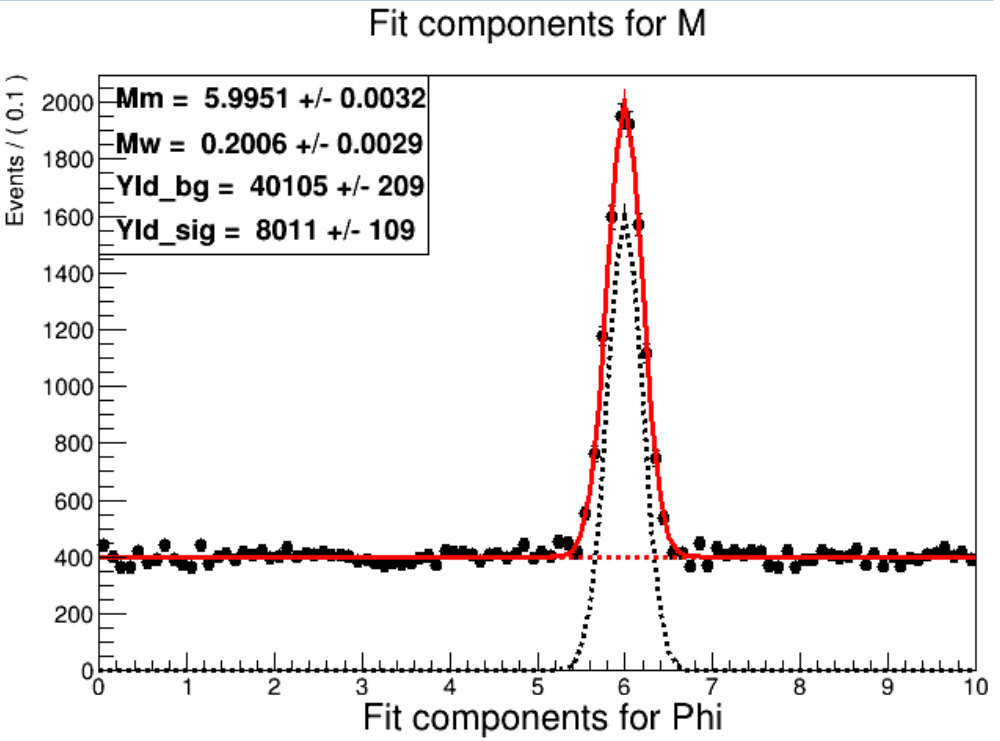
Test of weighted ML undertainties

Goal

- Test 2 methods for estimating the uncertainty of weighted ML fits
  - Generate 2D data (M,phi)
    - Signal Gaussian in M, background flat
  - Use sPlot weights to subtract background (flat in phi)
  - Fit cos2phi signal for different generated amplitudes and signal/backgrounds
  - Produce pull distribution from 400 toy MC fits
- Method 2 Correct covariance matrix using additional sumW2 covariance matrix (i.e. roofit method)
- Method 1 Multiply log likelihood by alpha=sumW/sumW2 (i.e. LHCb method)

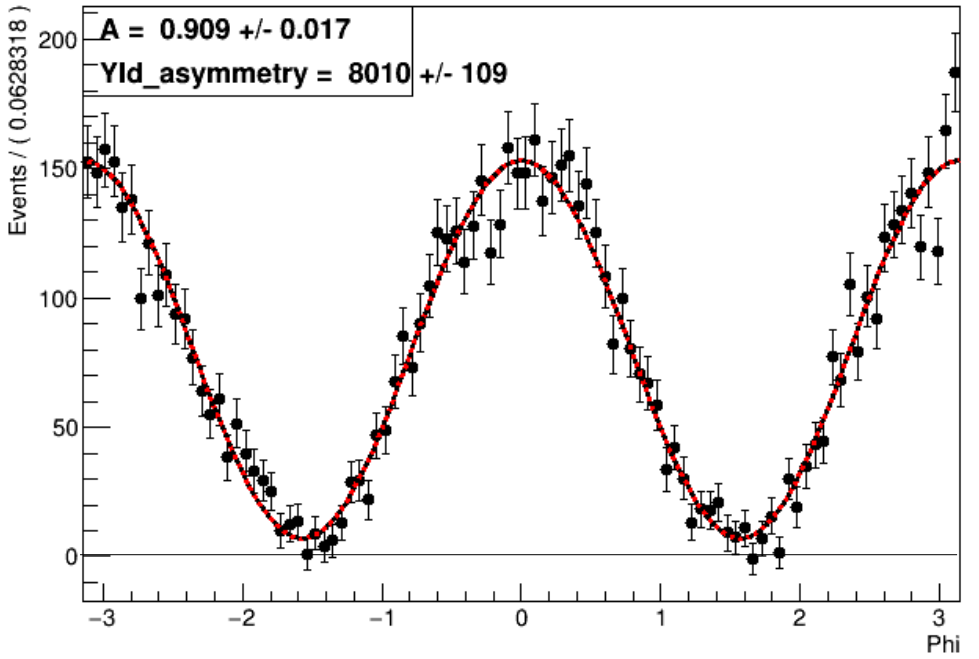
Sample fits

SPLOT fit to calculate weights.
From RooStats::sPlot class
Generated :
Mm=6, Mw=0.2
Yld_bg=40,000 (+Poisson fluctuation)
Yld_sig=8,000 (+Poisson fluctuation)

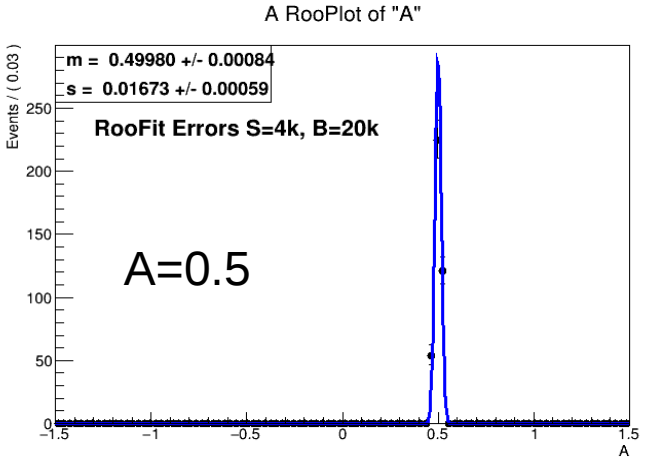


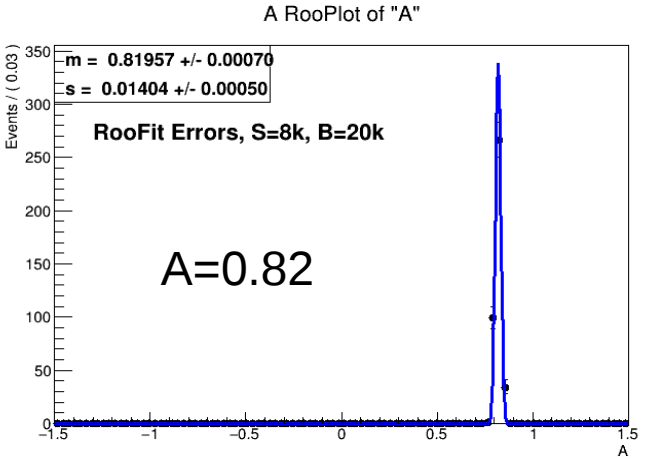
Cos2phi fit to signal weighted distribution
(Using roofit error calculation)

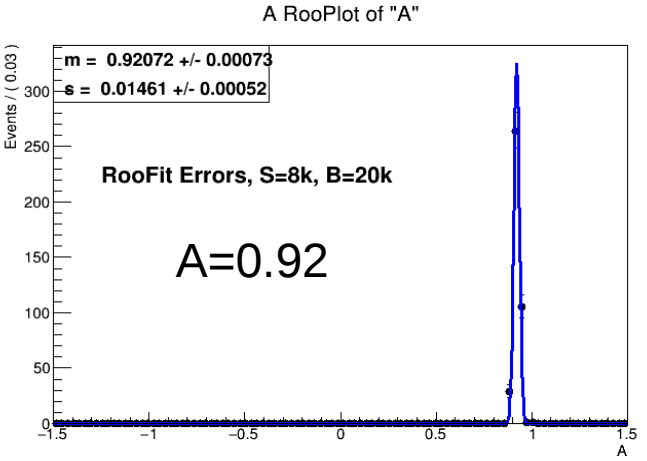
Generated A=0.92

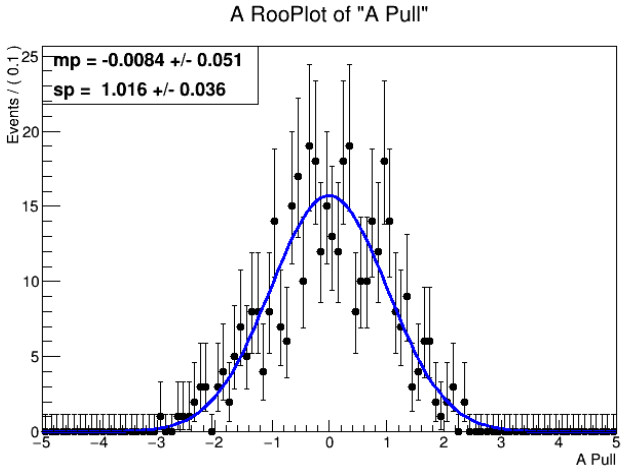


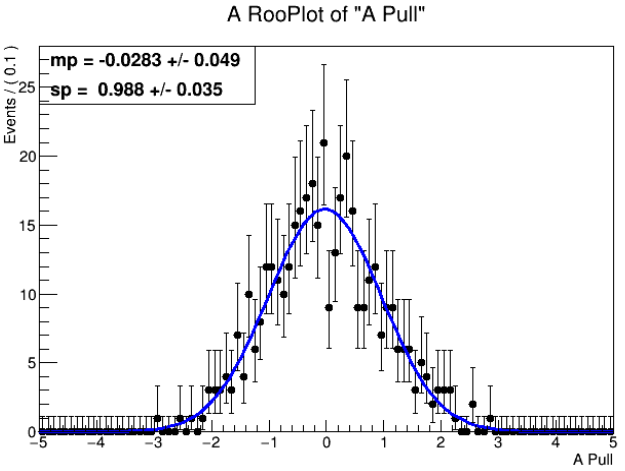
Results RooFit Errors Change A

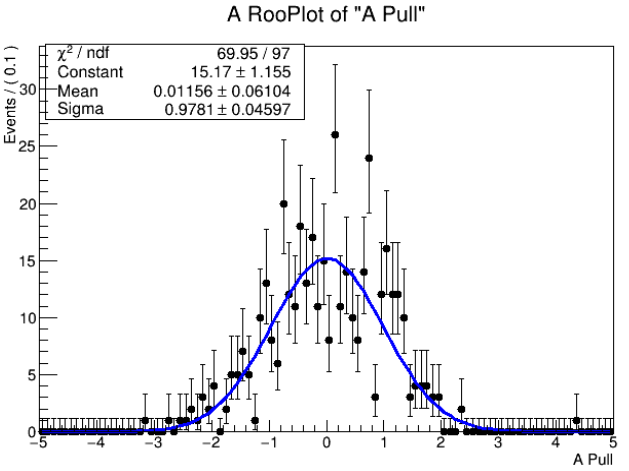




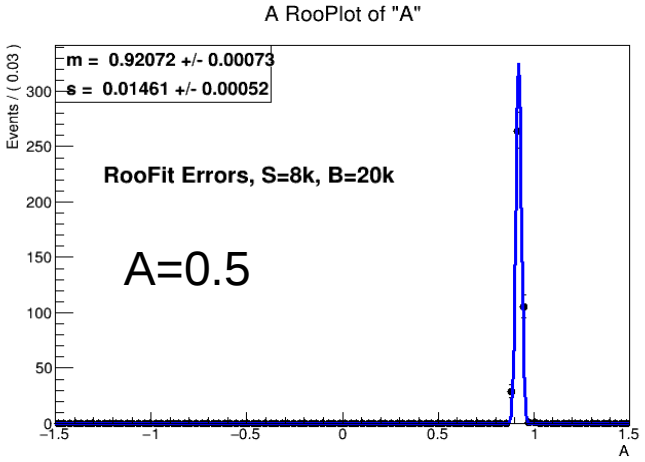


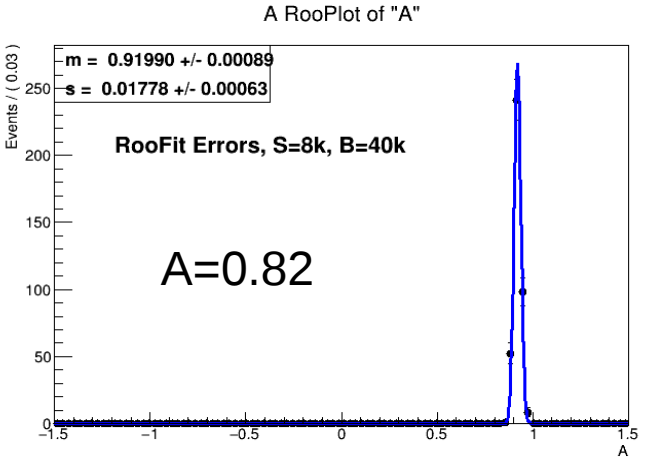


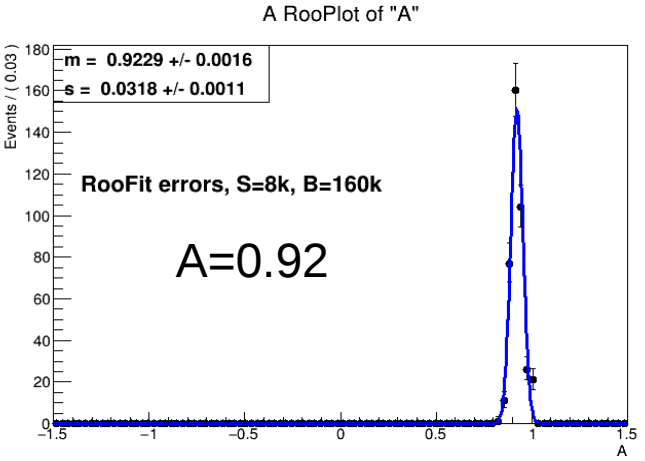


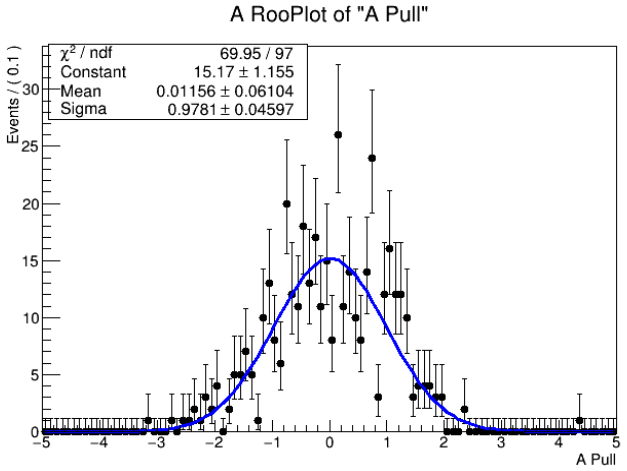


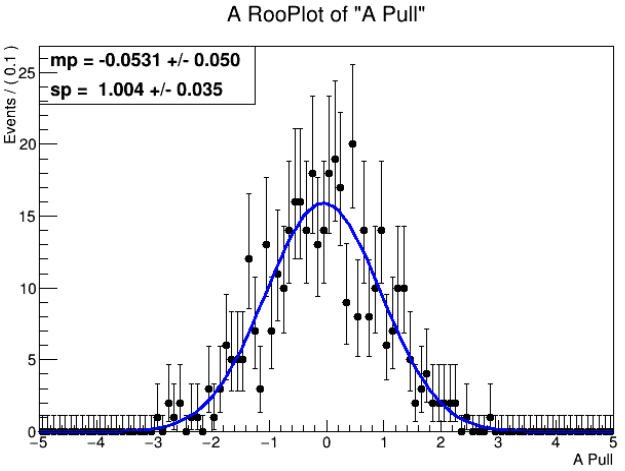
Results RooFit Errors Change B

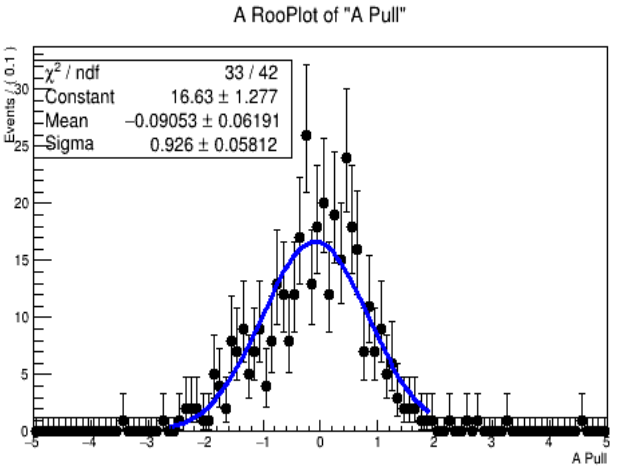






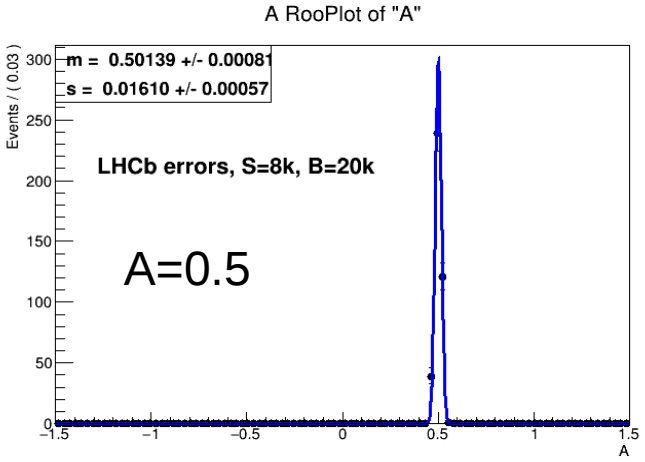


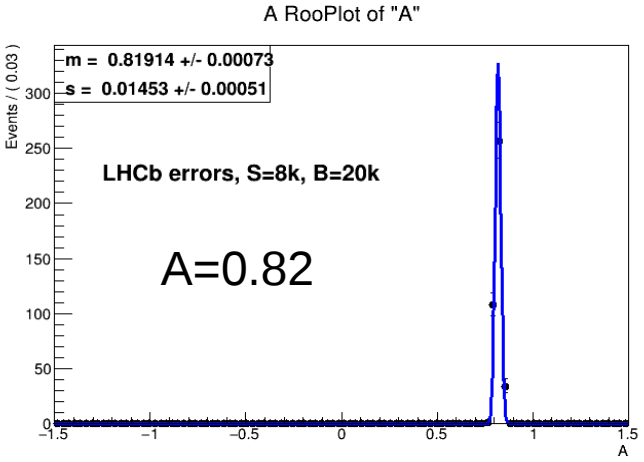


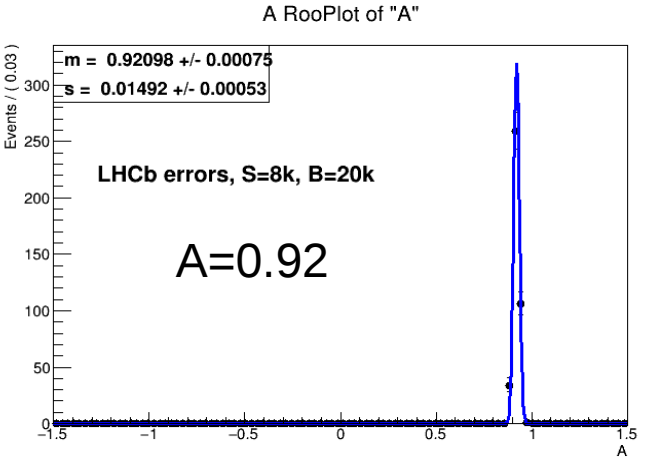


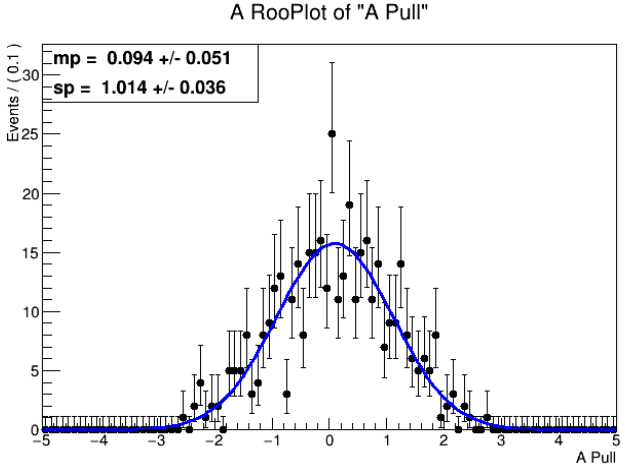
Here the width is<1.
This is due to the par limit being within range with the larger sigma Rather than the Uncertainty being incorrect (I think)

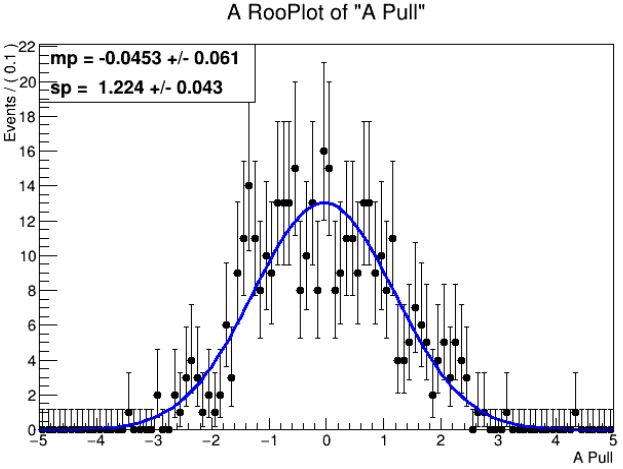
Results LHCb Errors Change A

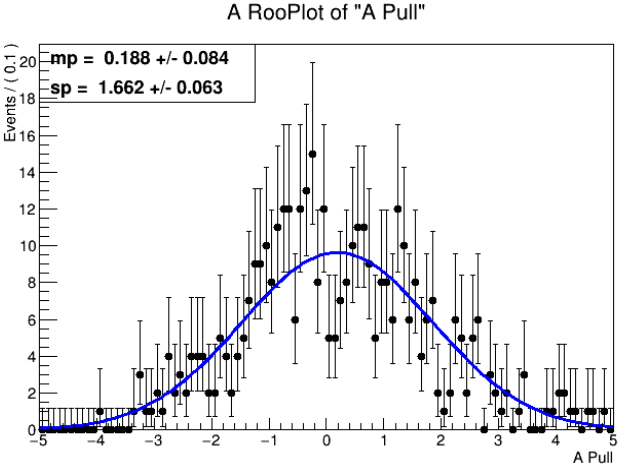












Results LHCb Errors Change B