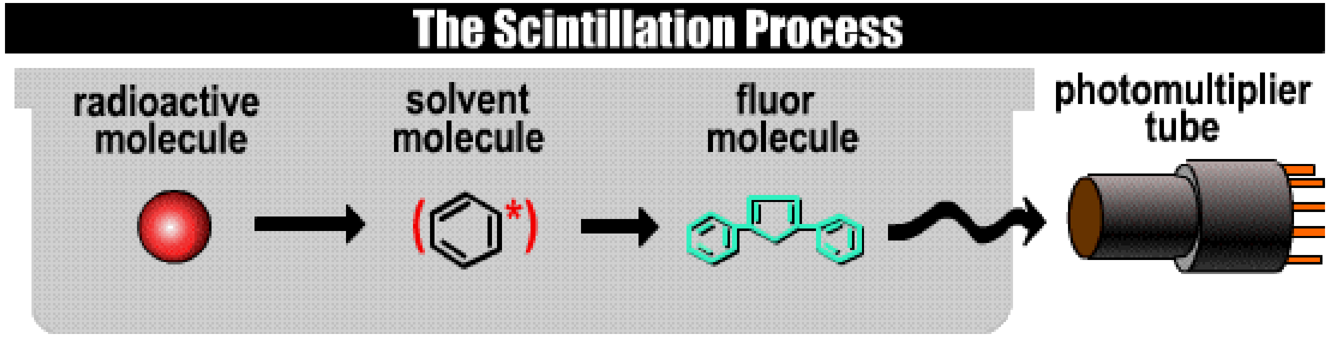
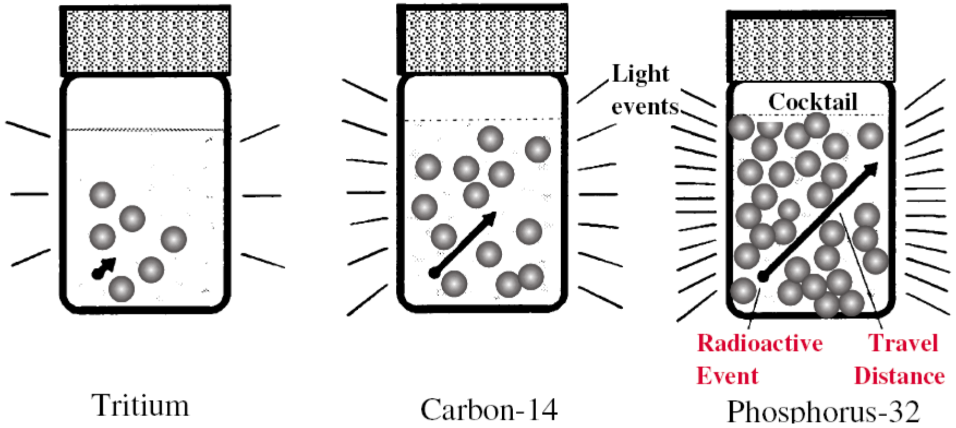
Scintillation Counter

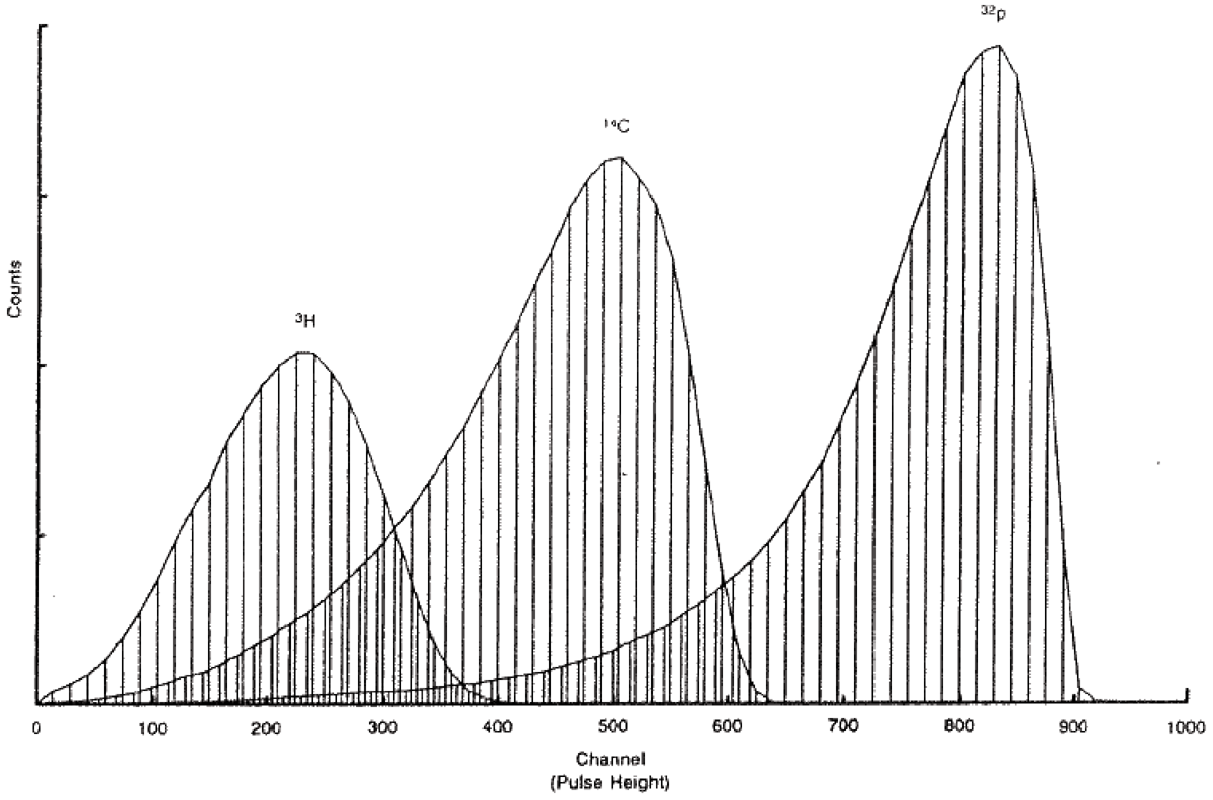


- Scintillation Cocktail contains solvent and fluor (or solute) molecules.
- Solvent is good at capturing energy of β-particles (electrons) but does not produce light.
- A fluor molecule enters an excited state following interaction with excited solvent.
- The excited fluor molecule decays to ground state by emitting light (usually in blue wavelength)
- Blue light is detected by photomultiplier tube (usually two PMT are used to minimize PMT errors.

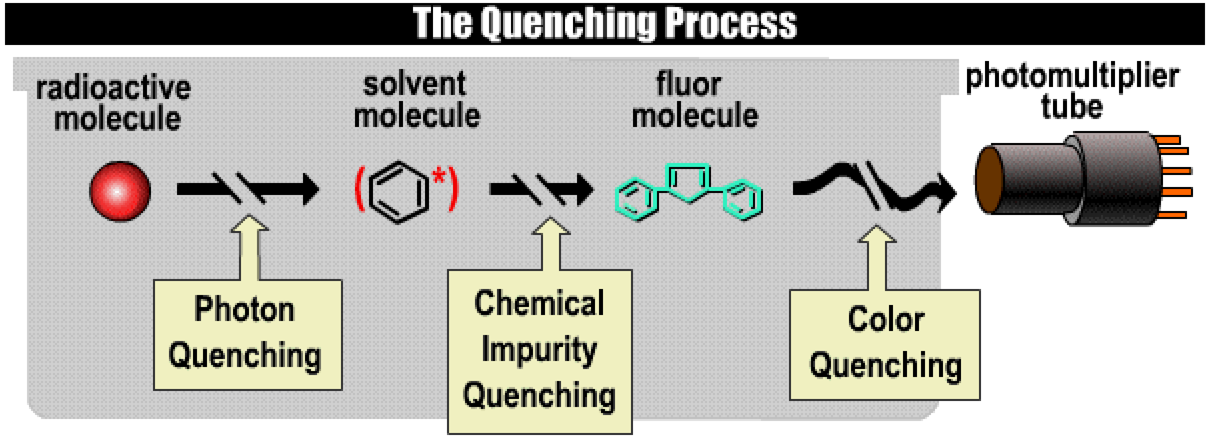
β-Energy and Light Intensity

Stronger β emitters generate stronger pulses of light, so that ^{3}H , ^{14}C, and ^{32}P can all be distinguished and counted at the same time.

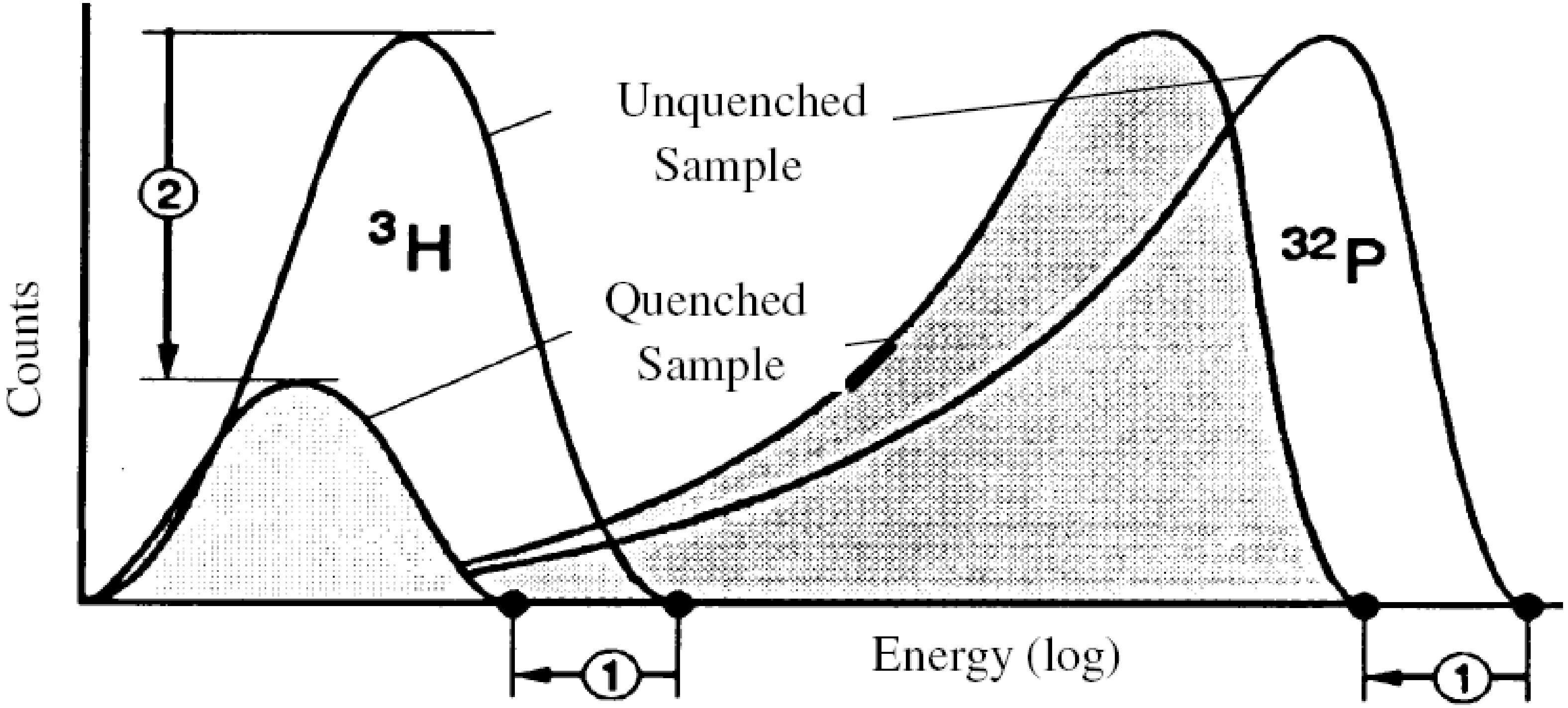




Quenching

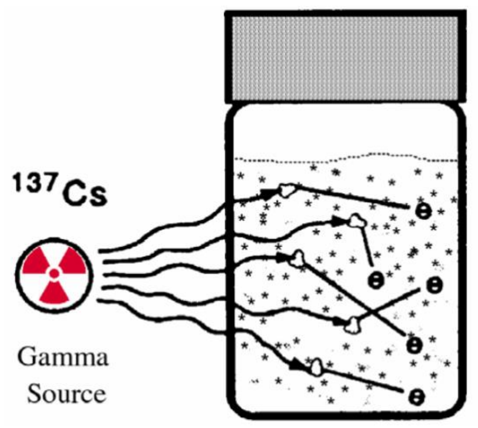


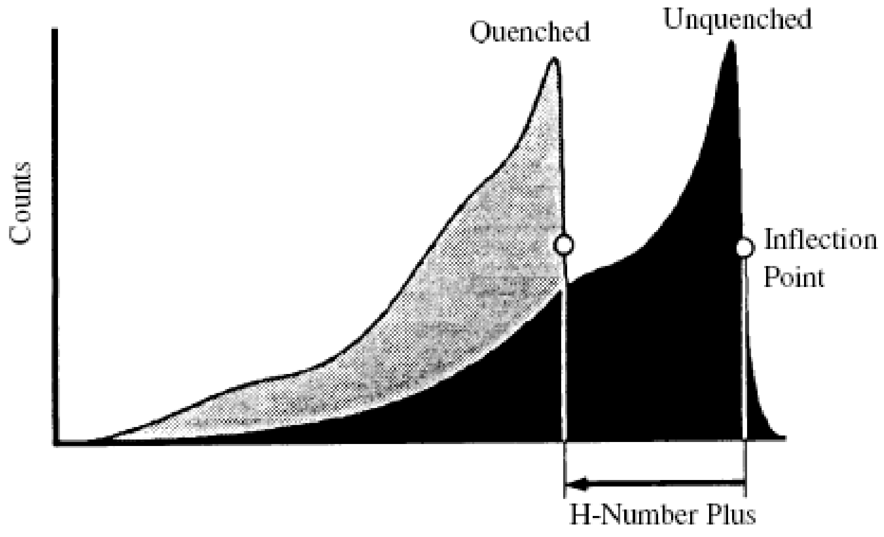
Effects of Quenching

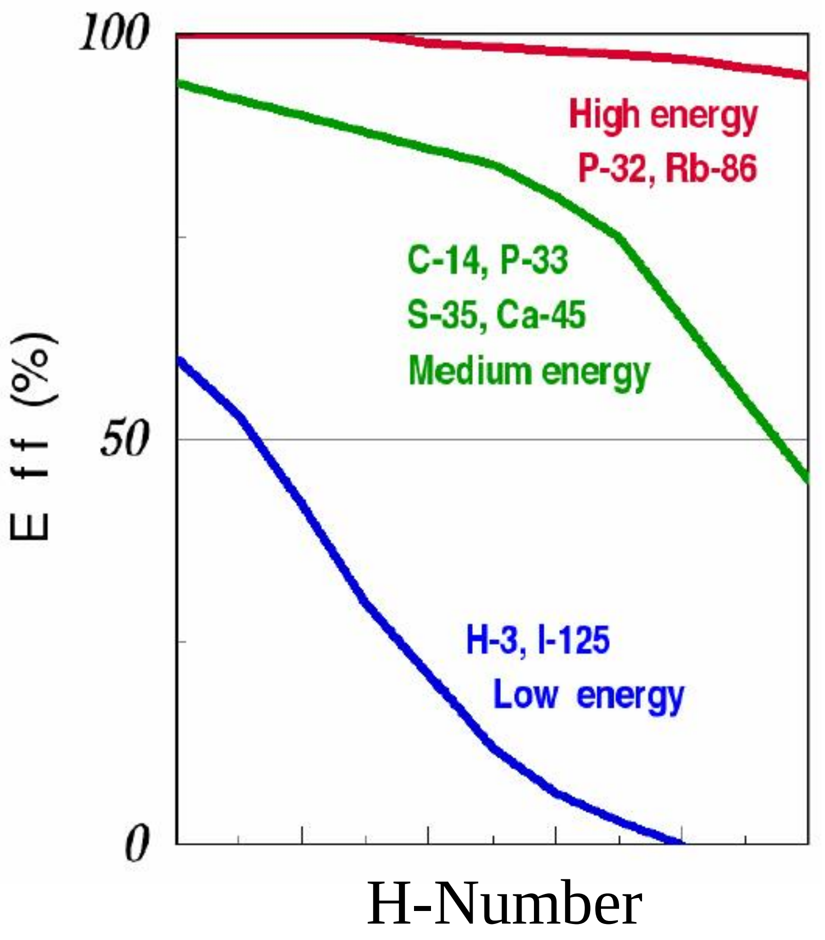


Beckman’s H#

Compton electrons





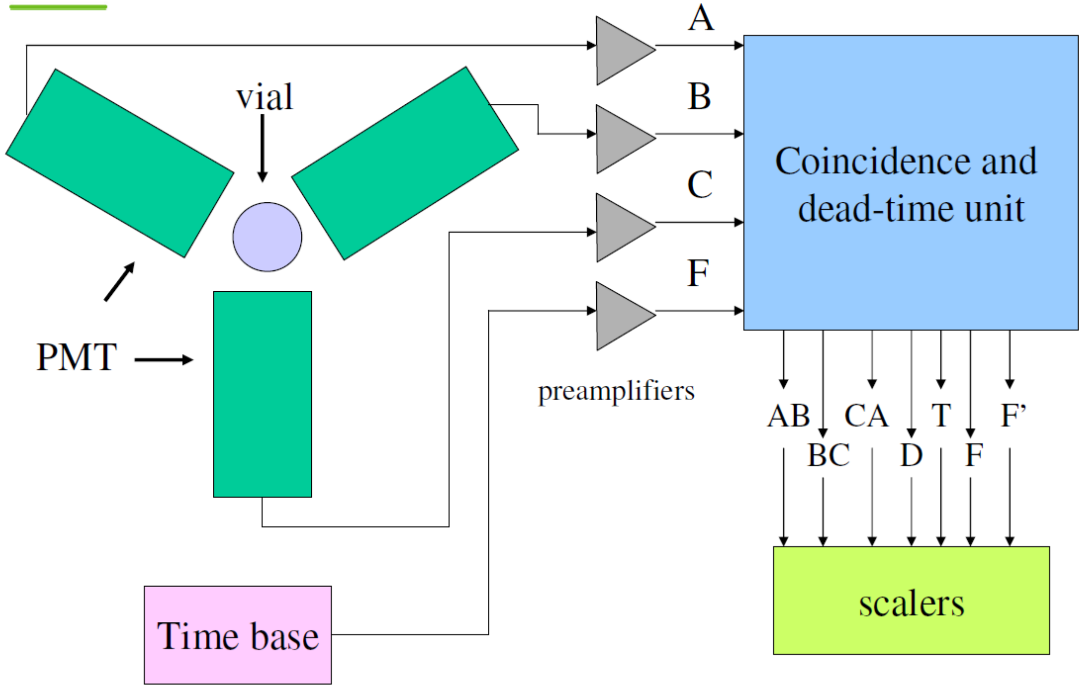


The larger the H number the greater the quenching

Hidex 300 SL

Triple to Double Coincidence Ratio (TDCR) method
(see http://www.nucleide.org/ICRM_LSCWG/icrmtdcr.htm)

$$TDCR = \frac{Triple\ Coincidence}{Double\ Coincidence} = \frac{\int_0^{E_{max}} S(E)(1-e^{-\eta})^3 dE}{\int_0^{E_{max}} S(E)(3(1-e^{-\eta})^2 - 2(1-e^{-\eta})^3) dE}$$



$S(E) \equiv$ Energy spectrum emitted by the radionuclide (known)

$\eta \equiv$ Efficiency of detector, determined numerically