BTAG Commissioning in ATLAS Experiment in 2010

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April 7, 2011

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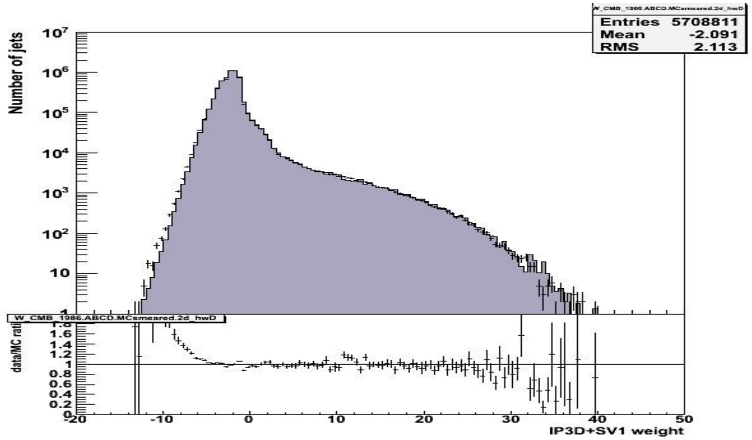
Outline

- Introduction to BTag Commissioning
- Status of Commission from 2010 Data
- Performance Study
- Summary and Prospect

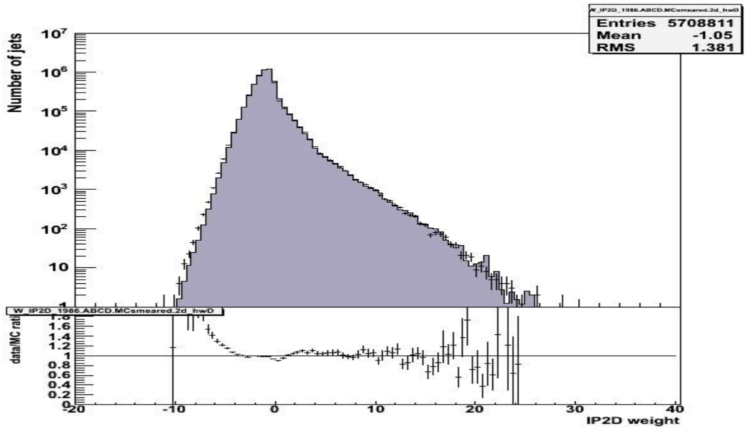
Introduction

- What is BTag : to select b jet out from light(from u,d,s quark or gluon) or charm jet
- Why Btag : Important to a lot of physics analysis channels
  - B jet as signal : any channel include top production
  - B jet as background : .i.e WH(H->WW) need b veto
- How to do Btag : B quark is heavy(~5GeV) and decay slowly ($c\tau$~1mm), that alllows
  - Btag via secondary vertex : SV0(decay length significance) ,
  - Track Imapct parameter information : IP2D, TrackCounting, JetProb
  - Advanced Tagger, combination of jet variables: JetFitter(NN), SV1+IP3D…
- Btag Commssioning:
  - Need to understand the performance of the taggers
    - The performance of taggers may be affected by multiple facts : condition, trigger configuration, luminosity .e.t.c.
  - Also do performance study
    - To improve the performance
    - To make our algorithm fit the situation we will meet in the future(Pile up .e.g)
  - All these work are in progress

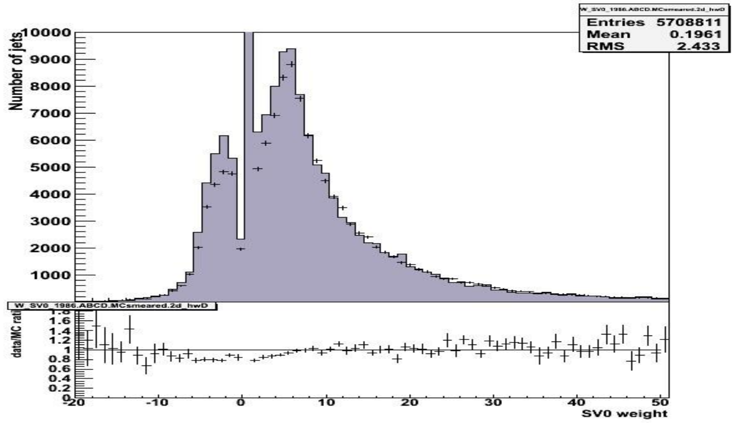
BTagging Commissioning Status(contributed from Nicolas Bousson)
Tagging Weights



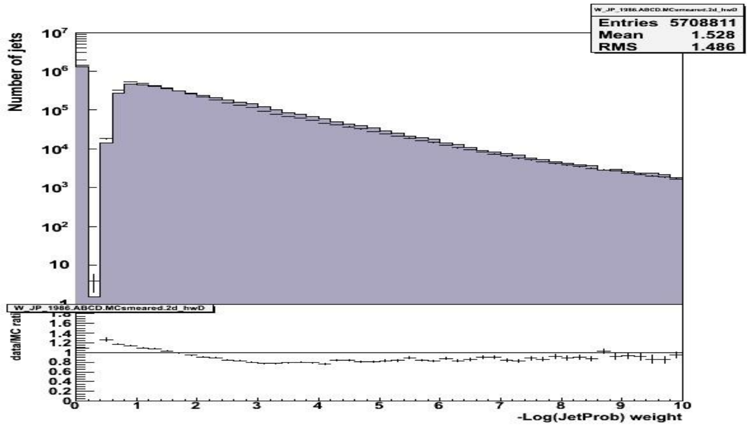
IP3D + SV1 tagger weight :data period A-D



IP2D tagger weight : data period A-D



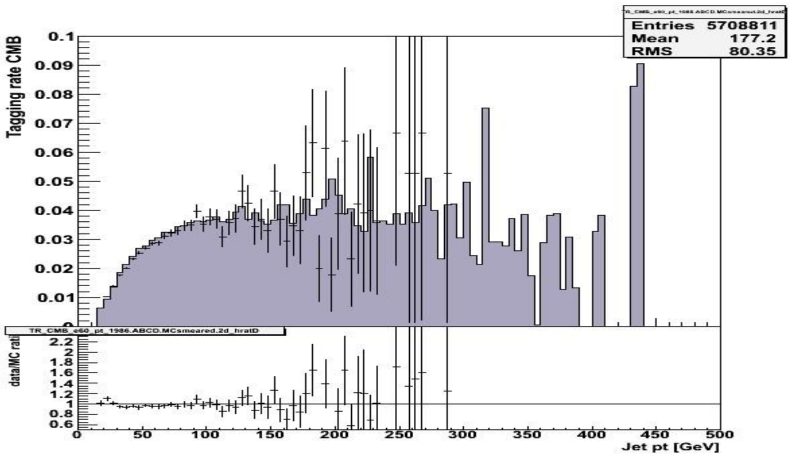
SV0 tagger weight : data period A-D



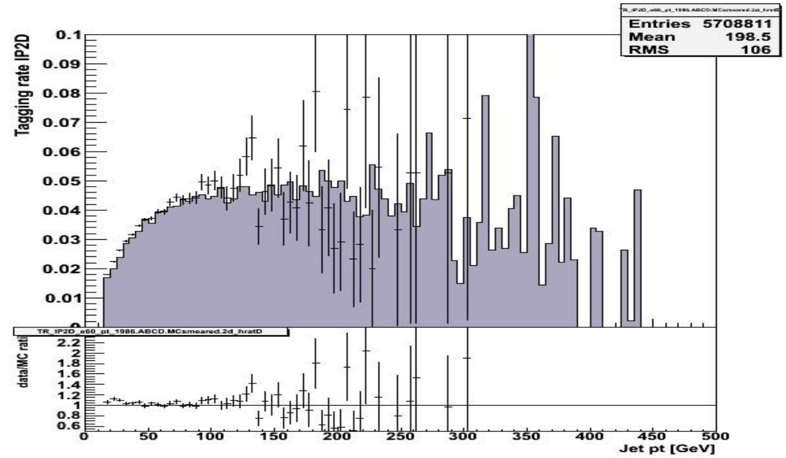
Jet Prob Tagger : data period A-D

MC fit data well in tag weight

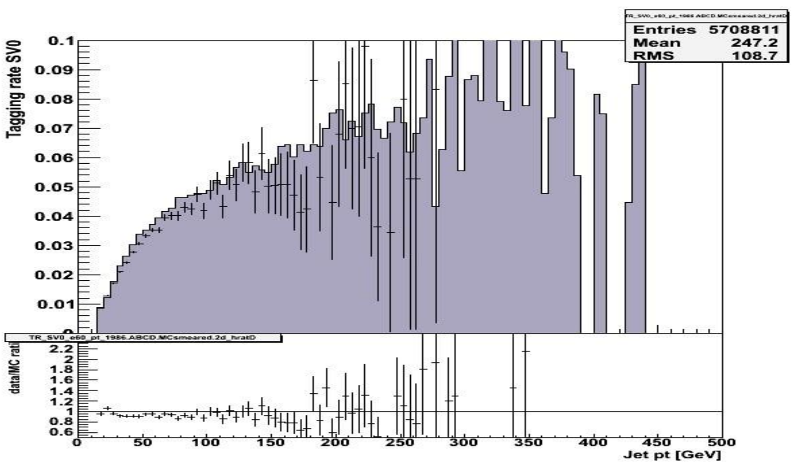
BTagging Commissioning Status: Tagging Rate



IP3D+SV1 Tag Rate (data Period A-D)



IP2D Tag Rate (data Period A-D)



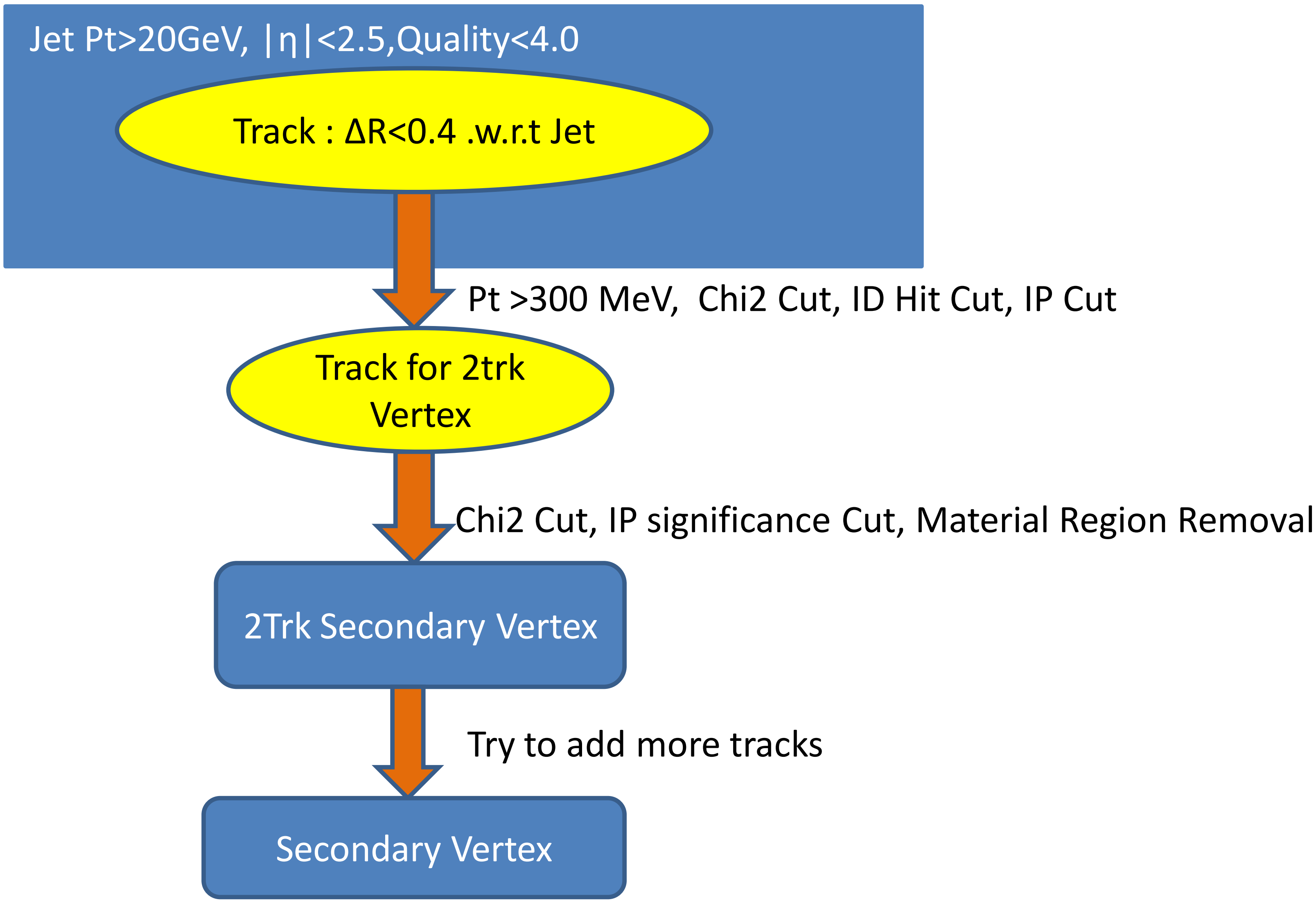
SV0 Tag Rate (data Period A-D)

- MC Tag Rate fits Data Well
- The results for latest runs are also in progress

Performance Study: Secondary Vertex Reconstruction

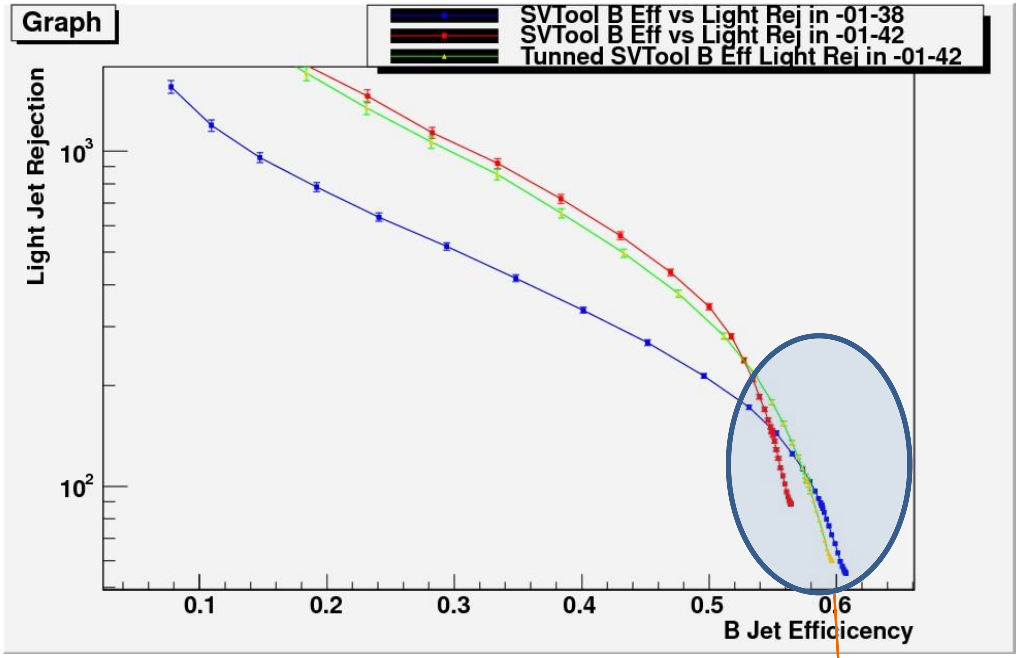
- SV taggers performance are strongly depend on secondary vertex reconstruction
- To improve the sv tagger performance by tuning the secondary vertex finder
- The result may applied in release 17
- Many thanks to Vadim Kostyukhin

Secondary Vertex Reconstruction



Secondary Vertex Reconstruction Performance Comparison(1)

- InDetVKalVxInJetTool-00-01-38
  - As a benchmark
- Default InDetVKalVxInJetTool-00-01-42
  - Tight AntiFake 2TrkVertex Cut: reject sv far from impact point(tight)
- Tunned -00-01-42
  - tunning on trksig cut, sv chi2 cut

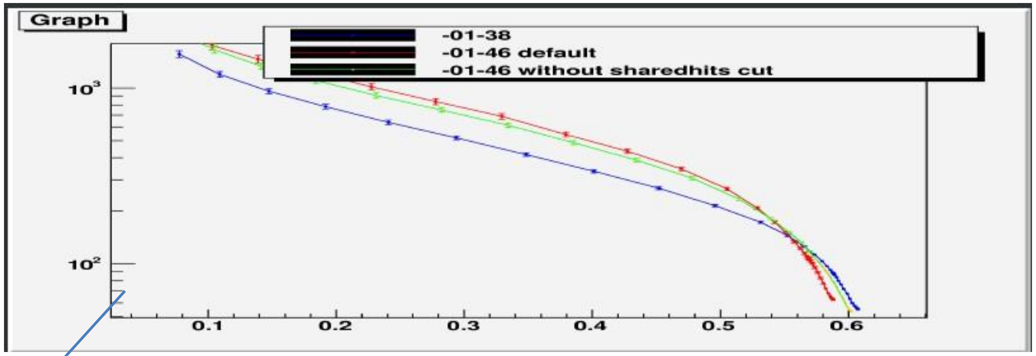


SV0 Performance

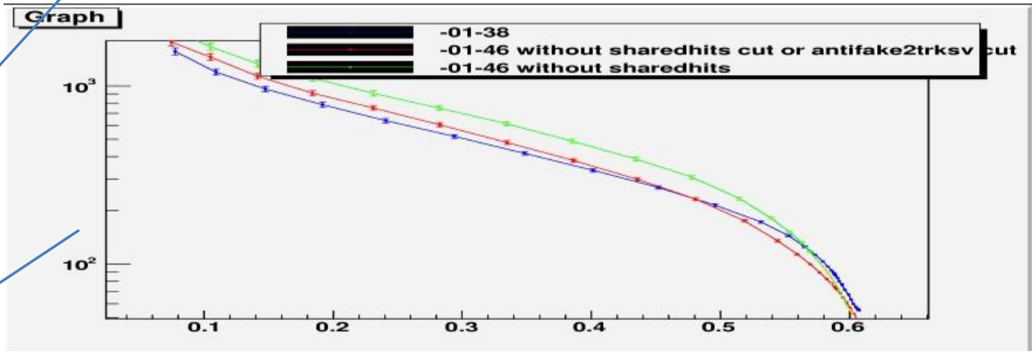
Significantly Higher Rejection, but lower sv reconstruction efficiency(make performance worse in high efficiency region). By tuning the cut in -00-01-42, we improve the performance in high efficiency region. Meanwhile the AntiFake2TrkVrt cut may be too tight.

Secondary Vertex Reconstruction Performance Comparison(2)

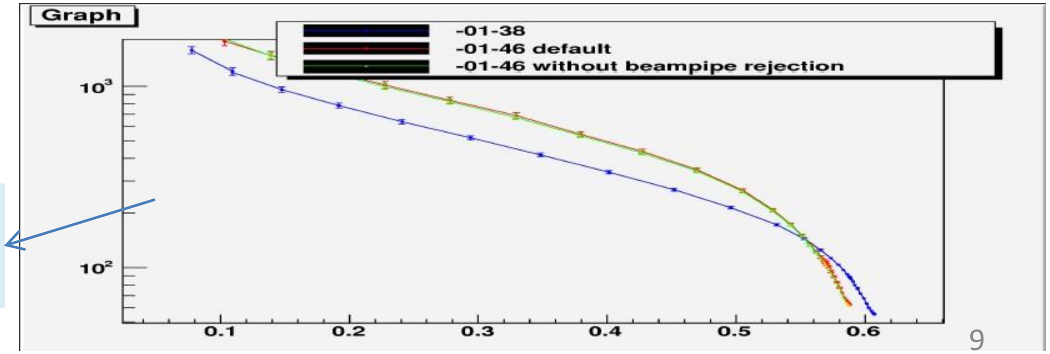
- InDetVKalVxInJetTool-00-01-38
  - As a benchmark
- InDetVKalVxInJetTool-00-01-46
  - Moderate anti fake 2trk vertex cut
  - Beam pipe rejection for sv
  - Shared track rejection



Shared Hits Cut doesn't help in high efficiency region



We cannot abandon antifake2trk vertex cut



Beam pipe rejection doesn't hurt performance

Conclusion from SV Tuning

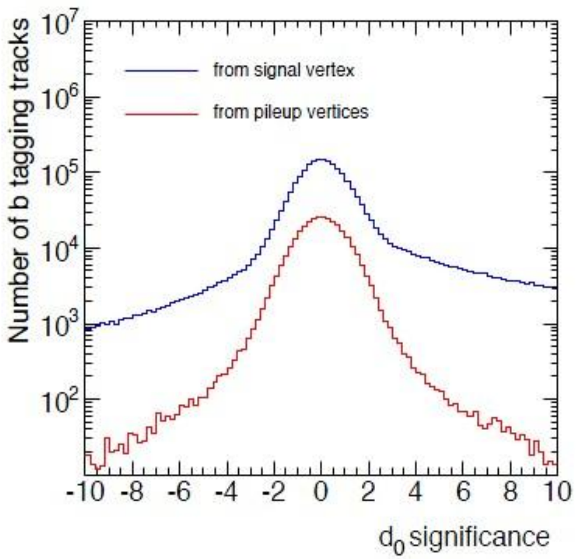
- A set of secondary vertex cut configuration (will be applied in future release)
  - Moderate antifake 2trk vertex cut
  - No Shared track rejection
  - Tunned value of track significance and sv chi2 cut
  - Beam pipe rejection doesn't have significant effect on the performance

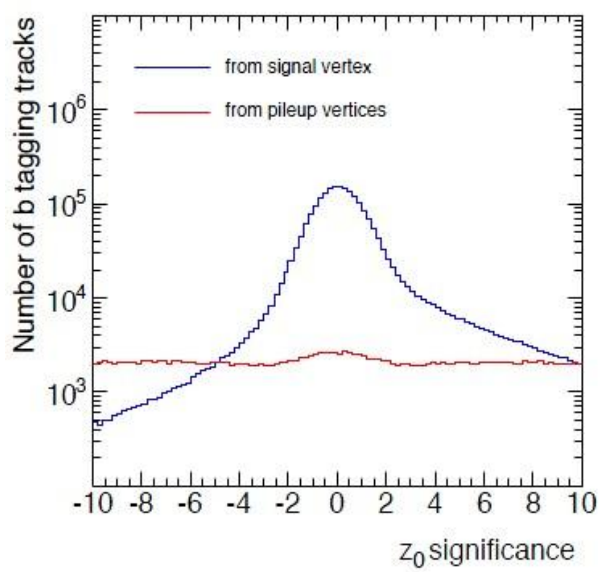
Pileup Cuts Performance Study (in progressing)

- More and more Pile-ups (6 currently, will up to 13 later this year)
- We want robust cuts against pile up
- So:
  - Data Set: Pile up QCD dijet sample with bunch train
  - Do the retagging (only IP2D are recalibrated now, un-recalibrated result was in back up) with different pile up cut configuration
  - Compare the performance between different pile up cuts on track selection

Cuts on Tracks against PU

- Hits Cuts
  - Default(no pile up consideration)   Pile Up Hits Cuts
    - nPix Hit>=2   ->   same
    - nSi Hit>=7   ->   nSiHit>=9
- d0%z0 AntiPU Cuts (inspired from IBL Study by Laurent and Nicolas)
  - If track D0Sig<3.0 and trackZ0Sig>3.8, reject this track





PU Cuts Study
Results : Relative Rejection Plots

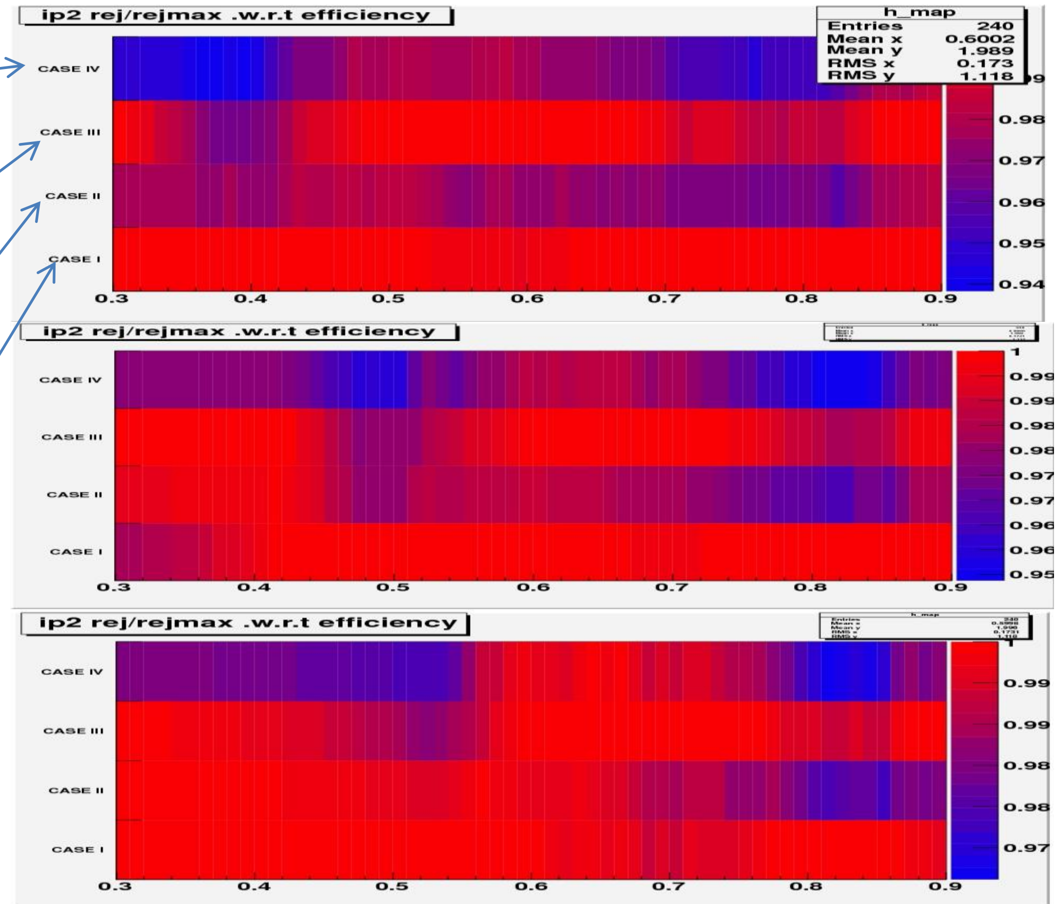
IP2D Relative Rejection Plots

- CASE IV
  - PU hits cuts withd0%z0
- CASE III
  - D0%z0 PU Cuts
- CASE II
  - PU Hits Cut
- CASE I
  - No pile up consideration

J2

J3

J4



Rejection is a function of efficiency : rej= rej(eff), and relative rejection is defined as: rej(eff)/(Maximum(rej_case_I(eff),rej_case_II(eff),rej_case_III(eff),rej_case_IV(eff)))

PU Cuts Study
Conclusion

- For IP2D antiPU improve the performance in some region
- These cuts have been put in rel 16.6.x.y but not applied in dataset production yet
- We need to do that for more taggers (so far only IP2D are recalibrated)

Summary and Prospect

- The ATLAS Btag Commissioning work is progressing and encouraging in 2010, although it is really hard work
- In 2011 the we will meet hasher conditions but we are confident to continue making progress and more advanced tagger would be used soon

Back Up
Data Set

- Data :2010 runs Period A-I (35pb^{-1}) by 2010 autumn reprocessing
  - Period A-D with L1Calo Stream
  - Period E-I with JetTauMissingEt Stream
- MC , QCD Dijet (Pt_true : 8GeV-1120GeV)
  - No Pile up sample
  - Pile up sample (with bunch train pile up)
  - Also use ttbar sample in some performance study

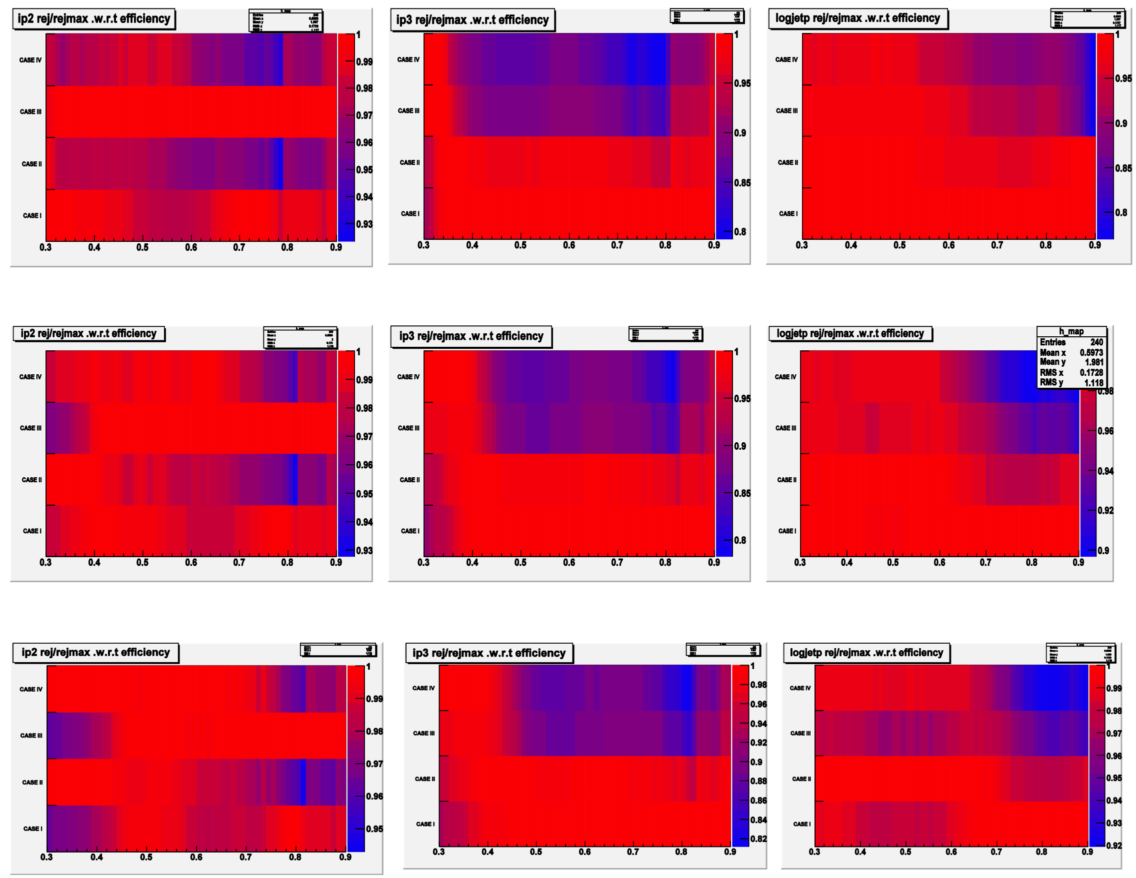
Back_up
Secondary Vertex Reconstruction Efficiency

	SV0		SV1	
	B Efficiency	Light Rejection	B Efficiency	Light Rejection
Old Version All Jet(01-38)	55.1	60.7%	30.4	67.8%
Old Version High Pt(38)	17.5	71.7%	10.2	75.2%
Default All Jets(01-46)	62.5	58.8%	39.1	65.6%
Tunned All Jets(01-46)	42.2	61.3%	25.9	68.4%
No SharedHits All Jets(46)	53.9	60.3%	35.8	67.2%
No BeampipRej(01-46)	61.5	58.8%	38.9	66.0%
Default HighPt Jets(46)	23.8∓0.8	(65.8∓0.3)%	14.4∓0.4	(70.3∓0.3)%
Tunned Highpt Jets(46)	16.6∓0.6	(70.8∓0.5)%	10.6∓0.3	(74.9∓0.5)%
No SharedHits HighPt(46)	19.1∓0.5	(69.7∓0.3)%	12.6∓0.3	(73.3∓0.3)%
No BeampipeRej HighPt(46)	23.5∓0.6	(65.7∓0.3)%	14.1∓0.3	(70.1∓0.3)%

Backup
Unrecalibrated Results : Relative Rejection Plots

- CASE I
  - Default(no pile up consideration)
- CASE II
  - Hits Cut
- CASE III
  - D0%z0 PU Cuts
- CASE IV
  - PU cuts withd0%z0 PU cuts

	IP2D	IP3D	JetProb
J2			
J3			
J4			



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