Observation of inclusive $B \to X_s\gamma$ decays in early Phase III data (untagged).

Belle II Collaboration

Abstract

This note contains spectrum of $b \to (s, d)\gamma$ candidates selected in early Phase III data overlaid with expectations for continuum events and background $B\bar{B}$ events. The plot also shows the difference between observed number of events and the background expectations.
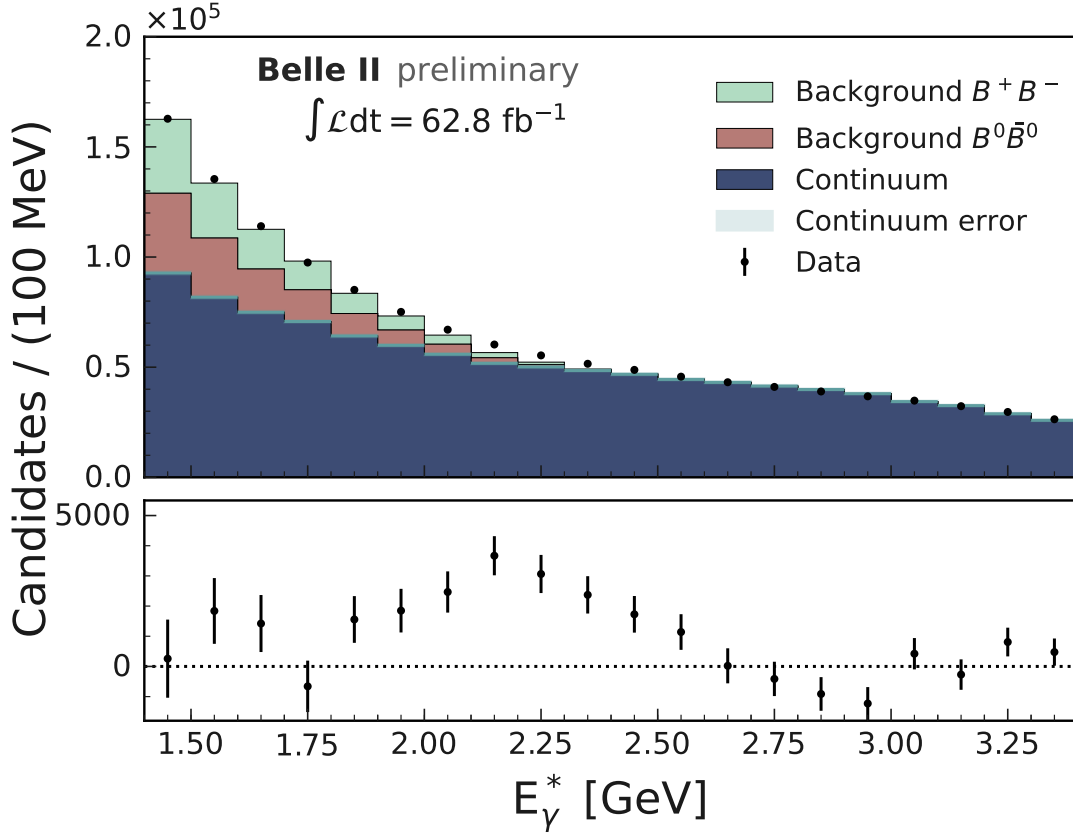
FIG. 1. Photon energy spectrum of selected $b \to (s, d)\gamma$ candidates measured in the $\Upsilon(4S)$ rest frame overlaid with expectations for continuum events and background $B\bar{B}$ events. The data points come from the dataset collected by the Belle II experiment in 2019 and 2020 with integrated luminosity of 62.8 fb^{-1}. The dataset with integrated luminosity of 9.2 fb^{-1} collected below the $\Upsilon(4S)$ resonance is used as a model for the continuum ($e^+e^- \to q\bar{q}$, $q = u, d, s, c$) background: the continuum spectrum are the off-resonance data scaled to match the on-resonance luminosity. The shape of the $B\bar{B}$ background component is obtained from simulation. The $B\bar{B}$ contribution is scaled so that sum of the expectations from $B\bar{B}$ background, continuum, and signal components in the first bin matches the number of observed events in this bin (the expected number of signal events is taken from simulations). The bottom plot shows the difference between the observed number of candidates and the sum of expected number of background candidates for each bin. Bottom plot indicates the evidence for an inclusive $B \to X_{(s,d)}\gamma$ signal. The shown uncertainties are statistical only.