

QCD

(1) PDF's

- (a) current knowledge and uncertainties **S**
- (b) likely improvements from LHC data, particularly precision Drell-Yan measurements **M**
- (c) PDF luminosities and uncertainties for 14, 33 and 100 TeV **S**
- (d) improvements from an LHeC (including α_s) **S**

(2) Cross sections at 14, 33 and 100 TeV

- (a) MCFM LO, NLO **S/M**
 - scale, PDF and α_s uncertainties?
 - comparisons to BFKL predictions a la HEJ
- (b) NLO, NNLO and beyond **S/M**
 - NLO extrapolation to higher parton multiplicities
 - improvements in NLO+PS, a la CKKW->comparisons
 - Higgs(+jets) cross sections as function of energy
 - importance of BFKL logs as a function of energy
- c) perturbative series convergence for boosted final states **M**

(3) Higgs+jets uncertainties

- (a) resummation of jet veto logs->pointing to a new scheme for Higgs+jets uncertainties? **M**
- (b) importance of jet veto logs as a function of energy **M**

(4) NLO QCD+NLO EW **M**

- (a) wishlist? putting current calculations together in one framework **S/M**
- (b) impact of the 'Sudakov zone' as a function of energy; gamma gamma processes **M**

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(1) PDF's

(a) current knowledge and uncertainties

central values and uncertainties are in general agreement between the 3 most widely used PDFs, CT10, MSTW08 and NNPDF2.3; there is room for improvement for the gluon distribution, especially in the range for Higgs production through gg fusion; the differences between the groups are mostly due to treatment of fixed target DIS data and is under investigation; collider-only fits are in better agreement but with much larger uncertainties; the use of META-PDFs may serve to greatly simplify theoretical comparisons; more conclusions should be available by Minneapolis

(b) likely improvements from LHC data, particularly precision Drell-Yan measurements

the LHC high luminosity jet data, especially after the NNLO jet cross section calculation is completed, will serve as a constraint on the gluon distribution, as will the $t\bar{t}$ rapidity and mass distributions, once that NNLO calculation is available; DY data will also be important but calculation of QCD+EWK corrections is necessary for high mass; for quark distributions, it will be hard to compete with the precision of the HERA data

(c) PDF luminosities and uncertainties for 14, 33 and 100 TeV

the exercise has been carried out and uncertainties for the higher energies are reasonable for most physics processes, except at low x and high x , where input from an LHeC be useful

(d) improvements from an LHeC (including α_s)

an LHeC will allow precision measurement of PDFs over complete kinematic range needed for 14 TeV and higher energies, plus the possibility of a per mille accuracy on α_s

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(2) Cross sections at 14, 33 and 100 TeV

(a) MCFM LO, NLO

-scale, PDF and α_s uncertainties?

-comparisons to BFKL predictions a la HEJ

NLO corrections for processes involving vector bosons and jets should be reasonably stable as the center-of-mass energy increases, as long as the jet threshold increases with the energy, but the K-factors for $W/Z+\gamma$ increase rapidly with increasing energy; more results, including comparisons with HEJ should be available by Minneapolis

(b) NLO, NNLO and beyond

better approximations available for calculation of $gg \rightarrow$ Higgs to NNNLO; full calculation available in 1-2 years; resumming BFKL-type logs in addition to threshold logs leads to greater scale stability for resulting cross sections

-NLO extrapolation to higher parton multiplicities

-improvements in NLO+PS, a la CKKW- \rightarrow comparisons

-Higgs(+jets) cross sections as function of energy

-importance of BFKL logs as a function of energy

conclusions for the above should be available by Minneapolis

(c) perturbative series convergence for boosted final states

application of typical boost cuts for searches such as WH greatly restricts the phase space such that resummation is necessary for any accurate prediction; relevant resummation studies underway; more information may be available by Minneapolis

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(3) Higgs+jets uncertainties

- (a) resummation of jet veto logs \rightarrow pointing to a new scheme for Higgs+jets uncertainties?
a great deal of theoretical work is going on this summer and a new scheme should result in the near future, possibly by the time of Minneapolis
- (b) importance of jet veto logs as a function of energy
more information should be available by the time of Minneapolis

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(4) NNLO QCD+NLO EW

(a)wishlist? putting current calculations together in one framework

a new wishlist for NNLO QCD calculations, including 2->3 processes, along with needed electroweak corrections was constructed at Les Houches, and will be discussed at Minneapolis; one of the key aspects is whether the EWK corrections factorize with the higher order QCD corrections; this is known explicitly only for a few processes

(b)impact of the 'Sudakov zone' as a function of energy; gamma gamma processes

Sudakov logs can be used as an approximation for the full NLO EW corrections in the Sudakov regime, where s and t are both large; they fail when s is large but t is not; Sudakov log effects can be easily included in Monte Carlos such as ALPGEN; new photon PDFs are coming out from NNPDF and CT; NNPDF indicates that the photon PDF is smaller than MRST2004qed at low x , and similar at high x