Supplementary Materials
for

High Throughput Electronic Detection of Biomarkers Using Enhanced Enzymatically Amplified Metallization on Nanostructured Surfaces

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Supplementary Text

Drawing designs of the chip (hz96mixed.dxf, hz965um.dxf) and casing for 3D printing (96chipHolder v27.stl, electronicsHolder v7.stl) can be accessed at https://github.com/spencerZh/easyELISAchip

Arduino code for the reader can be accessed at https://github.com/josiahrudge/impedance-multiplexing

Android application for data visualization and corresponding code can be accessed at https://github.com/josiahrudge/ELISA_App

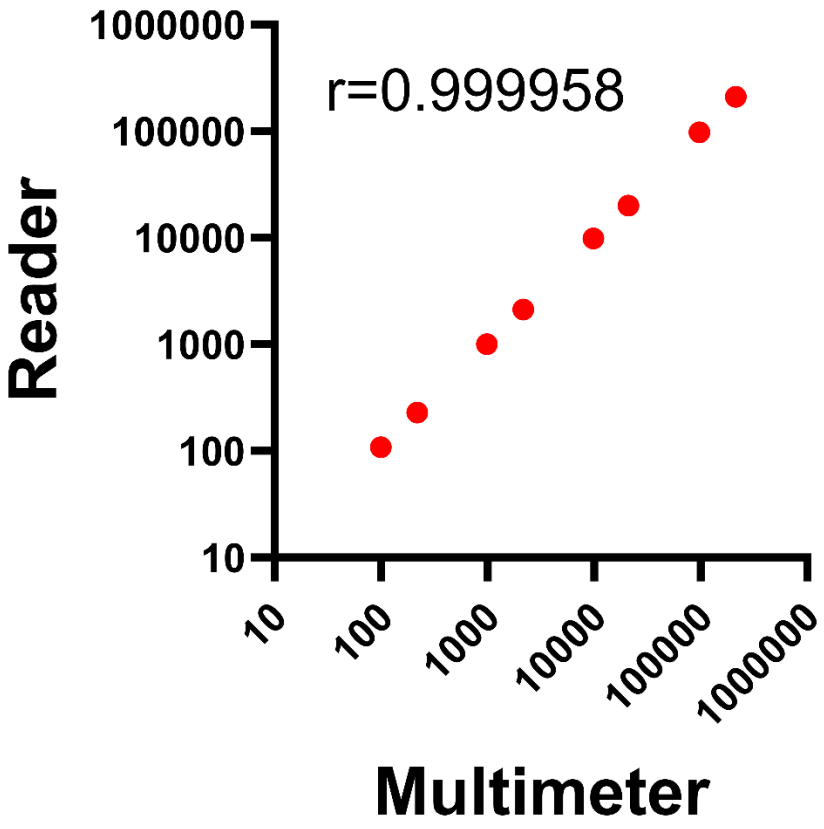

Fig. S1.
Correlation between resistance reading obtained from the portable reader and that of a digital multimeter. Eight different resistances were tested ranging from 100 ohms to 210000 ohms. Pearson correlation was performed with 95% confidence interval.

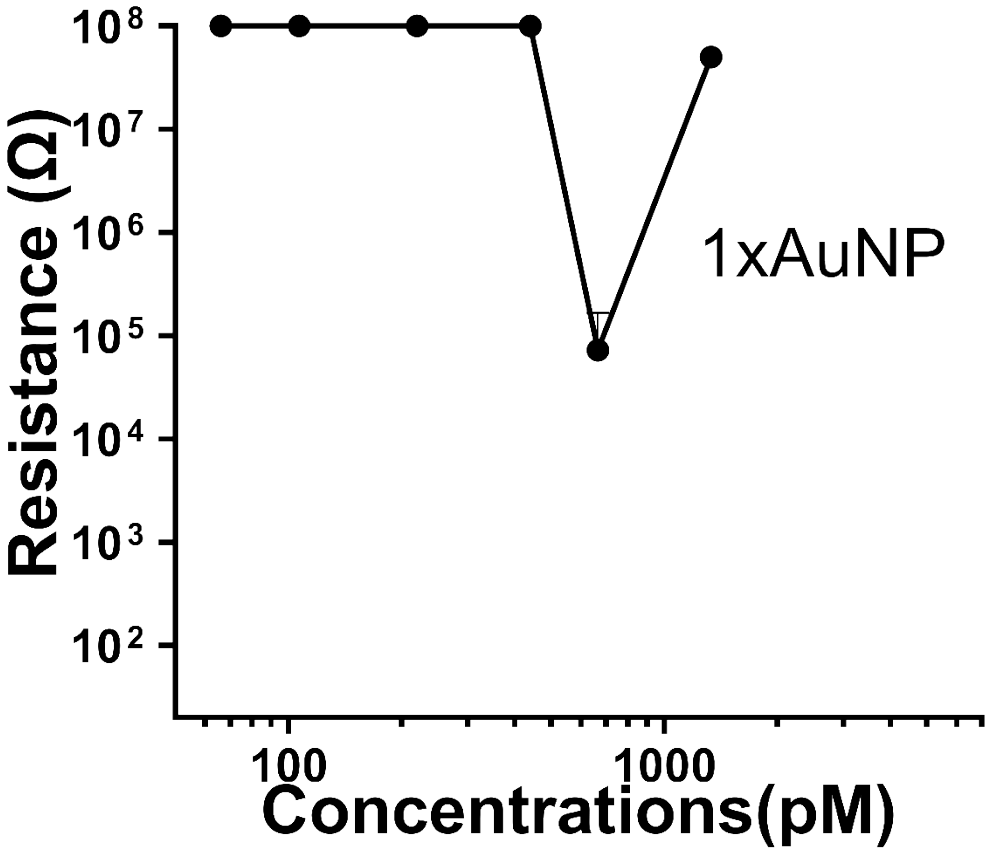

Fig. S2.
Resistance of μIDE using 1X 10nm AuNP on 5μm electrodes.

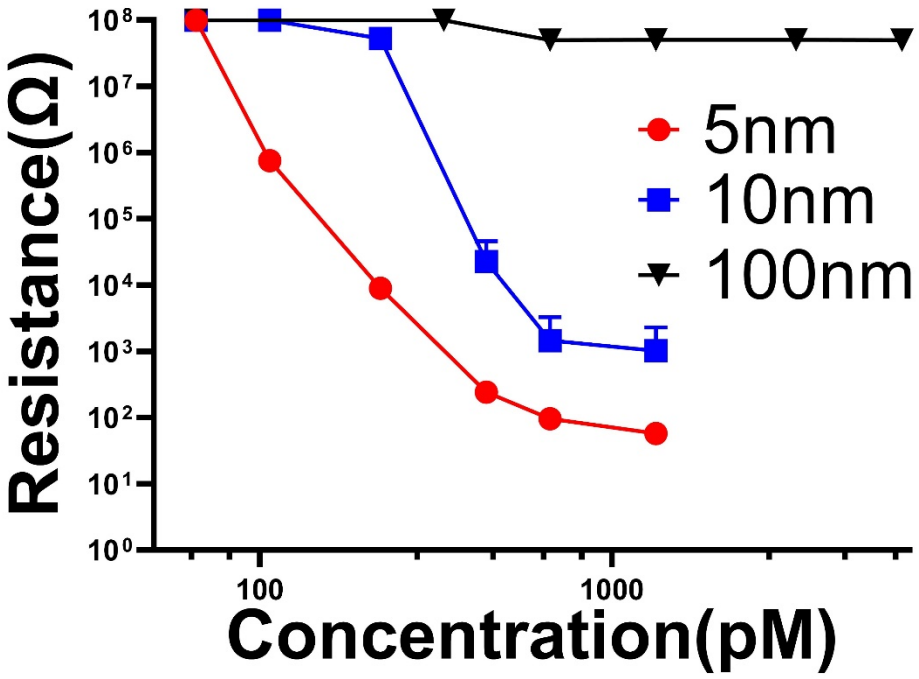

Fig. S3.

Resistance readings from dilution curves of anti-S mAb using 0.1X AuNP on µIDEs with 10µm electrode gaps with different AuNP diameters.

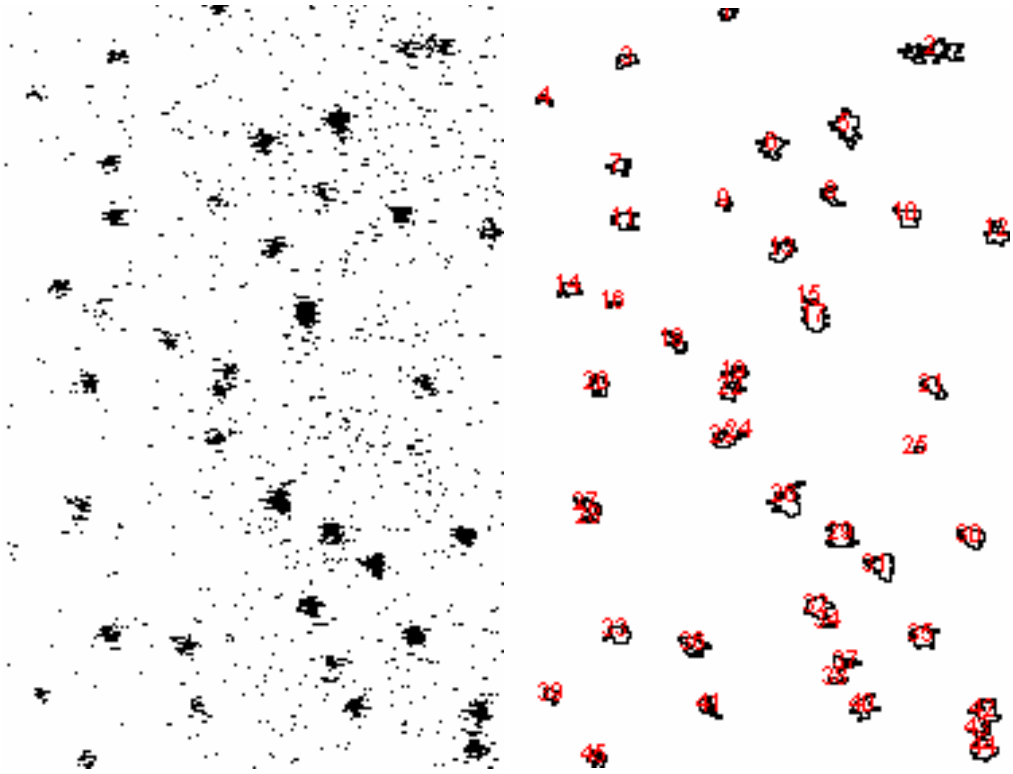

Fig. S4.
Procedure of ImageJ particle counting plugin with denoise (left) and corresponding particle location (right).

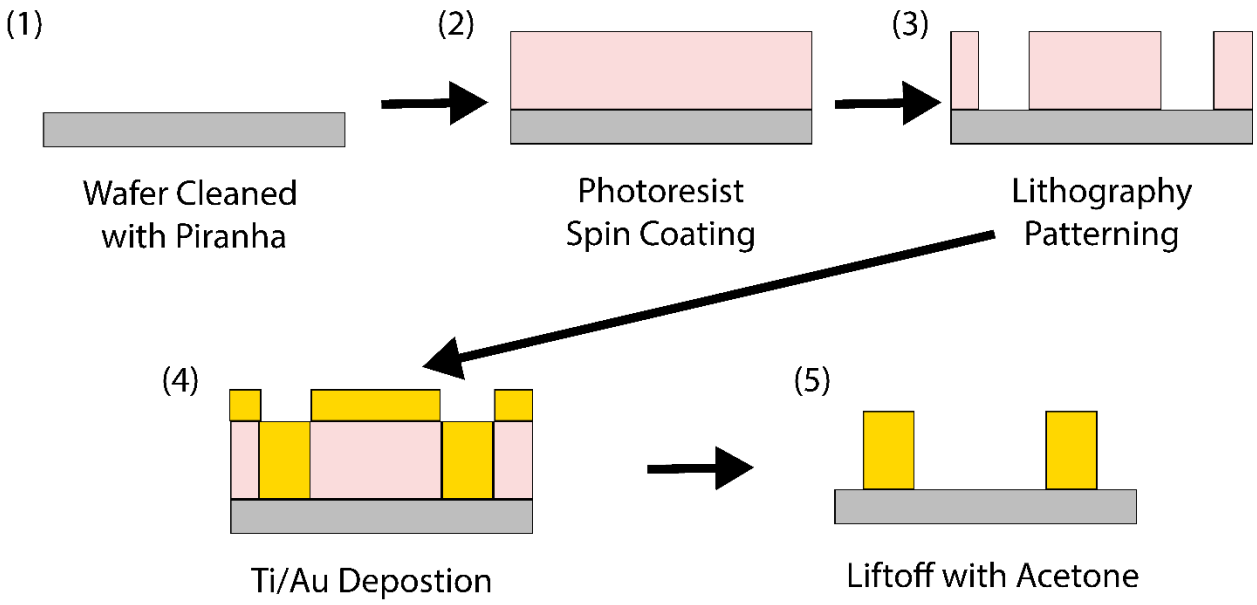

Fig. S5.
Procedure of microfabricating the EASyELISA chip.

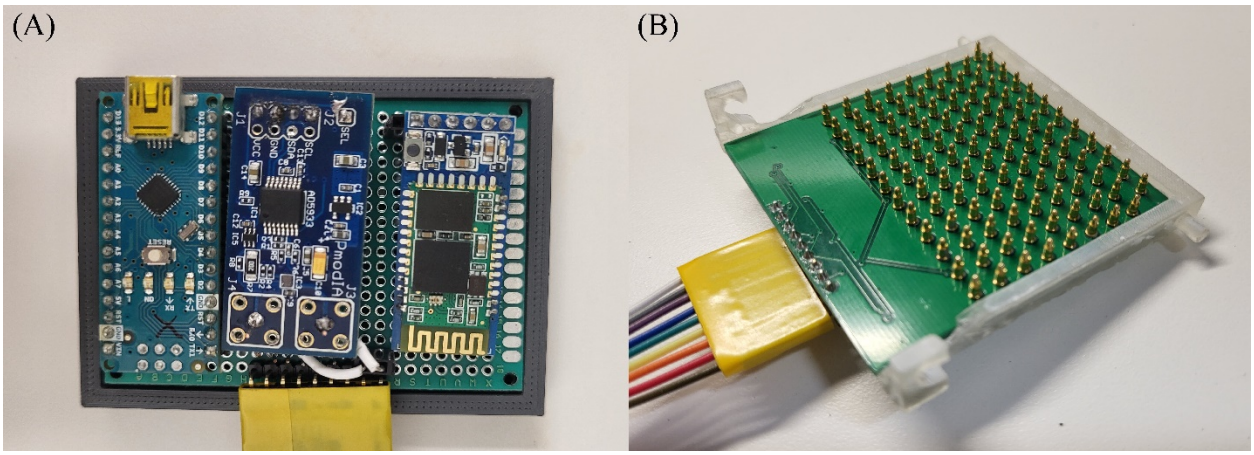

Fig. S6.

Close-up view of the portable reader including (A). Arduino Nano (left), PmodIA (middle), HC05 Bluetooth module (right) attached to a custom printed circuit board and (B) contact pins soldered on the board of ADG731 multiplexer.

	Compatible with ELISA	Detection Method	Analyte	High Throughput Demo	Fabrication Complexity	Dry or wet measurement
Chen, et al[1]	No	Optical	Enzyme only	No	N/A	Wet
Liu, et al[2]	No	Optical	Enzyme only	No	N/A	Wet
Weizmann, et al[3]	No	Electronic	DNA	No	Low	Dry
Juang, et al[4]	Yes	Electronic	Sandwich assay	Yes	High	Wet
Tang, et al[5]	Yes	Electronic	Sandwich assay	Yes	Medium	Wet
Glavan, et al[6]	Yes	Electronic	Sandwich assay	No	Low	Wet
Current Work	**Yes**	**Electronic**	**Anything compatible with sandwich assay format**	**Yes**	**Low (one patterning +deposition)**	**Dry**

Table S1.
Comparison between current work and existing works on detection assays utilizing enzyme, metal deposition and gold.

Diameter(nm)	Peak SPR Wavelength (nm)	NPS/ml	Particle Volume (nm^3)	Surface Area (nm^2)	OD
5	515-520	5.47E+13	6.54E+01	7.85E+01	1
10	515-520	5.98E+12	5.24E+02	3.14E+02	1
100	572	3.84E+09	5.24E+05	3.14E+04	1

Table S2.
Properties of AuNP in stock solutions.

References

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3. Y. Weizmann, D. M. Chenoweth and T. M. Swager, *Journal of the American Chemical Society*, 2011, **133**, 3238-3241.
4. D. S. Juang, C.-H. Lin, Y.-R. Huo, C.-Y. Tang, C.-R. Cheng, H.-S. Wu, S.-F. Huang, A. Kalnitsky and C.-C. Lin, *Biosensors and Bioelectronics*, 2018, **117**, 175-182.
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