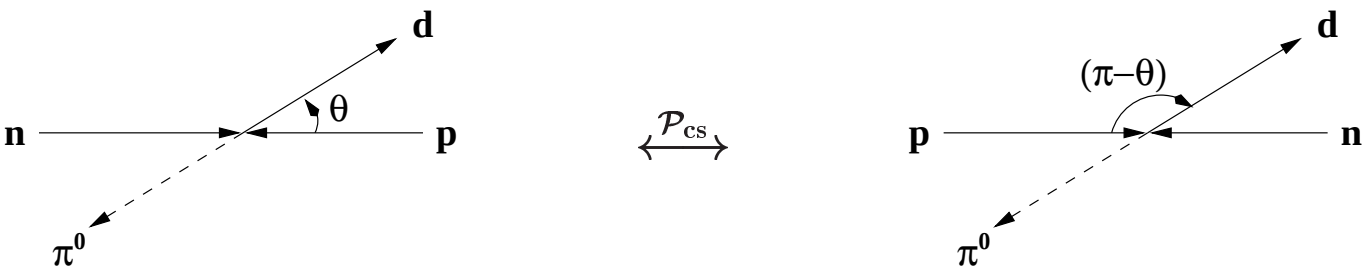
Inelastic np Scattering

$\mathbf{np \to d\pi^0}$



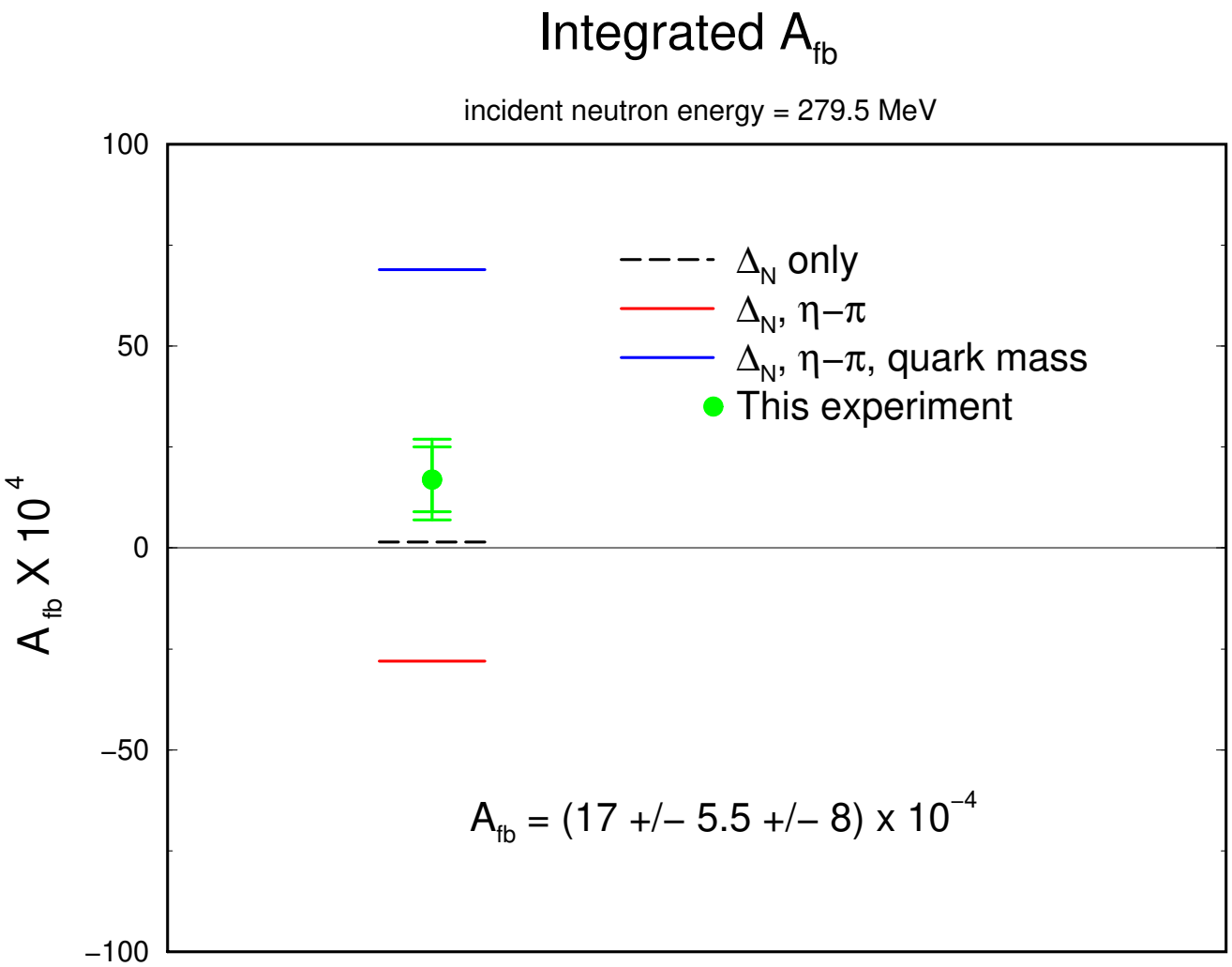
$$A_{fb}(\theta) \equiv \frac{\sigma(\theta)-\sigma(\pi-\theta)}{\sigma(\theta)+\sigma(\pi-\theta)} \text{ in cm}$$

$$A_{fb} \neq 0 \leftrightarrow \text{CSB}$$

Extract A_{fb} from

$$\frac{d\sigma}{d\Omega} = A_0 + A_1 P_1(\theta_{cm}) + A_2 P_2(\theta_{cm})$$

First precision measurement of A_{fb}



$$A_{fb} = -0.28\% \times \left[\frac{g_{\eta NN}\langle \pi^0 | \mathcal{H} | \eta \rangle}{-0.0059 \mathrm{GeV}^2} - \frac{0.87}{\mathrm{MeV}} \left(\delta m_N - \frac{\bar{\delta} m_N}{2} \right) \right]$$

$$\text{assume} \quad \langle \pi^0 | \mathcal{H} | \eta \rangle = -0.0059 \text{ GeV}^2 \quad \text{and} \quad g^2_{\eta NN}/4\pi = 3.68$$

$$\delta m_N = \tfrac{1}{2} \bar{\delta} m_N + 1.85 \text{ MeV} \pm 0.41 \text{ MeV}$$

$$\Delta_N = m_n - m_p = \delta m_N + \bar{\delta} m_N = 1.3 \text{ MeV}$$

$$\delta m_N = 1.66 \pm 0.27 \text{ MeV}$$

$$\bar{\delta} m_N = -0.36 \pm 0.27 \text{ MeV}$$