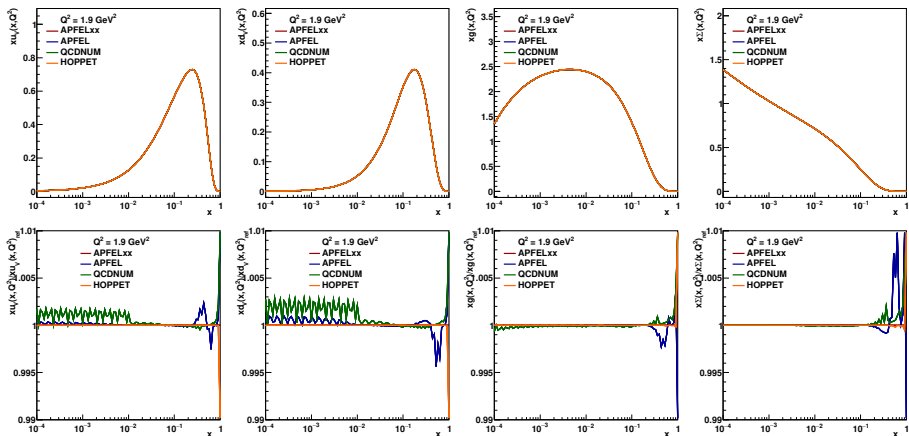
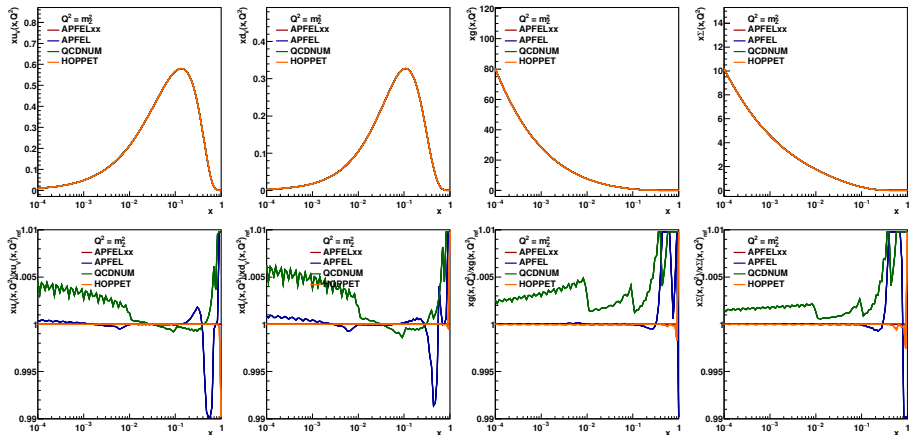


Benchmark of PDF evolution codes in xFitter

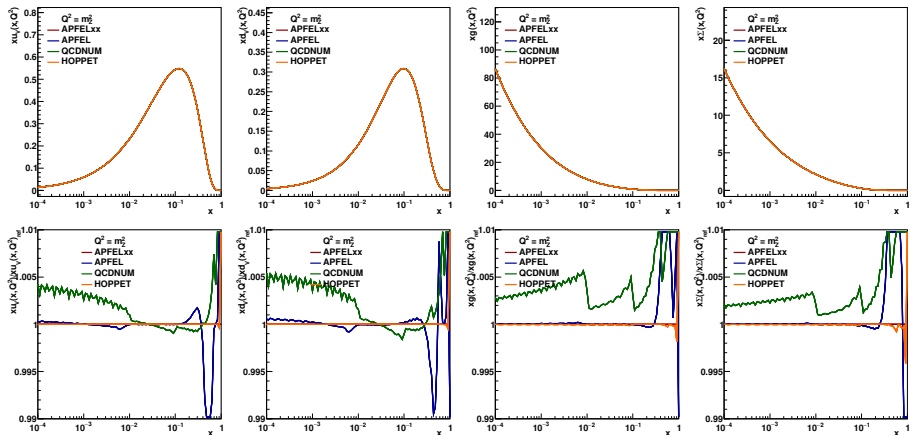
- Compared `APFELff` (FORTRAN), `APFEL` (C++), `QCDNUM` and `Hoppet` at LO, NLO, NNLO
- Based on `N3LO_Hoppet` branch (includes `Hoppet_test` and `N3LO`)
- All settings are xFitter default, VFNS with $n_f = 5$
- Same PDF parametrization at starting scale $Q_0^2 = 1.9 \text{ GeV}^2$



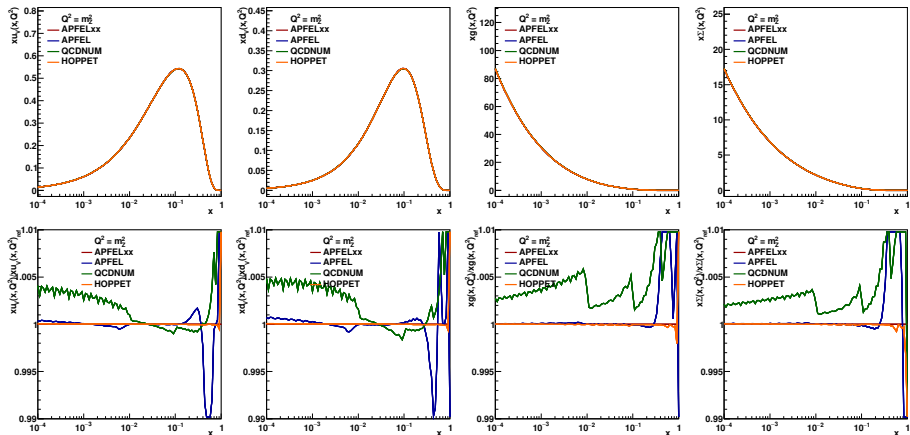
Benchmark of PDF evolution codes in xFitter: LO



Benchmark of PDF evolution codes in xFitter: NLO



Benchmark of PDF evolution codes in xFitter: NNLO

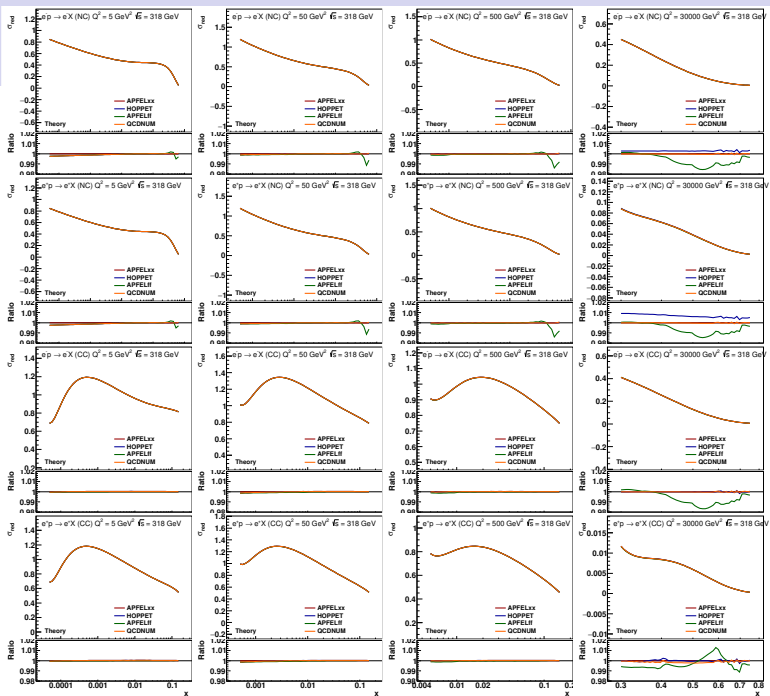


- Agreement between all codes within 0.5%
- Best agreement between APFEL and HOPPET $\ll 0.1\%$
- Agreement between APFELff, APFEL and HOPPET $\sim 0.1\%$
- QCDNUM: up to 0.5% differences vs. other codes

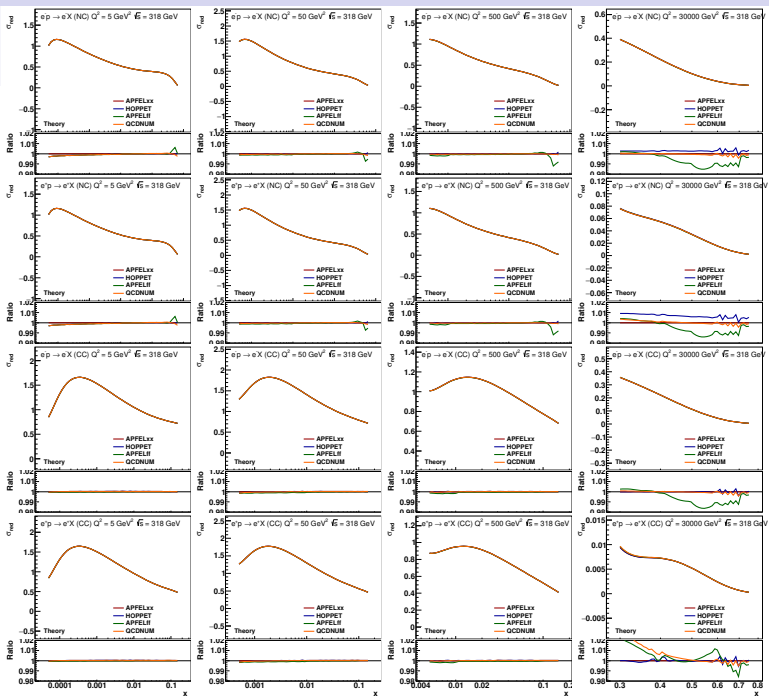
Benchmark of DIS reduced cross sections in xFitter

- (1) Compared `APFELff` (FORTRAN), `APFEL` (C++), `QCDNUM` and `Hoppet` at LO, NLO, NNLO
- (2) Compared `APFEL` (C++) and `Hoppet` at N3LO
 - Based on `N3LO_Hoppet` branch (includes `Hoppet_test` and `N3LO`)
 - All settings are xFitter default, ZM-VFNS with $n_f = 5$
 - ▶ introduced ZM option for `FONLL` reaction (`APFELff`) [\[commit\]](#)
 - ▶ introduced ZM option for `N3LO` reaction (`APFELxx`) [\[commit\]](#)
 - Predictions generated for pseudodata points
 - Same PDF parametrization at starting scale $Q_0^2 = 1.9 \text{ GeV}^2$, evolved with `QCDNUM`

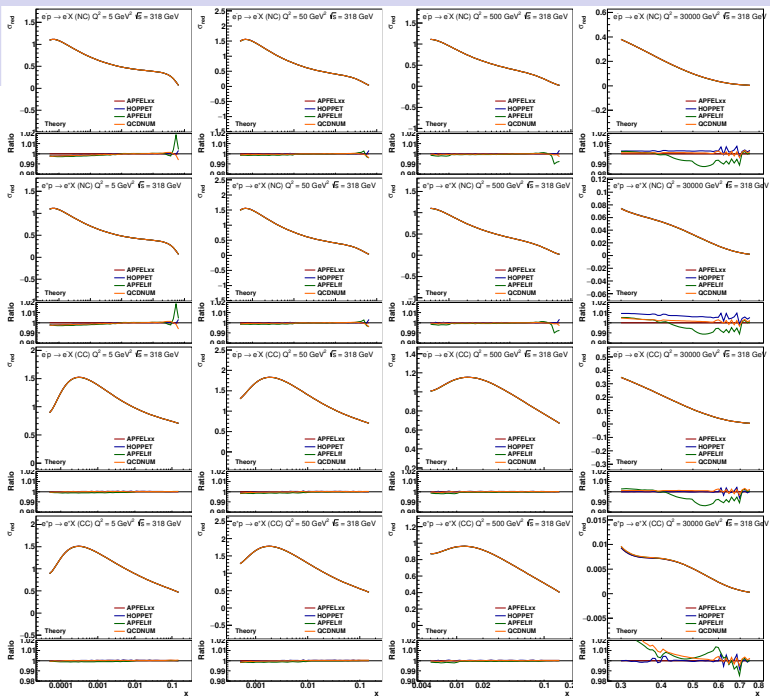
DIS reduced xsec, LO



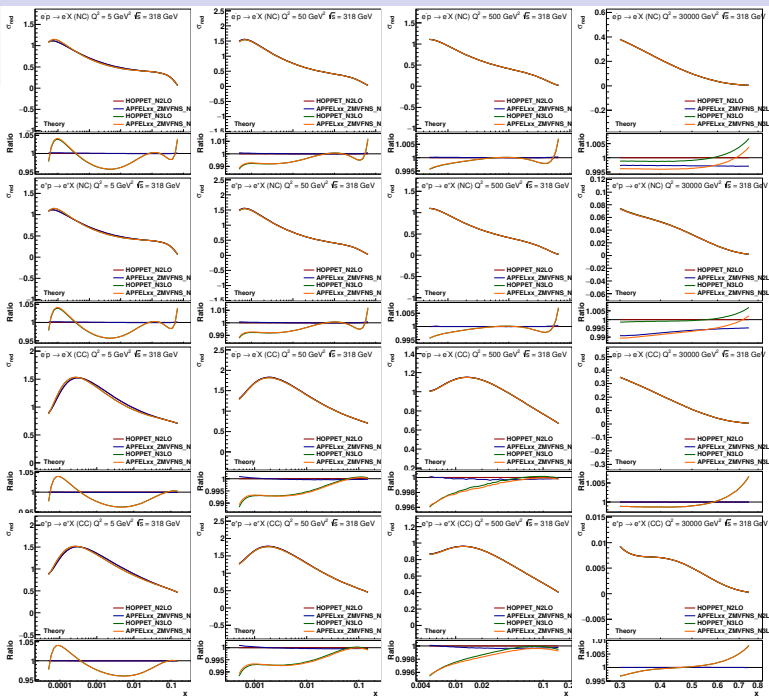
DIS reduced xsec, NLO



DIS reduced xsec, NNLO



DIS reduced xsec, NNNLO



Benchmark of DIS reduced cross sections in xFitter [NNLO]

Dataset	APFELxx	HOPPET	APFELff	QCDNUM
HERA1+2 NCep 820	85 / 68	85 / 68	86 / 68	86 / 68
HERA1+2 NCep 460	222 / 200	222 / 200	223 / 200	223 / 200
HERA1+2 CCep	46 / 39	46 / 39	47 / 39	46 / 39
HERA1+2 NCem	244 / 159	245 / 159	244 / 159	245 / 159
HERA1+2 CCem	58 / 42	58 / 42	58 / 42	58 / 42
HERA1+2 NCep 575	231 / 249	232 / 249	232 / 249	232 / 249
HERA1+2 NCep 920	643 / 363	645 / 363	644 / 363	645 / 363
Correlated χ^2	191	192	191	192
Log penalty χ^2	+21	+21	+19	+20
Total χ^2 / dof	1741 / 1106	1747 / 1106	1744 / 1106	1747 / 1106
χ^2 p-value	0.00	0.00	0.00	0.00