20. Exposure review, Dye Tech

Friday, November 1, 2024   2:55 PM

Today

Admin:
- Reading assignment: Guidebook, Dye Techniques 1 Do Not Disturb and 2 High Visibility
- Exposure review
- Dye Techniques

Exposure Review

What is exposure? What is a 'good' exposure?
Group discussions

How much light is coming into the camera
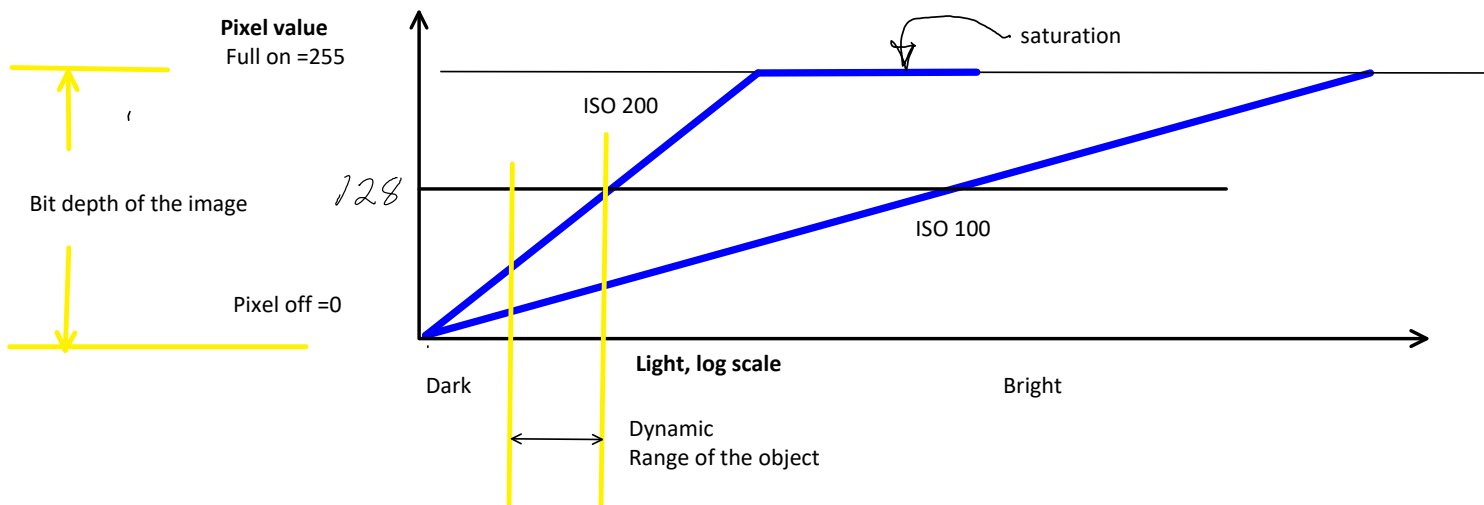How bright the image is
How well an image is lit

Balance lights and darks in image
Average level - adjusts ISO, aperture, shutter to reach a middle value for average pixel value

As we go through these, test yourself before discussing with your group. 5 minutes.

If ISO is low and dynamic range of the subject is also low, pixel values will be concentrated over only a few values, resulting in loss of resolution in light. A higher ISO would spread the values out.

Side Effects	If you want your photo Darker ——— Brighter	Side Effects
Deep depth of field Maybe lose overall sharpness	**Aperture** f/8 f/5.6 f/4 f/2.8 f/2.0 f/1.4	Shallow depth of field
Rolling shutter artifacts	**Shutter Speed** Fast 1/1000 sec Medium 1/250 sec Slow 1/30 sec	Motion blur
Maybe lose details in quantization	**ISO Sensitivity** Low gain ISO 100 High gain ISO 6400	Noise

SPECIFIC FV techniques

Boundary techniques. Boundary between 'seeded' and unseeded fluid.
Choice depends on physics desired
I DYES **Today**. Mostly in water.
Light/matter interactions in general
2 Light emitting fluids
3 Index of refraction techniques
- 4 Particles. In air (aerosols, fog, smoke)
5 Particles in water

Group discussion, then clicker short answers: How to not disturb flows with dye?

Similar densities
Match: density
Momentum
Velocity
Direction
Viscosity
Surface tension
Pressure
Temperature
diffusion

- Match fluid properties, including
  - velocity(speed and direction)
  - vorticity
  - density
  - viscosity
  - polarity; miscibility (will it mix)
  - pressure
  - temperature
  - molecular weight
  - intermolecular forces (to minimize surface tension effects)
  - diffusion coefficient
- Use small ports
- Premix a dilute solution of dye with the ambient fluid to help match properties.
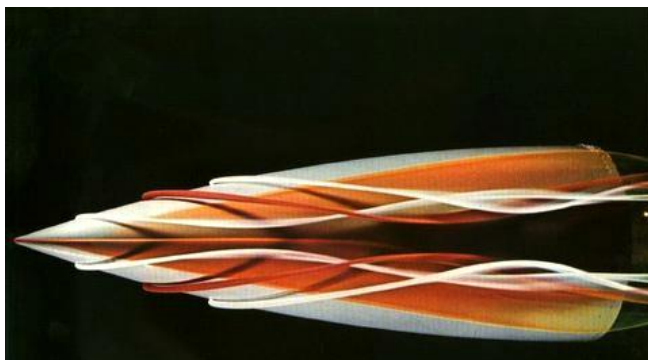
by Henri Werlé, at
ONERA = NASA of France
Master of colored dye streams

From Courants et Couleurs
https://www.dailymotion.com/video/x16dpof
1974
6 minutes

This is an ogive shape = gothic arch

Injection location has a huge effect.

This is an ogive shape – gothic arch

Injection location has a huge effect.

- Avoid injection altogether: Coat object with alcohol-dye mixture or water soluble paint (Tempera), let dry, then tow in tank. Shows vorticity layer, wake, boundary layer
  - Or coat short strings on a rake. OK for low speed, short run times

Example of dye that visualizes physics without disturbance

N.J. Mueschke et al., "Measurements of molecular mixing in a high-Schmidt-number Rayleigh-Taylor mixing layer," *Journal of Fluid Mechanics* 632, J. Fluid Mech. (UK) (2009): 17-48.

(a) Salt water; nigrosine dye →

Fresh water →

splitter plate

(b) BASIC

Salt water; $pH_1 = 11.5$ →

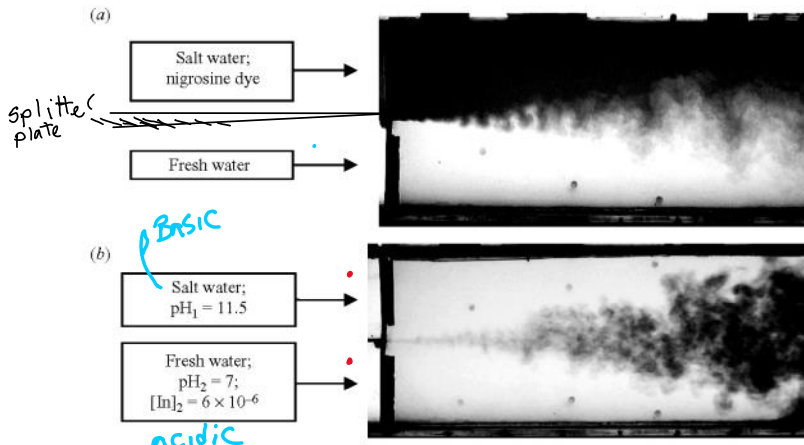Fresh water; $pH_2 = 7$; $[In]_2 = 6 \times 10^{-6}$ →

acidic

FIGURE 4. Photographs (contrast enhanced for visualization) of the buoyancy-generated mixing layer in a typical water channel experiment. (a) Nigrosine dye was added to the top stream. (b) Phenolphthalein was added to the bottom stream, which changes to its pink form as the two streams molecularly mix (here, "pink" is shown as dark regions within the mixing layer).

Indicator dye

Ph indicator, shows where mixing got to molecular level.

Tough to match all these properties! Dye properties are different from ambient fluid.
To match density, try a premix:
  For food dye in water, premix dye (dense, sinks in water) and isopropyl alcohol (floats) to get neutral buoyancy in water

Match diffusion coefficient?
Think Pair Share: What is diffusion? What causes it?

Refection
Diffraction
Refraction
Absorption
Florescence
Transmit
Interference (Destructive or Constructive, phases)