Powheg-EW tests in ATLAS

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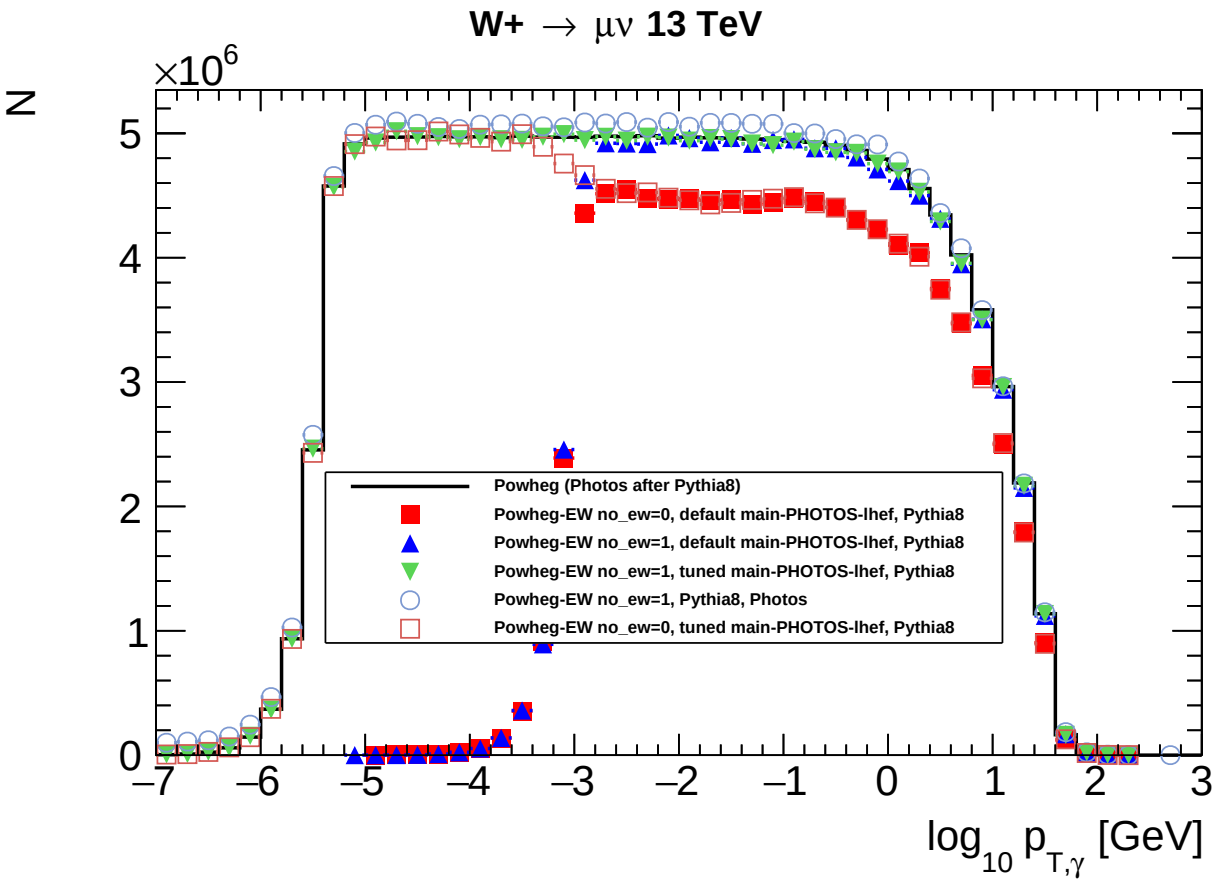
Reminder

- Testing Powheg-EW modules for W and Z, currently still using the pre-Orsay version (r 3376)
- At Orsay various non-understood features, which are meanwhile fixed:
  - one "user mistake" with interfering entries in LHE files that tripped main-PHOTOS-LHEF
  - one issue with new Pythia8 version
- "QCD" part (e.g. boson pT, y) is essentially identical to old Powheg W,Z modules – good
- Still seeing quite some differences in low-level plot regarding photon radiation

Photons ($W^+ \to \mu\nu$, 13 TeV)

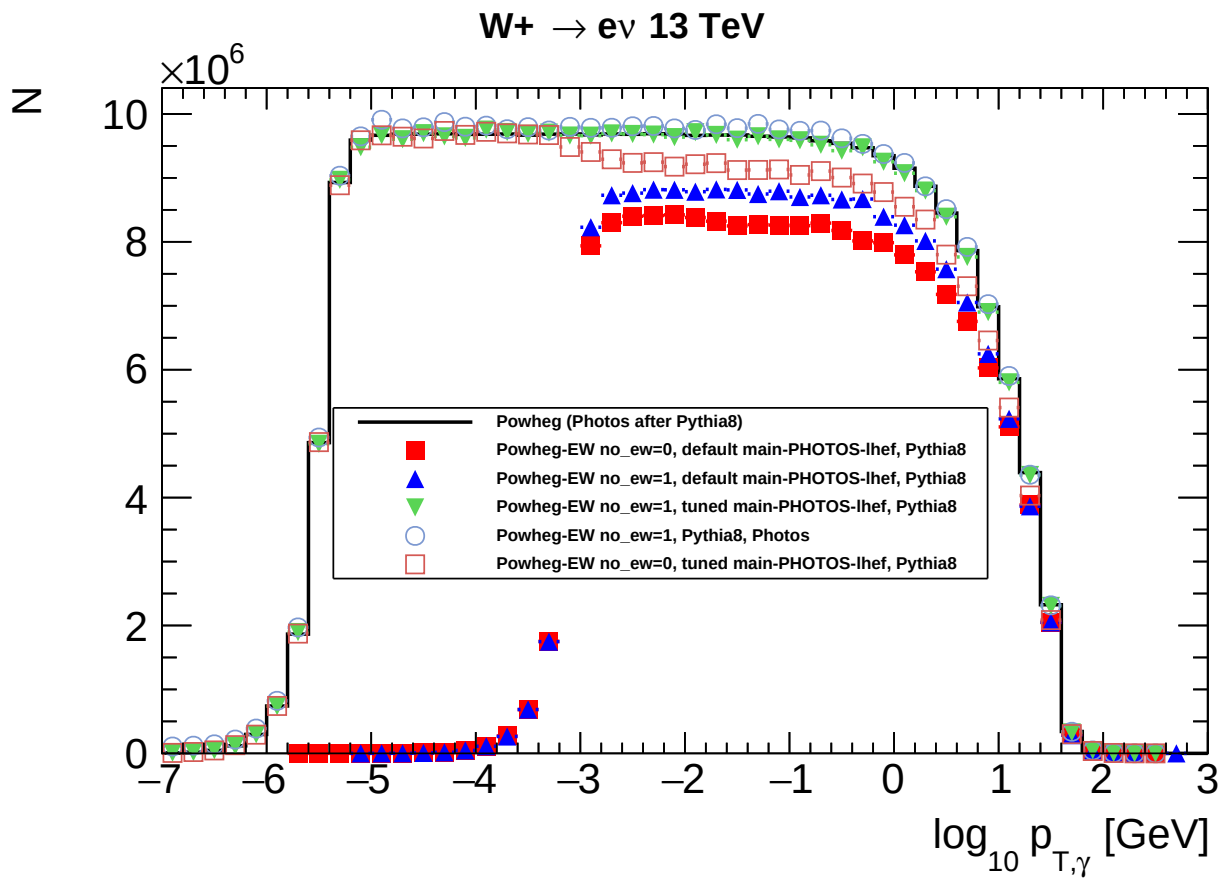
- low-level plot to evaluate amount of photon radiation, various options:
  1. previous default (as used in ATLAS analyses)
  2. Powheg-EW with full EW corrections, out of box
  3. Powheg-EW only Photos FSR, out of box



  4. Powheg-EW only Photos FSR, tuned Photos setting
  5. other workflow
  6. Powheg-EW with full EW corrections and tuned Photos
- "Photos tuning" = open lower cutoff, change treatment of electron mass (irrelevant for muons), enable matrix element corrections
- Lower radiation above Powheg cutoff is an "EW feature" (?!)

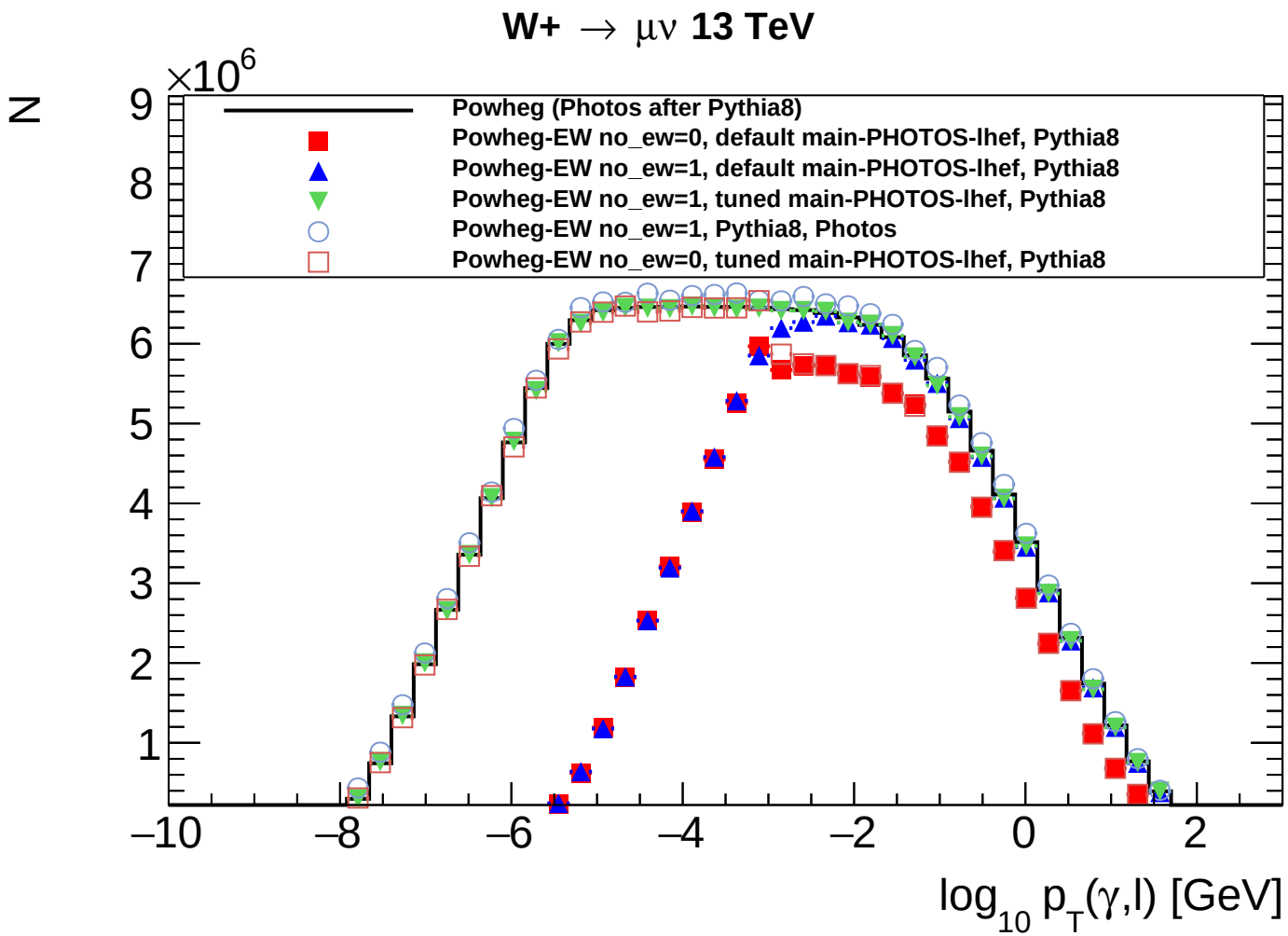
Photons ($W^+ \to e\nu$, 13 TeV)

- Same plot for electrons, more (soft) radiation



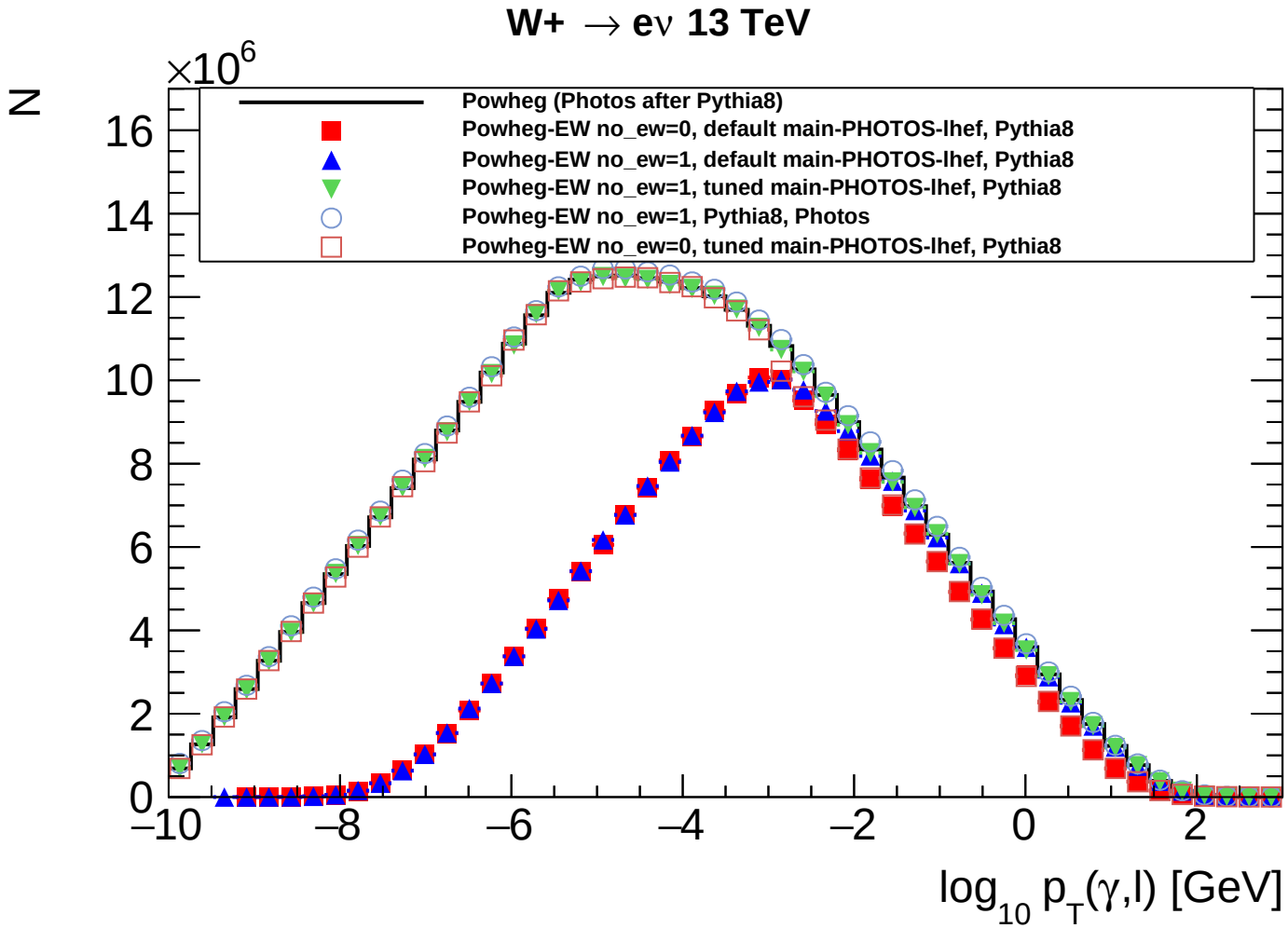
- "Photos tuning" has a significant impact here – electron mass treated imprecisely in the default setup of Photos as used in "default main-PHOTOS-lhef"

Photons ($W^+ \to \mu\nu$, 13 TeV)



- Similar plot, but recording the relative p_T of the photon closest in ΔR to the charged lepton

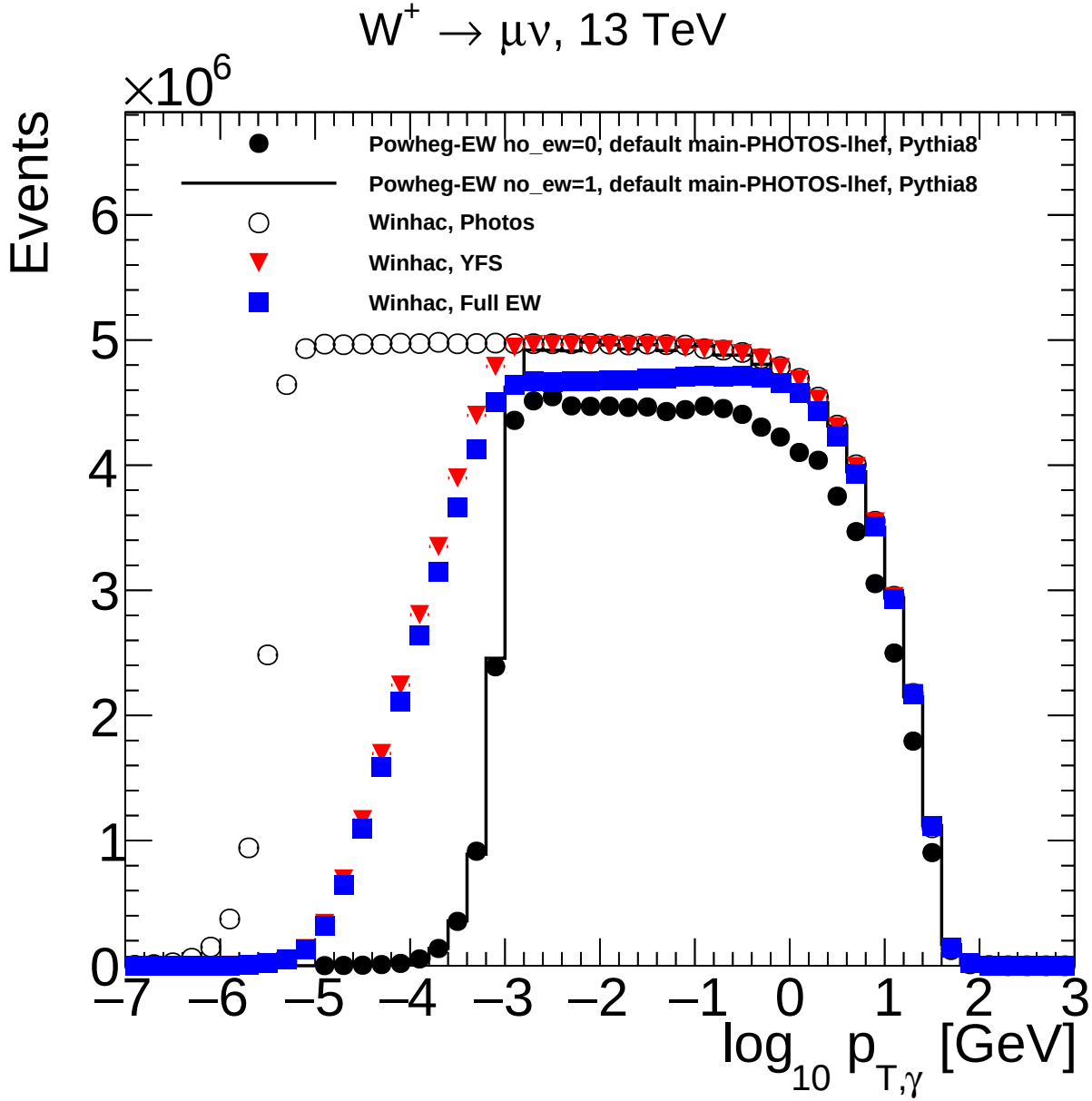
Photons ($W^+ \to e\nu$, 13 TeV)



- Similar plot, but recording the relative p_T of the photon closest in ΔR to the charged lepton

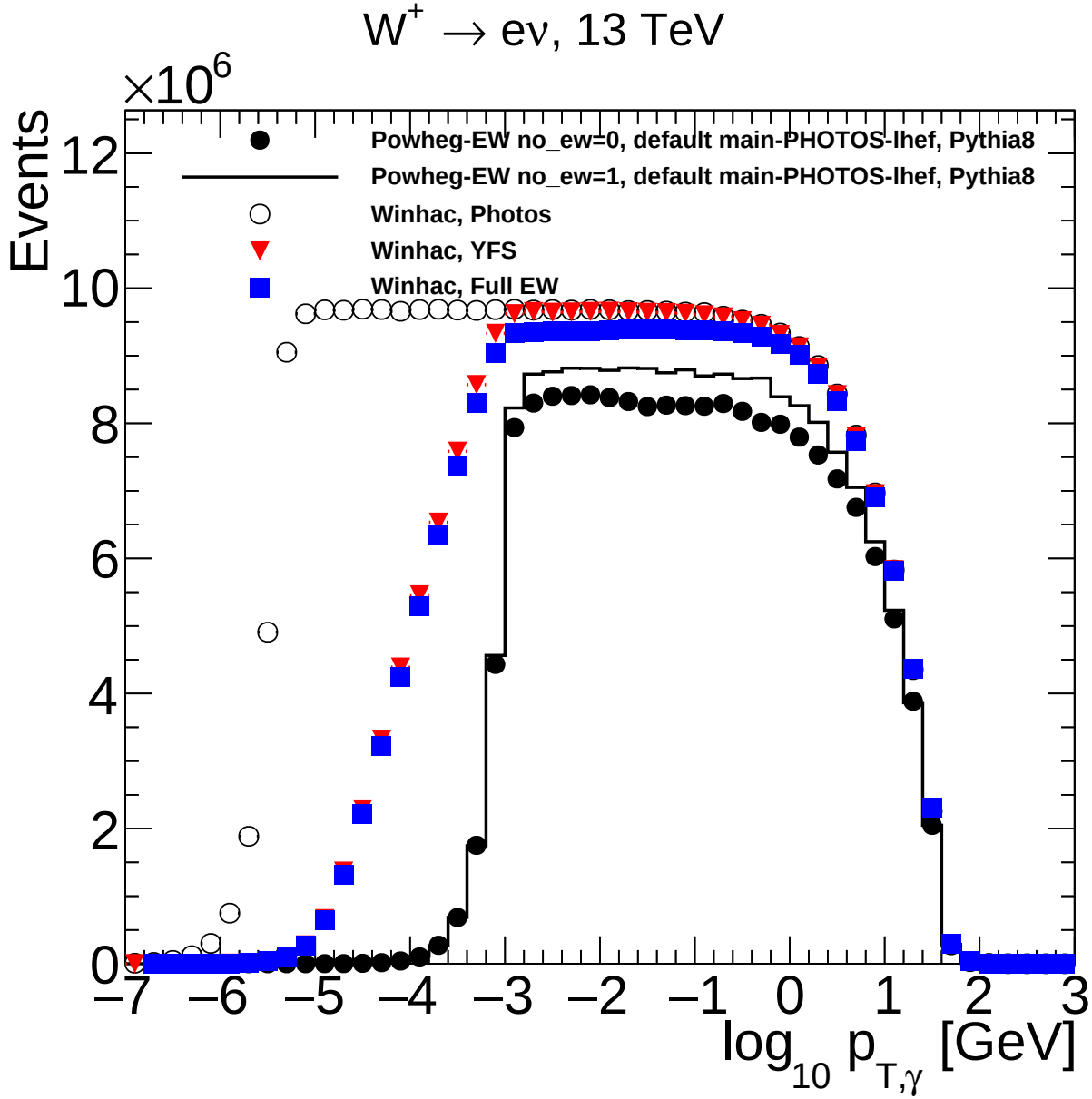
Cross-check full EW corrections: $W^+ \to \mu\nu$

- Alternative simulation of full EW corrections with Winhac, normalisation fixed to same number of sum weights for inclusive distributions, height of plateau proportional to radiation probability
- Full EW corrections reduce photon in softer region $\lesssim 0.5\,\text{GeV}$
- Powheg-EW shows stronger reduction than Winhac, especially in the harder region $\gtrsim 0.5\,\text{GeV}$!



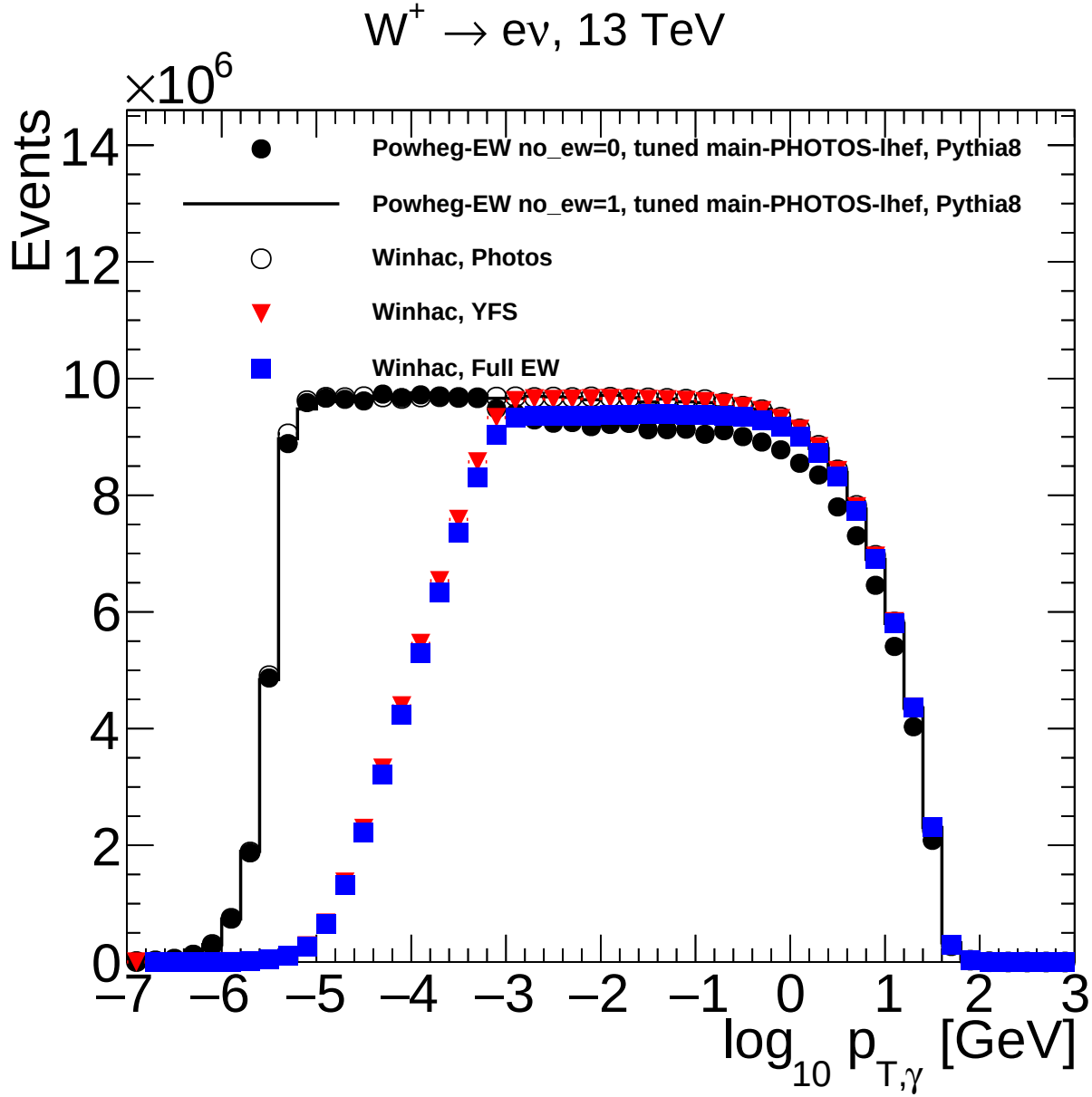
Cross-check full EW corrections: $W^+ \to e\nu$

- Same for electrons, "default main-PHOTOS-lhef"



Cross-check full EW corrections: $W^+ \to e\nu$

- Same for electrons, "tuned main-PHOTOS-lhef"



Lineshape

- Still seeing (small) shift vs. our old "running-width" samples, probably fixed latest releases?