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#10-301 A particle discrimination algorithm for lanthanum halide scintillators

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In the last few decades, lanthanum halide scintillators ($LaBr_3$(Ce), $LaBr_3$(Ce+Sr), $LaCl_3$(Ce)) have been extensively used for gamma ray spectroscopy measurements. They offer excellent energy resolution (about 3-4% at 662keV) and fast scintillation time, allowing high counting rate measurements (>300 kHz). These scintillators find applications in various research fields such as nuclear physics, astrophysics, nuclear fusion and nuclear medicine. More recently, thanks to the exploitation of the n-^{35}Cl nuclear reaction channel, $LaCl_3$(Ce) crystals have been use as neutron spectrometer. This opened up the opportunity to explore pulse shape discrimination algorithms for enabling the neutron/gamma discrimination.
In this work, an innovative algorithm for particle discrimination applied to lanthanum halide scintillators will be presented. The effectiveness of the algorithm has been demonstrated first on the intrinsic radioactivity measurement of the crystals, which is characterized by gamma ray emissions from ^{138}La decay and alpha decays due to actinides contamination, and then with neutrons. The particle discrimination feature allows for a better description of the intrinsic activity of the crystal and improved background suppression when performing gamma ray spectroscopy measurements in low cross-section measurements or in a mixed gamma-neutron radiation field.

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