$B^0 \to \pi^0 \pi^0$

Sebastiano

News from last time - fitter improvements

Old	New
Signal and BBbar shape parameters were fixed from MC, while continuum was left floating.	Continuum is also fixed from MC. Only free parameters are BF and BBbar yield.
Mbc Argus endpoint fixed to 5.29 GeV/c ² .	Mbc Argus endpoint fixed to 5.2897 GeV/c ² .
Modelling was done using wrong samples.	Use 1ab ⁻¹ sample to model BBbar and continuum, and signalMC to model signal.
When changing CS selection, signal and BBbar modelling was always the same (obtained applying CS>0.5)	When changing CS selection, signal, BBbar, and continuum are modelled using the correctly selected samples.

Example of 3D fit of MC sample (365fb⁻¹, CS>0.6)



Check pulls (365fb⁻¹, CS>0.6)

Generate 1000 toys from pdfs and fit them:



Toys drawn from pdf look fine.

CS selection optimisation

Vary CS selection. Generate and fit 1000 toys (from pdf) for each one, and compare BF uncertainty and significance.



Toys drawn from pdf \rightarrow realistic toys

From toys from pdf to realistic toys

Realistic toy: bootstrap background from genericMC, and signal from signalMC. Check pulls for some fixed selections:

Realistic toys

Toys from pdf



Realistic toys pulls are off

To understand the cause, check hybrid toys (bkg from pdf, realistic signal)

Hybrid toys (at CS>0.7)



Pulls are off: signal component is the problem.

Signal dependencies: $\Delta E vs Mbc$ (at CS>0.7)

Plot ΔE in slices of $M_{\rm bc}$:



Large dependence (in $M_{\rm bc}$ tails, ΔE is shifted and much broader) No dependencies found in ΔE vs CS or Mbc vs CS.

2D ΔE -Mbc function

Try 2D conditional signal function $f(\Delta E \mid M_{\rm hc})$: different ΔE model for each $M_{\rm bc}$ bin.



Candidates per 17 MeV





Projections look good

2D ΔE -Mbc function

Check the plots:



 $M_{\rm bc}$ modelling can be improved, but good starting point

Next step: now that signal is 2D-modelled, check the total fit and the pulls

Backup

Hybrid toys (at CS>0.7)

