

Today:

Finish resolution

Learning objectives: you will be able to analyze the spatial and temporal resolution of your images. You will be able to manipulate dynamic range of color channels in an editor.

Team Second publish date: Oct 25 minus your team number.

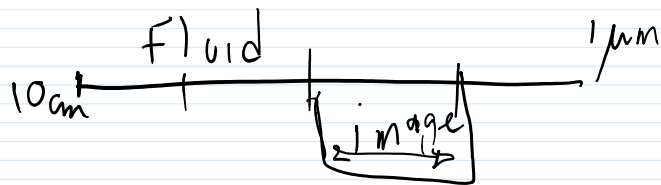
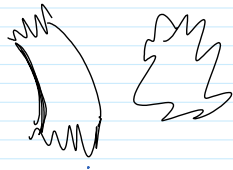
Minute paper: In your GW image, how many decades of length scale was in your **flow**?
Is there a sharp boundary in the flow that only takes up one or two pixels in the image?
Are all the scales of interest in the flow well-resolved in the **image**?
In other words, was your flow spatially resolved?

What was the major effect that degraded the resolution?

How to tell motion blur from bad focus:

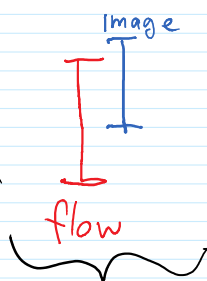
sides of streak will be in focus.

Just being out of focus will be an overall blur.

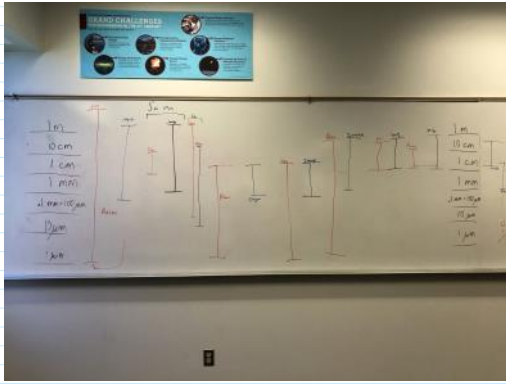


Draw your resolution ranges for your Get Wet flow and for your image

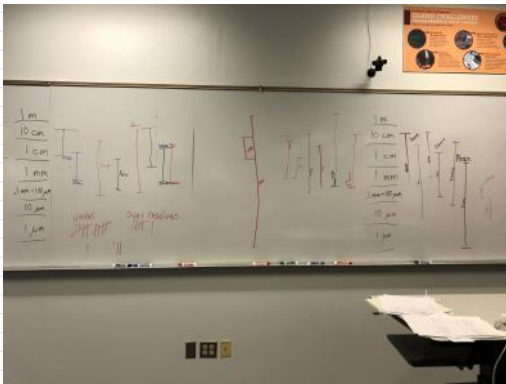
- 1 m
- 1 cm
- 1 mm
- 1 mm = 100 μm
- 10 μm
- 1 μm



Everybody do this on the board



Everybody did analysis on their get wet image. Some were underresolved, a few were overresolved.



Time resolution

Other considerations of shutter speed:

Short enough to 'freeze' flow= TIME RESOLVED

VS long enough to get desired particle tracks
or long enough to be TIME AVERAGED.

Calculate motion blur. How many pixels long? If unacceptable, increase time resolution= shorter exposure time

Increase shutter speed

DSLR max = $1/4000$ sec, = 250 μ sec

Max on cell phone is $1/23000$ = 0.043msec, 43 μ sec? At best.

High speed camera 30,000 fps $\sim 3 \times 10^{-5}$ sec = 30 μ sec

Freeze the flow with short light source (won't work for light emitting fluids, i.e. flames)

Strobe, camera flash $\sim 10^{-5}$ or -6 sec = 1-10 μ sec

Best at low power

Pulsed laser 3×10^{-9} sec = 3 nsec or less

Good resource for high speed photography: <http://www.hiviz.com/index.html>