Transition Radiation – Basics

"Transition radiation is omitted whenever a charged particle crosses an interface between two media with different dielectric functions." — L. Durand, Phys. Rev. D 11, 89 (1975)

$$\left(\frac{\mathrm{d}W}{\mathrm{d}\omega}\right)_{interface} = \frac{\alpha}{\pi}\left(\frac{\xi_1^2+\xi_2^2+2\gamma^{-2}}{\xi_1^2-\xi_2^2}\ln\frac{\gamma^{-2}+\xi_1^2}{\gamma^{-2}+\xi_2^2}-2\right)$$

for : $\gamma \gg 1; \quad \xi_1^2, \xi_2^2 \ll 1; \quad \theta \ll 1 \ (\theta \sim 1/\gamma)$

$\xi^2 = \omega_P^2/\omega^2 = 1-\epsilon(\omega)$

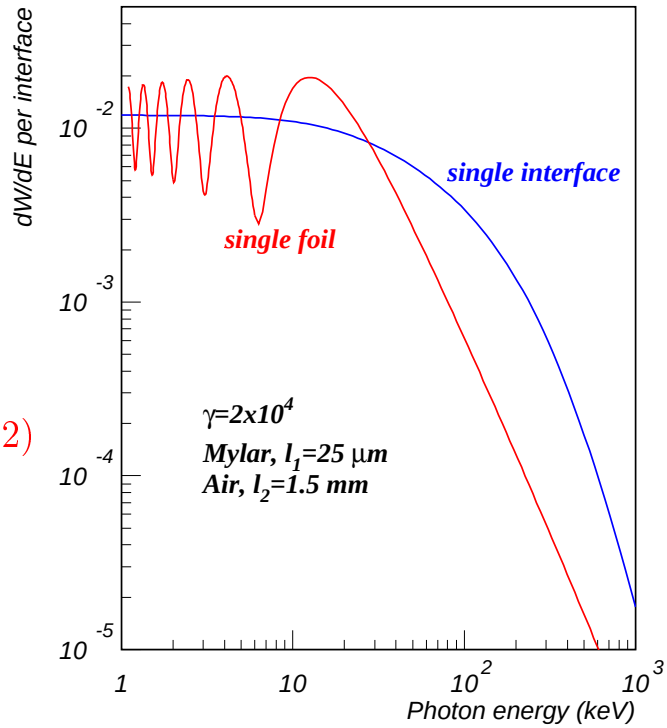
ω_P =plasma frequency

$\omega_P^{CH_2} = 20\mathrm{eV}$; $\omega_P^{Air} = 0.7$ eV

$$\left(\frac{\mathrm{d}^2W}{\mathrm{d}\omega\mathrm{d}\Omega}\right)_{foil} = \left(\frac{\mathrm{d}^2W}{\mathrm{d}\omega\mathrm{d}\Omega}\right)_{interface} \times 4\sin^2(\phi_1/2)$$

Ginzburg & Frank, 1946; Garibian, 1958

TR frequency spectrum without absorption



Average number of produced photons