

APFEL 1.0.1 & 2.0.0
New features and development overview
arXiv:1310.1394

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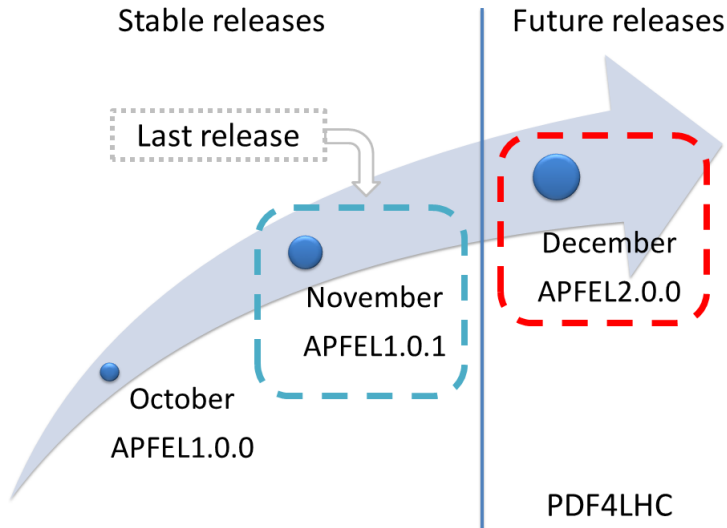
APFEL

<http://apfel.hepforge.org/>
in collaboration with Valerio Bertone and Juan Rojo



APFEL development road-map

- APFEL releases over time:



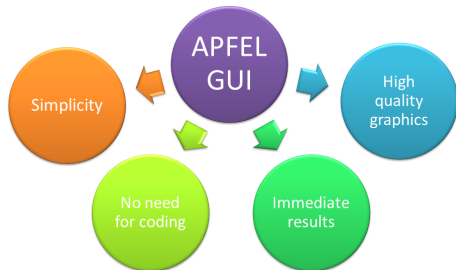
APFEL 1.0.1 features:

- *Theoretical features:*
 - ▶ QCD DGLAP up to NNLO, QED DGLAP at LO
 - ▶ innovative methodology for the QCD \otimes QED solution
 - ▶ variable-flavor-number scheme (VFNS) and FFNS
 - ▶ x-space solution
 - ▶ pole and $\overline{\text{MS}}$ schemes for the heavy quark masses
- *Technical features:*
 - ▶ interface to LHAPDF (input/output)
 - ▶ code interfaces in Fortran, C/C++ and Python
- *New features in v1.0.1:*
 - ▶ build-in luminosity computation (APFEL::LUMI())
 - ▶ APFEL graphical user interface (APFEL GUI)
 - ▶ updated website with more detailed information



The new APFEL GUI 1.0.1

- Why a **Graphical User Interface (GUI)**?



APFEL GUI v1.0.1

- ▶ PDF plots: **all LHAPDF grids**
- ▶ APFEL and LHAPDF for evolution.
- ▶ Computation of luminosities.
- ▶ Access to almost all APFEL functionalities.

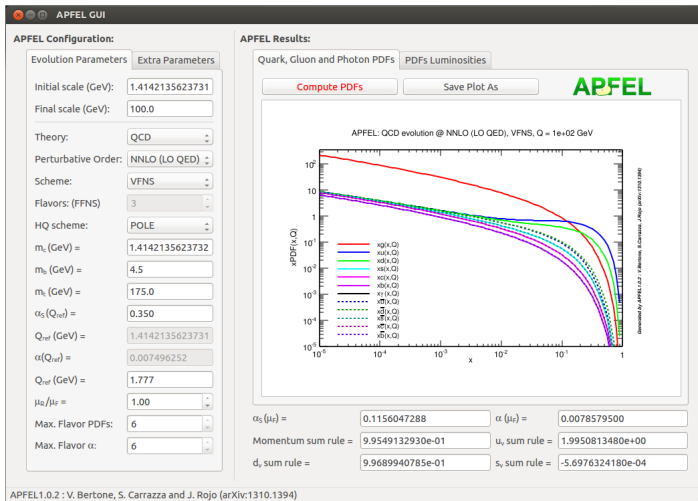
- APFEL GUI v1.0.1:

- ▶ Released in v1.0.1: <http://apfel.hepforge.org/download.html>
- ▶ System requirements: ROOT, APFEL, LHAPDF, Qt4



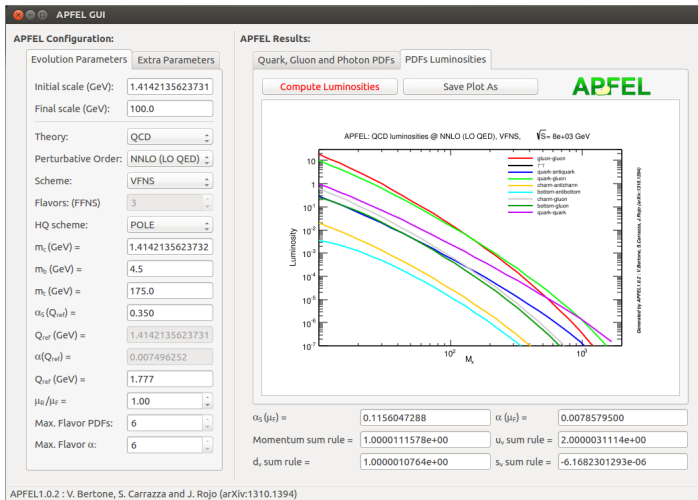
The new APFEL GUI 1.0.1

- PDF plotter: left panel \Rightarrow APFEL setup, right panel \Rightarrow plots



The new APFEL GUI 1.0.1

- PDFs luminosities. Possibility to save plots in EPS.



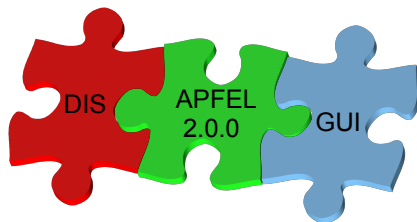
APFEL 2.0.0 development overview

- New features for **physics**:

- ▶ Observables using FONLL-A/B/C schemes (up to NNLO).
 - ★ Neutral current and Charged current
- ▶ FONLL code interfaced through APFEL and LHAPDF
 - ★ using the Les Houches benchmarking for heavy quarks.

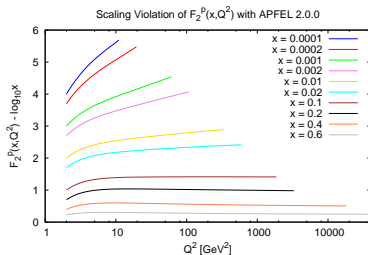
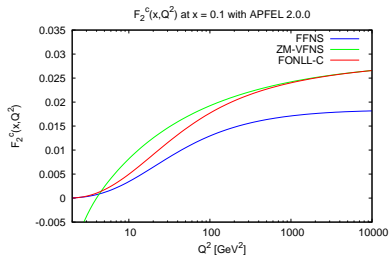
- New **technical** features:

- ▶ APFEL GUI 2.0.0: general tool for PDF manipulation: PDFs comparison, ratios, luminosities, uncertainties, members, etc.



APFEL 2.0.0 development overview

- Preliminary FONLL results using APFEL:
 - ▶ F_2^c and scaling violation.

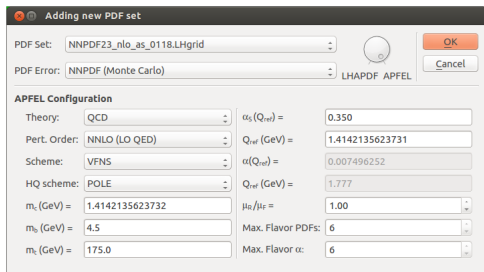
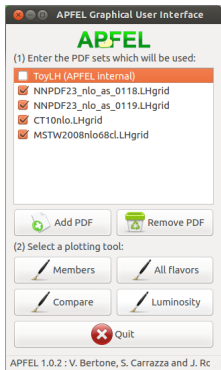


- APFEL 2.0.0 provides
 - ▶ a simple interface to compute observables in the FONLL scheme.
 - ▶ possibility to switch between LHAPDF and APFEL evolution.



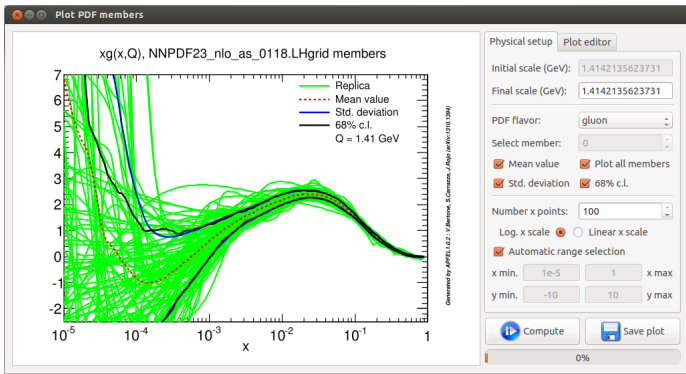
- Possibility to select and tune the evolution of every single PDF set.
 - ▶ takes as input **PDFs from LHAPDF** and the **internal APFEL toy**.
 - ▶ simple and intuitive replacement/setup of evolution.

Example Main window and PDF setup:



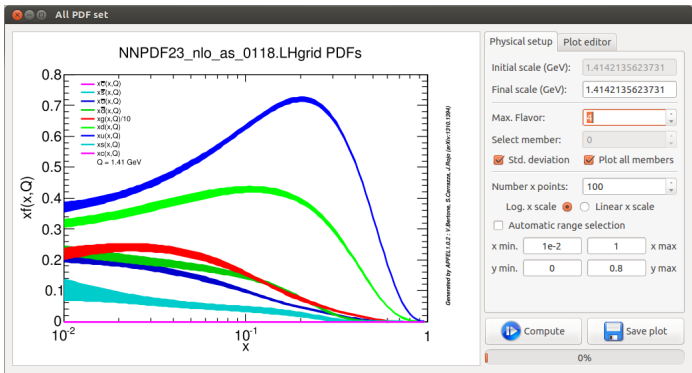
● Functionalities: Member plot:

- ▶ PDF Flavor: physical basis.
- ▶ Uncertainties: Monte Carlo, Eigenstates, etc.
- ▶ Plot customization: axis range, colors, titles, etc.

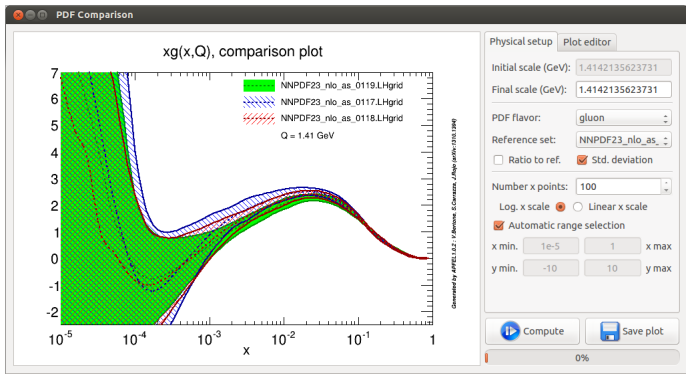


- **Functionalities:** All-in-on plot:

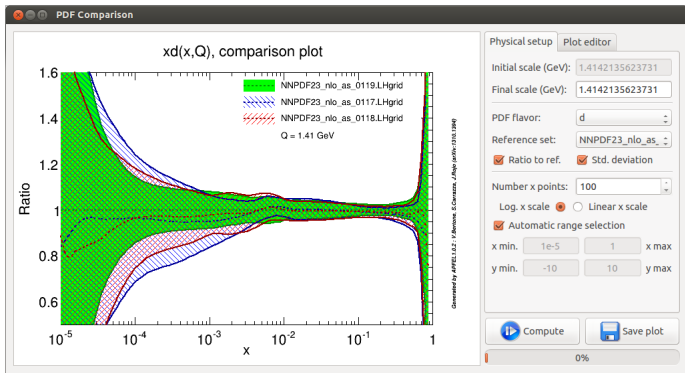
- ▶ PDG like plot with custom options.
- ▶ Possibility to save plots in: ps, eps, pdf, root, png.



- **Functionalities:** PDF comparison:
 - ▶ compares multiple PDF sets

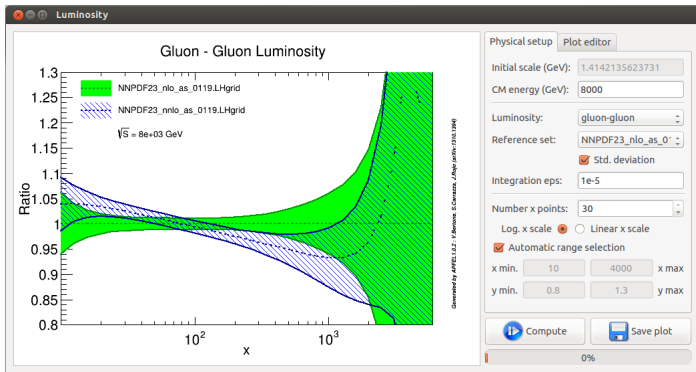


- **Functionalities:** PDF comparison ratio:
 - ▶ compares multiple PDF sets by performing the ratio



- **Functionalities:** PDF luminosity:

- ▶ compares PDF luminosities: $gg, q\bar{q}, qq, c\bar{c}, b\bar{b}, cg, bg, qq, \gamma\gamma, \gamma g$.



- **Outlook**

- ▶ v1.0.1 (last stable release)
 - ★ New Graphical User Interface
 - ★ Added luminosity function
- ▶ v2.0.0 in preparation (release in December)
 - ★ New DIS code based on FONLL-A/B/C
 - ★ New GUI: complete PDF analysis tool.
- ▶ Outlook:
 - ★ Hadronic processes (e.g. APPLgrid)
 - ★ Future web-application based on APFEL GUI 2.0.0.

- **Code/manual and instructions:**

<http://apfel.hepforge.org/>

