Here $\widehat{x}$, $\widehat{y}$, and $\widehat{z}$ are orthogonal unit vectors defined as follows:

$\widehat{z}$	is along the e momentum
$\widehat{y} = [\widehat{z} \times \vec{P}_\mu]/\lvert[\widehat{z} \times \vec{P}_\mu]\rvert$	is transverse to the e momentum and perpendicular to the "decay plane"
$\widehat{x} = \widehat{y} \times \widehat{z}$	is transverse to the e momentum and in the "decay plane."

The components of $\vec{P}_e$ then are given by

$$P_{T_1}(x,\theta) = P_\mu \sin\theta\, F_{T_1}(x) \Big/ \Big(F_{IS}(x) \pm P_\mu \cos\theta\, F_{AS}(x)\Big)$$

$$P_{T_2}(x,\theta) = P_\mu \sin\theta\, F_{T_2}(x) \Big/ \Big(F_{IS}(x) \pm P_\mu \cos\theta\, F_{AS}(x)\Big)$$

$$P_L(x,\theta) = \pm F_{IP}(x) + P_\mu \cos\theta \times F_{AP}(x) \Big/ \Big(F_{IS}(x) \pm P_\mu \cos\theta\, F_{AS}(x)\Big) ,$$

where

$$F_{T_1}(x) = \tfrac{1}{12}\Big\{ -2\Big[\xi'' + 12(\rho - \tfrac{3}{4})\Big](1-x)x_0 - 3\eta(x^2 - x_0^2) + \eta''(-3x^2 + 4x - x_0^2)\Big\}$$

$$F_{T_2}(x) = \tfrac{1}{3}\sqrt{x^2 - x_0^2}\,\Big\{ 3\frac{\alpha'}{A}(1-x) + 2\frac{\beta'}{A}\sqrt{1-x_0^2}\Big\}$$

$$F_{IP}(x) = \tfrac{1}{54}\sqrt{x^2 - x_0^2}\,\Big\{ 9\xi'\Big(-2x + 2 + \sqrt{1-x_0^2}\Big) + 4\xi(\delta - \tfrac{3}{4})\Big(4x - 4 + \sqrt{1-x_0^2}\Big)\Big\}$$

$$F_{AP}(x) = \tfrac{1}{6}\Big\{ \xi''(2x^2 - x - x_0^2) + 4(\rho - \tfrac{3}{4})(4x^2 - 3x - x_0^2) + 2\eta''(1-x)x_0 \Big\} .$$

For the experimental values of the decay parameters ρ, ξ, ξ', ξ'', δ, η, η'', α/A, β/A, α'/A, β'/A, which are not all independent, see the Data Listings below. Experiments in the past have also been analyzed using the parameters a, b, c, a', b', c', α/A, β/A, α'/A, β'/A (and $\eta = (\alpha - 2\beta)/2A$), as defined by Kinoshita and Sirlin [8]. They serve as a model-independent summary of all possible measurements on the decay electron (see Listings below). The relations between the two sets of parameters are

$$\rho - \frac{3}{4} = \frac{3}{4}(-a + 2c)/A ,$$

$$\eta = (\alpha - 2\beta)/A ,$$

$$\eta'' = (3\alpha + 2\beta)/A ,$$

$$\delta - \frac{3}{4} = \frac{9}{4} \cdot \frac{(a' - 2c')/A}{1 - [a + 3a' + 4(b + b') + 6c - 14c']/A} ,$$

$$1 - \xi\frac{\delta}{\rho} = 4\frac{[(b+b') + 2(c - c')]/A}{1 - (a - 2c)/A} ,$$

$$1 - \xi' = [(a + a') + 4(b + b') + 6(c + c')]/A ,$$

$$1 - \xi'' = (-2a + 20c)/A ,$$

where

$$A = a + 4b + 6c .$$

The relations to the coupling constants are:

$$a = 16(|g^V_{RL}|^2 + |g^V_{LR}|^2) + |g^S_{RL} + 6g^T_{RL}|^2 + |g^S_{LR} + 6g^T_{LR}|^2 ,$$

$$a' = 16(|g^V_{RL}|^2 - |g^V_{LR}|^2) + |g^S_{RL} + 6g^T_{RL}|^2 - |g^S_{LR} + 6g^T_{LR}|^2 ,$$

$$\alpha = 8\,\mathrm{Re}\Big[g^V_{RL}(g^S_{LR} + 6g^T_{LR})^* + g^V_{LR}(g^S_{RL} + 6g^T_{RL})^*\Big] ,$$

$$\alpha' = 8\,\mathrm{Im}\Big[-g^V_{LR}(g^S_{RL} + 6g^T_{RL})^* - g^V_{RL}(g^S_{LR} + 6g^T_{LR})^*\Big] ,$$

$$b = 4(|g^V_{RR}|^2 + |g^V_{LL}|^2) + |g^S_{RR}|^2 + |g^S_{LL}|^2 ,$$

$$b' = 4(|g^V_{RR}|^2 - |g^V_{LL}|^2) + |g^S_{RR}|^2 - |g^S_{LL}|^2 ,$$

$$\beta = -4\,\mathrm{Re}\Big[g^V_{RR}(g^S_{LL})^* + g^V_{LL}(g^S_{RR})^*\Big] ,$$

$$\beta' = 4\,\mathrm{Im}\Big[g^V_{RR}(g^S_{LL})^* - g^V_{LL}(g^S_{RR})^*\Big] ,$$

$$c = \tfrac{1}{2}\Big[|g^S_{RL} - 2g^T_{RL}|^2 + |g^S_{LR} - 2g^T_{LR}|^2\Big] ,$$

$$c' = \tfrac{1}{2}\Big[|g^S_{RL} - 2g^T_{RL}|^2 - |g^S_{LR} - 2g^T_{LR}|^2\Big] .$$

If also the electron mass is neglected, the energy and angular distribution of the electron in the rest frame of a polarized muon ($\mu^\mp$) is given by the Michel spectrum:

$$d^2\Gamma \sim \Big\{ 3(1-x) + \frac{2\rho}{3}(4x - 3) \mp \xi\,\cos\theta[1 - x + \frac{2\delta}{3}(4x-3)]\Big\}\, x^2 dx\, d(\cos\theta) .$$

Here θ is the angle between the electron momentum and the muon spin, and $x \equiv 2E_e/m_\mu$. For pure V–A coupling, we obtain $\rho = \xi\delta = 3/4$, $\xi = 1$, and the differential decay rate is

$$d^2\Gamma = \frac{G_F^2 m_\mu^5}{192\pi^3}\,[3 - 2x \pm \cos\theta(1 - 2x)]\, x^2 dx\, d(\cos\theta) .$$

Here the coefficient in front of the square bracket is the total decay rate.

In order to determine the amplitudes $g^\gamma_{\varepsilon\mu}$ uniquely from experiment, Fetscher *et al.* [2] introduced four probabilities $Q_{\varepsilon\mu}(\varepsilon, \mu = R, L)$ for the decay of a μ-handed muon into an ε-handed electron and showed that there exist upper bounds on Q_{RR}, Q_{LR}, and Q_{RL}, and a lower bound on Q_{LL}. These probabilities are given in terms of the $g^\gamma_{\varepsilon\mu}$'s by

$$Q_{\varepsilon\mu} = \frac{1}{4}|g^S_{\varepsilon\mu}|^2 + |g^V_{\varepsilon\mu}|^2 + 3(1 - \delta_{\varepsilon\mu})|g^T_{\varepsilon\mu}|^2 , \tag{2}$$

where $\delta_{\varepsilon\mu} = 1$ for $\varepsilon = \mu$ and $\delta_{\varepsilon\mu} = 0$ for $\varepsilon \neq \mu$. They are related to the parameters a, b, c, a', b', and c' by

$$Q_{RR} = 2(b + b')/A ,$$

$$Q_{LR} = [(a - a') + 6(c - c')]/2A ,$$

$$Q_{RL} = [(a + a') + 6(c + c')]/2A ,$$

$$Q_{LL} = 2(b - b')/A ,$$