The AC-LGAD (AC-coupled Low Gain Avalanche Detector/Diode) is a new type of semiconductor detector that incorporates an AC-coupled electrode into a conventional LGAD structure, thereby achieving high spatial resolution in addition to excellent timing performance. LGADs feature a strong internal electric-field multiplication region, which efficiently amplifies charges and provides time resolutions on the order of tens of picoseconds. However, conventional LGADs suffer from limited spatial resolution and dead zones because each pixel requires a separate readout electrode. Overcoming this "acceptance hole" typically necessitates a multilayer design, which increases both the material budget and the required installation space.

AC-LGADs address these challenges by coupling the readout electrode to the signal layer through an insulating layer and enabling charge sharing among adjacent electrodes, significantly improving spatial resolution. This design effectively eliminates acceptance holes by removing the gaps between electrodes. As a result, a single-layer configuration becomes feasible, reducing the total material and creating a more compact detector.

These advantages make AC-LGADs an attractive choice for tracking and timing layers in future large collider experiments, offering high time and spatial resolution with minimal interference for other detectors, even when experimental space is limited. Ongoing research and development of AC-LGAD-based detectors will play an essential role in advancing particle physics experiments.

In recent years, the ePIC collaboration has been actively developing this new technology for practical applications. The collaboration plans to employ it for particle identification in the low-$p_{\rm T}$ region. The collaboration is exploring various electrode designs, such as strip and pixel types, to accommodate different particle multiplicities. Specifically, strip detectors will cover the mid-rapidity region, while pixel detectors will be used in the forward-rapidity region (on the hadron-beam side).

These efforts have already achieved time resolutions below 35 ps and spatial resolutions better than 30 μm. Going forward, the ePIC collaboration will continue to enhance sensor performance and move toward an engineering design, aiming to deploy this technology as a fully operational detector.