# Analysis of 605nm Qdots imaged at 67fps on Hestia

Name this data analysis run

```
monkier = 'Analysis of 25-2-11 605nm Qdots imaged at 67fps on Hestia';
disp(monkier)
```

```
Analysis of 25-2-11 605nm Qdots imaged at 67fps on Hestia
```

Set the current directory for data saving purposes.

```
cd('C:\Users\al3xm\Documents\GitHub\HISTia')
```

This Report generated at

```
disp(datetime)
```

```
   20-Mar-2025 10:18:16
```

Define the source folder here:

```
main_folder =
"C:\Users\al3xm\Documents\_Local_Data\25.02.11_HILO_PAG\specimen2_24hrs_later\15ms_x
mls"
```

```
main_folder =
"C:\Users\al3xm\Documents\_Local_Data\25.02.11_HILO_PAG\specimen2_24hrs_later\15ms_xmls"
```

```
paths =  FileFinder(main_folder, '.xml')
```

```
paths = 1×2 string
"C:\Users\al3xm\Documents\_Local_Data\25.02.11_HILO_PAG\specimen2_24hrs…  "C:\Us ⋯
```

```
if ~isfolder(main_folder)
    error('please enter a valid directory')
elseif isempty(paths)
    error('please ensure the folder contains .xml ParticleTrack exports')
end
```

If you want to scale the tracks, set the scaling factor here in pixels/distance unit. Otherwise, set scaling to -1 to avoid scaling.

```
scaling = 1 % units per input unit
```

```
scaling = 1
```

Define the units

```
SpaceUnits = 'microns';
TimeUnits = 'seconds';
```

Enter the timestep **in time units. Ensure that you use the inverse of the fps, not exposure.**

```
dt=0.015 % 1/(fps)
```

```
dt = 0.0150
```

what is the minimum track length you want to consider?

```
MinTrackLength = 7
```

```
MinTrackLength = 7
```

Now, generate the MSD analyzer structure. Note that this filters out any tracks with a track length of less than 7 by default, though this can be changed.

```
ma1 = TrackMateImport(main_folder, true, MinTrackLength, scaling);
```

```
Warning: Directory already exists.
found 16420 tracks in the file.
found 22800 tracks in the file.
found a total of 22800 tracks in the directory
Warning: Scaling factor active!
Warning: plotting only tracks longer than threshold length
Computing MSD of 14247 tracks... 14Done.
```

```
ma1 =ma1.fitMSD(0.25); % set to short clipping factor to find diffusive rate
```

```
Fitting 14247 curves of MSD = f(t), taking only the first 25% of each curve... 14Done.
```

```
ma1 = ma1.fitLogLogMSD(0.75); % set to long clipping factor for linearity measure
```

```
Fitting 14247 curves of log(MSD) = f(log(t)), taking only the first 75% of each curve... Done.
```

```
d_est = mean(ma1.lfit.a) * (1/dt); % starts with units^2 per frame, divide by
frames/time unit.
% This gives the estimated slope of the MSD in units^2/second
gamma_est = mean(ma1.loglogfit.alpha); % Gives time scaling factor of the MSD.

fprintf(strcat("The diffusion coefficient is D=", string(d_est), ' ', SpaceUnits,
'^2/', TimeUnits));
```

```
The diffusion coefficient is D=17.0621microns^2/seconds
```

```
fprintf(strcat("The time scaling factor is gamma=", string(gamma_est), '.'));
```

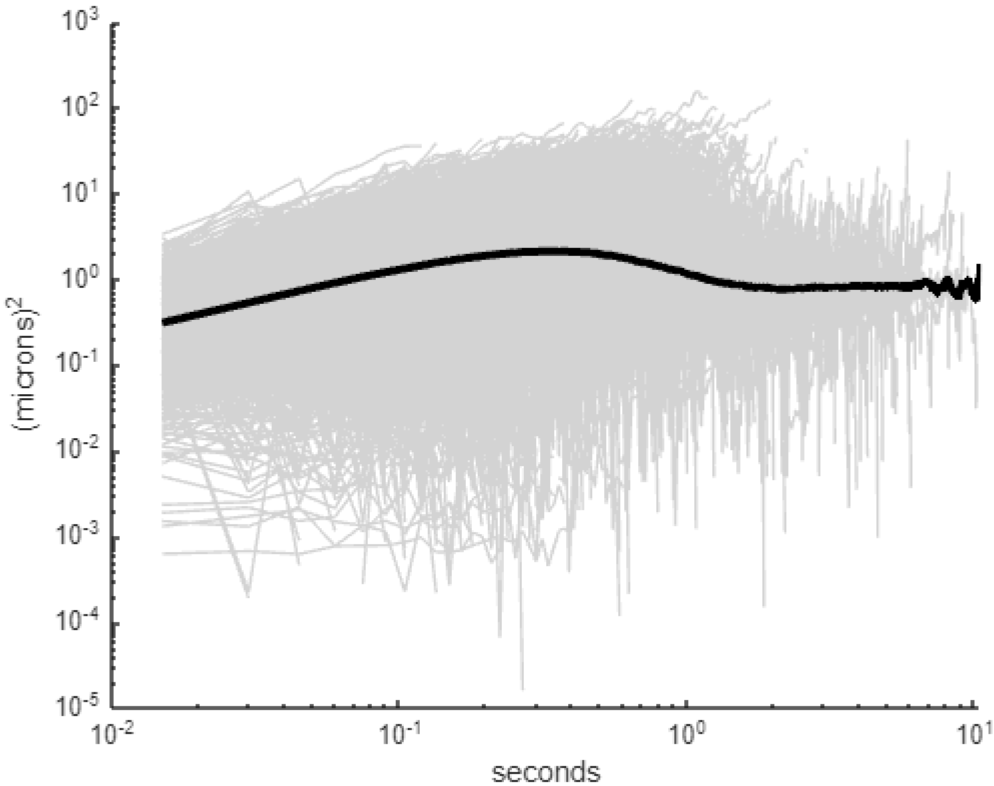
```
The time scaling factor is gamma=0.70779.
```

Now, we plot the MSD. If you want to plot an expected value, set it. Otherwise, set D to -1.

```
D_expect=-1;
fprintf(strcat('excpected diffusion coefficient: ', string(D_expect),' (',
SpaceUnits, ')^2/', TimeUnits))
```

```
excpected diffusion coefficient:-1 (microns)^2/seconds
```

```
FigMeanMSD(SpaceUnits, TimeUnits,ma1, dt,D_expect,true)
```

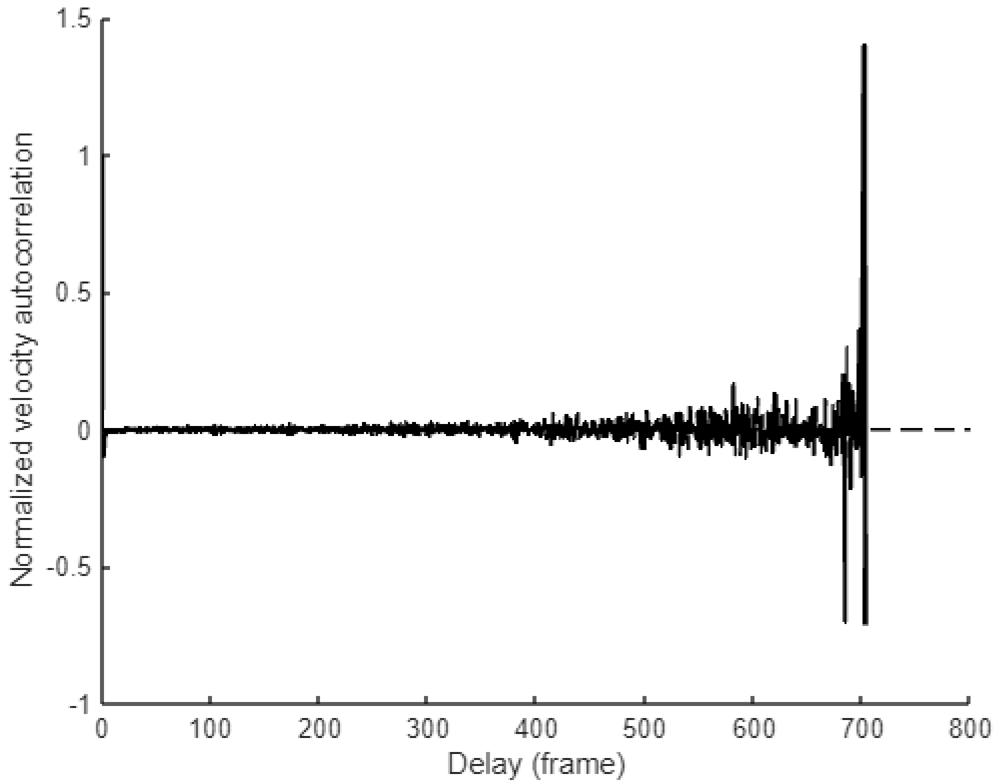



```
ans = 705×5
10^3  ×
         0         0         0    4.3488         0
    0.0000    0.0003    0.0002    3.7449   -0.0001
    0.0000    0.0005    0.0004    3.1502   -0.0001
    0.0000    0.0007    0.0006    2.8378   -0.0002
    0.0001    0.0009    0.0008    2.6367   -0.0002
    0.0001    0.0011    0.0010    2.4800   -0.0003
    0.0001    0.0012    0.0012    2.3569   -0.0004
    0.0001    0.0013    0.0013    2.2539   -0.0004
    0.0001    0.0014    0.0015    2.1257   -0.0005
    0.0001    0.0015    0.0016    1.9733   -0.0005
      ⋮
```

Now  we create a plot of the mean velocity correlation as a function of time.

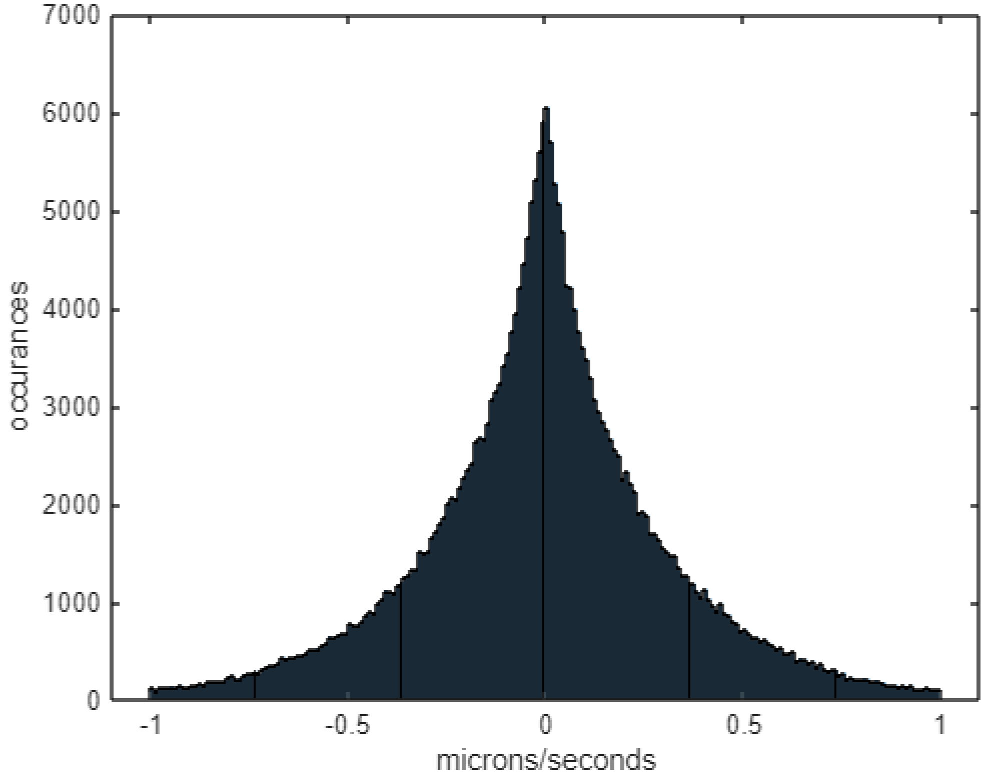
```
figure;
ma1.plotMeanVCorr;
```

```
Computing velocity autocorrelation of 14247 tracks...
```




We may also directly compute velocities and plot them as a historgram

```
v = ma1.getVelocities;
V=vertcat(v{:});
edges2 = -1:0.01:1;
histogram(V(:,2),edges2)
xlabel(strcat(SpaceUnits, '/', TimeUnits))
ylabel("occurances")
```




Now, we must call CenterTracks.

```
CenterTracks=CreateCenterTracks(ma1.tracks);
```

We may now create a short vs long track diagram.

```
figure();
% UniDomainFigCenterJuxt(SpaceUnits, CenterTracks, 10,10, 10, 10, true, true, 1)
```

Now create a VanHovePlot. This function calls the new VanHove2.m so it is relatively fast and creates bins with equal widths, but it can still take a while to run.

Now, we can can manimputme the CreateVanHovePlots function in a few ways.

We can change the time steps, the number of particles assigned to each bin, and the minimum bin width.

The BinSize determines the number of particles which the Van

```
BinSize = 10
```

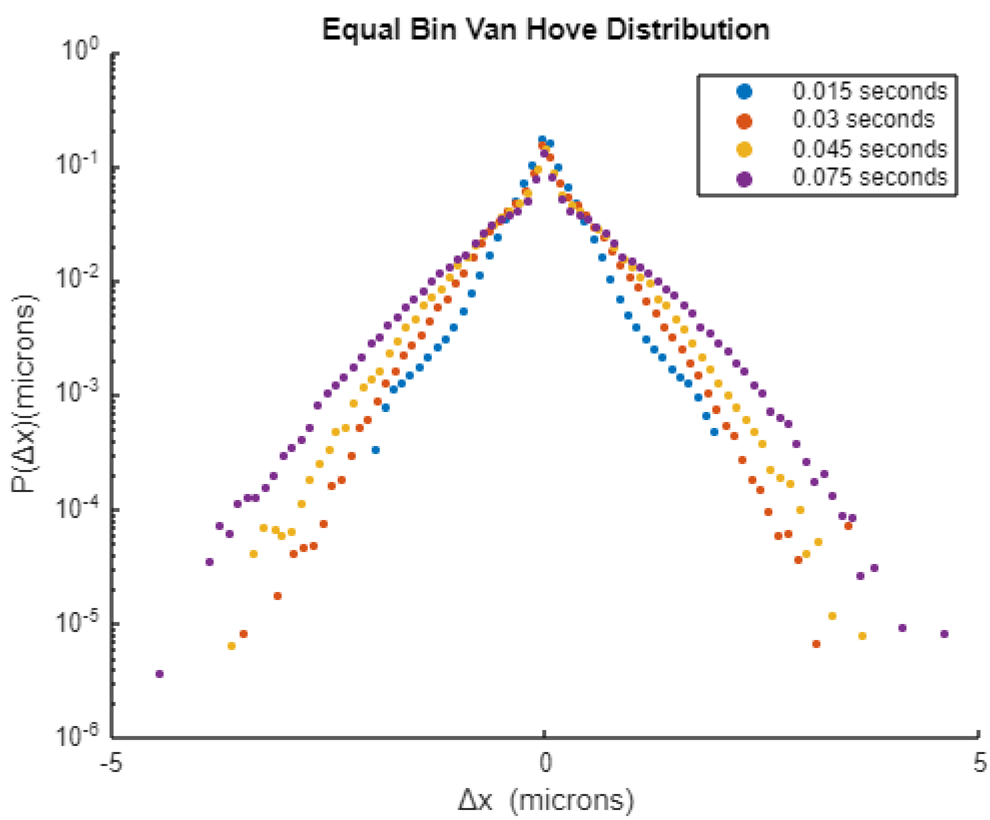
```
BinSize = 10
```

```
MinBin = 0.1 % In microns
```

```
MinBin = 0.1000
```

```
VanHoveStats= CreateVanHovePlots(SpaceUnits, TimeUnits, ma1.tracks, BinSize,
[1,2,3,5], main_folder, MinBin, dt)
```

```
 Calculating VanHove Distribution dt=1

5000
10000
 Calculating VanHove Distribution dt=2

5000
10000
 Calculating VanHove Distribution dt=3

5000
10000
 Calculating VanHove Distribution dt=5

5000
10000
 Cleaning up for dt=1

 Cleaning up for dt=2

 Cleaning up for dt=3

 Cleaning up for dt=5
Sorting dt=1 into bins
Sorting dt=2 into bins
Sorting dt=3 into bins
Sorting dt=5 into bins
```




```
VanHoveStats = struct with fields:
             Data: {5×1 cell}
      CenterPoint: {5×1 cell}
         EquiProb: {5×1 cell}
```

```
     TotStepsCount: [4×2 table]
           BinSize: 10
               tau: [1 2 3 5]
         FrameTime: 0.0150
            MinBin: 0.1000
```

Save the data in SuperStruct format to the SuperStructs Github folder.

```
MasterSaveD(monkier, ma1,main_folder, MinTrackLength, SpaceUnits, TimeUnits,
VanHoveStats, cd)
```

```
ans =
'C:\Users\al3xm\Documents\GitHub\HISTia\SuperStructs\Analysis of 25-2-11 605nm Qdots imaged at 67fps on Hestia'
```

Save this output as a pdf.

```
export(strcat('\TrackMate Reports\',monkier))
```

```
Error using export (line 74)
Unable to find file.
```