

$H \rightarrow WW$ **Combination:**
CDF Shape Systematics

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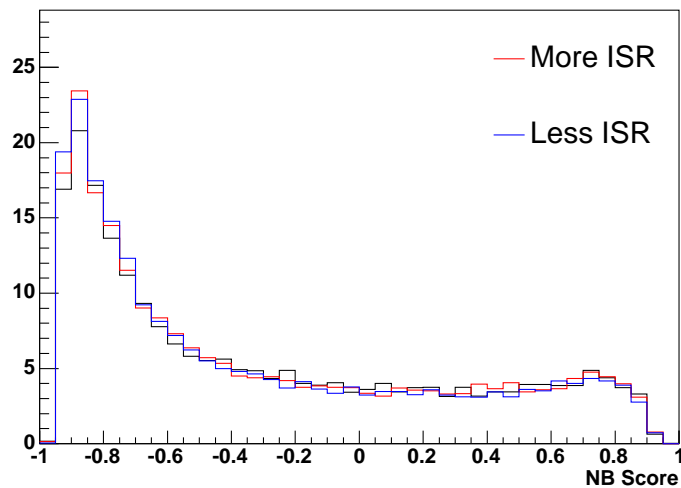
Shape Systematics Considered

- ▶ Have Considered the following shape systematics
 - HWW ISR more/less pythia settings
 - ◆ We only have this at $M_H = 160$ currently
 - WW ISR more/less pythia setting
- ▶ Shown here the “shapes” are normalized to the nominal prediction
 - Rate error is already well covered by our systematics
- ▶ Shown next are NN output template shapes all at $M_H = 160$ GeV

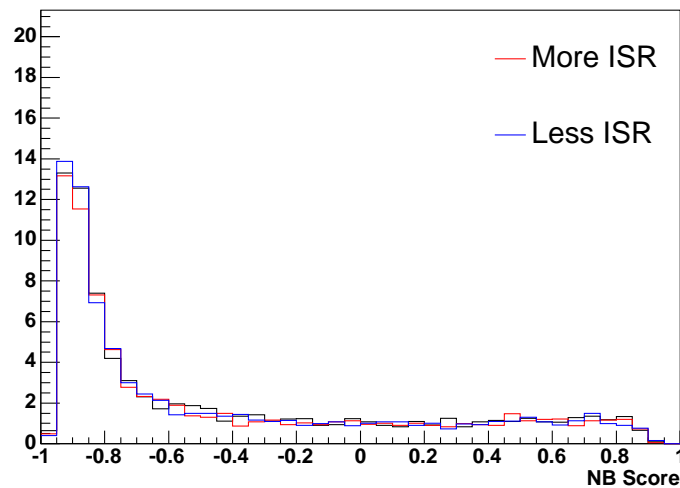


NN Shapes

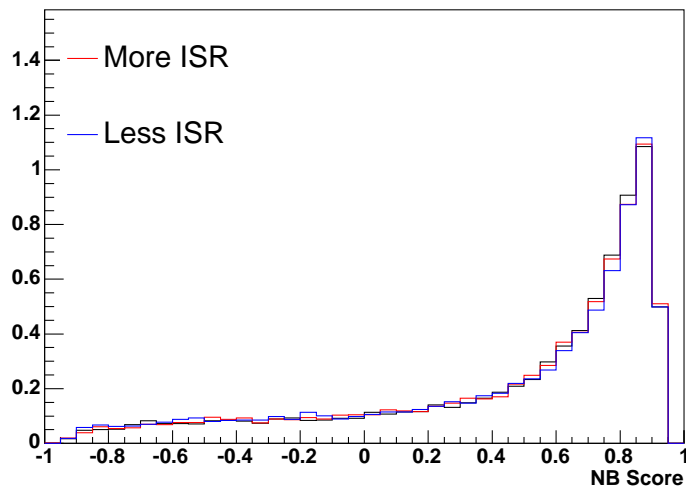
Dean_HighSB_WW



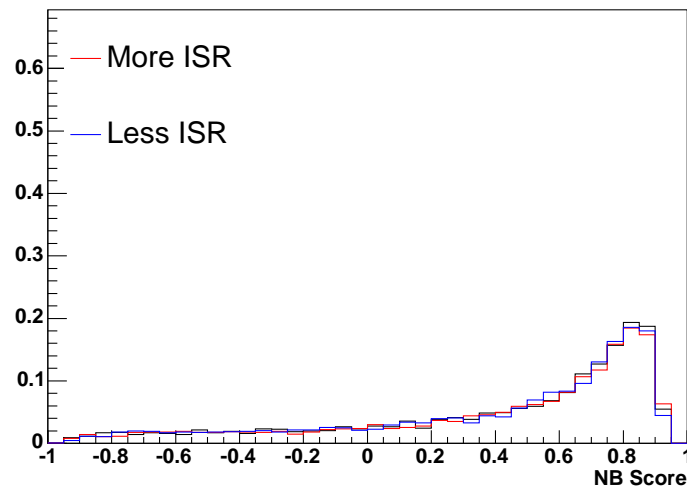
Dean_LowSB_WW



Dean_HighSB_HWW

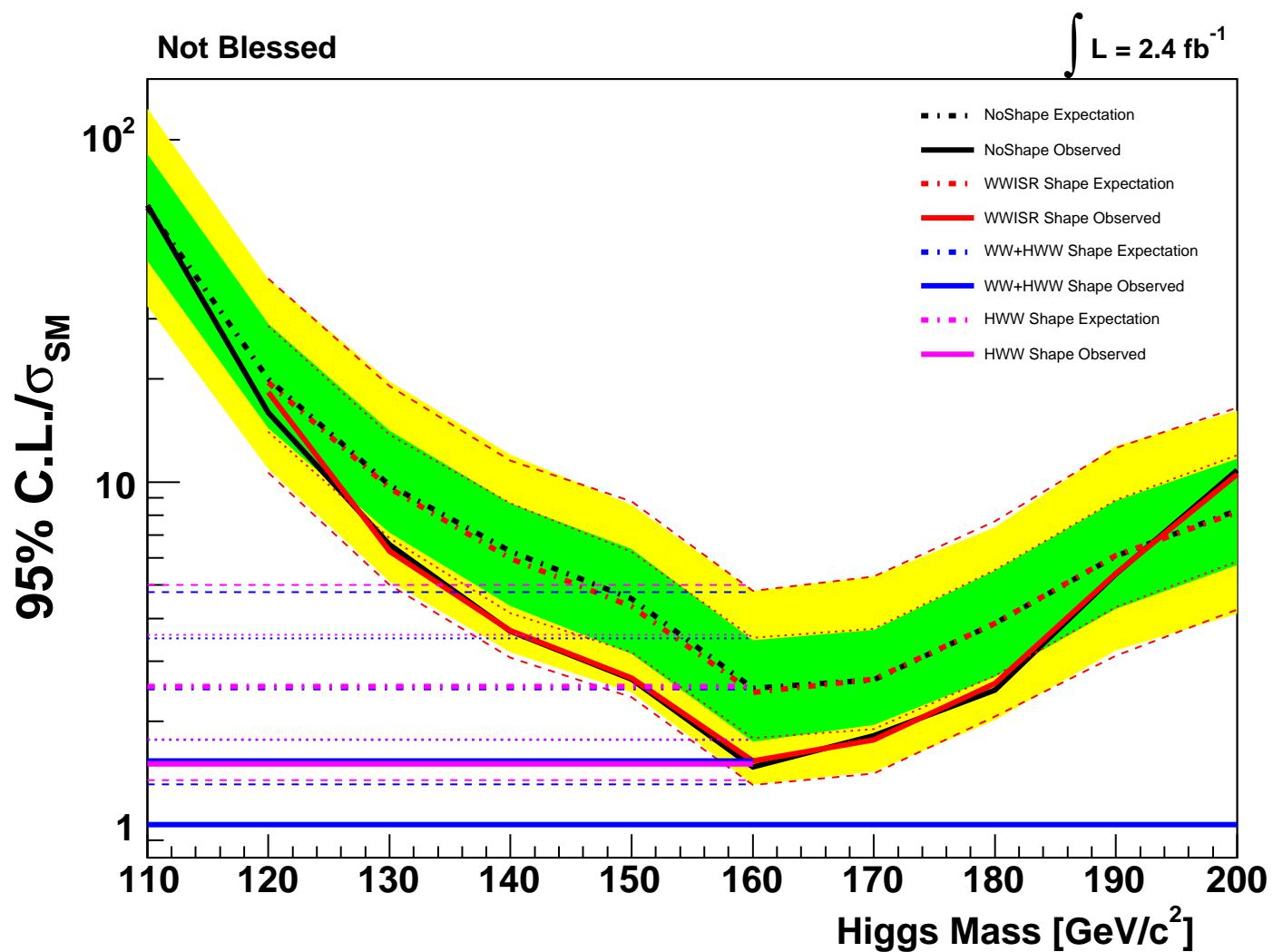


Dean_LowSB_HWW





Limits compared to blessed





Conclusion

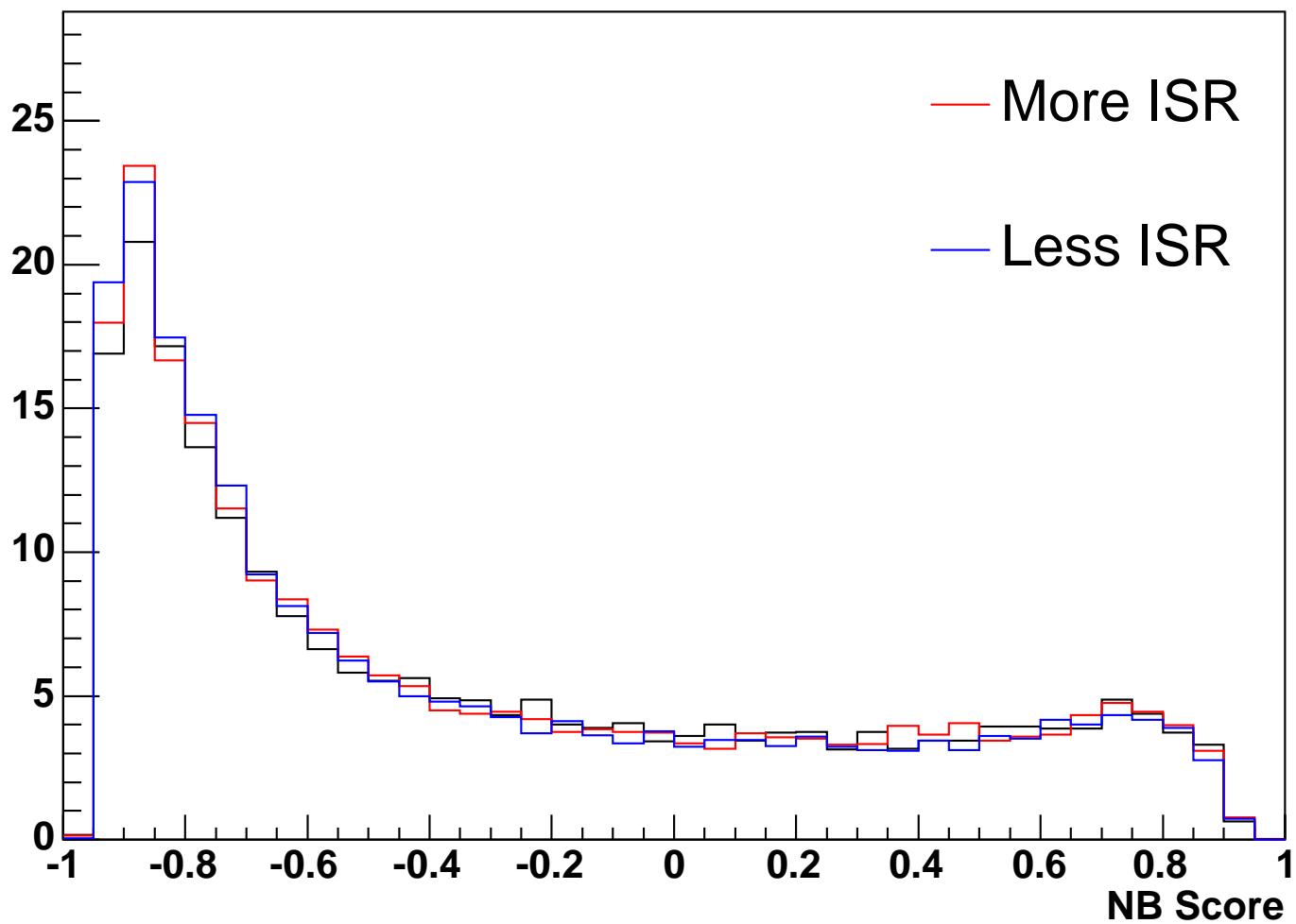
- ▶ Shape differences themselves look small
- ▶ Differences in the limits due to shapes is of the order of the error in doing 1k PEs



Backup

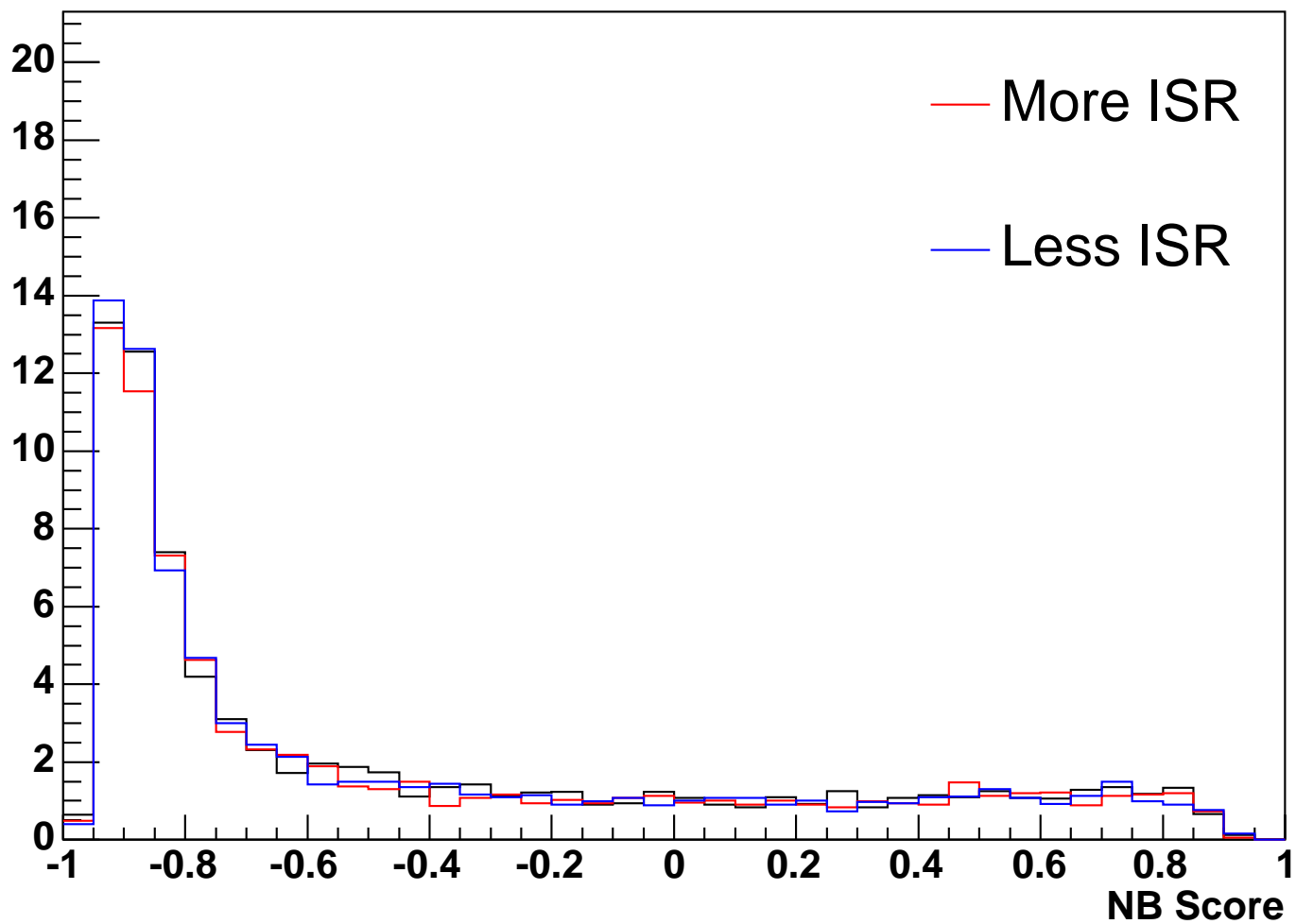
NN Shapes

Dean_HighSB_WW



NN Shapes

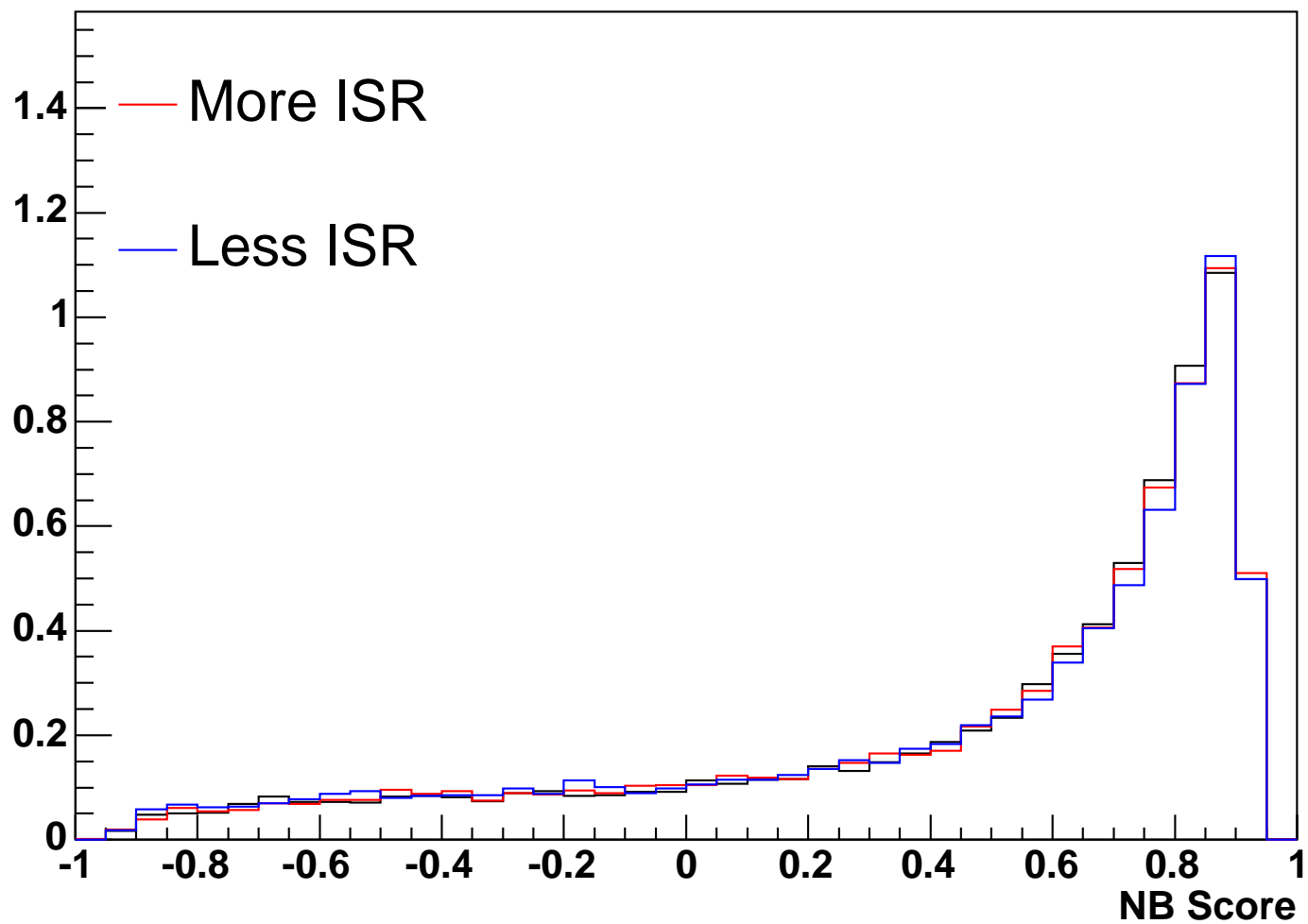
Dean_LowSB_WW





NN Shapes

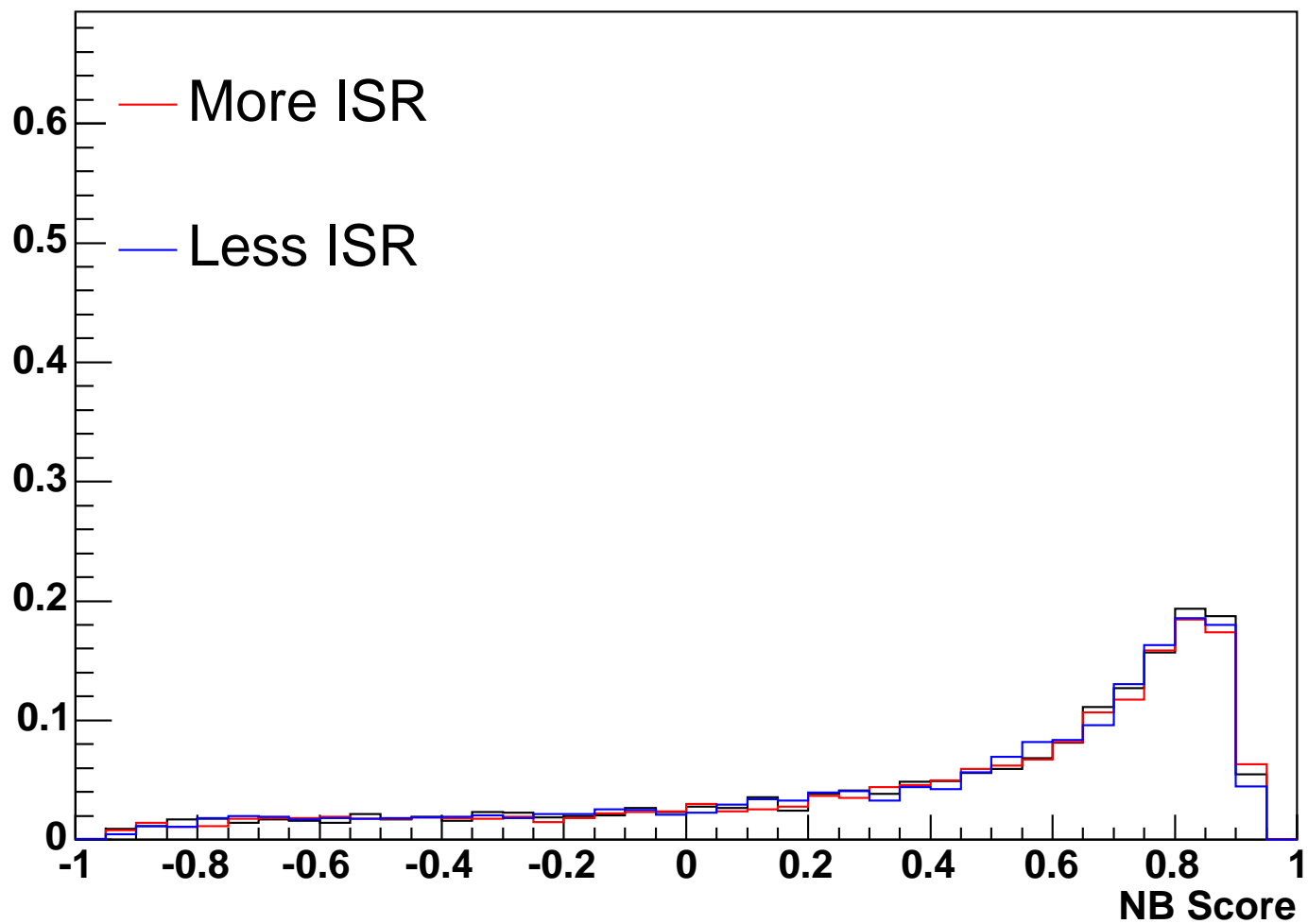
Dean_HighSB_HWW





NN Shapes

Dean_LowSB_HWW





1k PE Limits

HWW+WW Shape	160	HWW Shape	160
$-2\sigma/\sigma_{SM}$	1.31	$-2\sigma/\sigma_{SM}$	1.35
$-1\sigma/\sigma_{SM}$	1.77	$-1\sigma/\sigma_{SM}$	1.77
Median / σ_{SM}	2.51	Median / σ_{SM}	2.53
$+1\sigma/\sigma_{SM}$	3.50	$+1\sigma/\sigma_{SM}$	3.58
$+2\sigma/\sigma_{SM}$	4.76	$+2\sigma/\sigma_{SM}$	5.01
Observed / σ_{SM}	1.53	Observed / σ_{SM}	1.50



1k PS Limits

No Shape	110	120	130	140	150	160	170	180	190	200
$-2\sigma/\sigma_{SM}$	32.63	10.91	5.13	3.19	2.43	1.31	1.42	2.02	3.23	4.13
$-1\sigma/\sigma_{SM}$	44.22	14.39	7.12	4.34	3.15	1.75	1.95	2.70	4.26	5.73
Median/σ_{SM}	63.15	19.97	9.77	6.28	4.56	2.49	2.64	3.87	6.08	8.25
$+1\sigma/\sigma_{SM}$	90.46	29.01	14.14	8.66	6.37	3.46	3.70	5.52	8.80	11.71
$+2\sigma/\sigma_{SM}$	123.28	39.07	19.71	12.01	8.58	4.80	5.30	7.39	12.70	16.13
Observed/σ_{SM}	64.31	15.93	6.56	3.67	2.65	1.47	1.82	2.47	5.38	10.81

WW Shape	110	120	130	140	150	160	170	180	190	200
$-2\sigma/\sigma_{SM}$	000.00	10.67	5.01	3.07	2.35	1.30	1.41	2.06	3.10	4.24
$-1\sigma/\sigma_{SM}$	000.00	14.01	6.86	4.14	3.19	1.79	1.90	2.72	4.31	5.86
Median/σ_{SM}	000.00	19.55	9.60	5.98	4.32	2.43	2.65	3.87	6.10	8.18
$+1\sigma/\sigma_{SM}$	000.00	28.59	13.72	8.66	6.24	3.51	3.72	5.54	8.83	11.96
$+2\sigma/\sigma_{SM}$	000.00	39.33	19.08	11.53	8.79	4.80	5.30	7.67	12.60	16.47
Observed/σ_{SM}	000.00	18.33	6.27	3.69	2.67	1.53	1.77	2.58	5.39	10.55