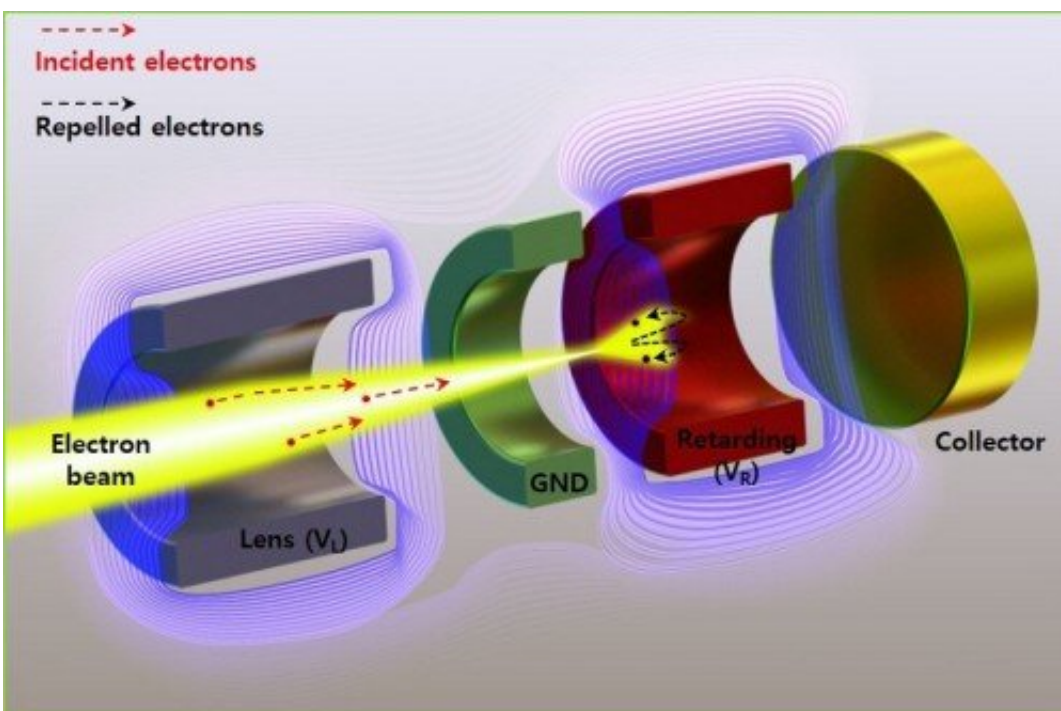


Comprehensive performance evaluation of electron microscopes empowers local companies in Korea

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Principle of the pre-lens retarding field energy analyzer. Credit: Korea Research Institute of Standards and Science (KRISS)

Korea Research Institute of Standards and Science (KRISS, President Hyun-Min Park) has succeeded in developing a high-performance energy analyzer, which is a key technology for determining the performance of electron microscopes. The service will be made available

to local equipment companies to foster the advanced microscope industry.

The performance of electron microscopes depends on the characteristics of the electron sources that produce the electron beams. This is because electron beams are focused on a lens to observe specimens. To allow precise focusing, the [energy](#) distribution of the electron particles must be uniform, even when observing extremely small specimens. As such, it is important to accurately measure the energy width, an indicator of the uniformity of energy distribution, in order to develop high-performance electron microscopes.

Many local companies have successfully developed electron microscopes, but have had to rely on numbers available in the literature instead of actual measurements, because there has been no energy analyzer capable of measuring energy width. The conventional approach does not allow comprehensive performance validation, as slight differences in performance across individual microscopes are overlooked. For companies to enter the high-performance electron microscope market, they must be able to obtain accurate measurements of energy width.

The KRISS research team developed design technology from simulations performed in 2019, and successfully developed a pre-lens retarding field energy analyzer. The production cost was relatively cheap at around a few million won, and the device can measure an energy distribution broadening of 13.8 meV. This energy analyzer can be utilized to perform evaluations of advanced research equipment, including scanning electron microscopes. It is only 60 mm in size, making it useful as an independent analyzer, or it can be attached inside existing equipment, for microscopes with an integrated electron beam performance evaluation function.

Energy analyzers can be mainly divided into two types. The hemispherical electron energy analyzer offers outstanding energy resolution, but is expensive and much larger in size (700 mm). The grid-type retarding field energy analyzer is compact and affordable, but is inadequate for performance evaluation as its energy resolution exceeds 300 meV.

In addition to using the existing measurement test of angular current density, KRISS established an energy width measurement platform, and launched a testing service for local companies in August. By the end of this year KRISS plans to establish an energy resolution performance evaluation platform to assess the influence of magnetic field, noise and vibration.

In-Yong Park, team leader of the KRISS Scientific Instruments Performance Evaluation Team, said, "Previously, Korea lacked technological self-reliance for high-performance [electron microscopes](#) despite their importance in materials, parts, and biotechnology. The new platform for comprehensive performance evaluation, ranging from individual microscope parts to the entire system, will pave the way for local companies to enter the high-performance [microscope](#) market."

More information: Ha Rim Lee et al, High-Performance Compact Pre-Lens Retarding Field Energy Analyzer for Energy Distribution Measurements of an Electron Gun, *Microscopy and Microanalysis* (2022). [DOI: 10.1017/S1431927622012235](https://doi.org/10.1017/S1431927622012235)

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