

What Values to Use for the Constants and Couplings?

Deuterium target:

$$A_{PV} = \frac{\sigma_R - \sigma_L}{\sigma_R + \sigma_L} = \left(\frac{G_F Q^2}{2\sqrt{2}\pi\alpha} \right) \left[g_A^e Y_1 \frac{F_1^{YZ}}{F_1^Y} + \frac{g_V^e}{2} Y_3 \frac{F_3^{YZ}}{F_1^Y} \right] = \left(\frac{G_F Q^2}{4\sqrt{2}\pi\alpha} \right) [a_1 Y_1 + a_3 Y_3]$$

Define: $\kappa = \left(\frac{3G_F}{2\sqrt{2}\pi\alpha} \right)$

$\frac{G_F}{(\hbar c)^3} = \frac{\sqrt{2}}{8} \left(\frac{g_W}{M_W} \right)^2 \quad g_W = \frac{g_e}{\sin \theta_W} \quad g_e = \sqrt{4\pi\alpha}$

Rule of Thumb: α , $\sin^2\theta_W$ run, G_F does not.

Q^2	$1/\alpha_{\text{eff}}$	$\sin^2\theta_W$ (eff)	$\hat{s}_Z^2(\bar{MS})$	G_F	κ (ppm/GeV ²)
8315.178 (Z-pole)	128.948	0.23147	0.23115(12) (JE)	1.166370E-5	507.825
1.925	134.196	0.23609	0.23647 (at 1.9?) (JE)	1.1663787(6)E-5 (PDG2012)	528.452
1.125					
0	137.036	0.23804			539.636
Proposal	137.036	0.235		1.166370E-5	539.63

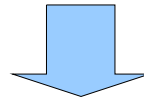
All **red numbers** from PDG2011, but use JE's if available

Differ by 2%!

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with QPM and other assumptions

$$A_d = \left(\frac{3 G_F Q^2}{2\sqrt{2} \pi \alpha} \right) \frac{2C_{1u}[1+R_C(x)] - C_{1d}[1+R_S(x)] + Y(2C_{2u} - C_{2d})R_V(x)}{5 + R_S(x) + 4R_C(x)}$$

$$C_{1u} = -\frac{1}{2} + \frac{4}{3} \sin^2 \theta_w = -0.1852,$$

$$C_{2d} = \frac{1}{2} - \frac{2}{3} \sin^2 \theta_w = 0.3426,$$

$$C_{2u} = -\frac{1}{2} + 2 \sin^2 \theta_w = -0.02782,$$

$$C_{2d} = \frac{1}{2} - 2 \sin^2 \theta_w = 0.02782.$$

OR

$$C_{1u} = \rho_e \left(-\frac{1}{2} + \frac{4}{3} \kappa_e \sin^2 \theta_w \right) + \lambda = -0.1822$$

$$C_{2d} = \rho_e' \left(\frac{1}{2} - \frac{2}{3} \kappa_e' \sin^2 \theta_w \right) - 2 \rho_e' = 0.3380$$

$$C_{2u} = \rho_e \left(-\frac{1}{2} + 2 \kappa_e \sin^2 \theta_w \right) + \rho_u = -0.02551,$$

$$C_{2d} = \rho_e * \left(\frac{1}{2} - 2 \kappa_e \sin^2 \theta_w \right) + \rho_d = 0.01661,$$

$$2C_{1u} - C_{1d} = -0.71304, 2C_{2u} - C_{2d} = -0.08347.$$

$$2C_{1u} - C_{1d} = -0.70232, 2C_{2u} - C_{2d} = -0.06764$$