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Wire Electrode Test and Simulation for the DARWIN experiment

The DARk matter Wimp search with liquid xenoN (DARWIN) observatory is a future dark matter detector aiming at reaching the sensitivity for WIMP at the neutrino floor and covering the mass range from 5 GeV/c2 to above 10 TeV/c2 [1]. The observatory uses the technology of a dual-phase time projection chamber (TPC) with 40 t active volume of liquid xenon (LXe) for the detection [1].
The electrodes of the TPC is one of the vital components that allows 3D position reconstruction of the signal and thus benefits the event selection processes. One aspect of the electrode that affects the signal amplification in the gaseous phase of the TPC is the sagging level of the wire. We performed 2D electrostatic simulation to quantify and correlate the effect of sagging on the signal, so as to foster the decision on acceptable sagging level in the context of the 2.6 m electrode in the context of DARWIN TPC. We also tested the mechanical properties of the candidate materials for the electrodes at different temperatures, including temperature close to LXe temperature.
This talk will briefly introduce the DARWIN experiment, the concepts of electrodes considered, and the methods and current results for the simulation and characterization work.

References

[1] J. Aalbers et al., J. Cosmol. Astropart. Phys., 11, 017 (2016)

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