

Next-Level Nanotechnology Tools  swiss quality

PicoBalance

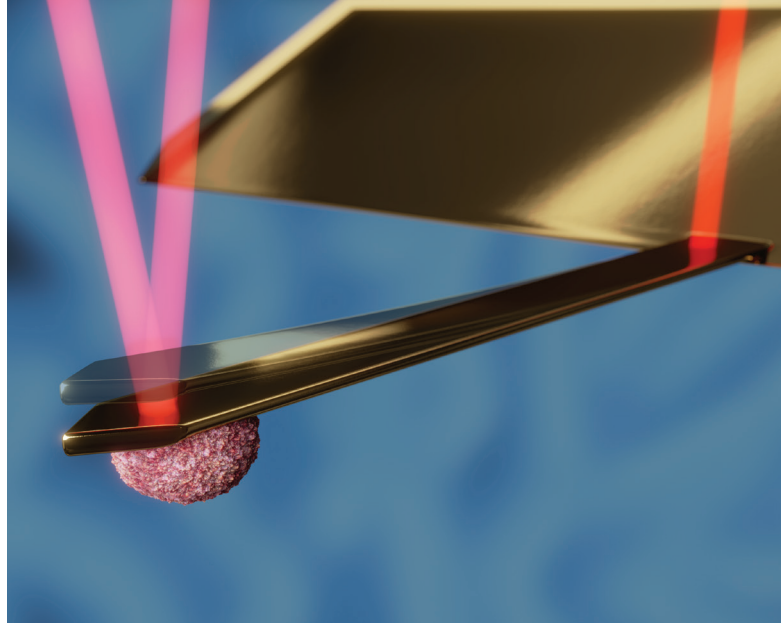
add-on for DriveAFM

Unparalleled precision balance

PicoBalance

The unparalleled precision balance

All over natural sciences and engineering mass is being measured to characterize and design a large variety of high performance systems. Yet there existed an instrumental void for weighing microscopically sized systems such as single cells or colloidal microparticles. Motivated by this problem and driven by innovation, Nanosurf now offers a unique solution that allows nanotechnological measurements of a new dimension: the PicoBalance. Whether as a stand-alone instrument or as an add-on to the DriveAFM, the PicoBalance enables users to non-invasively measure microscopic biological or material science systems reaching sub-picogram and millisecond resolution.

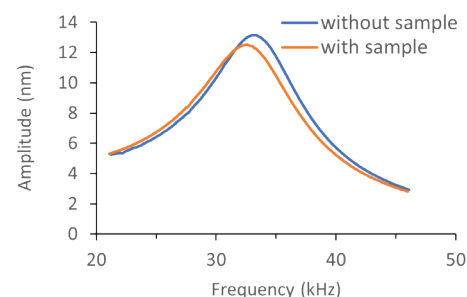
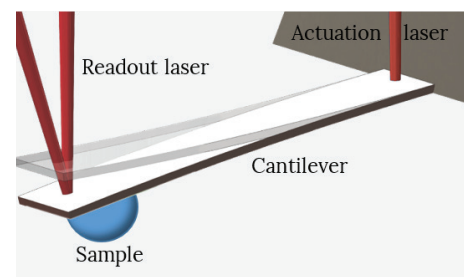


Key features & benefits

- Direct measurement of the total mass in liquids
- Mass resolution: 5 pg; range: tens of pg to tens of ng*
- Time resolution: 100 ms; range: from seconds to days*
- Long-term stability enabling day-long experiments
- Compatible with LiveCell chamber, inverted light microscopy, FluidFM and DriveAFM
- Characterizing material science systems

Mass measurement add-on for DriveAFM

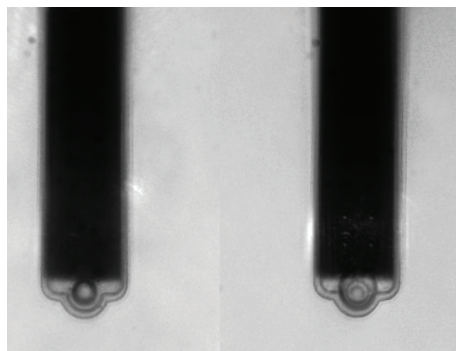
The PicoBalance technology is enabled by Nanosurf's CleanDrive, which precisely controls the movement of the cantilever. PicoBalance is available on a dedicated instrument, the DriveNMA, but is also seamlessly compatible with the DriveAFM. PicoBalance enables users to non-invasively measure microscopic biological or material science systems with a high mass and time resolution. Together with the imaging and spectroscopy capabilities of the DriveAFM, a fully-fledged high-performance AFM, users gain access to a wide range of different applications as well as an ever-growing set of multi-correlative experiments.



Mass induced frequency shift as seen in the amplitude response of the cantilever.

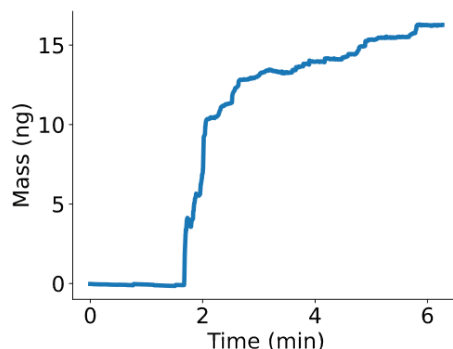
Characterizing material science systems

Mass determination with the PicoBalance is based on the measurement of the frequency shift that is induced by attaching the sample to the mass sensor, the cantilever. One area of application is the static size and mass characterization of colloidal systems, and their dynamic swelling properties in solvents. The combination with the FluidFM technology is of particular advantage – it allows fast and reversible attachment of the systems or the research of droplet-liquid interactions. Nanosurf has refined the mass measurement workflow and supplemented it with automatic procedures for preparing and executing the measurement.

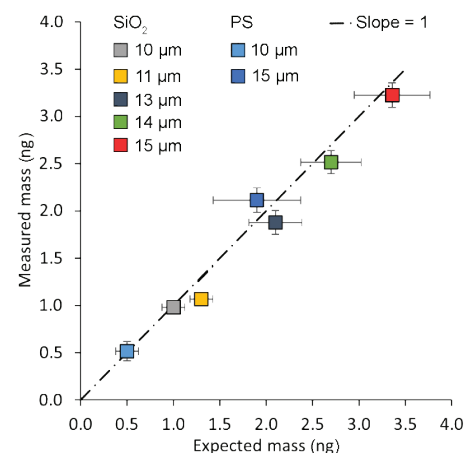


Differently sized colloids attached to a Fluid-FM cantilever for mass measurement.

Image width: 220 μm ; image courtesy:



Mass increase of paraffin bubble over time at an applied pressure of 700 mbar.



Measured vs expected bead masses. A straight line of slope 1 indicates the expected behaviour for an accurate, linear measurement.

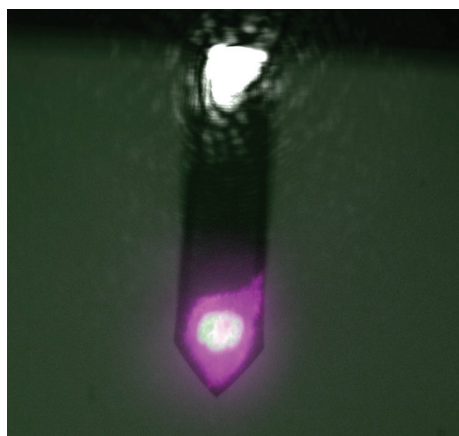
FluidFM®-ready

The DriveAFM and DriveNMA are fully compatible with the FluidFM technology, which integrates microfluidic channels in the cantilever, allowing to reliably aspirate, hold, and subsequently release individual particles. This is of particular use when measuring material science systems or suitable biological samples in rapid succession. In combination with the force sensitivity and positional accuracy of the DriveAFM, a wide range of exciting experiments from nanoscience to cell biology are possible:

- Direct measurement of the total mass in liquids
- Single cell force spectroscopy (both in cell-substrate and cell-cell configuration)
- Targeted cell injection
- Material extraction from cells for further analysis (e.g. mass spectrometry, PCR)
- Targeted deposition of substances on cells/tissues
- Substrate patterning or modification

Getting a new perspective on cellular systems

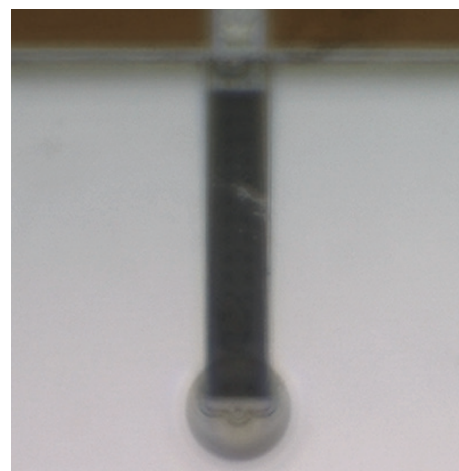
The PicoBalance also reveals new perspective on cellular systems found in fundamental, biotechnological and pharmacological research. Cells of varying sizes can be hosted on the cantilever, made to adhere by physiologically relevant substrates such as



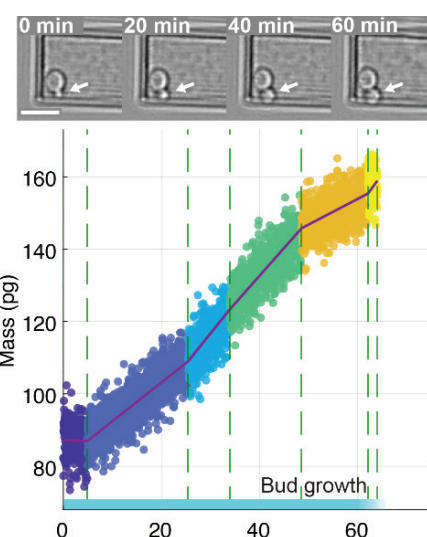
Actin (red) and H2B (green) labelled HeLa Kyoto cell on a NSC25 cantilever during a long-term measurement. Image width: 110 μm



Budding yeast proliferating on a cantilever. Fluorescent markers indicate the stage of the cell cycle. Cantilever width: 16 μm . Image courtesy: Computational systems biology group, ETH, Zurich.

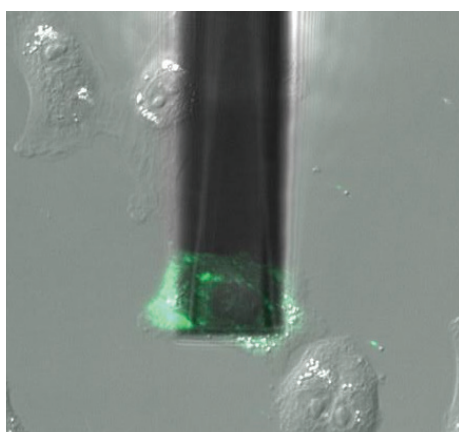


Paraffin bubble in water, growing at a FluidFM cantilever. Image width: 400 μm . Image courtesy: Biophysics group, ETH, Zurich.

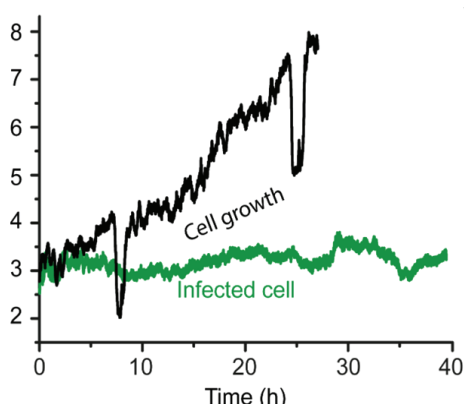


Budding yeast cell shows segments of different growth rates. Scale bar: 10 μm . A.P. Cuny et al. (2022), DOI: 10.1038/s41467-022-30781-y

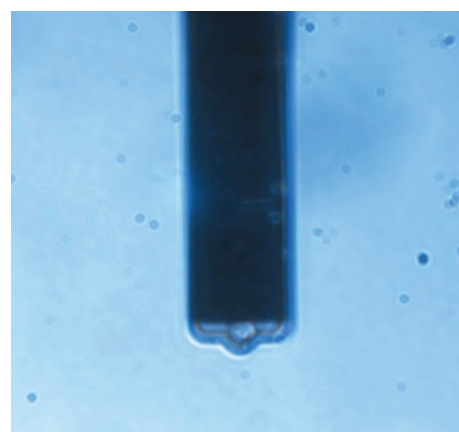
collagen, fibronectin, laminin etc. Researching the cell growth behaviour or the influence of chemicals on the cellular proliferation or function. The PicoBalance unlocks new applications in cell nutrition, mass regulation, disease related processes, and drug screening. The compatibility with transmitted light and fluorescence microscopy allows the correlation of mass measurements with cell morphology or cell state. All measurements can be performed under physiological conditions.



Contact with a virus infected BSC40 cell to infect a HeLa CLL-2 cell on the cantilever prior to mass measurement. Image width: 120 μm . Image courtesy: Biophysics group, ETH, Zurich.



Healthy cell accumulates mass, meanwhile the other cell has stopped growing as a result of its infection with a smallpox virus. Martínez-Martin et al., Nature (2017). DOI: 10.1038/nature24288



Fibroblast nucleus mass measurement on a FluidFM cantilever. Image width: 190 μm



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