Extraction of PDFs from DIS and DY data

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For the studies on LHC we need precise knowledge of PDFs (O(1%)) for $x = 10^{-4} \div 0.5$

What do we know from DIS?

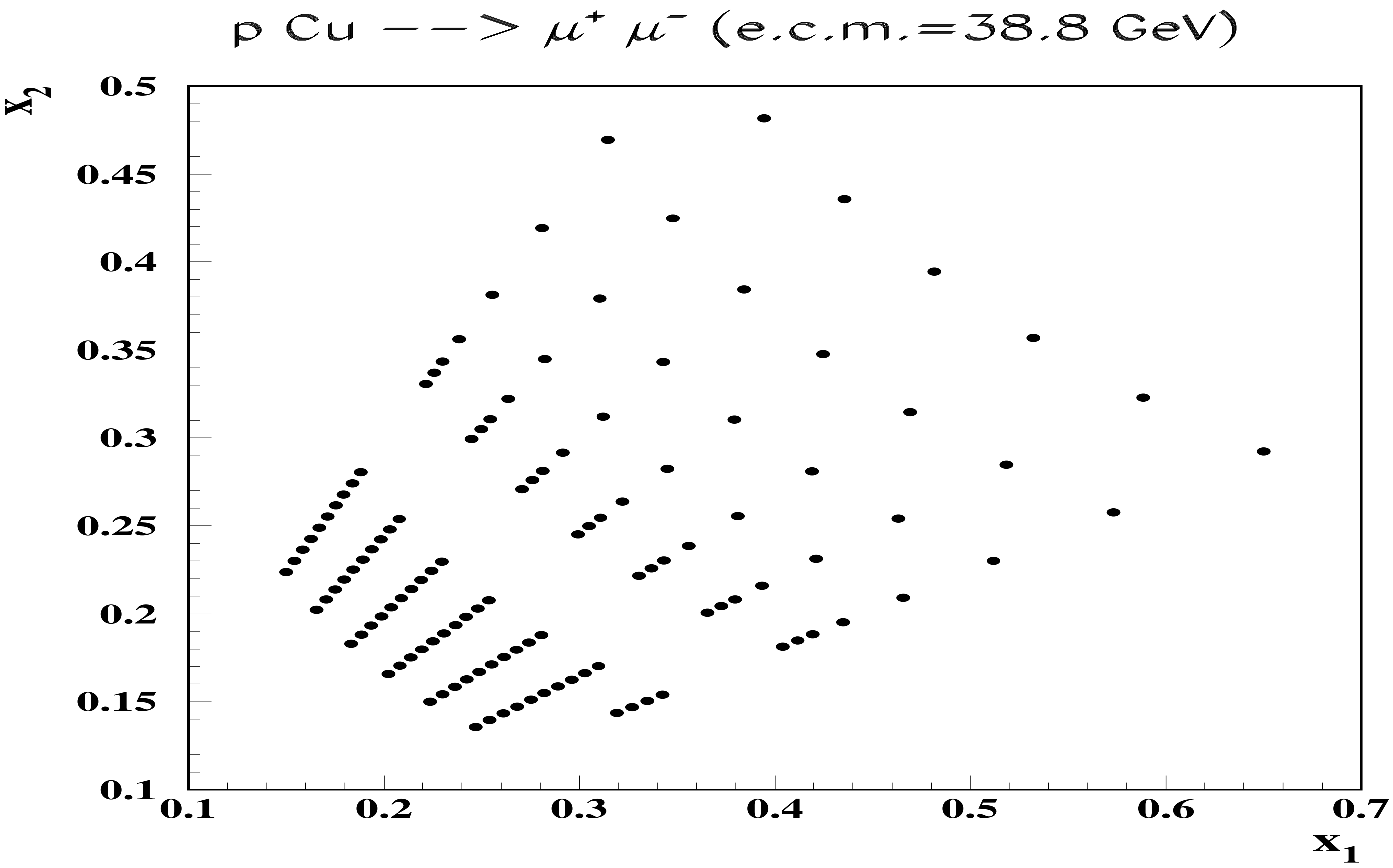
- Gluons and sea at $x = 10^{-4} \div 0.2$ (**HERA+NMC**)
- Valence quarks at $x < 0.8$ (**SLAC+BCDMS**)

What we do not know from DIS (known unknowns)

- Gluons at $x > 0.2$ (**jets**)
- Sea at $x > 0.2$ including $\bar{d} - \bar{u}$ (**Drell-Yan**)
- Strange sea everywhere ($\boldsymbol{\nu N}$)

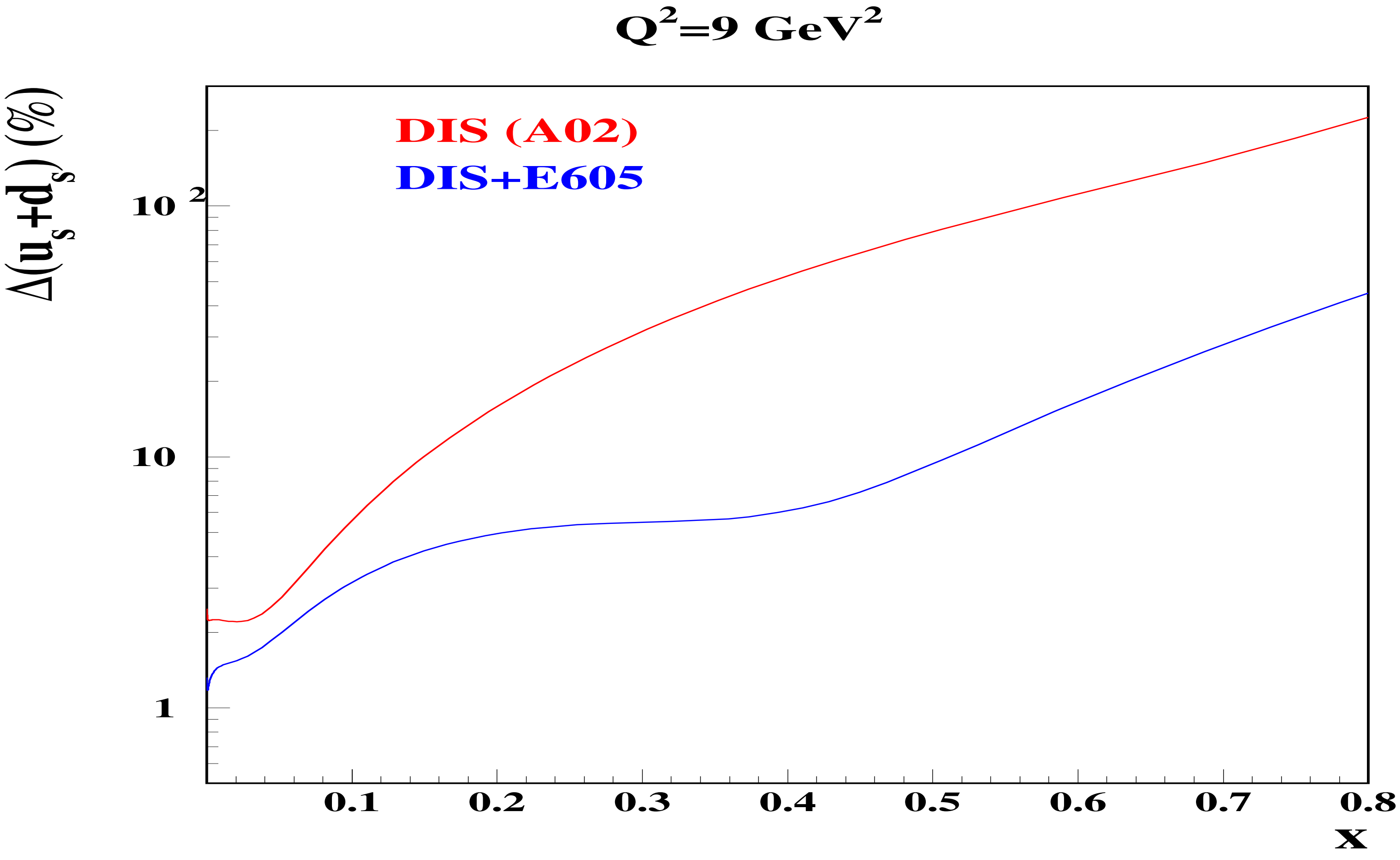
- Are the existing Drell-Yan data consistent with the DIS ones? (what is relevant value of $\Delta\chi^2$, remember discussions at the previous meetings)
- What is impact of the existing Drell-Yan data? (qualitative estimate and low limit on the errors in PDFs after new data will be added)
- Result of combination of Drell-Yan and DIS (using exact NNLO evolution kernels by Moch-Vermasseren-Vogt and the DY NNLO coefficient functions by Anastasiou-Dixon-Melnikov-Petriello)

Impact of the E605 data on PDFs

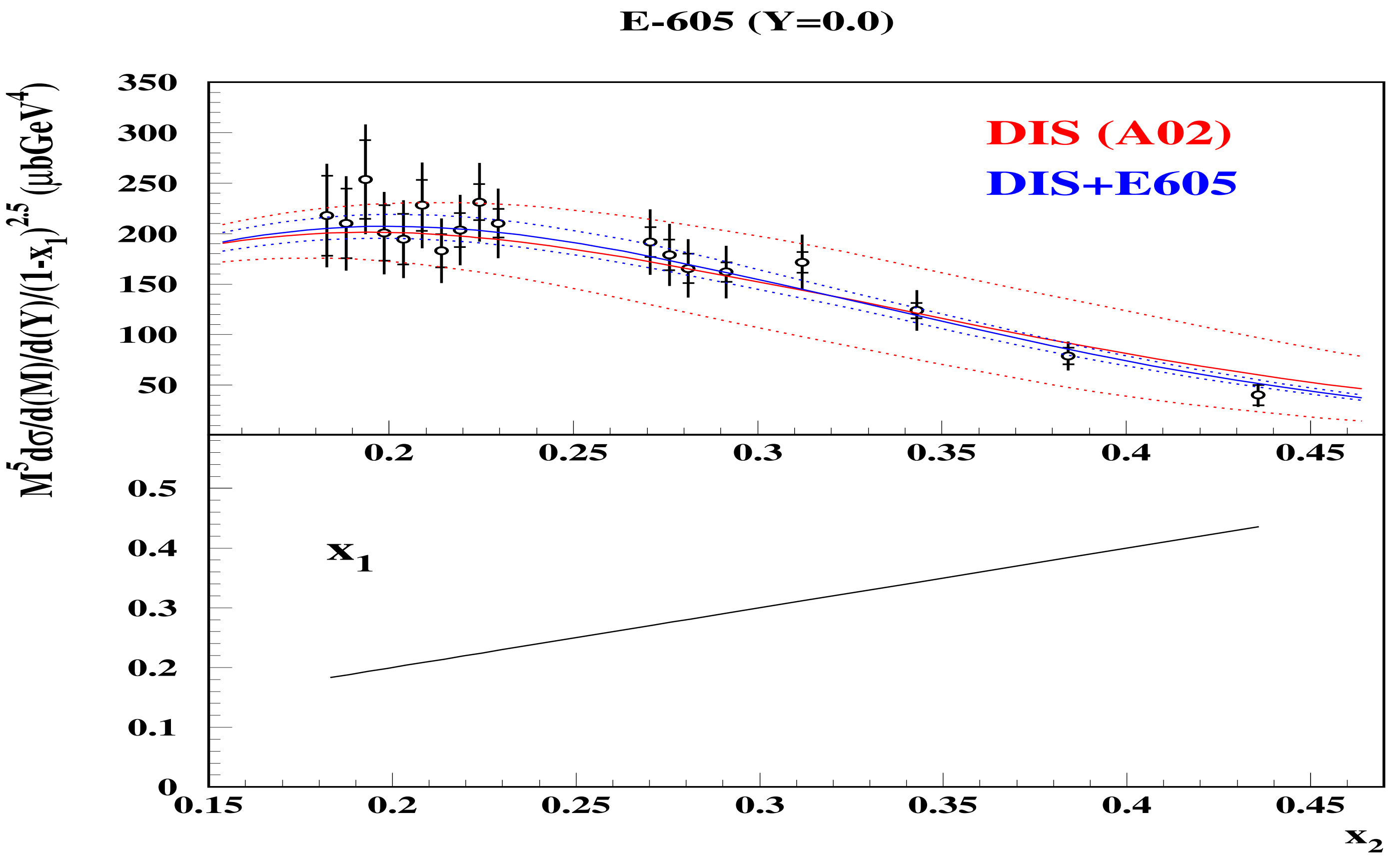


$$\sigma_{\rm DY} \sim q(x_1)\bar{q}(x_2) + q(x_2)\bar{q}(x_1)$$

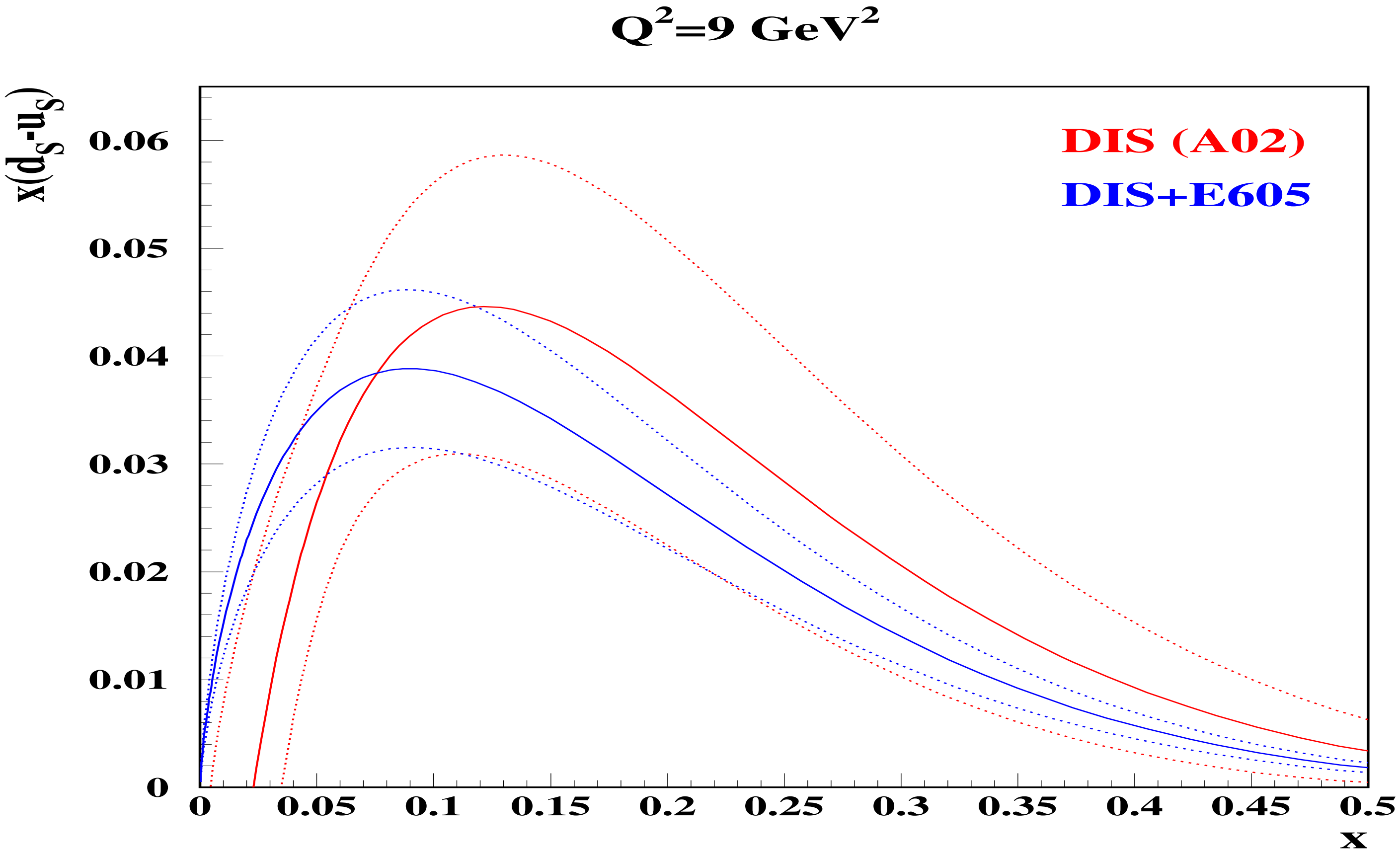
$$\Delta\sigma_{\rm DY} \lesssim 20\%, \Delta q \sim O(1\%) \quad \rightarrow \quad \Delta\bar{q} \lesssim 20\% \text{ at } x \lesssim 0.6$$



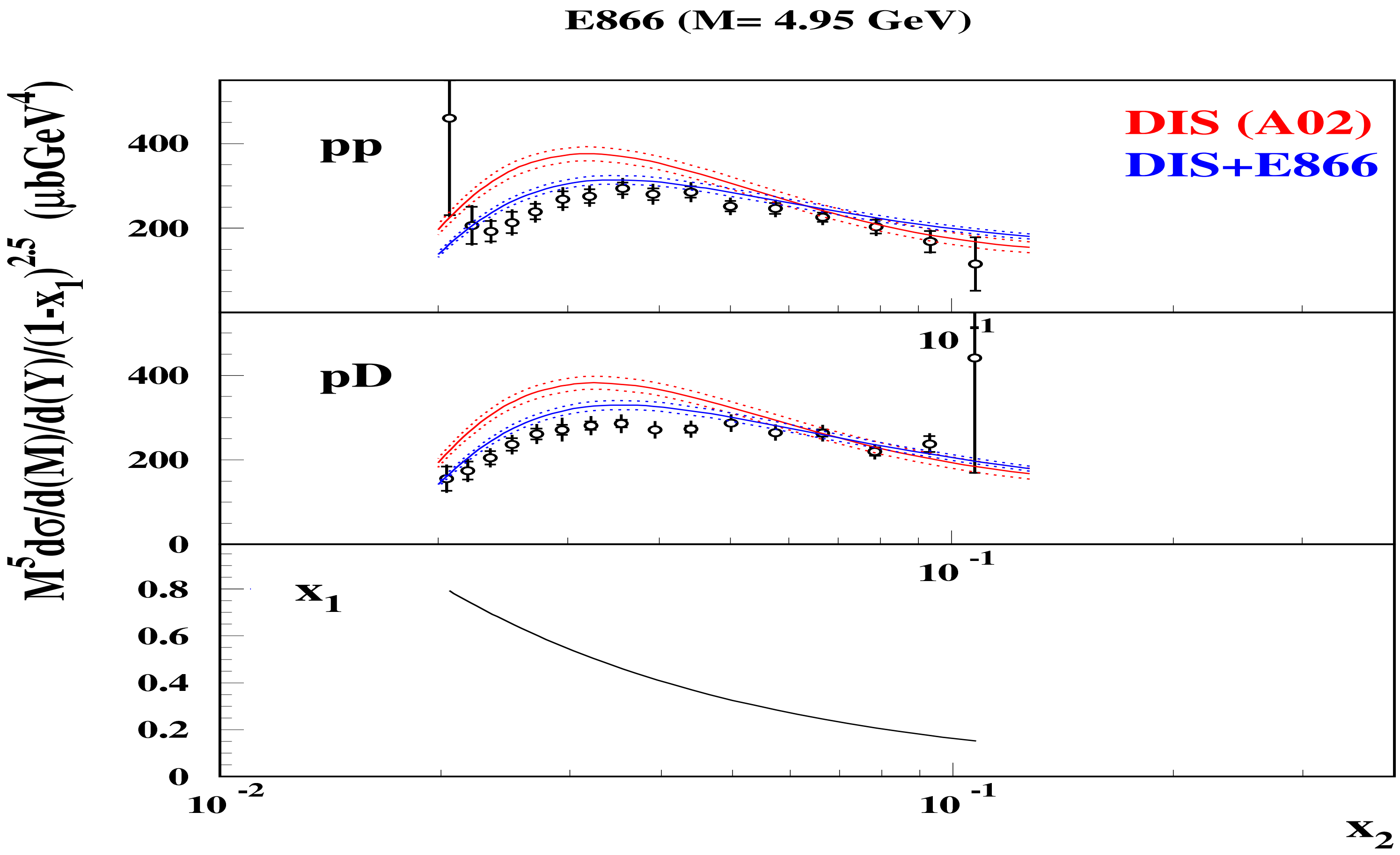
We do observe suppression of the error in sea up to 20% at $x \sim 0.6$



The overall consistency of the E605 and DIS data is good

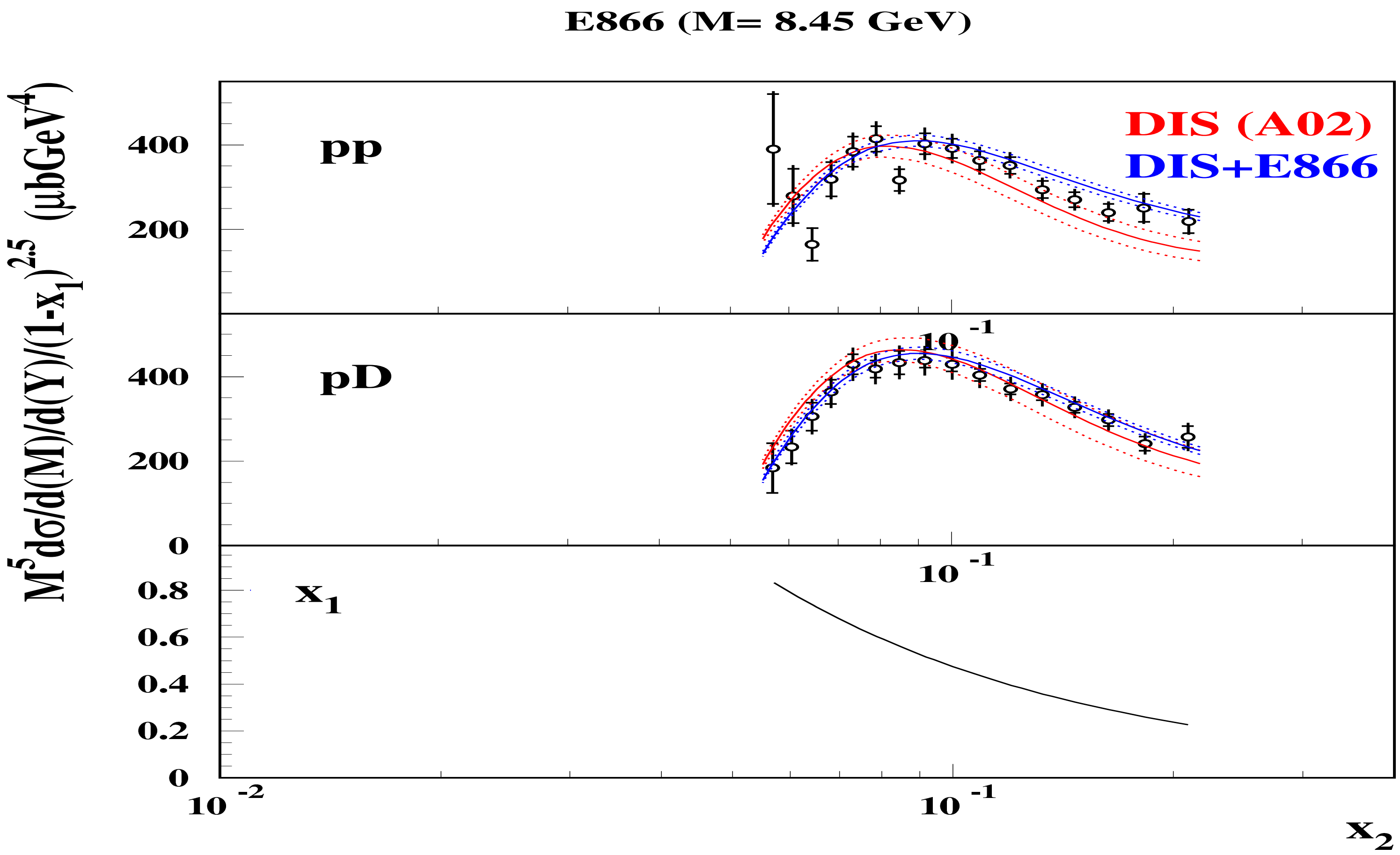


The error in isospin asymmetry is improved marginally

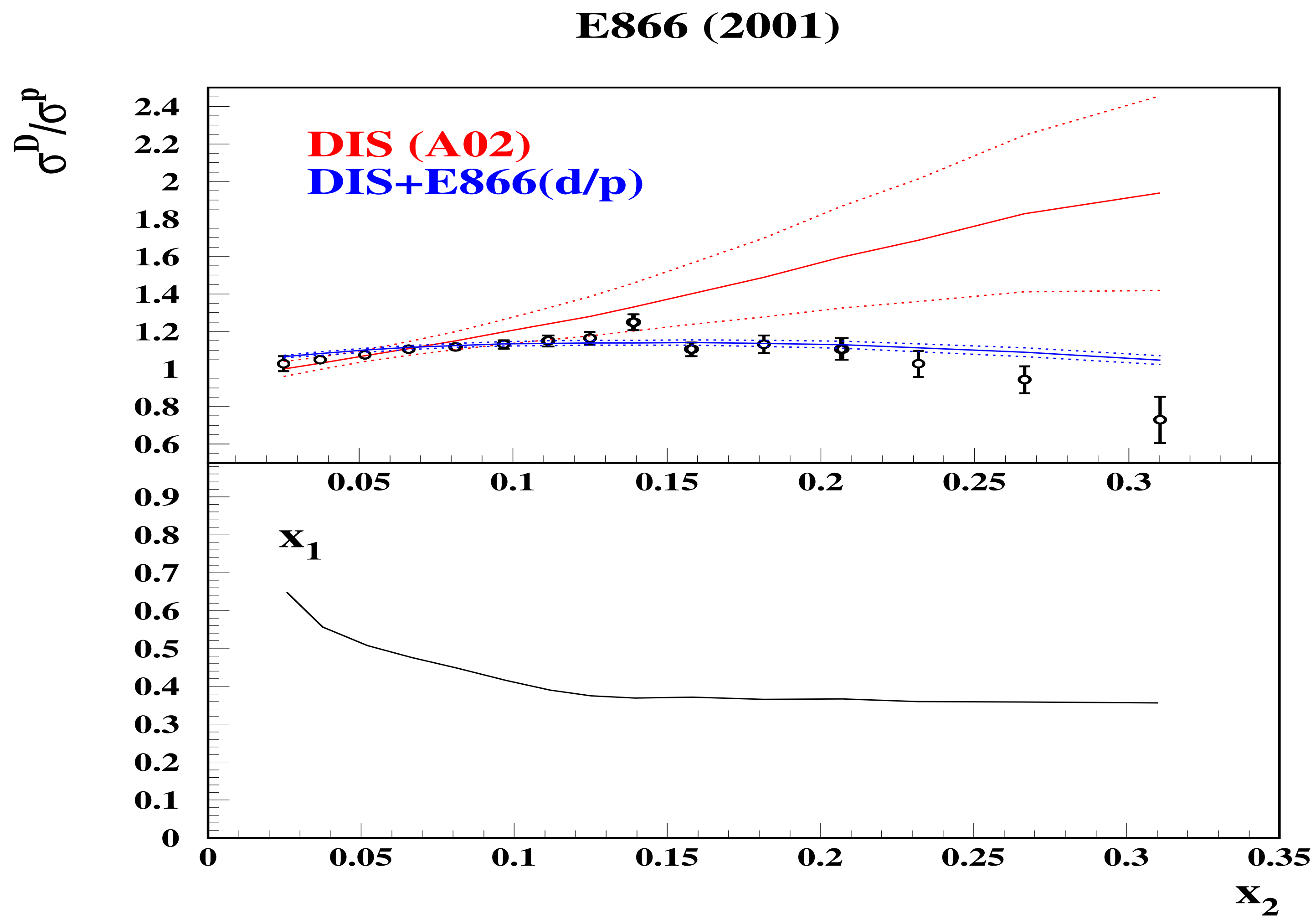


At low M/y the E866 data are in disagreement to the DIS ones

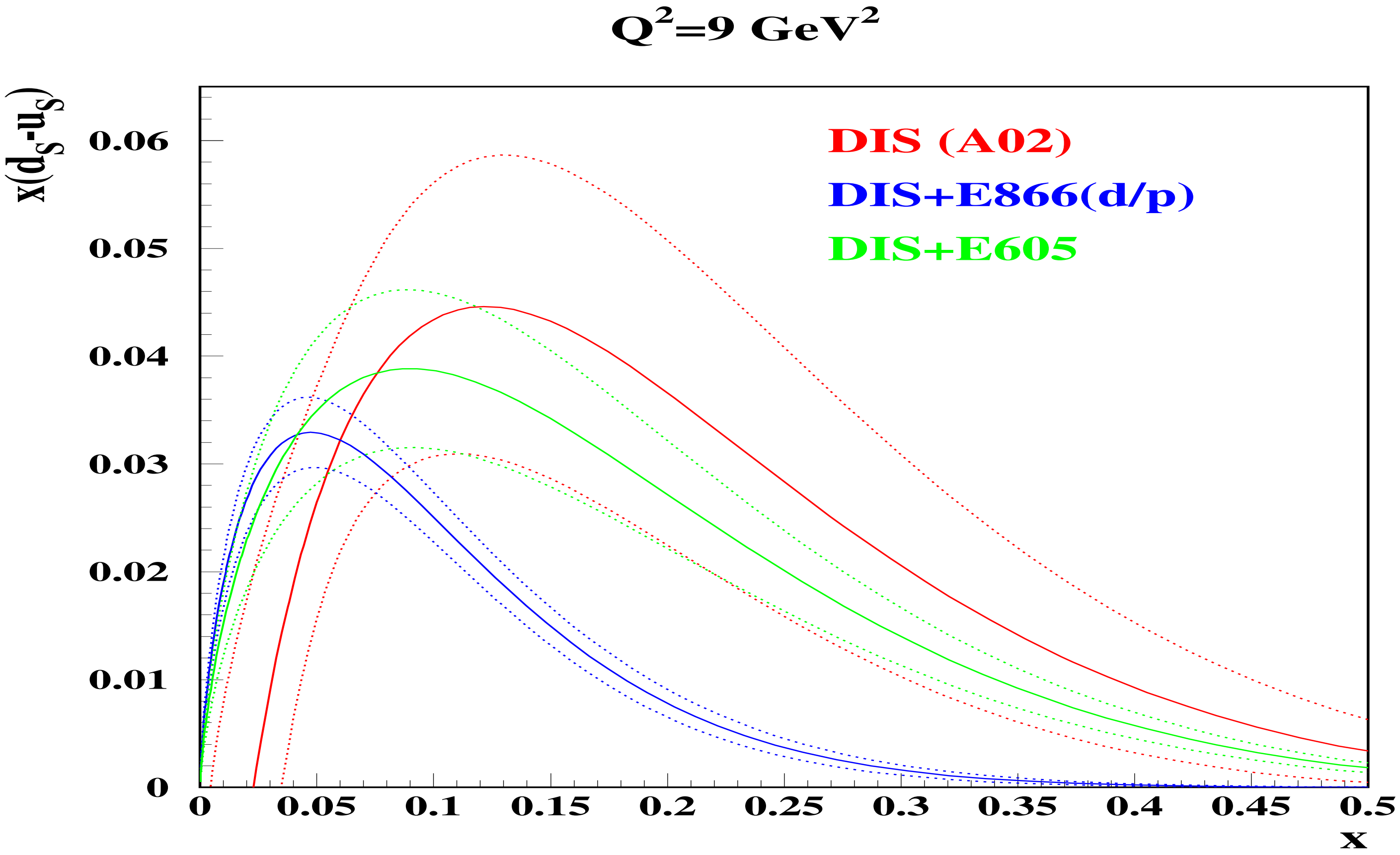
$\sigma_{\rm DY} \sim q(x_1)\bar{q}(x_2)$ and $\Delta q(x_1), \Delta\bar{q}(x_2) \sim O(1\%)$ from DIS



At high M/y the E866 data are in better agreement to the DIS ones



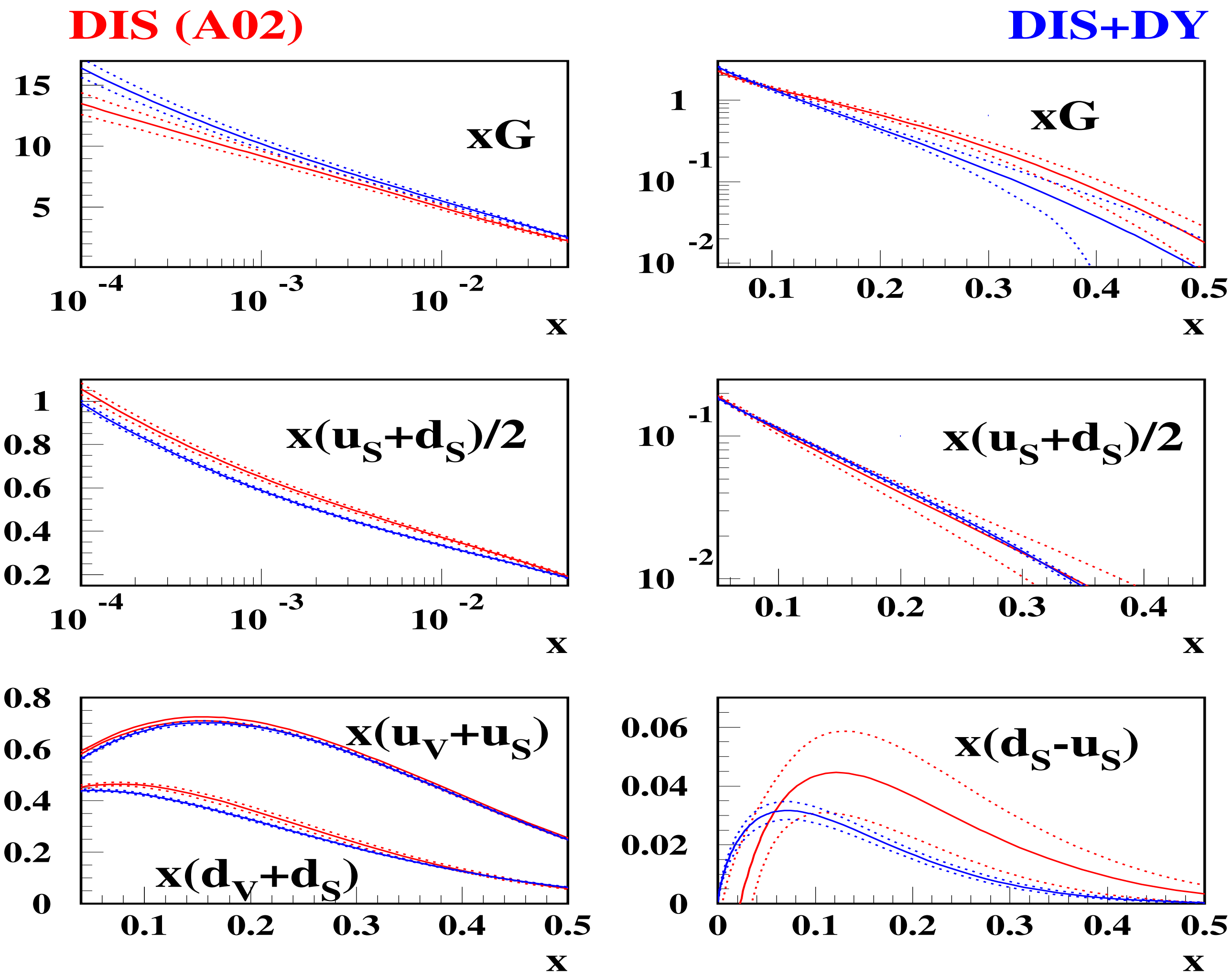
In the ratio disagreement almost vanishes

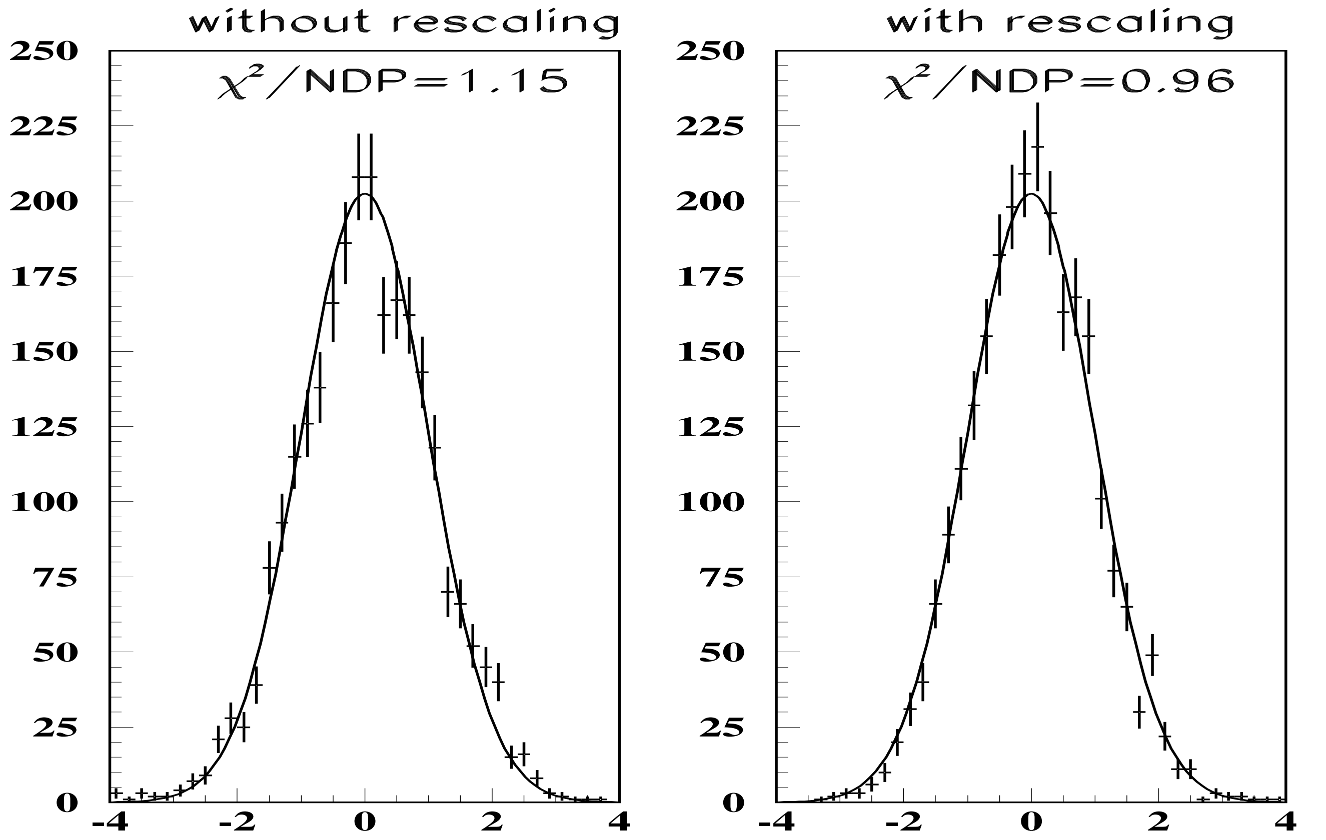


The disagreement of DIS and DY is $\sim 2\sigma$

Intermediate summary

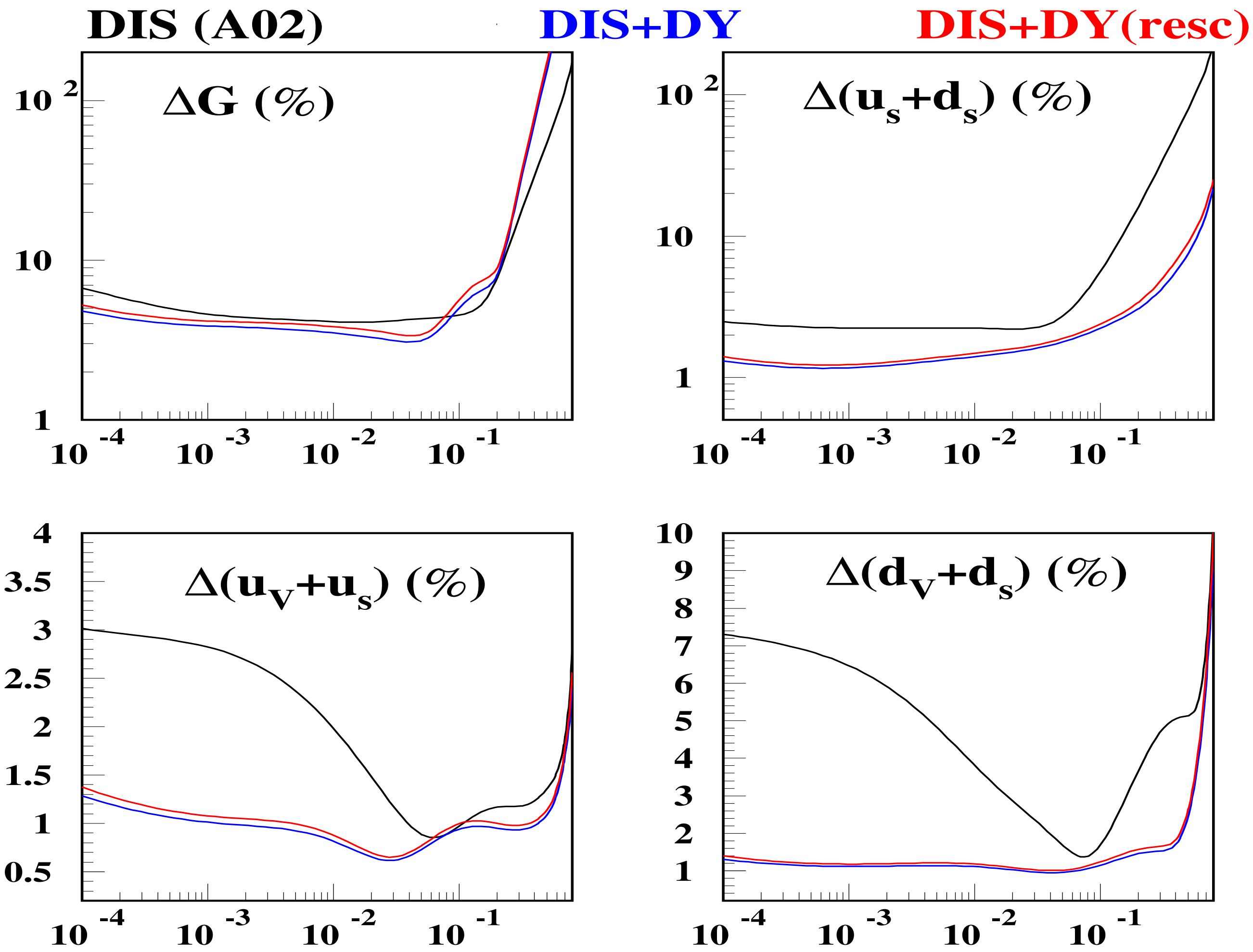
The Drell-Yan data are in certain disagreement with the DIS ones, for now the only possibility to use them in the combined fit is to take the E605 data (isoscalar) and the E866 data for d/p ratio


DIS (A02)
DIS+DY
xG
xG
x(us+ds)/2
x(us+ds)/2
x(uV+uS)
x(dV+dS)
x(dS-uS)
x
x
x
x
x
x



For the experiments with $\chi^2 > 1$ the statistical errors in data were rescaled in order to get $\chi^2 = 1$

Experiment	NDP	χ^2/NDP	scale factor
SLAC-E-49A	118	0.57	–
SLAC-E-49B	299	1.22	1.10
SLAC-E-87	218	0.95	–
SLAC-E-89A	148	1.38	1.18
SLAC-E-89B	162	0.83	–
SLAC-E-139	26	1.28	1.14
SLAC-E-140	17	0.57	–
BCDMS	605	1.13	1.07
NMC	490	1.24	1.12
H1(96-97)	135	1.18	1.09
ZEUS(96-97)	161	1.28	1.14
E605	119	1.5	1.22
E866	39	1.4	1.19


DIS (A02)
DIS+DY
DIS+DY(resc)
ΔG (%)
Δ(u_s+d_s) (%)
Δ(u_V+u_s) (%)
Δ(d_V+d_s) (%)

Summary

- Existing Drell-Yan data provide a good constraint on the sea distributions: their errors can be suppressed up to 20% at $x < 0.8$. The errors for the valence d-quarks and gluons at small x also decrease after inclusion of the Drell-Yan data.
- There is no need to introduce big scale factor in order to bring the E605 and E866(d/p) data into agreement to the DIS ones, however for the absolute E866 measurements significant disagreement with the DIS data is observed – more thoughtful theoretical studies and/or new measurements are necessary.