

## Research Result Report

### ICRR Inter-University Research Program 2025

Research Subject:

Research and Development for XENONnT and future Dark Matter Searches

Principal Investigator:

Kai Martens

Participating Researchers:

M. Yamashita, T. Zhu, C. Ishikawa, X. Wang, M. Moriyama, Y. Itow, A. Takeda, K. Abe, M. Yoshida, Y. Kaminaga, K. Otsuzuki, K. Okamura, S. Kazama, M. Kobayashi, J. Huang, M. Oliveira, R. Miyata, K. Fujikawa, A. Takeshita, A. Ishimaru, K. Miuchi, Y. Takeuchi, S. Nomura

Summary of Research Result :

In FY2025 the XENON collaboration exchanged XENONnT' s (XnT) dual phase liquid xenon (LXe) time projection chamber' s (TPC) cathode in order to achieve higher charge drift and reduce accidental coincidences in the data it produced. For our neutron veto (NV), which surrounds the TPC, that meant first a completed disassembly and then re-assembly after the repair work. This gave us an opportunity to identify non-stainless steel nuts and bolts and exchange them in the process. We also continued our analyses of data from the three science runs with XENONnT that were completed before we started the TPC repair; below are the physics papers that were published in FY2025:

E. Aprile et al., XENON Collaboration: **Search for Light Dark Matter in Low-Energy Ionization Signals from XENONnT**; Phys. Rev. Lett. 134, 16004 (2025)

E. Aprile et al., XENON Collaboration: **WIMP Dark Matter Search Using a 3.1 Tonne-Year Exposure of the XENONnT Experiment**; Phys. Rev. Lett. 135, 221003 (2025)

E. Aprile et al., XENON Collaboration: **Challenging Spontaneous Quantum Collapse with the XENONnT Dark Matter Detector**; Phys. Rev. Lett. 136, 120201 (2026)

A first NV paper was also published based on pure water performance, before any gadolinium sulfate was dissolved:

E. Aprile et al., XENON Collaboration: **The neutron veto of the XENONnT experiment: results with demineralized water**; Eur. Phys. J. C (2025) 85:695

No.2025d-B-05