Today
Last Team 1 images
Reports: UG MEs, need to make sure you refer to physics more, include
at least web-level references. Use self-assessment as check sheet. Ask if you
are unsure where to look for info.
Finish Resolution

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

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?

Examples from GW images; resolved vs not
resolved. What if there aren't two things close
together, how to estimate from an edge
gradient?

Human eye resolution, 74 to >500 Mpx, depending on how you count.

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.

30 seconds. NDF 8x

Need a tripod for macros, or shutters > 1/30 sec
Can tolerate maybe 5 px blur?

10 Mpx ~ 3750 X 2750

0.1 m / 3750 = 2.6 e-5 = 0.000026 m/px = 26µm/px

5 px = 1.3 e-4 m = 0.00013 = 0.13 mm estimated acceptable object displacement x

time t = x/velocity

1.3e-4 m / (0.5 m/s) = 2.6e-4 seconds

2.6e-4 sec = .00026 sec = 260 µsec ≈ 1/3750 Very short. Can your camera do this?

5/3750 = 0.0013 = 0.13% of image width

Estimate motion blur *in pixels* to guide choice of shutter speed.

Example:

Field of view = 10 cm

Fluid moving at 0.5 m/s

10 Mpx sensor

Minute paper: what shutter speed will 'freeze' this flow?