Poster session 4 – Friday 8 July

P4.064 **Topological signature in the NEXT high pressure xenon TPC**

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The NEXT experiment aims to observe the neutrinoless double beta decay of Xe-136 in a high-pressure xenon gas TPC using electroluminescence (EL) to amplify the signal from ionization. One of the main advantages of this technology is the possibility to reconstruct the electron tracks in events with energies close to the Q-value of the decay and use it to distinguish signal (two electrons) from background (single electron). In this poster we present the first demonstration of the power of topology in signal/background discrimination, using data obtained with the NEXT-DEMO prototype, taking advantage of the electron-positron pairs produced by conversions of gammas from the Th-228 decay chain to mimick the double-electron signal. The current track reconstruction is based on the analysis of the charge detected in each time bin by an array of silicon photomultipliers placed behind the EL area to search for 2D hits and a subsequent voxelization of the whole space which connects the hits to form tracks. Then, the energy deposited along the tracks is studied, to search for higher energy density at both ends (signature of a two electron track) versus one end (single-electron track).

Different reconstruction approaches are also presented, which are being explored in NEW, the first stage of NEXT, to improve the efficiency of the signal/background discrimination, such as minimum spanning tree algorithms to connect hits without voxelizing or deep neural networks to classify the tracks. Based on the results in prototypes and simulations, we conclude that the topological signature alone can improve background suppression in the 100 kg detector (NEXT-100) by at least one order of magnitude with minimal efficiency loss.

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