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XENONnT physics-driven 6D Surface Background Model

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The direct dark matter experiment XENONnT utilizes a dual-phase TPC with an active target of approximately 5.9 t of liquid xenon.
To optimize the detection of scintillation light, the TPC is enclosed by PTFE panels refined with a diamond-tip process.
These panels, in direct contact with the liquid xenon, can introduce a radiation background due to the long-lived Pb210 contaminant, which originates from the panels exposure to radon in the air.
This surface background mostly accounting for electrons and gammas generated in the Pb210 decay chain exhibits a different behavior with respect to the other electronic-recoil backgrounds.
Indeed, suffering from a S2 signal loss, these events present a lower ratio of ionization to scintillation signals, dangerously leaking into the nuclear recoil band, where the WIMP signal is searched.
The conventional method exploited to mitigate the impact of this background combines a geometrical fiducial volume cut with a data-driven model developed on unblinded side-bands.
The study reported here aims to assess the feasibility of a physics-driven surface background model with the goal of utilizing a more reliable model for future WIMP searches, and potentially expanding the fiducial volume to increase experimental exposure.

Primary author: FERRARI, Cecilia (Istituto Nazionale di Fisica Nucleare)

Presenter: FERRARI, Cecilia (Istituto Nazionale di Fisica Nucleare)

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