



UNIVERSITÀ DEGLI STUDI
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Photon-induced contributions and AFB predictions

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Status at the July meeting

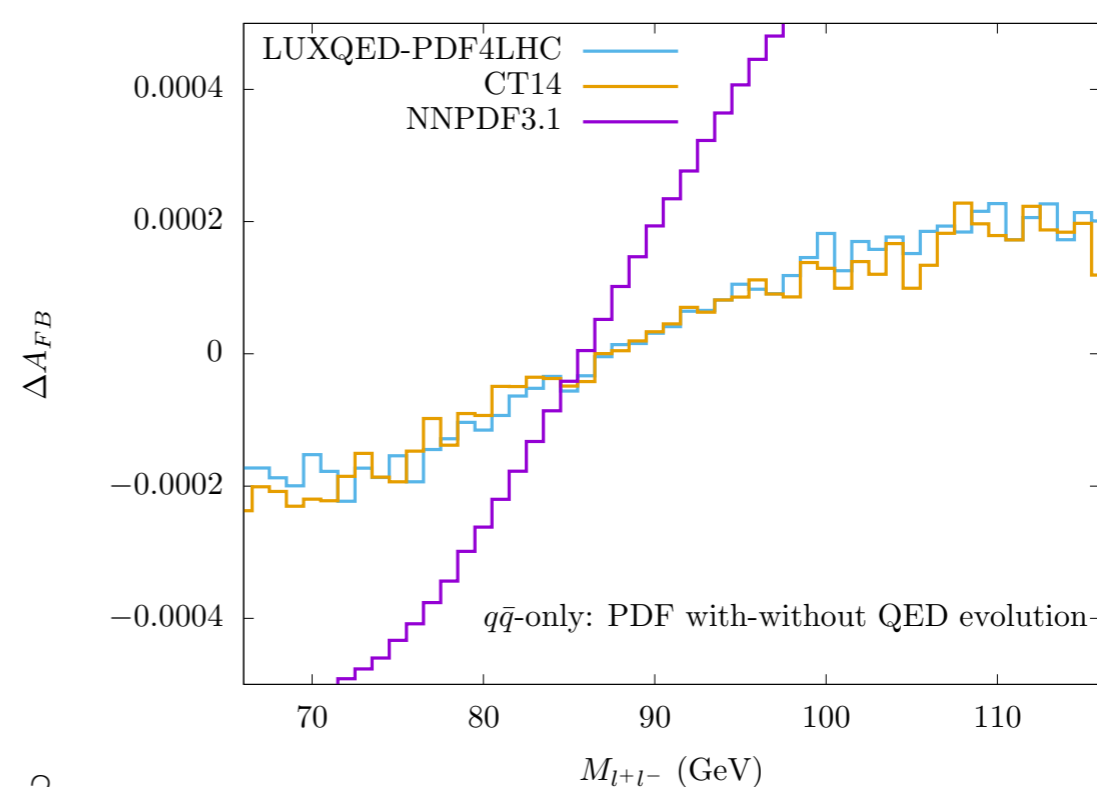
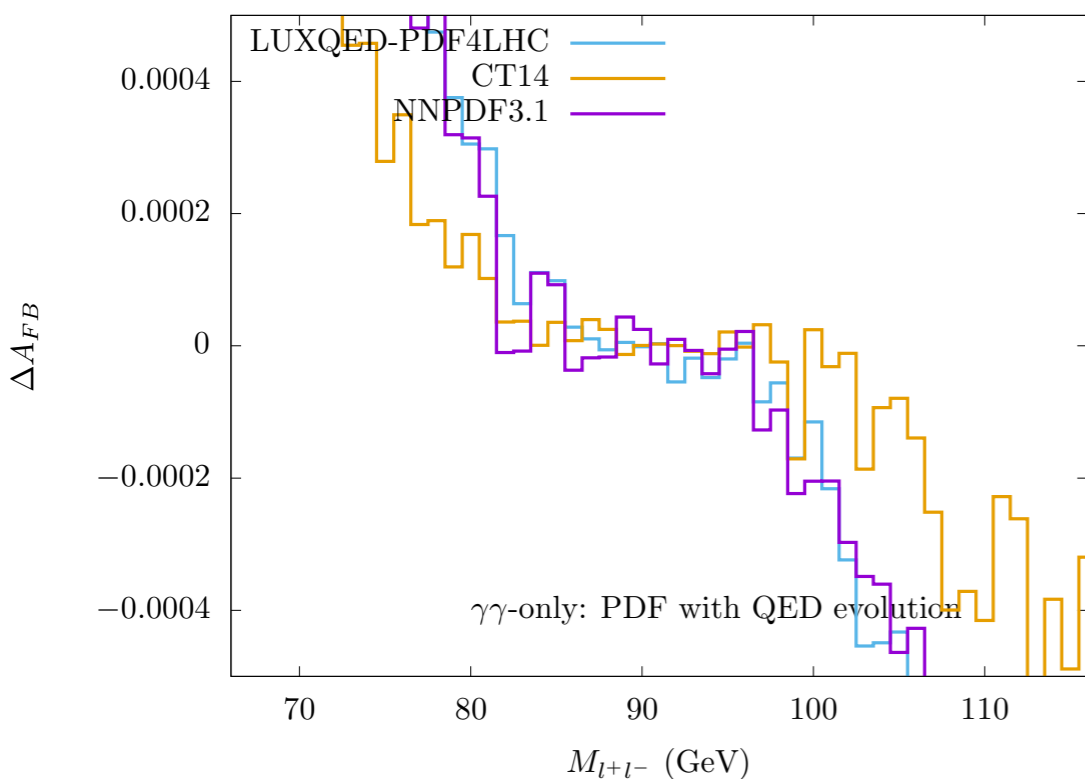
Photon-induced processes are a natural ingredient of EW processes at hadron colliders
(cancellation of QED IS mass singularities, contribution of photon density in the proton)

The NNPDF3.1_as_0118_nlo_luxqed PDF set induces a very large distortion of the AFB distribution, compared to its pure QCD counterpart

This feature is not visible with other PDF sets that include QED DGLAP evolution:
comparison against CT14QED (dynamically generated photon), PDF4LHC15-LUXQED

First attempts to breakdown the problem:

- 1) evaluation of only the $\gamma\gamma$ contribution \rightarrow similar AFB behaviour with different PDF sets
- 2) comparison of qqbar contribution QCD+QED vs QCD quarks
 \rightarrow differences between NNPDF3.1 and the other sets



New recent inputs from PDF collaborations

MMHT

two new PDF sets, including

- an implementation of the LUX-QED solution for the photon density (+quarks and gluons)
MMHT2015_nloqed (with further breakdown into elastic and inelastic components)
- only quarks and gluons evolving with only the QCD kernels
MMHT2015_nloqcd

NNPDF

three PDF sets corresponding to the different stages of the procedure used to include the photon density (LUX-QED solution) in the global NNPDF fit

ite0 quarks and gluons coincide with those of the “purely QCD” set
the photon $\gamma_0(x, Q)$ is computed from the quarks (LUX-QED)
sum rules are restored
→ very similar to the PDF4LHC15_LUXQED combination

ite1 $\gamma_1(x, Q_0) = \gamma_0(x, Q_0)$
quarks and gluons refitted in presence of the photon → proper sum rules inclusion
 $\gamma_1(x, Q) \neq \gamma_0(x, Q)$ because of different evolution induced by different quarks/gluons

ite2 $\gamma_2(x, Q)$ computed from the quarks and gluons of {ite1} (LUX-QED)
quarks and gluons refitted in presence of the photon $\gamma_2(x, Q)$ → sum rules
a refined treatment of the photon error is adopted
→ very similar to the final NNPDF3.1_LUXQED set

Comments

In the “QED sets” the quark densities change w.r.t. the “QCD sets”
not only because of the presence of QED evolution kernels
but also because the new different boundary conditions
implied by the simultaneous presence of quarks, gluons and photons densities in the fit

The whole discussion about the AFB shift
should be developed in presence of an estimate of the PDF uncertainty on AFB
(→ additional computational cost)

A check at the individual replicae can clarify how the NNPDF feature builds up.
are the sets with 100 and 1000 replicae equivalent in the prediction of this feature ?

Current status

The availability of new PDF sets will help to clarify some aspects of the AFB problem

A first round of simulation (this week) had computational problems → needs to be repeated

~ 1 week of the full Milano cluster should be sufficient to provide the results

→ interaction with MMHT and NNPDF authors

→ discussion via email in the EWWG subgroup