Today:

Admin

Resolution: Spatial and Temporal + FINISH SHUTTER SPEED

Admin

- Reminder: Clouds due Monday 9AM. Be prepared to comment on atmospheric stability, and fully categorize your cloud: genus, species, variety. Also, what you like about it, and what you wish you could change.
- High speed camera demo from Vision Research, Th March 3, 2 pm, Durning Lab. Could maybe get your next team assignment done if you have a set up ready. http://vimeo.com/19819283

Resolution

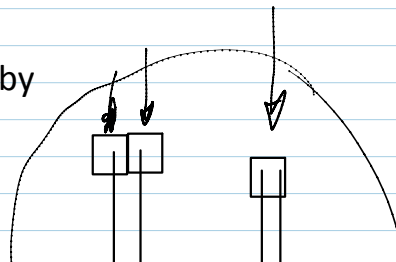Can two adjacent things be resolved?

Resolution = minimum distance between two objects for them to be recognized as separate.
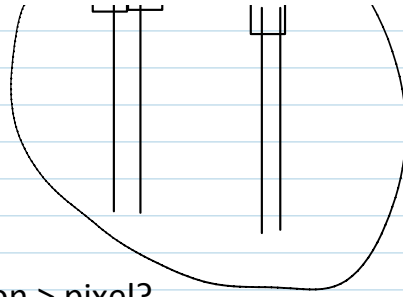Applies to objects (spatial resolution)
and events (temporal  or time resolution)
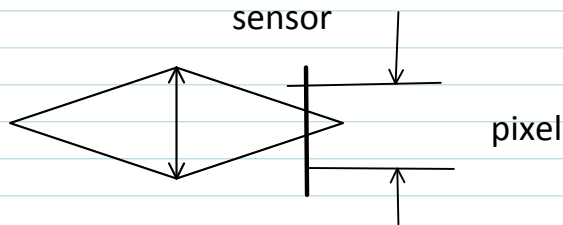
Spatial resolution can be DEGRADED by
- Bad focus
- Rastering, pixelation
- Diffraction effects
- Low contrast

- Rastering, pixelation
- Diffraction effects
- Low contrast
- Compression artifact (in jpegs)
- Motion blur

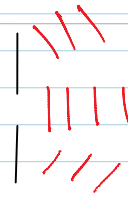- Bad focus: is circle of confusion > pixel?

sensor

pixel

- Diffraction effects if lens aperture or pixel size < λ wavelength of light

λ >d
woofers

λ < d
tweeters,
Beamy
effect

from interference effects

Example : http://www.luminous-landscape.com/tutorials/understanding-series/u-diffraction.shtml. Moral of the story: high f number has better depth of field, but sharpness can be defeated by diffraction effects.

Current sensor sizes range 35 - 3 mm. For 3k px wide, 1 pixel = 10 -1 μm.
Red λ = 0.7 μm. Pretty close!

How much resolution is needed?
Consider range of scales:
    3000 px wide image, can see 1:1000 = 3 decades of scales
    In flow, scales can be 3 minimum,
        For turbulence need 4 or 5 decades minimum
Same scale considerations as for CFD:
    If resolution is increased, is new information seen?
        Is it important information?
        In CFD, could have different physics
        In Flow Vis, could lead to misinterpretation of physics

$$\frac{3px}{1000} = X \text{ DECADES}$$

1 Decade
3 → 30
2nd decade
30 → 300

Minute paper: In your GW image, how many
decades of length scale was in your flow?

300 → 3000

Minute paper: In your GW image, how many
decades of length scale was in your flow?
How many did your image capture?
Was your flow spatially resolved?

*300 → 3000*

# Time resolution

Shutter nomenclature:
2 = 1/2 sec, 20 = 20 1/20th sec etc.
2" = 2 sec  ⟵
T = time = actuate open, actuate closed
B = bulb = open as long as actuated. Rare now.



To change exposure,
   lighten image, overexpose compared to AE suggestion +++
   Darken, underexpose compared to AE, -----

## 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.

If long shutter is needed, might be too much
light. Try a
NDF = Neutral Density Filter. Neutral = all
wavelengths equally. Gray.
NDF 1 = 1 /10 light transmission.
NDF 2 = 1/100 etc. Log scale.
http://en.wikipedia.org/wiki/File:Strickland_Falls
_Shadows_Lifted.jpg
30 seconds. NDF 8x

*got to here*