SF working group – theory summary

Jon Pumplin – 10 April 2008

Even if you went to a talk during every parallel session (as I did in role as convenor) you missed >80% of all talks.

Here is a brief summary of what you missed if you didn't go to SF sessions.

F_L Measurement

We should raise our glasses tonight at the banquet to those who did the political and experimental and theoretical work to get the F_L measurement done before the disassembly of HERA!

On the theory side, it's important for our understanding of applied QCD --- even though the statistical accuracy will not provide strong new constraints on PDFs.

Gamma p total cross section

A bonus from the F_L measurement: The need to run HERA at a lower energy will provide a measurement of the energy dependence of the total cross section for photoproduction (see Aharon Levy's talk), to compare with Donnachie/Landshoff, or your favorite model of total cross sections.

(This old-fashioned physics may become new physics at LHC where the interaction range in impact parameter receives a contribution from the pomeron that is for the first time comparable in size to the range associated with the proton size.)

Gamma-Z Interference

Another experimental highlight: e+p vs e-p at high Q, showing gamma/Z interference.

This will no doubt be discussed in the experimental summary. I mention it here because of its potential use in constraining flavor ratios in the PDF analysis.

Management Issue?

2/3 of HERA data is still to be analyzed.

We hope that the organization to get this data out and available in archival form can go smoothly in the presence of departures to new machines!

Potential new data

 A major theme in our post-HERA machine world is to find new sources of information on PDFs.

We had two talks on how forward W and Z measurements at LHCb could provide parton information down to $x=10^{-5}$.

Discussed less at this meeting, but prominent at other workshops, has been the importance of W, Z , and t tbar measurements for future PDF determinations.

PDFs

We will live many years with LHC broadband beams of quarks and gluons, especially as plans for the ILC recede into the future.

An important application of DIS is input to determining PDFs.

There were presentations on the work of the major PDF suppliers by Watt, Thorne, Nadolsky, Alekhin, Cooper-Sarkar; along with related talks by Olness and Pumplin.

PDF Highlights

 Treatment of heavy quarks in PDF analysis has settled down, as shown for example by predictions for the W, Z "standard candle" processes which are now in acceptable agreement between groups.

Progress in strangeness PDFs: more information on s+sbar, and some limits on s-sbar (both potentially important for LHC).

Parametrization dependence

All fitting groups use different functional forms for parametrization of PDFs at the Q0 start of DGLAP evolution. This automatically provides some control on that source of error. Other ways of studying this problem were also discussed.

The parametrization-free neural net approach (Rojo) continues to show promise, with systematic steps in progress toward becoming a full-fledged alternative method for PDF determination.

Higher Twist

 Most PDF fitting is done in leading-twist approximation, with cuts on Q (and W) imposed to try to make that a good approximation.

We had talks by Bluemlein and Alekhin on studying the non-leading power corrections.

Such corrections must be taken on as a subject of interest at JLAB, where they are kinematically unavoidable.

Color Dipoles

Much of the interest in Structure Functions is for their central importance in measuring PDFs via NLO or NNLO pQCD.

However there is also interest in other approaches to SFs, which might expand our understanding of the standard approach, and which can be extended to low Q and/or low W.

We had two talks (Schildknecht, Utermann) applying the color dipole picture to calculating SFs.

Scaling Laws

We had a talk (Royon) on scaling laws based on an Extended Balitsky-Kovchegov equation in DIS.

(Editorial comment: It would be nice to do the same analysis on the NLO and NNLO fits. If the scaling law works better for the data than for perturbative theory, it could point to a need to modify the perturbative theory, e.g. by resummation.)

BFKL

We had two talks on BFKL – one by L himself. I cannot summarize it.

A talk by Marzani calculated NNLO corrections to BFKL. Unfortunately, the NNLO correction appears to be as large as the LO correction at physical alpha_s, which could lead to pessimism about the convergence of the series – let alone the adequacy of stopping at NNLO.

Thanks

Thanks to the conference organizers for an excellent conference/workshop!

Thanks to my co-convenors Daniel Kollar and Voica Radescu!

(If we do it again, perhaps we will try to harder to break 20' talks into 15' slides + 5' discussion, so as to be less of a conference and more of a workshop.)