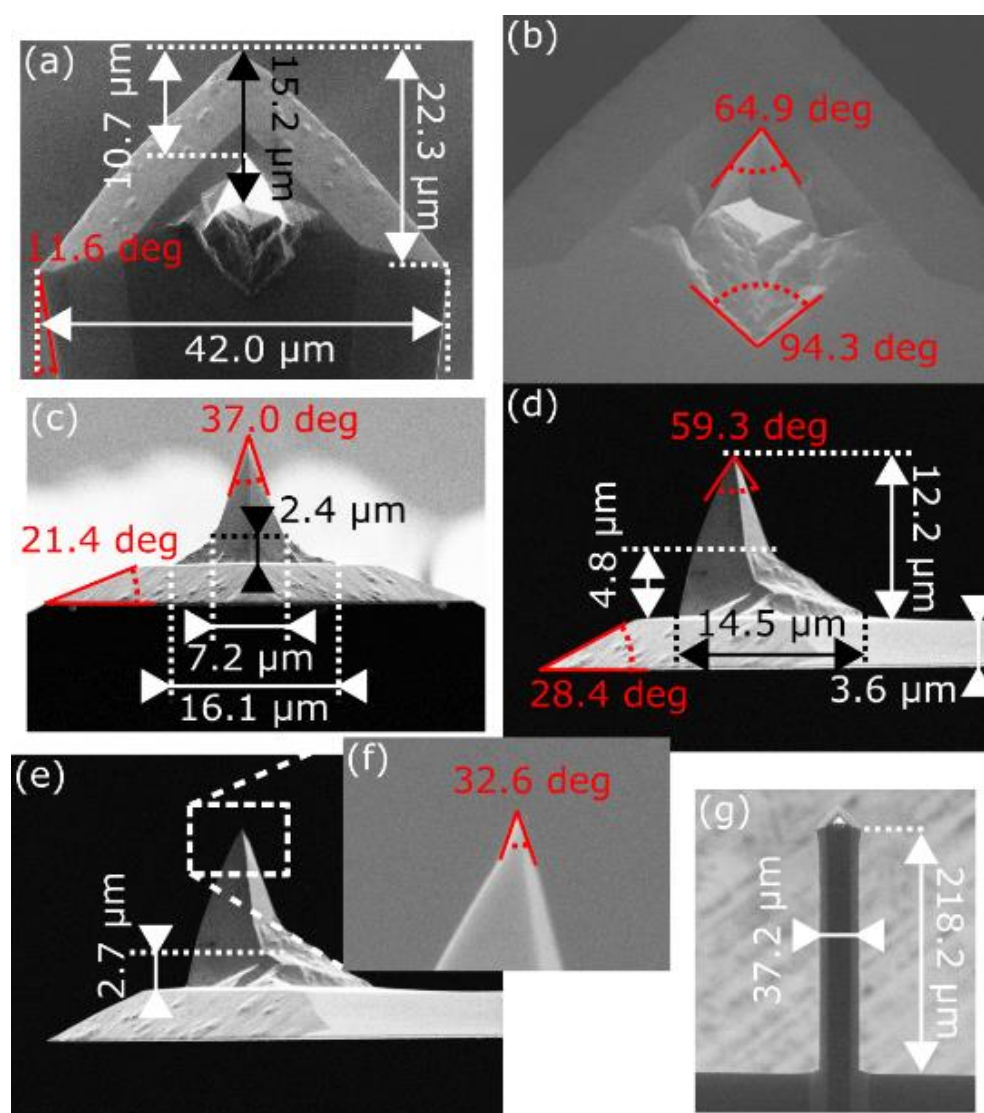


Figure S1. PPP-MFMR Nanosensors. (a)-(g) Probe's main geometrical features along their respective dimensions.

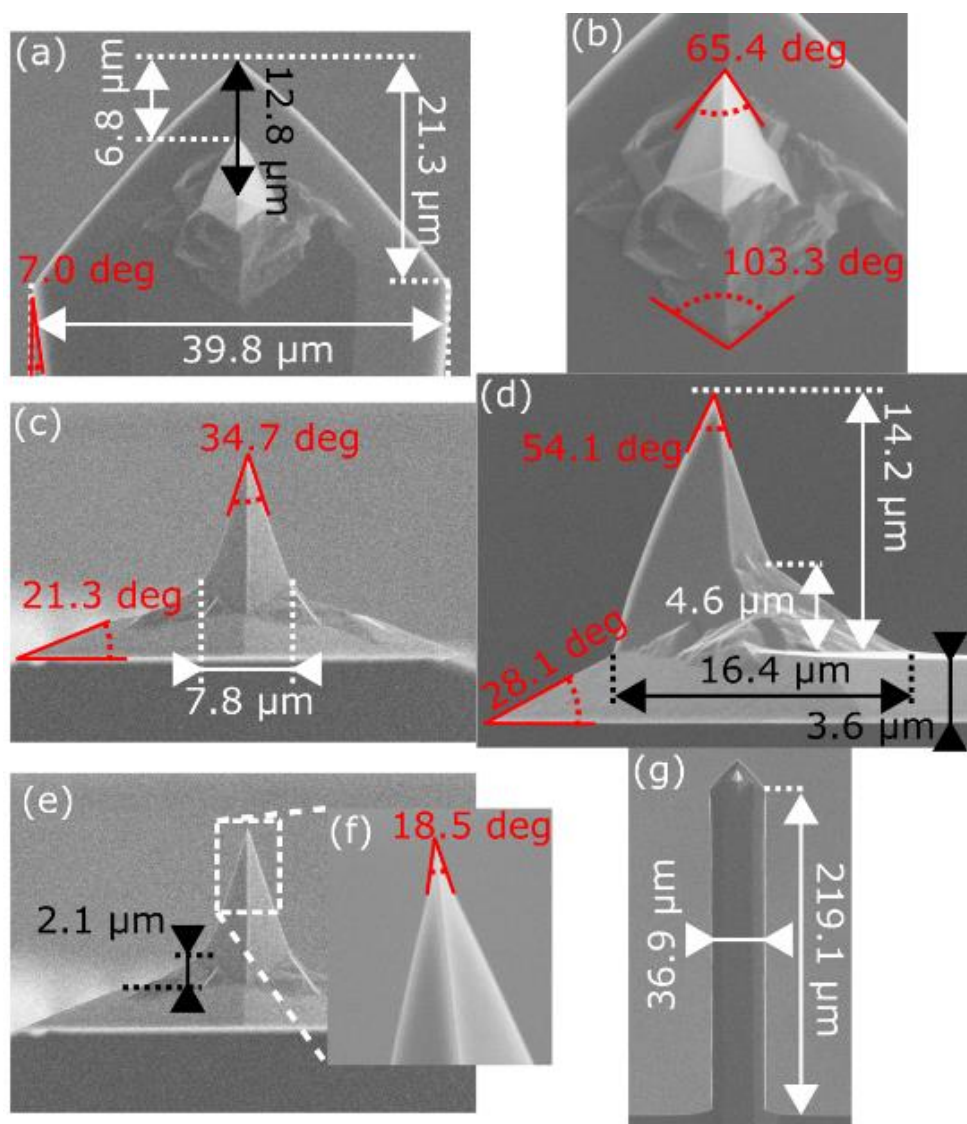


Figure S2. PPP-LM-MFMR Nanosensors. (a)-(g) Probe's main geometrical features along their respective dimensions.

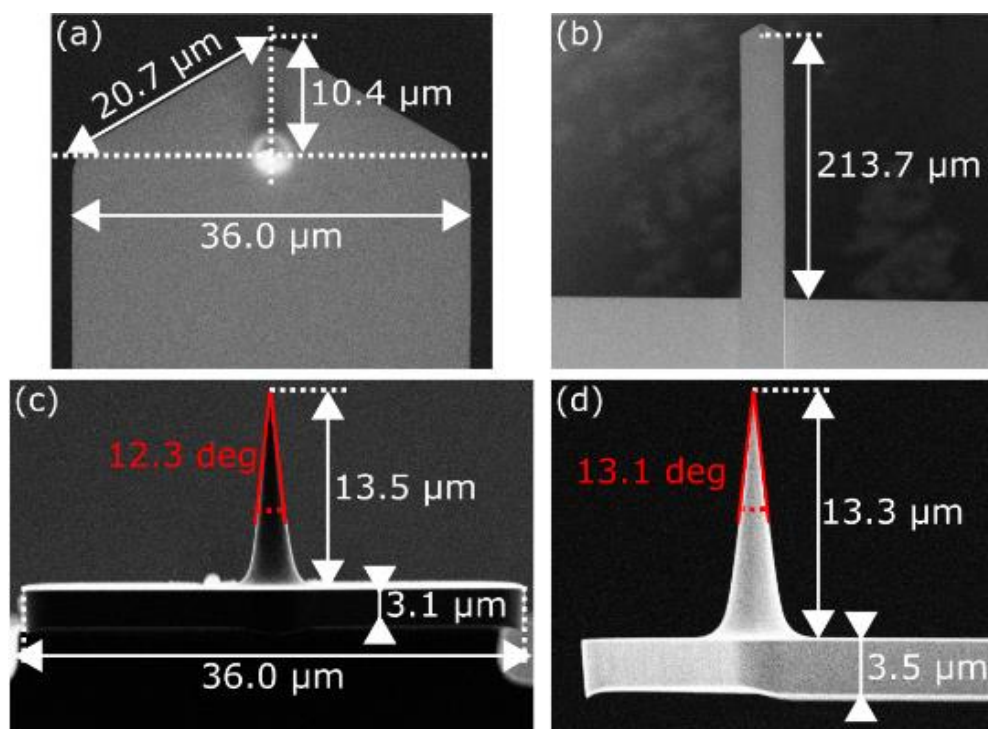


Figure S3. HR-MFM75 ML1 TeamNanotec. (a)-(d) Probe's main geometrical features along their respective dimensions.

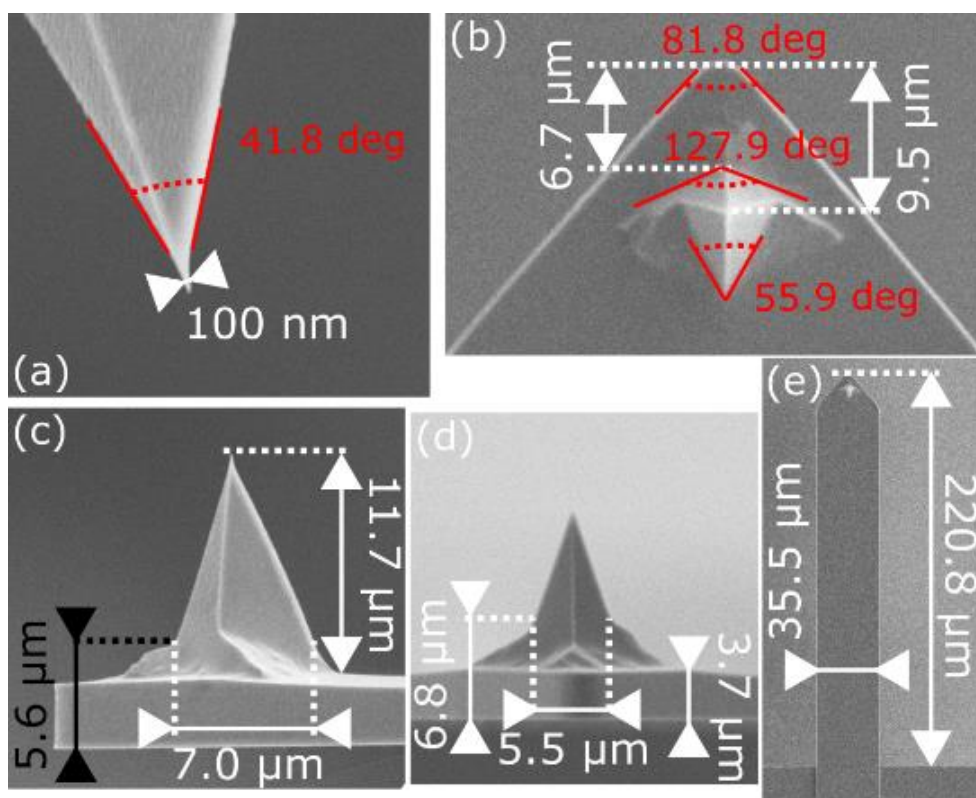


Figure S4. MESP V2 Bruker. (a)-(e) Probe's main geometrical features along their respective dimensions.

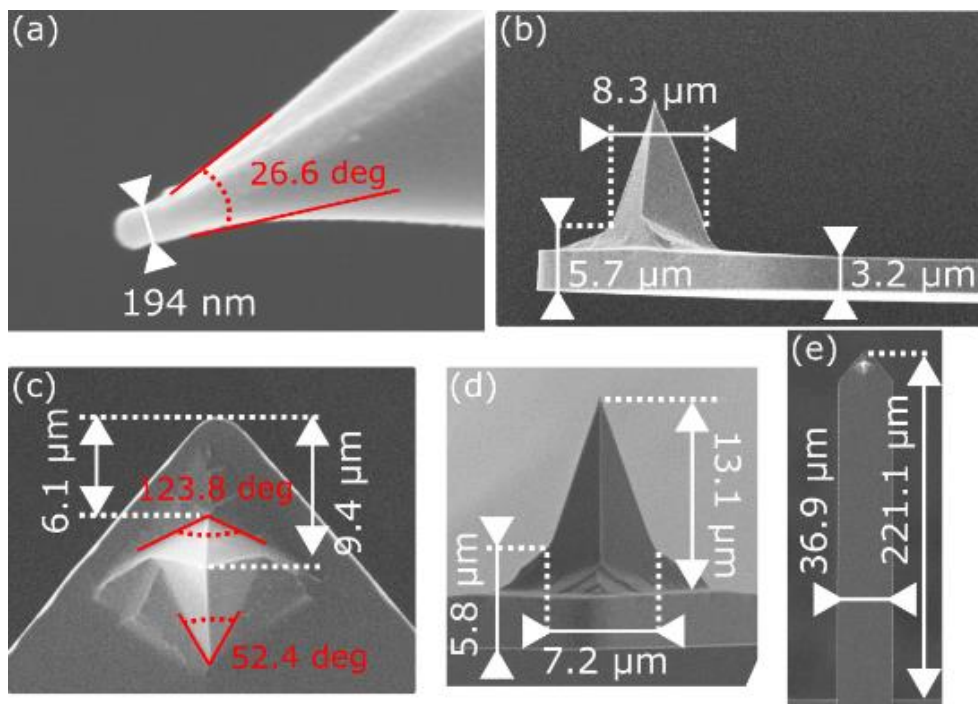


Figure S5. MESP HM V2 Bruker. (a)-(e) Probe's main geometrical features along their respective dimensions.

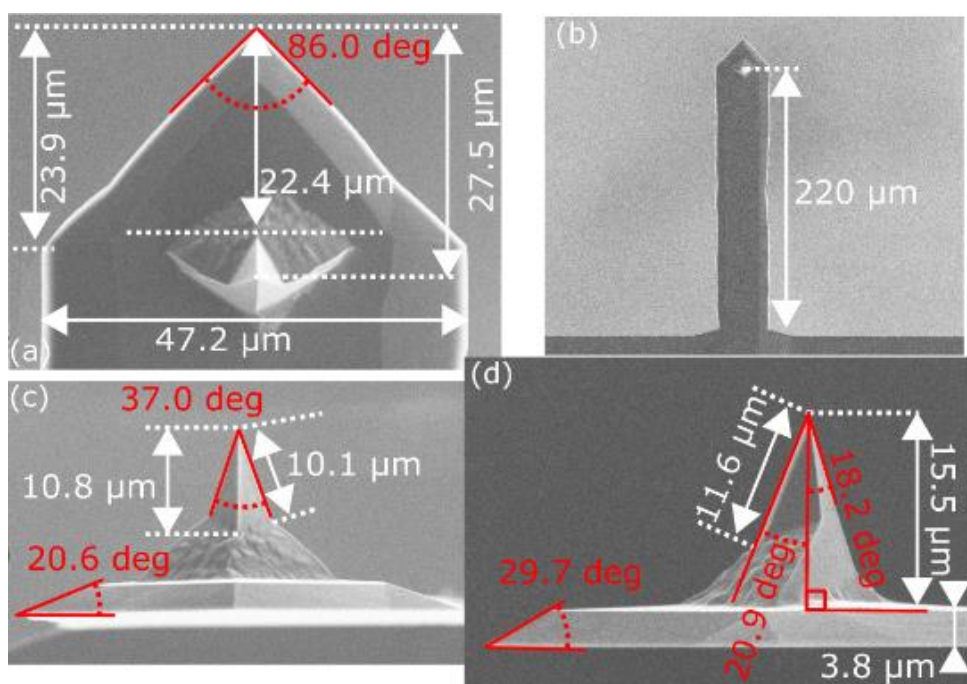


Figure S6. MFM01 TipsNano. (a)-(d) Probe's main geometrical features along their respective dimensions.

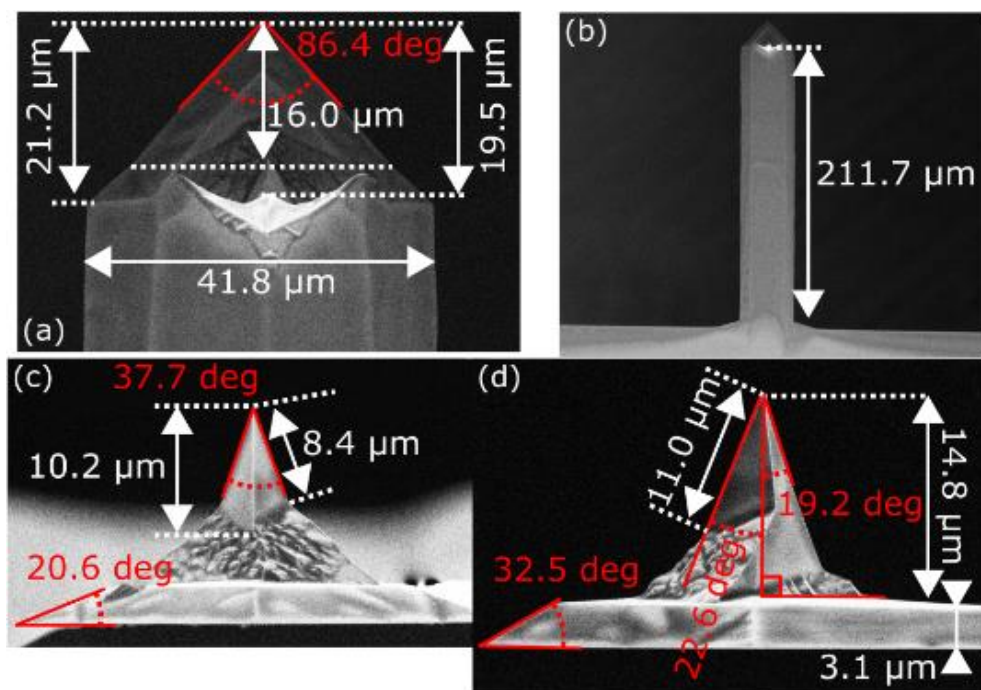


Figure S7. MFM_LM TipsNano. (a)-(d) Probe's main geometrical features along their respective dimensions.

2. Magnetic field sweep

Figure S8 shows for the probes used the phase, oscillation amplitude, lateral deflection and deflection as a function of the applied field when the field is ramped from negative to positive values and back again. Measurements were taken by placing the probes at 50 μm from the surface of an out-of-plane electromagnet and using a sweeping rate of 20 mT/min. Step changes in the curves reflect magnetization changes in the probe.

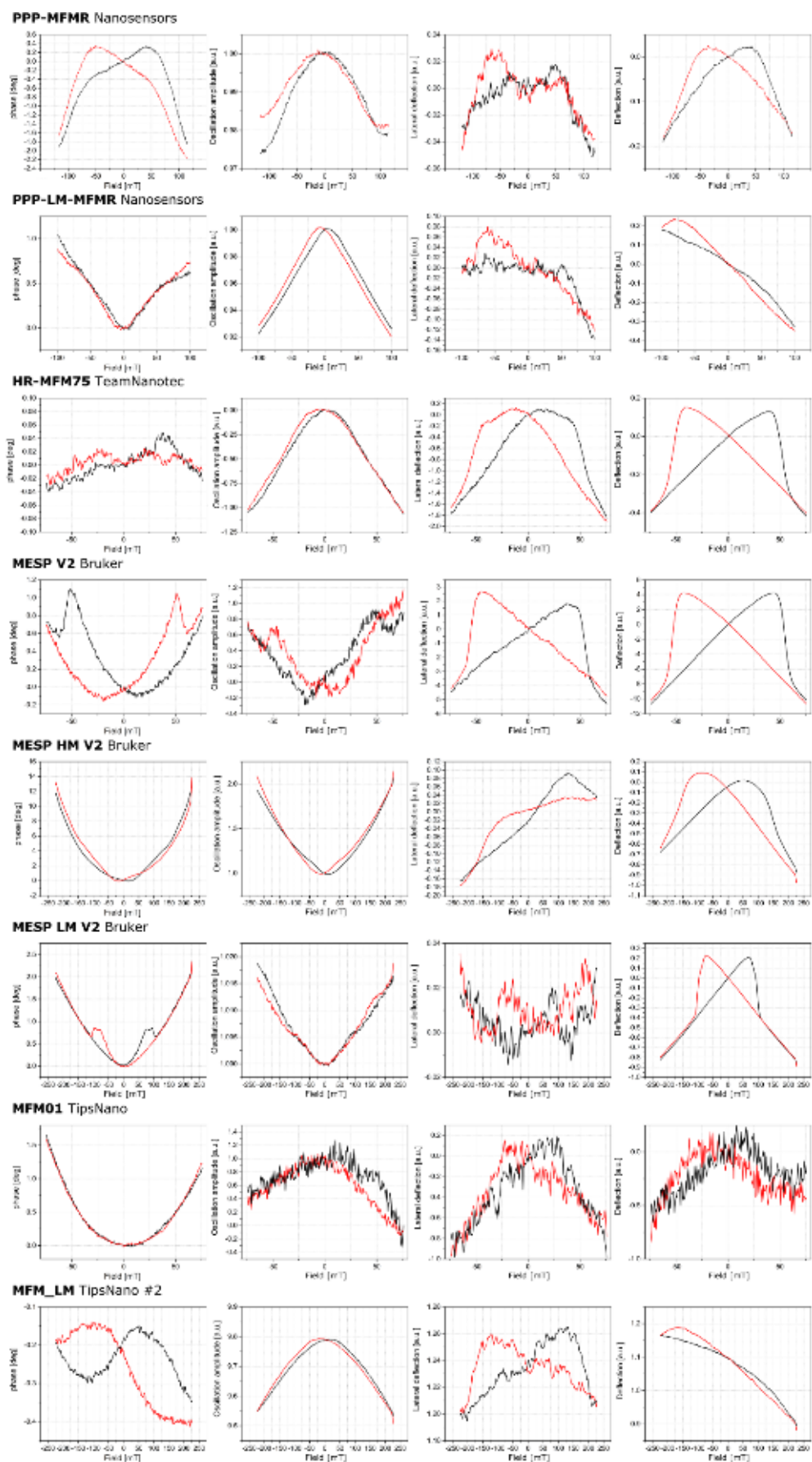


Figure S8. For each probe: phase, oscillation amplitude, lateral deflection, and deflection as the external magnetic field is sweep from negative to positive values and back again to negative.

3. Frequency sweeps

Figure S9 shows, for the probes used, the oscillation amplitude as a function of the excitation frequency obtained sweeping the excitation frequency while keeping constant the excitation amplitude.

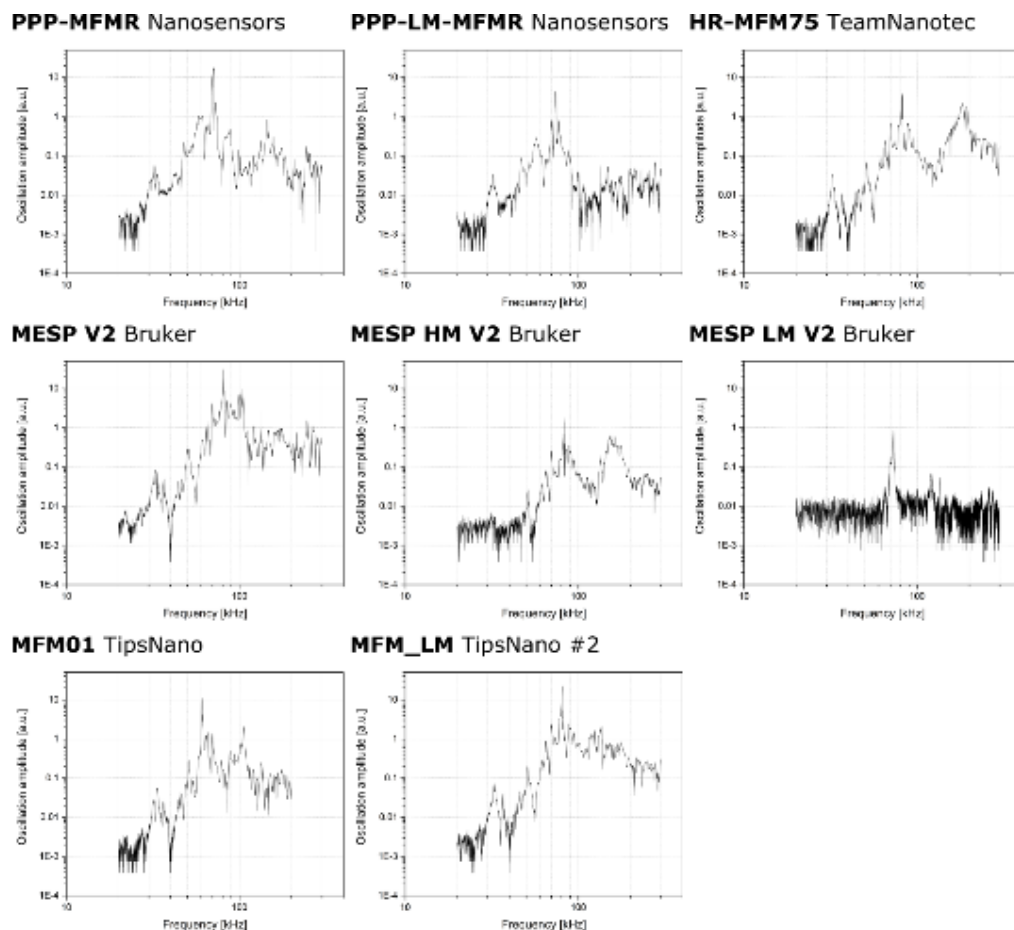


Figure S9. For each probe: oscillation amplitude as a function of the applied excitation frequency.

4. Ramp

Figure S10 is an example of the ramps taken during the calibration procedure to adjust the oscillation amplitude and measure the distance to the sample's surface during the first pass.

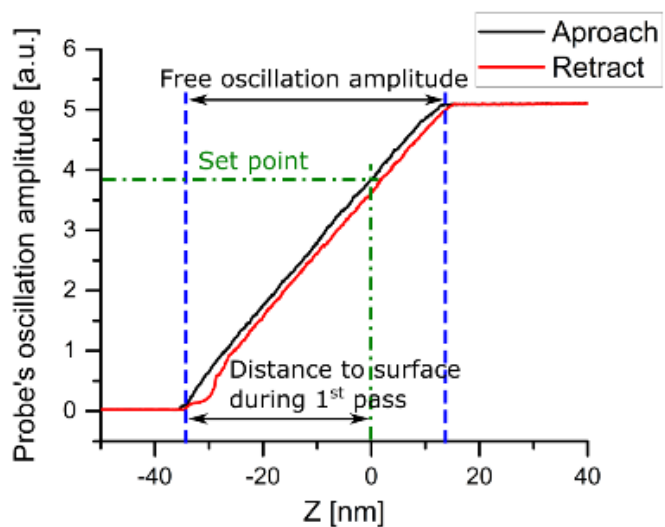


Figure S10. Typical ramp showing the distance during the first pass and the total oscillation amplitude.