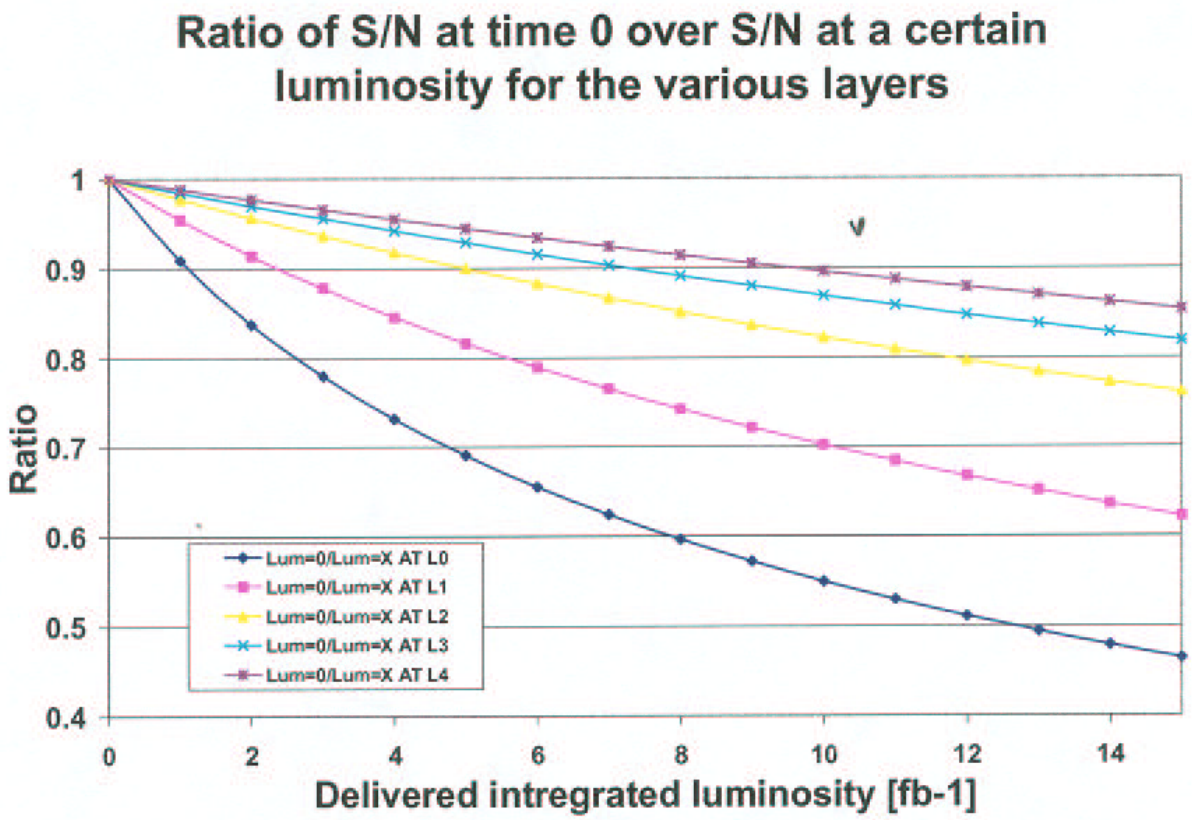
Using Offline Framework to Evaluate Effects of Rad Damage

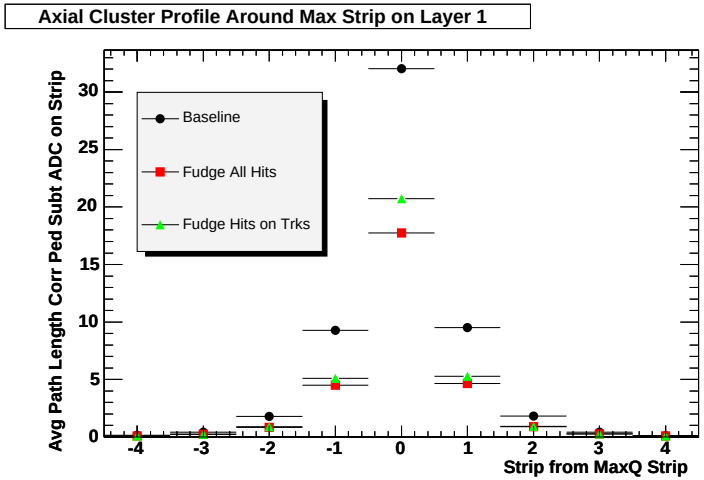
- Use inclusive jet data (`JET20,50,70,100`) and standard cluster and b-tag tools
  - Use `4.11.1` b-tag prescription and `Stntuple dev_240`
- Read `gjet09` data from output of `4.8.4` production, but recluster & retrack
- Emulate radiation damage by changing S/N in data in two ways
  1. Change ped subtr charge on ALL strips. Overdamps natural noise clusters since clustering makes cuts based on σ
  2. Change ped subtr charge on strips in HITS on TRACKS. Could under account for change if tracking picks up the "real" hit (which wasn't fudged) in the second pass
- Charge is rescaled layer-by-layer with talk-to's in new `TrackingUserMods/ClusterFudgeModule`
- More correct thing would have been to *smear* charge on every strip. But this requires changes to either database, or clustering code. Next iter.
- Set charge rescaling (fudge) by amounts specified by Gino and Steve W's studies (see next plot)
- For low-level studies, use run 162857. Same exact 3561 events for each fudge setting.

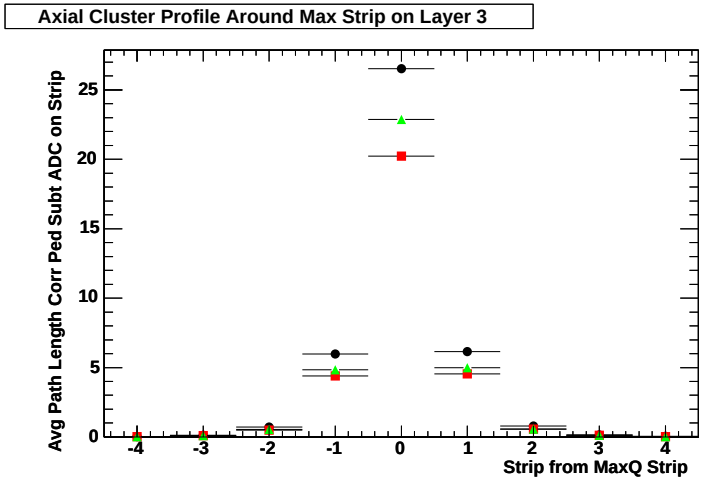
Gino's Relative Gain Change on Axial Layers

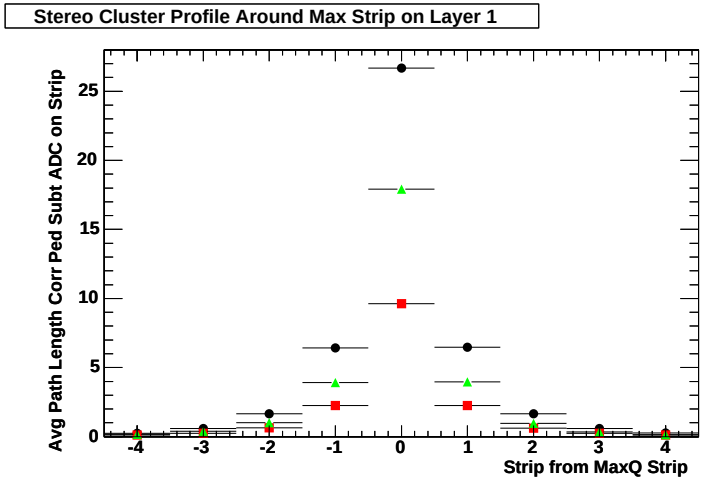


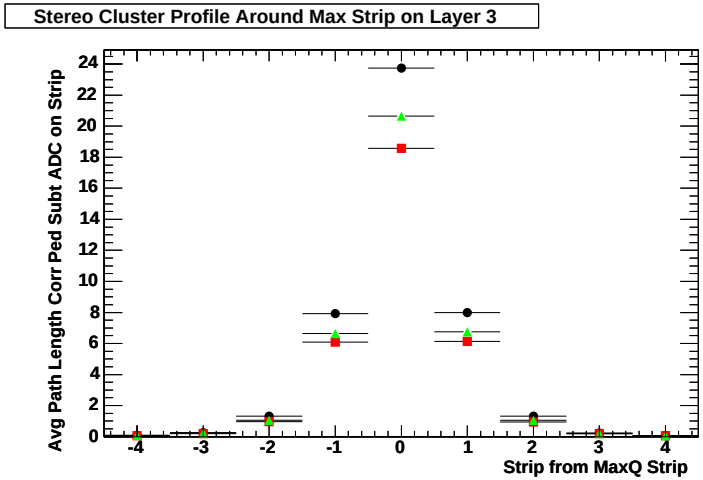
Choose two points: 0 and $8\mathrm{fb}^{-1}$. Assume degradation on z-side is same.

Effects on Cluster Profile of Good Hits on Tracks

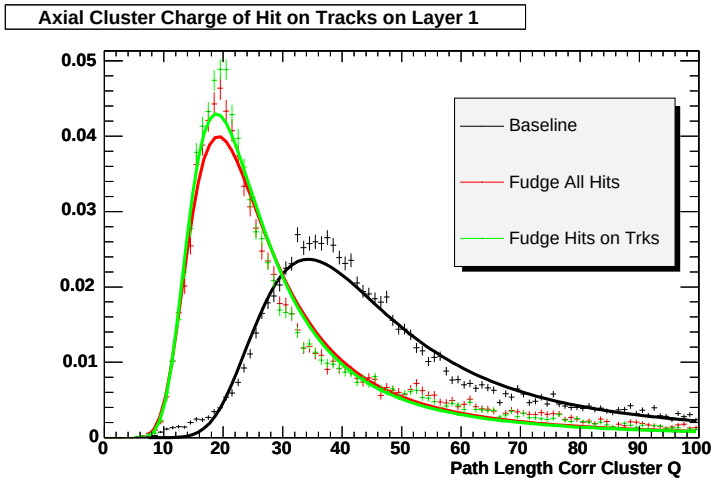


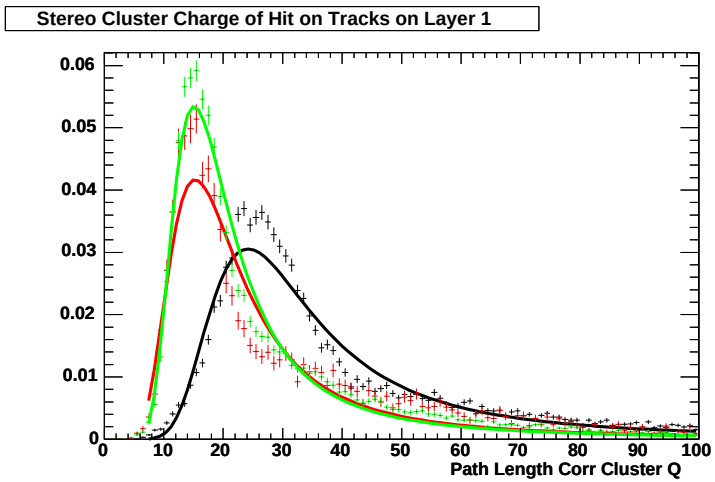






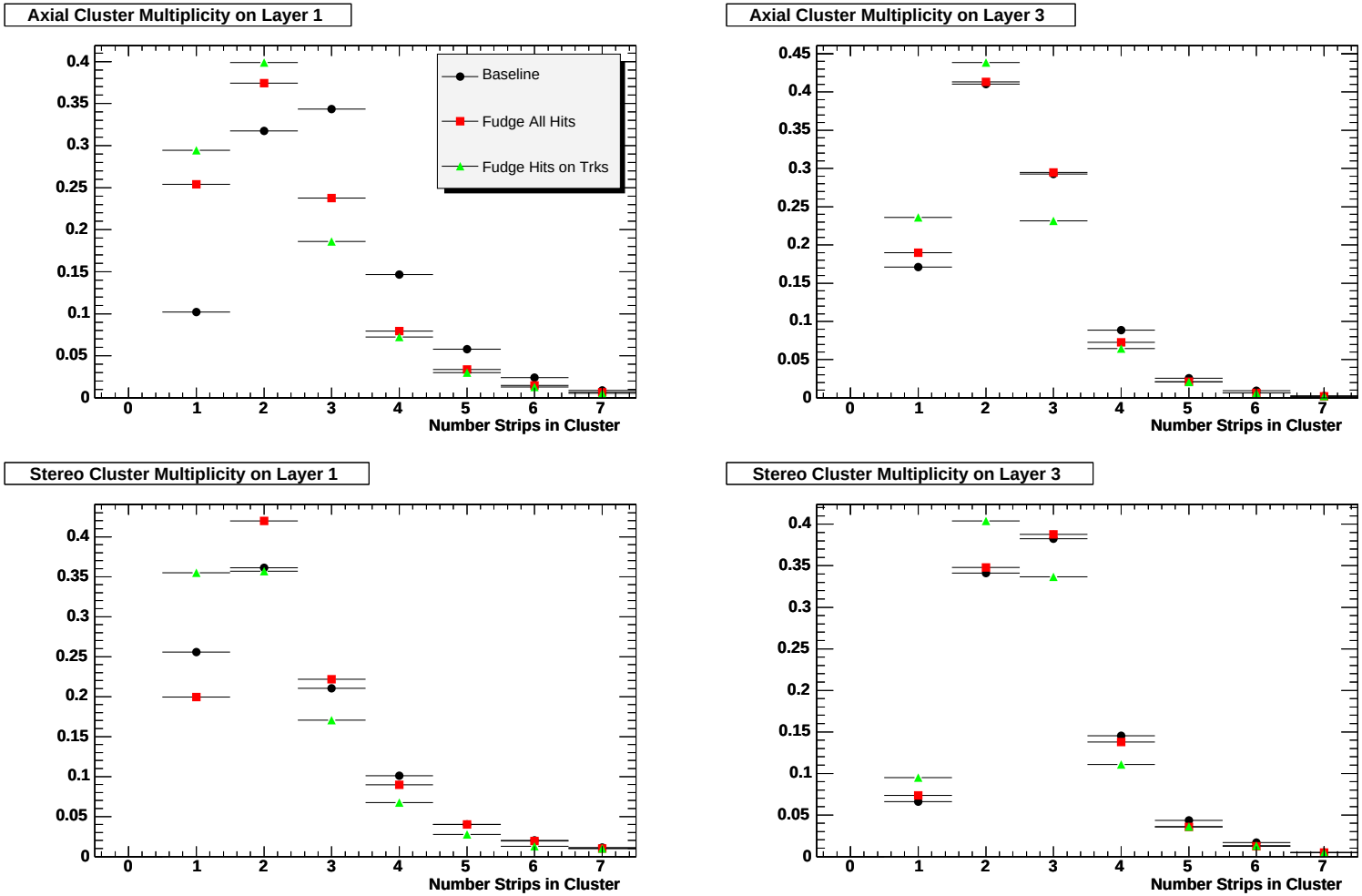
Effect on Cluster Charge of All Hits on Tracks



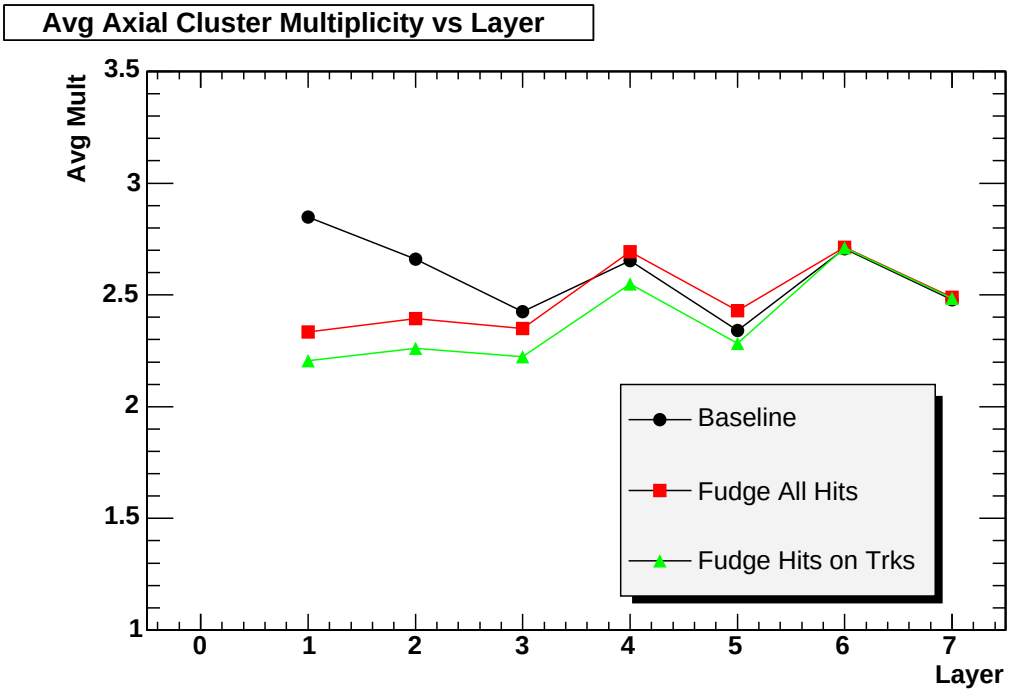


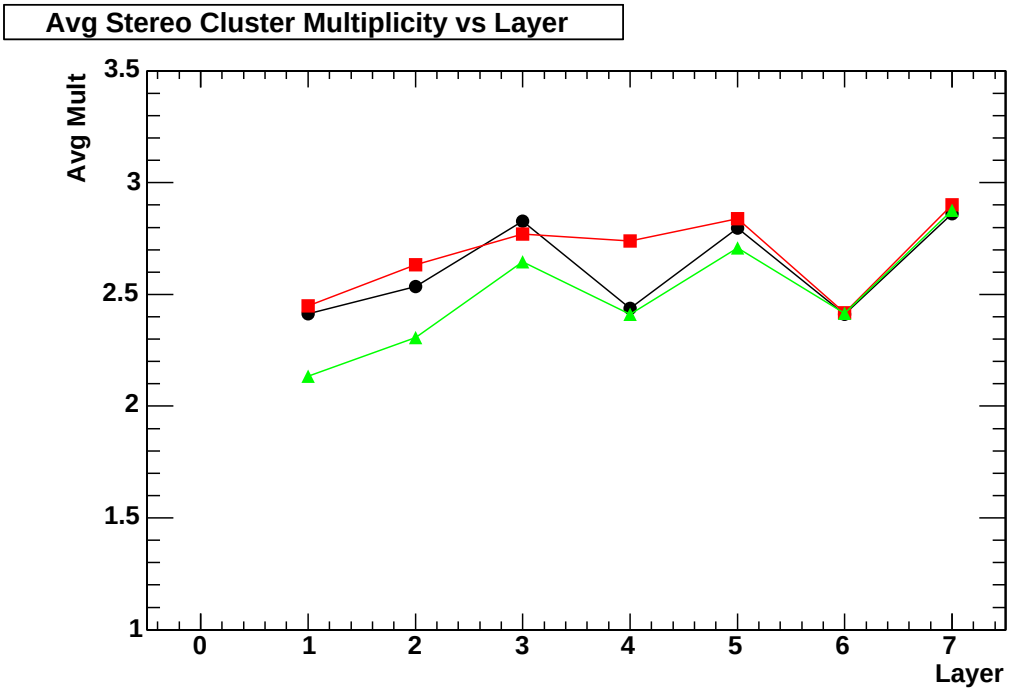
		Ratio of Landau MPV	
Layer	Input	All	Hits
L1p	0.6	0.56	0.55
L1z	0.6	0.63	0.62
L2p	0.75	0.73	0.71
L2z	0.75	0.74	0.73
L3p	0.85	0.86	0.83
L3z	0.85	0.88	0.83
L4p	0.9	0.92	0.89
L4z	0.9	0.95	0.90
L5p	0.9	0.94	0.89
L5z	0.9	0.93	0.89
L6p	1	1.00	1.00
L6z	1	1.00	1.00
L7p	1	1.01	1.00
L7z	1	1.01	1.01

Effects on Cluster Multiplicity of All Hits on Tracks

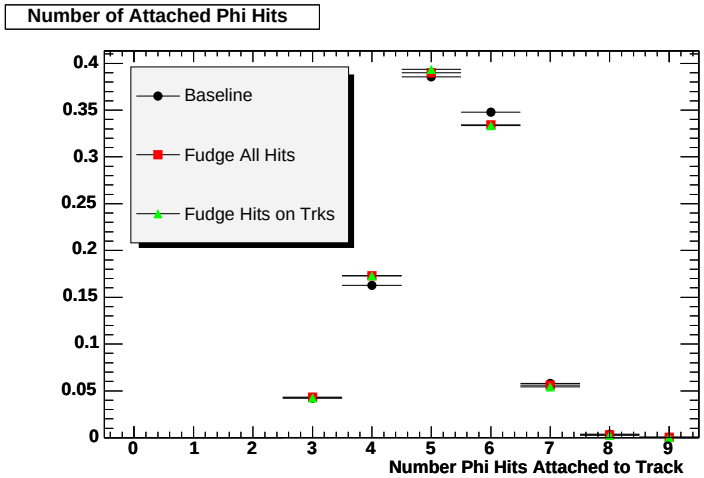


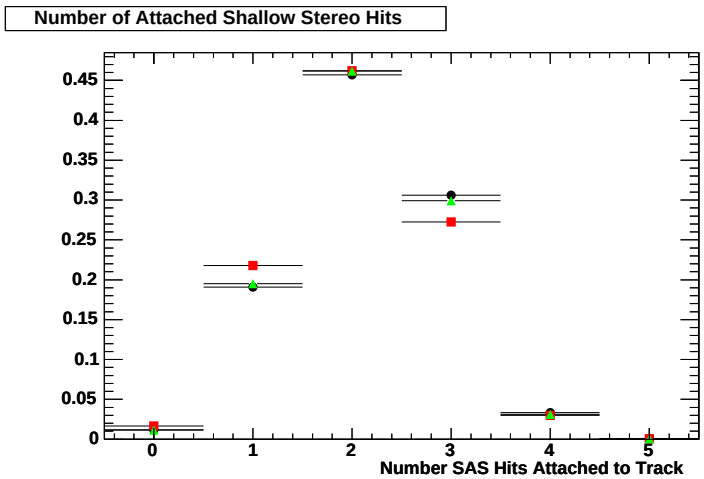
Cluster Multiplicity of All Layers

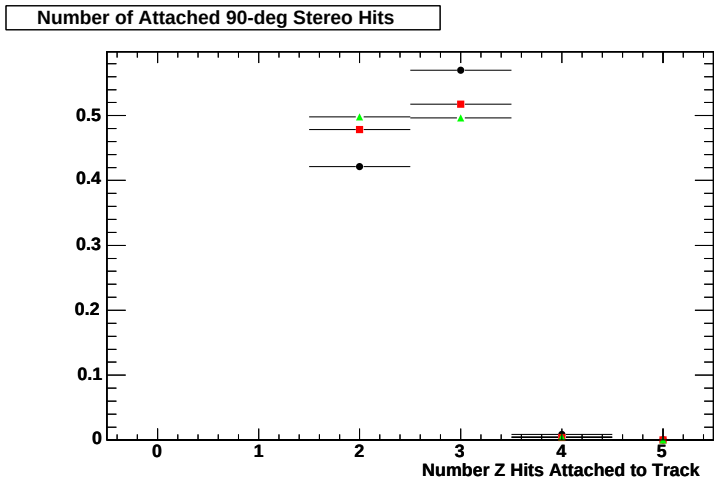




Effect on Hit Assignment

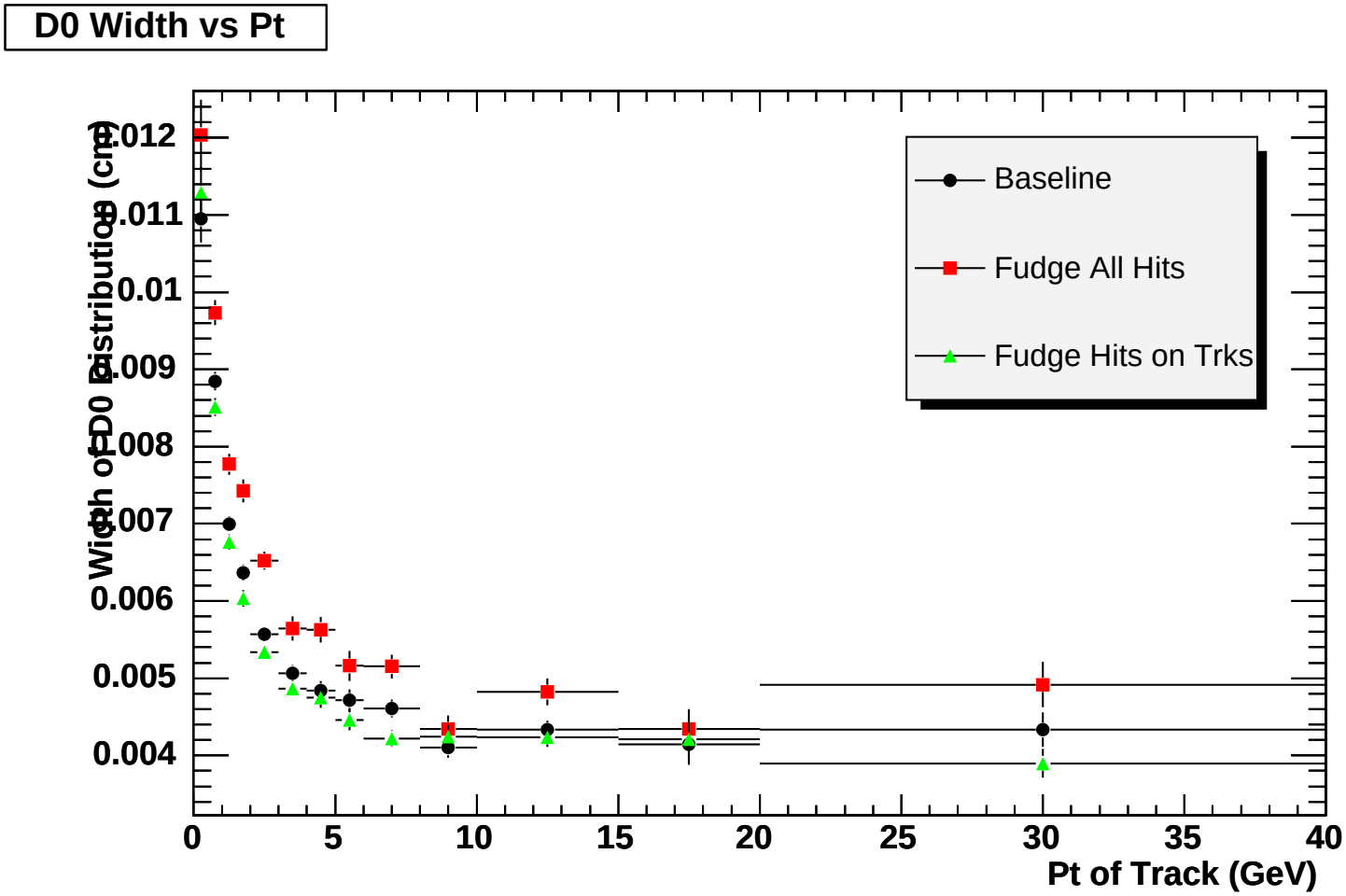




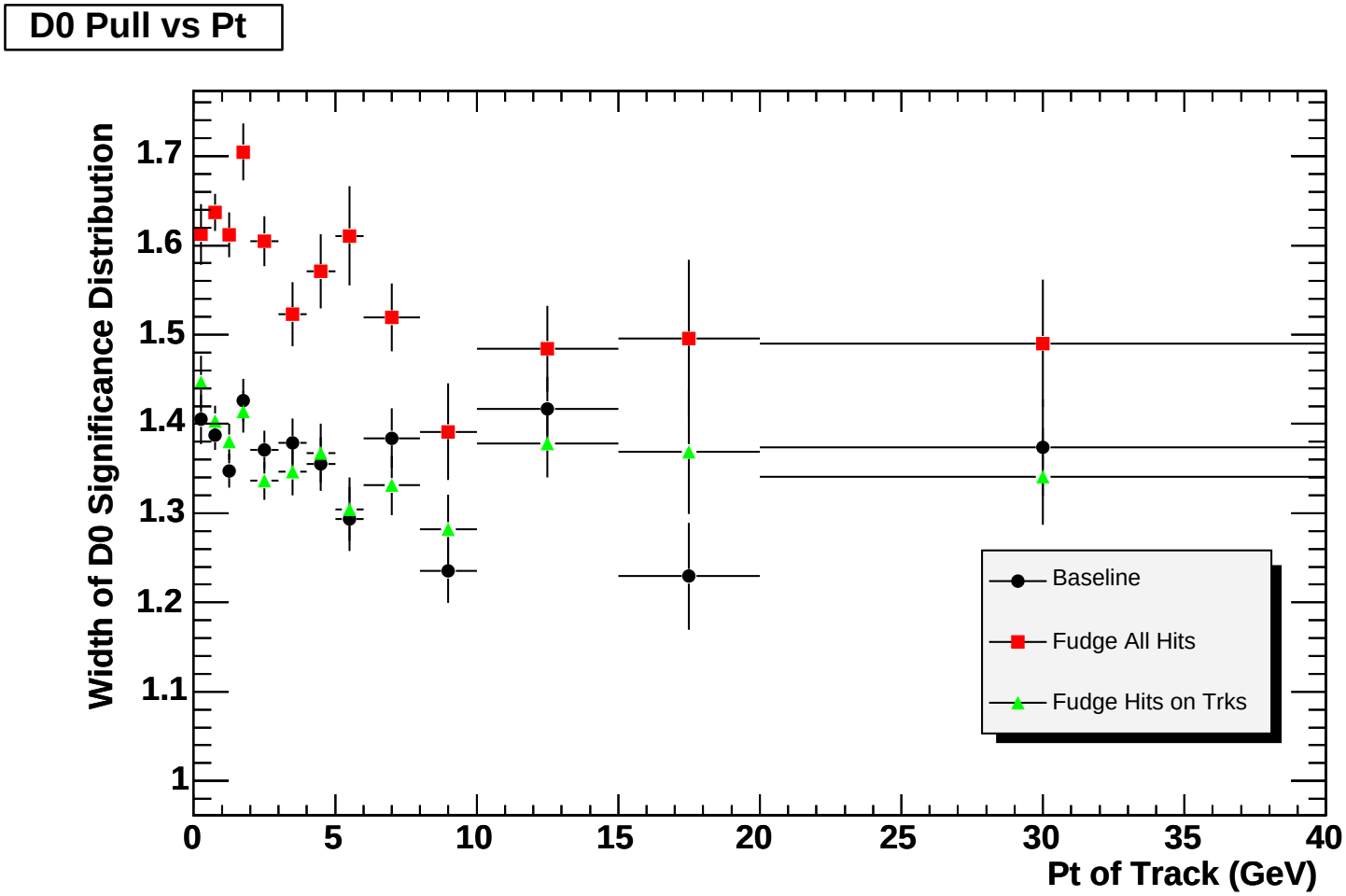


Only losing about 0.5 to 1 hit per track on axial side

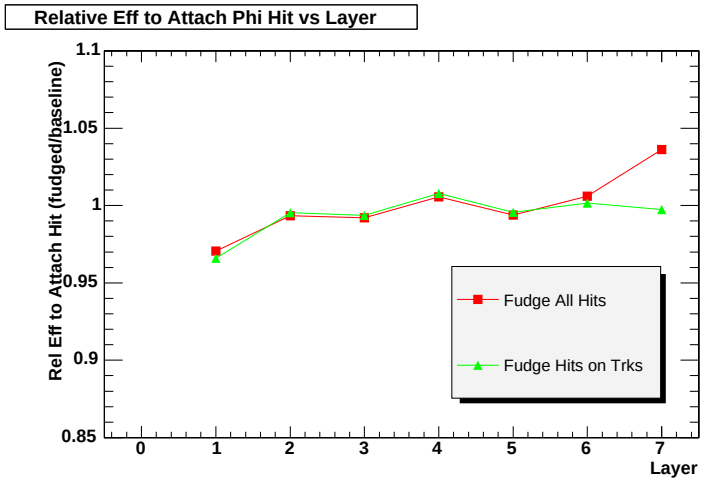
D0 Width vs Pt

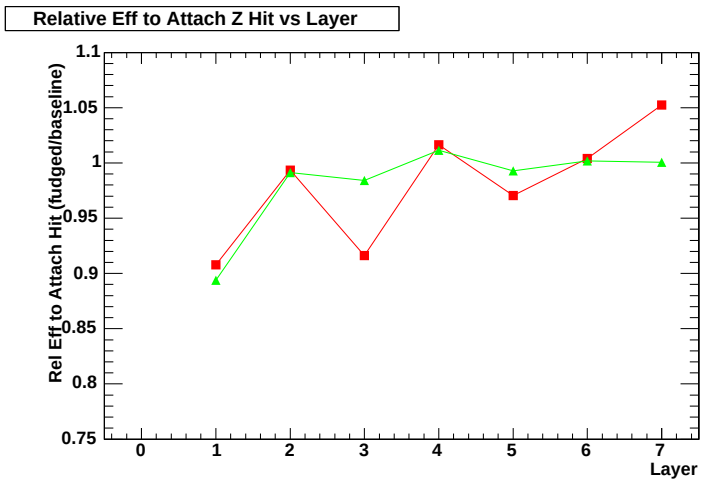


D0 Pull vs Pt


D0 Pull vs Pt
Width of D0 Significance Distribution
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0
5
10
15
20
25
30
35
40
Pt of Track (GeV)
Baseline
Fudge All Hits
Fudge Hits on Trks

Relative Efficiency to Attach Hits





- Take eff to attach hits per layer in baseline as the denominator
- Numerator is same but for different fudge models
- See only 5% efficiency drop in L1 axial side
- Bigger drop of 10% in L1 90° stereo
- Somewhat surprising that changes are so small
- Fluctuations in ALL Hits case is suspicious

Fraction of Bad Hits Attached to Tracks

Fudge	Fraction bad
Baseline	3.5%
All Hits	23.5%
Hits on Tracks	3.2%

- Surprising result is that reducing charge on all strips increases the chance that a BAD strip will be used in a cluster that is attached to a track.

- Mostly z-side hits cause this

Global Rel Eff to Find OIZ Tracks

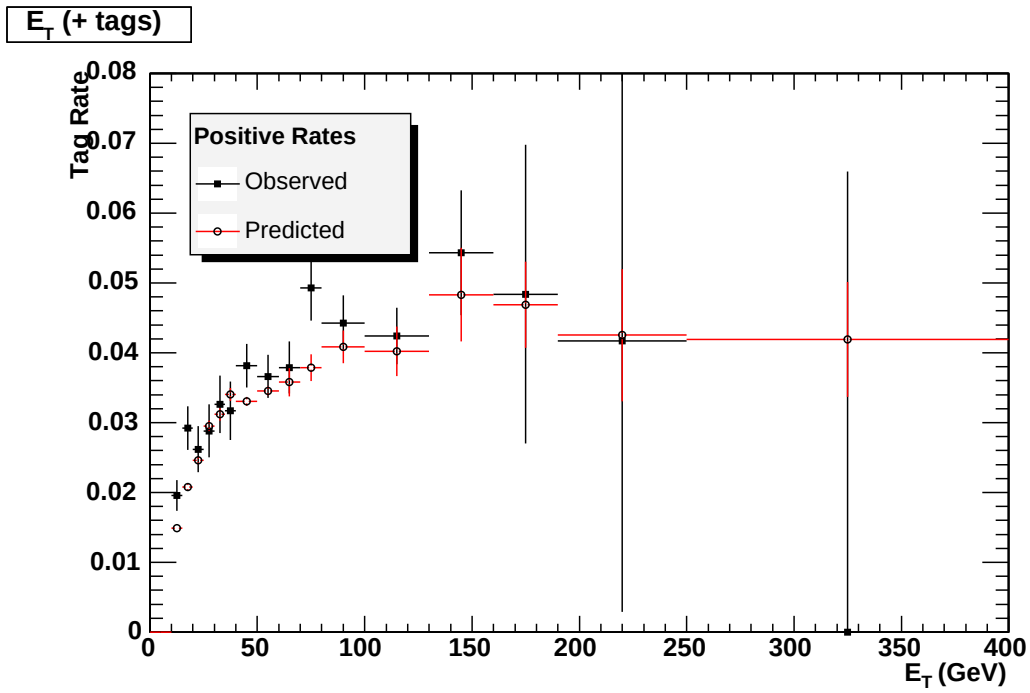
Fudge	Eff to Find "Good" OIZ Track
All Hits	24.9%
Hits on Tracks	93.3%

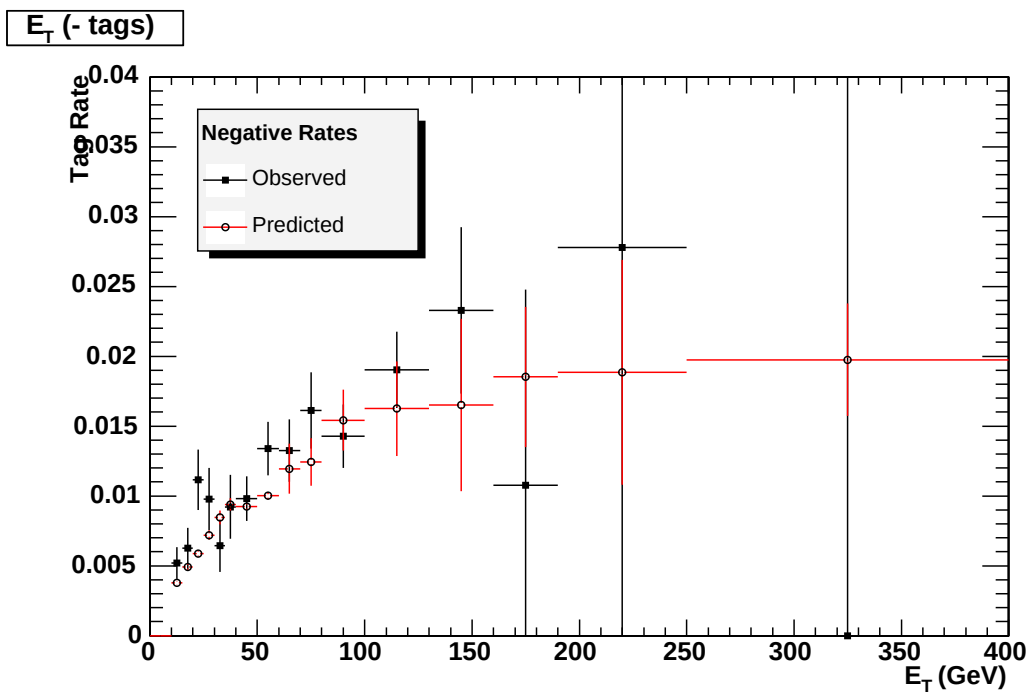
- Relative to baseline, this is eff to find an OIZ track with no more than 1 bad hit attached

On to B-Tagging...

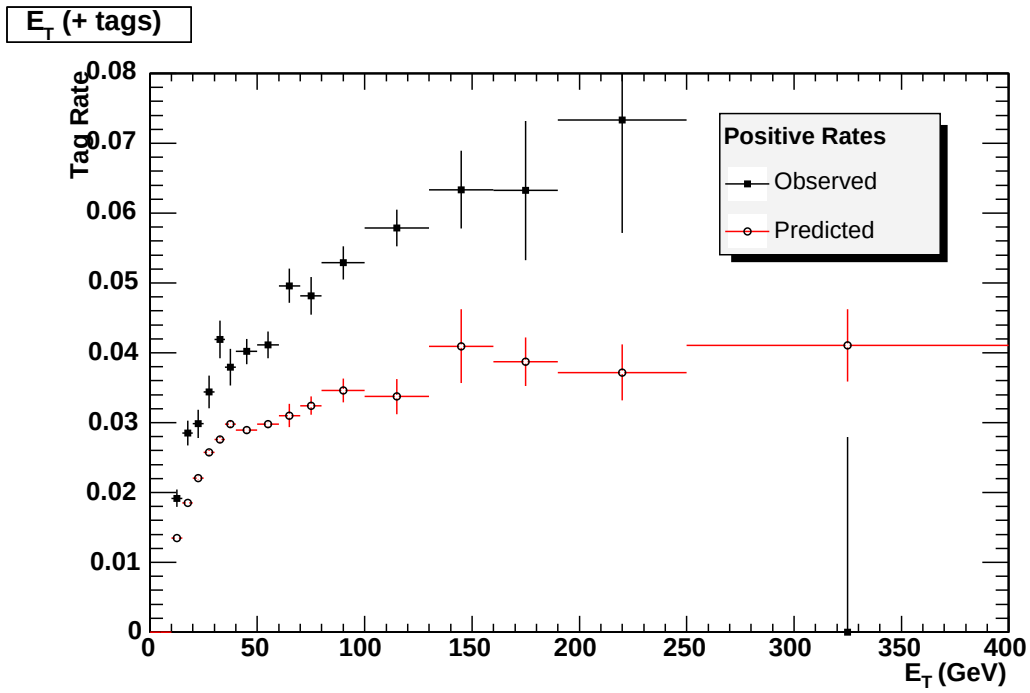
- Can't use exact summer '03 prescription for b-tag since we need to retrack
- Measure tag rates in inclusive jet data and compare to predicted rates from summer '03 mistag mtx

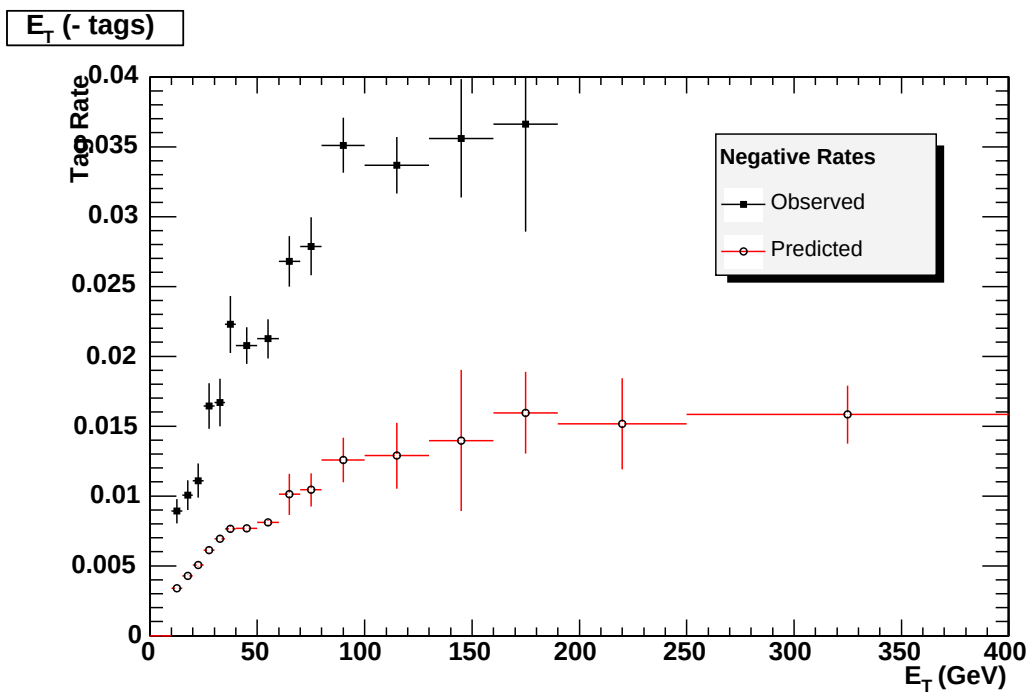
Baseline Tag Rate vs Et



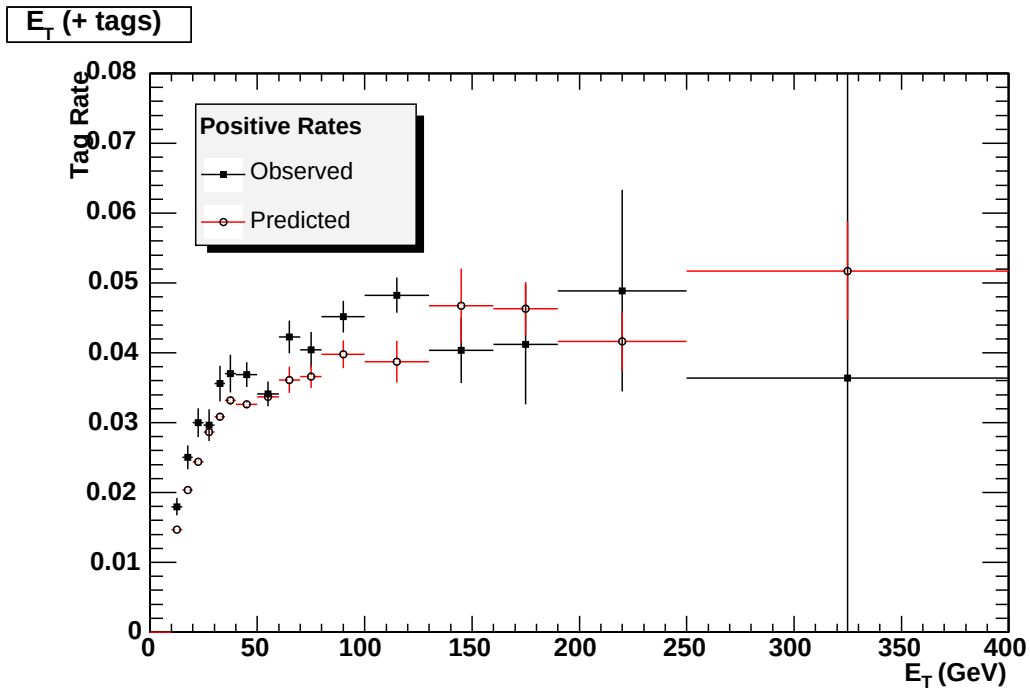


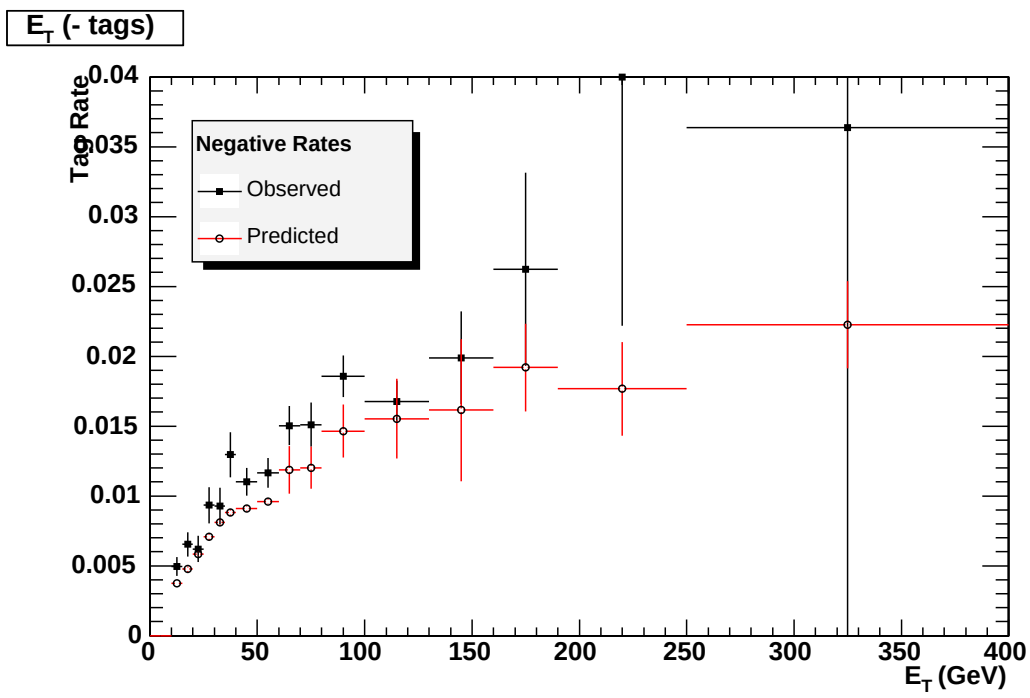
Fudge ALL Tag Rate vs Et





Fudge HITS Tag Rate vs Et





Total Tag Rates

fudge	Pos Excess Rate	Rel Change
Baseline	0.024 ± 0.001	1
ALL	0.0190 ± 0.0008	0.806
HITS	0.0231 ± 0.0007	0.984

fudge	S/B	Rel Change
Baseline	2.1 ± 0.1	1
ALL	0.90 ± 0.04	0.43
HITS	2.01 ± 0.08	0.96

fudge	$S/\sqrt{B}$	Rel Change
Baseline	0.22 ± 0.01	1
ALL	0.131 ± 0.005	0.589
HITS	0.216 ± 0.007	0.972

Conclusions

- NO conclusion so far...
- Good progress on setting up infrastructure
- Reality is somewhere between fudging of ALL and HITS.
- **Implement smearing!**
- To measure proper b-tag eff redo on inclusive electron sample
- Hit a few more int lumi points
- Should remeasure/estimate resolution change for proper retracking
- Compare cluster plots to actual data taken in special runs
- Compare results from Steve W's MC study