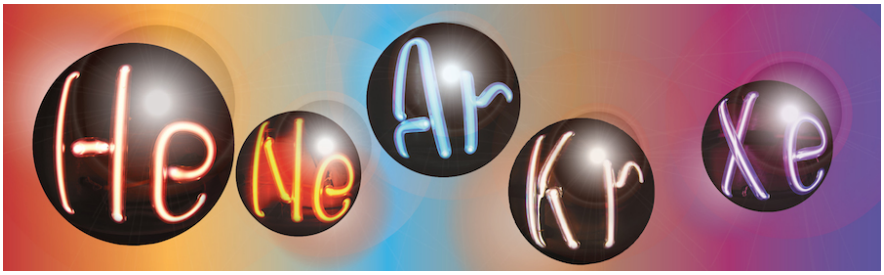

Contribution ID: **75** Type: **Oral Presentation**

Scaling Up TPCs for Rare Event Searches: Space Charge and Pile-Up Effects

Friday, 24 October 2025 10:40 (20 minutes)

The increasing size of liquid argon and xenon time projection chambers introduces new challenges related to higher event rates in the active volume. A key concern is pile-up, the overlap of multiple events within the maximum drift time, which can lead to S1–S2 misidentification and increased dead time. We discuss possible mitigation strategies, including optimized event selection and advanced reconstruction algorithms. We also examine the impact of positive ion accumulation, which leads to space charge effects, like electric field distortions, changes in electron drift velocity, and degraded spatial resolution. Continuous recombination between electrons and ions may further contribute to uncorrelated photon emission, worsening pile-up.
These effects are especially relevant in detectors with long drifts. Understanding and mitigating them is crucial for the next generation of high-performance TPCs for rare event detection.

Primary author: SANTORELLI, Roberto (CIEMAT)

Presenter: SANTORELLI, Roberto (CIEMAT)

Session Classification: Light/charge response in Noble Elements

Track Classification: Light/charge response in Noble Elements (gas, liquid, dual phase)