Electronic Supplementary Information

Polar coordinate active-matrix digital microfluidics for high-resolution concentration gradient generation

Bingbing Zhang,[ab] Jinxin Fu,[bc] Maohua Du,[d] Kai Jin,[b] Qi Huang,[b] Jiahao Li,[e] Dongping Wang,[b] Siyi Hu,[bd] Jinhua Li,[a*] and Hanbin Ma,[bd*]

a. Nanophotonics and Biophotonics Key Laboratory of Jilin Province, Changchun University of Science and Technology, Changchun, 130022, P.R.China.

b. CAS Key Laboratory of Bio-medical Diagnostics, Suzhou Institute of Biomedical Engineering and Technology, Chinese Academy of Sciences, No.88 Keling Road, Suzhou, Jiangsu province, 215163, P.R. China

c. School of Biomedical Engineering (Suzhou), Division of Life Sciences and Medicine, University of Science and Technology of China, Hefei 230027, Anhui, P. R. China

d. Guangdong ACXEL Micro & Nano Tech Co., Ltd, Guangdong province, 528000, P.R.China.

e. ACX Instruments Ltd, St John's Innovation Centre, Cowley Road, Cambridge, CB4 0WS, United Kingdom

* Corresponding author: mahb@sibet.ac.cn (H. Ma); lijh@cust.edu.cn (J. Li).

Table. 1 Electrode parameters of the AM-EWOD chip

Lap Number	Number of Electrodes	Electrodes Width (um)	Electrodes Area (μm^2)	Droplet Volume (nL)	Lap Number	Number of Electrodes	Electrodes Width (um)	Electrodes Area (μm^2)	Droplet volume (nL)
0	1	50.0	1519	0.03	17	60	208.7	43346	0.87
1	4	39.2	2127	0.04	18	64	216.2	46450	0.93
2	8	50.4	2852	0.06	19	68	223.4	49552	0.99
3	12	59.9	3756	0.08	20	72	230.5	52696	1.05
4	16	68.5	4751	0.1	21	72	250.6	62557	1.25
5	20	76.3	5789	0.12	22	76	258.1	66301	1.33
6	24	83.5	6865	0.14	23	80	265.5	70099	1.40
7	24	105.4	11262	0.23	24	84	272.7	73913	1.48
8	28	114.0	13053	0.26	25	88	279.7	77728	1.55
9	28	139.5	19936	0.4	26	88	299.7	89483	1.79
10	32	149.5	22715	0.45	27	92	307.1	93909	1.88
11	36	159.0	25548	0.51	28	96	314.4	98377	1.97
12	40	168.0	28415	0.57	29	96	335.0	111943	2.24
13	44	176.7	31326	0.63	30	96	356.9	127339	2.55
14	48	185.1	34279	0.69	31	96	380.1	144780	2.90
15	52	193.2	37264	0.75	32	96	405.0	164669	3.29
16	56	201.1	40293	0.81	/	/	/	/	/

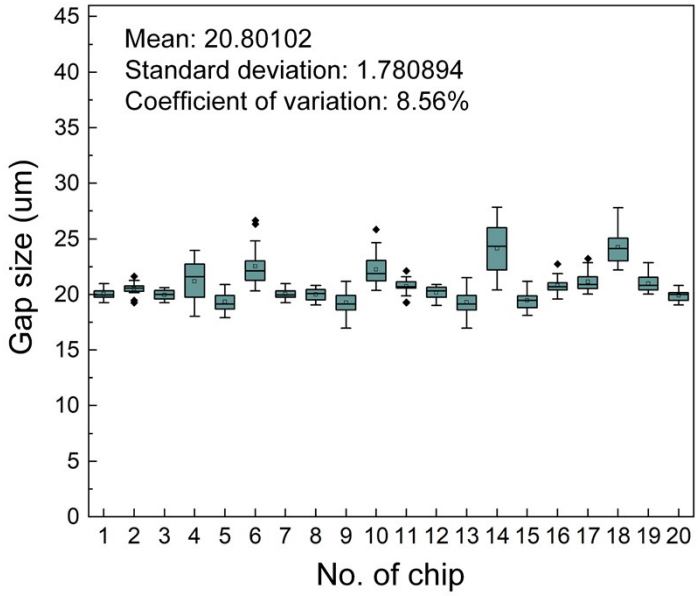

Fig.S1 The gap size data for 20 AM-EWOD chips.

The results shows that the average thickness is around 20.8 um over 20 different chips, the coefficient of variation is 8.56%, which is within our design requirements.

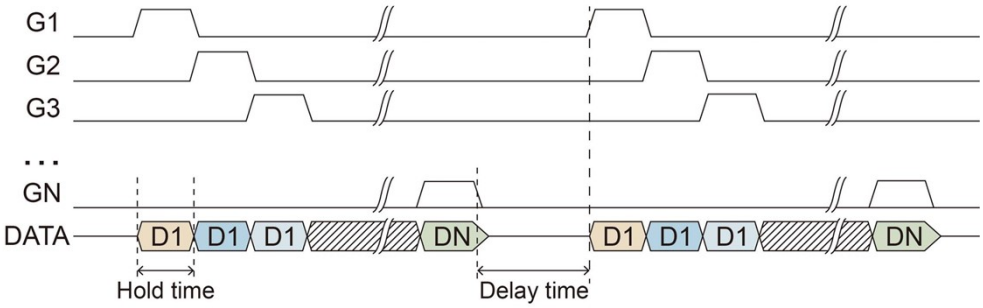

Fig.S2 Pixel circuit driving logic.

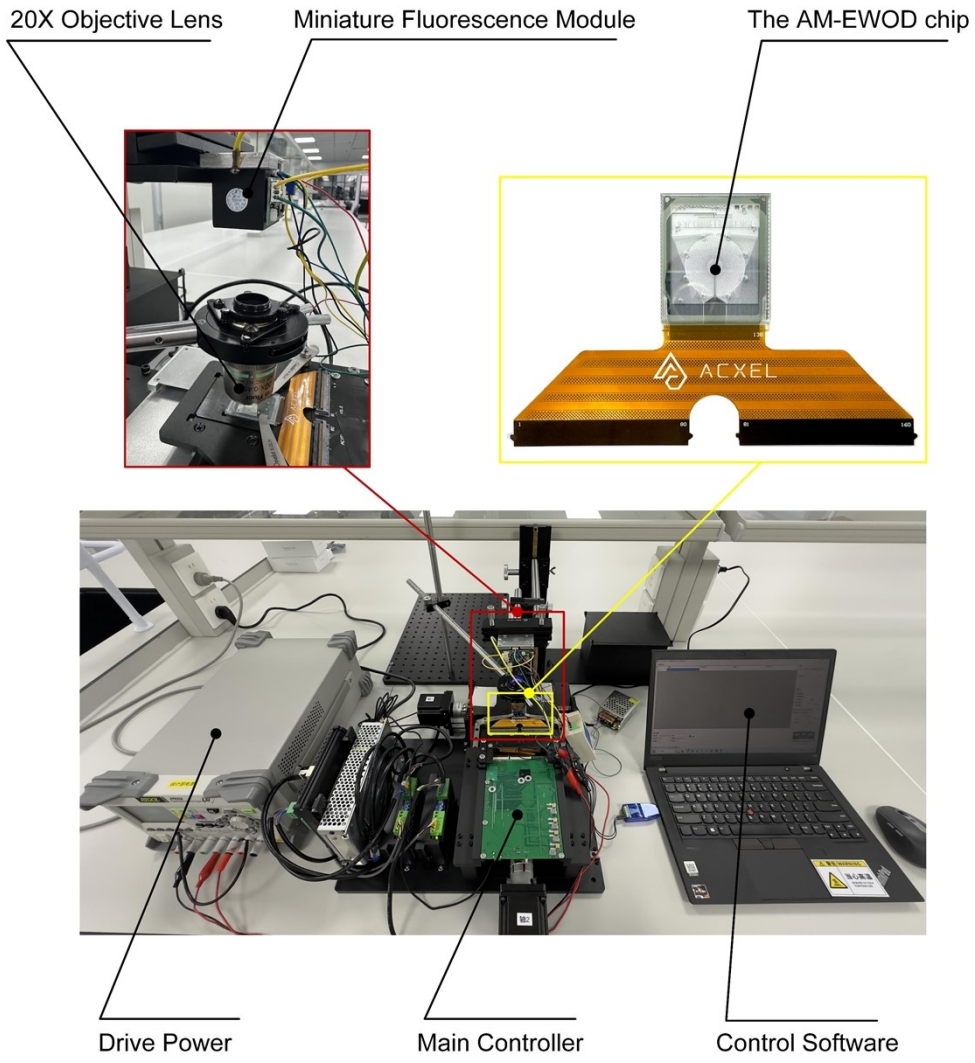

Fig.S3 The photograph of fluorescence detection system, including drive power, two-axis control system, main controller, control software, 20X objective lens, miniature fluorescence module, the AM-EWOD chip.

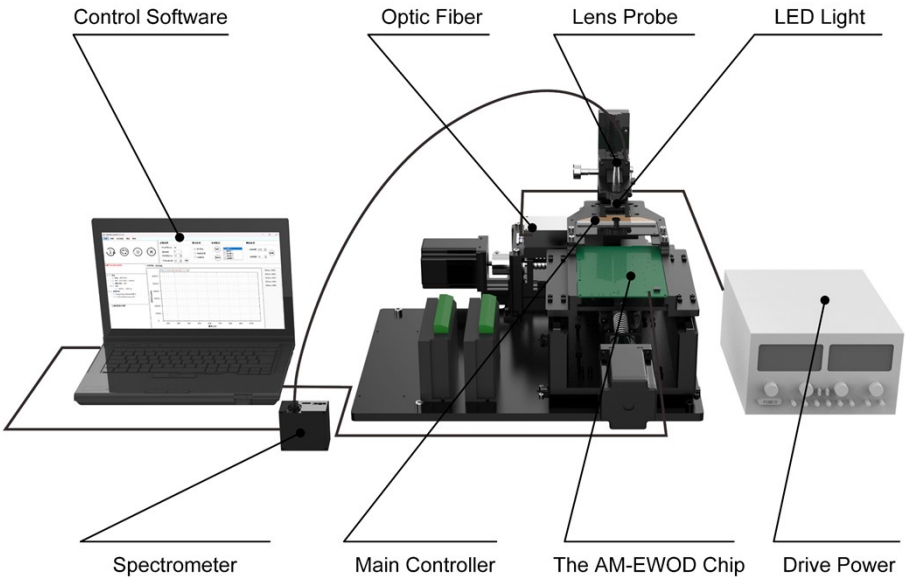

Fig.S4

The system structure diagram of absorbance detection system, including spectrometer, two-axis control system, main controller, the AM-EWOD chip, drive power, control software, optic fiber, lens probe, LED light.

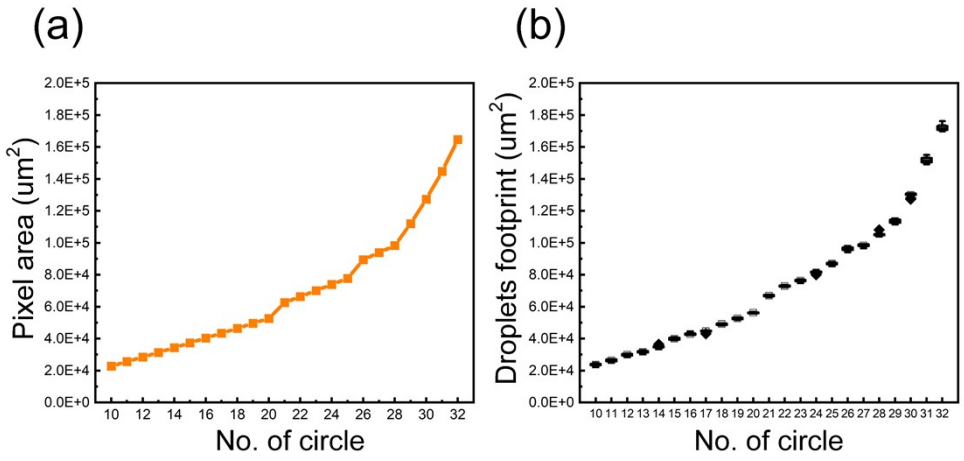

Fig.S5 (a) The pixel area of the 10-32 laps on the AM-EWOD chip. (b) The droplets footprint of the 10-32 laps on the AM-EWOD chip. Their trends are consistent.