$$F(r,z) = \begin{cases} (const_1\, r + const_2)\, e^{-\frac{z}{z_s}} & \text{for } r \le r_{in} \\ A_0\, e^{-\frac{r}{\lambda_s}}\, e^{-\frac{z}{z_s}} & \text{for } r \ge r_{in} \end{cases}$$

$$F(r_{in}, z) = (const_1\, r_{in} + const_2)\, e^{-\frac{z}{z_s}} = A_0\, e^{-\frac{r_{in}}{\lambda_s}}\, e^{-\frac{z}{z_s}}$$

$$const_1 = \frac{A_0\, e^{-\frac{r_{in}}{\lambda_s}} - const_2}{r_{in}}$$

for $r < r_{in}$

$$F(r,z) = \left(\frac{A_0\, e^{-\frac{r_{in}}{\lambda_s}} - const_2}{r_{in}} \cdot r + const_2 \right) e^{-\frac{z}{z_s}}$$

$$F(r,z) = \begin{cases} \left[A_0 \frac{r}{r_{in}}\, e^{-\frac{r_{in}}{\lambda_s}} + const_2 \left(1 - \frac{r}{r_{in}}\right) \right] e^{-\frac{z}{z_s}} & r < r_{in} \\ A_0\, e^{-\frac{r}{\lambda_s}}\, e^{-\frac{z}{z_s}} & r > r_{in} \end{cases}$$

$$const_2 = \chi A_0 e^{-\frac{r_{in}}{\lambda_s}}$$

$r < r_{in}$

$$F(r,z) = \left[A_0 \frac{r}{r_{in}} e^{-\frac{r_{in}}{\lambda_s}} + \chi A_0 e^{-\frac{r_{in}}{\lambda_s}} \left(1 - \frac{r}{r_{in}}\right) \right] e^{-\frac{z}{z_s}}$$

$$F(r,z) = A_0 \left[\frac{r}{r_{in}} (1-\chi) + \chi \right] e^{-\frac{r_{in}}{\lambda_s}} e^{-\frac{z}{z_s}}$$

$$F(r,z) = \begin{cases} A_0 \left[\frac{r}{r_{in}} (1-\chi) + \chi \right] e^{-\frac{r_{in}}{\lambda_s}} e^{-\frac{z}{z_s}} & r < r_{in} \\ A_0 e^{-\frac{r}{\lambda_s}} e^{-\frac{z}{z_s}} & r > r_{in} \end{cases}$$

$$I = 4\pi \int_0^{r_{in}} \int_0^{z_0} (const_1 \, r + const_2) e^{-\frac{z}{z_s}} r \, dr \, dz +$$

$$+ 4\pi \int_{r_{in}}^{r_0} \int_0^{z_0} A_0 e^{-\frac{r}{l_s}} e^{-\frac{z}{z_s}} r \, dr \, dz = I_1 + I_2$$

$$I_1 = \left(\frac{4\pi}{3} const_1 \cdot r_{in}^3 + 2\pi const_2 \cdot r_{in}^2 \right) z_s \left(1 - e^{-\frac{z_0}{z_s}}\right)$$

$$const_1 = \frac{A_0 e^{-\frac{r_{in}}{l_s}} - const_2}{r_{in}}$$

$$I_1 = \left(\frac{4\pi}{3} \frac{A_0 e^{-\frac{r_{in}}{l_s}} - const_2}{r_{in}} \cdot r_{in}^3 + 2\pi const_2 \cdot r_{in}^2 \right) z_s \left(1 - e^{-\frac{z_0}{z_s}}\right)$$

$$I_1 = \left[\frac{4\pi}{3} A_0 e^{-\frac{r_{in}}{l_s}} \cdot r_{in}^2 + \left(2\pi - \frac{4\pi}{3}\right) const_2 \cdot r_{in}^2 \right] z_s \left(1 - e^{-\frac{z_0}{z_s}}\right)$$

$$const_2 = \chi A_0 e^{-\frac{r_{in}}{l_s}}$$

$$I_1 = \left(\frac{4\pi}{3} A_0 e^{-\frac{r_{in}}{l_s}} r_{in}^2 + \frac{2\pi}{3} \chi A_0 e^{-\frac{r_{in}}{l_s}} \cdot r_{in}^2 \right) z_s \left(1 - e^{-\frac{z_0}{z_s}}\right)$$

$$I_1 = \frac{4\pi}{3} A_0 \left(1 + \frac{\chi}{2}\right) r_{in}^2 z_s e^{-\frac{r_{in}}{l_s}} \left(1 - e^{-\frac{z_0}{z_s}}\right)$$

$$I_2 = 4\pi z_s l_s^2 A_0 \left(1 - e^{-\frac{z_0}{z_s}}\right) \left(e^{-\frac{r_{in}}{l_s}} - e^{-\frac{r_0}{l_s}} + \frac{r_{in}}{l_s} e^{-\frac{r_{in}}{l_s}} - \frac{r_0}{l_s} e^{-\frac{r_0}{l_s}} \right)$$