New counter terms at order $\hbar^N$

$$F^0_{\mu\nu} = \partial_\mu A^0_\nu - \partial_\nu A^0_\mu + [A^0_\mu, A^0_\nu]$$

$$= \sqrt{Z_A}\left(\partial_\mu A_\nu - \partial_\nu A_\mu + \sqrt{Z_A}[A_\mu, A_\nu]\right)$$

$$= \sqrt{Z_A}\left(F_{\mu\nu} + (\sqrt{Z_A} - 1)[A_\mu, A_\nu]\right)$$

- $$\frac{1}{e_0^2}(F^0_{\mu\nu})^2 = \frac{Z_A}{e_0^2}\left(F_{\mu\nu} + (\sqrt{Z_A}-1)[A_\mu, A_\nu]\right)^2$$

$$\begin{cases} \sqrt{Z_A} = \sqrt{Z_A}_{\,old} + \hbar^N \sqrt{Z_A}^{(N)}_{new} + O(\hbar^{N+1}), \\ \dfrac{Z_A}{e_0^2} = \left(\dfrac{Z_A}{e_0^2}\right)_{old} + \hbar^N \left(\dfrac{Z_A}{e_0^2}\right)^{(N)}_{new} + O(\hbar^{N+1}), \end{cases}$$

$$= \text{old}$$

$$+ \hbar^N \left(\frac{Z_A}{e_0^2}\right)^{(N)}_{new} F_{\mu\nu}^2 + \hbar^N \frac{1}{e^2} \sqrt{Z_A}^{(N)}_{new} F_{\mu\nu} \cdot [A_\mu, A_\nu]$$

$$+ O(\hbar^{N+1}).$$

$$\bar\psi_0 \not{D}_{A_0} \psi_0 = Z_\psi \bar\psi (\not\partial + \sqrt{Z_A} \not{A}) \psi$$

$$= Z_\psi \bar\psi \not{D} \psi + Z_\psi (\sqrt{Z_A} - 1) \bar\psi \not{A} \psi$$

$$\begin{cases} Z_\psi = Z_{\psi\,\text{old}} + \hbar^N Z_{\psi\,\text{new}}^{(N)}, \\ \sqrt{Z_A} = \sqrt{Z_A}_{\,\text{old}} + \hbar^N \sqrt{Z_A}^{(N)}_{\,\text{new}} + O(\hbar^{N+1}). \end{cases}$$

$$= \text{old} + \hbar^N Z_{\psi\,\text{new}}^{(N)} \bar\psi \not{D} \psi + \hbar^N \sqrt{Z_A}^{(N)}_{\,\text{new}} \bar\psi \not{A} \psi + O(\hbar^{N+1}).$$

$$\bar\psi_0 m_0 \psi_0 = \bar\psi Z_\psi m \psi$$

$$\left[Z_\psi m_0 = (Z_\psi m_0)_{\text{old}} + \hbar^N (Z_\psi m_0)^{(N)}_{\text{new}} + O(\hbar^{N+1}) \right.$$

$$= \text{old} + \hbar^N \bar\psi (Z_\psi m_0)^{(N)}_{\text{new}} \psi + O(\hbar^{N+1}).$$

$$\bar{c}_0 \partial^\mu D^0_\mu c_0 = Z_c \bar{c} \partial^\mu (\partial_\mu c + \sqrt{Z_A} [A_\mu, c])$$

$$\begin{cases} Z_c = Z_{c\,\text{old}} + \hbar^N Z_{c\,\text{new}}^{(N)}, \\ \sqrt{Z_A} = \sqrt{Z_A}_{\,\text{old}} + \hbar^N \sqrt{Z_A}^{(N)}_{\,\text{new}} + O(\hbar^{N+1}). \end{cases}$$

$$= \text{old}$$

$$+ \hbar^N \bar{c} \partial^\mu \left(Z_{c\,\text{new}}^{(N)} \partial_\mu c + (Z_{c\,\text{new}}^{(N)} + \sqrt{Z_A}^{(N)}_{\,\text{new}}) [A_\mu, c] \right) + O(\hbar^{N+1}).$$

$$\bullet\ K_0^\mu D^0_\mu c_0 \overset{Z_{K^\mu} = Z_c}{=} Z_c K^\mu\left(\partial_\mu c + \sqrt{Z_A}\,[A_\mu, c]\right)$$

$$\overset{\text{same as above}}{=} \text{old}$$

$$+ \hbar^N K^\mu\left(Z^{(N)}_{c\,\text{now}} \partial_\mu c + \left(Z^{(N)}_{c\,\text{new}} + \sqrt{Z_A}^{(N)}_{\text{new}}\right)[A_\mu, c]\right) + O(\hbar^{N+1}).$$

$$\bullet\ K_0^\psi c_0 \psi_0 = \underbrace{\sqrt{Z_{K^\psi}}\sqrt{Z_c}\sqrt{Z_\psi}}_{\sqrt{Z_A}\, Z_c} K^\psi c \psi$$

$$Z_{K^\psi} Z_\psi = \# = Z_A Z_c$$

$$\overset{\text{same as above}}{=} \text{old} + \hbar^N\left(\sqrt{Z_A}^{(N)}_{\text{new}} + Z^{(N)}_{c\,\text{new}}\right) K^\psi c \psi + O(\hbar^{N+1}).$$

$$\bullet\ K_0^c \cdot [c_0, c_0] = \underbrace{\sqrt{Z_{K^c}}\, Z_c}_{\sqrt{Z_A}\, Z_c} K^c \cdot [c, c]$$

$$Z_{K^c} Z_c = \# = Z_A Z_c$$

$$\overset{\text{same as above}}{=} \text{old} + \hbar^N\left(\sqrt{Z_A}^{(N)}_{\text{new}} + Z^{(N)}_{c\,\text{new}}\right) K^c \cdot [c, c] + O(\hbar^{N+1}).$$