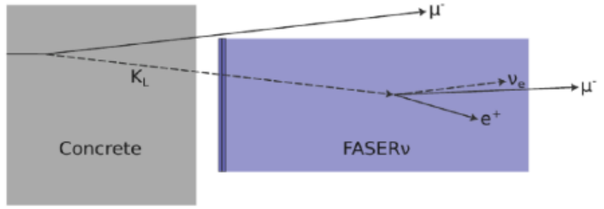
Background

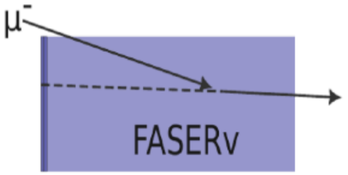
Consideration on FASER background

- Veto System in front of the detector: tells if a particle came from outside.
- 1. Neutral hadrons, but assume it misses veto system
  - Most neutral hadrons absorbed in tungsten without producing high-momentum track
  - Only a tiny number can fake a neutrino: **Expect 0.11 ± 0.06 events**
- Scattered muons that miss veto system (rare) :
  - These are muons from the LHC that scatter a bit before reaching the detector.
  - **Expect: 0.08 ± 1.83 events**

1)

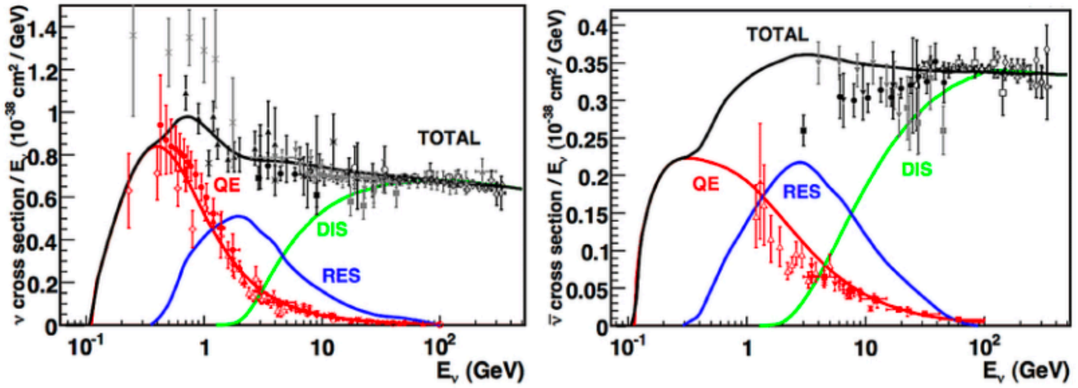


2)



Neutrino Interaction in matter

Pipeline



- **Quasi-Elastic (QE) Scattering:** the interaction's resolving power is insufficient to probe the internal structure of the nucleon. The neutrino elastically scatters off the nucleon, changing its type but leaving it intact. ($\nu_\mu + n \rightarrow \mu^- + p$)
- **Resonant (RES) Pion Production:** *momentum transfer becomes large enough to excite the target nucleon into a short-lived baryonic* ***resonance****, such as the Δ(1232), that quickly decays* ($\nu_\mu + p \rightarrow \mu^- + \Delta \rightarrow \mu^- + p + \pi$)
- **Deep Inelastic Scattering (DIS) ≈5 GeV:** the four-momentum squared transferred by the virtual boson, Q^2, is large enough that the interaction resolves the quarks and gluons inside the nucleon