41. (a) The charge q that flows past any cross section of the beam in time Δt is given by $q = i\,\Delta t$, and the number of electrons is $N = q/e = (i/e)\,\Delta t$. This is the number of electrons that are accelerated. Thus

$$N = \frac{(0.50\,\text{A})(0.10 \times 10^{-6}\,\text{s})}{1.60 \times 10^{-19}\,\text{C}} = 3.1 \times 10^{11} \ .$$

(b) Over a long time t the total charge is $Q = nqt$, where n is the number of pulses per unit time and q is the charge in one pulse. The average current is given by $i_{\text{avg}} = Q/t = nq$. Now $q = i\,\Delta t = (0.50\,\text{A})(0.10 \times 10^{-6}\,\text{s}) = 5.0 \times 10^{-8}\,\text{C}$, so

$$i_{\text{avg}} = (500/\text{s})(5.0 \times 10^{-8}\,\text{C}) = 2.5 \times 10^{-5}\ \text{A} \ .$$

(c) The accelerating potential difference is $V = K/e$, where K is the final kinetic energy of an electron. Since $K = 50\,\text{MeV}$, the accelerating potential is $V = 50\,\text{kV} = 5.0 \times 10^{7}\,\text{V}$. During a pulse the power output is

$$P = iV = (0.50\,\text{A})(5.0 \times 10^{7}\,\text{V}) = 2.5 \times 10^{7}\ \text{W} \ .$$

This is the peak power. The average power is

$$P_{\text{avg}} = i_{\text{avg}}V = (2.5 \times 10^{-5}\,\text{A})(5.0 \times 10^{7}\,\text{V}) = 1.3 \times 10^{3}\ \text{W} \ .$$