Testing (simplified) template fit method

- Testing on templates provided by Isis
 3L final state for tZq signal in ttbar sector
- Trying different variables
 - 1 kinematic variable M(FCNC top)
 - MVA variable using M(FCNC top), M_{lb}(SM top), #CSVM b-jets
 - -2 dimensional distribution using M(FCNC top) and M_{lb}(SM top)
- Idea:
 - 1) generate pseudodata (toy MC) from bkg+signal template
 - 2) fit bkg template and signal template to pseudodata
 - 3) calculate S = (fitted signal) / (uncertainty on fitted signal)
 - 4) obtain distribution of S by performing pseudoexperiments
 - 5) calculate "signal significance" as mean of S distribution

Advantage:

- significance calculation will not be affected much by presence of background *level* systematics contrary to "S/sqrt(S+B)"
- exploits shape of distributions

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Test 1: one kinematic variable M(FCNC top)



bkg+signal template Poisson fluctuated

Taking into account statistical errors on templates

 Fit background template and signal template to pseudodata (RooFit, currently default Minuit/Migrad binned maximum likelihood fit)

Test 1: one kinematic variable M(FCNC top)

• Generate 10k pseudoexperiments \rightarrow results in 10k values of the fitted signal s_{fit}, with corresponding fit uncertainty $\sigma_{s fit}$



Mean value can be considered as "signal significance" → this example: **significance = 2.7**

Test 1: one kinematic variable M(FCNC top)

 Note: considering statistical uncertainty on templates while generating pseudodata broadens significance distribution, but mean value stays practically the same



Test 2: MVA BDT output

Generate 10k pseudoexperiments



Mean value can be considered as "signal significance" \rightarrow this example: significance = 3.6 [increase w.r.t one-variable fit]

Test 3: 2D distribution M(FCNC top) and M_{Ib}(SM top)



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Generate 10k pseudoexperiments



Mean value can be considered as "signal significance" \rightarrow this example: significance = 3.6 [similar to MVA fit]

Warning: choice of binning can increase or decrease significance
 reasonable binning choice to be investigated