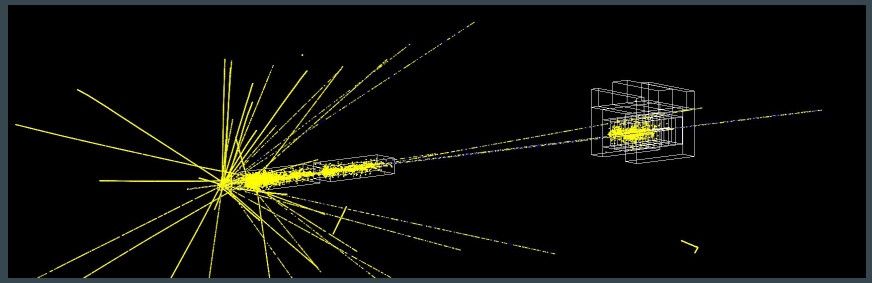

ProtoDUNE GEANT4 simulation

Update on background simulation from T2 and TAX

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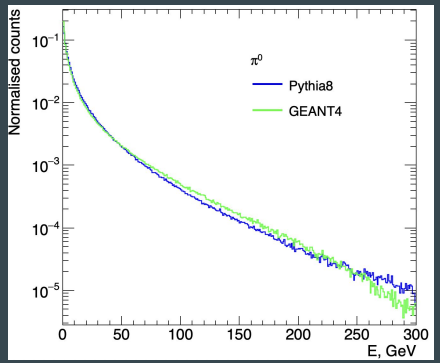
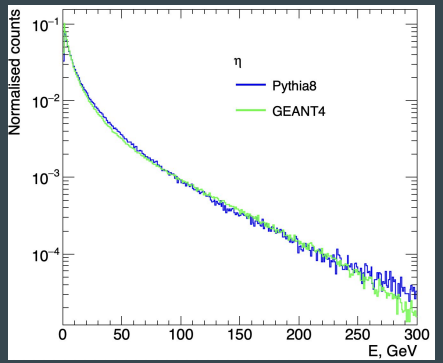
28.02.2024

Status of the work

Main task is **validation** of the simulation framework

- Comparison between Pythia8 output and GEANT4 results for **primary interactions** only





π^0	η	η'	D	D_s	τ
4.03	0.46	0.05	$4.8 \cdot 10^{-4}$	$1.4 \cdot 10^{-4}$	$7.4 \cdot 10^{-6}$
ρ	ω	ϕ	J/ψ	B	Υ
0.54	0.53	0.019	$4.4 \cdot 10^{-5}$	$1.2 \cdot 10^{-7}$	$2.3 \cdot 10^{-8}$

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Table I. Production yield (normalized per PoT) for each of the parent particles considered in this work, see text for details. Note that the number of τ leptons receives contributions from direct production as well as from indirect production through $D_s \to \tau\nu$, the latter being dominant.

~70% interaction rate

Particle	Rate per POT (Pythia8)	Rate per POT (GEANT4)
π^+	2.7	2.8
π^-	2.3	2.6
π^0	2.8	2.7
K^+	0.25	0.24
K^-	0.18	0.18
K_L^0	0.20	0.20
K_S^0	0.20	0.20
η	0.32	0.29

This work

Table 5: Light mesons production rate comparison for primary proton interaction, $pN \to X$, normalised per POT for Pythia8 and GEANT4. The Pythia8 rate accounts for proton non-interaction within the target with $P_{\text{int}} \simeq 0.7$.

→ need to compare and B's and D's