W Boson Mass Measurement at CDF and Tevatron-LHC Combination

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W Boson Mass Measurement at CDF

- Published measurement using 2.2/fb of integrated luminosity
  - About 500K W boson events in each of electron and muon channels
  - PRL 2012
  - PRD 2014
  - MW = 80387 ± 19 MeV

- Currently ongoing analysis of full Tevatron Run2 dataset, 8.8/fb of integrated luminosity

Combination of Tevatron and LHC Measurements

– PDF uncertainty

- In principle, correlation between Tevatron and LHC for PDF uncertainty in M_W can be derived from a common framework, using common PDF set and eigenvectors / replicas

- CDF and D0 assumed 100% correlation because of identical partonic *x* sampled

- Tevatron and LHC may not be 100% correlated because of different *x* sampled

  – Correlation may be weak, or possibly negative, which would be good fortune

- Need to publish M_W variation with eigenvectors / replicas

– PDF uncertainty improvements

- May use NNPDF3.1

- Replicas can be reweighted, incorporating weights from posterior fit to W charge asymmetry, forward-backward asymmetry off Z-boson mass peak, etc.

- May measure central ($\eta<1$) to forward ($\eta>1$) ratio of electron rates from W boson decay, as additional PDF constraint

Combination of Tevatron and LHC Measurements

– $P_T(W)$ uncertainty

- Correlation between Tevatron and LHC for $P_T(W)$ uncertainty in M_W should be negligible, to the extent the model parameters are tuned on Z boson data

- Tevatron uses RESBOS to fit and tune parameters of $P_T(V)$

- $P_T(W)/P_T(Z)$ ratio may be correlated between Tevatron and LHC

- Need to settle on theoretical framework / program to extract $P_T(W)/P_T(Z)$ ratio uncertainty