PROFILE LIKELIHOOD LIMIT SETTING

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Likelihoods

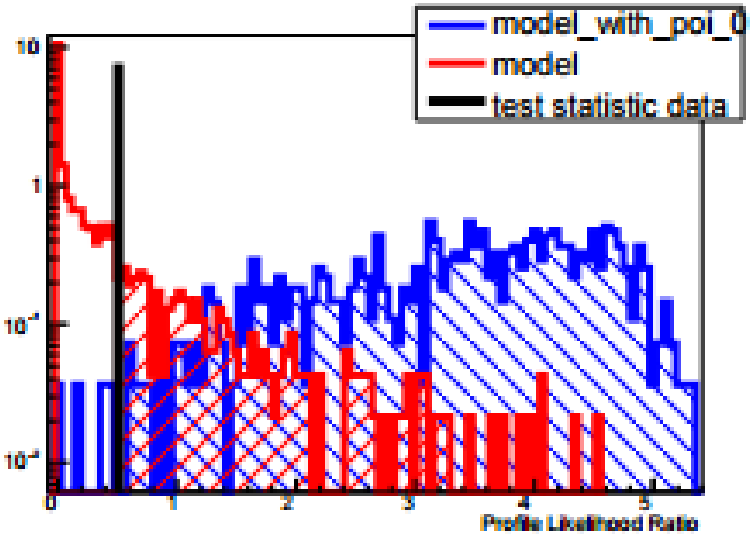
- Compares model with parameters to data.
- Example.
  - Model M predicts number of As vs number of Bs with parameter f_A = probability a given data event will be A. (1-f_A probability it will be B).
  - Given data set is x=[A, B, A]
  - $L(0.5|x) = P(x|0.5) = f_A*(1-f_A)*f_A = 0.5*0.5*0.5 = 0.125$
  - $L(2/3|x) = P(x|1/3) = 2/3 * 1/3 * 2/3 = 0.148$
    - L(2/3|x) is greater, more likely parameter value is 2/3

How to use them, Models

- Create two models: signal, background.
  - These models consist of PDFs in five dimensions (S1, Log10S2, Drift_time, Phi, R). These determine the probability of an event happening at every point in the phase space.
- Add the signal and background PDFs together, with various weightings of signal strength (i.e. scale the signal model higher relative to the background model).
- Determine the P value for each of these following the following steps

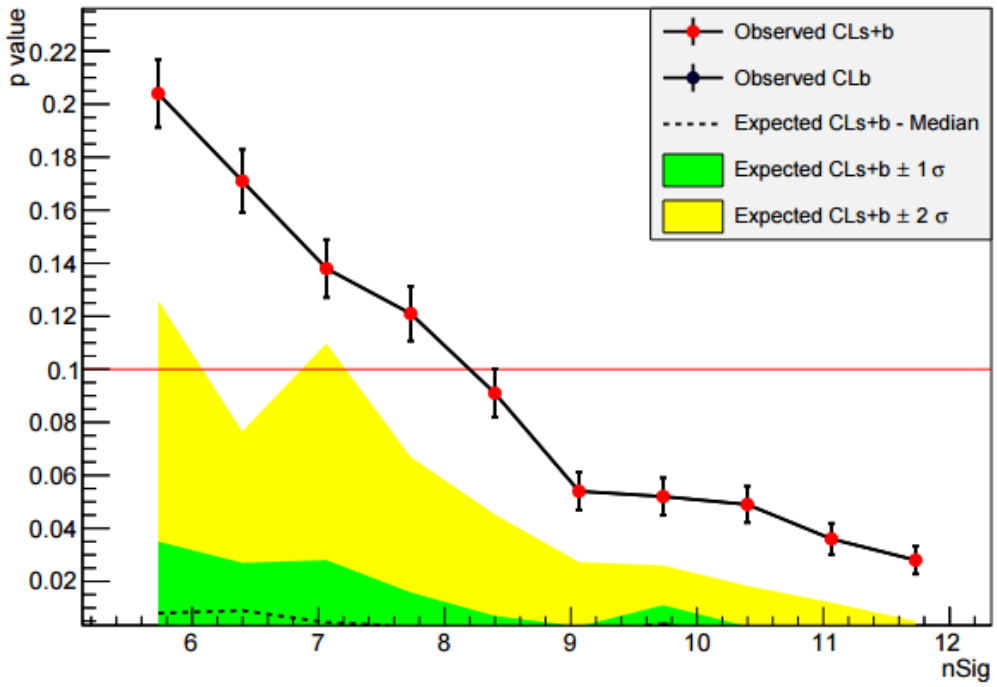
The Steps

- Step 1: Find the best fit model parameters by finding the maximum likelihood.
- Step 2 (iterate):
  - Create a data set using the best fit model.
  - Vary the best fit (from data) parameters within constraints.
  - Compute the likelihood of this altered model with the data set just constructed.
- Step 3: record what fraction of these likelihoods from altered models were more likely than the original



Compare these

- Look for the signal strength that gives you 90% of varied models do better than the first one.
- This is the cross-section of the 90% confidence limit.



Background model

- Made up of many sub-models
- Working on implementing Wall Model (backgrounds coming from the wall) in the limit code.