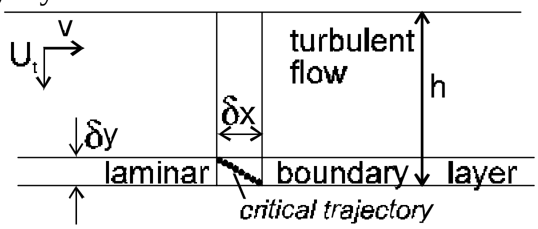
The flow through the chamber is turbulent but we can assume that the particles are deposited at their terminal velocity within the laminar boundary layer.

This is illustrated by the accompanying figure, that represents the flow on one of the tray surfaces. The critical particle trajectory approach (residence times horizontally and vertically are equal) may still be employed, but the analysis has to be restricted to the laminar boundary layer.



The following symbols are used on the figure: v is the horizontal gas and particle velocity, U_t is the terminal particle velocity and h is the channel height.

i) Using the critical particle trajectory approach the boundary layer height (δy) is:

a: δx **b:** $\frac{U_t}{v}\delta x$ c: $\frac{v}{U_t}$ d: $\frac{v}{U_t}\delta x$

ii) The most appropriate equation for the fractional volume inside the laminar layer compared to the total volume of the flow channel is - where W is the channel width is:

a: $\frac{\delta y \delta x W}{h \delta x W}$ b: $\frac{\delta y}{h}$ c: $\frac{v}{U_t}\frac{\delta x}{h}$ **d:** $\frac{U_t}{v}\frac{\delta x}{h}$

Note that the answers to parts (i) and (ii) could be written as differentials due to the linear relation between δy and δx inherent in the critical particle trajectory model. You will need to integrate the differentials in the following part.

iii) Using N for the number of particles, the fractional number of particles removed in δx is $-dN/N$, equate this with the fractional volume given in part (ii), and write down the equation for the number of particles left in suspension at a distance L down the channel.

Ans: $N=N_o \exp(-U_t L/Vh)$

iv) The fractional number of particles still in suspension at distance L is N/N_O, hence the fractional particle **REMOVAL** or efficiency (η) is:

Ans: $\eta = 1 - N/N_o = 1-\exp(-U_t L/Vh)$

where N_O is the initial number of particles at $L=0$.