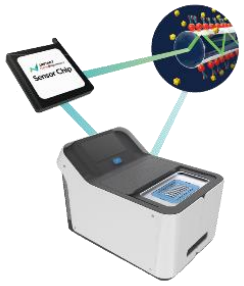
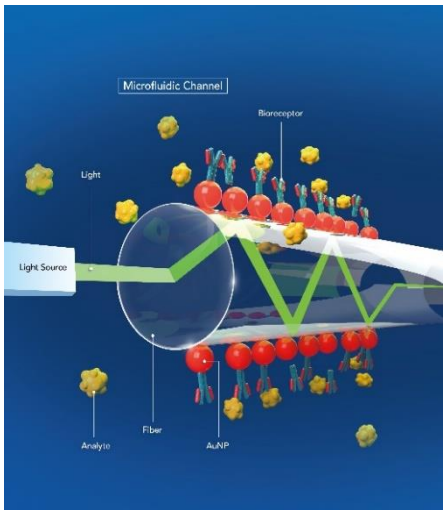
Why the Light-Sensing Biomarker Analyzer?

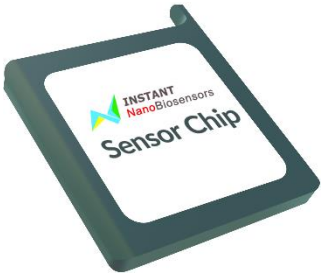
System Sensitivity, Compactibility, and Reliability



The Light-Sensing Biomarker Analyzer based on the unique & patented fiber optic particle plasmon resonance (FOPPR™) technology, are ultrasensitive and label-free detection platforms for real-time biomolecular interactions. From core technology to microfluidic chip design, system instrumentation to analysis software, innovative solutions for a wide range of biomarker research.



FOPPR™ features two crucial materials: **gold nanoparticles** and an **optical fiber**. Gold nanoparticles exhibit an optical property called particle plasmon resonance (PPR), which is the collective oscillation of conductive electrons at the nanoparticle surface in response to light of a particular wavelength. This optical phenomenon is extremely sensitive to refractive index changes in the surrounding environment, making it suitable for real-time molecular detection. The other component of FOPPR™, the optical fiber, guides light through multiple total internal reflection (TIR), producing a continuous evanescent field at the fiber surface. By combining gold nanoparticles with the optical fiber, the usually low absorbance of the nanoparticle monolayer is significantly enhanced. Functionalization of the nanoparticles with receptor ligands specific to the analyte of interest creates an ultrasensitive and label-free molecular detection tool tailored to the user's needs.



PPR of metal nanoparticles is similar to the surface plasmon resonance (SPR) property of thin metal films. However, unlike conventional SPR, PPR of nanoparticles is not angle-dependent. Thus, generation of PPR with an optical fiber does not require precise optical alignment. Integration of the sensing component with a unique **powerless *IN*Chip microfluidic** design enables the analysis of liquid samples without the use for external pumps or tubes. This reduces instrumentation complexity and eliminates the need for complicated system maintenance while containing all waste fluids within the disposable sensor chips.

In addition to using FOPPR™ as the detection principle and *IN*Chip as the microfluidic design, INB Light-Sensing Biomarker Analyzer utilize a **light emitting diode** (LED) and a photodiode (PD) as the excitation light source and detector, respectively, for each sensing channel. Unlike conventional light sources and photodetectors, use of these optical components reduces the need for large chambers or complex optical alignment, making the system compact and simple to use. Finally, as a benefit and extension of the

angle-independency of PPR, INB Light-Sensing Biomarker Analyzer employ a **self-calibrated data analysis** algorithm, alleviating the need for precise optical alignment while ensuring data precision.

To demonstrate system reliability, one of the critical considerations of an analysis instrument, Fig. 1 depicts a sensorgram for the measurement of different refractive index solutions with INB Light-Sensing Biomarker Analyzer. The relative standard deviation (RSD) of data points within a 300 second time frame for each solution is smaller than 0.01%, displaying the low noise of the optical system. Furthermore, the signal ratio of each refractive index solution is plotted against the solution refractive index in Fig. 2. The CV for the linearly-fitted slopes of sensor chips is 2.43% while maintaining a CV smaller than 10% for each refractive index solution, as seen in Table 1. Thus, INB Light-Sensing Biomarker Analyzer based on FOPPR™ not only offer high sensitivity and a wide linear range, the *IN*Chip microfluidic design and compact instrumentation do not compromise system reliability or precision and offers a platform to accommodate different biomolecular analysis interests and needs.

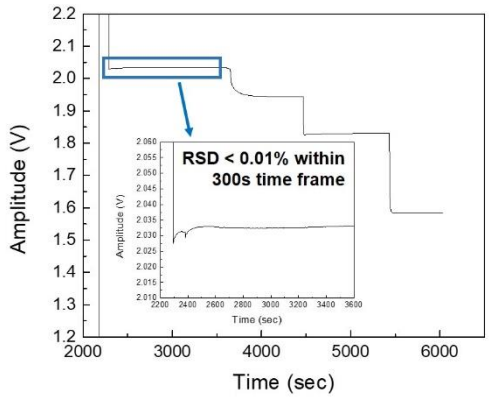


Fig. 1 Refractive index solutions response sensorgram.

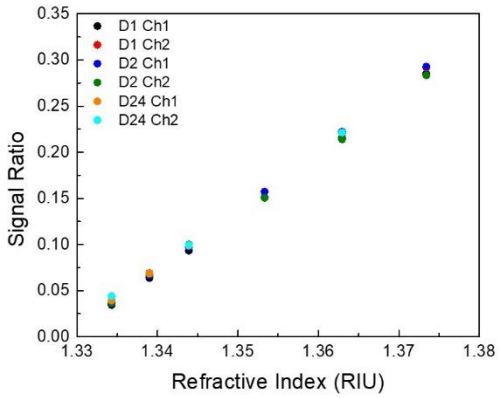


Fig. 2 Refractive index vs signal ratio plot.

Table 1 Top: intra-machine inter-chip slope CV for six refractive index solution measurements. Bottom: signal ratio CV for each refractive index solution measurement.

	Day 1 Ch1	Day 1 Ch2	Day 2 Ch1	Day 2 Ch2	Day 24 Ch1	Day 24 Ch2
slope	6.4111	6.4297	6.5621	6.2299	6.1675	6.2218
mean	6.3370					
CV (%)	2.4265					

	Solution 1 (n=6)	Solution 2 (n=5)	Solution 3 (n=6)	Solution 5 (n=5)
mean	0.0383	0.0671	0.0979	0.2188
stdev	0.0034	0.0021	0.0024	0.0037
CV (%)	8.8886	3.1670	2.4589	1.6884

References:
[1] Willets et al. *Annu. Rev. Phys. Chem.* 2007. 58:267–97
[2] Cheng et al. *Anal. Chem*. 2003**,** 75, 16-21