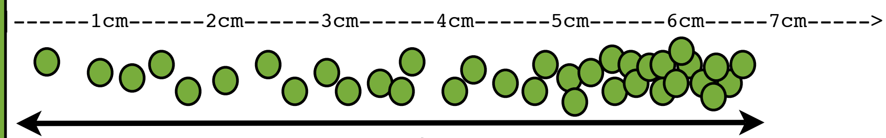
An exercise in droplet counting and dE/dx

This exercise assumes that you've focused the camera well enough to *count droplet densities.* If not, then you can substitute a fuzzier measure ("Greyscale value at center of track", for example) if you think it's proportional to droplet density.

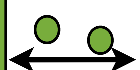
Here is a cartoon track with a countable number of droplets.



note total range: 6.8 +/- 0.1 cm

1) Using the ASTAR database: what energy alpha is expected to have a 6.8cm range? (Suppose the answer is 6000 keV)
2) Using the ASTAR database, what energy alpha is expected to have a range 1cm shorter, i.e. 5.8cm? (Suppose the answer is 5500 keV.)

That means the last 5.8cm of track is the last 5500 keV of the original 6000 ...

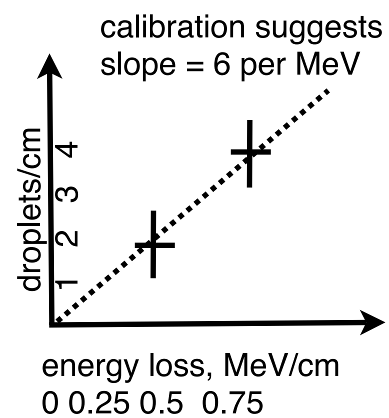


... which implies that the alpha lost 500 keV of energy in its first cm of travel. Note that this 500keV deposit led to 2 fog droplets.

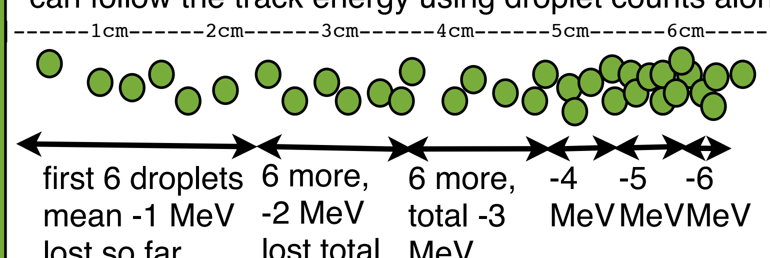
2) Using the ASTAR database, what energy alpha is expected to have a range 1cm shorter, say 4.8cm? (Suppose the answer is: 4700 keV.)

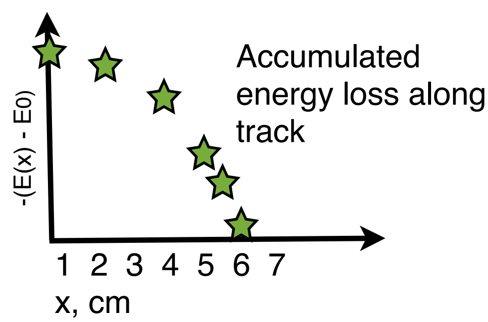
That means the last 4.8cm of track is the last 4700 keV of the original 6000.

Which further implies that the alpha lost 800 keV of energy in its second cm of travel. Note that this 800keV deposit led to 4 fog droplets. You may begin graphing "droplet density" vs. "energy deposit"---that calibrates droplets per energy loss.



3) Suppose your "calibration" tells you that on average there are 6 droplets per MeV of energy loss. Now, you can follow the track energy using droplet counts alone:





Various combinations of such measures can give you E(x), or dE/dx vs. x (the "Bragg curve"), or dE/dx vs. E (the "Bethe-Bloch energy loss")