

Update on lead PDF

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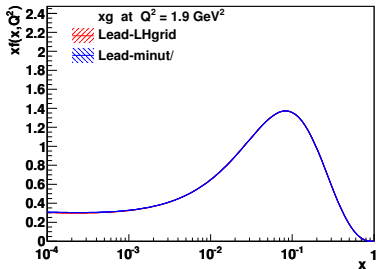
Include nCTEQ lead PDF in HeraFitter

We provide the nCTEQ lead PDF $f^{p/Pb}$ [arXiv:09072357]

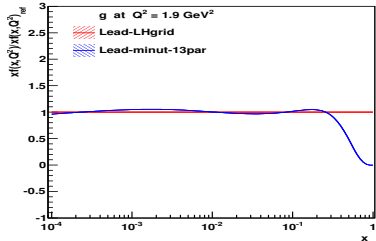
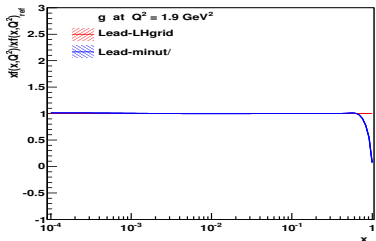
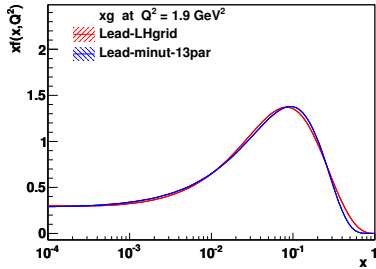
- ▶ as **LHAPDF** grid file: easy to use when comparing to nCTEQ results
- ▶ as **minuit.in.txt** file: to use as a starting point for fits of LHC lead data
 - ▶ 13p HERA parametrization 'HERAPDF' is fitted to the nCTEQ lead PDF $f^{p/Pb}$ at the initial scale

Include nCTEQ lead PDF in HeraFitter

general parametrization



13 parameters



Include nCTEQ lead PDF in HeraFitter

We provide the nCTEQ lead PDF $f^{p/Pb}$ [arXiv:09072357]

$f^{p/Pb}$ = PDF of a proton bound in lead nucleus

- ▶ This can be evolved in standard way by QCDNUM
- ▶ To calculate cross sections we need PDFs of lead nucleus (A -number of protons and neutrons, Z -number of protons)
 - ▶ use isospin symmetry:

$$f_i^{(A,Z)}(x, Q) = \frac{Z}{A} f_i^{p/A}(x, Q) + \frac{A-Z}{A} f_i^{n/A}(x, Q)$$

Provide routine for nuclear distribution for lead

(Voica thanks for help!)

- ▶ Switch **PDFType** (= proton or lead) in **steering.txt**
- ▶ Nuclear distribution $f_i^{(A,Z)}(x, Q)$ is calculated in subroutine **HF_Get_PDFs(x, q2, PDFSF)**

```
C---- switch for lead PDF: Combine to form nuclear pdf; scale by A
C----      For full cross section on lead, multiply by A
      if(lead) then
        tmpU  = (Z*PDFSF( 1) + (A-Z)*PDFSF( 2) )/A
        tmpD  = (Z*PDFSF( 2) + (A-Z)*PDFSF( 1) )/A
        tmpUb = (Z*PDFSF(-1) + (A-Z)*PDFSF(-2) )/A
        tmpDb = (Z*PDFSF(-2) + (A-Z)*PDFSF(-1) )/A
        PDFSF( 1) = tmpU
        PDFSF( 2) = tmpD
        PDFSF(-1) = tmpUb
        PDFSF(-2) = tmpDb
      endif
```

A and Z defined in **HF_Get_PDFs(x, q2, PDFSF)** is we need different nucleus they should be in steering.

Summary

- ▶ Lead PDFs are implemented, one can calculate cross sections or structure functions in the usual way:

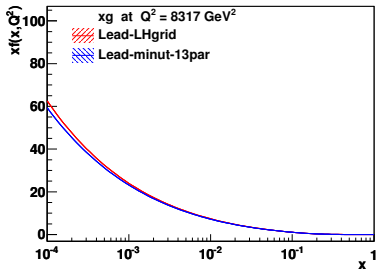
$$F_i^{(A,Z)}(x, Q) = \sum_k C_{ik} \otimes f_k^{(A,Z)}$$

- ▶ It can be generalized for different A and Z
(fitting the nuclear dependence not so easy...)
- ▶ We provided nCTEQ lead as a LHAPDF grid and `minuit.in.txt` file so that it can be used as a starting point for fitting lead PDF.
(If needed we can also provide LHAPDF grids for different nucleus)

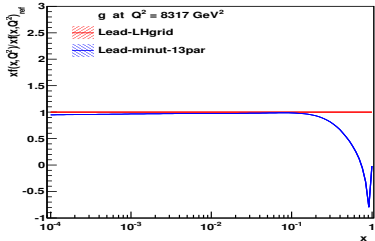
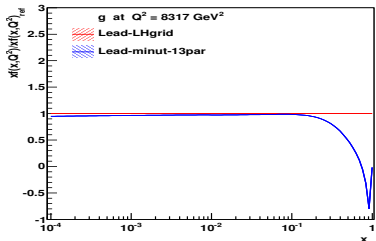
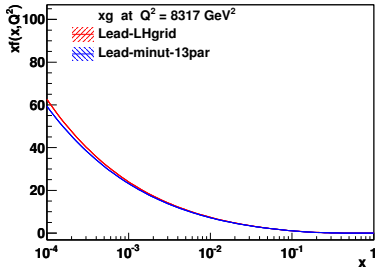
EXTRAS

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general parametrization



13 parameters



STEP 2: Fit lead PDF in HERA-Fitter:
Would need to limit parameters:
Maybe 10 or 13 style parameter fit

HERA-PDF $f(x, Q_0) = ax^b(1-x)^c(1+dx+ex^2)$

CTEQ $f(x, Q_0) = ax^b(1-x)^c(1+e^{dx} + \dots)$

