QUIZ-5 **11-10-05**

A beam of energy 500MeV protons with intensity Io = 2e6/s is incident on a thin slab of $^{27}Al_{13}$ (ρ=2.7 g/cm^3) of thickness z = 2cm. The interaction cross section for protons in Al is σ = 21b. (1 b =10^{-24} cm^2)

What is the beam intensity emerging from the slab? I = _____ 1/s

$n = \rho N_A/A = (2.7)\ (\ 6.02\text{x}10^{23}\ ) / 27 = 6.02\text{x}10^{22}$ atoms/cm^3

$I = Io \exp[- n \sigma z] = (2e6/s) \exp[-(6.02\text{x}10^{22}\ \text{atoms/cm}^3)\ (21 \text{ x } 10^{-24}\ \text{cm}^2\ )\ (\ 2\text{cm})]$

$I = (2e6/s) \exp\{-2.53) = 1.6e5\ /s$

What power from the beam is released in to the slab? P = _____ W

P = Eo (Io- I) = 500MeV (2.0-0.16)e6 = 9.20 e14 eV/s = 1.47e-4W