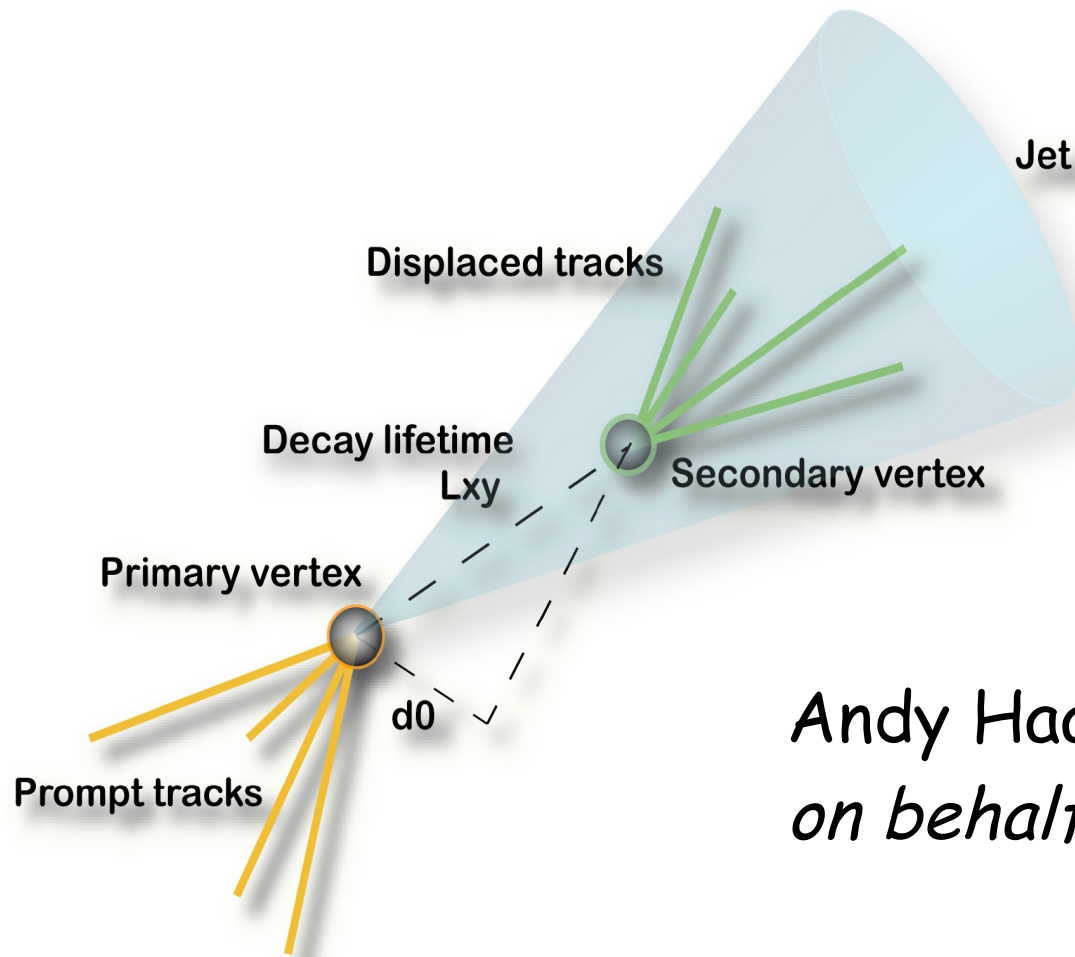


b-ID Status

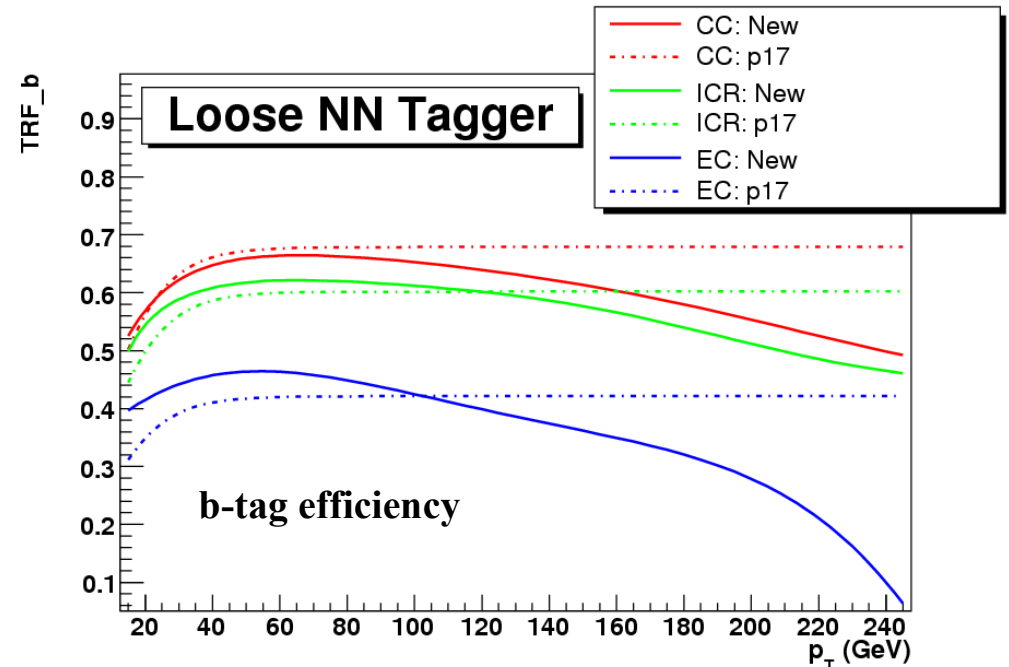
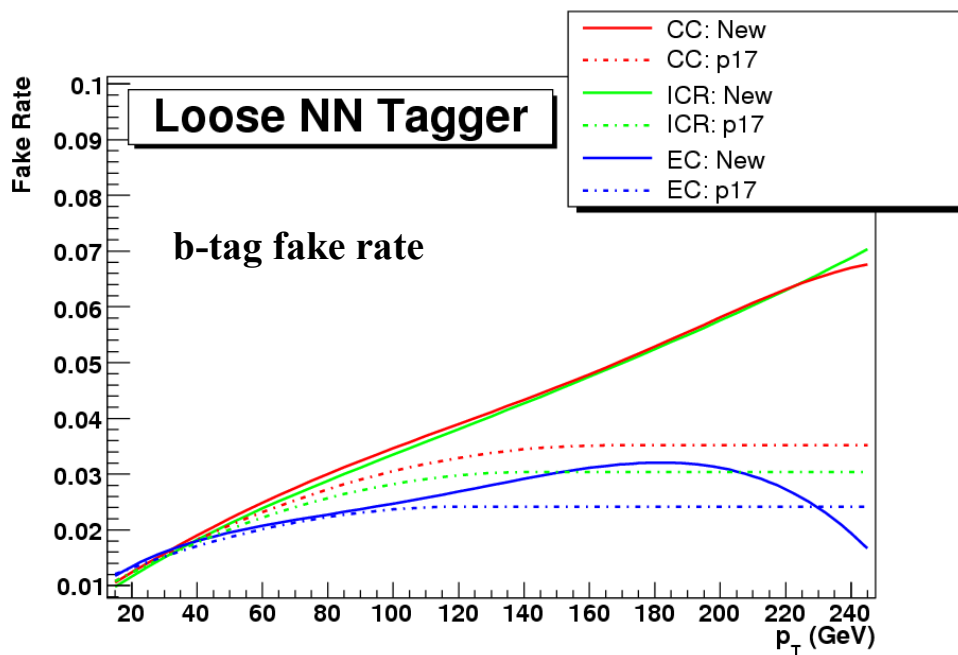


Andy Haas - Columbia University
on behalf of the b-ID group

D0 Collaboration Meeting @MSU
July 6, 2007

New TRFs

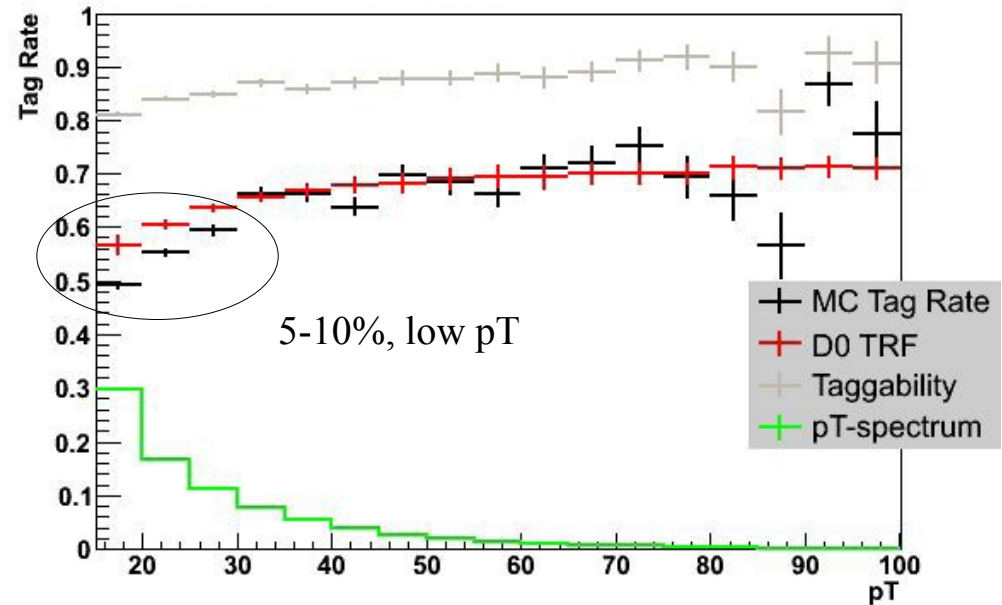
- **Tim Scanlon** has made new TRFs for p17 JLIP and NN
 - Extends to higher p_T
 - Separate p_T parameterization for each $|\eta|$ bin, so smaller systematic uncertainties
- Will be added to (p17) btags_cert soon, so can be used in CAFE
 - Some beta-testers have already tried this out
- We will eventually use the updated nn_cert for p20 certification
 - But want to take just one step at a time



TRF W/Z+bb Discrepancies

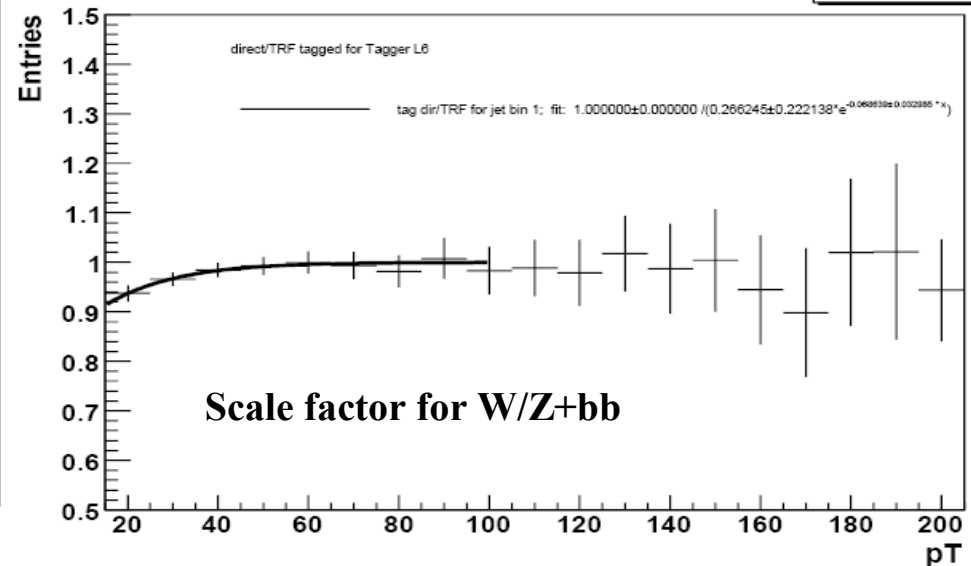
- Studied TRFs for *gluon-splitting* samples, like W+bb, Z+bb
 - Observe a 5-10% *overestimate* of the TRF, compared to actual tagging in MC at low pT
 - Due to lower b-quark momentum (as a fraction of the jet momentum) in these samples
- **Yvonne** has measured a correction for this
 - Will be put into BTagProcessor...
 - You will tell it that you're running on W/Z+bb and the TRF will be corrected

Tag Rate vs pT, Wbb_excl (0<|η|<2.4)



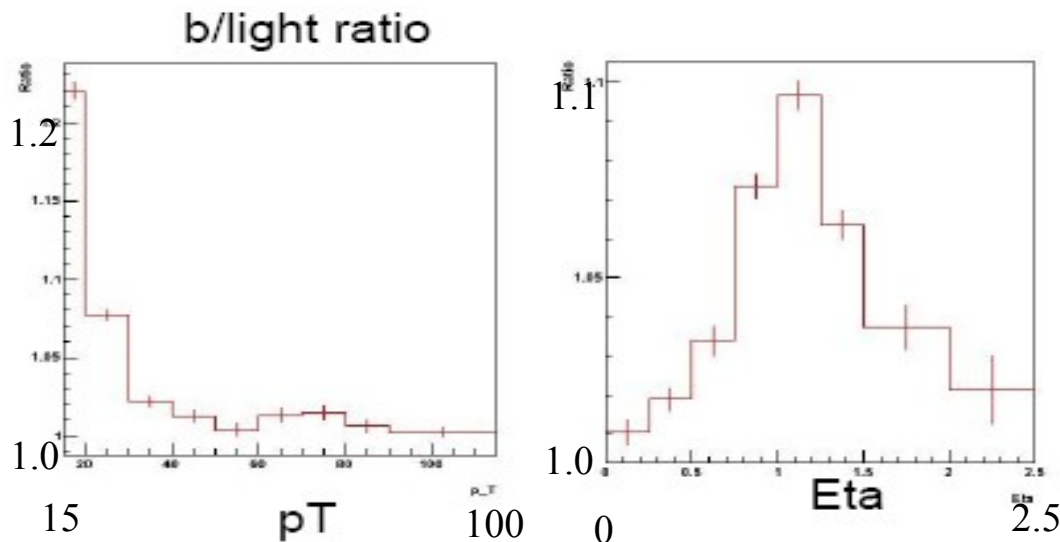
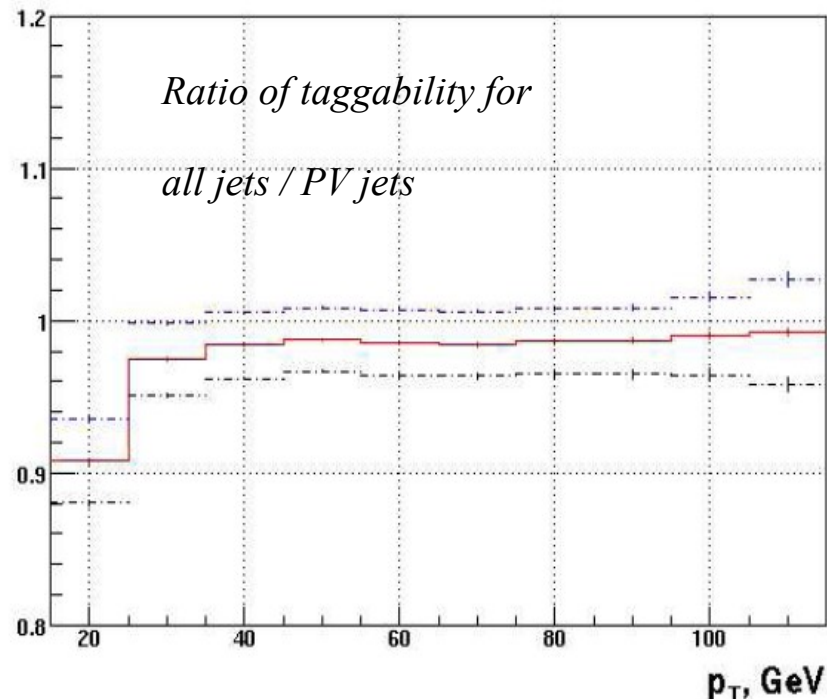
pT of b jets after direct tag for 1 jet bin

Mean	110
RMS	54.51



Taggability Issues

- **Thorsten** worked on the taggability processor
- Checked into CVS: btags_cert_caf
- BTagProcessor is able to apply parameterized taggability
- We are *underestimating* the taggability for jets from the PV at low p_T by 5-10% and 2% at high p_T
 - Not yet fixed in new processor...
- Has made progress on the *flavor dependence*...
 - Still need to study *tau* dependence...
- **In beta-testing... users are having success**



← **Taggability for b/c's goes up!**
20% at 15 GeV
10% in ICR

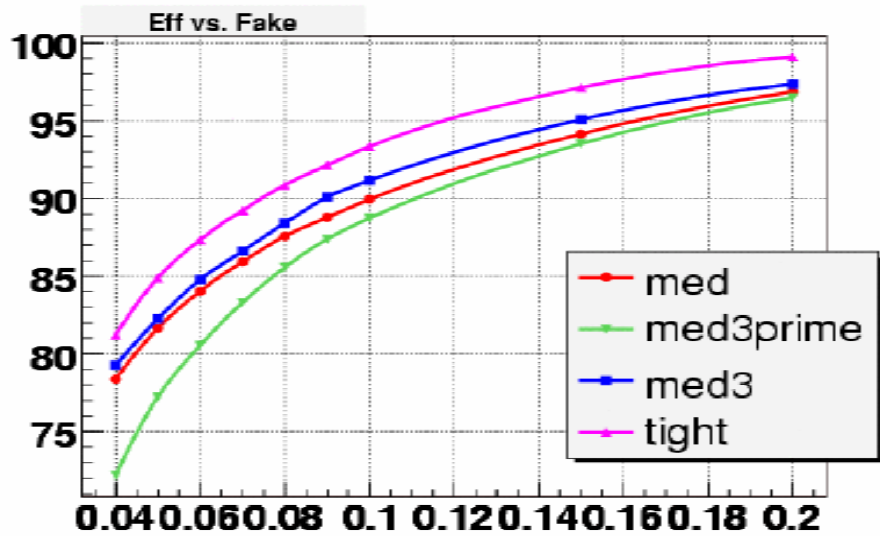
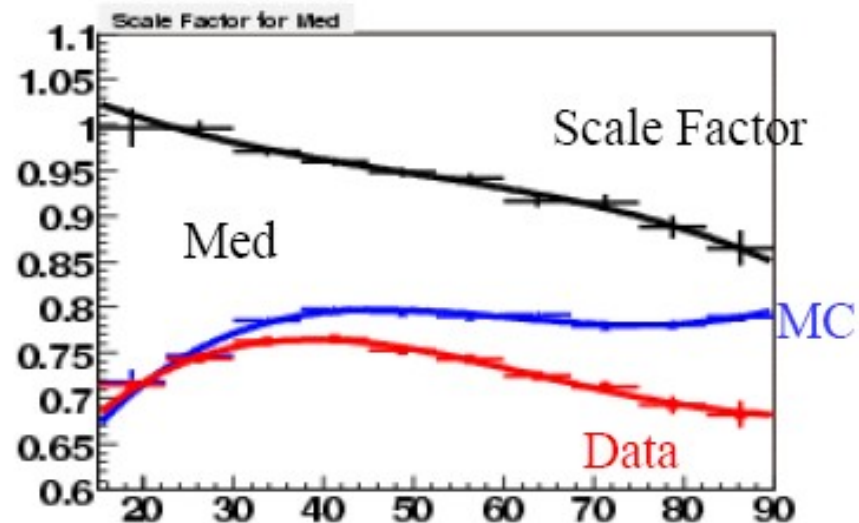
To do...

- **A couple big holes (in addition to the projects “underway”)**
 - **No TRF has been measured for taus!**
 - Just using the light-jet fake rate
 - We know this is wrong. Taus are tagged about as often as charm (after taggability)
 - **No light-jet data/MC scale factor!**
 - Can not do a “direct tagging” analysis involving light jets

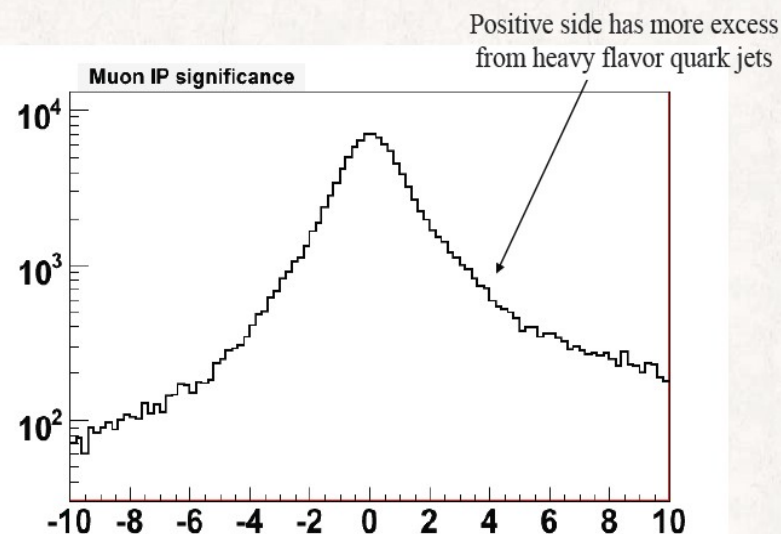
Muon Soft-lepton Tagger (NN)

- Hwidong**

- Adds ~5% efficiency to b-ID / negligible extra fake rate
- Have measured the tagging efficiency in data and MC!
 - Modified System8 method used
- Now working on measuring fake-tag-rate
 - Using Negative Tag Rate method based on muon IP significance
- **Next hurdle is the data/MC scale factors for the *muon* efficiency and fake rate in the jet**



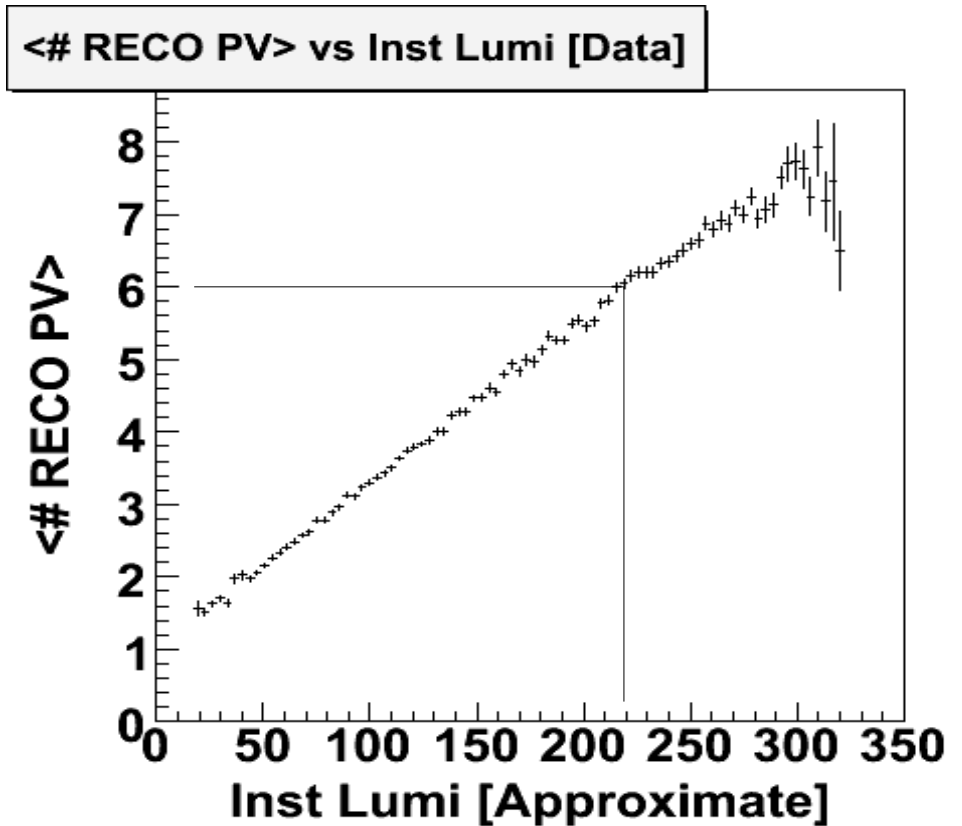
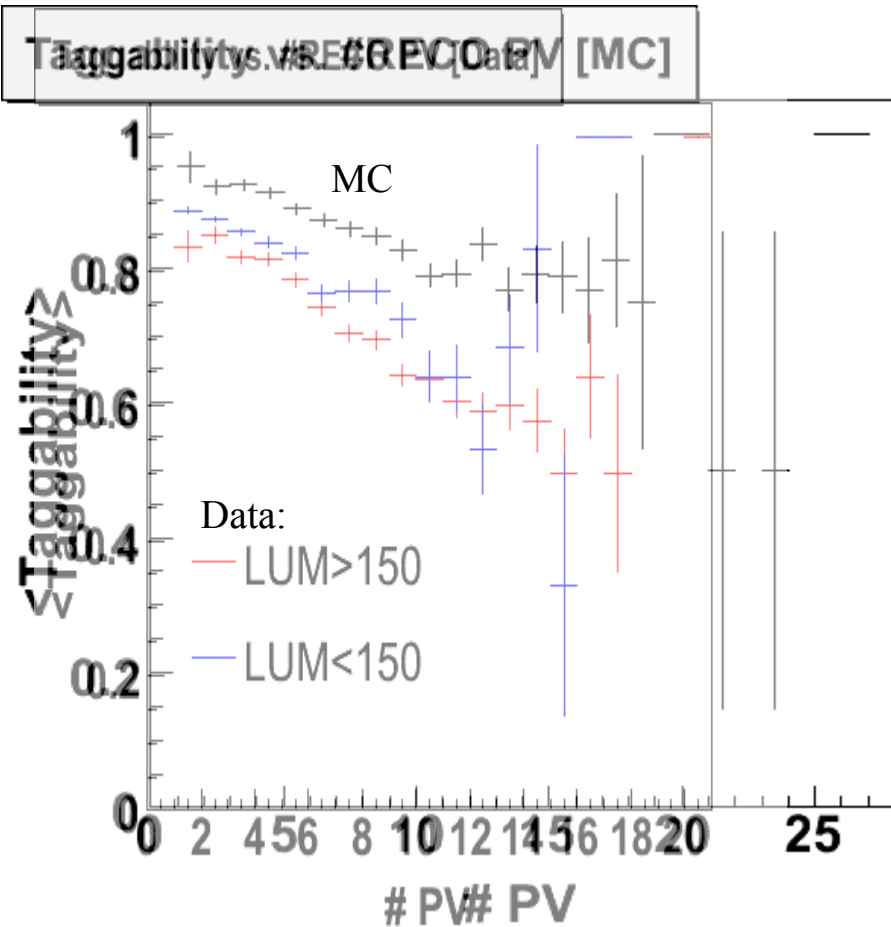
- We use Muon IP significance for NTR method



High Luminosity Studies

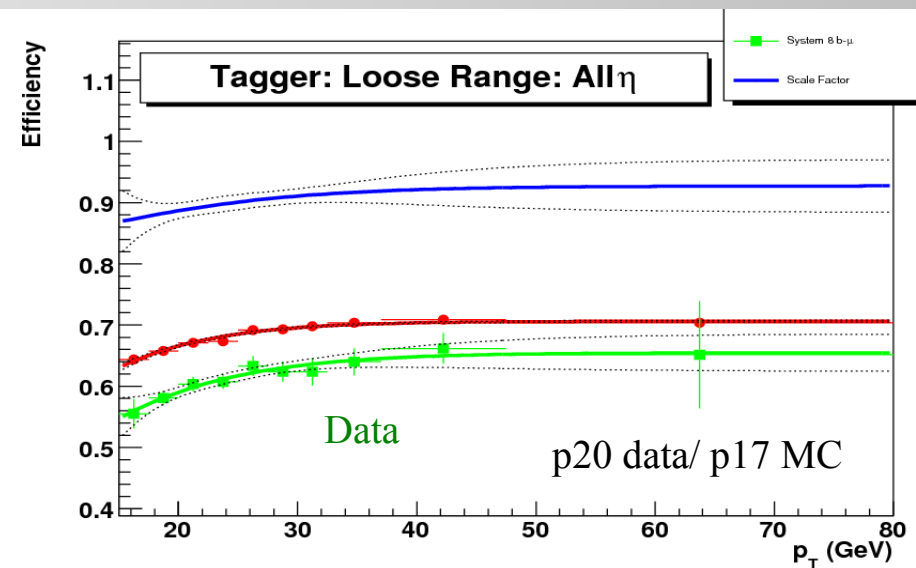
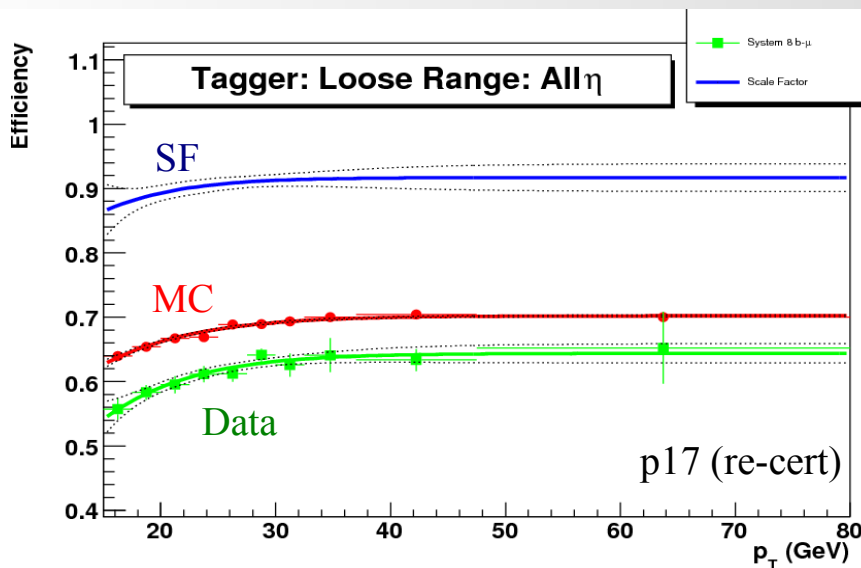
- Alejandro and Don (and Suneel)**

- b-id works fine at high luminosity, but taggability starts to suffer...



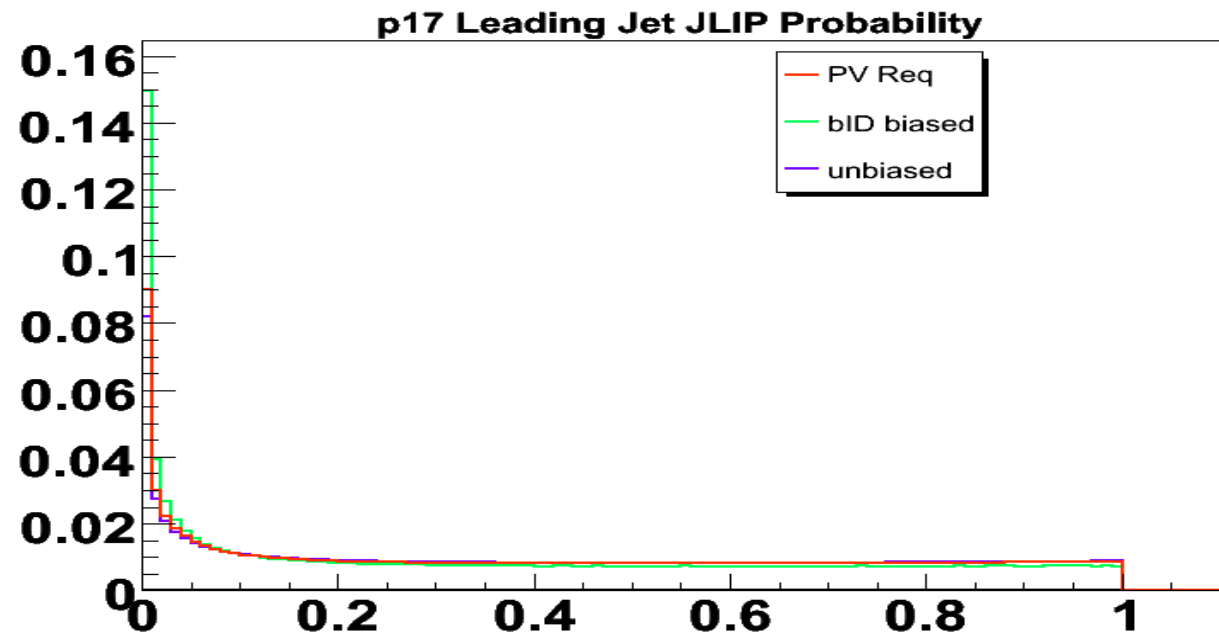
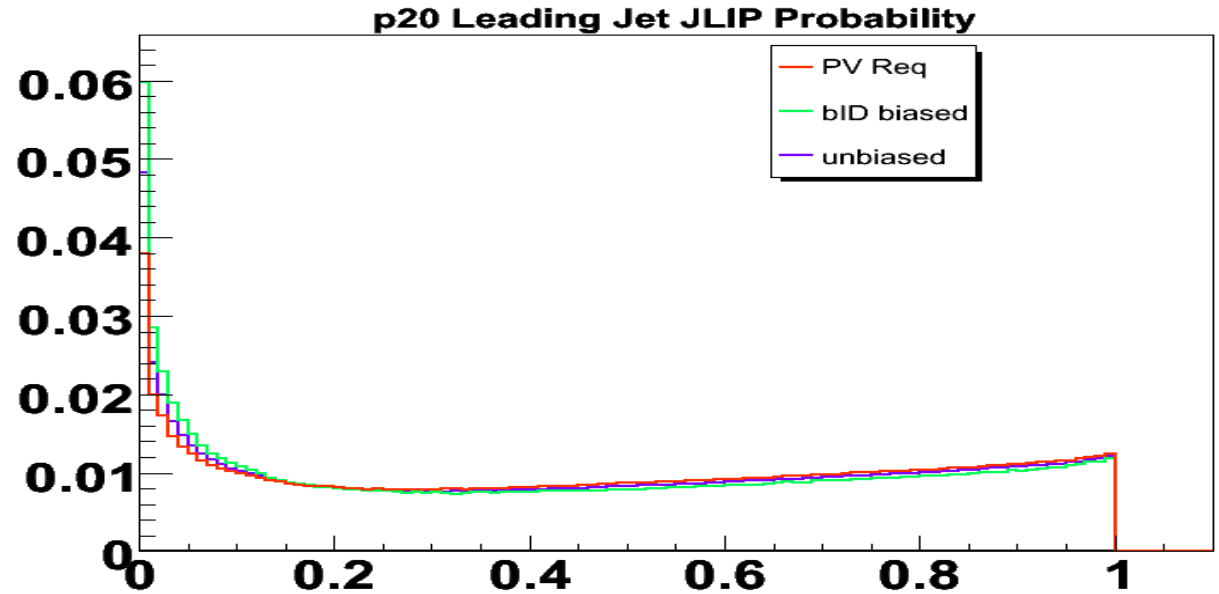
p20 NN Certification

- **Sarah Schlobohm + Andy Haas + Dale Johnston**
 - Have run several “certifications” so far:
 - Re-cert p17 data / MC (to cross-check with old p17 certification)
 - p20 pass1 data / p17 MC
 - p20 pass2 data / p17 MC
 - So far, using p17 NN tagger... results on p17 and p20 data are similar...
 - Need the “p20 NN tagger” -> **Needed p20 MC, now have it!**
 - Re-tune JLIP on p20 pass2 data and p20 MC -> **DONE!** (Thanks, Daniel Bloch!)
 - Re-train NN (with retrained JLIP) on p20 MC -> **IN PROGRESS**



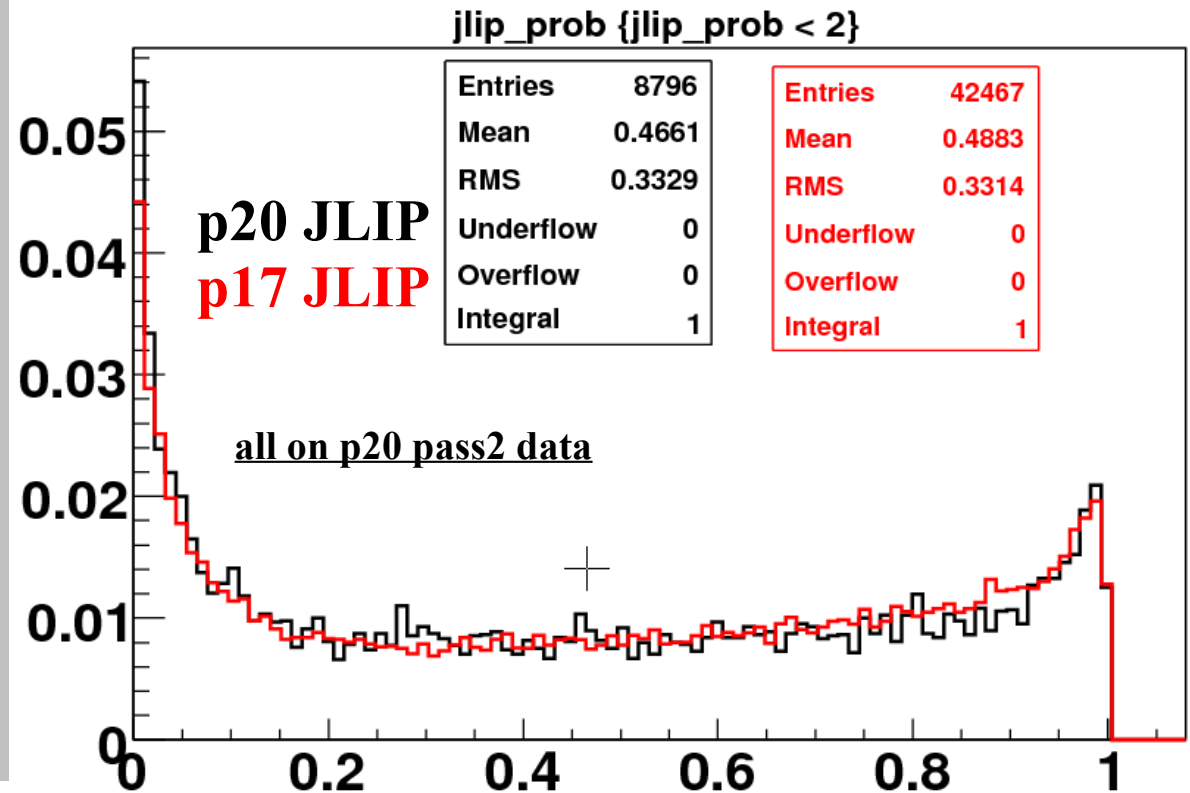
JLIP problems

- Problem seen in p20 JLIP inputs, compared to p17
- Much weaker discrimination in p20...



Re-tuned JLIP

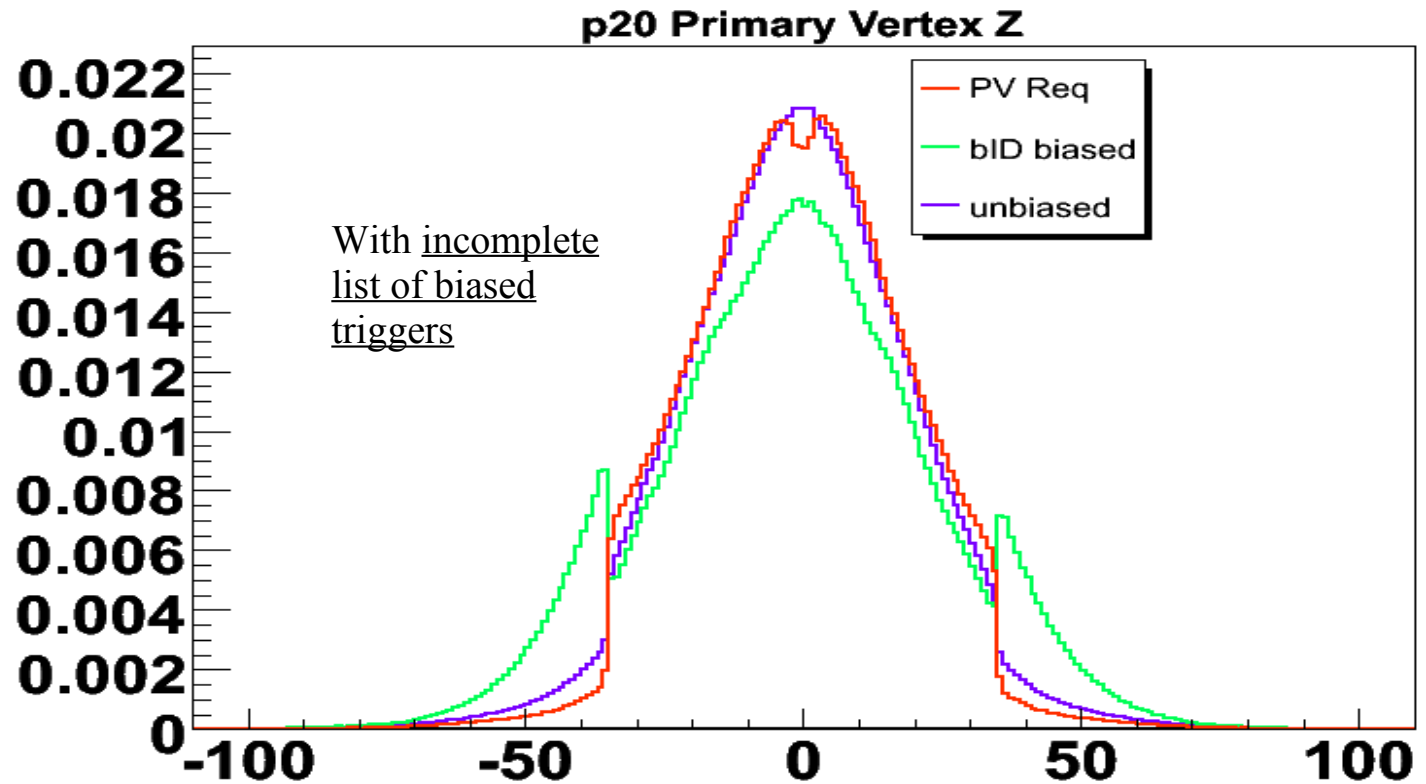
- re-tuned JLIP appears to be working better now!



p20 Trigger Issues

- **Dale Johnston**

- Important to exclude “biased” triggers when studying b-id efficiencies / fake-rates
- List of biased triggers has been re-examined and fixed up...



b-ID Status

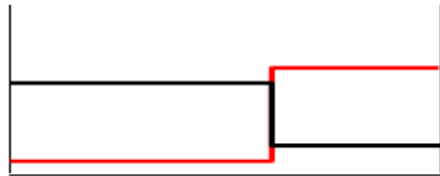
- Many improvements worked on lately, will be available soon:
 - New TRFs with higher pT range and smaller uncertainties
 - A correction for W/Z+bb TRFs
 - A taggability processor, with corrections for b,c,tau jet flavors...
- Inst. luminosity dependence studies well underway
- Muon soft-lepton tagger is maturing, fake-rate being measured in data
- We have preliminary p20 (pass2) NN TRFs!
 - But performance on p20 data is about the same as for p17 data...
 - Have re-tuned JLIP, will re-train NN --> Just got p20 MC!
 - Fixed up “unbiased” trigger list for p20 data
 - **Can use p17 TRFs for initial p20 studies**
 - **preliminary p20-tuned b-id ready by ~ end of July**
- A few major “holes” still exist (no one working on them yet...) !!!
 - tau TRFs, light-jet data/MC scale factors (needed for “direct-tag” analyses)
- Future projects:
 - Use of continuous NN output (many groups interested...)
 - b/c – jet separation (Brendan Casey, Gustavo et al.)
 - soft-electron tagger? b / g->bb separation?

Backup / Details

“Continuous” NN Output

- Several people have expressed interest in using the continuous b-ID NN output as a variable for *input* to a NN event selection
- Not an easy thing to do right!
 - MC and data do not give the same NN output shape!
 - There are several plausible methods for correcting the shape
- **Alan Magerkurth** has devised a way to use all 12 NN operating points
- **Mike Mulhearn** will investigate correcting the full output distribution, using the SF's, for use in a ME analysis
- **Gordon and John** are also interested in creating data TRF “functions” (TRFF's)

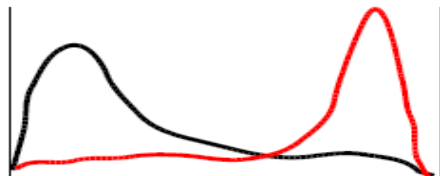
NN output (light, **b**)



What we're doing now



What I'm proposing



Best one could do

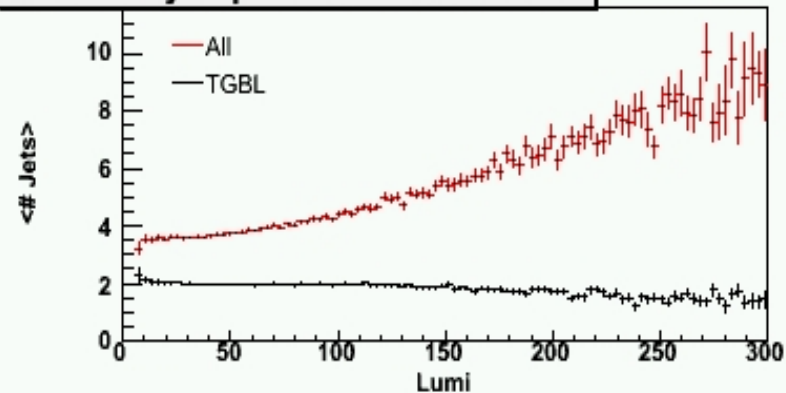
Inputs are all certified
Almost trivial to implement
Much better use of our b-tagging information



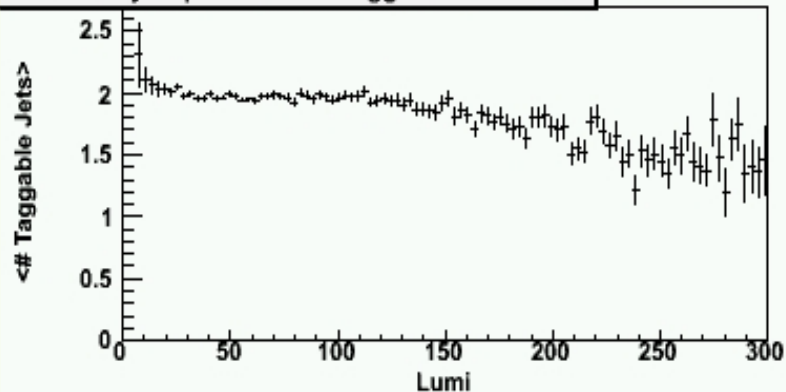
Inst. Luminosity Dependence

- **Suneel Dutt**
- Showed before that NN inputs / outputs are not sensitive to inst. lum.
- Taggability on average decreases with increasing inst. lum.
 - But taggability for “clean” events with <4 PV does not suffer at higher inst. lum.
- Can see average number of taggable jets start to fall off around $\sim 150e30$

Luminosity Dependence of Jets JT95

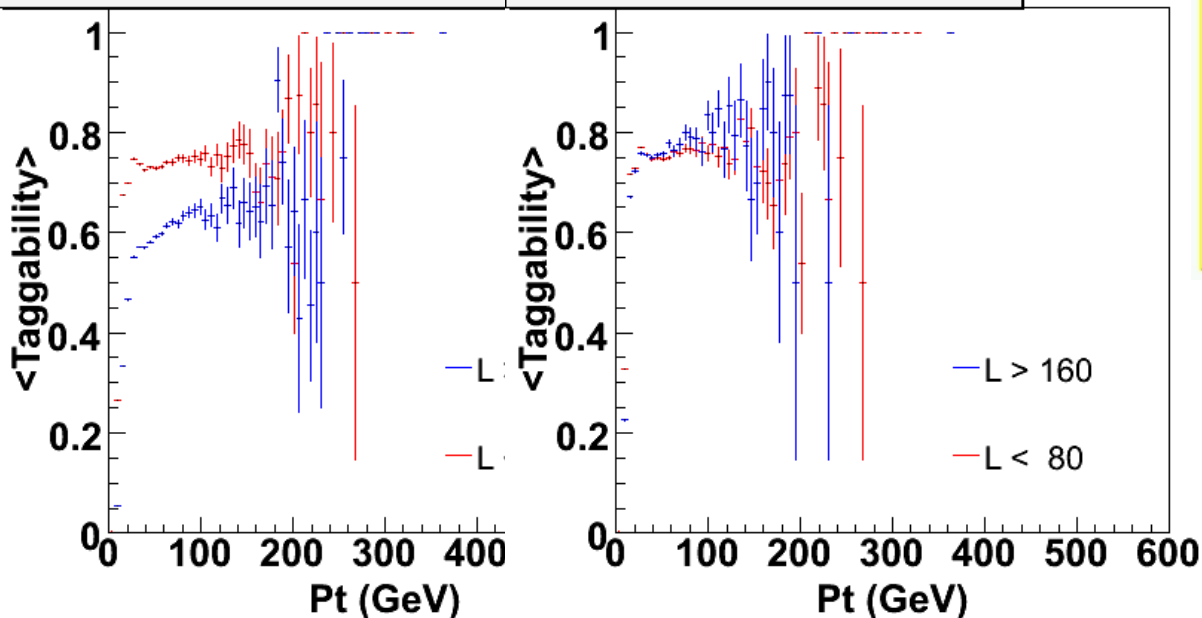


Luminosity Dependence of Taggable Jets JT95



MUJ1 Taggability Study

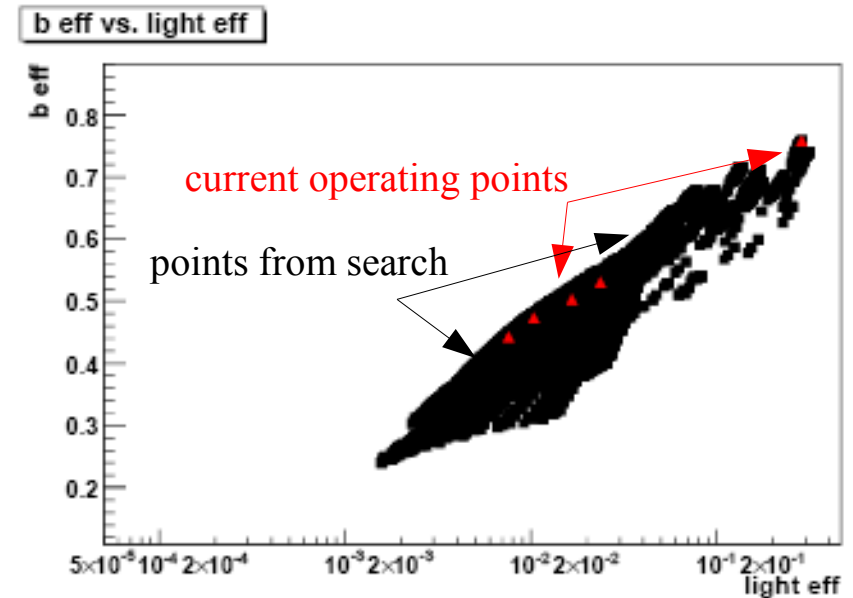
MUJ1 Taggability Study, #PV < 4



b-ID Improvements

- **SVT Optimization** (Yvonne)

- D0Note 5265
- Random grid search of taggability and secondary-vertexing parameters
- Fix old feature of re-using tracks on vertices
 - More realistic number of secondaries
 - Important – input to NN tagger!
- Revive the 2-pass vertexing algorithm
 - Look for a tight vertex first, then a loose one if no tight was found
 - Better vertex parameters
 - Input to NN tagger!
 - Slightly higher efficiency



TRFs and JSSR

- Fabrice pointed out that it's important to run BTagProcessor *after* JSSR
 - Otherwise $p_T > 15$ for taggability has different meaning in data vs. MC
- Result is to enhance the number of taggable jets at low p_T
- ***Is now the certified procedure for p17 (and p20) publications!***
 - <https://plone4.fnal.gov/P1/D0Wiki/object-id/bid/bidjssr>

