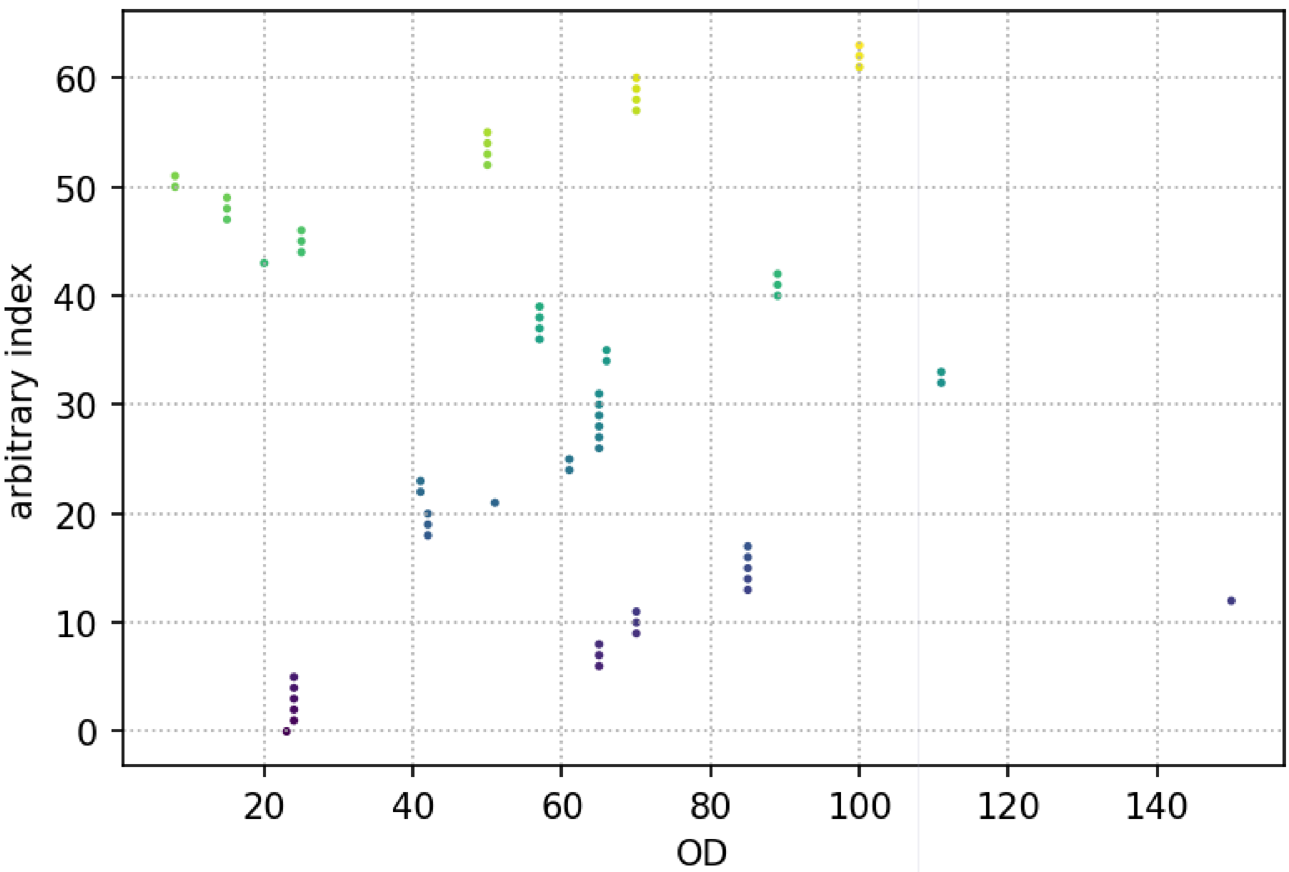
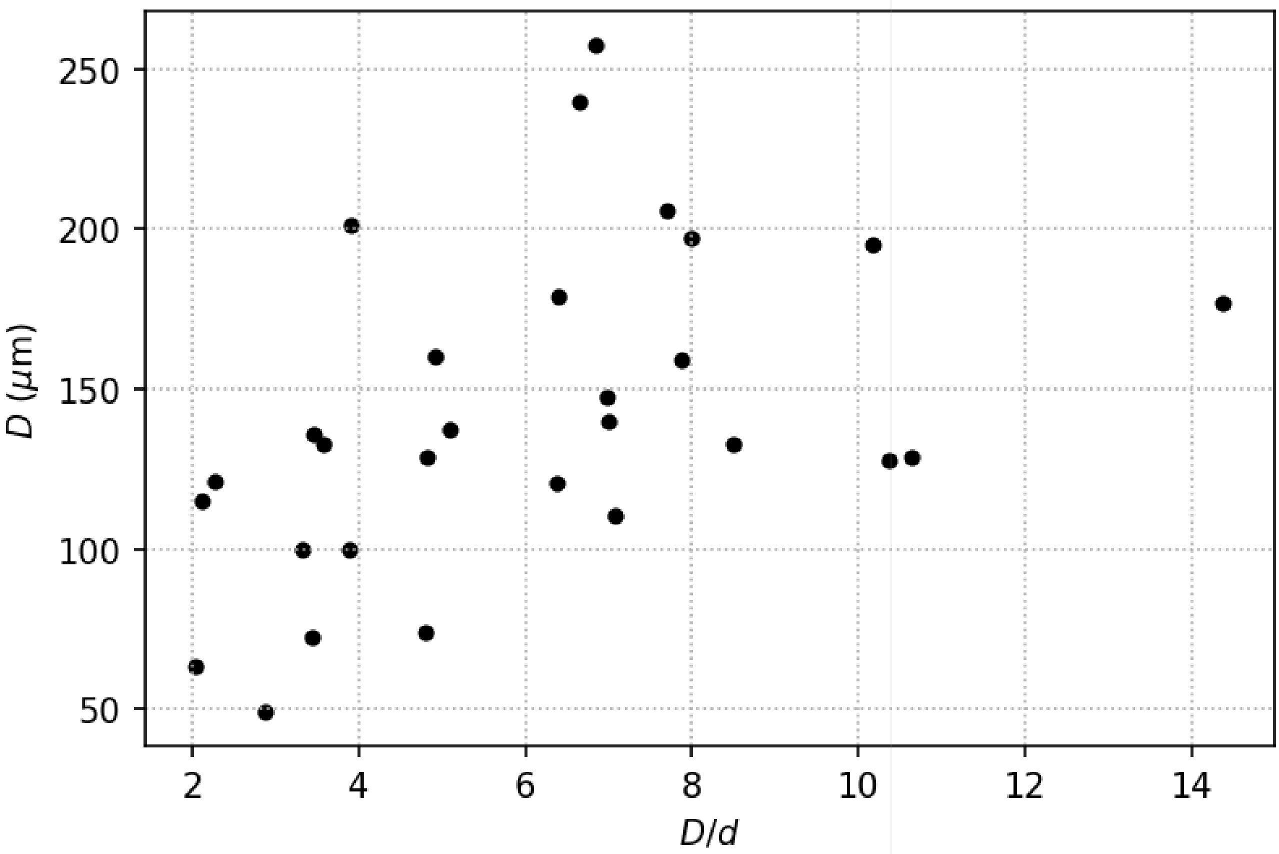
Review recent msd data

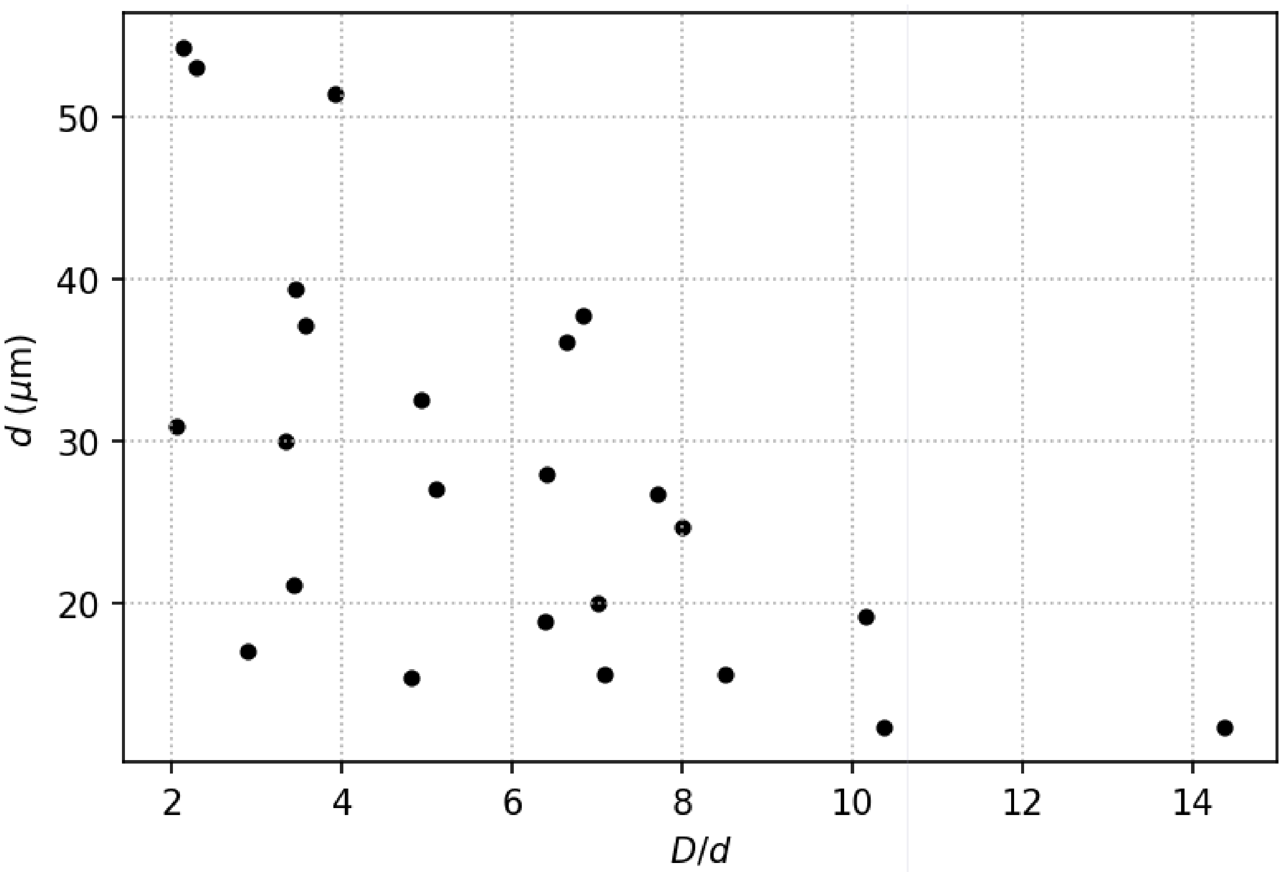
Cristian and I obtained more inner droplet motion data during his intern in Paris. In this note, I review these data and pick out the useful ones.



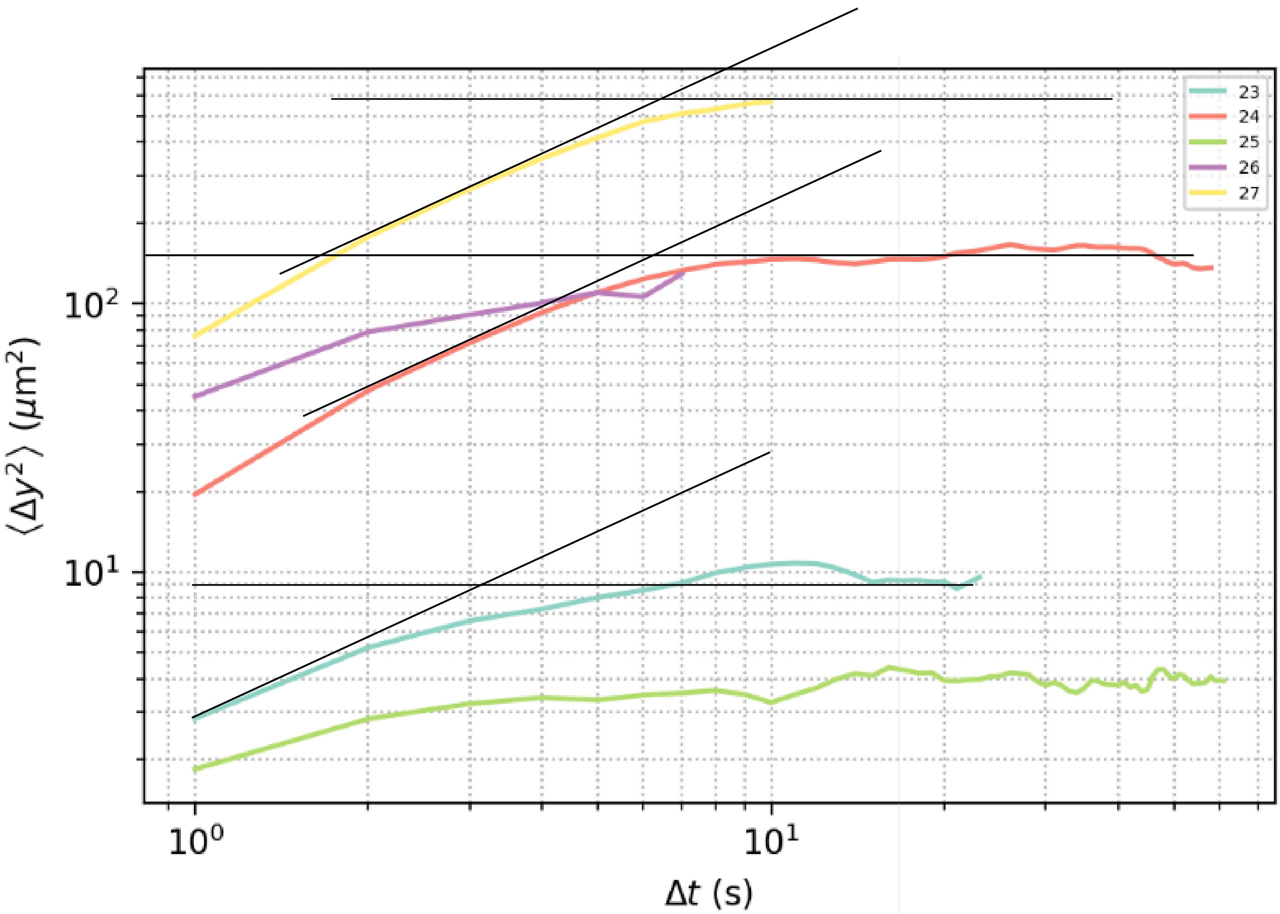
50-70 contains 29 experiments, and is the densest bin with size 20

With in this OD bracket, the outer and inner droplet diameters has the following distribution:

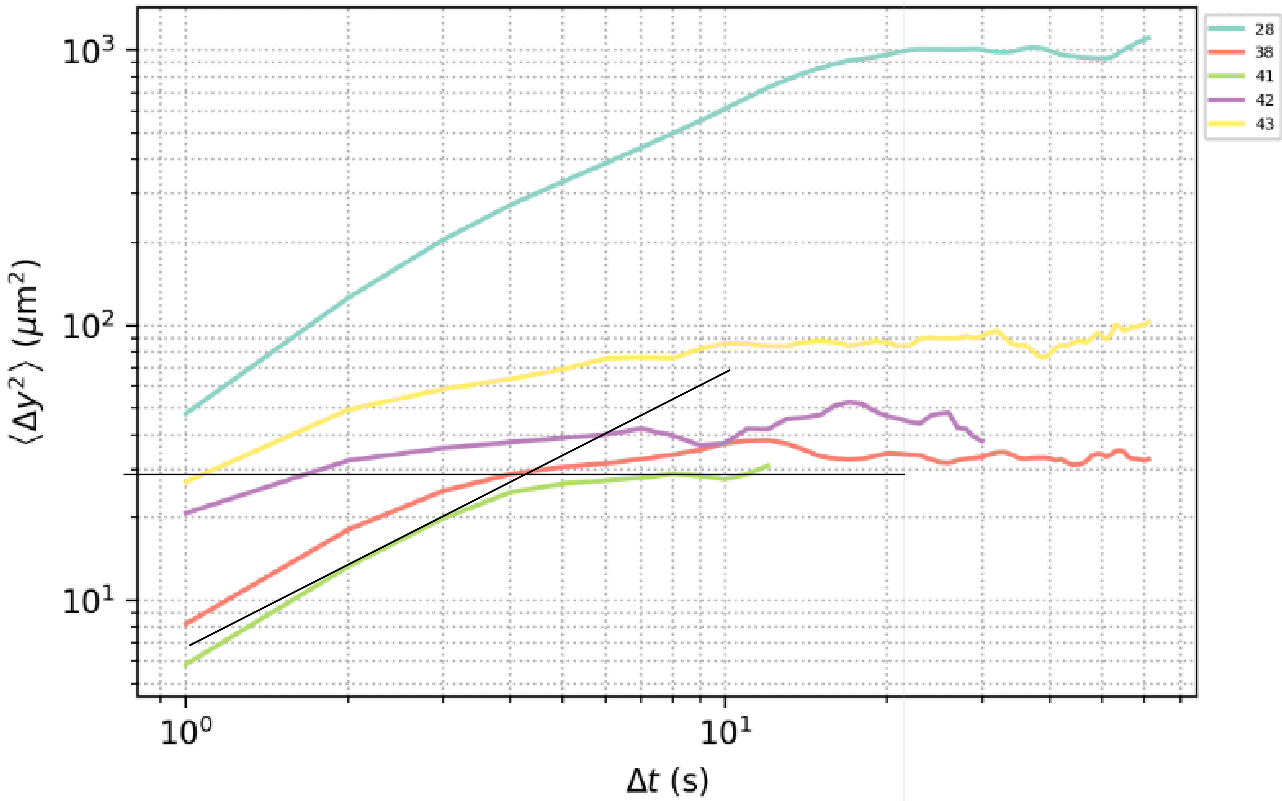

250
200
150
100
50
D (μm)
2
4
6
8
10
12
14
D/d


50
40
30
20
d (μm)
2
4
6
8
10
12
14
D/d

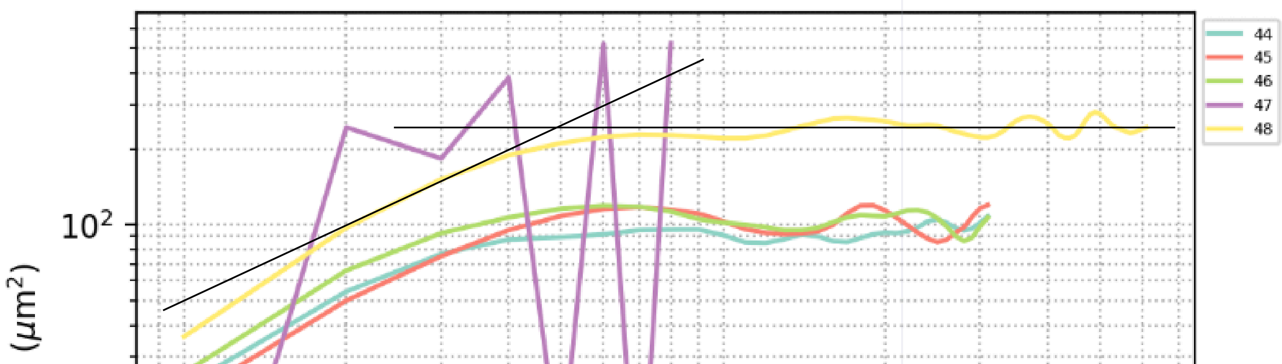
First, plot 5 MSD on one plot and manually measure R^∞ and τ^*, meantime filter out too short or too jumpy trajectories.



23
24
25
26
27
10^2
10^1
$\langle \Delta y^2 \rangle$ (μm^2)
10^0
10^1
Δt (s)

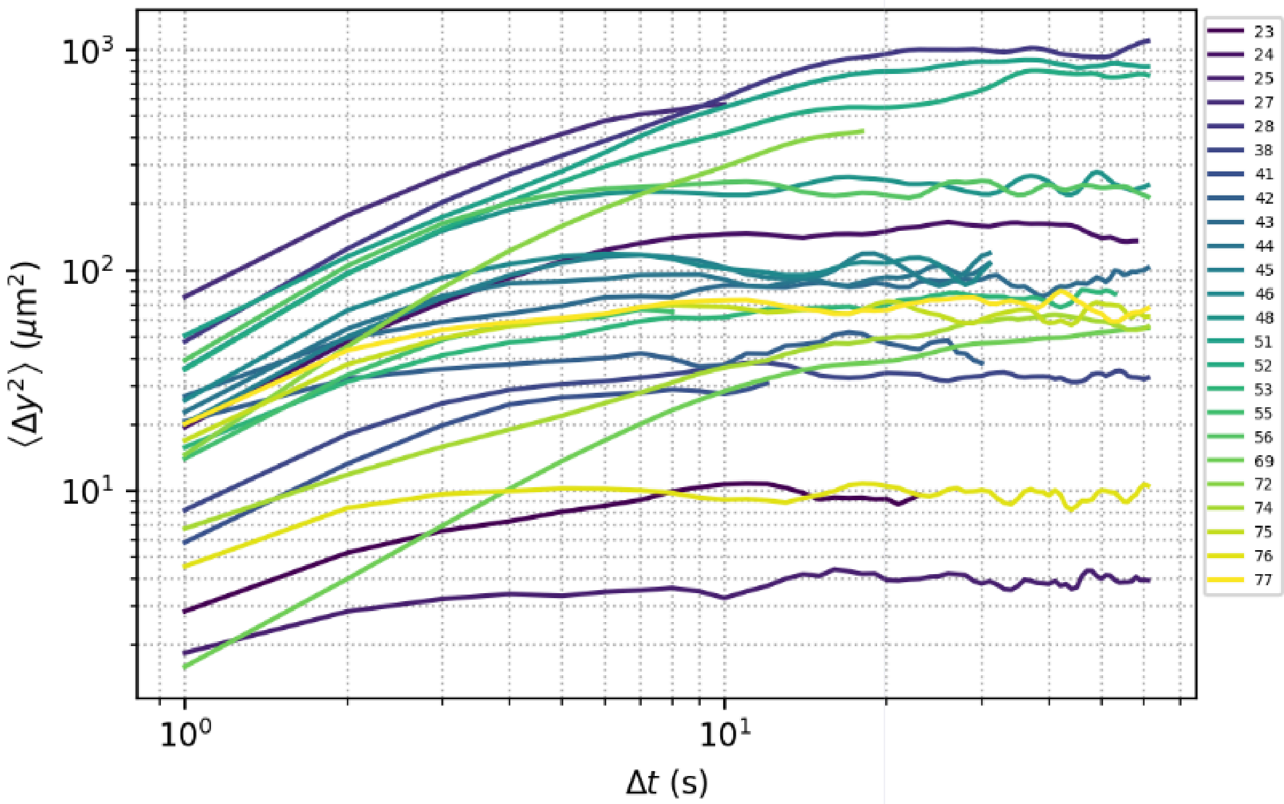


28
38
41
42
43
10^3
10^2
10^1
$\langle \Delta y^2 \rangle$ (μm^2)
10^0
10^1
Δt (s)

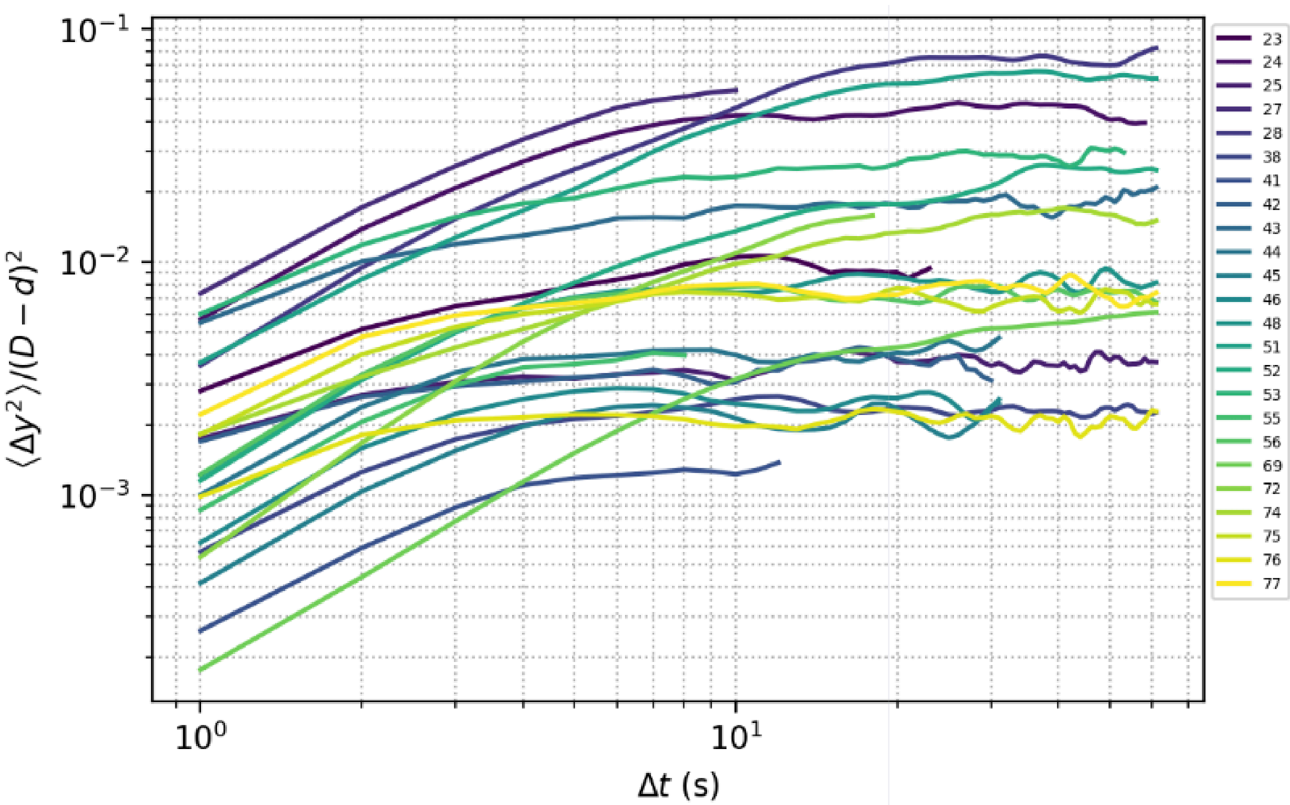


44
45
46
47
48
10^2
(μm^2)

Plot all the MSD's in the same plot, try to rescale $\langle \Delta y^2 \rangle$ with $(D-d)^2$. (unsuccessful attempt)

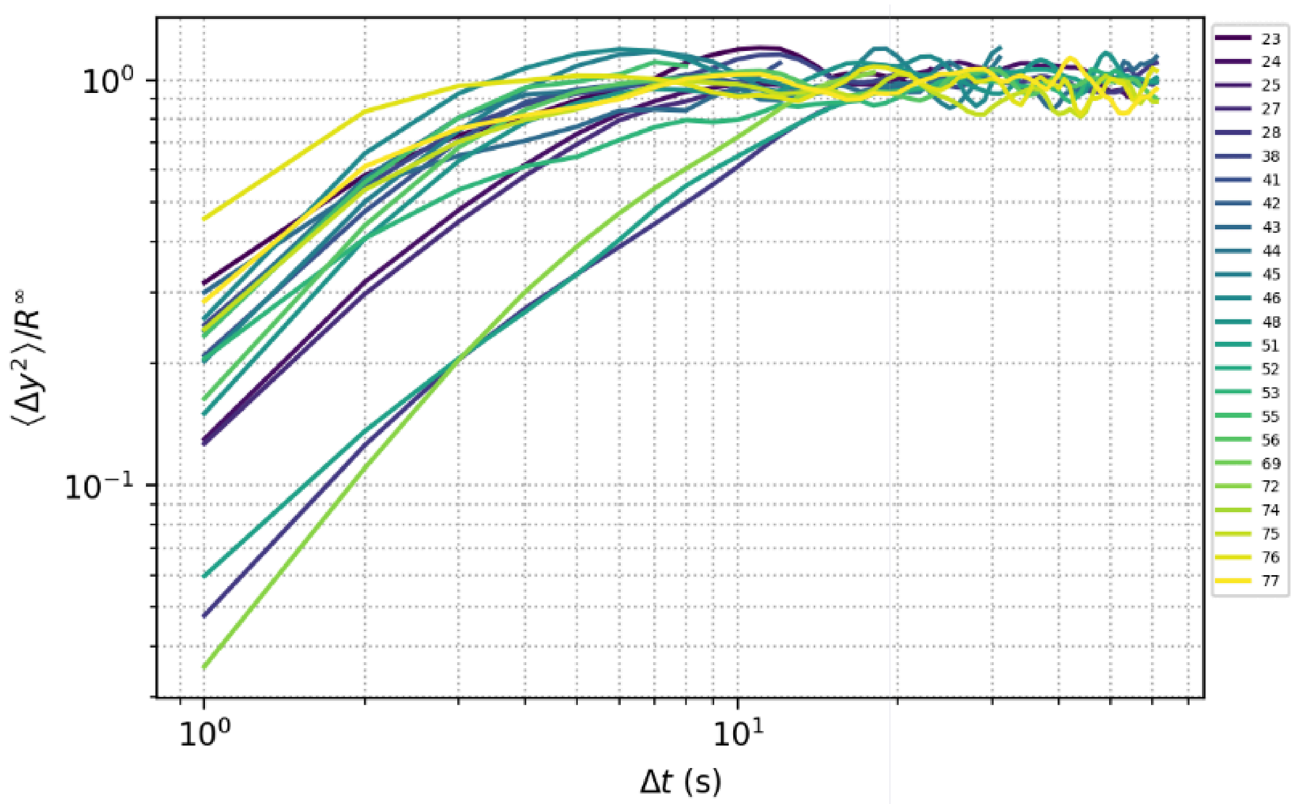


rescale y-axis

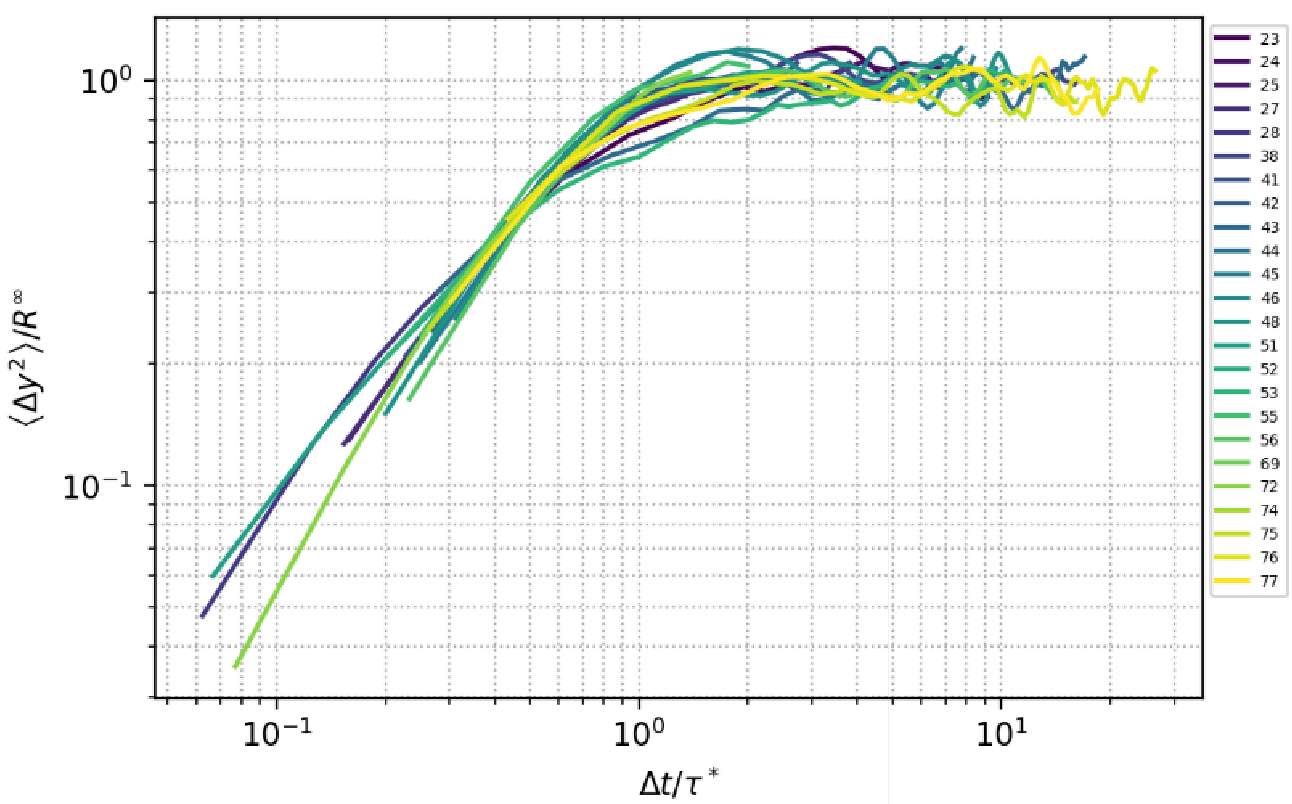


It's also interesting to rescale $\langle \Delta y^2 \rangle$ in such a way that all the plateau values

collapse, to inspect the time scale difference.



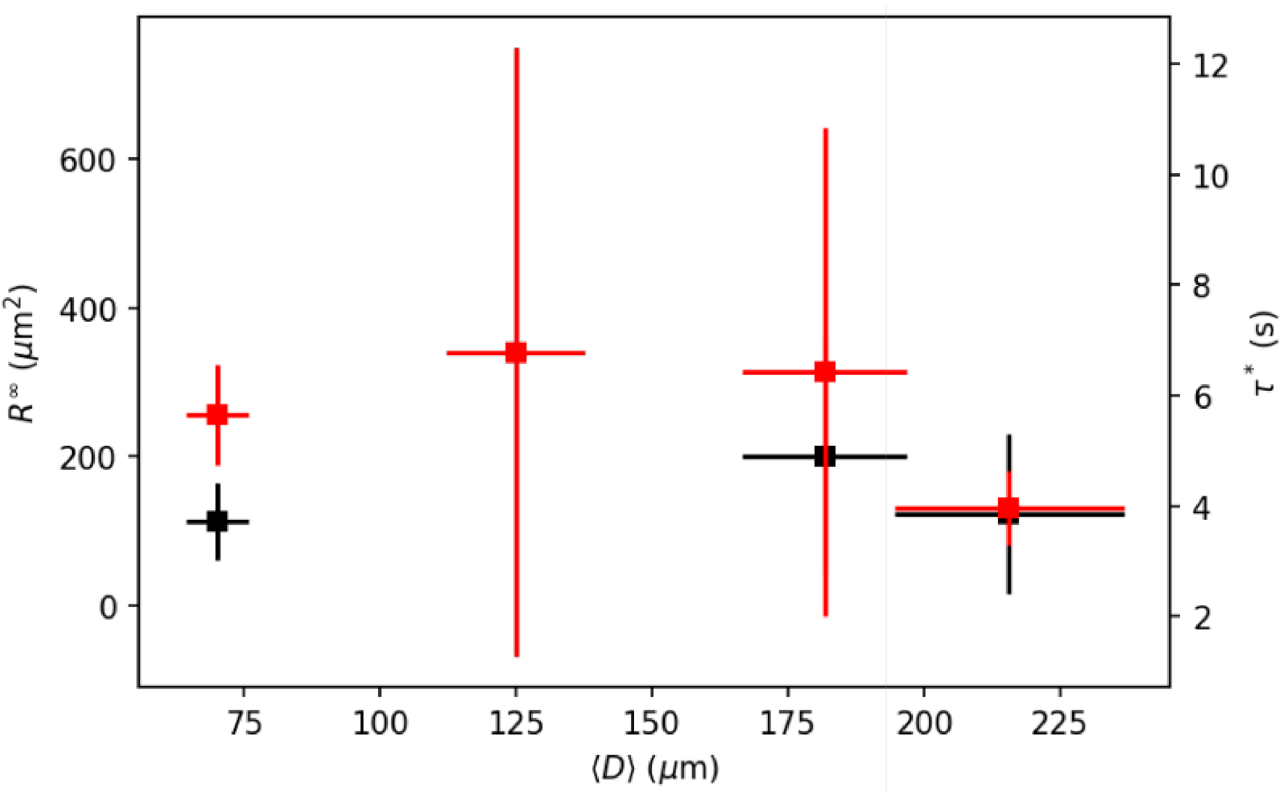
If we rescale Δt with τ^* as well, all the curves can be collapsed.



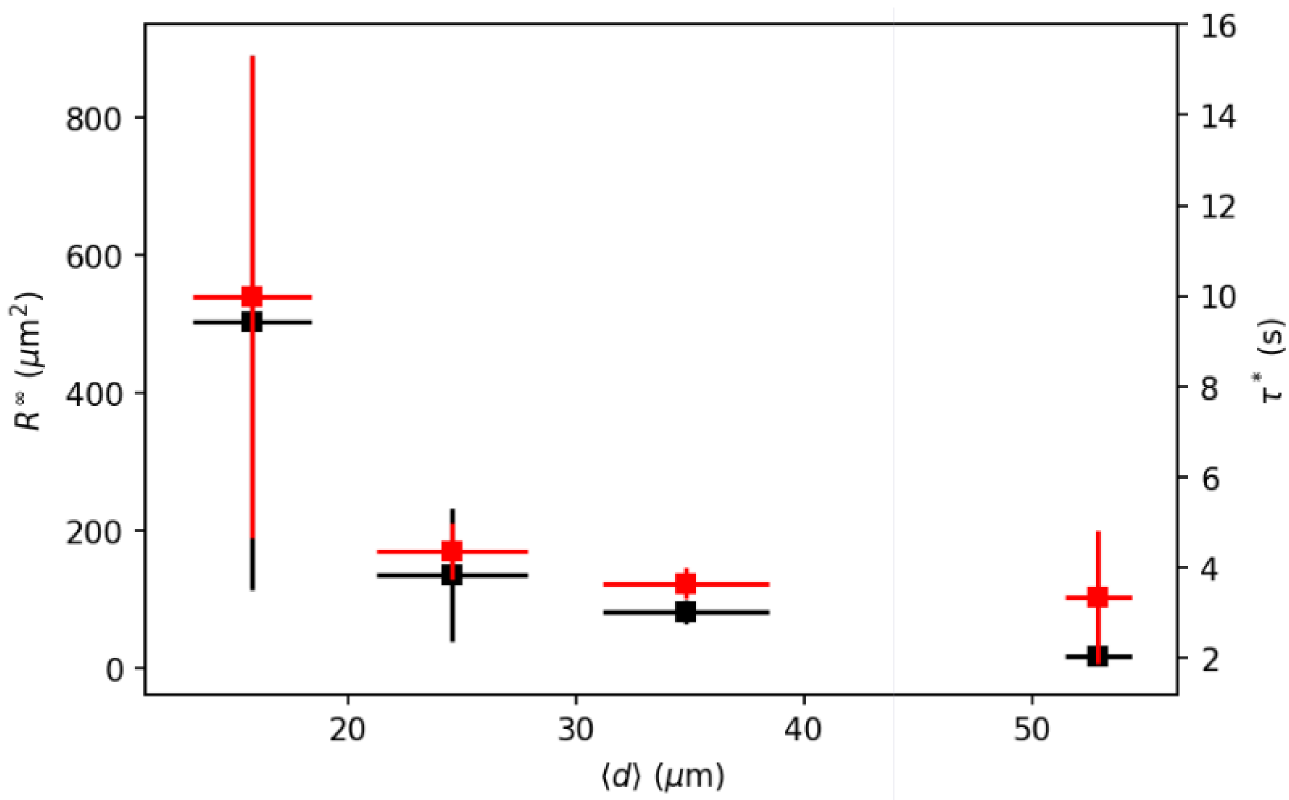
Such collapse demonstrates that the motions of inner droplets share a similar pattern, which can be described by two parameters R^∞ and τ^*. However, theoretical understanding of these two parameters, in particular how confinement influences them, is still lacking.

Next, we try to reveal the confinement effect by plotting R^{∞} and τ^{*} as functions of D and d.

vs. D

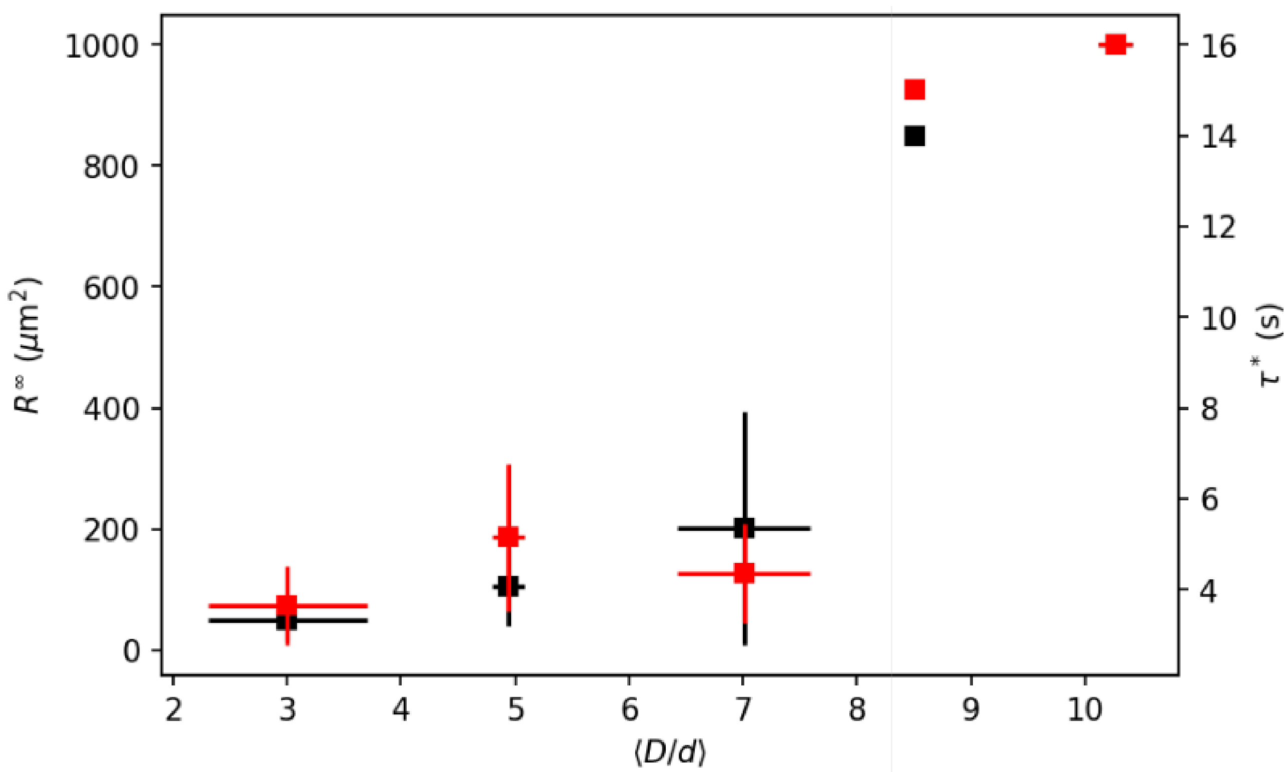


vs. d



800
600
400
200
0
R^∞ (μm^2)
20
30
40
50
$\langle d \rangle$ (μm)
16
14
12
10
8
6
4
2
τ^* (s)

vs. D/d



1000
800
600
400
200
0
R^∞ (μm^2)
2
3
4
5
6
7
8
9
10
$\langle D/d \rangle$
16
14
12
10
8
6
4
τ^* (s)