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Calibration of the XENON100 Time Projection Chamber
KYUNGEUN LIM, Columbia University — The XENON Dark Matter Experiment aims at the direct detection of dark matter Weakly Interacting Massive Particles (WIMPs) with dual phase (liquid/gas) xenon time projection chambers. Following the successful performance of the XENON10, we have designed and built a new detector with a total Xe mass of 170 kg, and with 100 times less background. The XENON100 detector is currently undergoing commissioning at the Gran Sasso Underground Laboratory. The calibration of the detector with gamma sources and with low energy neutrons is essential to determine the response to electron and nuclear recoils, and their discrimination based on the ratio of ionization to scintillation, as well as on event positioning and scattering-multiplicity within the active liquid volume. External gamma sources used for the XENON100 calibration include Cs-137, Co-57 and Co-60. An external Am-Be source is used for irradiation by neutrons. Additionally, we have been testing mixing Kr-83m (tau=12.6 hr, 18 and 32 keV electrons and 13 keV x-rays) into the LXe target, as internal source of low energy electron recoils. We discuss how different detector performance parameters such as light yield and electron lifetime can be inferred from these calibrations and show how the spatial dependence of some other parameters (light collection efficiency for example) can be obtained. We also present comparisons of results from calibrations with Monte Carlo simulations.

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