Flavour Tagging
Commissioning with Data

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Flavour Tagging P&P Meeting

07/07/15

Aims

• Plan to have two pub notes for EPS:
- Data Commissioning comparing Run 2 data to MC in dijet and top events.
- Improved b-tagging performance in Run 2 (Purely MC)

• This talk will focus on data to MC comparison in dijet events.
- There will be plots on the top event data commissioning in the top group.
- Another talk in this session on the b-tagging performance.

• The final version will contain last 2 runs - ~7 fb^{-1} of data.

• Tight Deadline for EPS
- Talks begins July 23rd.

Timeline for PUB Notes:
1. Circulation to the group by July 9 (plot style should be final, but data may be incomplete.)
2. Group approval by July 13.
3. Circulation to ATLAS by July 14.
4. Circulation finished by July 20, final update of plots using latest data.
5. Sign off by readers by July 22.

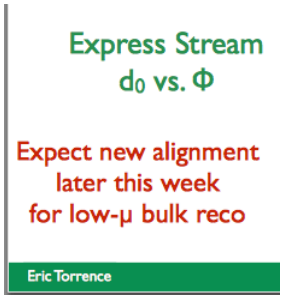
Timeline for performance plots:
1. Circulation to ATLAS on Thursday 17 June (plot style should be final, but data may be incomplete.)
2. End of circulation Monday July 20 noon.
3. Group approval meeting with final update of plots using latest data July 21 or 22.

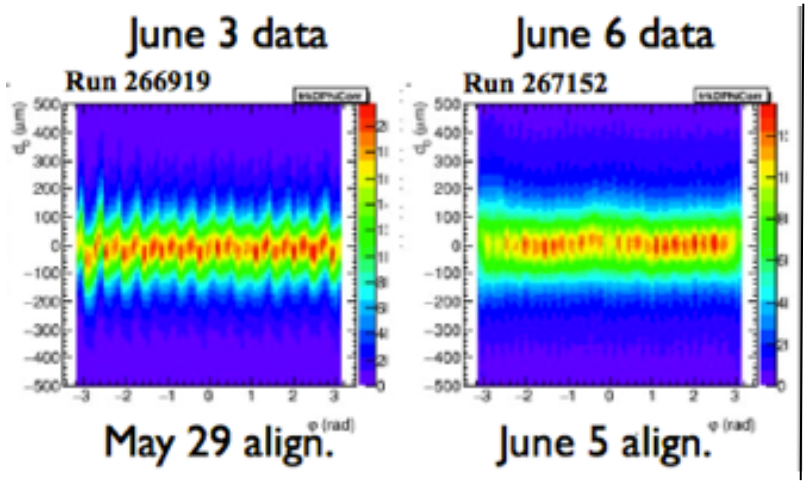
• We are using NTuples created using Run2BTagOptimisationFramework

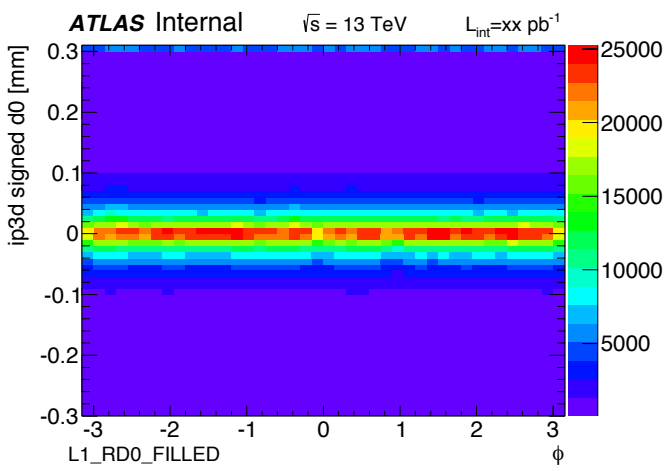
• MC Sample:
- *group.perf-flavtag.mc15_13TeV.3610*.Pythia8EvtGen_JZ*W.merge.AOD.*.BTAGNTUP_V12slim/*
- **Full xAOD**
- 50ns MC sample data
- Split into 5 slices and the re-weighted (see next slide) JZ1W-JZ5W - No JZ0W used.
- ~ 10M Events, an increase by a factor of 10 on previous study.

• Data Sample:
- *data15_13TeV.00267639.physics_Main.merge.DAOD_**FTAG1**.r6848_p2358_p2375/*
- Stable beam collisions
- ~3 Million Events from Run 267639
- Contains Latest Alignment - Performed on the first Run-II data with incorrect conditions for the pixel detector (Lorentz angle, temperature,…).
- So we must either re-process with new alignment or wait for new runs to be bulk processed.

Beam Spot Quality
- Eric Torrence







Details and Cuts

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

- L1_J25 Trigger for MC with Leading Jet P_T > 70 GeV.
- HLT_J60 Trigger for Data with Leading Jet P_T > 70 GeV.

- AntiKt4EMTopoJets
- Jet Calibration:

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

- GRL:

```
data15_13TeV.periodAllYear_DetStatus-v62-
pro18_DQDefects-00-01-02_PHYS_StandardGRL_All_Good.xml
```

- njets ≥ 1
- Run1LooseBadCuts and "ugly" jet removal.
- Leading |η| < 2.5
- Leading P_T > 70 GeV for
- JVT > 0.641 if (P_T < 50 GeV and |η| < 2.4)

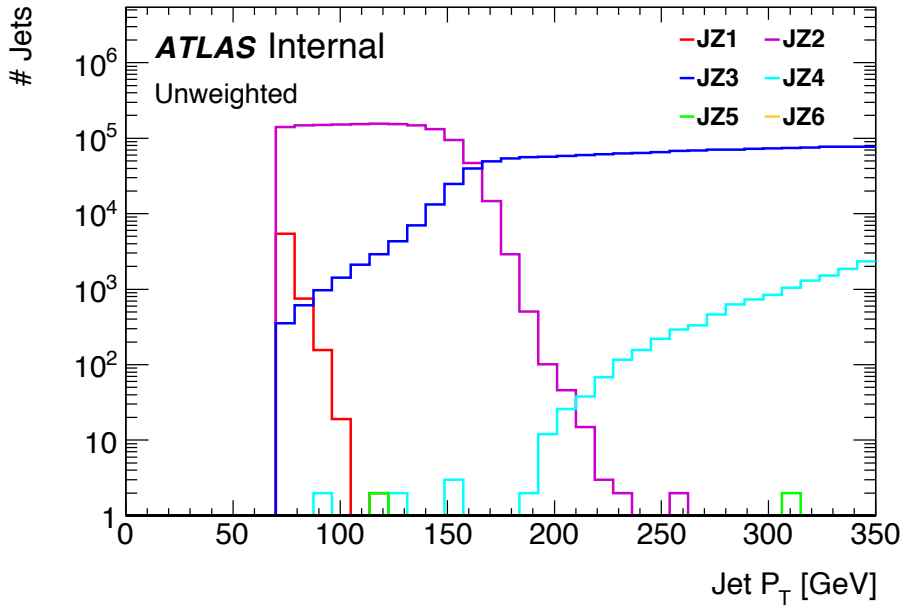
Then plot subleading if:
- Subleading P_T > 25 GeV
- Subleading |η| < 2.5

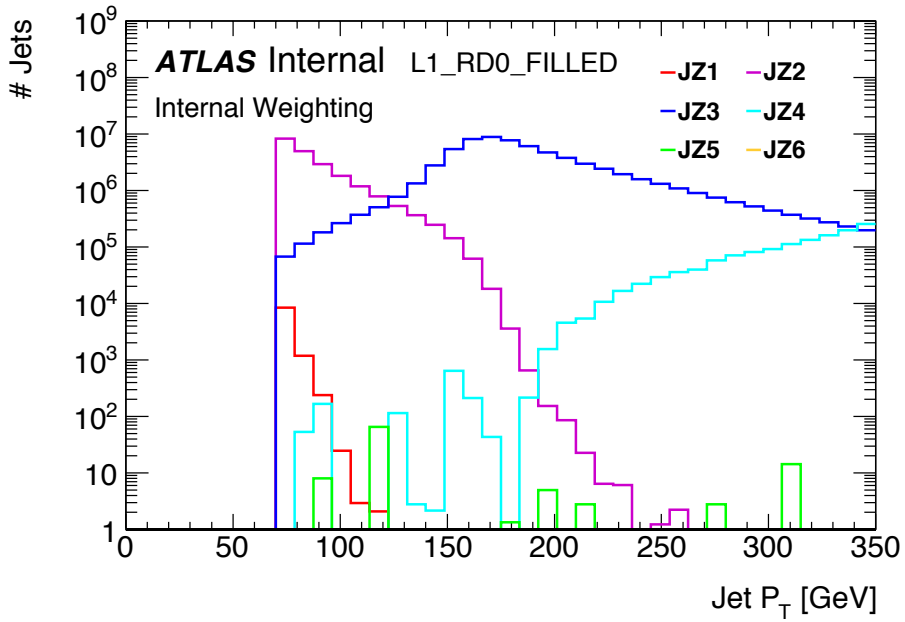
Just For MC

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
- (pt_1 < 1.4 * truth_pt_1), for njet =1

- LabDr_HadF truth matching.

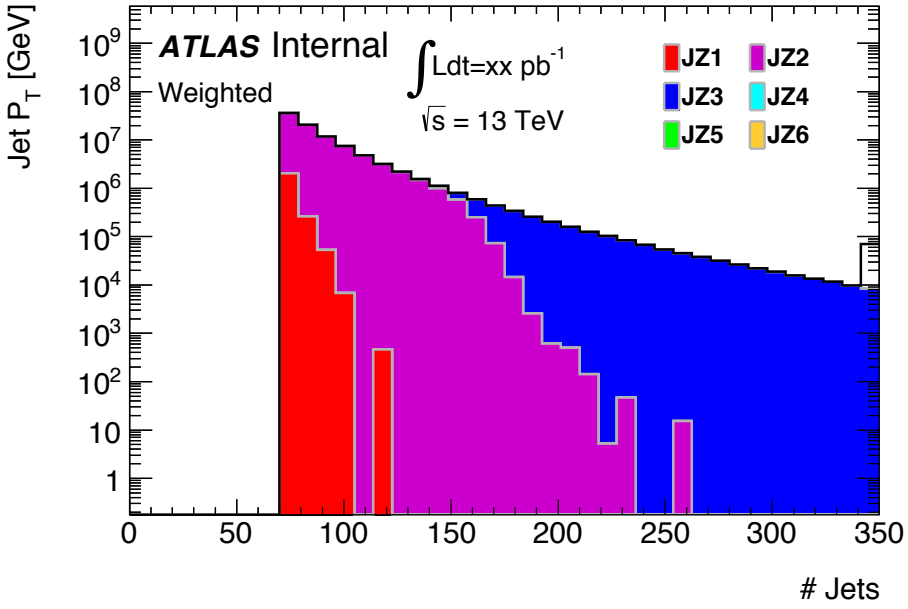
Di-jet sample re-weighting





Total Weight = ***mcwg*(Filter Eff.)*(CS[fb])*(Lumi[fb^{-1}])***
(# Events)

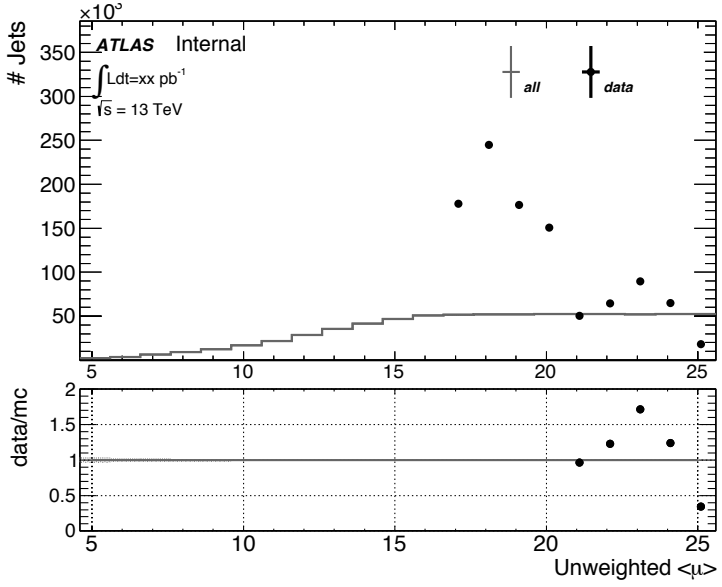
Xs(fb)	Eff.	Slice and Energy
7.8420E+13	6.7198E-04	#JZ1W 20-60 GeV
2.4334E+12	3.3264E-04	#JZ2W 60-160 GeV
2.6454E+10	3.1953E-04	#JZ3W 160-400 GeV
2.5464E+08	5.3009E-04	#JZ4W 400-800 GeV
4.5536E+06	9.2325E-04	#JZ5W 800-1300 GeV
2.5752E+05	9.4016E-04	#JZ6W 1300-1800 GeV



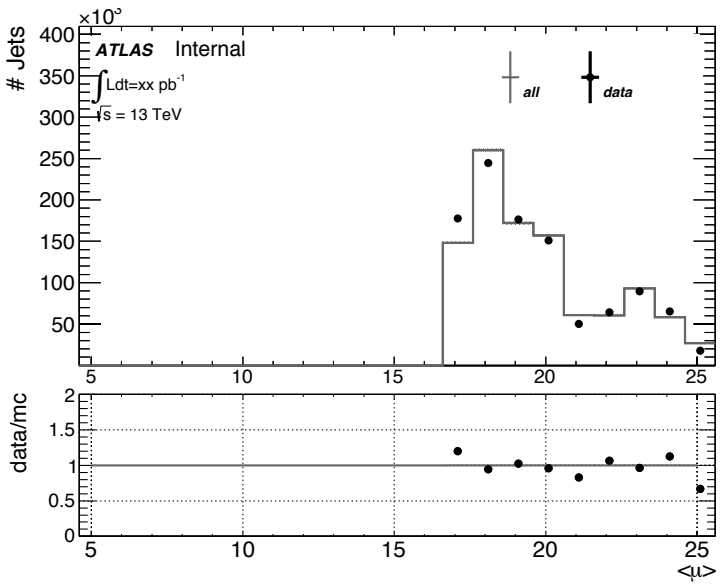
Then integral of MC is normalised to integral of data

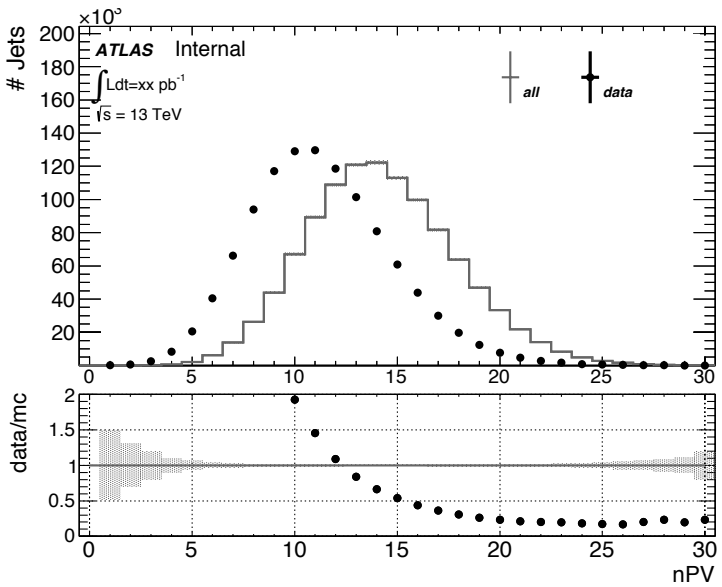
<μ> Reweighting

Before:

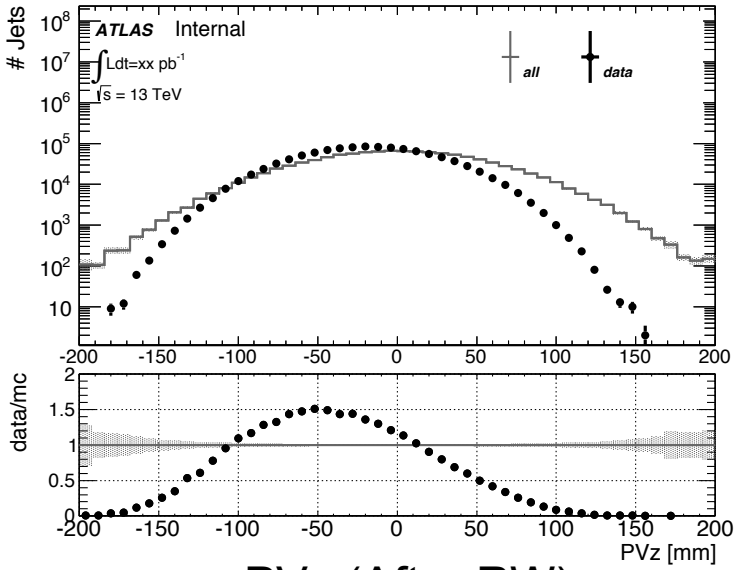


After:





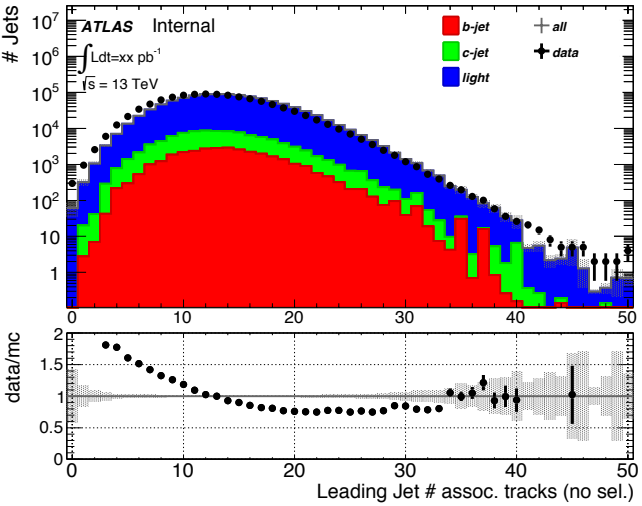
# of PVs (After RW)



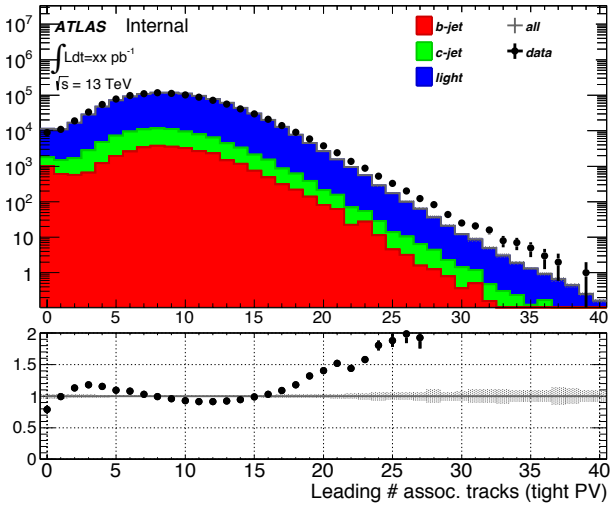
PVz (After RW)

Track Distributions

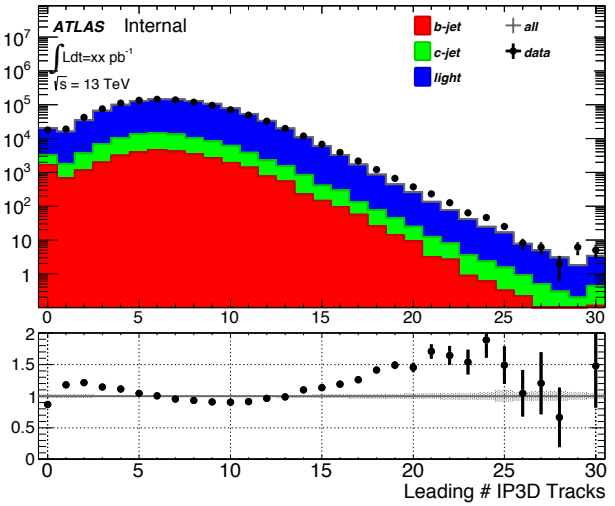
Leading Jet:



Tracks:
Directly from Track Container

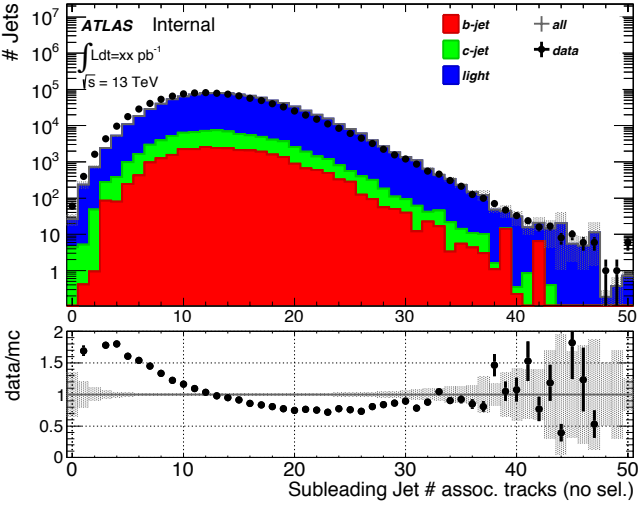


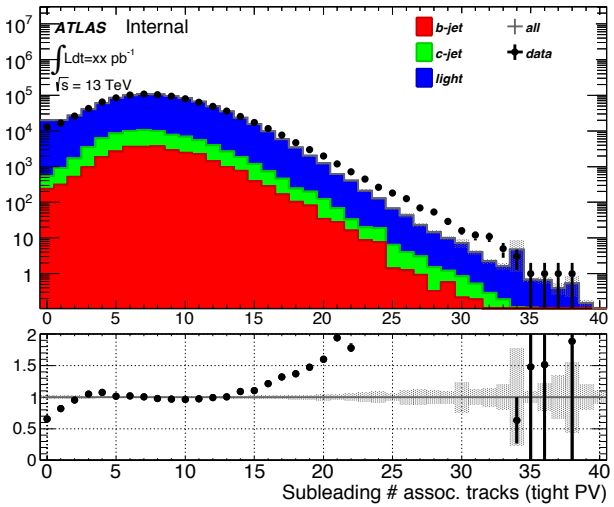
Tracks:
Tight PV Selection

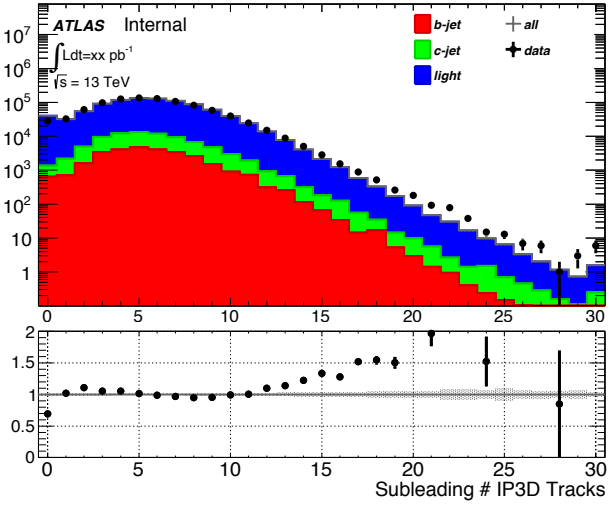


Tracks:
IP3D Selection
$P_T > 1$ GeV

Sub-Leading Jet:

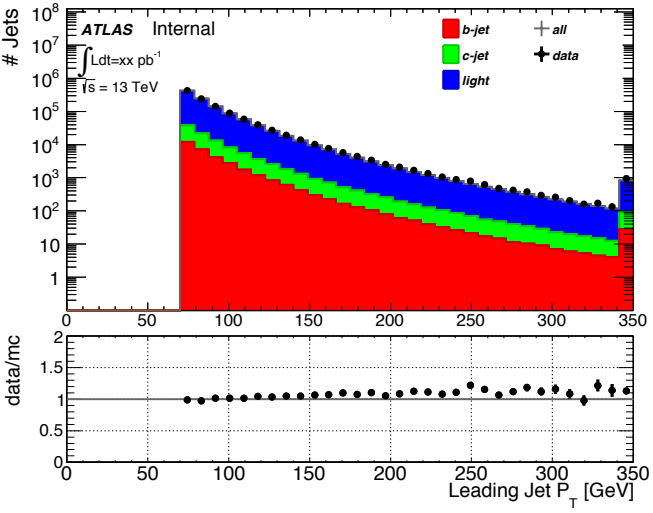




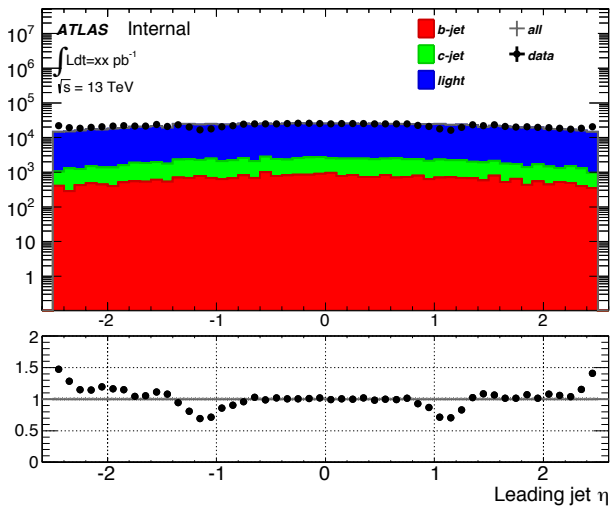


Jet Kinematic Distributions

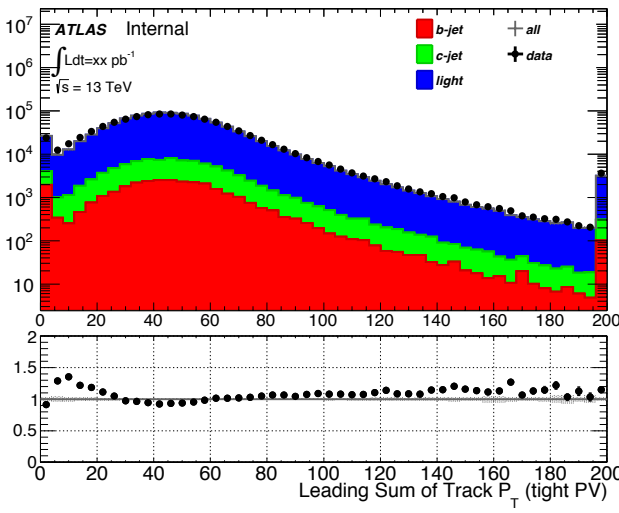
Leading Jet:



Jet P_T

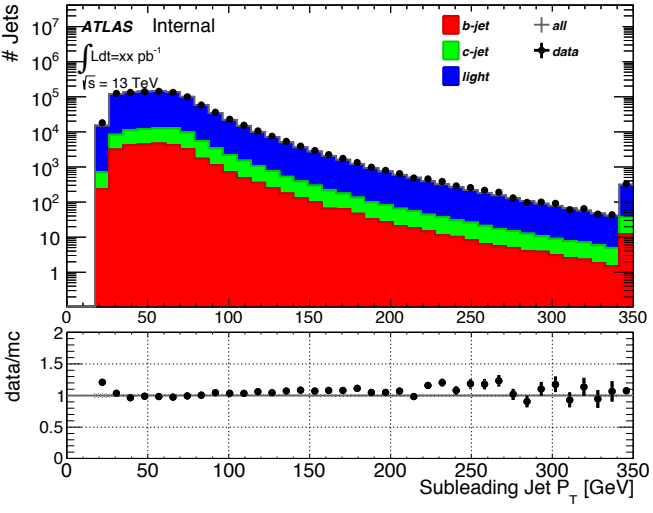


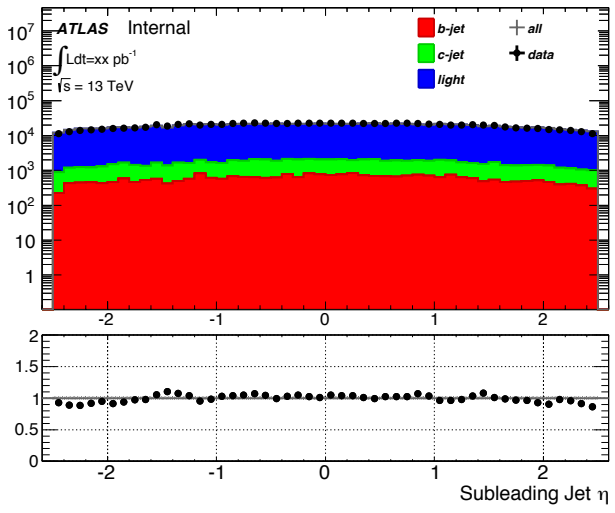
Eta

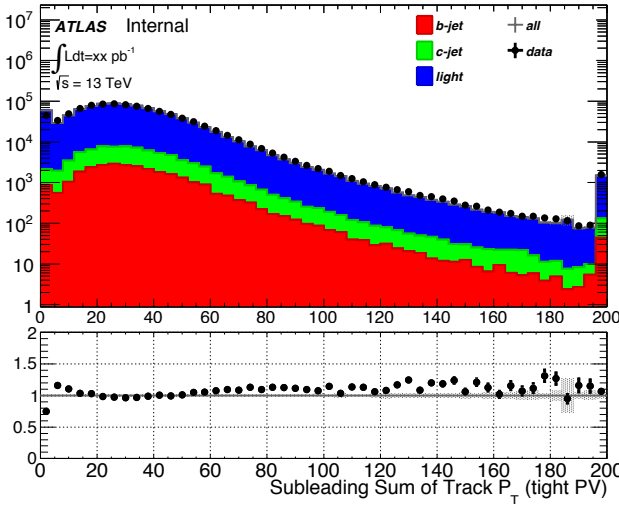


Sum of Track P_T

Sub-Leading Jet:

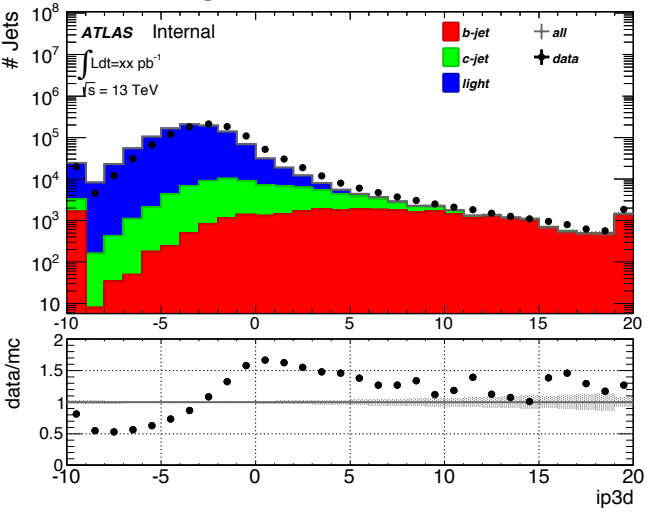




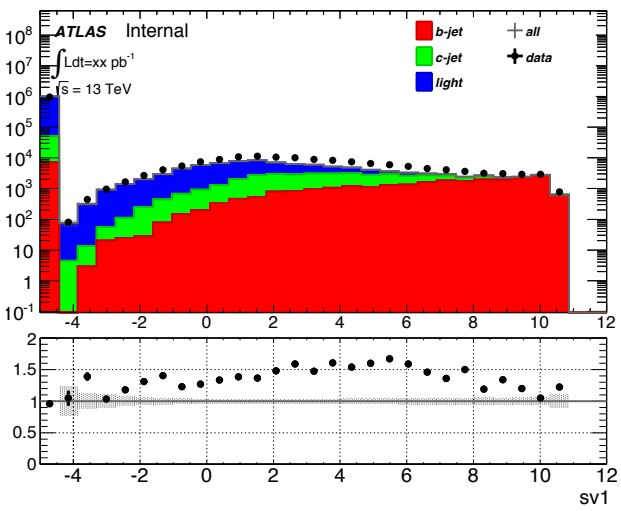


Input Taggers

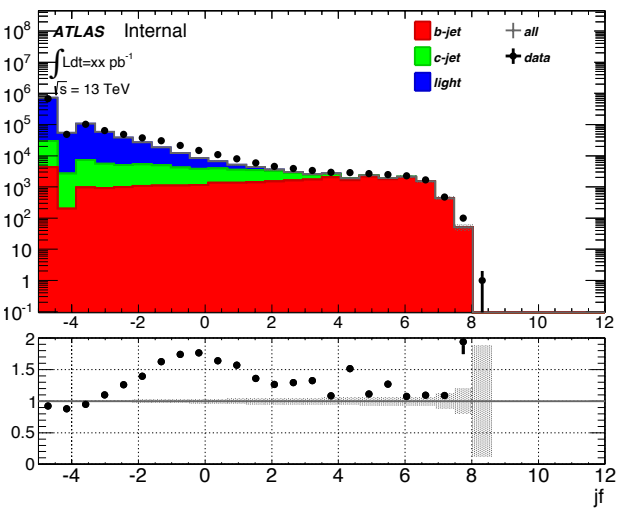
Leading Jet:



IP3D

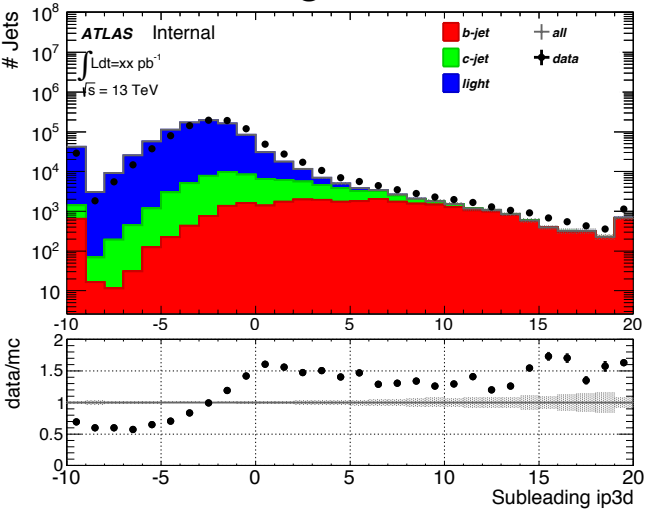


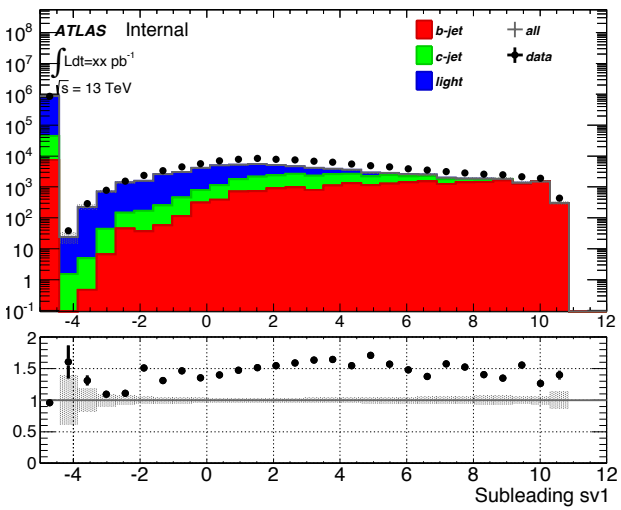
SV1

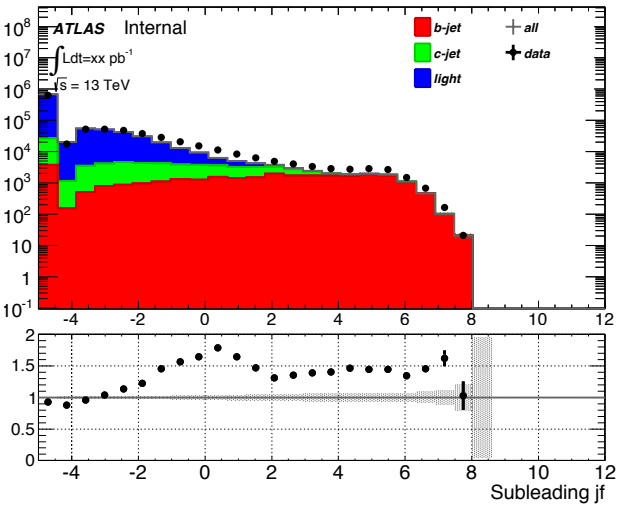


JF

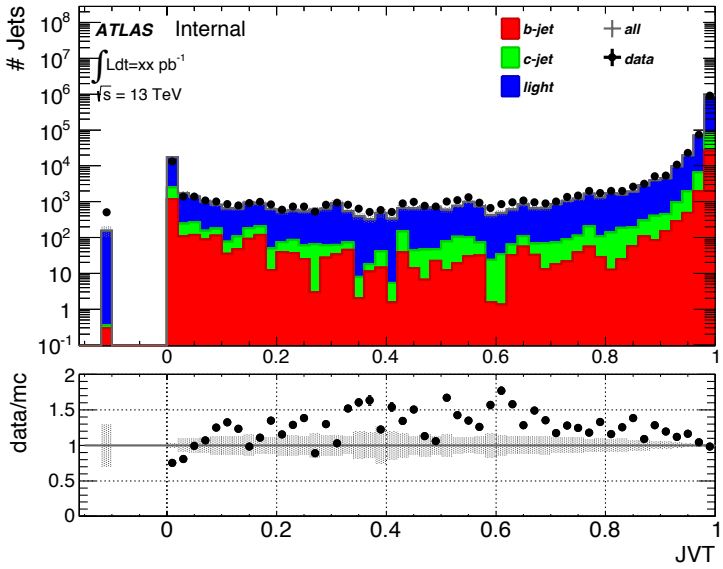
Sub-Leading Jet:

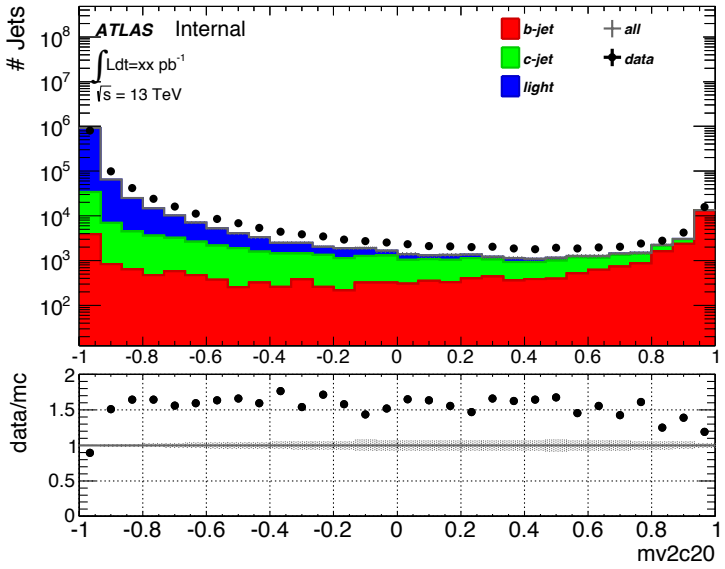






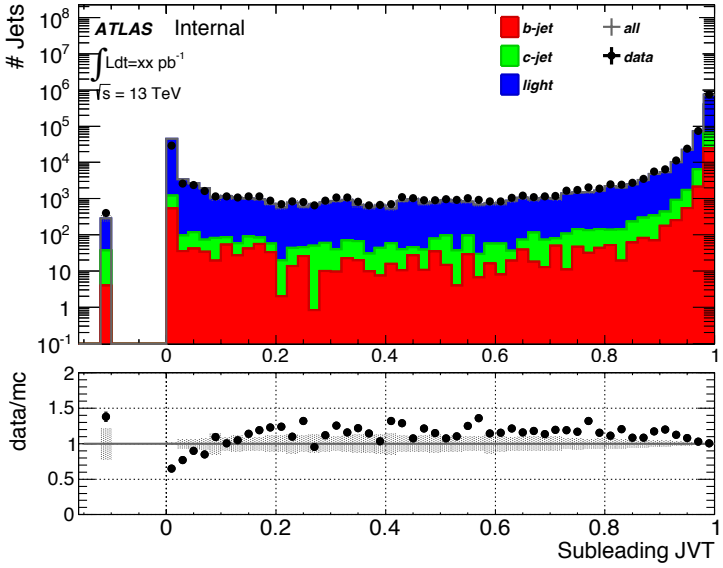
Leading Jet:



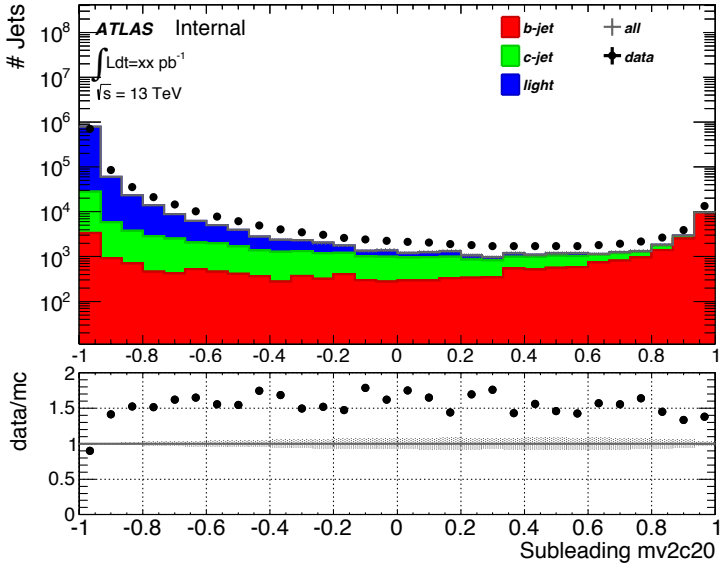


Sub-Leading Jet:

JVT



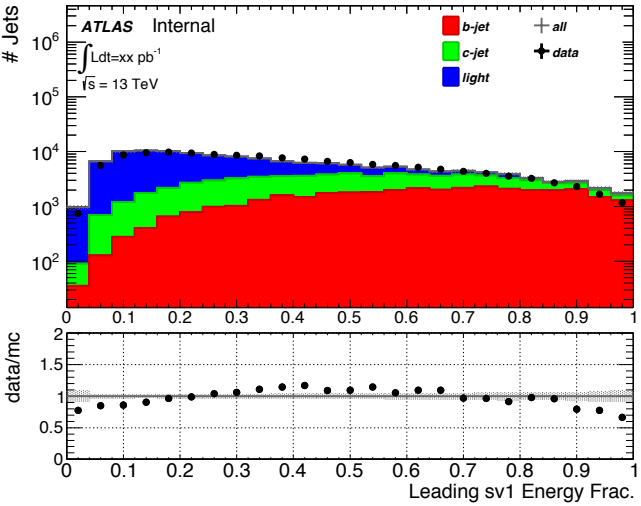
MV2c20



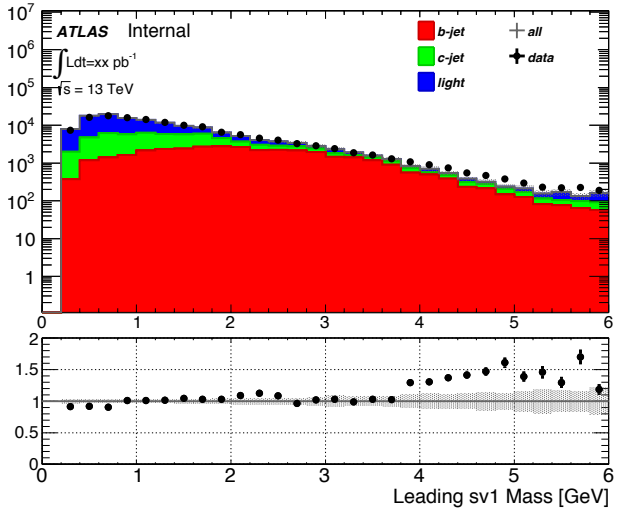
SV1 Variables

Leading Jet:

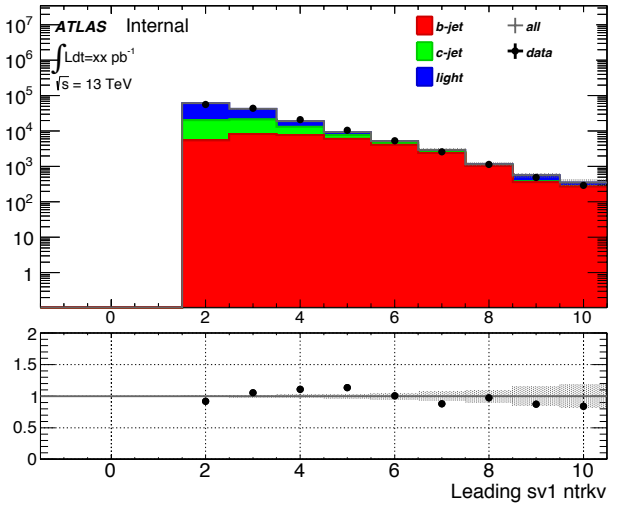
Only Filled if a Secondary Vertex is found



Energy Frac.

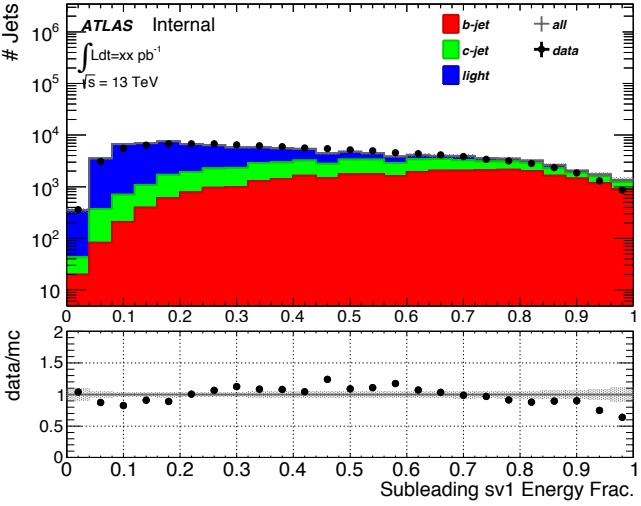


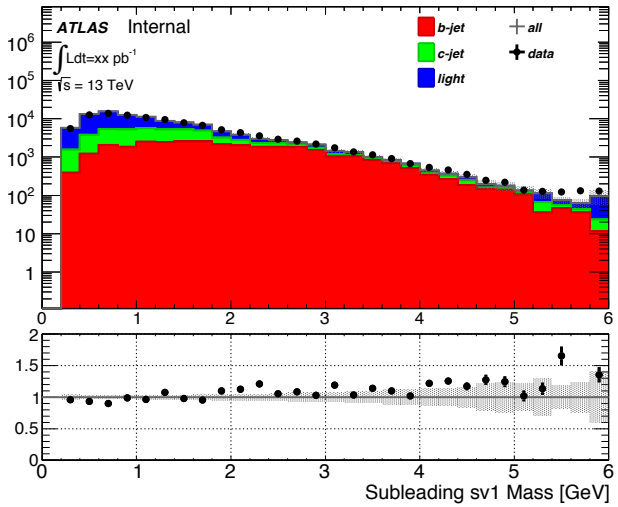
SV1 Mass

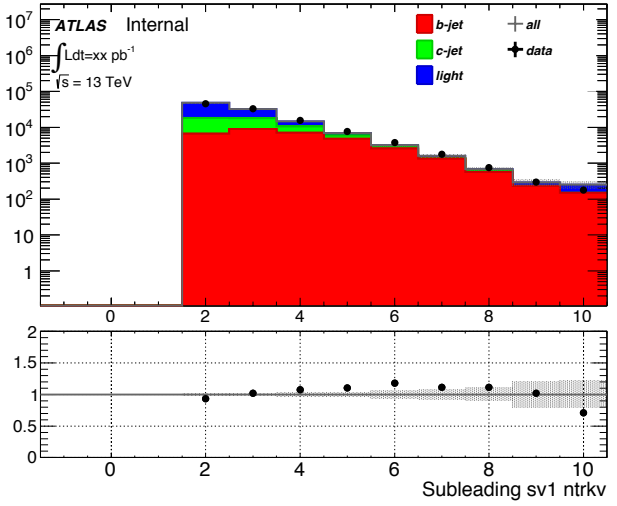


Tracks at SV1 Vertex

Sub-Leading Jet:



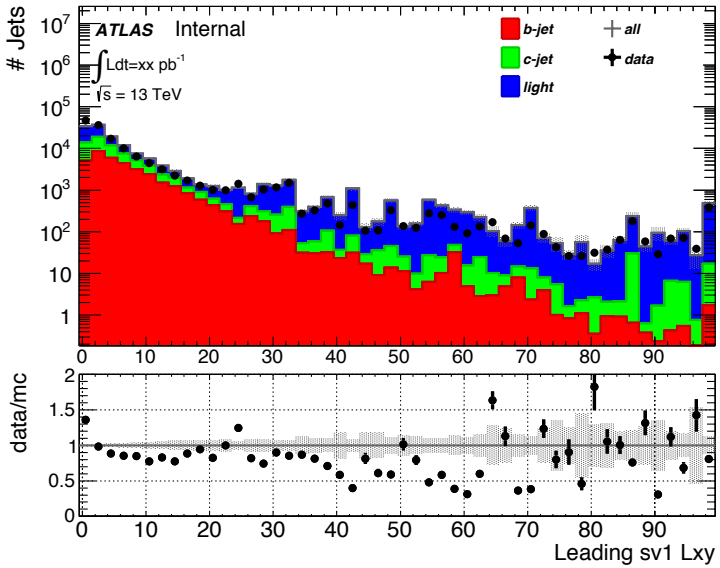


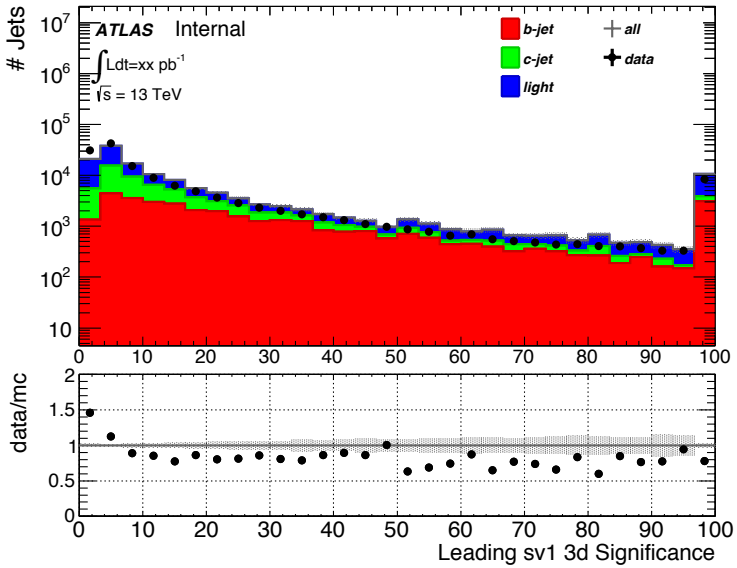


SV1 Variables Cont.

Leading Jet:

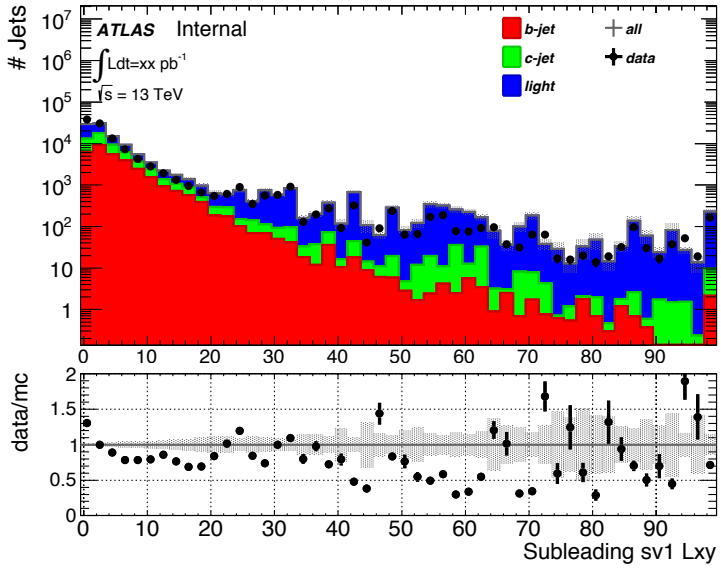
Only Filled if a Secondary Vertex is found



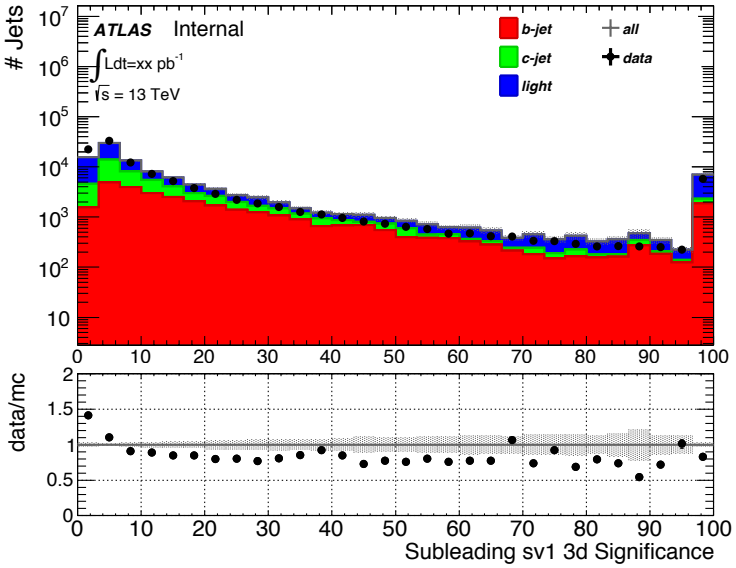


Sub-Leading Jet:

SV1 L_{xy}



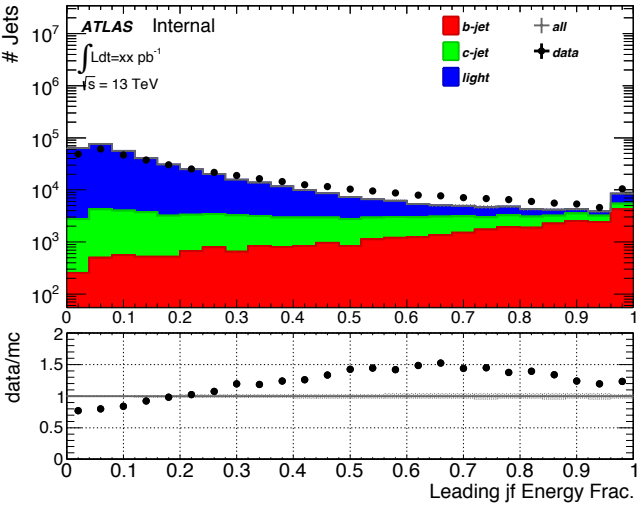
SV1 3D Sig



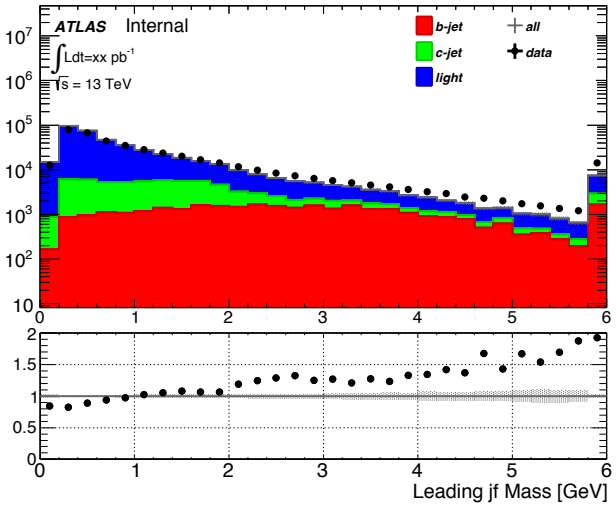
JF Variables

Leading Jet:

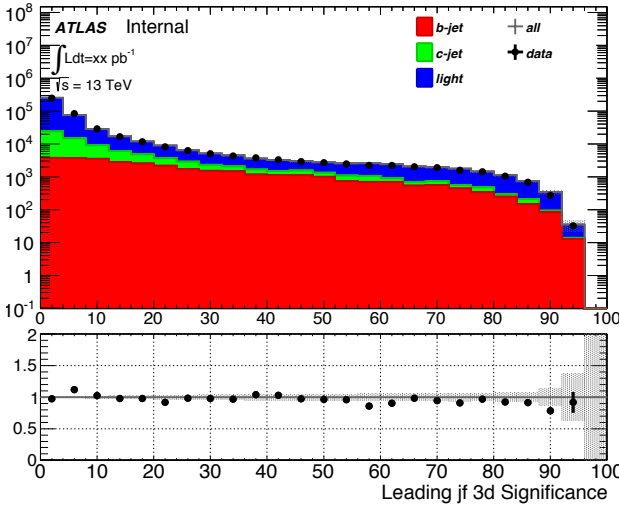
Only Filled if a Jet Fitter Vertex is found



Energy Frac.

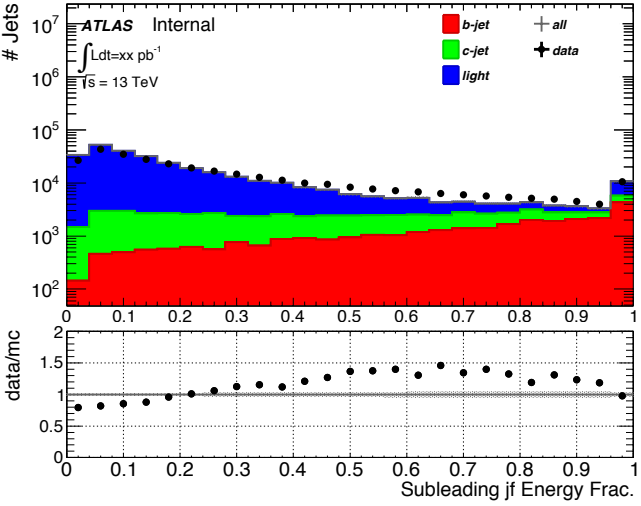


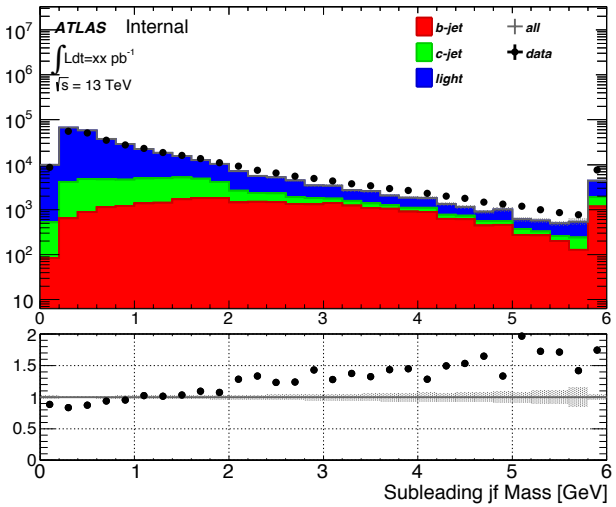
JF Mass

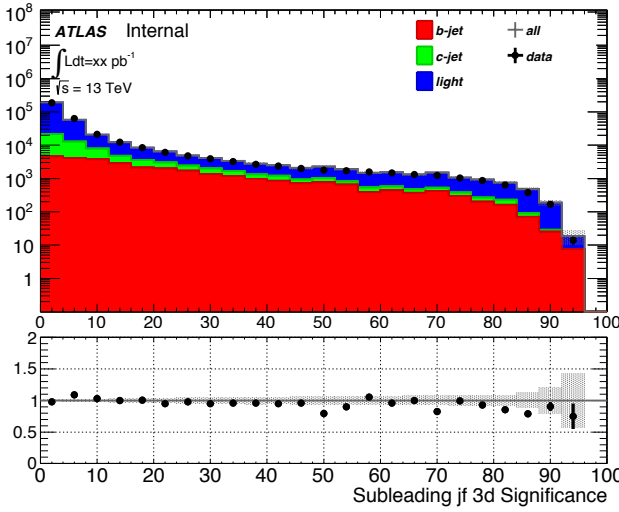


JF 3D Sig

Sub-Leading Jet:



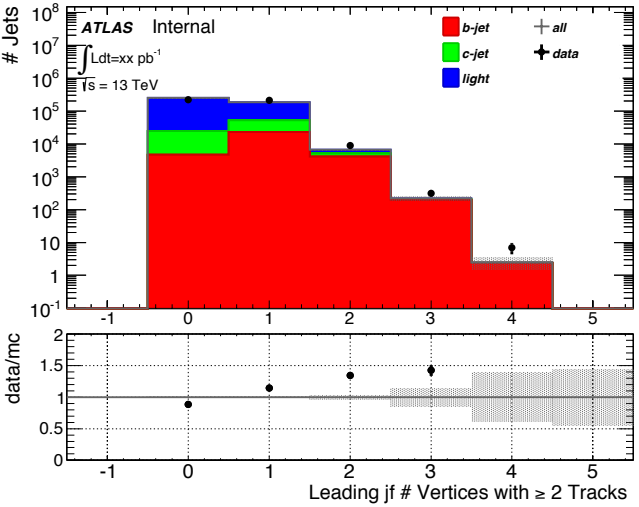




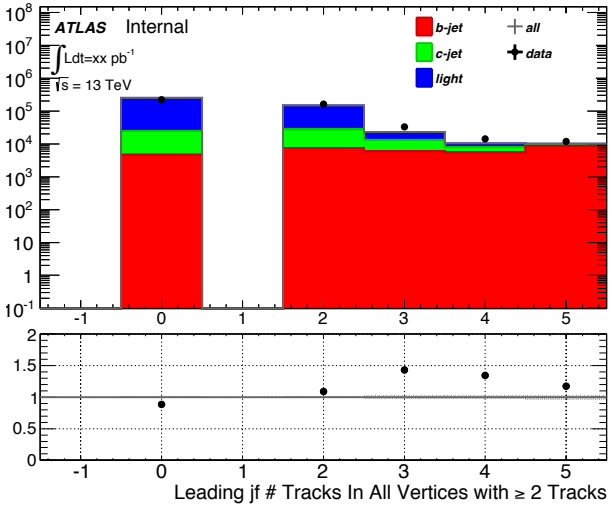
JF Variables Cont.

Only Filled if a Jet Fitter Vertex is found

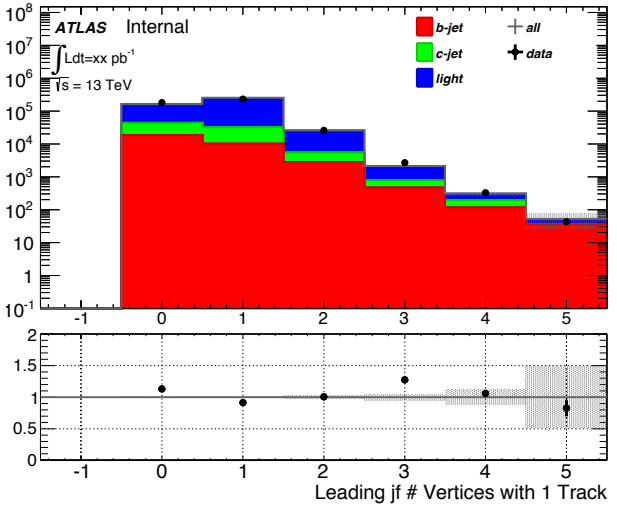
Leading Jet:



Vertices with at least 2 Tracks

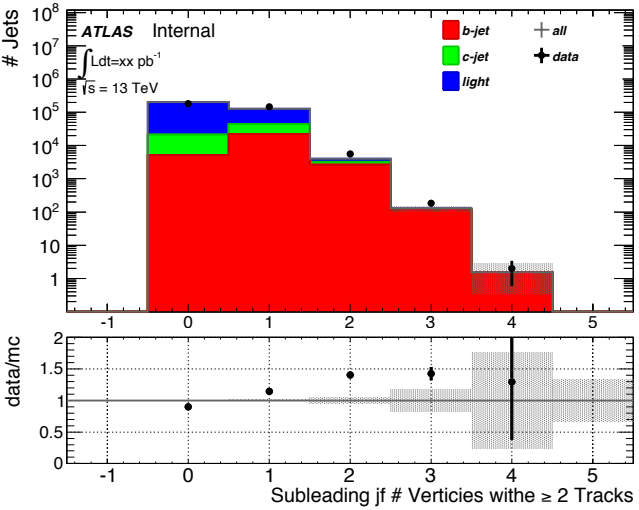


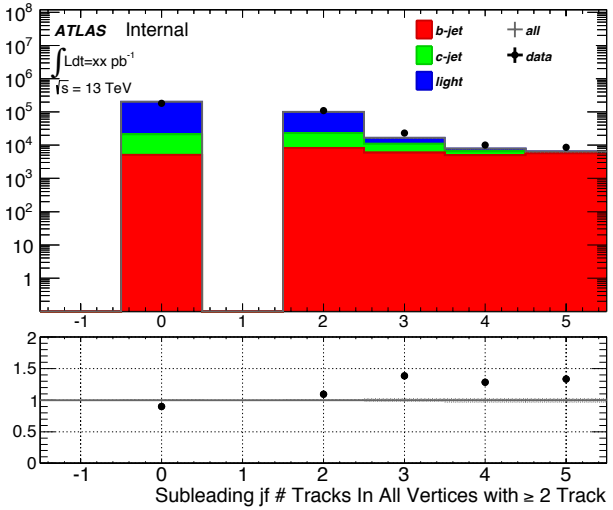
Tracks at Vertices with at least 2 Tracks

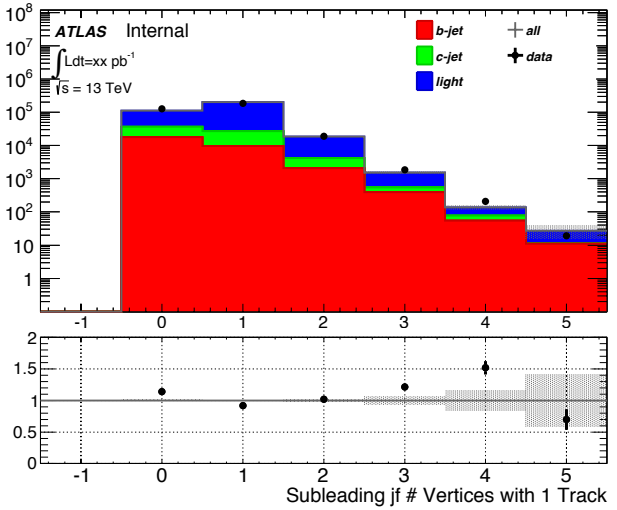


Vertices with 1 Track

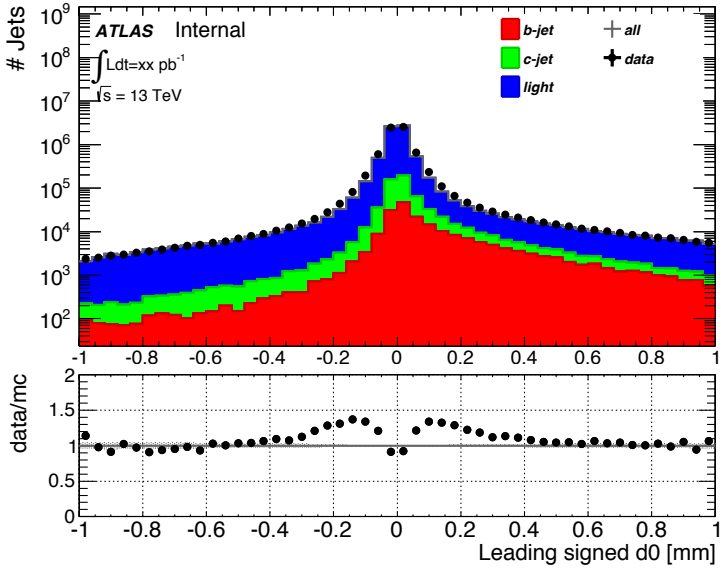
Sub-Leading Jet:

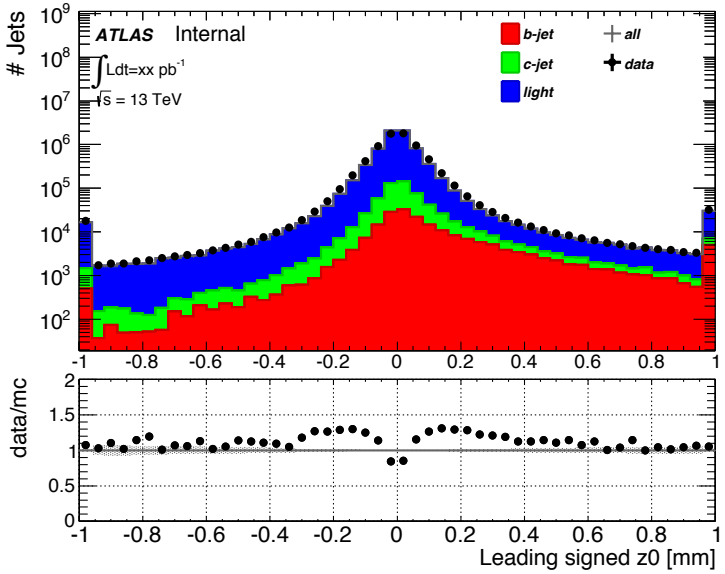






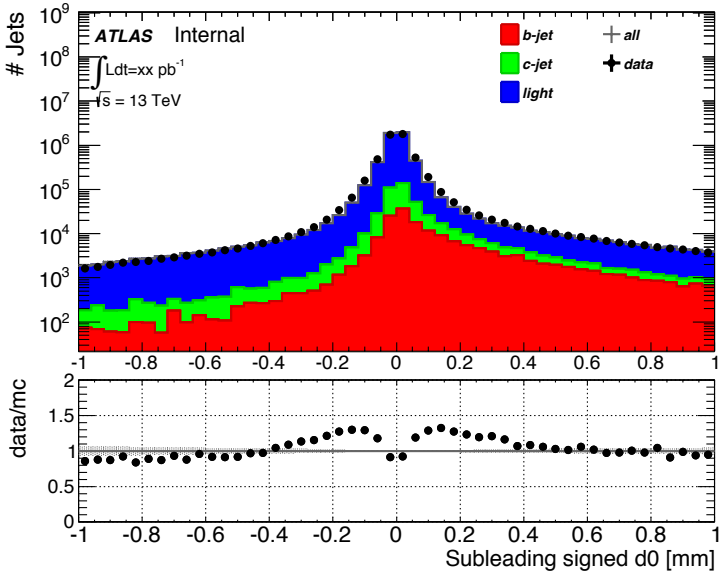
Leading Jet:



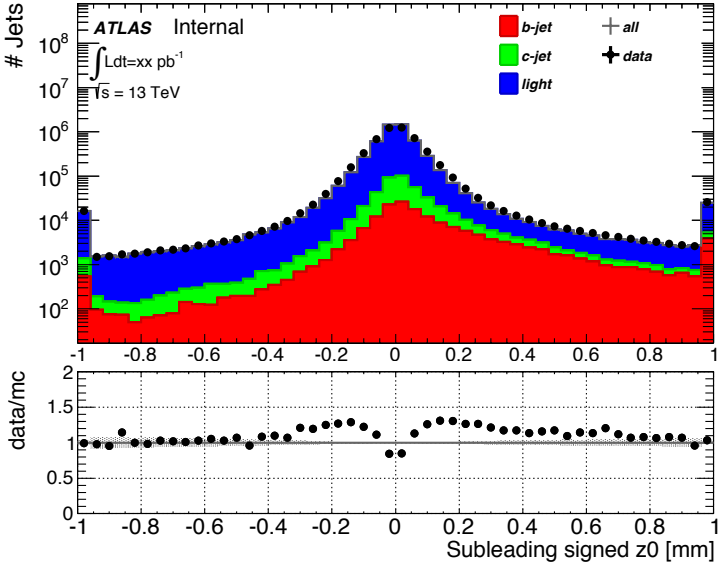


Sub-Leading Jet:

IP3D d0

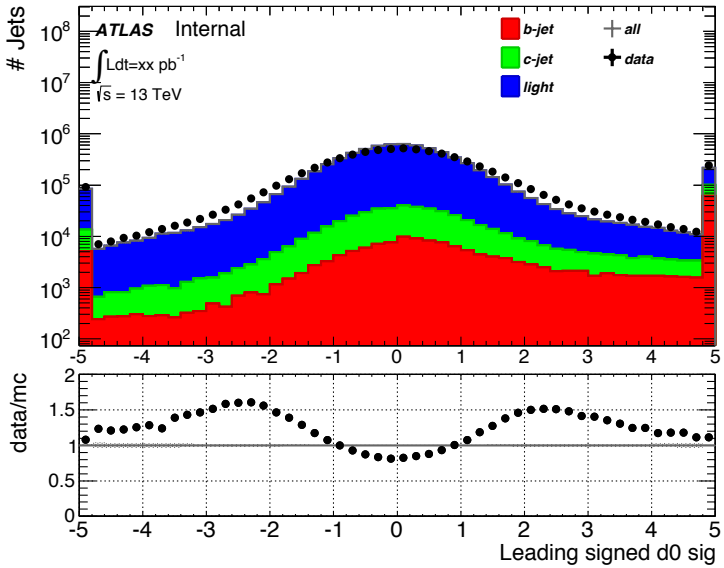


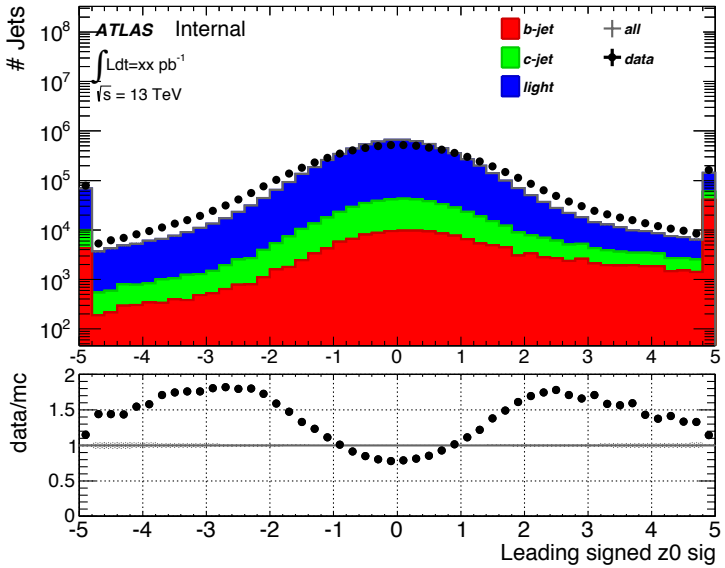
IP3D z0



IP3D d0 sig/ z0 sig

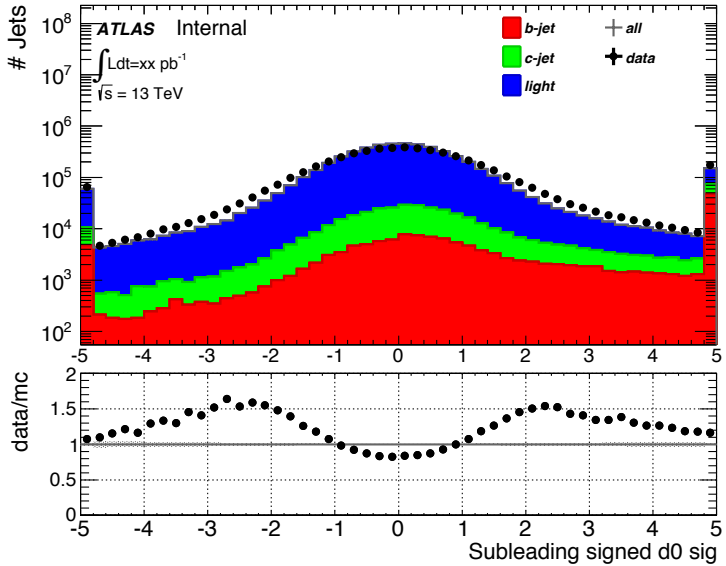
Leading Jet:



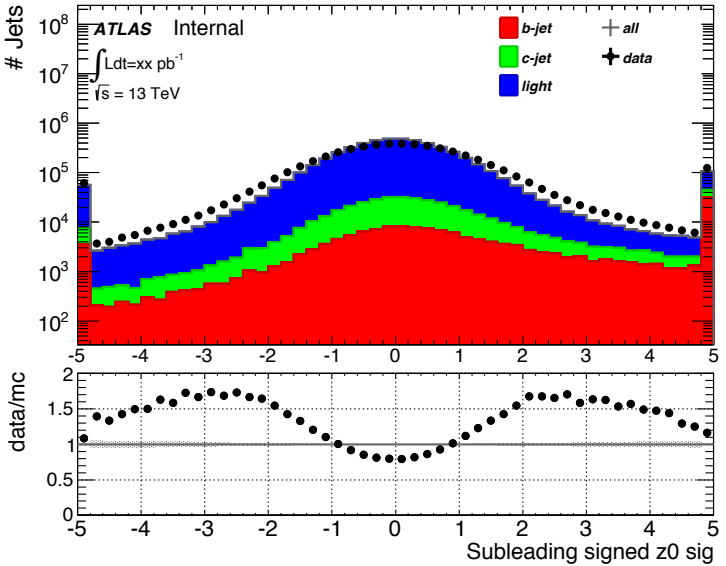


Sub-Leading Jet:

IP3D d0 sig



IP3D z0 sig



Conclusions

- The plot making framework is in place and first version of all plots made.

- Some good agreement: Kinematic and Input Tagger Quantities.

- Still some disagreements - outputs of taggers, d0 and z0 significance.

- Need to push on with documentation for Pub Note:

- We are a tight time scale for EPS.