Aspects of the same-sign diboson signature from wino pair production in SUSY with light higgsinos at high luminosity LHC

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Naturalness arguments applied to simple supersymmetric (SUSY) theories require a set of light higgsinos with mass $\tilde{\mu}$ not too far from m_h . These models have an inverted electroweakino spectrum $\mu < M_2$ which then implies the existence of a rather clean same-sign diboson (SSdB) signature arising from neutral-plus-charged wino pair production at hadron colliders. We calculate wino pair production signal rates along with improved background evaluations for the SSdB signature at high luminosity LHC (HL-LHC). We compute the HL-LHC reach in the SSdB channel for 3000 fb⁻¹ which extends to $m_{\tilde{w}_2} \sim 890$ (1080) GeV at the 5σ (95% *CL*). For the lower range of wino masses, the value of $m_{\tilde{w}_2}$ might be extracted from 1. direct counting of signal events, 2. fits to distributions in variables such as m_{T2} or m_T^{min} and 3. comparison to the charge asymmetry (++ vs. -- dilepton events) which also has some sensitivity to wino mass. While LHC gluino mass limits may preclude some of the lower range of wino masses in models with gaugino mass unification, we emphasize that the wino pair production signal offers an independent SUSY discovery channel which assumes increasing importance for models with a spread out spectrum of gauginos. We propose a simplified model for SSdB signature which may serve as a convenient template for future experimental searches in this channel.

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