Inclusive Jet Cross Section Measurement from 8TeV (SMP-12-012)

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On Behalf Of Inclusive Jet Team

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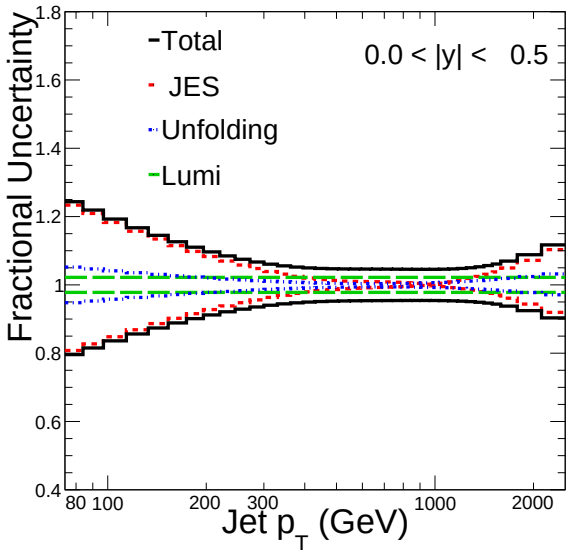
Outline

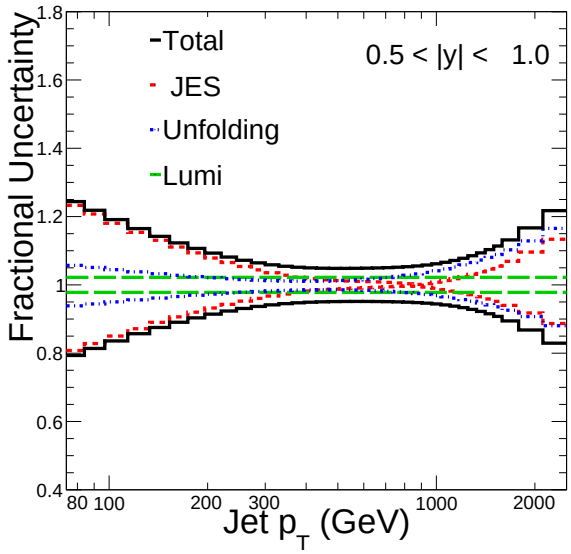
Experimental Uncertainty

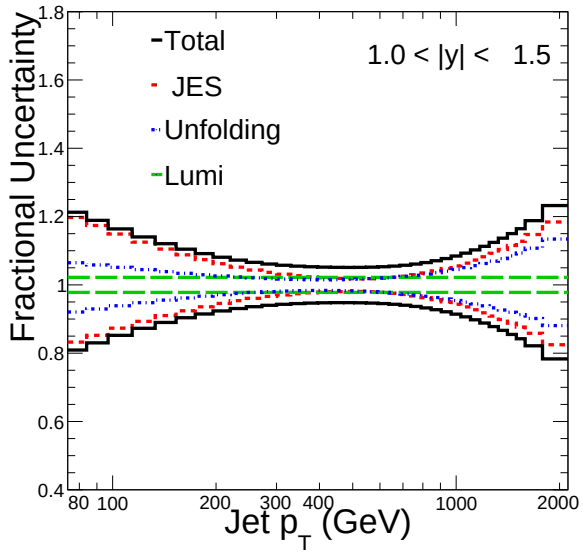
The Jet energy scale uncertainty has several independent components. They are as following

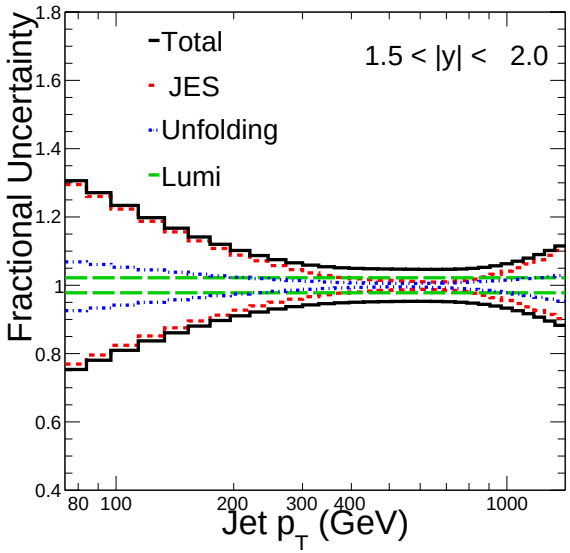
- Absolute, HighPtExtra, SinglePion(ECAL,HCAL), QCDFlavor, Time, RelativeJER(EC1,EC2,HF), RelativePt(BB,EC1,EC2,HF), RelativeFSR, RelativeStat(EC2,HF), PileUpDataMC, PileUpPt(BB,EC,HF), PileUpBias, FlavorZJet, FlavorPhotonJet, FlavorPureGluon, FlavorPureQuark, FlavorPureCharm, FlavorPureBottom.
- The total Jet Energy Scale uncertainty is obtained by summing the independent components in quadrature.

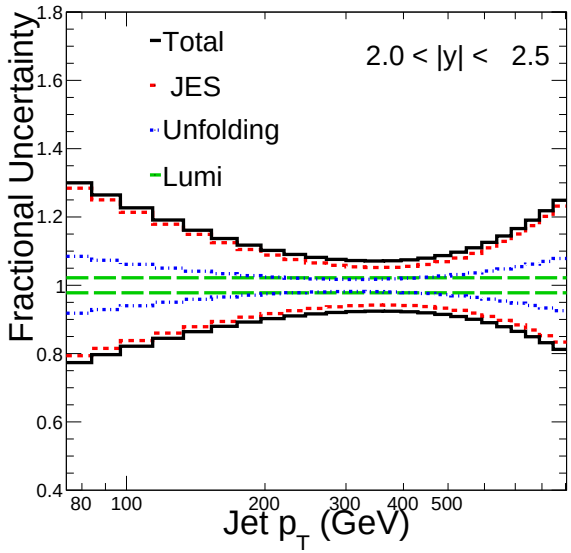
Experimental Uncertainty Total

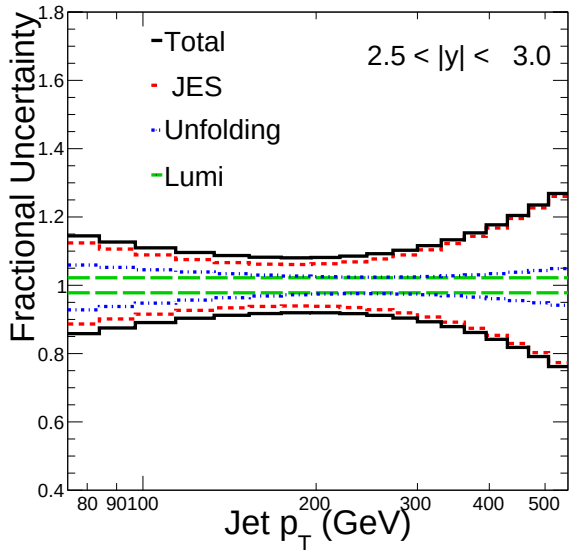






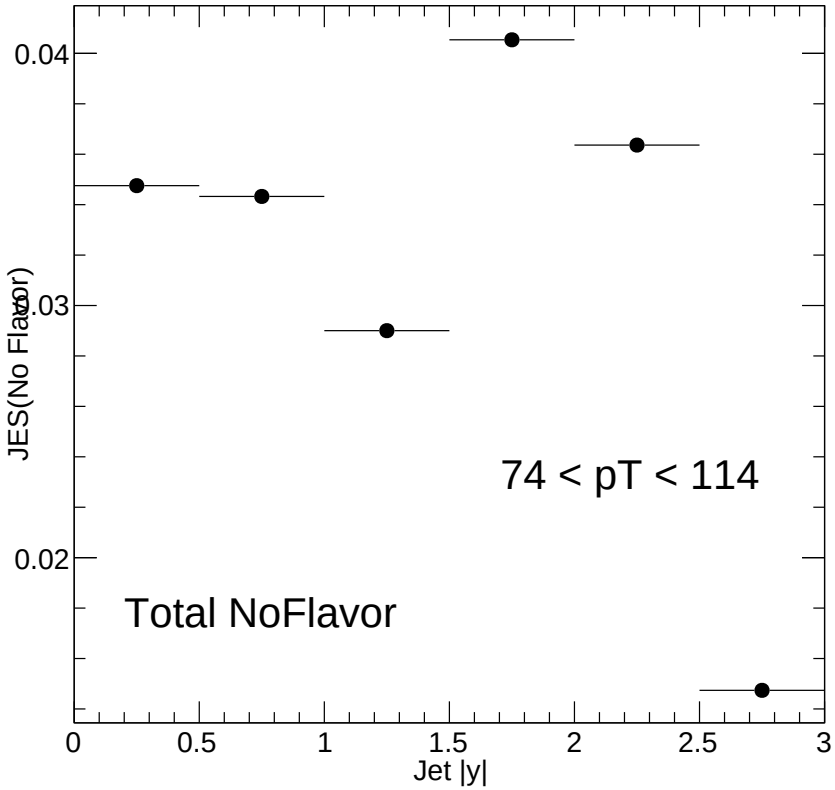


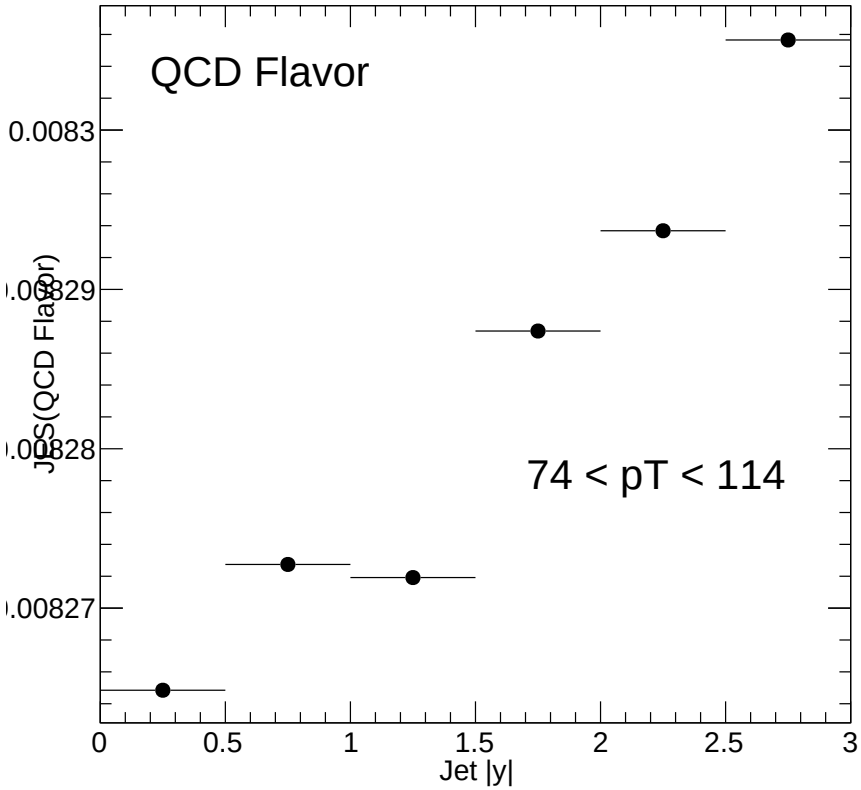




Experimental Uncertainty Limit On Measured Cross Section

JES factor vs $|y|$

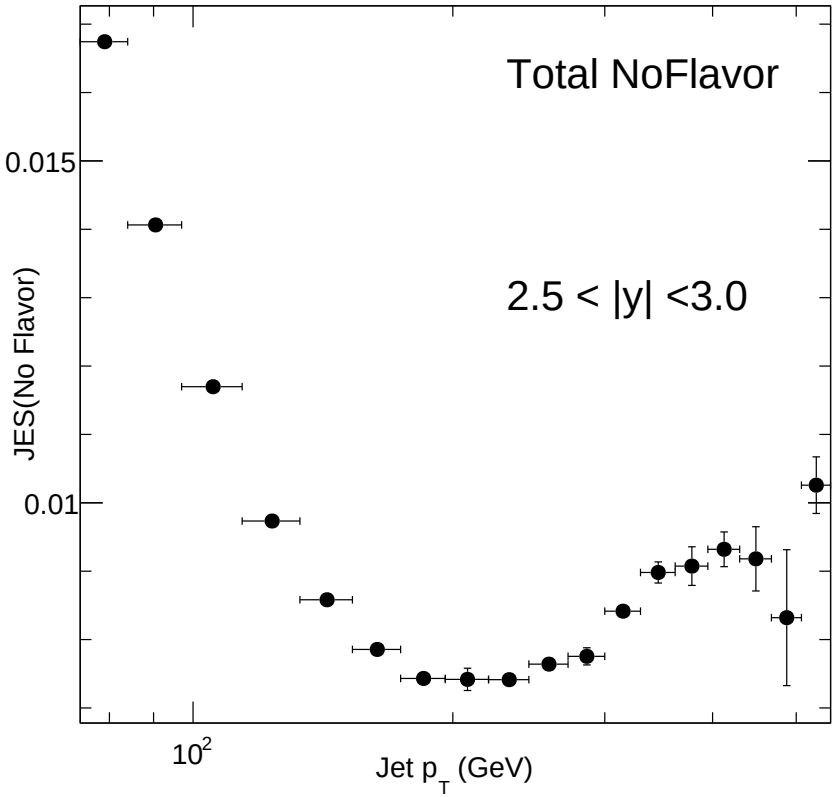


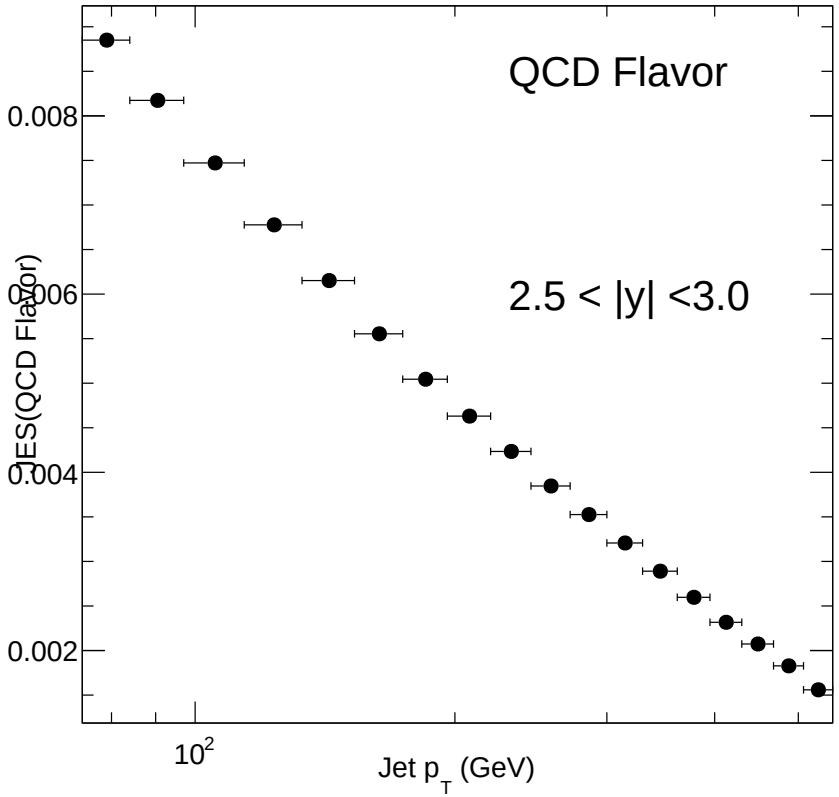


The JES factor as function of $|y|$ is shown for the range $74\ \mathrm{GeV} < \mathrm{p_T} < 114\ \mathrm{GeV}$.

The JES-NoFlavor component is falling for the last rapidity bin.

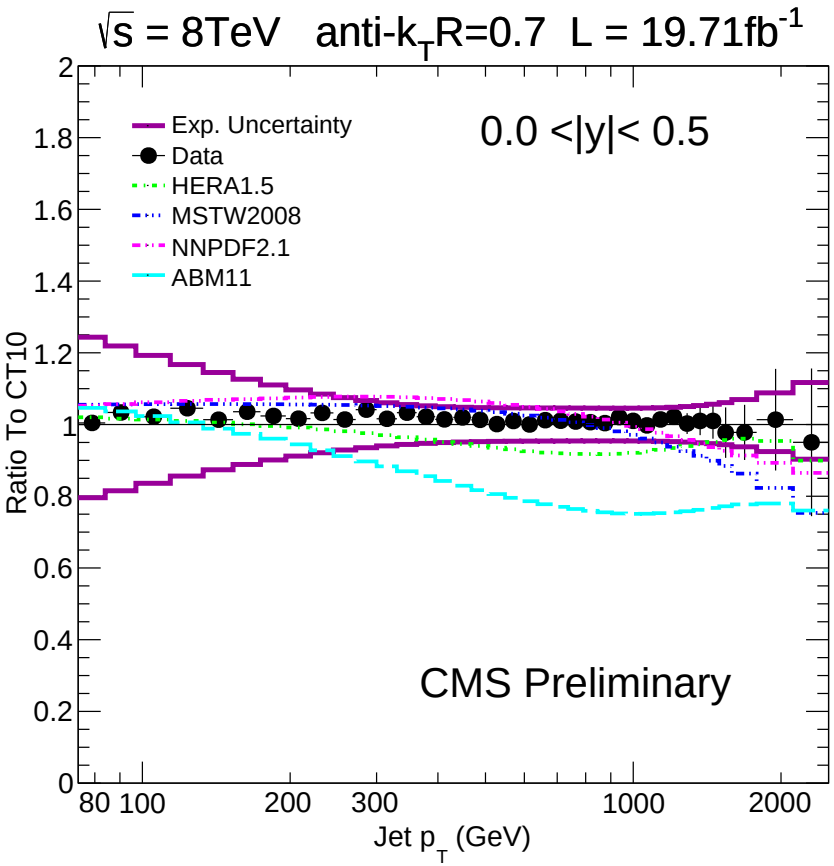
JES factor vs p_T

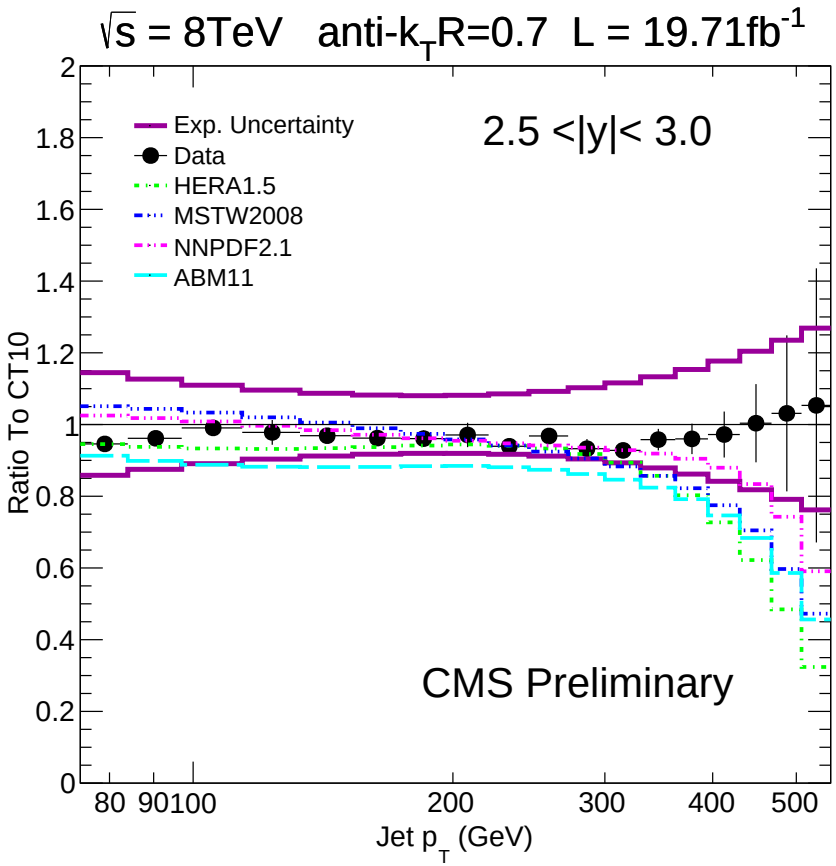




The JES factor as function of p_T for the last rapidity bin.

Data Over Theory





Data Over Theory compared to ratio with other PDF sets for CT10

$\alpha_s(M_z)$ Determination

From the obtained double differential crosss section, we aim to extract the strong coupling contact at $\alpha_s(M_z)$.
The $\alpha_s(M_z)$ is extracted from the minimum of $\chi^2(\alpha_s(M_z))$ which is defined as

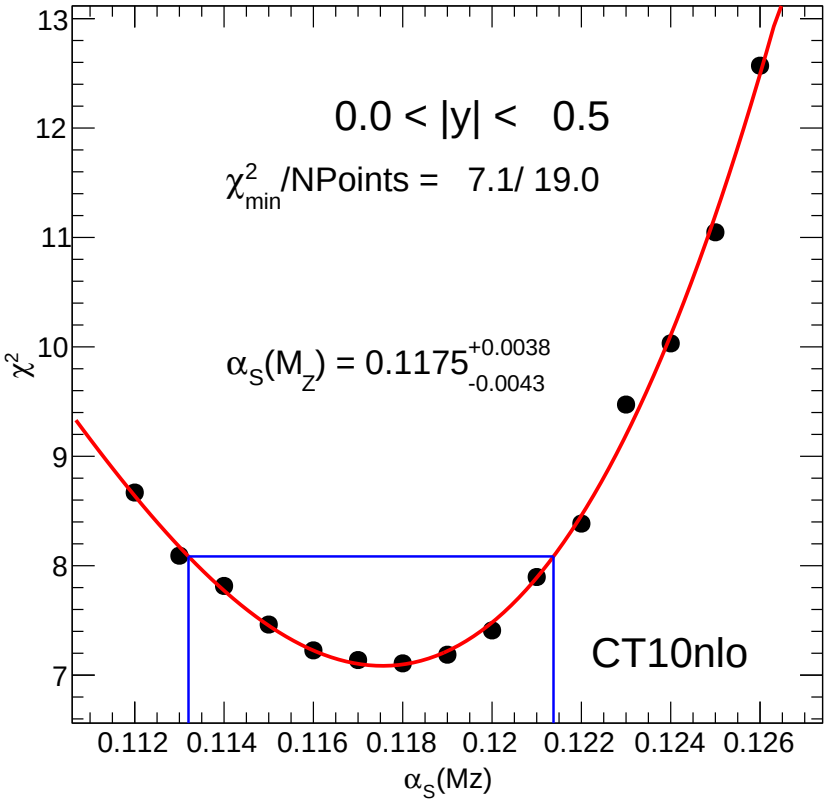
$$\chi^2 = \sum_{i,j=1}^{N_{BIN}} (\mathcal{O}^i_{Th} - \mathcal{O}^i_{Data}) C^{-1}_{ij} (\mathcal{O}^j_{Th} - \mathcal{O}^j_{Data})$$

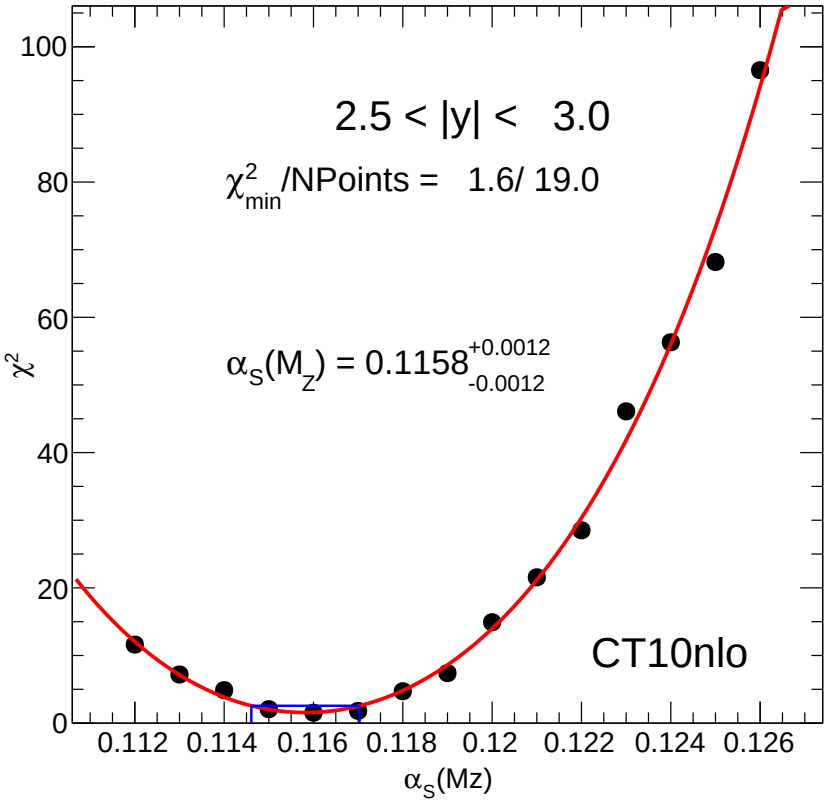
where $\mathcal{O} = \frac{d^2\sigma}{dp_T dy}$ and C is the covariance matrix which includes statistical and JES systematics.

$$C = Cov^{Unfolding} + \sum Cov^{JES} + Cov^{LUMI} + Cov^{Theo}$$

- The obtained χ^2 distribution as a function of $\alpha_s(M_Z)$ is fitted with a 4th order polynomial.
- The PDF and JES uncertainty are evaluated by removing the components in the covariance matrix.

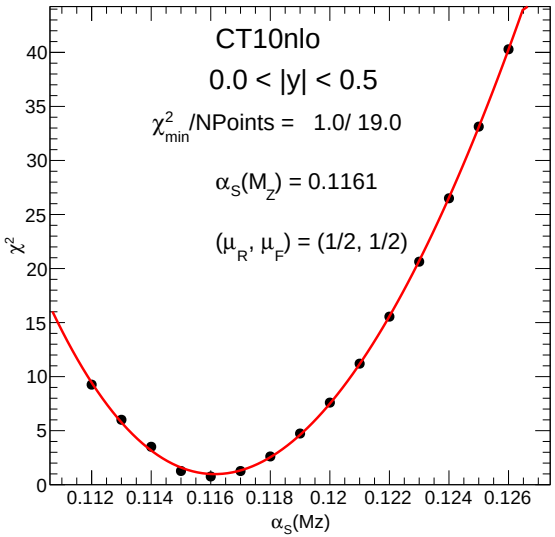
NLO χ^2 Plots

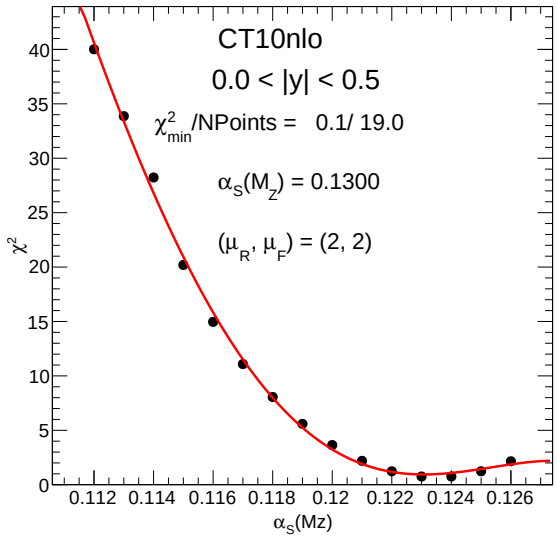


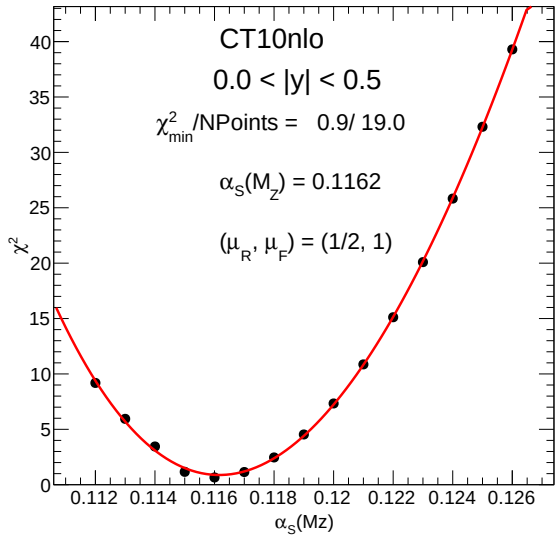


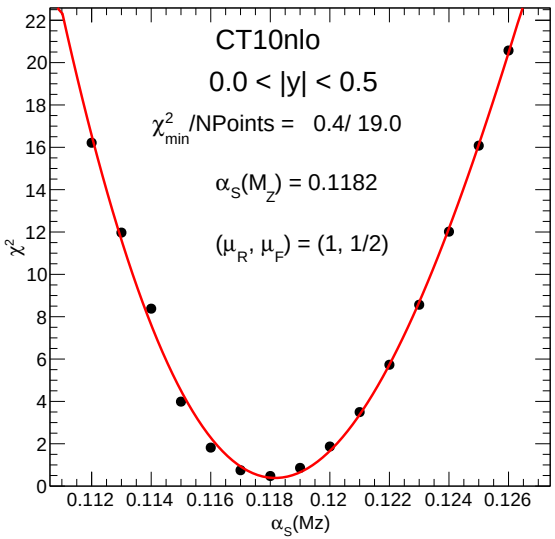
Basic χ^2 plots for two extreme rapidity bins using NLO CT10 PDF.

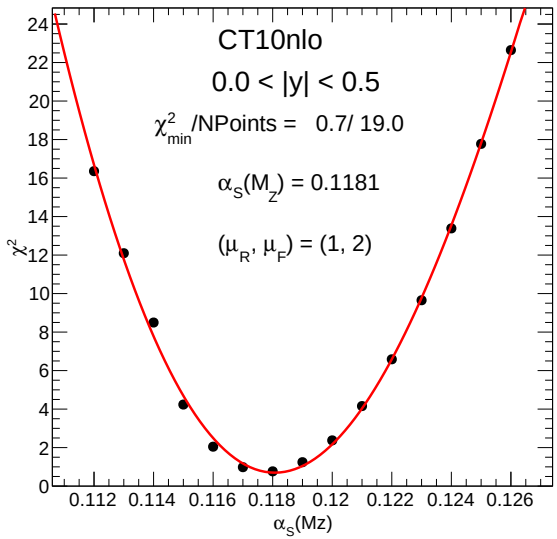
Scale Variation for YBin0

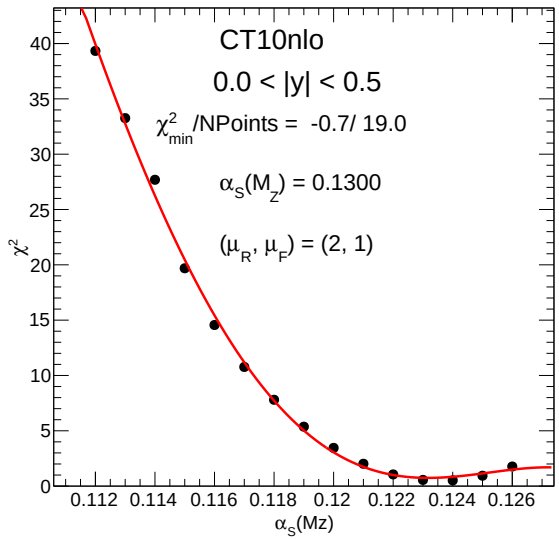






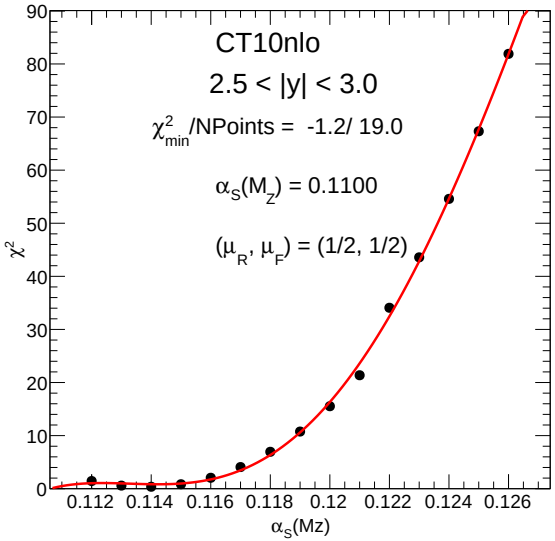


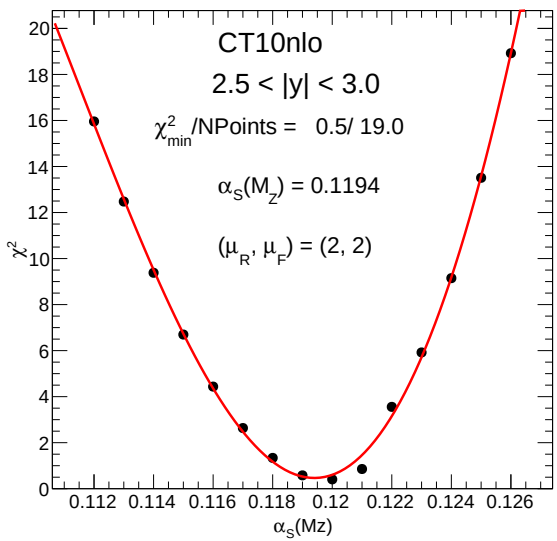


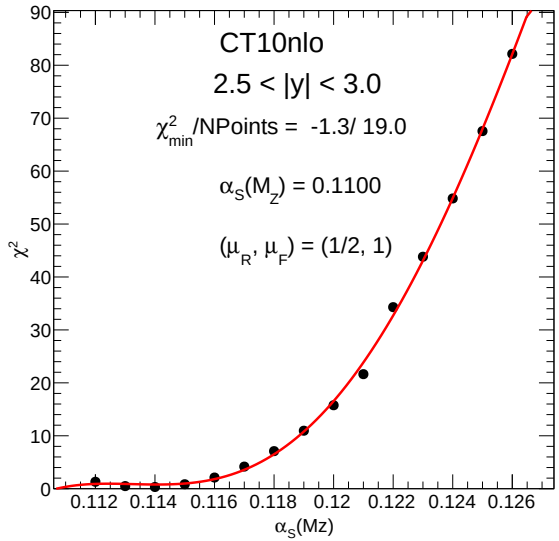


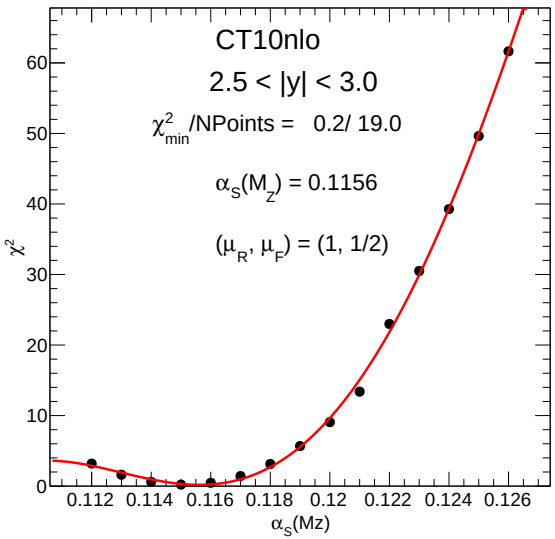
Basic χ^2 plots with varying (μ_R, μ_F) using NLO CT10 PDF.

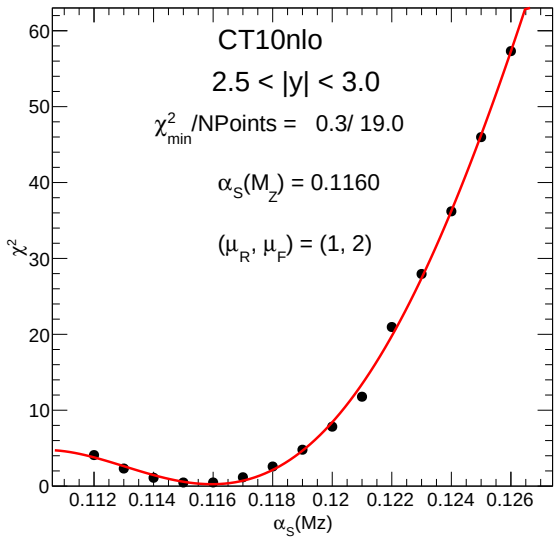
Scale Variation for YBin5

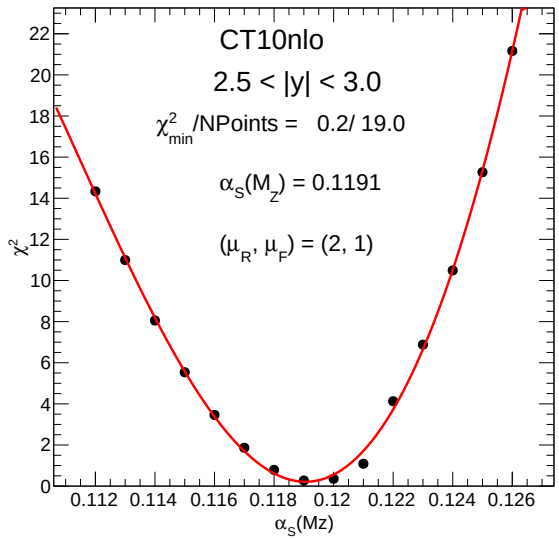






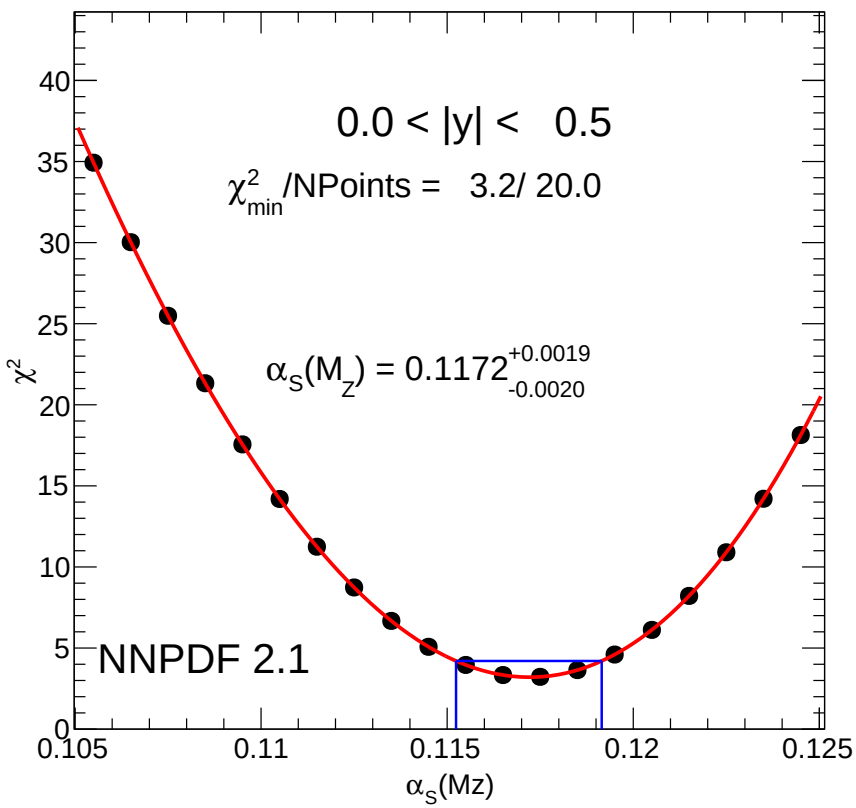


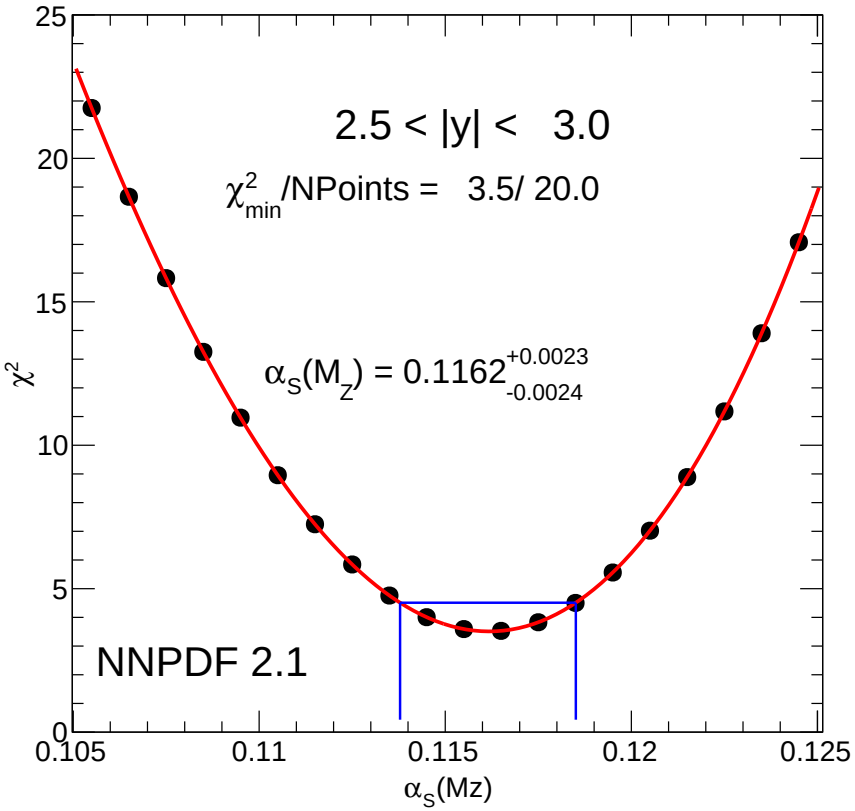




Basic χ^2 plots with varying (μ_R, μ_F) using NLO CT10 PDF.

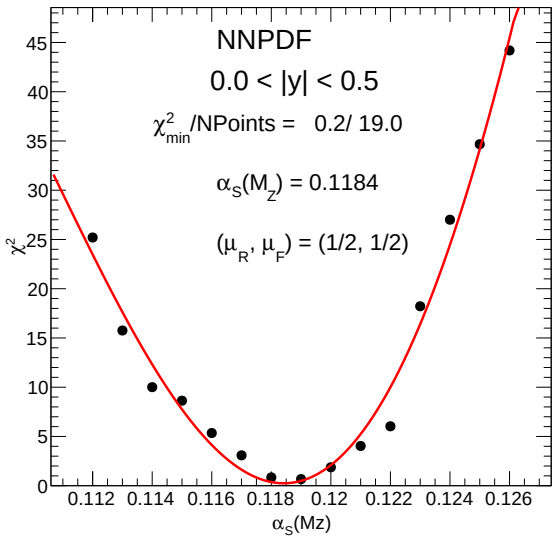
NNLO χ^2 Plots

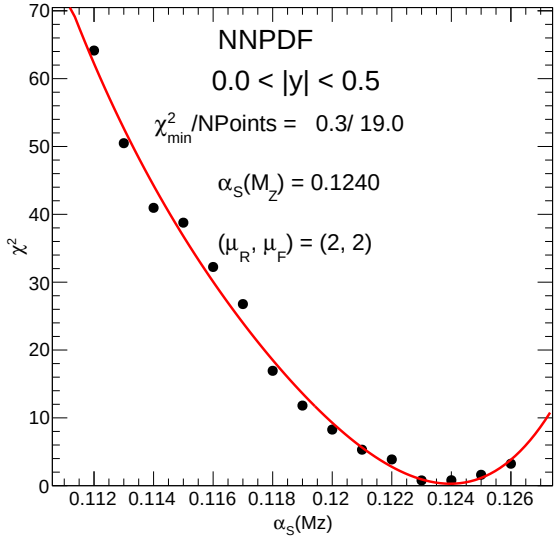


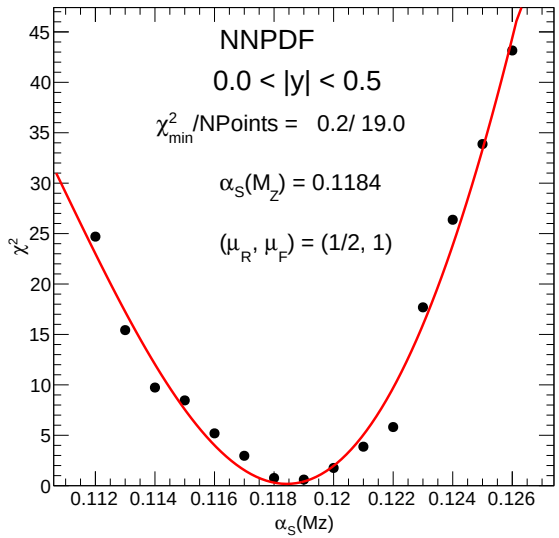


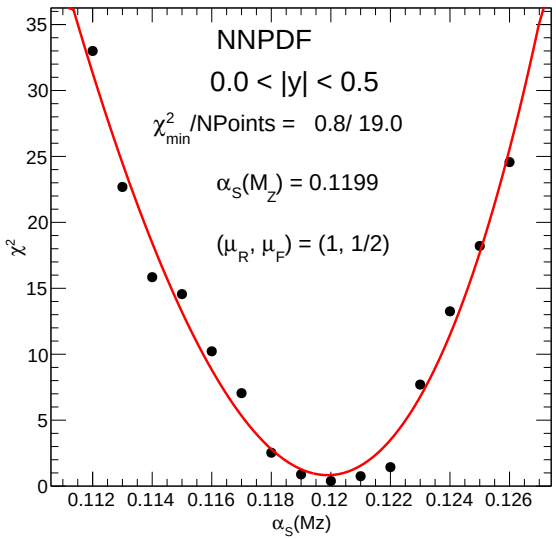
Basic χ^2 plots for two extreme rapidity bins using NNLO NNPDF2.1 PDF.

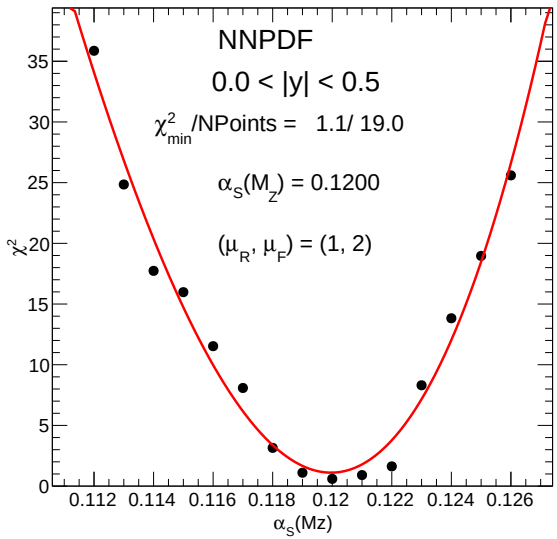
Scale Variation for YBin0

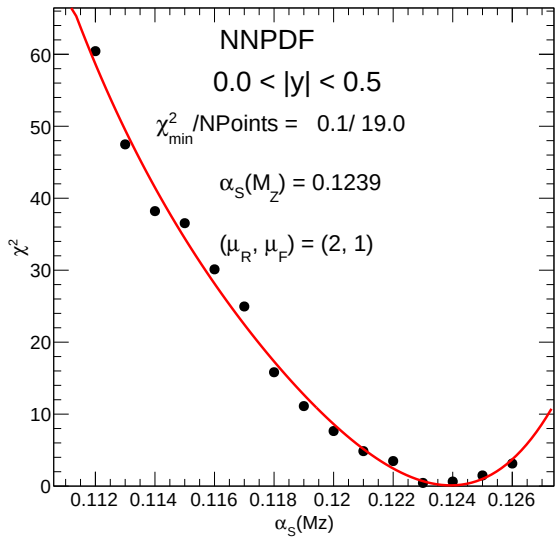






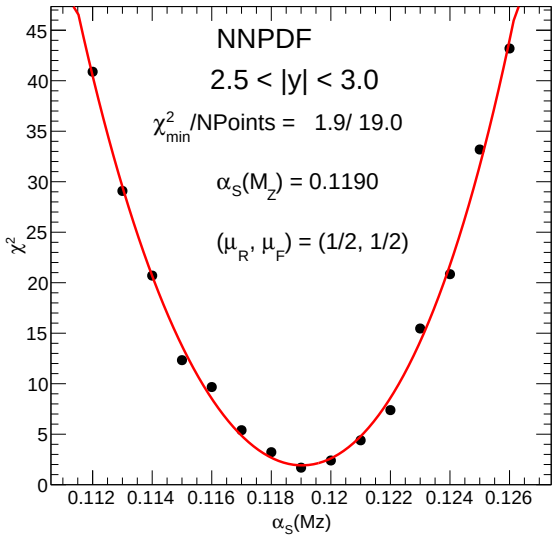


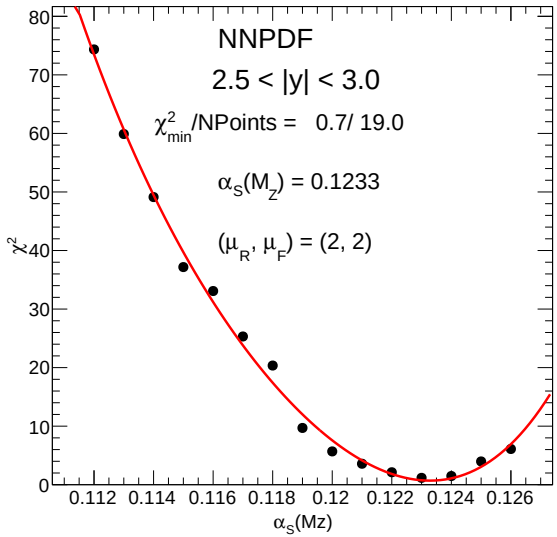


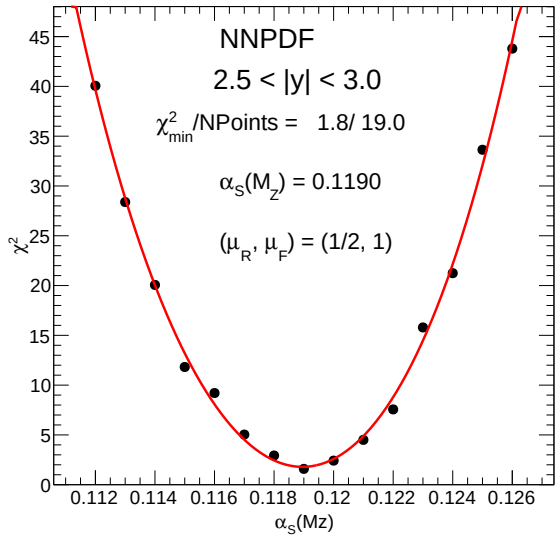


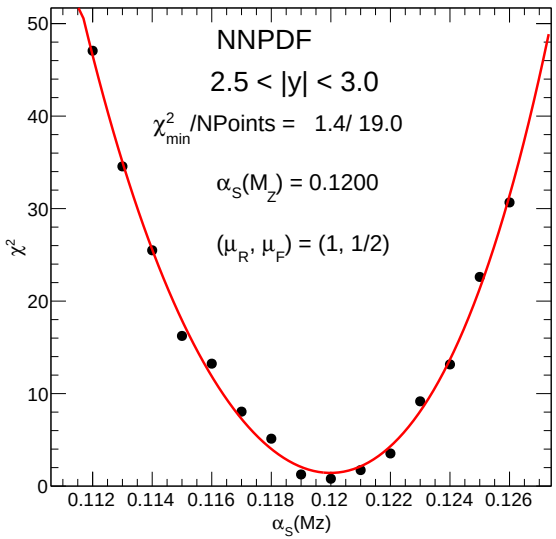
Basic χ^2 plots with varying (μ_R, μ_F) using NLO NNPDF PDF.

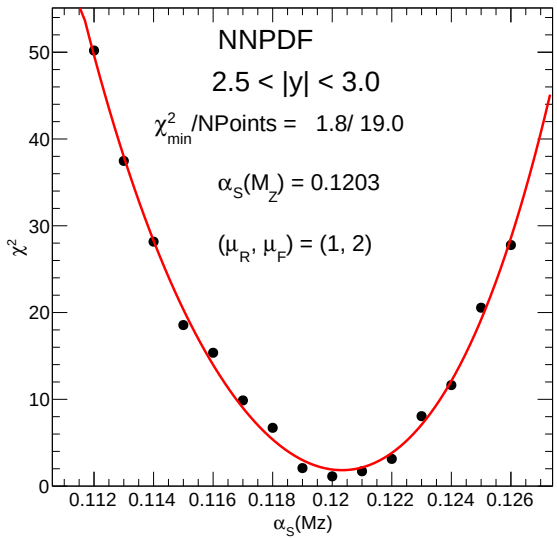
Scale Variation for YBin5

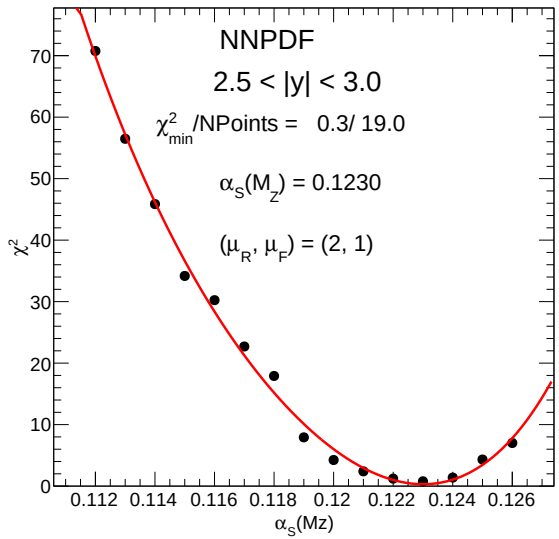






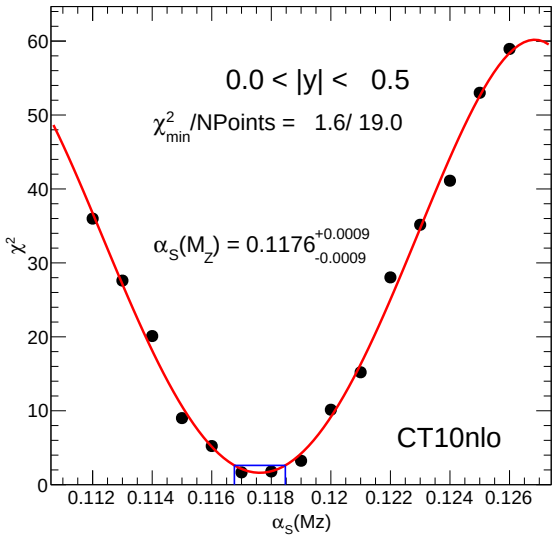


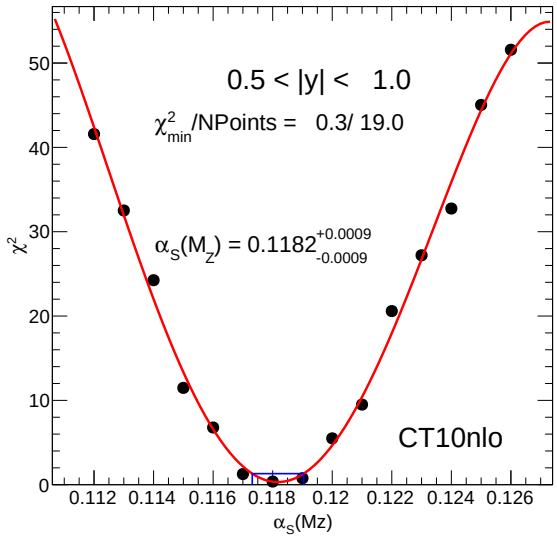


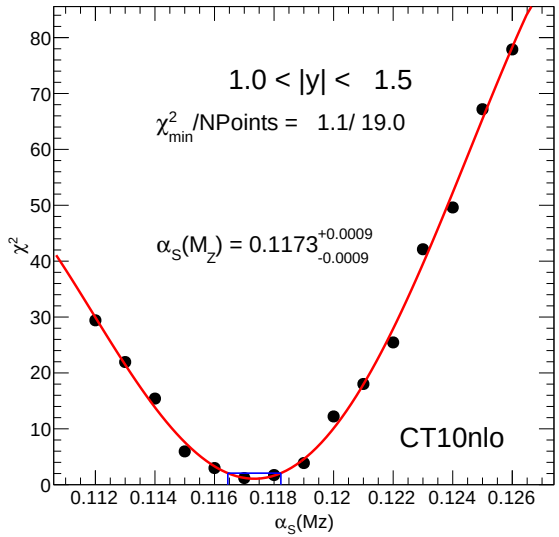


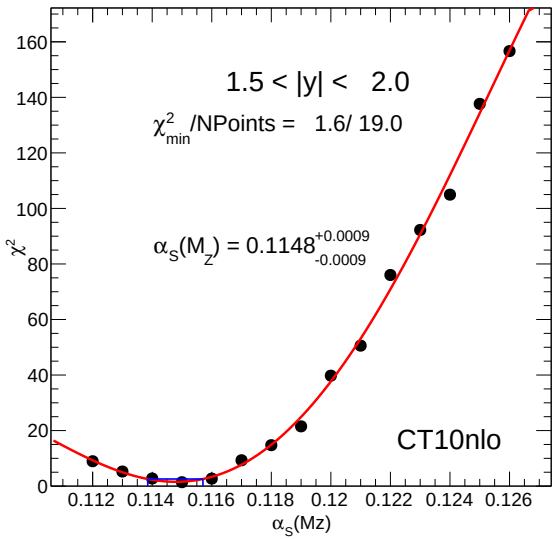
Basic χ^2 plots with varying (μ_R, μ_F) using NLO NNPDF PDF.

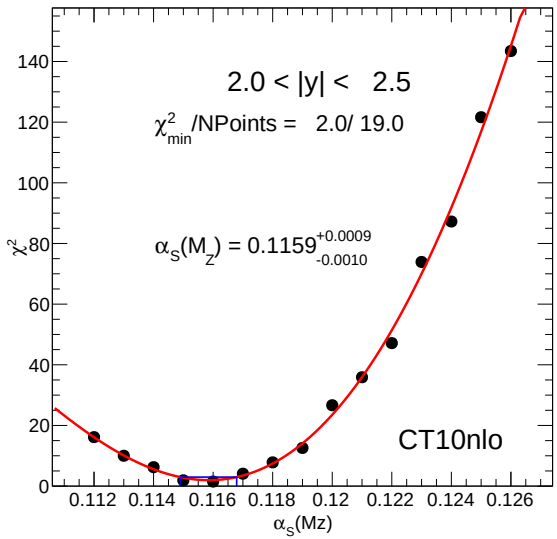
JES Uncertainty for CT10-NLO

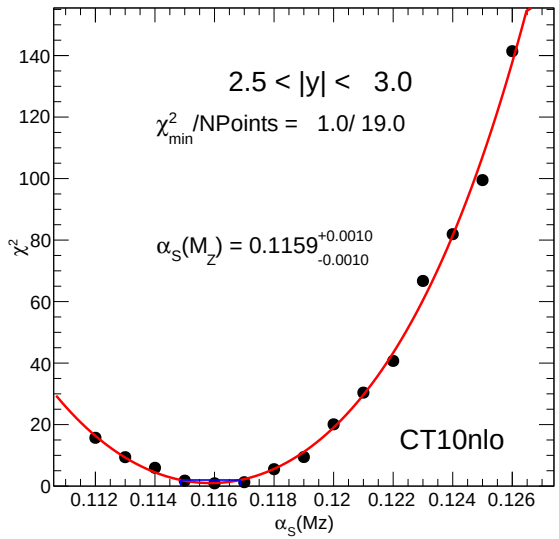






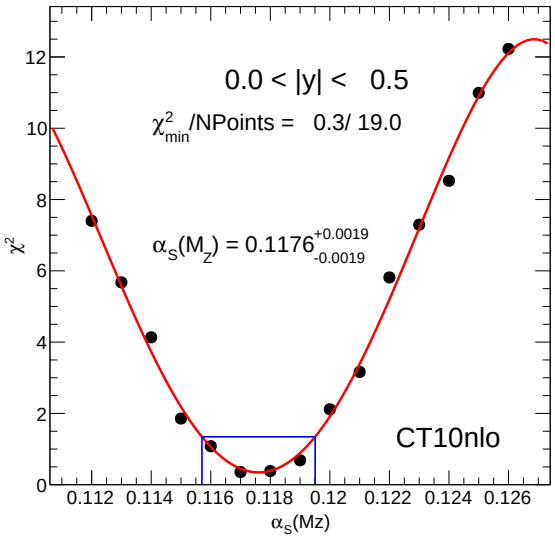


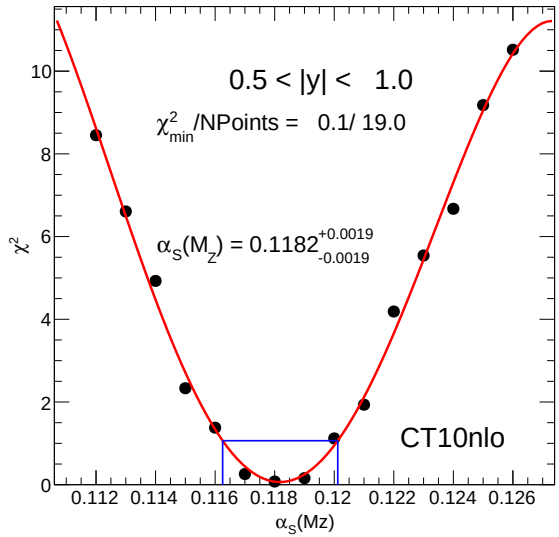


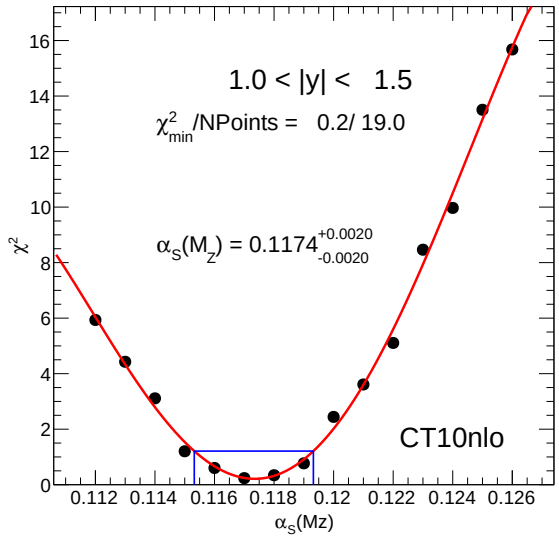


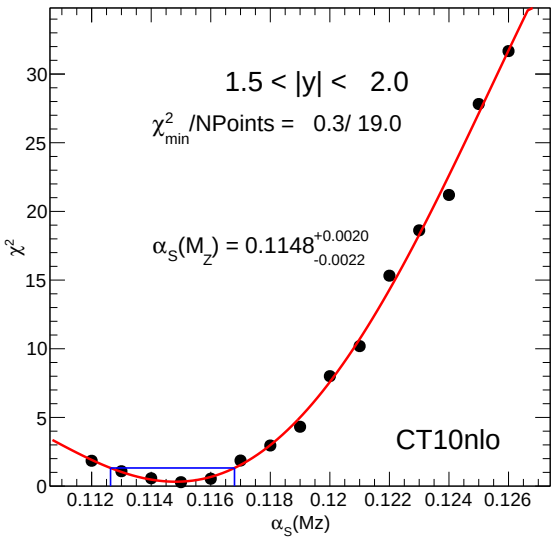
Basic χ^2 plots after removing JES from Cov matrix, for NLO CT10 PDF.

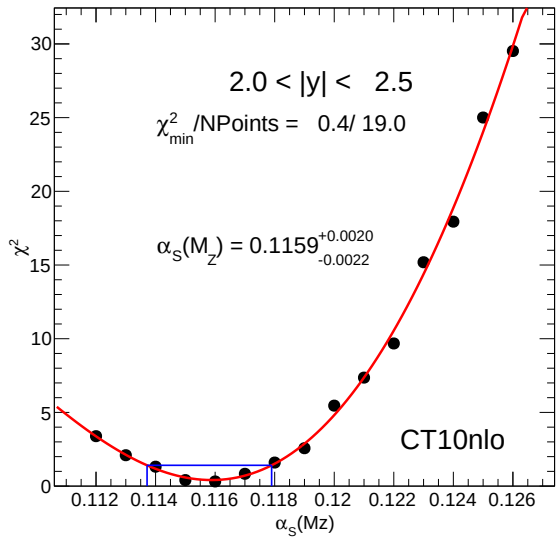
PDF Uncertainty for CT10-NLO

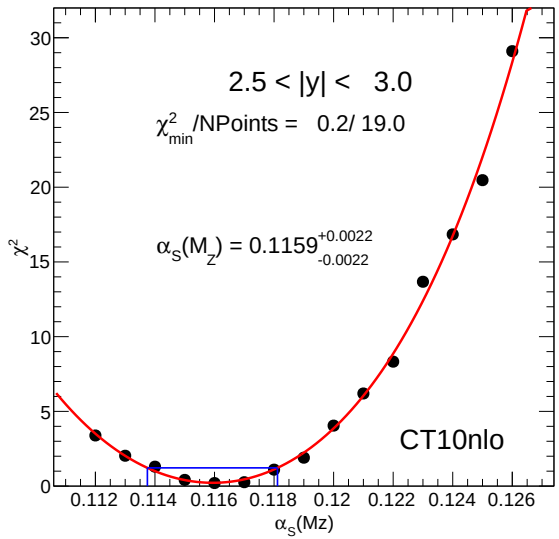






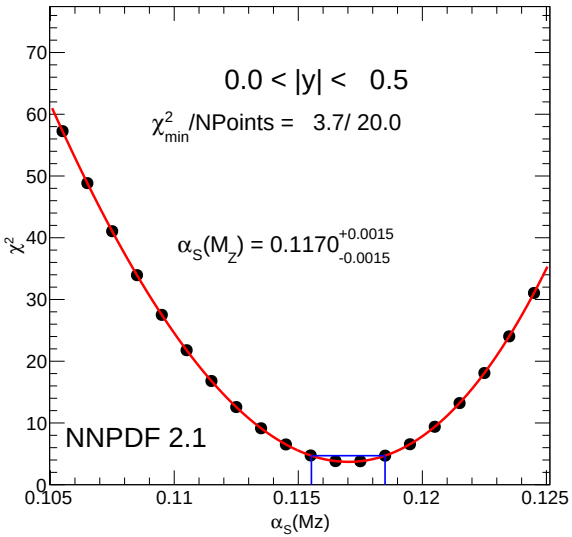


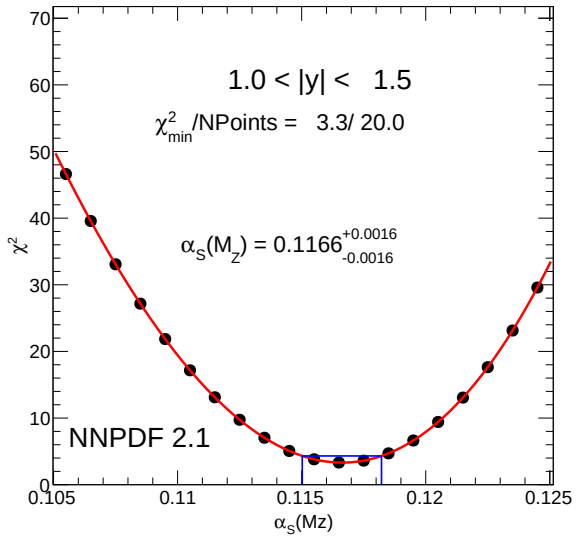


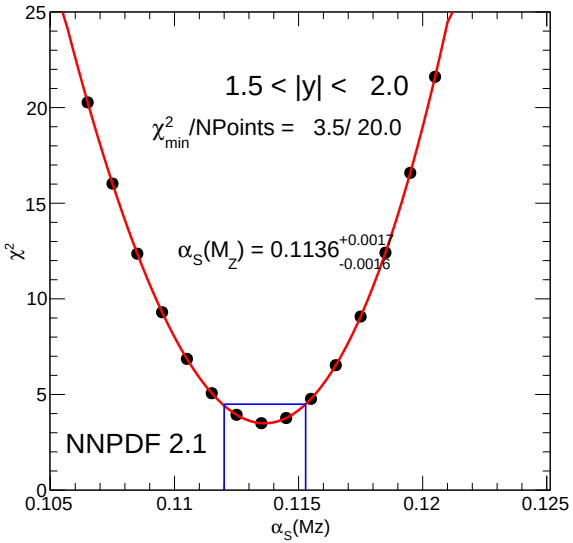


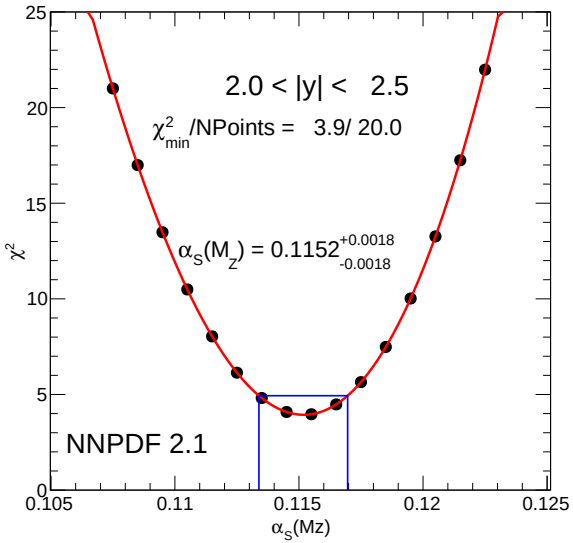
Basic χ^2 plots after removing PDF from Cov matrix, for NLO CT10 PDF.

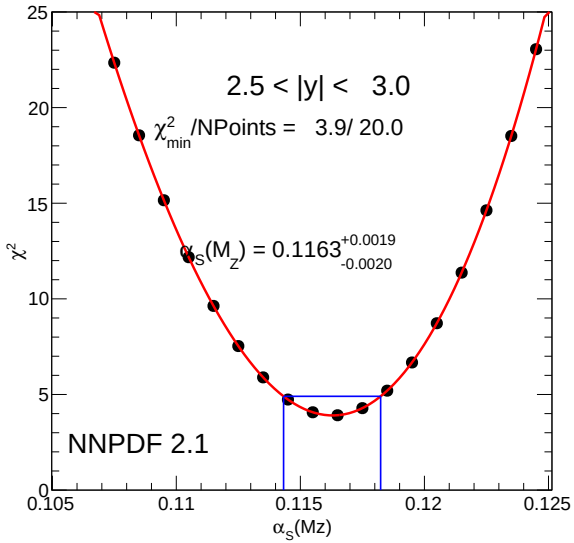
JES Uncertainty for NNPDF





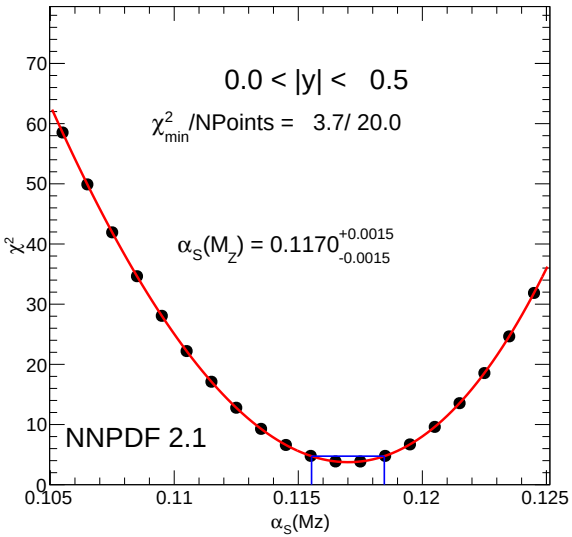


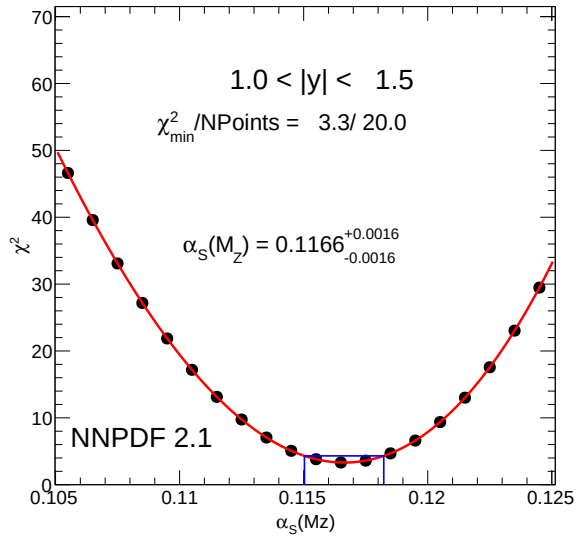


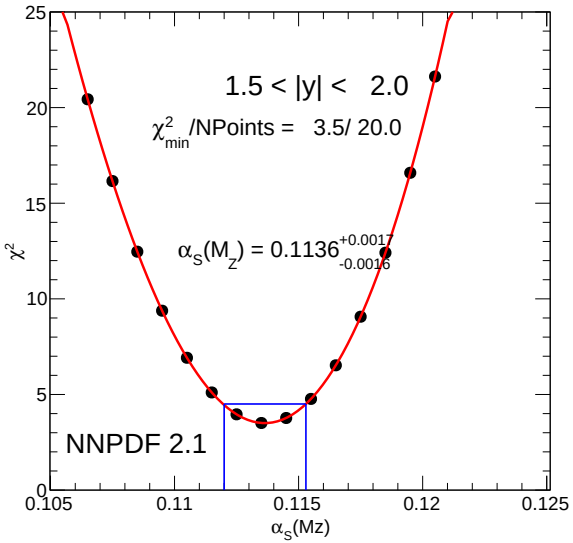


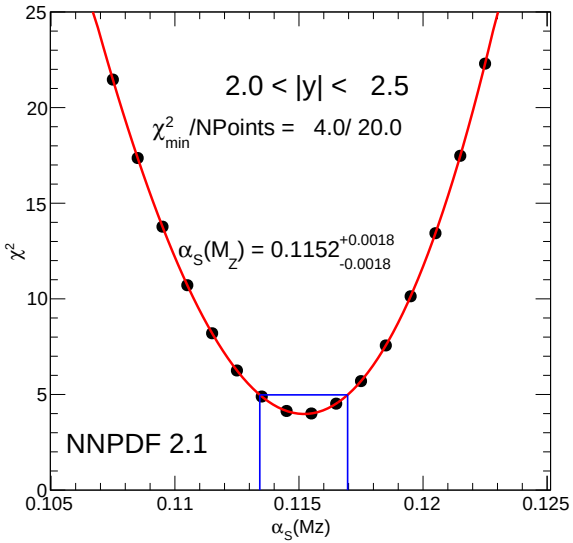
Basic χ^2 plots after removing JES from Cov matrix, for NNLO NNPDF PDF.

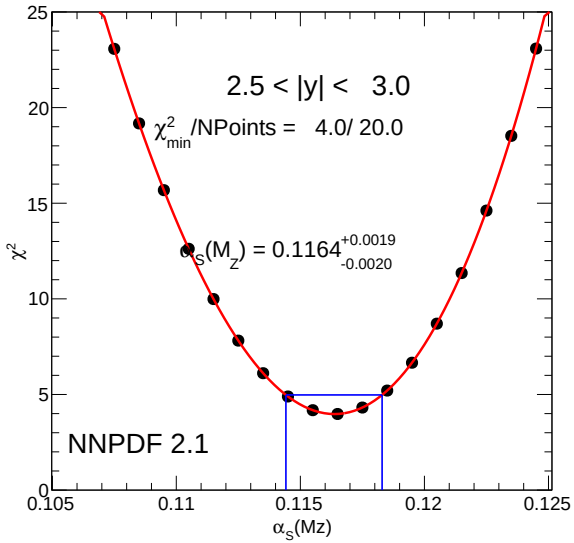
PDF Uncertainty for NNPDF











Basic χ^2 plots after removing PDF from Cov matrix, for NNLO NNPDF PDF.

Uncertainty Table for CT10-NLO

YBin	JES	PDF	SCALE
0.0 - 0.5	$^{+0.0030}_{-0.0040}$	$^{+0.0020}_{-0.0022}$	± 0.0014
0.5 - 1.0	$^{+0.0035}_{-0.0038}$	$^{+0.0022}_{-0.0029}$	± 0.0012
1.0 - 1.5	$^{+0.0037}_{-0.0039}$	$^{+0.0021}_{-0.0025}$	± 0.0015
1.5 - 2.0	$^{+0.0036}_{-0.0040}$	$^{+0.0025}_{-0.0031}$	± 0.0019
2.0 - 2.5	$^{+0.0034}_{-0.0036}$	$^{+0.0023}_{-0.0032}$	± 0.0028
2.5 - 3.0	$^{+0.0025}_{-0.0029}$	$^{+0.0026}_{-0.0028}$	± 0.0030

Remarks

Summary

- A re-evaluation of experimental uncertainty on measured cross-section carried out.
- The uncertainty band looks reasonable except last y bin for low p_T region.
- The JES factor found to be dicontinuous for the last y bin for low p_T region.
- An evaluation of JES, PDF and SCALE uncertainty is determined for the $\alpha_s(M_z)$ fitting.

Future Plans:

- The correlation of new flavor components of uncertainty has to be evaluated.
- The uncertainty on $\alpha_s(M_z)$ for other PDF sets has to be determined.
- We will proceed to study the $\alpha_s(Q)$ evolution with scale.