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A study of the b-quark fragmentation function with the DELPHI detector at LEP I and an averaged distribution obtained at the Z pole

The nature of b-quark jet hadronisation has been investigated using data taken at the Z peak by the DELPHI detector at LEP in the year 1994. The average value of $x_b^{\text{weak}} = E_b^{\text{weak}}/E_{\text{beam}}$ is measured to be 0.699 ± 0.011 . The resulting x_b^{weak} distribution is then analyzed in the framework of two choices for the perturbative contribution (parton shower and Next to Leading Log QCD calculation) in order to extract the non-perturbative component to be used in studies of b-hadron production in other experimental environments than LEP. In the parton shower framework, data favour the Lund model ansatz and corresponding values of its parameters have been determined within PYTHIA 6.156 from DELPHI data: $a = 1.84^{+0.23}_{-0.21}$ and $b = 0.642^{+0.073}_{-0.063}$ with a correlation factor $\rho = 92.2\%$. Combining the present measurement of b-quark fragmentation distributions with those obtained at the Z peak by ALEPH, OPAL and SLD, the average value of x_b^{weak} is found to be 0.7092 ± 0.0025 and the non-perturbative fragmentation component is also extracted. Using the combined distribution, a better determination of the Lund parameters is then obtained: $a = 1.48^{+0.11}_{-0.10}$ and $b = 0.509^{+0.024}_{-0.023}$ with a correlation factor $\rho = 92.6\%$.

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