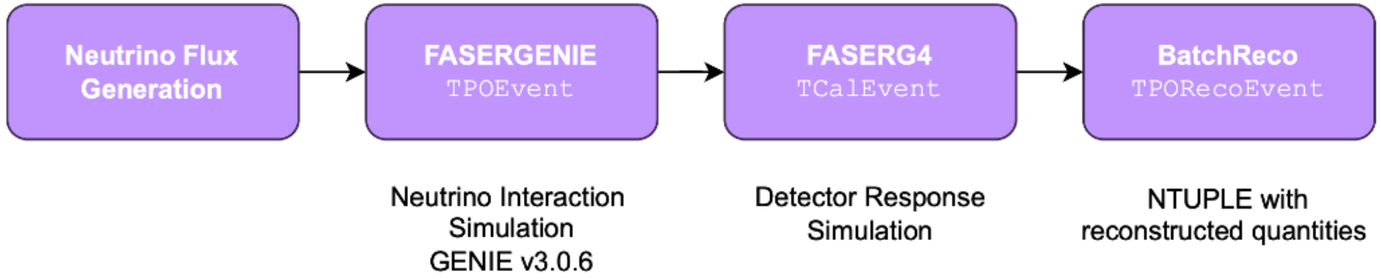
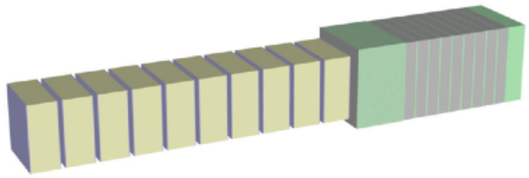
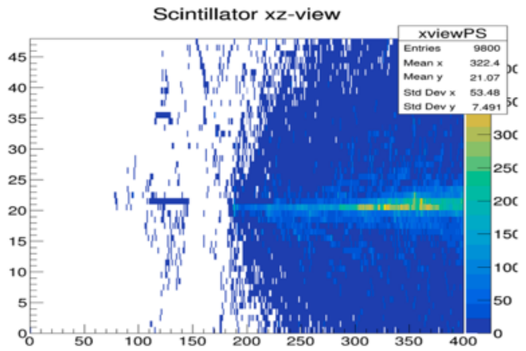
Data Generation

Pipeline



- **Neutrino flux:** generated using the SIBYLL 2.3d hadronic interaction model
  - Neutrinos propagated and projected onto a transverse plane located at z= 480m downstream of the IP, (FASER experimental site)
- **FASERGENIE:** simulation of neutrino-nucleus interactions. Using the GENIE (Generates Events for Neutrino Interaction Experiments).
  - GENIE simulates interaction of neutrinos from the flux with the materials defined in the detector geometry. (includes (DIS), (QE) and (RES) interactions for both (CC) and (NC) processes.
- **FASERG4:** FASERCal response built on Geant4: FASERG4 reads primary particles from GENIE and propagates them through the detector - simulating ionization, scattering, Bremsstrahlung, pair production, hadronic interactions, and particle decays
- **Event Reconstruction**

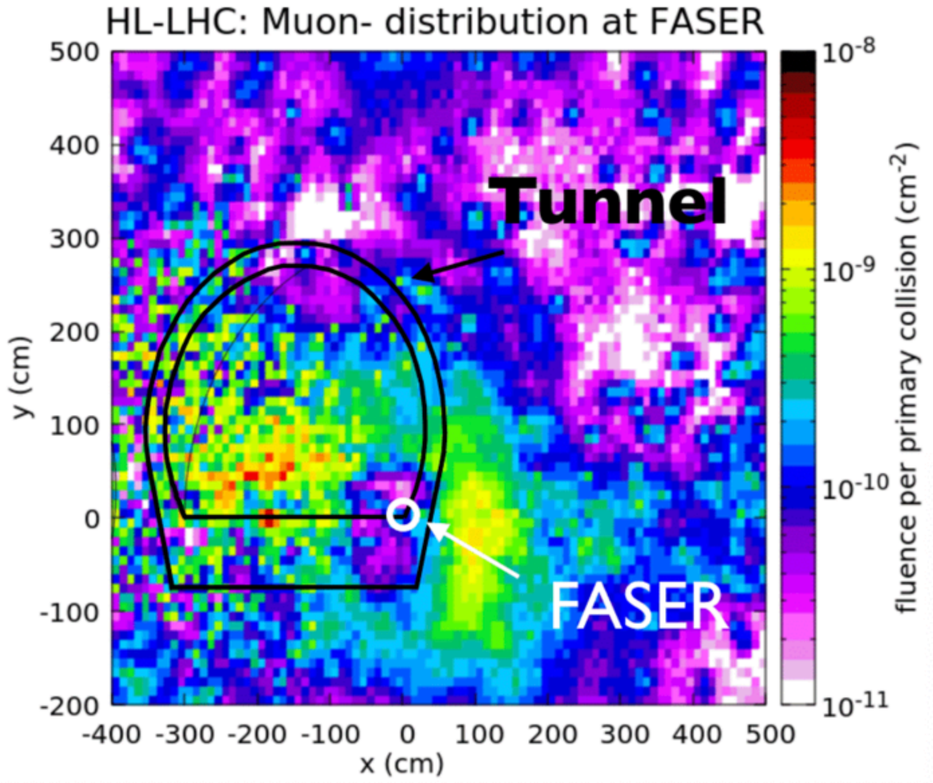




Background

Consideration on FASER background

- A residual **muon flux** (tens of Hz) still passes through the tunnel.
  - They can produce **secondary showers** via bremsstrahlung, pair production, or nuclear interactions.
- Background Simulations at FASER
  - FLUKA simulations by CERN EN-STI group.
  - Include effects of LHC magnets & infrastructure.
  - Simulated particle fluence rates at 13 TeV, normalized to $L = 2\times10^{34}$ $cm^{-2}s^{-1}$.
  - Muon flux higher off-axis due to LHC optics.
  - FASER placed in a *low-flux region* of TI12 tunnel → reduced background.
- Cosmic Rays: Negligible in comparison to beam-related particles.



*Fluence (Φ) is the number of particles crossing a unit area.