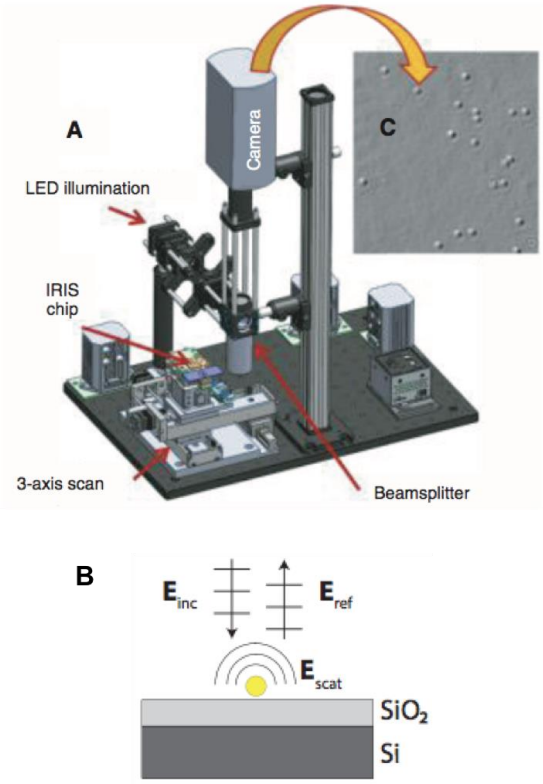
Boston University (BU)

Interferometric Reflectance Imaging Sensor (IRIS)

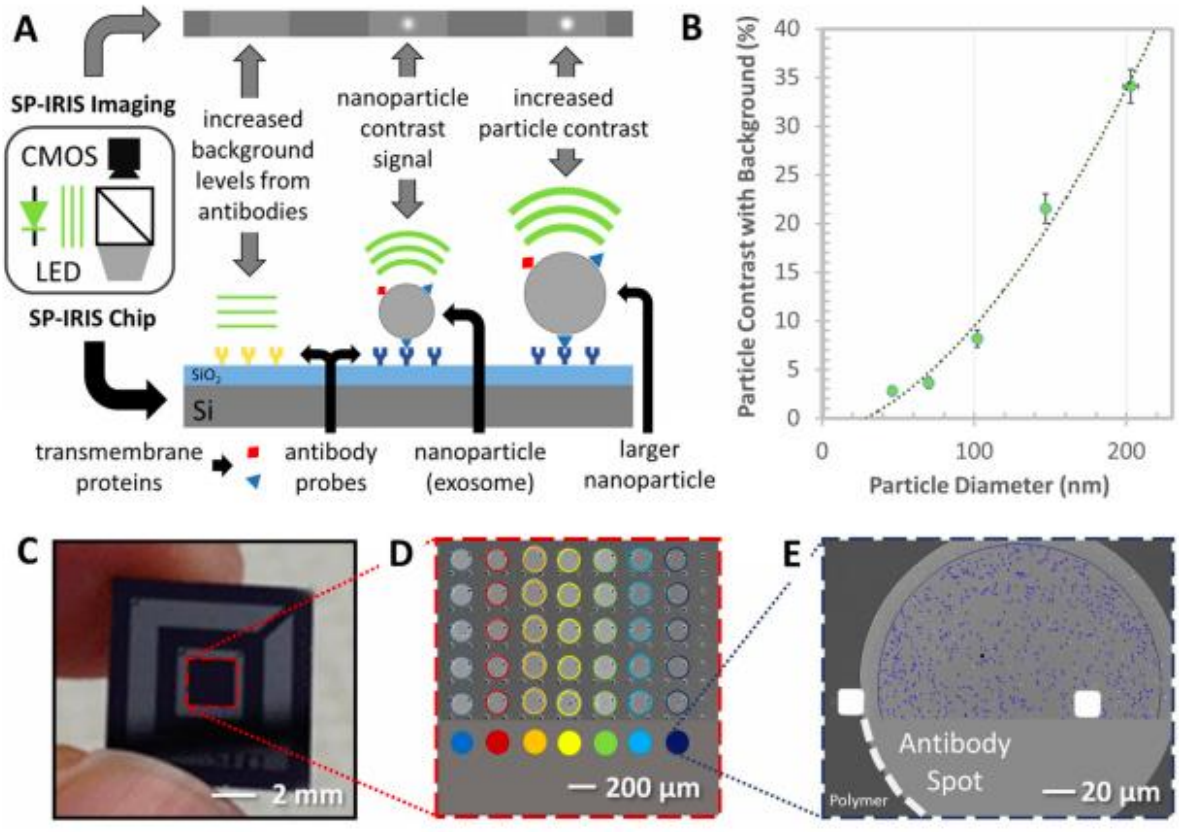
Partner BU has developed a sensing platform: Interferometric Reflectance Imaging Sensor (IRIS) for label-free, high-throughput, high-sensitivity, and dynamic detection of molecular binding on a solid surface. The IRIS signal is based upon the interference of the fields reflected off a layered substrate that is typically comprised of a SiO2 layer thermally grown atop a Si surface. IRIS renders two distinct detection modalities: (i) high-throughput label-free measurement of biomass accumulations; and (ii) digital detection of single particles with high-magnification, also known as Single Particle Interferometric Reflectance Imaging Sensor (SP-IRIS).

The detection method proposed in INDEX, SP-IRIS, is based on the enhanced contrast in the scattering signal from particles captured on a layered sensor surface. To detect and size nanoparticles, IRIS shines light from visible LED sources onto nanoparticles bound to the sensor surface, which consists of a silicon dioxide layer on top of a silicon substrate. Interference of light reflected from the sensor surface is modified by the presence of particles producing a distinct signal that correlates to the size of the particle. The detection of low-index dielectric particles with diameters of 50 nm to 200 nm is shown in Fig. 3 demonstrating that the SP-IRIS signal correlates with the size of the particle. For multiplexed exosome detection by SP-IRIS, antibodies are spotted on chips, exosomes are captured and image is analyzed to reveal the size of each individual particle. Detection of exosomes larger than 50nm size has been demonstrated by CNR-BU collaboration for dry chips.



SP-IRIS instrument. A) SP-IRIS optical setup consists of an LED lighting module, a high-NA objective and a camera. B) SP-IRIS substrate is a thin film of thermally grown oxide on silicon. Incident light (Einc) is both reflected by the substrate (Eref) and

scattered by the immobilized nanoparticle (Escat). C) A sample image showing response from individual nanoparticles.



(A) SP-IRIS detection principle, monochromatic LED light illuminates the sensor surface and the interferometriclly enhanced nanoparticle scattering signature is captured on a CMOS camera. (B) SP-IRIS signal for polystyrene nanoparticles with a diameter from 50–200 nm. (C) Image of the SP-IRIS chip. (D) Low-magnification interferometric image showing microarray of immobilized capture probes. (E) SP-IRIS image of a capture probe. Analysis software recognizes capture spot and detects nanoparticles.