1)

$$\boxed{z_d = M_{311}\, z^* + M_{312}\, \theta_3^*}$$

where
$$\begin{cases} M_{311} = \sqrt{\dfrac{\beta_3^*}{\beta_{3d}}} \left[\cos(\phi_{3d} - \phi_3^*) + \alpha_3^* \sin(\phi_{3d} - \phi_3^*) \right] \\ M_{312} = \sqrt{\beta_{3d}\,\beta_3^*} \quad \sin(\phi_{3d} - \phi_3^*) \end{cases}$$

$$\boxed{M_{311} = 0} \quad \begin{cases} \boxed{(\phi_{3d} - \phi_3^*) = \pi/2,\ 3\pi/2 \ \ldots} \\ \boxed{\alpha_3^* = 0} \quad \text{or} \quad \alpha_3^* \ll \dfrac{\beta_{3d}\,\theta_3^*}{\sigma_3^*} = 0.4 \end{cases}$$

In these conditions $M_{3,12} = L_{3\,eff}$

2) a).

$$\boxed{\theta_{3,d} = K \sqrt{\frac{\epsilon_3}{\beta_3^*}}}$$

Useful values for $\theta_{3,min} \simeq \sqrt{2}\, \theta_{3,d}$

Assuming: $K = 15$, $\epsilon_3 = 50 \times 10^{-10}$ m rad and
$\theta_{3min} \simeq 14\ \mu$rad $(|t_{3min}| = 10^{-2}\ \text{GeV}^2)$

$$\boxed{\beta_3^* \geq 1100\,\text{m}}$$

b).

$$\boxed{L_{3,eff}\ \theta_{3,d} \geq z_{d,min} = 1.5\,\text{mm}}$$

Assuming the same conditions:

$$\boxed{\beta_{3,d} \geq 20\,\text{m}}$$