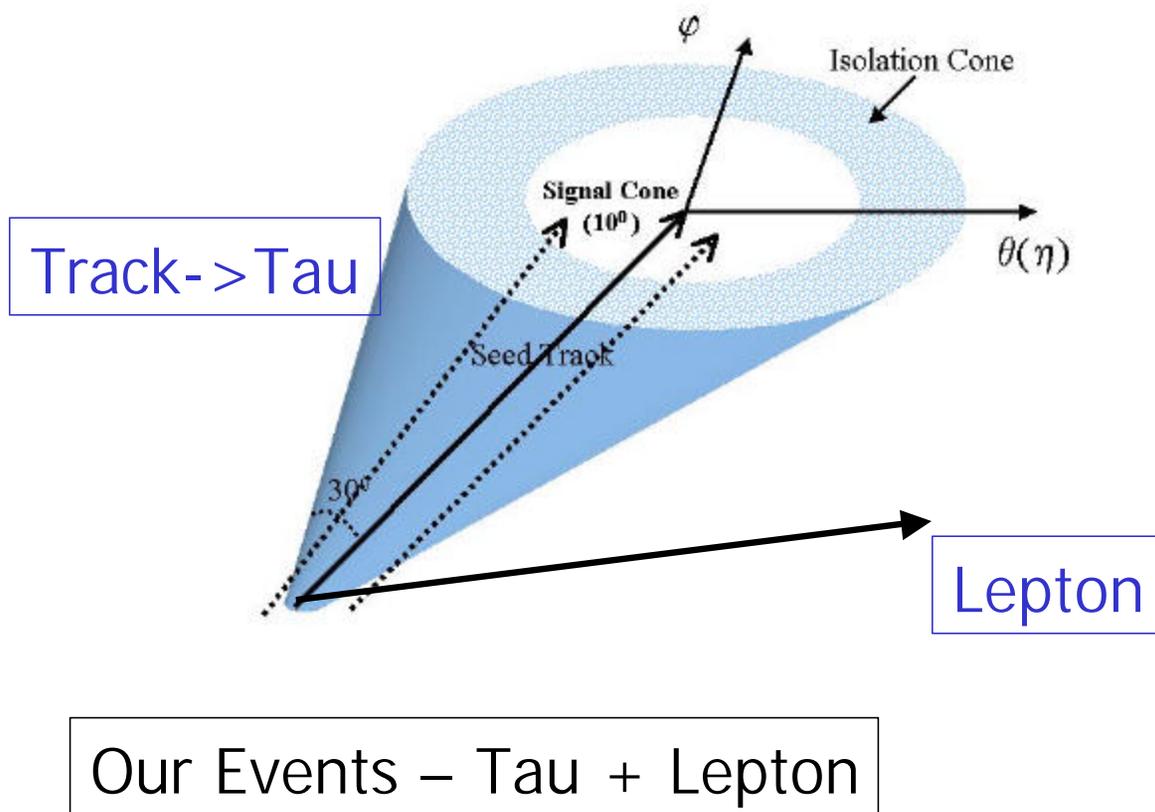
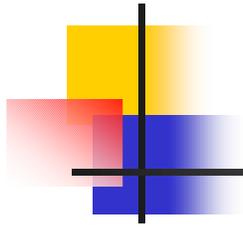


Current Lepton + Track Trigger



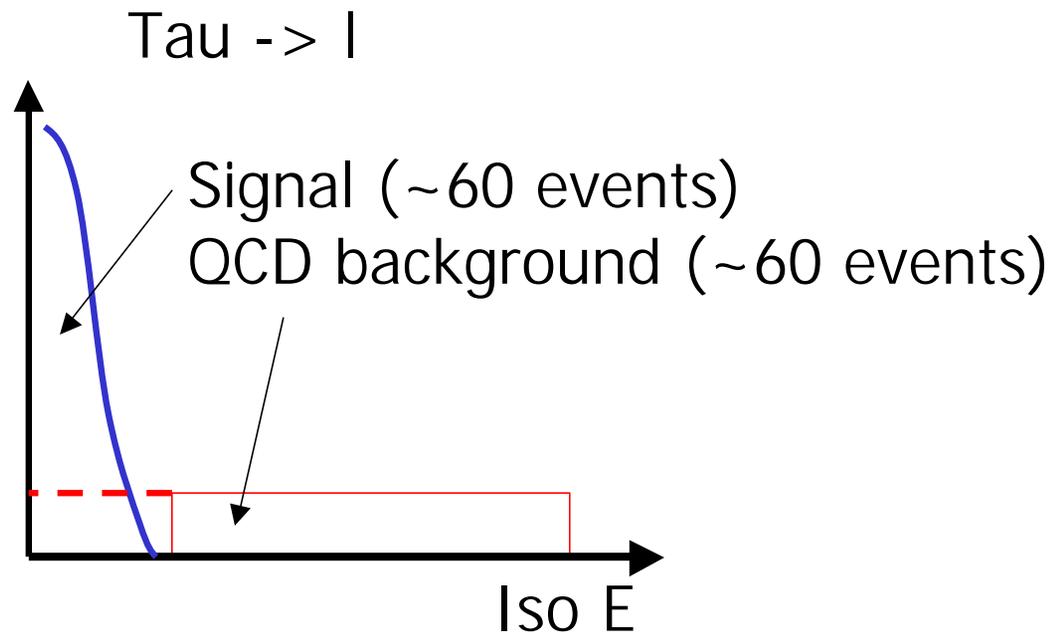


Motivation

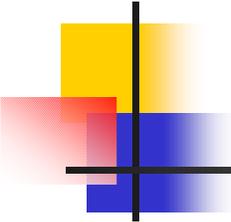
- unbiased fake rate estimates
- Higgs search using fake rates
(will become primary path)
- Higgs/Z isolation-based
background estimation

Z- \rightarrow Tau Tau

This is a control sample for future searches
Use it to understand backgrounds



New Trigger will allow us to do the same
with Tau isolation energy



Fake Tau rates

Lepton + track (L+t)
└─▶ τ :isolated

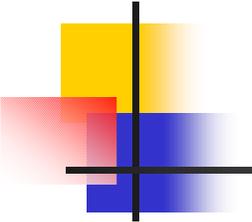
Fake Rate :

- take jet sample
- fake rate $f = N^{\text{tau}} / N_{\text{jets}} \sim 1\text{-}2\%$

Use this fake rate for L+t

- can't do because Tau already isolated
- solution: apply cuts to jets similar to L+t trigger
- fake rate $f = N^{\text{tau}} / (N_{\text{jets}} \otimes \text{Iso Tau}) \sim 20\%$
with such high fake rate it is hard to extract true fake rate after signal subtraction as the error on it is huge.

In the new trigger Tau is not isolated:
use it as a primary pass and apply



New Lepton+Track Triggers

New L3 paths; L2 part stays the same

Existing Triggers

New additions

L2_AUTO_L1_CMX6_PT8_CSX

L3_CMX8_TRACK5_ISO

L3_CMX8_TRACK5_NOISO

TAU_CMX8_TRACK5_ISO

TAU_NONISO_CMX8_ISO

TAU_LEPTON_1

L2_CEM8_PT8_CES2_&_TRK5_DPHI10

L3_ELECTRON8_TRACK5_ISO

L3_ELECTRON8_TRACK5_NOISO

TAU_ELECTRON8_TRACK5_ISO

TAU_NONISO_ELECTRON8_ISO

TAU_LEPTON_1

L2_TRK8_L1_CMUP6_PT4

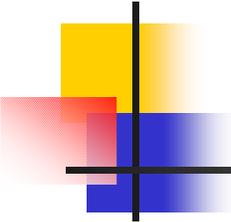
L3_CMUP8_TRACK5_ISO

L3_CMUP8_TRACK5_NOISO

TAU_CMUP8_TRACK5_ISO

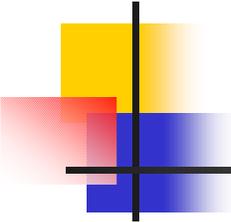
TAU_NONISO_CMUP8_ISO_v1

TAU_LEPTON_1



New Lepton+Track Triggers

- In the new triggers the track (Tau) isolation requirement is dropped, but we use output of the TauFinderModule
- Lepton part is exactly the same (no need even to clone modules)
- Use TrackFilterModule to impose isolation on leptons
Sum Pt < 8 GeV in Eta-Phi < 0.4 cone, $|\Delta Z| < 10$ cm
- TwoTrackFilterModule to separate track from lepton by at least 30° (3D Tau isolation cone)



New Trigger Rates

Run 166935 PHYSICS_1_05 [6,323,394]

L2 Trigger Rates:

L2_TRK8_L1_CMUP6_PT4	176.22 nb	=> CMUP8 path
L2_AUTO_L1_CMX6_PT8_CSX	84.77 nb	=> CMX8 path
L2_CEM8_PT8_CES2_&_TRK5_DPHI10	125.39 nb	=> Electron8 path

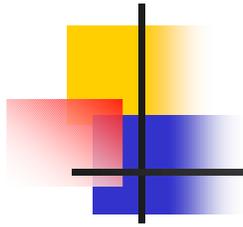
Existing L3 Trigger Rates:

CMUP8: 9.7 nb	=> L3/L2 = 5.5%
CMX8 : 5.3 nb	=> L3/L2 = 6.1%
Electron8: 25.8 nb	=> L3/L2 = 20.8%

To check the new Trigger Rates we used different samples:

- L3 for the sample should not be biased with our trigger
- New Triggers come from the same L2 paths as the old ones
- There are two sides: Tau and Lepton

Strategy: sample => strip events with L2 bits on=>
feed them to the L3 Trigger => get L3/L2 ratio



New Trigger Rates

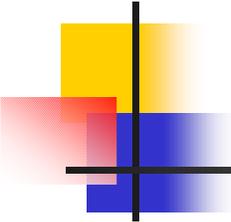
Existing L3 Trigger Rates:

CMUP8: 9.7 nb	=> L3/L2 = 5.5%
CMX8 : 5.3 nb	=> L3/L2 = 6.1%
Electron8: 25.8 nb	=> L3/L2 = 20.8%
<u>Total : 40.8 nb</u>	

New L3 Trigger Rates:

Sample: JET_CAL_SINGLETOWER_5 (cross-checked with jget08)	MUON_CMX18	ELECTRON_CENTRAL_8_NO_L2
CMUP8: L3/L2 = 3.8% => 6.7nb	5.71%	
CMX8: L3/L2 = 5% => 4.3nb	6.1 %	
Electron8: L3/L2 = 16.1% => 20.2nb	17.1%	25.8 %
<u>Total : 30.2 nb</u>	<u>30.1 nb</u>	<u>47.4 nb</u>

Each Pass ~ 20K events



Changes to current Triggers

There are differences in Tau objects in L3 and PROD

L3

>1.5 GeV

15 cm

η - ϕ Cone

10 cm

3D Cone

Tracks min P_T
 $|\Delta Z|$ from Seed
Cone around Seed

PROD

>1.0 GeV

10 cm

3D Cone



Improve in the
next Trigger
reincarnation?

Red: cut is harder Blue: cut is softer

Conventional wisdom: L3 cuts should be softer