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Optimal Pair-finding For Flow Mapping in Liquid Xenon Time Projection Chambers

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Liquid xenon time projection chambers (LXe-TPCs) combine self-shielding, event position reconstruction, particle-type discrimination, and scalability to produce consistently world leading Weakly Interacting Massive Particle (WIMP) sensitivity. LUX-ZEPLIN (LZ) has the furthest physics reach of any xenon TPC built to date, however Rn222 chain Pb214 decays still represent the largest background contribution to any low energy searches. In position-reconstructing solid-state detectors, Pb214 events are easily tagged by the preceding and following decays in the 222Rn chain, separated by O(10)-minute half-lives, but the constant convection-driven flow in a TPC has thus far prevented such tagging in liquid detectors. This talk will discuss robust parent-child decay pairing methods that allow for discrete direct measurement of flow, as well as generalization of discrete flow measurements to a full flow map, which can be used to reject the Pb214 decays much more effectively than particle-type discrimination alone.

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