

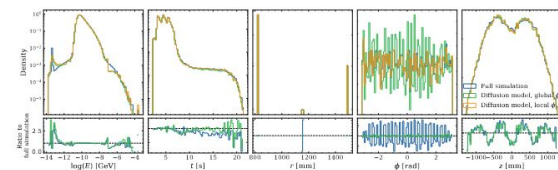
Update: GenAI for BIB Team

08/04/2026

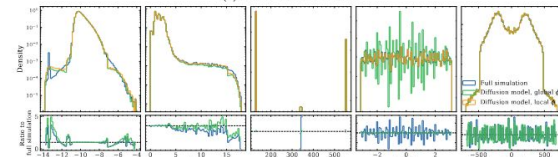
Progress so far: “Event-level” BIB generation

- Currently the Chicago + Brown groups are working on a write-up of the event-level BIB generation studies that we showed at IMCC and AI4MuC
- We’re showing the results of the **diffusion model**, which seems to have less mismodeling errors
- We’re hoping to have something on the arXiv by the end of August!

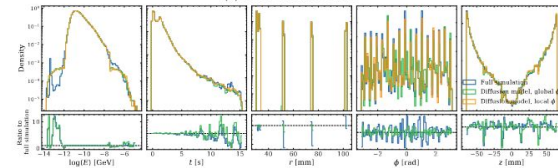
Collection Name	diff_large_cond4_global					diff_large_cond4_local						
	ROC AUC	BDT Feature Importances					ROC AUC	BDT Feature Importances				
		log(E)	t	r	ϕ	z		log(E)	t	r	ϕ	z
Outer Tracker Barrel	0.576	0.155	0.150	0.361	0.155	0.180	0.553	0.091	0.144	0.249	0.063	0.453
Inner Tracker Barrel	0.581	0.044	0.073	0.587	0.159	0.137	0.527	0.086	0.172	0.243	0.081	0.417
Vertex Barrel	0.530	0.081	0.130	0.446	0.159	0.185	0.512	0.130	0.204	0.206	0.111	0.348
Outer Tracker Endcap	0.531	0.226	0.161	0.150	0.117	0.346	0.528	0.234	0.163	0.165	0.084	0.354
Inner Tracker Endcap	0.533	0.139	0.275	0.207	0.120	0.258	0.532	0.132	0.298	0.193	0.093	0.284
Vertex Endcap	0.542	0.171	0.114	0.165	0.163	0.387	0.540	0.191	0.120	0.173	0.107	0.408
All collections	0.546	0.091	0.134	0.606	0.074	0.093	0.520	0.235	0.159	0.296	0.060	0.250



(a) Outer Tracker Barrel



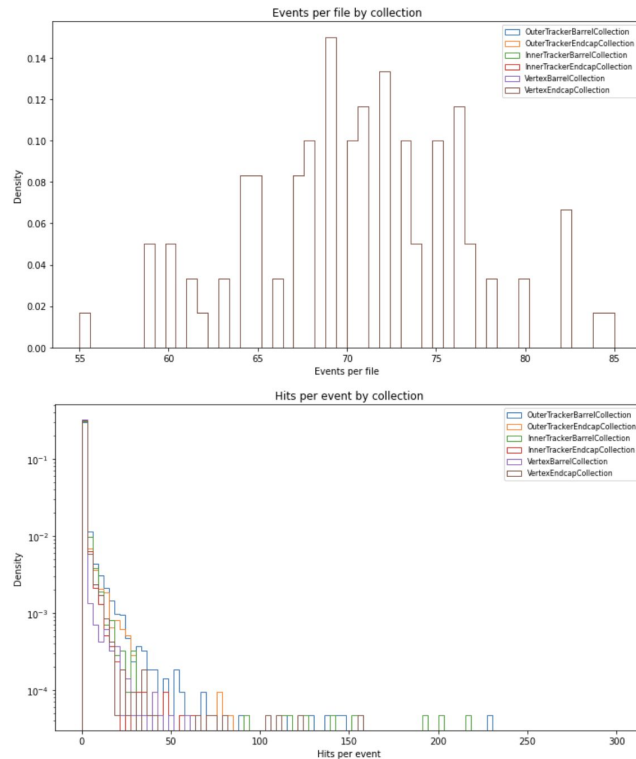
(b) Inner Tracker Barrel



(c) Vertex Tracker Barrel

Progress so far: “particle-level” BIB generation

- With the BIB studies, we have no way of saying if the generated samples have the right intra-event correlations
- So, we are trying a new way to generate BIB: we generate 1 mother muon’s pass through the detector at a time, then ensemble many mother muons
- Currently still in the early stages of architecture design (not helped by the Perlmutter shutdown...)



Progress so far: “particle-level” BIB generation

- Problem: some of the mother muon samples have bizarre times!
 - If we enforce timing windows before the model training stage, how tight can the windows be?

```
OuterTrackerBarrelCollection: min time -3.5480544567108154, max time 1.0037755182579712e+16
OuterTrackerEndcapCollection: min time -7.248371124267578, max time 2104439619977216.0
InnerTrackerBarrelCollection: min time -1.5492589473724365, max time 424558322515968.0
InnerTrackerEndcapCollection: min time -6.53560400091553, max time 523762504040448.0
VertexBarrelCollection: min time -0.21757493913173676, max time 205056229376.0
VertexEndcapCollection: min time -0.9529614448547363, max time 39589448253440.0
```

