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The Background Control of PandaX-4T and A Low-background PMT for PandaX-xT

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The PandaX-4T experiment uses a liquid xenon time projection chamber (TPC) to search for dark matter and other rare events. To achieve this, PandaX employs various techniques to remove and precisely measure the radioactivity of detector components, such as radon detectors, krypton systems, alpha detectors, and HPGe detectors. The photomultiplier tubes (PMTs) significantly contribute to the background, especially for the next-generation PandaX-xT detector, making their control crucial. In collaboration with Hamamatsu, PMT components are screened using HPGe detectors, leading to the development of the low-background R12699 PMT. This PMT achieves extremely low levels of Co-60 (~ 0.6 mBq/pc), Th-232, and U-238 (~ 0.1 mBq/pc). Additionally, its dark noise, position reconstruction accuracy, afterpulse probability (APP), and quantum efficiency (QE) meet high standards, making it suitable for next-generation rare decay detection experiments.

Primary authors: YUN, Youhui (ShangHai JiaoTong University); MENG, Yue (ShangHai JiaoTong University)

Presenter: YUN, Youhui (ShangHai JiaoTong University)

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