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Erratum

Erratum to: A phenomenological study of bottom-quark fragmentation in top-quark decay

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Abstract We update the results on the B-lepton invariant-mass distribution in the dilepton channel in top decay, with respect to the ones presented in Corcella and Mescia (Eur. Phys. J. C 65:171, 2010).

The figures and tables on the $m_{B\ell}$ invariant-mass distribution in top decay in [1] referred actually to the $p_B \cdot p_\ell$ scalar product. In the following, we shall present the correct figures and tables.

Figure 1 shows the $m_{B\ell}$ spectrum yielded by tuned and default HERWIG and PYTHIA, for a top mass value $m_t = 175$ GeV. Figure 2 presents the invariant-mass distribution for $m_t = 171$ and 179 GeV, according to HERWIG (a) and PYTHIA (b).

Tables 1 and 2 quote the first four Mellin moments of the m_{Bl} spectra, as given by the tuned versions of HERWIG and PYTHIA, respectively. The average value $\langle m_{B\ell}\rangle$ can be expressed in terms of m_t according to a linear fit, by means of the least-square method, as follows:

$$\langle m_{B\ell}\rangle_{\rm H} \simeq -25.31\ {\rm GeV} + 0.61\ m_t; \qquad \delta = 0.043\ {\rm GeV}, \tag{1}$$

$$\langle m_{B\ell}\rangle_{\rm P} \simeq -24.11\ {\rm GeV} + 0.59\ m_t; \qquad \delta = 0.022\ {\rm GeV}, \tag{2}$$

where δ is the mean square deviation in the fit and the subscripts H and P refer to HERWIG and PYTHIA, respectively. The best-fit straight lines, as a function of m_t, are plotted in Fig. 3. As Tables 1 and 2 tell us that the typical difference between HERWIG and PYTHIA is $\langle m_{B\ell}\rangle \simeq$ 1.2–1.3 GeV, the corresponding uncertainty inferred on m_t can be up to about $\Delta m_t \simeq 2$ GeV, given the slopes of the straight lines in Fig. 3. If we discard the low- and high-$m_{B\ell}$ tails and restrict ourselves, e.g., to the range 50 GeV $< m_{B\ell} <$ 120 GeV, we obtain the truncated moments presented in Tables 3 and 4.

The best linear fits of the average value $\langle m_{B\ell}\rangle$ in terms of m_t read:

$$\langle m_{B\ell}\rangle_{\rm H} \simeq 53.33\ {\rm GeV} + 0.18\ m_t; \qquad \delta = 0.034\ {\rm GeV}, \tag{3}$$

$$\langle m_{B\ell}\rangle_{\rm P} \simeq 55.83\ {\rm GeV} + 0.17\ m_t; \qquad \delta = 0.020\ {\rm GeV}. \tag{4}$$

The corresponding straight lines are plotted in Fig. 4. As the found discrepancy between HERWIG and PYTHIA is about $\Delta\langle m_{B\ell}\rangle \simeq$ 200–300 MeV, the induced uncertainty on the top mass, thinking of extracting it by fitting the mean value $\langle m_{B\ell}\rangle$, amounts to $\Delta m_t \simeq 1.5$ GeV. The results on Δm_t obtained in [1] are therefore confirmed.

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References

1. G. Corcella, F. Mescia, Eur. Phys. J. C **65**, 171 (2010)

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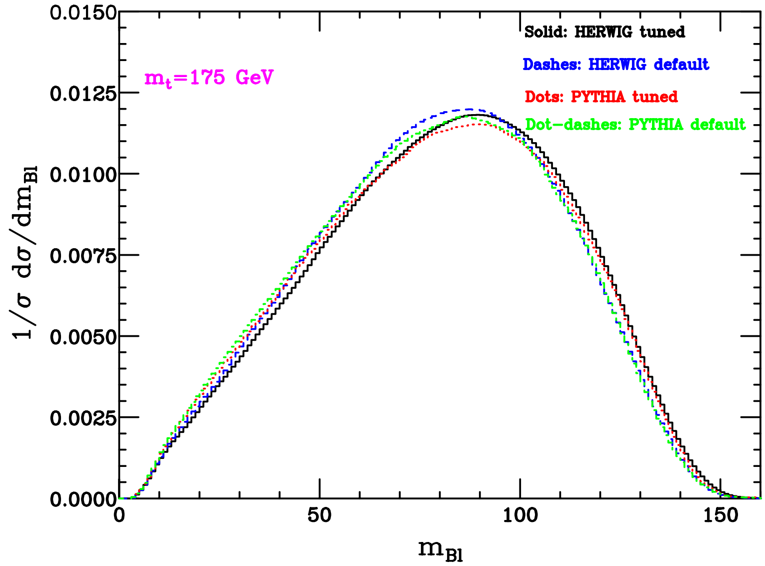

Fig. 1 B-lepton invariant-mass distribution, in top decay and in the dilepton channel, according to tuned and default HERWIG and PYTHIA, for $m_t = 175$ GeV

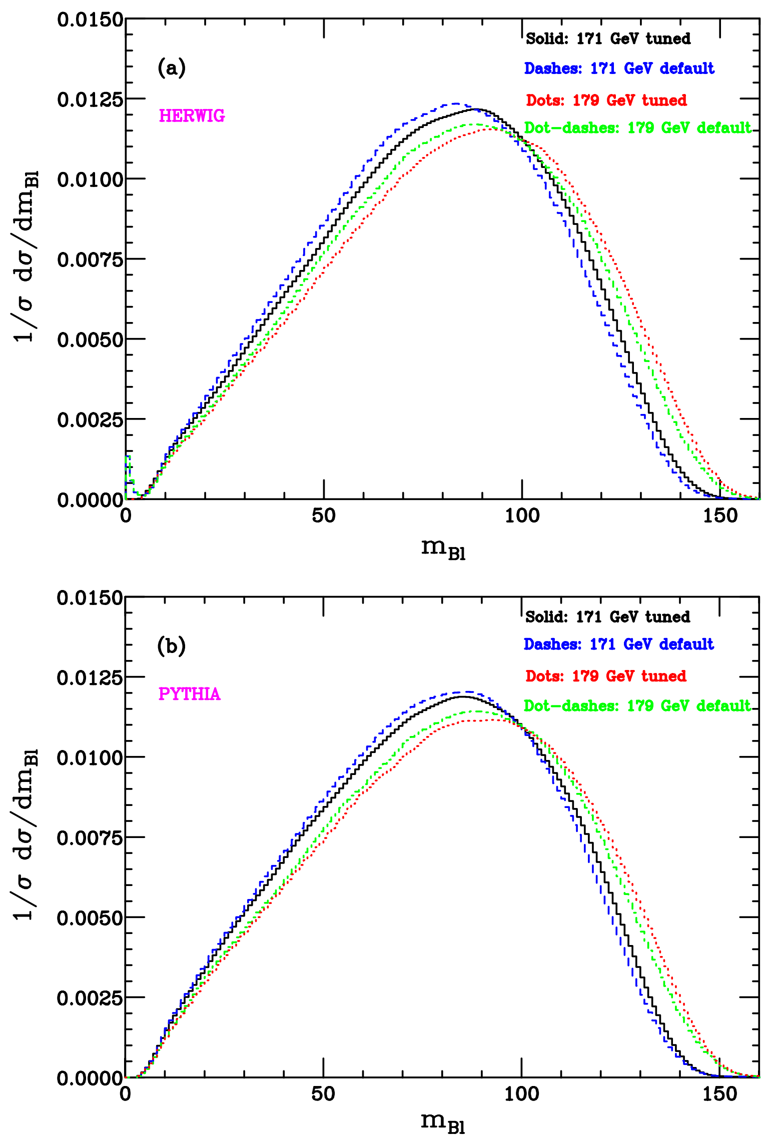

Fig. 2 $m_{B\ell}$ spectrum in top decay for $m_t = 171$ and 179 GeV, according to default and tuned HERWIG (**a**) and PYTHIA (**b**)

Table 1 First four moments of the $m_{B\ell}$ spectrum in top decay, yielded by HERWIG, after tuning the cluster model to ALEPH, OPAL and SLD data, for 171 GeV $< m_t <$ 179 GeV

m_t (GeV)	$\langle m_{B\ell}\rangle$ (GeV)	$\langle m^2_{B\ell}\rangle$ (GeV^2)	$\langle m^3_{B\ell}\rangle$ (GeV^3)	$\langle m^4_{B\ell}\rangle$ (GeV^4)
171	78.39	7.01×10^3	6.82×10^5	7.02×10^8
173	79.52	7.22×10^3	7.12×10^5	7.43×10^8
175	80.82	7.45×10^3	7.46×10^5	7.91×10^8
177	82.02	7.67×10^3	7.79×10^5	8.37×10^8
179	83.21	7.89×10^3	8.13×10^5	8.86×10^8

Table 2 As in Table 1, but using the PYTHIA event generator

m_t (GeV)	$\langle m_{B\ell}\rangle$ (GeV)	$\langle m^2_{B\ell}\rangle$ (GeV^2)	$\langle m^3_{B\ell}\rangle$ (GeV^3)	$\langle m^4_{B\ell}\rangle$ (GeV^4)
171	77.17	6.85×10^3	6.62×10^5	6.81×10^8
173	78.37	7.06×10^3	6.94×10^5	7.23×10^8
175	79.55	7.27×10^3	7.25×10^5	7.67×10^8
177	80.70	7.48×10^3	7.56×10^5	8.12×10^8
179	81.93	7.71×10^3	7.91×10^5	8.61×10^8

Fig. 3 Linear fits of $\langle m_{B\ell}\rangle$ as a function of m_t, as obtained from HERWIG and PYTHIA codes

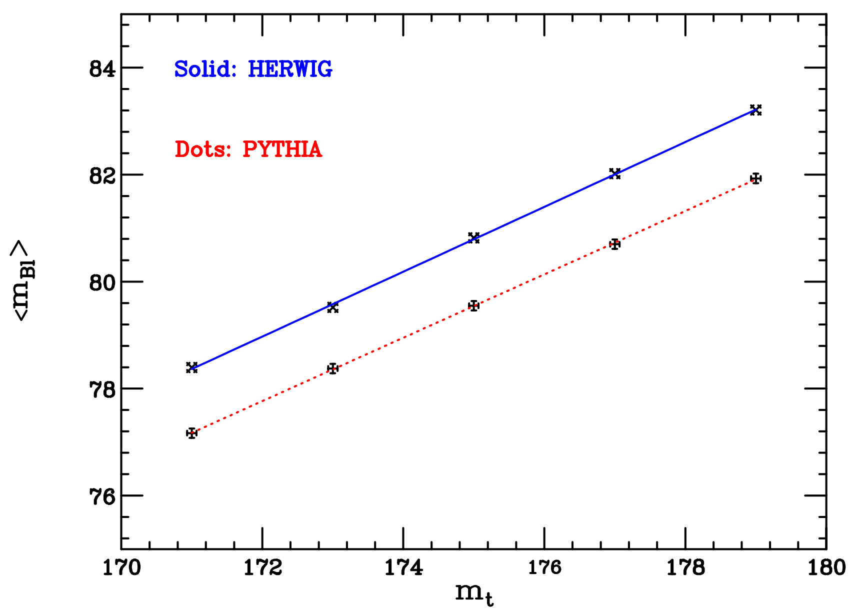

Table 3 Truncated moments of the $m_{B\ell}$ spectrum, according to HERWIG in the range 50 GeV $< m_{B\ell} <$ 120 GeV

m_t (GeV)	$\langle m_{B\ell}\rangle$ (GeV)	$\langle m^2_{B\ell}\rangle$ (GeV^2)	$\langle m^3_{B\ell}\rangle$ (GeV^3)	$\langle m^4_{B\ell}\rangle$ (GeV^4)
171	84.64	7.52×10^3	6.97×10^5	6.70×10^8
173	85.01	7.59×10^3	7.06×10^5	6.81×10^8
175	85.43	7.66×10^3	7.17×10^5	6.94×10^8
177	85.78	7.72×10^3	7.25×10^5	7.04×10^8
179	86.09	7.78×10^3	7.32×10^5	7.13×10^8

Table 4 As in Table 3, but using the PYTHIA event generator

m_t (GeV)	$\langle m_{B\ell}\rangle$ (GeV)	$\langle m^2_{B\ell}\rangle$ (GeV^2)	$\langle m^3_{B\ell}\rangle$ (GeV^3)	$\langle m^4_{B\ell}\rangle$ (GeV^4)
171	84.42	7.49×10^3	6.93×10^5	6.65×10^8
173	84.79	7.55×10^3	7.02×10^5	6.77×10^8
175	85.13	7.61×10^3	7.10×10^5	6.87×10^8
177	85.45	7.67×10^3	7.18×10^5	6.97×10^8
179	85.77	7.73×10^3	7.26×10^5	7.06×10^8

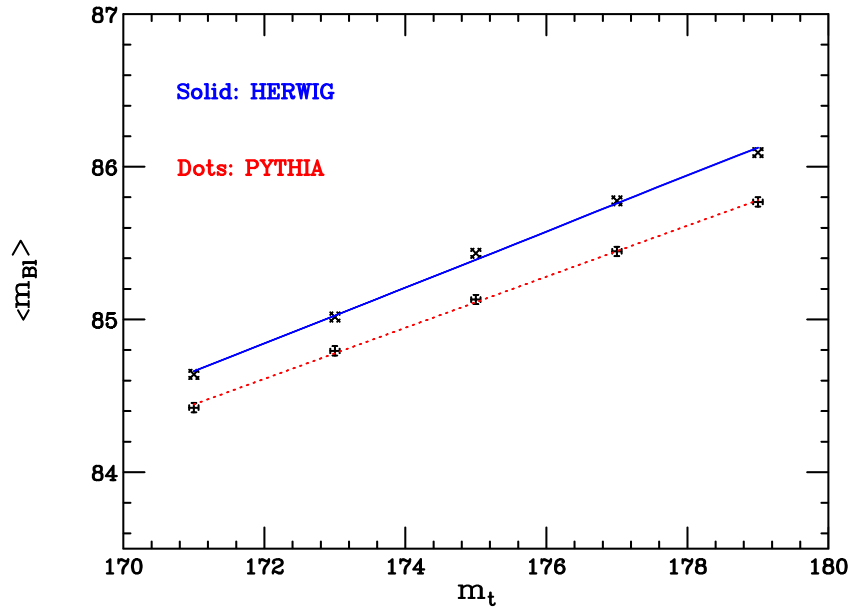

Fig. 4 Linear fits of $\langle m_{B\ell}\rangle$, as a function of m_t, using HERWIG and PYTHIA in the range 50 GeV $< m_{B\ell} <$ 120 GeV