HERWIG FOR TOP PHYSICS:

PROGRESS REPORT

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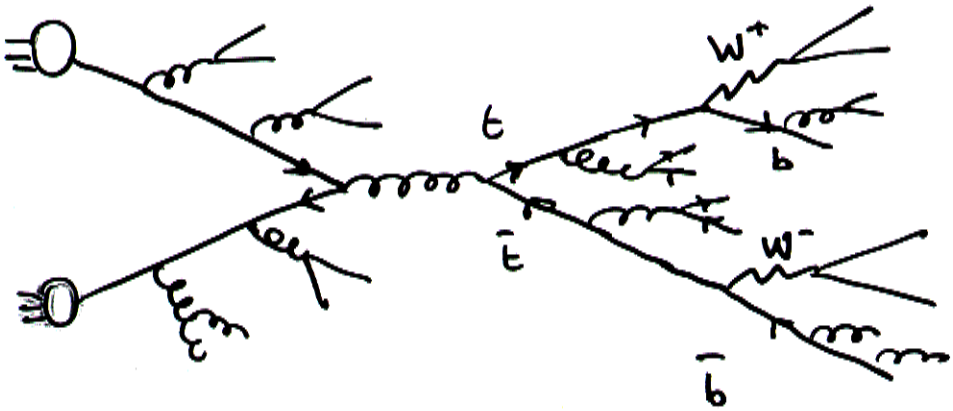
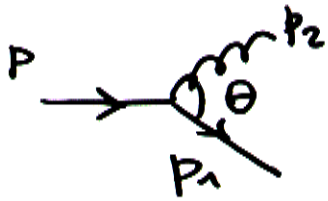
- NEW FEATURES OF HERWIG 6.1 (hep-ph/9912396)
- FUTURE PLANS

TOP PRODUCTION AND DECAY



$2 \to 2$ PROCESS: EXACT MATRIX ELEMENT

GLUON RADIATION IN THE SOFT/COLLINEAR APPROXIMATION



$$z = \frac{E_2}{E}$$

$$dP = \frac{\alpha_s}{2\pi} P(z)\, dz \frac{d\cos\theta}{1-\cos\theta} \Delta_s(\theta_{max}, \theta) \qquad P(z) = C_F \frac{1+(1-z)^2}{z}$$

HERWIG: ANGULAR ORDERING

EMISSION FOR $\theta \lesssim \frac{\pi}{2}$

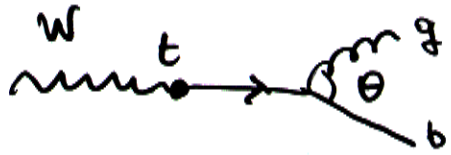
NO RADIATION FOR $\frac{\pi}{2} < \theta < \pi$: DEAD ZONE

MATRIX-ELEMENT CORRECTIONS

TOP DECAYS IN HERWIG

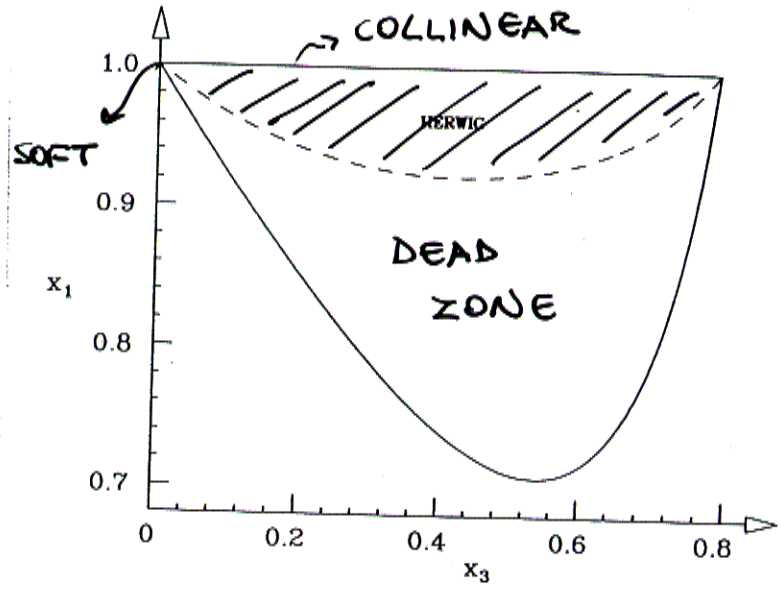
TOP REST FRAME : NO RADIATION FROM THE

b EMITS SOFT GLUONS AT $0 < \theta < \pi/2$



TOTAL ENERGY LOSS ROUGHLY RIGHT

$\Delta = \frac{\alpha_s}{2\pi}(1-\log 2)$, BUT NOT ANGULAR DISTRIBUTIONS



$t(q) \to W(p_1)\, b(p_2)\, g(p_3)$

$x_1 = \frac{2p_1 \cdot q}{m_t^2} - a$

$x_3 = \frac{2p_3 \cdot q}{m_t^2}$

$a = m_W^2 / m_t^2$

HARD CORRECTIONS: EXACT $\mathcal{O}(\alpha_s)$ $\frac{d^2\Gamma}{dx_1 dx_3}$

IN THE DEAD ZONE

SOFT CORRECTIONS: EXACT $\mathcal{O}(\alpha_s)$ $\frac{d^2\Gamma}{dx_1 dx_3}$

IN THE HERWIG REGION ANY TIME

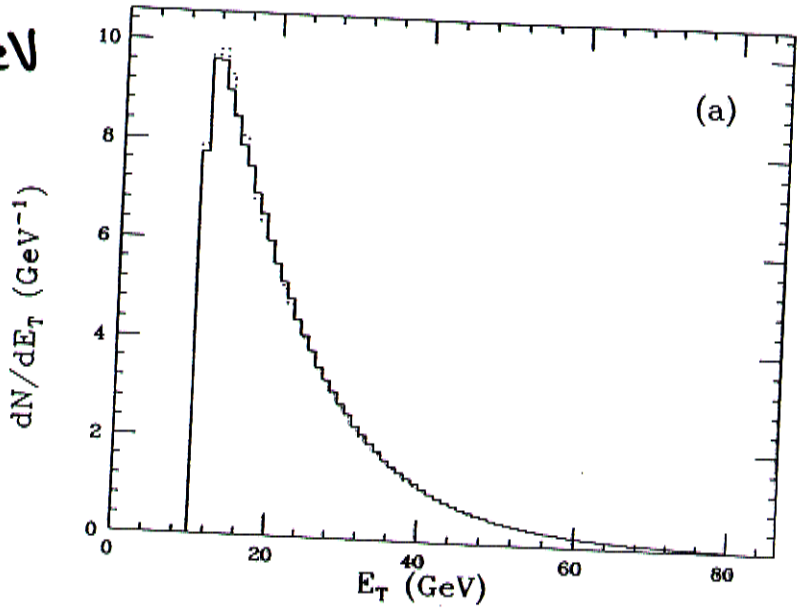
AN EMISSION IS THE "HARDEST SO FAR"

G.C. AND M.H. SEYMOUR, PLB 442 (1998) 417

JET OBSERVABLES IN $t\bar{t}$ EVENTS

TRANSVERSE ENERGY OF THE "THIRD JET"
(k_T ALGORITHM, INCLUSIVE VERSION, $R = 0.5$)

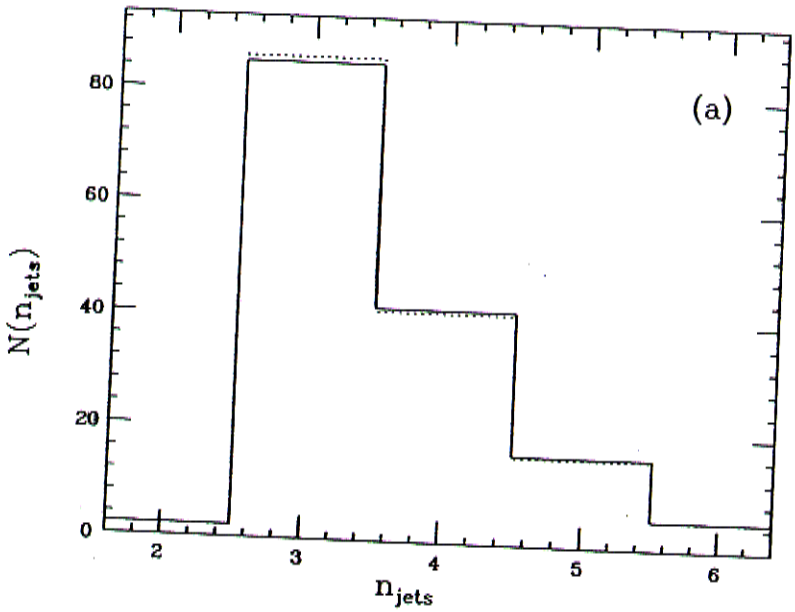
$E_T > 10$ GeV



—— 6.1

.... 6.0

NUMBER OF JETS WITH $E_T > 10$ GeV

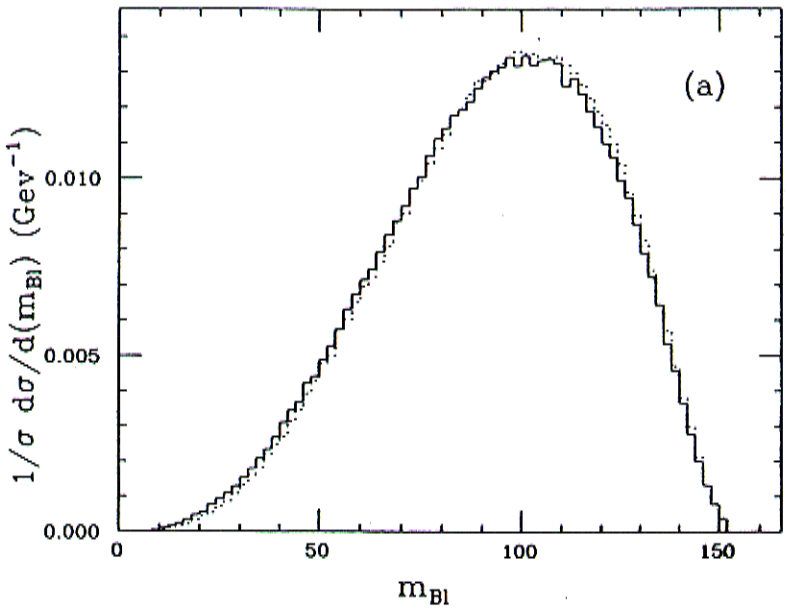


—— 6.1

.... 6.0

SMALL EFFECT OF MATRIX-ELEMENT CORRECTIONS TO TOP DECAYS

INVARIANT MASS DISTRIBUTIONS m_{Be}



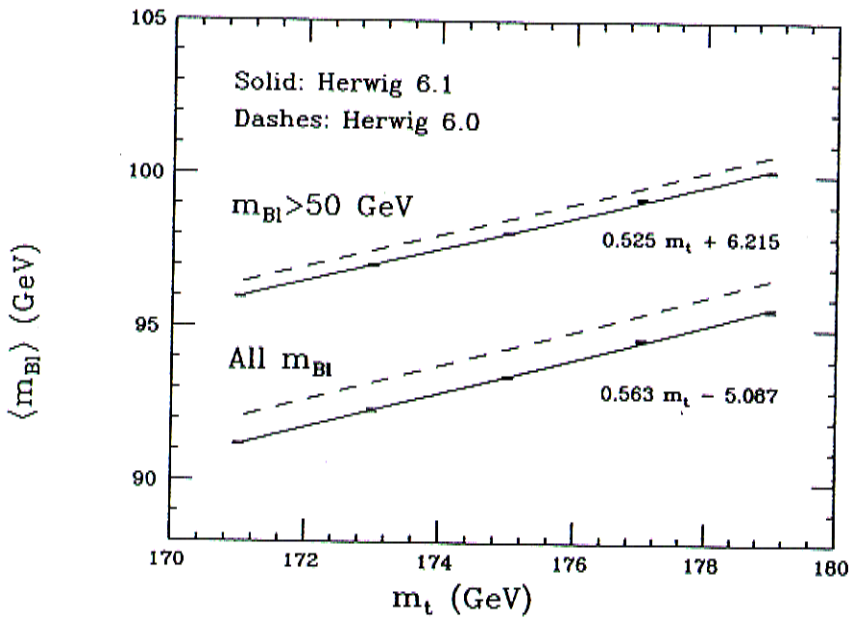
$M_t = 175$ GeV

—— 6.1

.... 6.0

ALL SPECTRUM: $\Delta \langle m_{Be} \rangle \simeq 800-900$ MeV

$m_{Be} > 50$ GeV : $\Delta \langle m_{Be} \rangle \simeq 400-500$ MeV



ALL SPECTRUM: $\Delta m_t \simeq 1.5$ GeV

$m_{Be} > 50$ GeV : $\Delta m_t \simeq 1.0$ GeV

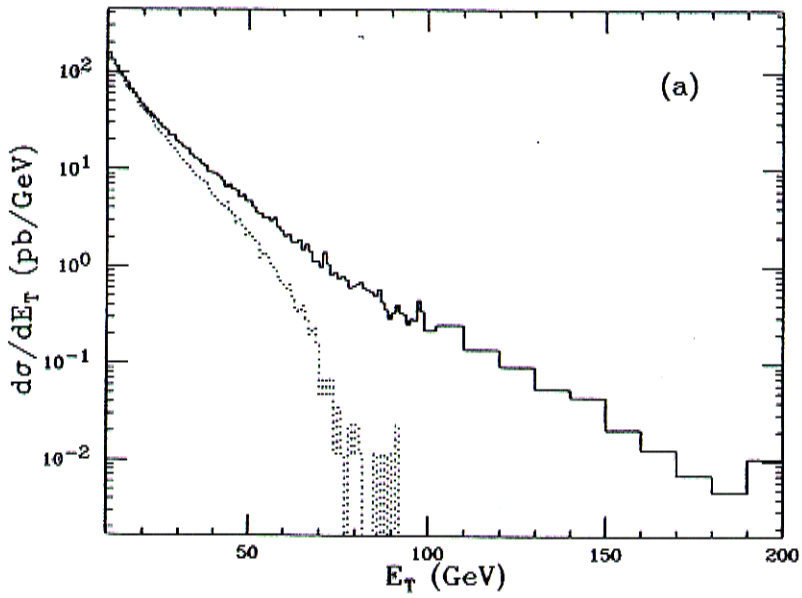
SEE: LHC WORKSHOP (YELLOW REPORT)

A. KHARCHILAVA, PLB 476 (2000) 73

S.C., M.L. MANGANO AND M.H. SEYMOUR, JHEP 0007 (2000) 004

MATRIX-ELEMENT CORRECTIONS TO W/Z PRODUCTION

W+JETS : E_T OF THE "FIRST JET"



— 6.1

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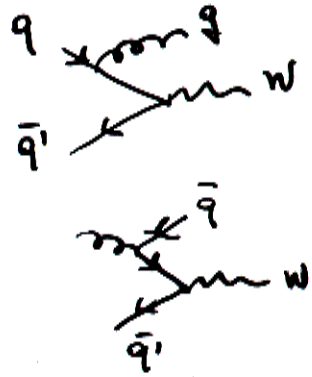
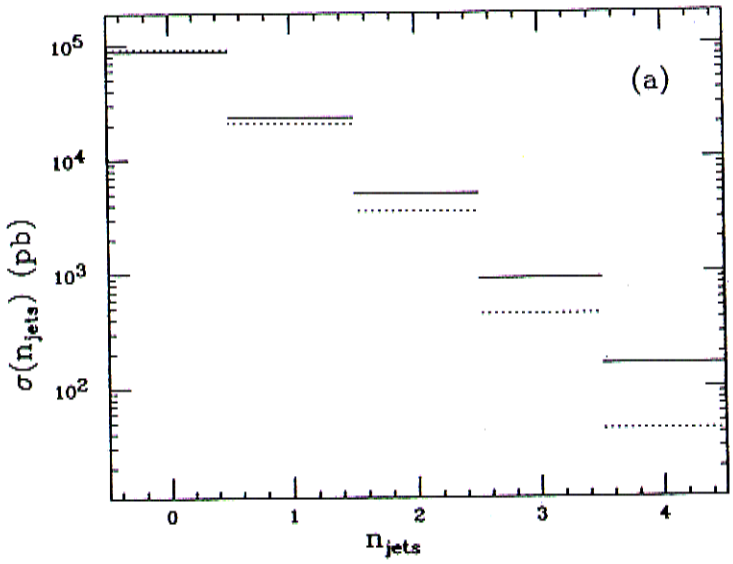


NUMBER OF JETS WITH $E_T > 10$ GeV



3 JETS: ENHANCEMENT OF FACTOR 2

4 JETS: ENHANCEMENT OF FACTOR 4

BIG EFFECT ME CORRECTIONS TO W PRODUCTION

FUTURE PLANS

- MATRIX-ELEMENT CORRECTIONS TO TOP PRODUCTION AND $W \to q\bar{q}'$

- b-QUARK FRAGMENTATION:
TUNING OF HERWIG TO LEP/SLD DATA
NLO CALCULATION $t \to bW(g)$
AND CONVOLUTION WITH THE b FRAGMENTATION FUNCTION (WITH A. MITOV)

- SPIN CORRELATIONS