SEARCH OF JET-JET RESONACES IN lνjj FINAL STATE

Tesi di laurea magistrale in Fisica.
Anno 2012-2013

WAVELET ANALYSIS

- Wavelet transform:

  $$W_n(s) = \sum_{n'=0}^{N-1} x_{n'} \Psi\left(\frac{(n'-n)dm}{s}\right)$$

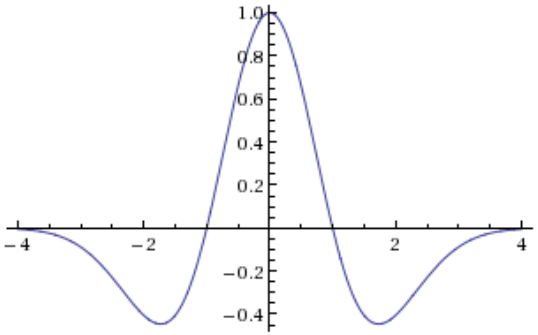
  n → bin number

  x_n → bin content

  dm → bin width

  s → scale

  Ψ → wavelet function, here: $\Psi(\eta) \propto (1-\eta^2)e^{-\eta^2/2}$



- It's computed for s varying from 1 to ~10^2

- For a gaussian signal of mean μ and standard deviation σ :

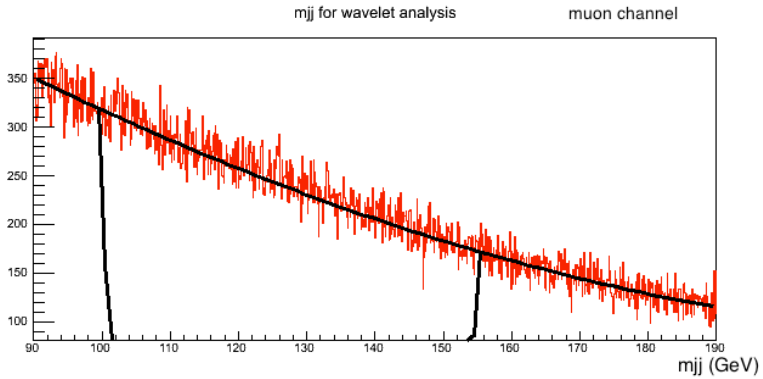
  $$W_n(s) = A(s) \cdot N_{events} \cdot \left(1 - \frac{(ndm-\mu)^2}{\sigma^2+s^2}\right) e^{-\frac{(ndm-\mu)^2}{2(\sigma^2+s^2)}}$$

- In the following, background has been subtracted before the wavelet transform is computed; some tests have also been done without subtracting the background.

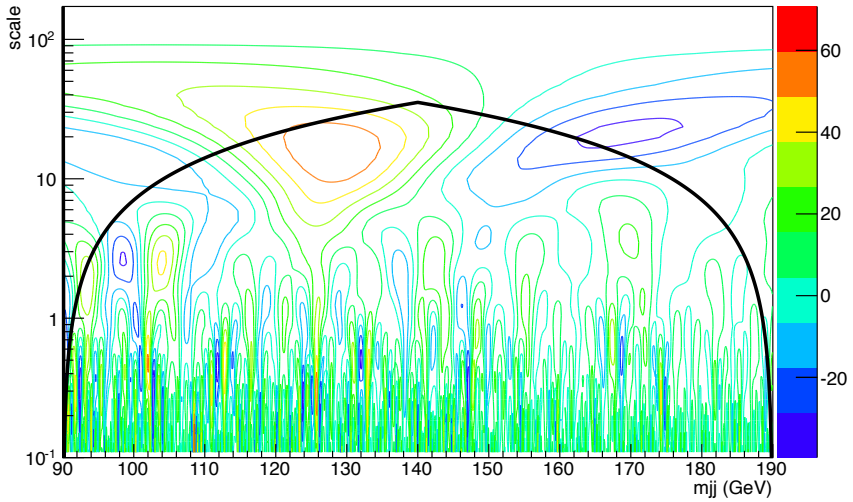
DATA

- Mass range [100,200] GeV

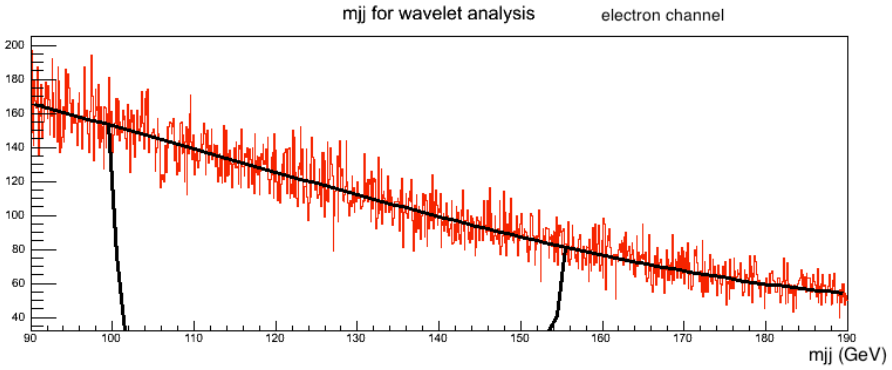
μ channel



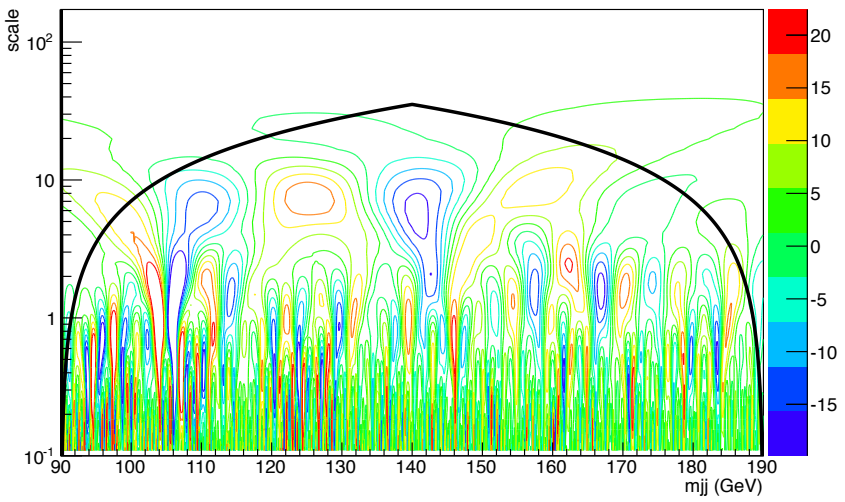
Wavelet transform: muon channel



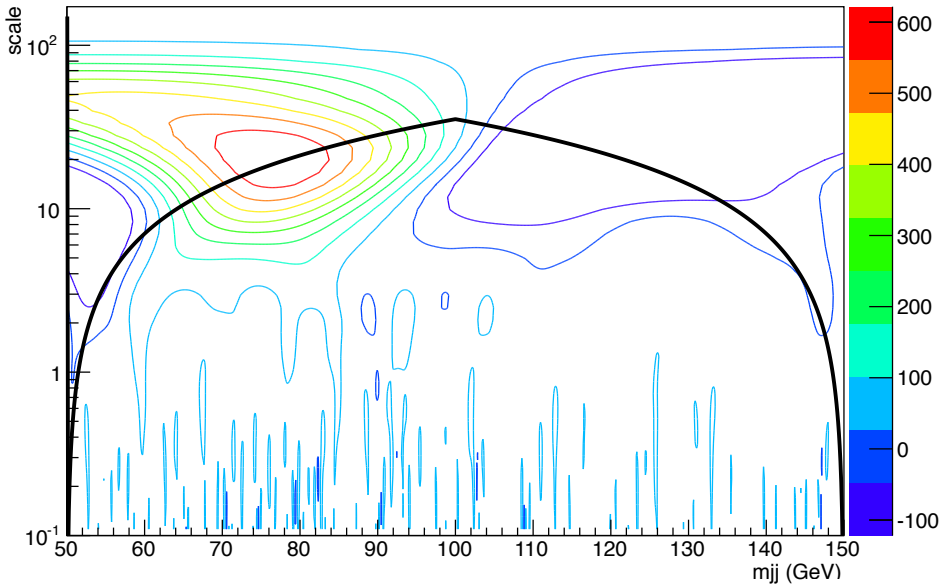
e channel



Wavelet transform: electron channel



Wavelet transform: muon channel

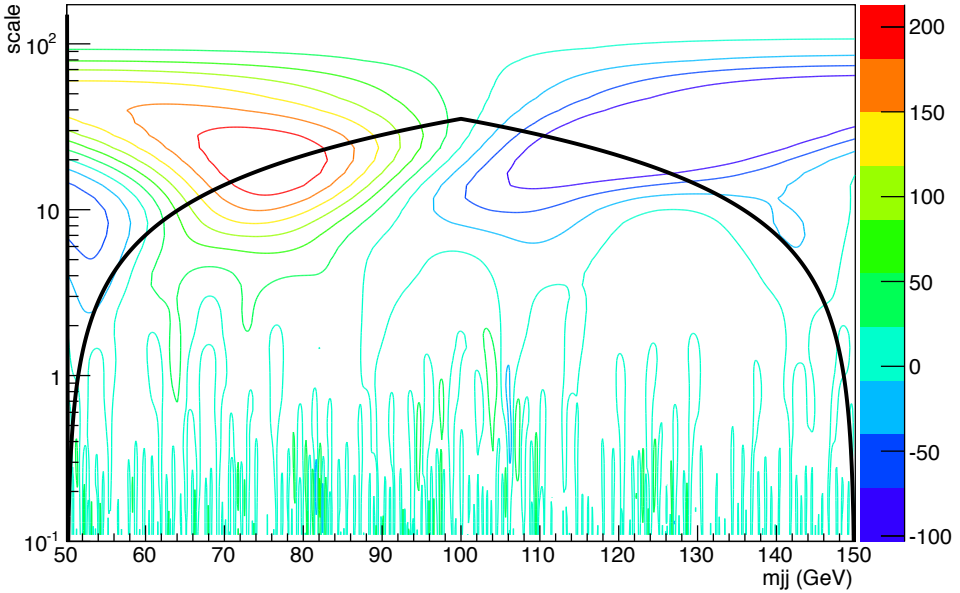


μ channel

- Mass range [70,170] GeV :
the background peak causes problems

e channel

Wavelet transform: electron channel



WORK IN PROGRESS TO CHECK IF THEESE RESULTS ARE SIGNIFICANT

- The effects of background subtraction must be carefully checked
  - Here, the background shape has been fitted to data, excluding the signal region

- Toy MC has been used to test the method:
  - Background shape is fitted to data
  - MC sample is generated from the fitted function
  - A gaussian signal is added, varying the number of events

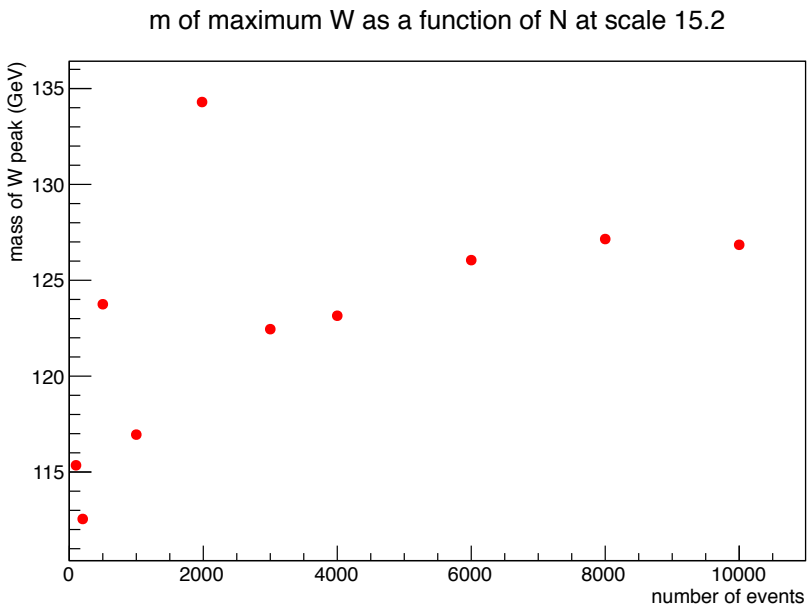
- Fixed the scale *s*, the maximum of *W(m)* has been plotted as a function of the number of events.

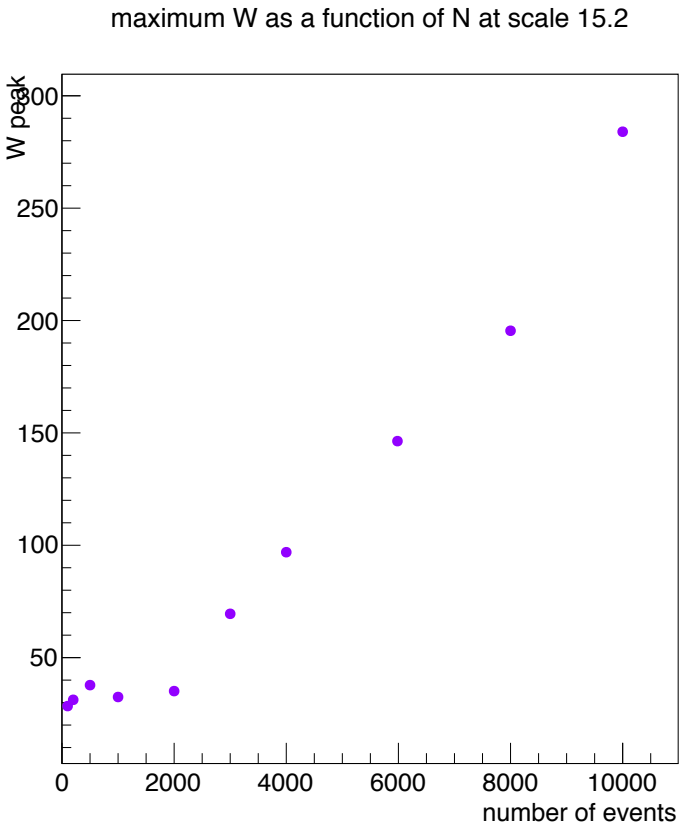
  Two cases are considered:

  1. the known background shape is used for subtraction (slide 6)
  2. the background is fitted as in real data (slide 7)

- Other wavelet parameters are being checked (width in mass and scale, dependency on the signal σ,….)

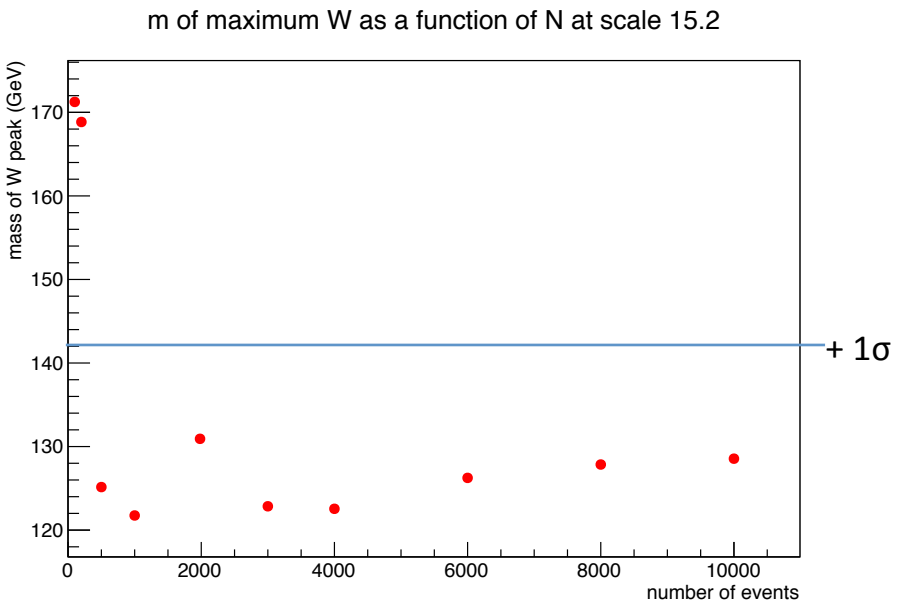
Known background shape is used for subtraction

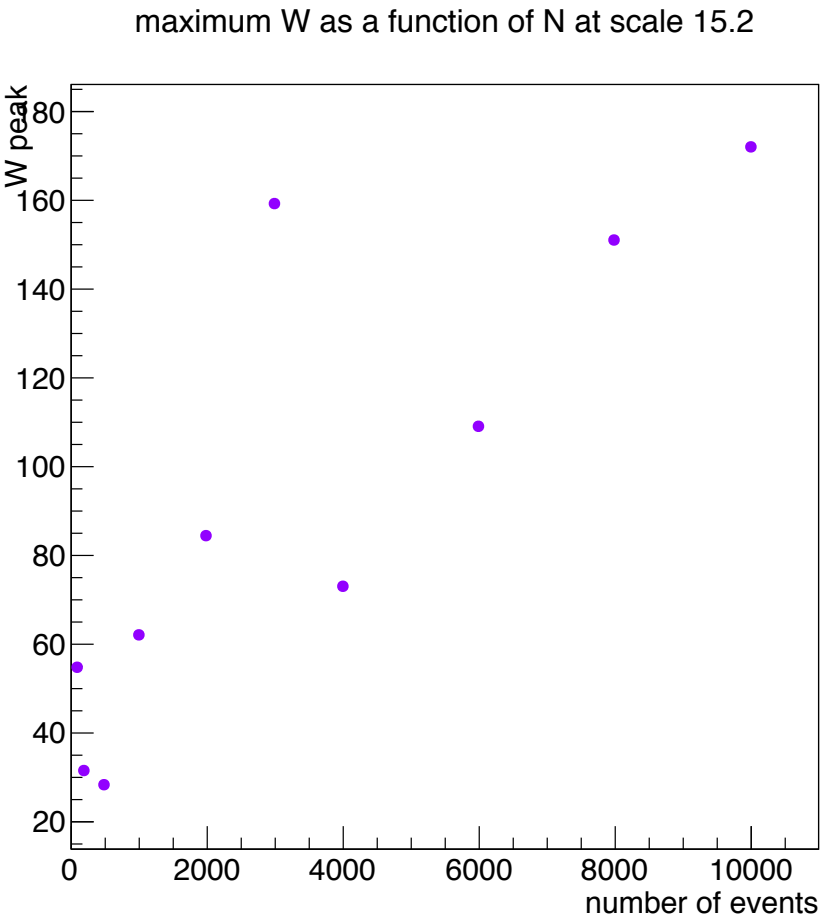




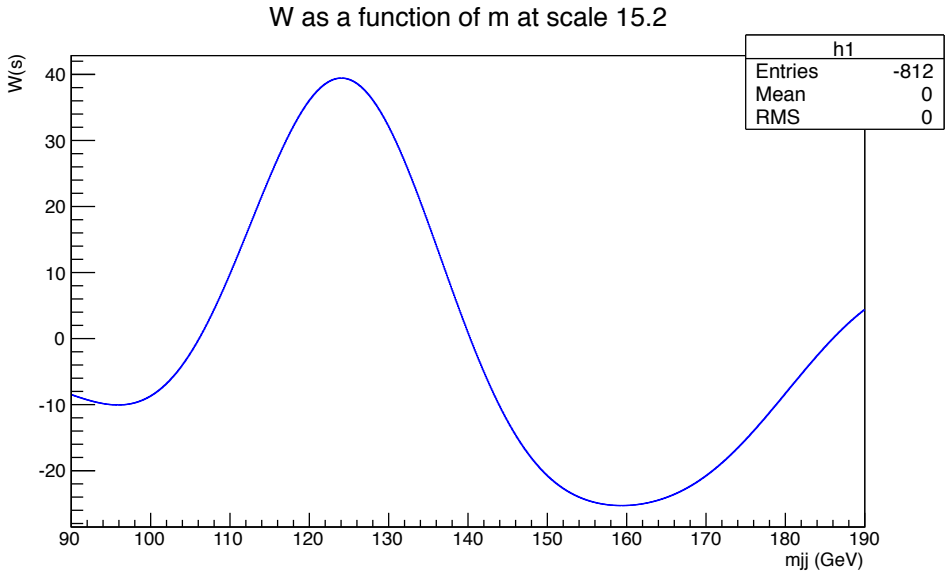
For small N_{events} the linearity seems to be lost.

Fitted background shape is used for subtraction



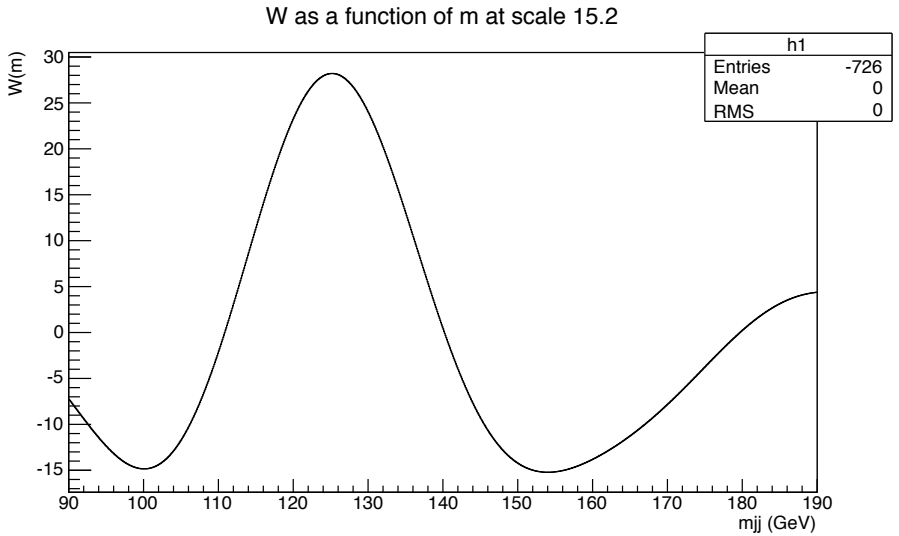


BACKUP



500 events

Known background shape is used for subtraction



Fitted background shape is used for subtraction