Cumulative (CDF): $F_X(x) = P(X \leq x) = \int_{-\infty}^{x} f_X(t)\,dt$
PDF: $f_X(x) = \frac{dF}{dx}(x)$
Survival function: $SF_X(x) = P(X > x) = \int_{x}^{\infty} f_X(t)\,dt = 1 - F_X(x)$

$$\text{p-value}(H) = \int_{\{q:\text{more extreme than } q_{\text{obs}}\}} f_{Q|H}(q)\,dq$$

For right-tailed Q

$$\text{p-value}(H) = \int_{q_{\text{obs}}}^{\infty} f_{Q|H}(q)\,dq = SF_{Q|H}(q_{\text{obs}})$$

One sided:

$$z = F^{-1}_{N(0,1)}(1 - \text{p-value}) = SF^{-1}_{N(0,1)}(\text{p-value})$$

1 Discovery

$$q_0 = \begin{cases} -2\log\dfrac{L(0)}{L(\hat{\mu})} & \hat{\mu} \geq 0 \\ 0 & \hat{\mu} < 0 \end{cases} \quad \text{and nuisances profiled}$$

$$q_0|\mu = 0 \sim \frac{1}{2}\delta + \chi^2_1$$

2 Upper limits

$$q_\mu = \begin{cases} -2\log\dfrac{L(\mu)}{L(\hat{\mu})} & \hat{\mu} \leq \mu \\ 0 & \hat{\mu} > \mu \end{cases} \quad \text{and nuisances profiled}$$

$$\tilde{q}_\mu = \begin{cases} -2\log\dfrac{L(\mu)}{L(0)} & \hat{\mu} < 0 \\ -2\log\dfrac{L(\mu)}{L(\hat{\mu})} & 0 \leq \hat{\mu} < \mu \\ 0 & \hat{\mu} > \mu \end{cases} \quad \text{and nuisances profiled}$$

$$p_{s+b} = \text{p-value}(\mu) = \int_{q_{\text{obs}}}^{\infty} f_Q(q|\mu)\,dq$$

$$p_b = \text{p-value}(\mu = 0) = \int_{q_{\text{obs}}}^{\infty} f_Q(q|\mu = 0)\,dq$$

$$CL_s = \frac{CL_{s+b}}{CL_b} = \frac{p_{s+b}}{1 - p_b}$$

$$\mu_{95}^{\text{sup}} = \inf\{\mu : CL_s(\mu) < 0.05\}$$