

W mass studies
Hadronic decay Study
WG1 & WG2 working meeting

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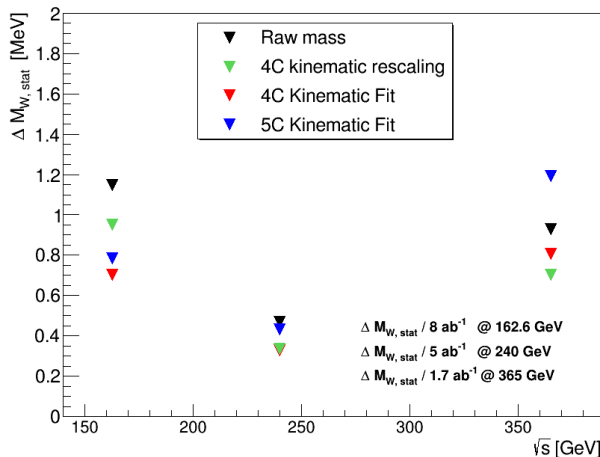
July 24, 2018

1 Hadronic decay $e^+e^- \rightarrow W^+W^- \rightarrow qqqq$

- Previously...
- Deeper in the hadronic decay
 - Studies
 - Pairing test

2 Conclusion and Outlook

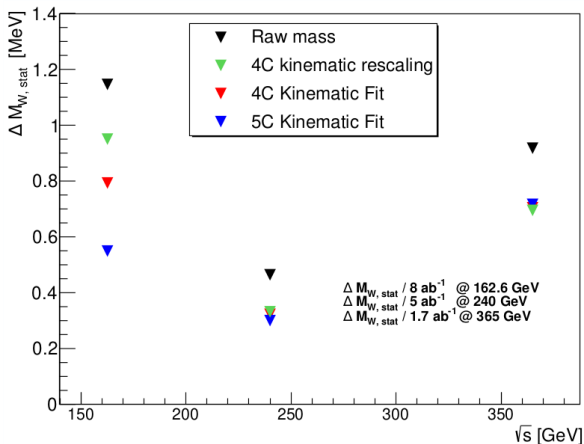
Previously in the hadronic channel...



Full luminosity
uncertainty

WRONG : the pairing is done differently between kinematic fit and direct reconstructions.

... with the χ^2 pairing

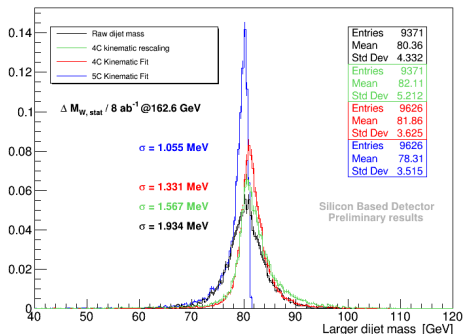
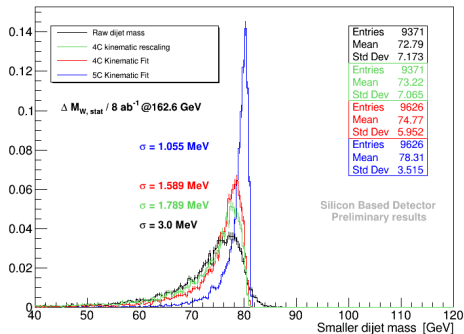


Full luminosity
uncertainty

- 5C fit still bad at high energy \rightarrow Discussed in the following
- 5C fit at 162.6 GeV will be dropped.

162.6 GeV interlude

At threshold : on-shell and off-shell mass. Force the masses equality put both of them off-shell → Not physics.



End of interlude

Deeper in the hadronic decay - Studies

- GenLevel study : without detector ;
- Discard events with photon-jet ;
- Several algorithms :
 - Durham forced 4 jets ;
 - Durham with ycut ;
 - Cone algorithm.

162,6 GeV

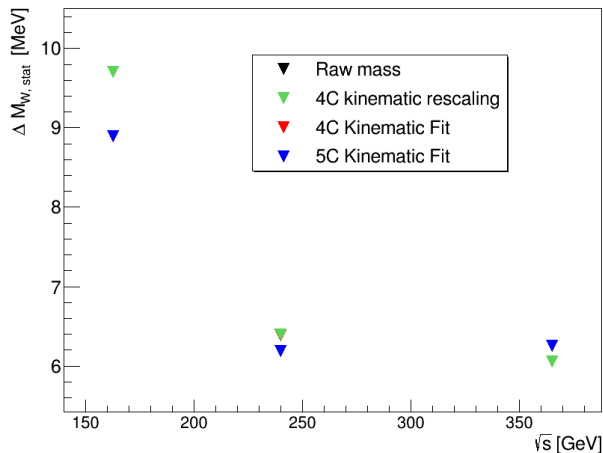
240 GeV

365 GeV

Still same behaviour → need to go more deeply !

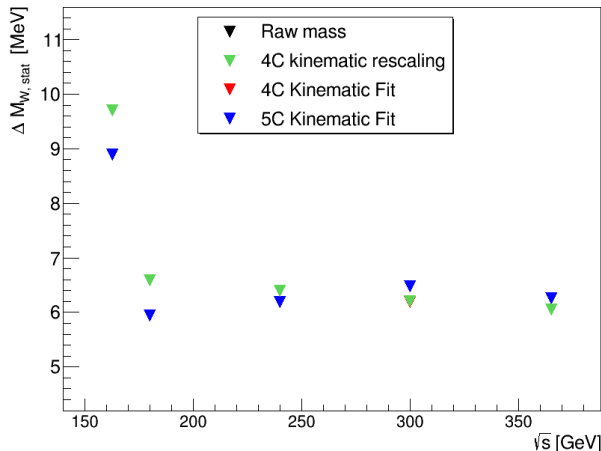
- GenLevel
- Discard events with photon-jet or non-clustered particles (neutrino or $p_T < 10^{-5}$) ;
- Durham algorithm forced 4 jets ;
- Pythia simulation **without ISR/FSR/Remnant** and **without colour reconnections**.

Deeper in the hadronic decay - Studies



Not the full luminosity uncertainty

Deeper in the hadronic decay - Studies



Not the full luminosity uncertainty

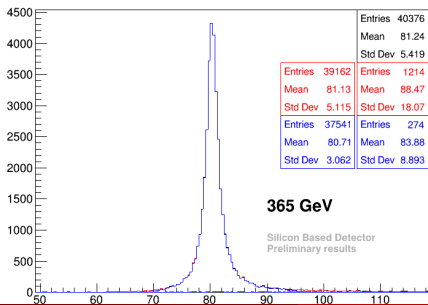
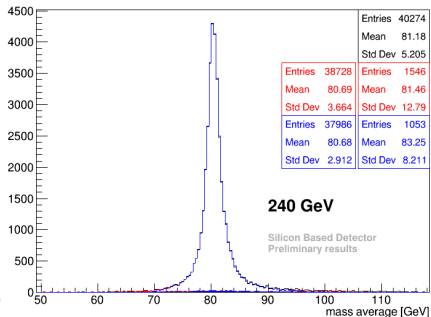
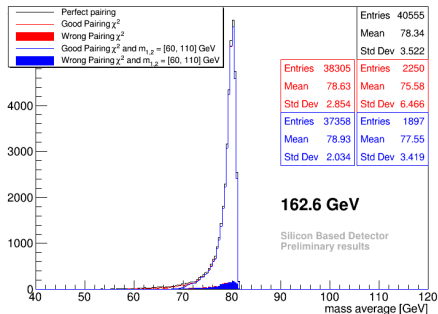
Same studies at 180 and 300 GeV.

Effect increasing with energy ?

Potential source of error:

- Jet pairing
- Jet clustering

Deeper in the hadronic decay - Pairing test

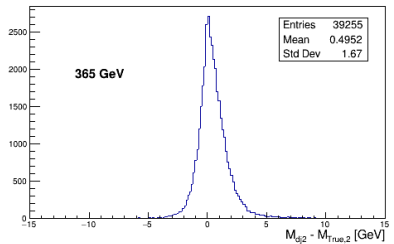
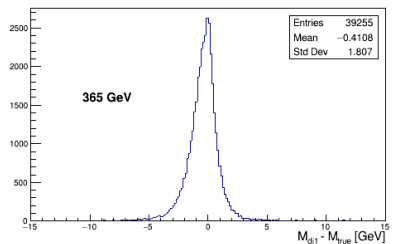
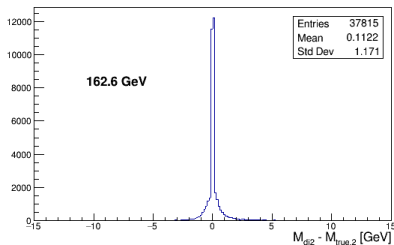
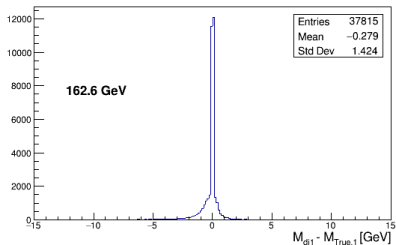


Pairing comparison - Raw mass

Conclusion

The pairing method is good since only few percent of the events are wrongly paired. Wrong pairing decreases with the energy.

Deeper in the hadronic decay - Comparison M_{reco} , M_{true}



Particles mixing between jets

This effect increases with the E_{CM} because the jets are closer.

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2 Conclusion and Outlook

Conclusion and Outlook

In the hadronic channel, the 5C fit issue is due to the **mix of particles between jets**.

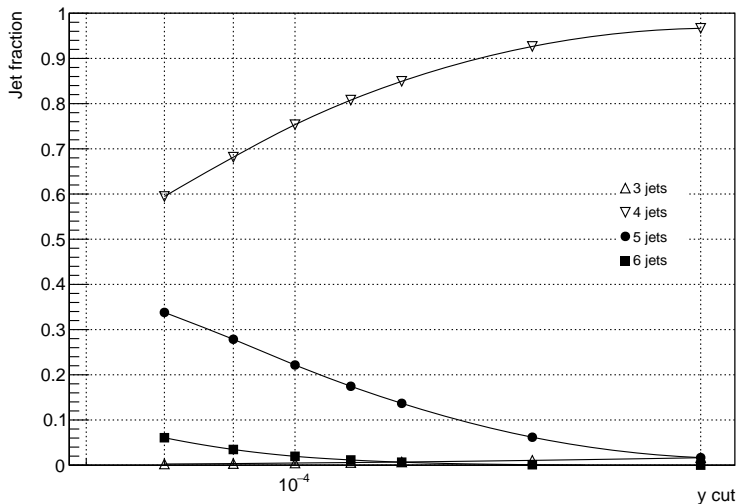
A complete study of jet algorithm will be done to reduce this effect. Some studies were made but nothing very conclusive up to now. The Durham algorithm with y_{cut} instead of forcing 4 jets, does not appear to improve the study. The pairing efficiency and the W reconstructed masses distributions are similar to the Durham forced in 4 jets.

Thanks for your attention

BACK-UP

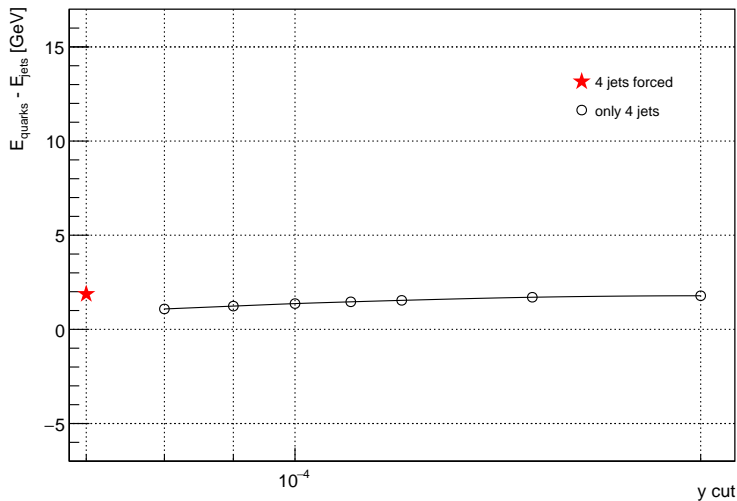
300 GeV

Graph



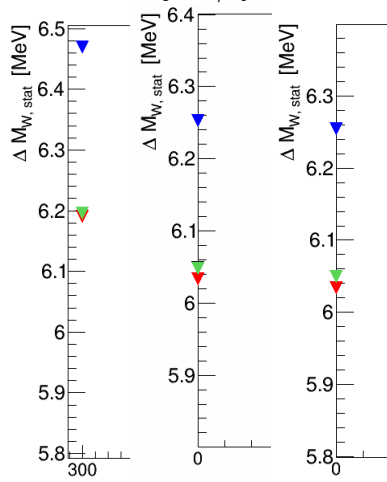
300 GeV

Graph

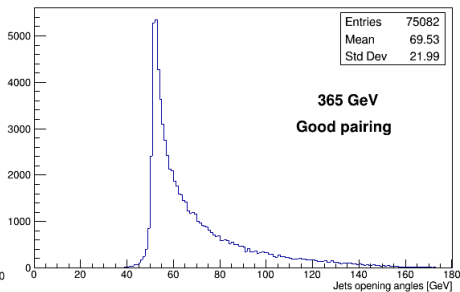
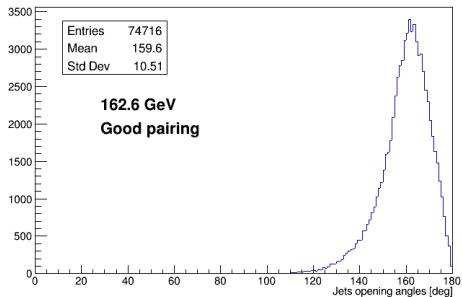


Algorithm study

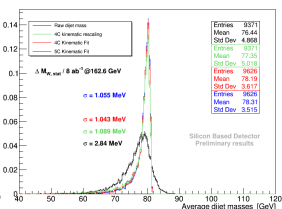
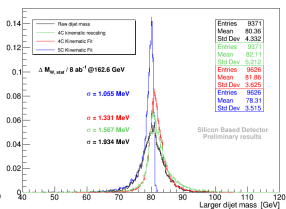
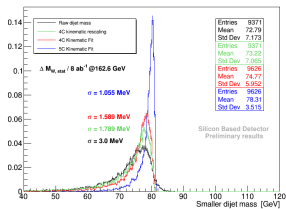
300 GeV - 4 jets / $y_{\text{cut}} = 0.0001$ / $y_{\text{cut}} = 0.00008$



Jet-Jet angle distributions



masses distributions 162.6 GeV



masses distributions 240 GeV

