Comparison of Two Unfolding Approaches

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Inclusive Jet Meeting

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Intro

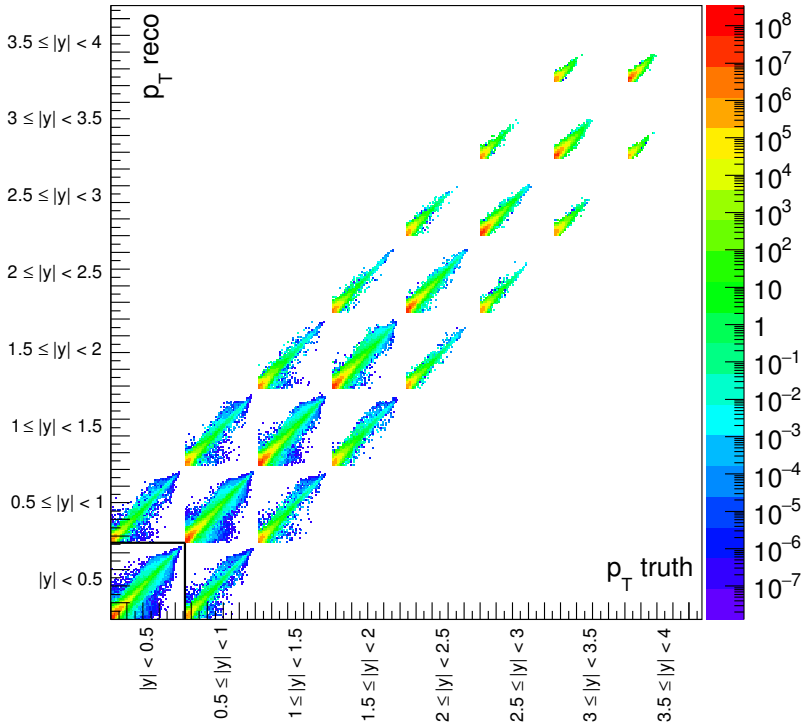
- Double differential inclusive jet cross section in p_T and $|y|$
- **Data**
  - `mc14_13TeV, AntiKt4LCTopoJets`
- **Event Seelction**
  - $p_T > 15\,\text{GeV}$, $|y| < 4$
  - # reco jets ≥ 1 & # truth jets ≥ 1
  - $0.6 < p^{reco}_{T,leading} / p^{truth}_{T,leading} < 1.4$.
- **Jet matching**
  - Angular matching starting from lowest dR_{ij}
  - $dR_{ij} = \sqrt{d\phi_{ij}^2 + dy_{ij}^2} < 0.2$

Intro to Unfolding

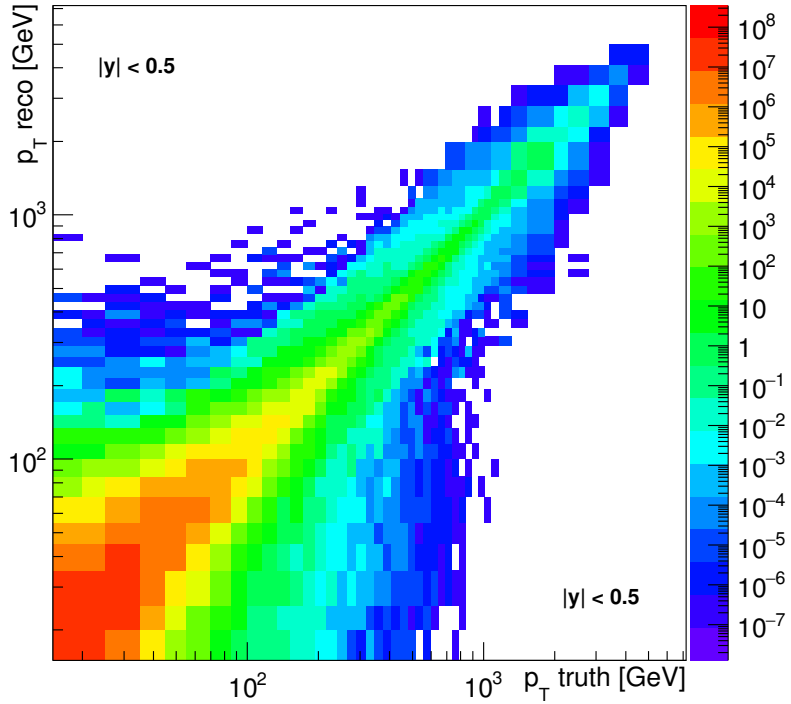
- Used two approaches to unfolding
- **Simple Unfolding**
  - Matching only within the same rapidity bins.
  - 8 transfer matrices 46x46 (8 = # y-Bins, 46 = # p_T-Bins).
  - Unfolding done for each transfer matrix separately.
- **2D Unfolding**
  - Matching between different rapidity bins allowed.
  - 1 transfer matrix 368x368 (368 = 8x46).
- **Differences:**
  - Different transfer matrices.
  - Different matching efficiencies.

Transfer matrices

2D unfolding



Simple unfolding



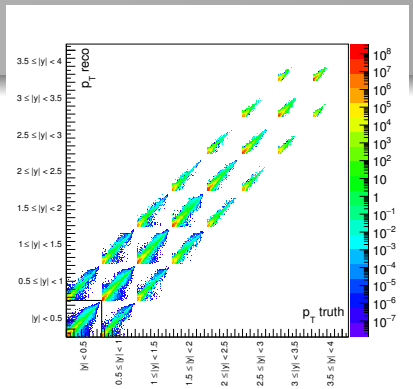
High p_T Difference in Matched Jets

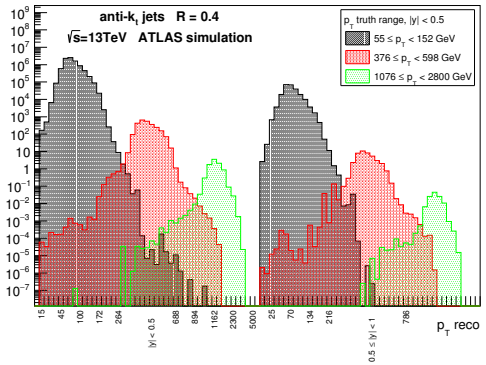
mc14_13TeV.147915.Pythia8_AU2CT10_jetjet_JZ5W.merge.AOD.e2743_s1982_s2008_r5787_r5853/
AOD.01598029._000003.pool.root.1 event # 1087 (left)
mc14_13TeV.147916.Pythia8_AU2CT10_jetjet_JZ6W.merge.AOD.e2743_s1982_s2008_r5787_r5853/
AOD.01598030._000005.pool.root.2 event # 1388 (right)

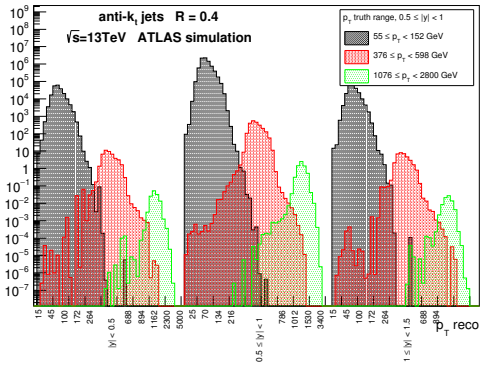
Jet Level	p_T	y	ϕ
RECO	1948.9	0.7973	-2.996
TRUTH	1913.0	0.8159	-2.996
RECO	1526.4	-0.686	0.1032
TRUTH	1851.6	-0.674	0.1646
RECO	330.04	-0.732	0.5231
TRUTH	30.748	-0.839	0.5972
RECO	101.92	-0.271	-0.133
TRUTH	97.678	-0.266	-0.116
RECO	55.632	-0.086	-2.942
TRUTH	52.407	-0.014	-2.905
RECO	17.514	-2.471	-2.271
TRUTH	25.189	-2.472	-2.377
RECO	19.760	-1.650	2.6354
RECO	19.303	-0.242	-1.035
RECO	17.814	0.4432	2.8272
RECO	16.998	1.8389	0.9921
RECO	15.435	-0.692	-2.578

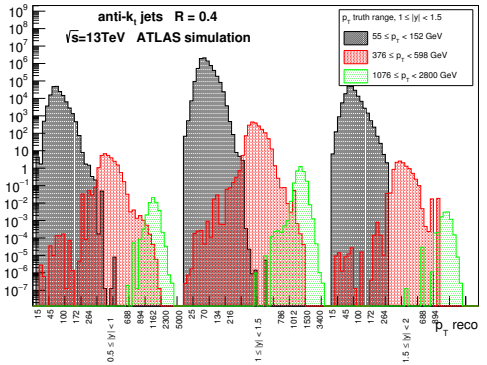
Jet Level	p_T	y	ϕ
RECO	1468.5	0.1580	2.0229
TRUTH	1420.1	0.1633	2.0300
RECO	1267.6	0.1966	-0.928
TRUTH	963.99	0.2578	-0.857
RECO	177.77	2.1969	-2.344
TRUTH	169.13	2.2085	-2.349
RECO	112.19	2.0599	-1.753
TRUTH	108.35	2.0499	-1.759
RECO	56.778	1.4397	2.0556
TRUTH	31.550	1.3559	2.0508
RECO	19.091	-0.111	-1.313
TRUTH	340.94	0.0072	-1.195
RECO	20.420	0.6798	-0.871
RECO	19.792	0.3520	-1.622

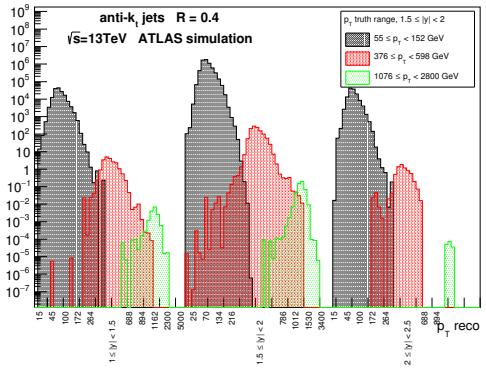
Slices in Transfer Matrix

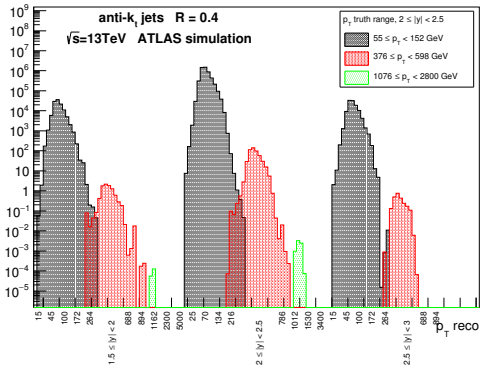


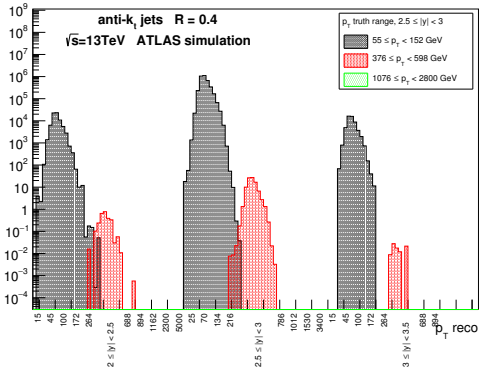






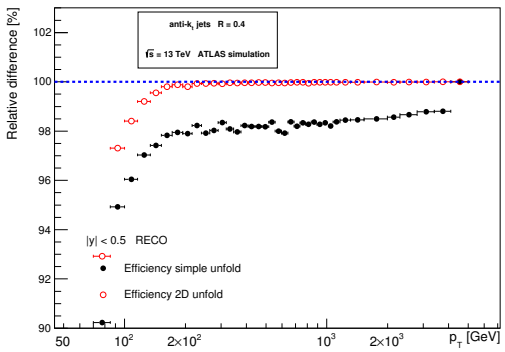


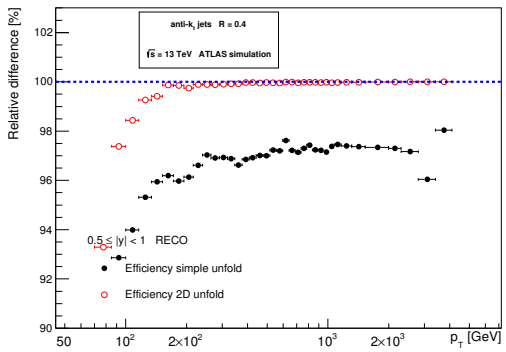


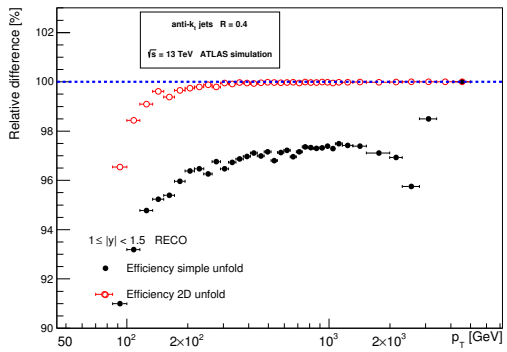


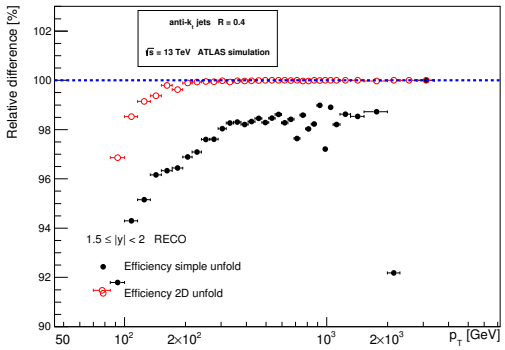
Matching Efficiencies

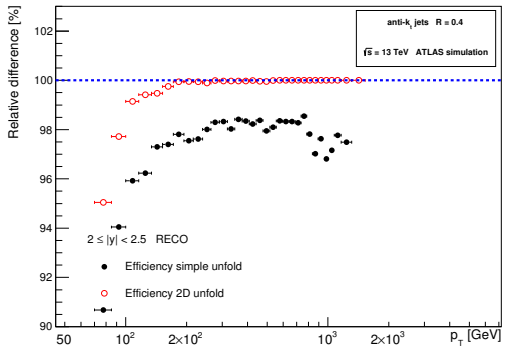
Reco Jets

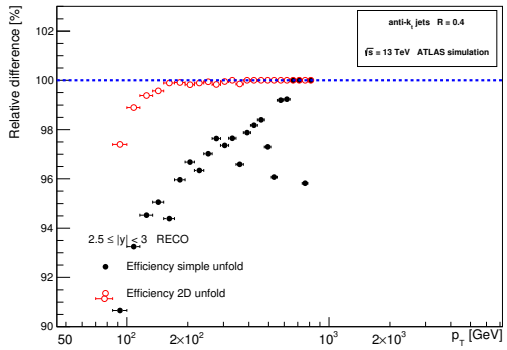




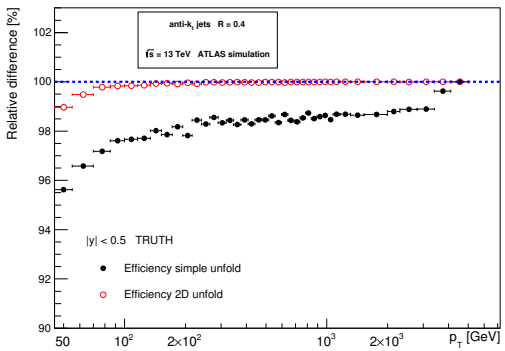


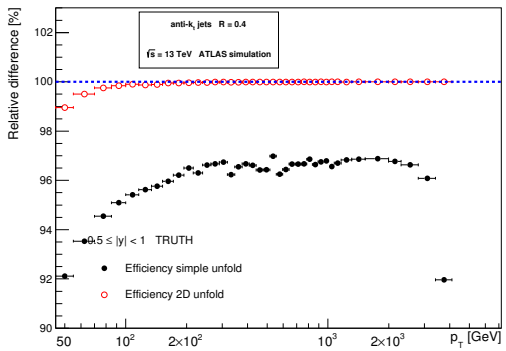


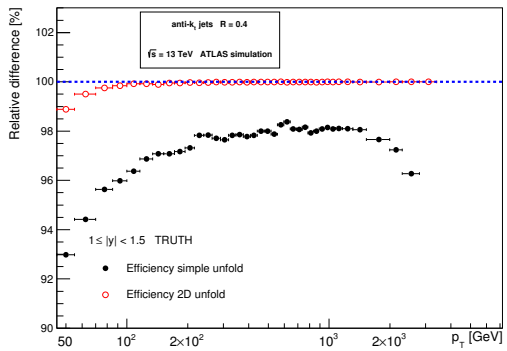


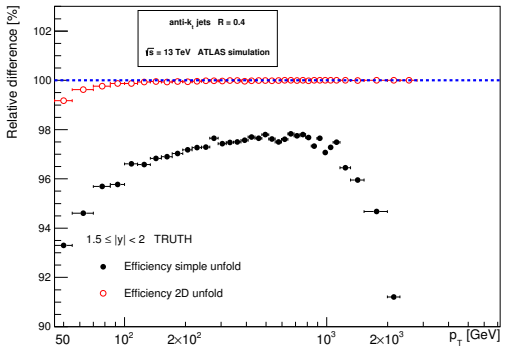


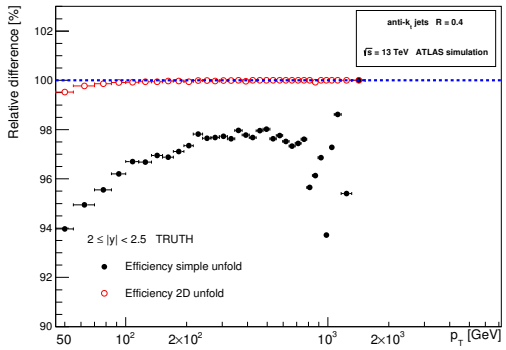
Matching Efficiencies
Truth Jets

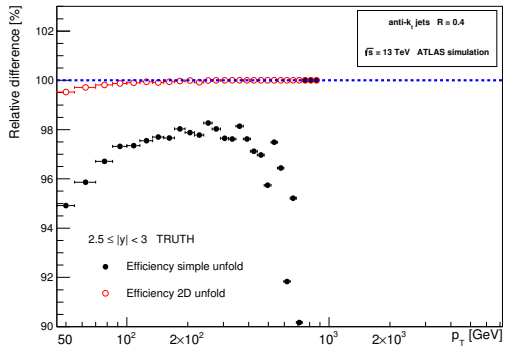












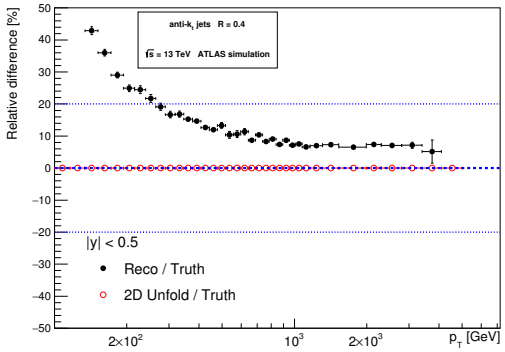
Different y-bins, $p_T > 1000$ GeV

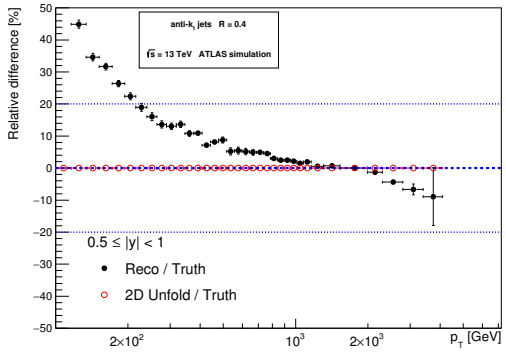
mc14_13TeV.147915.Pythia8_AU2CT10_jetjet_JZ5W.merge.AOD.e2743_s1982_s2008_r5787_r5853/
AOD.01598029._000003.pool.root.1 event # 959 (left) event # 986 (right)

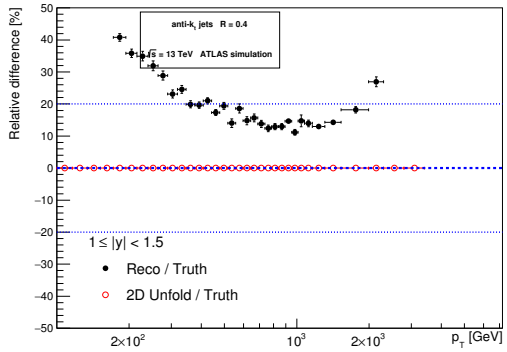
Jet Level	p_T	y	ϕ
RECO	1047.2	0.50084	-0.525
TRUTH	1043.6	0.49142	-0.515
RECO	919.36	-0.8124	3.0295
TRUTH	859.44	-0.8250	3.0283
RECO	202.45	0.15152	1.5866
TRUTH	209.20	0.13535	1.5925
RECO	107.19	3.20412	0.9019
TRUTH	110.20	3.20996	0.8821
RECO	86.126	-1.0504	2.4963
TRUTH	94.136	-1.0531	2.5268
RECO	62.074	-1.3096	-3.053
TRUTH	52.706	-1.2922	-3.057
RECO	22.069	-0.7635	2.0193
TRUTH	31.753	-0.8044	1.8596
RECO	16.189	0.79967	2.1690
TRUTH	23.677	0.93080	2.1237
TRUTH	19.405	3.71203	1.5590

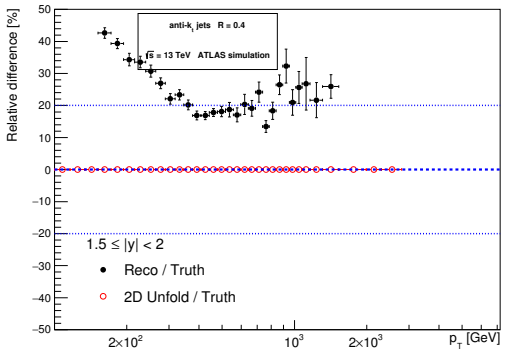
Jet Level	p_T	y	ϕ
RECO	1139.3	0.15506	-2.8719
TRUTH	1196.3	0.12358	-2.8624
RECO	1083.3	-0.9936	0.29643
TRUTH	1052.4	-1.0141	0.29564
RECO	66.773	-0.1154	0.48034
TRUTH	56.250	-0.1492	0.47566
RECO	37.744	0.47975	0.69324
TRUTH	39.587	0.46135	0.67427
RECO	35.383	-1.3730	-0.4060
TRUTH	47.301	-1.4579	-0.4784
RECO	33.156	0.79242	0.02433
TRUTH	33.734	0.76861	0.01449
RECO	27.010	1.82468	1.61042
RECO	22.444	-0.2102	1.59064
RECO	21.114	-1.5798	1.49738
RECO	18.381	-2.9413	2.87425
RECO	15.81	0.5550	-2.2601

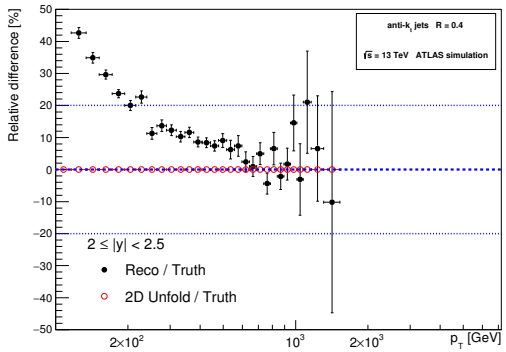
Unfolding Results
Reco & 2D Unfold / Truth

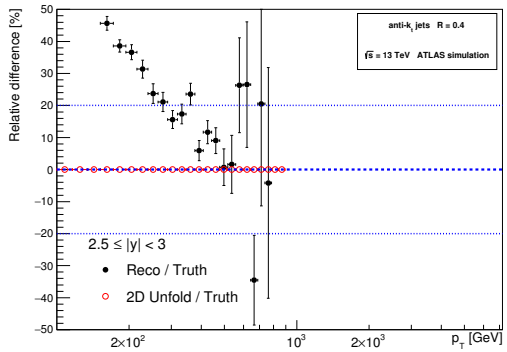






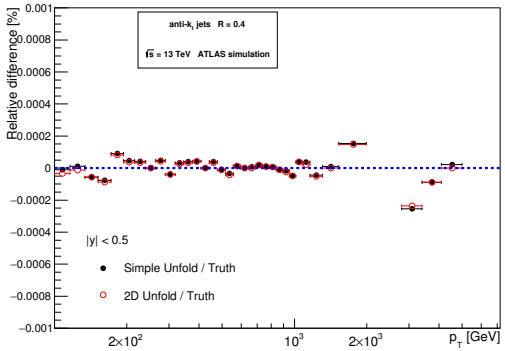


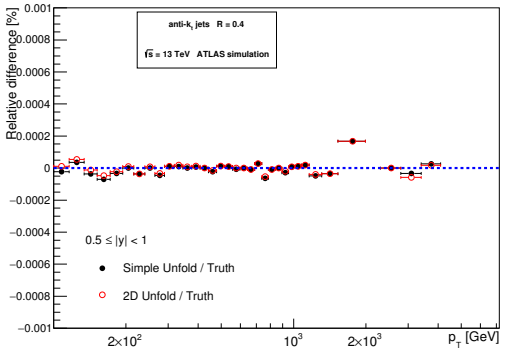


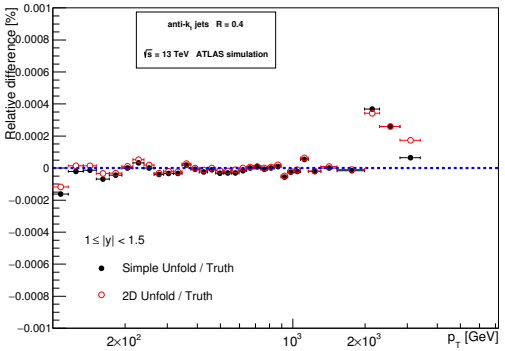


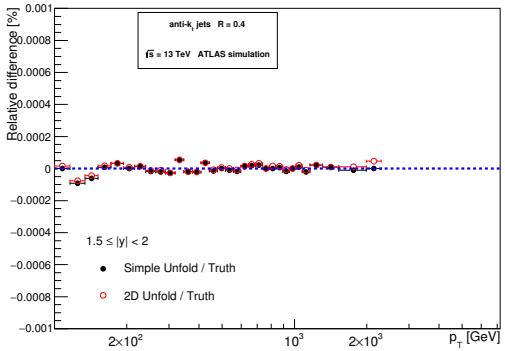
Unfolding Results

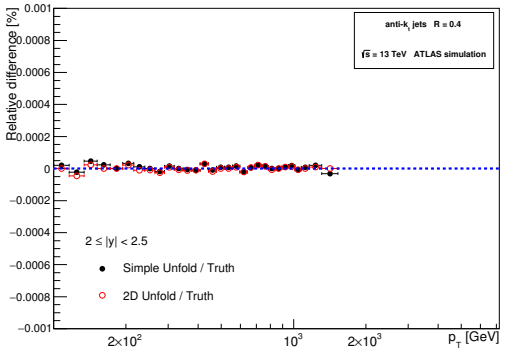
Simple Unfold & 2D Unfold / Truth

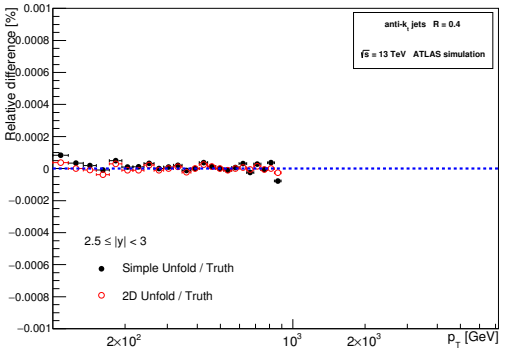








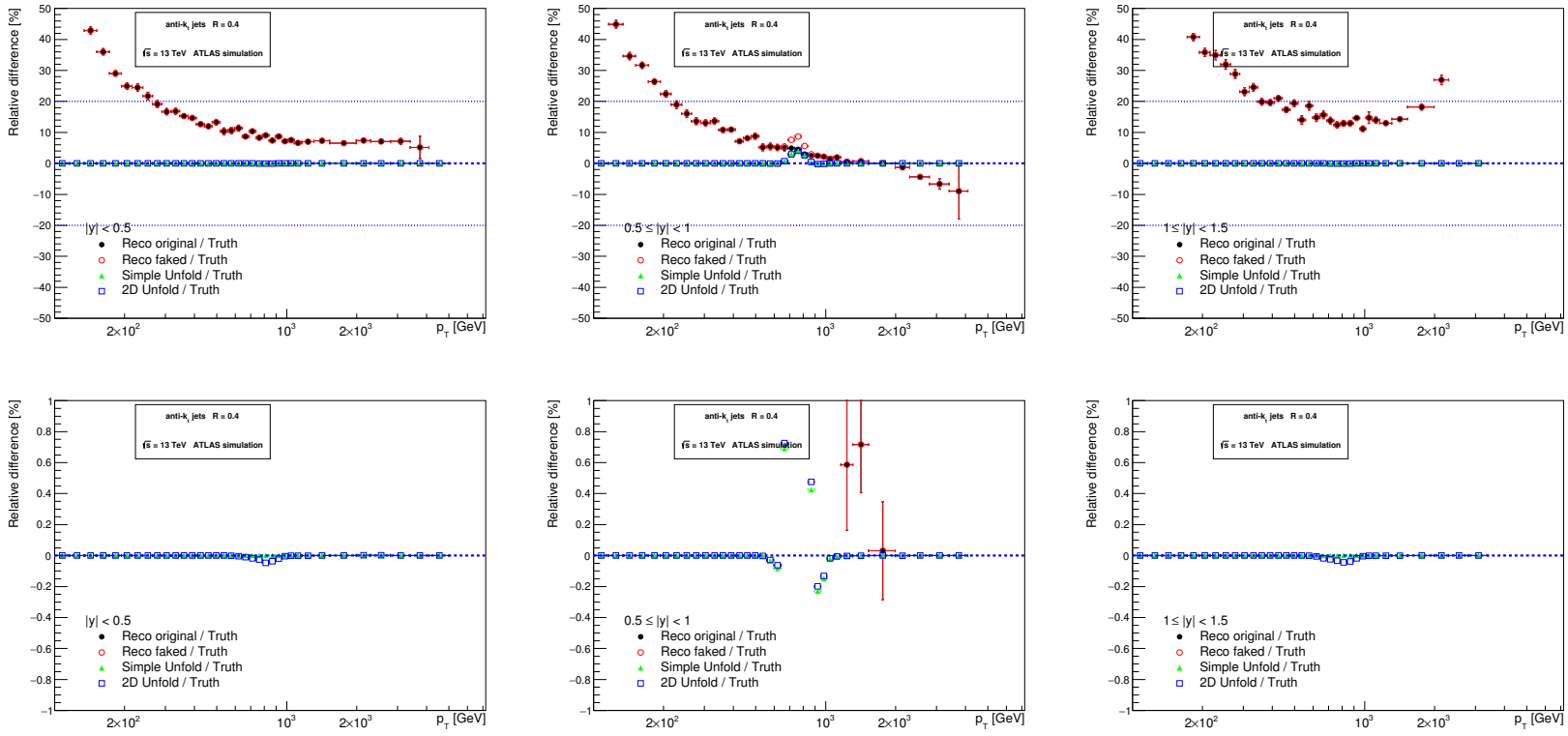




Unfolding Results for Modified p_T Reco Spectrum

Reco Original & Reco Modified & Simple Unfold & 2D Unfold / Truth

Unfolding trained on Reco Original, but executed on Reco Modified



Conclusions

Matching Efficiencies

2D Unfolding: $> 99\,\%$ for almost every bin with $p_T > 100\,\mathrm{GeV}$.
Simple Unfolding: $\sim 2 - 5\,\%$ worse.

Unfolding Results

Small differences between both of these approaches.