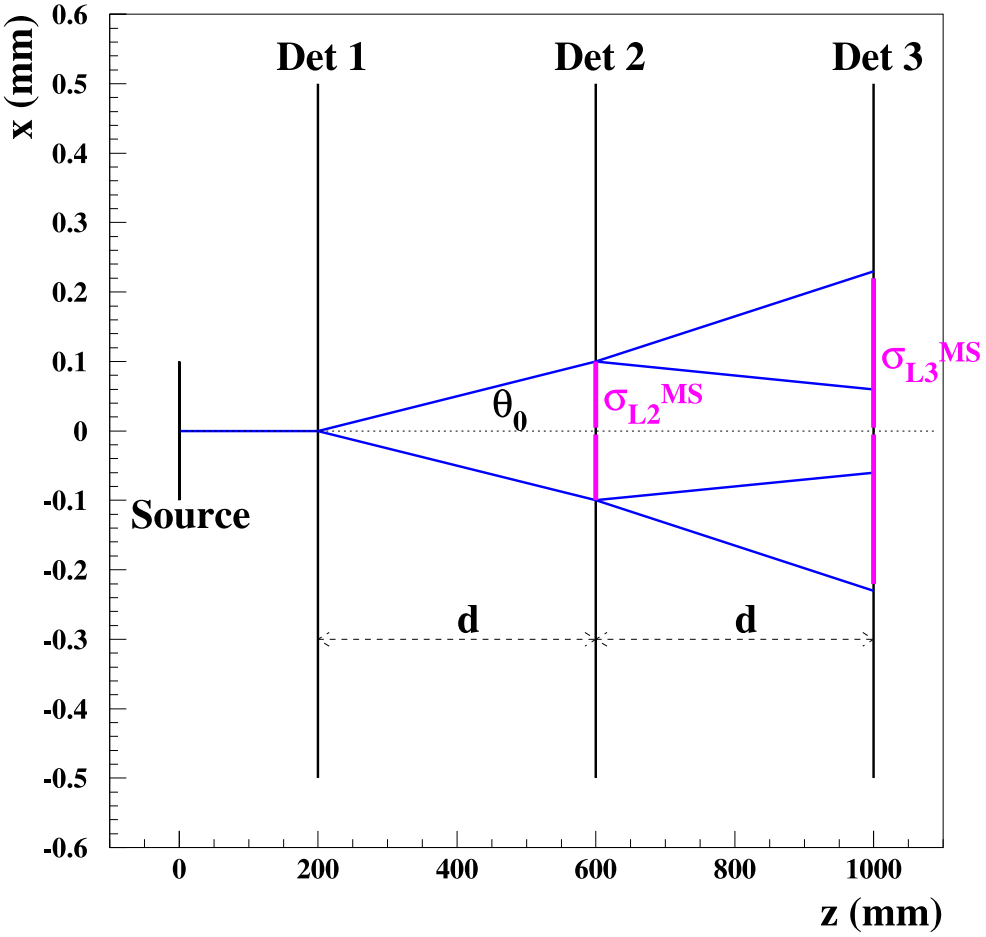
Multiple scattering effects

Dominated by multiple Coulomb scattering from nuclei



According to PDG 2008 Review p.271:

$$\theta_{plane}^{RMS} = \theta_0 = \frac{13.6\,MeV/p}{\beta cp} z\sqrt{X/X_0}[1+0.038\,ln(X/X_0)]$$

In our case

- $z = 1$ (Pions)
- $x = 0.03$ cm; $X_0 = 9.36$ cm

$$\Rightarrow \sqrt{X/X_0} = \sqrt{0.03/9.36} = 0.056$$

$$\Rightarrow \theta_0 \approx \frac{13.6\ MeV}{p}\sqrt{X/X_0} = \frac{0.77\ mrad}{p[GeV]}$$

$\Rightarrow$ Spread in Layer 2 (from MS in Layer 1):

$$\sigma_{L2}^{MS} = d \cdot \theta_0 = \frac{400\text{ mm} \cdot 0.77\text{ mrad}}{p[GeV]} = \frac{306\ \mu\text{m}}{p[GeV]}$$

$\Rightarrow$ Spread in Layer 3 (from MS in Layer 1 and Layer 2):

$$\sigma_{L3}^{MS} = \sqrt{4d^2 + 1d^2} \cdot \theta_0 = 2.24\,\sigma_{L2}^{MS} = \frac{684\ \mu\text{m}}{p[GeV]}$$