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Displaced vertices of a light neutralino from B-meson decays with baryon-number-violating R-parity violation at Belle II

In R-parity-violating (RPV) supersymmetry (SUSY), GeV-scale bino-like neutralinos are allowed by all constraints and can be produced in association with a baryon in *B*-meson decays via certain $\bar{U}\bar{D}\bar{D}$ operators. We investigate theoretical scenarios with a pair of non-vanishing RPV couplings at the low-energy scale. With one RPV coupling governing the neutralino production rate and another determining its lifetime, this scenario can lead to large signals with a displaced-vertex signatures in the tracking volume of *B*-factories. We study the discovery potential of the ongoing Belle II experiment for such signatures with a new partial-reconstruction techniques that ensures high efficiency for reconstruction. Studying the signal processes as well as potential background sources, we perform detailed Monte-Carlo simulation to determine the detector efficiency as a function of the lifetime and mass of the lightest neutralino. We proceed to obtain numerical results of the sensitivity reach of Belle II, showing that large parts of the parameter space can be probed, beyond current bounds.

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