

Nuclear PDFs: nCTEQ Lead PDF now included:

We want lead to compute processes with nuclear beams at LHC
e.g., W/Z production with lead

STEP 1: Include lead PDF in HERA-Fitter:

Two methods:

- a) Use LHAPDF to link to external grid in $\{x, Q\}$
- b) Give QCDNUM $f(x, Q_0)$ and evolve

DONE

STEP 2: Fit lead PDF in HERA-Fitter:

Would need to limit parameters:
Maybe 10 or 13 style parameter fit

CLOSE

Fred Olness, Alex Kusina, Ben Clark
9 September 2013

THANKS TO:

Alex Kusina, Ingo Schienbein, Tzvetalina Stavreva, Ji Young Yu, Ben Clark, Eric Godat

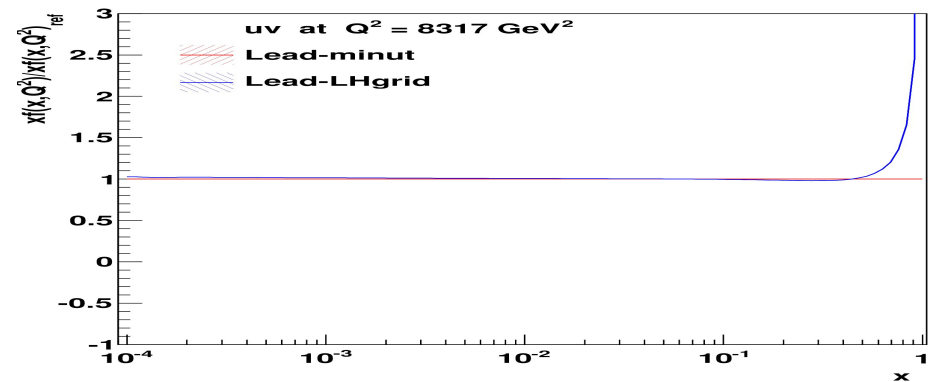
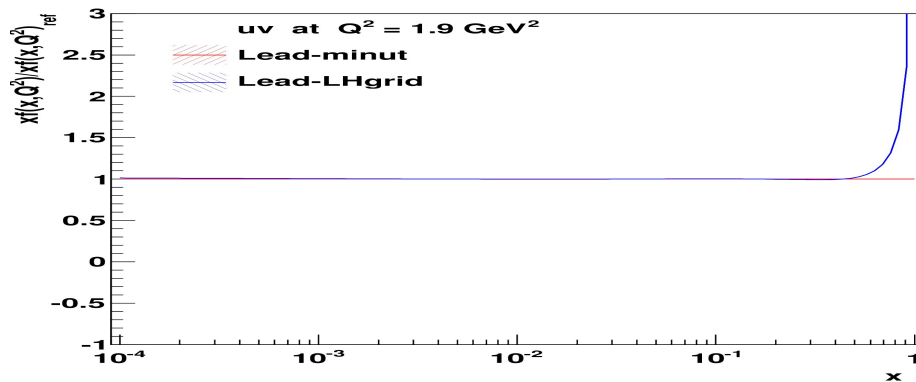
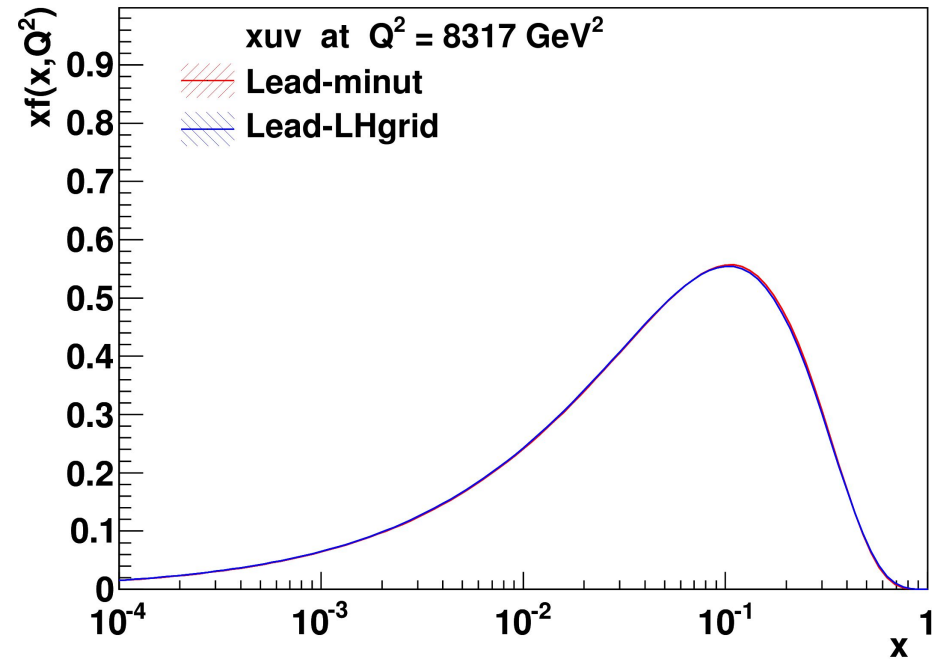
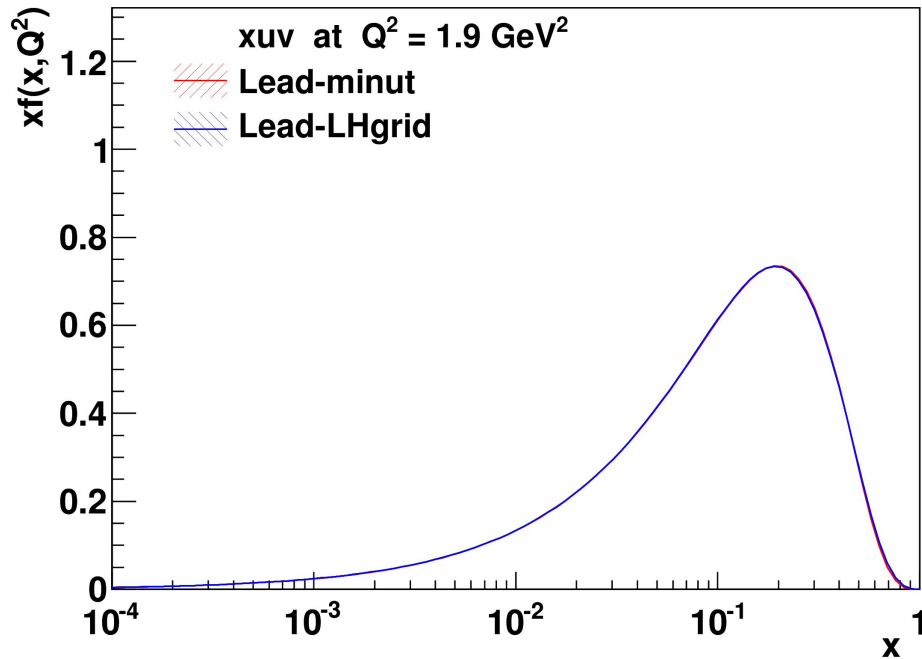
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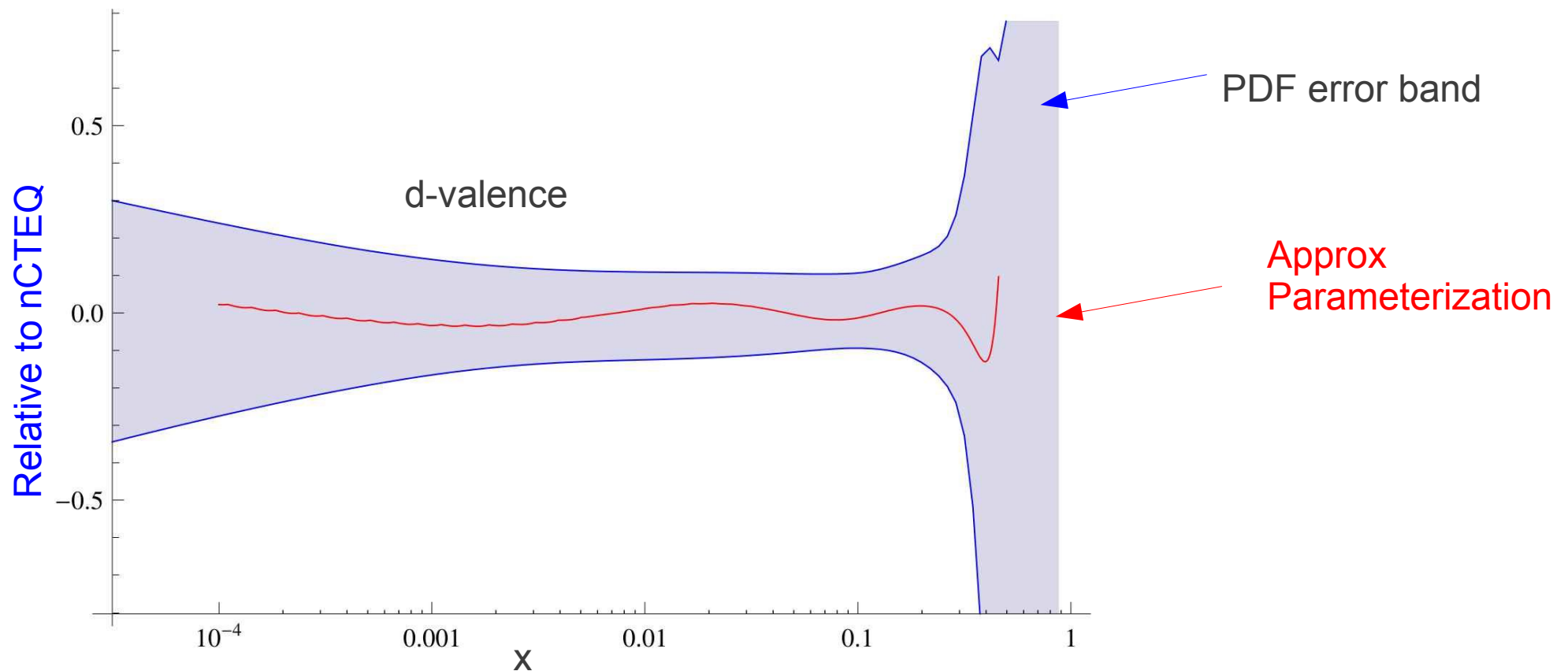
Note: This means that QCDNUM can perform the evolution of the nuclear PDFs. This is because we compute proton in lead, and then convert to nuclear case:

$$u_{\text{LEAD}}(x, Q) = 82 u_p(x, Q) + 125 u_n(x, Q)$$



STEP 2: Fit lead PDF in HERA-Fitter:
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HERA-PDF $f(x, Q_0) = ax^b(1-x)^c(1+dx+ex^2)$
CTEQ $f(x, Q_0) = ax^b(1-x)^c(1+e^{dx} + \dots)$



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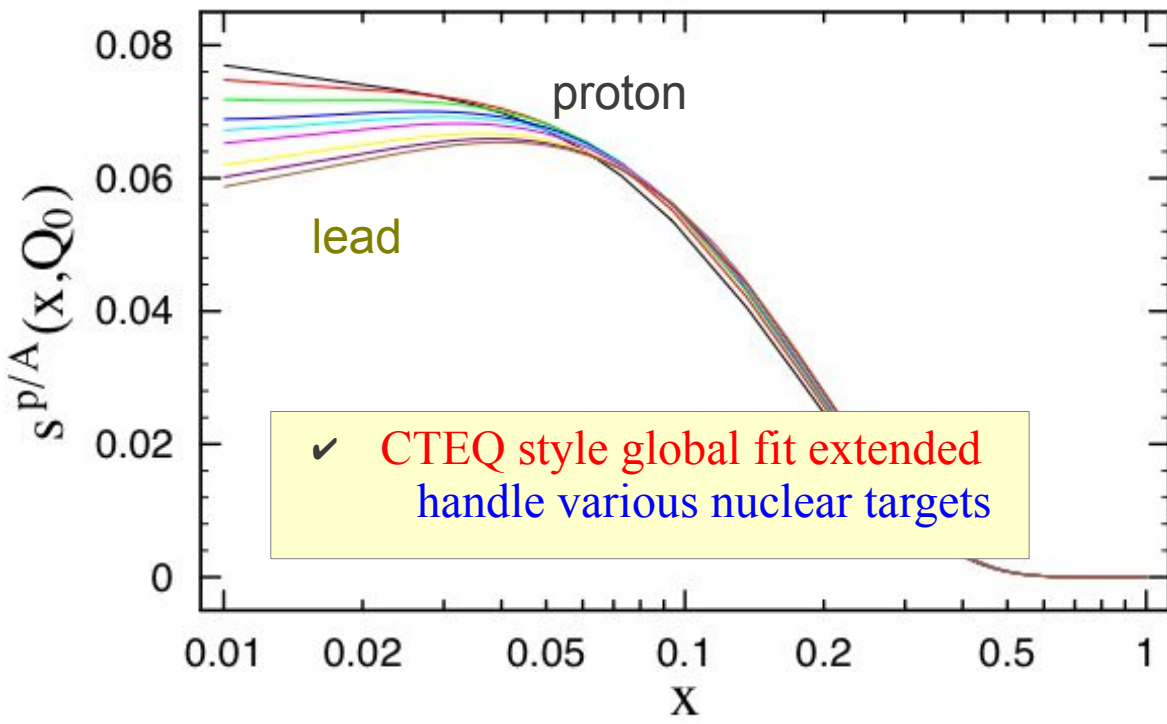
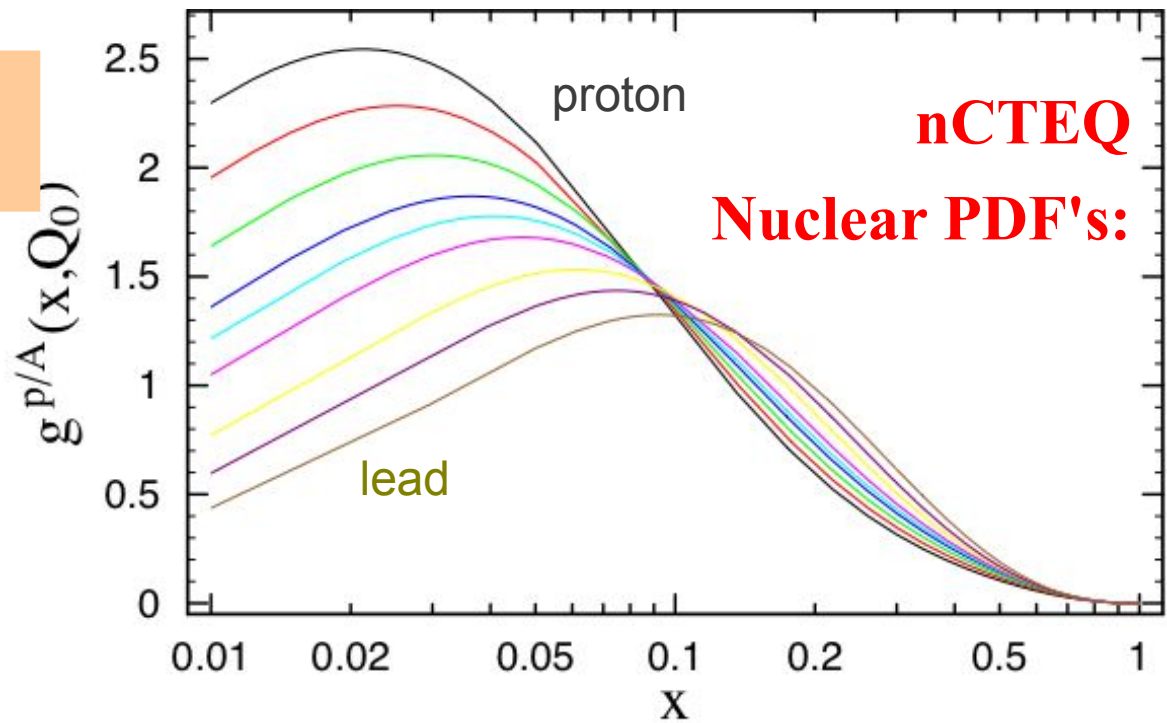
BACKUP

```
call PDFINP ( subr, iset, offset, *epsi, *nwds )
subroutine SUBR ( x, qmu2, xpdf )
```

SUBR provided w/ 3 options:

- Lead
- Proton
- Ratio

← Compute Nuc corrections for other PDF sets



A-Dependent PDFs

$$xf(x) = x^{a_1} (1-x)^{a_2} e^{a_3 x} (1 + e^{a_4 x})^{a_5}$$

$$a_i \rightarrow a_i(A)$$

$$a_k = a_{k,0} + a_{k,1} (1 - A^{-a_{k,2}})$$

Nuclear PDFs from neutrino deep inelastic scattering.
I. Schienbein, J.Y. Yu, C. Keppel, J.G. Morfin,
 F. Olness, J.F. Owens. Phys.Rev.D77:054013,2008.