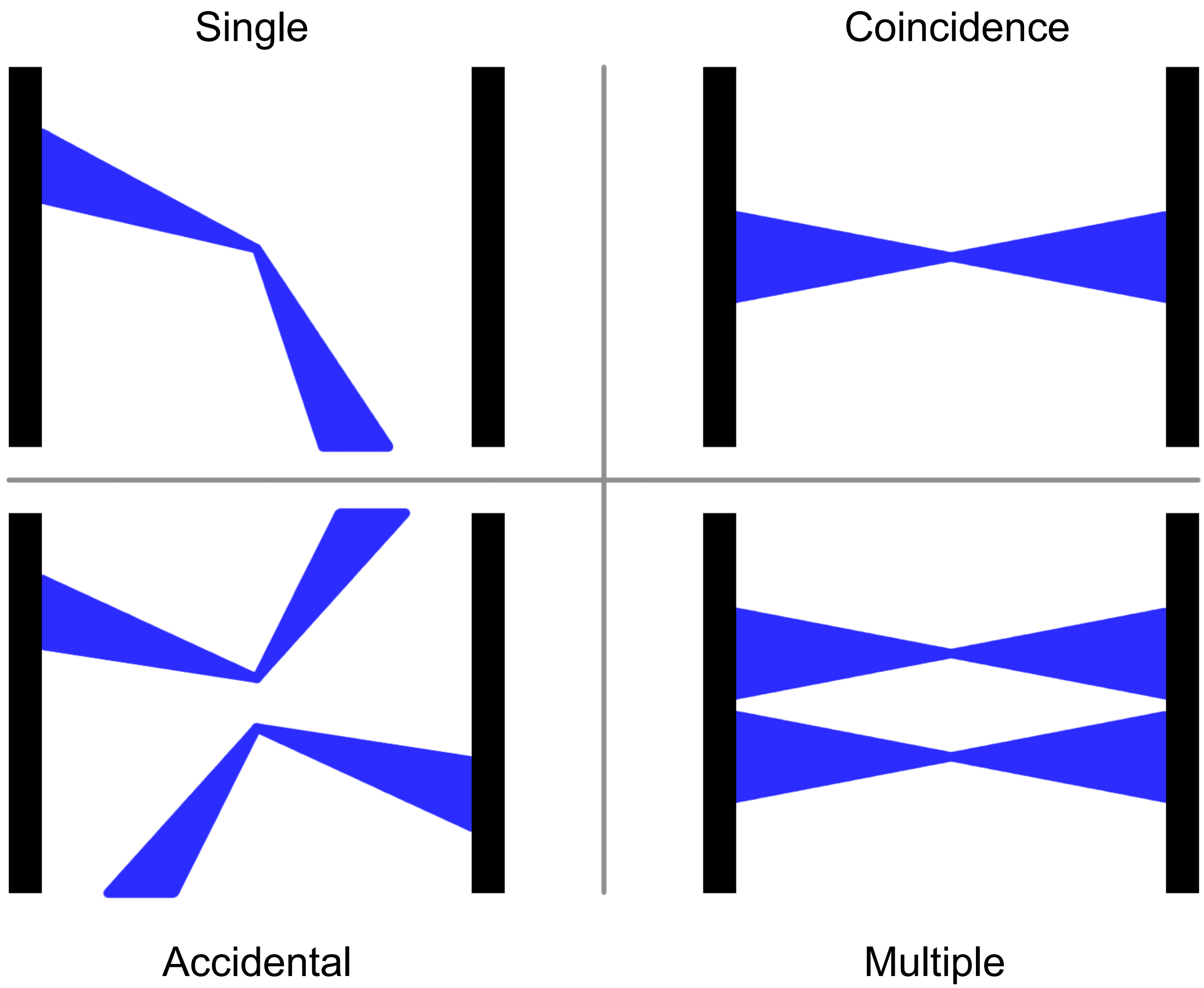
Accidentals / Multiples Corrections*



*a.k.a. "CDF Luminosity Corrections"
Reference: Cronin-Hennessy, et. al; "Luminosity monitoring and measurement at CDF"
Nuclear Instruments and Methods in Physics Research A 443 (2000) 37-50

Accidentals Correction

Physical Process Probabilities

$$\mathscr{P}_E \ - \ \text{east single only}$$

$$\mathscr{P}_W \ - \ \text{west single only}$$

$$\mathscr{P}_X \ - \ \text{coincidence only, not two singles}$$

Scaled Probabilities

(see next slide for diagrams)

$$P_{\{E,W,X\}} = \frac{N_{\{E,W,X\}}}{N_{bx}}$$

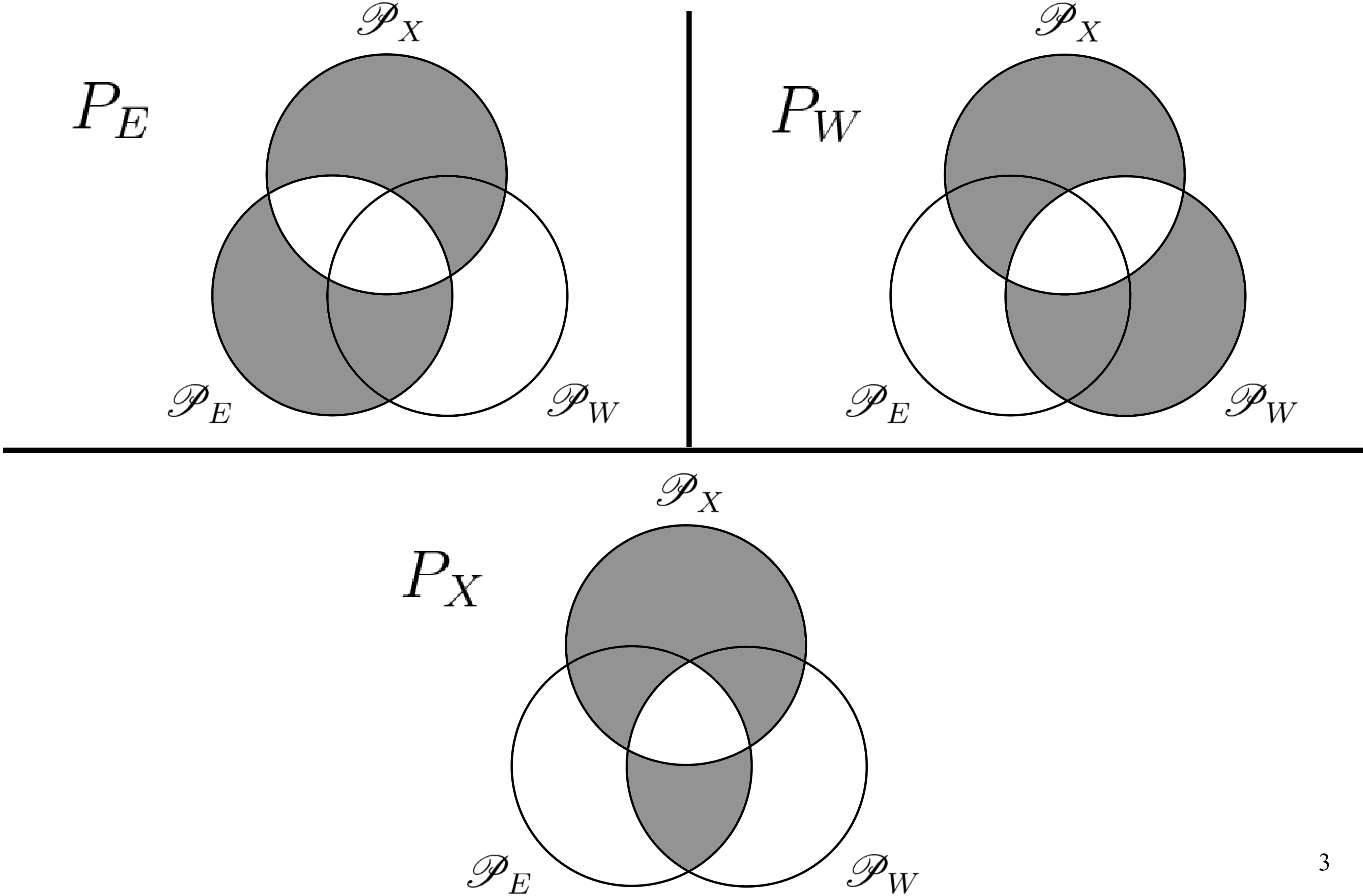
scalers

$$P_E = \mathscr{P}_E + \mathscr{P}_X - \mathscr{P}_E \cdot \mathscr{P}_X$$

$$P_W = \mathscr{P}_W + \mathscr{P}_X - \mathscr{P}_W \cdot \mathscr{P}_X$$

$$P_X = \mathscr{P}_X + \mathscr{P}_E \cdot \mathscr{P}_W - \mathscr{P}_E \cdot \mathscr{P}_W \cdot \mathscr{P}_X$$

Accidentals Correction



Accidentals Correction

Physical Process Probabilities i.t.o. Scaled Quantities

$$\mathscr{P}_E = \frac{P_E - P_X}{1 - P_W} = \frac{N_E - N_X}{N_{bx} - N_W}$$

$$\mathscr{P}_W = \frac{P_W - P_X}{1 - P_E} = \frac{N_W - N_X}{N_{bx} - N_E}$$

$$\mathscr{P}_X = \frac{P_X - P_E P_W}{1 + P_X - P_E - P_W} = \frac{N_X - N_E N_W / N_{bx}}{N_{bx} + N_X - N_E - N_W}$$

Multiples Correction

Poisson distribution for *k* events with *λ* as the "true" # events in a single bXing

$$\mathscr{P}(\lambda, k) = \sum_{k} \frac{e^{-\lambda}\lambda^{k}}{k!}$$

$$\Longrightarrow \mathscr{P}(\lambda, k = 0) = e^{-\lambda} = 1 - \mathscr{P}(\lambda, k \neq 0)$$

$$\therefore \ \lambda = -\ln\left[1 - \mathscr{P}(k \neq 0)\right]$$

Corrected # scalers: $\mathscr{N} = \lambda \cdot N_{bx}$

Accidentals / Multiples Corrections

Final Correction Equations

$$\mathcal{N}_E = -N_{bx} \cdot \ln\left(1 - \frac{N_E - N_X}{N_{bx} - N_W}\right)$$

$$\mathcal{N}_W = -N_{bx} \cdot \ln\left(1 - \frac{N_W - N_X}{N_{bx} - N_E}\right)$$

$$\mathcal{N}_X = -N_{bx} \cdot \ln\left(1 - \frac{N_X - N_E N_W / N_{bx}}{N_{bx} + N_X - N_E - N_W}\right)$$