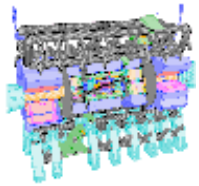
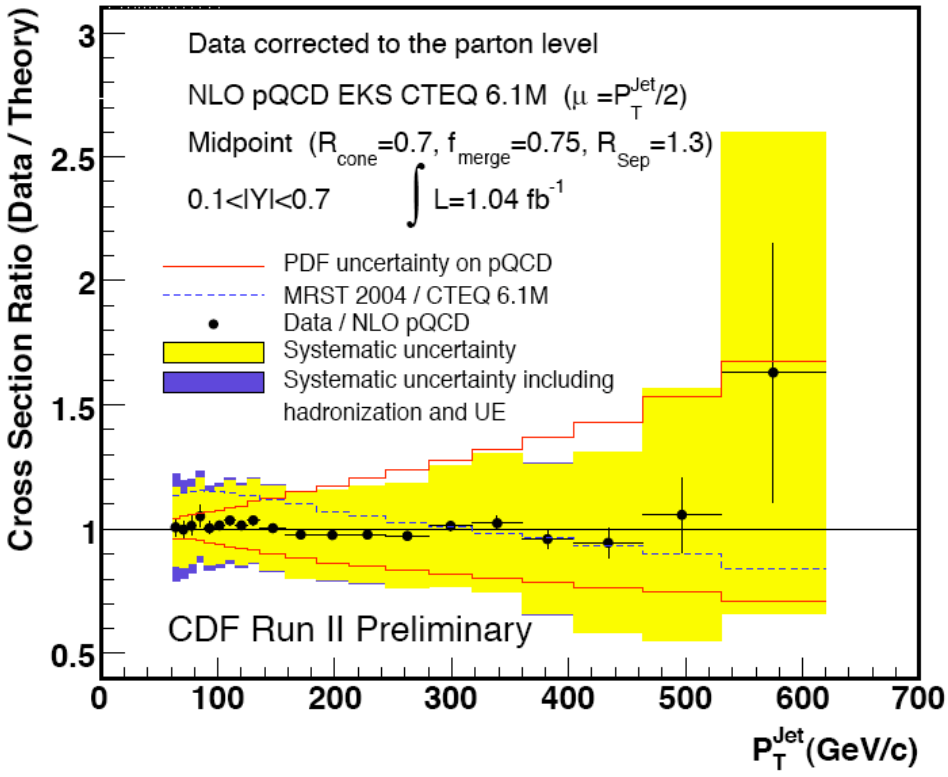


CDF jets and some other issues

J. Huston

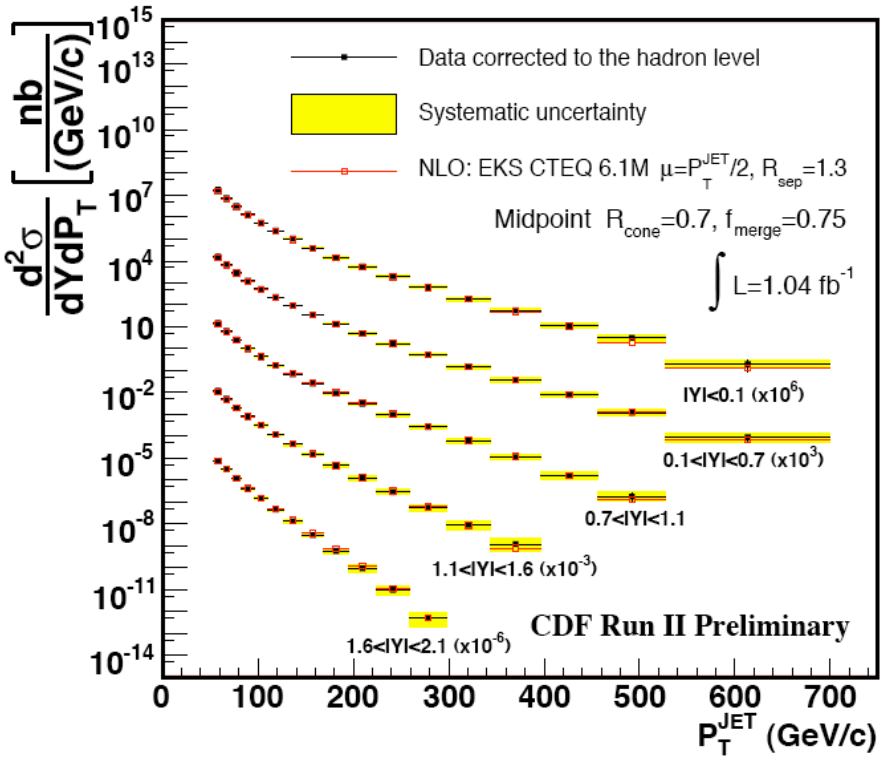
Cone jets

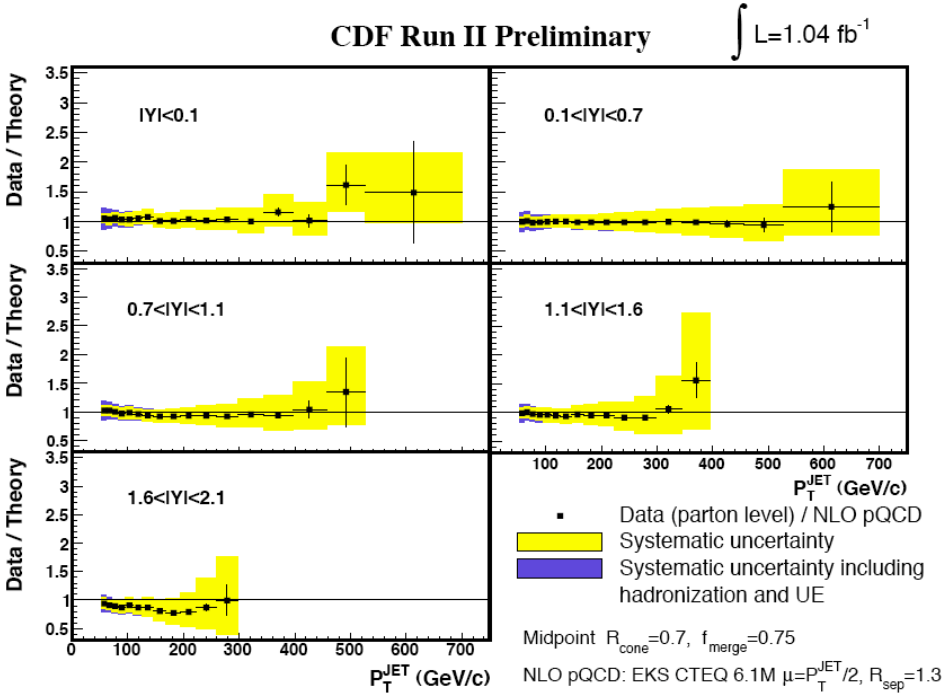
- Data cross section results for 1 fb^{-1} of data
  - first analysis in CDF to use > 1 fb^{-1}
- Excellent agreement with CTEQ6.1 predictions in the central region
  - extends 150 GeV/c further than Run 1
  - pdf uncertainties ~ systematic uncertainties; dominated by eigenvector 15

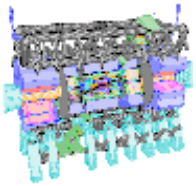


More cone jets

- Measurement has been extended to forward rapidities as well
  - again good agreement with CTEQ6.1

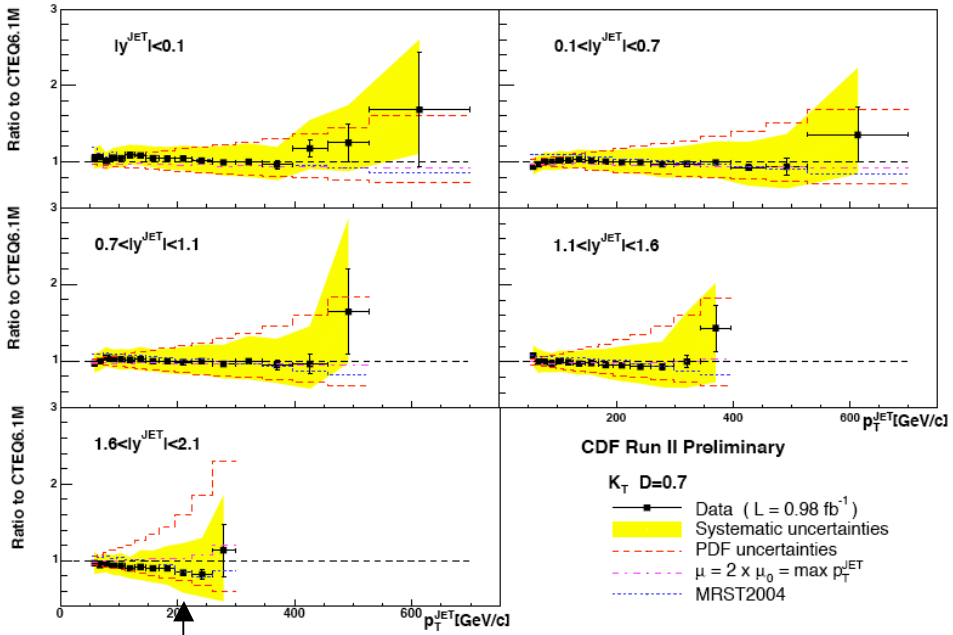




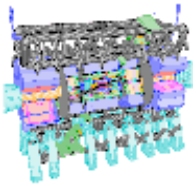


k_T jets

- Also good agreement with k_T jet analysis
- In fact, agreement with NLO theory is almost exactly the same for the two jet algorithms
- k_T algorithms can be used in a hadron-hadron collider enviroment
  - caveat: needs to be checked at lower p_T and in presence of (many) extra min bias events
  - existing correction technique won't work there



…note pdf errors >> systematic errors



So what's the problem(s)

- Matching a cone algorithm at (NLO) parton level and at detector level
- Parton configurations that will be included in a jet at NLO will not be at hadron level due to stochastic smearing because of parton showering/hadronization
- ~10% effect on the data/theory cross section comparison, so not negligible
- Modified midpoint algorithm uses smaller initial search cone, reduces unclustered energy, but is more IR-sensitive
  - default midpoint algorithm has ~2% of 400 GeV/c dijet events with >50 GeV/c of unclustered energy

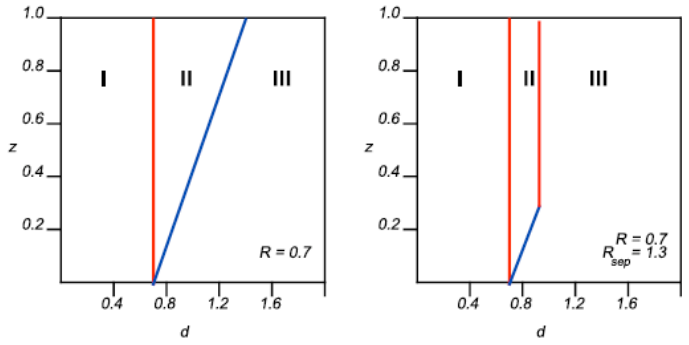
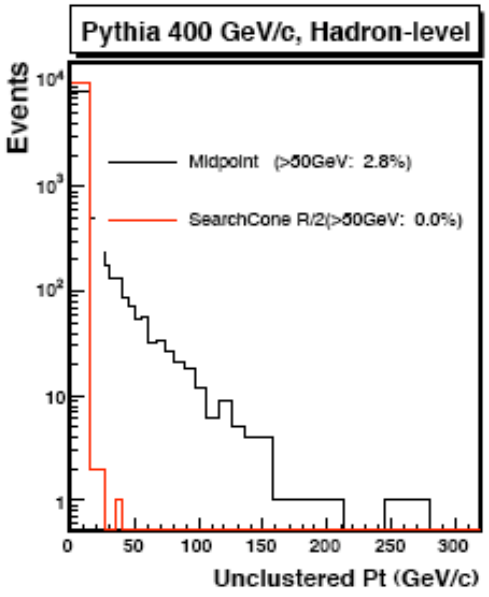
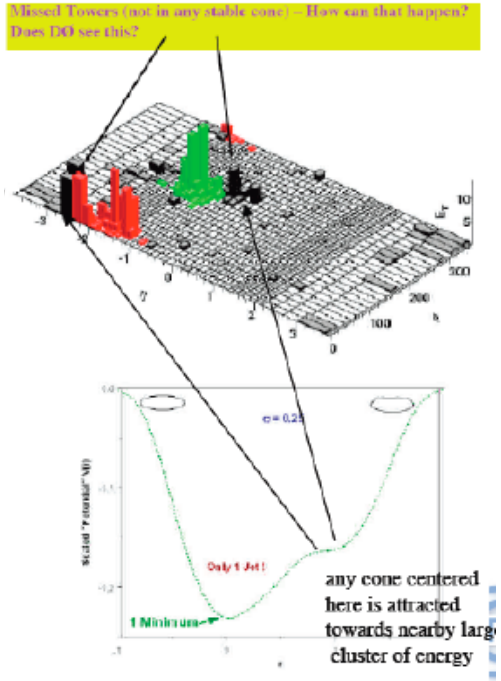


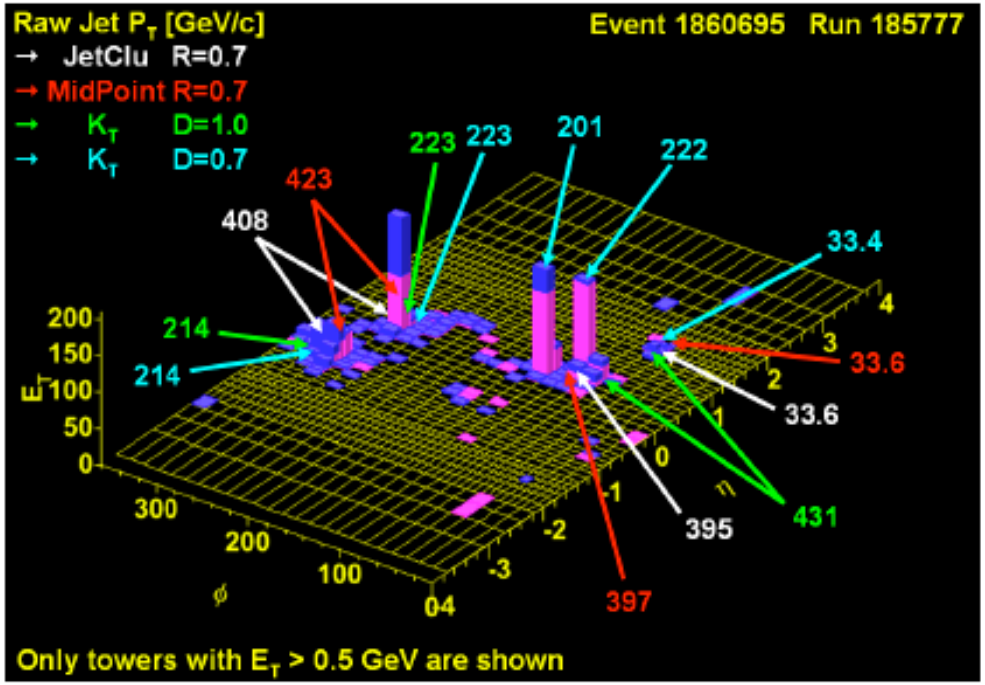
Figure 15. The parameter space (d,Z) for which two partons will be merged into a single jet.





Can't we all just get along?

- I still believe that at the LHC, need both k_T and cone jet algorithms
- Can we come up with a cone algorithm everyone is happy with?
  - or not too unhappy with?



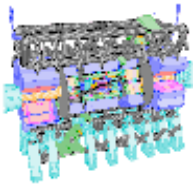
- Trying to summarize/think for TeV4LHC writeup
- Meeting to consider jet algorithms for LHC at CERN on July 19

Some other issues

- Still working on Standard Model Benchmarks for the LHC
  - www.pa.msu.edu/~huston/Les_Houches/Les_Houches_SM.html
  - North American ATLAS Standard Model and Higgs meeting here at ANL 2 weeks ago
    - ANL is ATLAS ASC
    - I'm one of co-convenors

Roadmap for early ATLAS physics

- End at **Stockholm**
- **Total Est. Time:** 18 hours, 50 minutes
- **Total Est. Distance:** 1264.67 miles



Some other issues

- Almost finished with review paper on LHC physics with James Stirling and John Campbell
  - www.pa.msu.edu/~huston/hard_interaction/
  - I have some copies of Section 3 with me for criticism

Lots of useful stuff: pdf luminosities and uncertainties

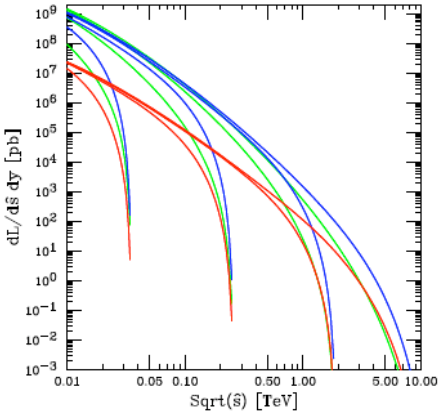


Figure 6. dLuminosity/dy at $y = 0, 2, 4, 6$. Green=gg, Blue=$g(d + u + s + c + b) + g(\bar{d} + \bar{u} + \bar{s} + \bar{c} + \bar{b}) + (d + u + s + c + b)g + (\bar{d} + \bar{u} + \bar{s} + \bar{c} + \bar{b})g$, Red=$d\bar{d} + u\bar{u} + s\bar{s} + c\bar{c} + b\bar{b} + \bar{d}d + \bar{u}u + \bar{s}s + \bar{c}c + \bar{b}b$.

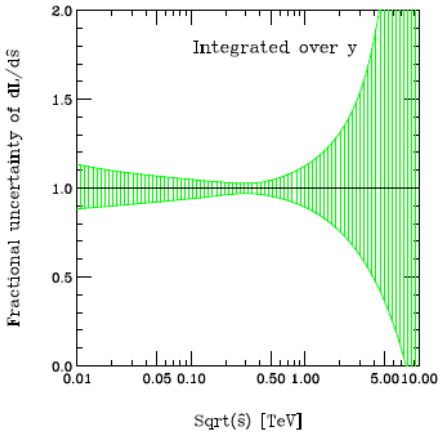
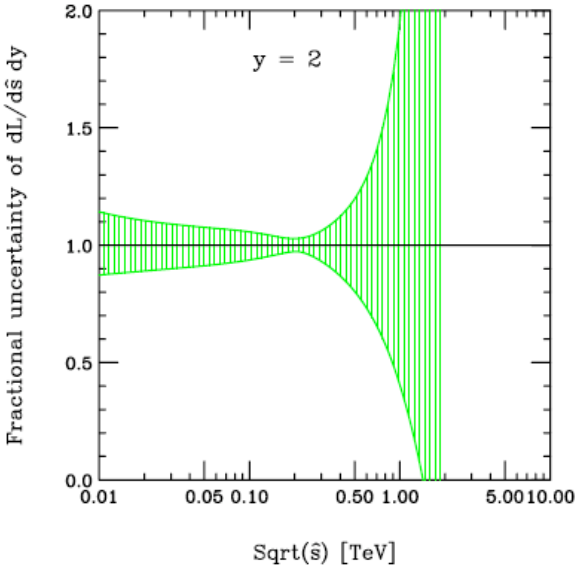
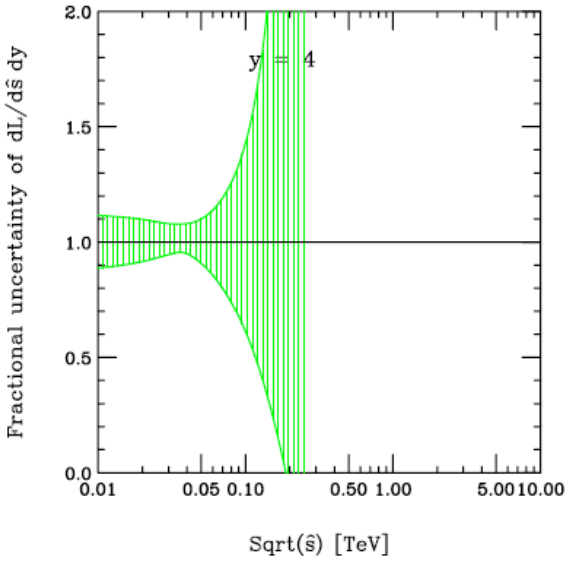
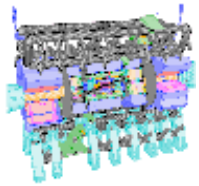


Figure 7. Fractional uncertainty of the gg luminosity integrated over y.







Sudakov form factors

- Since most collisions at the LHC will be at small x, high Q^2 and involving gluons, there will be a large probability of emitting reasonable p_T gluons, i.e. the Sudakov suppression for not emitting them will be large
- Note that I did not bother plotting below x=0.03 for the quark Sudakov
  - quiz question 1: why?

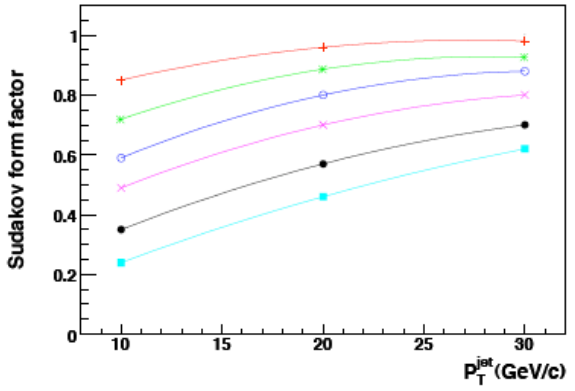


Figure 11. The Sudakov form factors for initial state gluons at a hard scale of 100 GeV/c as a function of the transverse momentum of the emitted gluon. The form factors are for (top to bottom) parton x values of 0.3,0.1,0.03,0.01,0.001 and 0.0001.

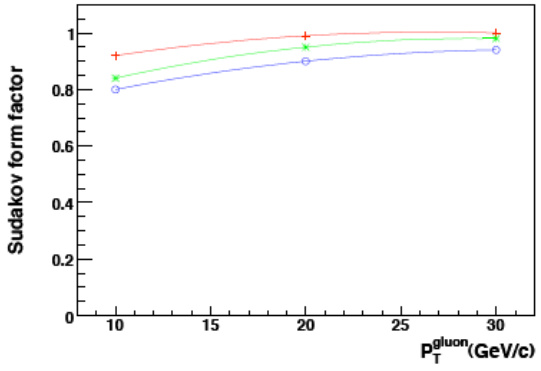


Figure 13. The Sudakov form factors for initial state quarks at a hard scale of 100 GeV/c as a function of the transverse momentum of the emitted gluon. The form factors are for (top to bottom) parton x values of 0.3,0.1 and 0.03.

Quiz question 2

- What's the difference between the upper and low set of diagrams?
- Related question: at what rapidity does ISR peak?

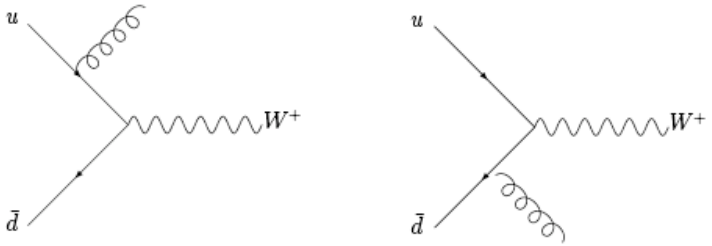


Figure 1. Lowest order diagrams for the production of a W and one jet at hadron colliders.

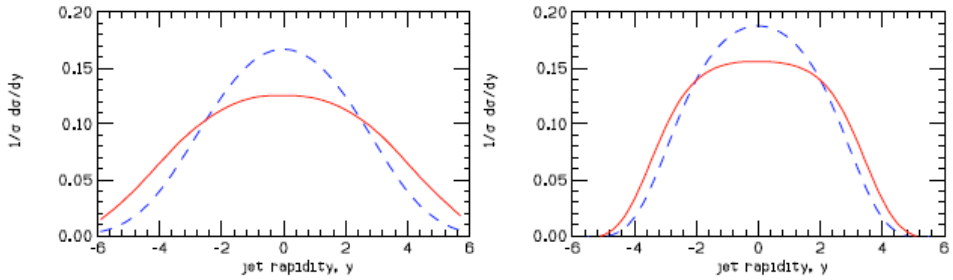


Figure 2. The rapidity distribution of the additional parton found in the real radiation corrections to Drell-Yan production of a W at the LHC. The parton is required to have a p_T larger than 2 GeV (left) or 50 GeV(right). Contributions from $q\bar{q}$ annihilation (solid red line) and the qg process (dashed blue line) are shown separately.

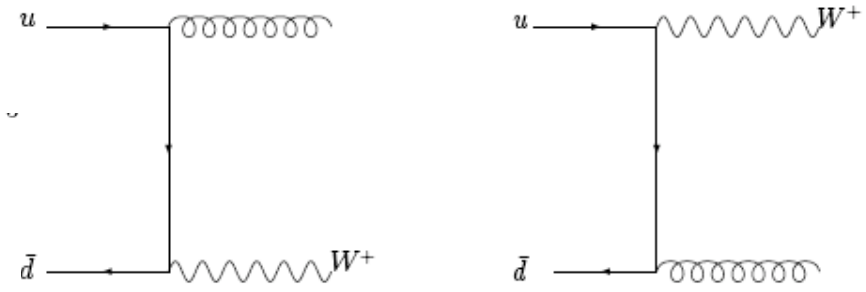


Figure 3. An alternative way of drawing the diagrams of Figure 1.