W^+/W^- ratio analysis Run 17

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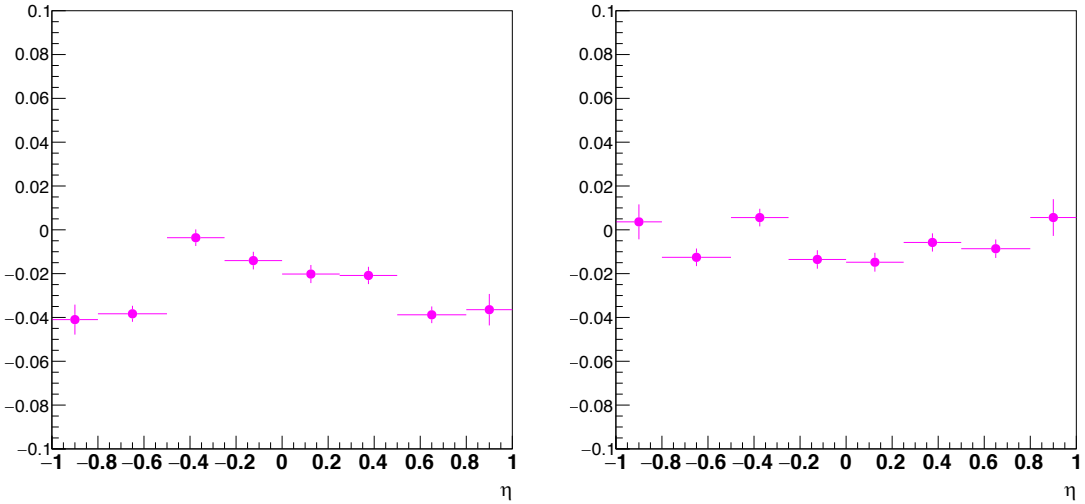
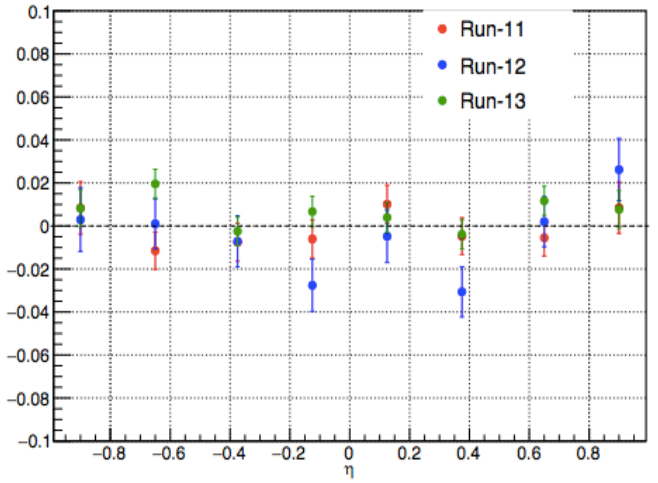
Recap & Overview

$\epsilon^+ - \epsilon^-$ (Run 17, Left: no E_T cut, Right: $E_T > 25\ GeV$)

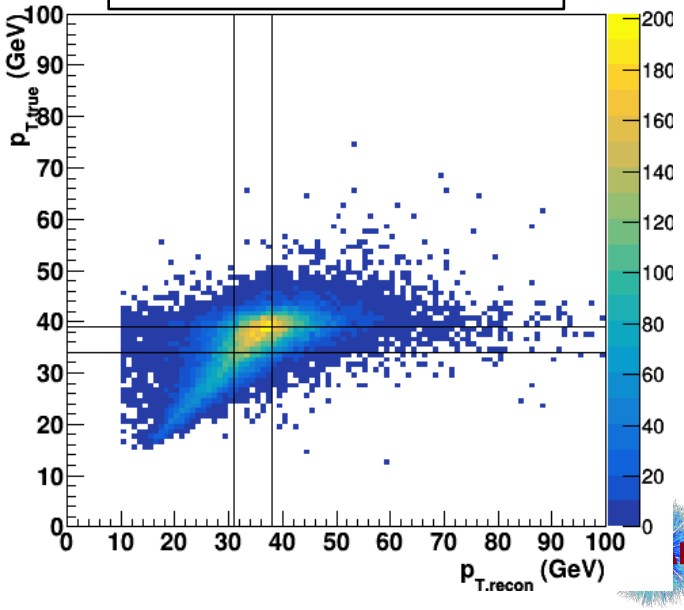


$\epsilon^+ - \epsilon^-$ (Run 11+12+13)



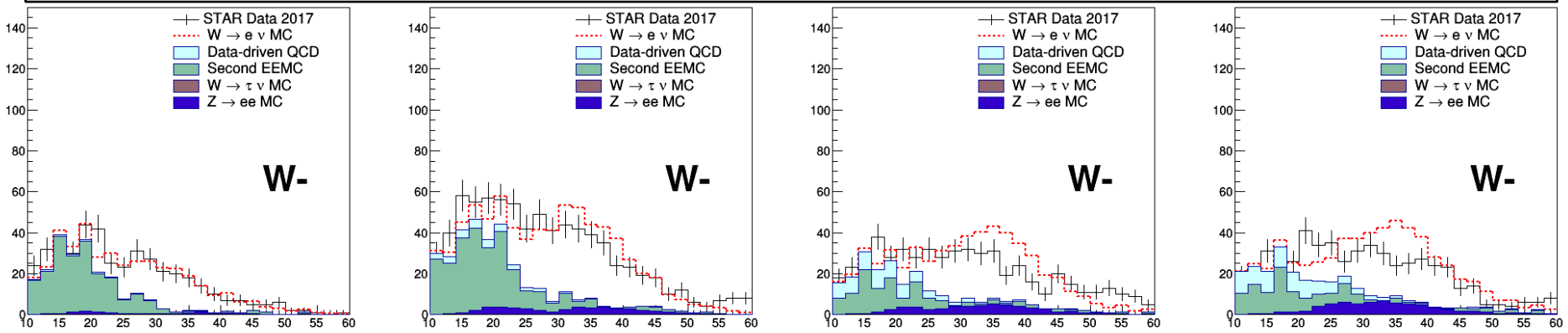
- Mismatch in $\epsilon^+ - \epsilon^-$ between Run 17 & Run 11-13
  - Has been fixed by introducing a kinematic cut at $E_T > 25\ GeV$.
  - Reasonable $\epsilon^{\pm}(p_T)$
- p_T binning
  - Each η bins are separated into 3 bins in p_T with ~ equal statistics (Bin edges = [0,31,38,100]).
  - Same has been done for $p_{T,true}$.
- Confirm data & MC matching before unfolding.

$p_{T,true}$ vs $p_{T,recon}$

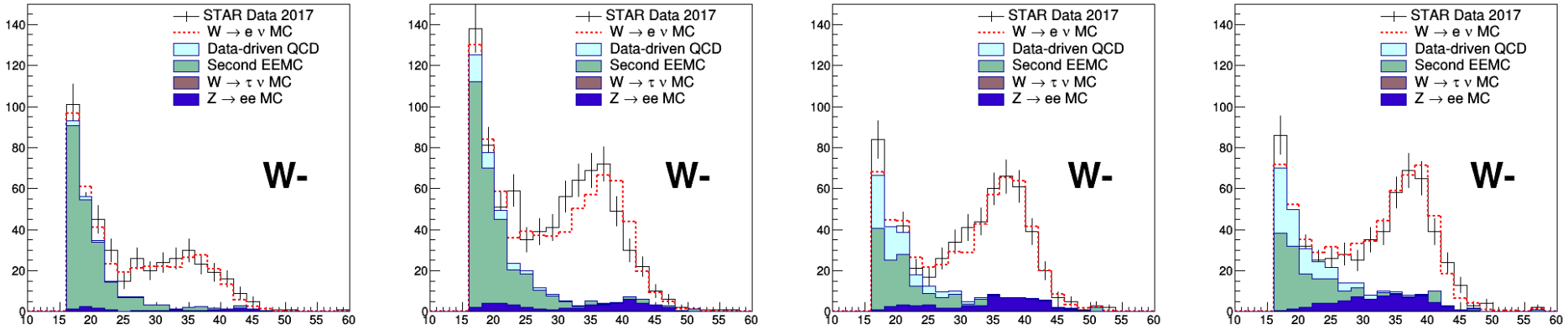


e^{W-} in p_T distributions ($\eta < 0$)

p_T $(W^-, -1 < \eta < 0)$



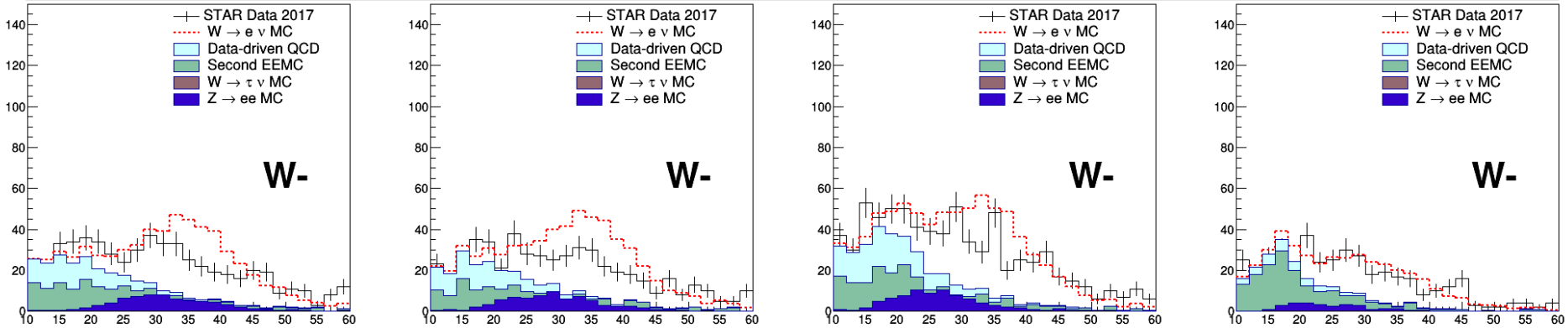
E_T $(W^-, -1 < \eta < 0)$



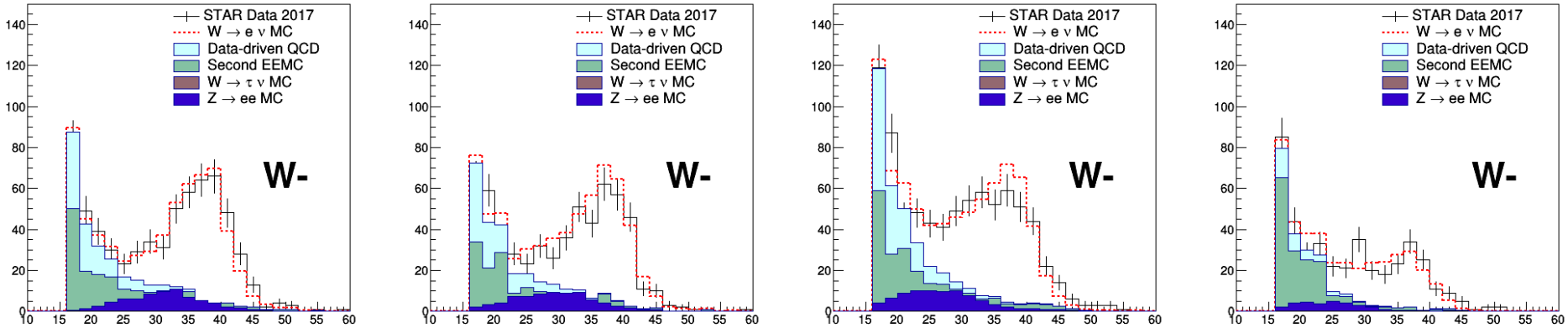
- QCD background normalization obtained from E_T distributions.
- $W \rightarrow \tau$ process not included.
- MC overestimates data in central p_T region.

e^{W-} in p_T distributions ($\eta > 0$)

p_T $(W^-, 0 < \eta < 1)$

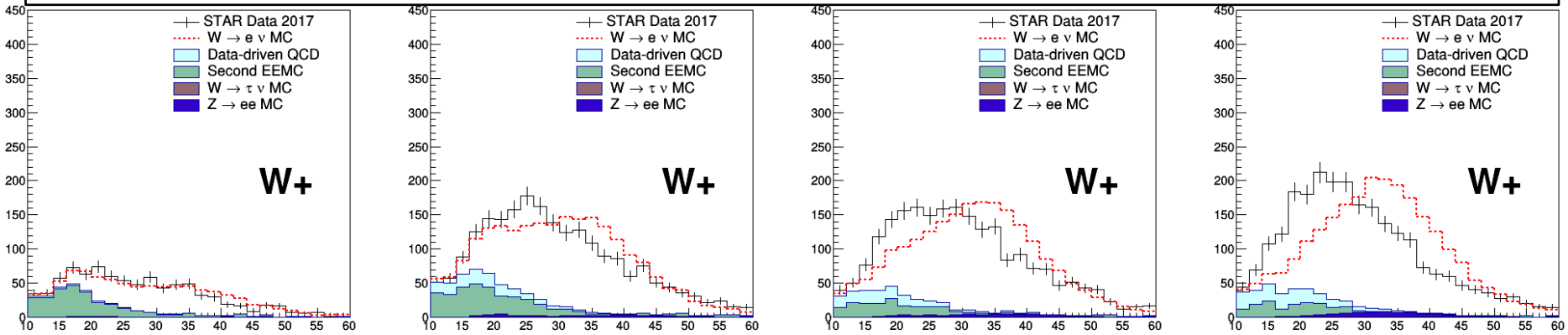


E_T $(W^-, 0 < \eta < 1)$

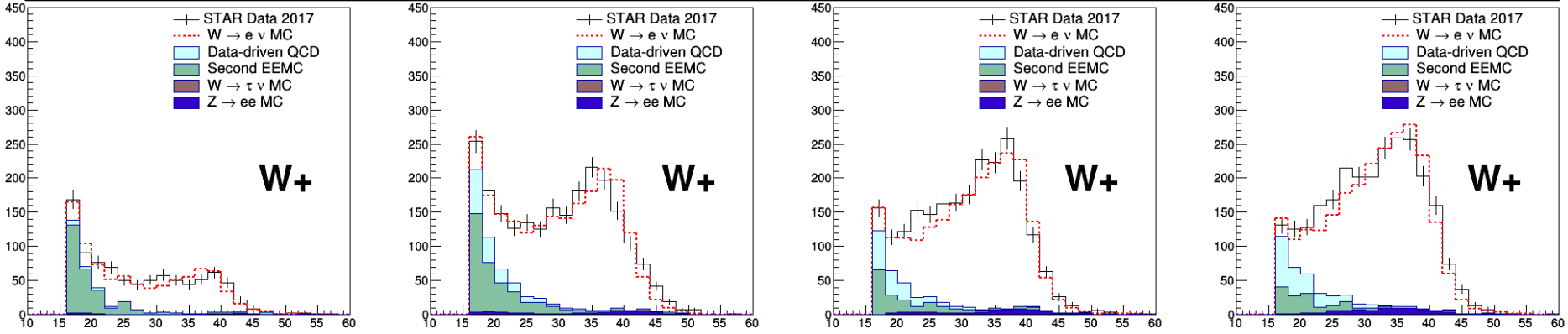


e^{W+} in p_T distributions ($\eta < 0$)

p_T $(W^+, -1 < \eta < 0)$



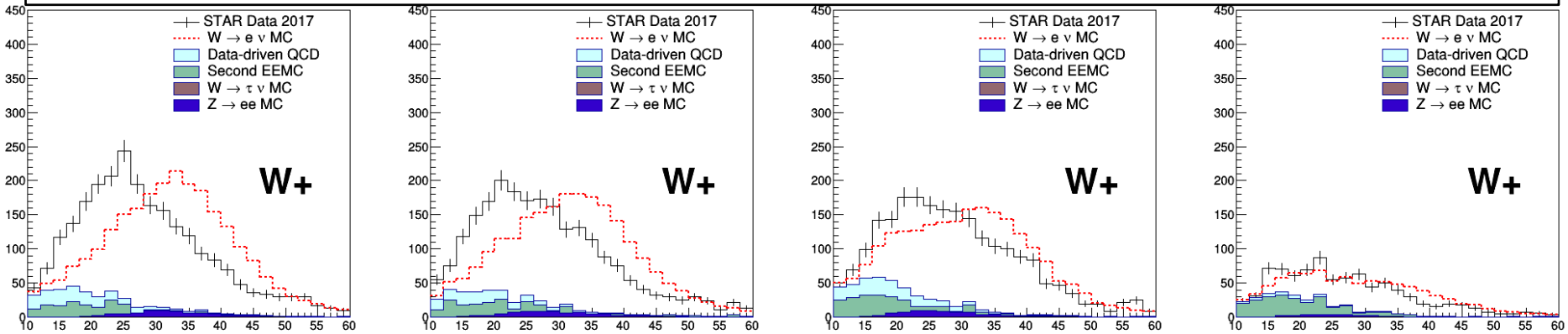
E_T $(W^+, -1 < \eta < 0)$



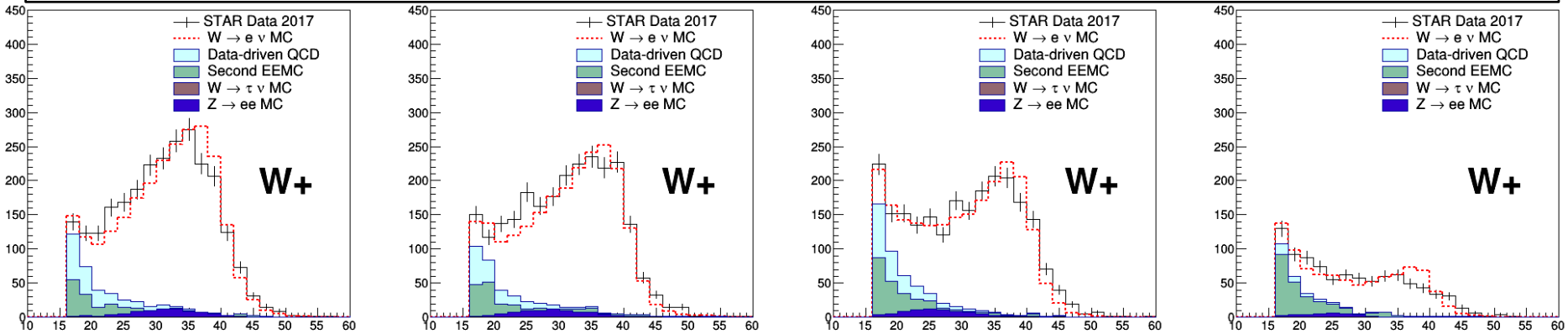
- Unlike in W^-, mismatch happens both in high and low p_T regions in W^+.
- A shift due to different p_T resolution between MC and data?

e^{W+} in p_T distributions ($\eta > 0$)

p_T $(W^+, 0 < \eta < 1)$

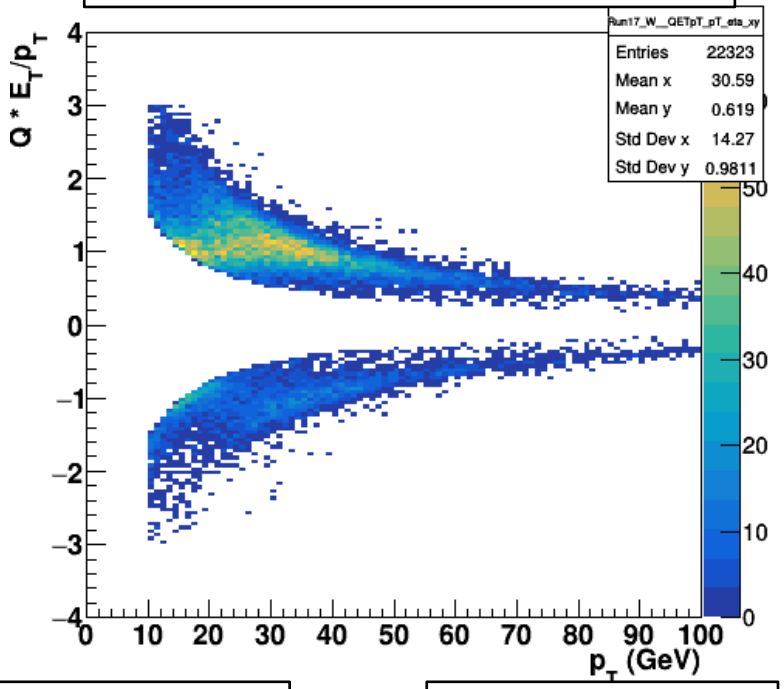


E_T $(W^+, 0 < \eta < 1)$

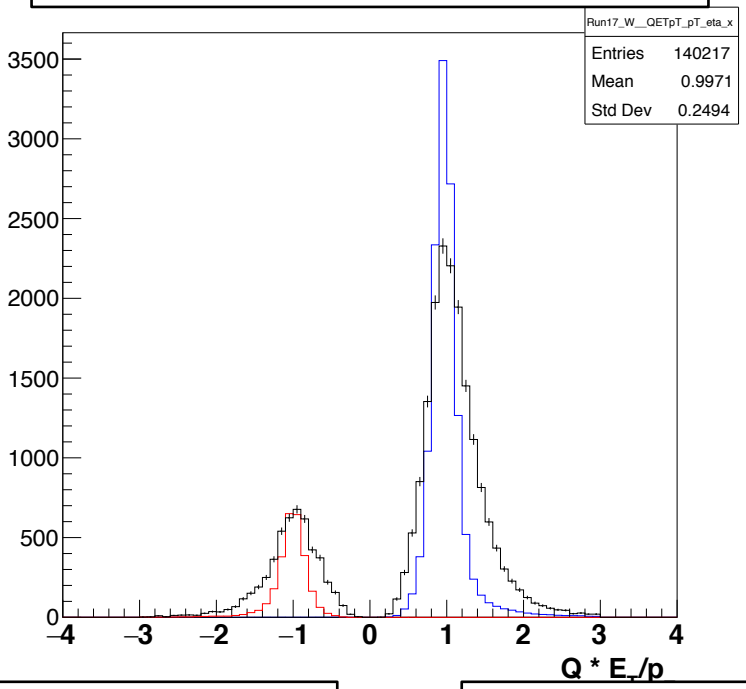


Resolution effect?

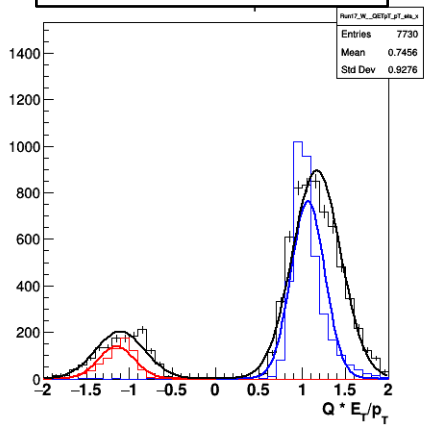
$Q \times E_T/p_T$ vs p_T



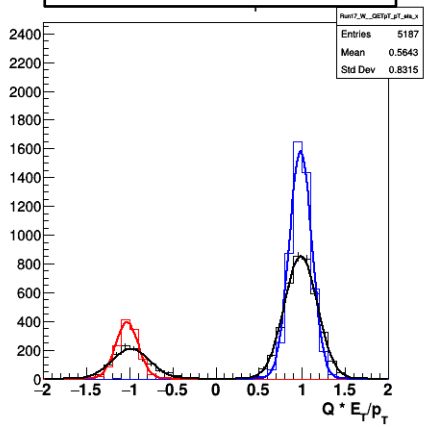
$Q \times E_T/p_T$ $(0 < p_T < 100\ GeV)$



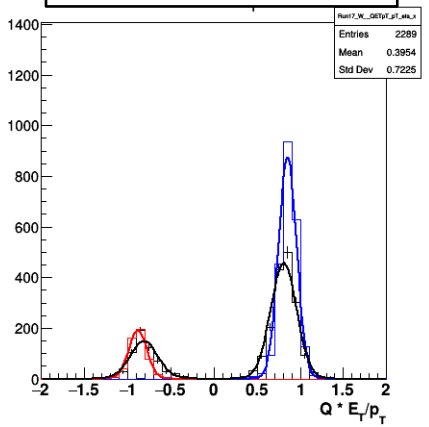
$20 < p_T < 30\ GeV$



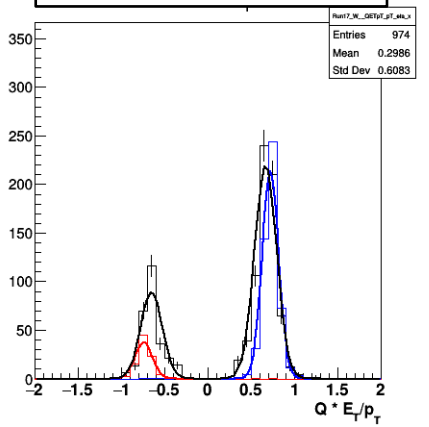
$30 < p_T < 40\ GeV$



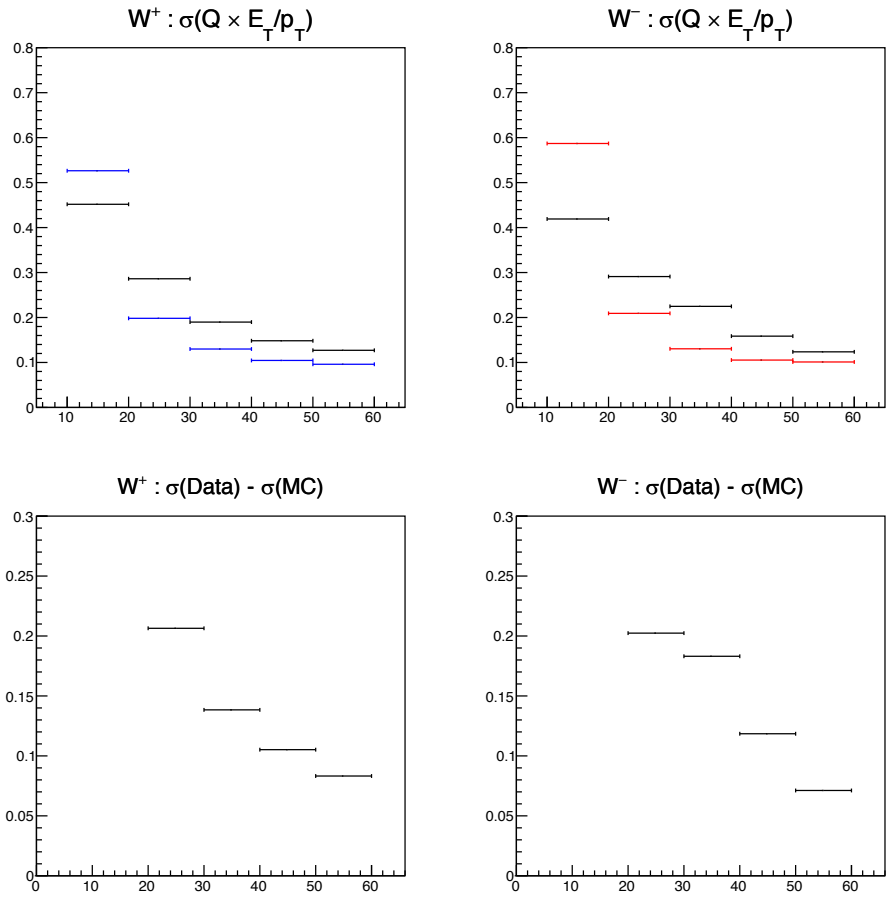
$40 < p_T < 50\ GeV$



$50 < p_T < 60\ GeV$



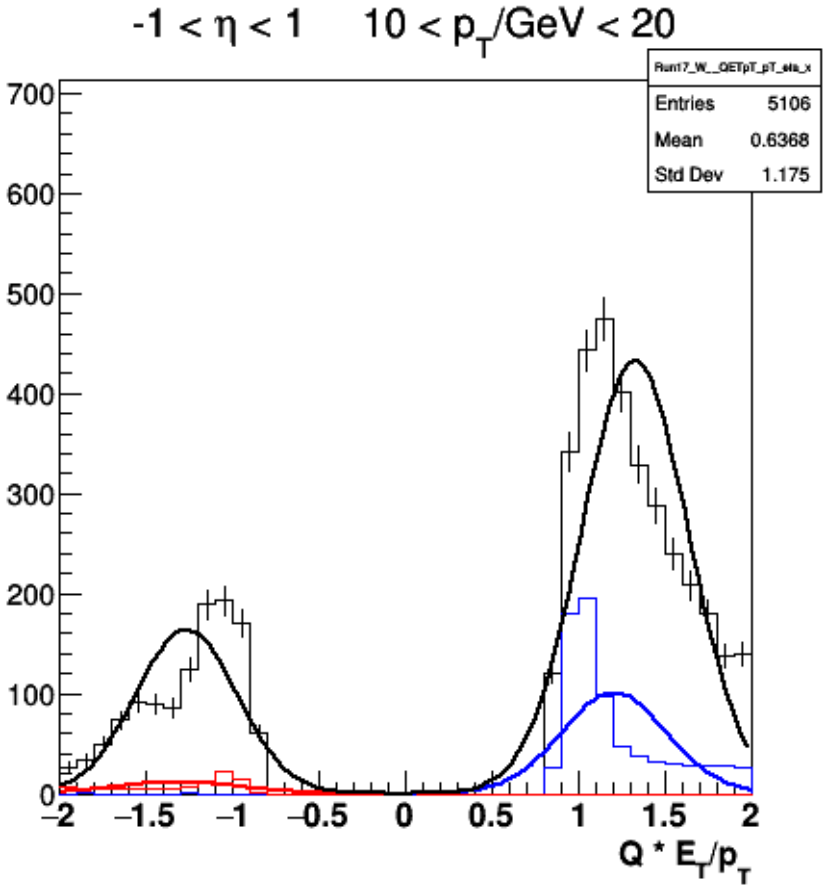
Summary



- Mismatch between data & MC in p_T.
  - For W^-, data lacks yield in the ~30 GeV.
  - W^+, the peak seems to have shifted.
- Difference in p_T resolution between data and MC.
  - Can be observed in E_T/p_T distributions.
  - Momentum dependent behaviour
  - Charge dependent?
  - Potentially, the cause of the shift that we see in p_T.
- Future plans
  - Cut on E/p*
    - At $0.3 < |E_T/p_T| < 1.7$ found to be ineffective
  - Introduce smearing in MC.
  - Revisit $W \rightarrow \tau\nu$ sample

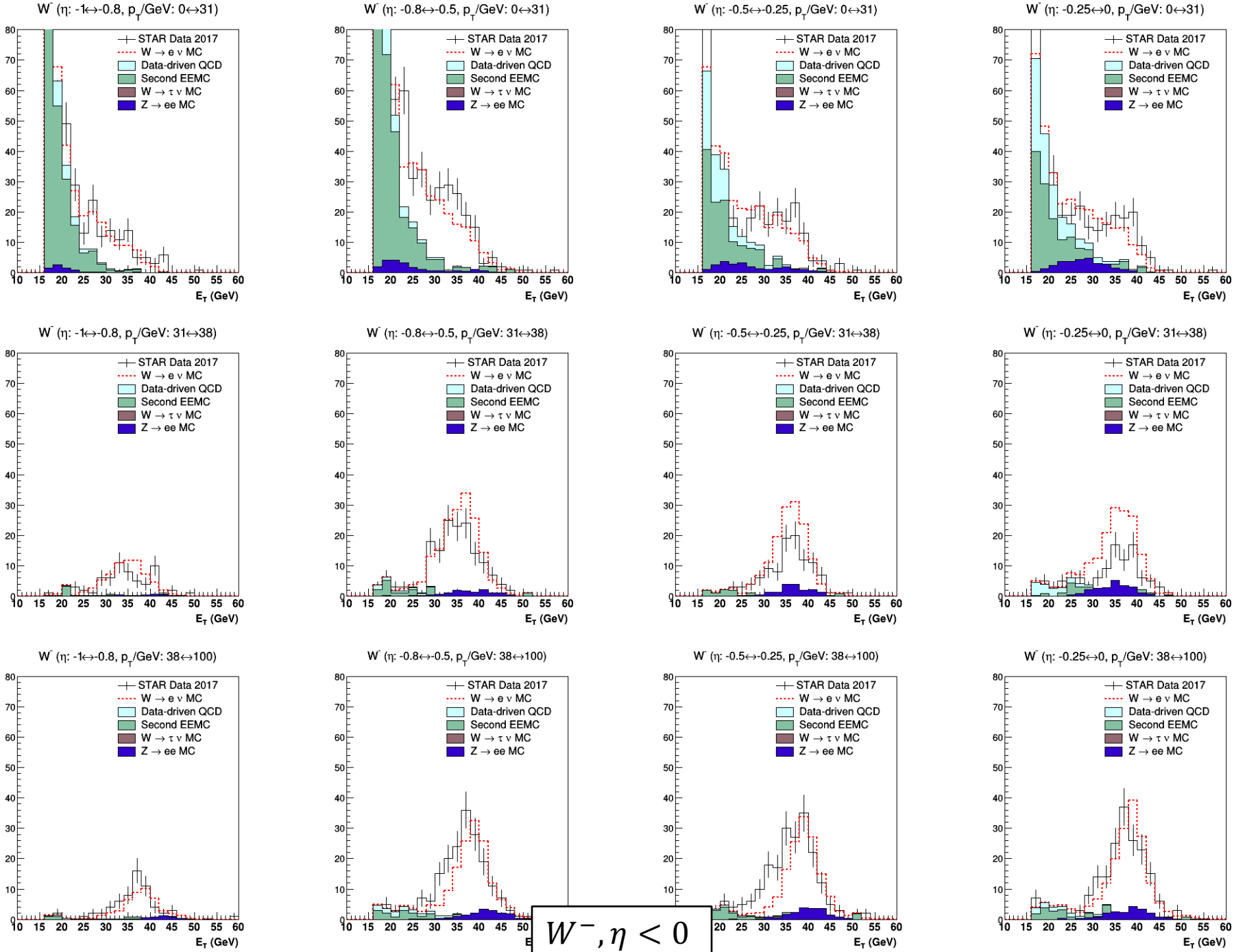
Backup

- E_T/p_T in p_T range 10-20 GeV



E_T in p_T and η bins

- $W^-, \eta < 0$
- $W^-, \eta > 0$
- $W^+, \eta < 0$
- $W^+, \eta > 0$


W⁻ (η: -1↔-0.8, p_T/GeV: 0↔31)
W⁻ (η: -0.8↔-0.5, p_T/GeV: 0↔31)
W⁻ (η: -0.5↔-0.25, p_T/GeV: 0↔31)
W⁻ (η: -0.25↔0, p_T/GeV: 0↔31)
W⁻ (η: -1↔-0.8, p_T/GeV: 31↔38)
W⁻ (η: -0.8↔-0.5, p_T/GeV: 31↔38)
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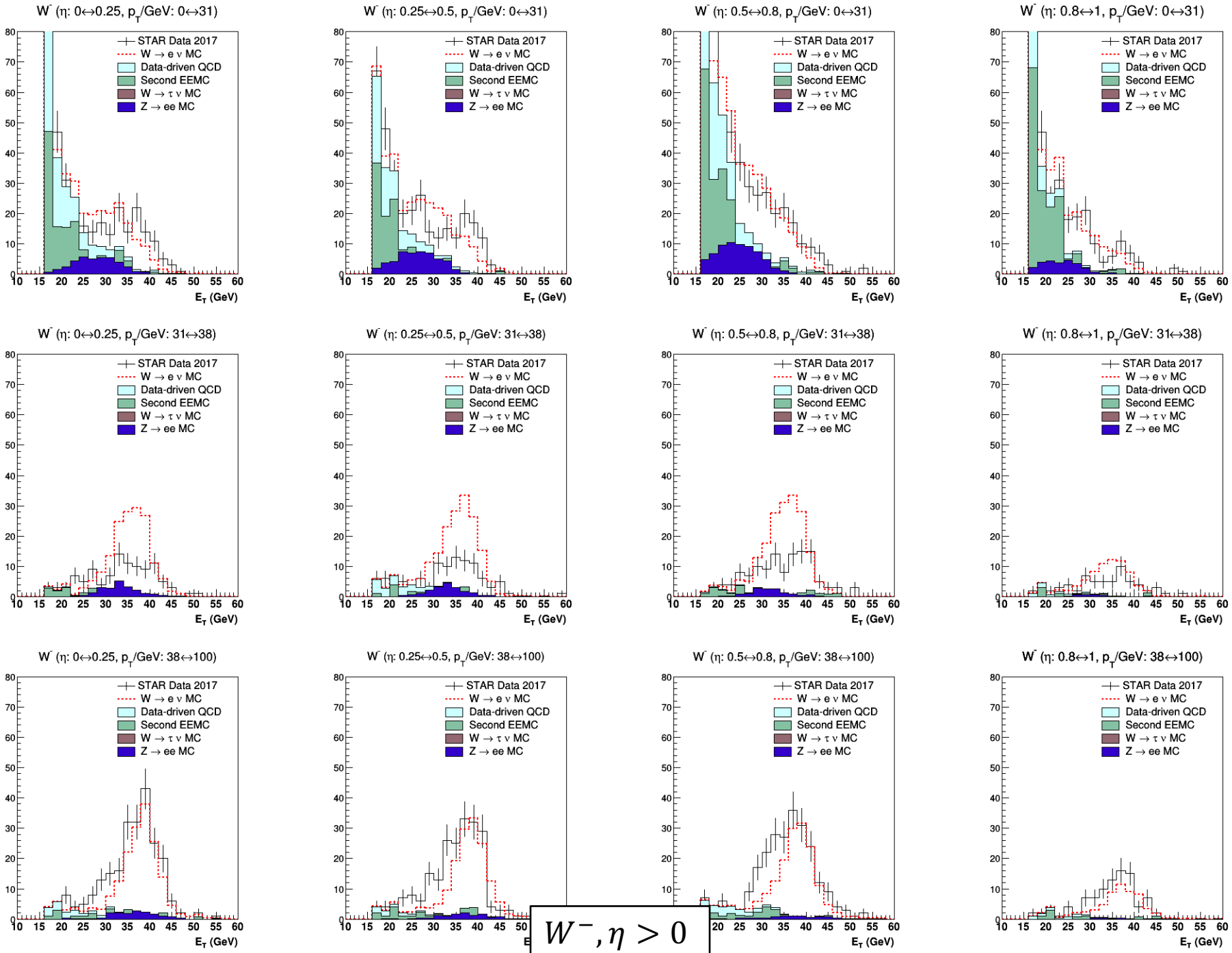
W⁻ (η: -0.5↔-0.25, p_T/GeV: 38↔100)
W⁻ (η: -0.25↔0, p_T/GeV: 38↔100)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
E_T (GeV)
$W^-, \eta < 0$


W⁻ (η: 0↔0.25, p_T/GeV: 0↔31)
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W⁻ (η: 0.5↔0.8, p_T/GeV: 0↔31)
W⁻ (η: 0.8↔1, p_T/GeV: 0↔31)
W⁻ (η: 0↔0.25, p_T/GeV: 31↔38)
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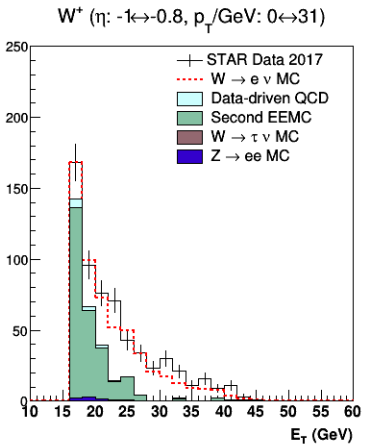
E_T (GeV)
$W^-, \eta > 0$


W+ (η: -1↔-0.8, pT/GeV: 0↔31)
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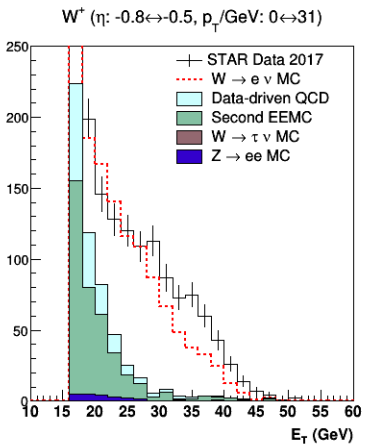
W+ (η: -0.8↔-0.5, pT/GeV: 0↔31)
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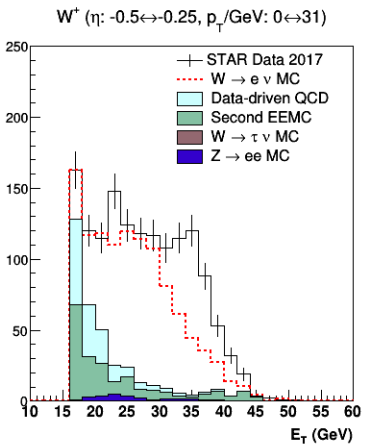
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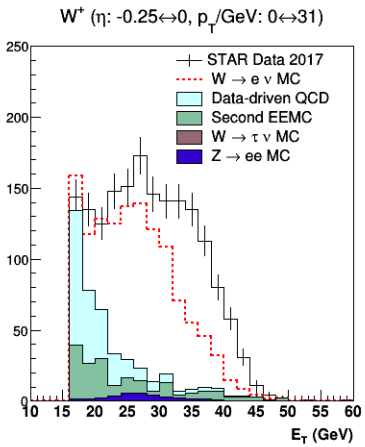
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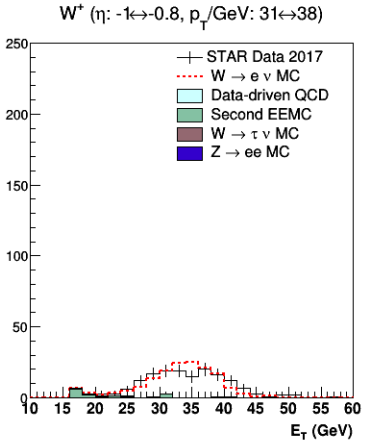
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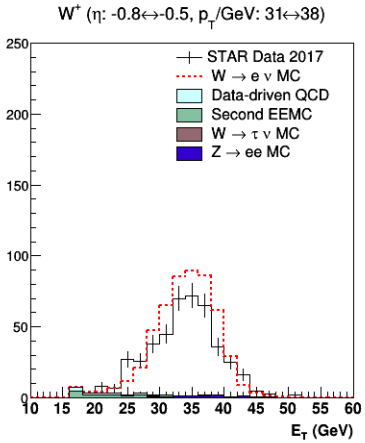
W+ (η: -0.8↔-0.5, pT/GeV: 31↔38)
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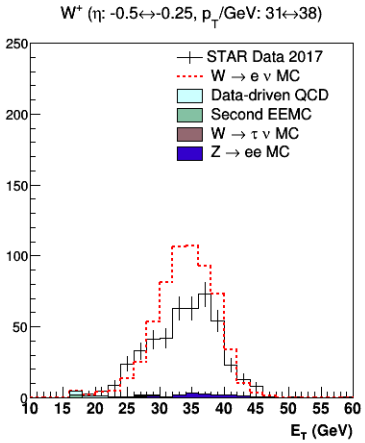
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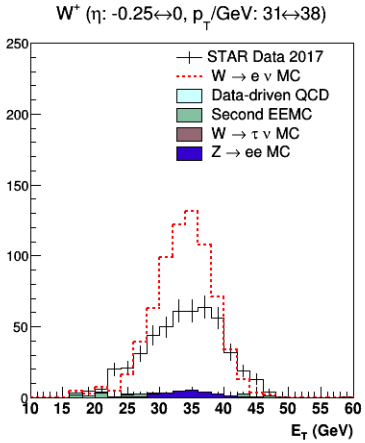
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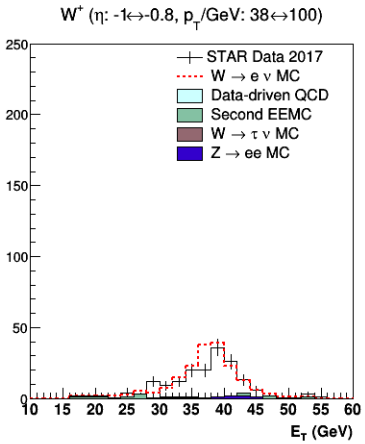
W+ (η: -1↔-0.8, pT/GeV: 38↔100)
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Second EEMC
W → τ ν MC
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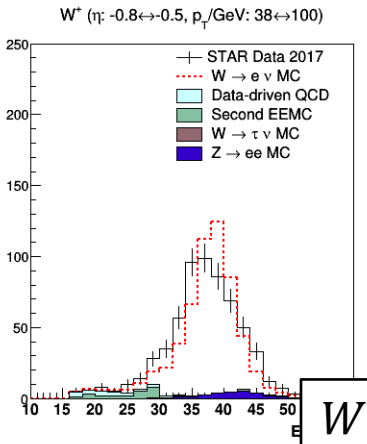
ET (GeV)


W+ (η: -0.8↔-0.5, pT/GeV: 38↔100)
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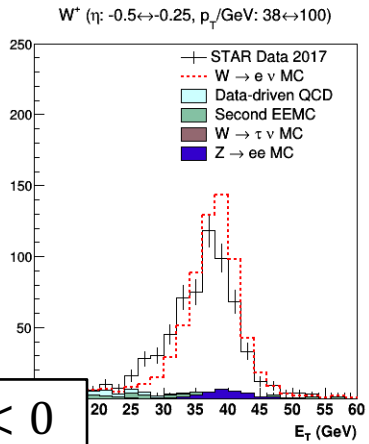
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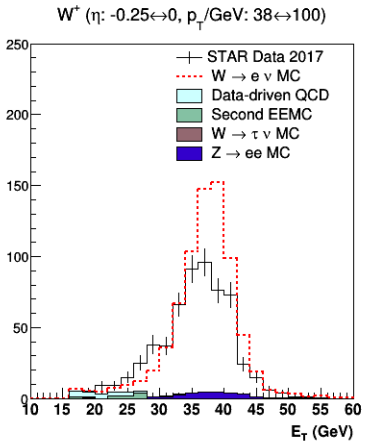
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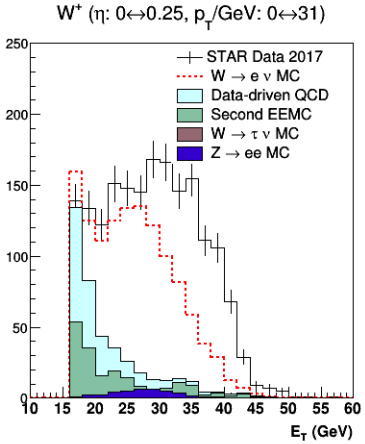
ET (GeV)

$W^+, \eta < 0$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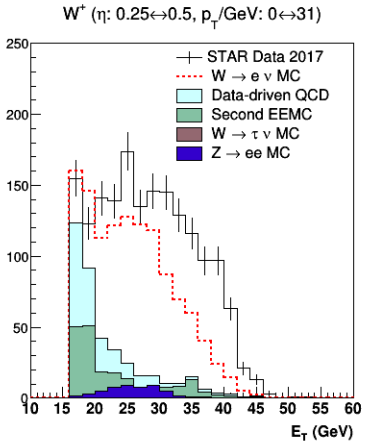
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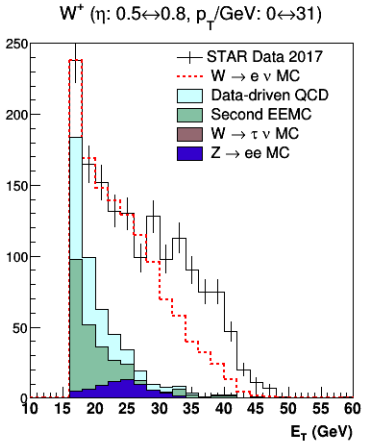
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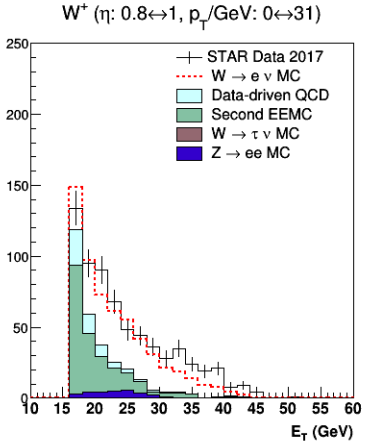
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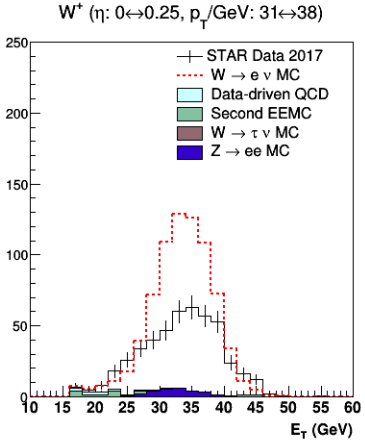
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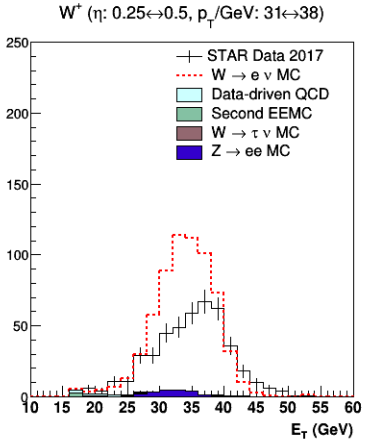
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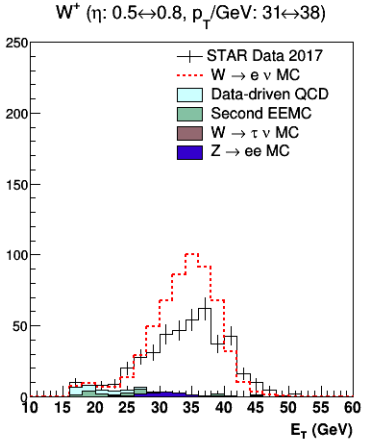
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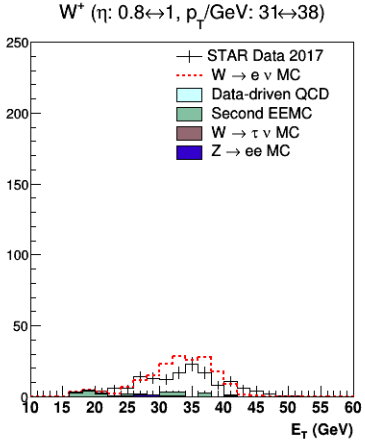
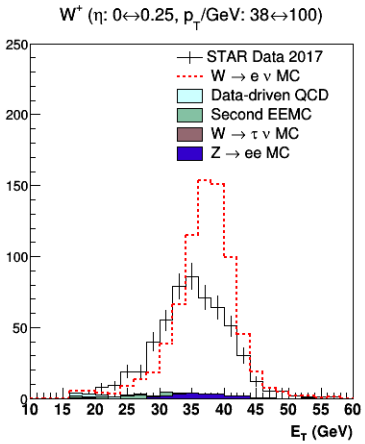
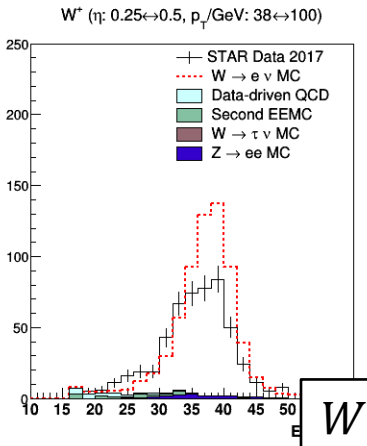
Z → ee MC
ET (GeV)


W+ (η: 0.8↔1, pT/GeV: 31↔38)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)


W+ (η: 0↔0.25, pT/GeV: 38↔100)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)


W+ (η: 0.25↔0.5, pT/GeV: 38↔100)
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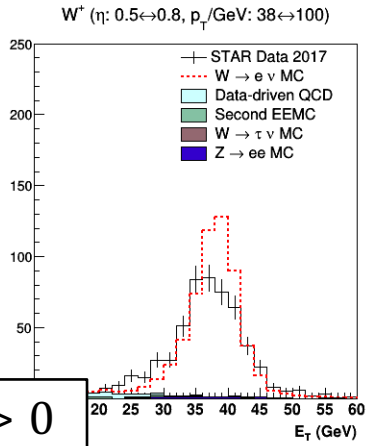
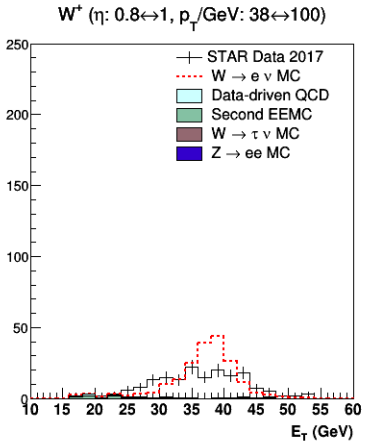
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

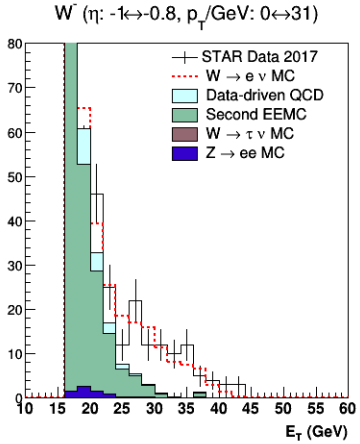

W+ (η: 0.5↔0.8, pT/GeV: 38↔100)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)


W+ (η: 0.8↔1, pT/GeV: 38↔100)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

$W^+, \eta > 0$

E_T in p_T and η bins with E_T/p_T cut

- At $0.3 < E_T/p_T < 1.7$
- $W^-, \eta < 0$
- $W^-, \eta > 0$
- $W^+, \eta < 0$
- $W^+, \eta > 0$


W⁻ (η: -1↔-0.8, p_T/GeV: 0↔31)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
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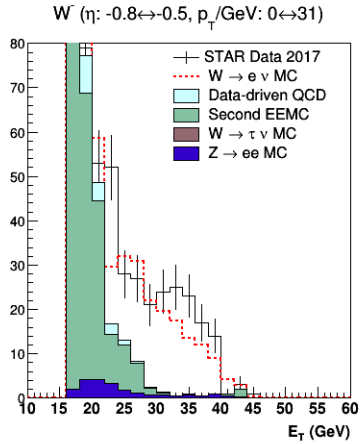
W⁻ (η: -0.8↔-0.5, p_T/GeV: 0↔31)
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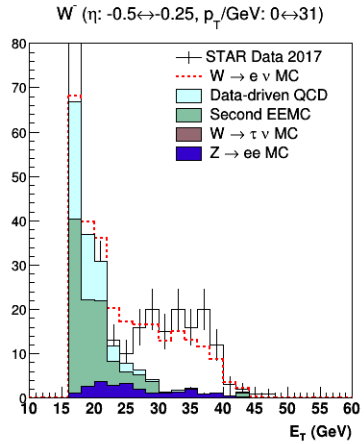
W⁻ (η: -0.5↔-0.25, p_T/GeV: 0↔31)
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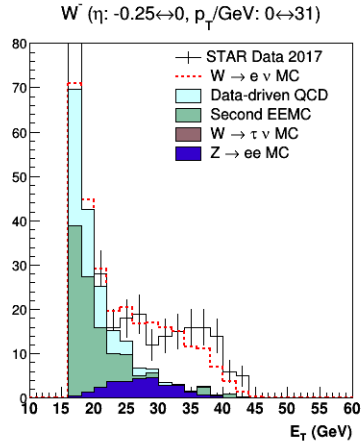
W⁻ (η: -0.25↔0, p_T/GeV: 0↔31)
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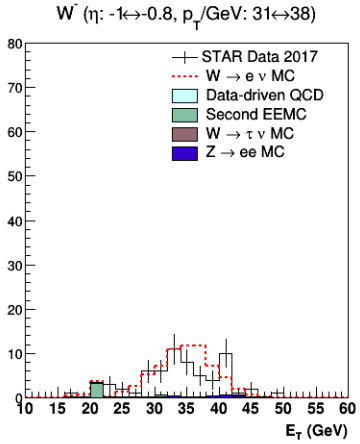
W⁻ (η: -1↔-0.8, p_T/GeV: 31↔38)
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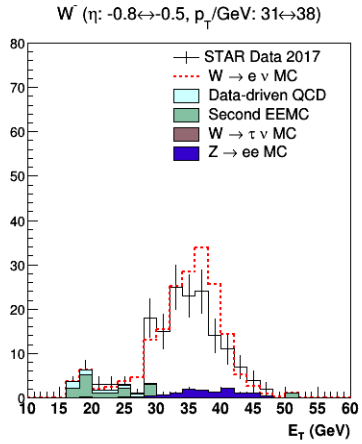
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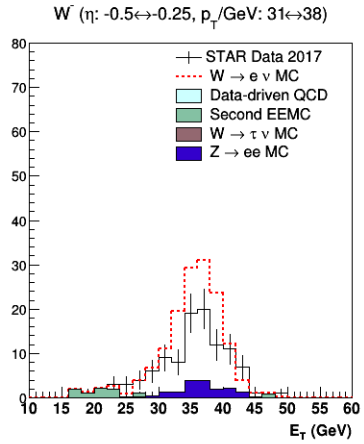
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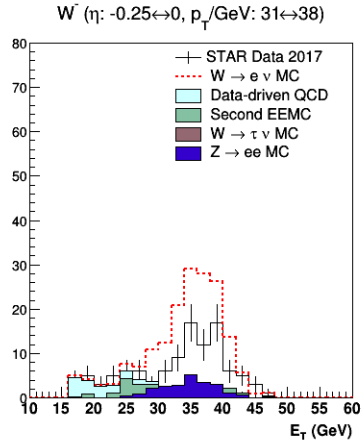
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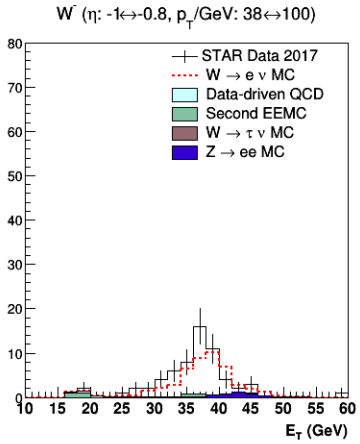
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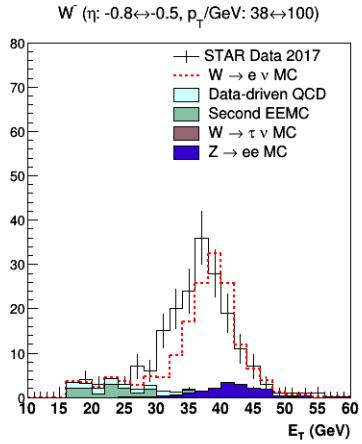
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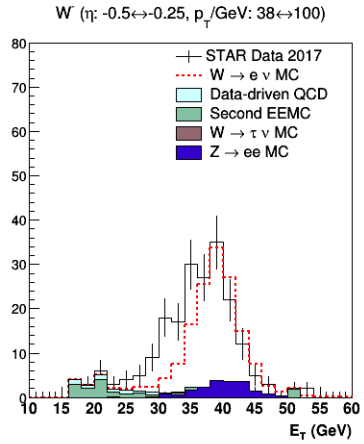
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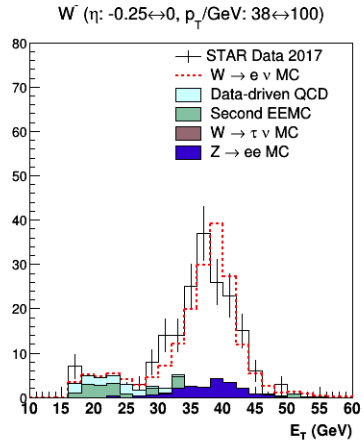
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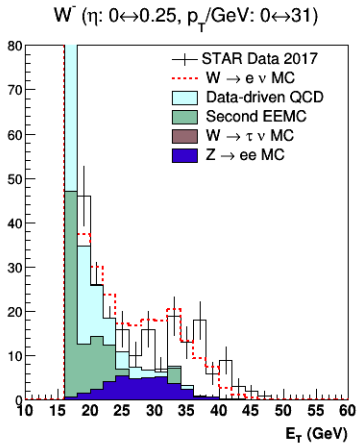
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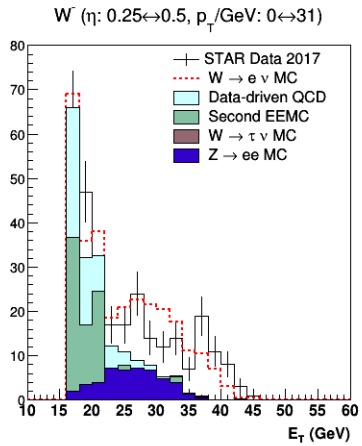
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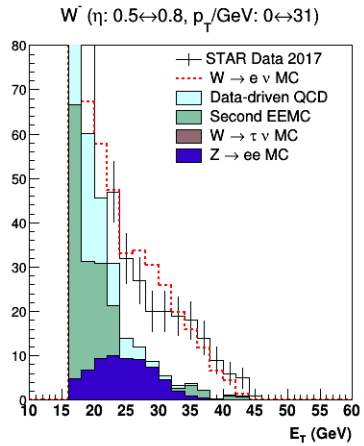
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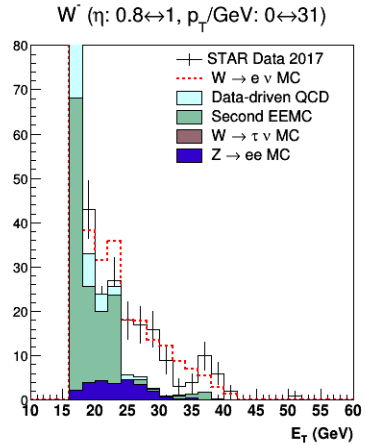
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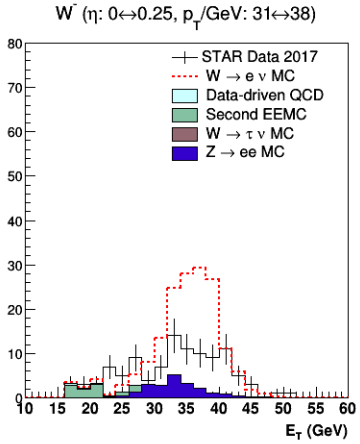
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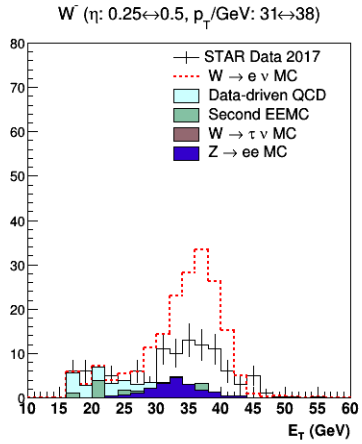
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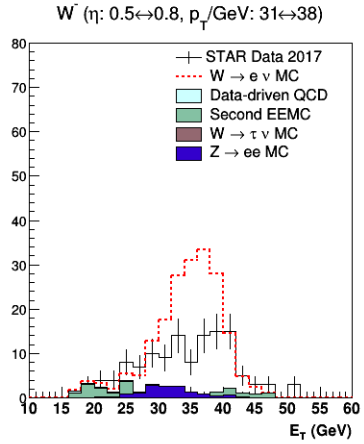
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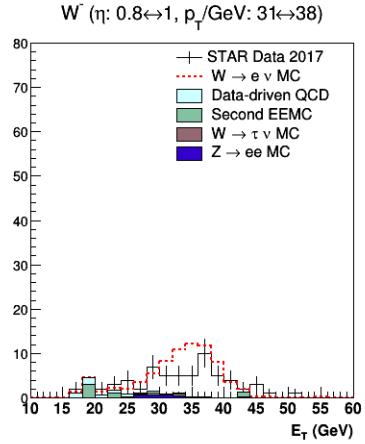
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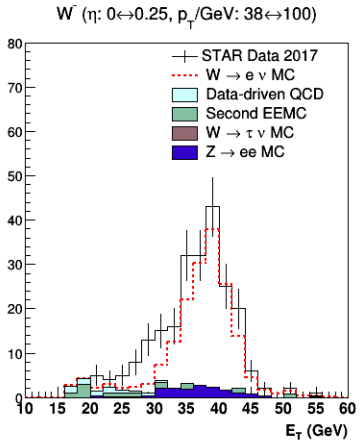
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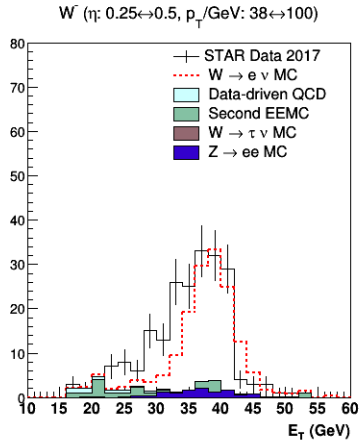
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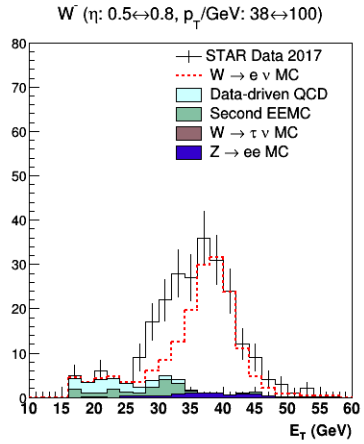
W⁻ (η: 0.5↔0.8, p_T/GeV: 38↔100)
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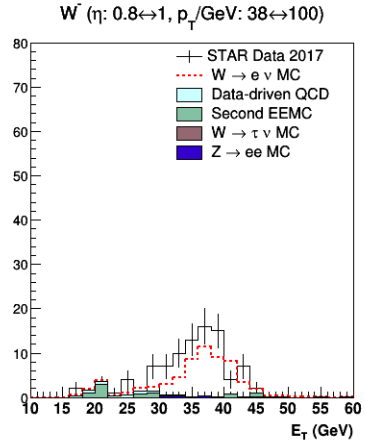
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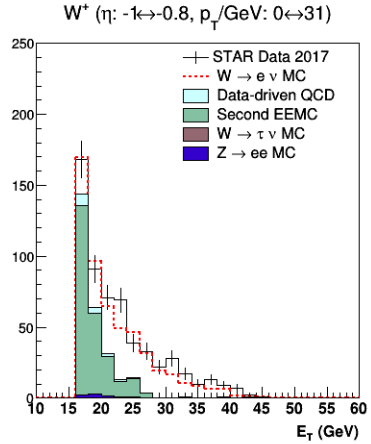
W+ (η: -1↔-0.8, pT/GeV: 0↔31)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
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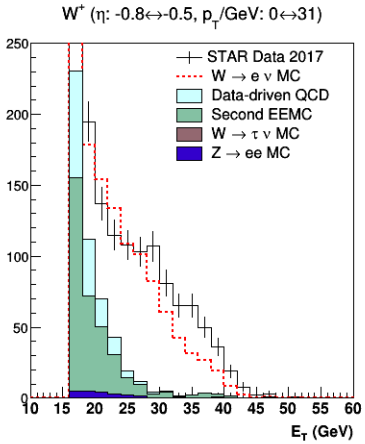
ET (GeV)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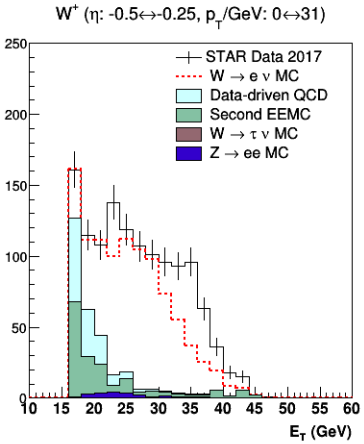
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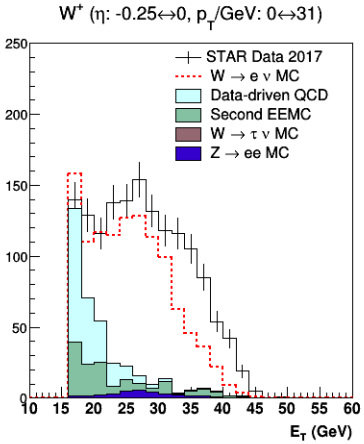
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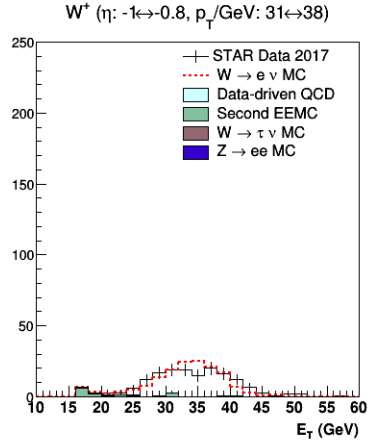
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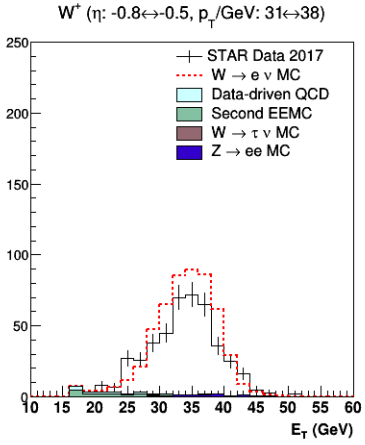
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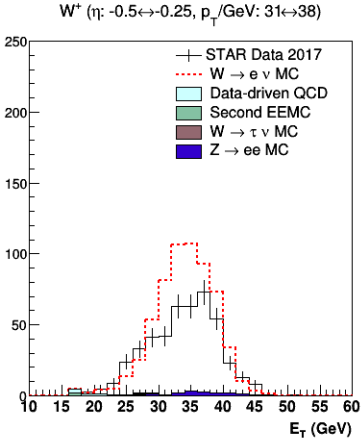
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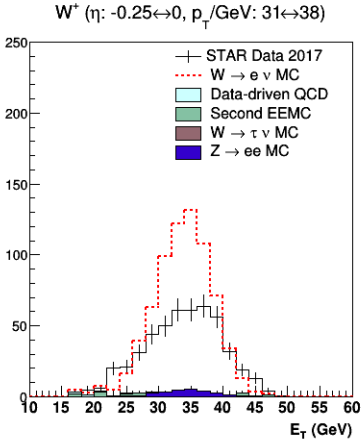
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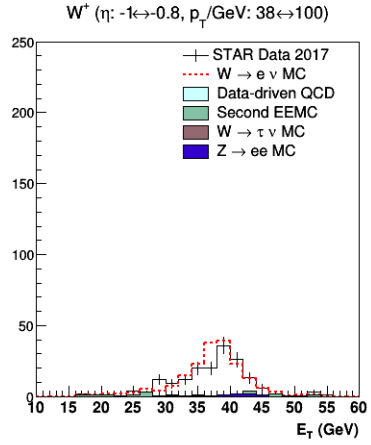
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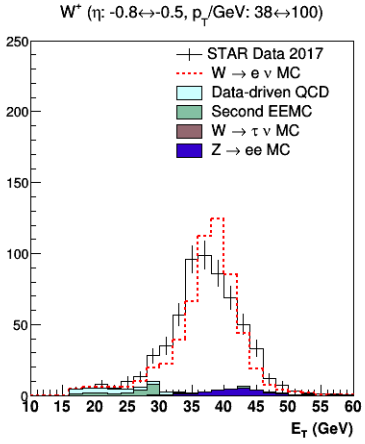
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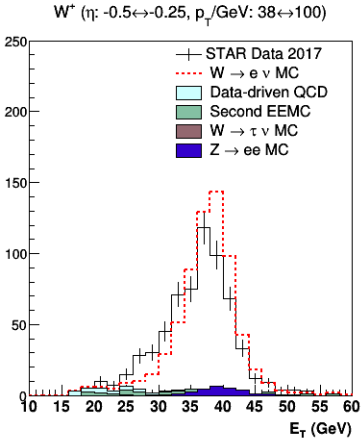
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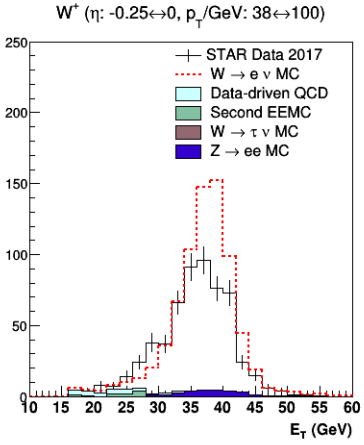
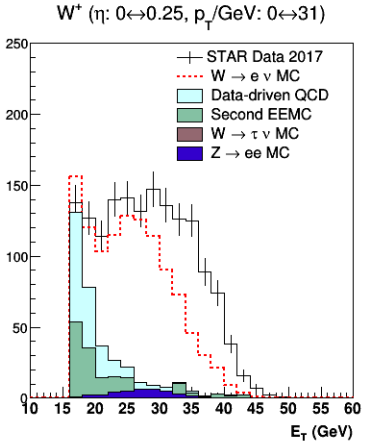
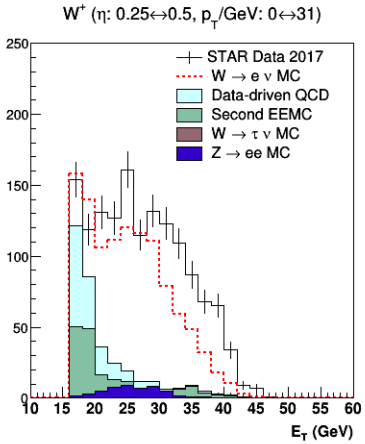
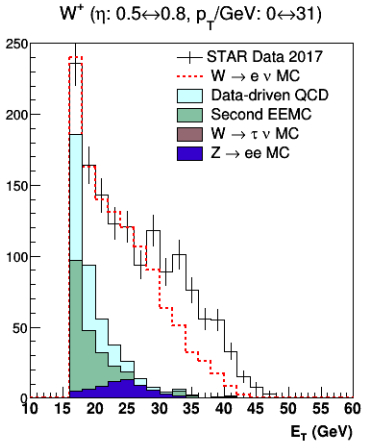
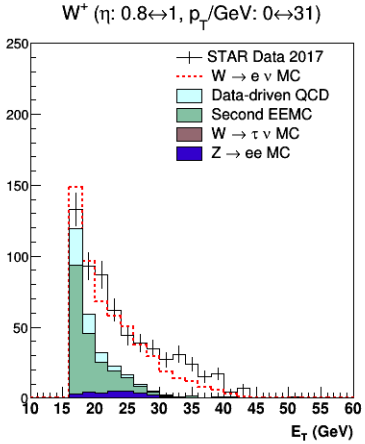
Z → ee MC
ET (GeV)

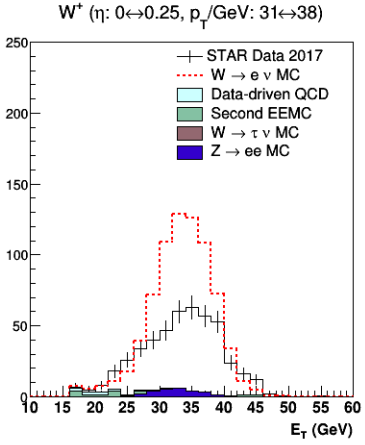

W+ (η: -0.25↔0, pT/GeV: 38↔100)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

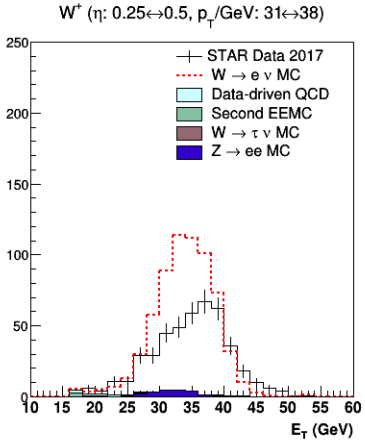

W+ (η: 0↔0.25, pT/GeV: 0↔31)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

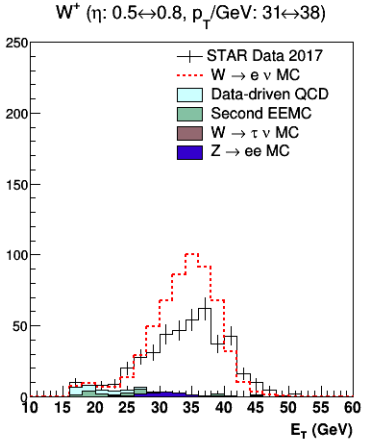

W+ (η: 0.25↔0.5, pT/GeV: 0↔31)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

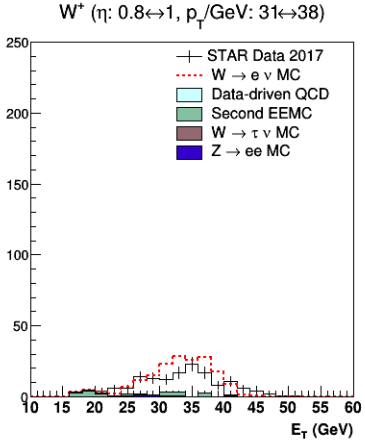

W+ (η: 0.5↔0.8, pT/GeV: 0↔31)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

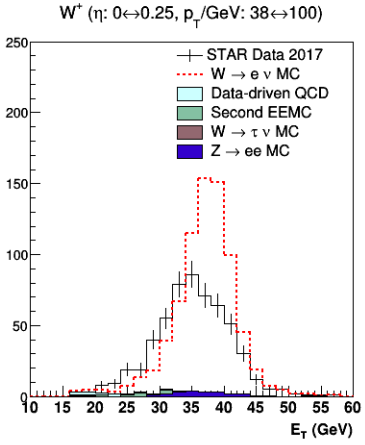

W+ (η: 0.8↔1, pT/GeV: 0↔31)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

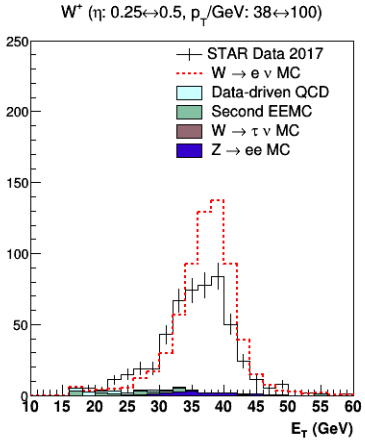

W+ (η: 0↔0.25, pT/GeV: 31↔38)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

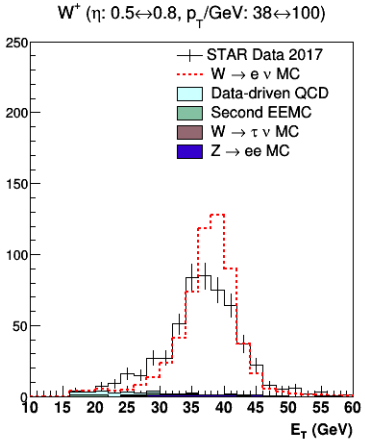

W+ (η: 0.25↔0.5, pT/GeV: 31↔38)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

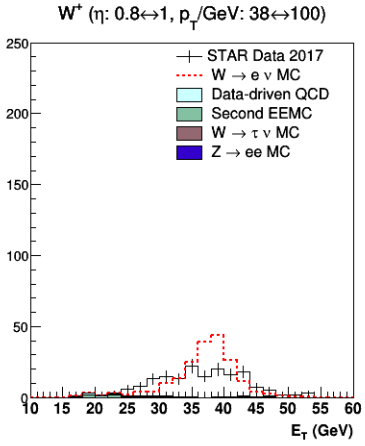

W+ (η: 0.5↔0.8, pT/GeV: 31↔38)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)


W+ (η: 0.8↔1, pT/GeV: 31↔38)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

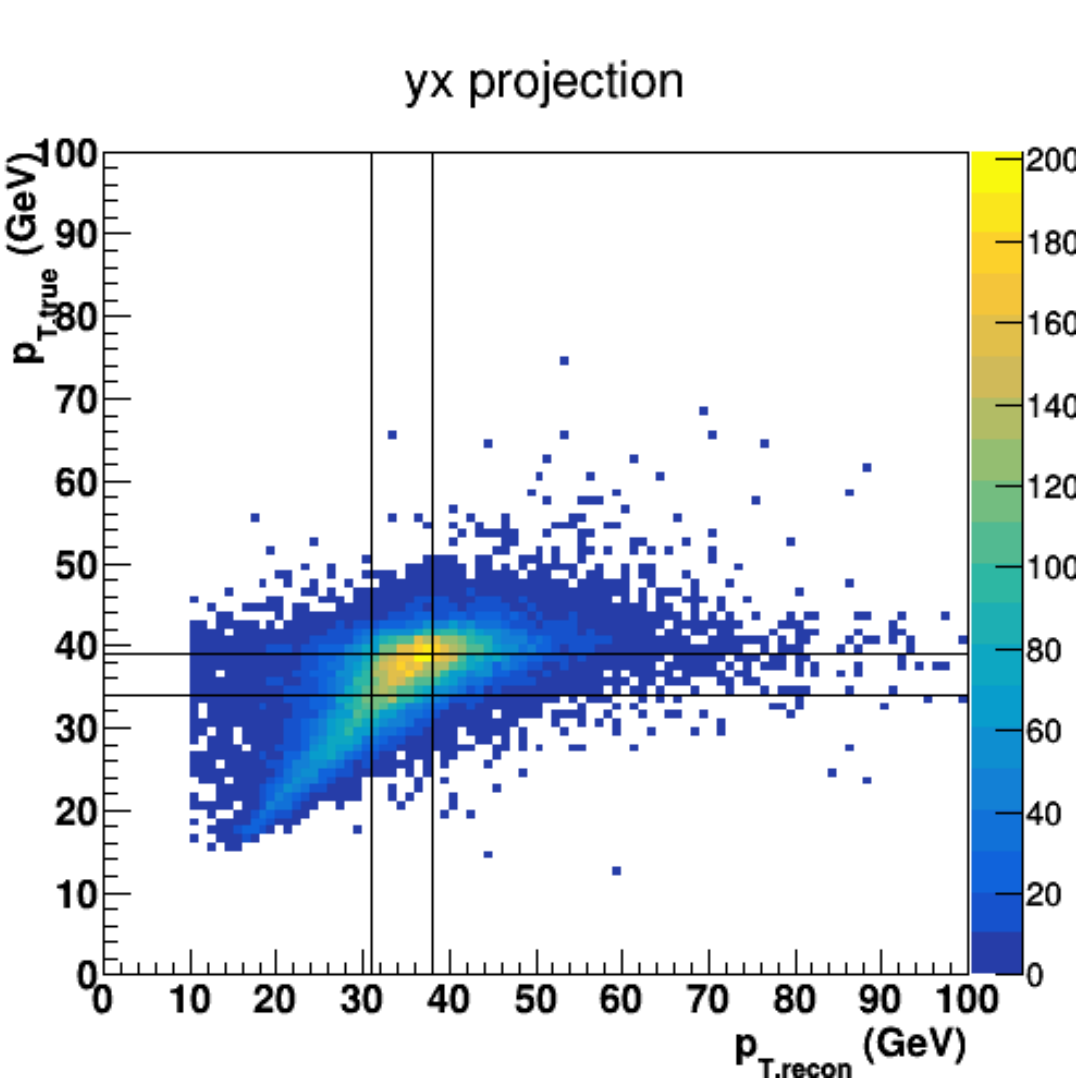

W+ (η: 0↔0.25, pT/GeV: 38↔100)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

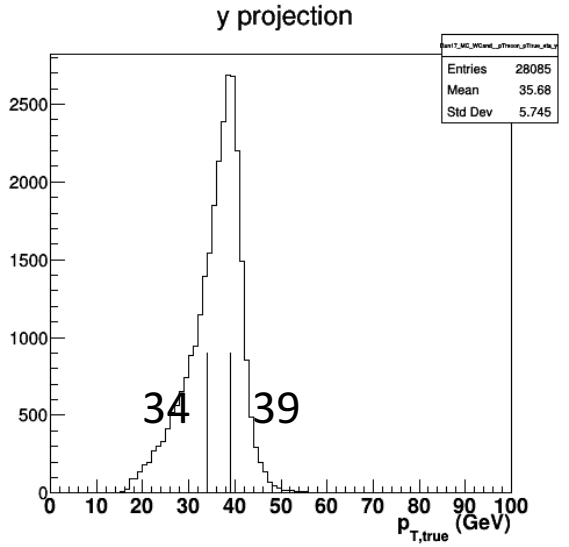

W+ (η: 0.25↔0.5, pT/GeV: 38↔100)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

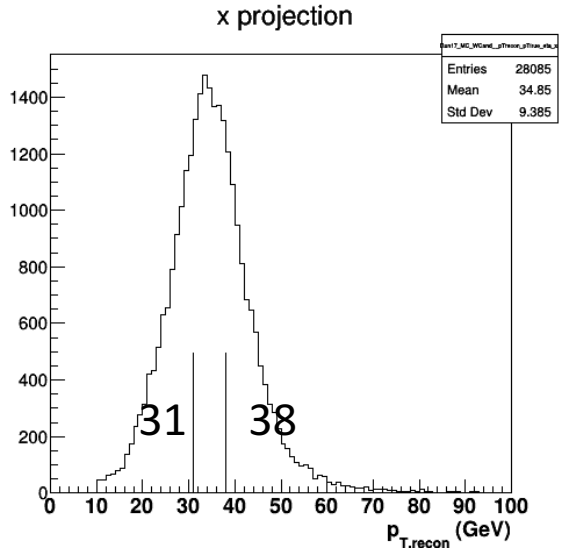

W+ (η: 0.5↔0.8, pT/GeV: 38↔100)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)


W+ (η: 0.8↔1, pT/GeV: 38↔100)
STAR Data 2017
W → e ν MC
Data-driven QCD
Second EEMC
W → τ ν MC
Z → ee MC
ET (GeV)

p_T binning


yx projection
$p_{T,true}$ (GeV)
$p_{T,recon}$ (GeV)


y projection
Entries 28085
Mean 35.68
Std Dev 5.745
34
39
$p_{T,true}$ (GeV)


x projection
Entries 28085
Mean 34.85
Std Dev 9.385
31
38
$p_{T,recon}$ (GeV)