About the LAESI DP-1000

Protea’s LAESI DP-1000 System revolutionizes sample introduction and data analysis for imaging and high-throughput biological mass spectrometry. This ‘smart source’ offers you unprecedented access and visualization of your molecules of interest directly as they exist and where they exist in nature, changing the way you think about sample analysis by mass spectrometry.

Combining proprietary Laser Ablation Electrospray Ionization (LAESI) technology with a high performance and versatile XYZ platform, the LAESI DP-1000 system allows fast and accurate direct ionization and mapping of biomolecules in biological samples and open well plates. Designed for 2D and 3D sample imaging, the LAESI DP-1000 enables mass spectrometric analysis of any sample containing water without the need for any additional sample preparation. In a two-stage process, ambient pressure laser ablation and subsequent electrospray ionization enable mass spectrometric analysis of living cells and tissues, without the introduction of artifacts or sample degradation. Tissues are elegantly mapped in two and three dimensions, displaying the molecular profile across the sample, or profiling the spatial distribution of intracellular molecules throughout the tissue.

The LAESI DP-1000 open well plate imaging facilitates high-throughput biological fluid analysis. Biological fluids can be directly analyzed for compound detection or quantitative studies without any upstream sample preparation. Samples can be analyzed in a variety of standard well plate sizes, with ultra-fast programmable stage movement to increase laboratory productivity and overall sample processing capabilities.

Traditional methods of sample analysis require extensive and time consuming sample preparation. The LAESI DP-1000 changes this paradigm by directly ionizing your sample as it exists in nature, providing information on the native chemistry of the sample as well as distribution profiling of molecules.
The LAESI DP-1000 directly ionizes samples in a two-step process: laser ablation and electrospray ionization. The process begins when the sample is ablated by a short, mid-IR laser pulse that is tuned to the strong absorption line of liquid water (2940 nm). This laser pulse creates a small plume of non-ionized material. As the plume collapses, a secondary jet of material is ejected from the sample surface and into the ESI stream where it is ionized. The ionized material is then swept into the mass spectrometer for analysis. LAESI DP-1000 combines laser resolution capabilities with electrospray ionization benefits.
The LAESI DP-1000 provides 2D and 3D imaging capabilities, with ambient pressure sampling that requires no laborious matrix addition. With virtually no sample preparation required, the LAESI DP-1000 elegantly maps the spatial distribution of any biomolecule of interest; either directly from the native sample or in an open well plate.

The laser ablation process allows analysis of intracellular fluids directly from a tissue providing a non-selective extraction of molecules as neutrals. Molecules intersect with an ESI stream and are ionized. Ionization polarity is part of the method development parameters, and both positive and negative ion modes are available for a more complete representation of the biomolecular profile of a sample.

In order to provide the accurate spatial distribution data, the LAESI DP-1000 uses a programmable XYZ translation stage to control movement of the sample while scanning. The thermoelectric Peltier stage controls temperature to enabling frozen tissue profiling or reaction kinetics analysis at increased temperatures.

Cryosection of Rat Brain
3D imaging with the LAESI DP-1000 is made possible as the powerful onboard laser tunnels through thicker sections of tissues. The LAESI DP-1000 system delivers the ejected material of each ablation pulse to the mass spec for analysis. Laser tunneling eliminates the need for sample slicing and complicated sample alignment issues, thereby saving many hours of sample preparation and providing a more accurate representation of the native sample.

Sample visualization to obtain method set-up is aided by the use of a high resolution, wide-angle camera which captures pre- and post-analysis photos of the sample. In addition to the wide-angle camera, a near-field camera is equipped for viewing and targeting the sample area of interest. The LAESI DP-1000 control software allows for the area of interest to be profiled in a grid pattern, or specific areas of the sample can simply be targeted independently, which saves time by not ablating any unwanted areas of the sample. Focus of the near-field camera is synchronized with laser focusing to facilitate system set-up.

Once the sample data has been collected, the LAESI DP-1000 uses the proprietary ProteaPlot™ imaging software to create publication quality contour plots showing the spatial distribution of molecules throughout the tissue. This dedicated, intuitive software allows you to select and plot known and unknown molecules of interest, create molecular depth profile plots, and overlay the molecular distribution plot with the original high-resolution sample image. ProteaPlot works with your mass spec data to deliver spatial representation of your compounds. No third-party software is needed.
High Throughput Biofluid Analysis

The LAESI DP-1000 brings never before imagined processing speed to the analysis of biological fluids on standard well plates. With no sample prep and a programmable translation stage, the LAESI DP-1000 enables sample acquisition in seconds, saving time and allowing for quicker sample screening. Whether analyzing 96 or 384 standard well plates, the LAESI DP-1000 allows a one-run-per-plate approach and multiple spatial distribution of sampling per well (dithering method).

Without the need for any upstream LC sample separation, samples are directly ablated, ionized and then analyzed by mass spectrometry. This rapid and direct analysis enables absolute quantitation and detection of drugs or other biomolecules in low concentrations. Either with or without adding an internal standard to the biofluid samples, quantitation of specific molecules can be consistently achieved in just a few seconds per sample.
Using the stage and control software, the LAESI DP-1000 acts as a temperature controlled autosampler that includes preprogrammed and automated sample analysis. The stage area is contained in a closed ionization conditions which protects the ionization environment from outside influences and contaminants. For profiling of different sample plate sizes and styles, various laser raster settings can be programmed for ultrafast sampling.

Understanding the amount of specific molecules in biofluids is extremely important in discovery and development. The LAESI DP-1000 allows the precise quantitation of specific molecules at low concentrations for quick screening studies and more thorough analyses. Since LAESI DP-1000 is operating at ambient pressure, essays can be monitored in real-time to measure the consumption or generation of specific metabolites, without any manipulation of the sample of interest.
Understanding how cells and tissues work at the molecular level is essential to your ability to develop pharmaceuticals to target specific cells or tissues of interest. The LAESI DP-1000’s innovative technology and engineering allows for the direct analysis of living cells and tissues. Native sample ionization allows for the analysis of living cells and tissues in their natural state. Without the need to manipulate samples, the profile generated by your mass spec is a more accurate representation of the actual expression profile of the cells. This gives you more accurate data and a truly better understanding of what is happening at the molecular level inside the cells or tissues. Performing ionization at ambient pressure give you a true representation of a living culture’s biodynamics.

This as-is analysis dramatically expands your sample type options to include cell colonies, live cell cultures and tissues for imaging experiments. In addition to the ambient conditions, these sample types do not require the addition of any matrix, giving you a better signal-to-noise ratio and easier to interpret spectra.
Biomarker Discovery

Using the LAESI DP-1000, it is possible to evaluate metabolite biomarkers in biological samples resulting from changes in environmental or pathologic conditions. This is critical in understanding the role of these biomarkers in various diseases.

LAESI DP-1000 direct ionization capabilities redefine how you approach biomarker research. Now, you can directly search for new and unexpected molecules by using LAESI mass spectrometry combined with multivariate statistics. This changes the traditional experimental design and accelerates the speed of discovery of new biological paths. Without the need for sample preparation, researchers can directly investigate biological samples to determine differences in diseased and normal cell types. The combination of direct sample analysis by the LAESI DP-1000 with multivariate statistics on high resolution MS data allows you to dig deeper into understanding the differences between your various experimental samples. High confidence statistical outliers are potential biomarkers and can be investigated further to determine identity and function.

S-Plot of LAESI DP-1000 mass spectra from control and stromal co-cultured cells. The highlighted m/z values contribute to the greatest variance between the mass spectra of control REH cells and stromal co-cultured REH cells.
Thin layer chromatography (or TLC) plate analysis is a great method to quickly separate complex sample mixtures. The LAESI DP-1000 system can enhance this well-established analytical technique by scanning the plate to locate and identify specific molecules of interest, even if complete chromatographic separation has not been achieved. Traditional approaches for TLC plate characterization by MALDI MS require the addition of matrix to the TLC plate and subsequent analysis under vacuum. Matrix addition can cause sample spreading and dilution, as well as increase the background noise in the low mass range, which can interfere with the detection of small analytes. The LAESI DP-1000 overcomes this challenge by simply spraying a film of water onto the plates, with no complex matrix being required. In addition, analysis of TLC plates with the LAESI DP-1000 can be performed on standard TLC silica plates, without the need for specialized TLC plates. Contour plots can then be generated with the ProteaPlot software to map the location and relative intensity of the molecules of interest. This approach adds a complete new dimension to TLC analysis: molecular confirmation based on MS data.
Flexibility and Support

The LAESI DP-1000 conveniently integrates with different mass spectrometers, including single quad, triple quad, TOF and HDMS systems from several manufactures. This integration capitalizes on high resolution, accurate mass and quantitative aspects of a coupled mass spec system. Fully adjustable vertical and horizontal articulation of the LAESI DP-1000 easily adjust the system to fit various bench heights and mass spec set-ups. LAESI DP-1000 set-up and installation is intuitive, and the system can be easily removed for alternative upstream chromatography workflows using the same mass spectrometer without breaking the instrument’s vacuum.

Although the LAESI DP-1000 system is easy to set up and install, we understand that you may have questions about your specific application. Our team of dedicated professionals strives to ensure you receive the best data from your LAESI DP-1000 system.

• On-site installation and client orientation, repair and maintenance
• Technical and application support
• Customizable service agreements, including LAESI-based imaging projects

RP TLC plate showing mass of eluted compounds.

m/z = 552.8
m/z = 648.8
Protea is a leader in the emerging field of Bioanalytics. The company develops new technology for the identification, characterization, and quantitation of biologically-critical molecules for basic research, pharmaceutical development, and diagnostic applications. Bioanalytics is the direct identification and characterization of the products of all living cells, including proteins, lipids, metabolites and nucleic acids. Bioanalytics is emerging as a crucial area, where new technology is needed to support the future of medical research, and virtually every other field of life science research.

We are your source for Bioanalytical Solutions to your research questions. Solutions include reagents and consumables for proteomics, as well as the LAESI DP-1000 system.

We are your source for Bioanalytical Services. We develop new bioanalytical methods that enable the direct analysis of proteins and other biomolecules, and apply our capabilities to support your laboratory’s research objectives.