Supporting Information

# Multiplex detection of urinary miRNA biomarker by transmission surface plasmon resonance

Wing Kiu Yeung[a] , Huai-Yi Chen[a,b,c] , Juan-Jie Sun[a], Tung-Han Hsieh[a], Mansoureh Z. Mousavi[d], Hsi-Hsien Chen[g,h], Kuang-Li Lee[a,e], Heng Lin[f], Pei-Kuen Wei[a] and Ji-Yen Cheng [a,c,h,i]

a. Research Center for Applied Science, Academia Sinica, Taiwan

b. Department of Engineering and System Science, National Tsing Hua University, Taiwan

c. Nano Science and Technology Program, Taiwan International Graduate Program, Academia Sinica and National Tsing Hua University, Taiwan

d. Istituto Italiano Di Technologia, Genova, Italy

e. Institute of Physics, Academia Sinica, Taiwan

f. Department of Physiology, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan

g. Division of Nephrology, Department of Internal Medicine, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan

h. Division of Nephrology, Department of Internal Medicine, Taipei Medical University Hospital, Taipei, Taiwan

i. Department of Mechanical and Mechantronic Engineering, National Taiwan Ocean University

Corresponding author : Ji-Yen Cheng, email : jycheng@gate.sinica.edu.tw

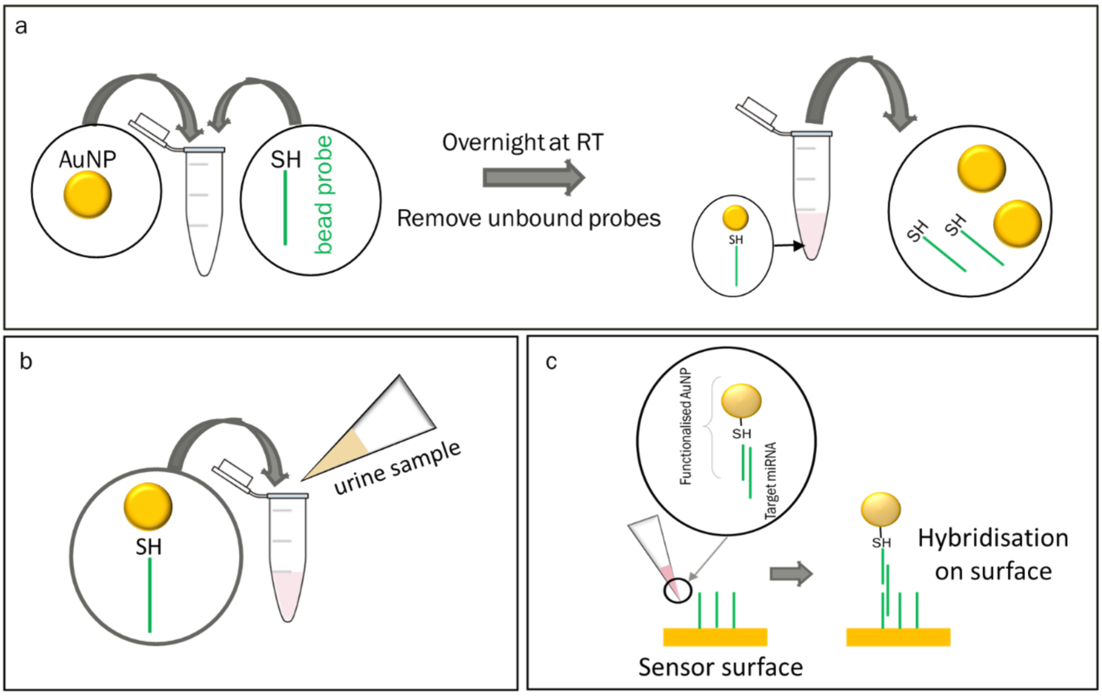


Fig. S1 A schematic of the double hybridisation method used to detect miRNA target in urine samples. (a) First step: Functionalsation of AuNP by bead probe. (b) Second step: Urine sample added to functionalized AuNP. (c) Hybridising of the target molecule, together with the AuNP, on the CG nanoslit surface.

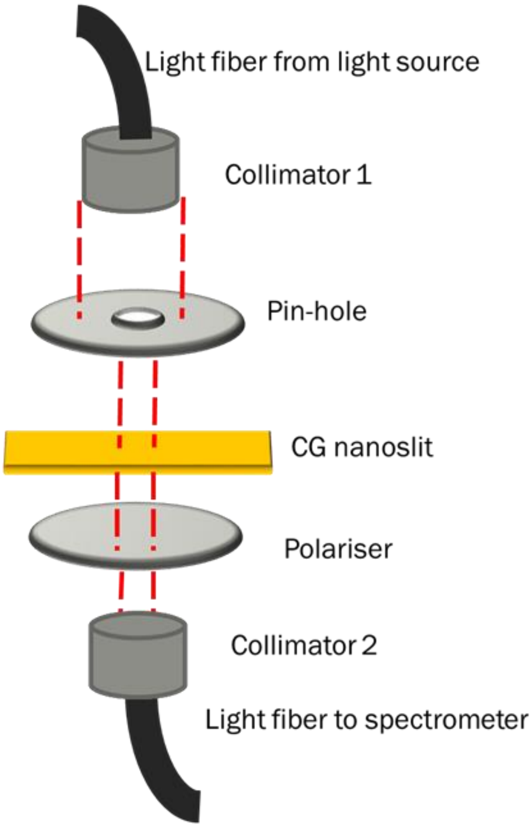


Fig. S2 Schematic illustrating the optical pathway of the experimental setup used for measuring the transmission spectra through the detection window.

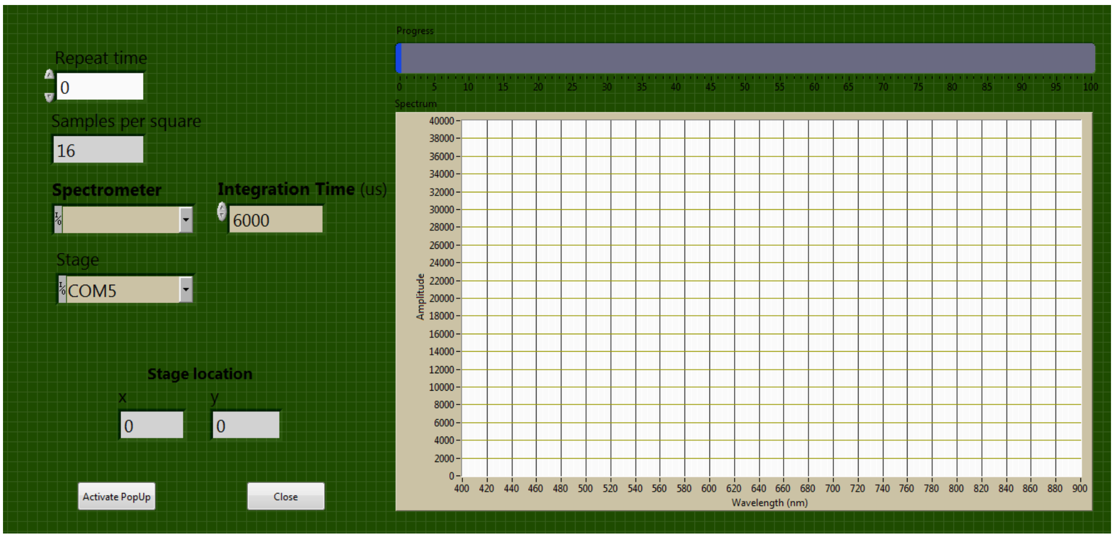


Fig. S3 The user-interface of the automated system used in this work

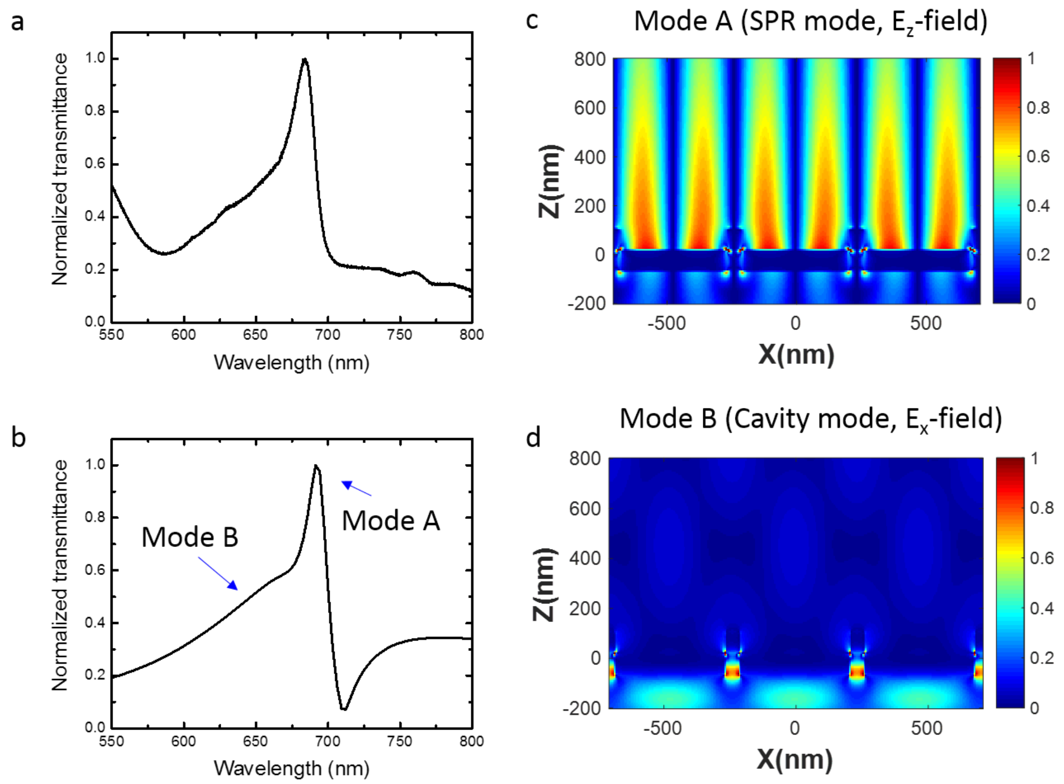


Fig. S4 The Fano resonance and optical fields was simulated using FDTA method. The (a) simulated and (b) normalised transmission spectra obtained. The optical modes (c) Ez and (d) Ex field distribution was calculated. Mode A refers to surface plasmon mode extending into the bulk solution, whilst mode B refers to the cavity mode, where it is localised. The asymmetrical Fano resonance spectrum is a result of the interference between the cavity and the surface plasmon mode.

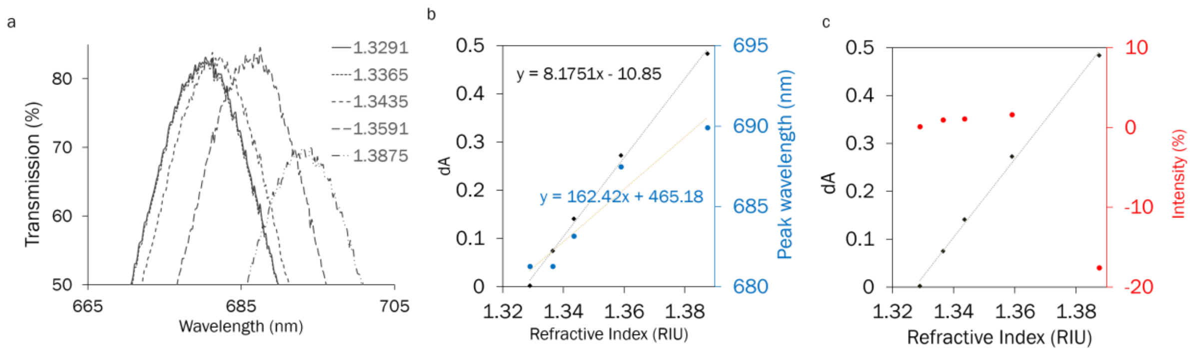


Fig. S5 Analysing the refractive index sensing capabilities of the capped gold nanoslit using different approach (a) Transmission % spectra obtained in various water/glycerine mixtures (b) The dA and peak wavelength against the refractive index of the medium. The slopes of the curves show that the refractive index sensitive were 8.175 and 162.42 for the dA and dλ analysis method, respectively.

To examine the sensitivity of the analysis approaches, water mixed with various glycerol was introduced to the microfluidic chip. Fig. S5a shows the transmission % spectra of the CG nanoslit with various water/glycerol mixtures. As the concentration of glycerol increase, the Fano resonance peak was redshifted. It must be noted that when the RI change is low (RIU range 1.3290 -1.3365), the redshift was not significant. Fig. S5b shows the resonance peak wavelength shift and dA change against the refractive index of the medium. The slopes of the fitting curves demonstrated that the refractive index sensitives were 8.17 and 162.4 for dA and dλ, respectively. The measured intensity sensitivity demonstrated that at RIU range 1.3290 to 1.3590 the change is not significant. In order to compare the RIR values between three calculation methods, we used method as described by Ng *et al* (1), which also takes the SPR fluctuations into considerations. The RIR was calculated for dA, dI and dλ was 5.805 x $10^{-5}$, -0.000148 and 0.00139 RIU, respectively.

1. Ng SP, Loo FC, Wu SY, Kong SK, Wu CML, Ho HP. Common-path spectral interferometry with temporal carrier for highly sensitive surface plasmon resonance sensing. Opt Express. 2013;21(17):20268-73.