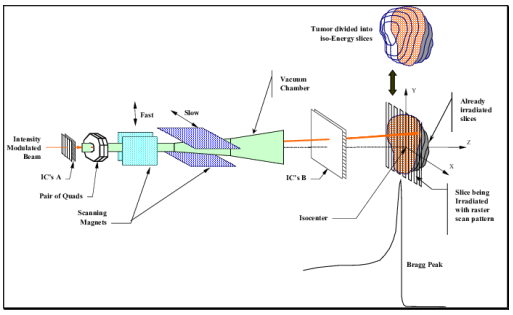
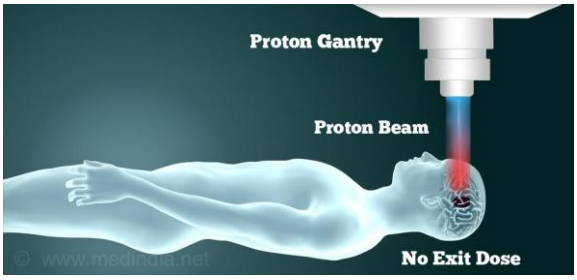
Hand-In Problem 6: Ph 213

Proton therapy is a relatively new way to treat some types of tumors. In proton therapy protons are accelerated to high speeds and then bombarded into cancerous cells.

A cylindrical beam of protons is aimed at a cancerous tumor. The beam current is non-uniform in both space and time and can be described by the current density function $J(r,t)=a(r^2-b)t^3$. One pulse of protons lasts for about 3.0ms.

a. What units should the variables a and b have in the above equation in order for the units to work out in SI units?
b. What is the current in in the beam at t=3ms?
c. If the beam is 1.73mm in radius, how many protons are delivered to the tumor after 3ms?
   ($b = 2.34\cdot10^{-6}$, and $a = 5.67\cdot10^{17}$, both in standard units)
d. Each proton is traveling at $1.00\cdot10^{8}$m/s. Neglecting relativity, how much energy is delivered to the tumor in those 3ms.





Note that I will put the solution up for this HIP on Saturday on the course website.