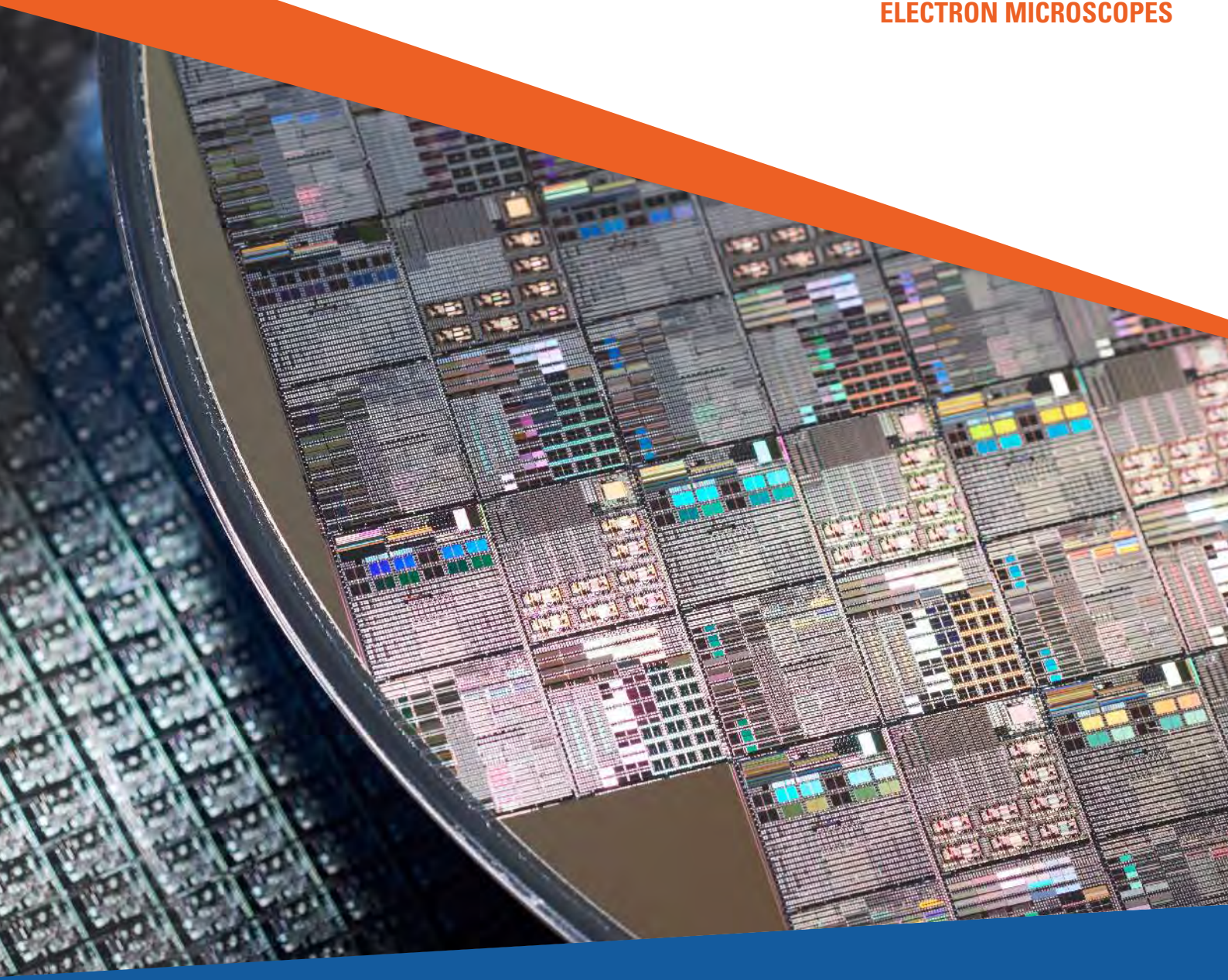
LION PRECISION

SEMICONDUCTOR CASE STUDY

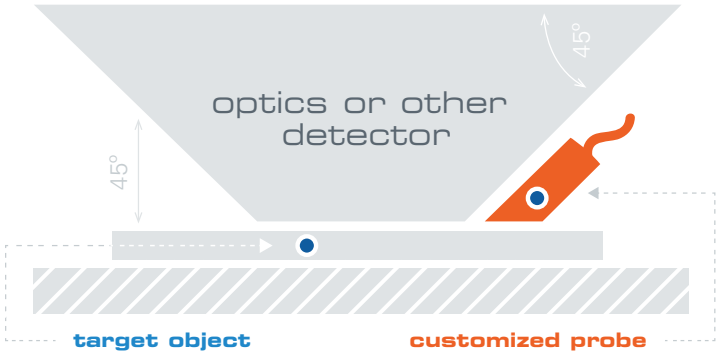
Z-HEIGHT MEASUREMENT FOR SCANNING ELECTRON MICROSCOPES



APPLICATION:
Z-height distance measurement of a SEM (Scanning Electron Microscope) optical head over a semiconductor wafer in a wafer inspection tool

SENSOR SOLUTION:
Lion Precision Vacuum Compatible Capacitive Probe and CPL290 driver

BENEFITS:
The Customer saves about 6 seconds per cycle of operation when using a capacitive sensor to quickly focus the electron microscope onto a wafer. The electron microscope is used to locate and correct surface defects. Since these platforms are in operation 24/7, this results in a significant time savings. This in turn allows more wafer throughput and generates more revenue per hour.



A Scanning Electron Microscope (SEM)

is a type of microscope that produces images of a sample by scanning the surface with a focused beam of electrons. The electrons interact with atoms in the sample, producing a signal that contains various information about the sample's surface topography and composition. The electron beam is scanned in a raster scan pattern, and the beam's position is combined with the detected signal to produce an image. SEM can achieve resolution better than 1 nanometer. Specimens can be observed in high vacuum in conventional SEM, or in low vacuum or wet conditions in variable pressure or environmental SEM, and at a wide range of cryogenic or elevated temperatures with specialized instruments.

A Semiconductor OEM

Manufacturer wanted to add a new capability to their existing SEM System to increase throughput. Lion Precision provided them an integrated sensor solution that allowed the optical head of the electron microscope to be quickly moved into its focal range over the wafer. A custom designed capacitive probe with a 45° surface was required to fit the available space. The probe was encapsulated in PEEK (a plastic insulating material) to improve reliability and prevent charging issues in the vacuum chamber. The capacitive driver was optimized to allow on/off switching within 1 ms. The dual range option on the driver allowed for the microscope to be positioned at two different heights. The system was supplied for a HV (high vacuum 10-6 torr) environment with a vacuum feed-through and LEMO connectors. A capacitive probe is mounted on the side of the electron microscope optics. As the microscope head is moved down in the Z direction the cap sensor measurement is used to quickly move it into its focal range above the wafer. Then the final (fine) focus of the electron microscope is achieved.

In the diagram above, you can see that a single Lion Precision capacitive probe sangled at 45° is mounted rigidly on the side of the electron microscope. In this configuration the surface of the probe and the top surface of the wafer are parallel. This insures the best sensor performance within the SEM control system.

Besides scanning electron microscopes, Lion Precision sensors can be used for Z-height displacement measurements on other types of microscopes and optical based metrology systems.