

# QED PDFs in QCDNUM

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# Status

- The NLO QCD + LO QED evolution is implemented into `QCDNUM` beta version `17-01-0b` released by Michiel Botje on 26.07.2013. This version allows to solve  $n$  coupled evolution equations in FFNS and VFNS
- For  $n_f = 5$  we have 4 coupled equations for  $\Delta, \Sigma, g, \gamma$  and 5 uncoupled equations for  $d_v, u_v, \Delta_{ds}, \Delta_{uc}, \Delta_{sb}$  (assuming  $s = \bar{s}, c = \bar{c}, b = \bar{b}$ )
- The results in FFNS were cross-checked with `partonevolution-1.1.3` program of S. Weinzierl and in VFNS with `MRST2004QED` PDF set

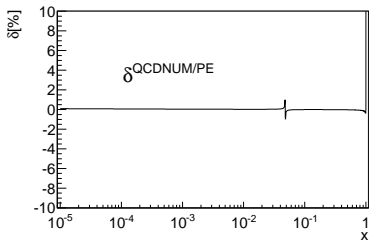
# Delta definitions

$$\delta^{\text{QCDNUM/PE}} = \frac{xf(\text{QCDNUM with QED}) - xf(\text{PE})}{xf(\text{PE})}$$

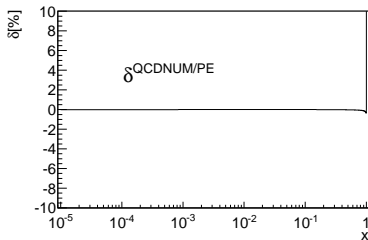
$$\delta^{\text{QCDNUM/MRST2004QED}} = \frac{xf(\text{QCDNUM with QED}) - xf(\text{MRST2004QED})}{xf(\text{MRST2004QED})}$$

# Comparison between QCDNUM+QED and PE at $\mu = 100$ GeV

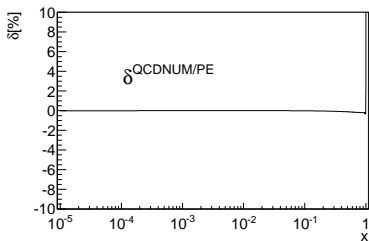
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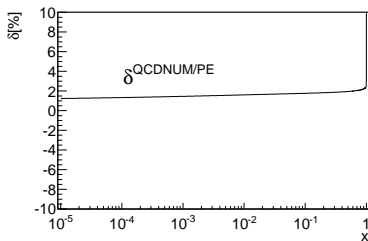
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gluon:

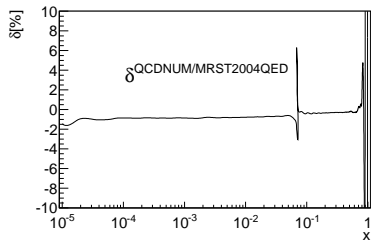


photon:

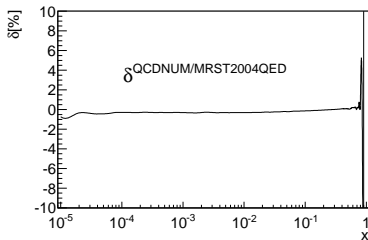


# Comparison between QCDNUM+QED and MRST2004QED at $\mu = 100$ GeV

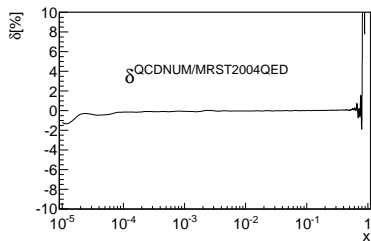
delta:



singlet:



gluon:



photon:

