

Comparison Between 3T and 3.5T $mumuH \rightarrow mumu$ +bb/cc/gg Analysis

Yu Bai
Southeast University

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Outline

- Full simulation of Signal and Dominant background (zzsl->mumu+qq)
- Background both from 3T and 3.5T are filtered
- Fit template not updated

Efficiency and Fit Configuration

	H->bb	H->cc	H->gg
3.5T	54.35%	53.92%	50.31%
3T	52.47%	51.78%	49.40%

- **Signal Only Fit**
- **Signal Recoil :Crystal Ball + Double Sided Exponential**
- **Flavor template from MC**
- **Hww and Hzz are fixed**

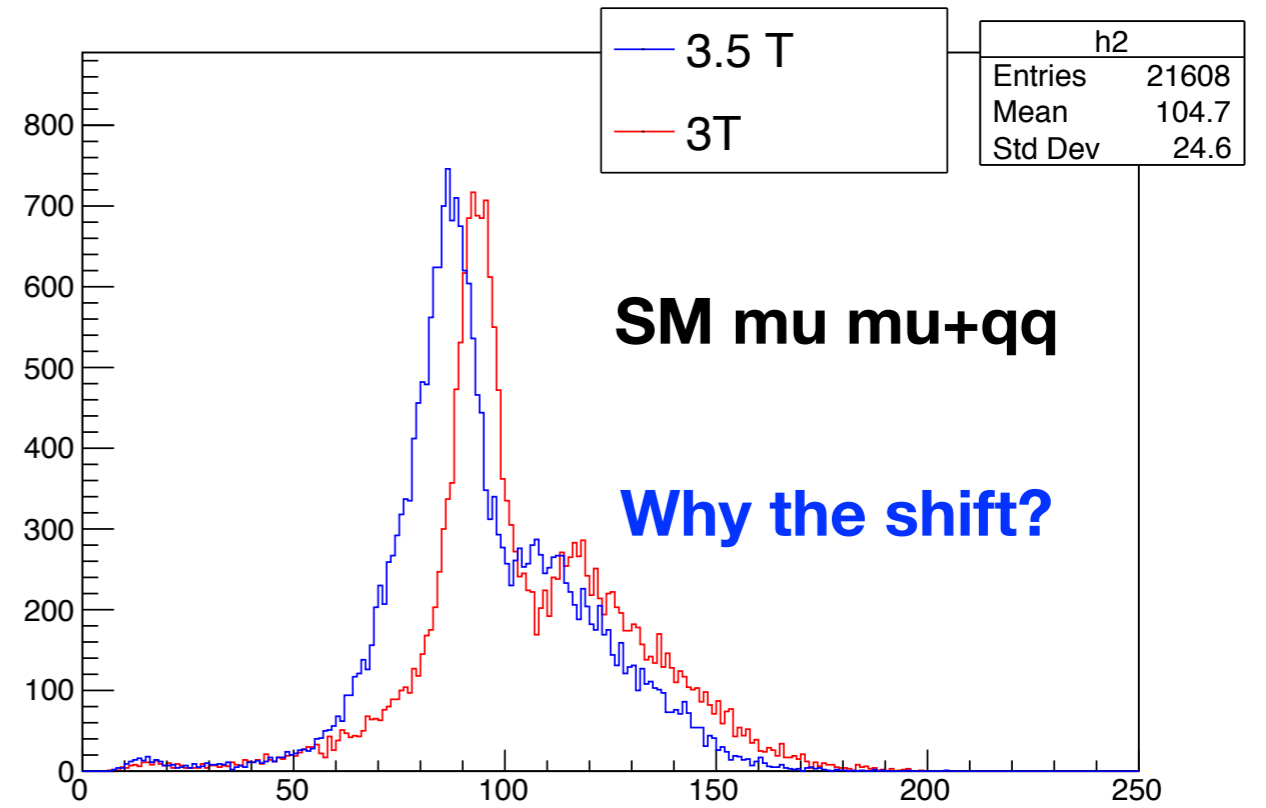
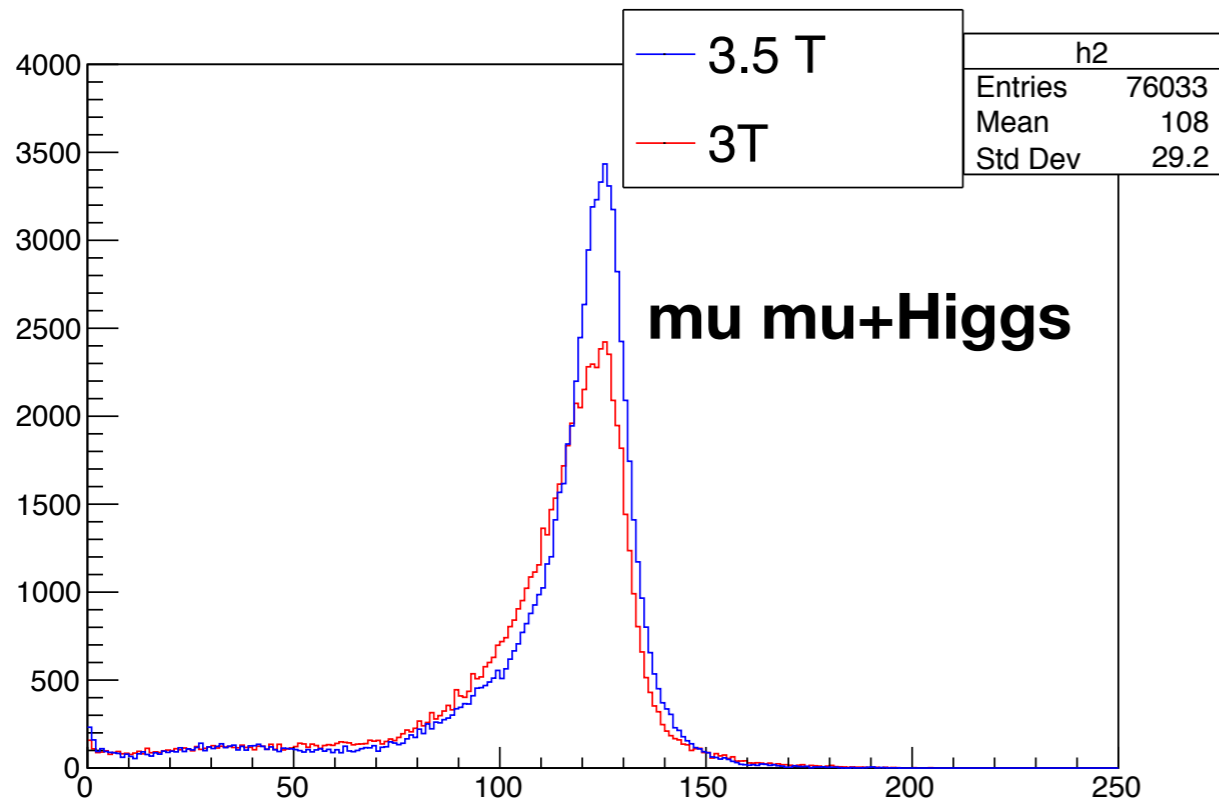
Cutflow of $H \rightarrow b\bar{b}$

	3T	3.5T	Eff Ratio	InEff Ratio
FSClasser	86.4622%	87.2201%	0.99131	1.059304
$\cos \theta_z$	83.2223%	82.9499%	1.003284	0.984024
$\cos \theta_{\mu\mu}$	95.2939%	95.4212%	0.998666	1.027802
$M_{\mu\mu}$	94.7533%	96.0762%	0.986231	1.337148
M_recoil	92.7102%	92.7839%	0.999206	1.010213
2J+Lep_Veto	98.5379%	99.2262%	0.993063	1.889506
JetnPFO	99.4802%	99.7175%	0.997620	1.84
$\cos \theta_{JJ}$	92.8495%	92.8624%	0.999861	1.001807
M_{JJ}	99.2394%	99.6308%	0.996071	2.060130
y-value	96.4361%	96.4749%	0.999598	1.01107

Cutflow of ZZ->mumu+bb

	3T	3.5T	Eff Ratio
Filter	4.5%		
FSClasser	Unknown		
$\cos \theta_z$	68.021%	68.619%	0.9913
$\cos \theta_{\mu\mu}$	89.068%	89.052%	1.0002
$M_{\mu\mu}$	88.390%	89.680%	0.9968
M_{recoil}	44.845%	45.302%	0.9899
2J+Lep_Veto	97.111%	98.397%	0.9869
JetnPFO	99.346%	97.403%	1.0199
$\cos \theta_{JJ}$	91.916%	92.420%	0.9945
M_{JJ}	94.528%	85.973%	1.0995
y-value	93.246%	94.013%	0.9918

Mjj Distribution



Fit Results Old Result

3 T

1	C	4.63771e-06	1.56602e-02	1.01085e-01	-1.56399e+00
2	a	-1.00557e+00	2.99852e-02	3.72188e-04	-1.00727e-01
3	a1	-2.43770e-01	2.63290e-02	7.52463e-03	-2.43770e-01
4	mean	1.25257e+02	6.39905e-03	1.72087e-03	1.75479e-01
5	n	9.41634e-01	2.88469e-02	2.42414e-03	2.98852e-01
6	nHbb	1.08464e+04	1.30466e+02	3.57319e-03	8.46955e-02
7	nHcc	4.96133e+02	5.49569e+01	7.18293e-03	-1.12198e+00
8	nHgg	1.44653e+03	8.44655e+01	1.01782e-02	-4.35290e-01
9	nbkg	9.76894e+00	9.79351e+00	3.14972e-02	-1.37280e+00
10	nzzsl_mu_bb	1.29880e+03	8.37043e+01	7.34777e-03	-6.80454e-01
11	nzzsl_mu_cc	1.40250e+03	5.94881e+01	6.03987e-03	-6.42893e-01
12	nzzsl_mu_uds	4.09005e+03	8.59436e+01	2.99677e-03	-6.32390e-01
13	sigma	3.13544e-01	6.19355e-03	3.97967e-03	-4.84922e-01

True Value:

nHbb: 10806.7

nHcc: 497.2

nHgg: 1471.6

nzzsl_bb: 1339.6

nzzsl_cc: 1394.1

nzzsl_uds:4069.4

3.5 T

EXT NO.	PARAMETER NAME	VALUE	ERROR	INTERNAL STEP SIZE	INTERNAL VALUE
1	C	1.41328e-02	7.10576e-03	1.01215e-03	-1.19261e+00
2	a	-1.01980e+00	2.94849e-02	7.41963e-05	-1.02158e-01
3	a1	-2.66733e-01	2.54298e-02	3.01040e-04	-2.66733e-01
4	mean	1.25237e+02	5.49928e-03	5.93974e-05	1.52509e-01
5	n	9.26723e-01	2.62138e-02	9.01569e-05	2.88466e-01
6	nHbb	1.12289e+04	1.31894e+02	1.49502e-04	1.23154e-01
7	nHcc	5.13406e+02	5.57593e+01	2.94123e-04	-1.11409e+00
8	nHgg	1.54518e+03	8.43853e+01	2.09080e-03	-3.92181e-01
9	nbkg	-3.45779e+00	1.68808e+01	7.00937e-04	-9.69263e-01
10	nzzsl_mu_bb	1.37520e+03	8.65005e+01	3.07609e-04	-6.52678e-01
11	nzzsl_mu_cc	1.46155e+03	5.98813e+01	2.46129e-04	-6.21972e-01
12	nzzsl_mu_uds	4.30471e+03	8.62719e+01	1.22858e-04	-6.06028e-01
13	sigma	2.69436e-01	5.42597e-03	1.48470e-04	-6.14327e-01

ERR DEF= 0.5

True Value:

nHbb: 11188.2

nHcc: 518.2

nHgg: 1502.4

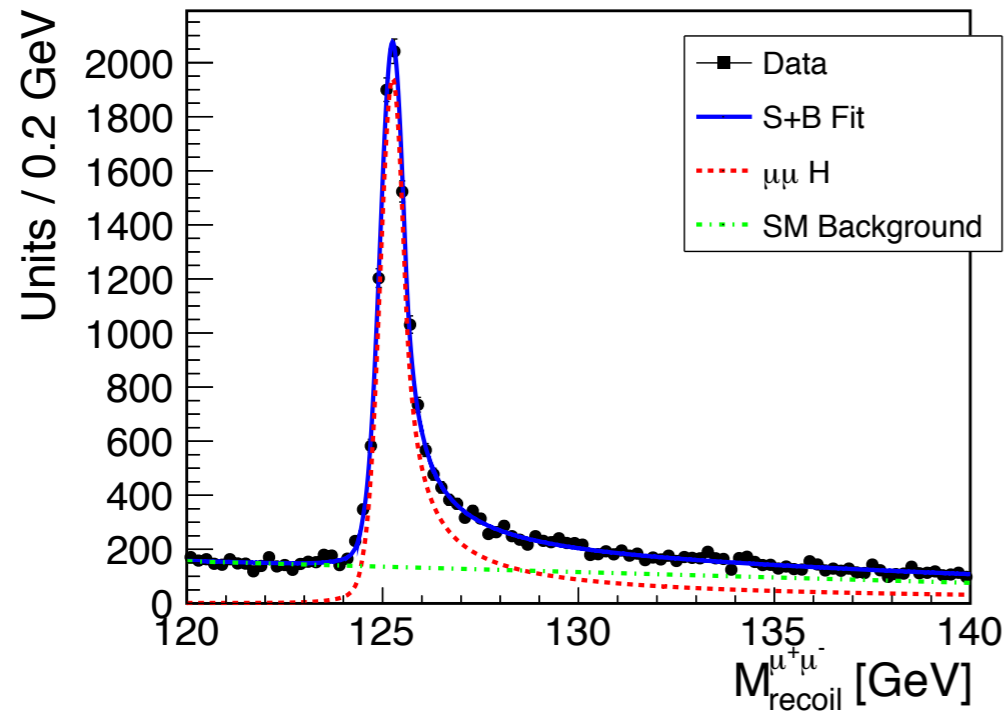
nzzsl_bb: 1423.2

nzzsl_cc:1447.3238

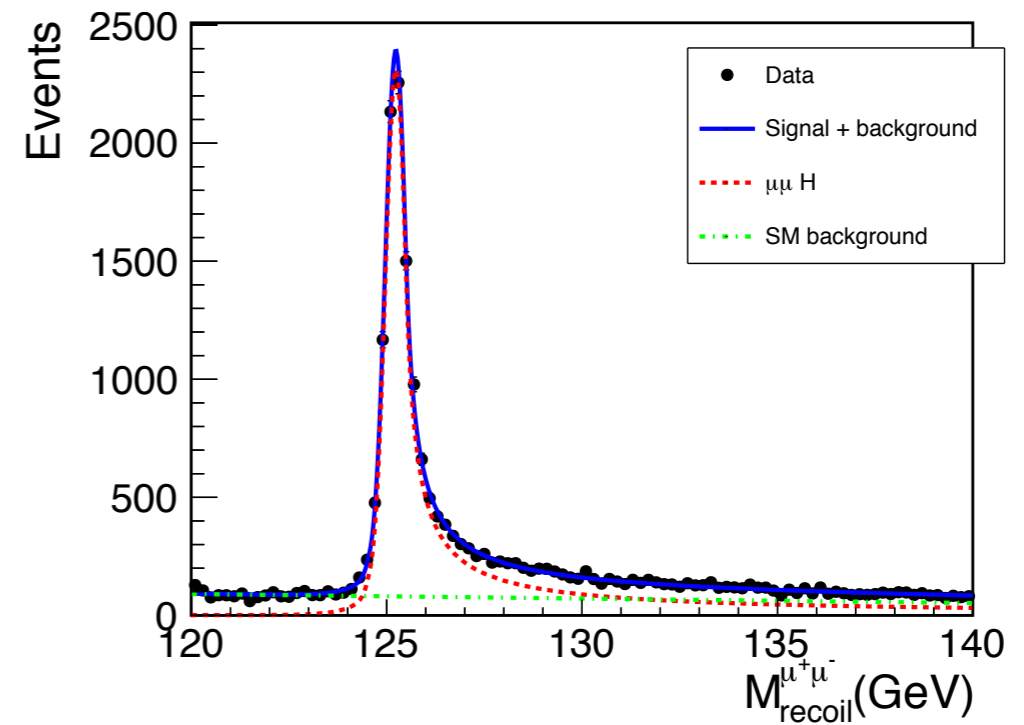
nzzsl_uds: 4330.6

Mrecoil from Fit

3 T

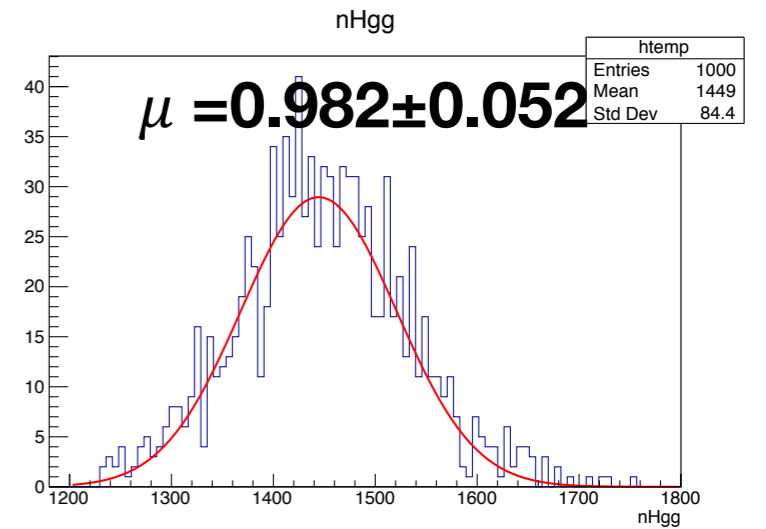
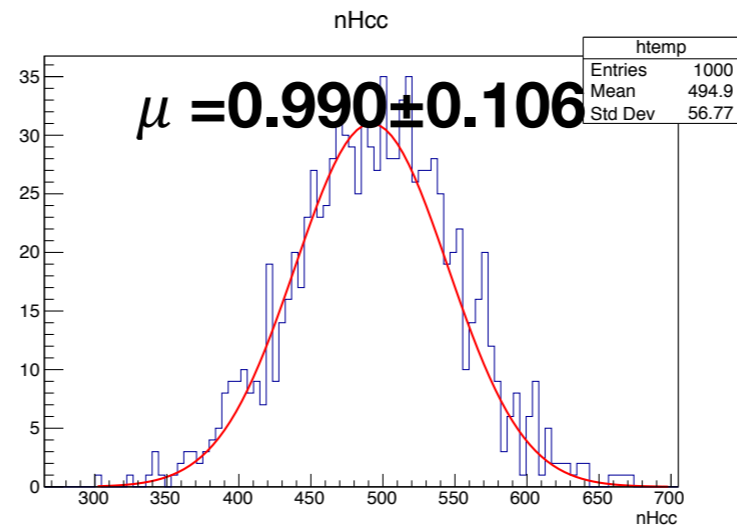
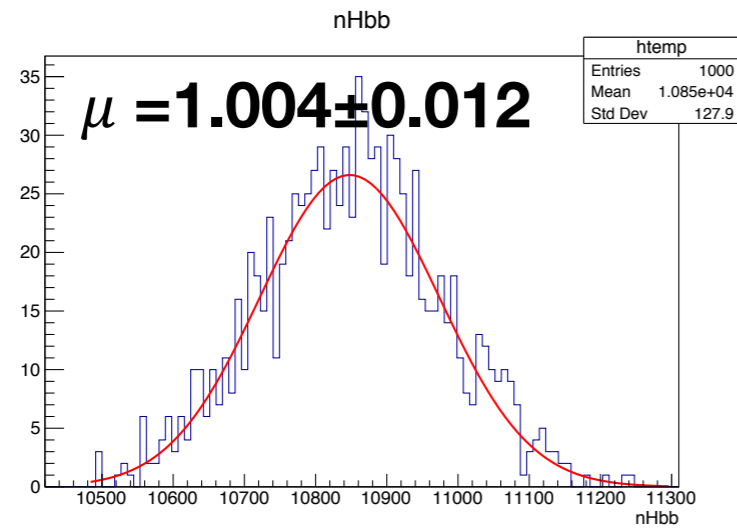


3.5 T

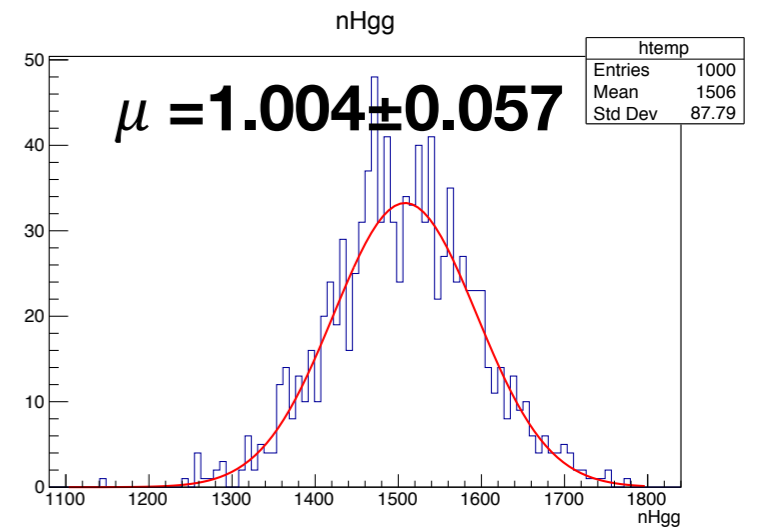
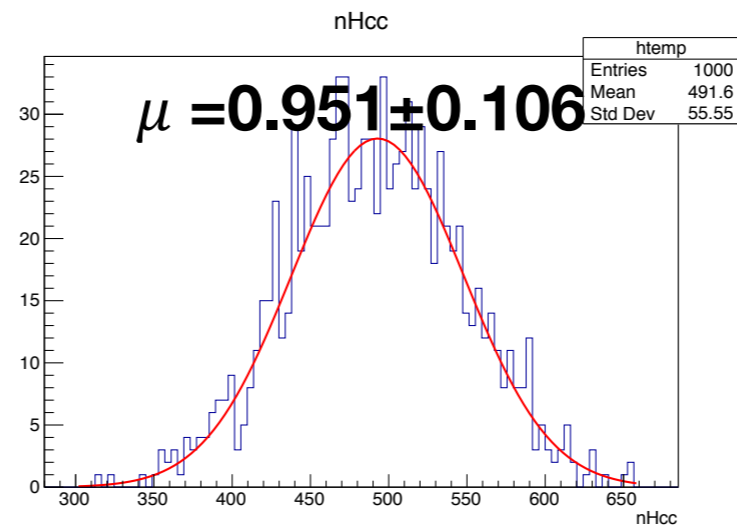
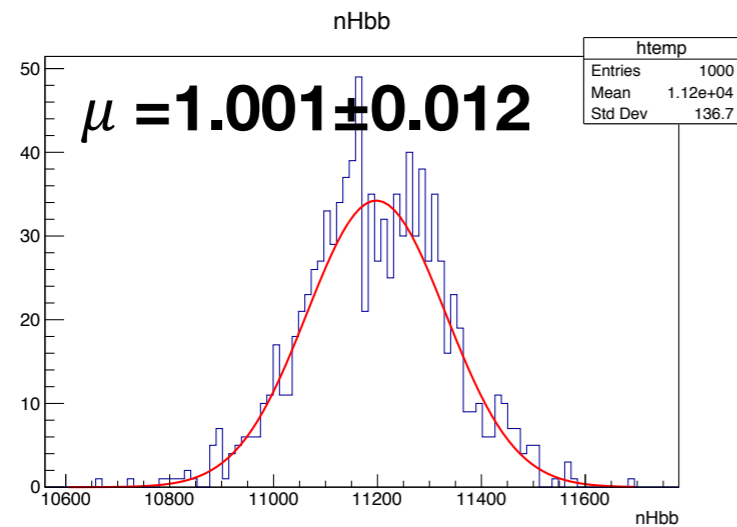


Results of ToyMC

3T



3.5T



No Significant change in terms of uncertainty

Backup

Conclusion

- A shift found in SM $mumu+qq$ background, leading to difference in jet pair invariance cut efficiency
- No significant change found in terms of the uncertainty from toyMC

Cutflow $zz_{sl} \rightarrow \mu\mu qq$ (old result)

	3T down	3.5T down	3T up	3.5T up
FSClasser+filter	21699	24189	14259	15367
$\cos \theta_z$	14984	16853	9821	10627
$\cos \theta_{\mu\mu}$	13367	15002	8638	9327
$M_{\mu\mu}$	11893	13524	7725	8429
M_{recoil}	5434	6209	3617	3942
2J+Lep_Veto	5147	6111	3450	3906
JetnPFO	4992	5632	3326	3589
$\cos \theta_{JJ}$	4580	5188	3030	3291
M_{JJ}	4434	4672	2903	3054
y-value	4145	4375	2726	2857

Fit Results Old Result

3 T

EXT NO.	PARAMETER NAME	VALUE	ERROR	INTERNAL STEP SIZE	INTERNAL VALUE
1	C	2.98443e-02	1.16010e-02	3.22969e-02	-1.01746e+00
2	a	-1.03607e+00	3.15654e-02	4.79707e-04	-1.03789e-01
3	a1	-3.44392e-01	1.92103e-02	6.12484e-03	-3.44392e-01
4	mean	1.25256e+02	6.52233e-03	1.96390e-03	1.74202e-01
5	n	9.17291e-01	3.01802e-02	2.76175e-03	2.81914e-01
6	nHbb	1.09549e+04	1.38980e+02	4.07062e-03	9.55916e-02
7	nHcc	5.41724e+02	6.00616e+01	8.19061e-03	-1.10141e+00
8	nHgg	1.41318e+03	9.02291e+01	1.22954e-02	-4.50956e-01
9	nbkg	3.39381e+00	9.68549e+00	6.40192e-02	-1.46313e+00
10	nzzsl_mu_bb	2.42790e+03	1.04827e+02	8.22363e-03	-3.11516e-01
11	nzzsl_mu_cc	2.08545e+03	7.09836e+01	6.90997e-03	-4.16277e-01
12	nzzsl_mu_uds	7.08060e+03	1.06463e+02	3.51638e-03	-2.96322e-01
13	sigma	3.22645e-01	6.59870e-03	4.57437e-03	-4.59375e-01

FRR DEF= 0.5

True Value:
nHbb: 10806
nHcc: 497
nHgg: 1471.6

3.5 T

EXT NO.	PARAMETER NAME	VALUE	ERROR	INTERNAL STEP SIZE	INTERNAL VALUE
1	C	1.41257e-02	7.10497e-03	1.01210e-03	-1.19271e+00
2	a	-1.01976e+00	2.94921e-02	7.42029e-05	-1.02154e-01
3	a1	-2.66861e-01	2.54429e-02	3.01143e-04	-2.66861e-01
4	mean	1.25237e+02	5.50034e-03	5.94020e-05	1.52510e-01
5	n	9.26916e-01	2.62238e-02	9.02018e-05	2.88600e-01
6	nHhh	1.12777e+04	1.31890e+02	1.49491e-04	1.73038e-01
7	nHcc	5.13029e+02	5.57565e+01	2.94354e-04	-1.11426e+00
8	nHgg	1.54453e+03	8.43753e+01	4.18157e-04	-3.92464e-01
9	nbkg	5.00001e-01	7.91414e+00	4.45507e-01	-1.57075e+00
WARNING - ABOVE PARAMETER IS AT LIMIT.					
10	nzzsl_mu_bb	1.37509e+03	8.65210e+01	3.07649e-04	-6.52715e-01
11	nzzsl_mu_cc	1.46088e+03	5.98302e+01	2.46184e-04	-6.22211e-01
12	nzzsl_mu_uds	4.30346e+03	8.63575e+01	1.22372e-04	-6.06180e-01
13	sigma	2.69439e-01	5.42687e-03	1.48477e-04	-6.14320e-01

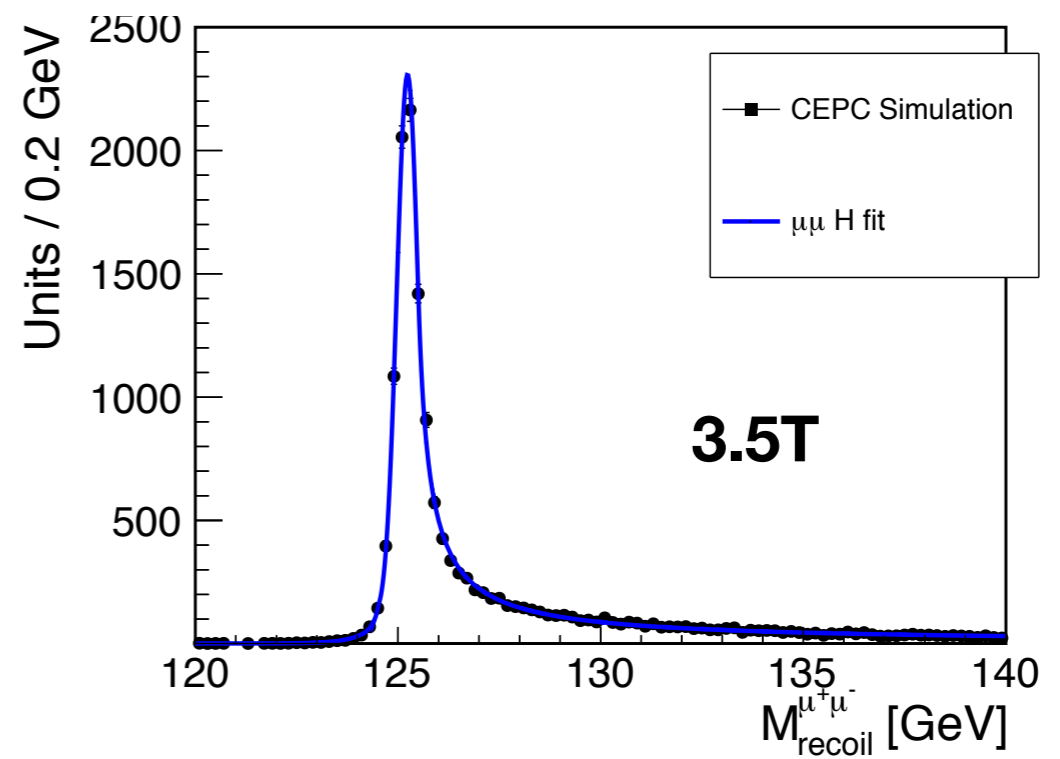
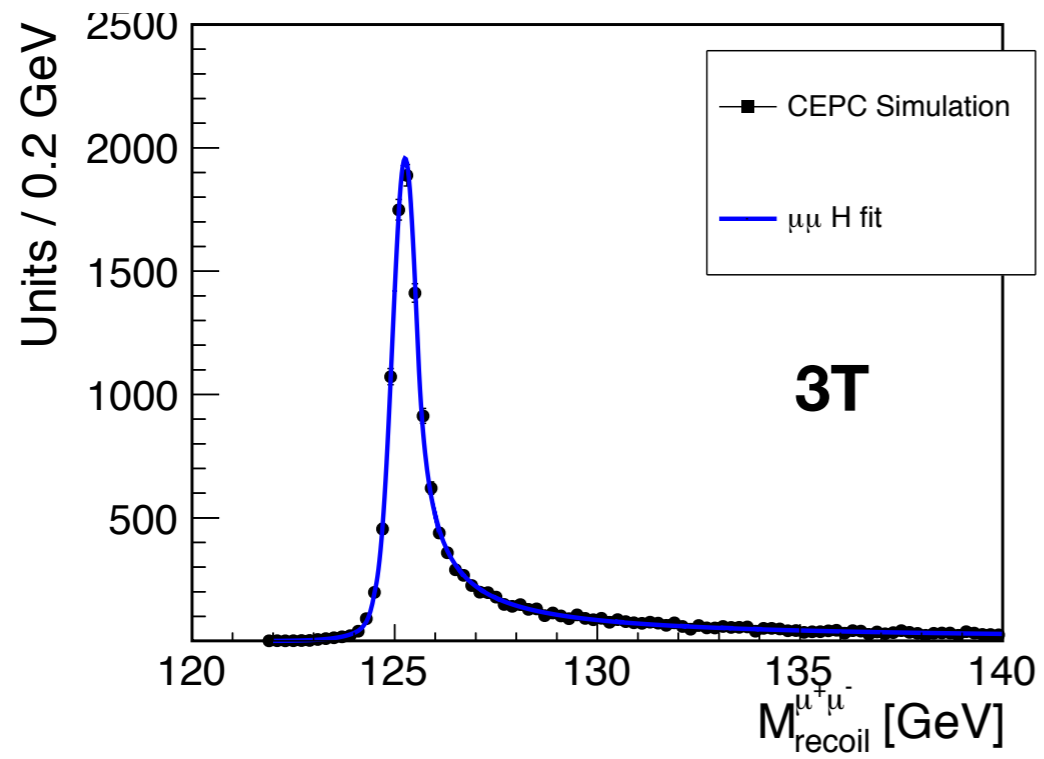
FRR DEF= 0.5

True Value:
nHbb: 11188.2
nHcc: 518.2
nHgg: 1502.4

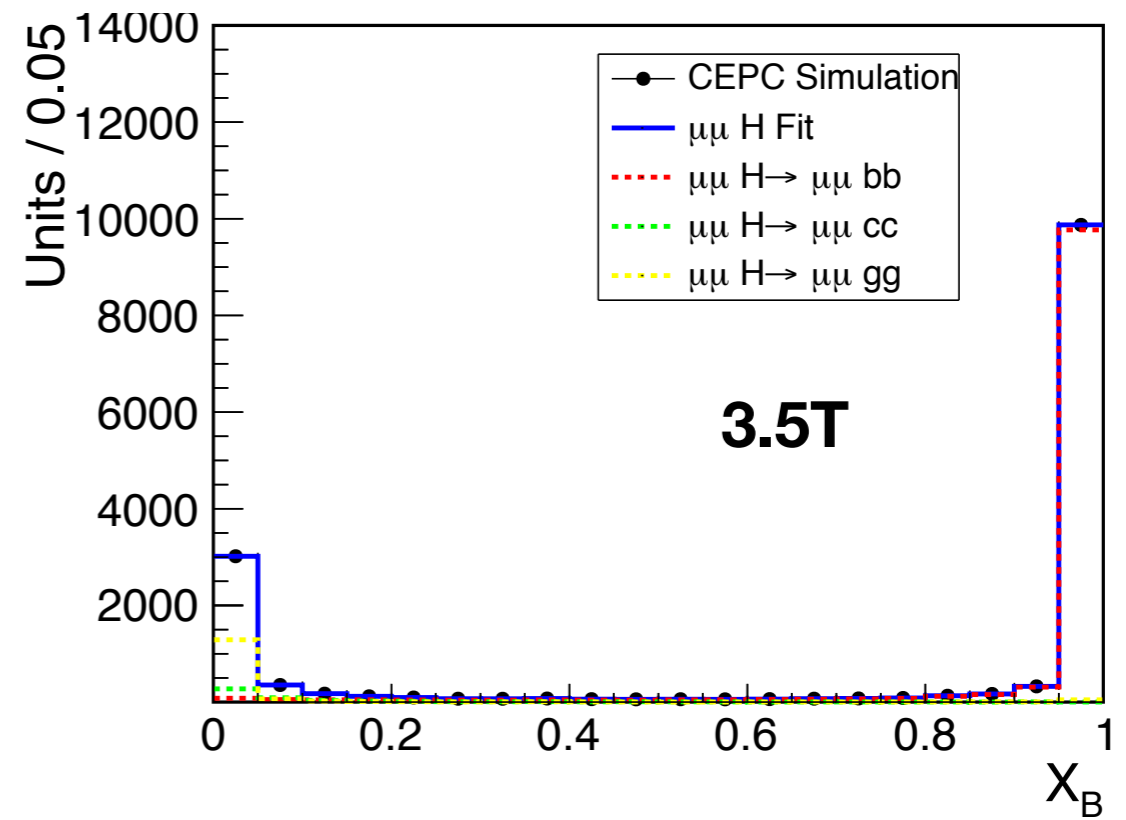
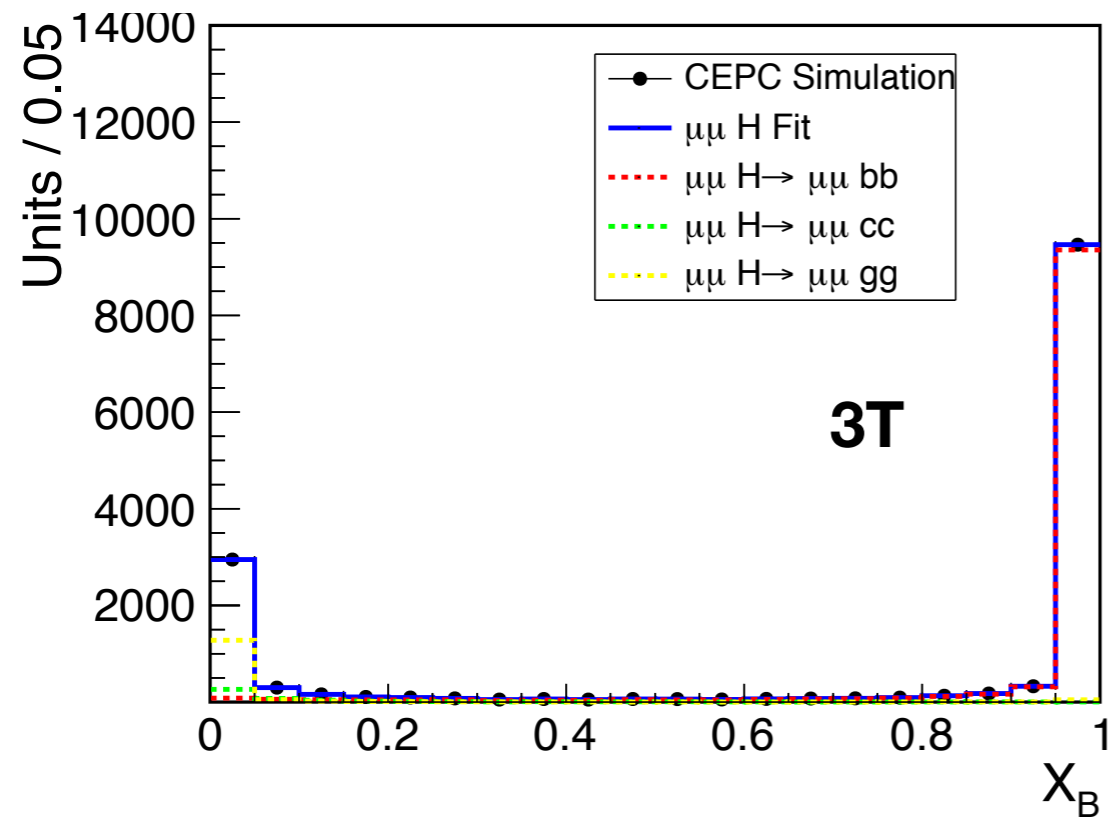
Fit Result

	3T		3.5 T	
	Value	ERROR	VALUE	ERROR
nHbb	1.08074×10^4	106.798	1.111884×10^4	108.469
nHcc	496.335	40.874	518.285	40.8309
nHgg	1.46764×10^3	57.649	1.50056×10^3	58.8540
nHbkg	13.7384	8.19635	15.7974	8.20483
sigma	0.316155	6.08143×10^{-3}	0.269189	5.05385×10^{-3}
mean	125.259	6.28207×10^{-3}	125.237	5.39250×10^{-3}
a	-1.00508	0.027144	-1.00956	2.64415×10^{-2}
n	0.948601	0.0219960	0.939792	0.0204244
peak	124.496	-	124.524	-
tau	0.503652	-	0.463546	-
tail_fraction	0.96875879	-	0.9636108	-
$\mu_{H \rightarrow bb} - 1$	9.91×10^{-5}	9.88×10^{-3}	-6.164×10^{-3}	9.695×10^{-3}
$\mu_{H \rightarrow cc} - 1$	-1.74×10^{-3}	8.22×10^{-2}	1.76×10^{-4}	0.078795
$\mu_{H \rightarrow gg} - 1$	-2.679×10^{-3}	3.917×10^{-2}	-1.199×10^{-3}	0.039174

M_recoil



B Likeness



C Likeness

