

# W/Z PT modelling issues

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on behalf of the LHCb experiment

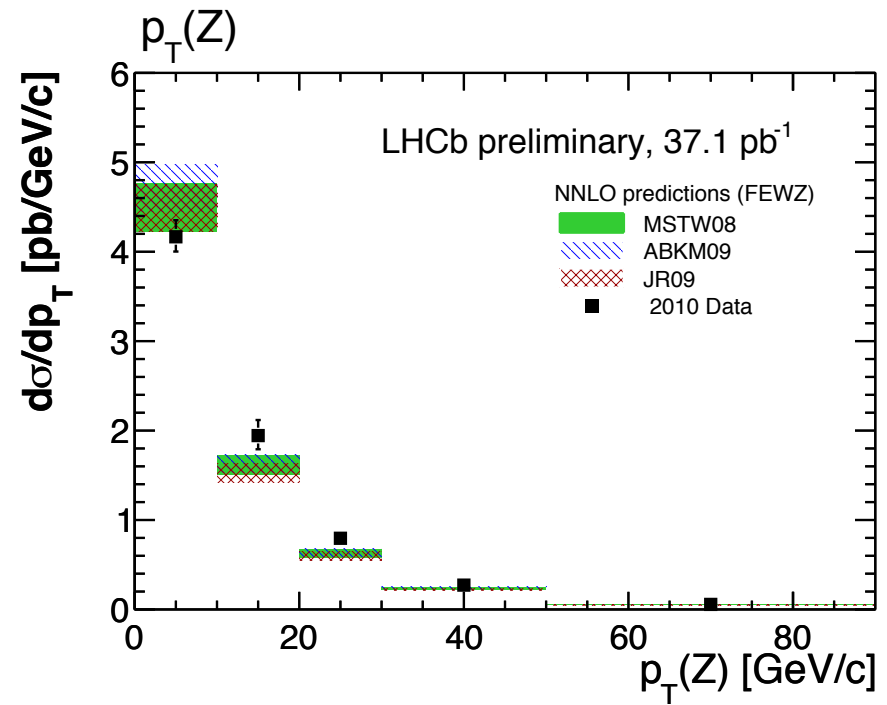
# Issue: how well is boson PT modelled?

## Comparison to data:

Z: PT measured directly and compared to NNLO (FEWZ) prediction.

Theory uncertainty grows as PT reduces.

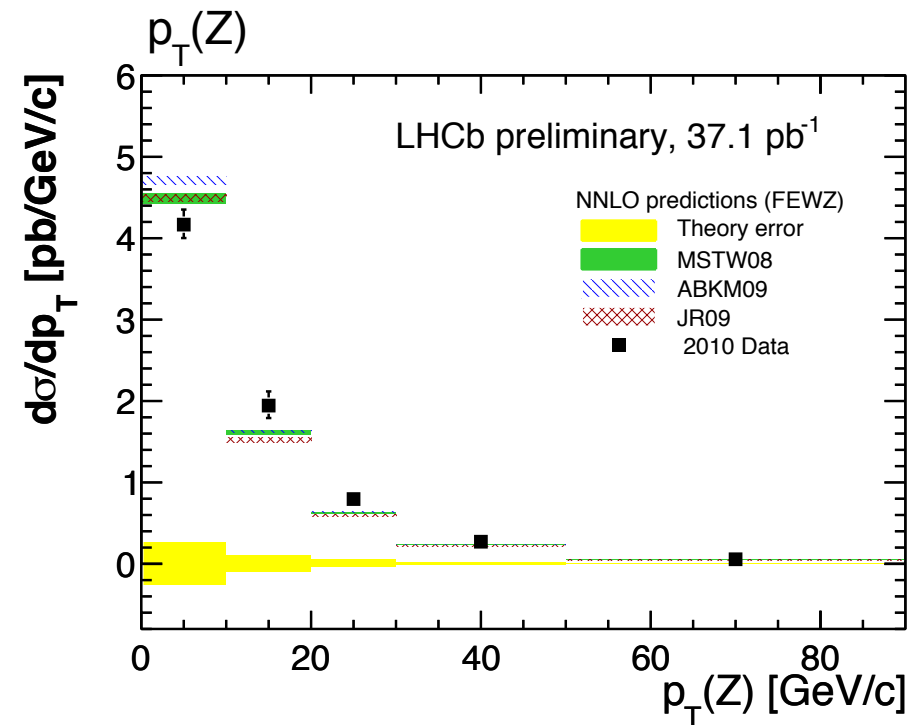
- Scale uncertainty grows.



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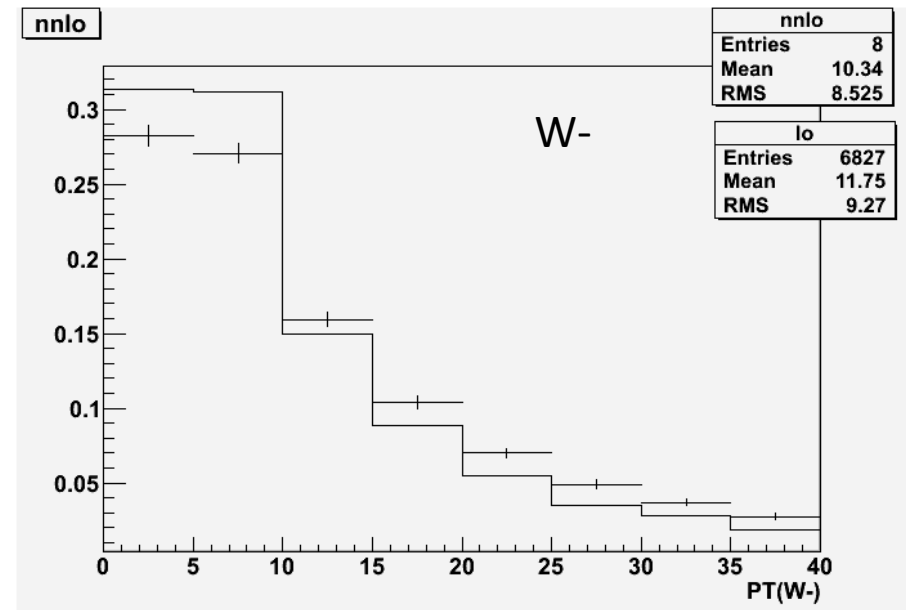
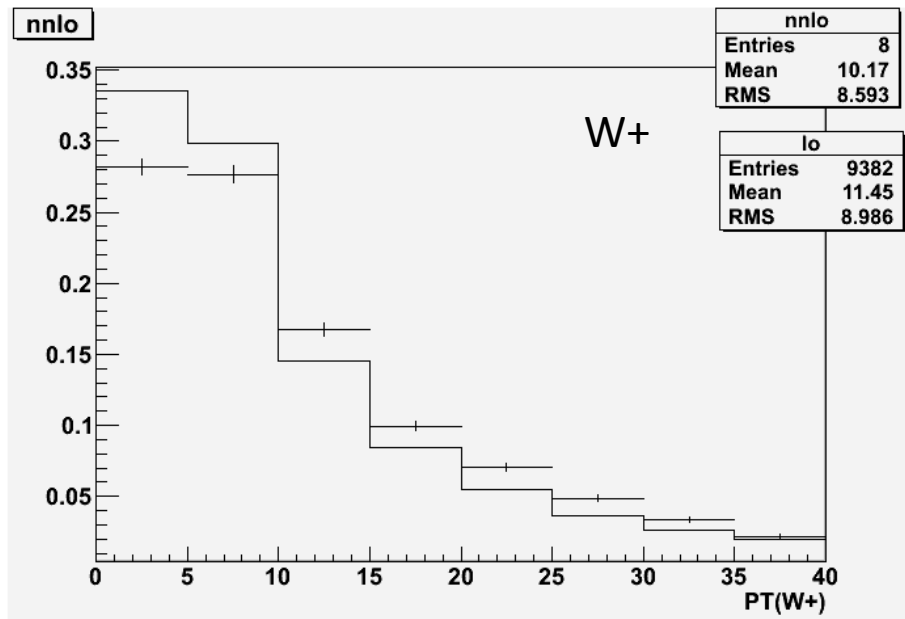
- **Scale uncertainty grows.**



Already discussed: Which predictions give a reliable boson PT distribution?

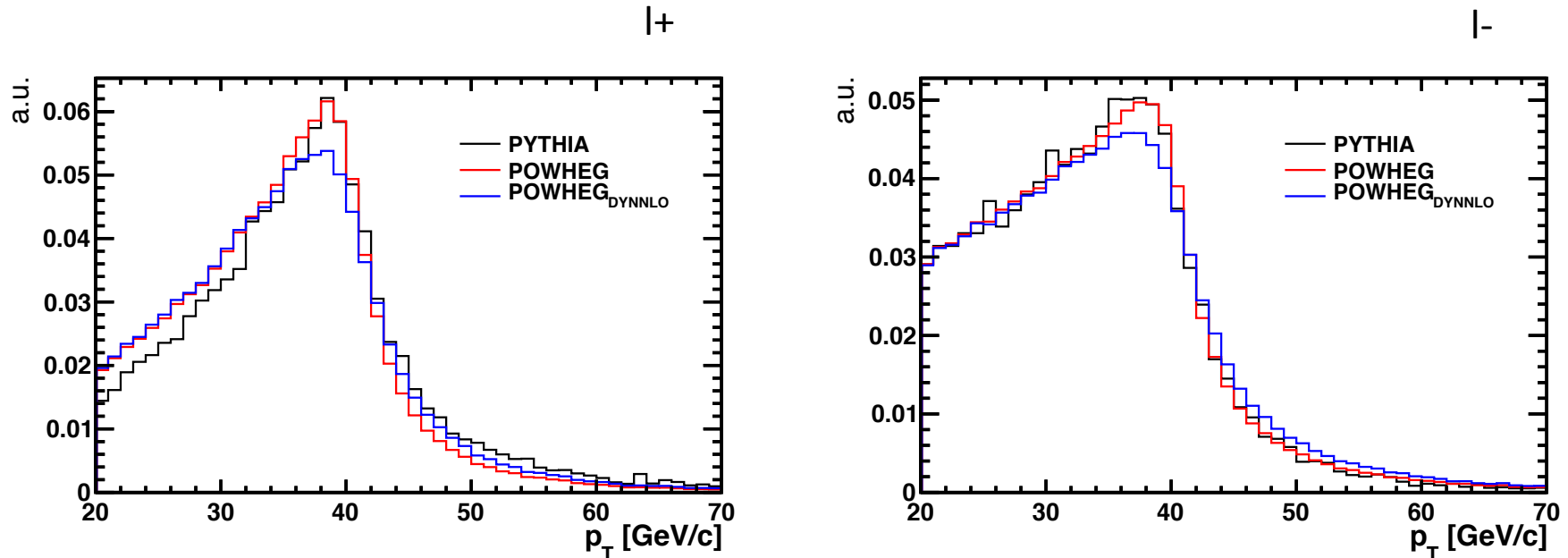
# Implication: modelling of lepton PT in W purity fits

We fit lepton PT to estimate the purity of our W selection.  
W PT spectrum affects lepton PT.



NNLO = DYNNLO + MSTW08 (histo)  
LO = Pythia 6 + CTEQ6 LO (points)

# Implication: modelling of lepton $p_T$ in W purity fits



**Assumed boson  $p_T$  alters lepton  $p_T$ .**

**W<sup>-</sup>**; lepton boosted in direction of flight, lepton has **higher  $\eta$ , lower  $p_T$**

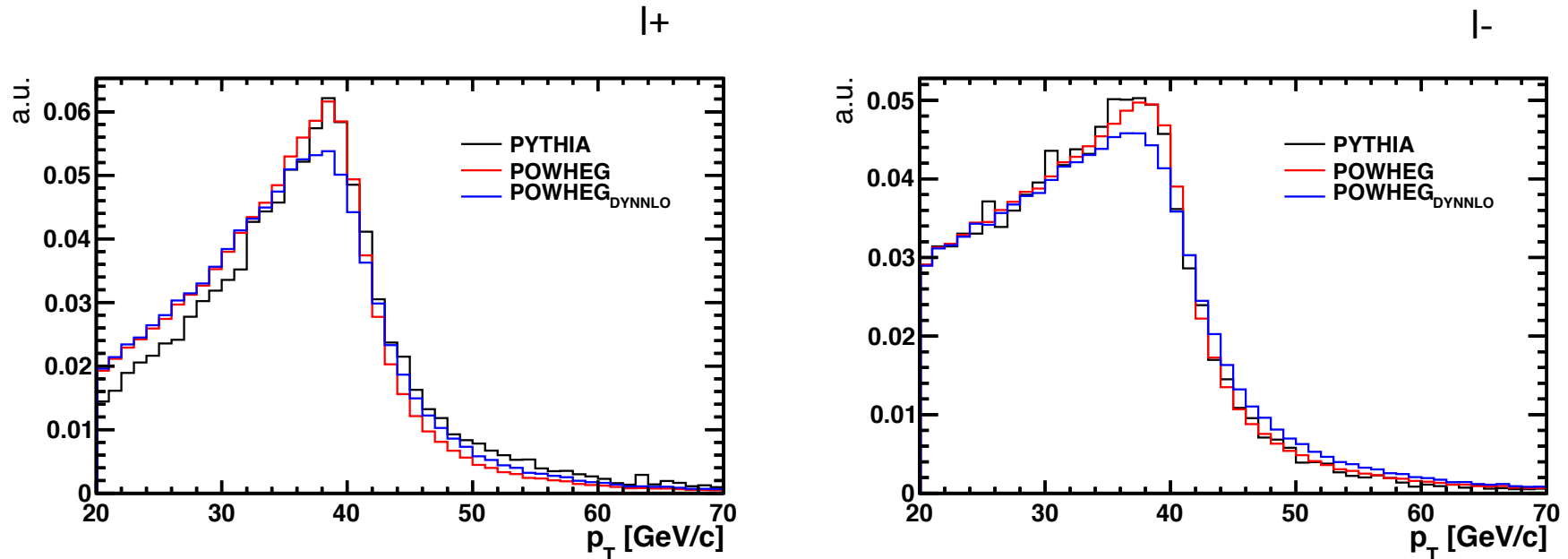
**W<sup>+</sup>**; lepton boosted against direction of flight, lepton has **lower  $\eta$ , higher  $p_T$**

W  $p_T$  increases lepton  $p_T$ , reduces lepton  $\eta$ .

=> Shape of lepton  $p_T$  changes, as can  $\eta$  dependence.

(May also affect acceptance calculation.)

# Implication: modelling of lepton PT in W purity fits



**Fits to background + signal lepton PT are sensitive to underlying PT**

Pythia vs. POWHEG => 1.4% – 2% difference on cross-section.

Powheg vs. DYNNLO reweighted => smaller (~0.1 %)

Not a limiting systematic (yet), but sensitivity nonetheless.

**Should we consider a “standard” set of generators to quantify effect?**