

Higgs to Tau Tau Analysis For CEPC

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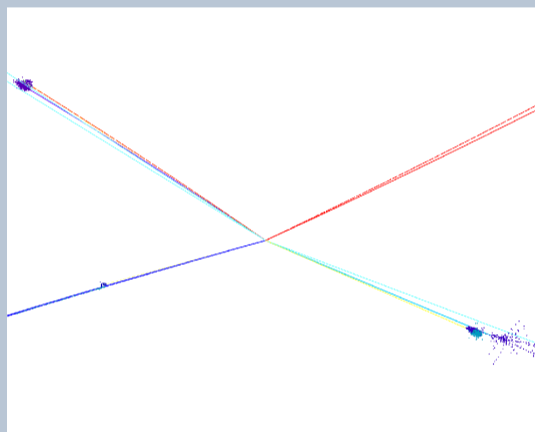
Introduction

Two different τ finding algorithms are developed corresponding to the leptonic events and hadronic events (corresponding to if the final state includes jets).

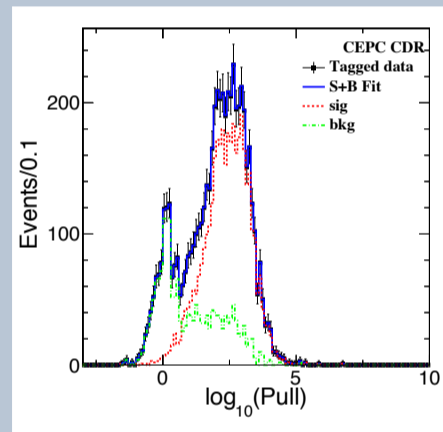
The combine accuracy for CEPC τ channel is 0.8%

Lepton Channel

- Veto the two isolate lepton
- Divide the whole space into 2 part
- Use the multiplicity and impact parameter for $\tau\tau$ event selection.
- Fit the impact parameter for signal and background statistics

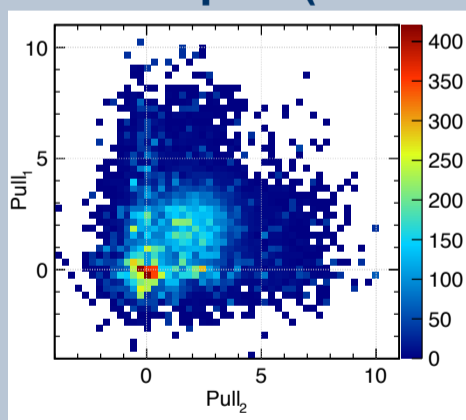


Topology of $\mu\mu H$ with H to $\tau\tau$ event

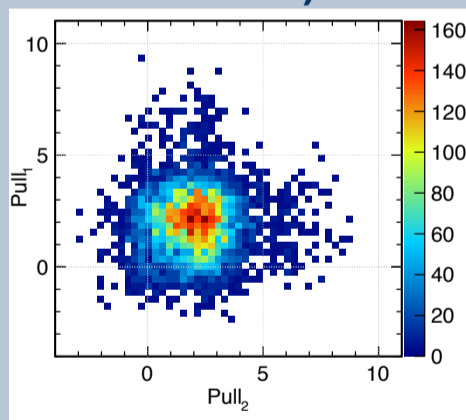


The impact parameter after the $\tau\tau$ event selection (Leptonic)

Pulls of τ pair (After event selection)



Impact parameter of the leading τ pair (Inclusive background)



Impact parameter of the leading τ pair (signal)

Conclusion

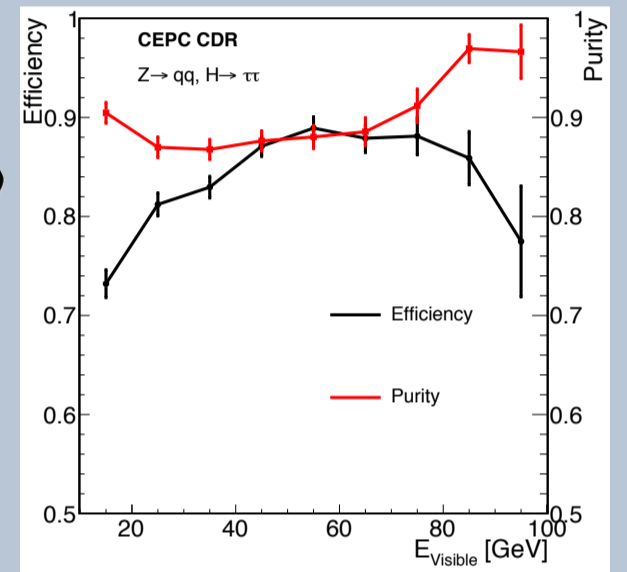
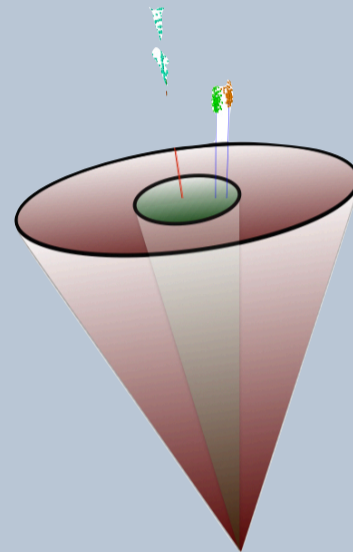
- A high efficiency and purity identification of tau candidates
- PFA oriented design make use of jet information and vertex information
- The final accuracy of H to $\tau\tau$ channel is:

	$\mu\mu H$	eeH	$\nu\nu H$	qqH	combined
$\Delta(\sigma \times BR)/(\sigma \times BR)$	2.6	2.7	2.7	0.9	0.8

Hadronic Channel

TAURUS (Tau reconstruction package)

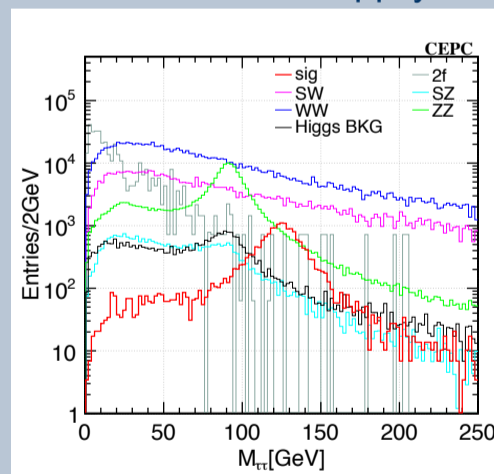
- Find seeds (Tracks with enough energy)
- Collect particle in two cones
- Use the multiplicity, energy ration between two cones, invariant Mass for τ tagging



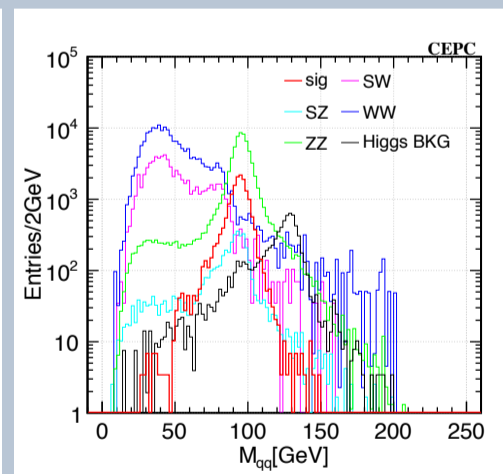
cone-based τ finding efficiency and purity in ZH to $qq\tau\tau$ events

The leading τ pair with opposite energy are selected as the Higgs decayed τ s, and the rest particle are treated as qq pair, to calculate:

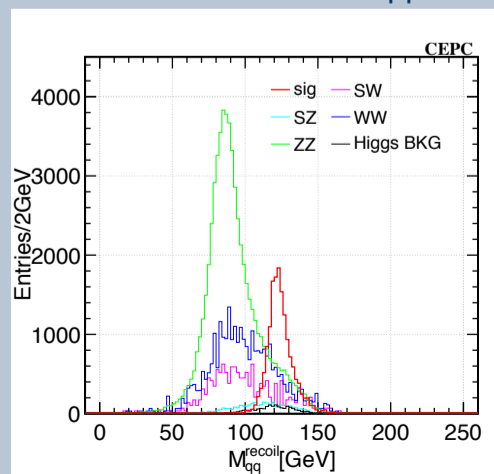
- The τ pair mass using collinear approximation
- The invariant mass of qq system
- The recoil mass of qq system



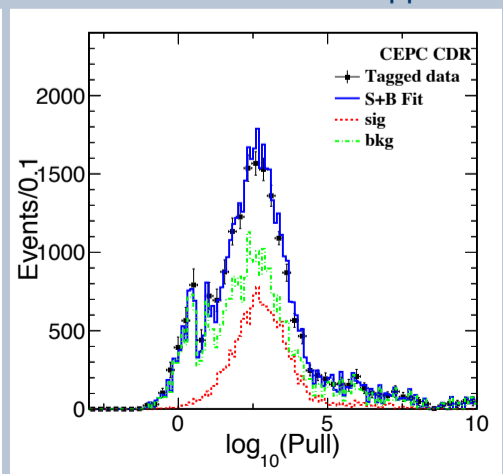
The collinear τ pair mass a cut of 90-160 GeV is applied



The qq system mass a cut of 70-110 GeV is applied



The qq recoil mass a cut of >100 GeV is applied



The impact parameter after the $\tau\tau$ event selection (hadronic)