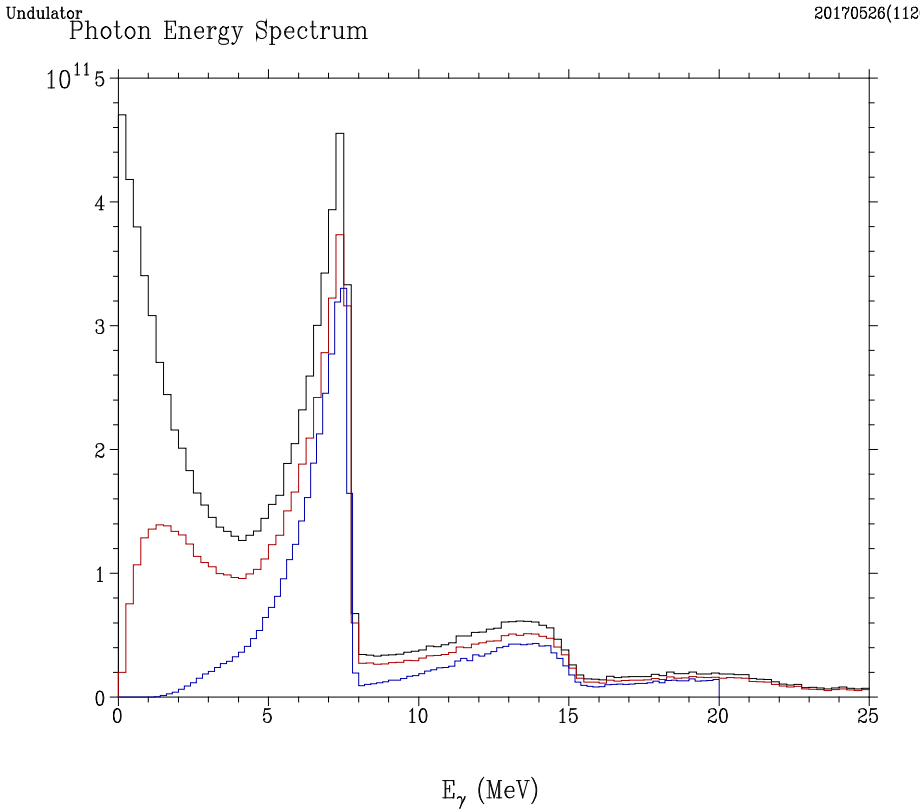
Exercise (ILC Introduction)

- Undulator scheme requires very high energy electron to create positron
- Radiation from a helical undulator has a photon energy spectrum as shown.
- The wavelength of the first harmonics is

$$\lambda = \frac{\lambda_w}{2\gamma^2}\left(1 + K^2\right)$$

- λ_w : wiggler pitch
- γ : electron Lorentz factor
- K : wiggler parameter



- ILC adopts λ_w=11.5mm, K=0.92 with electron energy 125GeV
- Problems
  - Calculate λ
  - Convert it to the photon energy

Answer

- $\gamma = 125/0.511\text{x}10^{-3} = 2.446\text{x}10^{5}$
- $\lambda = \frac{11.5\times10^{-3}}{2\times(2.446\times10^{5})^{2}} \times (1 + 0.92^{2}) = 1.775 \times 10^{-13}$ m
- Energy E_γ is proportional to $1/\lambda$
- Compton wavelength $2.4\text{x}10^{-12}$ m corresponds to the electron mass 0.511MeV
- So, $E_\gamma = 0.511 \text{ x } (2.4\text{x}10^{-12}/1.775\text{x}10^{-13}) =$ 6.9 MeV
- Note: the plot in the previous page is slightly different because K=0.85