Effect of reco and trigger efficiency correction on shape

More details in Analysis Note: AN-11-266

Kalanand Mishra

All efficiency tables provided by
Jeffrey Berryhill

Jeff's recommendation for trigger use (I)

8 Trigger selection

8.1 Run2010: Runs 136033–149442

- Muon data:
  Mu11_v* OR Mu17_v*
- Electron data:
  Ele10_* OR Ele15_* OR Ele17_*

8.2 Run2011A: Menus 5E32 (Runs: 160404–163869), 1E33 (Runs:165088-166967), and 1.4E33 (Runs:167039-167913)

- Muon data:
  IsoMu17_v* OR Mu30_v*
  Note: We really needed to OR in the nonisolated muon trigger as it recovers about half of the offline-isolated muons rejected by IsoMu, increasing the trigger efficiency by 5%.
- Electron data:
  Ele27_CaloIdVT_CaloIsoT_TrkIdT_TrkIsoT_v* 5E32 epoch
  Ele17_CaloIdVT_CaloIsoT_TrkIdT_TrkIsoT_CentralJet30_CentralJet25_PFMHT15_v*
  1E33 epoch
  Ele22_CaloIdVT_CaloIsoT_TrkIdT_TrkIsoT_CentralJet30_CentralJet25_PFMHT20_v*
  1.4E33 epoch

Jeff's recommendation for trigger use (II)

8.3 Run2011A:Menu 2E33, Runs 170249–173198

- Muon data:
  (IsoMu17_v13 OR IsoMu20_v8 OR IsoMu24_v8) OR (Mu30_v7 OR Mu40_v5)

  Note: This epoch was complicated because Mu30, IsoMu17, and IsoMu20 were all prescaled for brief periods, so we could either break it down into sub-epochs or lump them together. We chose the latter because it is predominantly IsoMu17 and the sub-epoch lumi accounting is painful.
- Electron data:
  Ele22_CaloIdVT_CaloIsoT_TrkIdT_TrkIsoT_CentralJet30_CentralJet25_PFMHT20_v*
  v1.1 epoch 170249–170759
  HLT_Ele27_CaloIdVT_CaloIsoT_TrkIdT_TrkIsoT_CentralJet30_CentralJet25_PFMHT20_v*
  v1.2 epoch 170826–173198

8.4 Run2011A:Menu 3E33, Runs: 173236–173692

- Muon data:
  HLT_IsoMu20_v9 OR HLT_Mu40_eta2p1_v1
- Electron data:
  Ele27_CaloIdVT_CaloIsoT_TrkIdT_TrkIsoT_CentralJet30_CentralJet25_PFMHT20_v*

8.5 Run2011B: Menu 3E33, Runs: 175832–178380

- Muon data:
  (IsoMu30_eta2p1_v3 OR IsoMu24_eta2p1_v3 OR IsoMu24_v9 OR IsoMu20_v9)
  OR
  (Mu40_eta2p1_v1 OR HLT_Mu40_v6)

Jeff's recommendation for trigger use (III)

- Electron data:
  Ele27_CaloIdVT_CaloIsoT_TrkIdT_TrkIsoT_CentralJet30_CentralJet25_PFMHT20_v2
  (v2.0-v2.2, 175832–176309)
  OR
  Ele30_CaloIdVT_CaloIsoT_TrkIdT_TrkIsoT_DiCentralJet30_PFMHT25_v1 (v2.3-v5.0, 176461–178380)

8.6 Run2011B: Menu 5E33, Runs: 178420–end

- Muon data:
  (IsoMu30_eta2p1_v6 OR IsoMu24_eta2p1_v6 OR IsoMu24_v12 OR
  IsoMu30_eta2p1_v7 OR IsoMu24_eta2p1_v7 OR IsoMu24_v13)
  OR
  (Mu40_eta2p1_v4 OR Mu40_v9) (v1.4, 178420-179889)
  OR (Mu40_eta2p1_v5 OR Mu40_v10) (v2.2, 179959–end)
- Electron data:
  Ele30_CaloIdVT_CaloIsoT_TrkIdT_TrkIsoT_DiCentralJet30_PFMHT25_v1

Efficiency calculation for cross triggers (I)

The efficiency of the "HLT_Ele27_CentralJet30_CentralJet25_PFMHT20" trigger for offline selected electron+$\not{E}_T$ + 2jet events can be computed as:

$$\epsilon^{HLT}_{\text{Data}} = \text{eff(Ele27)} \times \text{eff(jet1, jet2)} \times \text{eff(MHT20)}, \quad (1)$$

where

$$\begin{aligned} \text{eff(jet1, jet2)} &= \text{eff30(jet1)} \times \text{eff30(jet2)} + \\ &\quad \text{eff30(jet1)} \times \text{eff25!30(jet2)} + \\ &\quad \text{eff30(jet2)} \times \text{eff25!30(jet1)}. \end{aligned} \quad (2)$$

If there are N jets we need to systematically consider all combinations of disjoint subcases, *i.e.*, whether a given jet

- passes jet30,
- fails jet30 and passes jet25, or
- fails both.

Thus,

$$\begin{aligned} \text{eff(jet1, ..., jetN)} &= \text{sum over all n-jet products of efficiency outcomes,} \\ &\quad \text{where any term with 2 jet30's or a jet30/jet25!30 pair} \\ &\quad \text{is kept, and the rest are discarded.} \end{aligned} \quad (3)$$

Efficiency calculation for cross triggers (II)

For N = 3, this leads to 27 subcases, 16 of which are kept. Consider all 3-digit base 3 numbers and keep all of them which have a pair of 2's or a 1 and a 2. Therefore, efficiency of the "HLT_Ele27_CentralJet30_CentralJet25_PFMHT20" trigger for offline selected electron+$\not{E}_T$ + 3jet events is given by:

$$\epsilon^{HLT}_{\mathrm{Data}} = \mathrm{eff(Ele27)} \times \mathrm{eff(jet1, jet2, jet3)} \times \mathrm{eff(MHT20)}, \quad (4)$$

where

$$\begin{aligned} \mathrm{eff(jet1, jet2, jet3)} = & [1 - \mathrm{eff30(jet1)} - \mathrm{eff25!30(jet1)}] \cdot \mathrm{eff25!30(jet2)} \cdot \mathrm{eff30(jet3)} \ (\textit{i.e.}, \mathrm{term}\text{"012"}) \\ & + \text{"021"} + \text{"022"} + \text{"102"} + \text{"112"} + \text{"120"} + \text{"121"} + \text{"122"} + \text{"201"} \\ & + \text{"202"} + \text{"210"} + \text{"211"} + \text{"212"} + \text{"220"} + \text{"221"} + \text{"222"}. \quad (5) \end{aligned}$$

The N jet generalization is as follows. Consider all N-digit base-3 numbers

for i[1] = 0 to 2
for i[2] = 0 to 2
...
for i[N] = 0 to 2

if i[1], ..., i[N] has a pair of 2's or a 1 and a 2
effN += effi[1](jet1) * effi[2](jet2) * ... effi[N](jetN),

In the present analysis we only care about events which have either 2 or 3 offline reconstructed jets. In later slides I will show plots where I lump both categories of events together.

Efficiency calculation for cross triggers (III)

Lepton+Jet30+Jet30+MHT triggers

The formulae on the previous slide simplify if the two jet legs are equal:

$$\mathrm{eff}(\mathrm{jet1},\mathrm{jet2}) = \mathrm{eff30}(\mathrm{jet1}) \times \mathrm{eff30}(\mathrm{jet2}).$$

$$\begin{aligned}\mathrm{eff}(\mathrm{jet1},\mathrm{jet2},\mathrm{jet3}) \quad = \quad & [1-\mathrm{eff30}(\mathrm{jet1})]\cdot \mathrm{eff30}(\mathrm{jet2})\cdot \mathrm{eff30}(\mathrm{jet3}) + \\ & \mathrm{eff30}(\mathrm{jet1})\cdot [1-\mathrm{eff30}(\mathrm{jet2})]\cdot \mathrm{eff30}(\mathrm{jet3}) + \\ & \mathrm{eff30}(\mathrm{jet1})\cdot \mathrm{eff30}(\mathrm{jet2})\cdot [1-\mathrm{eff30}(\mathrm{jet3})] + \\ & \mathrm{eff30}(\mathrm{jet1})\cdot \mathrm{eff30}(\mathrm{jet2})\cdot \mathrm{eff30}(\mathrm{jet3}).\end{aligned}$$

Jeff provided us “luminosity weighted average (LWA)” efficiency for each leg separately.

Muon HLT efficiency table

p_T range (GeV)	η range	ϵ_{Data}	η range	ϵ_{Data}
25–30	-2.1–-1.5	0.8490 ± 0.0032	1.5–2.1	0.8457 ± 0.0033
	-1.5–-1.0	0.8725 ± 0.0032	1.0–1.5	0.8628 ± 0.0032
	-1.0–-0.5	0.9057 ± 0.0026	0.5–1.0	0.8999 ± 0.0027
	-0.5– 0.0	0.9211 ± 0.0022	0.0–0.5	0.9251 ± 0.0022
30–35	-2.1–-1.5	0.8797 ± 0.0031	1.5–2.1	0.8768 ± 0.0031
	-1.5–-1.0	0.9136 ± 0.0030	1.0–1.5	0.9016 ± 0.0031
	-1.0–-0.5	0.9397 ± 0.0025	0.5–1.0	0.9387 ± 0.0025
	-0.5– 0.0	0.9579 ± 0.0022	0.0–0.5	0.9556 ± 0.0021
35–40	-2.1–-1.5	0.8816 ± 0.0027	1.5–2.1	0.8894 ± 0.0026
	-1.5–-1.0	0.9142 ± 0.0025	1.0–1.5	0.9008 ± 0.0026
	-1.0–-0.5	0.9385 ± 0.0022	0.5–1.0	0.9385 ± 0.0021
	-0.5– 0.0	0.9571 ± 0.0019	0.0–0.5	0.9546 ± 0.0019
40–45	-2.1–-1.5	0.8878 ± 0.0024	1.5–2.1	0.8902 ± 0.0024
	-1.5–-1.0	0.9221 ± 0.0021	1.0–1.5	0.9076 ± 0.0022
	-1.0–-0.5	0.9443 ± 0.0020	0.5–1.0	0.9457 ± 0.0019
	-0.5– 0.0	0.9622 ± 0.0018	0.0–0.5	0.9617 ± 0.0018
45–50	-2.1–-1.5	0.8922 ± 0.0029	1.5–2.1	0.8934 ± 0.0028
	-1.5–-1.0	0.9202 ± 0.0027	1.0–1.5	0.9069 ± 0.0027
	-1.0–-0.5	0.9458 ± 0.0024	0.5–1.0	0.9437 ± 0.0025
	-0.5– 0.0	0.9625 ± 0.0023	0.0–0.5	0.9615 ± 0.0023
50–200	-2.1–-1.5	0.8920 ± 0.0031	1.5–2.1	0.8903 ± 0.0032
	-1.5–-1.0	0.9178 ± 0.0030	1.0–1.5	0.9041 ± 0.0030
	-1.0–-0.5	0.9419 ± 0.0027	0.5–1.0	0.9424 ± 0.0028
	-0.5– 0.0	0.9606 ± 0.0026	0.0–0.5	0.9604 ± 0.0025

Some variation observed in p_T, η

Muon isolation efficiency data/MC scale factor

p_T range (GeV)	η range	$\frac{\epsilon_{Data}}{\epsilon_{MC}}$	η range	$\frac{\epsilon_{Data}}{\epsilon_{MC}}$
25–30	-2.1– -1.5	1.00 ± 0.00	1.5–2.1	1.00 ± 0.00
	-1.5– -1.0	0.99 ± 0.00	1.0–1.5	1.00 ± 0.00
	-1.0– -0.5	1.00 ± 0.00	0.5–1.0	1.00 ± 0.00
	-0.5– 0.0	1.00 ± 0.00	0.0–0.5	1.00 ± 0.02
30–35	-2.1– -1.5	1.00 ± 0.00	1.5–2.1	1.00 ± 0.00
	-1.5– -1.0	0.99 ± 0.00	1.0–1.5	1.00 ± 0.00
	-1.0– -0.5	1.00 ± 0.00	0.5–1.0	1.00 ± 0.00
	-0.5– 0.0	1.00 ± 0.00	0.0–0.5	1.00 ± 0.00
35–40	-2.1– -1.5	0.99 ± 0.00	1.5–2.1	1.00 ± 0.00
	-1.5– -1.0	0.99 ± 0.00	1.0–1.5	1.00 ± 0.00
	-1.0– -0.5	1.00 ± 0.00	0.5–1.0	1.00 ± 0.00
	-0.5– 0.0	1.00 ± 0.00	0.0–0.5	1.00 ± 0.00
40–45	-2.1– -1.5	1.00 ± 0.00	1.5–2.1	1.00 ± 0.01
	-1.5– -1.0	0.99 ± 0.00	1.0–1.5	1.00 ± 0.00
	-1.0– -0.5	1.00 ± 0.00	0.5–1.0	1.00 ± 0.00
	-0.5– 0.0	1.00 ± 0.00	0.0–0.5	1.00 ± 0.00
45–50	-2.1– -1.5	1.00 ± 0.00	1.5–2.1	1.00 ± 0.00
	-1.5– -1.0	0.99 ± 0.00	1.0–1.5	1.00 ± 0.00
	-1.0– -0.5	1.00 ± 0.00	0.5–1.0	1.00 ± 0.00
	-0.5– 0.0	1.00 ± 0.00	0.0–0.5	1.00 ± 0.00
50–200	-2.1– -1.5	1.00 ± 0.00	1.5–2.1	1.00 ± 0.00
	-1.5– -1.0	0.99 ± 0.00	1.0–1.5	1.00 ± 0.00
	-1.0– -0.5	1.00 ± 0.00	0.5–1.0	1.00 ± 0.00
	-0.5– 0.0	1.00 ± 0.00	0.0–0.5	1.00 ± 0.00

Flat in pt, eta

Electron reco/ID efficiency data/MC scale factor

Reco

p_T range (GeV)	η range	$\frac{\epsilon_{Data}}{\epsilon_{MC}}$	η range	$\frac{\epsilon_{Data}}{\epsilon_{MC}}$
30–35	-2.5– -1.5	1.0096 ± 0.0062	1.5–2.5	1.0094 ± 0.0015
	-1.5– 0.0	1.0060 ± 0.0029	0.0–1.5	1.0021 ± 0.0029
35–40	-2.5– -1.5	1.0038 ± 0.0043	1.5–2.5	1.0135 ± 0.0040
	-1.5– 0.0	0.9987 ± 0.0016	0.0–1.5	0.9935 ± 0.0016
40–45	-2.5– -1.5	1.0002 ± 0.0070	1.5–2.5	1.0111 ± 0.0034
	-1.5– 0.0	0.9951 ± 0.0012	0.0–1.5	0.9941 ± 0.0012
45–50	-2.5– -1.5	1.0202 ± 0.0021	1.5–2.5	1.0170 ± 0.0080
	-1.5– 0.0	0.9941 ± 0.0014	0.0–1.5	0.9967 ± 0.0013
50–200	-2.5– -1.5	1.0287 ± 0.0049	1.5–2.5	1.0421 ± 0.0092
	-1.5– 0.0	0.9805 ± 0.0130	0.0–1.5	0.9989 ± 0.0018

ID

p_T range (GeV)	η range	$\frac{\epsilon_{Data}}{\epsilon_{MC}}$	η range	$\frac{\epsilon_{Data}}{\epsilon_{MC}}$
30–35	-2.5– -1.5	0.9937 ± 0.0073	1.5–2.5	0.9372 ± 0.0074
	-1.5– 0.0	1.0018 ± 0.0009	0.0–1.5	0.9958 ± 0.0039
35–40	-2.5– -1.5	0.9545 ± 0.0055	1.5–2.5	0.9607 ± 0.0053
	-1.5– 0.0	0.9910 ± 0.0024	0.0–1.5	0.9960 ± 0.0025
40–45	-2.5– -1.5	0.9661 ± 0.1567	1.5–2.5	0.9648 ± 0.0024
	-1.5– 0.0	0.9946 ± 0.0019	0.0–1.5	0.9892 ± 0.0877
45–50	-2.5– -1.5	0.9672 ± 0.0050	1.5–2.5	0.9729 ± 0.0051
	-1.5– 0.0	0.9938 ± 0.0773	0.0–1.5	0.9917 ± 0.0022
50–200	-2.5– -1.5	0.9836 ± 0.0066	1.5–2.5	0.9813 ± 0.0068
	-1.5– 0.0	0.9915 ± 0.0030	0.0–1.5	0.9857 ± 0.0030

Some variation observed in p_T, η

Electron HLT efficiency: Ele27 in May10 reReco

p_T range (GeV)	η range	ϵ_{Data}	η range	ϵ_{Data}
30–35	-2.5– -1.5	0.96 ± 0.01	1.5–2.5	0.93 ± 0.01
	-1.5– 0.0	0.97 ± 0.00	0.0–1.5	0.97 ± 0.00
35–40	-2.5– -1.5	0.97 ± 0.00	1.5–2.5	0.97 ± 0.00
	-1.5– 0.0	0.97 ± 0.00	0.0–1.5	0.97 ± 0.00
40–45	-2.5– -1.5	0.97 ± 0.00	1.5–2.5	0.97 ± 0.00
	-1.5– 0.0	0.98 ± 0.00	0.0–1.5	0.98 ± 0.00
45–50	-2.5– -1.5	0.97 ± 0.00	1.5–2.5	0.97 ± 0.00
	-1.5– 0.0	0.98 ± 0.00	0.0–1.5	0.98 ± 0.00
50–200	-2.5– -1.5	0.97 ± 0.01	1.5–2.5	0.98 ± 0.00
	-1.5– 0.0	0.98 ± 0.00	0.0–1.5	0.98 ± 0.00

Almost flat in pt, eta

Electron HLT efficiency: Ele+2j+MHT: ele, MET

p_T range (GeV)	η range	ϵ_{Data}	η range	ϵ_{Data}
30–35	-2.5– -1.5	0.8742 ± 0.0039	1.5–2.5	0.8519 ± 0.0040
	-1.5– 0.0	0.9711 ± 0.0010	0.0–1.5	0.9690 ± 0.0011
35–40	-2.5– -1.5	0.9630 ± 0.0017	1.5–2.5	0.9623 ± 0.0017
	-1.5– 0.0	0.9775 ± 0.0006	0.0–1.5	0.9757 ± 0.0007
40–45	-2.5– -1.5	0.9720 ± 0.0013	1.5–2.5	0.9699 ± 0.0013
	-1.5– 0.0	0.9789 ± 0.0006	0.0–1.5	0.9762 ± 0.0006
45–50	-2.5– -1.5	0.9720 ± 0.0014	1.5–2.5	0.9727 ± 0.0014
	-1.5– 0.0	0.9782 ± 0.0007	0.0–1.5	0.9764 ± 0.0007
50–200	-2.5– -1.5	0.9747 ± 0.0017	1.5–2.5	0.9746 ± 0.0016
	-1.5– 0.0	0.9820 ± 0.0008	0.0–1.5	0.9808 ± 0.0008

Ele leg: Similar to the previous slide (i.e., single ele efficiency)

PF missing $\not\!\!E_T$ range (GeV)	ϵ_{Data}
30–35	0.9136 ± 0.0072
35–40	0.9393 ± 0.0064
40–45	0.9807 ± 0.0045
45–50	0.9821 ± 0.0055
50–60	0.9933 ± 0.0030
60–70	0.9955 ± 0.0049
70–100	0.9954 ± 0.0037

MET leg: Not fully efficient up to 60 GeV

Electron HLT efficiency: Ele+2j+MHT: jet30 leg

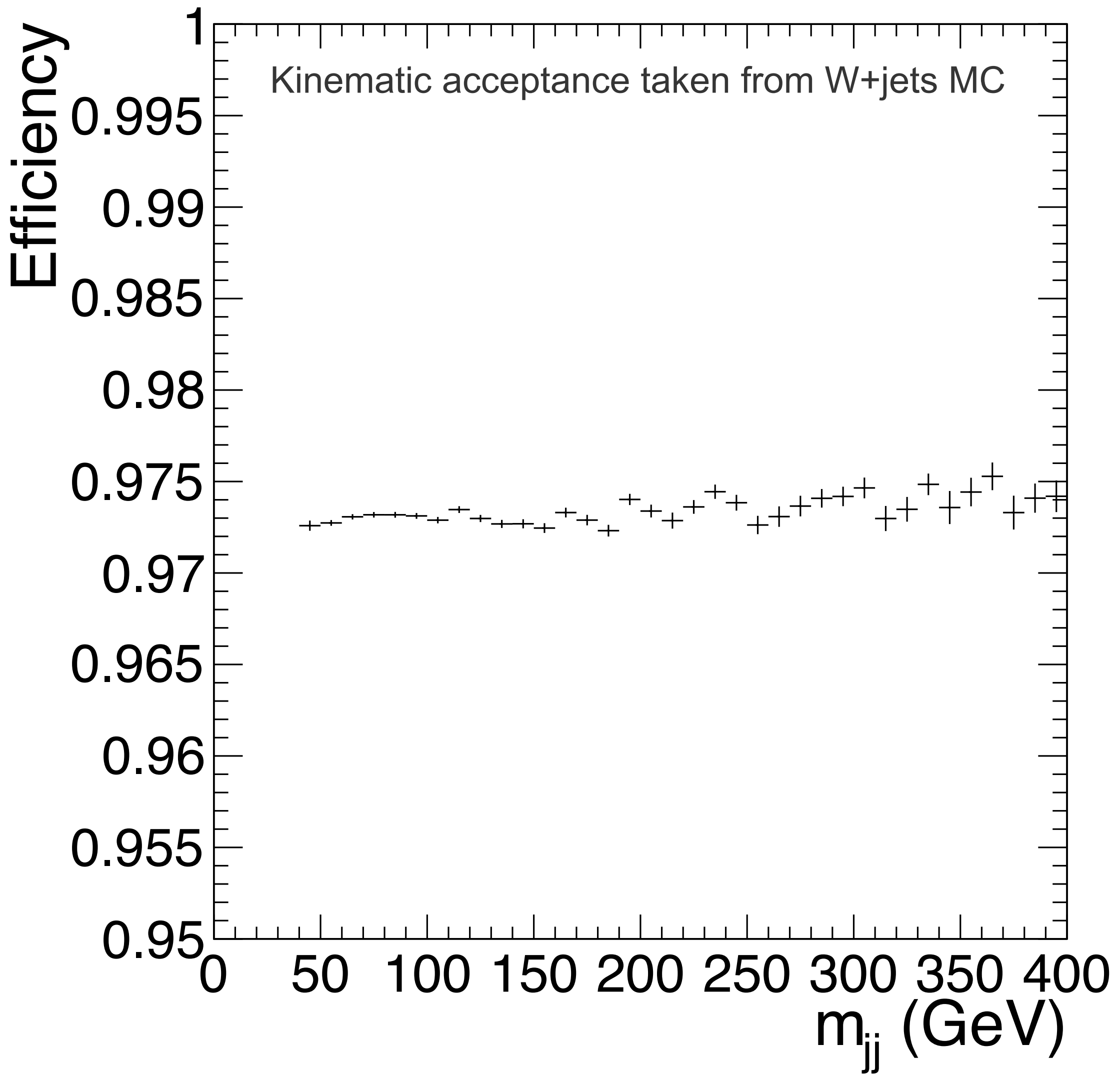
p_T range (GeV)	η range	ϵ_{Data}	η range	ϵ_{Data}
30–35	-2.4– -1.5	0.4209 ± 0.0092	1.5–2.4	0.4292 ± 0.0090
	-1.5– 0.0	0.5051 ± 0.0064	0.0–1.5	0.5051 ± 0.0064
35–40	-2.4– -1.5	0.7081 ± 0.0100	1.5–2.4	0.6849 ± 0.0100
	-1.5– 0.0	0.7268 ± 0.0062	0.0–1.5	0.7109 ± 0.0063
40–45	-2.4– -1.5	0.8689 ± 0.0090	1.5–2.4	0.8630 ± 0.0088
	-1.5– 0.0	0.8562 ± 0.0057	0.0–1.5	0.8693 ± 0.0054
45–50	-2.4– -1.5	0.9522 ± 0.0067	1.5–2.4	0.9377 ± 0.0077
	-1.5– 0.0	0.9343 ± 0.0047	0.0–1.5	0.9318 ± 0.0047
50–55	-2.4– -1.5	0.9698 ± 0.0064	1.5–2.4	0.9751 ± 0.0058
	-1.5– 0.0	0.9734 ± 0.0035	0.0–1.5	0.9622 ± 0.0041
55–60	-2.4– -1.5	0.9847 ± 0.0055	1.5–2.4	0.9743 ± 0.0066
	-1.5– 0.0	0.9800 ± 0.0034	0.0–1.5	0.9802 ± 0.0035
60–65	-2.4– -1.5	0.9767 ± 0.0076	1.5–2.4	0.9807 ± 0.0066
	-1.5– 0.0	0.9884 ± 0.0030	0.0–1.5	0.9871 ± 0.0033
65–70	-2.4– -1.5	0.9829 ± 0.0071	1.5–2.4	0.9891 ± 0.0064
	-1.5– 0.0	0.9904 ± 0.0032	0.0–1.5	0.9861 ± 0.0036
70–80	-2.4– -1.5	0.9915 ± 0.0044	1.5–2.4	0.9904 ± 0.0046
	-1.5– 0.0	0.9893 ± 0.0025	0.0–1.5	0.9904 ± 0.0024
80–90	-2.4– -1.5	0.9915 ± 0.0056	1.5–2.4	0.9963 ± 0.0047
	-1.5– 0.0	0.9914 ± 0.0027	0.0–1.5	0.9915 ± 0.0027
90–100	-2.4– -1.5	0.9897 ± 0.0074	1.5–2.4	0.9924 ± 0.0060
	-1.5– 0.0	0.9912 ± 0.0033	0.0–1.5	0.9909 ± 0.0032
100–200	-2.4– -1.5	0.9924 ± 0.0032	1.5–2.4	0.9925 ± 0.0032
	-1.5– 0.0	0.9951 ± 0.0013	0.0–1.5	0.9953 ± 0.0012

Electron HLT efficiency: Ele+2j+MHT: jet25!30

p_T range (GeV)	η range	ϵ_{Data}	η range	ϵ_{Data}
30–35	-2.4– -1.5	0.1923 ± 0.0070	1.5–2.4	0.2124 ± 0.0071
	-1.5– 0.0	0.1468 ± 0.0043	0.0–1.5	0.1516 ± 0.0043
35–40	-2.4– -1.5	0.0892 ± 0.0055	1.5–2.4	0.1168 ± 0.0061
	-1.5– 0.0	0.0792 ± 0.0033	0.0–1.5	0.0885 ± 0.0034
40–45	-2.4– -1.5	0.0374 ± 0.0041	1.5–2.4	0.0368 ± 0.0041
	-1.5– 0.0	0.0337 ± 0.0024	0.0–1.5	0.0378 ± 0.0025
45–50	-2.4– -1.5	0.0154 ± 0.0031	1.5–2.4	0.0212 ± 0.0035
	-1.5– 0.0	0.0139 ± 0.0018	0.0–1.5	0.0146 ± 0.0018
50–55	-2.4– -1.5	0.0061 ± 0.0024	1.5–2.4	0.0053 ± 0.0022
	-1.5– 0.0	0.0051 ± 0.0012	0.0–1.5	0.0076 ± 0.0015
55–60	-2.4– -1.5	0.0027 ± 0.0021	1.5–2.4	0.0028 ± 0.0019
	-1.5– 0.0	0.0020 ± 0.0009	0.0–1.5	0.0041 ± 0.0013
60–65	-2.4– -1.5	0.0016 ± 0.0020	1.5–2.4	0.0006 ± 0.0016
	-1.5– 0.0	0.0018 ± 0.0010	0.0–1.5	0.0014 ± 0.0010
65–70	-2.4– -1.5	0.0008 ± 0.0020	1.5–2.4	0.0000 ± 0.0017
	-1.5– 0.0	0.0010 ± 0.0009	0.0–1.5	0.0000 ± 0.0006
70–80	-2.4– -1.5	0.0005 ± 0.0012	1.5–2.4	0.0000 ± 0.0011
	-1.5– 0.0	0.0004 ± 0.0005	0.0–1.5	0.0004 ± 0.0005
80–90	-2.4– -1.5	0.0000 ± 0.0016	1.5–2.4	0.0007 ± 0.0017
	-1.5– 0.0	0.0003 ± 0.0006	0.0–1.5	0.0006 ± 0.0007
90–100	-2.4– -1.5	0.0000 ± 0.0020	1.5–2.4	0.0000 ± 0.0019
	-1.5– 0.0	0.0004 ± 0.0008	0.0–1.5	0.0000 ± 0.0006
100–200	-2.4– -1.5	0.0000 ± 0.0007	1.5–2.4	0.0000 ± 0.0007
	-1.5– 0.0	0.0001 ± 0.0003	0.0–1.5	0.0001 ± 0.0003

How does efficiency affect my shape ?

Muon HLT efficiency



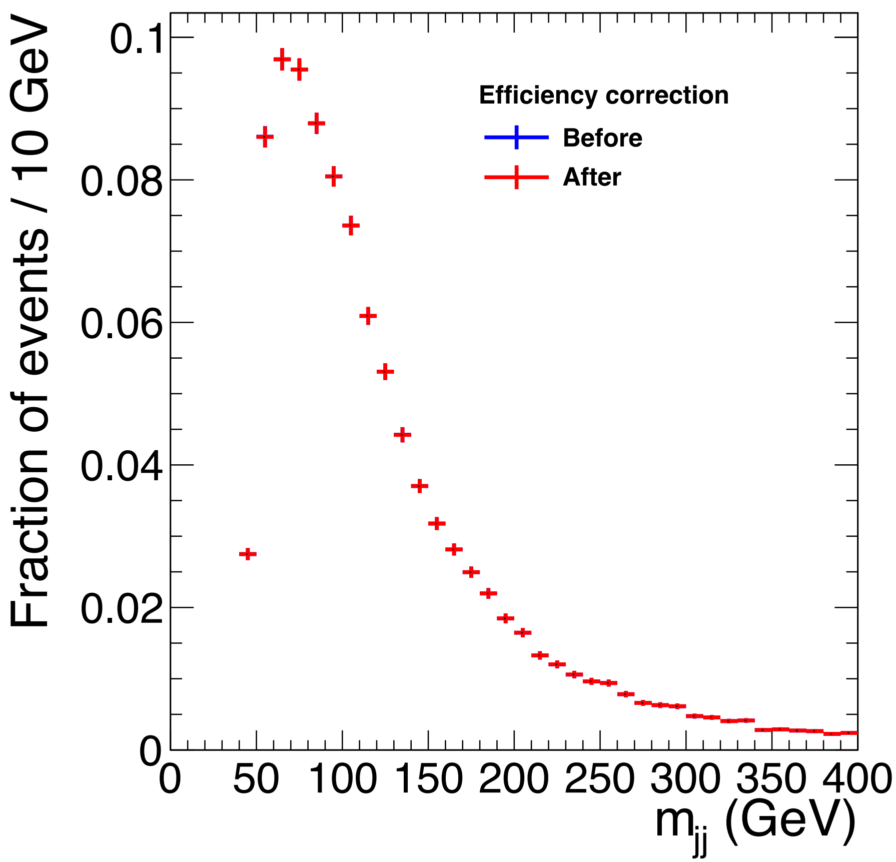
- Lumi weighted average
- For the combination of trigger paths recommended by Jeff

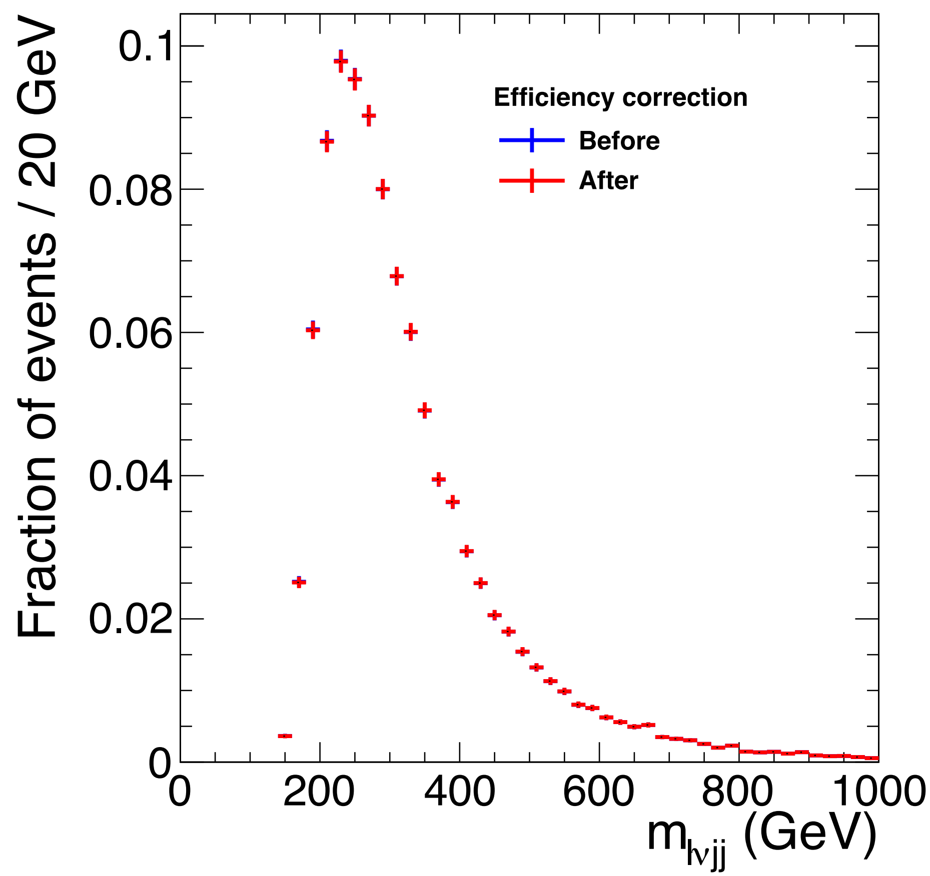
The efficiency

☑ Is flat in m_{jj} & $m_{l\nu jj}$, although not flat in muon η

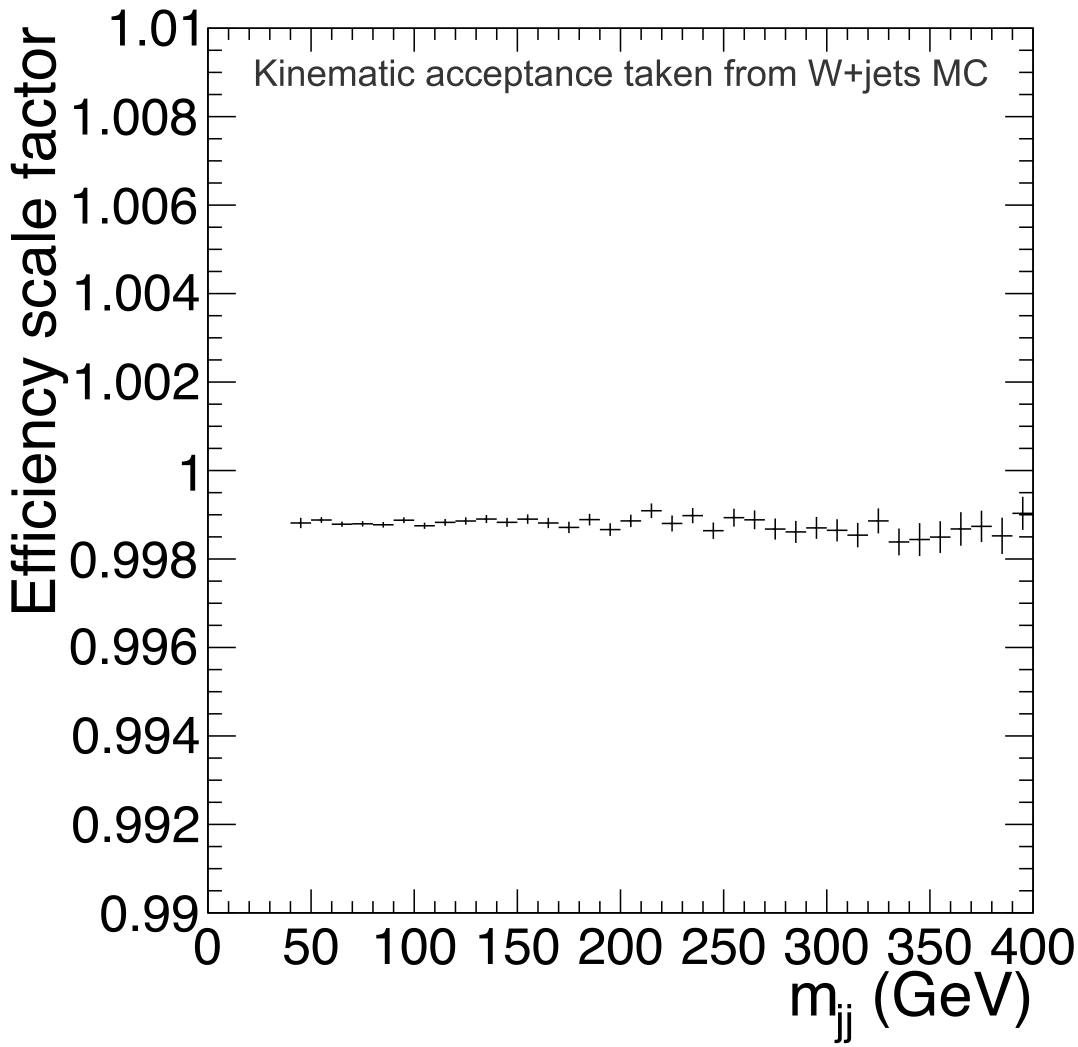
☑ Has practically no impact on template after efficiency correction

Muon HLT efficiency: effect on W+jets template





Muon isolation efficiency scale factor

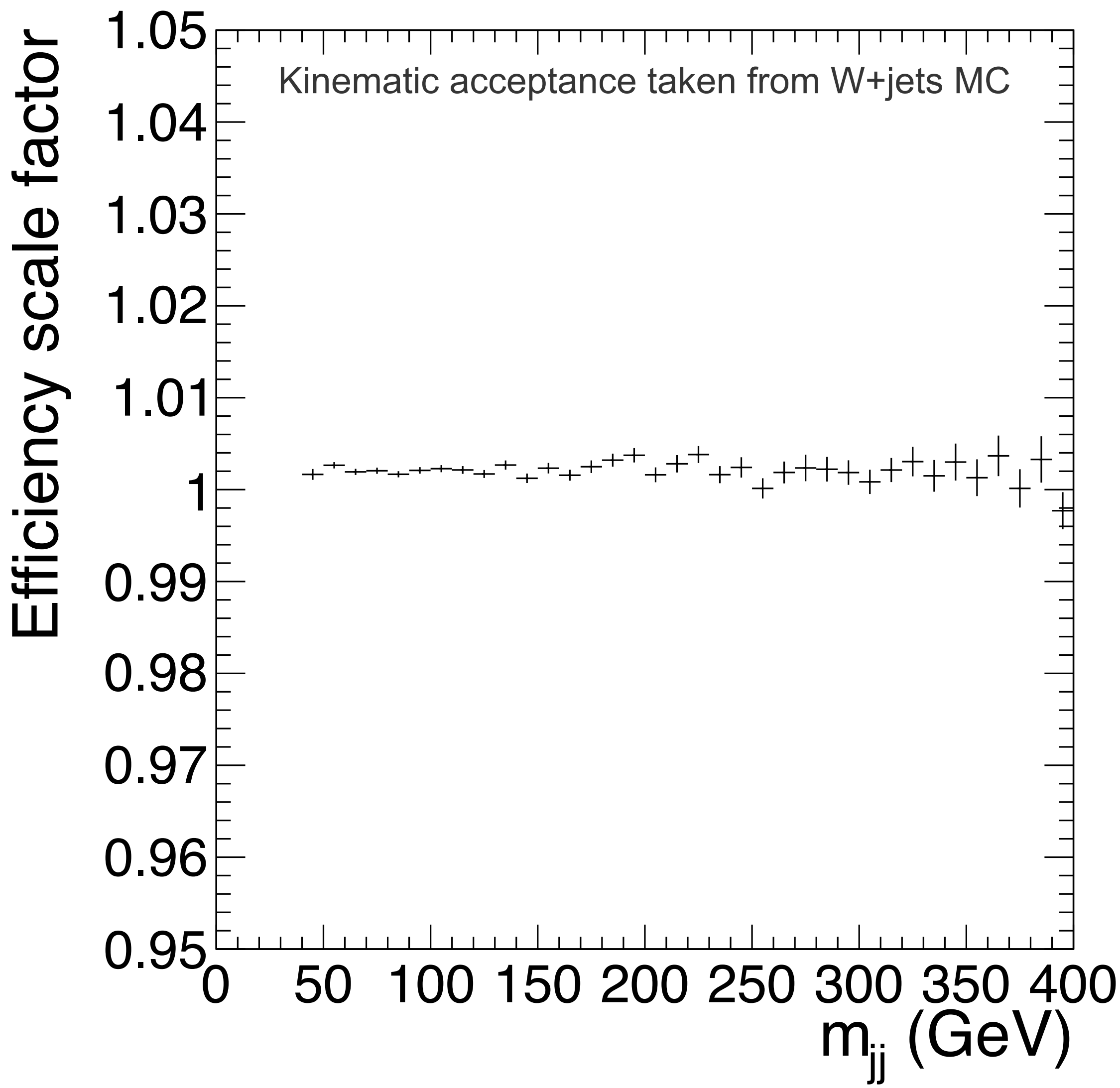


- Lumi weighted average

☑ Flat in m_{jj} & $m_{l\nu jj}$

☑ No impact on template from efficiency correction

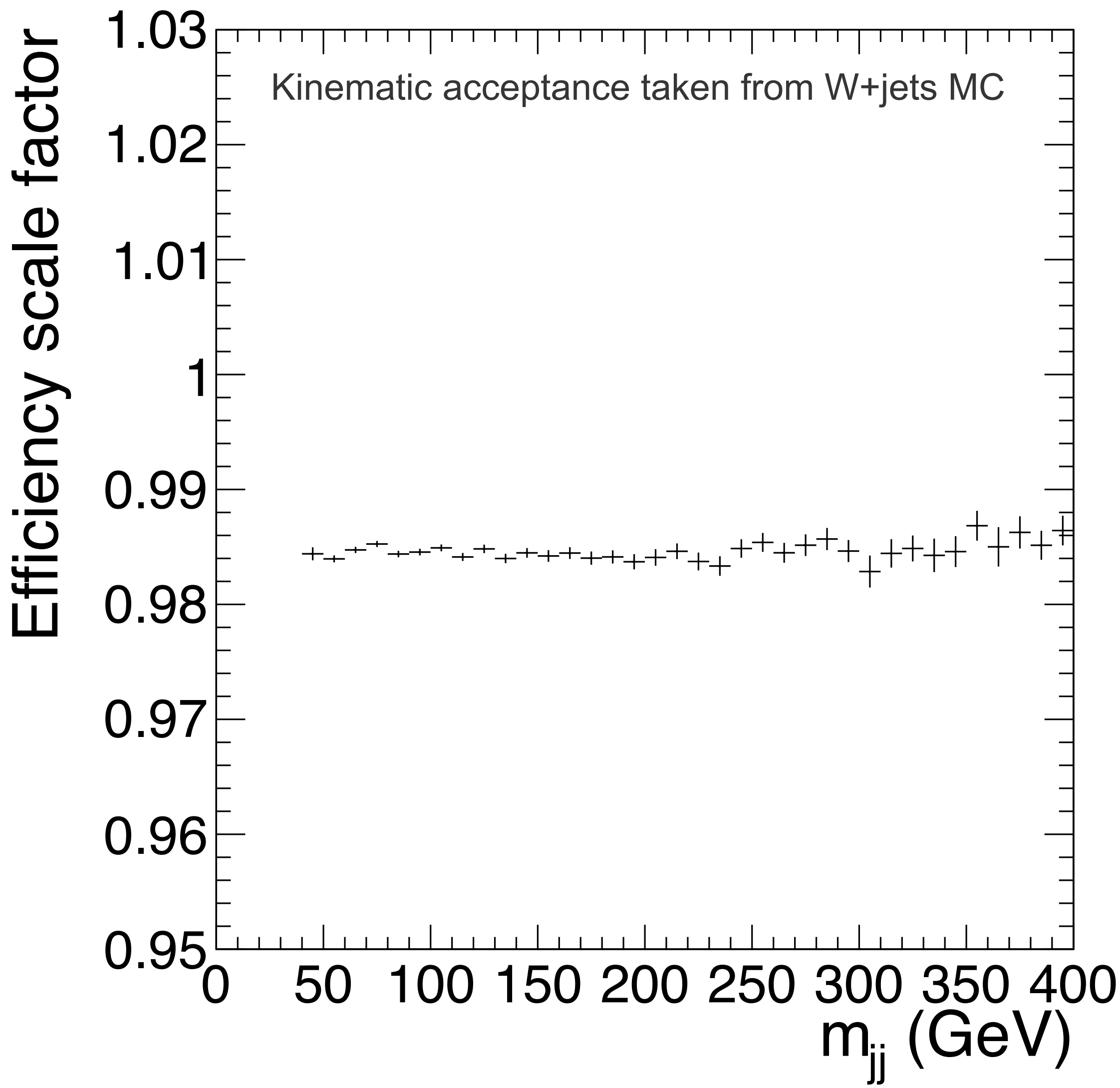
Electron reco efficiency scale factor



- Super cluster ➔ Gsf electron efficiency
- Lumi weighted average

☑ Flat in m_{jj} & $m_{l\nu jj}$
☑ No impact on template

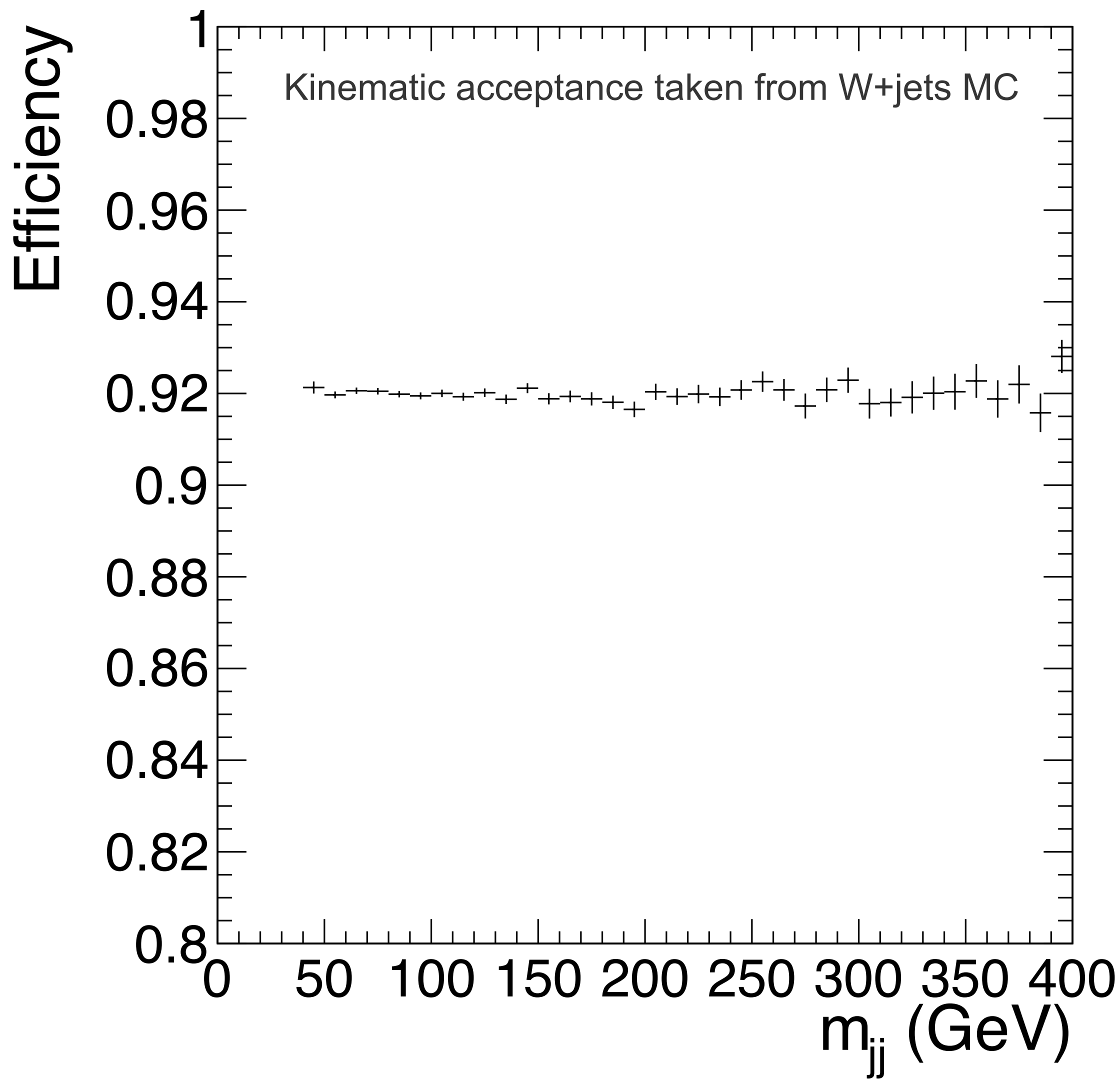
Electron ID efficiency scale factor



- Gsf Electron ➔ ID efficiency
- Lumi weighted average

☑ Flat in m_{jj} & $m_{l\nu jj}$
☑ No impact on template

Electron HLT efficiency: Ele27 in May10 reReco

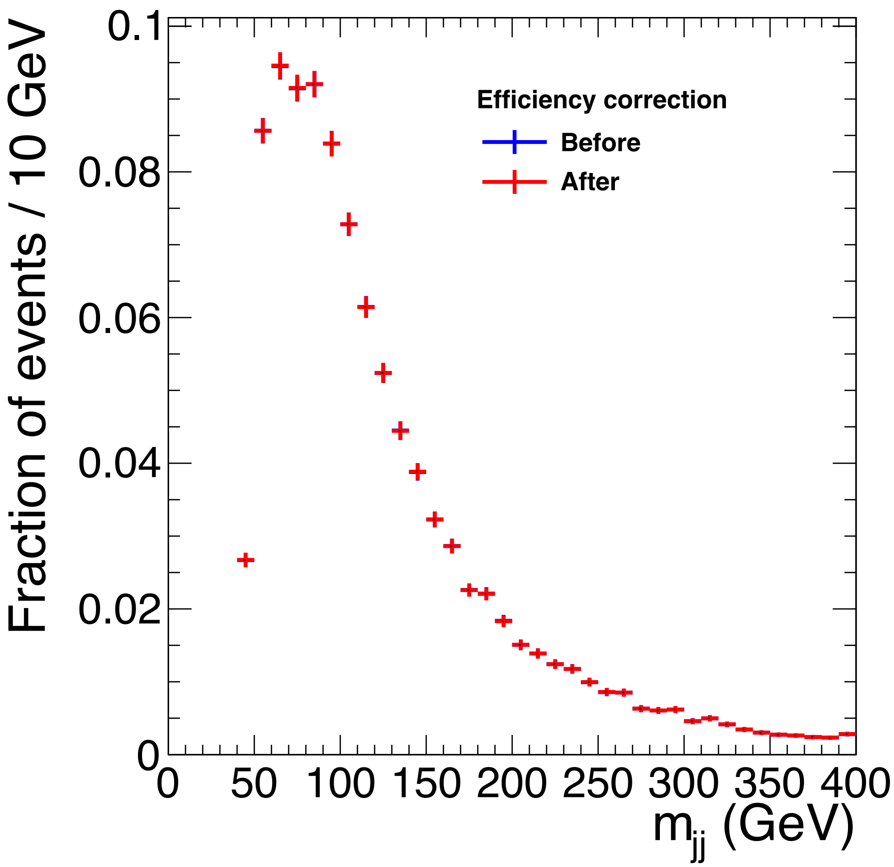


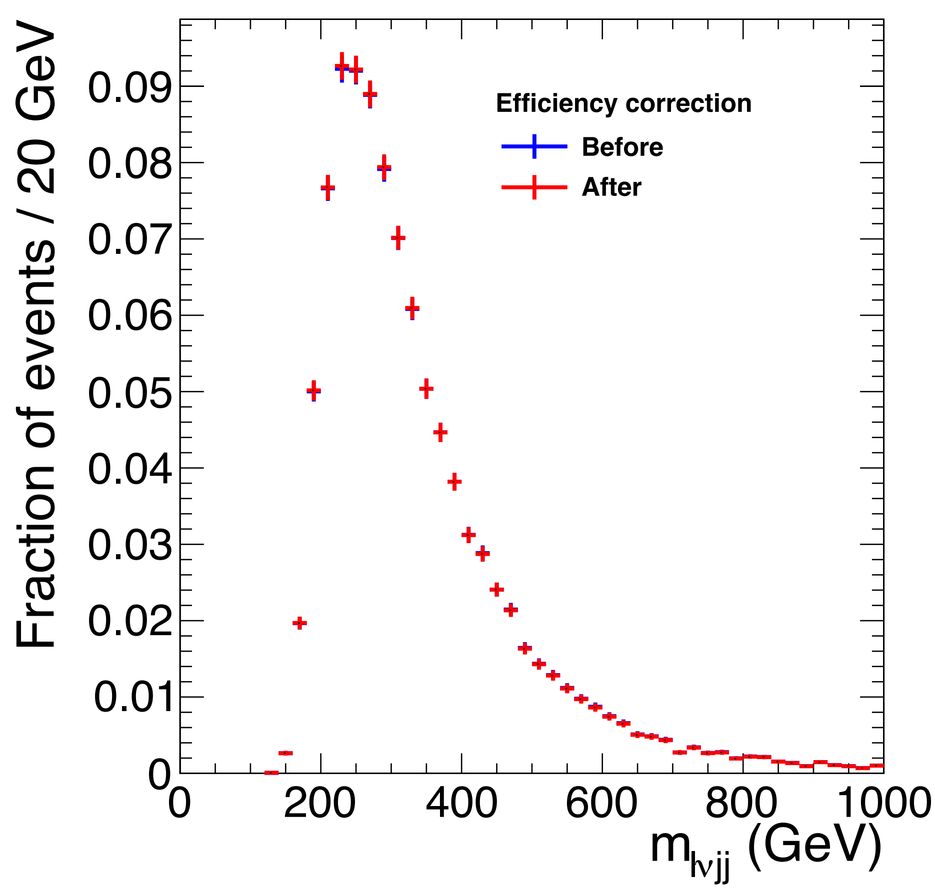
- Lumi weighted average
- For the combination of trigger paths recommended by Jeff

The efficiency

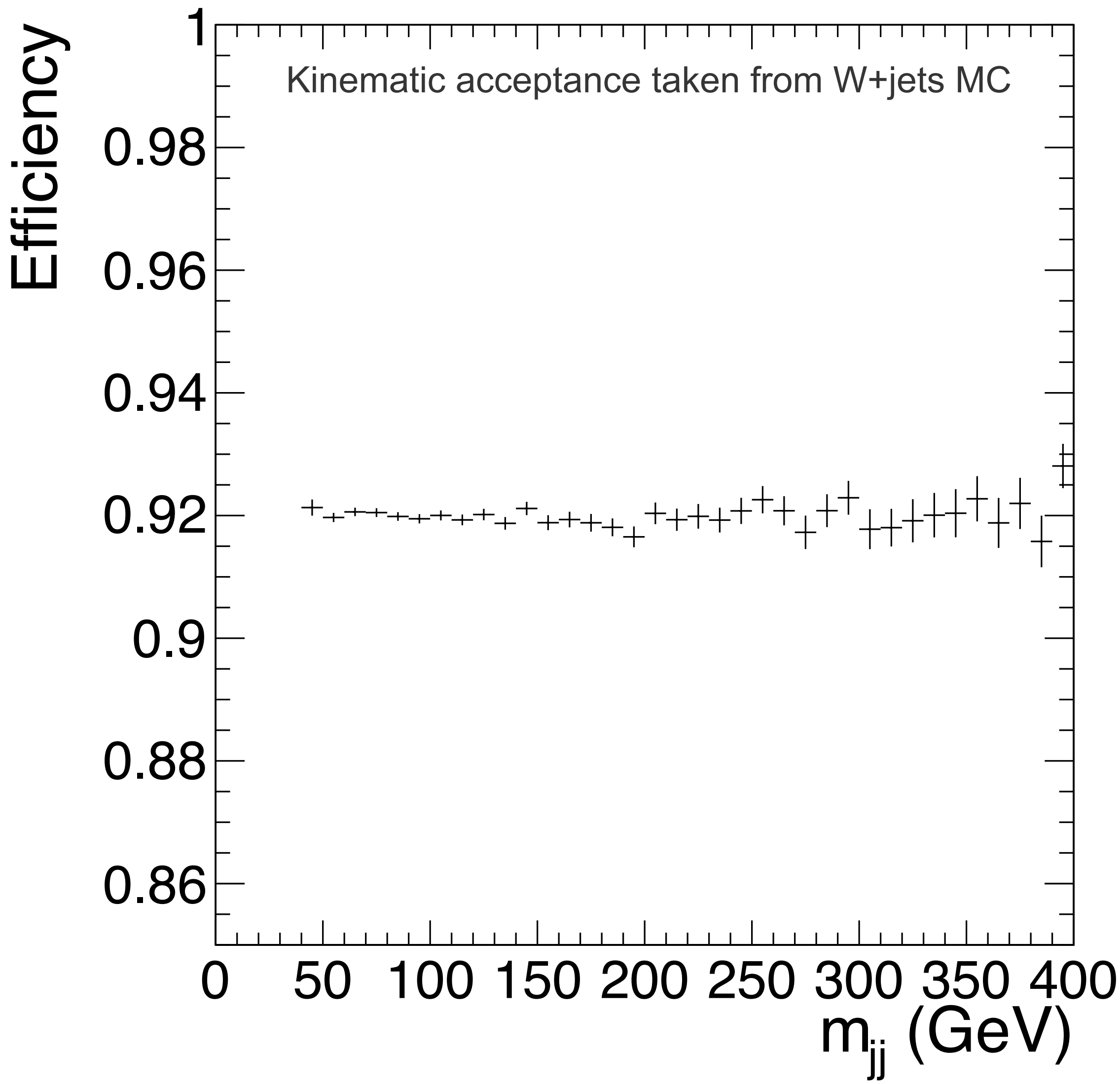
- ☑ Is flat in m_{jj} & $m_{l\nu jj}$, although not flat in el p_T, η
- ☑ Has practically no impact on template after efficiency correction

Ele27 May10 reReco: effect on W+jets template





Electron HLT efficiency: Ele+2j+MHT: ele leg

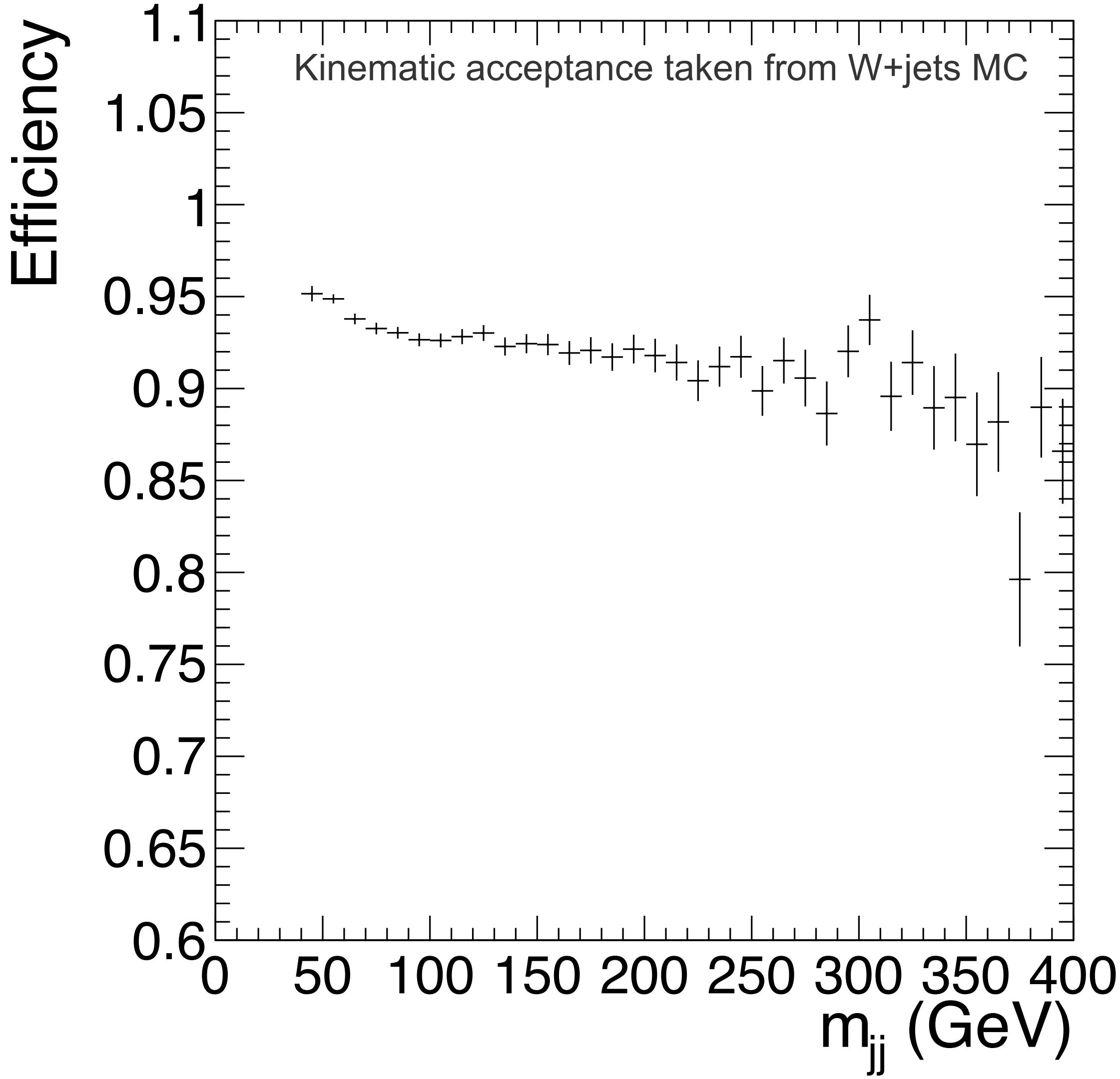


- Lumi weighted average

Efficiency of this leg is

☑ Consistent with Ele27 efficiency shown earlier

Electron HLT efficiency: Ele+2j+MHT: MHT leg

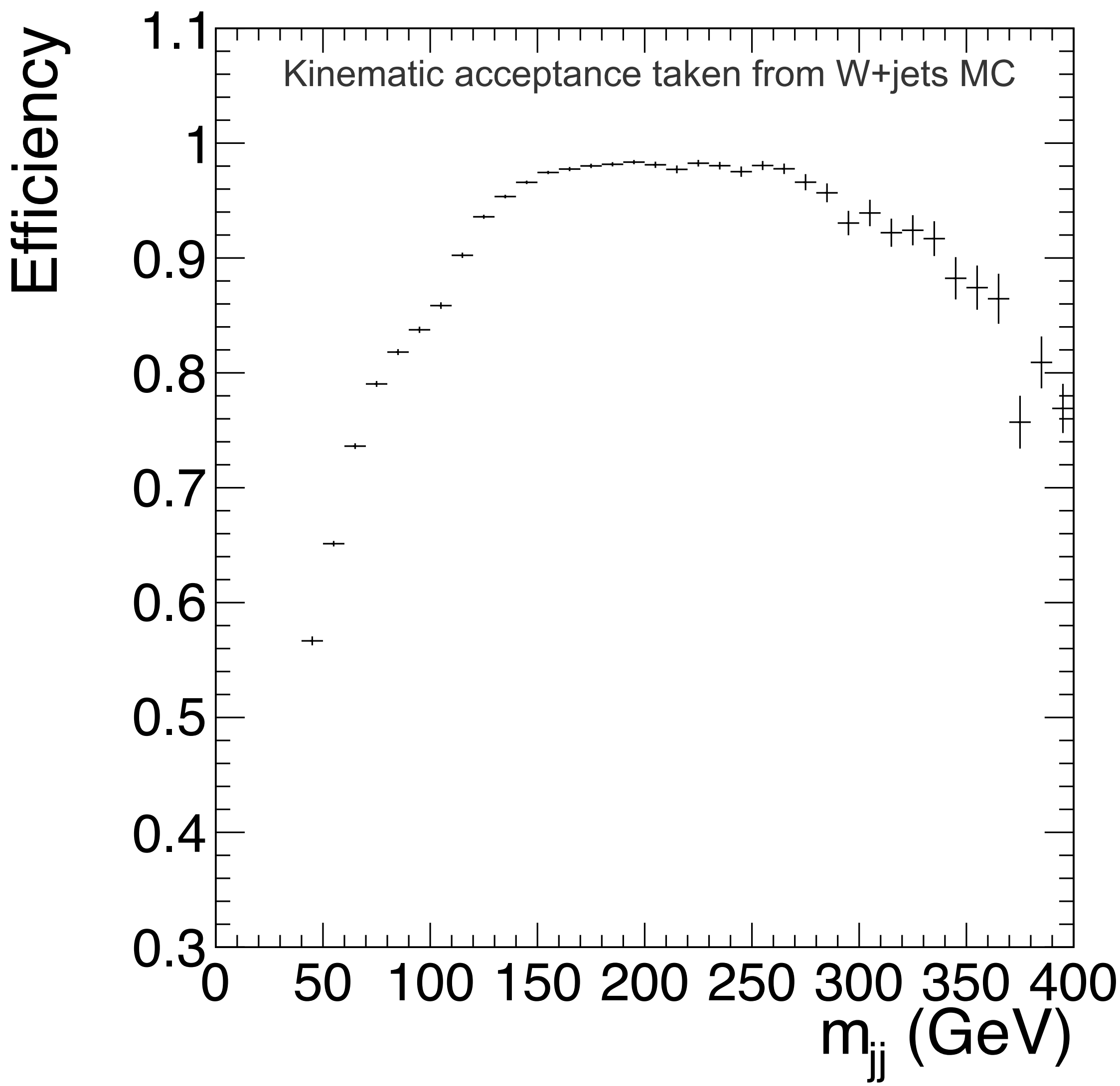


- Lumi weighted average

Efficiency of this leg

- ☑ Is NOT flat: decreases monotonically by 5% from low m_{jj} to high m_{jj}
- ☑ Has small variation between 50−130 GeV, i.e., the region relevant for Higgs & diboson analyses.

Electron HLT efficiency: Ele+2j+MHT: 2j leg



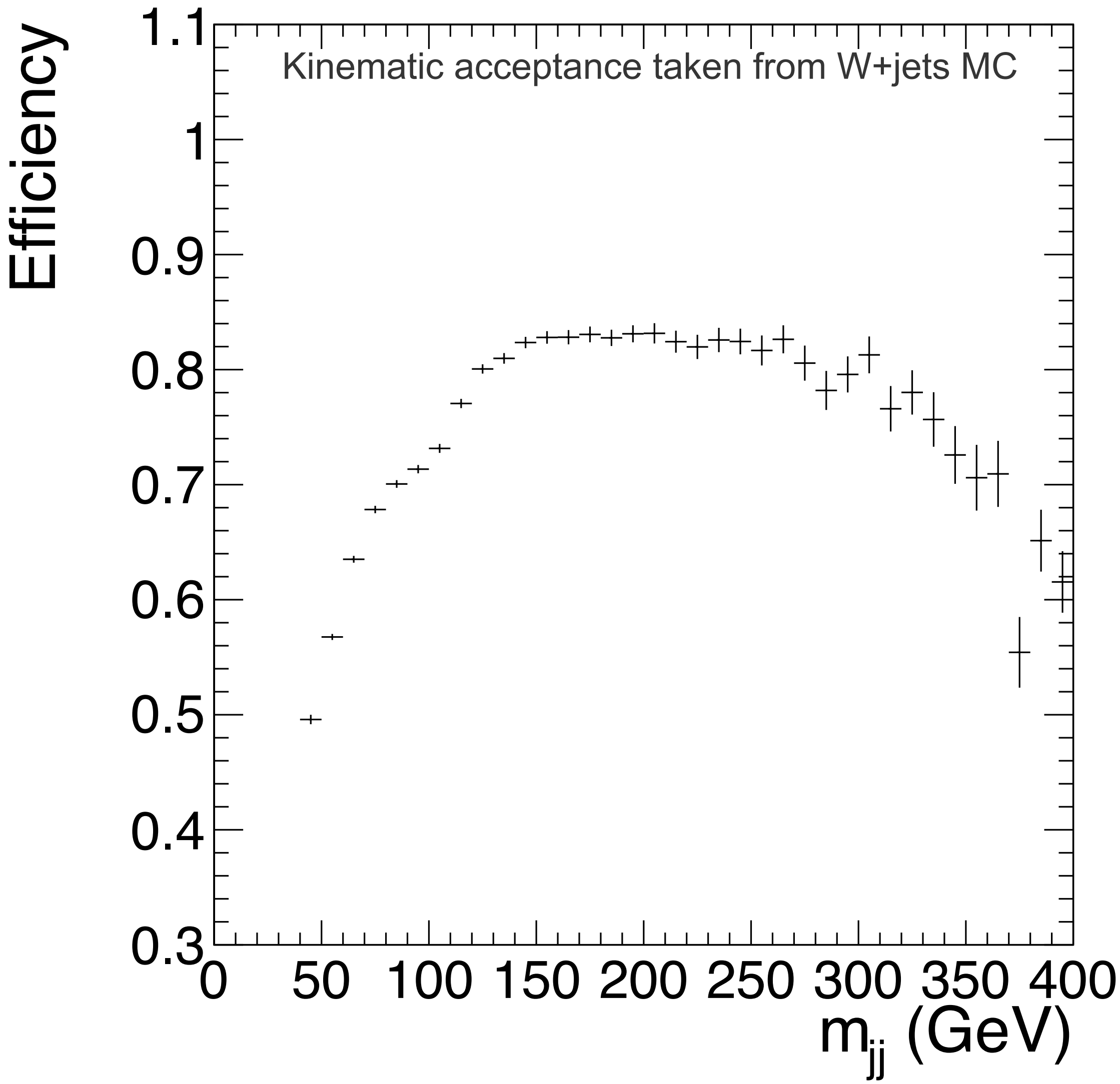
- Lumi weighted average

Efficiency of this leg is

☑ NOT flat: plateau is reached at 160 GeV

☑ Decrease at high mass is from dijet combination where the leading jet has high p_T and second jet has low p_T.

Electron HLT efficiency: Ele+2j+MHT: total

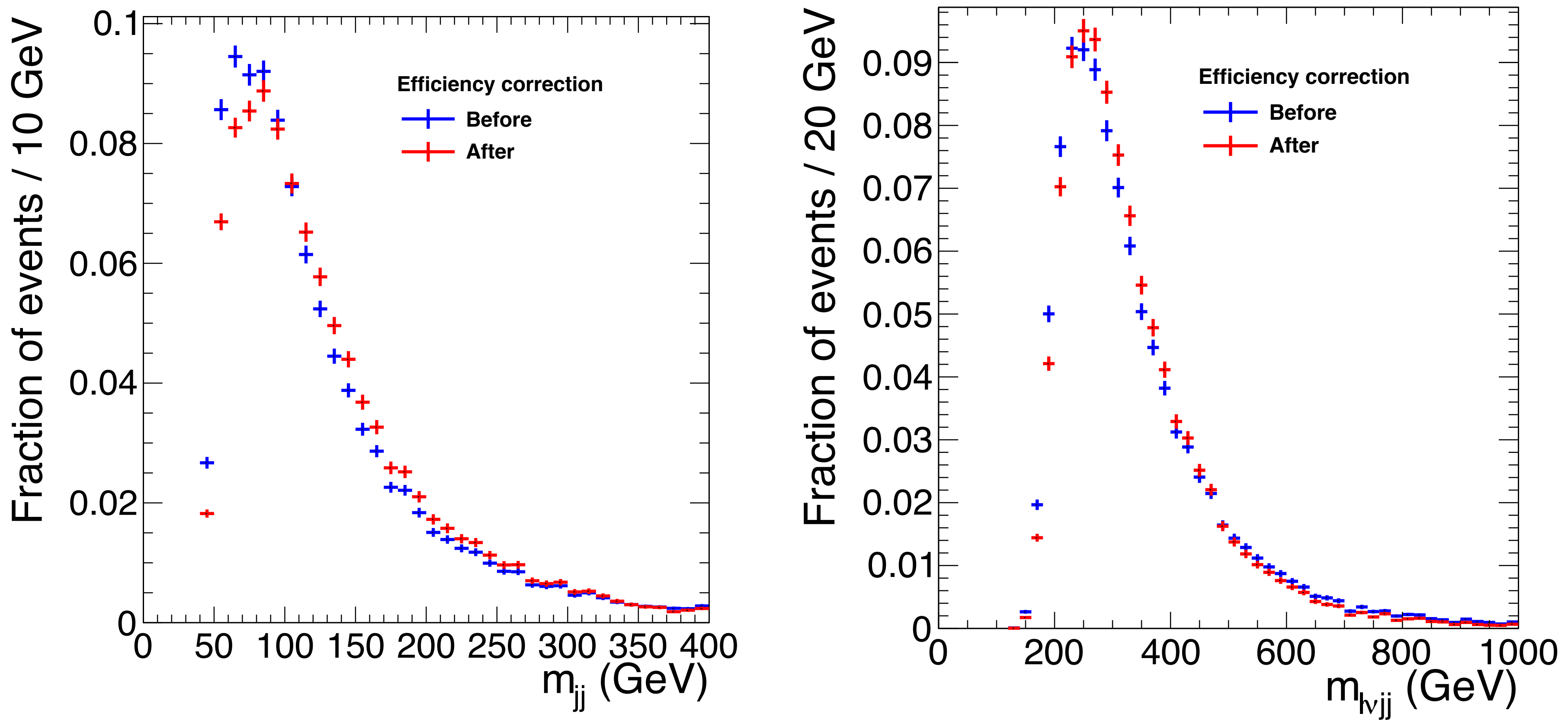


- Lumi weighted average

The efficiency

☑ has non-negligible impact on template after efficiency correction

Ele+2j+MHT: effect on W+jets template



Summary

✦I have developed machinery to compute efficiency correction factors as a function of m_{jj} and $m_{l\nu jj}$. If this group thinks it would be useful then I can put these in some common place (cvs or svn) so that people can use these to correct their template shapes.

✦The reco and ID efficiency scale factors, and single lepton trigger efficiency are independent of sample

-although they need to be computed as "lumi-weighted average".

✦Trigger efficiency for lepton+2jet+MHT trigger is sample dependent

-Need to derive correction factors separately for each physics process of interest: W+jets, diboson, ttbar, single top, QCD, Z +jets, Higgs, technicolor, Z', WH.