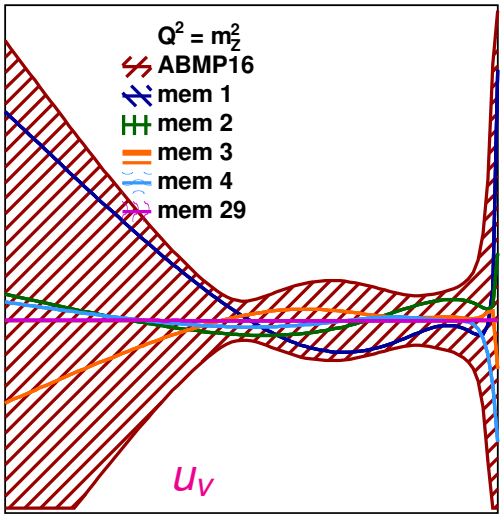
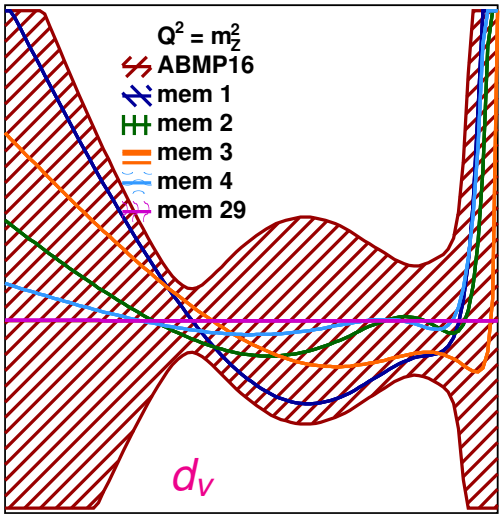
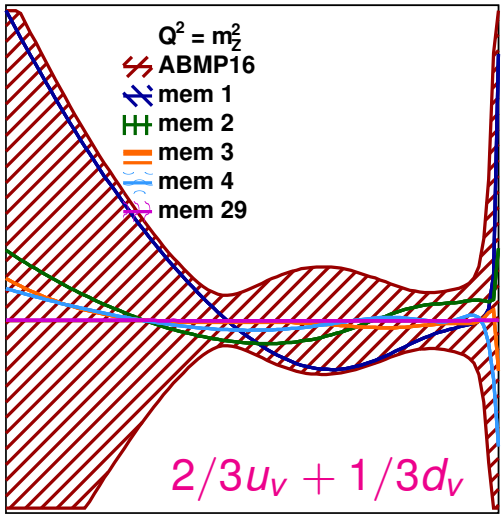
Remaining TODO items

- check sensitivity to different PDFs (xfitter-process): DONE
- plot partial derivatives weighted by stat. unc.
- check chi2 for different PDF sets using pseudodata produced with another PDF set
- somehow check sensitivity in different bins (by using different parameters in different bins?)

PDF rotation (ABMP16)







- Used instructions at
  `https://gitlab.cern.ch/fitters/xfitter/-/wikis/PDF%20rotation`
- New 'feature' of `xfitter-draw`: no axis labels... (ROOT Version: 6.28/04)
- Largest impact on $2/3u_v + 1/3d_v$
- 1st eigenvector almost fully determines PDF error band:

ABMP16_5_nnlo	mem1	mem2	mem3	mem4	mem29
χ^2/dof	878/120	81/120	46/120	4/120	0/120

- Consistent with results from arXiv:1907.07727

PDF rotation (from arXiv:1907.07727)

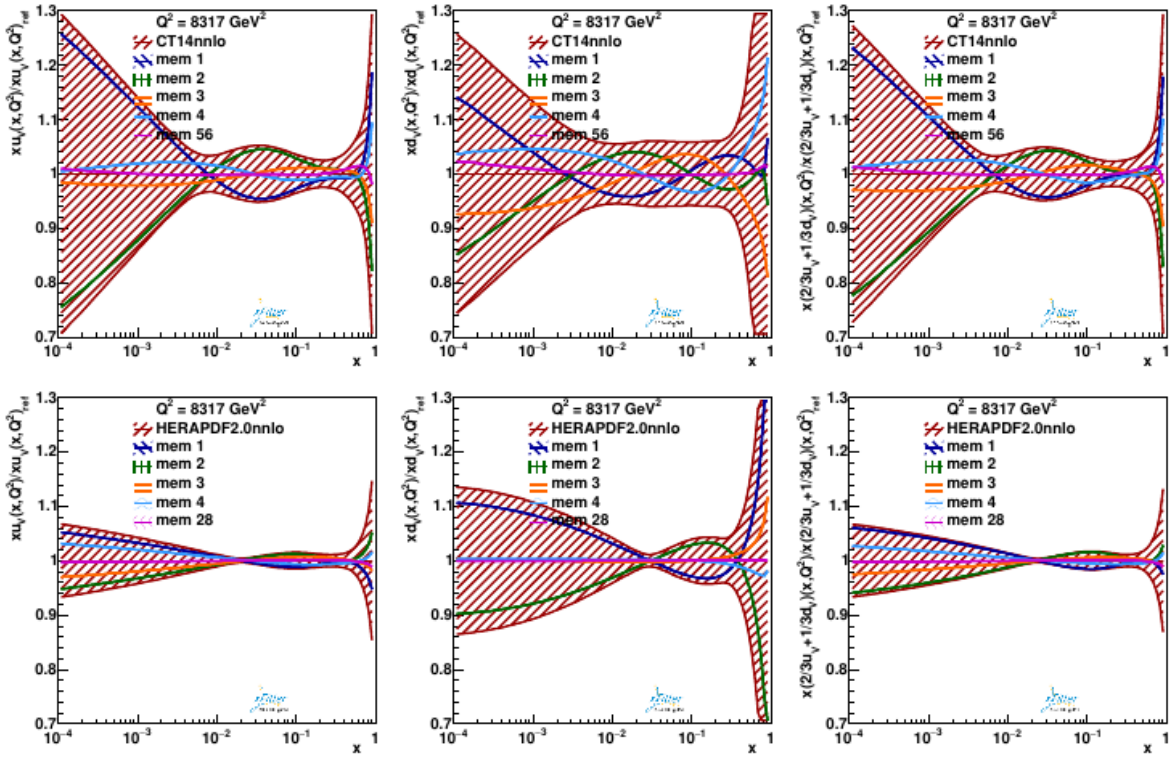


Figure 6. Contribution of the first four and last rotated eigenvectors to the uncertainty error bands of the normalised distribution of the ratios of (left to right) u-valence, d-valence and $((2/3)u+(1/3)d)$-valence of the CT14nnlo (top row) and HERAPDF2.0nnlo (bottom row) PDF sets. The eigenvectors are rotated and sorted according to their sensitivity to $A_{\rm FB}^*$ pseudodata corresponding to an integrated luminosity of 300 fb^{-1}.

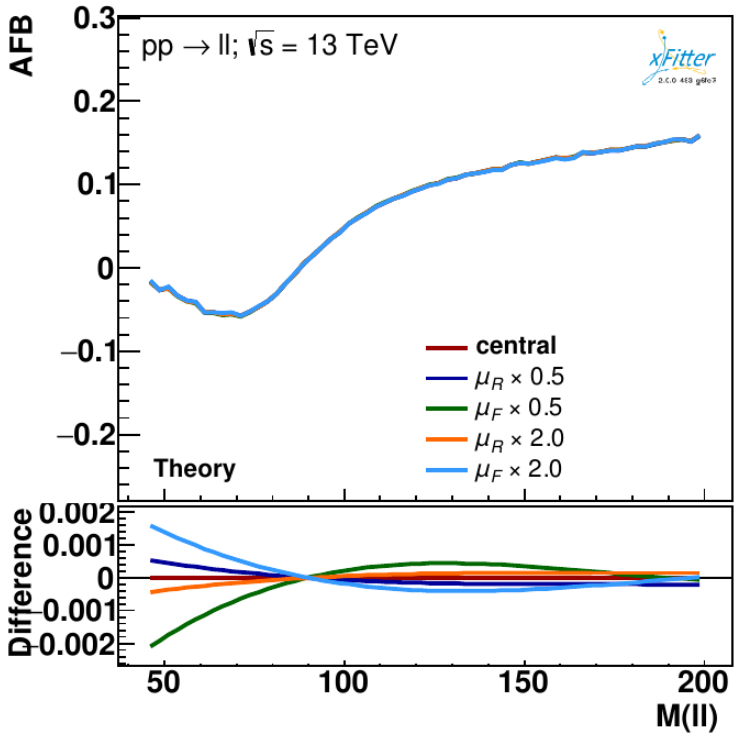
CT14nnlo	mem1	mem2	mem3	mem4	mem56
Total χ^2/d.o.f.	164/106	169/106	10/106	14/106	0.98/106
HERAPDF2.0nnlo	mem1	mem2	mem3	mem4	mem28
Total χ^2/d.o.f.	4.8/106	8.0/106	0.48/106	0.74/106	0.01/106

Table 1. The χ^2 table for the CT14nnlo and HERAPDF2.0nnlo sets with rotated eigenvectors.

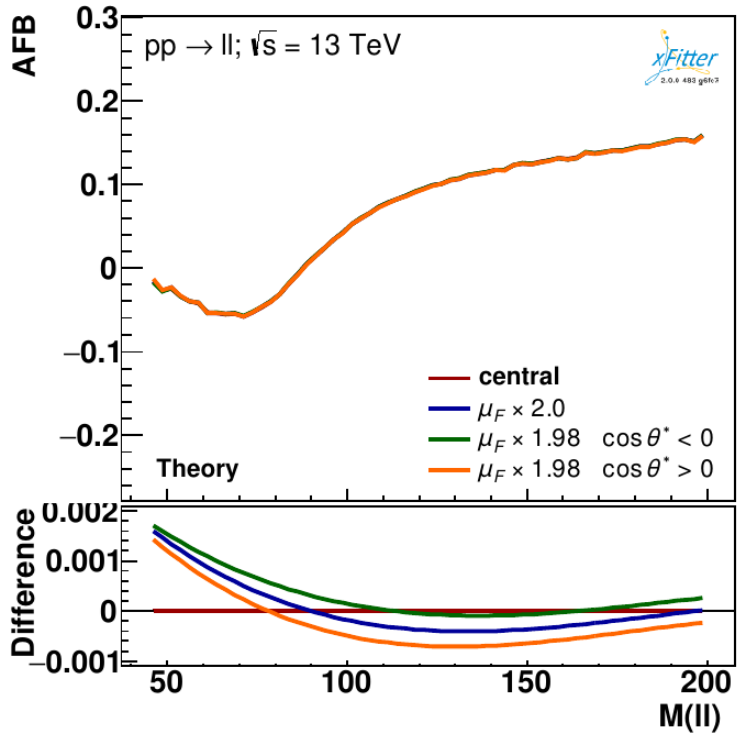
BACKUP

Missing higher order uncertainties

- This sensitivity study is done at LO
- From arXiv:1907.0772 we have NLO grids [MCFM]
- They are affected by limited statistics, however the effect of NLO scale variations is rather smooth (it was further smoothed as function of M for the paper)
- Binning: $0 < y < 2.5$ (5 bins), $45 < M < 145$ GeV (40 bins), but in arXiv:1907.0772 we looked only at M bins

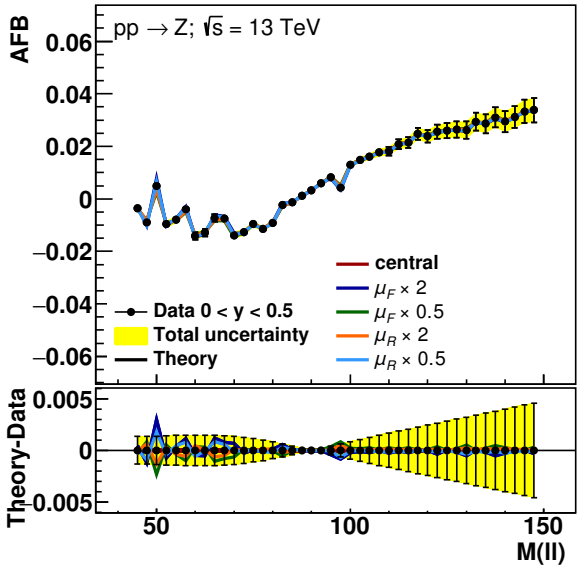


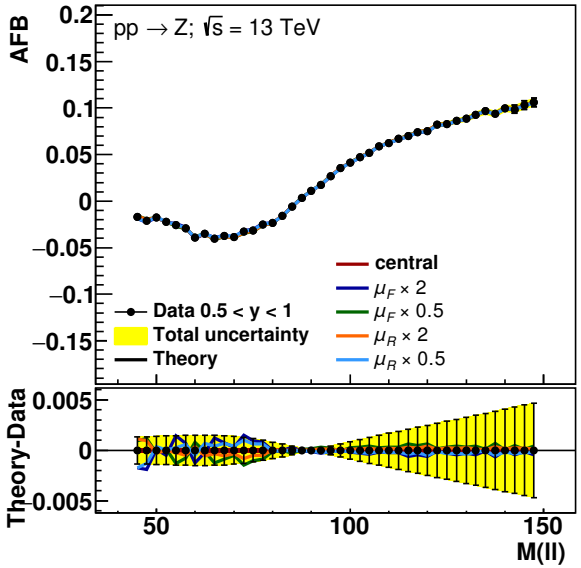
(a)

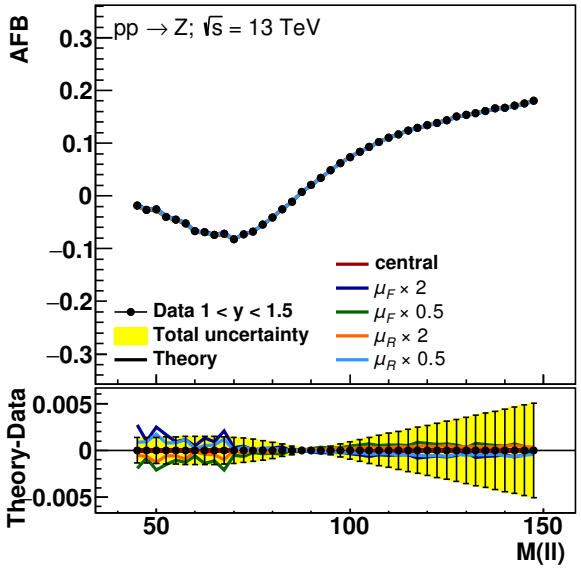


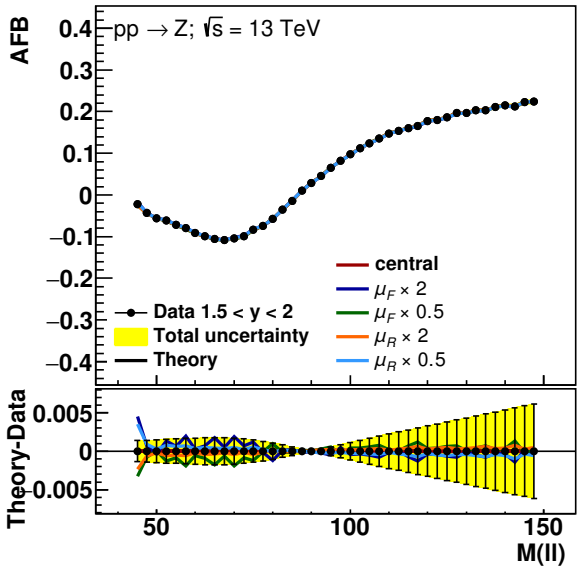
(b)

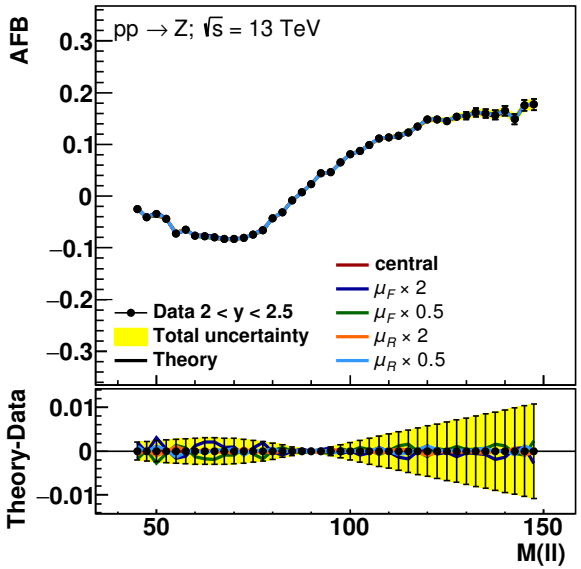
NLO scale variations





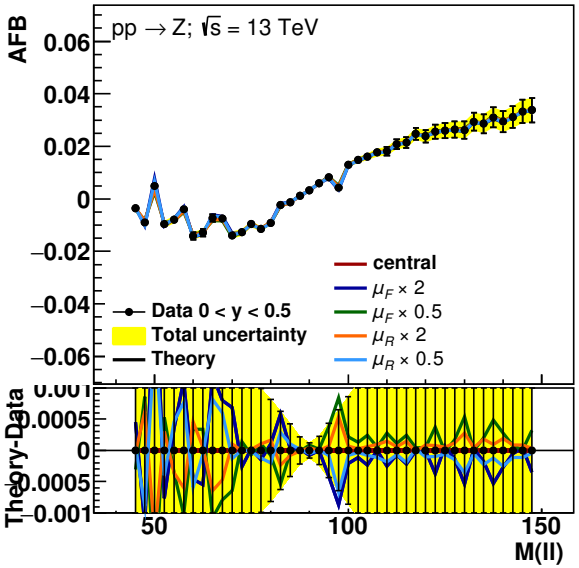


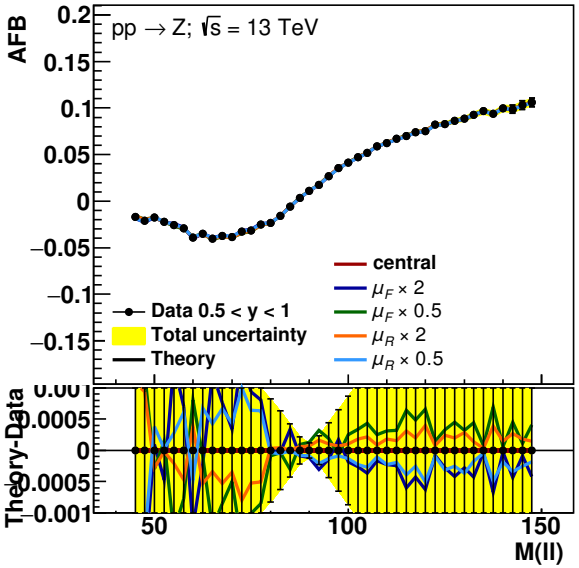


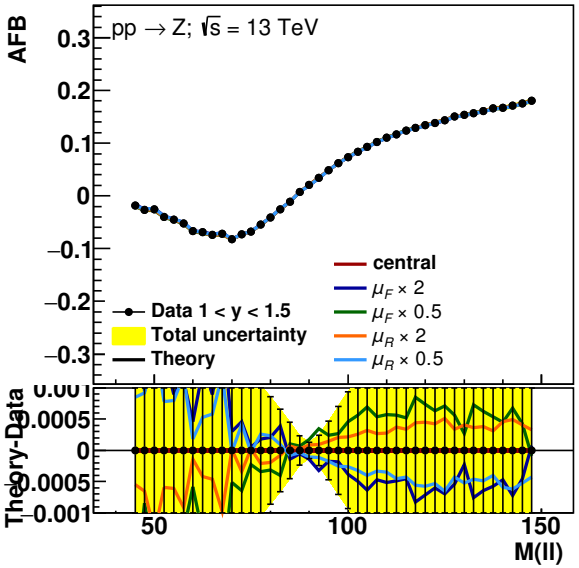


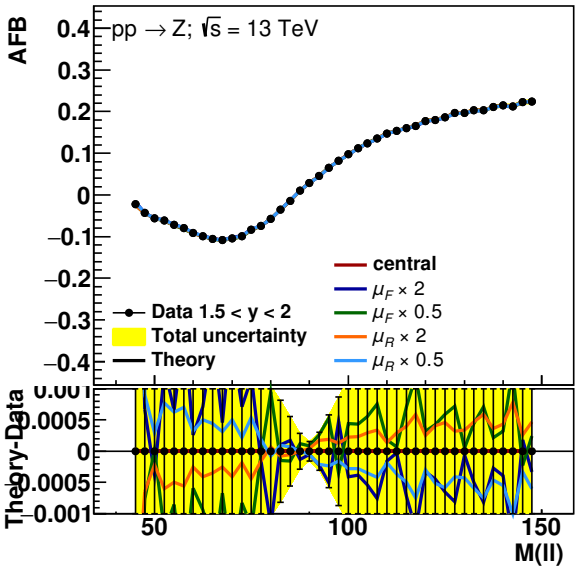
- NLO scale variations are generally smaller than stat. unc. of pseudodata

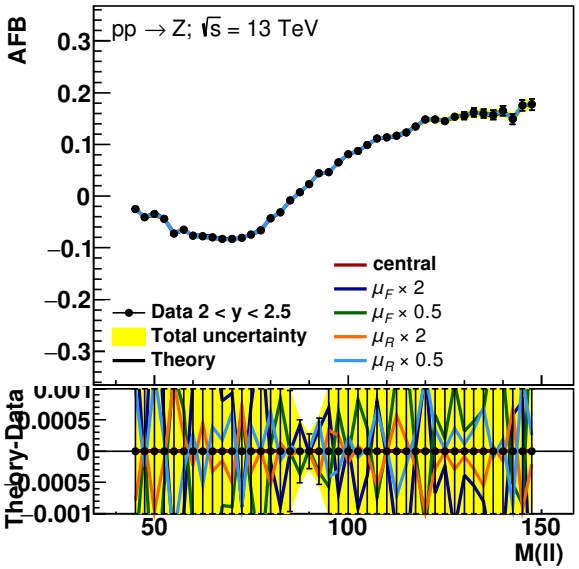
NLO scale variations











- For the future real analysis at NNLO one expects even smaller effect