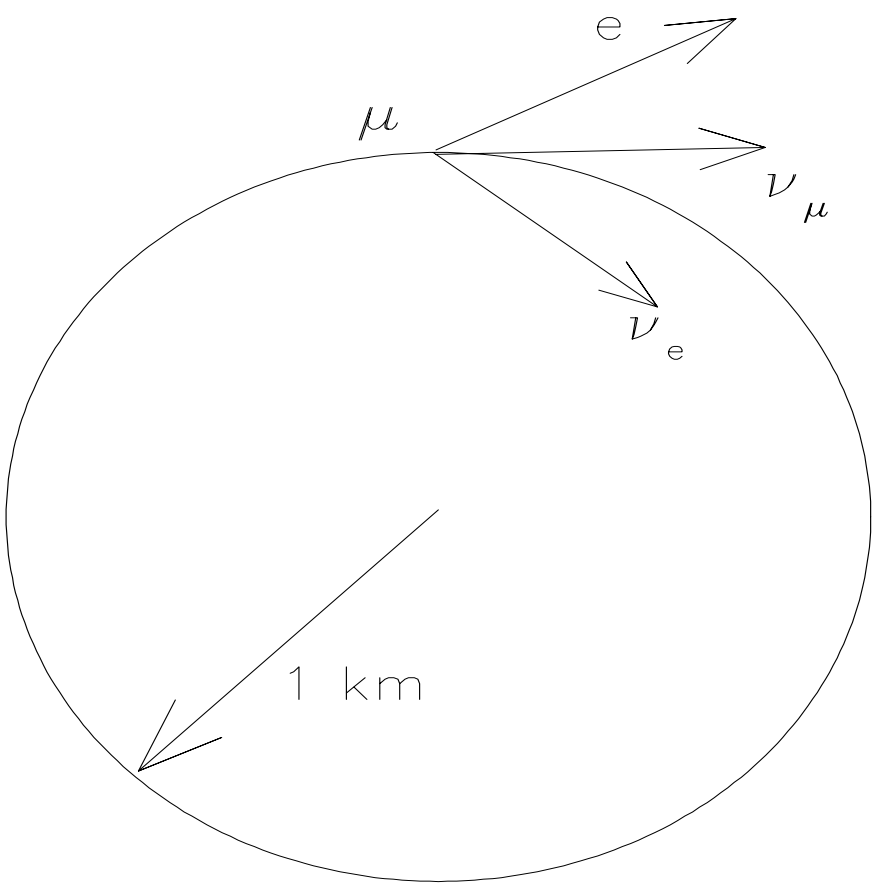
Neutrino-Induced Radiation Hazard



Muon Decay

$$\mu^- ==> \nu_\mu + \overline{\nu}_e + e^-$$

$$\mu^+ ==> \overline{\nu}_\mu + \nu_e + e^+$$

Typical opening angle:

$$\theta_\nu \approx \frac{1}{\gamma_\mu}$$

For 2 TeV muons

$$\theta_\mu \approx 50\,\mu rad$$

ν INTERACTIONS (DIS)

TeV-scale NEUTRINOS
interact primarily through
Deep Inelastic Scattering
(DIS) on nucleons (N)

$$\nu_{\substack{\mu \\ e}} + N \longrightarrow$$

$$\substack{\mu \\ e} + Hadrons\ (75\%)$$
$$\nu + Hadrons\ (25\%)$$

Producing the particles:

Hadron showers	*meters*	$\approx 40\%$ *of* E_T
Electromag. showers	*meters*	$\approx 20\%$ *of* E_T
Muons	*km*	$\approx 20\%$ *of* E_T
Neutrino		$\approx 20\%$ *of* E_T

Question: isn't the neutrino cross-section very small?

$$\sigma_{\nu N}^{total} \approx$$

$$7 \times 10^{-36}\, cm^2 \times E_\nu[TeV]$$

The off-site dose limit is:

$$10\, mrem/year =$$

$$600\, TeV/kg/year$$ (for min.ion.radiation)

$$\approx Energy\, of\, 10^3 \nu's$$

The small cross-section is compensated by:

6×01^{26} N/kg

2×10^{21} ν/year