

Bkg Characterization for $B \rightarrow \tau \nu_\tau$ Analysis

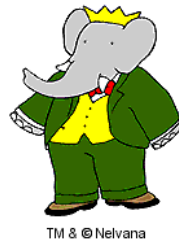
A. Rakitin

Caltech

May 11, 2010

DGWW Meeting

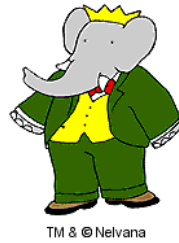
<http://www.hep.caltech.edu/~arakitin/tex/2010.May.11.SuperB/talk.pdf>



- In my previous talk I showed distribution (“spectrum”) of the tag B **rec’d** decay modes in signal and background samples for $B \rightarrow \tau \nu$ analysis
- Today I will show spectrum of the tag B **true** decay modes, and correlation of both (true and rec’d) spectra



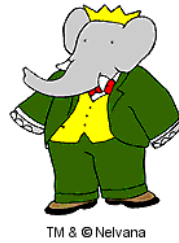
Reminder



- FastSim ntuples produced at CNAF contain multiple hadronic tag and signal B candidates
- All reconstructed tag B 's are paired up with all non-overlapping signal B 's
- I select the best tag B candidate (by smallest ΔE)
- I look at **rec'd** and **true** decay modes of this "Min. ΔE " tag B with no consideration of sig B
- The analysis is done for:
 - signal ($B^+B^-_{\text{taunu_DX}}$) and background ($B^+B^-_{\text{generic}}$) MC samples
 - "SuperB w/Bwd" detector geometry only



Reminder: decay mode coding



Each tag B decay coded by a 5-digit number: 3-digit charm decay + 2-digit B decay

<http://www.slac.stanford.edu/BFROOT//www/Physics/Analysis/AWG/EHBD0C/skims/modesID.txt>

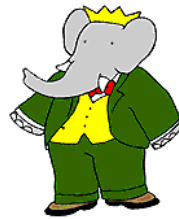
	$D^0 \rightarrow K\pi$	$D^0 \rightarrow K\pi\pi^0$	$D^0 \rightarrow K\pi\pi\pi$	$D^0 \rightarrow K_S\pi$	
D^0	110	111	112	113	
$D^{*\pm}, D^{*\pm} \rightarrow D^0\pi_S^\pm$	120	121	122	123	
$D^{*0}, D^{*0} \rightarrow D^0\pi^0$	140	141	142	143	
$D^{*0}, D^{*0} \rightarrow D^0\gamma$	150	151	152	153	
	$D^\pm \rightarrow K_S\pi$	$D^\pm \rightarrow K\pi\pi$	$D^\pm \rightarrow K_S\pi\pi^0$	$D^\pm \rightarrow K\pi\pi\pi^0$	$D^\pm \rightarrow K_S\pi\pi^0$
D^\pm	130	131	132	133	134
$D^{*0}, D^{*0} \rightarrow D^\pm$	-	-	-	-	-

Different B decays range from 01 to 53

\implies Thus, tag B decays range from 11001 to 15353 (with gaps)



Rec'd decay modes

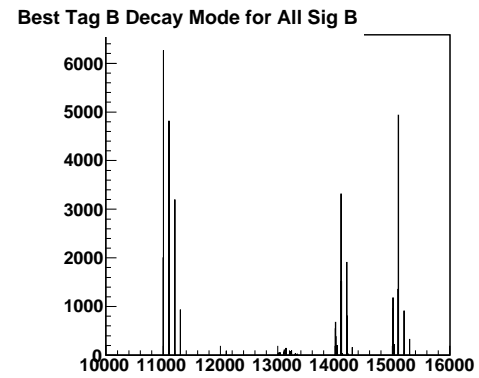
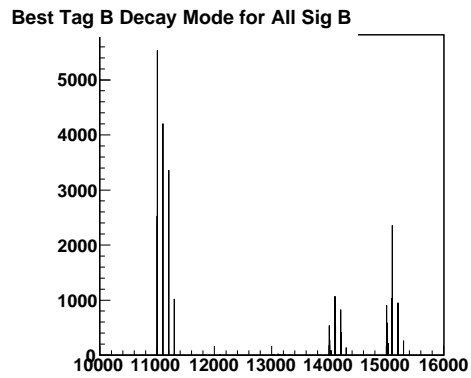


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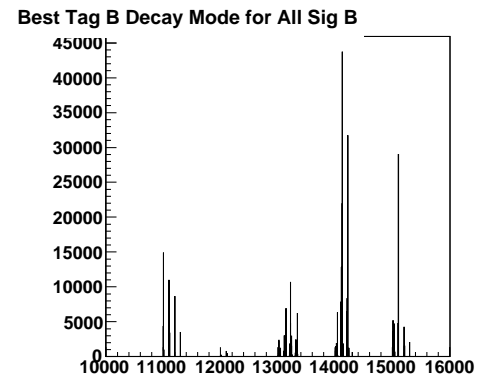
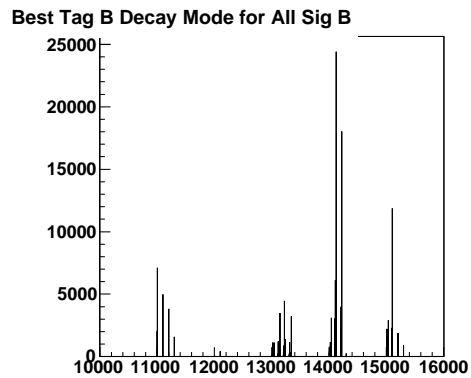
November

February

$\tau\nu DX$ sig. MC

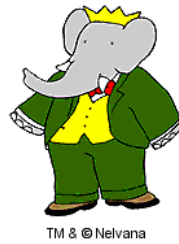


$B^+ B^-$ gen. MC





True decay modes

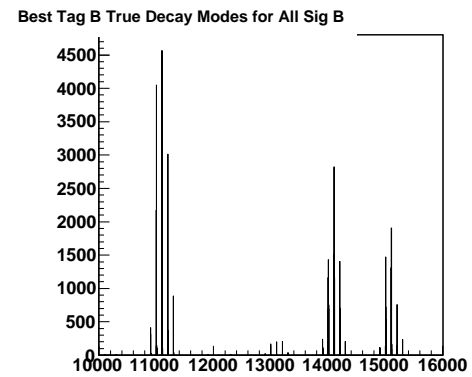
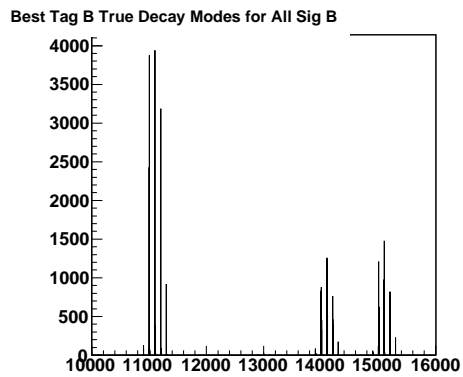


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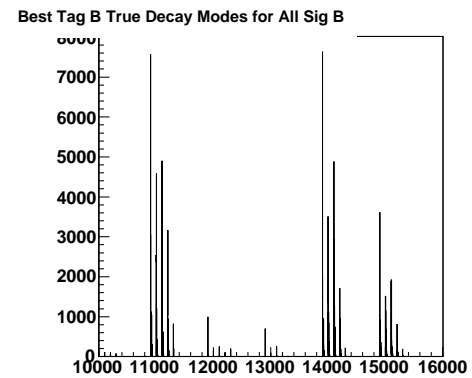
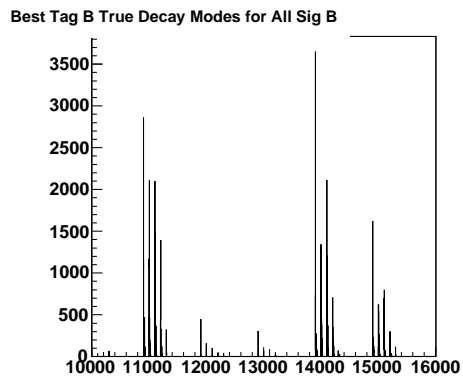
November

February

$\tau\nu DX$ sig. MC

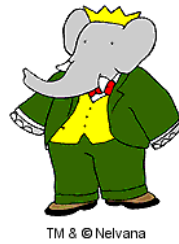


$B^+ B^-$ gen. MC





True vs rec'd



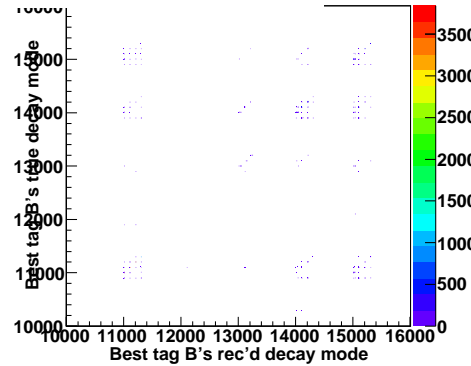
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November

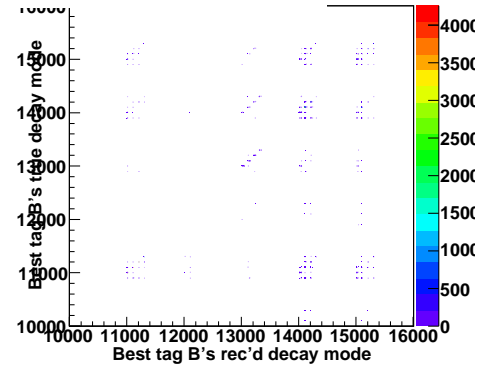
February

$\tau\nu D X$ sig. MC

Best Tag B Decay Mode vs True Decay Mode for All Sig B

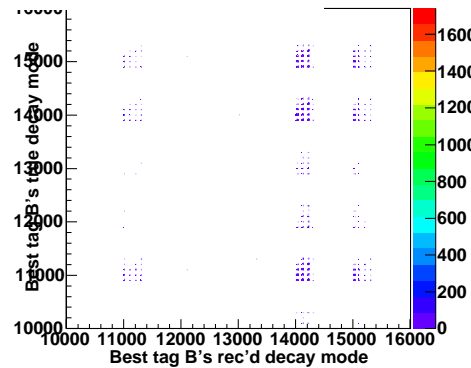


Best Tag B Decay Mode vs True Decay Mode for All Sig B

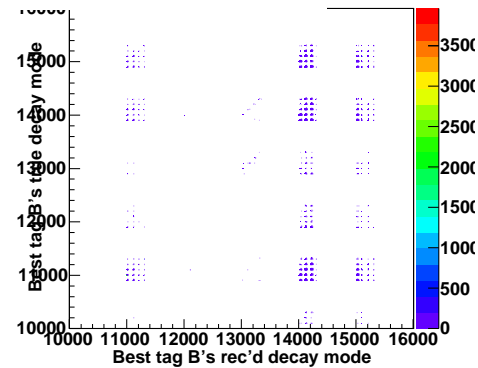


$B^+ B^-$ gen. MC

Best Tag B Decay Mode vs True Decay Mode for All Sig B



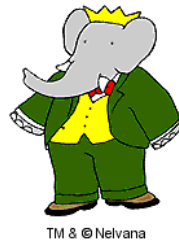
Best Tag B Decay Mode vs True Decay Mode for All Sig B



We see that any true decay mode can be misrec'd as anything else



D-only rec'd decay modes

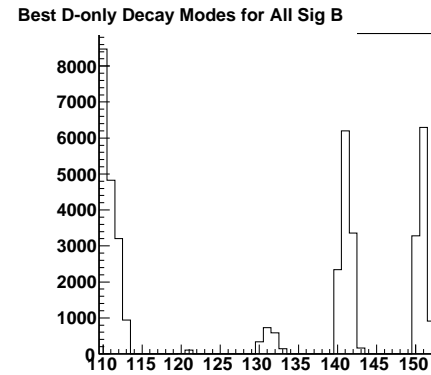
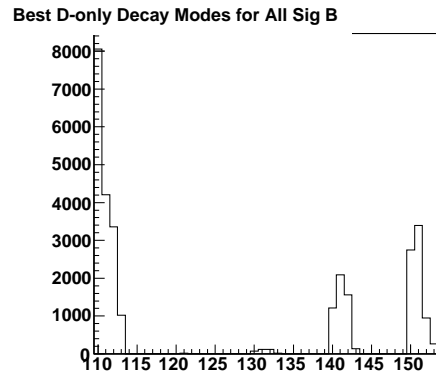


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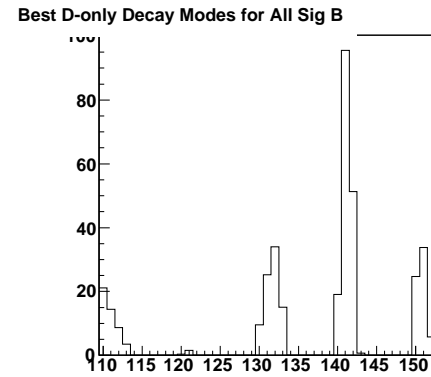
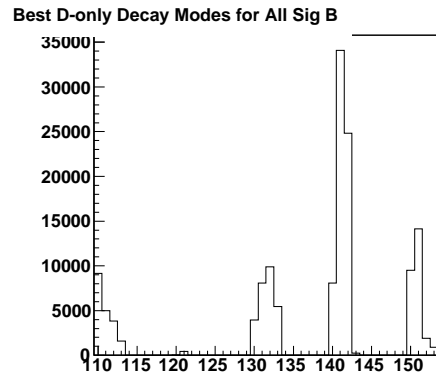
November

February

$\tau \nu D X$ sig. MC

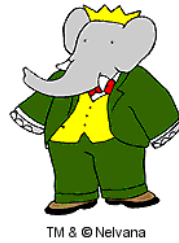


$B^+ B^-$ gen. MC





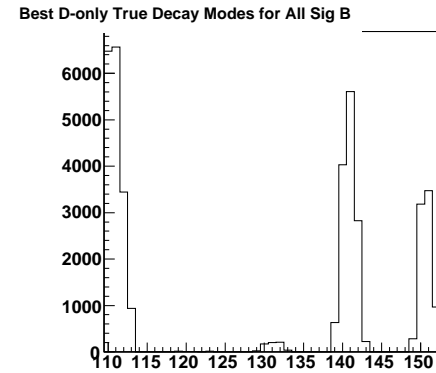
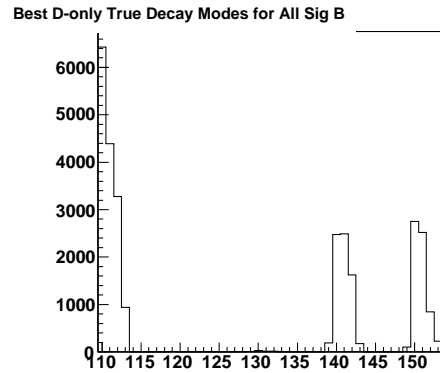
D-only true decay modes



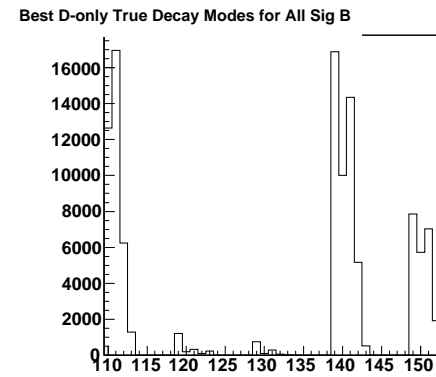
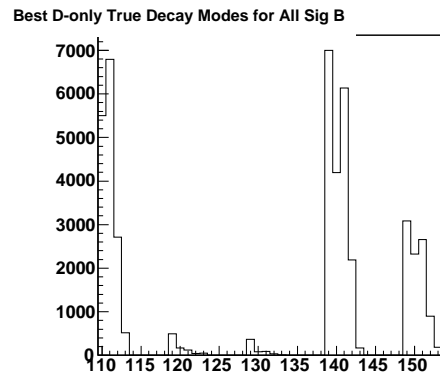
November

February

$\tau \nu D X$ sig. MC

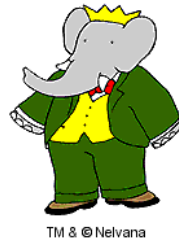


$B^+ B^-$ gen. MC





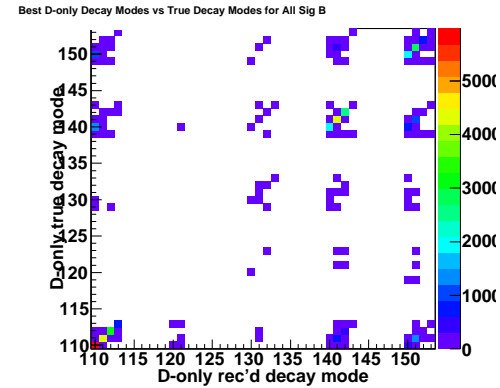
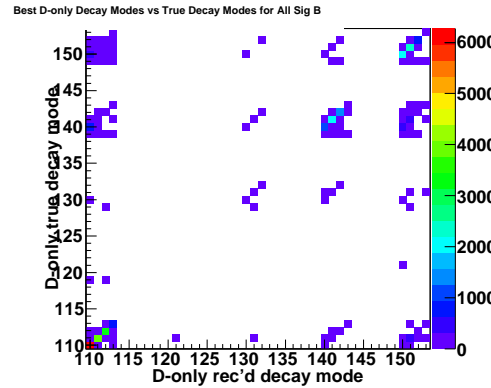
True vs. rec'd D -only decay modes



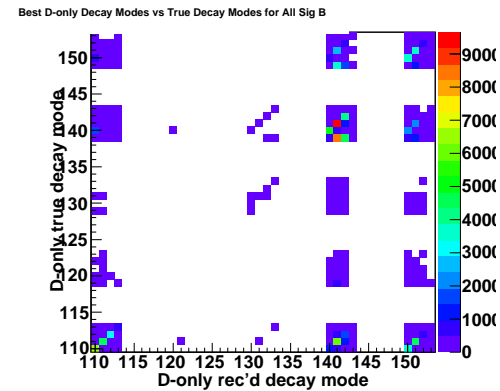
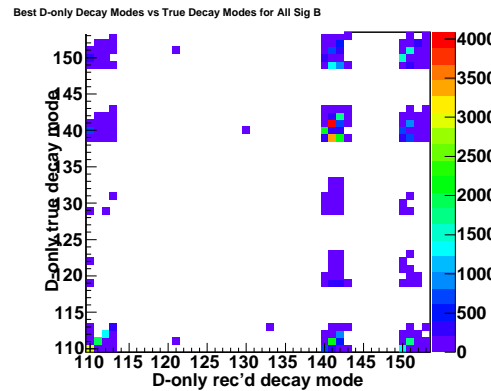
November

February

$\tau\nu DX$ sig. MC

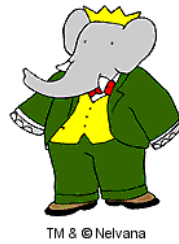


$B^+ B^-$ gen. MC





B-only rec'd decay modes

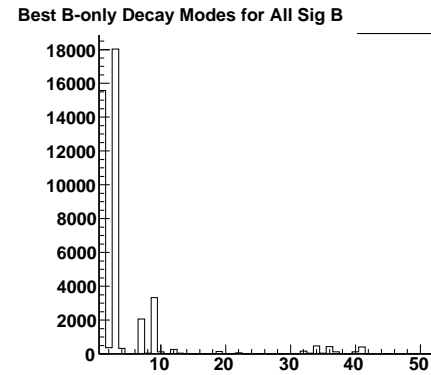
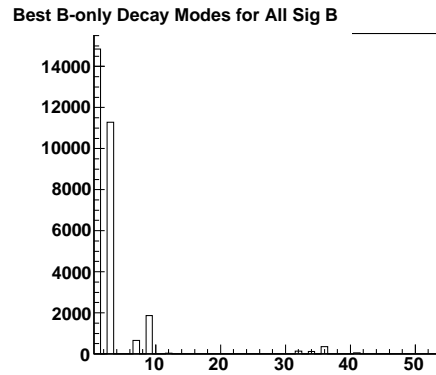


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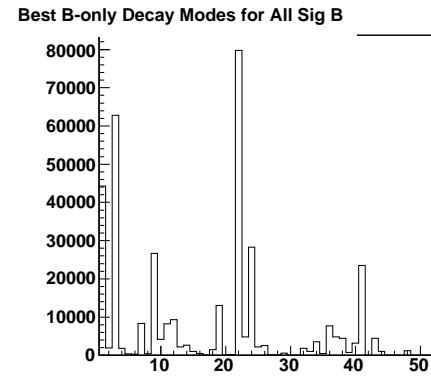
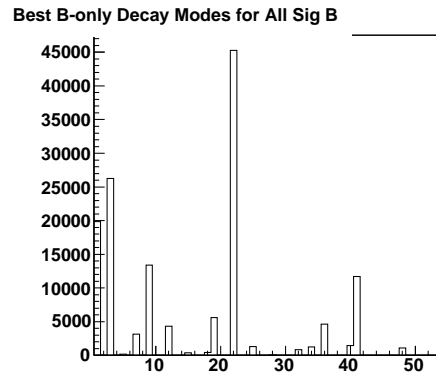
November

February

$\tau \nu D X$ sig. MC

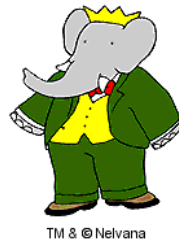


$B^+ B^-$ gen. MC





B-only true decay modes

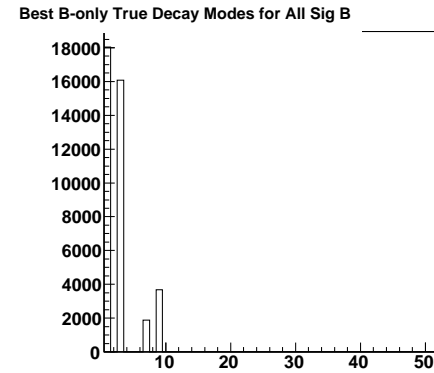
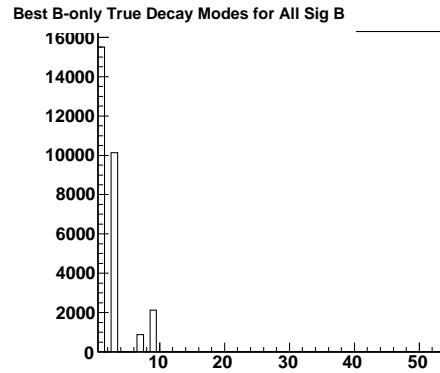


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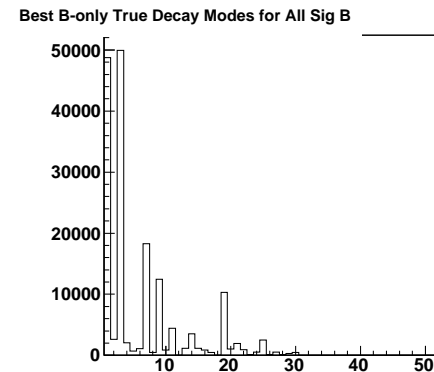
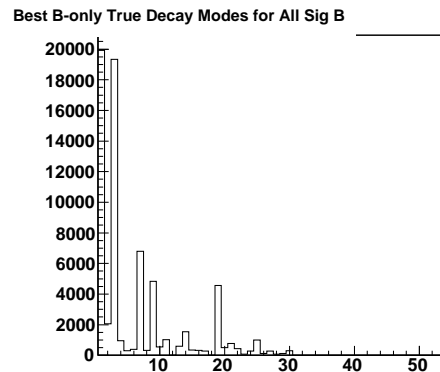
November

February

$\tau \nu D X$ sig. MC

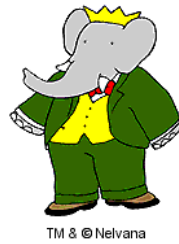


$B^+ B^-$ gen. MC





True vs rec'd B -only decay modes

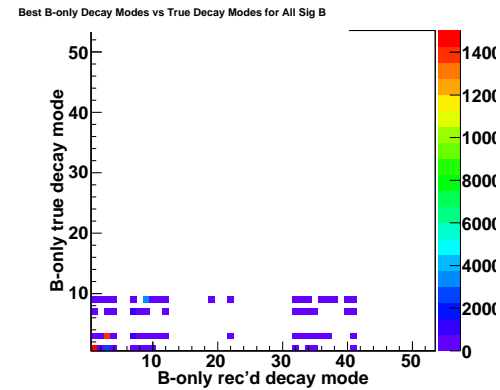
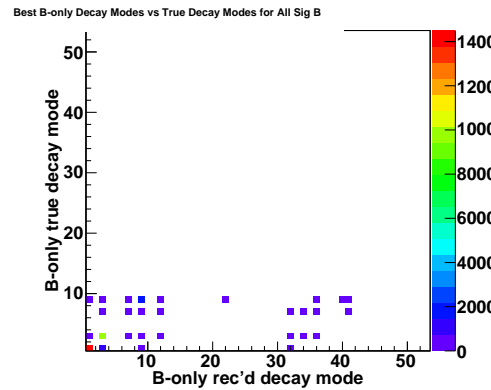


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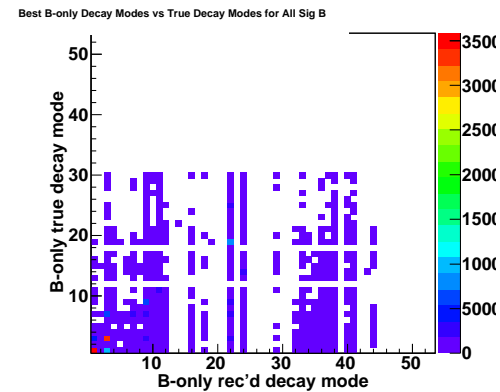
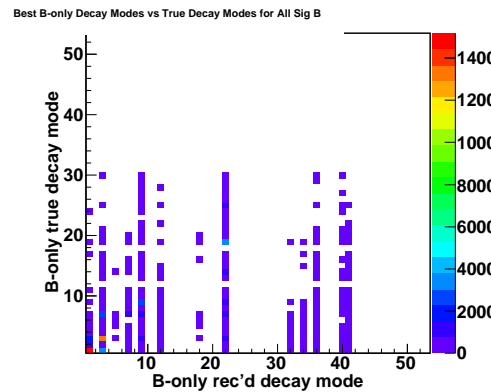
November

February

$\tau\nu DX$ sig. MC

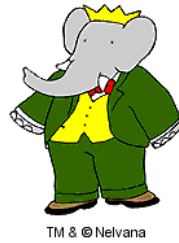


$B^+ B^-$ gen. MC





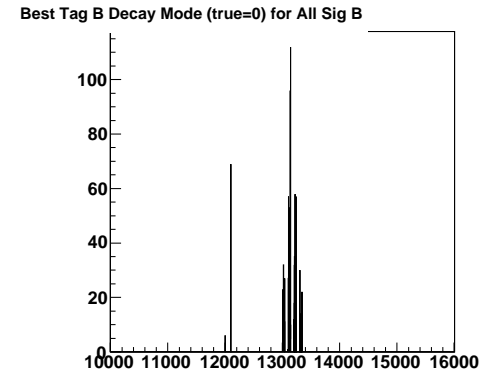
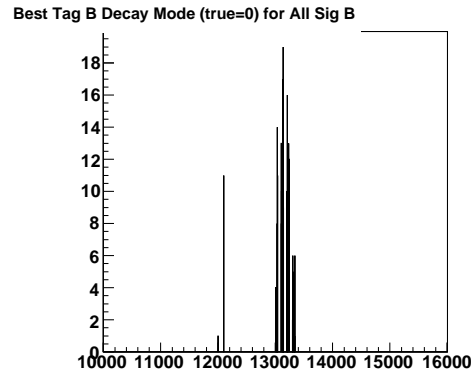
Special case: $\text{true}==0$



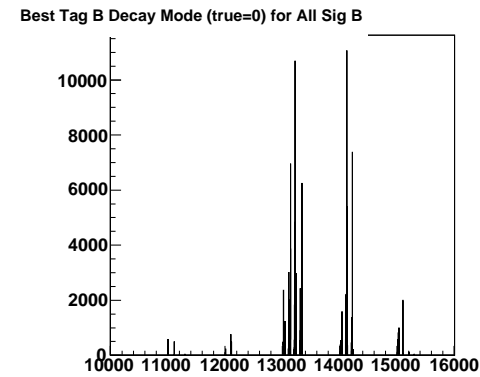
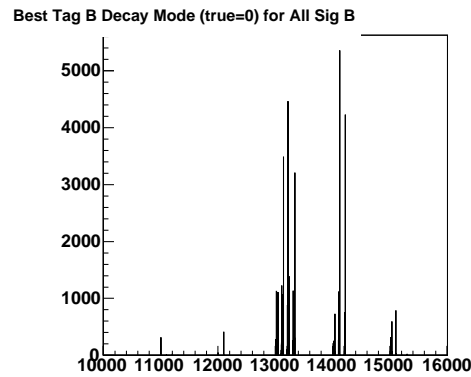
November

February

$\tau\nu DX$ sig. MC



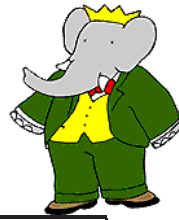
B^+B^- gen. MC



“Unknown” true decay mode is usually reconstructed as one of 13000



Event count

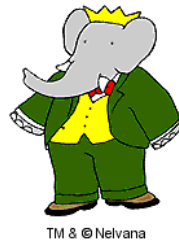


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	November					February				
	Exact match	<i>B</i> -only match	<i>D</i> -only match	No match (true!=0)	No match (true=0)	Exact match	<i>B</i> -only match	<i>D</i> -only match	No match (true!=0)	No match (true=0)
$\tau\nu$	80.80 %	9.55 %	2.18 %	6.59 %	0.87 %	62.26 %	16.21 %	7.46 %	11.33 %	2.74 %
B^+B^-	7.16 %	16.24 %	5.56 %	39.93 %	31.10 %	6.68 %	16.25 %	4.73 %	37.69 %	34.66 %



Interesting decays



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List of "Min ΔE " tag B decay modes comprising more than 5% of total number of tag B 's:

		November		February	
		Rec'd	True	Rec'd	True
$\tau\nu DX$ sig. MC		11001	11001	11003	11001
		11003	11003	11101	11003
		11101	11101	11201	11101
		11201	11201	14103	11201
		15103	15103	15103	14103
B^+B^- gen. MC		11003	10900	14122	10900
		14122	13900	14124	13900
		14222		14222	
		15103		15103	

Legend for this table is available at

<http://www.slac.stanford.edu/BFROOT//www/Physics/Analysis/AWG/EHBD0C/skims/modesID.txt>