

Combining QED and Approximate N<sup>3</sup>LO QCD Corrections in a  
Global PDF Fit: MSHT20qed\_an3lo PDFs (arXiv:2312.07665) by T.  
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## Referee Report

In the manuscript titled: “Combining QED and Approximate N<sup>3</sup>LO QCD Corrections in a Global PDF Fit: MSHT20qed\_an3lo PDFs” the authors present the MSHTQED\_an3lo PDFs extracted from a fit which combines the known QED corrections including  $\alpha$ ,  $\alpha_s\alpha$ , and  $\alpha^2$  contributions, with QCD corrections including full NNLO plus aN<sup>3</sup>LO corrections. They do not include recent development in the calculation of the splitting functions at N<sup>3</sup>LO (and this is explicitly stressed in the text). Nevertheless, using the same information included in their previous MSHTaN<sup>3</sup>LO analysis, the authors provide an estimate of impact of the QED effects using their original PDF release as a reference. In addition, they present the results of a novel PDF extraction at LO in QCD which includes QED corrections.

The manuscript is timely and well written, and contains new information which will be beneficial for future precision analyses at the LHC. It meets the journal acceptance criteria and I therefore recommend the manuscript for a publication in SciPost. I only have a couple of minor requests which are listed below:

- It would be interesting to compare the MHSTQED\_aN3LO PDFs and their errors to those from other groups (e.g., NNPDF and CTEQ) which performed similar analyses including QED effects but at NNLO in QCD. A figure similar to Fig. 1 in the manuscript could be added illustrating this comparison with a brief explanation in the text. In particular, the authors could show the MHSTQED\_aN3LO PDFs vs MHSTQED\_NNLO PDFs vs NNPDF4.0QED vs CT18QED. I believe this would increase the value of the manuscript.
- The authors should run a full spell check on the manuscripts as I have spotted a few typos.

After these minor points are addressed the manuscript is accepted for a publication in SciPost.