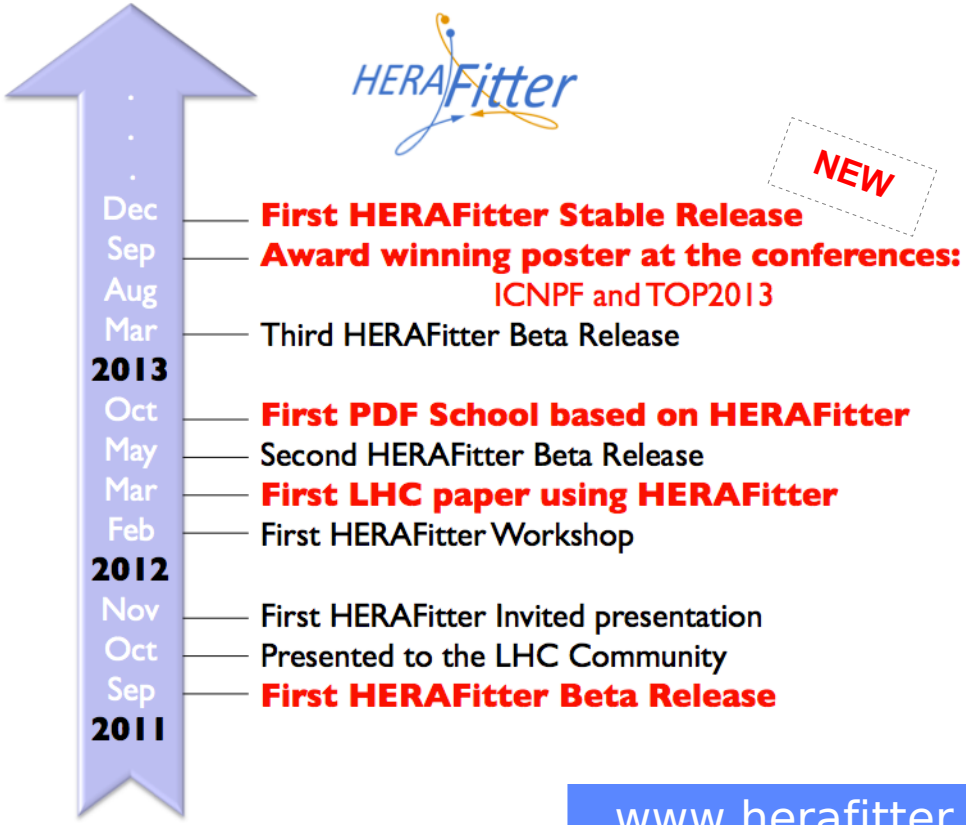
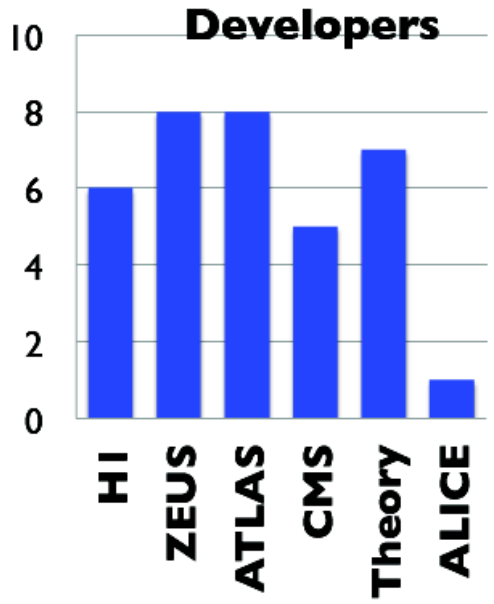
HERAFitter Users Meeting

10th of December 2013

- HERAPDF-1.0.0 stable release NEW
  → information on download of the package
  → developments in the stable release
- future developments
- HERAFitter representation in conferences
- today's agenda

HERAFitter: News





www.herafitter.org

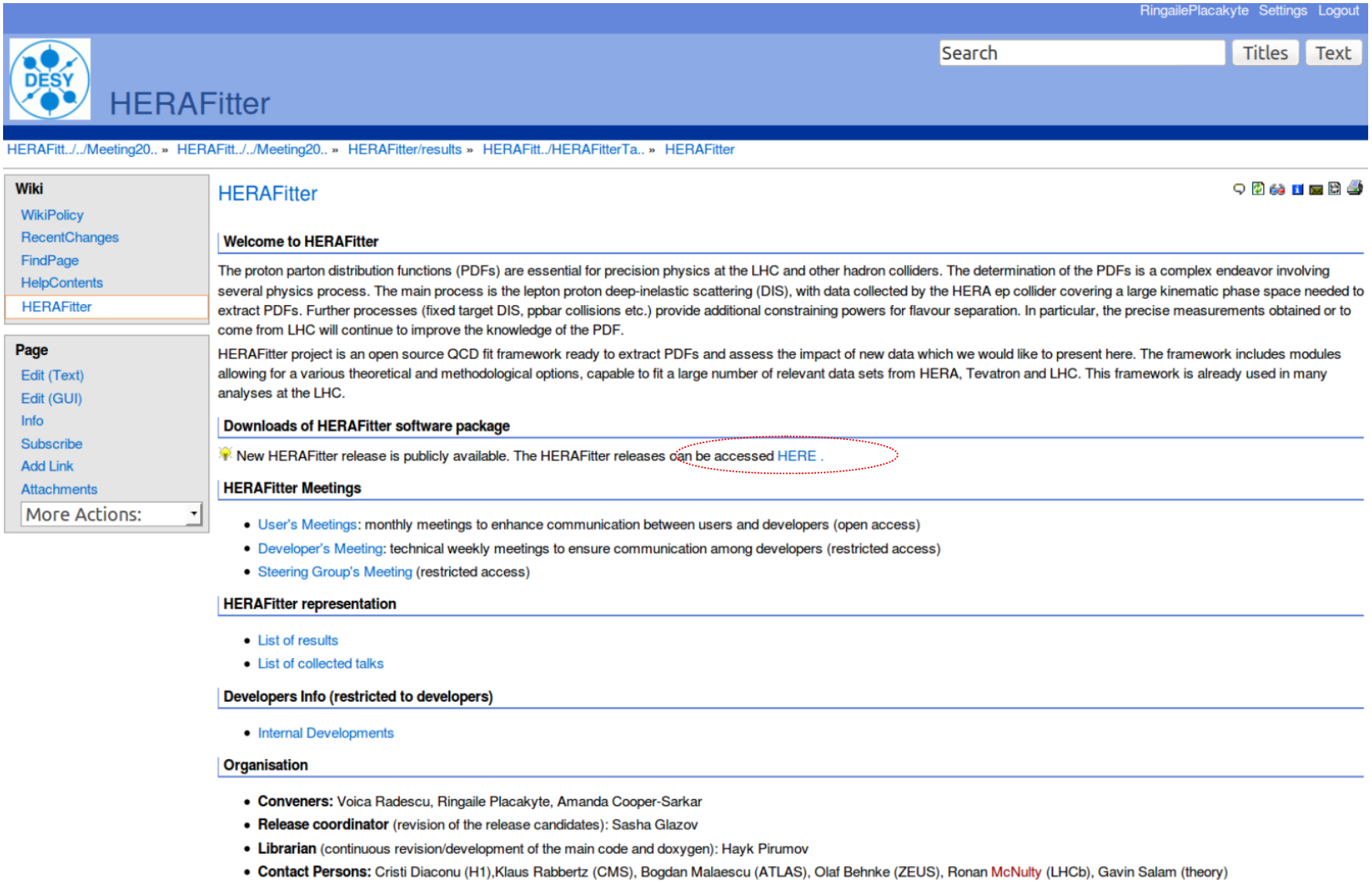
NEWS:

→ enlarged developers team (since last beta3 release in June)

→ first CMS results released where HERAFitter is used

→ first stable HERAFitter-1.0.0 release announced today

HERAPDF-1.0.0 download



RingailePlacakyte Settings Logout

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- HERAFitter

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More Actions:

HERAFitter

Welcome to HERAFitter

The proton parton distribution functions (PDFs) are essential for precision physics at the LHC and other hadron colliders. The determination of the PDFs is a complex endeavor involving several physics process. The main process is the lepton proton deep-inelastic scattering (DIS), with data collected by the HERA ep collider covering a large kinematic phase space needed to extract PDFs. Further processes (fixed target DIS, ppbar collisions etc.) provide additional constraining powers for flavour separation. In particular, the precise measurements obtained or to come from LHC will continue to improve the knowledge of the PDF.

HERAFitter project is an open source QCD fit framework ready to extract PDFs and assess the impact of new data which we would like to present here. The framework includes modules allowing for a various theoretical and methodological options, capable to fit a large number of relevant data sets from HERA, Tevatron and LHC. This framework is already used in many analyses at the LHC.

Downloads of HERAFitter software package

New HERAFitter release is publicly available. The HERAFitter releases can be accessed HERE .

HERAFitter Meetings

- User's Meetings: monthly meetings to enhance communication between users and developers (open access)
- Developer's Meeting: technical weekly meetings to ensure communication among developers (restricted access)
- Steering Group's Meeting (restricted access)

HERAFitter representation

- List of results
- List of collected talks

Developers Info (restricted to developers)

- Internal Developments

Organisation

- **Conveners:** Voica Radescu, Ringaile Placakyte, Amanda Cooper-Sarkar
- **Release coordinator** (revision of the release candidates): Sasha Glazov
- **Librarian** (continuous revision/development of the main code and doxygen): Hayk Pirumov
- **Contact Persons:** Cristi Diaconu (H1),Klaus Rabbertz (CMS), Bogdan Malaescu (ATLAS), Olaf Behnke (ZEUS), Ronan McNulty (LHCb), Gavin Salam (theory)

HERAPDF-1.0.0 download

HERAFitter / DownloadPage

Releases of the HERAFitter QCD analysis package

- Versioning convention: **i.j.k** with
  - **i** - stable release
  - **j** - beta release
  - **k** - bug fixes.
- The release notes can be found in this attachment: HERAFitter_release_notes.pdf.

Date	Version	Files	Remarks
12/2013	**1.0.0**	herafitter-1.0.0.tgz	stable released with decoupled theoryfiles.tgz
06/2013	0.3.1	herafitter-0.3.1.tgz	fix release includes manual-0.3.1.pdf and decoupled theoryfiles.tgz
03/2013	0.3.0	herafitter-0.3.0.tgz	release includes manual-0.3.1.pdf and decoupled theoryfiles.tgz
07/2012	0.2.1	herafitter-0.2.1.tgz	fix release for 0.2.0
05/2012	0.2.0	herafitter-0.2.0.tgz	added functionality for LHC users
09/2011	0.1.0	herafitter-0.1.0.tgz	first release

Releases (publicly accessible)

Documentation

- Data set Index used in HERAFitter to identify each data set is stored for logging purposes in here.
- From 0.3.0 on a manual is provided together with an example directory.
- The **README** file (accessible via the package) gives an explanation for a quick start.

Web access to SVN

- For users with a valid DESY account, the SVN repository is accessible on the web at https://svnsrv.desy.de/k5viewvc/h1fitter .
- For users without DESY account, the SVN repository is accessible on the web at https://svnsrv.desy.de/basviewvc/h1fitter/ with herafitter-user@desy.de account and PDFfits password.

Doxygen Documentation

- The doxygen documentation is located here

Documentation: manual, release notes, README, DOXYGEN

Links to external packages

External packages that could be run with HERAFitter via configuration flags can be accessed for convenience HERE .

External packages

HERAverager data combination package

Information can be accessed here https://wiki-zeuthen.desy.de/HERAverager

Subscription

We encourage users to subscribe to mailing list for news and updates related to the HERAFitter webpage. (average rate of e-mails is once a month), please contact herafitter-help@desy.de (or by creating a user account to this wiki we get a notification)

HERAPDF-1.0.0 download

Theory files are downloadable as separate file:

Date	Version	Files	Remarks
12/2013	**1.0.0**	herafitter-1.0.0.tgz	stable released with decoupled theoryfiles.tgz
06/2013	0.3.1	herafitter-0.3.1.tgz	fix release includes manual-0.3.1.pdf and decoupled theoryfiles.tgz
03/2013	0.3.0	herafitter-0.3.0.tgz	release includes manual-0.3.1.pdf and decoupled theoryfiles.tgz
07/2012	0.2.1	herafitter-0.2.1.tgz	fix release for 0.2.0
05/2012	0.2.0	herafitter-0.2.0.tgz	added functionality for LHC users
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Documentation: manual, release notes, README, DOXYGEN

Links to external packages that are set to run with HERAFitter:

Package	Description	Remarks
QCDNUM	evolution code	./configure
APPLGRID	interfaced to MCFM, access to jets and DY calculations	./configure --enable-applgrid
LHAPDF	access to global PDFs	./configure --enable-lhapdf
HATHOR	ttbar cross section calculations	./configure --enable-hathor

External packages

HERAPDF-1.0.0: README

HERAFITTER --- PDF fit program from HERA.

HERAFITTER has been used as one of the main software packages for the determination of the HERAPDF1.0 set proton parton densities (PDFs). HERAPDF is a common initiative by the H1 and ZEUS collaborations and extended now to the LHC collaborations to provide precision QCD analyses. HERAFitter has been used to produce the ATLAS-epWZ12 (NNLO), LHEC (NLO) PDF sets now available in the LHAPDFv5.9.1.

General description

++
1) Installation and Usage Instructions: please refer to the INSTALLATION file.
==========

INSTALLATION now as separate file

2) BRIEF DESCRIPTION
==========
a) Steering cards
b) inclusion of data
c) data file formats
d) minuit cards
e) applying cuts
f) choosing the heavy flavour scheme
g) understanding the output
h) PDF type
i) parametrisation style
j) options for the chi2 choice

Short description of available options (now stored in one README file)

3) FITTING uPDF (TMD)
==========
4) USING NNPDF REWEIGHTING PROGRAM
==========
5) DESCRIPTION OF DiffDIS PACKAGE

REFERENCES file is available containing relevant citation information

HERAPDF-1.0.0: Release Notes

HERAFitter: Releases and Updates

December, 2013

Documentation: manual, release notes, README, DOXYGEN

HERAFitter versions are labeled as **herafitter-i.j.k** where **i** is the stable release number, **j** is beta release number, and **k** is bug fixes.

Release	Date	Description
herafitter-1.0.0	10.12.2013	• Added possibility to change the name of the output directory in `steering.txt` • Added a dummy reaction type for testing data formats. • Centralised implementation of the scale variations for the DIS processes. • Enabled possibility to perform LO PDF fits. • Added possibility to determine generalised minima based on multiple sampling of `minuit` files. • Improved quantitative comparison of data to predictions by adding: – Possibility to include PDF uncertainties in the χ^2 evaluation; – Possibility to use external predictions as text les (similar format style as for data) in the χ^2 evaluation; • Added more options for χ^2 representation: – Use of covariance and/or correlation matrix (statistical or systematic); – Use of parabolic approximation for asymmetric uncertainties. • Considerable improvements in the drawing tools: – Added new executable to draw PDFs: `DrawPdfs`; – Added possibility of multiple overlays, each PDF can be plotted separately; – Possibility to visualise the pulls (only for data sets that provide bin ranges). • Possibility to fit Lead PDF; • Improved interface to Transverse Momentum Distributions (TMDs): – Evolution is fully integrated into `HERAFitter`; – Evolution of valence quarks is also included; – Calculation of the longitudinal cross-section is also included; • Simplified interface to the parametrisation style; • Fixes to the LHAPDF reweighted PDFs due to random seed generator causing large fluctuations. • New generalised `APPLGRID` interface: – Added parser to identify theory expressions; – Added possibility to select the values for the CKM matrix elements from `APPLGRID` or `HERAFitter` . – Added possibility to flag a data bin to be excluded from the fit. • Tool to convert covariance matrix to nuisance parameter representation.

Developments in the Stable Release

Code restructuring, updates of existing packages and fixes:

→ restructuring of the code, improved naming for module

→ clean up of the code (e.g. removed 'old' chi2 code)

→ updated comments, Doxygen

→ unification of the heavy quark scale variation across different packages

→ simplified interface to parametrisation style

→ fixes to the reweighting tool (problem in the random seed generator causing large fluctuations and overestimate of errors)

→ parallelising of the code with OpenMP (RT scheme)

→ updates to TDM (uPDF) code (fully integrated evolution and calculation of FL)

→ updated interface to latest HATHOR-1.5 version

→ enabled possibility to fit LO PDFs

→ added a dummy reaction type for testing data formats

Developments in the Stable Release

New developments added to HERAFitter-1.0.0:

→ improved quantitative theory to data comparison:

- → calculation of theory errors in chi2 for PDFs (LHAPDF)
- → external predictions can be used in chi2 evaluation (ascii file)
- → more options included in the chi2 code for the covariance or correlation matrix usage
- → tool to transform cov matrix to nuisance parameter representation

→ generic tool for finding global minima solution

- → general idea: random sample parameter space to locate primary minima candidates
- → activated via flag 'genetic' in minuit card (results stored in output/genetic*)

→ lead PDFs

- → a flag to define the type of PDFs:

```
! PDF type. Possible types are currently available:
! 'proton'  -- default (fitting proton data)
! 'lead'    -- fitting ONLY lead data (can't be used in combination with proton data)

PDFType = 'proton'
```

→ talk today by B. Clark

See also F. Olness talk in User's meeting 9th of Sept:

https://indico.cern.ch/getFile.py/access?contribId=3&resId=0&materialId=slides&confId=268500

Developments in the Stable Release

New developments added to HERAFitter-1.0.0:

→ new user friendly interface to APPLGRIDs with math operations enabled

→ operations via "expression" in data file:

→ possibility to exclude particular data bins in the fit

```
TheoryType     = 'expression'
TermName = 'A1', 'A2'
TermType = 'applgrid','applgrid'
TermSource = 'theoryfiles/cms/SPM_12_001/CMS-PAS-SMP-12-001-Wplus_eta4.root',
             'theoryfiles/cms/SPM_12_001/CMS-PAS-SMP-12-001-Wminus_eta3.root'
TheorExpr= '(A1-A2)/(A1+A2)'
```

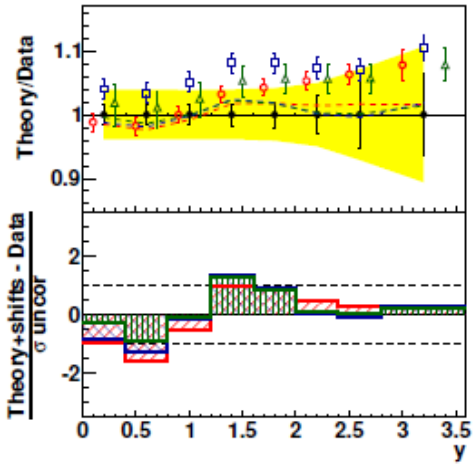
See V. Radescu talk in User's meeting 19th of Nov:

https://indico.cern.ch/getFile.py/access?contribId=0&resId=0&materialId=slides&confId=283268

→ Significantly improved drawing tools:

bin/DrawPdfs [options] dir1[:label1] [dir2:[label2]] [...]

First directory is used as reference for PDF ratio plots
and to display data in data pulls plots.
Directory labels are used in the legends of the plots, to add spaces and special characters to the labels use quotation marks " (ex. dir:'HERA I').
To specify greek letters and latex commands in the labels use the ROOT notation (#alpha #bar{u}).



See S. Camarda talk in User's meeting 16th of Oct:

https://indico.cern.ch/getFile.py/access?subContId=1&contribId=4&resId=0&materialId=slides&confId=274887

Documentation and Feedback

Paper in preparation:

short paper planned (EPJC) → after stable release

→ currently iterating with Steering Group

The feedback from Users is very welcome on:

HERAFitter-1.0.0 release

→ next release planed soon with the inclusion of the QCD+QED PDFs

Technical aspects:

→ installation issues (gcc version, root, Cern lib dependencies?)

→ experience on different platforms (SL5/6, lxplus, MAC, linux..)

Documentation

Suggestions for further (web page, meetings, ...) improvements?

herafitter-help@desy.de

Future Developments

Longer term developments planed in HERAFitter:

- **Theory side:**

→ QED+QCD PDFs (generalised evolution in QCDNUM)

→ first comparison of APFEL with QCDNUM performed by Renat:

→ small differences for photon and others PDFs at large-x

→ possibility to interface APFEL (A PDF Evolution with QED corrections)

Top sector:

→ ttbar differential cross sections

→ inclusion of Top++ (total top pair production)

Heavy flavour sector:

→ ACOT scheme at NNLO

→ ACOT scheme inclusion in QCDNUM

→ intrinsic charm

- **Interfaces and code:**

→ APPLGRID interfaces to DYNNLO

→ LHAPDF6 (C++) interface

→ OpenMP (currently exist for RT scheme, planned to extend to ACOT)

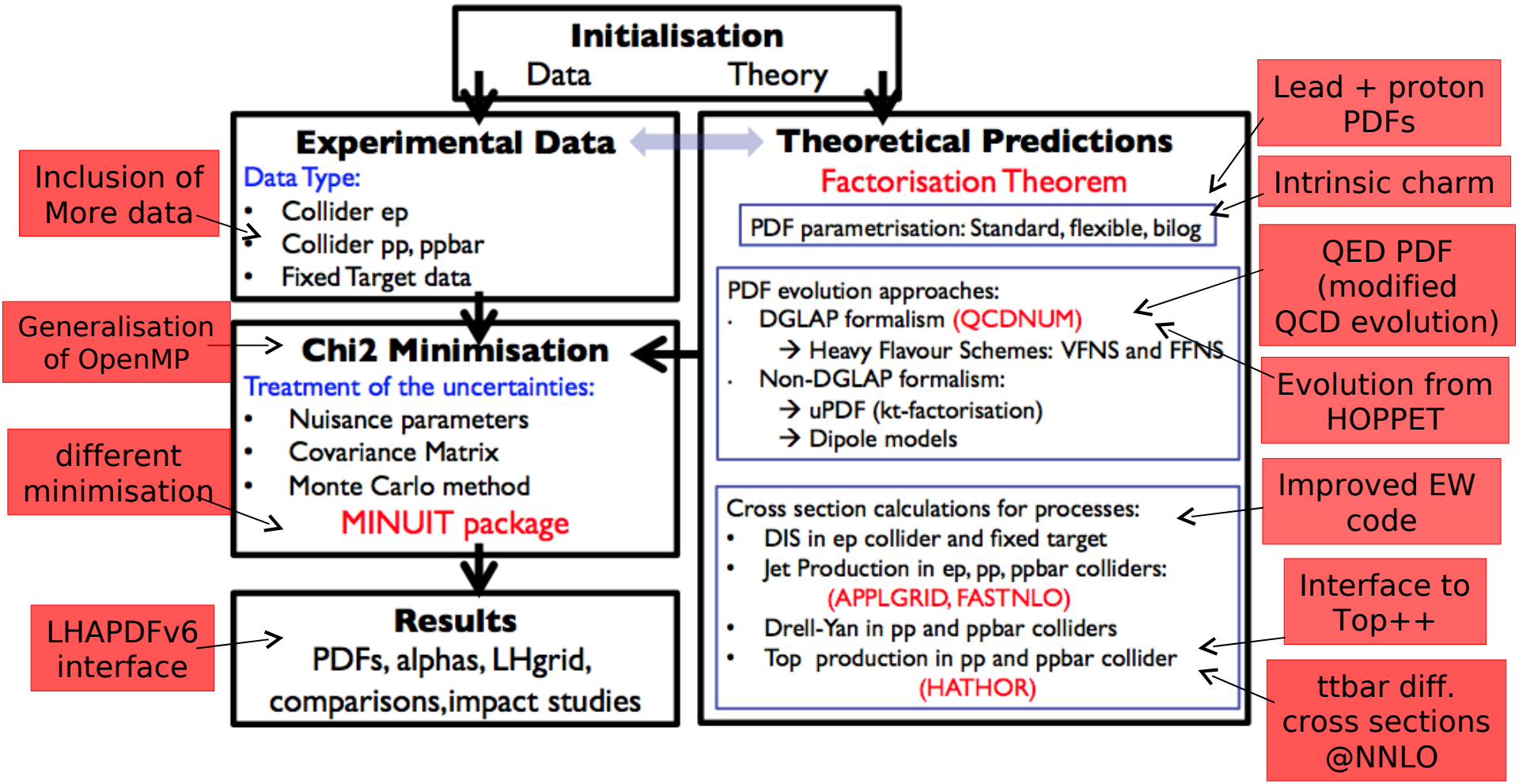
- **Others:**

→ fitting photon PDFs

→ different evolution codes, ...

Prospectives

Longer term developments planed in HERAFitter:



We welcome more ideas!

Conferences

Conferences in 2013:

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

Date	Conference/Workshop	Presenter	Link	Remarks
16-20.12.2013	HEP in the LHC Era 2013	P. Laycock	HERAFitter talk	stable release
13.12. 2013	PDF4LHC	S. Camarda	HERAFitter talk	stable release
2-4.12.2013	Helmholtz Alliance "Physics at the Terascale"	V. Radescu	HERAFitter talk	HERAFitter project overview
14-15.11.2013	QCD tools for LHC	R. Placakyte	talk on quark PDFs (LHC)	HERAFitter slides adverts
4-8.11.2013	HADRON2013	V. Radescu	dedicated talk	beta3.1/stable release
24.10.2013	PRC76 open session	R. Placakyte	talk	HERAFitter project overview
15-20.09.2013	ISMD	P. Starovoitov/K.Wichmann	dedicated poster	beta3.1 release
19-21.09.2013	ATLAS SM workshop	V. Radescu	poster: pdf pptx	beta3.1 release
14-19.09.2013	TOP2013	S. Camarda	dedicated poster	beta3.1 release
2-6.09.2013	QCD@LHC	R. Sadykov	dedicated talk	beta3.1 release
28.08-5.09.2013	ICNFP	R. Placakyte	poster.pdf	beta3.1 release
18.07.2013	EPS2013	A. Sapronov	dedicated talk	beta3.1 release
30.06.2013	Hadron Structure 2013	A. Gizhko	talk.pdf	beta3.1 release
30.05.2013	Low X	V. Radescu	dedicated talk	beta3 release
22.05.2013	Photon2013	K. Wichmann, V. Chekelian	talk on HERA physics	HERAFitter slides adverts
16.05.2013	LHCP	H. Pirumov	dedicated poster	First Poster
23.04.2013	DIS	R. Placakyte	dedicated talk	beta3 release
17.04.2013	PDF4LHC	V. Radescu	dedicated talk	beta3 release

Agenda

Today's agenda:

HERAFitter User's meeting

Tuesday, 10 December 2013 from **15:30** to **17:35** (Europe/Zurich)
at **CERN (42-R-031)**
DESY: SR 05

Description ONLY If default VIDYO fails —— a backup VIDYO LINK:

Extension 9265520
Meeting PIN 2323
Auto-join URL http://vidyoportal.cern.ch/flex.html?roomdirect.html&key=QpFaaSZLsTe1

Video Services Vidyo public room : HERAFitter_Users_meeting More Info | **Join Now!** | Connect 42-R-031

Tuesday, 10 December 2013

15:30 - 15:50 **Status** *20'*
Speakers: Voica Ana Maria Radescu (Deutsches Elektronen-Synchrotron (DE)), Ringaile Placakyte (Deutsch Elektronen-Synchrotron (DE))

15:50 - 16:10 **interface to aMC@NLO** *20'*
Speaker: Juan Rojo Chacon
Material: **Slides**

16:10 - 16:30 **APFEL program - news** *20'*
Speakers: Juan Rojo Chacon (CERN), Stefano Carrazza (Università degli Studi e INFN Milano (IT)), Valerio Bertone (CERN)
Material: **Slides**

16:30 - 16:50 **Lead PDFs and Uncertainties** *20'*
Speaker: Benjamin Clark
Material: **Slides**