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Title:	SEARCH FOR THE DARK PHOTON AND LOW MOMENTUM MUONS STUDY
Authors:	John, Teena V. (/jspui/browse?type=author&value=John%2C+Teena+V.)
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Abstract:	<p>A dark photon is a well-motivated hypothetical particle. If it is found, that will be a sure New Physics (NP) beyond the Standard Model (SM). Using kinetic mixing model, one can expect to search for the dark photon using <math>D^* \rightarrow D^0 A</math> decay mode which has suppressed branching ratio of <math>B(D^* \rightarrow D^0 A) = 2 B(D^* \rightarrow D^0 \gamma)</math>. Here 2 is expected to have value between <math>10^{-6}</math> and <math>10^{-8}</math>. In this MS thesis, I studied the production of <math>D^* \rightarrow D^0 A</math> at Belle (II) for the first time. We studied the reconstruction efficiency using different mass hypothesis for the dark photon. In order to increase the signal statistics, we include five decay modes of <math>D^0</math>: <math>K^- \pi^+</math>, <math>K^- \pi^+ \pi^0</math>, <math>K^- \pi^+ \pi^+ \pi^-</math>, <math>K_S^0 \pi^+ \pi^-</math>, and <math>K_S^0 \pi^+ \pi^- \pi^0</math>. These 5 modes cover 34% of the total <math>D^0</math> modes, helping us to achieve better efficiency. We estimated signal events for each mode separately and found to be 10-35 signal events in each mode at Belle. We also studied the background using the generic MC sample. Based on this preliminary study, we expect that one can put some constraints on the dark photon model using the Belle (II) data. In the second part of my work, efforts were directed towards the improvement of low momentum muon identification at Belle II. As the muon detector is located at the end of the Belle II detector, low momentum muons <math>&lt; 500</math> MeV are lost and left undetected. The detection of low momentum muons will increase the reach of Belle II and can help in improving the signal sensitivity of New Physics (NP) searches (such as Flavour-Changing Neutral Current and Lepton Flavour Violation). We found that at first principle one should be able to exploit inner part detectors (PXD, SVD, and CDC) to identify low momentum muons.</p>
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