Preliminary Btagging Performances on CSC Single Top Data and Comparison with previous data

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Samples and Code

- First look at v12 Wt and s-channel data
  - 5500 (19750 evts)

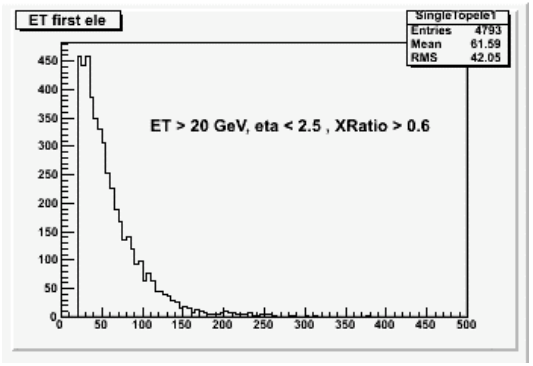
    trig1_misal1_mc12.005500.AcerMC_Wt.recon.AOD.v12000601_tid006192
  - 5501 (20750 evts)

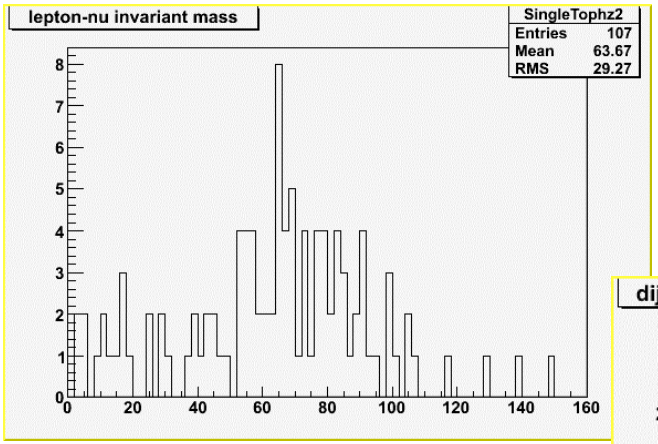
    trig1_misal1_mc12.005501.AcerMC_schan.recon.AOD.v12000601_tid006193

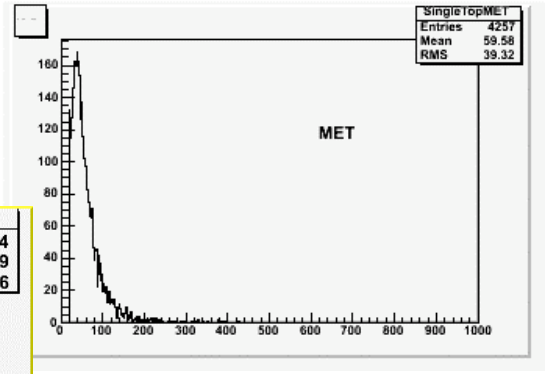
- My own EvtNtuple code
  - Objects accessed:
    - ElectronCollection
    - MET_Final
    - ConeTowerParticleJets (Cone4TowerParticleJets)

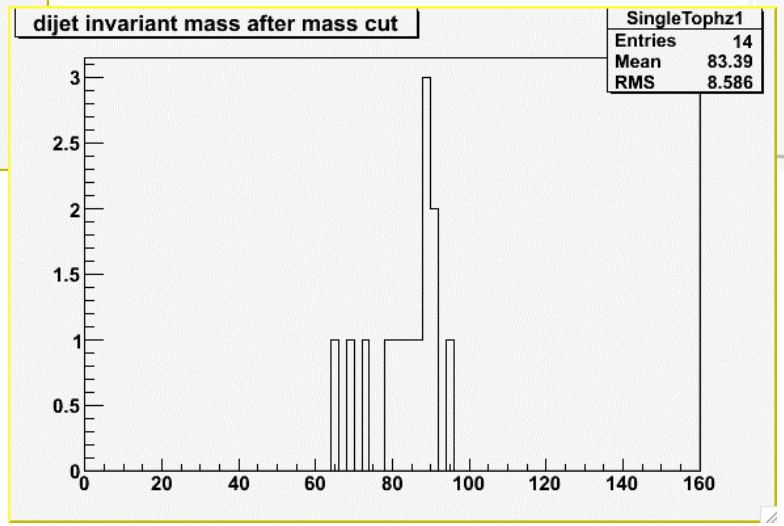
Quick test of cuts: Wt channel

Number of processed events	19750
Number of events with one high pt ele	4793
Number of events with one high pt ele and MET > 20	4257
Number of events with one b-jet > 50	2148
Number of reduced events,(one ele OR on muon) + btag + 2 jets	410
Number of events with one jet > 30	337
Number of events with two jets > 30	107
Number of events with two jets > 30 and mjj : 60-95	14









Summary on b-tagging algorithms

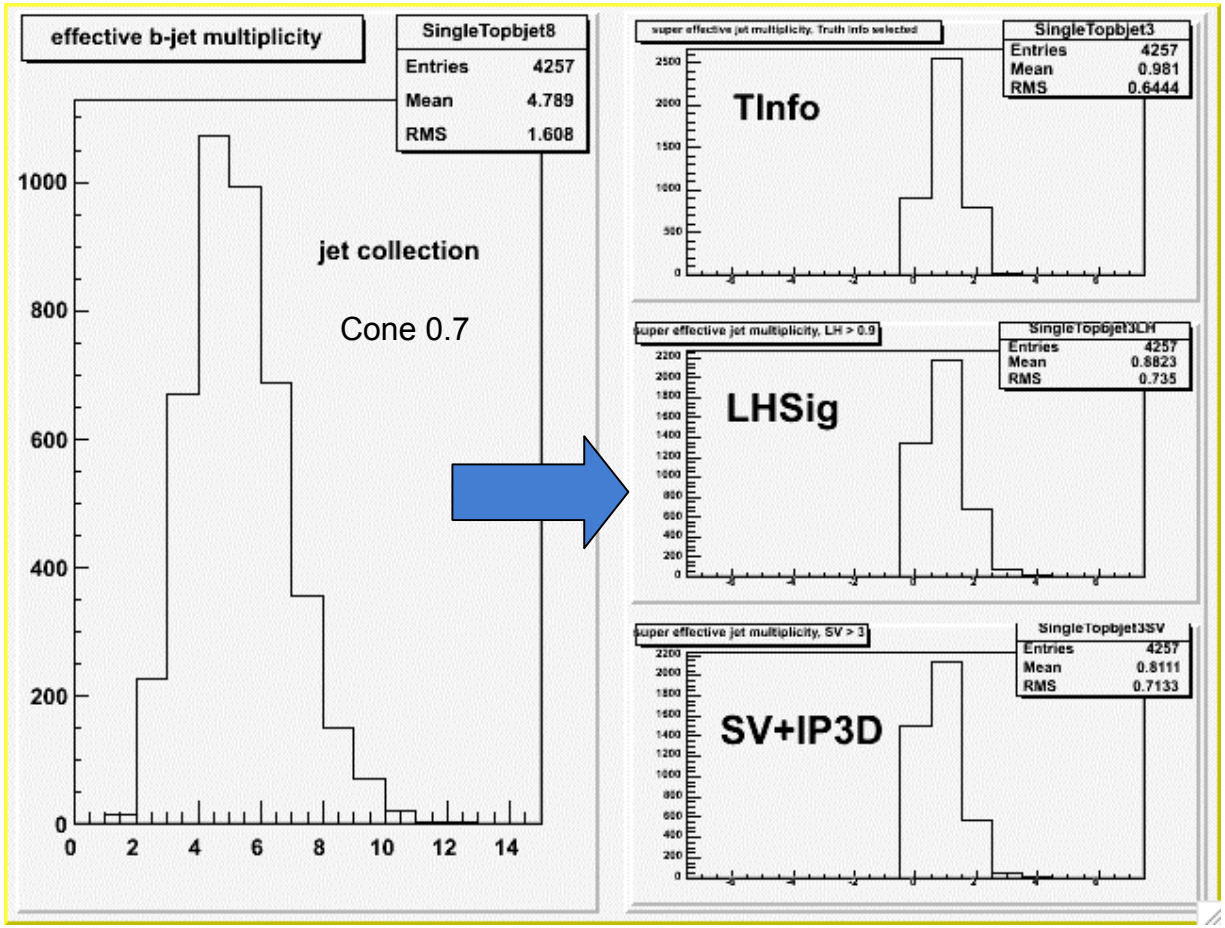
- Historical » taggers:
  - **IP2D**: transverse impact parameter
  - **IP3D**: 2D+longitudinal
  - **SV1, SV2**: inclusive secondary vertex **SV1+IP3D** (called SV1 in CBNT)
- New taggers:
  - Lifetime2D: transverse impact parameter
  - **IhSig**: secondary vertex + impact parameter (2D&3D)
- Tagging weight:
  - IP2D: based on impact parameter significances $S=d_0/\sigma(d_0)$
  - Track weight: likelihood ratio $w_t=P_b(S)/P_u(S)$
  - Jet weight: $W_j= \Sigma \ln w_t^i$
- Generalization of the weight for other taggers, can be combined by summing them up.

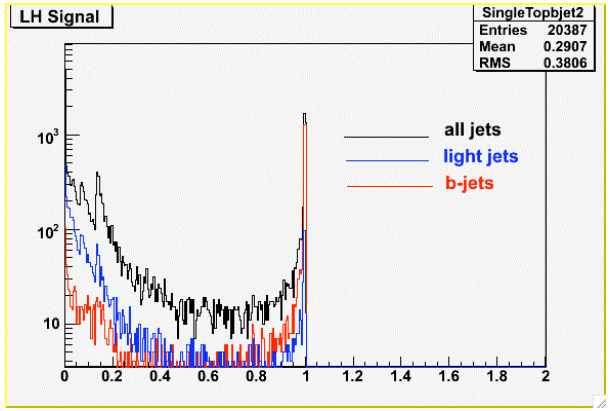
B-tagging Algorithms tested

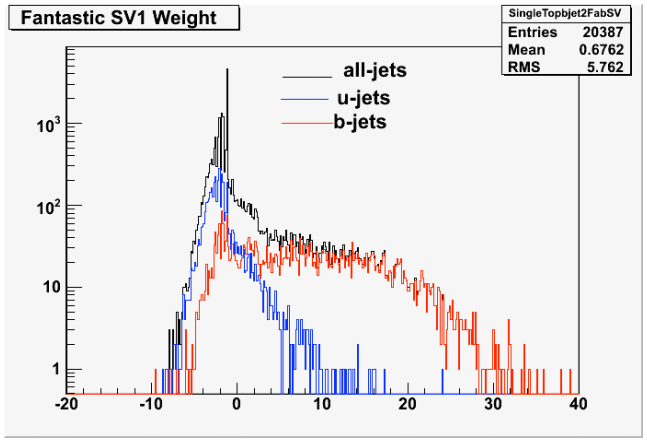
- Combined likelihood: LHSig
- SV: SV1 + IP3D
- IP2D/IP3D
- AOD access:
  - m_bjetwSV1[j] = (*newBJets)[j]->lhSig()
  - m_bjetwSV1[j] = (*newBJets)[j]->weightForTag(); (SV1+IP3D)
  - m_bjetwSV1[j] = (*newBJets)[j]->weightForTag("SV1");
  - m_bjetwIP2D[j] = (*newBJets)[j]->weightForTag("IP2D");
  - m_bjetwIP3D[j] = (*newBJets)[j]->weightForTag("IP3D");

B-jet selection

From the Btag collection jets were selected using TruthInfo, LHSig (>0.9) and SV1 (> 3)





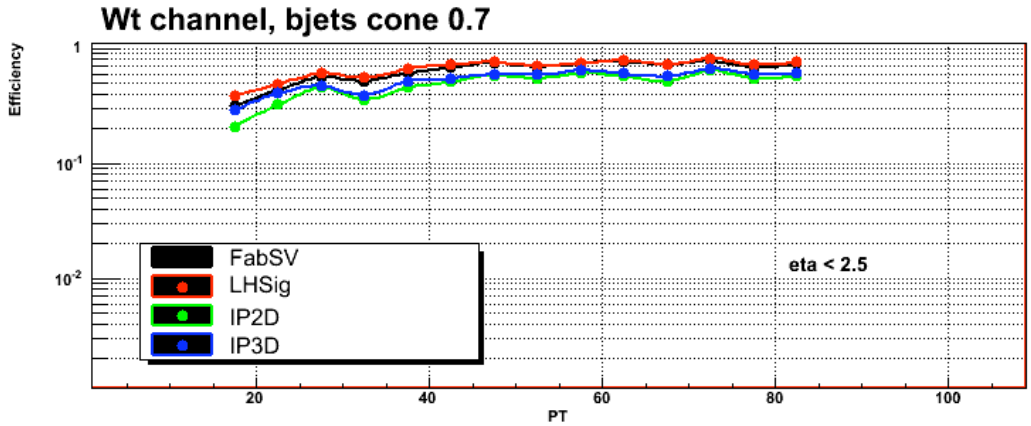


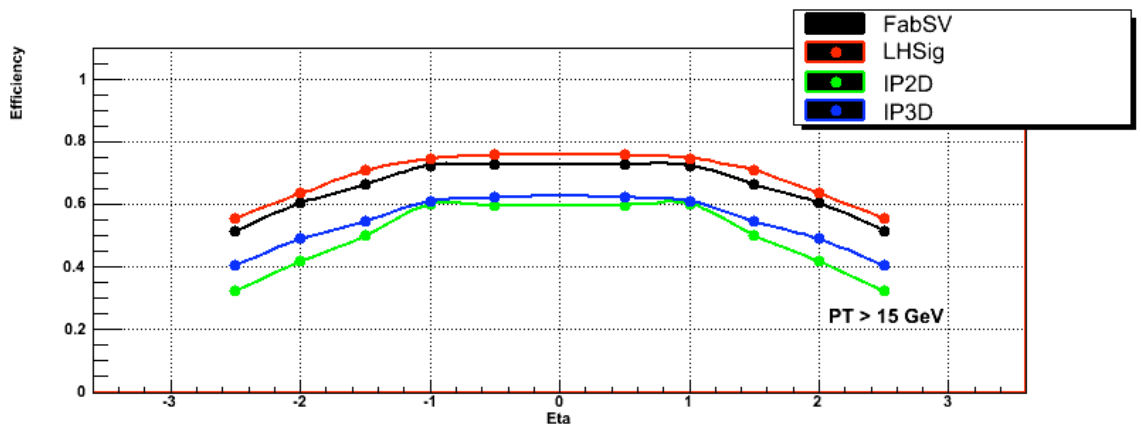
b-tagging performance estimators

- b-jet efficiency ε_b:
  - Denominator:
    - jets defined as b using MC truth with (raw) p_T>15 GeV/c, $|\eta|$<2.5
    - NB: jets with no "good" tracks for b-tagging **are** included
    - NB: iso. electrons are not present in the JetTag collection (.)
  - Numerator:
    - ditto + cut on a tagging weight
- light-jet rejection $R_u = 1 / \varepsilon_u$
  - R=100 means 1% mistag rate
  - light jets: u, d, s, g

Btag Efficiency

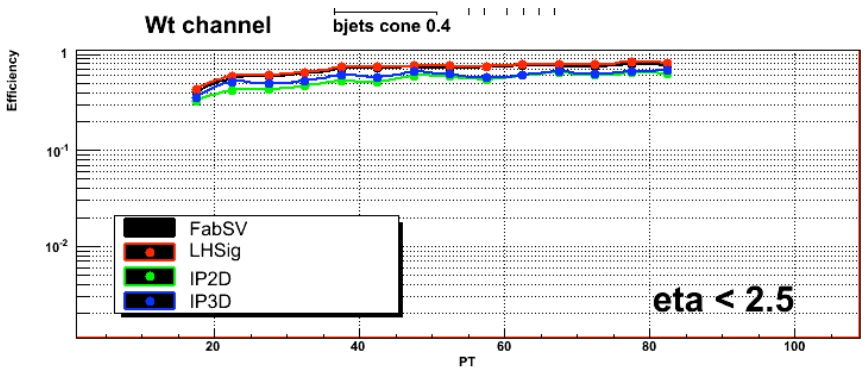
$$\varepsilon = \frac{\text{Number of tagged jets in Pt/}\eta\text{ range passing cut}}{\text{Number of tagged jets in Pt/}\eta\text{ range}}$$

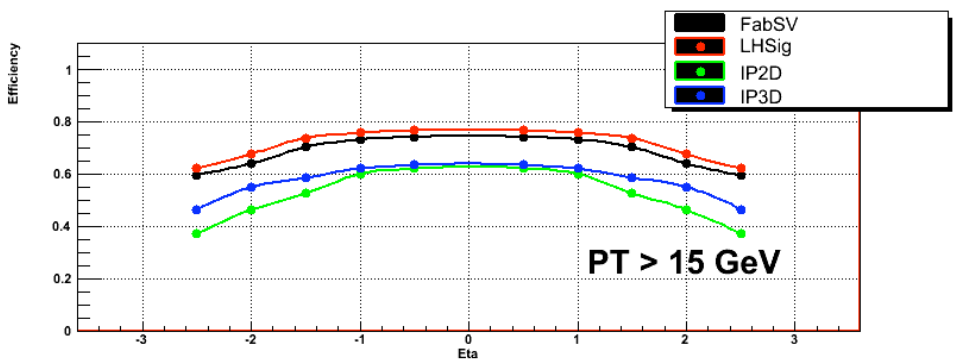




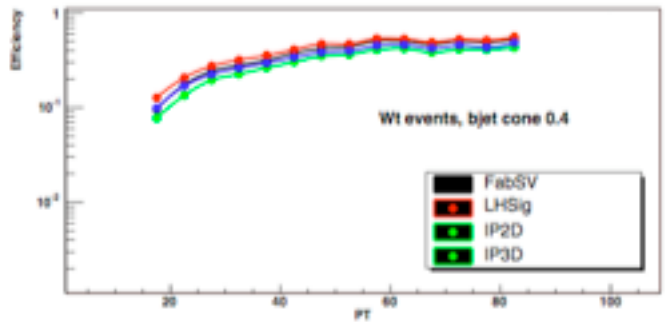
Wt efficiencies

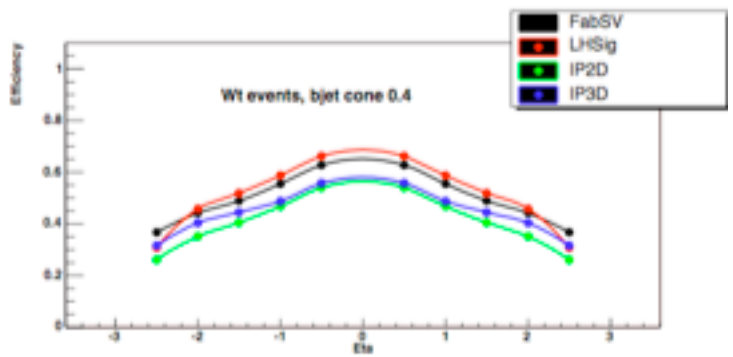
12.0.6





10.0.1 + patches

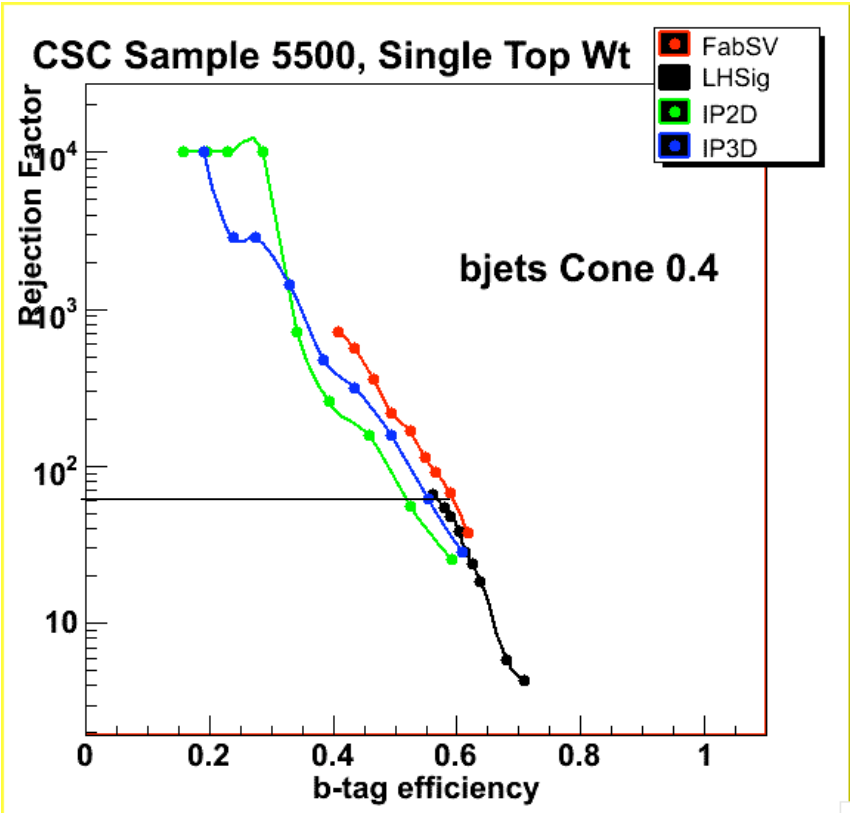




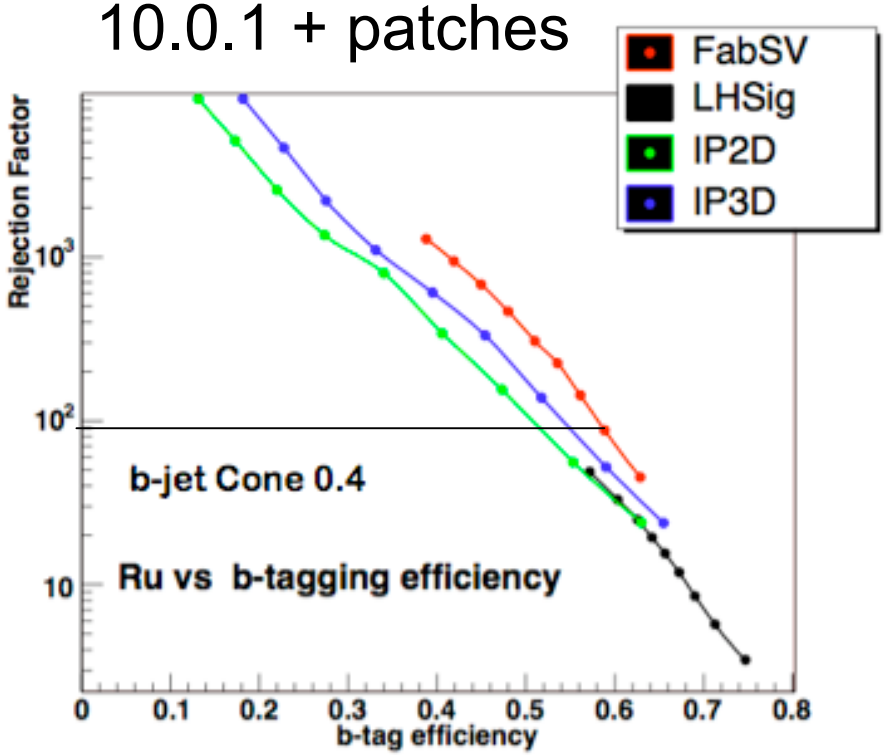
Rejection Factors

CSC sample 5500, 5000 events

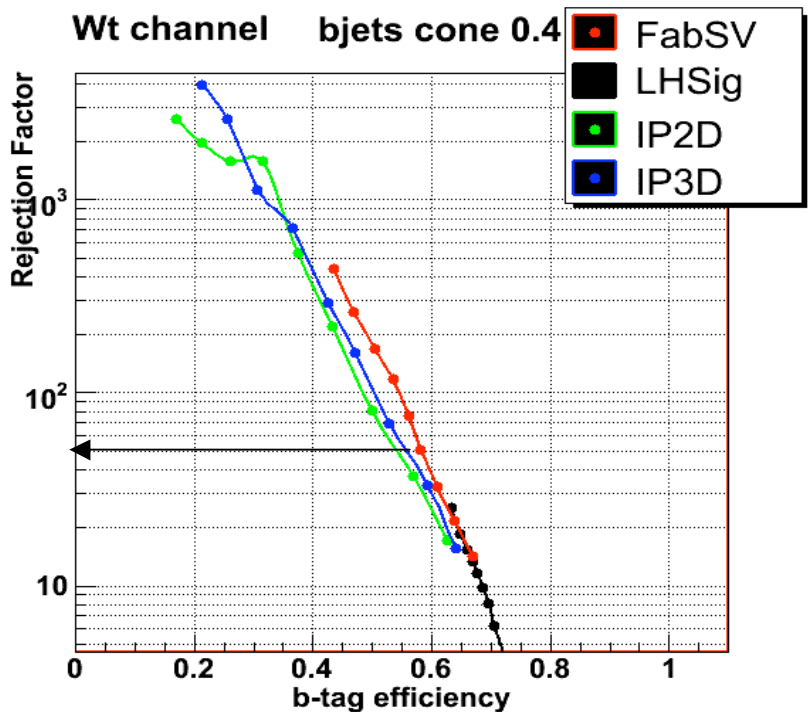
11.0.5

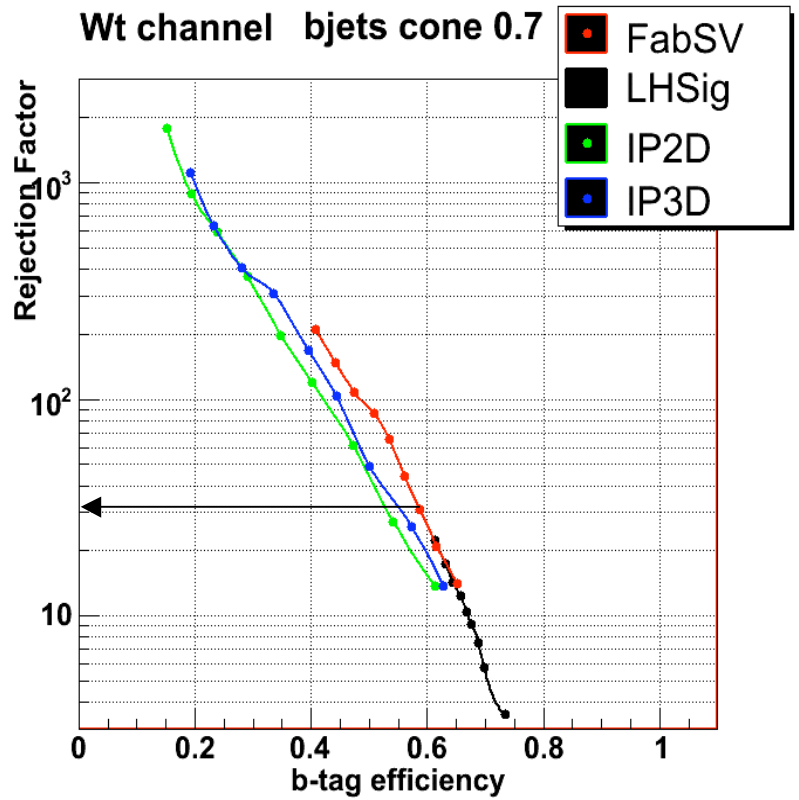


10.0.1 + patches



CSC 5500 v12


Wt channel bjets cone 0.4
FabSV
LHSig
IP2D
IP3D
Rejection Factor
10^3
10^2
10
0
0.2
0.4
0.6
0.8
1
b-tag efficiency


Wt channel bjets cone 0.7
FabSV
LHSig
IP2D
IP3D
Rejection Factor
10^3
10^2
10
0
0.2
0.4
0.6
0.8
1
b-tag efficiency

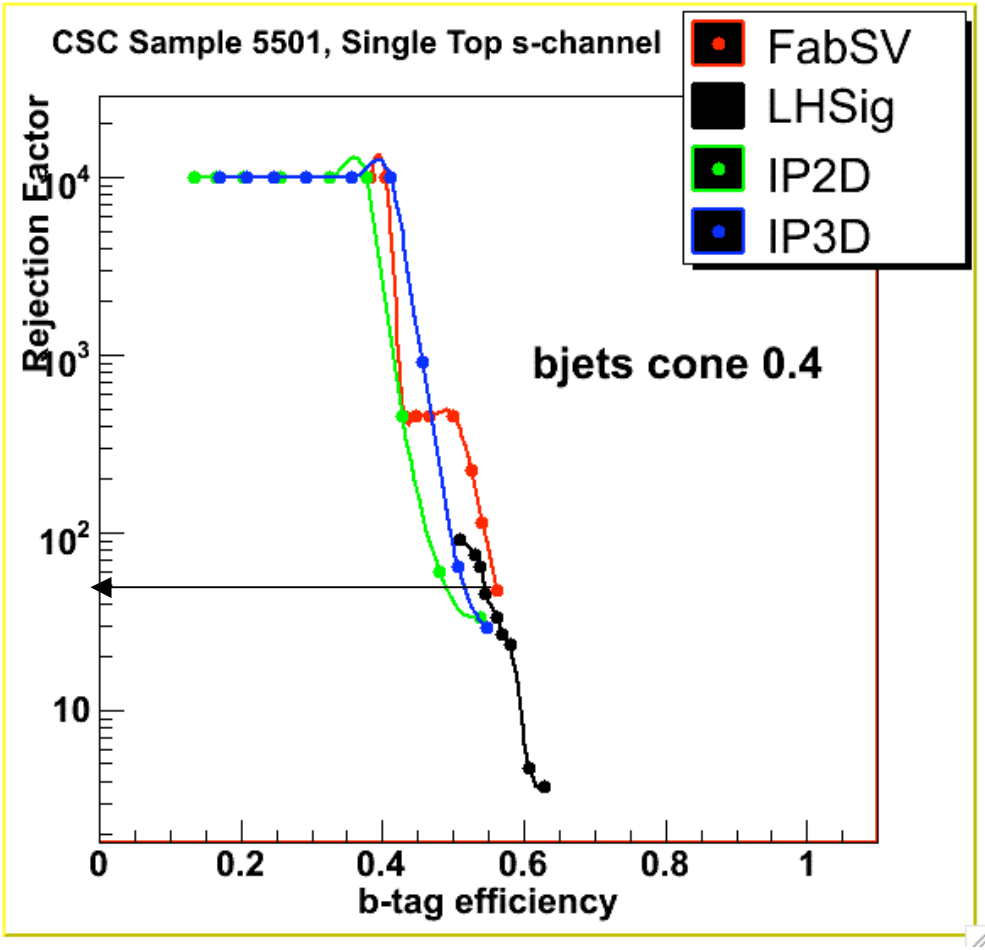
Wt rejection factors
10.0.1 vs 11.0.5 vs 12

10.0.1	11.0.5	12.0.6
RLH[0] = 4.35069	RLH[0] = 2.99374	RLH[0] = 3.67101
RSV[0] = 37.3816	RSV[0] = 31.3678	RSV[0] = 14.3436
RIP2D[0] = 25.5946	RIP2D[0] = 19.6049	RIP2D[0] = 17.1874
RIP3D[0] = 28.41	RIP3D[0] = 21.4688	RIP3D[0] = 15.6839
RLH[1] = 5.80982	RLH[1] = 4.09753	RLH[1] = 6.22652
RSV[1] = 67.6429	RSV[1] = 52.0011	RSV[1] = 21.6137
RIP2D[1] = 55.7059	RIP2D[1] = 33.7557	RIP2D[1] = 37.2123
RIP3D[1] = 61.7609	RIP3D[1] = 39.8831	RIP3D[1] = 33.1471
RLH[2] = 18.4481	RLH[2] = 6.18762	RLH[2] = 8.06646
RSV[2] = 91.6452	RSV[2] = 77.9185	RSV[2] = 32.465
RIP2D[2] = 157.833	RIP2D[2] = 62.5346	RIP2D[2] = 80.5
RIP3D[2] = 157.833	RIP3D[2] = 81.0249	RIP3D[2] = 69.2018
RLH[3] = 24.0763	RLH[3] = 8.95484	RLH[3] = 9.82441
RSV[3] = 113.64	RSV[3] = 105.35	RSV[3] = 50.2484
RIP2D[3] = 258.273	RIP2D[3] = 99.7485	RIP2D[3] = 219.139
RIP3D[3] = 315.667	RIP3D[3] = 158.367	RIP3D[3] = 161
RLH[4] = 28.697	RLH[4] = 11.2105	RLH[4] = 11.5505
RSV[4] = 167.118	RSV[4] = 132.187	RSV[4] = 76.5922
RIP2D[4] = 710.25	RIP2D[4] = 135.116	RIP2D[4] = 525.933
RIP3D[4] = 473.5	RIP3D[4] = 248.862	RIP3D[4] = 292.185
RLH[5] = 38.3919	RLH[5] = 13.6211	RLH[5] = 13.2811
RSV[5] = 218.538	RSV[5] = 167.045	RSV[5] = 117.746
RIP2D[5] = 10000	RIP2D[5] = 163.134	RIP2D[5] = 1577.8
RIP3D[5] = 1420.5	RIP3D[5] = 361.311	RIP3D[5] = 717.182
RLH[6] = 48.1525	RLH[6] = 17.169	RLH[6] = 15.4384
RSV[6] = 355.125	RSV[6] = 207.562	RSV[6] = 167.851
RIP2D[6] = 10000	RIP2D[6] = 192.794	RIP2D[6] = 1577.8
RIP3D[6] = 2841	RIP3D[6] = 625.346	RIP3D[6] = 1127
RLH[7] = 54.6346	RLH[7] = 21.7366	RLH[7] = 18.5624
RSV[7] = 568.2	RSV[7] = 274.028	RSV[7] = 262.967
RIP2D[7] = 10000	RIP2D[7] = 210.246	RIP2D[7] = 1972.25
RIP3D[7] = 2841	RIP3D[7] = 1189.68	RIP3D[7] = 2629.67
RLH[8] = 66.0698	RLH[8] = 30.4096	RLH[8] = 25.4484
RSV[8] = 710.25	RSV[8] = 320.901	RSV[8] = 438.278
RIP2D[8] = 10000	RIP2D[8] = 217.754	RIP2D[8] = 2629.67
RIP3D[8] = 10000	RIP3D[8] = 1742.04	RIP3D[8] = 3944.5

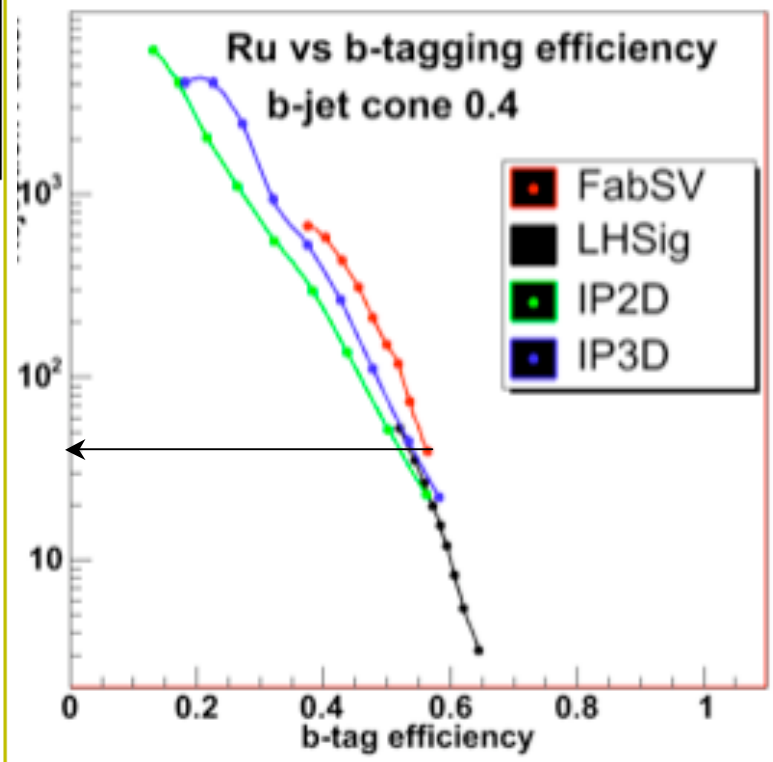
S-channel

CSC Sample 5501, 50k events

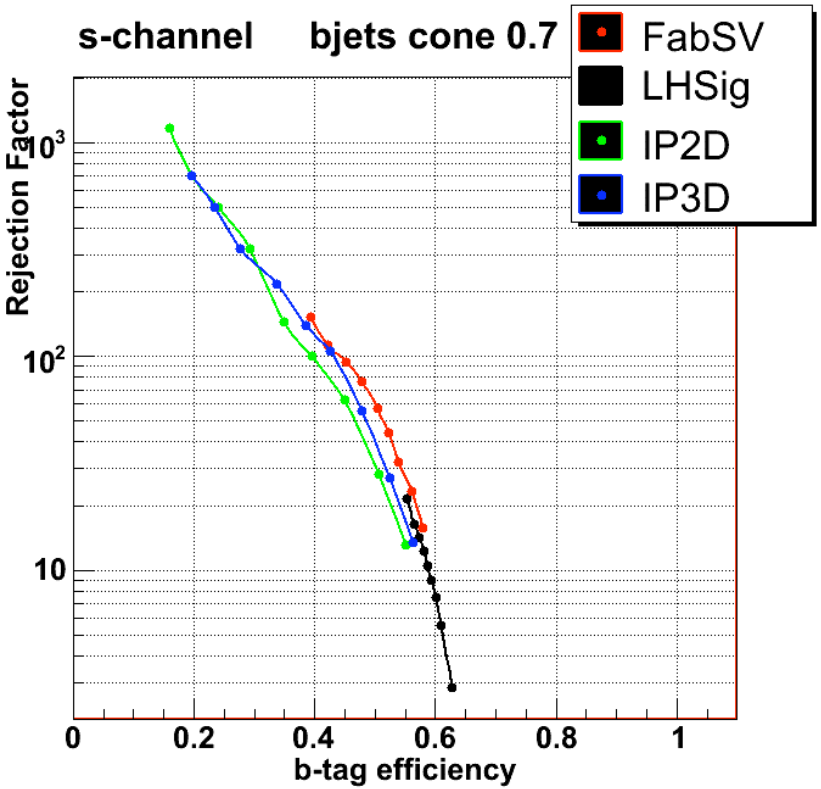
11.0.5

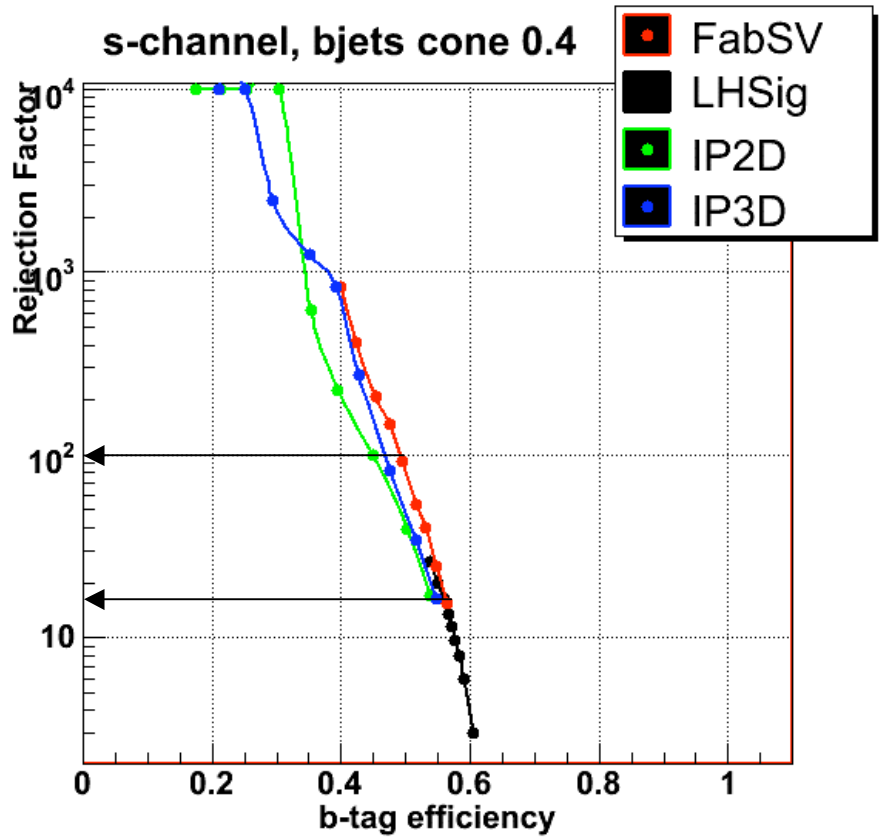


10.0.1 + patches



S-channel v12.0.6





Rejection Factors s-channel

10.0.1	11.0.5	12.0.6
RLH[0] = 3.28645	RLH[0] = 2.99374	RLH[0] = 3.00363
RSV[0] = 32.5924	RSV[0] = 31.3678	RSV[0] = 15.3148
RIP2D[0] = 22.6416	RIP2D[0] = 19.6049	RIP2D[0] = 17.1103
RIP3D[0] = 24.0235	RIP3D[0] = 21.4688	RIP3D[0] = 16.2157
RLH[1] = 4.26062	RLH[1] = 4.09753	RLH[1] = 5.89311
RSV[1] = 61.6506	RSV[1] = 52.0011	RSV[1] = 24.5644
RIP2D[1] = 46.0991	RIP2D[1] = 33.7557	RIP2D[1] = 39.381
RIP3D[1] = 51.6869	RIP3D[1] = 39.8831	RIP3D[1] = 33.9863
RLH[2] = 17.3458	RLH[2] = 6.18762	RLH[2] = 8.02913
RSV[2] = 91.375	RSV[2] = 77.9185	RSV[2] = 40.0161
RIP2D[2] = 150.5	RIP2D[2] = 62.5346	RIP2D[2] = 99.24
RIP3D[2] = 127.925	RIP3D[2] = 81.0249	RIP3D[2] = 82.7
RLH[3] = 22.443	RLH[3] = 8.95484	RLH[3] = 9.72941
RSV[3] = 121.833	RSV[3] = 105.35	RSV[3] = 53.9348
RIP2D[3] = 426.417	RIP2D[3] = 99.7485	RIP2D[3] = 225.545
RIP3D[3] = 341.133	RIP3D[3] = 158.367	RIP3D[3] = 275.667
RLH[4] = 28.2707	RLH[4] = 11.2105	RLH[4] = 11.4861
RSV[4] = 150.5	RSV[4] = 132.187	RSV[4] = 91.8889
RIP2D[4] = 731	RIP2D[4] = 135.116	RIP2D[4] = 620.25
RIP3D[4] = 511.7	RIP3D[4] = 248.862	RIP3D[4] = 827
RLH[5] = 34.3423	RLH[5] = 13.6211	RLH[5] = 13.4837
RSV[5] = 196.808	RSV[5] = 167.045	RSV[5] = 145.941
RIP2D[5] = 5117	RIP2D[5] = 163.134	RIP2D[5] = 10000
RIP3D[5] = 731	RIP3D[5] = 361.311	RIP3D[5] = 1240.5
RLH[6] = 44.4957	RLH[6] = 17.169	RLH[6] = 16.4305
RSV[6] = 269.316	RSV[6] = 207.562	RSV[6] = 206.75
RIP2D[6] = 5117	RIP2D[6] = 192.794	RIP2D[6] = 10000
RIP3D[6] = 2558.5	RIP3D[6] = 625.346	RIP3D[6] = 2481
RLH[7] = 52.2143	RLH[7] = 21.7366	RLH[7] = 20.0081
RSV[7] = 393.615	RSV[7] = 274.028	RSV[7] = 413.5
RIP2D[7] = 5117	RIP2D[7] = 210.246	RIP2D[7] = 10000
RIP3D[7] = 5117	RIP3D[7] = 1189.68	RIP3D[7] = 10000
RLH[8] = 72.0704	RLH[8] = 30.4096	RLH[8] = 26.1158
RSV[8] = 426.417	RSV[8] = 320.901	RSV[8] = 827
RIP2D[8] = 10000	RIP2D[8] = 217.754	RIP2D[8] = 10000
RIP3D[8] = 5117	RIP3D[8] = 1742.04	RIP3D[8] = 10000

Conclusions & Plans

- First look at v12 data
- Same approach as last year
  - Need to update with current btagging development
    - Btaggin workshop this Friday in Marseille
  - Wt and s-channel only
    - Will add t-channel
    - Will add background
- Plan to finalize results for T&P week