Search for WIMP Inelastic Scattering Off Xenon Nuclei With Xenon100 Data*

Ann Author† and Second Author‡
Authors' institution and/or address
*This line break forced with *
(XENON Collaboration)

Authors
Second institution and/or address
This line break forced and
Affiliation
(Dated: November 28, 2016)

I. INTRODUCTION

Astrophysical evidence indicates that the dominant mass fraction of our Universe consists of some yet unknown form of dark matter. Well motivated models predict Dark Matter in the form of Weakly Interacting Massive Particles (WIMPs), hypothesis which is currently being tested by several direct and indirect detection experiment.

Most of direct detection searches focuses on elastic scattering of dark matter particles off nuclei. In this analysis instead we explore an inelastic scattering process, we consider the ^{129}Xe isotope being excited to a low-lying state with subsequent prompt de-excitation via the emission a photon. This isotope is an excellent target since its abundance in natural xenon is of 26.4% and a relatively low energy is necessary to excite its 3/2+ state above the 1/2+ spin ground state. Inelastic WIMP-nucleus scattering in xenon is complementary to elastic scattering for spin-dependent interactions, the former dominates the integrated rate above $\simeq$ 10 keV of energy deposition. Furthermore, in the case of dark matter detection, this channel can be employed to asses whether the nature of the fundamental interaction is spin-dependent or not.

II. XENON100 DETECTOR

The Xenon100 experiment is a dual phase liquid xenon TPC. For a given interaction in the liquid target this type of detector produces two separated signals, one proportional to the prompt scintillation (S1) the other to ionization (S2).

To add: sentences about detector stability, science run data used, Ly and Y measurements used.

III. DATA ANALYSIS

The inelastic scattering of a WIMP with the nucleus of ^{129}Xe produces an energy deposit via nuclear recoil with subsequent emission of a 39.6 KeV de-exitation photon. The largest fraction of the energy released in the event is via electronic recoil (ER) due to the emitted photon, this represents an unusual signature for this kind of detector and brings the signal to overlay a phase space region with large backgrounds. The choosen region of interest for this analysis surrounds the 39.6 KeV line in the cS1-cS2 plane which is further divided into sub regions, as shown in figure 1.

Events are asked, other than falling in the defined region of interest, to fullfill several selection criteria: quality selection aimed to reduce noise impact toghether with energy and threshold selection on S2, selection of single scatter events and fiducial volume definitions are reported in detail in [1], only few modification have been designed for this analysis and discussed below.

brief explaination of the signature, selection cuts, few words about acceptances, image of signal region and control region.

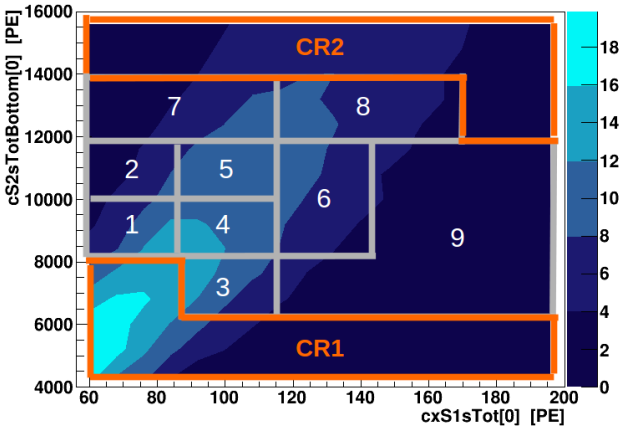

FIG. 1. Signal region and control region.

*

† Also at Physics Department, XYZ University.

‡ Second.Author@institution.edu

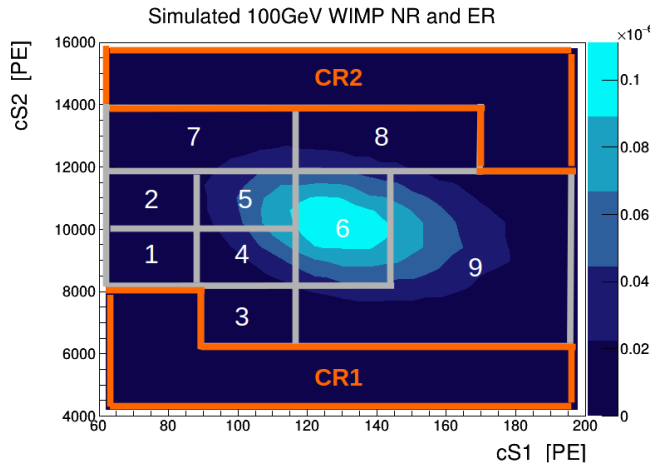

FIG. 2. Signal region and control region, for WIMP of mass 100 GeV.

A. Signal Simulation

description of the simulated signal, few words about cross checks MC matching.

B. Background Model

Description of the data driven bkg model evaluation, few numbers on estimated background, words about cross checks with Th232.

C. Systematic Uncertainties

few words, mainly a table summarizing uncertainties.

IV. RESULTS

No evidence of dark matter.

[1] **XENON100 Collaboration**, E. Aprile et al., *Analysis of the XENON100 Dark Matter Search Data*, Astropart. Phys. 54 (2014) 11, arXiv:1207.3458.

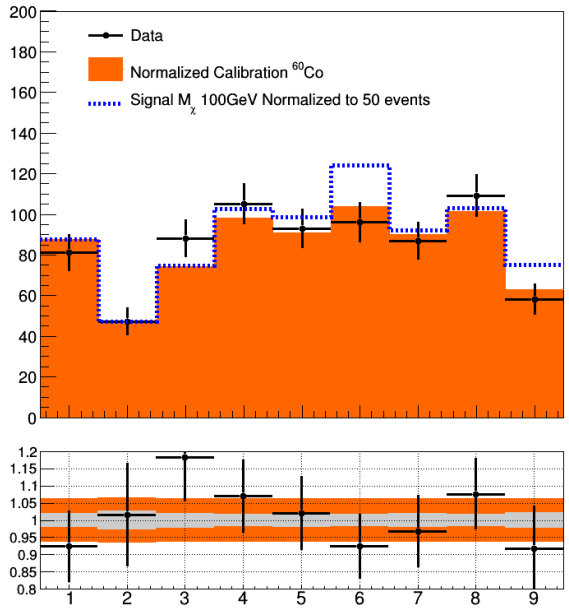

FIG. 3. Results, comparison between data and expected background.

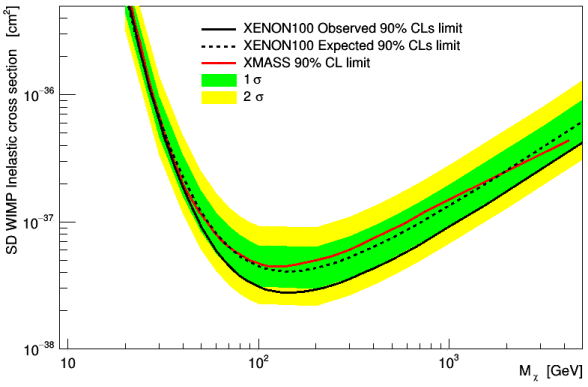

FIG. 4. Observed and expected limits.