

HERAFitter Users Meeting



HERAFitter External Meeting

13 May 2015
Physikalisches Institut Heidelberg
Europe/Zurich timezone

Overview

- Scientific Programme
- Timetable
- Contribution List
- Author List
- My Conference
- My Contributions**
- Registration
- Participant List
- Venue
- Accommodation

HERAFitter external meeting to discuss the ongoing developments towards next stable release and future plans



May 13, 2015

HERAFitter is actively represented in various conferences/workshops

<https://www.herafitter.org/HERAFitter/HERAFitter/HERAFitterTalks>

2015

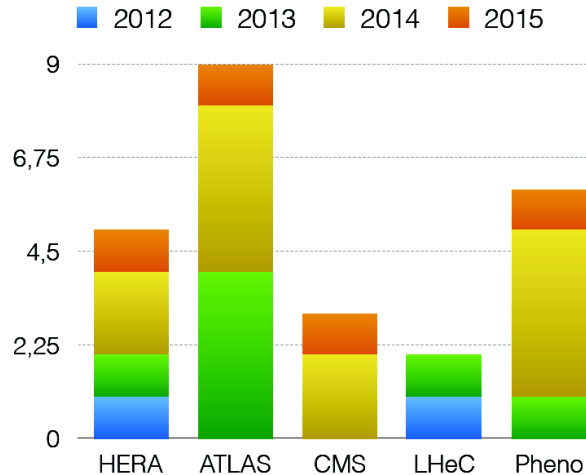
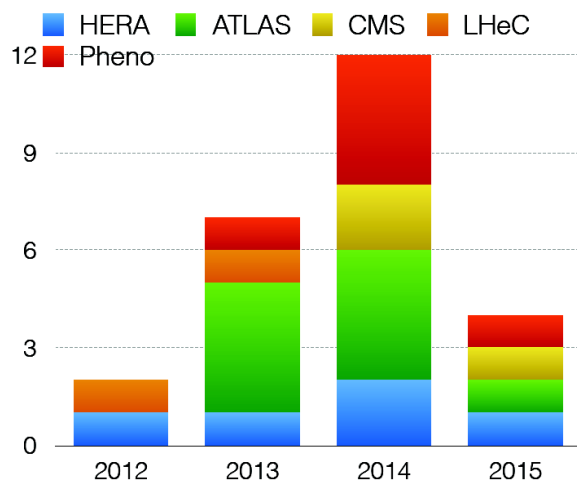
DESY Brochure - submitted @draft.pdf

Date	Conference/Workshop	Presenter	Link	Remarks
01-06.09.2015	LowX2015	speaker?	HERAFitter talk	abstract TBS
01-05.09.2015	QCD@LHC	speaker?	HERAFitter talk	abstract TBS (deadline 15.06)
17-22.08.2015	LP2015	speaker?	HERAFitter talk	abstract submitted
22-29.07.2015	EPS2015	speaker?	HERAFitter talk	abstract submitted
20-30.07.2015	School&Workshop "Theory challenges for LHC physics"	speaker?	HERAFitter talk ?	abstract TBS (deadline 07.06)
27.04-1.05.2015	DIS2015	R. Placakyte	@HERAFitter talk	abstract accepted
21-24.04.2015	SM@LHC	A. Glazov	HERAFitter talk	abstract accepted
13.04.2015	PDF4LHC	S. Camarda	HERAFitter talk	
21-28.03.2015	MoriondQCD	S. Camarda	@HERAFitter talk	abstract accepted
9-13.03.2015	DPG2015	R. Placakyte	PDF talk	invited talk
15-21.02.2015	PDFs 4 LHC	H. Pirumov	HERAFitter talk	abstract accepted

Date	Group	Reference	Title
NEW 05.2015	LHC/CMS	CMS PAS SMP-14-022	Measurement of the muon charge asymmetry in inclusive pp->W+X production at 8 TeV
NEW 03.2015	LHC/ATLAS	arXiv:1503.03709	Measurement of the forward-backward asymmetry of e and m pair-production in pp collisions at 7 TeV with the ATLAS detector
NEW 03.2015	PROSA	arXiv:1503.04581	Impact of the LHCb measurements of forward charm and beauty production on PDFs

HERAFitter Developers Team publications:

NEW 03.2015	HERAFitter team	to be submitted to EPJC, arXiv:1503.05221	QCD analysis of W- and Z-boson production at Tevatron NEW
10.2014	HERAFitter team	submitted to EPJC, arXiv:1410.4412	HERAFitter Open Source QCD Fit Project
04.2014	HERAFitter team	EPJC (2014) 74: 3039, arXiv:1404.4234	Parton distribution functions at LO, NLO and NNLO with correlated uncertainties between orders



Tevatron W and Z production data sets (used in the QCD analysis)

Observable	Experiment	Integrated luminosity	Kinematic requirements	Used in the nominal fit	Ref.
$d\sigma(Z)/dy$	D0	0.4 fb^{-1}	$71 < m_{ee} < 111 \text{ GeV}$	yes	Phys Rev D 76 (2007) 012003
$d\sigma(Z)/dy$	CDF	2.1 fb^{-1}	$66 < m_{ee} < 116 \text{ GeV}$	yes	Phys Lett B 692 (2010) 232
$A^\mu W \rightarrow \mu\nu$	D0	7.3 fb^{-1}	$p_T^\mu > 25 \text{ GeV}, p_T^\nu > 25 \text{ GeV}$	yes	Phys Rev D 88 (2013) 091102
$A_e^\mu W \rightarrow e\nu$	D0	9.7 fb^{-1}	$E_T^e > 25 \text{ GeV}, p_T^\nu > 25 \text{ GeV}$	<u>no</u>	Phys Rev D 91 no3 (2015) 032007
$A_W^e W \rightarrow e\nu$	CDF	1.0 fb^{-1}	none	yes	Phys Rev Lett 102 (2009) 181801
$A_W^e W \rightarrow e\nu$	D0	9.7 fb^{-1}	$E_T^e > 25 \text{ GeV}, p_T^\nu > 25 \text{ GeV}$	yes	Phys Rev Lett 112 no15 (2014)151803

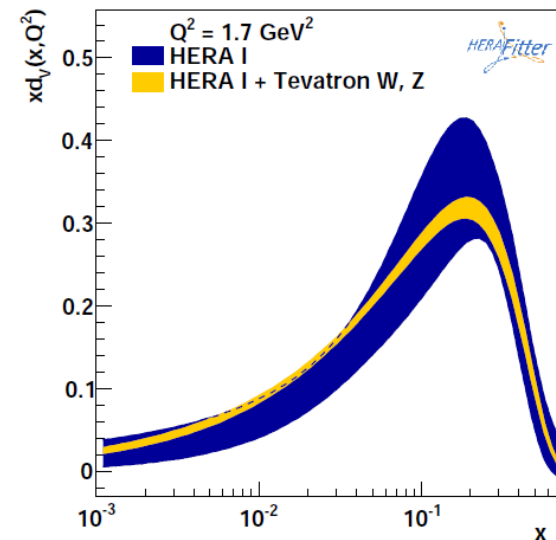
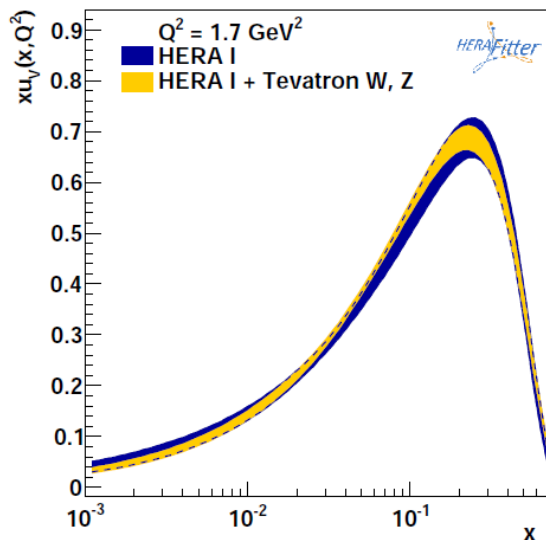
Revised correlation model:

→ uncertainties of data-driven corrections are treated as bin-to-bin uncorrelated (lepton ID, trigger and charge efficiencies)

Good total and partial (per data set) χ^2 of the fit:

Data set	HERA I χ^2 / number of points	HERA I + Tevatron W, Z χ^2 / number of points
NC DIS cross sections H1-ZEUS combined e^-p .	112 / 145	109 / 145
NC DIS cross sections H1-ZEUS combined e^+p .	326 / 337	333 / 337
CC DIS cross sections H1-ZEUS combined e^-p .	20 / 34	20 / 34
CC DIS cross sections H1-ZEUS combined e^+p .	27 / 34	31 / 34
HERA I correlated χ^2	21	23
D0 $d\sigma(Z)/dy$	-	23 / 28
CDF $d\sigma(Z)/dy$	-	32 / 28
D0 muon charge asymmetry in $W \rightarrow \mu\nu$	-	12 / 10
CDF W charge asymmetry in $W \rightarrow e\nu$	-	14 / 13
D0 W charge asymmetry in $W \rightarrow e\nu$	-	8 / 14
Total χ^2_{\min} / dof	505 / 535	606 / 628

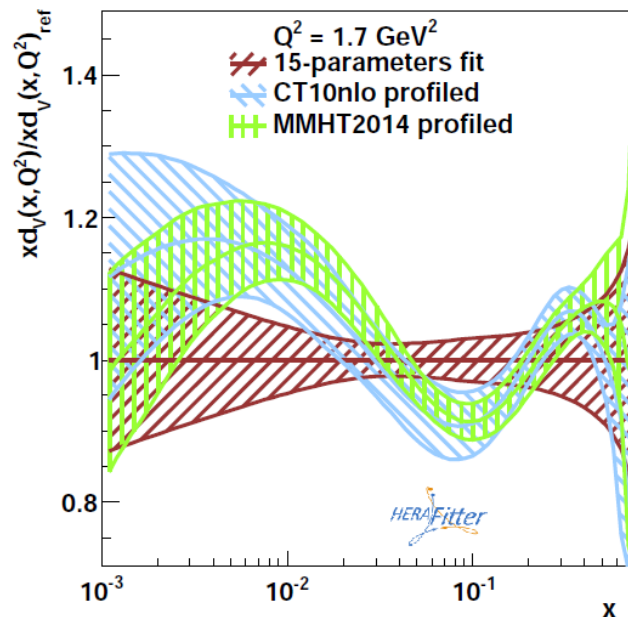
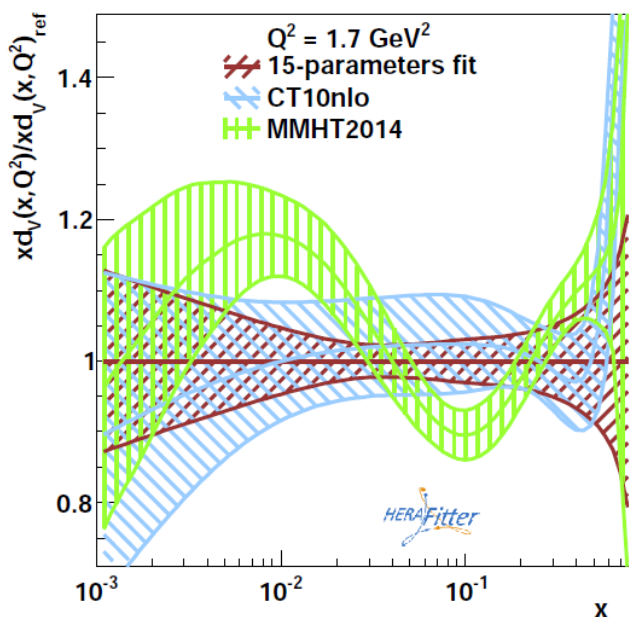
Significant impact on the valence quarks



Impact of Tevatron data on PDFs can be studied by minimizing data to theory χ^2 vs nuisance parameters corresponding to PDF eigenvectors (“profiling”)

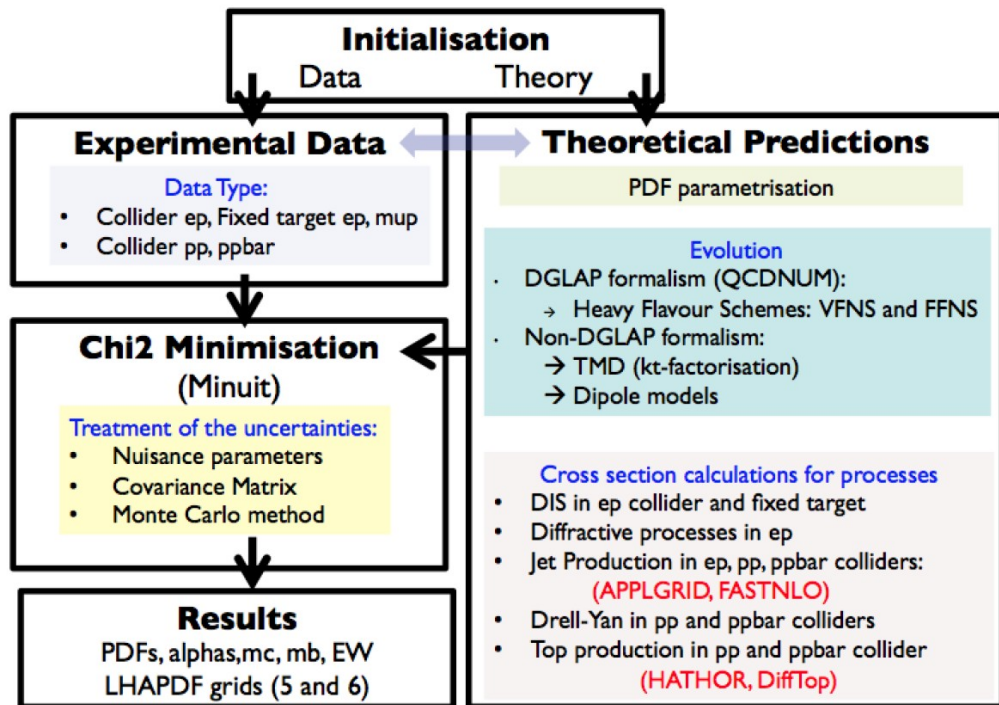
$$\chi^2 = \sum_i \left(\frac{\mu_i - m_i \left[1 + \sum_j b_j^{\text{exp}} \gamma_{ji}^{\text{exp}} + \sum_j b_j^{\text{theo}} \gamma_{ji}^{\text{theo}} \right]}{\Delta_i} \right)^2 + \sum_j (b_j^{\text{exp}})^2 + \sum_j (b_j^{\text{theo}})^2$$

μ_i - data, m_i - theory, β_j^{theo} - nuisance parameters of theory uncertainties (PDF)
(asymmetric uncertainties are taken into account)



→ data tables and APPLGRID predictions to fit the Tevatron data are available in herafitter.org

After HERAFitter-1.1.1 release, many new ongoing developments



ongoing developments:

- QED+QCD PDFs
- improvements in the reweighting
- generalised parametrisation
- QED part from APFEL
- DrawingTools using LHAPDF
- direct access of the data sets
- etc.

(most of the points are discussed in todays meeting)

We added the recommendation (in LICENCE) do use HERAFitter **logo** if using our drawing tools

Longer term plans include: ACOT scheme at NNLO, including resummation programs, better c++ and fortran interfaces, integration with HEP tools, ..

To Do List from Dallas/SMU

Fred Olness, Florian Lyonnet, Ben Clark, Eric Godat, (and friends) Olek Kusina, Ingo Schienbein ...

nCTEQ15 done (*presented at DIS*) with nuclear error bands

- To Do: use in HERA-Fitter via grids.
 - Looking at W/Z with Pb-Pb, and Pb-p (**Ben Clark**)

ACOT N2LO & N3LO are in HERA-Fitter

- at present, accessible only via debug mode
- compare with other HQ calculations, particularly for F_L

Stand-alone Mathematica Code:

- beta version at HEP-Forge (part of nCTEQ code)
- updates in progress: more robust; more formats; variety of error defs

ACOT package for QCDNUM: (*a belated thanks to Michiel for extensive help*)

- code working; needs clean up & testing (**Eric Godat & Olek Kusina**)

Topics Discussed in the External Meeting

HERAFitter Developers meeting

	Status	<i>Voica Ana Maria RADESCU et al.</i>
	<i>Physikalisches Institut Heidelberg</i>	09:30 - 09:50
10:00	News from QCDNUM	<i>Michiel BOTJE</i>
	<i>Physikalisches Institut Heidelberg</i>	09:50 - 10:10
	QED + QCD PDFs in HERAFitter	<i>Renat SADYKOV</i>
	<i>Physikalisches Institut Heidelberg</i>	10:10 - 10:30
	Interplay between APPLGRID and HERAFitter [TBC]	<i>Pavel STAROVOITOV et al.</i>
	<i>Physikalisches Institut Heidelberg</i>	10:30 - 10:50
11:00	Coffee break	
	<i>Physikalisches Institut Heidelberg</i>	10:50 - 11:10
	Interplay between APFEL and HERAFitter [TBC]	<i>Valerio BERTONE et al.</i>
	<i>Physikalisches Institut Heidelberg</i>	11:10 - 11:30
	Updates and plans for TMD PDFs in HERAFitter	<i>Hannes JUNG</i>
	<i>Physikalisches Institut Heidelberg</i>	11:30 - 11:50
12:00	Status and updates of the Bayesian reweighting in HERAFitter	<i>Alberto GUFFANTI</i>
	<i>Physikalisches Institut Heidelberg</i>	11:50 - 12:10

- plans for stable QCDNUM version
- progress in QED+QCD PDFs
- additional processes included via DYNNLO, Sherpa, aMC@NLO
- various options via APFEL interface in HERAFitter
- sea quarks included for the first time in TMD PDFs
- implement Giele-Keller weights, etc..

(discussions foreseen to continue in the afternoon)

HERAFitter Users meeting **today's agenda:**

14:00	News from HERAFitter	<i>Ringaile PLACAKYTE et al.</i>
	<i>Physikalisches Institut Heidelberg</i>	14:00 - 14:20
	Updates to QCDNUM	<i>Michiel BOTJE</i>
	<i>Physikalisches Institut Heidelberg</i>	14:20 - 14:40
	News from APFEL and interface to HERAFitter	<i>Stefano CARRAZZA</i>
	<i>Physikalisches Institut Heidelberg</i>	14:40 - 15:00

15:00