D0 bbh(->bb) Limit Setting Method

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1. Background normalization

2. Confidence Level for no Signal

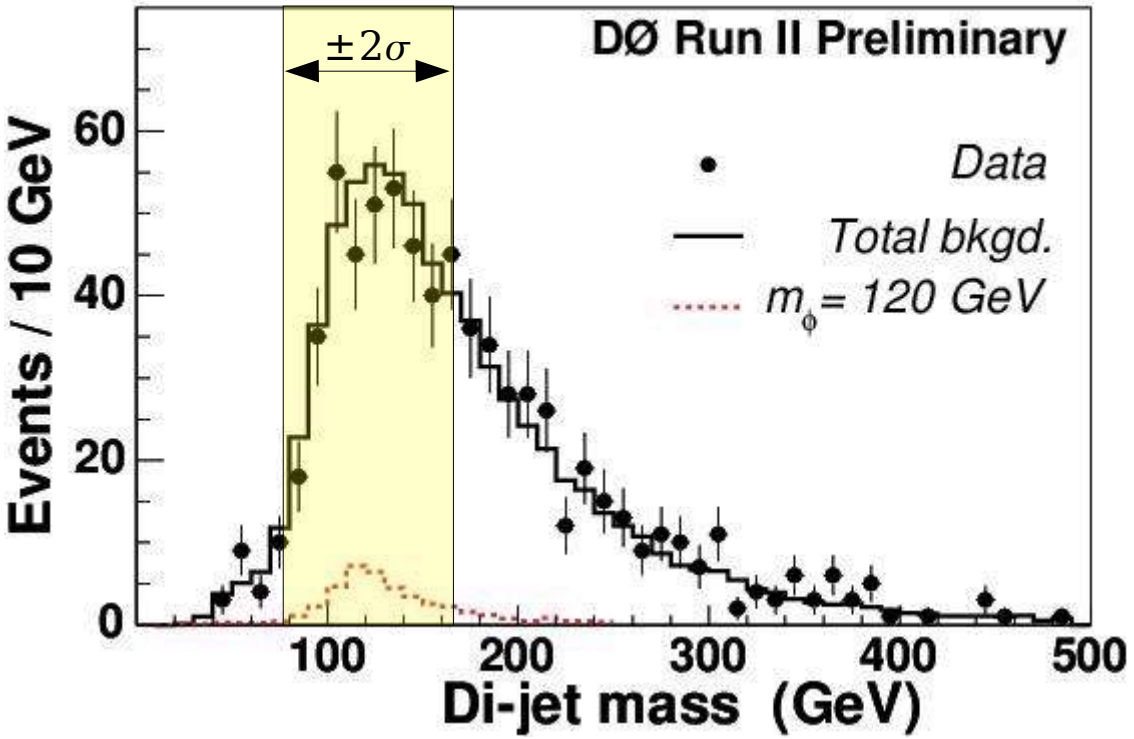
3. Cross-section Limit at 95% Confidence Level

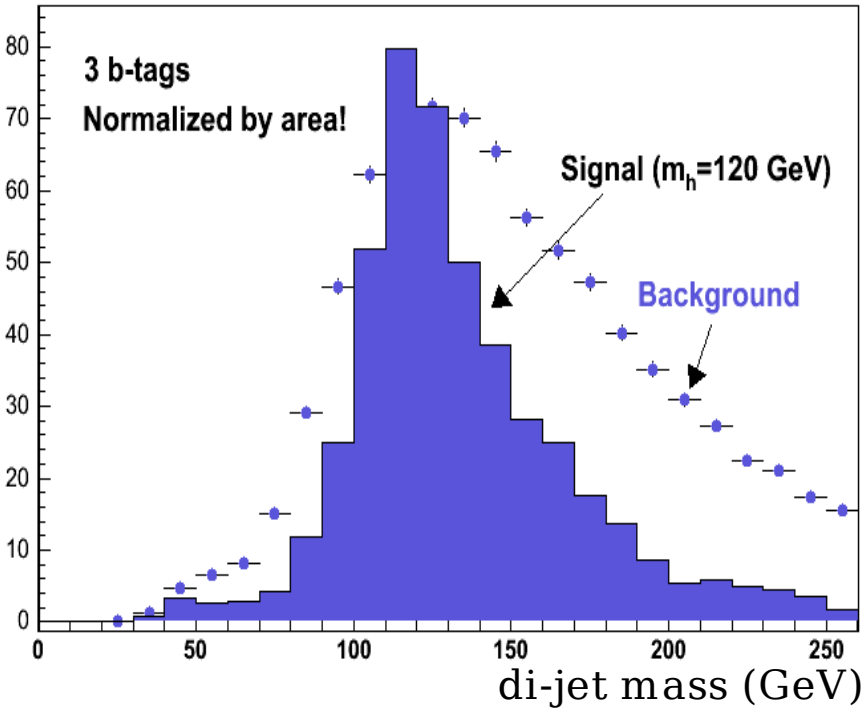
1. Background normalization

The shape of the background is determined from a fit to the double b-tagged data, which is then extrapolated to the expected triple b-tagged spectrum using a tag-rate-function which accounts for the kinematic bias from requiring a third b-tag.

The signal distribution is fit to a double Gaussian. The first Gaussian describes the central peak whose width is determined by the di-jet mass resolution of the experiment. The second Gaussian is wider and is due to tails from combinatoric background (choosing b's not from the Higgs decay).

The background is fit to the data, after subtracting the expected signal at a given signal cross-section. A window twice the width of the central Gaussian (±2 sigma) is excluded during the fit, taking advantage of the difference in shapes between signal and background. The fit is a binned chi-squared minimization. This normalization of the background is performed independently for each signal mass, but differs by less than 2% amongst all masses tested.





2. Confidence Level for no Signal

Fits have been performed to the data of a sum of background and signal shapes, to determine that the data prefers a background-only shape. This has been done for each trial signal mass.

The modified frequentist method is used to determine the confidence level at which a given signal cross-section is excluded. The full data, background, and signal histograms are used as input. MC experiments are performed to determine the fraction of experiments which exclude signal, while varying the signal and background histograms within their respective systematic errors. The statistic used for confidence level is $CL_S = CL_{S+B} / CL_B$.

3. Cross-section Limit at 95% Confidence Level

To determine the lowest cross-section which can be excluded at 95% confidence level, the following cycle is performed, starting with a small cross-section, until the confidence level reaches 95%:

- Normalize the background, outside the mass window, using the given signal cross-section in the side-band
- Determine the confidence level for no signal using the full histograms
- If the confidence level is < 95%, then raise the signal cross-section and repeat