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SUSY searches in the Z+jets+MET final state in 7 TeV pp collisions with the Jet-Z balance method

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Introduction

The Z+jets+MET final state is a clean and distinct signature present in many models of physics beyond the SM (BSM), including SuperSYmmetry (SUSY). The production of a Z boson in the decay chain of the neutralinos is a direct implication of the gauge structure of SUSY and is realized whenever it is kinematically allowed, depending on the neturalino composition [1].

To first order the most significant background for this final state is the Standard Model Z+jets process, followed by top pair production. In such events, while the Z boson momentum is accurately measured from its leptonic decay products, the imperfect measurement of the jet energy scale (primarly due to miscalibration and detector resolutions) leads to instrumental MET mimicking signal events. The ability to observe an excess of signal over background therefore relies on the ability to accurately predict the missing energy "tail" of this background. The Jet-Z Balance (JZB) method has been devised to predict the MET contribution from mismeasured Z+jets events [2]. It has already been shown in various SUSY scenarios that this method offers strong signal discrimination against SM background [3]. The JZB observable is defined as the difference between the transverse momentum of the sum of the jets and the transverse momentum of the Z boson. This observable is distributed symmetrically around 0 for processes with instrumental MET, and is shifted to positive values for processes with real MET (see figure 1).

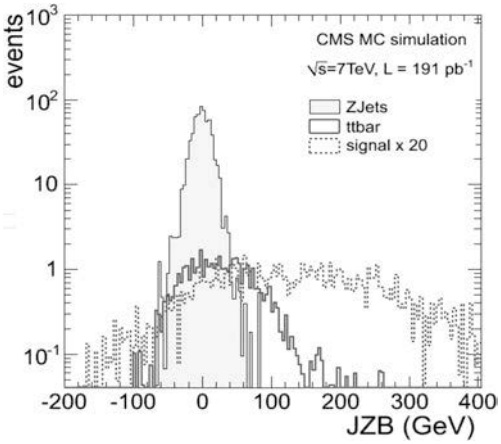

Figure 1. JZB distribution in MC simulation, for the signal (scaled by a factor 20) and the most important SM backgrounds.

Analysis steps

For a final state with a Z boson the background is naturally decomposed into two components:

– background with a real (visible) Z boson