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## New detector development and performance evaluation for KamLAND2-Zen experiment

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Neutrino-less double-beta ( $0\nu\beta\beta$ ) decay is a rare nuclear process with profound implications for verifying the Majorana nature of neutrinos and determining their masses. The Majorana nature of neutrinos is crucial for understanding neutrino properties and the origin of the matter-dominant universe.

The KamLAND-Zen experiment, located at the Kamioka underground laboratory in Japan, has been at the forefront of the search for  $0\nu\beta\beta$  decays for more than a decade. The experiment started a search for  $0\nu\beta\beta$  decay of xenon-136 nuclei in 2011 (KamLAND-Zen 400), which was upgraded in 2019 by doubling the number of xenon nuclei and a tenfold reduction in uranium and thorium contamination (KamLAND-Zen 800). A combined analysis of the KamLAND-Zen 400 and 800 dataset has provided the world's most stringent limits on the effective Majorana neutrino mass of 36-156 meV with different nuclear matrix elements. This result establishes KamLAND-Zen as a pioneering effort in the global pursuit to unravel the fundamental properties of the neutrino.

The KamLAND-Zen collaboration has taken the next step forward: The upcoming phase of KamLAND-Zen, KamLAND2-Zen, will employ a new high light-yield liquid scintillator, light collecting mirror and high quantum efficiency photomultipliers.

This oral presentation aims to the process of developing the prototype detector installing these improvements and its performance evaluation by simply reproducing a part of the KamLAND2-Zen.

### Primary experiment

The KamLAND-Zen collaboration

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