

τ reconstruction at the Muon Collider: Cross section measurement of the $H \rightarrow \tau\tau$ process

Kevin Dewyspelaere, Giacomo Da Molin, Giovanni Battista Marozzo

Under the supervision of Michele Gallinaro

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LIP - Laboratório de Instrumentação e Física Experimental de
Partículas, Lisbon, Portugal

15000 τ events generated:

- $0 \leq \varphi \leq 2\pi$ rad
- $10^\circ \leq \theta \leq 170^\circ$
- $20 \leq p_T \leq 320$ GeV/c

15000 $\mu^+ \mu^- \rightarrow Z \nu_\mu \bar{\nu}_\mu, Z \rightarrow q^+ q^-$

15000 $\mu^+ \mu^- \rightarrow Z \nu_\mu \bar{\nu}_\mu, Z \rightarrow b^+ b^-$

100 000 $\mu^+ \mu^- \rightarrow H \nu_\mu \bar{\nu}_\mu, H \rightarrow \tau^+ \tau^-$

100 000 $\mu^+ \mu^- \rightarrow Z \nu_\mu \bar{\nu}_\mu, Z \rightarrow \tau^+ \tau^-$

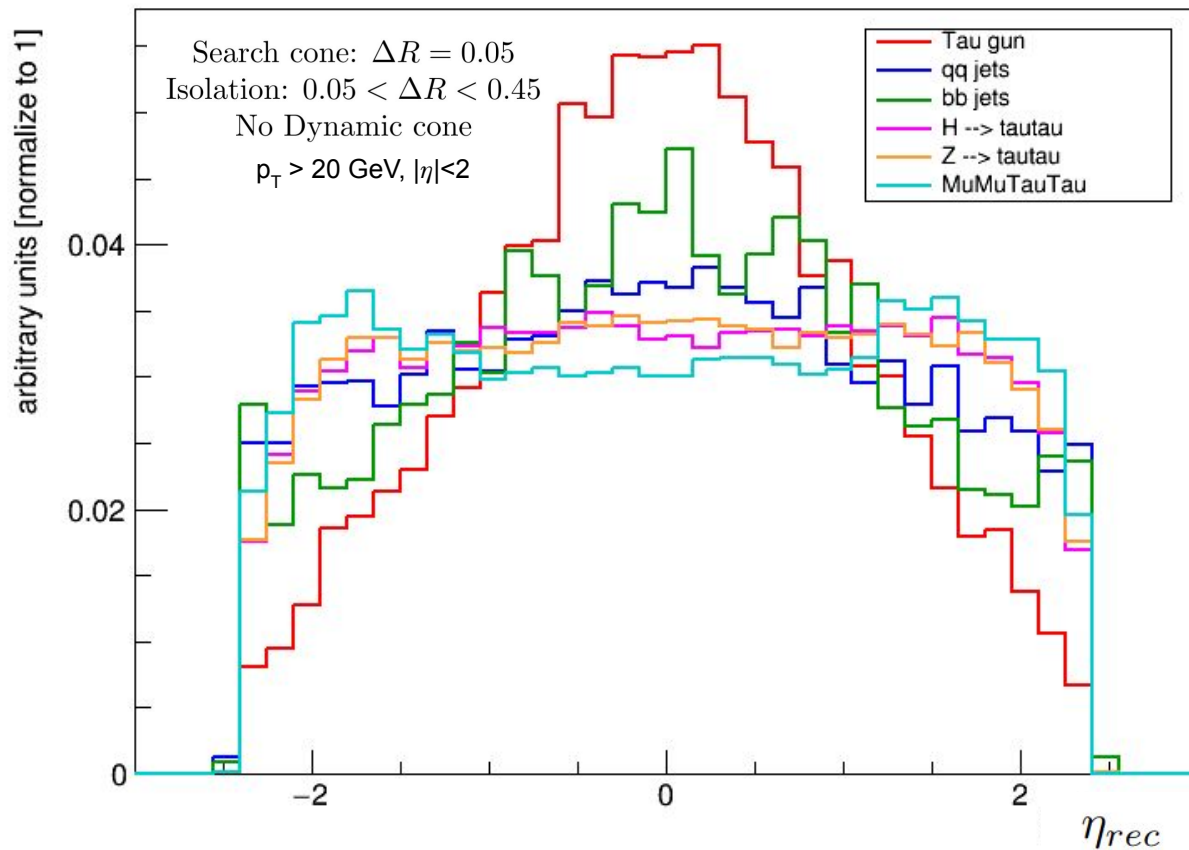
100 000 $\mu^+ \mu^- \rightarrow \tau^+ \tau^- \mu^+ \mu^-$

Search cone: $\Delta R \leq 0.05$

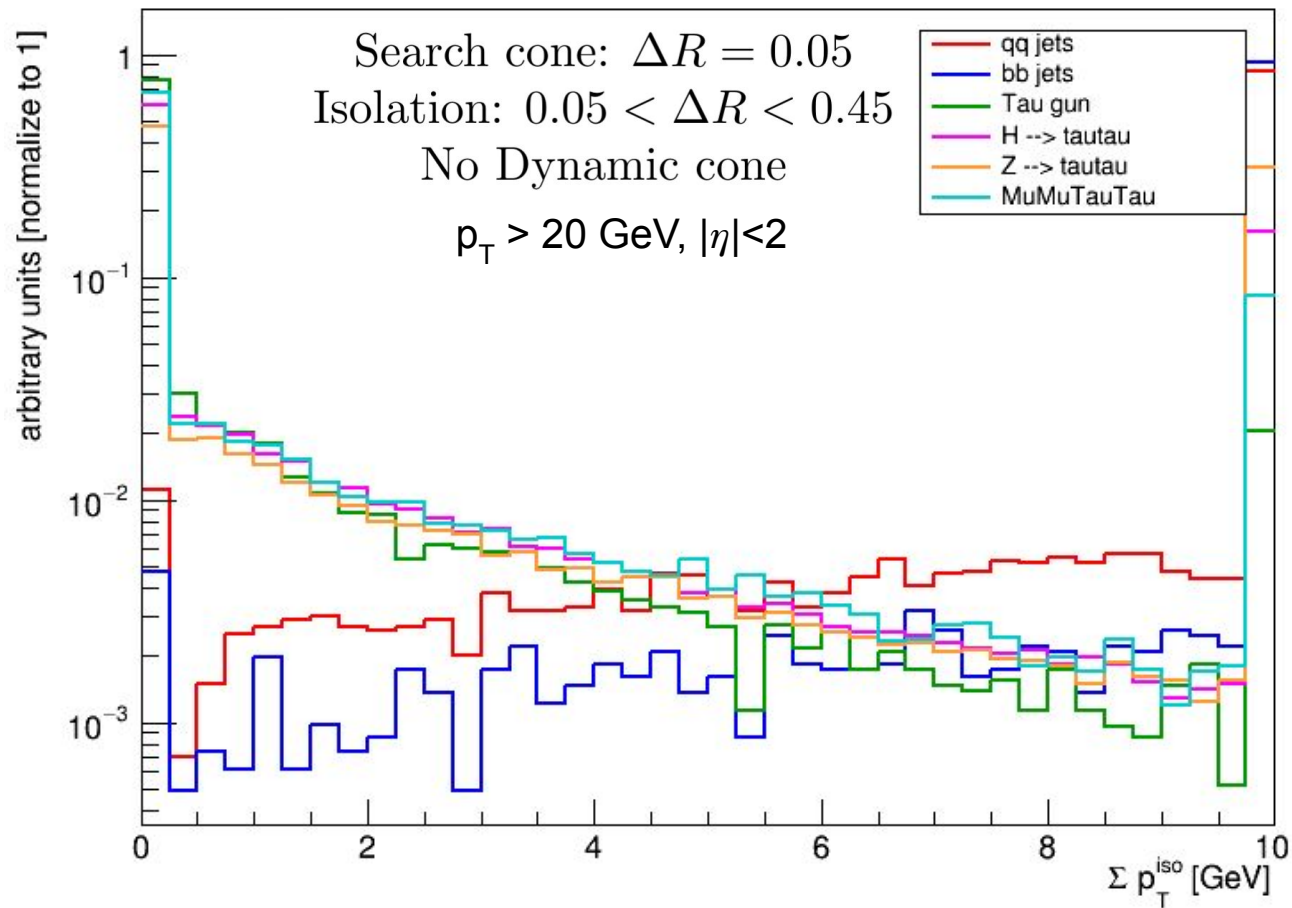
Isolation cone: $0.05 < \Delta R < 0.45$

No Dynamic cone

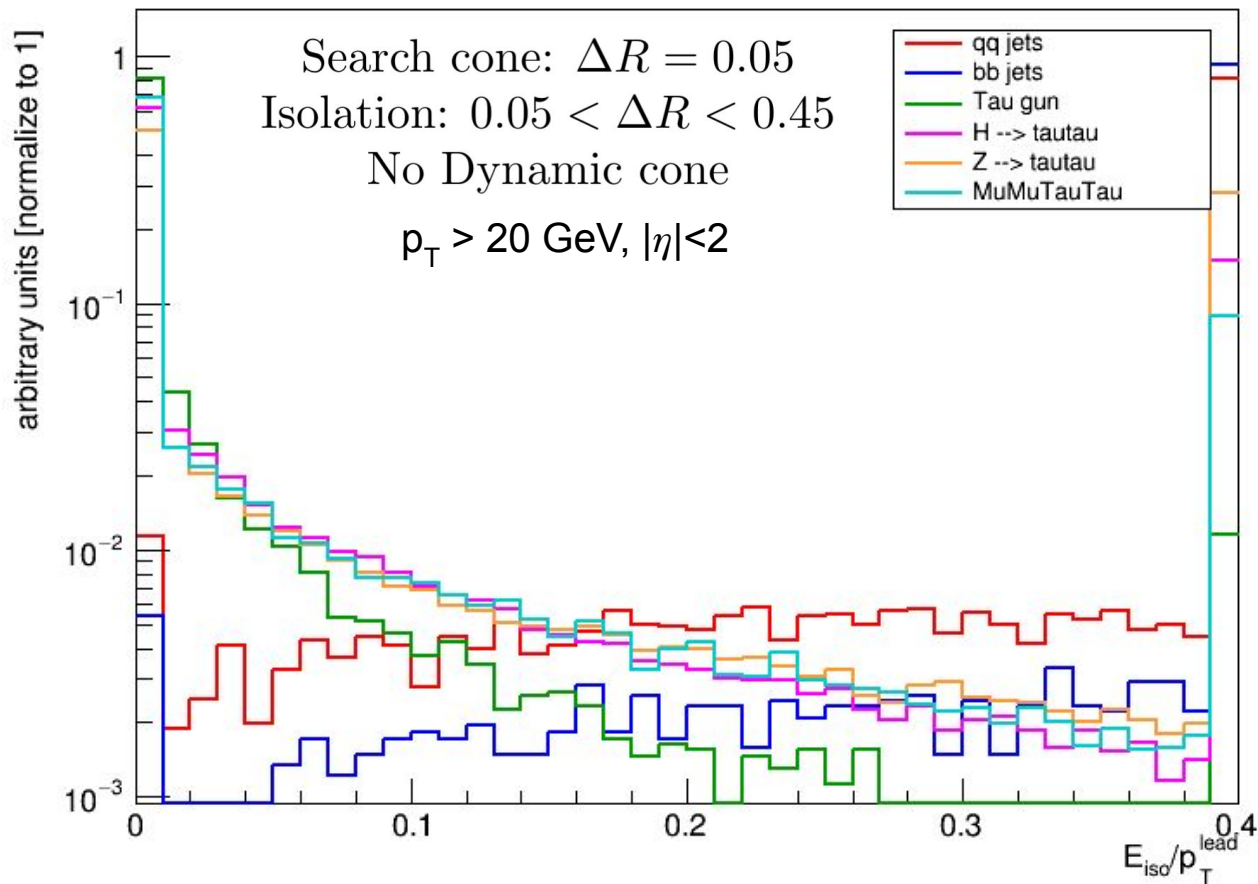
Eta distribution



Isolation Energy



Isolation energy over Leading Pfo pt of the tau



Tau mis-identification efficiency



Jets: 15000 $Z \rightarrow qq$ jets & 15000 $Z \rightarrow bb$ jets

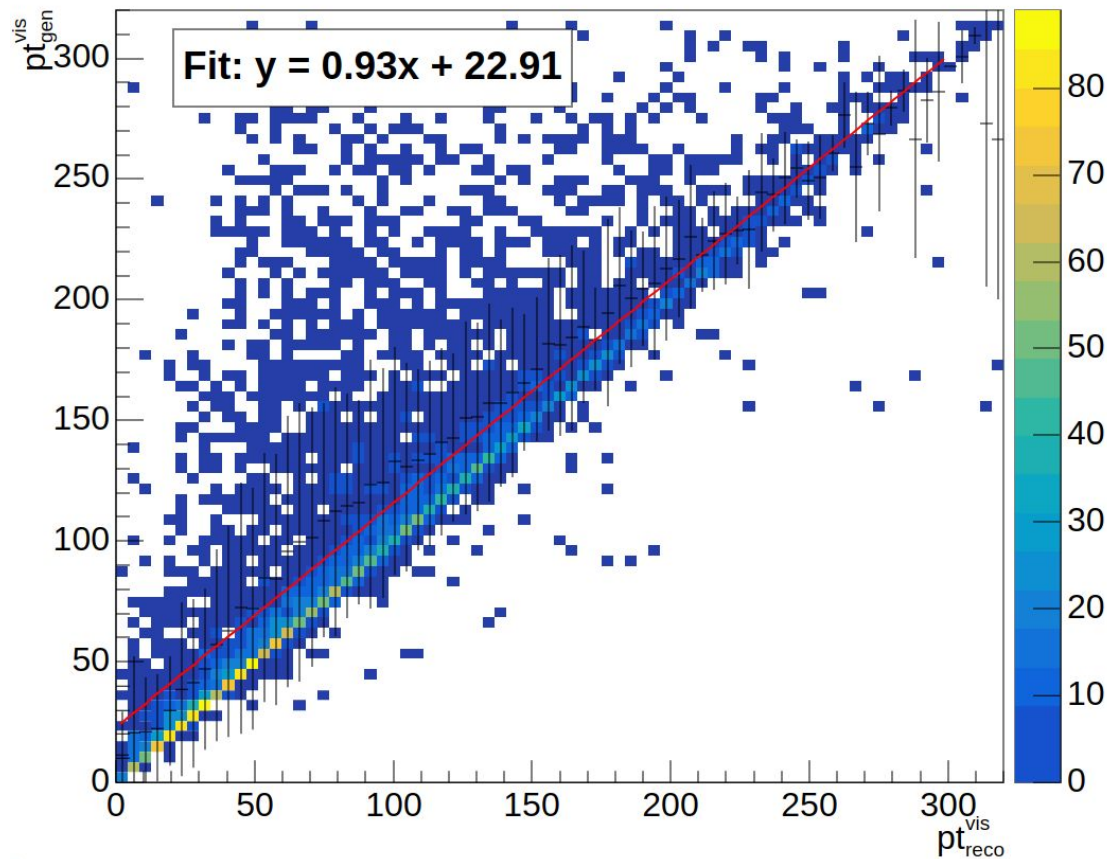
We define the efficiency as: $\varepsilon_{\text{Jets}} = \frac{N_{\tau}^{\text{reco}}}{N_{\text{jets}}}$

Kinematic requirements: jet do not contains gen-level τ s, $p_T > 20$ GeV, $|\eta| < 2$ (jets); # of charged tracks $\neq 2$ & 4, $\text{Minv} < 3$ GeV, # of reconstructed particles composing the τ h candidate < 8 (τ -Id), $\text{EMF} < 1.0$

The number of jets (N_{jets}) is calculated with the number of quarks in the hepmc files passing the requirements $p_T > 20$; $|\eta| < 2$

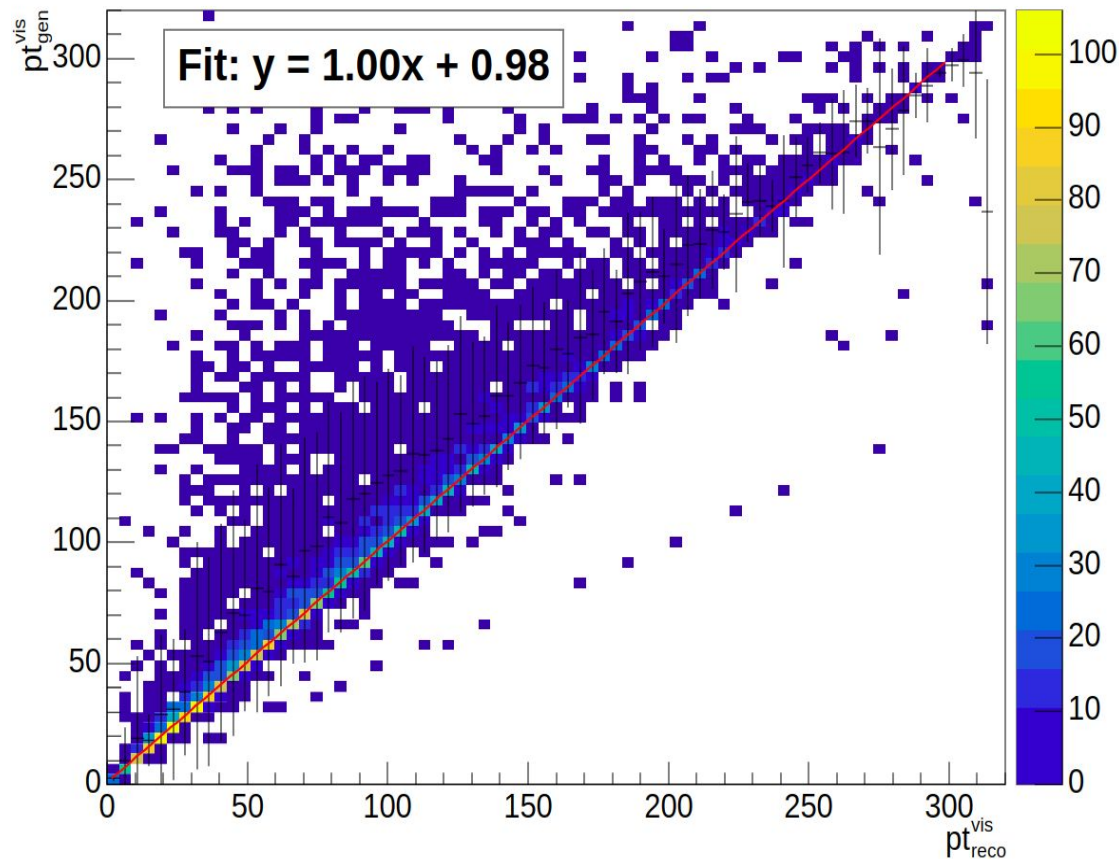
Physical objects	(u, s, d) jets	b -jets	τ_h
kinematics	20%	14%	69%
kin. + $E_{\text{iso}} < 3$ GeV	0.6%	0.11%	63%
kin. + $E_{\text{iso}}/p_T^{\text{lead}} < 0.1$	0.7%	0.11%	66%

Tau energy corrections



Search cone: $\Delta R = 0.05$
Isolation: $0.05 < \Delta R < 0.45$
No Dynamic cone

Tau energy corrections



Isolation: $0.15 < \Delta R < 0.35$

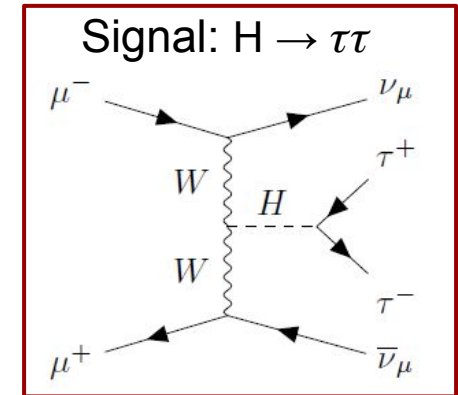
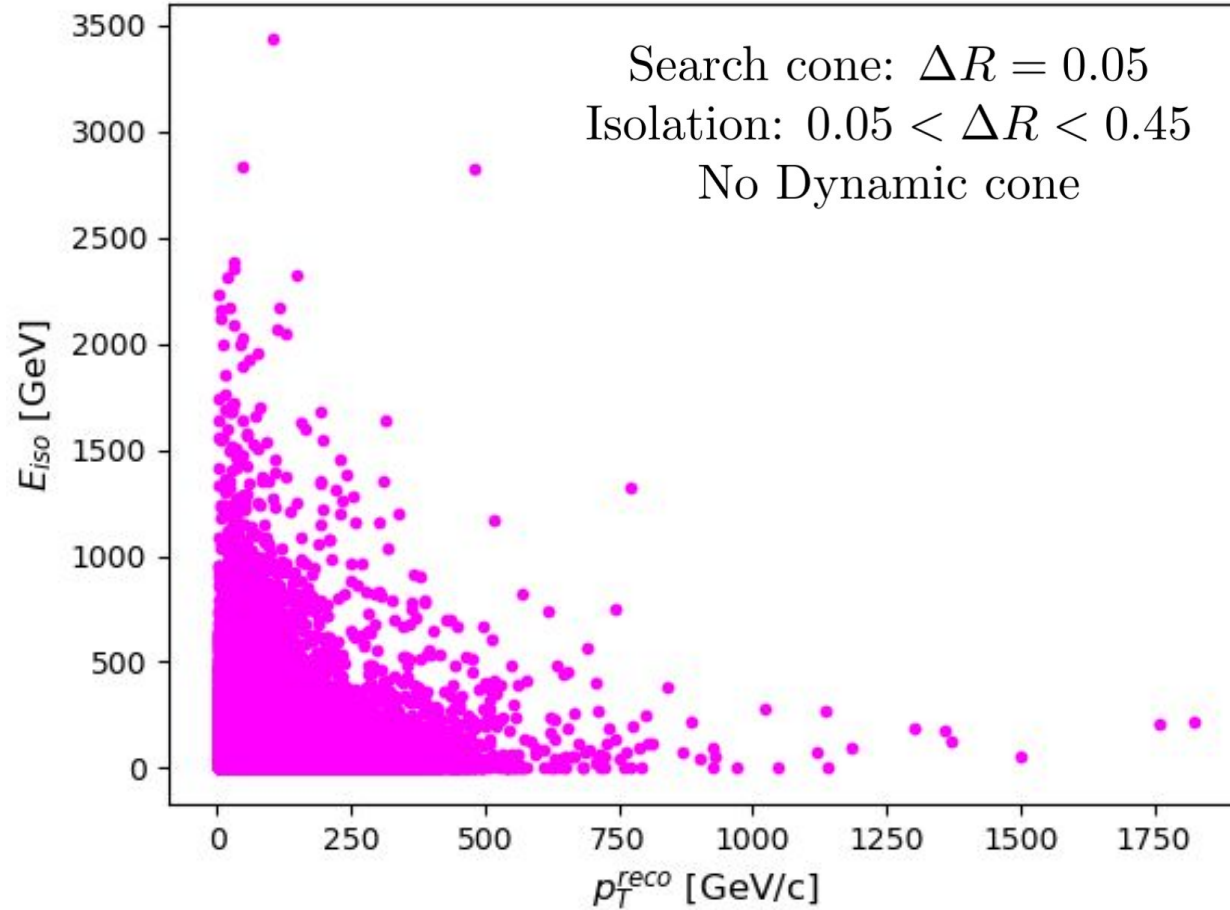
Dynamic Cone

$$\begin{cases} 0.6 & p_T \leq 10 \\ \frac{6}{p_T} & 10 < p_T < 120 \\ 0.05 & p_T \geq 120 \end{cases}$$

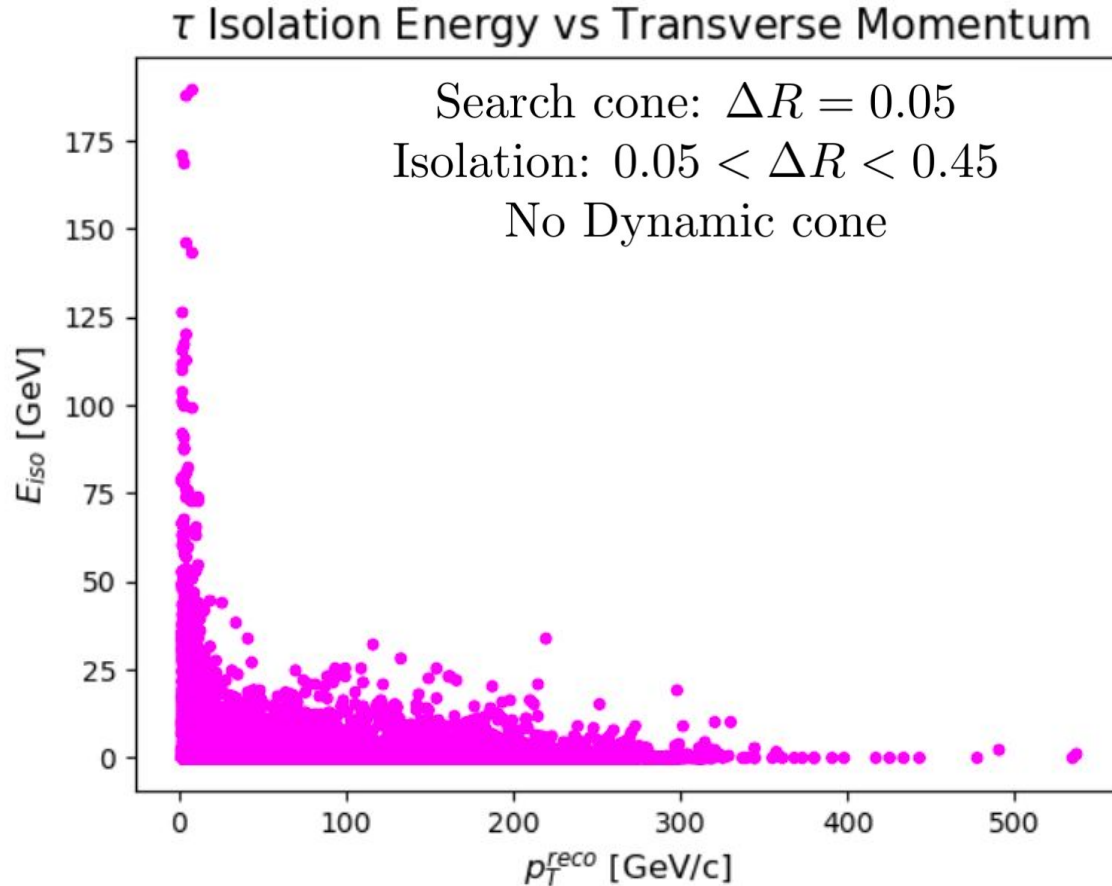


Thank you for your attention

Reconstructed tau Isolation energy vs Tau Pt

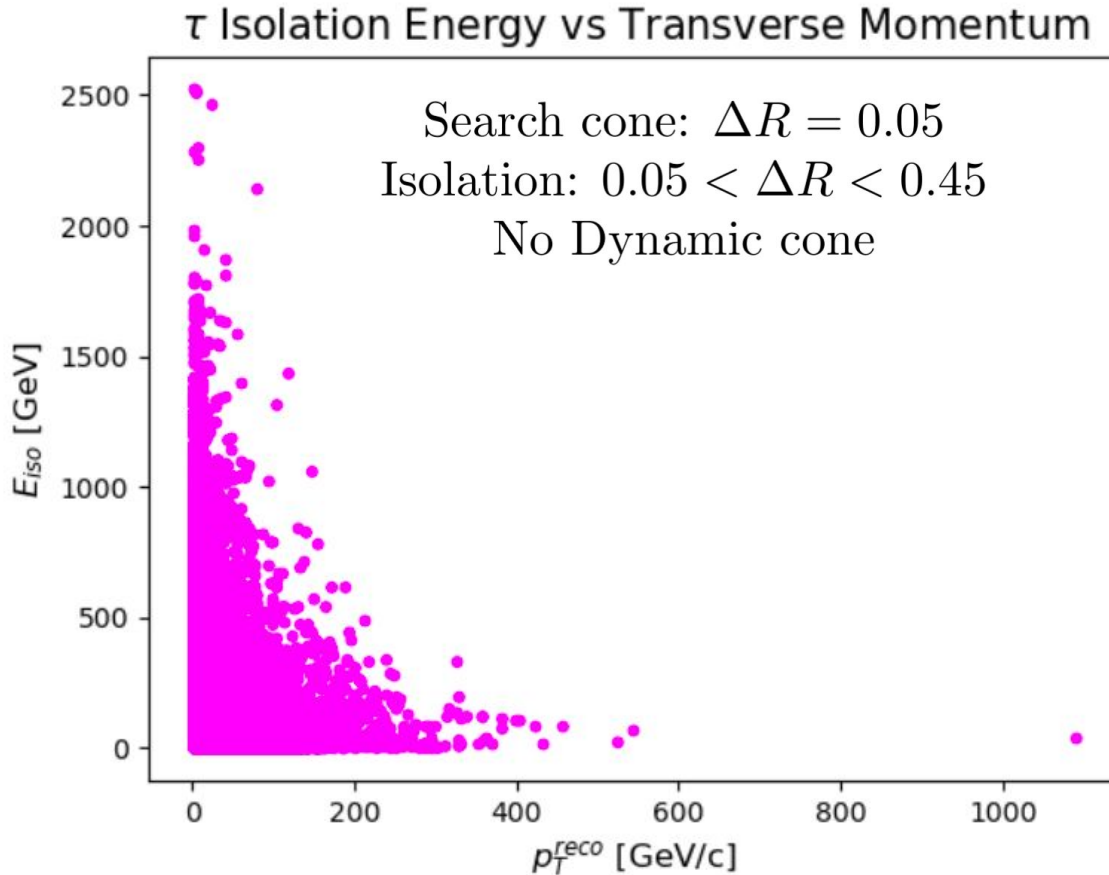


Reconstructed tau Isolation energy vs Tau Pt



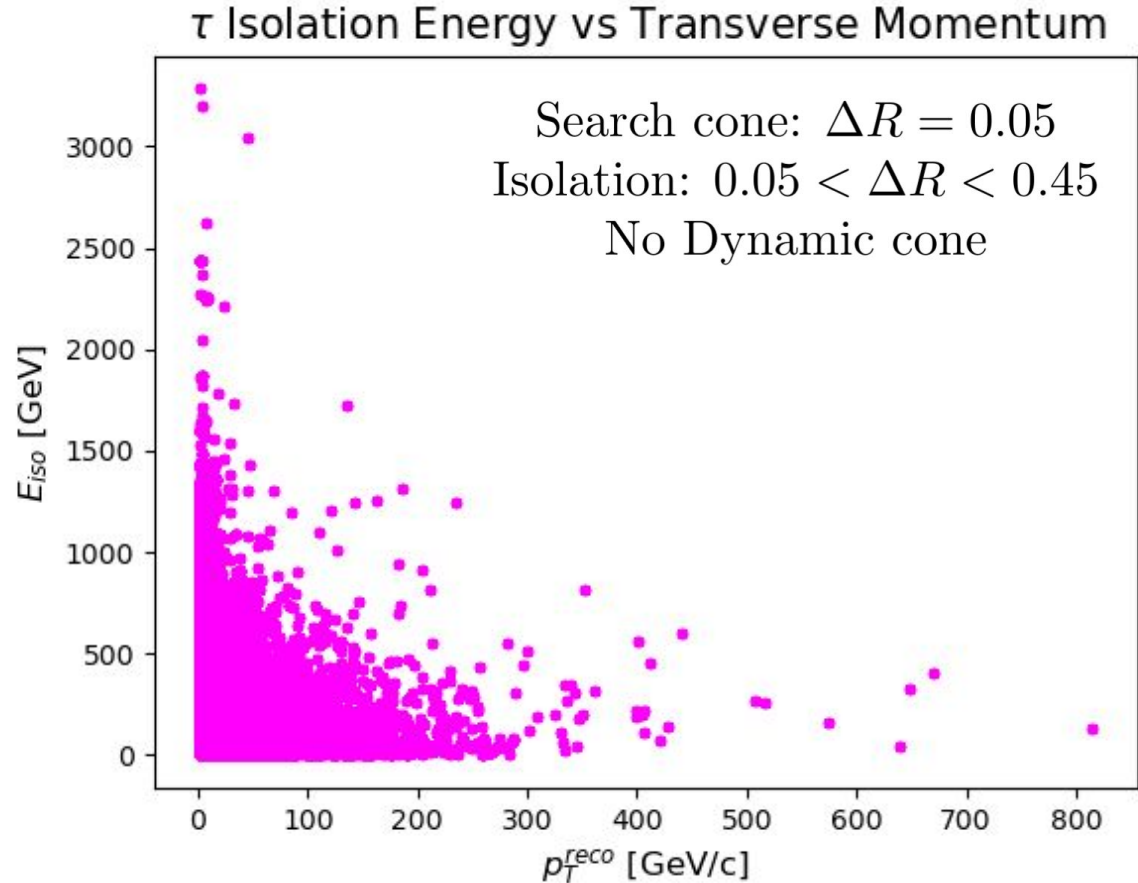
Tau gun

Reconstructed tau Isolation energy vs Tau Pt



$Z \rightarrow qq$ jets

Reconstructed tau Isolation energy vs Tau Pt



$Z \rightarrow b\bar{b}$ jets