Flavour Tagging Commissioning with Data

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Flavour Tagging Meeting
04/08/15

Aims

- Pub note for Data Commissioning for Flavour Tagging in Run2 Data
- Comparing data to MC in dijet and top events to test our understanding of flavour tagging.
- This talk will focus on dijet events.

Progress

Same data as before but I have looked at a few extra plots.
- Improved jet multiplicity plots
- Looked at 77% efficiency point
- Reverse stacking
- Examined the flavour fractions in the samples.

3 Samples

- MC Sample:

- **Full xAOD**
- 50ns dijet MC sample data
- Split into 4 slices and the re-weighted (see backup) JZ1W-JZ4W - No JZ0W used.
- ~ 8M Events.

"mc15_13TeV.361021.Pythia8EvtGen_A14NNPDF23LO_jetjet_JZ1W.merge.AOD.e3569_s2576_s2132_r6630_r6264/"
"mc15_13TeV.361022.Pythia8EvtGen_A14NNPDF23LO_jetjet_JZ2W.merge.AOD.e3668_s2576_s2132_r6630_r6264/"
"mc15_13TeV.361023.Pythia8EvtGen_A14NNPDF23LO_jetjet_JZ3W.merge.AOD.e3668_s2576_s2132_r6630_r6264/"
"mc15_13TeV.361024.Pythia8EvtGen_A14NNPDF23LO_jetjet_JZ4W.merge.AOD.e3668_s2576_s2132_r6630_r6264/"

- Data Sample:

- 50ns data from stable beam collisions.
- **FTAG** derivation
- ~6M Events from 7 Runs: 270806, 270953, 271048, 271298, 271421, 271516 and 271595
- This corresponds to 770K events passing cuts.

"data15_13TeV.00270806.physics_Main.merge.DAOD_FTAG1.f611_m1463_p2375/"
"data15_13TeV.00270953.physics_Main.merge.DAOD_FTAG1.f611_m1463_p2375/"
"data15_13TeV.00271048physics_Main.merge.DAOD_FTAG1.f611_m1463_p2375/"
"data15_13TeV.00271421.physics_Main.merge.DAOD_FTAG1.f611_m1463_p2375/"
"data15_13TeV.00271516.physics_Main.merge.DAOD_FTAG1.f611_m1463_p2375/"
"data15_13TeV.00271595.physics_Main.merge.DAOD_FTAG1.f611_m1463_p2375/"

- We are using NTuples created using Run2BTagOptimisationFramework

Details and Cuts

- 20.1.5.3 with all tags recommended by CP group
- Running xAOD fix on full xAOD

- HLT_j60 Trigger for MC and Data with Leading Jet P_T > 70 GeV.

- AntiKt4EMTopoJets
- Run1LooseBadCuts and "ugly" jet removal.
- Jet Calibration:

- calibfile ="JES_MC15Prerecommendation_April2015.config"
- calSeg ="JetArea_Residual_Origin_EtaJES_GSC" (_Insitu for data)

- GRL = *"data15_13TeV.periodAllYear_DetStatus-v63-pro18-01_DQDefects-00-01-02_PHYS_StandardGRL_All_Good.xml"*

- **μ reweighing applied to all plots**

Select event if leading jet has:
- njets ≥ 1
- |η| < 2.5
- P_T > 70 GeV
- JVT > 0.641 if (P_T < 50 GeV and |η| < 2.4)

Then plot subleading if subleading jet has:
- P_T > 35 GeV
- |η| < 2.5
- JVT > 0.641 if (P_T < 50 GeV and |η| < 2.4)

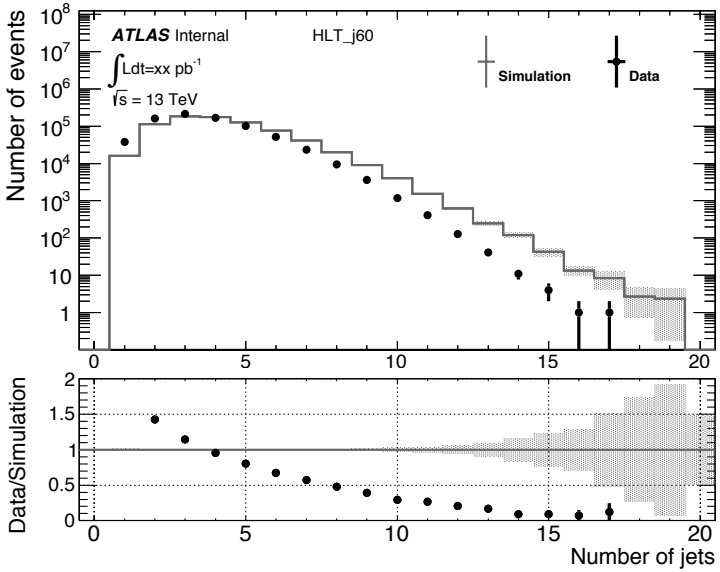
Just For MC

Truth Dijet Test applied to MC to clean sample
- (Lead P_T +Sublead P_T)/2 < 1.4* Truth Lead P_T, for njet > 1
- (Sublead P_T < 1.4 * Truth Sublead P_T), for njet =1

- LabDr_HadF truth matching.

Jet Multipicity

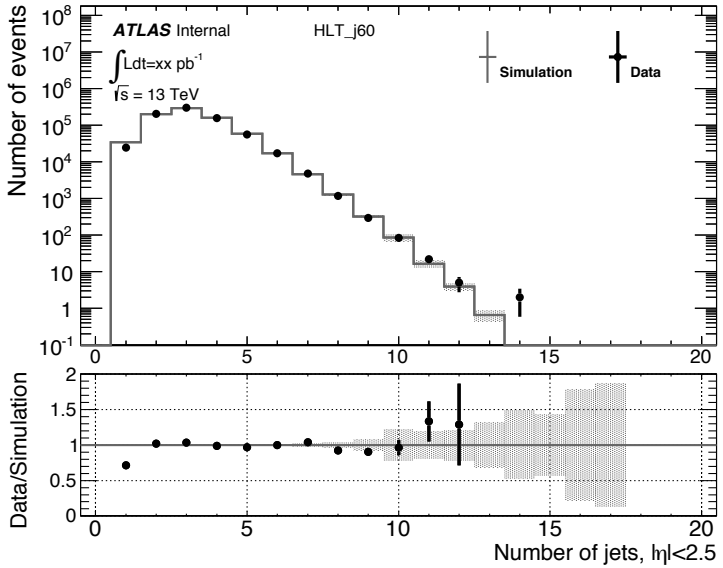
No Jet Selection:



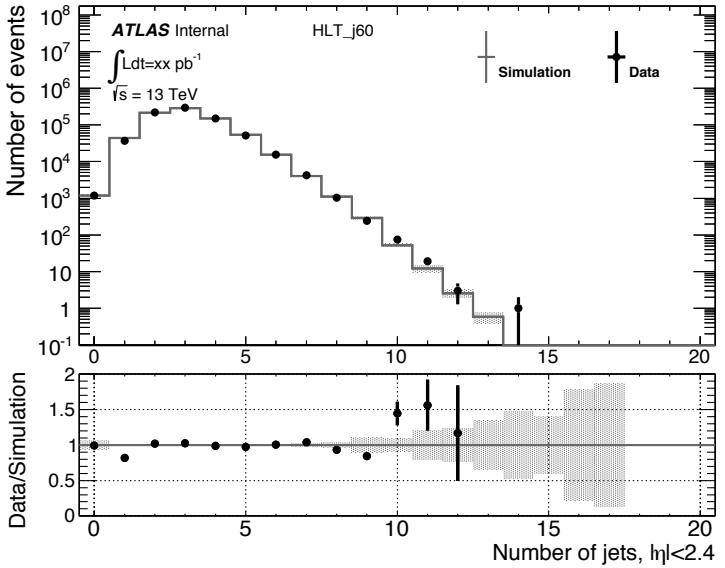
Default Subleading Selection:
p_T > 35 GeV, **|η| < 2.5**,
JVT > 0.641 if p_T < 50 GeV and |η| < 2.4

Changed Eta Subleading Selection:
p_T > 35 GeV, **|η| < 2.4**,
JVT > 0.641 if p_T < 50 GeV

Default Subleading Selection:

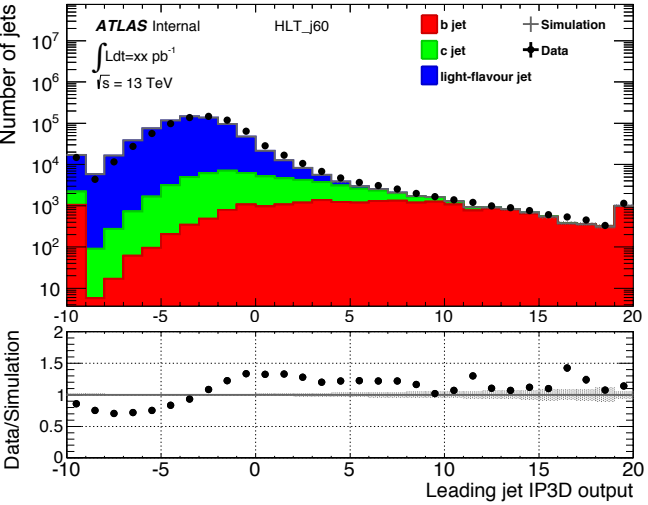


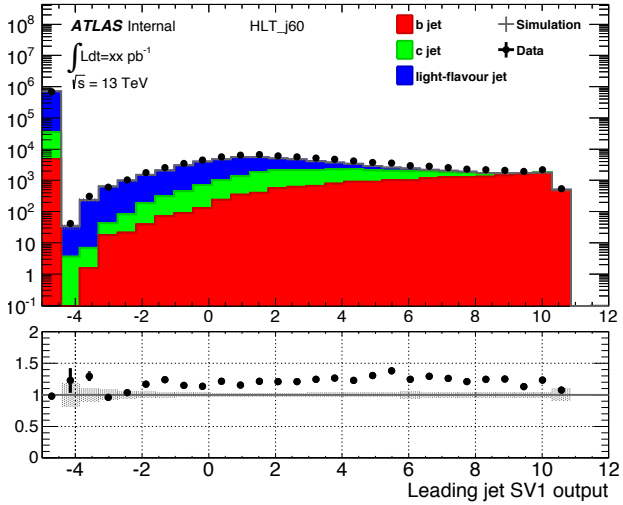
Changed Eta Subleading Selection:

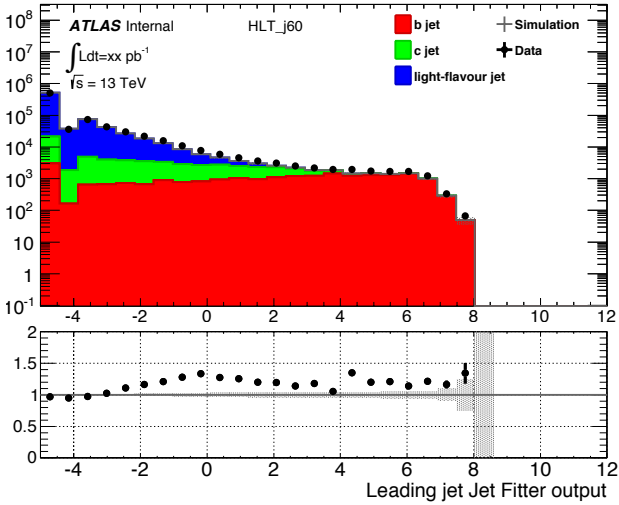


Input Taggers

Leading Jet:

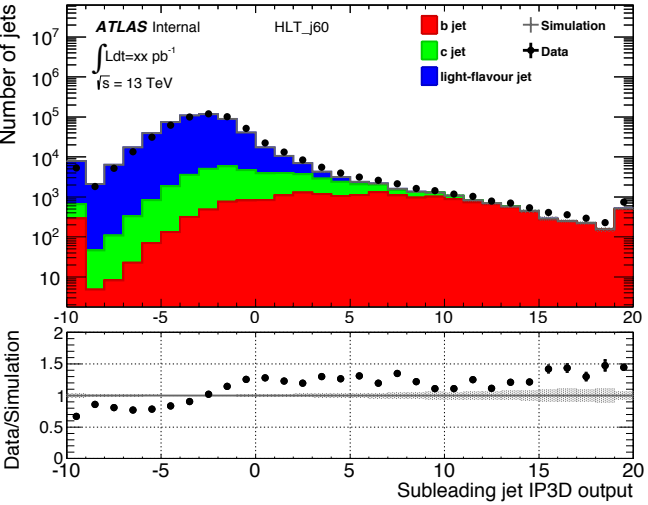


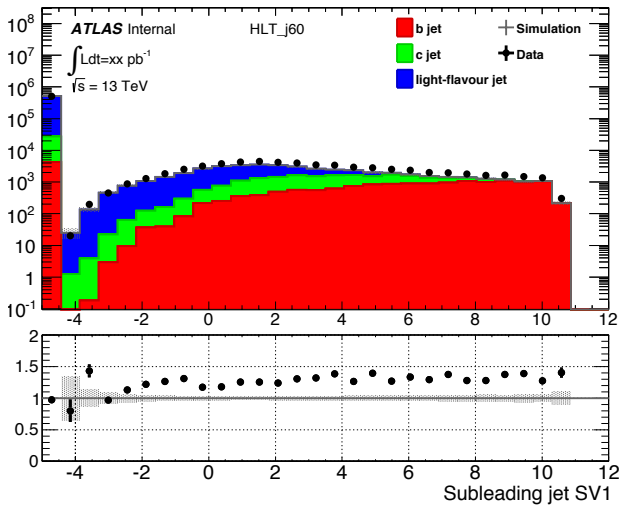


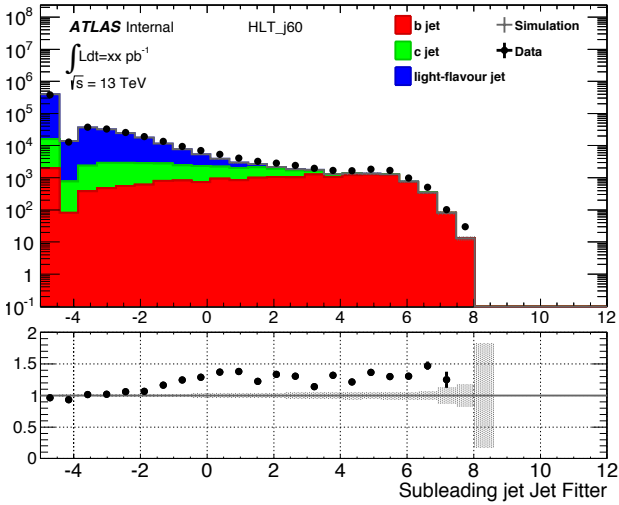


IP3D SV1 JF

Sub-Leading Jet:

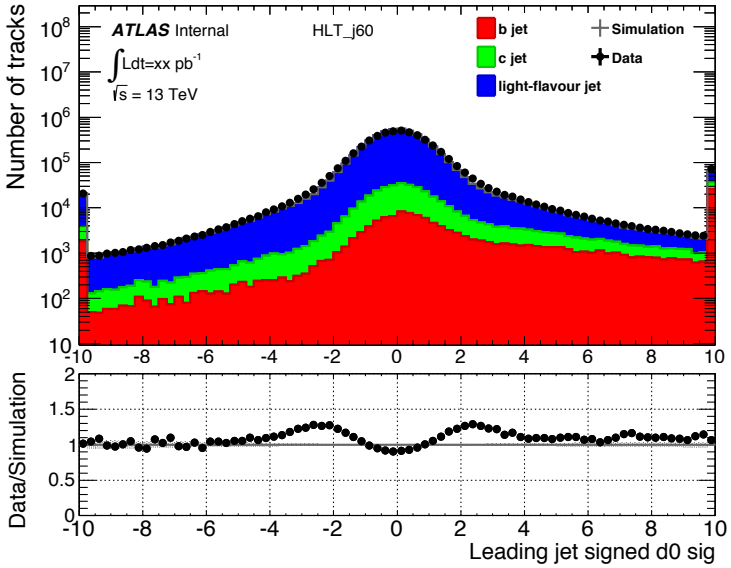


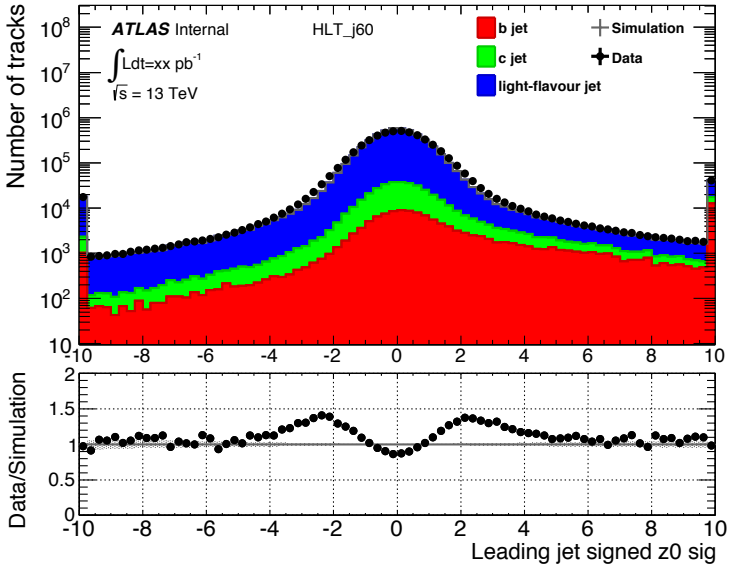




IP3D d0 sig / z0 sig

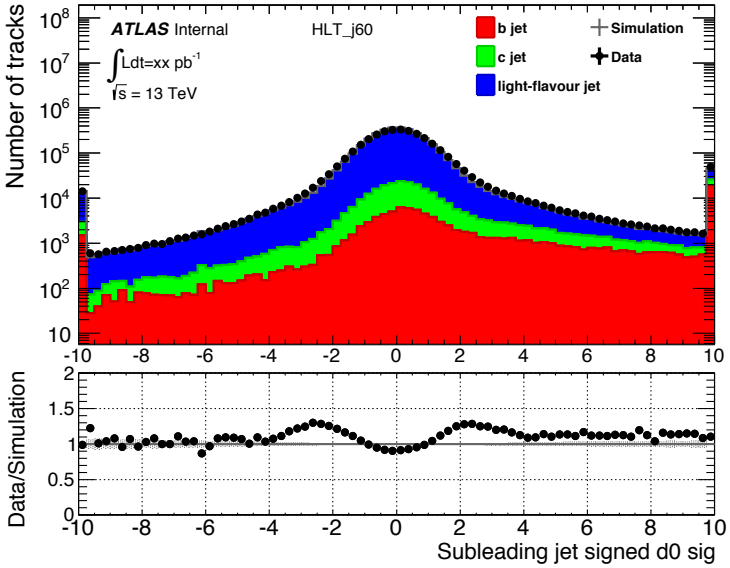
Leading Jet:



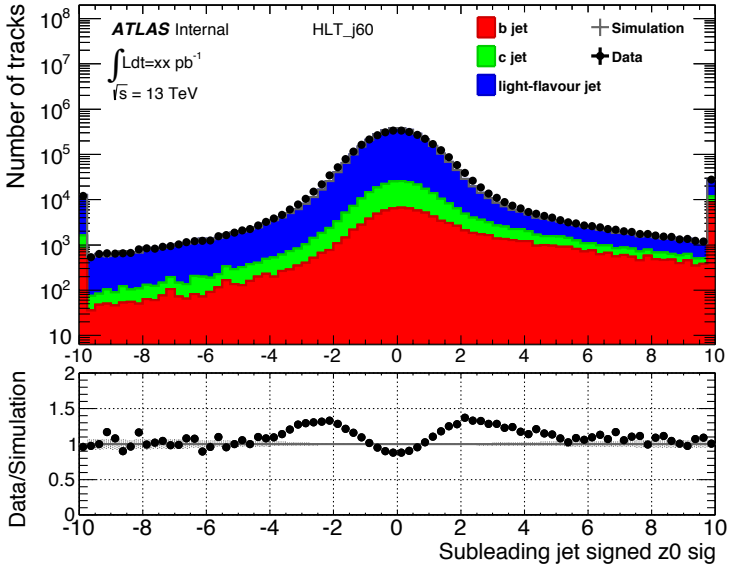


Sub-Leading Jet:

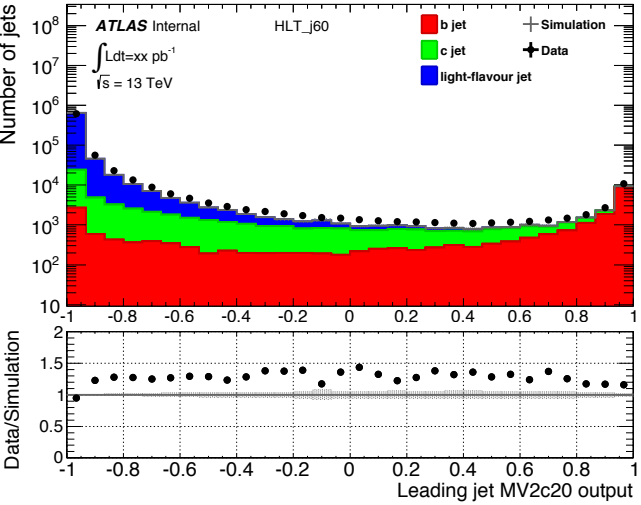
IP3D d0 sig



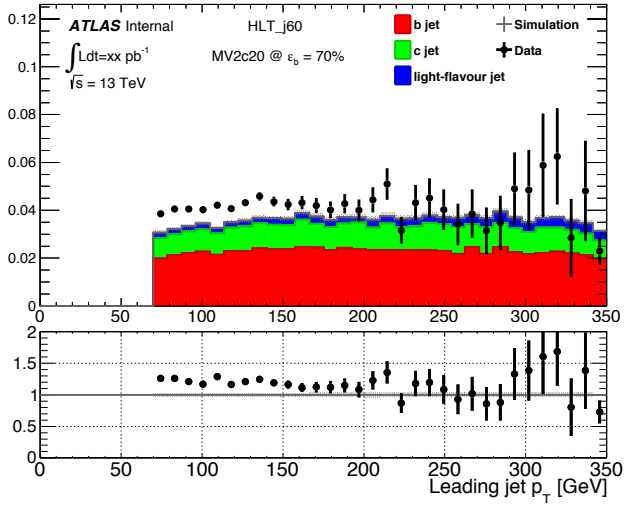
IP3D z0 sig



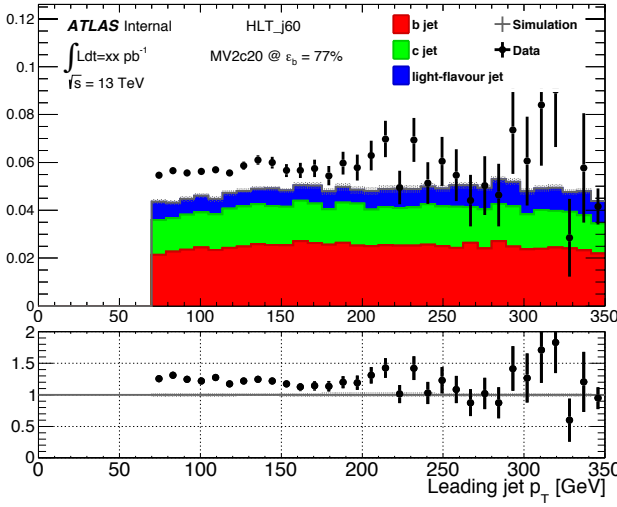
Leading Jet:



MV2c20

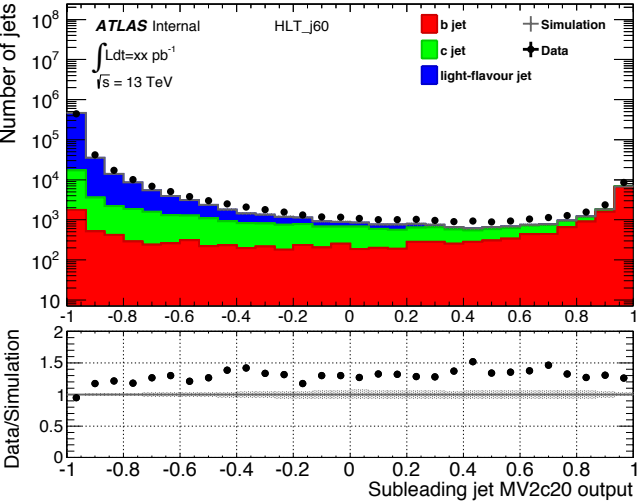


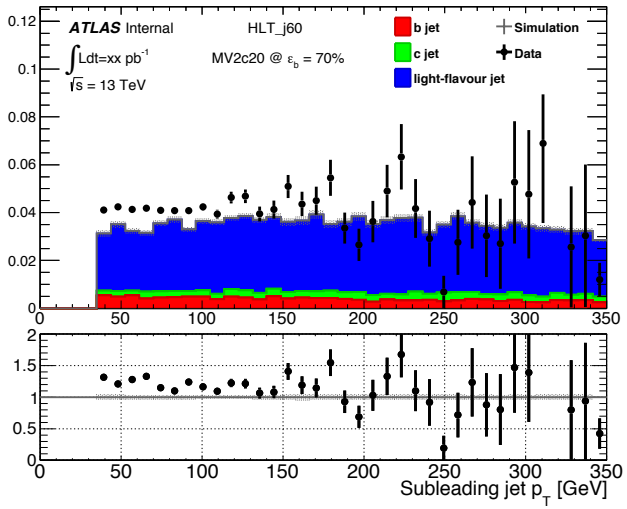
70% Tag on Leading Jet

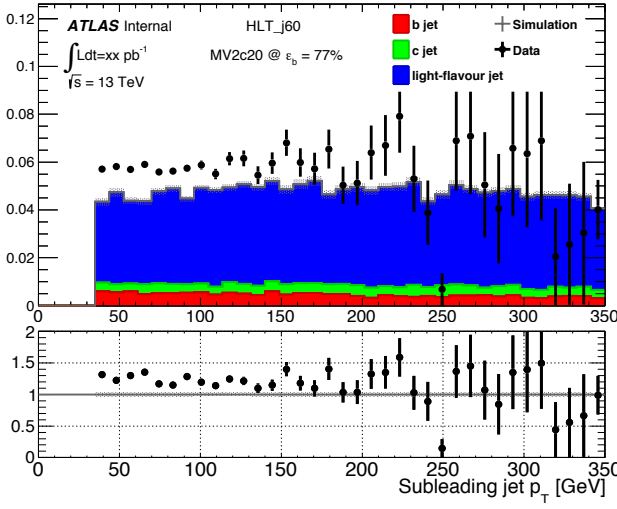


77% Tag on Leading Jet

Sub-Leading Jet:





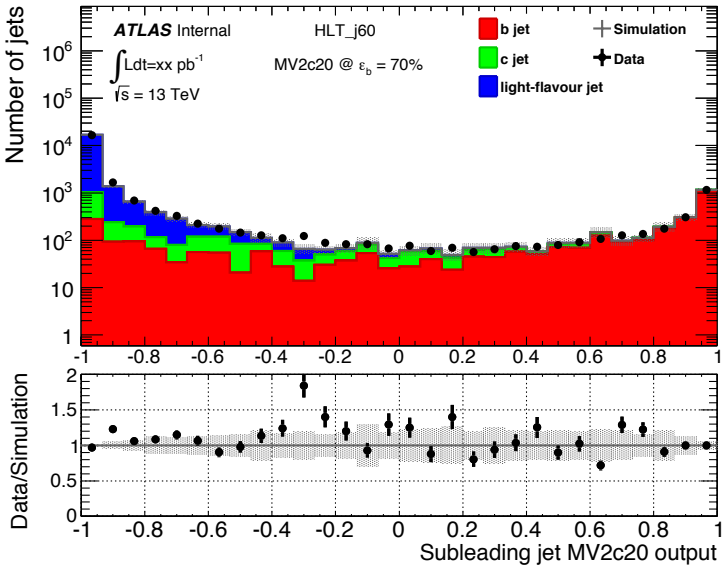


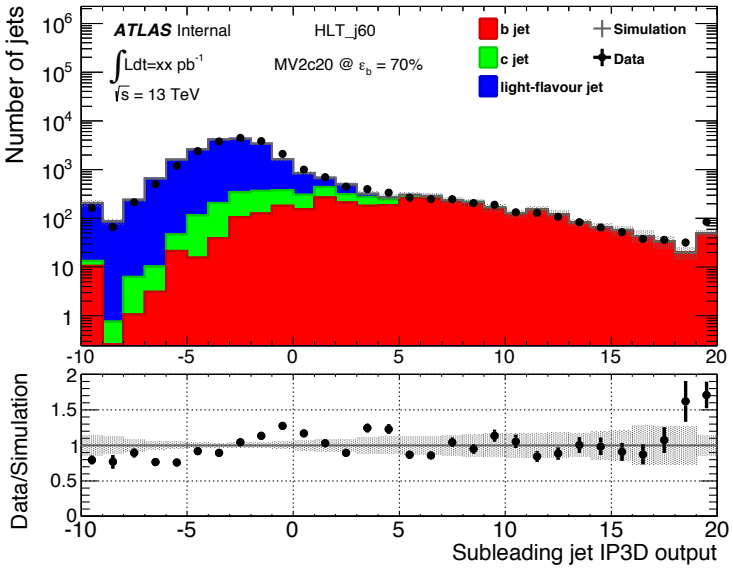
b Enhanced Samples

Working Point	Leading(L) or Subleading(SL) Jet?	Number of Jets	Fraction of b-jets	Fraction of c-jets	Fraction of Light Jets
100	L	9.37E+07	0.0296618	0.0620351	0.908303
	SL	6.38E+07	0.0326757	0.0613788	0.905941
70	L	3.04E+06	0.652715	0.27544	0.0718448
	SL	2.15E+06	0.141575	0.071646	0.786777
77	L	4.17E+06	0.511131	0.330284	0.158584
	SL	2.92E+06	0.117495	0.0829505	0.799553

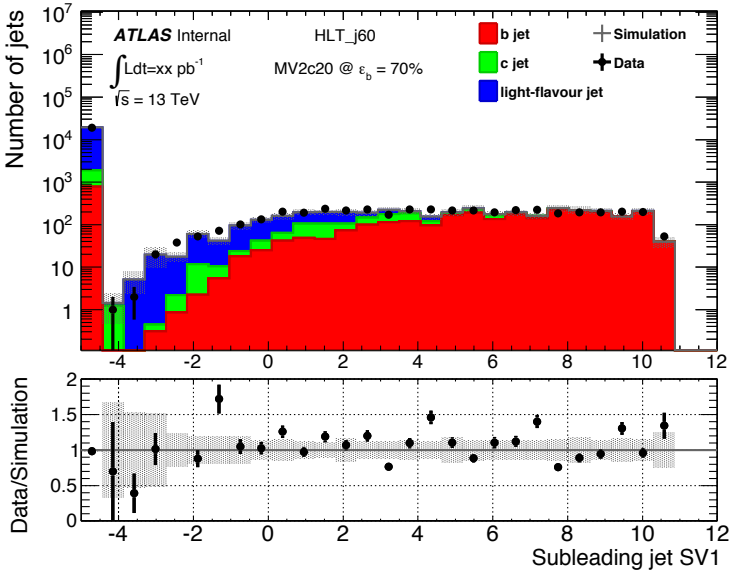
b Enhanced Sample - 70% - Subleading Jet

MV2c20: *Leading MV2c20 > -0.0436 which is 70% b-efficiency* IP3D:

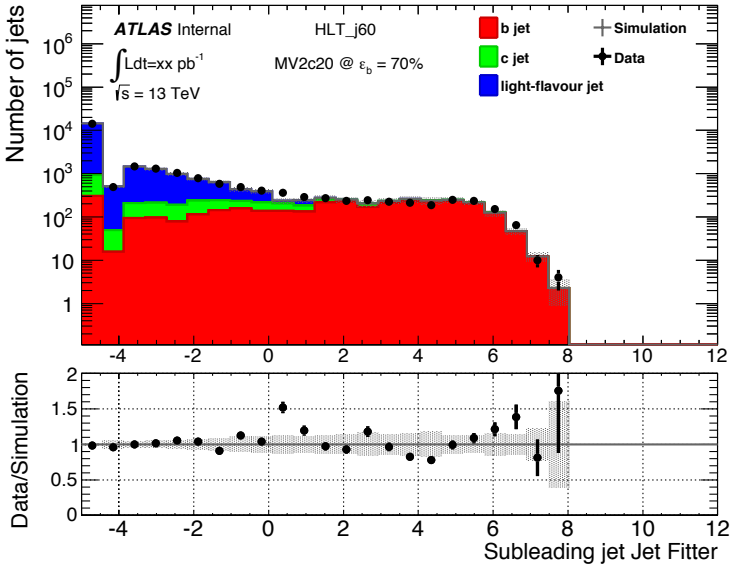




SV1:



Jet Fitter:



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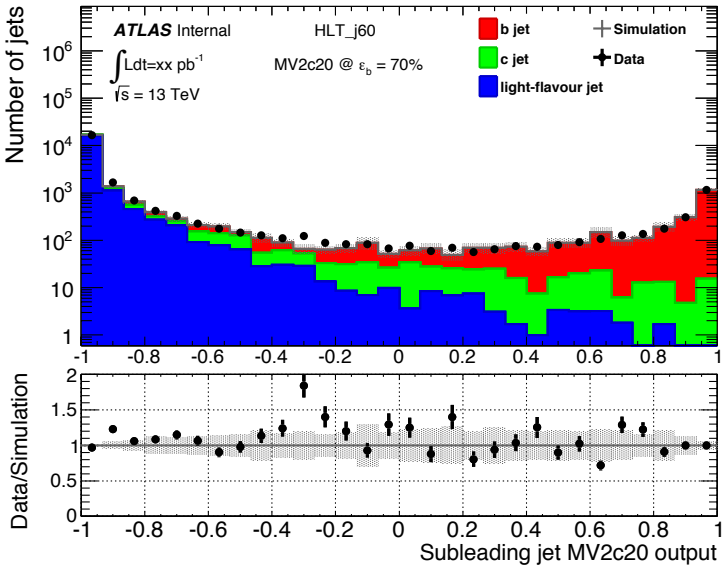
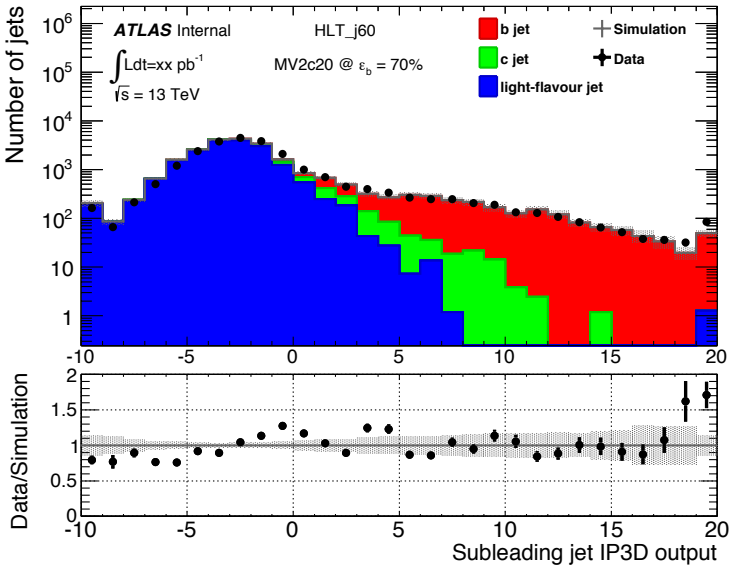
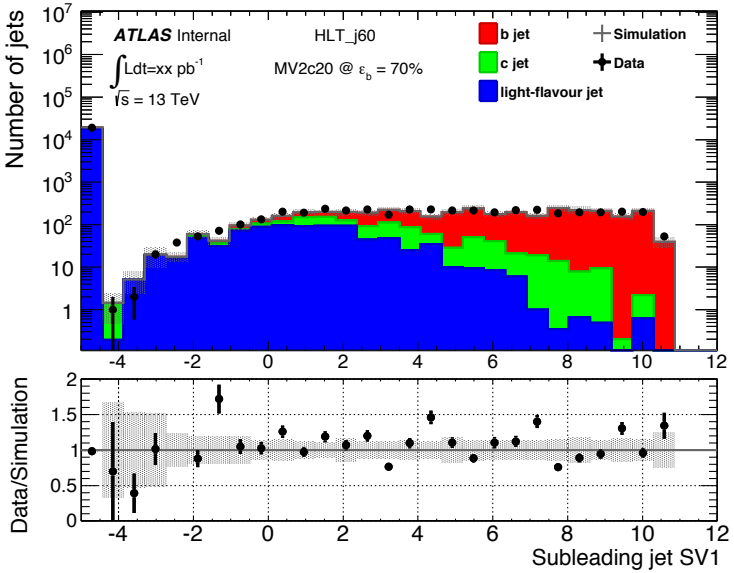


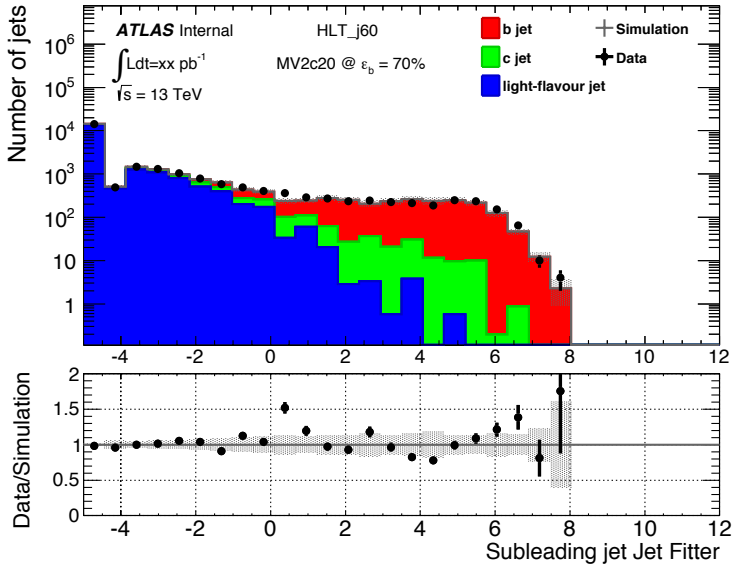
IP3D:



SV1:



Jet Fitter:



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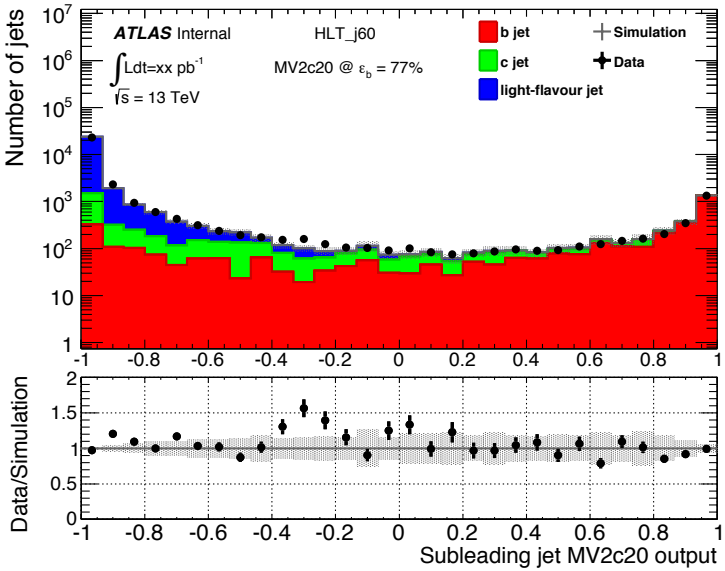
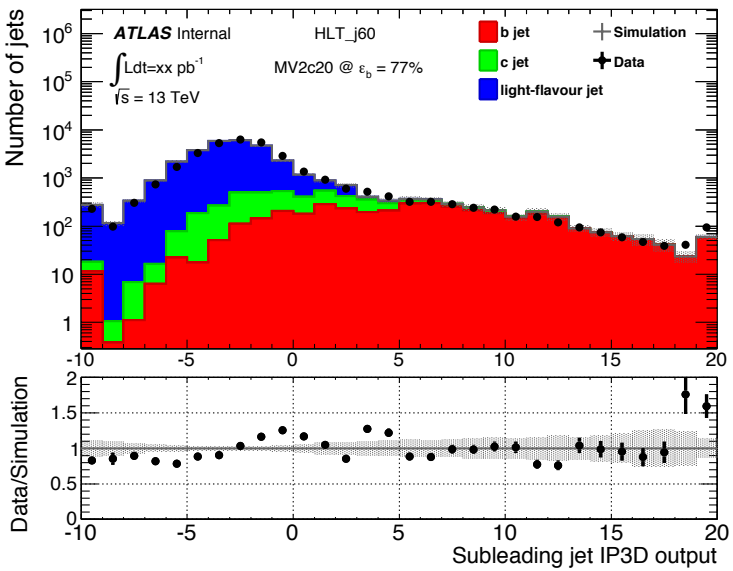
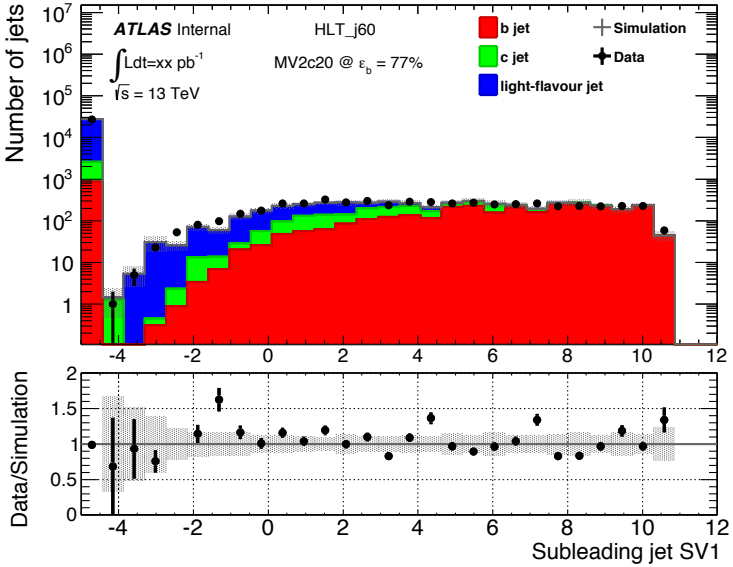
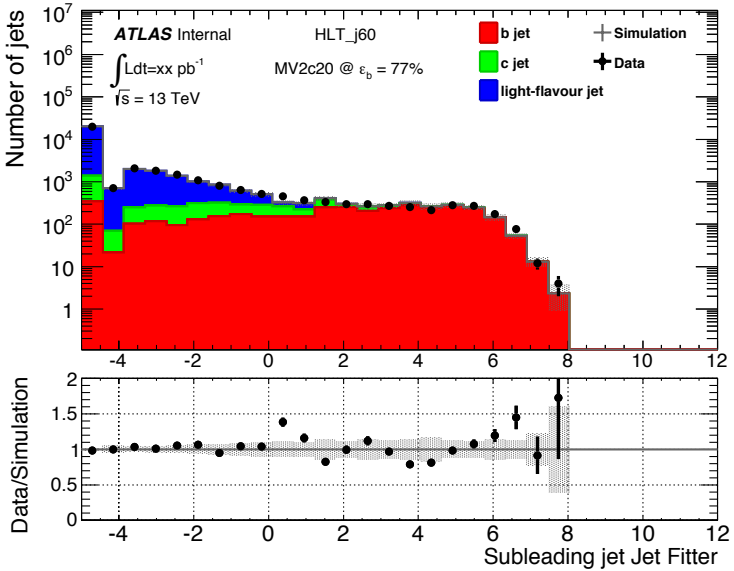




SV1:



Jet Fitter:



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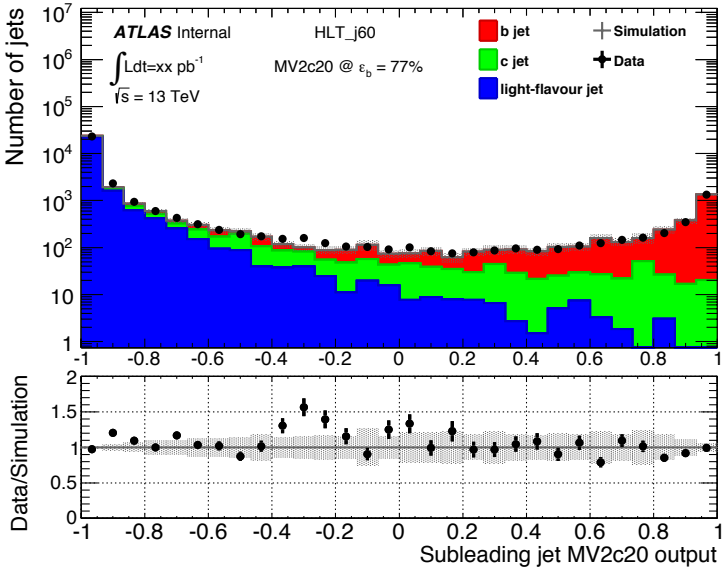
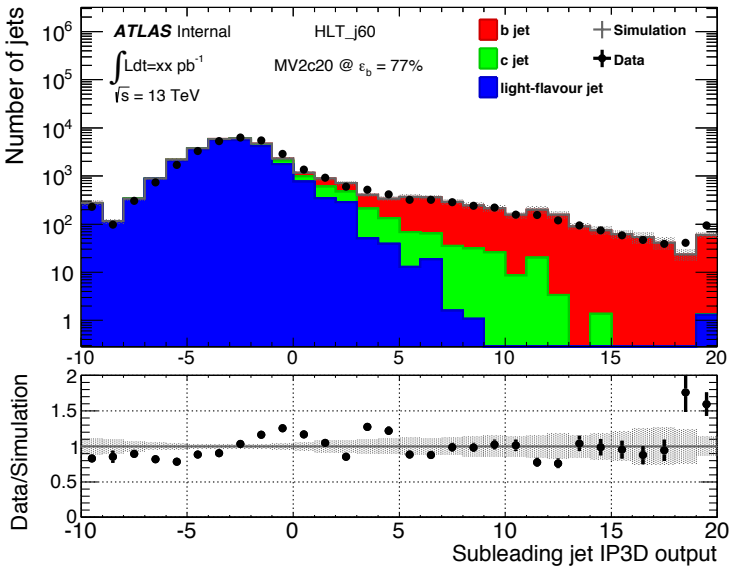
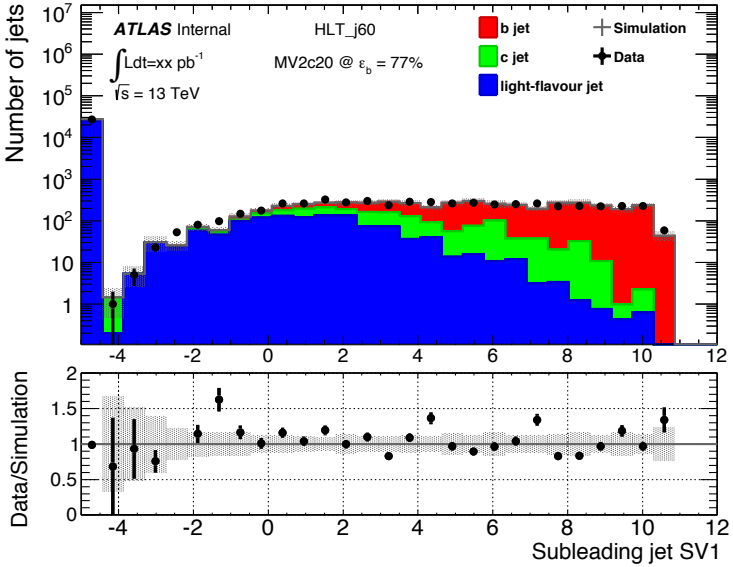
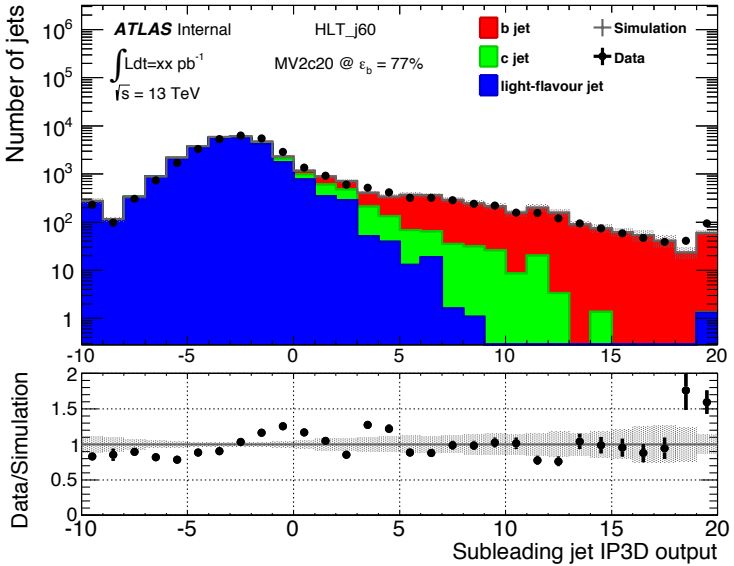




SV1:



Jet Fitter:



To Do

Add plots:
- # IP3D Tracks vs. pT and η
- Study IP3D track categories against pT
- A plot of PVx and PVy corrected run by run.
- d0 and z0 error against pT and η.

- Re-running on data to pick-up the fix for JetCalibration tag.
- The re-run will also allow us to include one last missing run.
- Re-running on both MC and data to improve calculation of <μ>

Question: Is there going to be reprocessed 50ns data set with the new geometry tag?

Conclusions

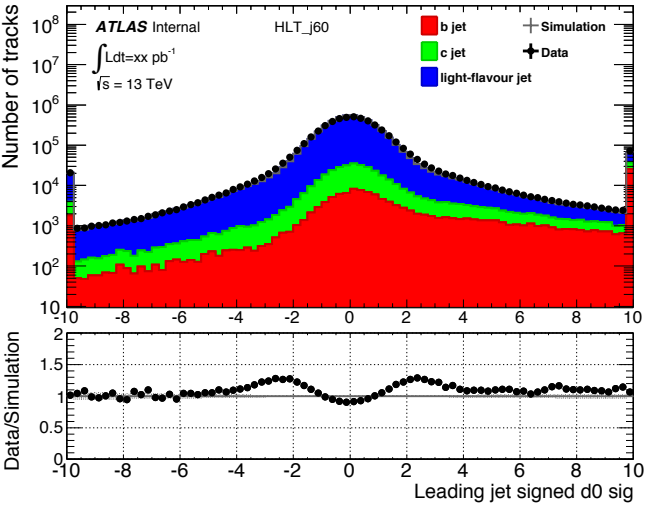
IP resolution will improve in coming weeks
- This will hopefully improve b-tagging Data/MC

In a good place for note to be ready for Lepton Photon in August
- Note written: https://cds.cern.ch/record/2032461
- First comments now addressed
- Ready for more data with improving alignment!

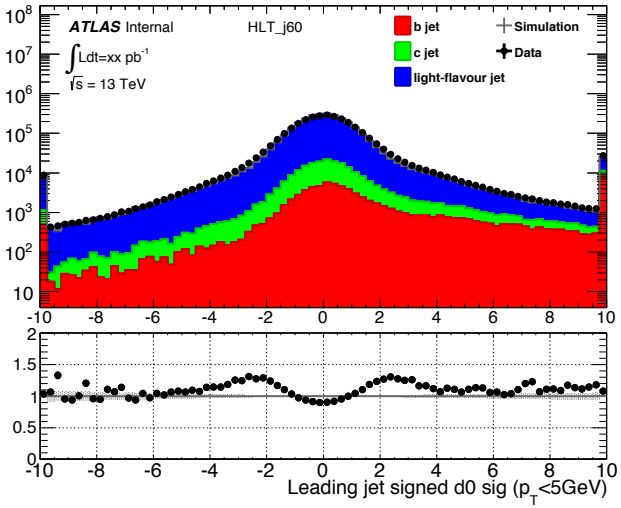
Backup

Signed d0/z0 Significance - Varying Track pT

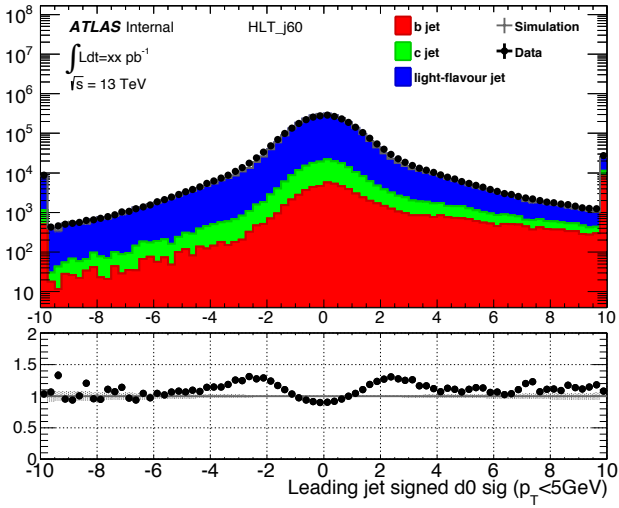
d0 Significance:



All (pT > 1 GeV)

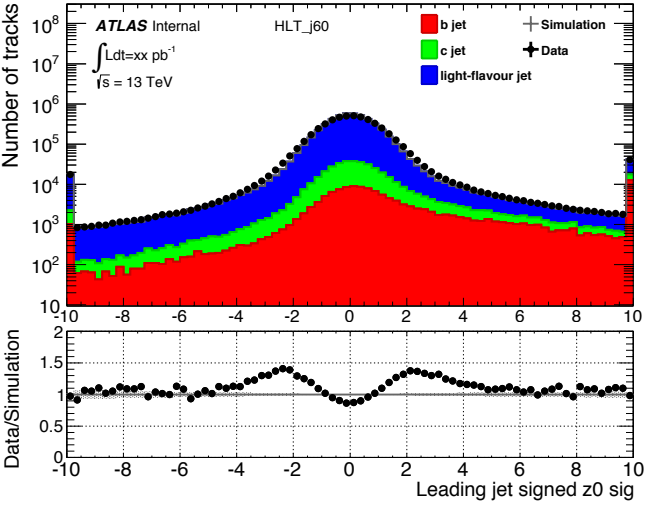


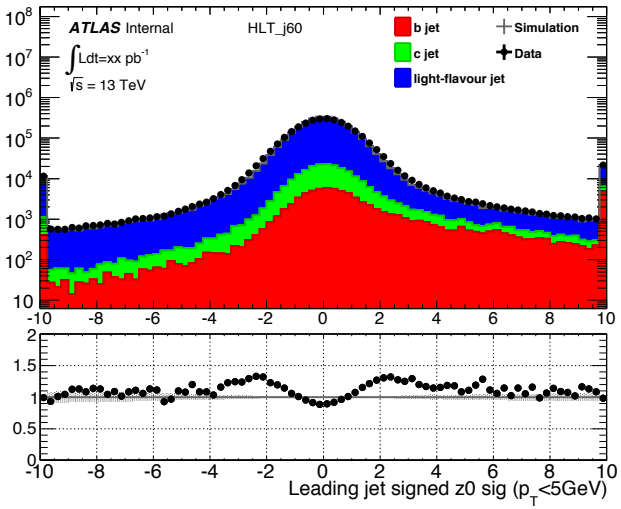
1 GeV < track pT < 5 GeV

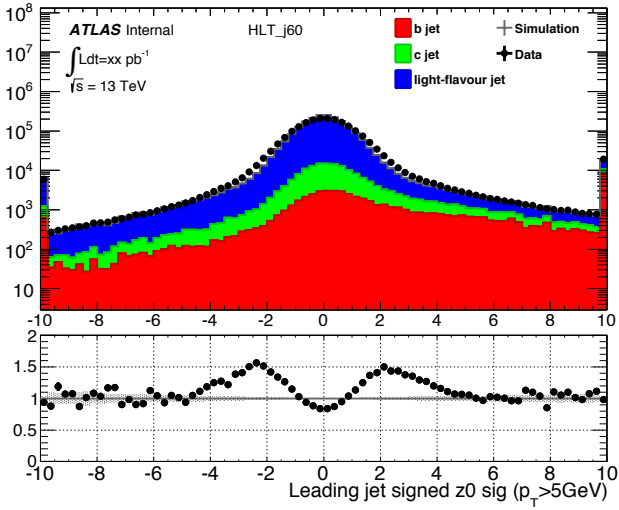


track pT > 5 GeV

z0 Significance:

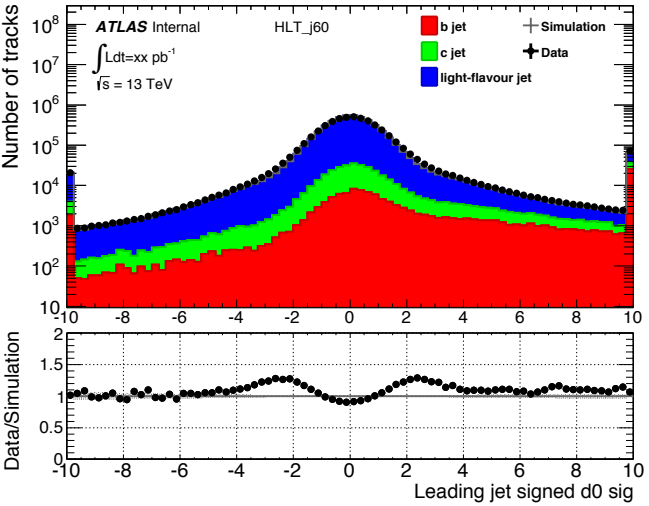


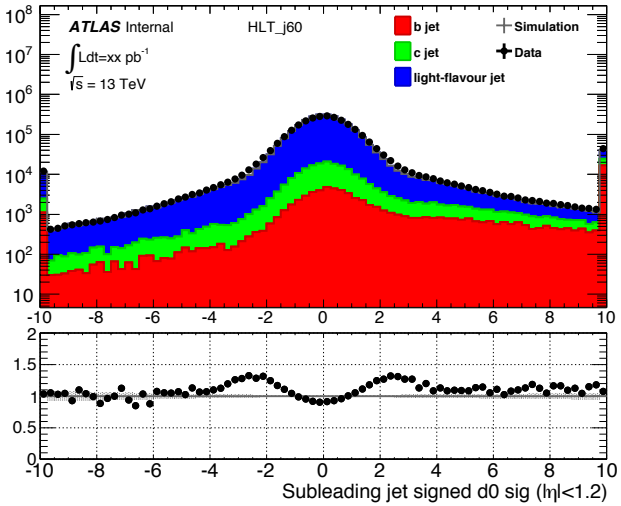


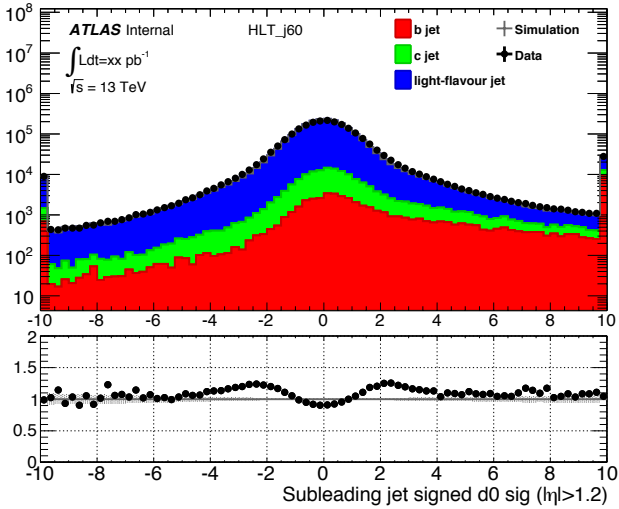


Signed d0/z0 Significance - Varying η

d0 Significance:







All | $|\eta| < 1.2$ | $|\eta| > 1.2$

z0 Significance: