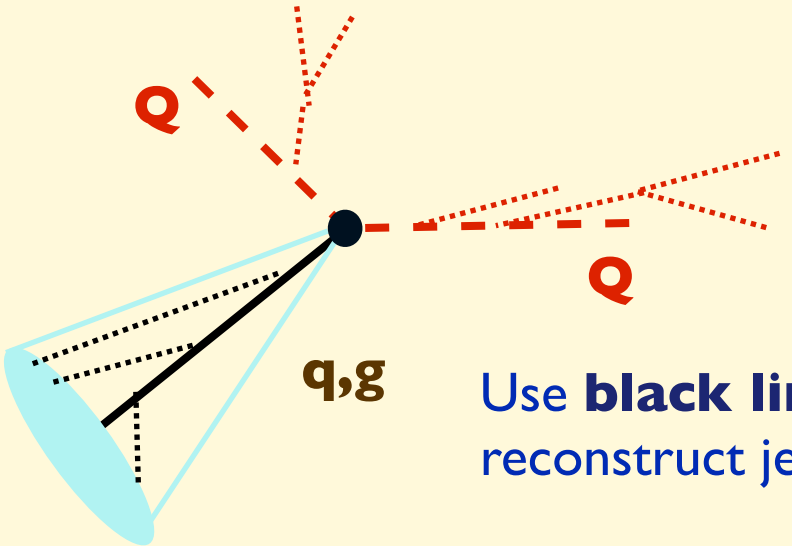
Alpgen treatment of heavy quarks -- M.L. Mangano

Final states and matching

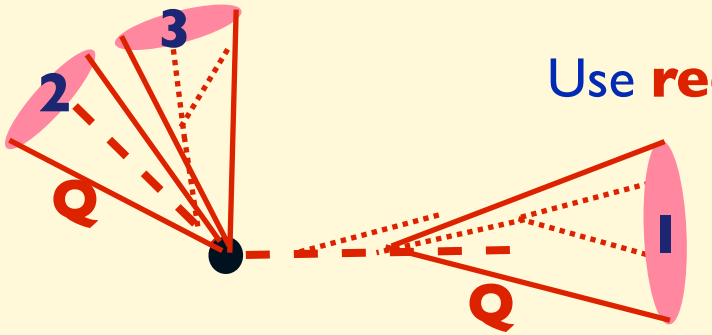
1st pass of merging prescription does not require matching of heavy quarks:



Leave **red lines** (hvq shower daughters) out of jet reconstruction

Use **black lines** (ISR+light-parton FSR) to reconstruct jets for matching

2nd pass of merging clusters the heavy quark shower daughters:

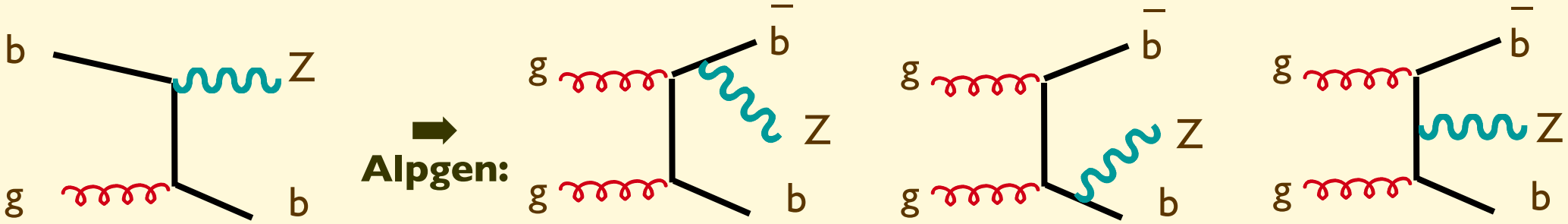


Use **red lines** only to reconstruct jets

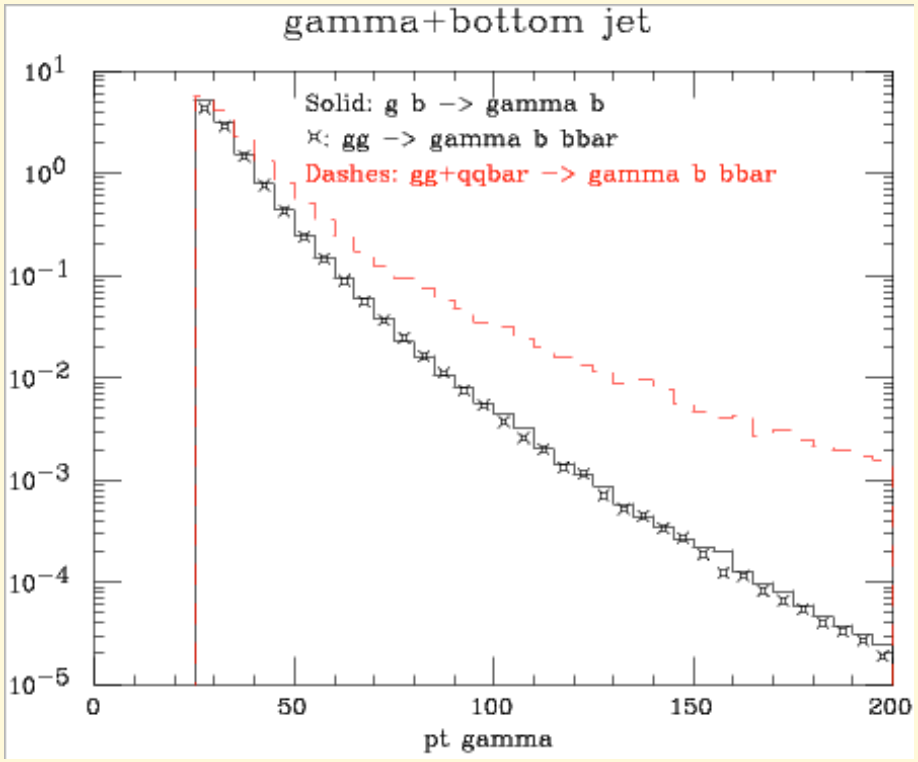
* If jet contains the heavy quark itself (e.g. **1** and **2**), keep event
* If jet does not contain the heavy quark itself (e.g. **3**), treat it as extra jet:
  - reject event if exclusive sample
  - keep if E_T smaller than all matched jets

Initial states

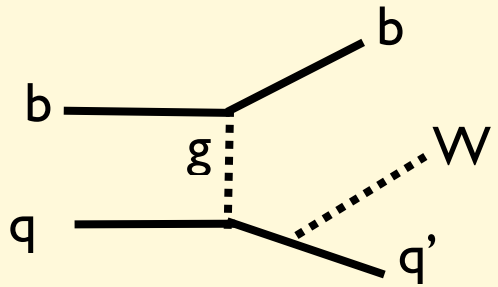
In ALPGEN heavy quarks never appear in the initial state. Processes with initial-state HVQs are produced by higher-order diagrams with initial-state gluon splittings



Comparison of the two approaches for γb:

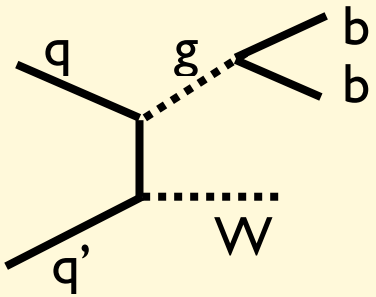


NB: Contrary to Zb and γb, in Wb the LO processes with initial state b quarks have one extra jet:



(included by Alpgen through the gq->Wbbq contribution)

and the LO process has no contribution from initial state b quarks



W+b-jet
CDF analysis

- p_T lepton > 20 GeV , $|\eta_{lepton}| < 1.1$ MET>25 GeV
- p_T jet > 20 GeV , $|\eta_{jet}| < 2$, R=0.4

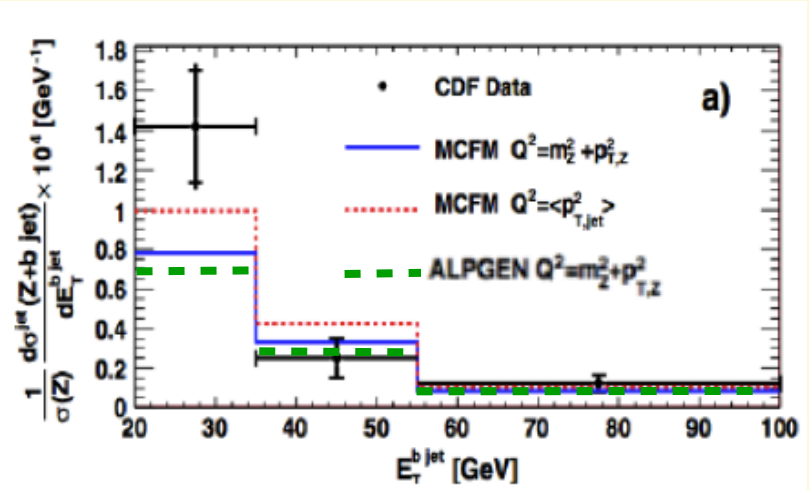
	σ_{Wb} x BR(W→e nu) [pb]
CDF	2.74 ± 0.27 (stat) ± 0.42 (syst)
MCFM	1.22 ± 0.14
Wbb+ Wbb1jet MLM matching with Herwig	$[0.504]_{Wbb} + [0.126]_{Wbbj} = 0.73$

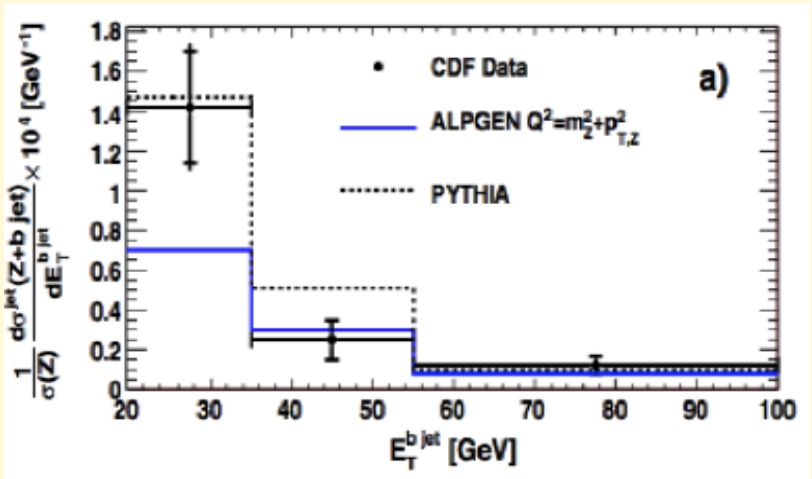
Data/NLO > 2 !!

Data/Alpgen > 3 !!

Z+b-jet
CDF analysis

- E_T jet > 20 GeV
- $|\eta_{jet}| < 1.5$ R=0.7





	CDF	MCFM $Q^2=M^2+p_T^2$	MCFM $Q^2=\langle p_T^2\rangle$	ALP $Q^2=M^2+p_T^2$	ALP $Q^2=\langle p_T^2\rangle$
σ[Z+b-jet] / σ[Z+jet]	2.1 ± 0.4 %	1.8%	2.2%	1.6%	2.3%
σ[Z+b-jet] / σ[Z]	0.33 ±0.07%	0.23%	0.28%	0.21%	0.3%