

Tau3MuGNNs

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GCOM



Content

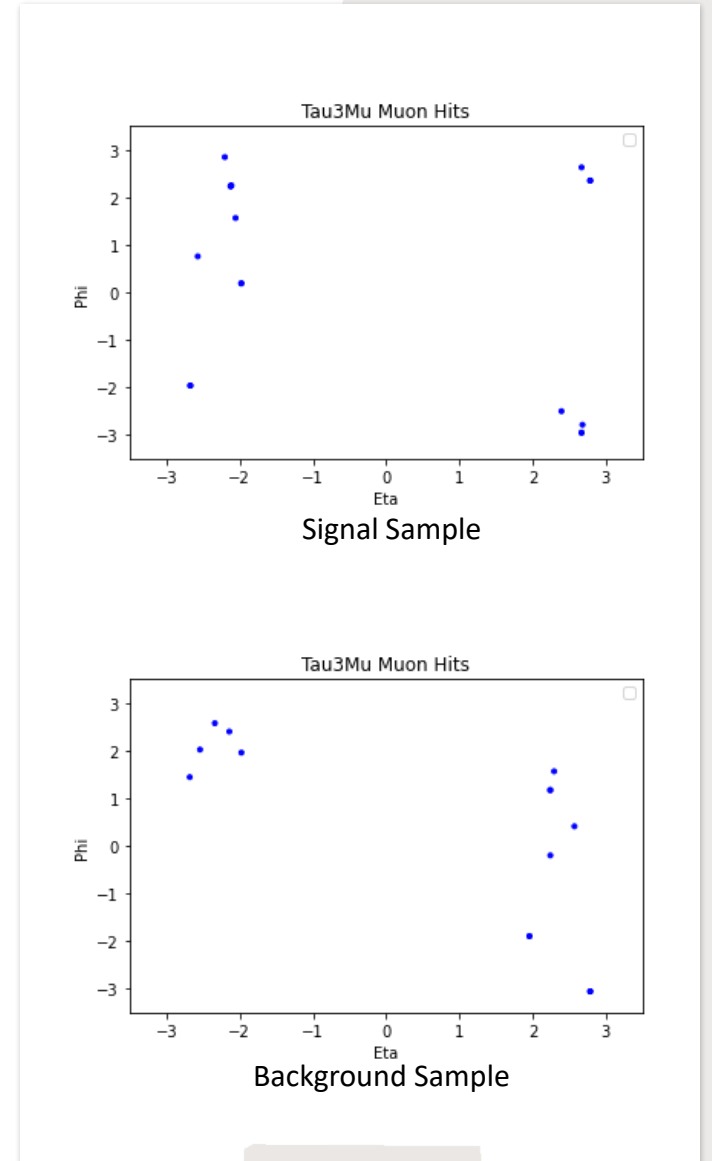
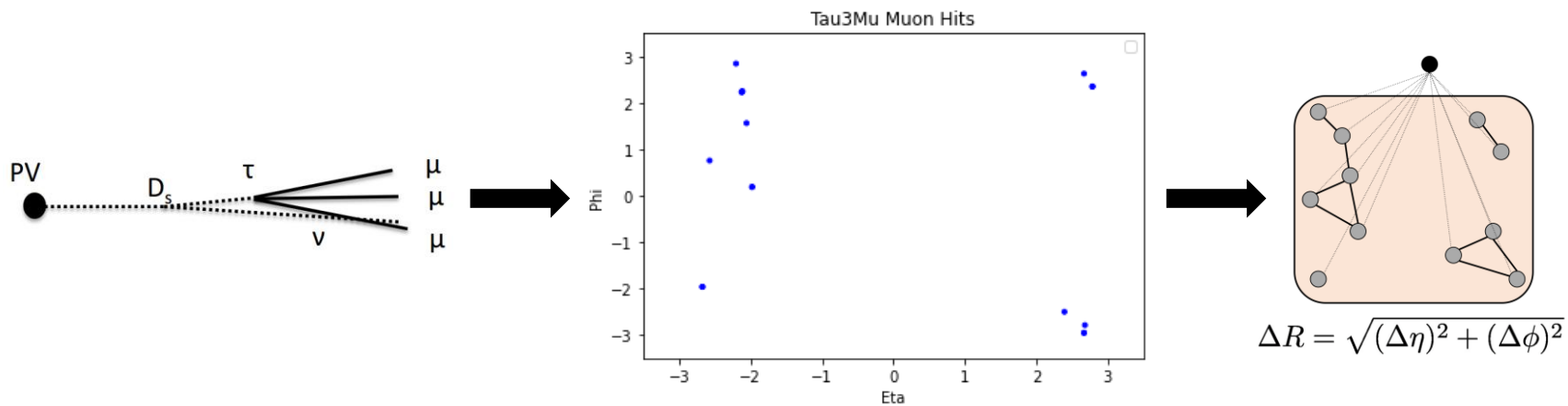
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Background

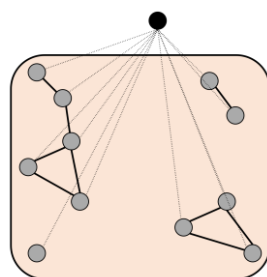
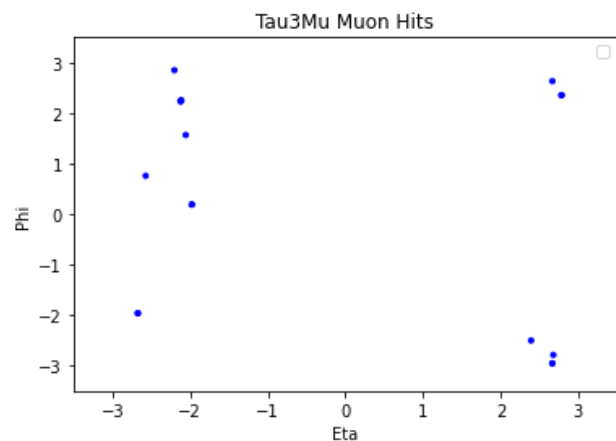
- Physics Beyond the Standard Model
 - Search for charged lepton flavor violating (CLFV) decays
 - $\tau \rightarrow 3\mu$ decay is the cleanest CLFV signature
- τ leptons and their muons
 - soft transverse momenta p_T
 - mostly towards in the forward region of the CMS detector
- Online detection and reconstruction with raw detector measurements!

$\tau \rightarrow 3\mu$ Dataset

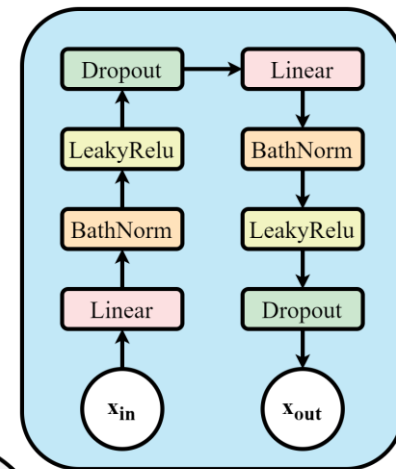
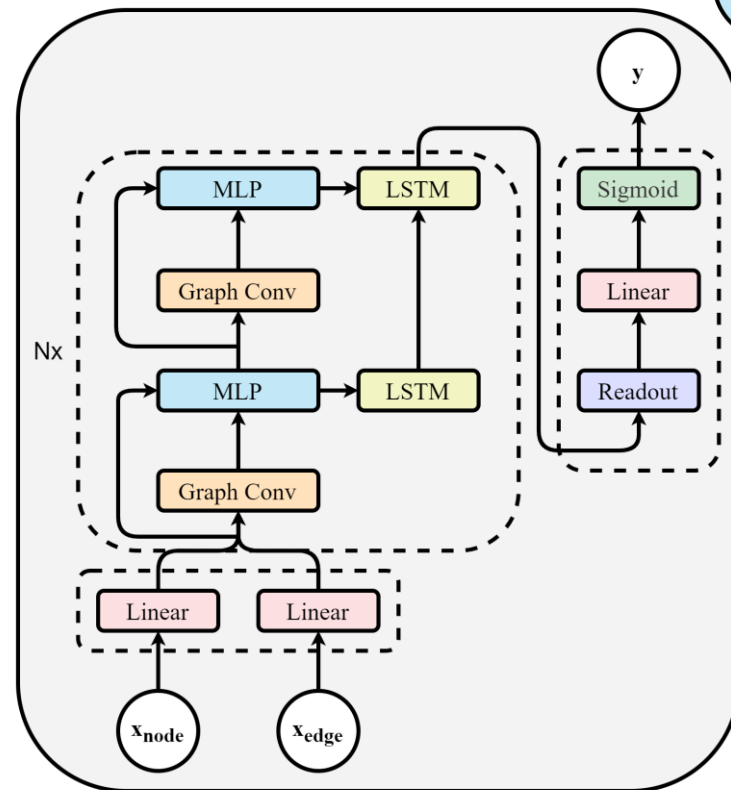
- The signal events are generated at particle level using Pythia 8
- The hard-scattering process is superimposed with additional pp
- Samples
 - signal plus background
 - pure background
- Graph Construction



Model Architecture



$$\Delta R = \sqrt{(\Delta\eta)^2 + (\Delta\phi)^2}$$



Model Performance

- Performance: Trigger Acceptance Rate@30kHz Trigger Rate ([Recall@0.1%FPR](#))
 - MLP: 0.210
 - GNN: 0.953
- If use information from both muon and tracker detectors (Phase-2 L1-trigger): 0.25
- Time to construct graphs: 0.8 ms per sample
 - CPU: Intel(R) Xeon(R) Gold 6248R CPU @ 3.00GHz
 - GPU: Quadro RTX 6000

# Layers	# Hidden Size	# Parameters	Speed (ms)	Performance
16	128	1197473	0.098	0.953
8	128	666001	0.049	0.931
4	128	400265	0.026	0.920
# Layers	# Hidden Size	# Parameters	Speed (ms)	Performance
16	64	303841	0.062	0.870
8	64	169169	0.032	0.847
4	64	101833	0.015	0.742

Thank You!