T-Junction experiment

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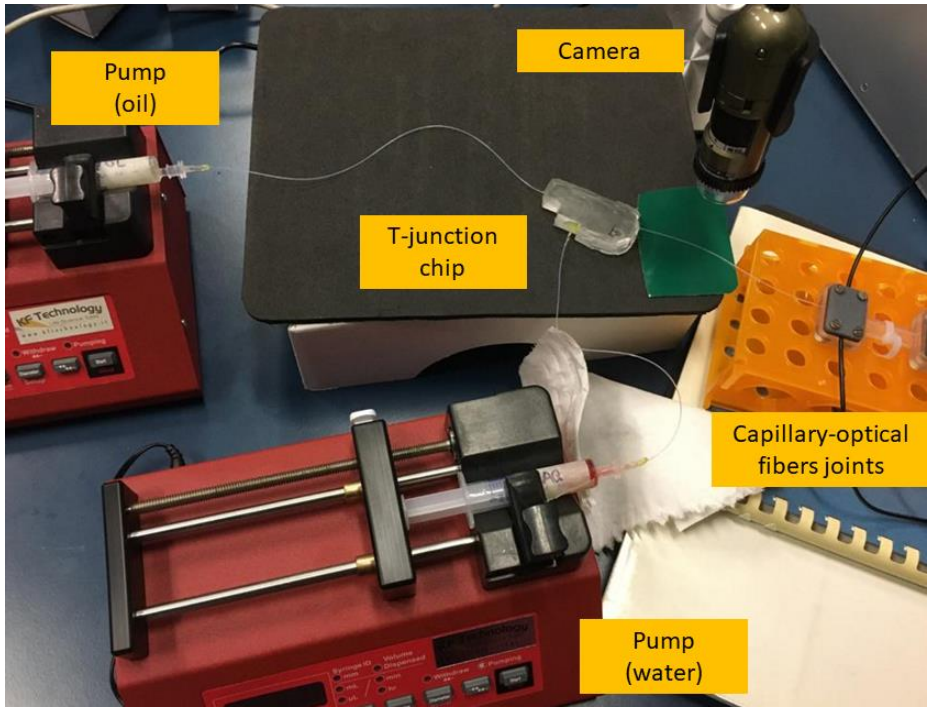
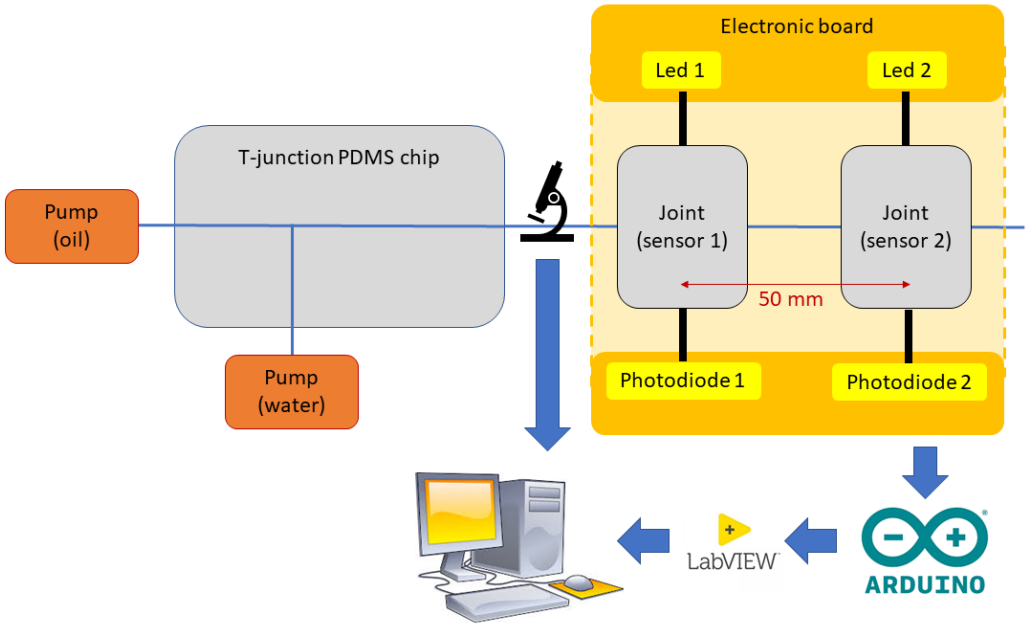
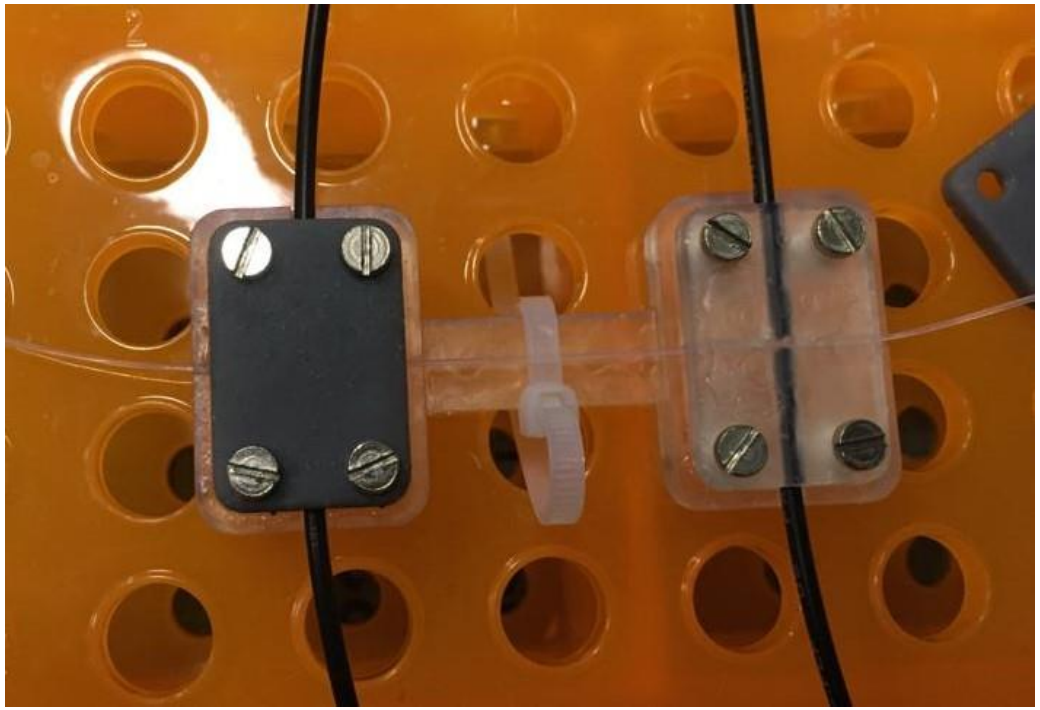
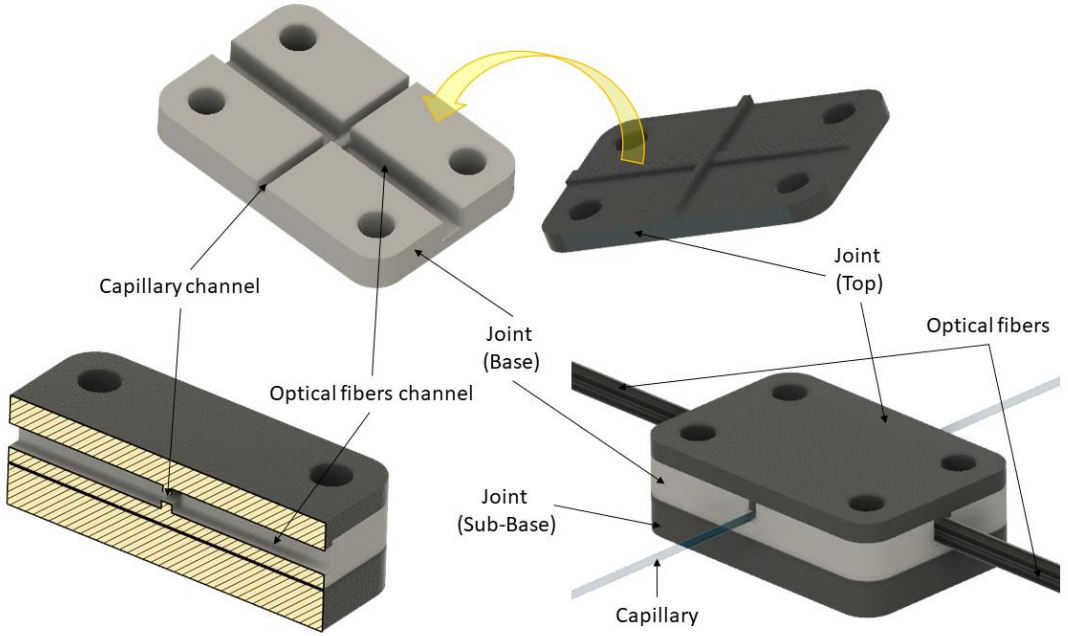
Experimental apparatus



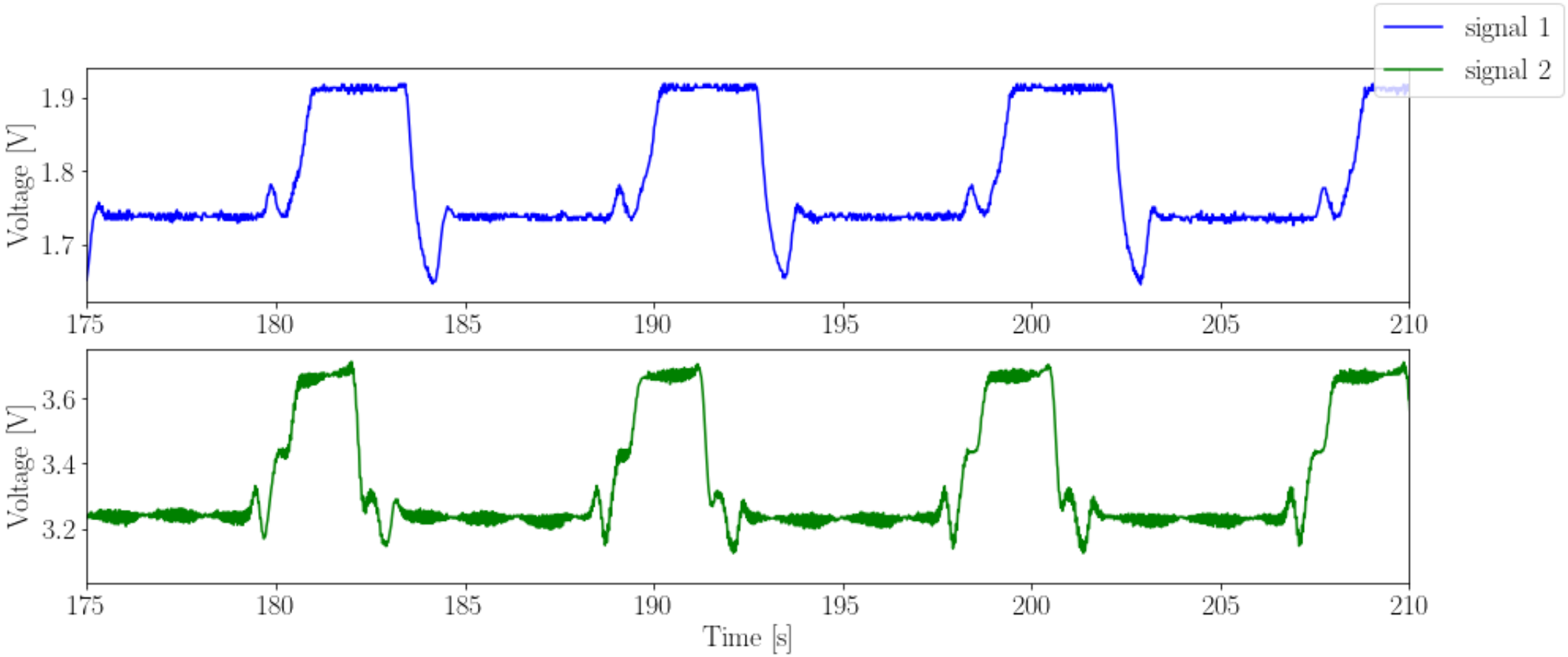


Fiber-capillary joint

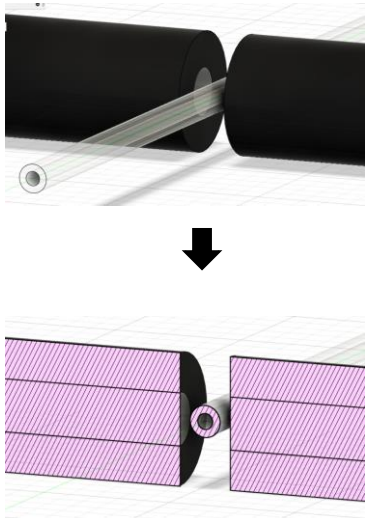




Electronic waveforms

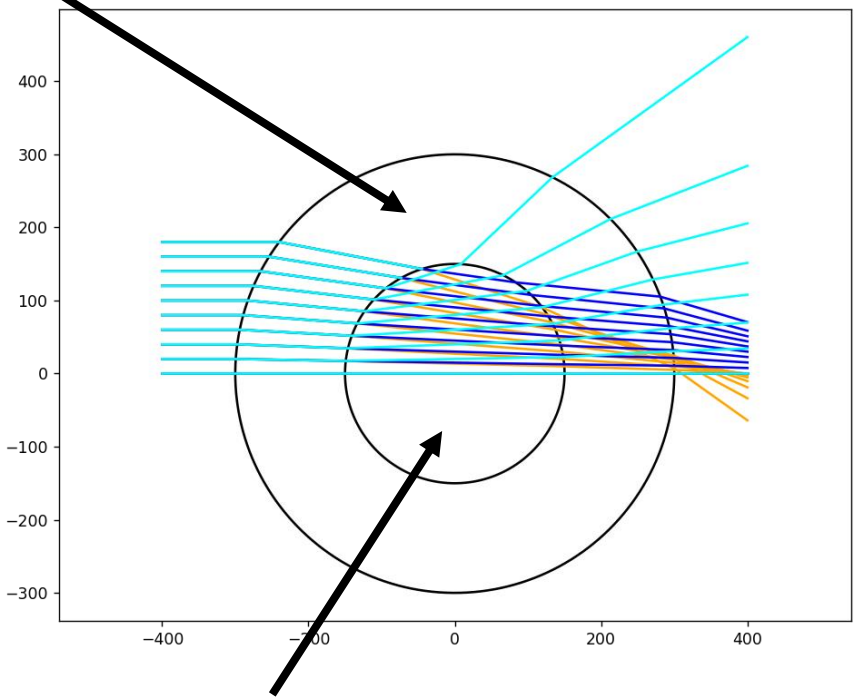


Effect of the circularity of the capillary



Capillary:
$n_c = 1.36$

Light from LED



Light to photodiode

Fluid:
$n_{oil} = 1.47$
$n_{water} = 1.33$
$n_{air} = 1$

Overly focused: low signal from the photodiode

Properly focused: high signal from the photodiode

Defocused: no signal from the photodiode

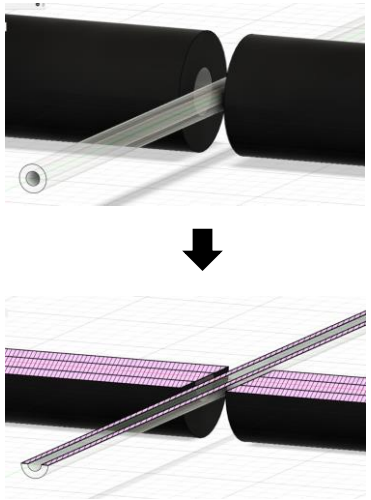
Effect of the menisci

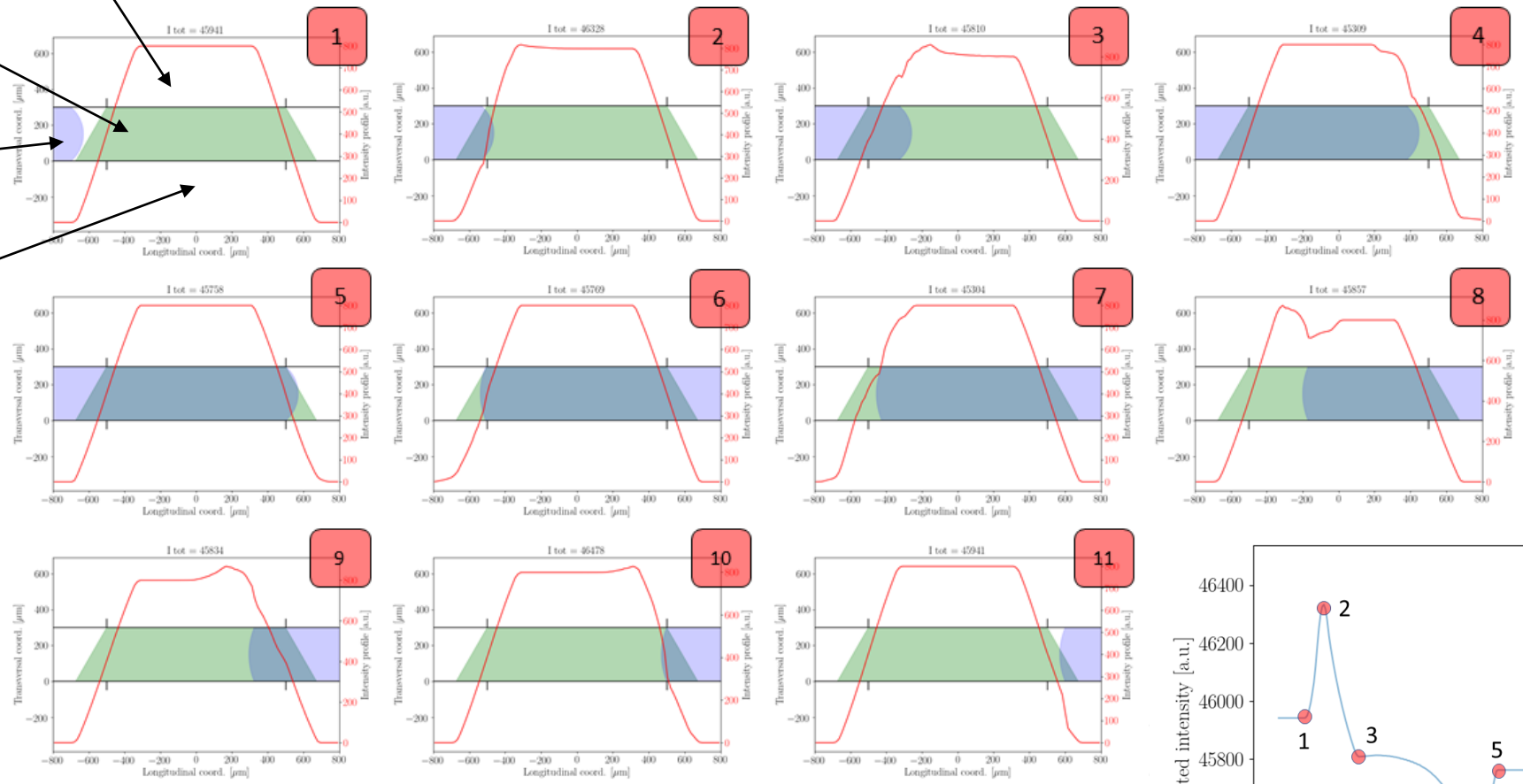
Optical fiber from LED

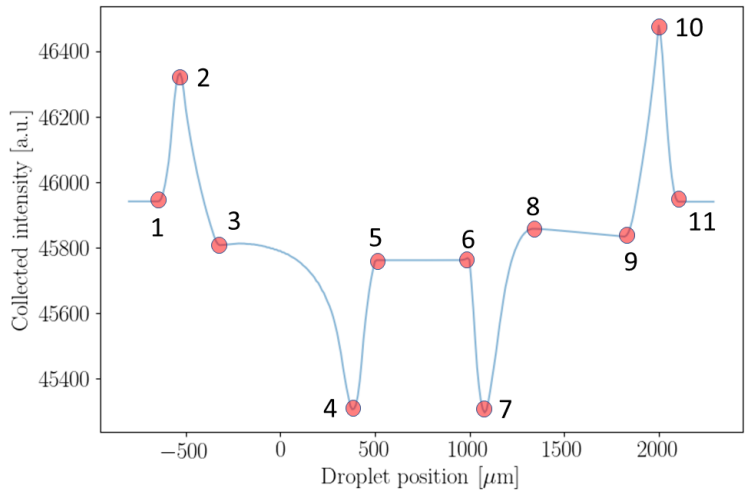
Light cone

Water droplet

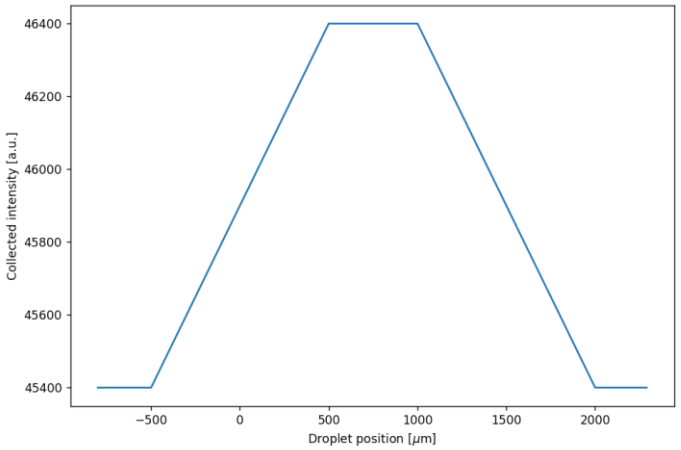
Collection fiber







Combining the two effects



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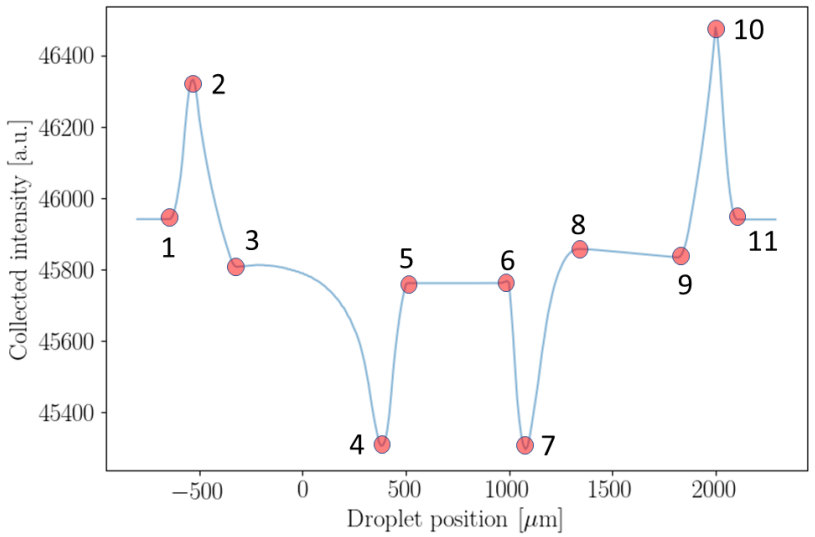

Simulated waveforms

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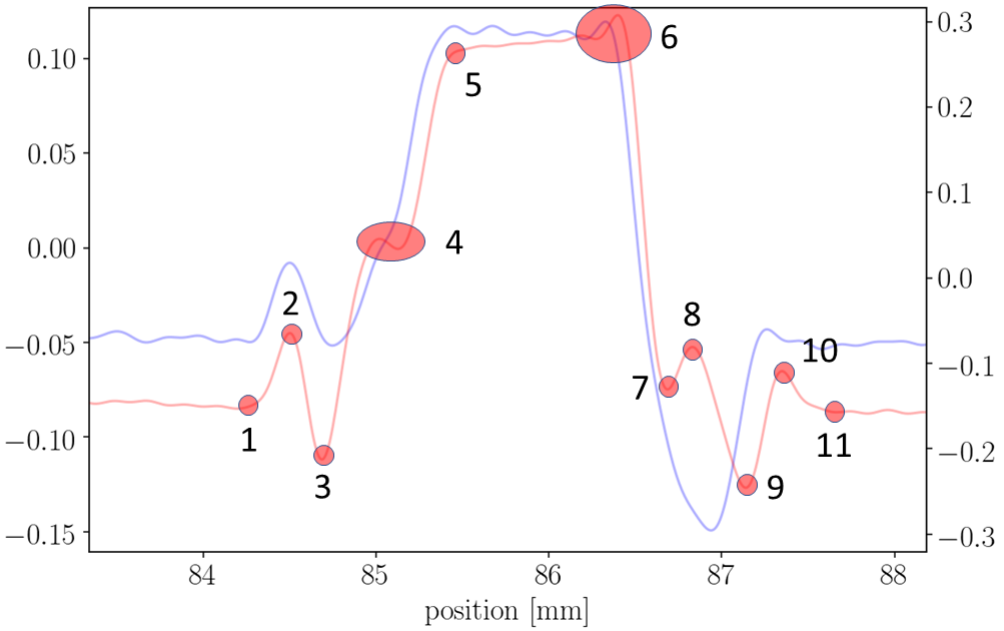
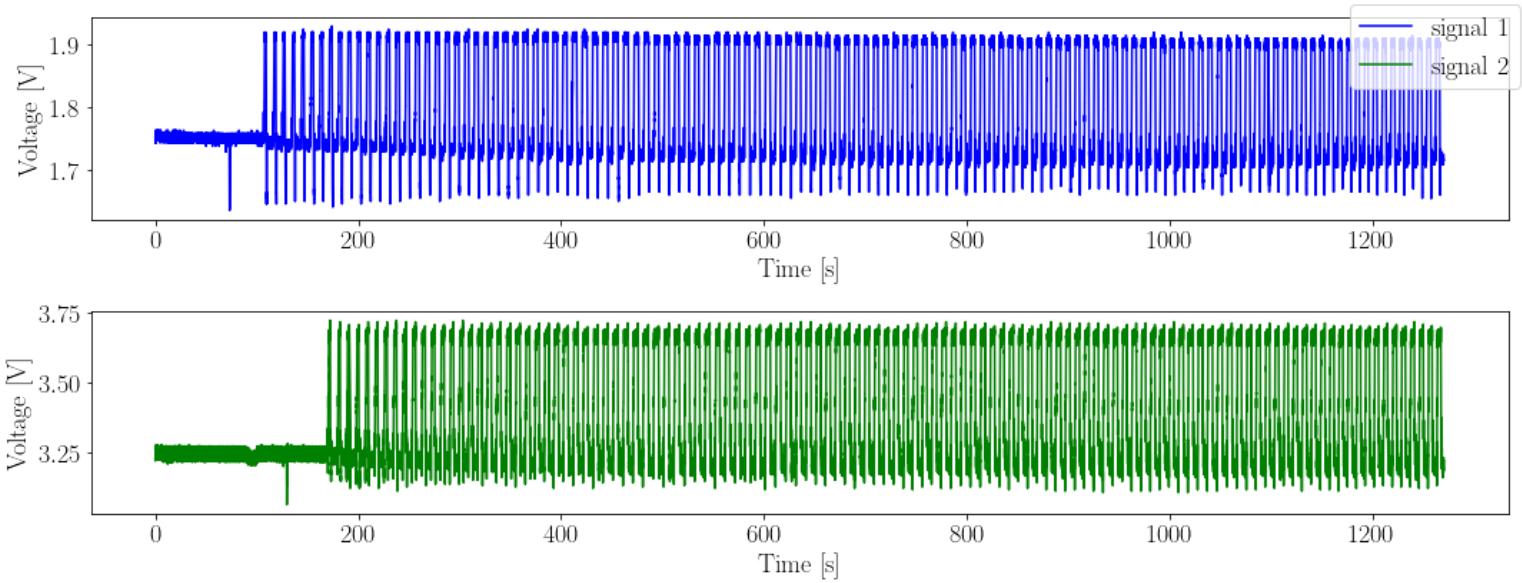
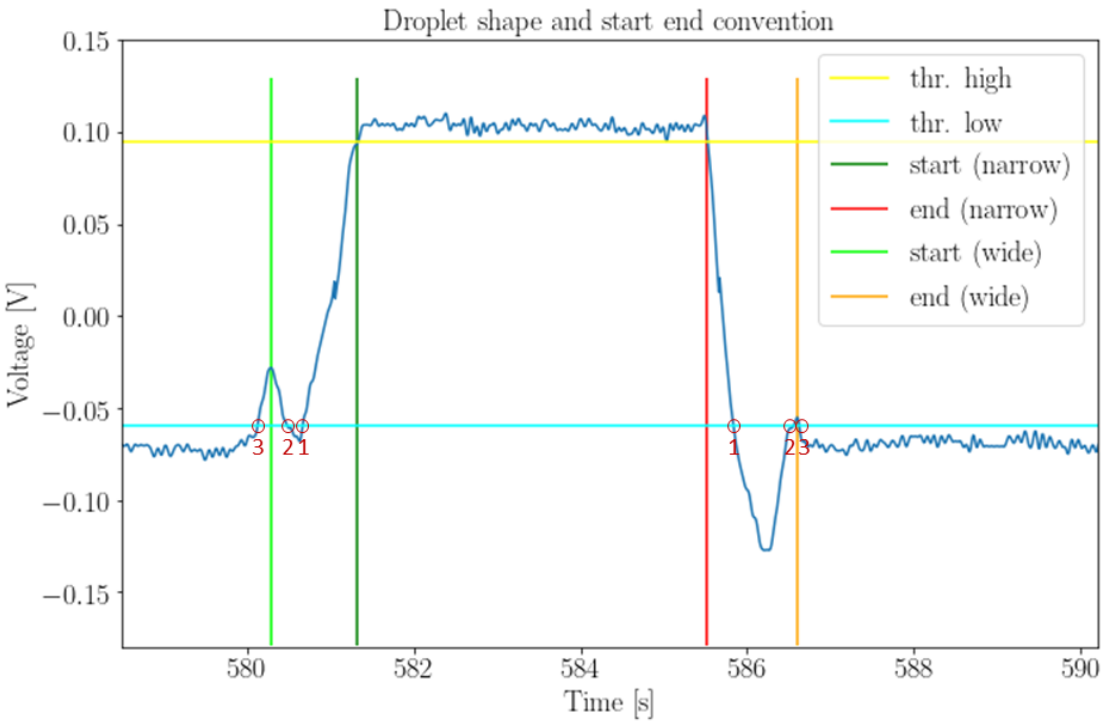
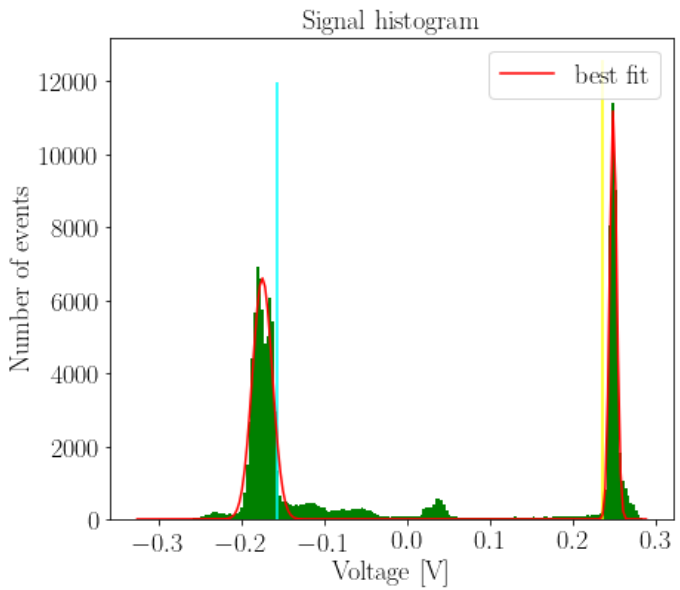


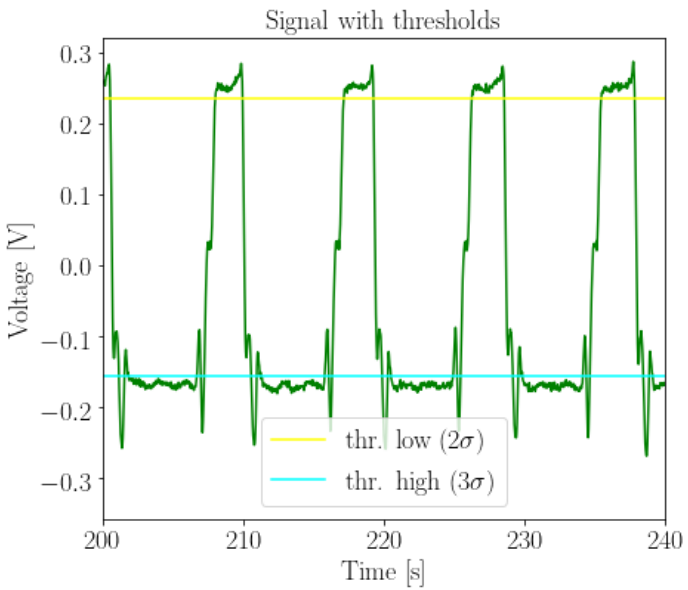
Experimental waveforms:
Photodiode 1
Photodiode 2

Waveforms
analysis

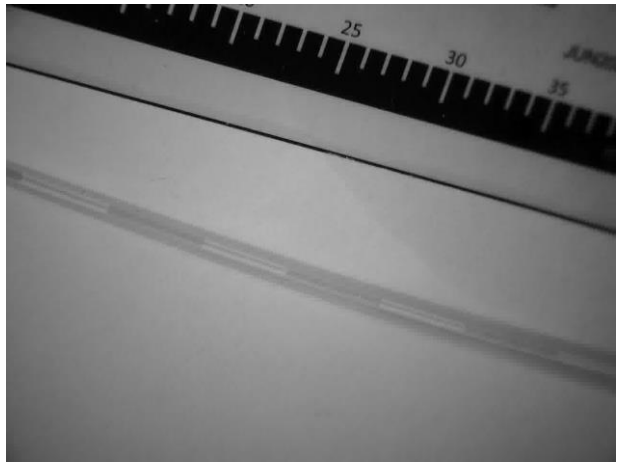


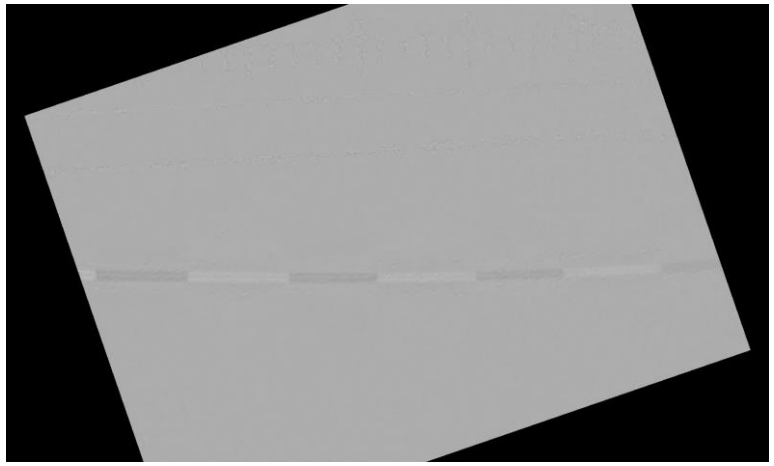


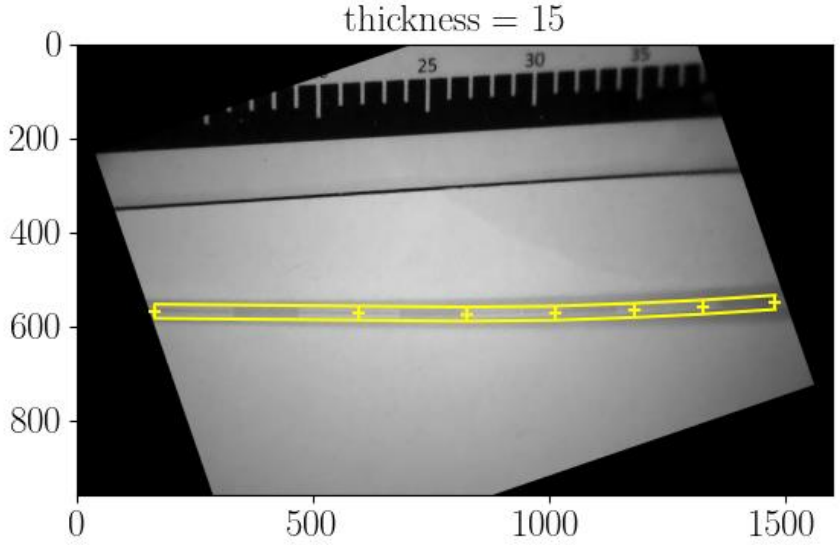


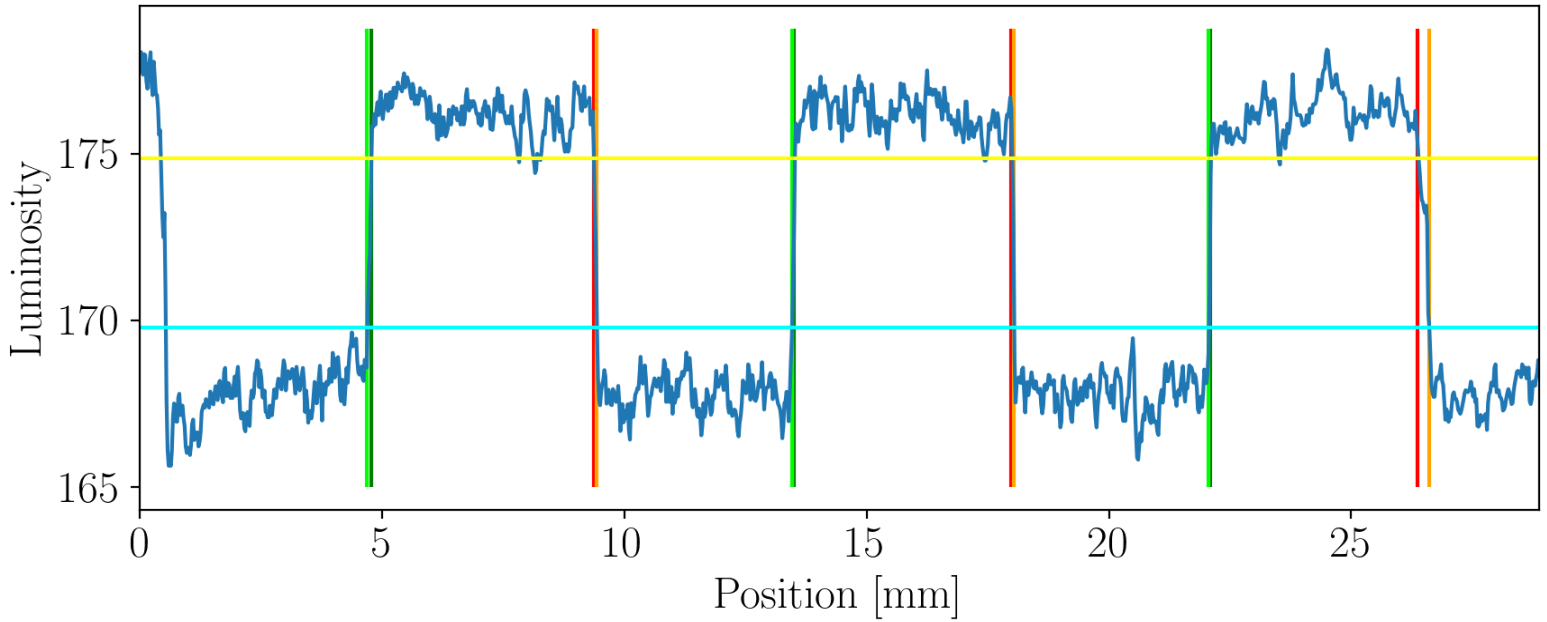


Images from the microscope

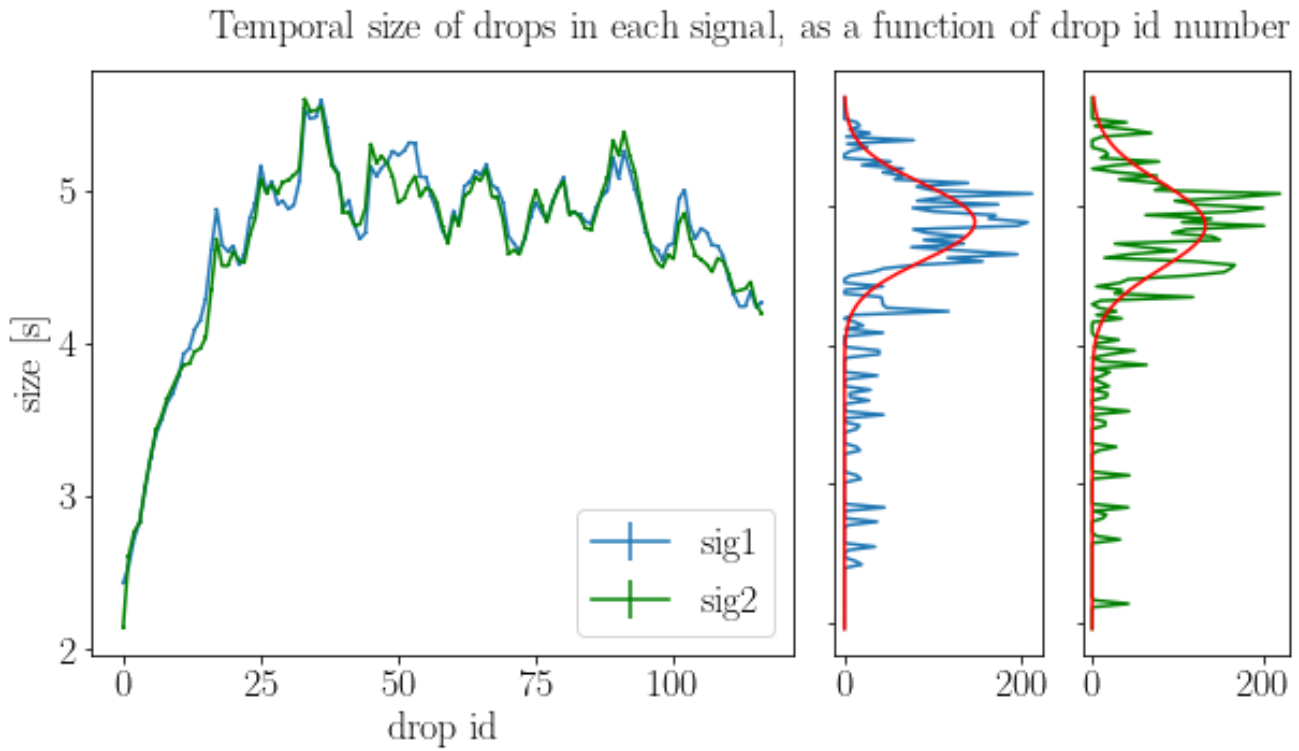




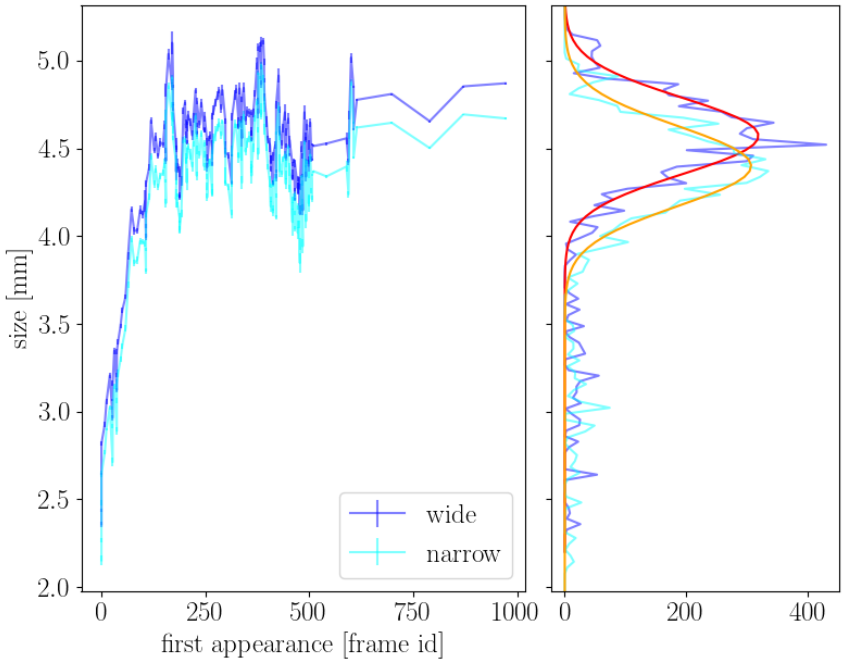




Statistics of droplet properties

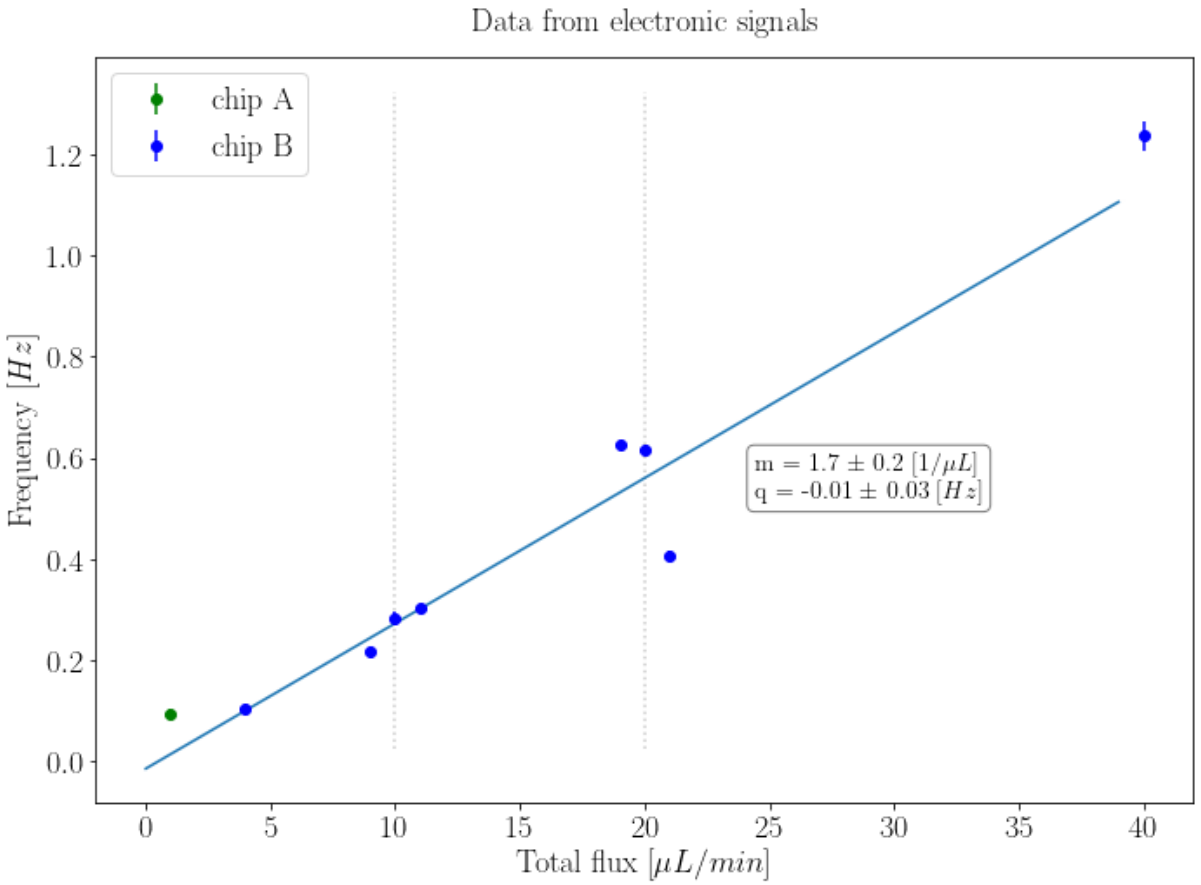


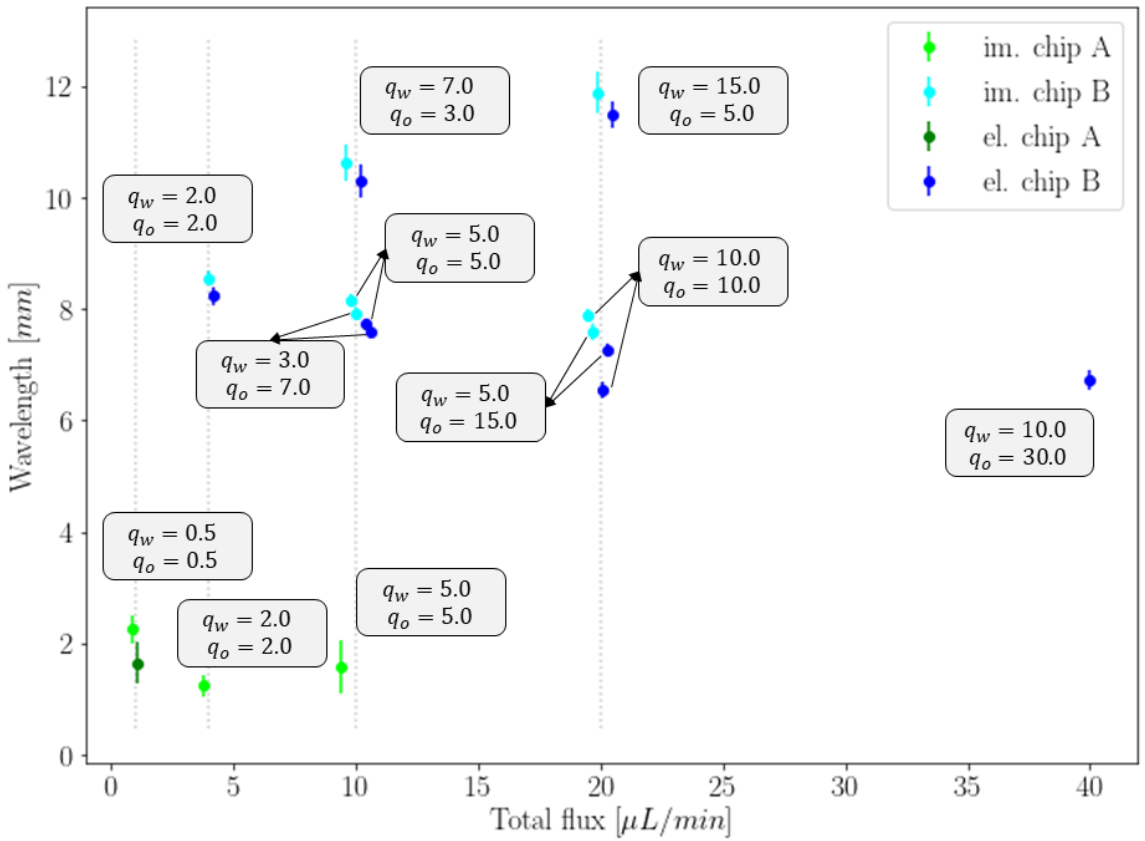
From electronic signals

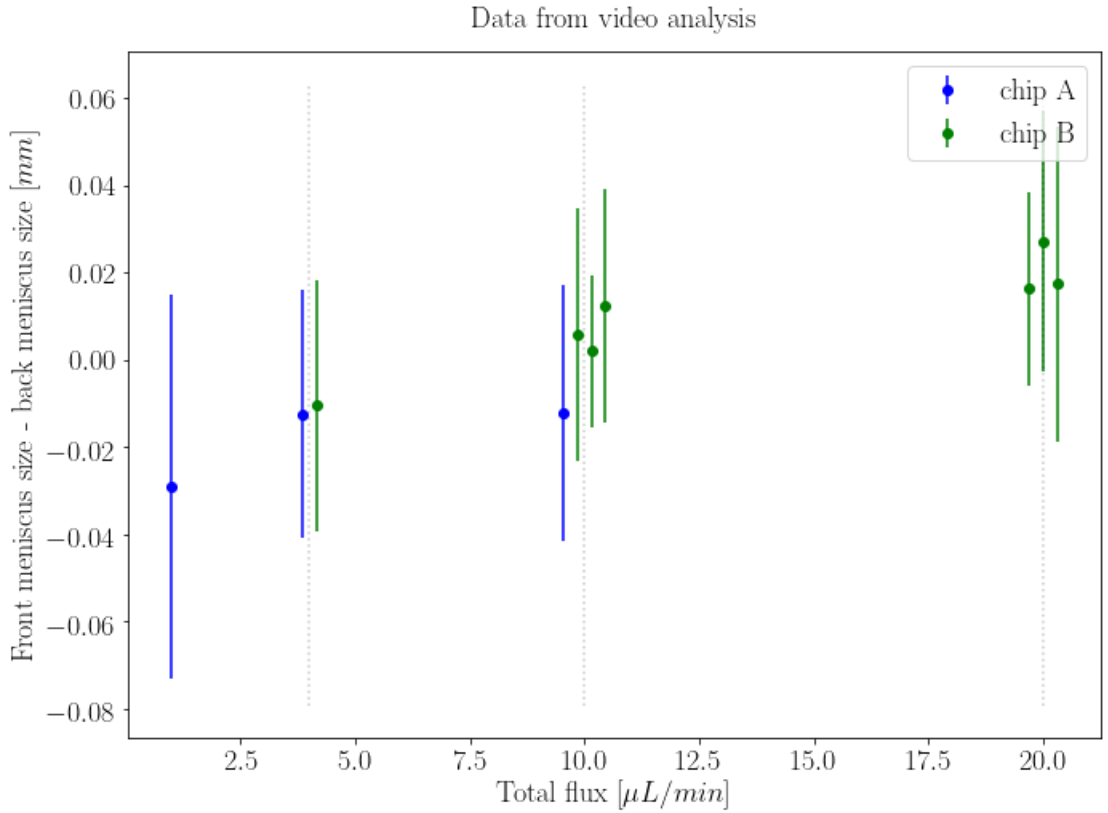


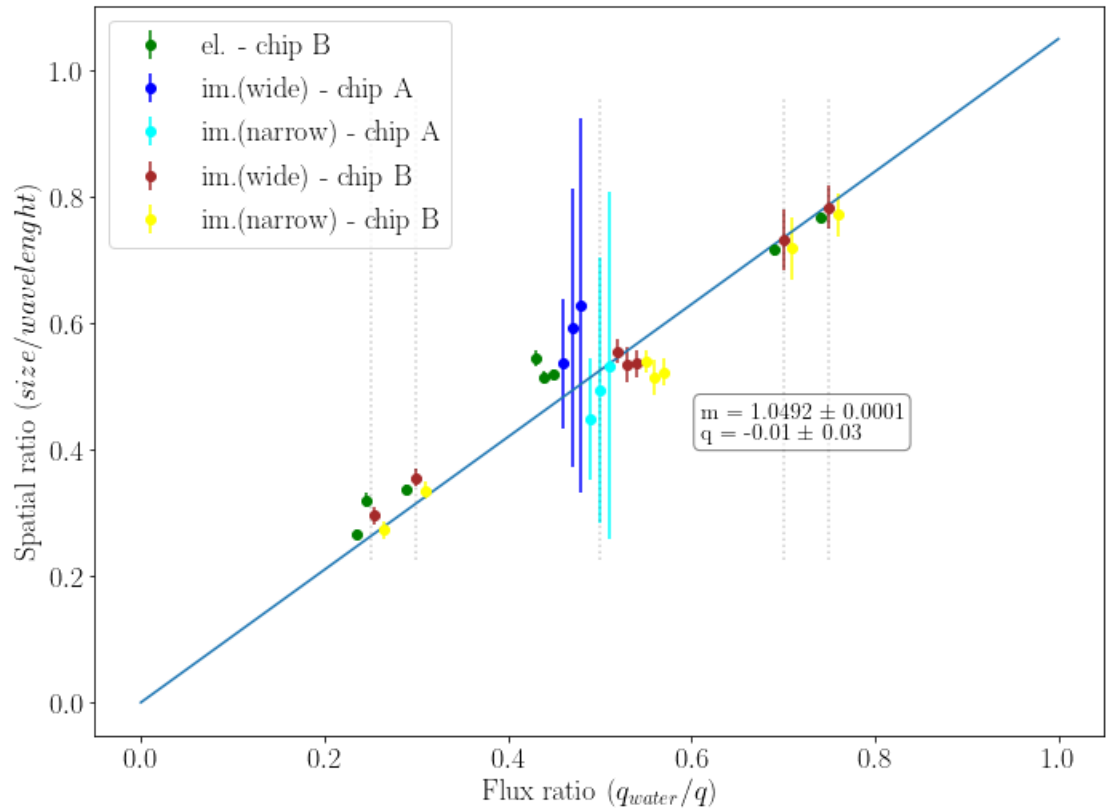
From images

Results


Data from electronic signals
chip A
chip B
m = 1.7 ± 0.2 [1/μL]
q = -0.01 ± 0.03 [Hz]
Frequency [Hz]
Total flux [μL/min]

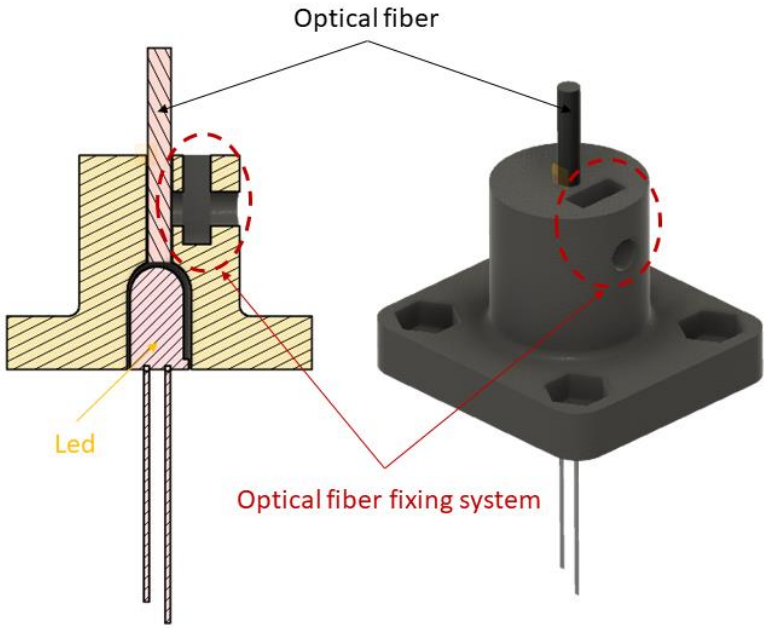

im. chip A
im. chip B
el. chip A
el. chip B
$q_w = 7.0$ $q_o = 3.0$
$q_w = 15.0$ $q_o = 5.0$
$q_w = 2.0$ $q_o = 2.0$
$q_w = 5.0$ $q_o = 5.0$
$q_w = 10.0$ $q_o = 10.0$
$q_w = 3.0$ $q_o = 7.0$
$q_w = 5.0$ $q_o = 15.0$
$q_w = 10.0$ $q_o = 30.0$
$q_w = 0.5$ $q_o = 0.5$
$q_w = 2.0$ $q_o = 2.0$
$q_w = 5.0$ $q_o = 5.0$
Wavelength [mm]
Total flux [μL/min]

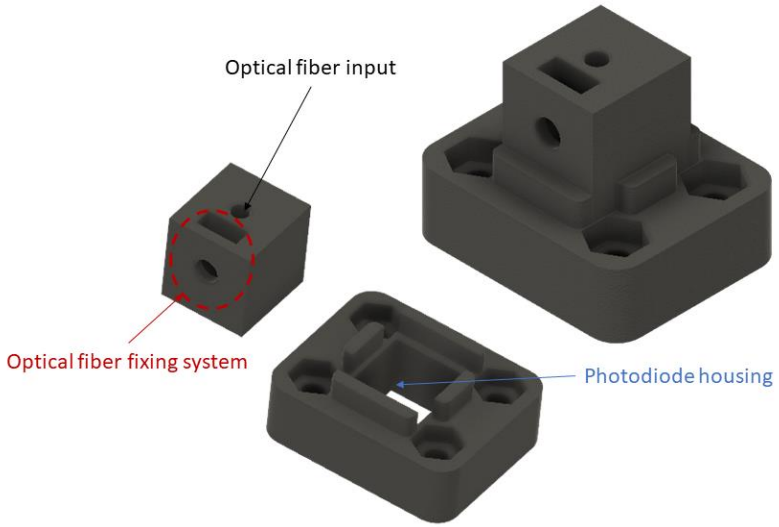

Data from video analysis
chip A
chip B
Front meniscus size - back meniscus size [mm]
Total flux [μL/min]
0.06
0.04
0.02
0.00
−0.02
−0.04
−0.06
−0.08
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0

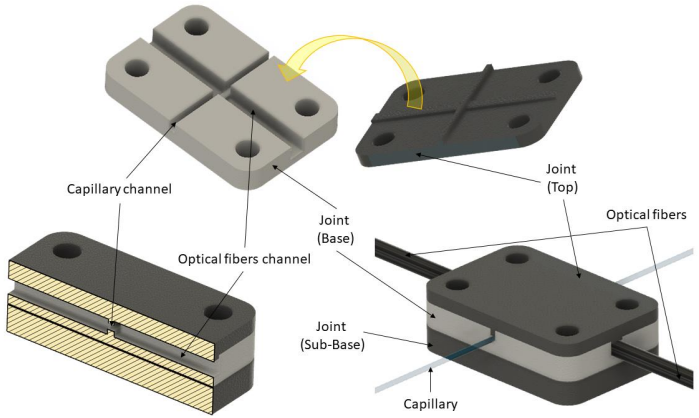

el. - chip B
im.(wide) - chip A
im.(narrow) - chip A
im.(wide) - chip B
im.(narrow) - chip B
m = 1.0492 ± 0.0001
q = -0.01 ± 0.03
Spatial ratio (size/wavelenght)
Flux ratio (q_water/q)
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0

End

3D printed components







Electronic board