Discussion Benchmark cross sections

Motivation

Different theoretical approaches for for heavy flavour cross-sections
each approach typically available both for HERA and LHC
An incomplete set of those with full differential prediction reported here:

Model	HERA γp	HERA DIS	LHC
LO(massless)+PS	Pythia	Pythia, Lepto	Pythia
LO+PS+MI	Pythia/JIMMY		Pythia/JIMMY
LO(massive)+PS	Pythia	Rapgap, Aroma	Pythia
CCFM MC (Cascade)	X	X	X
NLO	FMNR	HVQDIS	HVQMNR
FONLL	X		X
NLO(massive)+PS	(MCaNLO ?)		MCaNLO
Massless (KK)	X		X
K_T factorization			X
Enhancment at low-x		?	X
Saturation at Low-x Kutak			X

Motivation 2

It would be nice to have in the workshop proceedings prediction from all these different models for a given set of observables:

- **Direct way to compare features of different models and show regions of (un)compatibility**
- **show in a single place how the same approach works for HERA and LHC**
- **are two models equivalent for LHC but not for HERA and vice-versa ?**
- **Collect all available prediction in a "reference" book**

To do this we need to:

- **Define a standard set of observables, the "benchmark cross sections", typically differential cross sections after some cut**
- **Ask theorists or in general who has access ro the programs to calculate prediction for the different models**
- **predictions should have uncertainty bands or at least provide a set of curves for different (reasonable) parameter choices**

Which cross sections ?

Not too far from experimental observables

Not too complicate

i.e don't repeat exactly expt. cuts (as in JetWeb)

Basic observables such as $d\sigma/dp_T$ in a given y range

Interesting observables to spot particular regions where models may differ

the number of cross sections should not be too large (< 10)

Quark or hadron cross sections or both ? (I think hadron)

Cross Sections for LHC

Differential cross sections ($d\sigma/dX$, where X:)

Basic:

1.1) p_T **central rapidity** $|y| < 2.5$ **(ATLAS/CMS)**
1.2) p_T **large rapidity** $2.5 < |y| < 4.5$ **(LHC-B)**
1.3) y **for** $p_T > 2$ **GeV ? (LHC-B/Alice)**

need special Alice range ?
different cuts for charm and b ?

Correlations:

observables sensitive to intrinsic k_T **and g splitting:**
1.4) $p_T(Q + \bar{Q})$
1.5) $\Delta\phi(Q - \bar{Q})$

observables sensitive to 4b production:
1.6) $\Delta y(QQ)$

Cross Sections for HERA (γp)

Basic cross sections:
2.1) p_T **for** $|y| < 1.5$**,** $130 < W < 300$**GeV,** $Q^2 < 1$**GeV**^{2} **(range of existing** D^* **mesurements)**
2.2) y **for** $p_T > 2$ **GeV,** $130 < W < 280$**GeV,** $Q^2 < 1$**GeV**^{2}

More complex vars:
x_γ **is interesting but beyond a very simple implementation of Heavy Hadron cross sections**

Correlations:
2.3) $p_T(Q + \bar{Q})$ **and/or**
2.4) $\Delta\phi(Q - \bar{Q})$

(in which range ?)

...

Cross Sections for HERA (DIS)

Here it's more complex: many variables (x, Q^2 and y, p_t, ϕ of the HQ)
I see two possible choices:
a) plot y,p_T for ranges in x, Q^2 ?
b) fix a range in y, p_T and plot x, for different Q^2 ?

Option b) is probably better:

1.1-4) x **for** $Q^2 = 1, 10, 100, 1000$ **GeV**^{2}**,** $p_T > 1.5$**,** $|y| < 1.5$
similar to "visible" F_2^c

with or without EW corrections ? (without)

Let's discuss and see ...

14×2**(b+c) cross section proposed, too many ?**

remove some, propose some new

fix standard PDFs, α_S, m_b, m_c ?

find who does what !