

PHI TRIFT V
*nano*TOF

Time-of-Flight SIMS

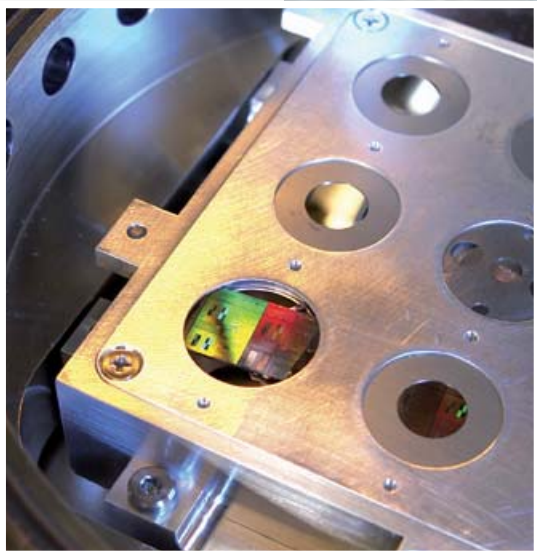


PHYSICAL
ELECTRONICS

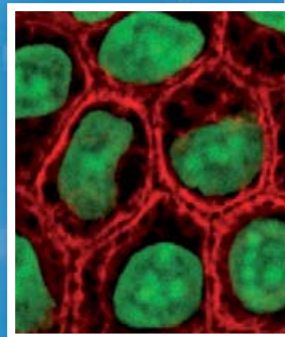
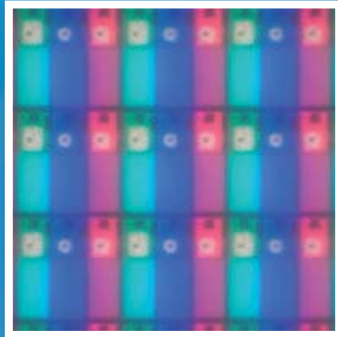
Combining Superior TRIFT
Analyzer Performance
with Revolutionary
Sample Handling



PHI TRIFT V
*nano*TOF



ENABLING PROGRESS IN A WIDE RANGE OF
Advanced Technologies



Superior TRIFT Analyzer Performance

Revolutionary Sample Handling

State-of-the-Art Ion Gun Performance

“Turn Key” Insulator Analysis

THE NEXT LEVEL IN TIME-OF-FLIGHT SIMS

Physical Electronics (PHI) and ULVAC-PHI, the world's leading supplier of ultrahigh vacuum based surface analysis instruments, brings you the next generation TOF-SIMS instrument, the PHI TRIFT V *nanoTOF*. PHI has designed, manufactured, and supported innovative surface analysis instrumentation for over 35 years. Our products are built around core technologies that address the ever changing surface characterization needs of a wide range of high technology industries and research fields. Time-of-flight SIMS has emerged as an important analytical tool for enabling key advances in technology because of its unique combination of sensitivity, spatial resolution, and chemical specificity. The *nanoTOF* takes TOF-SIMS to the next level, offering superior performance and revolutionary sample handling.

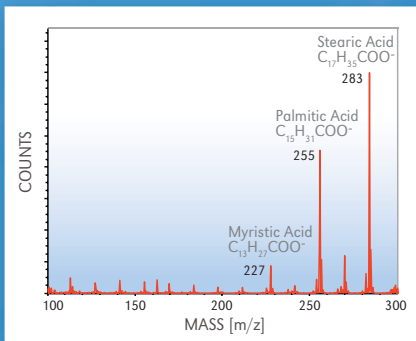


Analytical Capabilities

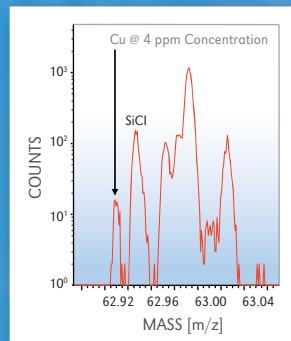
TOF-SIMS PRINCIPLES

TOF-SIMS employs a pulsed primary ion beam to induce the desorption and ionization of atomic and molecular species from a solid sample surface. The resulting secondary ions are accelerated into the mass spectrometer where they are mass separated by measuring the time-of-flight from the sample to the detector. An image is generated by rastering a finely focused beam across the sample surface. A depth profile may be constructed by using an ion beam to remove sequential layers of material from the surface while acquiring mass spectra at each depth.

CAPABILITIES

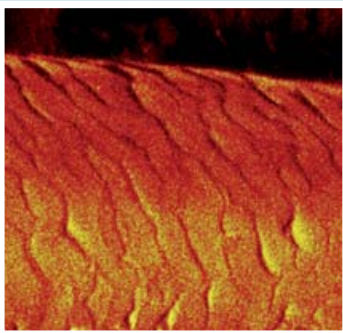


Organic Molecular Analysis

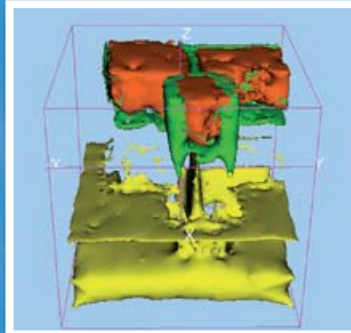


Trace Analysis

- Analysis of all conducting, semi-conducting and insulating solids
- Parallel detection of atomic and molecular species, both organic and inorganic
- Detection and resolution of all elements and isotopes
- Identification of high mass organic molecules
- Sensitivities down to parts-per-billion
- 2D and 3D characterization



High Resolution Image of Hair Surface



3D Image Depth Profiling

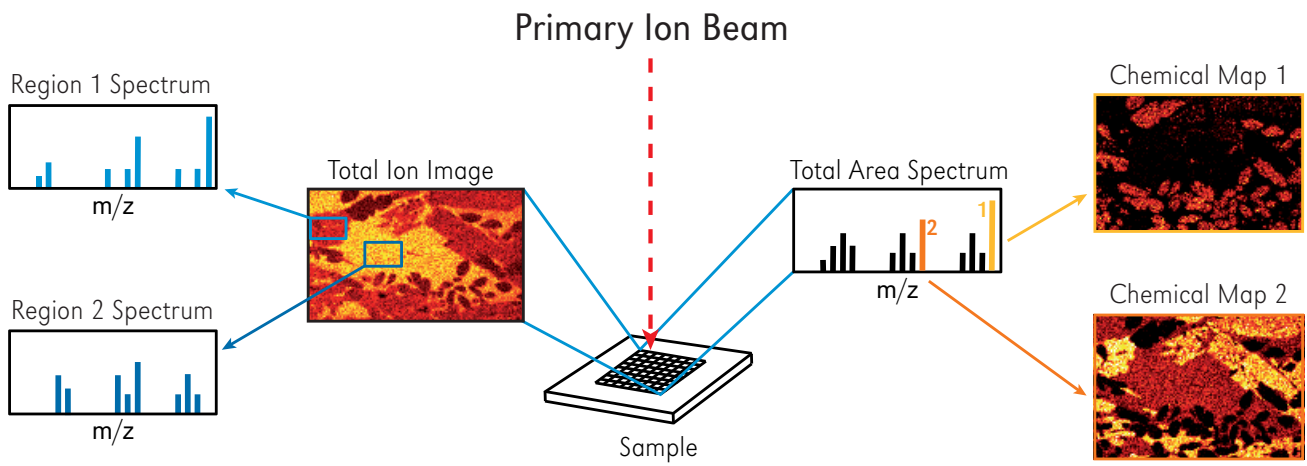
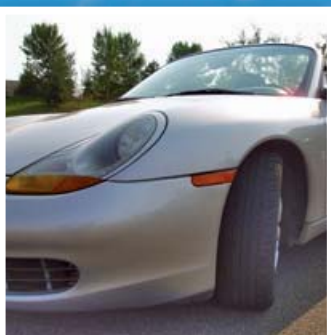
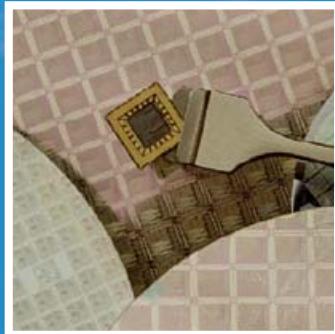


Illustration of Retrospective Analysis

APPLICATIONS



Research Areas

- Nanodevices
- Polymer blends
- Quantum structures
- Biocompatibility
- Biofouling
- Pharmaceuticals
- Drug eluting coatings

Advanced Technologies

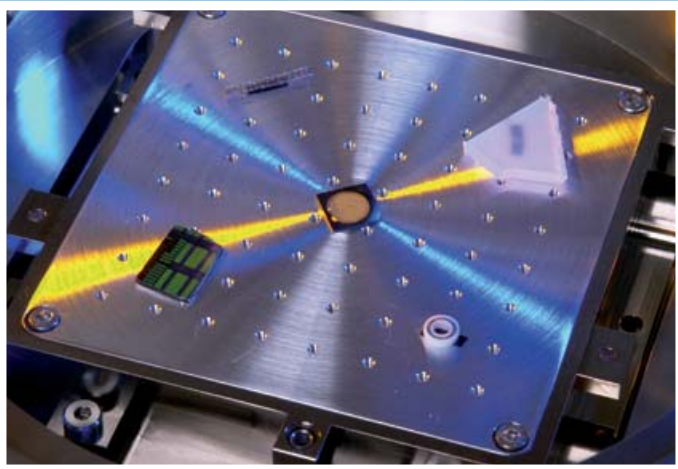
- Paints
- Metals
- Semiconductors
- Glass
- Ceramics
- Coatings
- Paper
- Thin films
- Fibers

Revolutionary Sample Handling

INNOVATIVE STAGE DESIGN

The patented sample handling has been engineered specifically for TOF-SIMS applications, keeping in mind the analytical rigors and the variety of specimens encountered. The result is a stable, highly versatile, fully automated 5-axis sample handling system for any TOF-SIMS application.

FLEXIBILITY IN SAMPLE MOUNTING



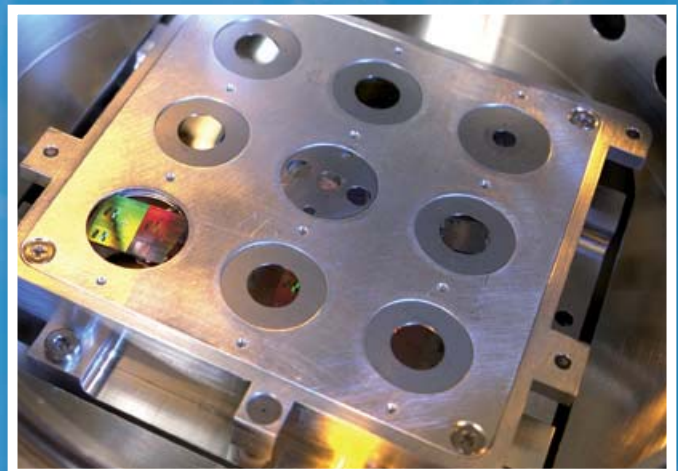
Front Sample Mounting



Large Sample Mounting



Cryogenic Sample Holder



Rear Sample Mounting

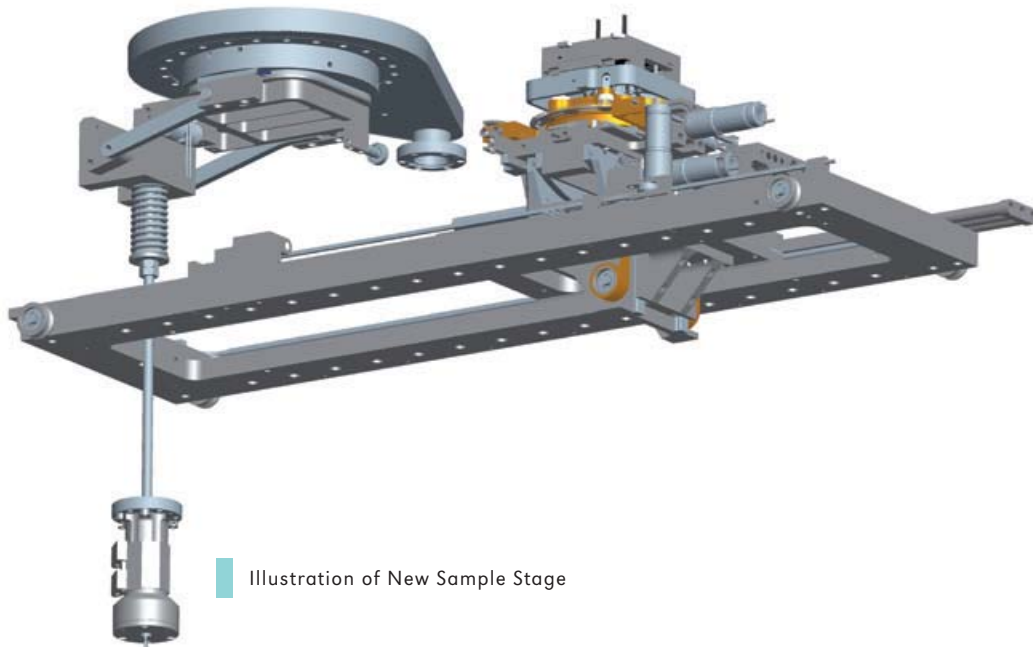


Illustration of New Sample Stage

INNOVATIVE STAGE FEATURES



Sample Platen in Fast Entry Chamber

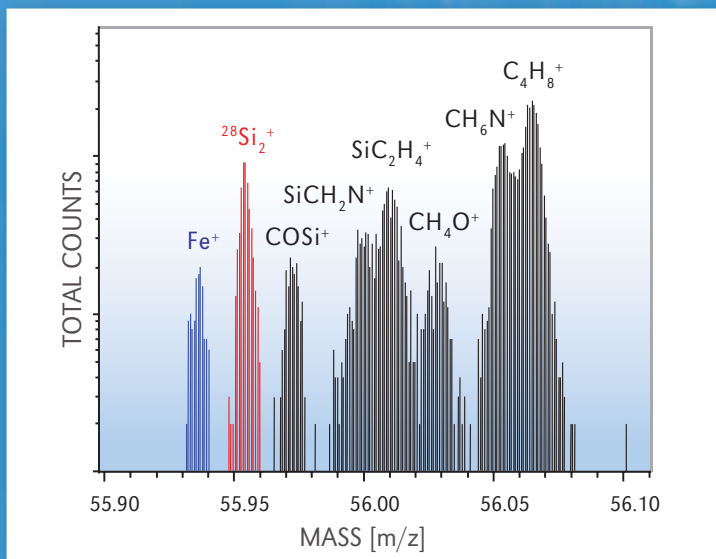
- **Sample holder is mounted directly onto analysis stage** in the fast entry chamber
- **Automated 5-axis stage** with X, Y, Z, rotation and tilt
- **Large sample handling** up to 100 mm square and 25 mm thick
- **Front and back loading** sample holders
- **Uninterrupted control and monitoring** of sample temperature from fast entry chamber to analysis position
- **Optional hot and cold modules** can be added or removed in the fast entry chamber
- **Fully computer controlled** sample introduction
- **Rigid sample mounting** for excellent imaging performance
- **Base stage is 300 mm compatible**

Superior TRIFT Analyzer Performance

OPTIMIZED CONFIGURATION

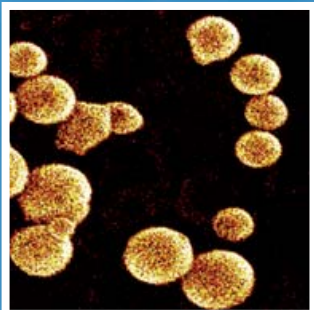
In the PHI TRIFT V *nanoTOF*, the analyzer has been oriented vertically to accommodate horizontal sample positioning. The new *nanoTOF* extraction optics have been redesigned to allow up to four ion guns to be aligned to the same analysis position. Higher spatial resolution performance is achieved with the new extraction optics while the superior imaging and spectroscopy performance of the triple electrostatic analyzer (ESA) design is maintained.

TRIFT CHARACTERISTICS

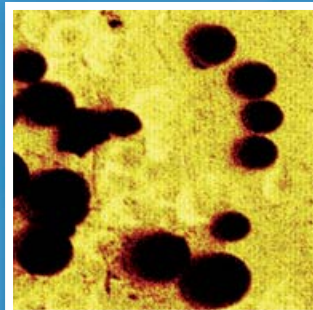


Low Background of TRIFT Analyzer

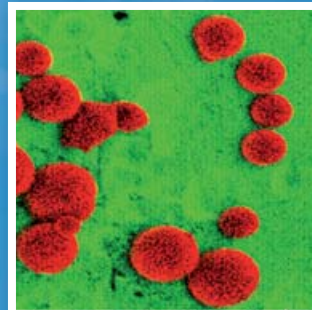
- **Ultimate mass resolution** over large analysis areas
- **Low background** due to metastable ion rejection from the triple ESA design
- **Exceptionally large solid angle** of collection results in uniform imaging sensitivity on curved or faceted surfaces
- **Superior depth-of-field** in images due to large energy acceptance window
- **High mass sensitivity** enabled by 20 kV post-acceleration
- **Ease-of-use** due to spectrometer voltages that do not require tuning, even on insulating materials



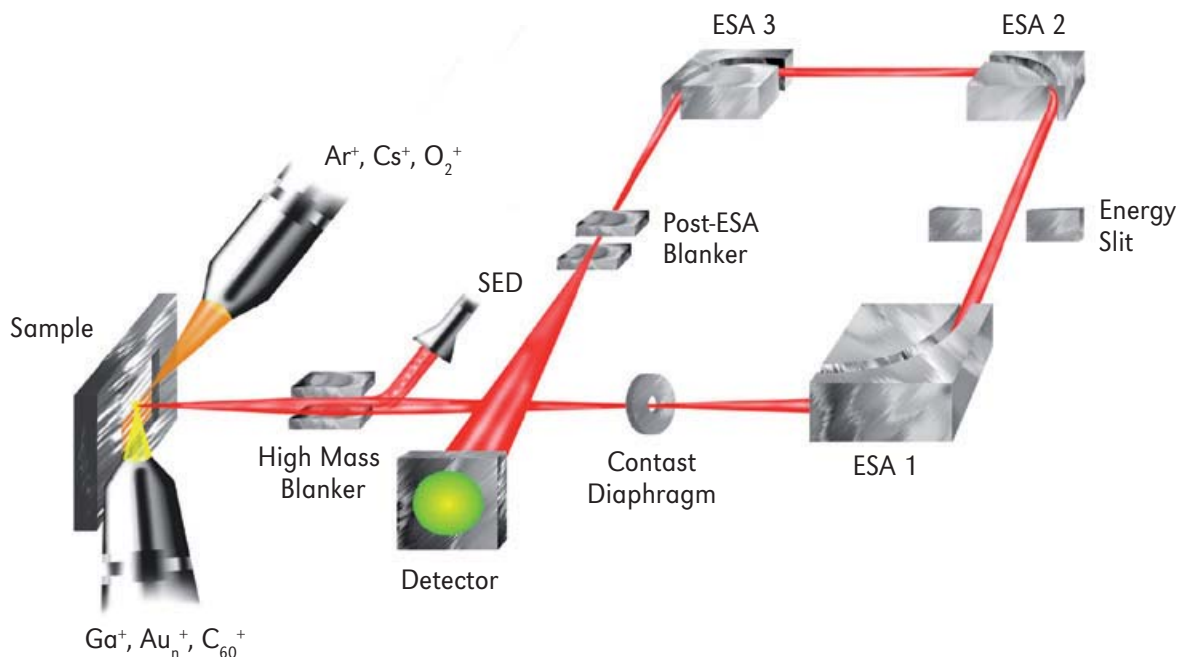
Nickel Spheres



Indium Foil

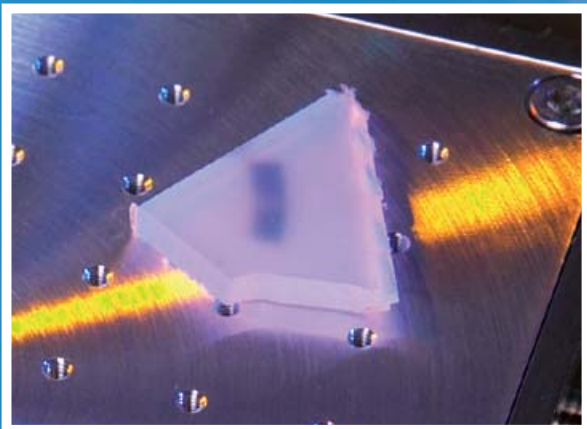


Nickel (red), Indium (green)
Overlay

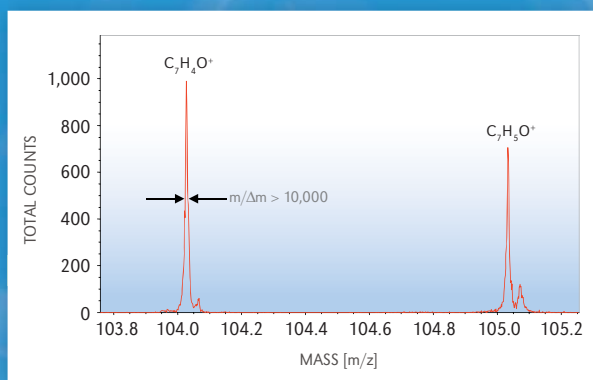


TRIFT Schematic

“TURN KEY” INSULATOR ANALYSIS



Bulk Polymer Sample



High Mass Resolution Analysis of PET

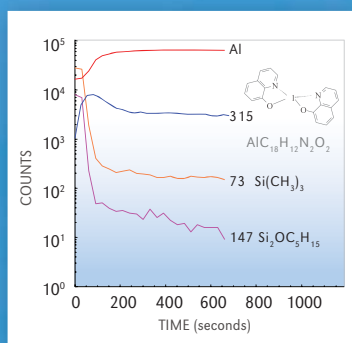
- **The patented charge compensation method** has been used for many years on PHI XPS instruments
- **This dual-beam charge compensation method** has proven successful at making insulator analysis “turn-key”
- **The dual beam method** allows electron energies below 10 eV to be used, reducing sample damage
- **Low energy ion beam** is below the threshold for chemical damage
- **More effective charge compensation** makes it possible to image insulators at higher magnifications

State-of-the-Art Ion Gun Performance

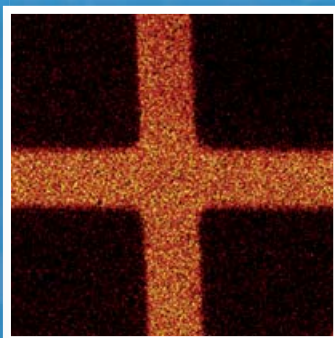
ION GUNS

The performance of the *nanoTOF* instrument is a result of integrating state-of-the-art ion gun technology into the total system design. The *nanoTOF* provides superior image resolution, outstanding mass resolution, and enhanced molecular ion sensitivity for complete chemical analysis. Moreover, the 20 kV C_{60} ion gun provides a unique capability for molecular depth profiling and imaging high mass organic species at high spatial resolution. Careful consideration has been given to both the working distance and the angle of impact for each ion gun. Each parameter has been optimized to allow a wide variety of analytical applications.

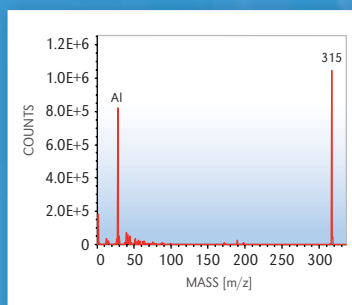
MULTIPLE ION GUN OPTIONS



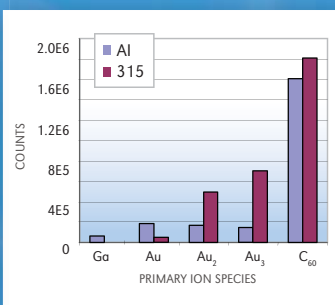
40 keV C_{60}^{+2} Depth Profile



Al^+ Image Using Au_3^+ (25 μm FOV)



Mass Spectrum of Alq3 Using C_{60}

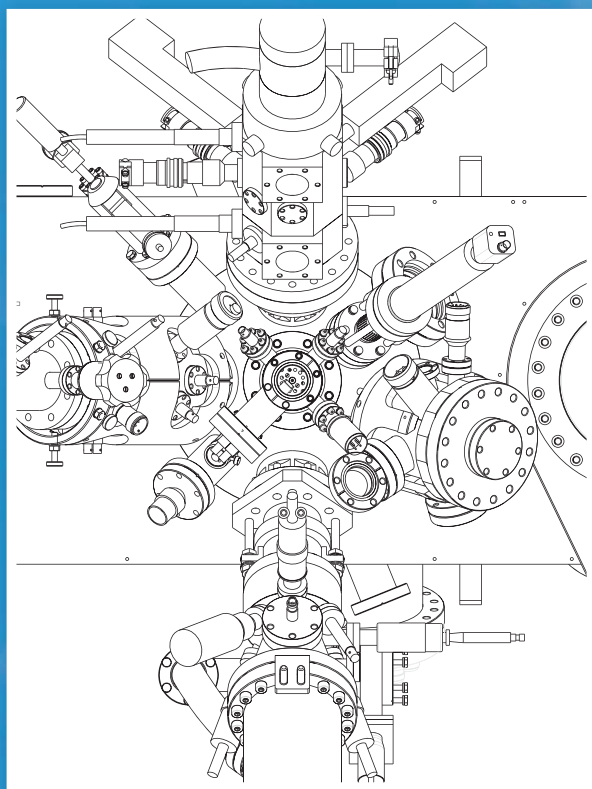


Relative Ion Yields from Alq3

- **Superior LMIG Imaging**
- **Submicron LMIG spatial resolution** with ultimate mass resolution
- **Ease of LMIG tuning** allows optimizing conditions for every application
- **20 kV C_{60} ion gun** for better imaging and reduced damage to organics
- **Unique capability** for C_{60} molecular depth profiling
- **Gas ion gun** for high sensitivity positive ion depth profiling
- **Cesium ion gun** for high sensitivity negative ion depth profiling



VERSATILE ANALYSIS CHAMBER



Top Down View of Analysis Chamber

The sample analysis chamber has been engineered to unite optimum performance characteristics with experimental and analytical flexibility.

- **Combines the best** TOF analyzer with revolutionary sample handling capability
- **Horizontal sample positioning**, includes both front and back loaded sample holders
- **Capability to incorporate 4 ion sources**
- **Live sample viewing** with variable field of view (FOV) from μm to mm
- **No rods required** for sample transfer
- **Patented turn key charge compensation**
- **High performance** vibration isolation
- **Optional 300 mm sample handling**
- **Ultrahigh vacuum (UHV)** operation

PHI TRIFT V *nano*TOF

CONTACT US

Developing next generation products and advancing the understanding of complex scientific issues becomes more challenging every year. At PHI, we want to better understand your analytical requirements. To explore how the new PHI TRIFT V *nano*TOF can be used to help you achieve your goals, contact a Physical Electronics representative.

FEATURES AND OPTIONS

- **Innovative** 5-axis stage design
- **Flexibility** of front and back loading samples
- **100 mm and 300 mm sample handling**
- **Sample holder is mounted directly onto analysis stage** in the fast entry chamber
- **Uninterrupted heating/cooling** of sample from fast entry chamber to analysis position
- **Versatile analysis chamber** can incorporate up to 4 different ion guns
- **Low spectral and image background** due to metastable ion rejection in the TRIFT analyzer
- **Exceptionally large** solid angle of collection results in uniform imaging sensitivity
- **Patented charge compensation** method makes insulator analysis “turn key”
- **Superior spatial resolution** LMIG performance
- **Optional 20 kV C₆₀ ion beam** for enhanced sensitivity and depth profiling of organics
- **Optional Cs ion gun** for high sensitivity negative ion depth profiling
- **Optional gas ion gun** for high sensitivity positive ion depth profiling

Combining Superior TRIFT Analyzer Performance
with Revolutionary Sample Handling

PHYSICAL ELECTRONICS



About PHI

Surface Analysis Instrumentation - Enhancing Performance, Productivity and Profitability

Physical Electronics (PHI) is a subsidiary of the ULVAC Corporation and the world's leading supplier of surface analysis instrumentation. PHI's innovative XPS, AES, and SIMS technologies provide our customers with unique tools to solve challenging materials problems and accelerate the development of new processes and products. As the only supplier that provides a full range of high performance XPS, AES, and SIMS instruments, PHI is in a unique position to provide complete surface analysis solutions to potential clients in a broad range of high technology fields including nanotechnology, microelectronics, storage media, catalysis, bio-materials, pharmaceuticals and basic materials such as metals, polymers, composites and coatings.

Our products are designed to provide high performance and reliability to meet our commitment to total customer satisfaction. Our skilled scientific staff, applications specialists and global customer service organization provide a uniquely high level of customer support.

To learn more about our products or how they can be used to meet your analytical needs, please visit our website or contact us directly.

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