$W + HF$ Backgrounds and $t\bar{t}$ Acceptance in `5.3.3_nt`

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L+J Meeting

- Comparisons of $W + b\bar{b} + 1p$ Background and $t\bar{t}$ signal
- Comparisons of acceptance and efficiencies

MC Samples

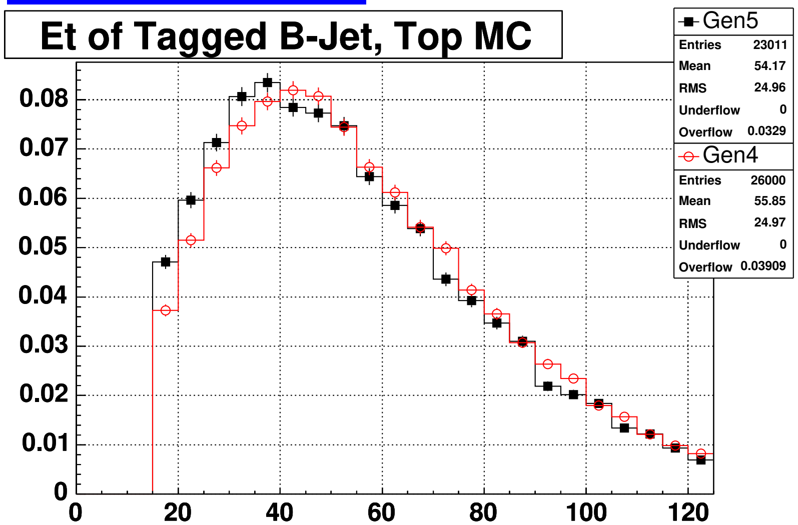
- Gen5
  - `5.3.3_nt TopFind`
  - `ttopel` $t\bar{t}$ MC (PYTHIA, $M_{top} = 178$ GeV)
  - `ttopvb` and `ttopib` $W + b\bar{b} + 1p$ MC (ALPGEN + HERWIG)
  - Jet corrections `jetCorr01` (version 5)
- Gen4
  - `4.11.2` REMAKE `TopFind`
  - `ttopei` $t\bar{t}$ MC (PYTHIA, $M_{top} = 175$ GeV)
  - `atop41` and `atop57` $W + b\bar{b} + 1p$ MC (ALPGEN + HERWIG)
  - Jet corrections `jetCorr01` (version 4)

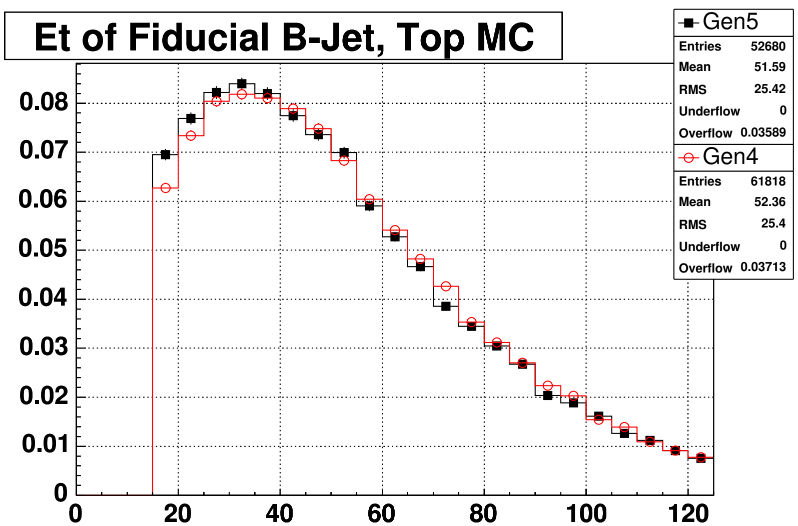
Gen4 Vs **Gen5**

- Examining distributions of fiducial and tagged b-jets
- Check $t\bar{t}$ and $W + b\bar{b} + 1p$ Monte Carlo samples
- Following plots: Examine distributions *normalized to unity*
  - Top : `SecVtx` Tagged b-jets
  - Bottom: Fiducial b-jets (unless it's a vertex quantity)
  - Left : $t\bar{t}$ MC
  - Right : $W + b\bar{b}$ MC

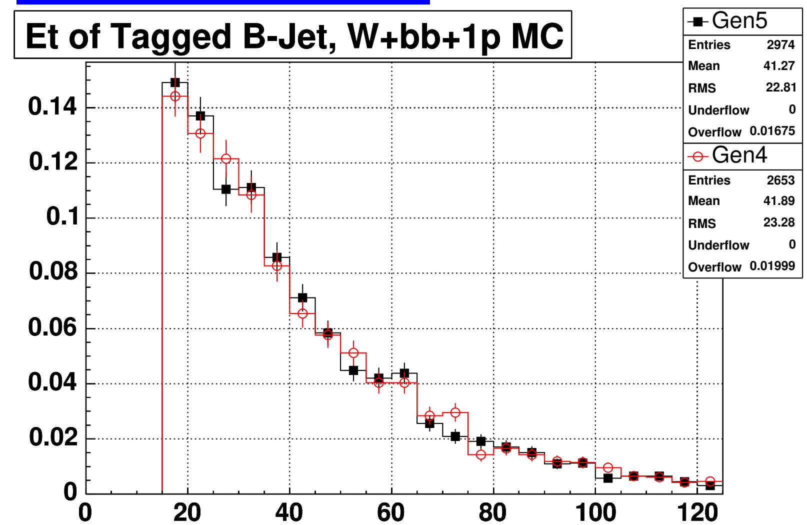
  - **Red is Gen4**, **Black is Gen5**

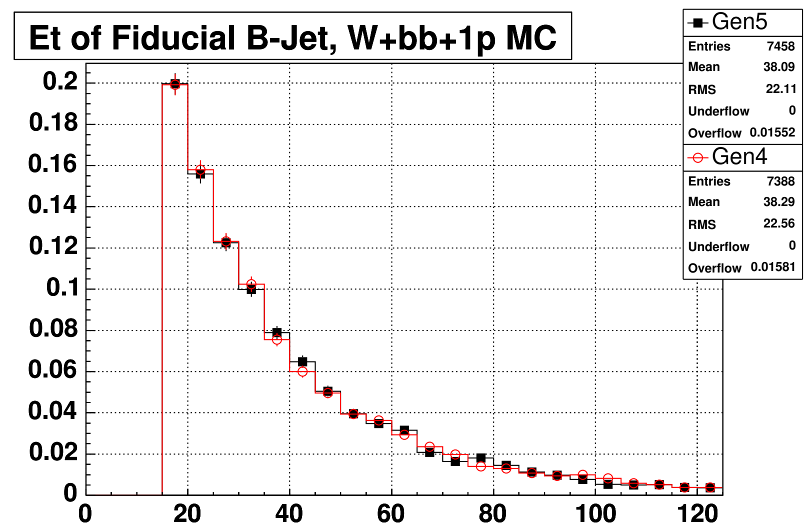
Top MC : Jet Et





W+bb+1p : Jet Et

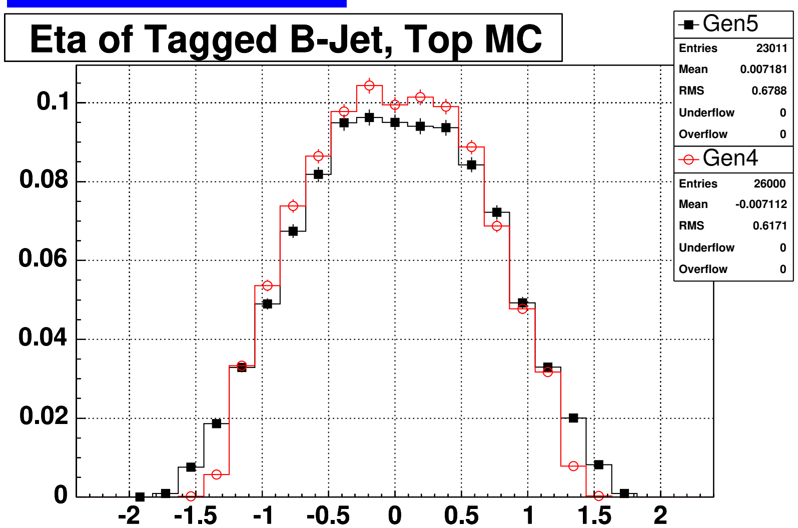


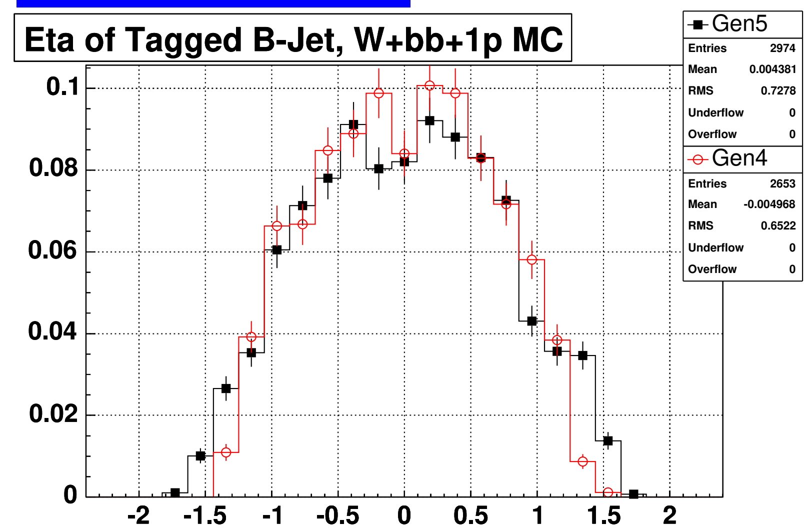


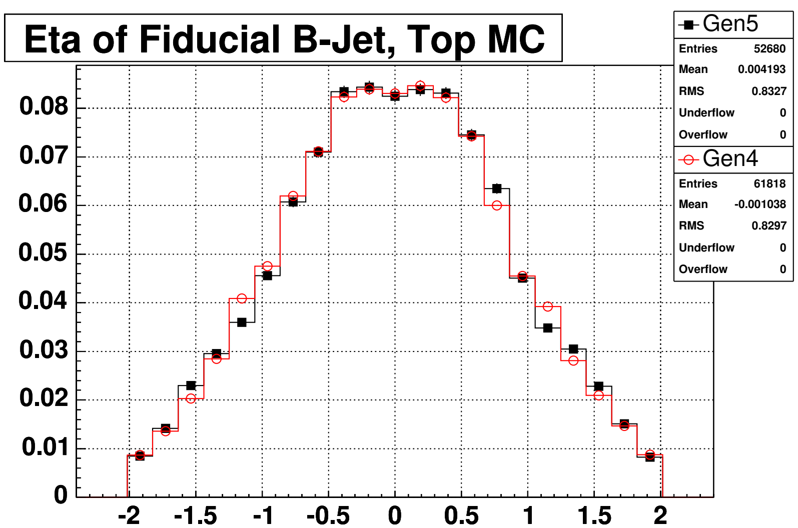
E_T in top MC slightly softer???

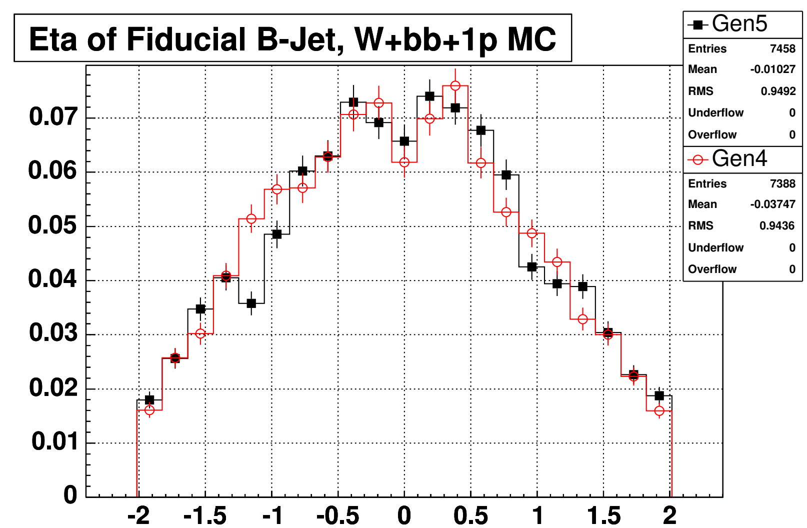
Top MC : Jet η

W+bb+1p : Jet η



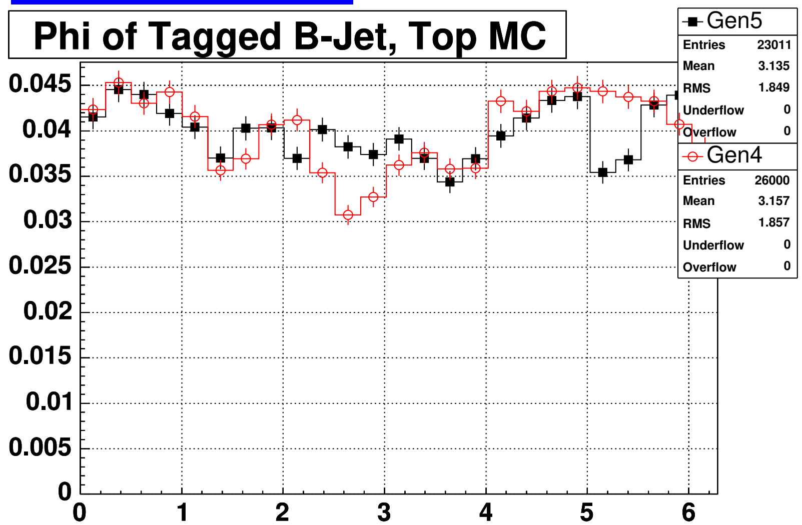


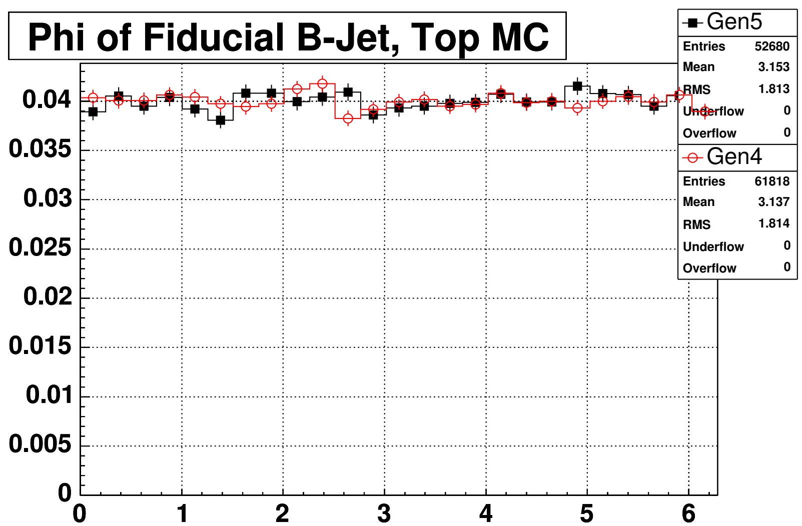




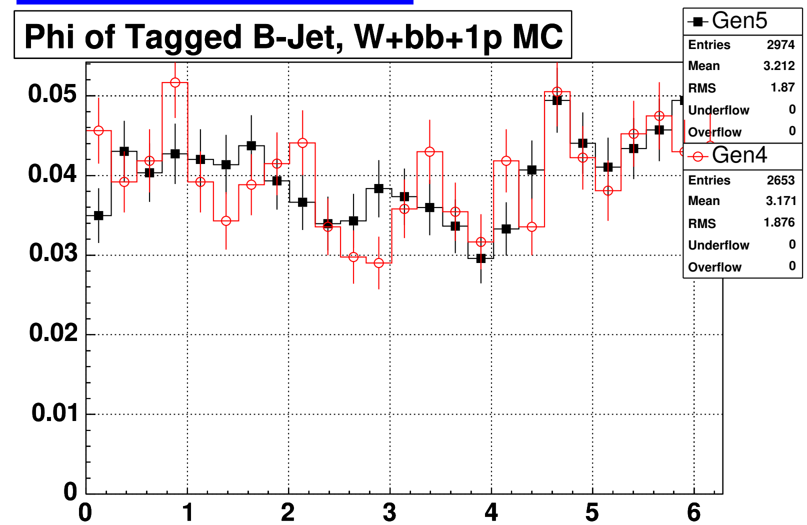
Using IO tracks helps in forward region.

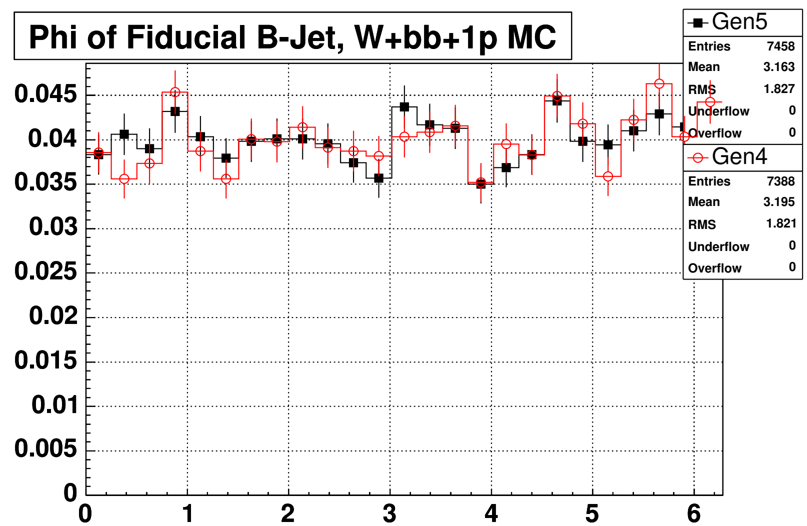
Top MC : Jet ϕ





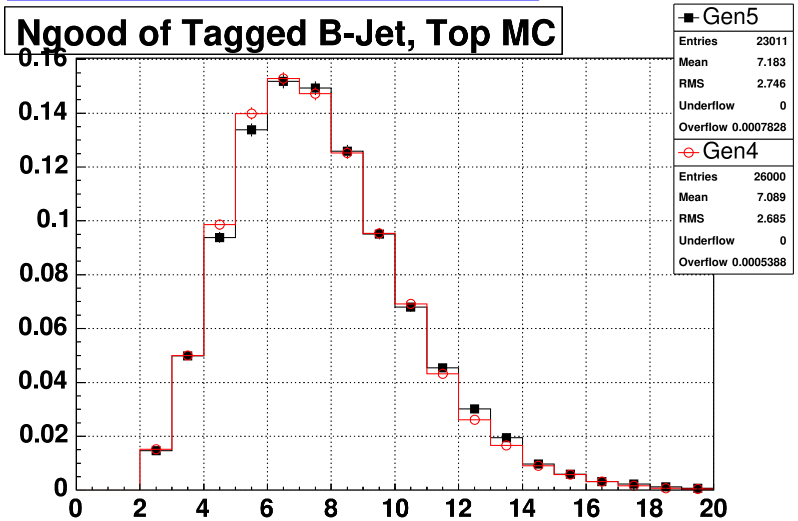
W+bb+1p : Jet ϕ

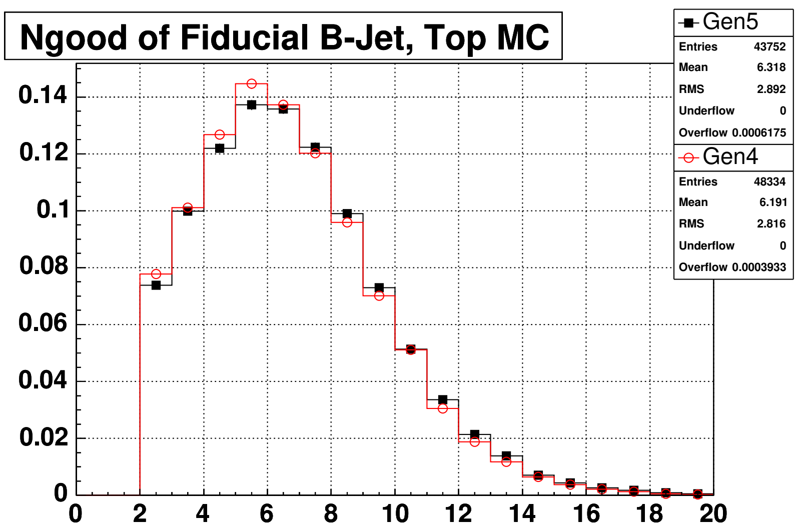




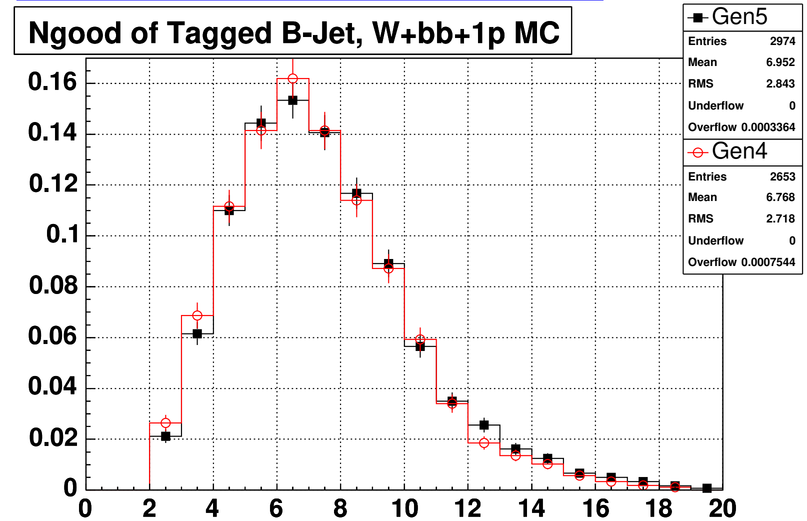
Using run-dependent MC will make MC look more like data.

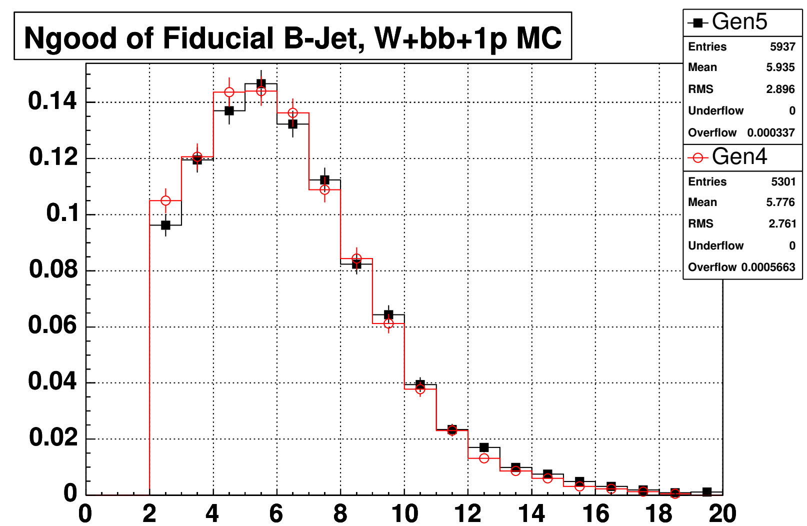
Top MC : N Good Tracks





W+bb+1p : N Good Tracks

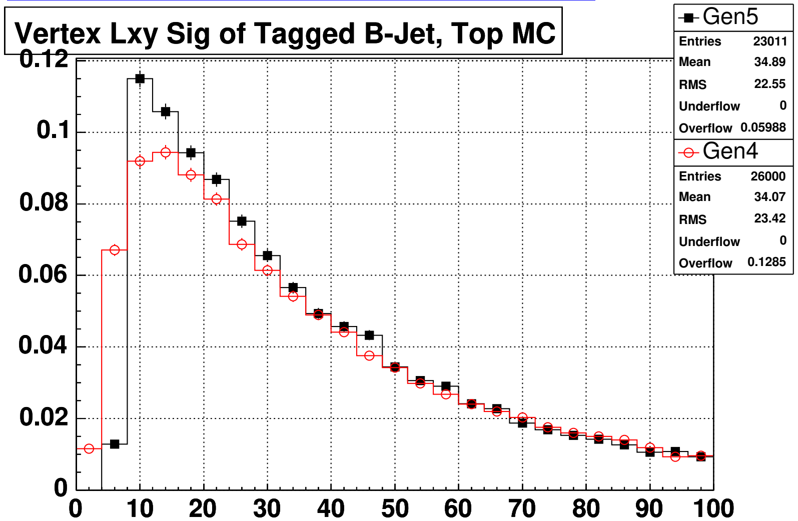




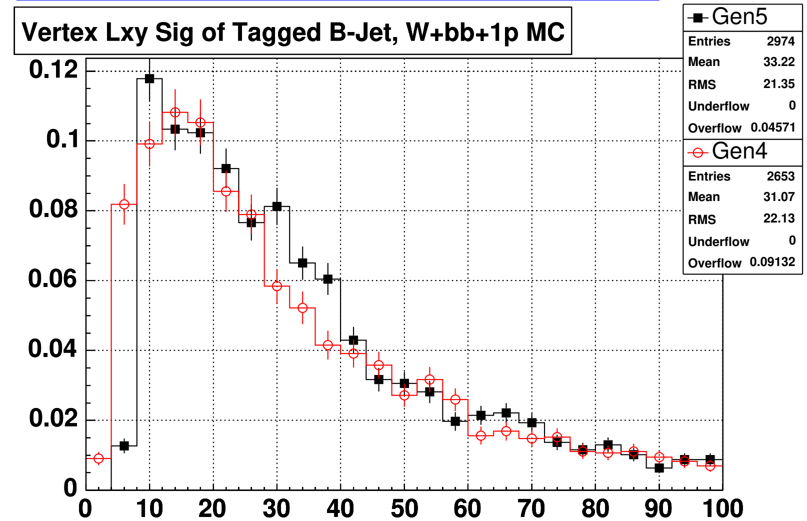
Increase in good tracks available to `SecVtx`

(Note: plotting taggable jets on bottom for this plot only.)

Top MC : Vertex L_{2D}/σ_{L_2D}

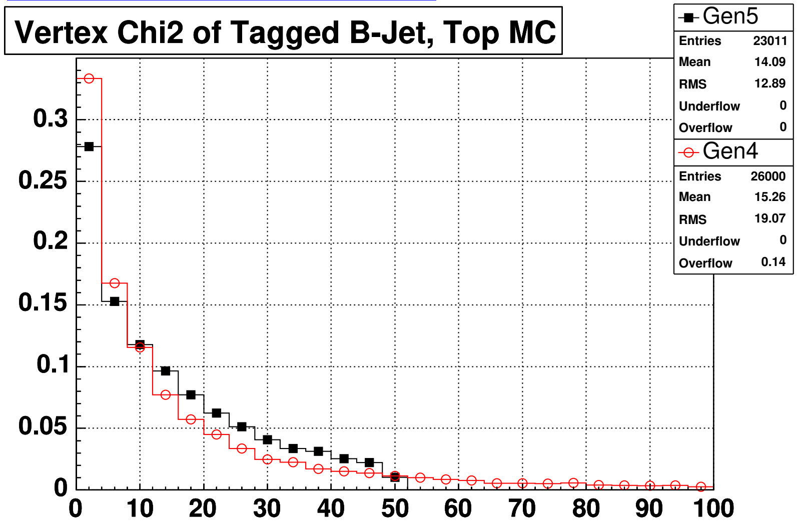


W+bb+1p : Vertex L_{2D}/σ_{L_2D}

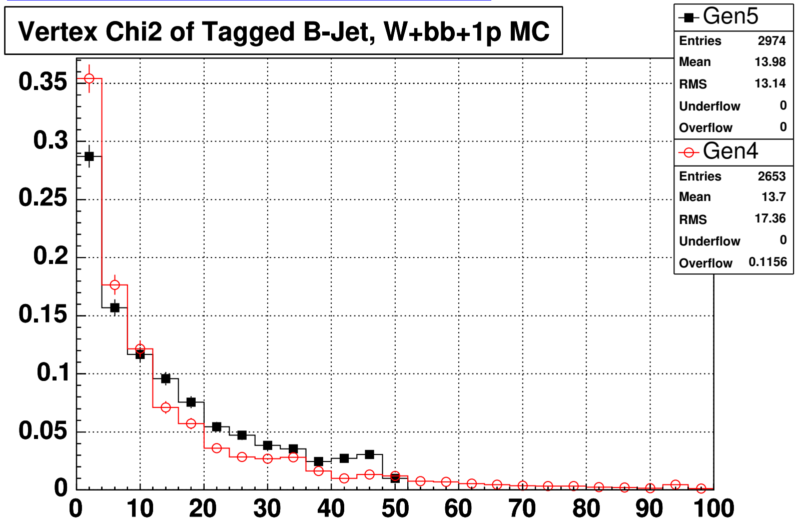


Loosened d_0/σ_{d_0} cuts to get more at low L_{2D}, tighten $L_{2D}/\sigma_{L_{2D}}$ cut to reduce mistags

Top MC : Vertex χ^2

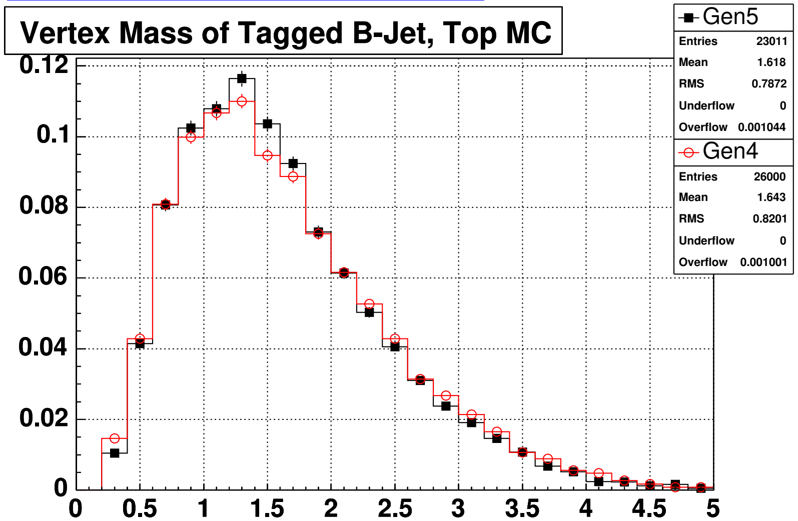


W+bb+1p : Vertex χ^2

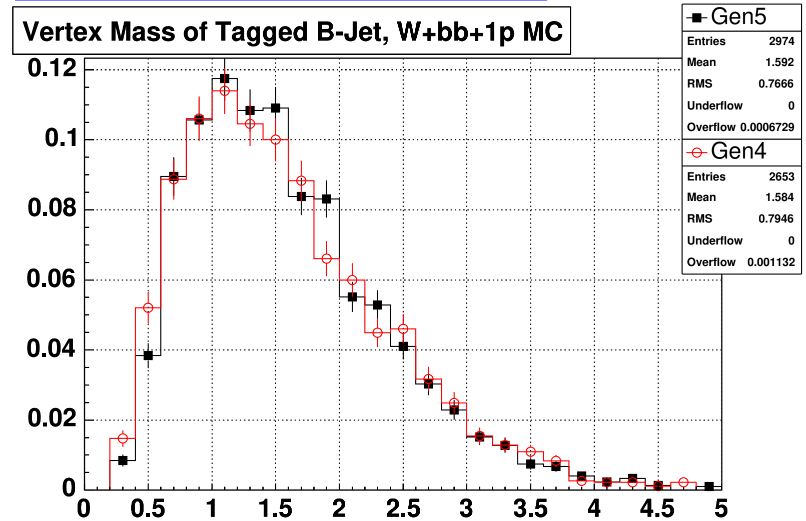


Cutting harder on χ^2 to reduce mistags, doesn't hurt efficiency.

Top MC : Vertex Mass

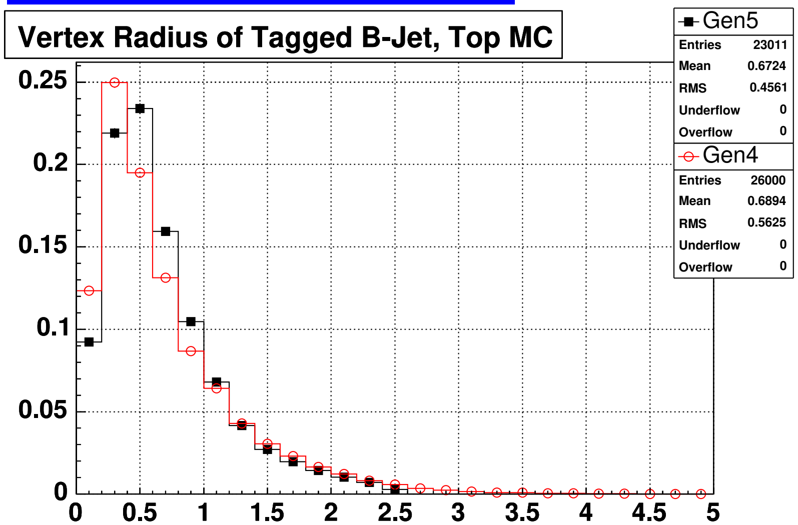


W+bb+1p : Vertex Mass

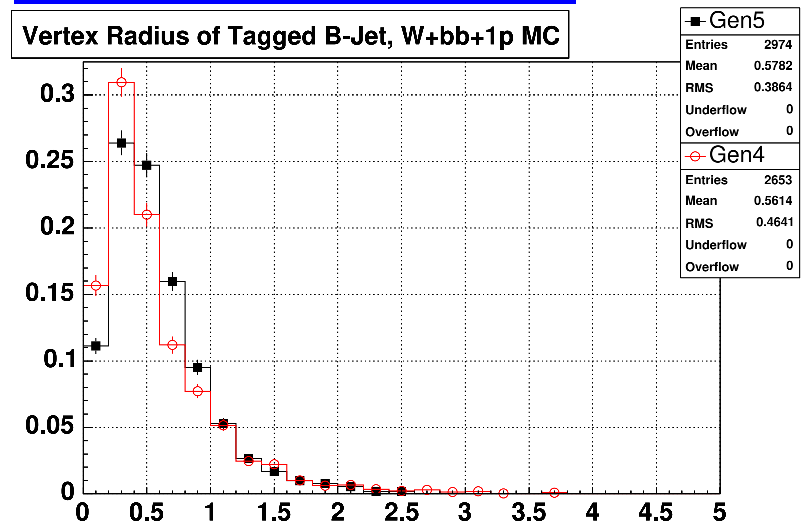


Mass looks similar qualitatively

Top MC : Vertex Radius



W+bb+1p : Vertex Radius



L_{2D} tightening increases radius of tags slightly, $|d_0| < 0.15$ reduces tags at large radius.

Event Efficiencies

- Want to examine event efficiencies for $W + b\bar{b}$ and $t\bar{t}$ Monte Carlo
- **W+HF**
  - Compare **fiducial efficiencies** to compare different taggers.
  - Would need to normalize to events before "taggable jets" to get the number of expected W+HF events.
- **Pretag Efficiency:**
  - Use **same lepton selection** in Gen4 and Gen5 to make apples-to-apples comparisons
    - *Examine changes in event tagging efficiency only*
  - Re-evaluate luminosity-weighted efficiency (i.e. total denominator) to reflect luminosity up to Feb 13 ($\sim 221\ pb^{-1}$)
  - Assume all **lepton ID scale factors**, etc. are the same for Gen5 and Gen4, just to compare
    - When available, will update to the correct numbers.
- ≥ 1 **Tag Efficiency:**
  - Use **VERY PRELIMINARY** b-tagging scale factor of $95 \pm 8\%$ in Gen5.
  - Quote fiducial heavy flavor fractions to compare different taggers.

$W + b\bar{b} + 1p$

	Gen4	Gen5
ϵ_{MC} (Fid)(%)	36 ± 1	40 ± 1
≥ 1 (1B) (%)	29 ± 3	38 ± 3
≥ 1 (2B) (%)	41 ± 3	47 ± 4
≥ 2 (2B) (%)	8 ± 1	14 ± 2

- $\geq 1, 2$ tag rates quoted include scale factor
- **TO DO:** Get HFF, quote overall increase in backgrounds

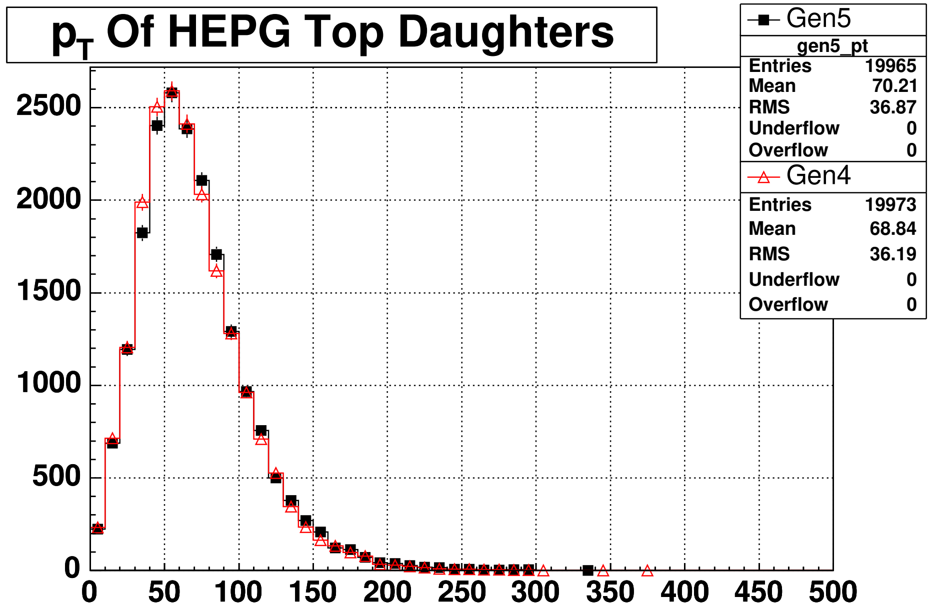
$t\bar{t}$ Acceptance and Efficiency

	Gen4	Gen4 (Scale to Lum)	Gen5
CEM $A \times \epsilon_{pretag}$ (%)	4.88 ± 0.04		4.75 ± 0.04
CMUP $A \times \epsilon_{pretag}$ (%)	3.00 ± 0.03		2.93 ± 0.03
CMX $A \times \epsilon_{pretag}$ (%)	1.11 ± 0.01		1.04 ± 0.02
CEM $A \times \epsilon_{pretag} \times SF_{lepid}$ (%)	4.4 ± 0.3		4.2 ± 0.3
CMUP $A \times \epsilon_{pretag} \times SF_{lepid}$ (%)	2.3 ± 0.2		2.2 ± 0.2
CMX $A \times \epsilon_{pretag} \times SF_{lepid}$ (%)	1.0 ± 0.1		1.0 ± 0.1
F_{1b}(Fid) (%)	21.6 ± 0.2		22.5 ± 0.2
F_{2b}(Fid) (%)	77.6 ± 0.2		76.6 ± 0.2
ϵ_{MC}(Fid)(%)	42.1 ± 0.2		43.7 ± 0.2
B-Tag SF (%)	81 ± 7		95 ± 8
$\epsilon_{\geq 1\ tag}$(%)	52.3 ± 3.6		59.5 ± 4.1
$\epsilon_{\geq 2\ tags}$(%)	11.6 ± 2.3		17.2 ± 2.8
$\int \mathcal{L}_{CEM} dt$	161.5 ± 9.5	221.1 ± 13.0	221.1 ± 13.0
$\int \mathcal{L}_{CMUP} dt$	161.5 ± 9.5	221.1 ± 13.0	221.1 ± 13.0
$\int \mathcal{L}_{CMX} dt$	149.8 ± 8.8	209.4 ± 12.2	209.4 ± 12.2
$\epsilon_{pre} \int \mathcal{L} dt$	12.2 ± 1.1	16.8 ± 1.4	16.6 ± 1.4
$\epsilon_{\geq 1\ tag} \epsilon_{pre} \int \mathcal{L} dt$	6.3 ± 1.0	8.8 ± 1.3	9.9 ± 1.1
$\epsilon_{\geq 2\ tags} \epsilon_{pre} \int \mathcal{L} dt$	1.4 ± 0.3	2.0 ± 0.4	2.9 ± 0.5

15% increase in ≥ 1 tags, 45% increase in ≥ 2 tags

Expect 111 pretags, 66 in ≥ 1 tag, 19 in ≥ 2 tags from top

Top Monte Carlo Top Daughter p_T



- p_T of b's from top look okay for $M_{top} : 175 \to 178$
- Is this just jet corrections?
- Curious because the same effect is not present in W+HF MC.