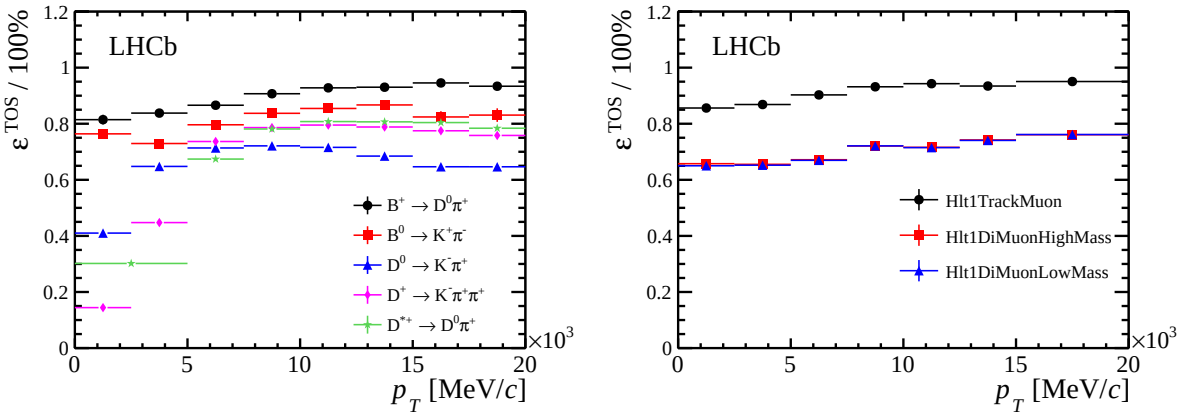

Figure 45: HLT1 inclusive track trigger performance: TOS efficiency for various channels as a function of B or D $p_{\rm T}$ (left) . HLT1 muon trigger performance : TOS efficiency for $B^+ \to J/\psi\, K^+$ candidates as function of B^+ $p_{\rm T}$ (right).

5.3.2 Second level

HLT1 reduces the event rate to about 80 kHz, which is sufficiently low to allow the forward tracking of all VELO tracks in HLT2. As described in Section 2.2, the offline reconstruction uses two complementary tracking algorithms. Due to the CPU constraints, HLT2 only searches for long tracks based on VELO seeds. This simplification leads to a lower tracking efficiency compared to the offline reconstruction of $1-2\%$ per track.

The processing time is further reduced by restricting the search to tracks with $p > 3\,{\rm GeV}/c$ and $p_{\rm T} > 0.3\,{\rm GeV}/c$. Muon identification in HLT2 is performed using the offline muon identification algorithm. Tracks are also associated to ECAL clusters to identify electrons. Photons and neutral pions are built starting from the energy clusters reconstructed by the L0-Calorimeter system.

Generic beauty trigger

A significant portion of the output rate of HLT2 is selected by the 'topological' lines, which are designed to trigger on partially reconstructed b-hadron decays. These topological lines cover all b-hadron decays with at least two charged particles in the final state and a displaced decay vertex. The inclusive nature of these lines makes them less susceptible to the $1-2\%$ loss in efficiency per reconstructed track in HLT2. Tracks are selected based on their track fit χ^2/ndf, IP and muon or electron identification. Two-, three- or four-body vertices are constructed from the selected tracks with a requirement on their distance of closest approach (DOCA).

Candidate n-body combinations are selected based on the following variables: $\sum |p_{\rm T}|$, $p_{\rm T}^{\rm min}$, n-body invariant mass (m), DOCA, IPχ^2 and flight distance (FD) χ^2. In addition, the corrected mass is defined as $m_{\rm corr} = \sqrt{m^2 + |p'_{\rm Tmiss}|^2} + |p'_{\rm Tmiss}|$, where $p'_{\rm Tmiss}$ is the missing momentum transverse to the line of flight between the n-body vertex and the PV to which it has the smallest IP [88]. Figure 46 shows the reconstructed 2-body