Zbb as a benchmark for Higgs (Hbb)

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- The Z production process with associated jets Zbb is topologically similar to Hbb.
- Verification of MC, NLO calculations, kinematics, b,Z pT spectrum
- To convince people that the Higgs mass peak can be reconstructed: to understand and reconstruct the Z peak and show the mass is correctly measured. If that can be done, the same method should work similarly for the Higgs boson.
- How to select Zbb at LHC?
- Studied Higgs channel: MSSM H/A$\rightarrow \tau\tau$ in fully leptonic final states.
- Due to neutrinos in the final state, the mass is reconstructed using the collinear approximation: neutrinos are assumed to be emitted along the leptons.
- Missing Et resolution important, as it determines the mass resolution: leptons are measured well.

Analysis

The plan is to study Zbb events as signal, and to suppress the Z+j background (and tt,single top)

- The Higgs analysis background suppression methods can be used
- Z+j is huge compared to Zbb
- Z peak suppressed using b tagging
- Zbb - the signal model - irreducible
- Double b tagging may be necessary to suppress the Z+j and to get Zbb visible
- The Higgs signal is ∼killed with double b tagging, but Zbb cross section is larger (Hbb,H$\rightarrow \tau\tau \rightarrow e\mu$: ∼0.1pb vs Zbb,Z$\rightarrow \tau\tau \rightarrow e\mu$: ∼1.7pb)
- How about using Zbb,Z$\rightarrow \mu\mu$ ($\sim$ 27pb) and Zbb,Z$\rightarrow ee$ ($\sim$ 27pb)?

The key parts of this analysis

- b tagging
- Mass reco
- MET

Using ORCA for event reconstruction (full simulation), and official CMS data samples. Zbb sample (comphep): no cuts on b quarks.

b tagging

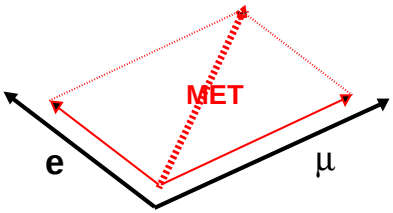
- Associated quarks are soft - jets are soft.
- Jet reconstruction efficiency low for soft jets
- b tagging efficiency low for soft jets.

Some preliminary b tagging results for H$\longrightarrow \tau\tau \longrightarrow \ell\ell$. Efficiencies given as eff/jet.

- to suppress the tt background with genuine b jets only one jet is tagged and jet veto is used. In this case double b tagging is also an option since Z+j is more severe background than tt
- b tagging results comparable with earlier studies, no dramatic changes expected
- several tagging algorithms available.

Algorithm	btag efficiency	mistag prob
BTaggingAlgorithmByTrackCounting	0.41	0.014
BTaggingAlgorithmBySecondaryVertices	0.46	0.010
BTaggingAlgorithmByJetProbability	0.27	0.019
ByCount (discriminator > 3)	0.42	0.012
BySecondaryVertex (discriminator > 1)	0.50	0.0096
ByProb (discriminator)	-	-

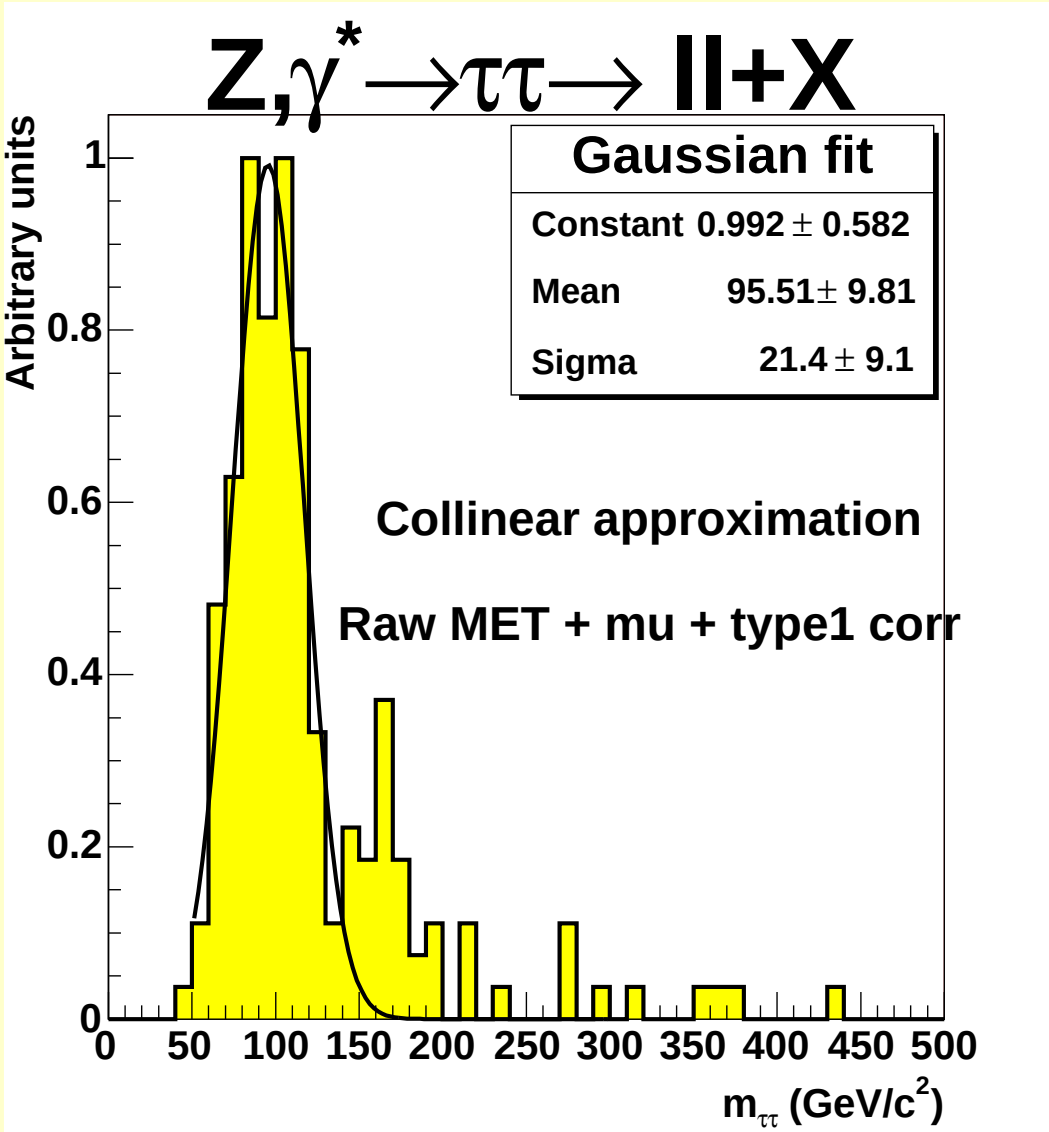
Mass reconstruction



Collinear approximation

Mass reconstruction using the collinear approximation. Neutrinos are assumed to be emitted along the leptons. The missing Et is divided into components. The lepton directions in 3D give possibility to estimate also the z component of the neutrino momentum.

Here the peak is at the right position within the error bars 95.5 ± 9.8 GeV.



MET

Missing Et reconstruction

- calorimeters
- muons
- corrections

Low MET, measuring difficult

Trying different MET reconstruction methods

$\longrightarrow$ find corrections which give best mass peak
(position and width)