Accepted Manuscript

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 PII:
 S0168-9002(17)30994-4

 DOI:
 https://doi.org/10.1016/j.nima.2017.09.024

 Reference:
 NIMA 60103

To appear in: Nuclear Inst. and Methods in Physics Research, A

Received date : 16 June 2017 Revised date : 10 September 2017 Accepted date : 12 September 2017

Please cite this article as: D. González-Díaz, F. Monrabal, S. Murphy, Gaseous and dual-phase time projection chambers for imaging rare processes, *Nuclear Inst. and Methods in Physics Research, A* (2017), https://doi.org/10.1016/j.nima.2017.09.024

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Gaseous and dual-phase time projection chambers for imaging rare processes

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Abstract

Modern approaches to the detection and imaging of rare particle interactions through gaseous and dual-phase time projection chambers are discussed. We introduce and examine their basic working principles and enabling technological assets.

 $Key\ words:$ Time Projection Chambers, TPCs, drift chambers, imaging chambers PACS: 29.40, Cs

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The introduction of the time projection chamber (TPC) 35 by David Nygren in 1974 [1] has exerted a perdurable influ-36 ence in particle and nuclear physics, casting its shadow over 37 much of today's instrumentation. TPCs revolutionized ex-38 perimentation at colliders with the introduction of a novel 39 scheme for reconstructing particle trajectories, in which 40 electric and magnetic fields would be set parallel to each 41 other [2]: with the passage of charged particles, ionization 42 electrons are locally released in the detector medium and 43 then collected after meter-long drift distances, their spread 44 reduced through the convenient orientation of the E and 45 **B** fields. Once collected at an x,y-sensitive image plane, 46 their arrival times are back-converted to longitudinal posi-47 tions (z) through their average drift velocity, a technique 48 borrowed from drift chambers (e.g., [3,4]). 49

By identifying a preferred alignment relative to the spectrometer's magnetic field, Nygren posited a detector con-51 Download English Version:

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