

Di-Higgs All-Hadronic Channel Analysis

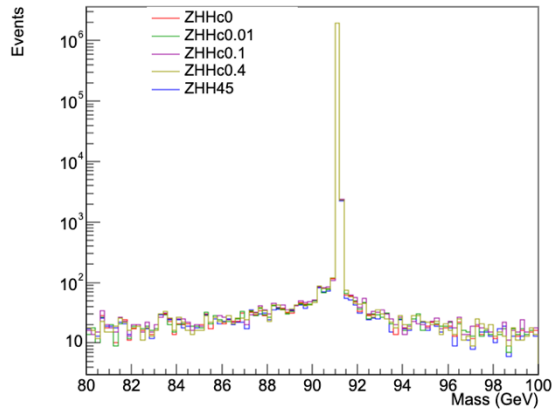
TAN MAN HONG

Work Progress Update on 27th May 2026

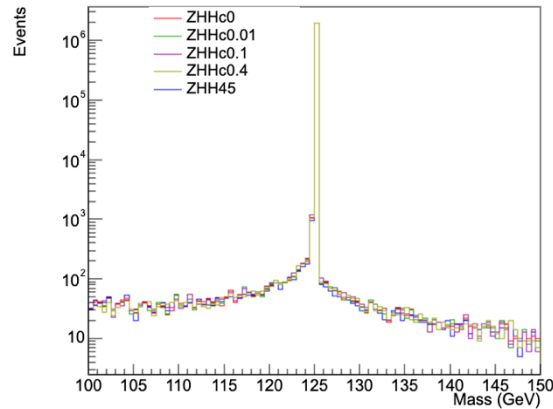
Current issues

- **LAW run creates faulty events (fiterrorcode=0, but not achieving hard mass constraint postfit mass, high chi2)**

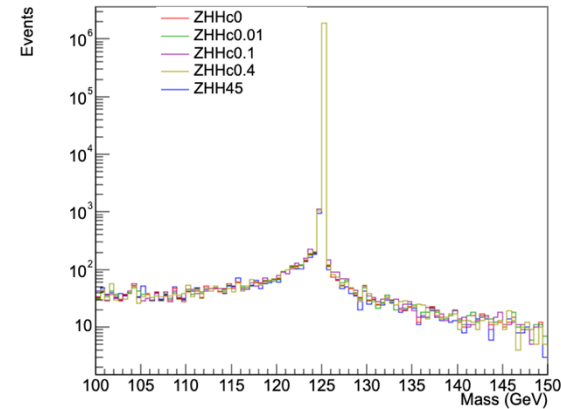
Z Mass



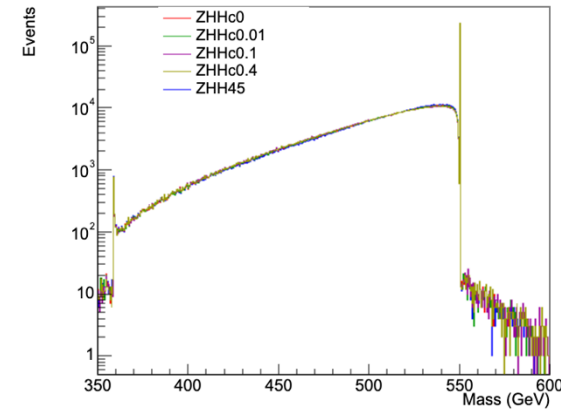
H1 Mass



H2 Mass



ZHH Mass



Current issues

- LAW run creates faulty events (fitererrorcode=0, but not achieving hard mass constraint postfit mass, high chi2)
- **The issue don't appear when rerunning the same event**

```
pool > ZHH > QQanalysis > 21may.log
97200 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Value of pzc before adding ISR: 5.60095e-57
97201 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Value of ec before adding ISR: 5.183
97202 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" start four-vector of ISR photon: ( 0 fix, 0 fix, 0.77238 +- 1) => [1.4
97203 [ MESSAGE8 "MyZHHKinFitQ0_ZHH"
97204 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Value of E_lab before fit: 550.054
97205 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Value of target_p_due_crossing_angle before fit: 3.85
97206 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Value of pxc after adding ISR before fit: 14.0162
97207 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Value of pyc after adding ISR before fit: -4.20453
97208 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Value of pzc after adding ISR before fit: -6.66134e-16
97209 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Value of ec after adding ISR before fit: 6.67938
97210 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" start mass of Z : 99.0491
97211 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" start mass of H1: 102.977
97212 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" start mass of H2: 166.724
97213 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" start mass of HH: 392.788
97214 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" start mass of ZHH: 554.931
97215 [ MESSAGE6 "MyZHHKinFitQ0_ZHH" fit using GSL Fitter
97216 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" ISR added to fit
97217 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" constraints added to fit:
97218 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" sum(p_x) constraint value = 14.0162
97219 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" sum(p_y) constraint value = -4.20453
97220 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" sum(p_z) constraint value = -6.66134e-16
97221 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" sum(E) constraint value = 6.67938
97222 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" higgs1 mass constraint value = -22.0233
97223 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" higgs2 mass constraint value = 41.7244
97224 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" hard z2 mass constraint value = 7.84908
97225 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" helper constraints added
97226 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" fit probability: 5.95522e-243 is better than 0 use that one
97227 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" fit chi2 = 1144.84
97228 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" error code: 0
97229 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" After fit four-vector of ISR photon: ( 0 fix, 0 fix, 1.46351 +- 0.0163
97230 [ MESSAGE8 "MyZHHKinFitQ0_ZHH"
97231 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" After fit ISR energy45.6555
97232 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" =====
97233 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" iperm = 6
97234 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Picking jets 0 1 4 5 2 3 start four-vector of jet jet0: ( 151.343 +- 3.
97235 [ MESSAGE8 "MyZHHKinFitQ0_ZHH"
97236 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" start four-vector of jet jet1: ( 95.2522 +- 2.00969, 2.3056 +- 0.006972
97237 [ MESSAGE8 "MyZHHKinFitQ0_ZHH"
97238 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" start four-vector of jet jet4: ( 73.8697 +- 1.33442, 1.28762 +- 0.01191
97239 [ MESSAGE8 "MyZHHKinFitQ0_ZHH"
97240 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" start four-vector of jet jet5: ( 66.1225 +- 3.45756, 1.52733 +- 0.02435

data > dust > user > tmanhong > zhh > bAnalysisFinal0.4perms > 550-qhfh-fast-perf > stdall_29To30.txt
97362 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Value of pyc > 0.994829
97363 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Value of pzc before adding ISR: 5.183
97364 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Value of ec before adding ISR: 5.183
97365 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" start four-vector of ISR photon: ( 0 fix, 0 fix, 0.77238 +- 1) =>
97366 [ MESSAGE8 "MyZHHKinFitQ0_ZHH"
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97389 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" fit probability: 0.994829 is better than 0 use that one
97390 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" fit chi2 = 0.999953
97391 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" error code: 0
97392 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" After fit four-vector of ISR photon: ( 0 fix, 0 fix, 0.854856 +-
97393 [ MESSAGE8 "MyZHHKinFitQ0_ZHH"
97394 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" After fit ISR energy2.87037
97395 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" =====
97396 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" iperm = 6
97397 [ MESSAGE8 "MyZHHKinFitQ0_ZHH" Picking jets 0 1 4 5 2 3 start four-vector of jet jet0: ( 151.343
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97402 [ MESSAGE8 "MyZHHKinFitQ0_ZHH"
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```

Current issues

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- The issue don't appear when rerunning the same event individually
- **Faulty events are random for each LAW run, although some appears in both**

```
event = chain.event
chi2 = chain.FitChi2
z_mass = chain.ZMassAfterFit
error_code = chain.FitErrorCode
file_path = chain.GetFile().GetName()

if error_code == 0 and chi2 < 1 and (z_mass < 90 or z_mass > 92):
    print(f"{event} | {chi2} | {z_mass} | {file_path}")
```

Event	FitChi2	ZMassAfterFit	File Path
11132	0.9999697804459989	161.39761352539062	/data/dust/user/tmanhong/zhh/AnalysisFinal/550-gqhh-fast-perf/E550-Test.Pqggh.Gwhizard-
81927	0.9999823570251465	137.3283233642578	/data/dust/user/tmanhong/zhh/AnalysisFinal/550-gqhh-fast-perf/E550-Test.Pqggh.Gwhizard-
109153	0.9999133944511414	154.28985595703125	/data/dust/user/tmanhong/zhh/AnalysisFinal/550-gqhh-fast-perf/E550-Test.Pqggh.Gwhizard-
5675	0.9999201893806458	153.05287170410156	/data/dust/user/tmanhong/zhh/AnalysisFinal/550-gqhh-fast-perf/E550-Test.Pqggh.Gwhizard-
98119	0.9999958872795105	101.74738311767578	/data/dust/user/tmanhong/zhh/AnalysisFinal/550-gqhh-fast-perf/E550-Test.Pqggh.Gwhizard-
591127	0.694413959980011	93.93292999267578	/data/dust/user/tmanhong/zhh/AnalysisFinal/550-gqhh-fast-perf/E550-Test.Pqggh.Gwhizard-
773586	0.9999075531959534	255.0616455078125	/data/dust/user/tmanhong/zhh/AnalysisFinal/550-gqhh-fast-perf/E550-Test.Pqggh.Gwhizard-
801679	0.5961213111877441	199.39512634277344	/data/dust/user/tmanhong/zhh/AnalysisFinal/550-gqhh-fast-perf/E550-Test.Pqggh.Gwhizard-
850173	0.4417906701564789	366.8029479980469	/data/dust/user/tmanhong/zhh/AnalysisFinal/550-gqhh-fast-perf/E550-Test.Pqggh.Gwhizard-
387406	0.2836911380290985	128.03152465820312	/data/dust/user/tmanhong/zhh/AnalysisFinal/550-gqhh-fast-perf/E550-Test.Pqggh.Gwhizard-

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    print(f"{event} | {chi2} | {z_mass} | {file_path}")
```

Event	FitChi2	ZMassAfterFit	File Path
38754	0.9999533891677856	98.92650604248047	/data/dust/user/tmanhong/zhh/bAnalysisFinal0.4perms/550-gqhh-fast-perf/E
587043	0.9999350905418396	311.6350402832031	/data/dust/user/tmanhong/zhh/bAnalysisFinal0.4perms/550-gqhh-fast-perf/
845818	0.9999463558197021	147.9270782470703	/data/dust/user/tmanhong/zhh/bAnalysisFinal0.4perms/550-gqhh-fast-perf/
880260	0.9999306797981262	113.4448013305664	/data/dust/user/tmanhong/zhh/bAnalysisFinal0.4perms/550-gqhh-fast-perf/
201212	0.9999235272407532	157.88348388671875	/data/dust/user/tmanhong/zhh/bAnalysisFinal0.4perms/550-gqhh-fast-perf/
178031	0.9999505877494812	309.3352966308594	/data/dust/user/tmanhong/zhh/bAnalysisFinal0.4perms/550-gqhh-fast-perf/
413439	0.9999846816062927	80.77495574951172	/data/dust/user/tmanhong/zhh/bAnalysisFinal0.4perms/550-gqhh-fast-perf/
98119	0.9999958872795105	101.74738311767578	/data/dust/user/tmanhong/zhh/bAnalysisFinal0.4perms/550-gqhh-fast-perf/
556792	0.9999495148658752	141.5333709716797	/data/dust/user/tmanhong/zhh/bAnalysisFinal0.4perms/550-gqhh-fast-perf/
595787	0.9999209046363831	77.02574920654297	/data/dust/user/tmanhong/zhh/bAnalysisFinal0.4perms/550-gqhh-fast-perf/
598782	0.9999271035194397	33.90334701538086	/data/dust/user/tmanhong/zhh/bAnalysisFinal0.4perms/550-gqhh-fast-perf/
773586	0.9999075531959534	255.0616455078125	/data/dust/user/tmanhong/zhh/bAnalysisFinal0.4perms/550-gqhh-fast-perf/

Current issues

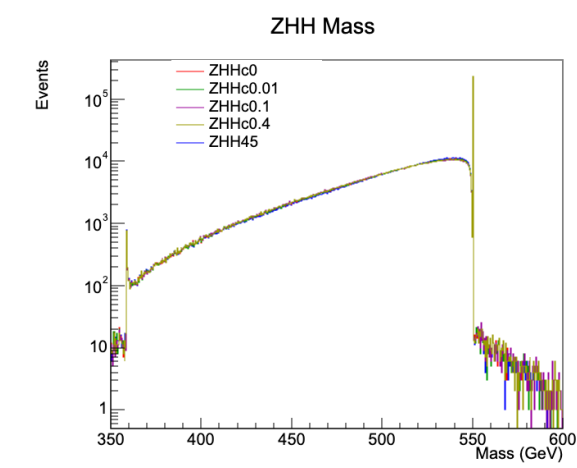
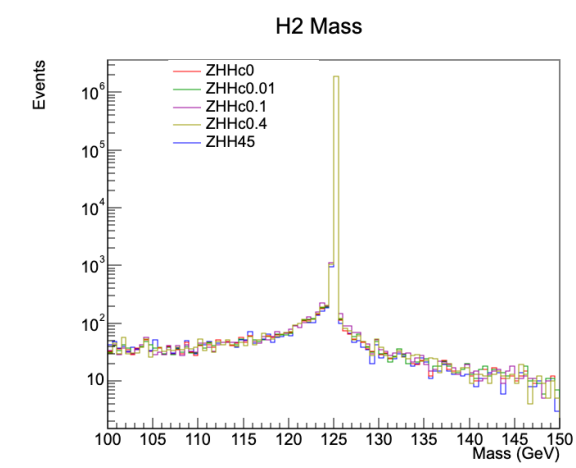
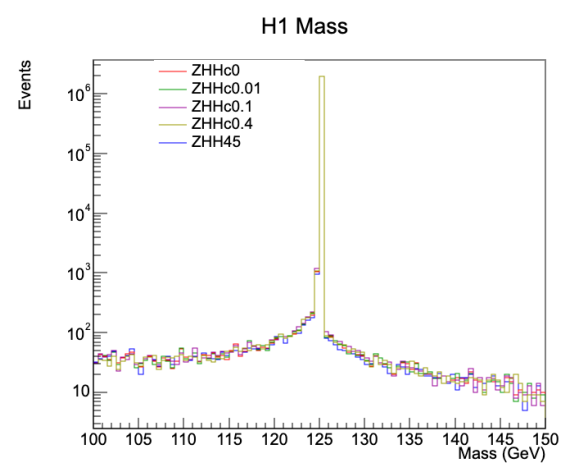
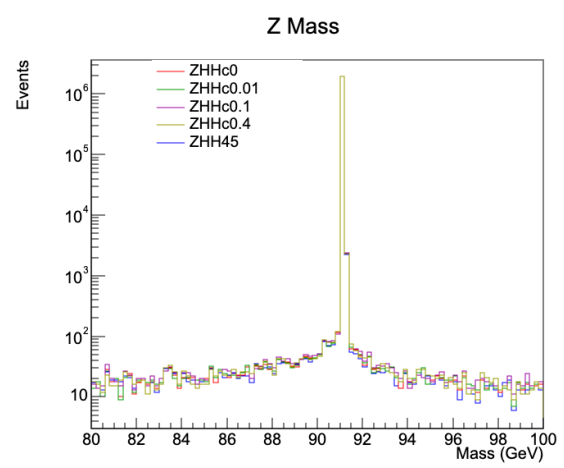
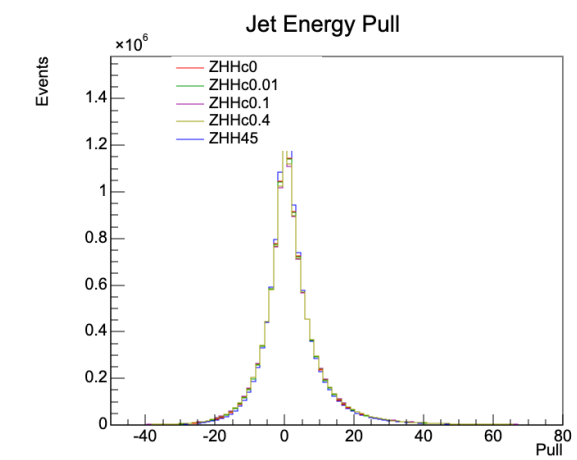
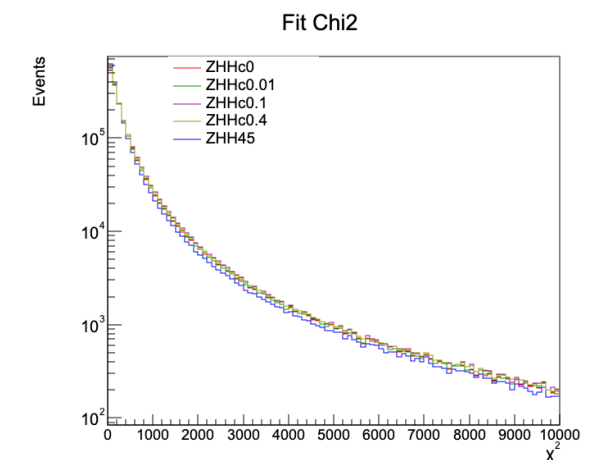
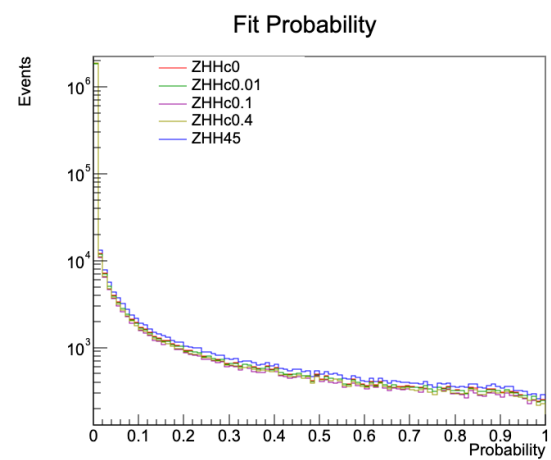
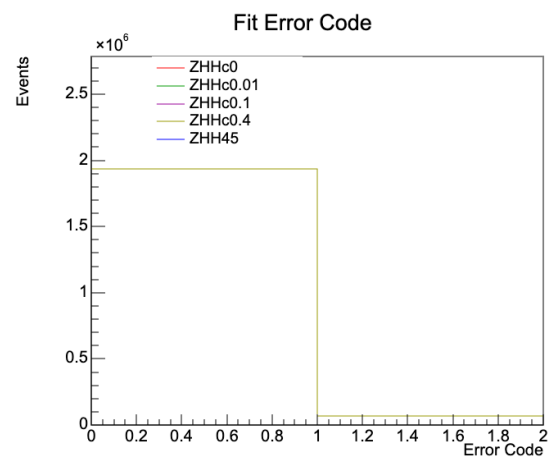
- LAW run creates faulty events (fiterrorcode=0, but not achieving hard mass constraint postfit mass, high chi2)
- The issue don't appear when rerunning the same event individually
- Faulty events are random for each LAW run, although some appears in both
- **Tried rerunning just 1 event using LAW with trace but:**

```
bash-5.1$ tail -f 26may0.4just773586.log
10:32:20: all: 2464, pending: 0 (+0), running: 0 (-1), finished: 2463 (+0), retry: 1 (+1), failed: 0 (+0)
1 failed job(s) in task AnalysisFinal_1_False_bde3be6953:
  job: 1044, branches: [1043], id: 3465722.0, status: retry, code: 0, error: Diskusage 25402418 higher than 20480000 MB, use Request Disk, log: /data/dust/user/tmanhong/zhh/AnalysisFinal/550-qghh-fast-perf/stdall_1043To1044.txt
going to submit 1 htcondor job(s)
(Re-)Running task AnalysisFinal with increased requirements
submitted 1 htcondor job(s)
10:33:20: all: 2464, pending: 0 (+0), running: 1 (+1), finished: 2463 (+0), retry: 0 (-1), failed: 0 (+0)
10:34:21: all: 2464, pending: 0 (+0), running: 1 (+0), finished: 2463 (+0), retry: 0 (+0), failed: 0 (+0)
10:35:21: all: 2464, pending: 0 (+0), running: 1 (+0), finished: 2463 (+0), retry: 0 (+0), failed: 0 (+0)
10:36:21: all: 2464, pending: 0 (+0), running: 1 (+0), finished: 2463 (+0), retry: 0 (+0), failed: 0 (+0)
10:37:21: all: 2464, pending: 0 (+0), running: 1 (+0), finished: 2463 (+0), retry: 0 (+0), failed: 0 (+0)
10:38:22: all: 2464, pending: 0 (+0), running: 1 (+0), finished: 2463 (+0), retry: 0 (+0), failed: 0 (+0)
10:39:22: all: 2464, pending: 0 (+0), running: 1 (+0), finished: 2463 (+0), retry: 0 (+0), failed: 0 (+0)
10:40:22: all: 2464, pending: 0 (+0), running: 1 (+0), finished: 2463 (+0), retry: 0 (+0), failed: 0 (+0)
10:41:23: all: 2464, pending: 0 (+0), running: 1 (+0), finished: 2463 (+0), retry: 0 (+0), failed: 0 (+0)
10:42:23: all: 2464, pending: 0 (+0), running: 1 (+0), finished: 2463 (+0), retry: 0 (+0), failed: 0 (+0)
10:43:23: all: 2464, pending: 0 (+0), running: 0 (-1), finished: 2463 (+0), retry: 1 (+1), failed: 0 (+0)
1 failed job(s) in task AnalysisFinal_1_False_bde3be6953:
  job: 1044, branches: [1043], id: 3465758.0, status: retry, code: 0, error: Diskusage 28930647 higher than 20480000 MB, use Request Disk, log: /data/dust/user/tmanhong/zhh/AnalysisFinal/550-qghh-fast-perf/stdall_1043To1044.txt
going to submit 1 htcondor job(s)
(Re-)Running task AnalysisFinal with increased requirements
submitted 1 htcondor job(s)
```

Backups

Current issues

- LAW run creates faulty events (fiterrorcode=0, but not achieving hard mass constraint postfit mass, high chi2)
- The issue don't appear when rerunning the same event individually
- Faulty events are random for each LAW run, although some appears in both
- Tried rerunning just 1 event using LAW with trace but job: 1044, branches: [1043], id: 3465610.0, status: retry, code: 0, error: Diskusage 35164764 higher than 20480000 MB, use Request_Disk



- Only events with FitErrorCode == 0 is plotted
- Hard mass constraint on individual masses

```

* 140 * 0 * 125 *
* 141 * 0 * 125 *
* 142 * 0 * 125 *
* 143 * 0 * 139.08805 *
* 144 * 0 * 125 *
* 145 * 0 * 125 *
* 146 * 0 * 125 *

```

```

* 862 * 0 * 125 *
* 863 * 0 * 125 *
* 864 * 0 * 125 *
* 865 * 0 * 125 *
* 866 * 0 * 97.719528 *
* 867 * 0 * 125 *
* 868 * 1 * 0 *
* 869 * 0 * 125 *

```

Some events with FitErrorCode = 0 did not fit to hard constraint value

```

bool converged = 0;
ierr = 0;
double chi2new = calcChi2();
nit = 0;
do {
#ifdef FIT_TRACEOFF
if (tracer) tracer->step (*this);
#endif
// Store old x values in xold
gsl_blas_dcopy (x, xold);
// Fill errors into perr
fillperr(perr);

// Now, calculate the result vector y with the values of the derivatives
// d chi^2/d x
int ifail = calcNewtonDx(dx, dxscal, x, perr, M, Mscal, y, yscal, W, W2, permW, v1);
if (ifail) {
ierr = 99;
if (debug > 0) {
std::cout << "NewFitterGSL::fit: calcNewtonDx error " << ifail << std::endl;
}
break;
}
// test convergence:
if (gsl_blas_dasum (dxscal) < 1E-6*idim) {
converged = true;
break;
}
double alpha = 1;
double mu = 0;
int imode = 2;
calcLimitedDx (alpha, mu, xnew, imode, x, v2, dx, dxscal, perr, M, Mscal, W, v1);

gsl_blas_dcopy (xnew, x);

```

FitErrorCode = 0 criteria:

1. calcNewtonDx
2. dxscal
3. nit

```

chi2new = calcChi2();
//cout << "chi2: " << chi2old << " -> " << chi2new << endl;
// *-- Convergence criteria

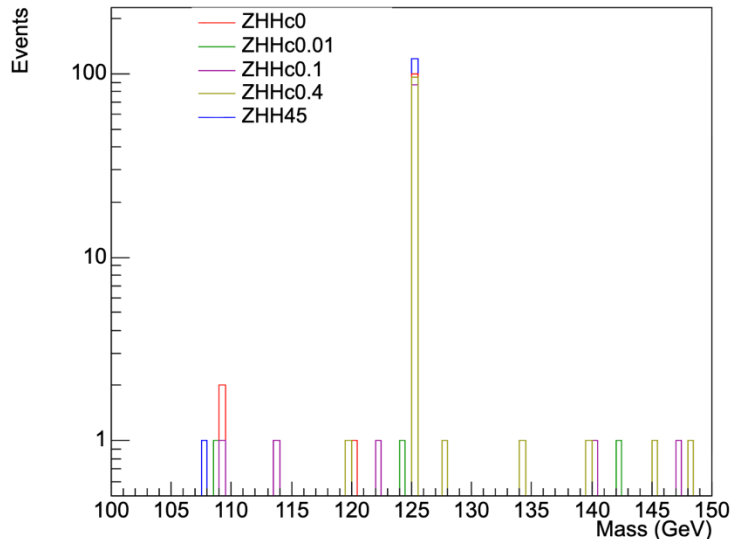
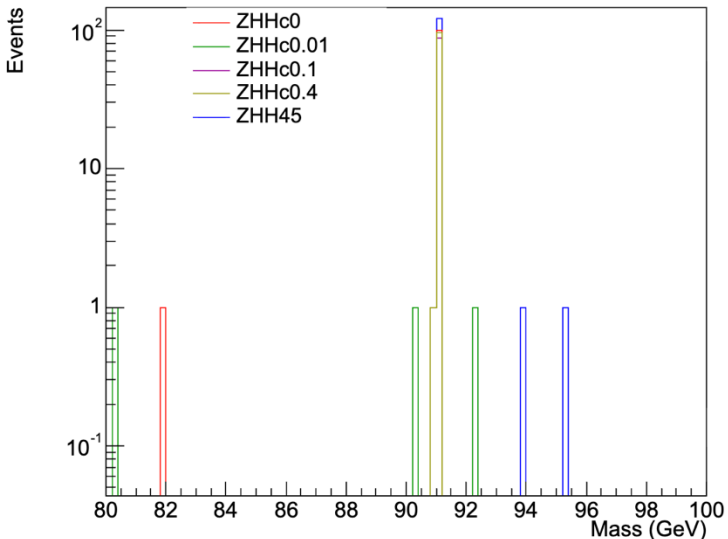
++nit;
if (nit > 200) ierr = 1;
converged = (abs (chi2new - chi2old) < 0.0001);
// if (abs (chi2new - chi2old) >= 0.001)
// cout << "abs (chi2new - chi2old)=" << abs (chi2new - chi2old) << " -> try again\n";
// if (fvalbest >= 1E-3)
// cout << "fvalbest=" << fvalbest << " -> try again\n";
// if (fvalbest >= 1E-6 && abs(fvals[0]-fvalbest) >= 0.2*fvalbest )
// cout << "fvalbest=" << fvalbest
// << ", abs(fvals[0]-fvalbest)=" << abs(fvals[0]-fvalbest)<< " -> try again\n";
// if (stepbest >= 1E-3)
// cout << "stepbest=" << stepbest << " -> try again\n";
// cout << "converged=" << converged << endl;
if (debug > 2 && converged) {
cout << "abs (chi2new - chi2old)=" << abs (chi2new - chi2old) << "\n"
<< "fvalbest=" << fvalbest << "\n"
<< "abs(fvals[0]-fvalbest)=" << abs(fvals[0]-fvalbest)<< "\n";
}
} while (!(converged || ierr));

```

After applied :FitErrorCode == 0 && FitChi2 < 1

Z Mass

H1 Mass

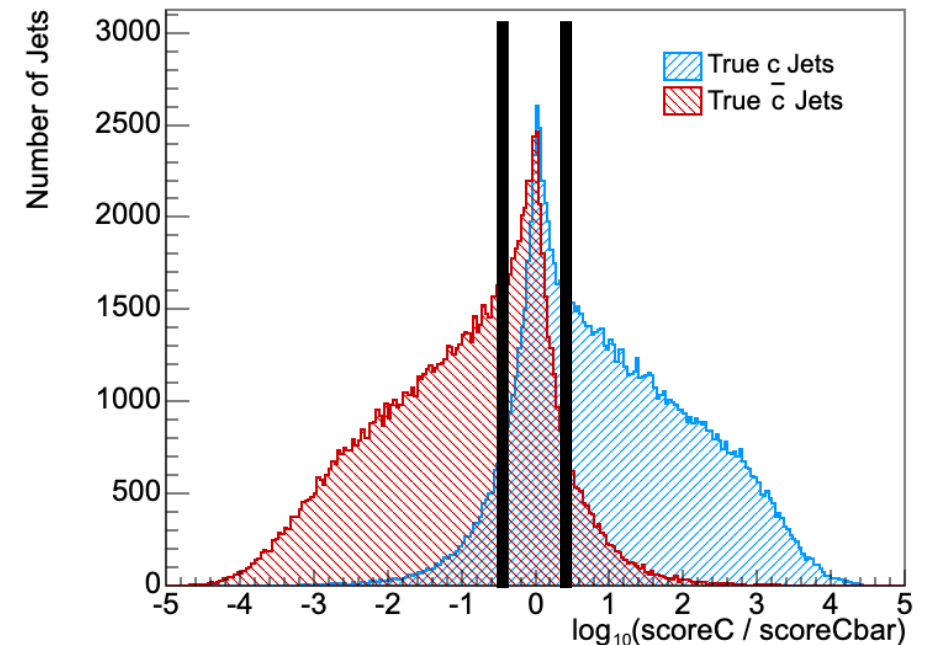
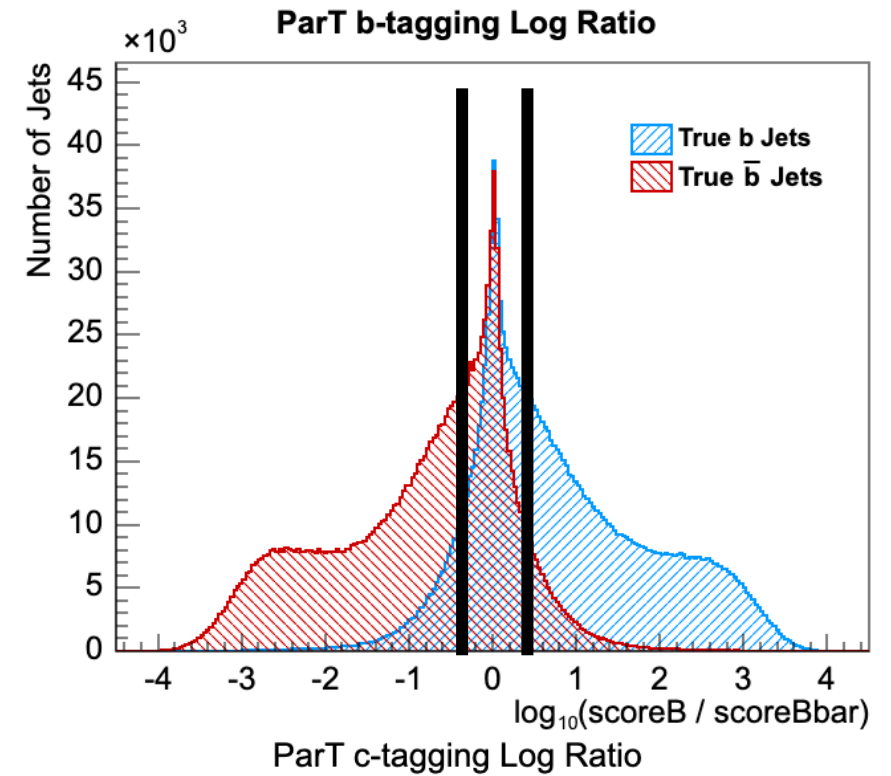


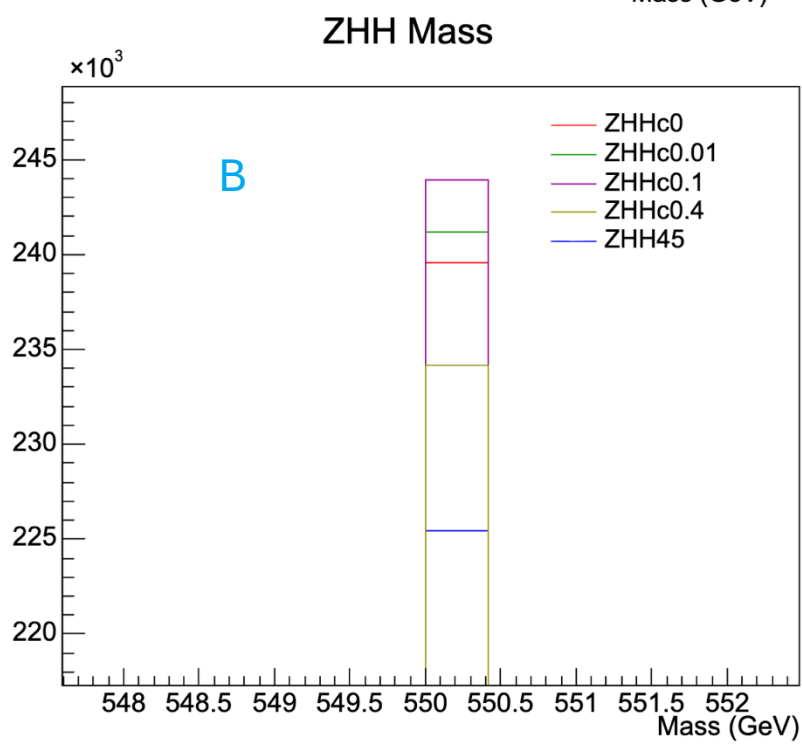
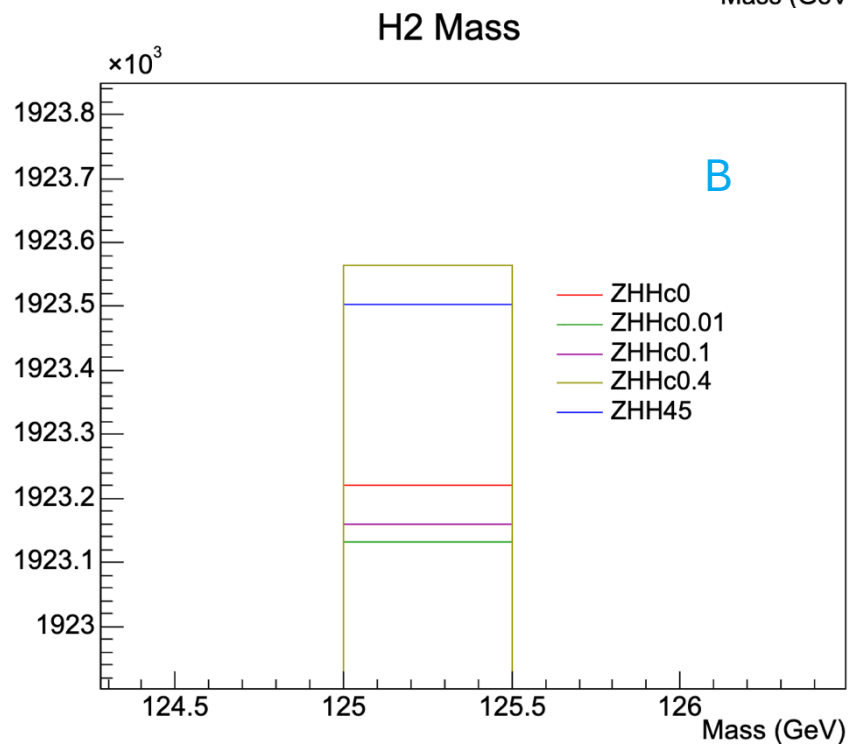
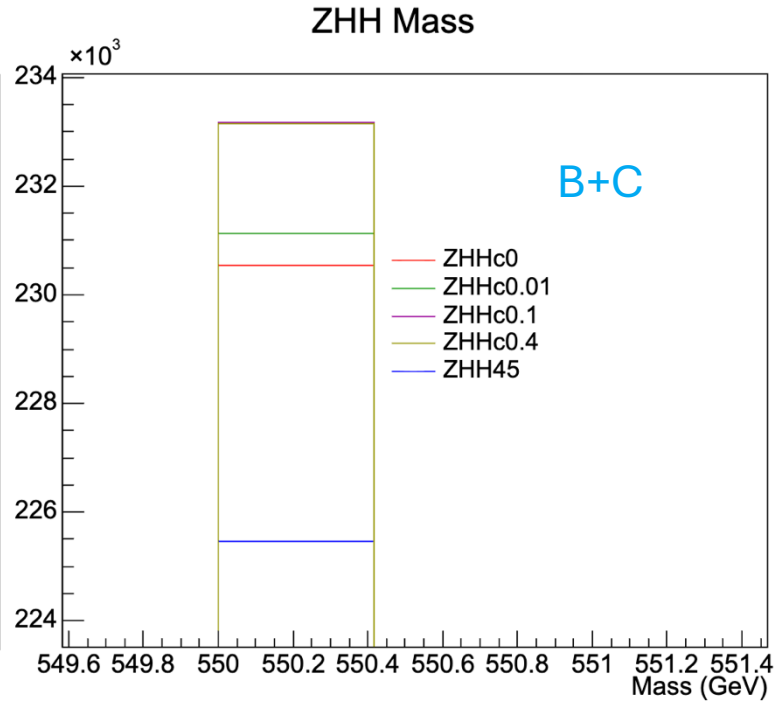
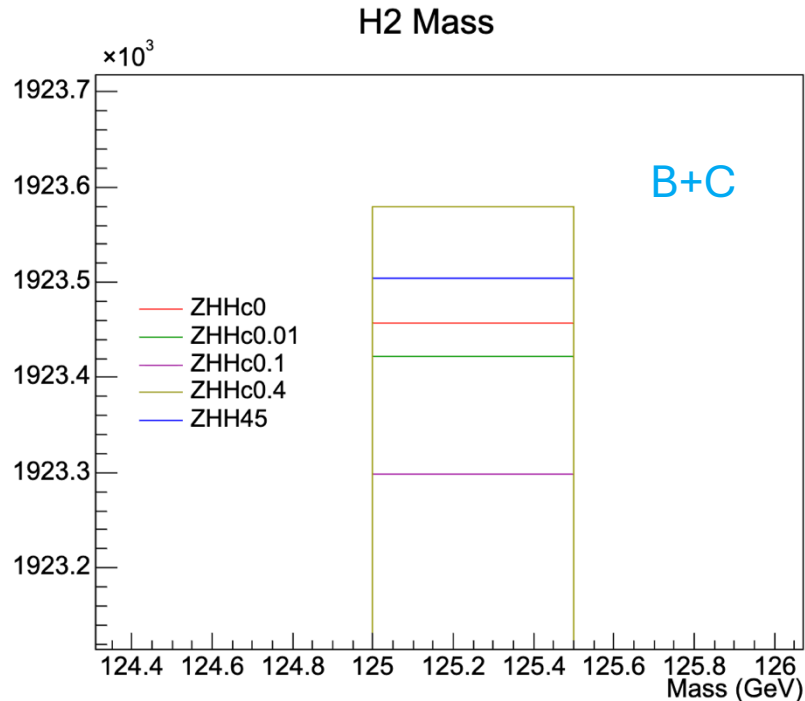
Why event info do not match up?

Event	FitChi2	ZMassAfterFit	File Path
109153	0.9999133944511414	154.28985595703125	/data/dust/user/tmanhong/zhh/An
504583	0.9999009370803833	108.69320678710938	/data/dust/user/tmanhong/zhh/Ana
608884	0.9999759197235107	70.12799072265625	/data/dust/user/tmanhong/zhh/Ana
640733	0.9999035596847534	129.66354370117188	/data/dust/user/tmanhong/zhh/An
851834	0.4476035535335541	95.34463500976562	/data/dust/user/tmanhong/zhh/Ana
940888	0.9999696016311646	170.2714080810547	/data/dust/user/tmanhong/zhh/Ana
145878	0.9999136924743652	100.0264663696289	/data/dust/user/tmanhong/zhh/Ana
146066	0.8469420075416565	36.472023010253906	/data/dust/user/tmanhong/zhh/An
171377	0.9999967813491821	210.94873046875	/data/dust/user/tmanhong/zhh/AnaLy
284938	0.9999436140060425	78.99983978271484	/data/dust/user/tmanhong/zhh/Ana
477873	0.9999906420707703	257.6137390136719	/data/dust/user/tmanhong/zhh/Ana
591127	0.694413959980011	93.93292999267578	/data/dust/user/tmanhong/zhh/Anal
773586	0.9999075531959534	255.0616455078125	/data/dust/user/tmanhong/zhh/Ana
911112	0.819556474685669	79.32839965820312	/data/dust/user/tmanhong/zhh/Anal
167506	0.9999611973762512	107.99821472167969	/data/dust/user/tmanhong/zhh/An
203990	0.9999852180480957	76.4360580444336	/data/dust/user/tmanhong/zhh/Anal
283850	0.9999371767044067	123.97274780273438	/data/dust/user/tmanhong/zhh/An
360881	0.7926355004310608	141.50051879882812	/data/dust/user/tmanhong/zhh/An

```
[ MESSAGE1 "MyZHHKinFitQQ_ZHH"] Z mass prefit = 99.9817
[ MESSAGE1 "MyZHHKinFitQQ_ZHH"] H1 mass prefit = 127.851
[ MESSAGE1 "MyZHHKinFitQQ_ZHH"] H2 mass prefit = 152.68
[ MESSAGE1 "MyZHHKinFitQQ_ZHH"] HH mass prefit = 346.291
[ MESSAGE1 "MyZHHKinFitQQ_ZHH"] ZHH mass prefit = 549.714
[ MESSAGE "MyZHHKinFitQQ_ZHH"] Z mass postfit = 91.2
[ MESSAGE "MyZHHKinFitQQ_ZHH"] H1 mass postfit = 125
[ MESSAGE "MyZHHKinFitQQ_ZHH"] H2 mass postfit = 125
[ MESSAGE "MyZHHKinFitQQ_ZHH"] HH mass postfit = 312.696
[ MESSAGE "MyZHHKinFitQQ_ZHH"] ZHH mass postfit = 505.877
[ MESSAGE "MyZHHKinFitQQ_ZHH"] ISR energy true = 1.09563e-05
[ MESSAGE "MyZHHKinFitQQ_ZHH"] ISR energy postfit = 42.3891
[ MESSAGE "MyZHHKinFitQQ_ZHH"] pulls jet0: -4.11888, 8.52584, -4.7647
[ MESSAGE "MyZHHKinFitQQ_ZHH"] pulls jet1: 2.03751, 7.46853, -5.74896
[ MESSAGE "MyZHHKinFitQQ_ZHH"] pulls jet2: -8.36573, 1.93551, -10.7941
[ MESSAGE "MyZHHKinFitQQ_ZHH"] pulls jet3: -0.528419, 4.96093, 11.7205
[ MESSAGE "MyZHHKinFitQQ_ZHH"] pulls jet4: -13.4661, 15.8359, -12.8261
[ MESSAGE "MyZHHKinFitQQ_ZHH"] pulls jet5: -17.4563, 13.7738, 17.3617
[ MESSAGE "MyStatusmonitor"] ===== Run : 0 Event: 871
[ MESSAGE1 "MyZHHKinFitQQ_ZHH"]
[ WARNING "MyZHHKinFitQQ_ZHH"] ////////////////////////////////// processing event 109154 in run 404009 /
```

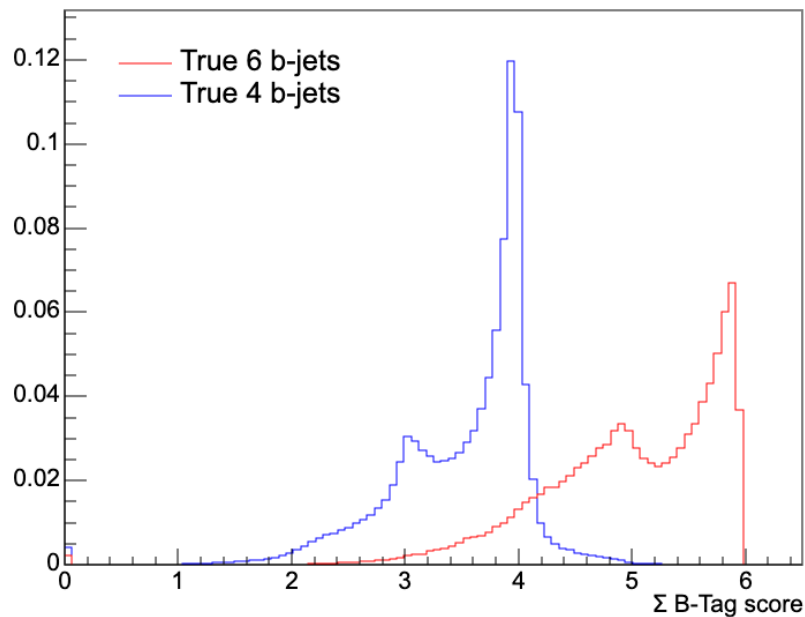
- The $j\bar{j}$ informed permutations for 6 jets event.
 - jets passed the cut \rightarrow well defined charge
 - 4 event cases based on no. of passed cut jets:
 - $3q \parallel 3\bar{q} \rightarrow 18$ perms
 - $2q \ \&\& \ 2\bar{q} \rightarrow 30$ perms
 - $2q \parallel 2\bar{q} \parallel 4q \parallel 4\bar{q} \rightarrow 36$ perms
 - $1q \parallel 1\bar{q} \parallel \text{else} \rightarrow 45$ perms



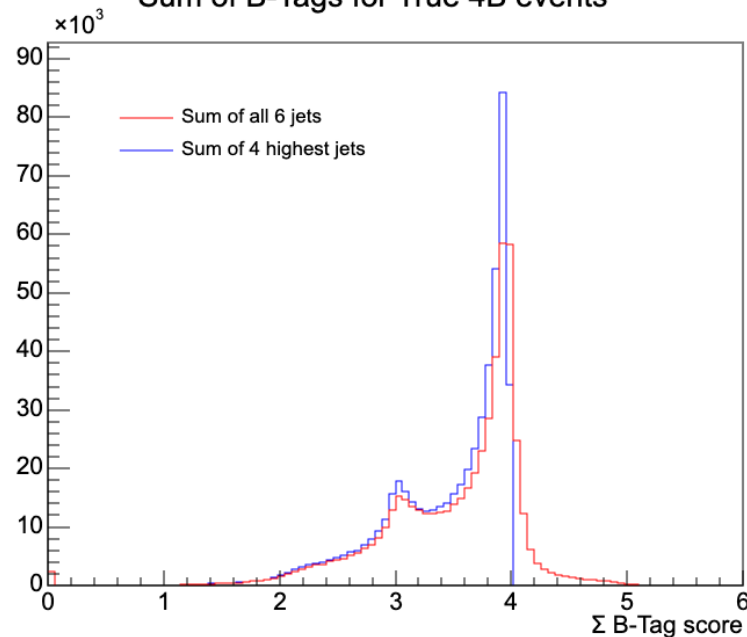


- Similar performance in individual mass reconstruction
- Just B tag cut $\sim 10k$ more events in ZHH 550 bin
- Just B tag cut is sufficient

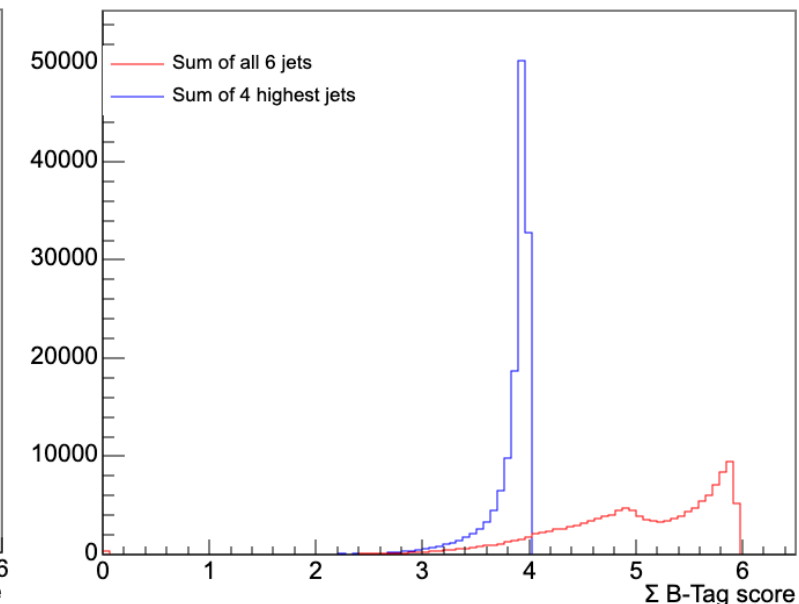
Sum of B-Tags



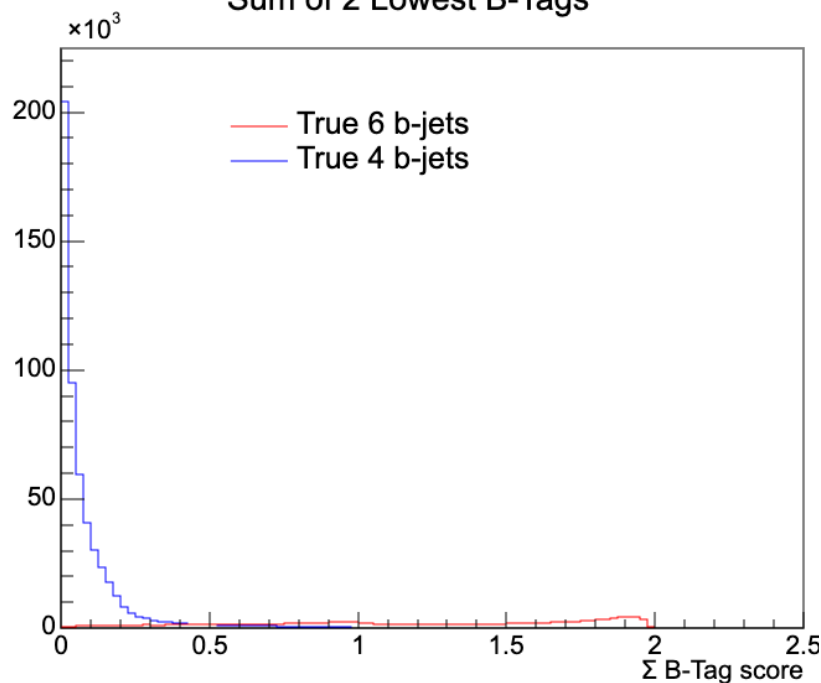
Sum of B-Tags for True 4B events



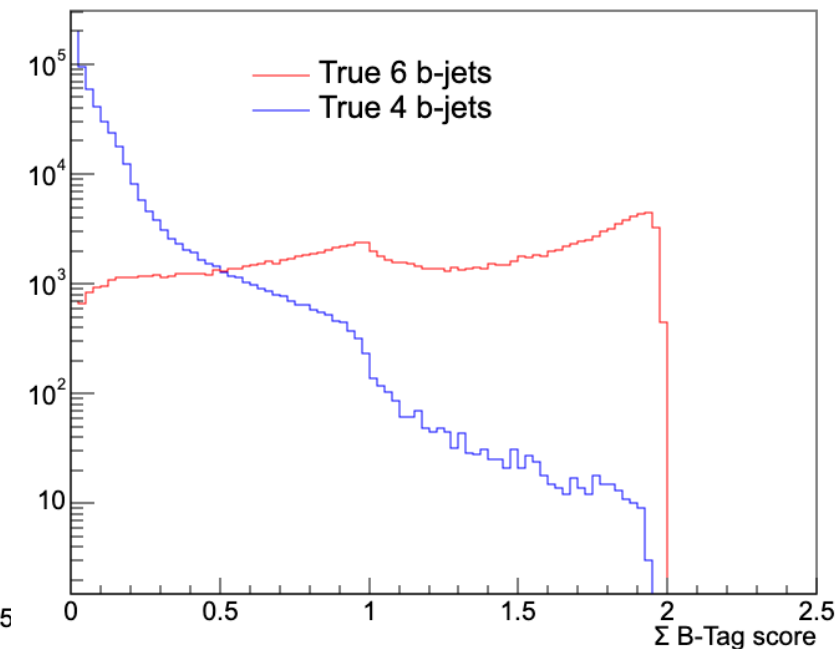
Sum of B-Tags for True 6B events



Sum of 2 Lowest B-Tags



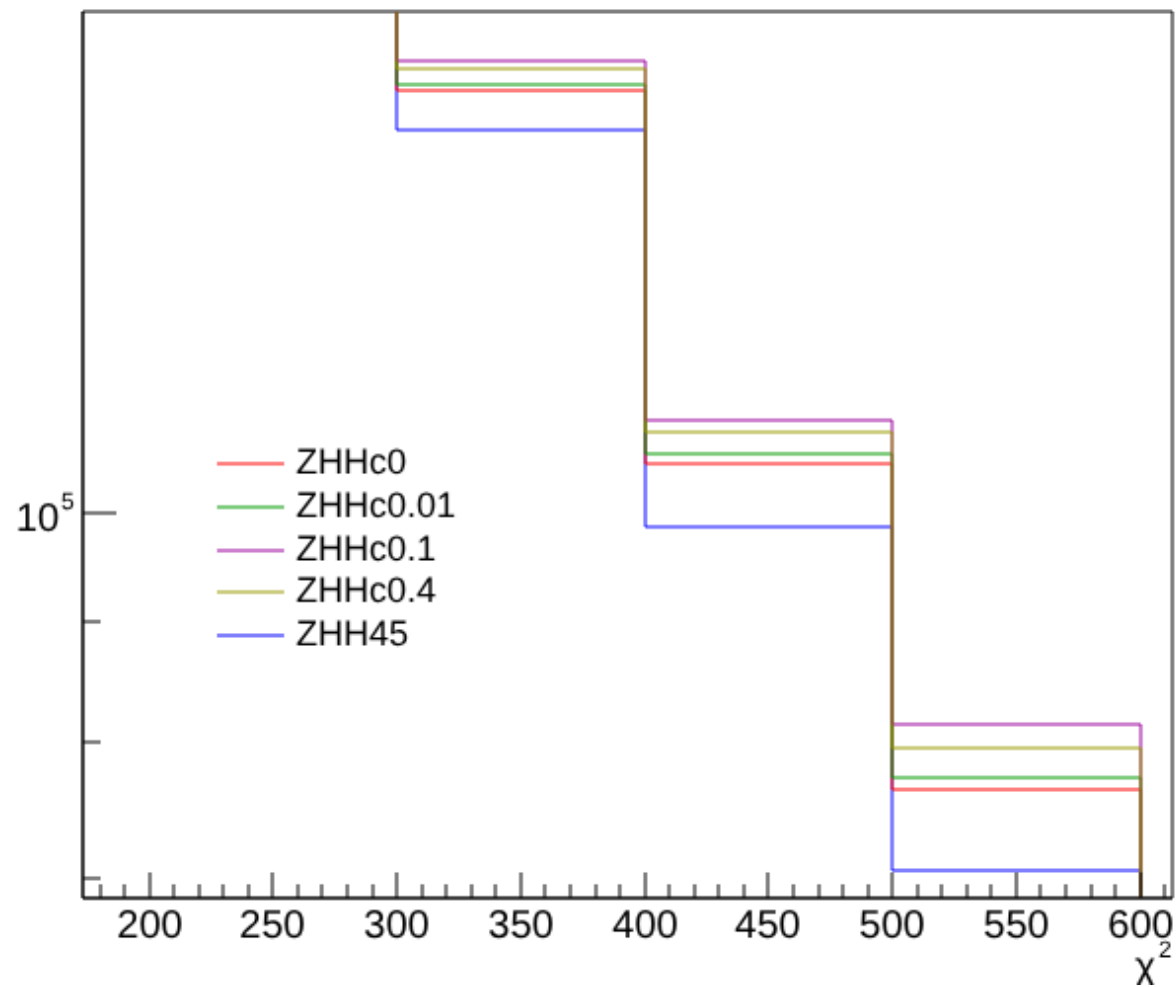
Sum of 2 Lowest B-Tags



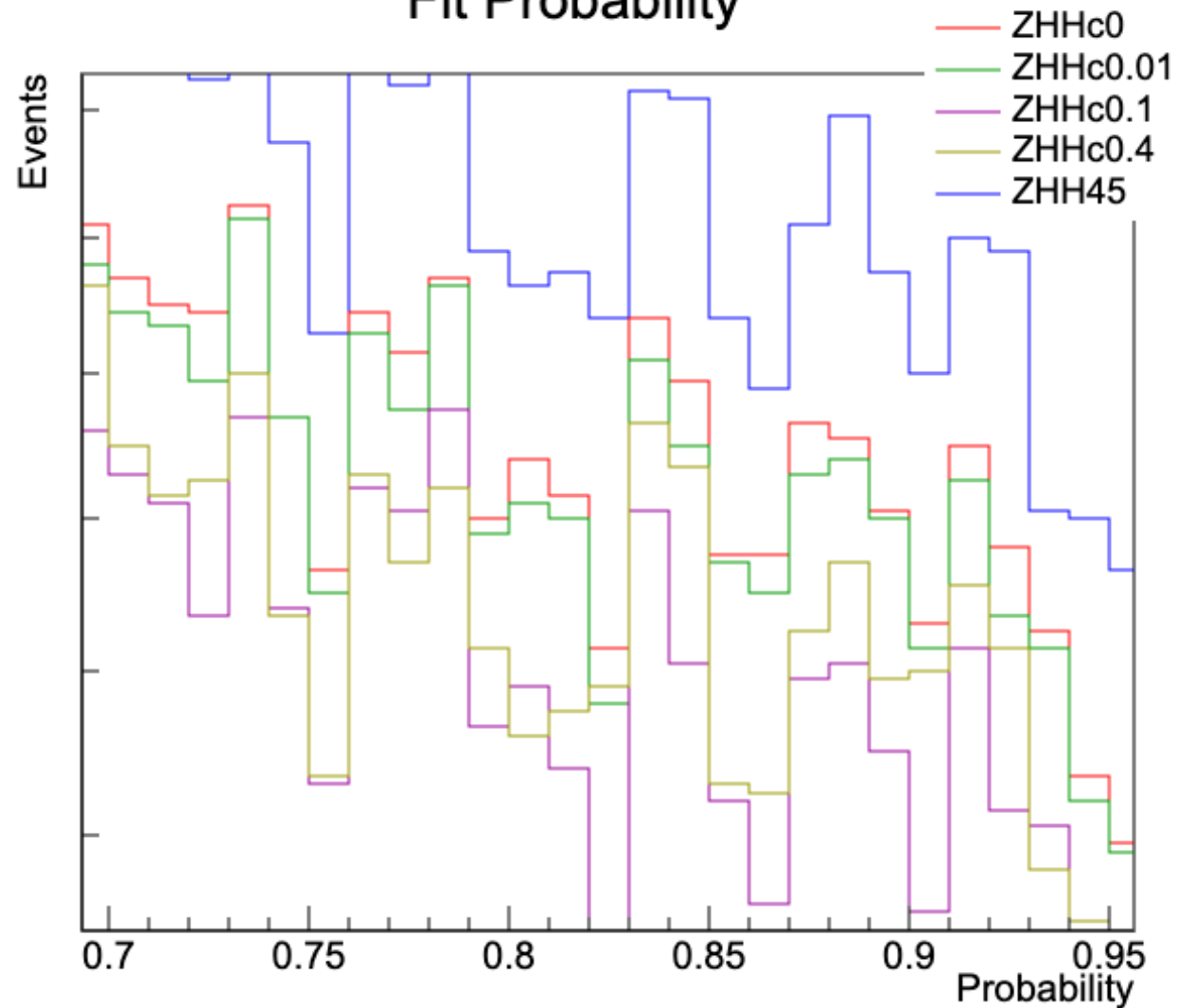
- Exploring to separate 4b-jets/6b-jets
- If $\sum \text{btag} < 4$,
 - If hypo = zhh(soft)/EQM
 - bmax1-4 \rightarrow HH
 - bmax5,6 \rightarrow Z
 - 3 perms
 - if hypo = zzh(soft)/MH
 - bmax5,6 not higgs
 - bmax1-4 \rightarrow Z&H
 - 6 perms

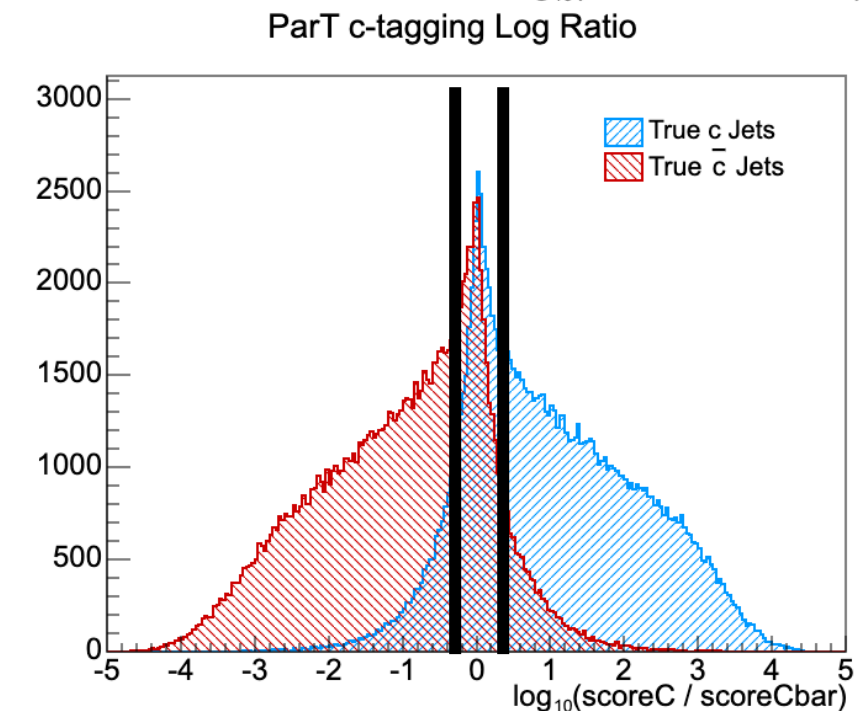
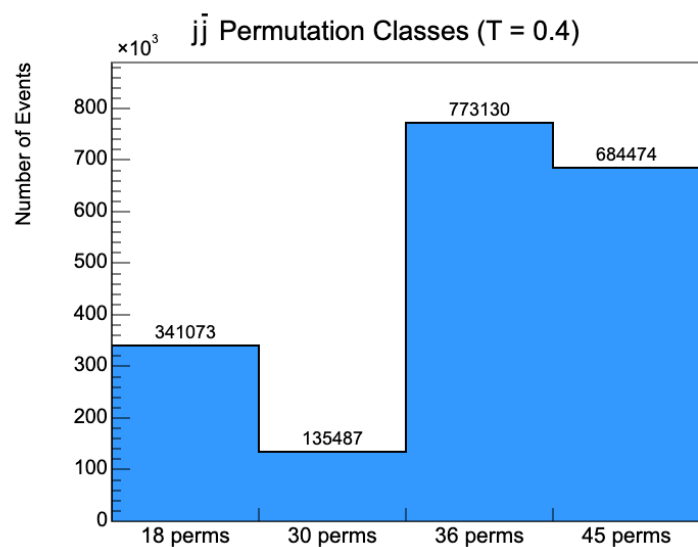
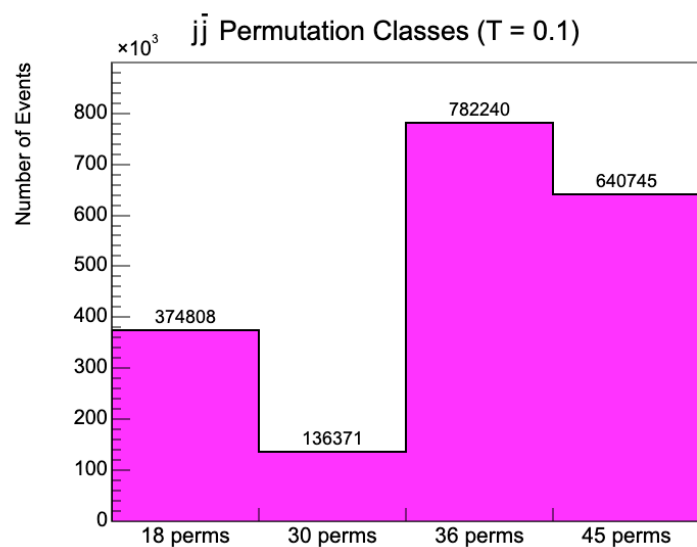
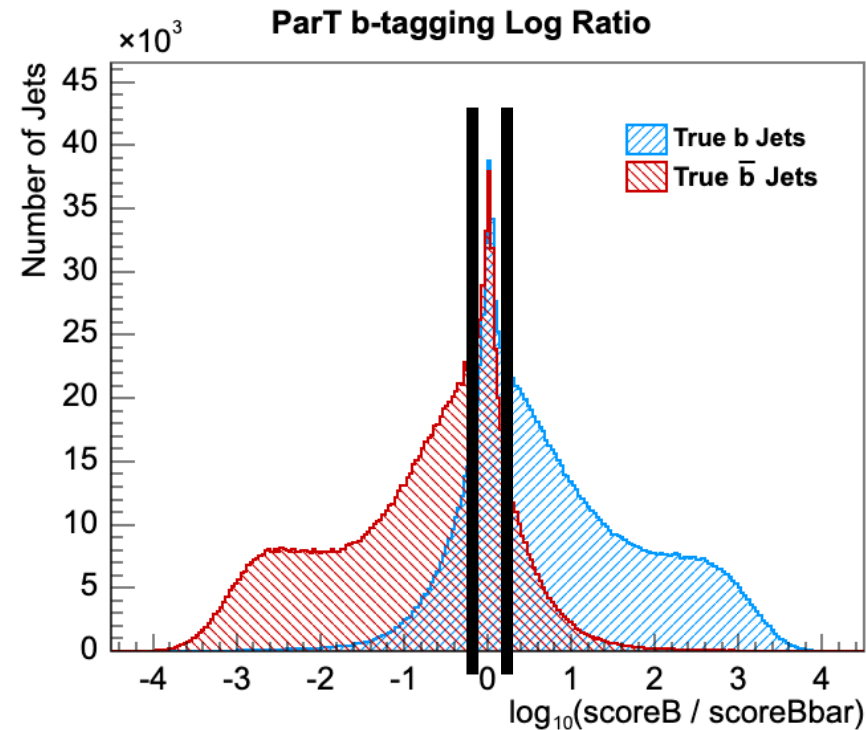
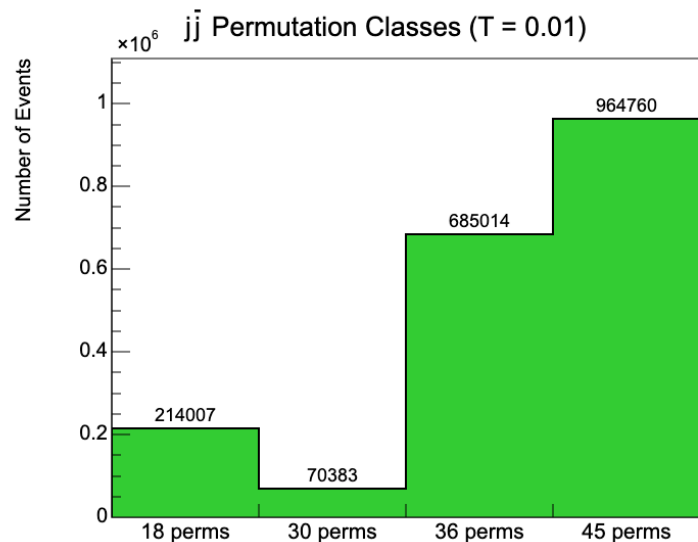
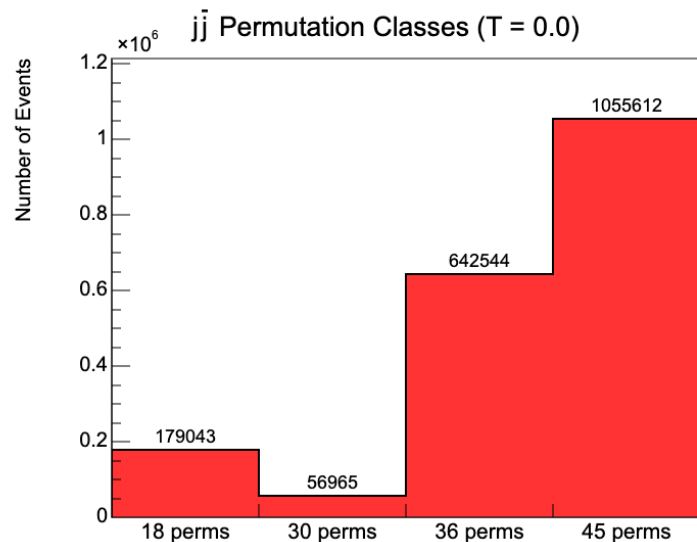
- More events in 97-98 fitprob in b/ctag(0) than just b tag(0.4) for best cut
- But other cuts perform much worse for b/c tag than b tag at 97-98
- Fit performance(based on fitprob) still follows no of events in 45

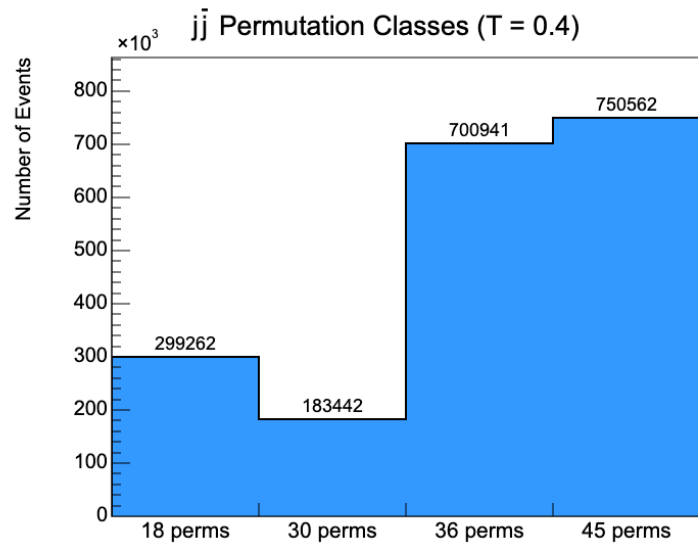
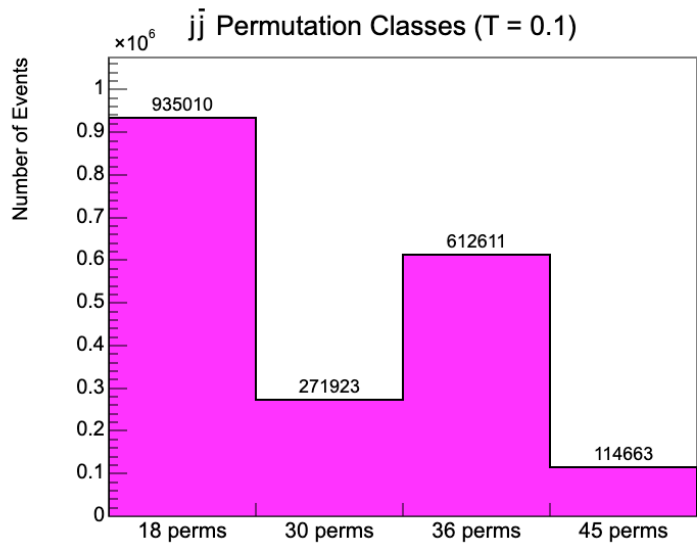
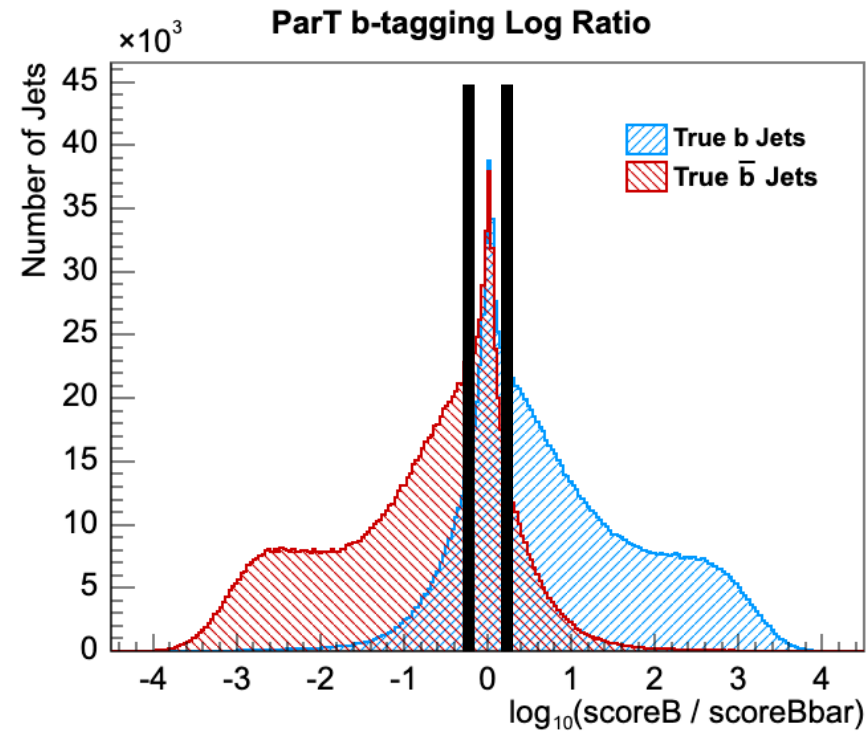
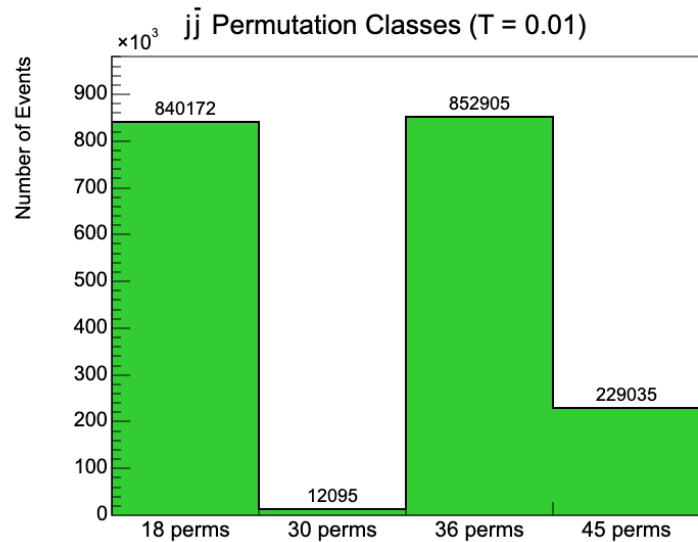
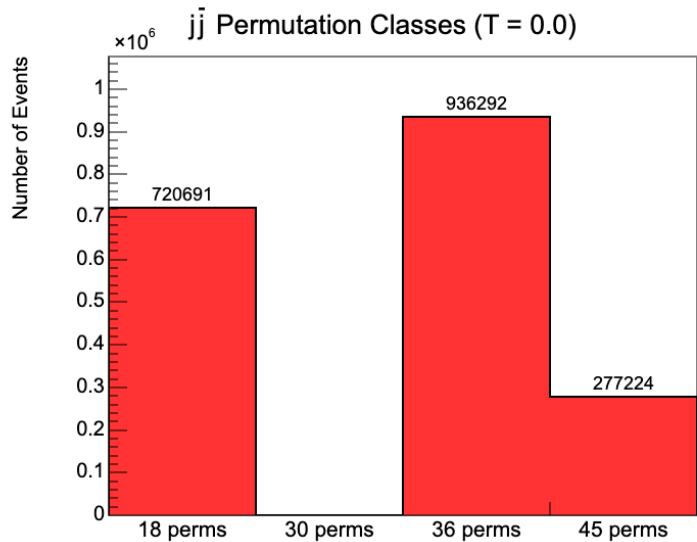
Fit Chi2



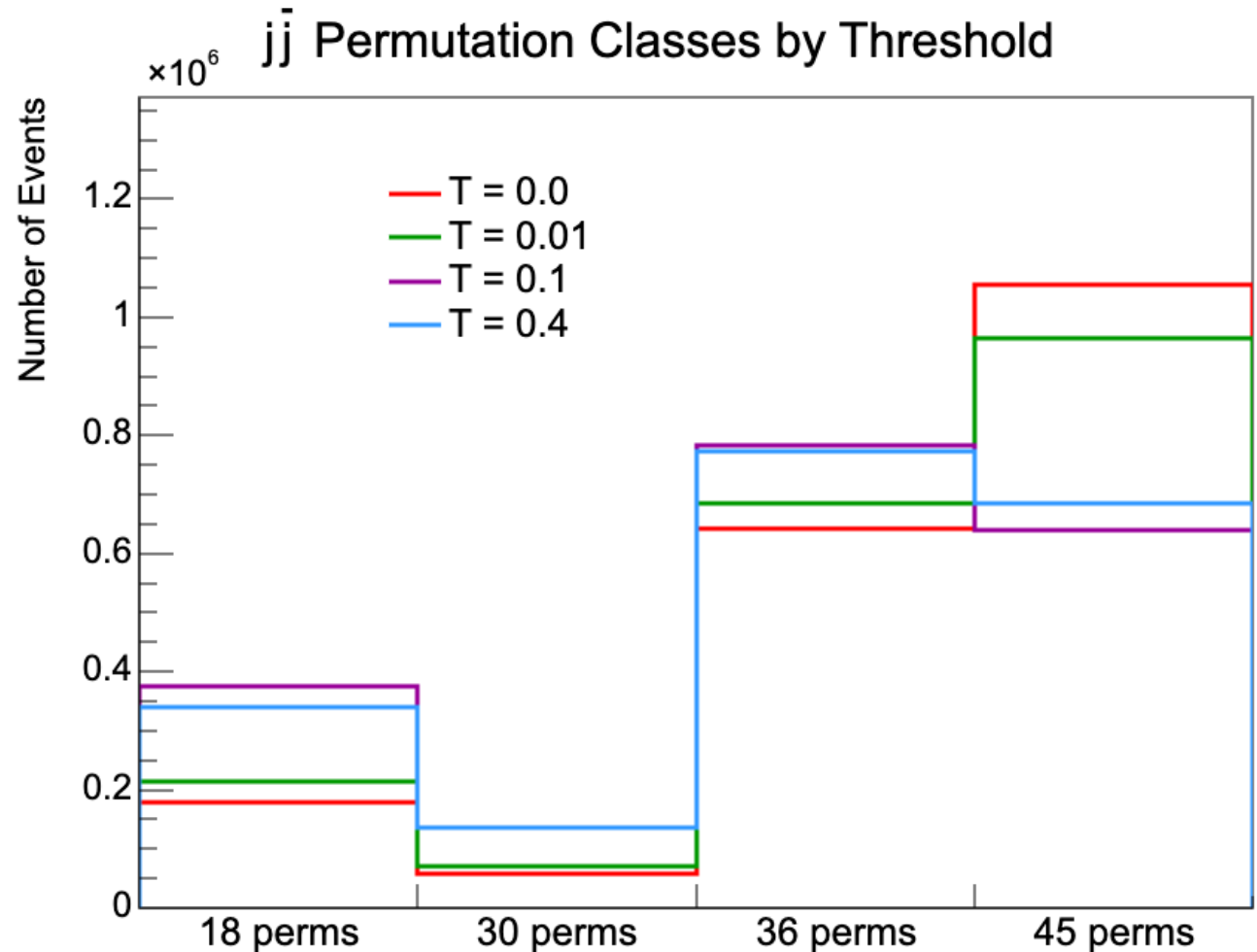
Fit Probability







- Counter-expectation from class:
 - > 2 jets passed cut → non-45perms
 - Lower T, more jets pass cut, more > 2 events, less events in 45 perm
- Could be for extreme low cut 0.0 and 0.01:
 - If conflicting sign from logB and logC → Ambiguous
 - Low cut T, more conflicting cases, more < 2 events in 45 perms
- For 0.1 and 0.4 back to expectation:
 - 0.4 is more strict, more ambiguous



perms = bmax1,bmax2,bmax3,bmax4
bmax1,bmax3,bmax2,bmax4
bmax1,bmax4,bmax2,bmax3

perms = bmax1,bmax2,bmax3,bmax4
bmax3,bmax4,bmax1,bmax2
bmax1,bmax3,bmax2,bmax4
bmax2,bmax4,bmax1,bmax3
bmax1,bmax4,bmax2,bmax3
bmax2,bmax3,bmax1,bmax4

