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Central Exclusive Dimuon Production at $\sqrt{s} = 7$

Note: the results are superseded by paper 2012-004, except the result on χ_c

The paper is available here (LHCb-CONF-2011-022) [↗](#)

More detailed information: ANA note 2011-033 [↗](#)

Abstract

This note presents preliminary results for the measurement of the cross-section for the production of exclusive dimuon final states. Cross-section measurements for exclusive J/ψ , $\chi_c(2S)$ and for non-resonant production $pp \rightarrow p\mu^+\mu^-p$ are presented and compared to theoretical predictions. The addition of a photon in the final state allows the cross-section for exclusive χ_c to be measured and the contributions coming from χ_{c0} , χ_{c1} , χ_{c2} to be estimated.

Figures

(eps versions are available under attachments).

Caption	Figure
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Figure 1: Feynman diagrams for the production of exclusive dimuon final states: a) diphoton production (left); b) photon-pomeron fusion (centre); c) double pomeron exchange (right).

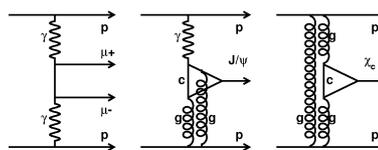


Figure 2: Number of forward tracks in dimuon triggered events with less than 20 SPD hits, which have one or more backward tracks (upper histogram) or no backward tracks (lower histogram).

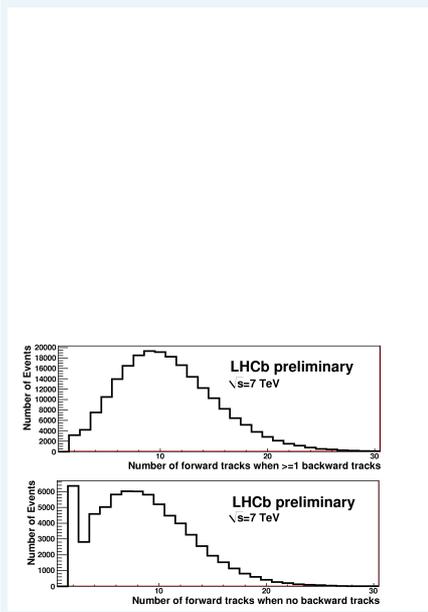


Figure 3: Dimuon invariant mass in the mass range from 1 GeV/c² to 4GeV/c² (left plot) and from 4GeV/c² to 15GeV/c² (right plot). In each case, the upper histograms are for all events passing the trigger and stripping while the lower histograms are with the additional requirement of no backwards tracks and precisely two forward tracks. (The discontinuity at 2.7 GeV/c² is due to a threshold in one of the triggers.)

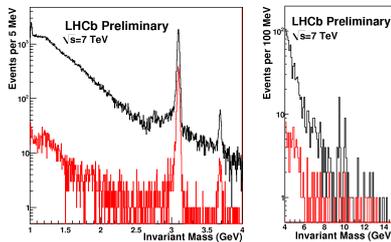


Figure 4: Number of forward tracks when no backward tracks in events where the invariant mass of the muons is consistent with the J/ψ or $\psi(2S)$. The data points in the left-most plot are for events consistent with the $\psi(2S)$. The data points in the central plot are for events consistent with the J/ψ . The shaded histogram is the estimated component from $\psi(2S)$ decays having a J/ψ in the final state. The data points in the right-most plot have had this background subtracted.

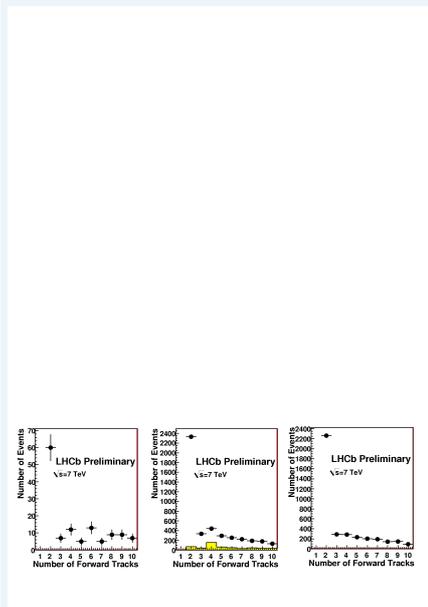


Figure 5: Number of photons in events with no backward tracks and two forward tracks whose invariant mass is consistent with a J/ψ (left) or $\psi(2S)$ (right). The points are data. The shaded histogram is the estimated feed-down from the decay of c .

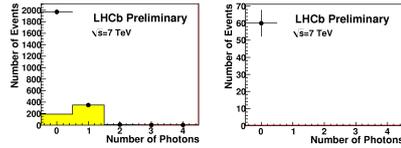


Figure 6: Diffractive processes which produces a non-exclusive J/ψ .

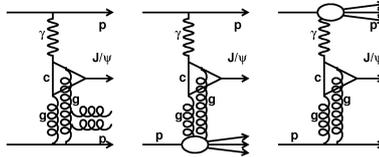


Figure 7: Transverse momentum distribution for J/ψ candidates with no backwards tracks and precisely two forward tracks. The points are data. The green/light-shaded histogram is the exclusive signal as estimated by Starlight, while the red/dark-shaded histogram is the non-exclusive background as estimated from data.

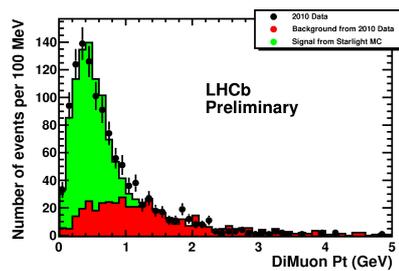


Figure 8: Invariant mass distribution on linear (left) and log (right) scales for events with no backward tracks, two forward tracks and no identified photon. The fit is to the sum of a Crystal Ball Function and an exponential.

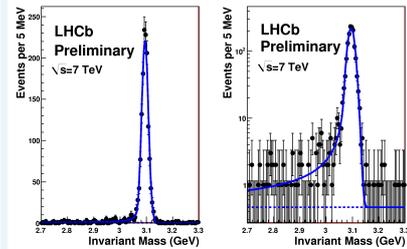


Figure 9: Invariant mass distribution for events with no backward tracks, two forward tracks and no identified photon. The fit is to the sum of a Crystal Ball Function and an exponential.

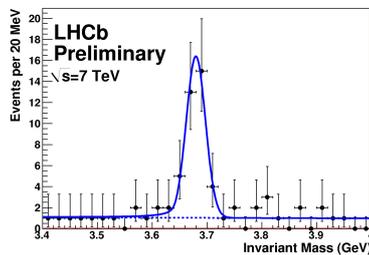


Figure 10: Transverse momentum distribution for dimuon events with invariant masses above 2.5 GeV/c² which are greater than 100 MeV/c² away from the J/ and (2S) resonance. The points are data. Left: Events with greater than two forward tracks. The histograms are the background expectations from LPAIR and POMWIG. Right: Events with precisely two forward tracks and no photons. The histograms are the signal expectation from LPAIR and the background template as provided by the lefthand plot.

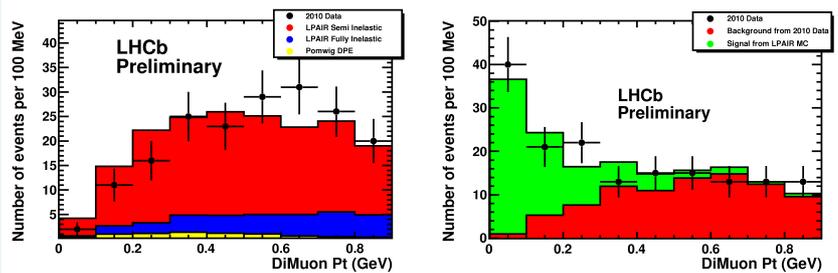
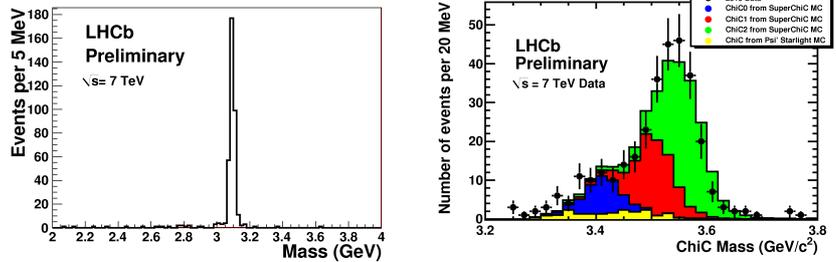


Figure 11: Left: Invariant mass of dimuon system when an additional photon is required. Right: Invariant mass of dimuon plus photon system. The fit is to the shapes as predicted from the simulation which from bottom to top come from $(2S)$ decays (with a single identified photon in the final state), c_0 , c_1 , c_2 .



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