Adrian deCola 9/7/21

Lab 0 Part B

don't care about sig figs*

$\boxed{1.8}$ $\boxed{ii}$ $N = N_0 \exp(-x/\lambda)$

$N_0 = 1000 \pm 5\cdot 10^6$

$x = 1.00 \pm .01\,m$

$\lambda = 0.25 \pm .06\,m$

$N_{best} = 1000 \cdot \exp\left(\frac{-1}{.25}\right)\cdot 10^6$

$= 1000 \exp(-4) \cdot 10^6$

$= 18.3156\ldots \cdot 10^6$ particles

$\sigma_N^2 = \sum_i \left(\frac{\partial N}{\partial P_i}\right)^2 \sigma_{P_i}^2 \qquad P_1 = N_0 \quad P_2 = x \quad P_3 = \lambda$

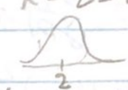
$\frac{\partial N}{\partial N_0} = \exp\left(-\frac{x}{\lambda}\right)$

$\frac{\partial N}{\partial x} = \frac{-N_0}{\lambda}\exp\left(-\frac{x}{\lambda}\right)$

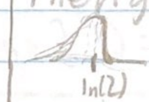
$\frac{\partial N}{\partial \lambda} = N_0 \exp\left(\frac{-x}{\lambda}\right)(-x)\left(-\frac{1}{\lambda^2}\right)$

$= \frac{N_0 x}{\lambda^2}\exp\left(\frac{-x}{\lambda}\right)$

Could the way these numbers play into the equation change our best result? For example, $y = \ln(x)$ if $x = 2 \pm .5$



since the log will essentially squish the gaussian from the right...



We might want define a new best result due to the fatter tail on the left

$\sigma_N^2 = \left(\exp\left(\frac{-1}{.25}\right)5\cdot 10^6\right)^2 + \left(\frac{-10^9}{.25}\exp\left(\frac{-1}{.25}\right)(.01)\right)^2 + \left(10^9\frac{1}{.25^2}\exp\left(\frac{-1}{.25}\right)(.06)\right)^2$

$= 3.097\ldots \cdot 10^{14}$

$\sigma_N = \sqrt{3.097\ldots\cdot 10^{14}} = 1.7\cdot 10^7 \approx 2\cdot 10^7$ *1 sig fig*

$\boxed{N = (2 \pm 2)\cdot 10^7 \text{ particles}}$