H1-prelim-02-071
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$D^*\mu$ correlations in ep scattering at HERA

H1 Collaboration

Abstract

$D^*\mu$ coincidences are studied using data taken with the H1 detector at HERA during the years 1997 to 2000, corresponding to an integrated luminosity of about 90 pb^{-1}. With the aid of charge and angle correlations between the D^* and the muon, a separation of charm and beauty production is possible. Measurements are performed of the total charm and beauty production cross sections in the kinematical region $p_t(D^*) < 1.5$ GeV/c, $|\eta(D^*)| < 1.5$, $p_t(\mu) > 1.0$ GeV/c, $|\eta(\mu)| < 1.74$ and $0.05 < y < 0.75$, where p_t (η) denote the tranverse momentum (pseudorapidity) of the D^* meson and the muon. Cross sections differential in several $D^*\mu$ quantities, such as the squared transverse momentum of the $D^*\mu$ pair, are compared with the prediction of a Leading Order (LO) Monte Carlo.

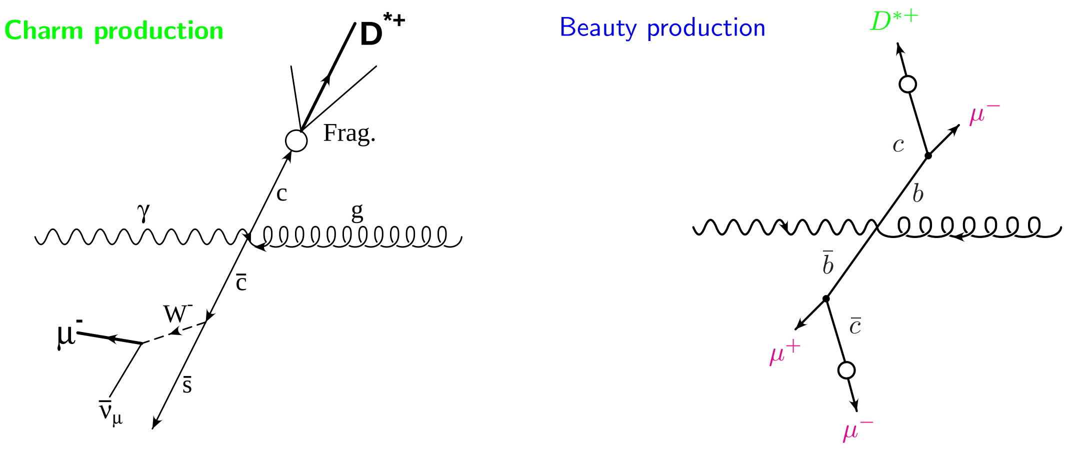

Figure 1: Leading order (LO) picture of charm and beauty production in the photon gluon center of mass frame.

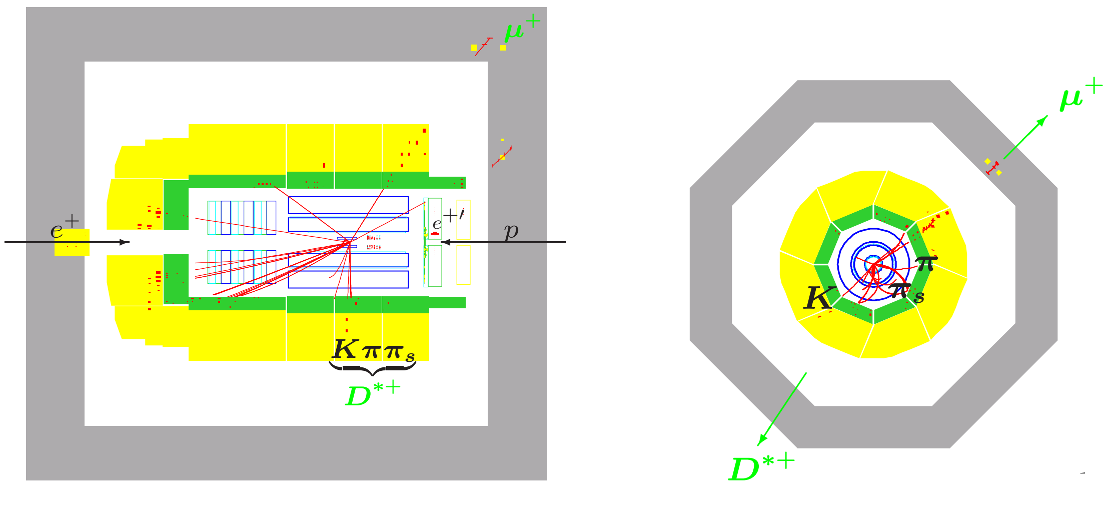

Figure 2: Eventdisplay of a nice $D^*\mu$ candidate. On the left side the rz-view is shown and on the right side the radial view. The $D^*\mu$ event is a DIS event ($Q^2 = 5.1$ GeV^2) and further it is a beauty candidate due to $\Delta\Phi \approx 180^\circ$ (see right plot) and $Q(D^*) = Q(\mu)$.

	$\Delta\Phi \leq 90°$	$\Delta\Phi \geq 90°$
$Q(\mu) = Q(D^*)$	1 no charm few beauty	2 no charm beauty
$Q(\mu) \neq Q(D^*)$	3 few charm beauty	4 charm beauty

Figure 3: Definition of the so called correlation regions depending on the charge of the D^* and the muon and on the azimuthal angle $\Delta\Phi^*$ between the D^* and the muon determined in the γp frame.

$\sigma_{vis}(ep \to e' D^* \mu X)$ [pb]	charm	beauty
data (H1 Prelim.)	720	380
stat. error [pb]	115	120
syst. error [pb]	245	130
LO + PS	398	106

Table 1: Total visible $D^*\mu$ cross sections $\sigma_{vis}(ep \to e' D^* \mu X)$ for charm and beauty production compared with the leading order (LO) + parton shower (PS) prediction for the same kinematic region obtained using the AROMA Monte Carlo generator.

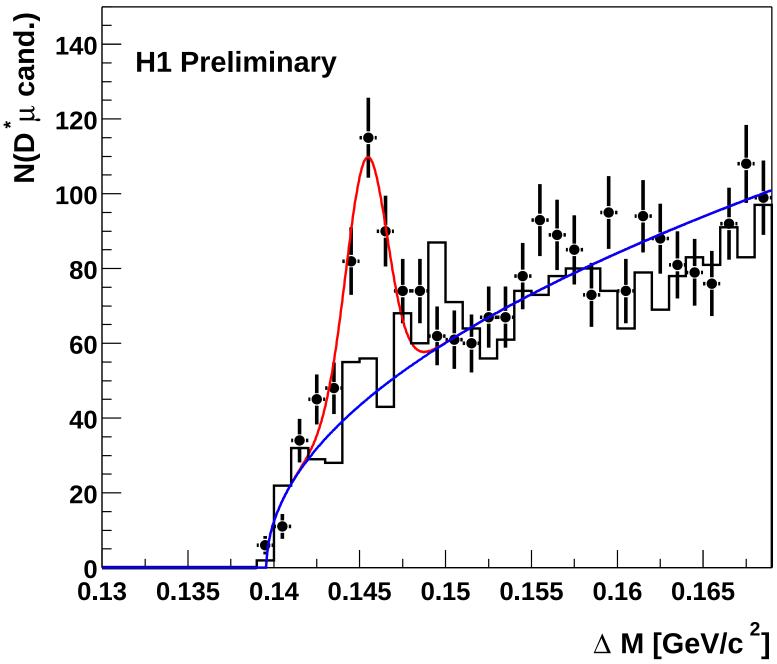

Figure 4: Distribution of the D^* mass difference discriminator $\Delta M = m_{K\pi\pi_s} - m_{K\pi}$ for the full sample in which a D^* and a muon are reconstructed. The solids points represent the data. The histogram indicates the background as obtained from wrong charge combinations in the D^* reconstruction. The solid lines represent the simultaneous fit of a Gaussian for the D^* signal plus a term for the background, describing both the right and wrong charge combinations.

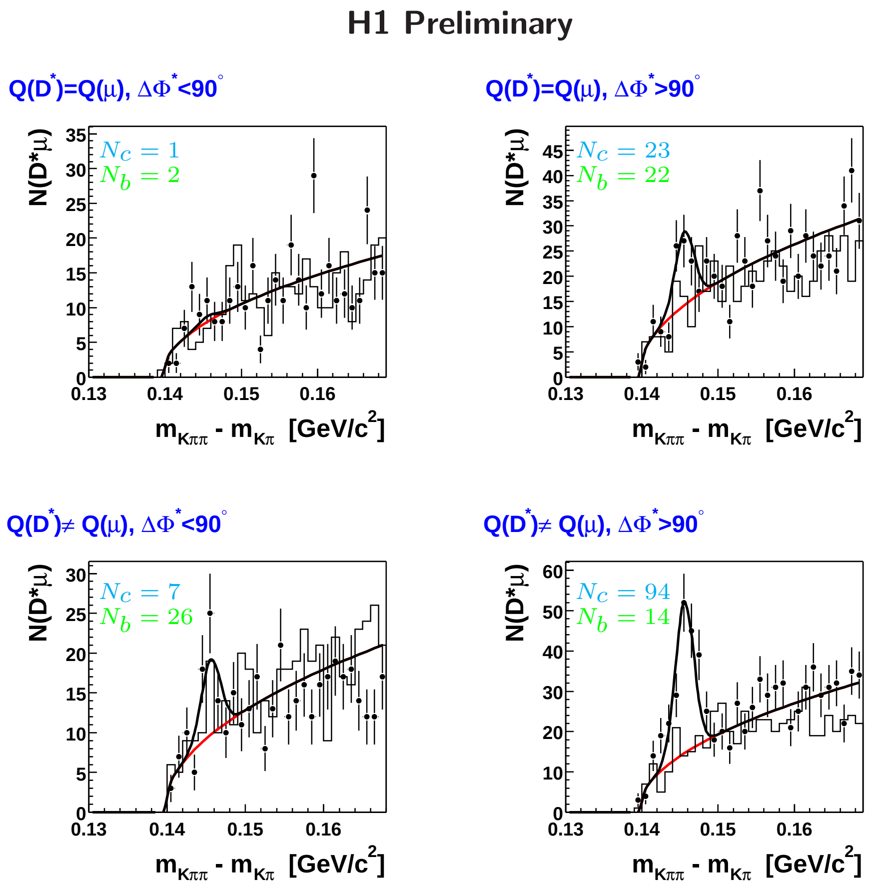

Figure 5: Distributions of the mass difference $\Delta M = m_{K\pi\pi_s} - m_{K\pi}$ in the four correlation regions considered, depending on the relative charges of the D^* and the muon and on the azimuthal angle $\Delta\Phi$ between them. The solid points represent the data, the histogram indicates the background as estimated from wrong charge combinations. The solid lines are the projected result of a 2 dimensional simultaneous fit of right and wrong charge combinations to all four distributions to extract the beauty and charm contributions.

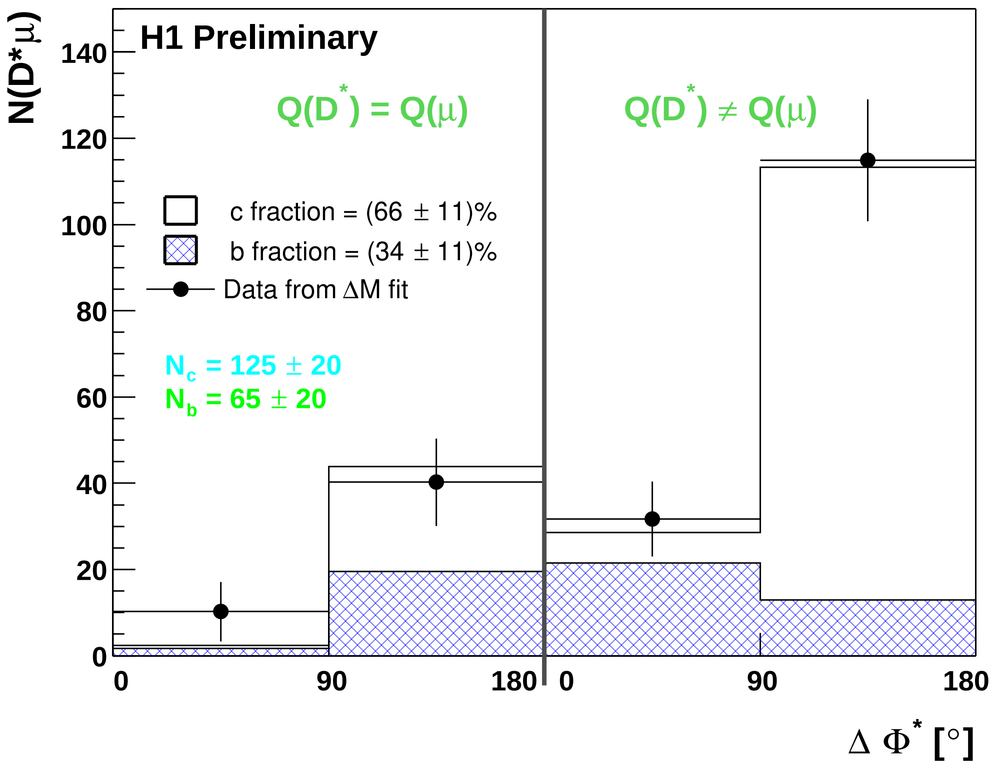

Figure 6: Estimated decomposition of the uncorrected data in the four correlation regions, depending on the charge of the D^* and the muon and on the azimuthal angle $\Delta\Phi$ between them. The solid points are the result of a fit to the ΔM distribution in each correlation region. The solid line gives the sum of charm and beauty $D^*\mu$ signal events as obtained from the 2 dimensional fit. The blue hatched histogram represents the beauty contribution. The distributions still contain background from hadrons misidentified as muons and muons from the decays of light hadrons, which are corrected for separately. This background to the muon selection represents about 30% of the charm signal and 5% of the beauty signal.

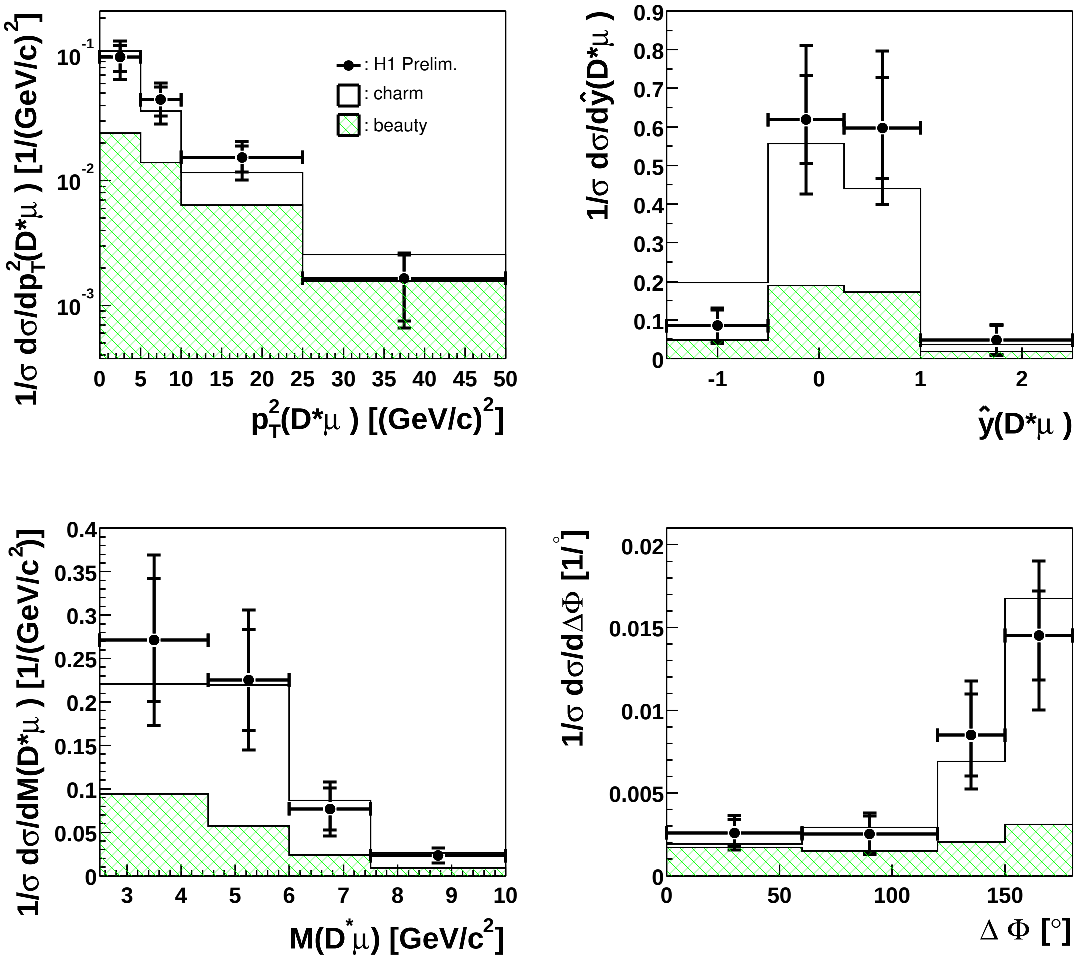

Figure 7: Fully corrected cross sections for $D^* + \mu$ production normalised to the total cross section in the visible range and divided into the charm and beauty contributions. For charm the cross section predicted by the LO is multiplied by a factor 1.8 and for beauty by 3.6, the results of the total cross sections (table 1). The cross sections are shown differentially in the combined transverse momentum of the D^*, μ system ($p_T^2(D^*\mu)$), its rapidity in the laboratory frame ($\hat{y}(D^*\mu)$), its invariant mass ($M(D^*\mu)$) and the azimuthal angle $\Delta\Phi$ between the D^* and the μ in the laboratory frame. The results are compared with the leading oder (LO) + parton shower (PS) prediction from the AROMA Monte Carlo generator.