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Atucha II experiment: neutrino and BSM physics inside a nuclear power plant using Skipper-CCD

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Atucha-II is a short baseline neutrino experiment that employs 2.2 g of Skipper-CCD. The detector, installed inside the containment sphere of the 2 GWth Atucha II nuclear reactor at a distance of 12 m from the core, has been operating since December 2021. It currently achieves a readout noise of ~ 0.20 e⁻ by averaging 300 samples of the collected charge in each pixel, with a reactor-OFF background rate of ~ 30 kdr. In addition to the search for the coherent elastic neutrino-nucleus scattering (CEvNS) of reactor antineutrinos with the silicon nuclei, we recently reported, in collaboration with CONNIE, world leading limits on milli-charged particle charge across a mass range spanning six orders of magnitude, demonstrating the experiment's potential for rare-event searches. Here we discuss the analysis and experimental features that led to such results. Finally, we present upgrades of the experimental setup, including the addition of 1.4 tons of gamma shielding and assess their impact on the measured background.

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