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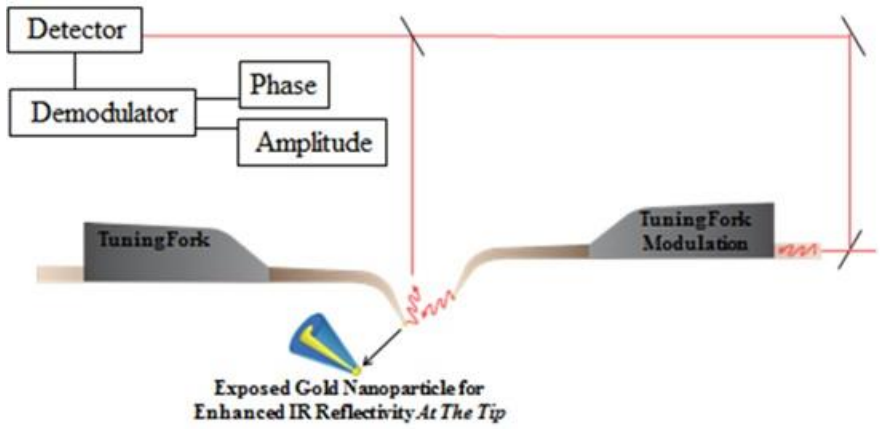
Multiprobe platform for Low Background Apertureless NSOM (ANSOM)

In standard approaches to apertureless NSOM (ANSOM), the probe functions as a modulated scatterer with gross far-field optical illumination using elements such as lenses or mirrors, which cause large spot sizes of radiation around the scattering probe. It has been very challenging to develop ways to reduce the artifacts that arise from the background that is created by these far-field optical elements. This background can interfere with the desired signal from the nanometric tip of an atomic force sensor capturing the near-field surface component in a large far-field radiation background.

The MultiView 4000 with its unique multiprobe capability enables the reduction of both the optical and mechanical background and thus increase the overall S/N in your ANSOM experiments.

With a multiprobe system, one probe can be used as a limited illumination spot onto a second scattering probe, as shown in the schematic below. This reduces the optical background and generates the correct k vectors to excite the scattering probe. The feedback also employs tuning forks so that the scattering probe can be kept with an oscillation amplitude of 1 nm without jump to contact and without variation in z, which add additional background noise from mechanical sources. Furthermore, the rigid tuning fork frequency enhances significantly heterodyne and homodyne lock-in detection schemes to further reduce background.



This scheme diagrammatically describes the two probe configuration where the illuminating probe excites the scattering probe and this probe can even be a single gold nanoparticle with high scattering contrast at the exposed tip of the AFM probe for increased signal from the very tip of the probe. These probes have been developed by Nanonics for Tip Enhanced Raman Spectroscopy

Near-Field Plasmon Excitation & Apertureless Scattering and Collection Apertureless NSOM (ANSOM)

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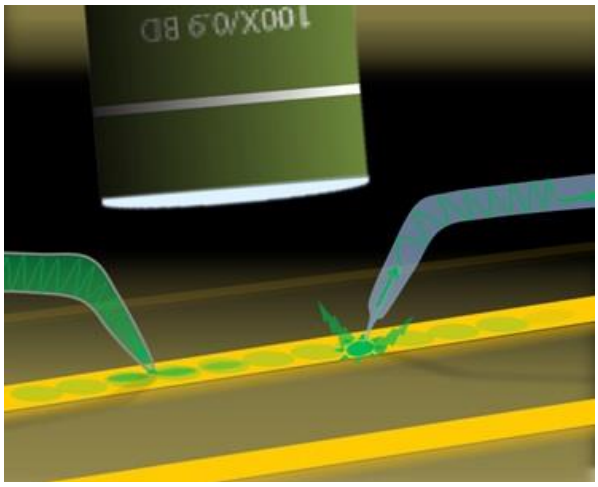
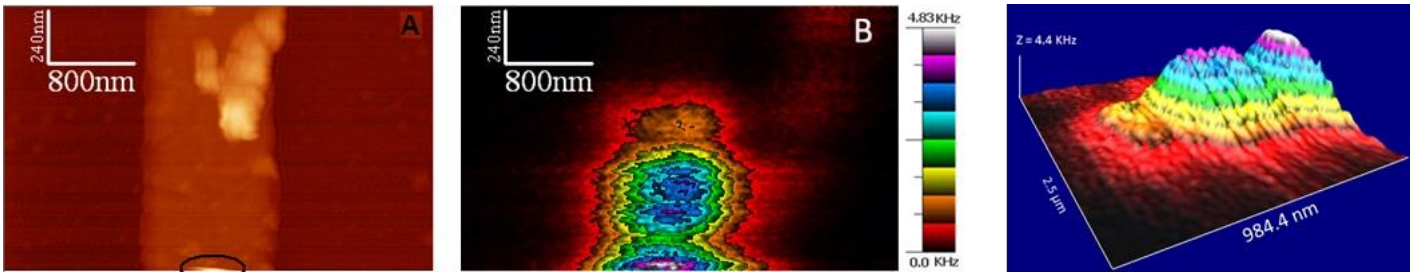
A two Probe SPM setup with the Nanonics Multiview 4000 has been used for effective localized illumination of a plasmonic structure with an apertured NSOM probe which produces all k-vectors. The propagating plasmons are scattered and then collected with a second probe which has a very low dielectric constant and minimal perturbation of the plasmonic propagation



Two Probe Setup Scheme: An apertured probe to produce an evanescent field with a spectrum of k vectors to effectively excite SPP (Left Probe). Right probe is a very low dielectric contrast, highly exposed, non-interfering scanning and work in Photon Tunneling mode to scatter SPP and directly collect the photons produced by such scattering



Left: AFM Height image of the Au strip performed with the ANSOM scanning tip. The circle at the bottom shows the effect of the illumination apertured tip when scanning in its close proximity. **Middle**: ANSOM image performed with the scanning tip. Rich contrast is seen with the apertureless probe doing the AFM and ANSOM imaging. **Right**: 3D ANSOM image shows sustained plasmon propagation and then rapid decay

Low dielectric constant apertureless probes exclusively from Nanonics

Standard probes that effectively scatter the plasmonic signal have significant perturbation on the plasmonic propagation since they have a high dielectric constant to obtain an effective signal to noise ratio.
Nanonics exclusively provides Apertureless probes of glass containing plasmonic or non-plasmonic scattering particles. Nanonics ANSOM probes are low dielectric constant, provide

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non-interfering scanning, and they work in Photon Tunneling Mode to scatter SPP. For such plasmonic probes, glass provides for high dielectric contrast for exceptional antenna effects at the tip of the probe. Such probes can be provided with a nanoparticle as small as 10 nm or simple 5nm diameter glass probes can be provided.

Nanonics MultiProbe Apertureless NSOM:

- Multiprobe systems are singularly capable of exceptional apertureless and scattering NSOM imaging.
- Ideal Apertureless solution with minimum stray light & maximal plasmonic excitation
- MultiProbe ANSOM appears to have significant potential to reduce background and maximizing signal at the highest resolution