



Advanced Materials characterization toolbox

product – measurement – technology – applications – features



Laser diffraction
Light scattering
Imaging
Near Infra-red
X-ray fluorescence
X-ray diffraction
Sample preparation

Particle size distribution, shape and concentration



Product	Mastersizer 3000+	Hydro Insight	Spraytec	Insitec
What does it measure?	Particle size	Particle size, shape, appearance	Particle size	Particle size
Technologies used	Laser Diffraction	Dynamic imaging	Laser Diffraction	Laser Diffraction
What is it used for?	<ul style="list-style-type: none"> Measuring the size distribution of suspensions, emulsions and dry powders from 10nm to 3500µm Controlling powder properties such as wettability, bulk density, powder flow and solubility Optimizing suspension and emulsion rheology Automated particle size distribution (PSD) measurements 	<ul style="list-style-type: none"> Sits alongside Mastersizer 3000+ collecting images of particles Providing quantitative information about particle size and shape covering the size range from 1µm to 800µm Helps in method design and simplifies troubleshooting 	<ul style="list-style-type: none"> Measuring the size distribution of sprays and aerosols from 0.1µm to 2000µm Defining the deposition pattern and bioavailability of drug materials delivered using pump sprays and inhalers Understanding the environmental impact of spraying in coating consumer or agrochemical applications Resolve the fluctuations in droplet size during the rapid firing of automotive fuel injector systems 	<ul style="list-style-type: none"> Online continuous particle size analysis needed for efficient, cost-effective monitoring and control of industrial processes Suitable for the widest variety of process streams from dry powders to hot sticky slurries, sprays and emulsions, whether milligrams of material or hundreds of tonnes per hour Insitec systems measure particles in the size range 0.1 micron to 2.5 mm
What is special about this product?	<ul style="list-style-type: none"> Quality data you can rely on Class-leading particle sizing performance with added intelligence Intuitive software with built-in expertise to guide you Flexible reporting to display your data the way you want Fast smart swap between wet and dry units Rapid and effective wet dispersion for dispersions and emulsions Fast, reliable particle size measurement of fragile and cohesive dry powders Unique adaptive diffraction to separate transient from steady state data Smart Manager Enabled 	<ul style="list-style-type: none"> High-speed, high resolution dynamic imaging technology 127-frames-per-second digital camera with up to 5 megapixel resolution Imaging of individual particles and liquid particle dispersions Thumbnail images saved for post-run viewing Quantitative data on particle size and shape, including particle width and elongation data 	<ul style="list-style-type: none"> Measurement across a wide size range without requiring constant optics changes Resolve rapid changes in droplet size over time, by measuring up to 10,000 measurements a second Deliver accurate, concentration-independent results using a patented multiple scattering analysis Characterize wide spray plumes without risking optical contamination Reveal dynamic changes in spray particle size through the unique size history analysis software 	<ul style="list-style-type: none"> Industrially robust technologically proven measures particles in the size range 0.1 to 2500 µm delivers real-time monitoring and control Base model hardware manufactured to GAMP5 standards and compatible with CIP/SIP requirements to meet specific manufacturing specifications Easy to use software and fully automated operation to minimize training requirements and release operator time Integration with existing control platforms to simplify development of automated control protocols High reliability of >95% with little downtime, minimal maintenance and maximum ROI



* Select Science 2023 Platinum Seal of Quality awarded to Mastersizer 3000

Particle size, shape, chemistry, concentration, molecular weight, Formulation stability and intrinsic viscosity



Product	Morphologi 4/4-ID	Zetasizer Advance	NanoSight Pro	Product
What does it measure?	Chemical identification, Particle shape, Particle size	Zeta potential, Particle size, Particle concentration, Molecular size, Molecular weight, Protein mobility	Particle concentration, Particle size	What does it measure?
Technologies used	Image Analysis, Raman Spectroscopy	Dynamic Light Scattering, Electrophoretic Light Scattering, Static Light Scattering	Nanoparticle Tracking Analysis	Technologies used
What is it used for?	<ul style="list-style-type: none"> Size measurement of non-spherical particles such as needle shaped crystals from 0.5µm to 1000µm Measurement of shape differences where particle size alone does not allow differentiation Detection and enumeration of agglomerates, oversized particles and contaminant particles Automation of manual methods such as microscopy Physical characterization of individual components within a mixture Cross-validation of particle size measurements such as laser diffraction 	<ul style="list-style-type: none"> Measuring the size of colloids, nanoparticles and molecules in solution from 0.6nm to 15µm Determining the molecular weight of polymers and proteins Optimizing and predicting dispersion stability of colloids and biomolecules Monitoring molecular aggregation and particle flocculation processes 	<ul style="list-style-type: none"> Detection and visualization of nanoparticle populations on a particle-by-particle basis from 10nm to 1µm Measurement of particle size and particle concentration Tracking of aggregation and dissolution processes in real time Applications include nanotoxicology, biomarker detection and drug delivery research Fluorescence mode to provide differentiation of labeled or naturally fluorescing particles 	What is it used for?
What is special about this product?	<ul style="list-style-type: none"> Measures particle size, shape and chemical identity in one platform Integrated dry powder dispersion unit automates sample preparation for consistent measurements Versatile sample presentation accessories for measuring suspended and filtered samples Simple SOP operation from sample dispersion through to size, shape and chemical analysis Automatic selection, targeting and chemical classification of thousands of individual particles Powerful and intuitive software interface making both visual and statistical interpretation of your data easier than ever 	<ul style="list-style-type: none"> Technologies include NIBS, M3-PALS, DLS, ELS Simplicity of operation means minimal training and robust results High sensitivity for nanoparticles, proteins, and macromolecules High optical quality and temperature control ensures accuracy and repeatability MPT-3 Autotitrator option Adaptive Correlation to enhance repeatability MADLS for angle independent size analysis with improved precision and resolution. Also used for accurate particle concentration measurements M3-PAL and constant current mode for Zeta potential to reduce errors NEW Zetasizer sample assistant to free the operator from manually changing samples 	<ul style="list-style-type: none"> Simultaneous measurement of multiple characteristics Visual validation of results gives extra confidence User friendly software with easy set-up of SOPs for routine use Minimal sample preparation Automated multiple sample analysis when used with a syringe pump or autosampler Minimal consumables reduce running costs on a day-to-day basis High resolution particle sizing technique, ideal for polydisperse systems New practical and easy to use NS Xplorer software with embedded smart features 	What is special about this product?



Molecular and crystalline structure, composition, crystalline quality



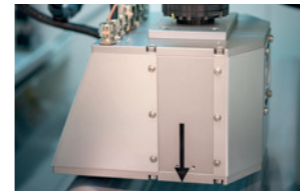
Sample preparation for XRF and ICP



Product	OMNISEC	Empyrean	Aeris		LeNeo	FORJ	Eagon2	LeDoser-12	Product	
What does it measure?	Absolute molecular weight (Mw), molecular size, intrinsic viscosity (IV), branching and other polymer parameters	Crystalline phase crystallographic structure materials microstructure Thin film structure Epitaxial strain	Crystalline phase		<ul style="list-style-type: none"> Automated fused bead machine, for sample preparation that provides a factor x10 improvement in accuracy for XRF measurements Automated preparation of peroxide and borate solutions for ICP. Decrease the sample preparation time, achieves complete dissolution, increase users' safety 			Automated sample weighing and borate flux dispensing for sample preparation by fusion	What does it measure?	
Technologies used	Gel Permeation Chromatography, Size Exclusion Chromatography, Static Light Scattering	X-ray diffraction, reflectometry, SAXS, CT	X-ray diffraction, reflectometry			Automated borate fusion			High precision autonomous weighing	Technologies used
What is it used for?	<ul style="list-style-type: none"> Determining absolute and relative Mw and Mw distribution of synthetic and natural polymers Measuring IV to investigate molecular structure and branching Assessing polymer degradation Controlling mechanical properties of plastics Characterizing and quantifying components in blends Measuring sample concentration e.g., polymer additives in fuel 	<ul style="list-style-type: none"> Phase Identification Phase quantification Thin Film characterization Epitaxial layer analysis Bulk material characterization Non-Ambient phase change Battery in-operando study In-situ phase change Stress and residual strain Crystallographic texture 3D flaw detection Nanoparticle analysis 	<ul style="list-style-type: none"> Phase identification and quantification in reflection, transmission or grazing incidence Thin film analysis Stress measurement 		<ul style="list-style-type: none"> Preparing glass disks for elemental analysis using XRF Preparing peroxide or borate solutions for elemental analysis using ICP 	<ul style="list-style-type: none"> Preparing glass disks for elemental analysis using XRF Preparing peroxide or borate solutions for elemental analysis using ICP 	<ul style="list-style-type: none"> Preparing glass discs for elemental analysis using XRF 	<ul style="list-style-type: none"> Eliminates repetition of operators' tasks, reduces fatigue and errors. Increases productivity 	What is it used for?	
What is special about this product?	<ul style="list-style-type: none"> OMNISEC REVEAL – a fully integrated temperature controlled multidetector module with minimized inter-detector volumes for maximum stability and sensitivity Market leading light scattering detector for absolute Mw High sensitivity RI detector, for low concentrations Self-balancing viscometer for accuracy in IV Wide UV/VIS wavelength range for all applications Maximum sensitivity detectors with MALS capability Intuitive, advanced and automated software OMNISEC RESOLVE - an integrated pump, degasser, autosampler and column oven in a single unit 	<ul style="list-style-type: none"> Most versatile and productive XRD system with the highest data and product quality on the market Highest angular resolution of any laboratory powder diffractometer and delivers data closest to synchrotron quality Widest range of non-ambient and in-situ environments All relevant diffraction geometries (reflection, transmission, capillary, microdiffraction, Debye-Scherrer) with batch automation Wide selection of components to match every customer Cost-effective options for SAXS and CT configurations Customizable and special solutions Full selection of analysis software packages including HighScore+ 	<ul style="list-style-type: none"> Compact X-ray diffractometer External loading intuitive operation, accessible to non-experts Touch screen user interface lets you proceed effortlessly through the measurement process of your samples Low cost of ownership, limited infrastructure requirements no need for compressed air or external cooling, lowest power consumption X-ray tube has a virtually unlimited lifetime Automation capabilities HighScore software for ease of analysis Upgradable for power, grazing incidence, transmission, non-ambience 		<ul style="list-style-type: none"> 3 preparation modes in 1 instrument 1 fusion position Small and compact, fits in limited space Ready to use right out of the box Self-installed Absolute safety for the operator Quick and easy replacement of internal refractory plates 	<ul style="list-style-type: none"> 6 positions for fusion Resistance-based heating system Completely closed furnace without risks of injuries for the operators A patented handling mechanism transfers the crucibles and molds into the furnace, improving fusion cycle time and robustness Heat-drop and heat-ramp functions to enhance oxidation conditions while boosting production rate Sample agitation by swirling to increased sample homogeneity, dissolution speed and fusion success rate Optimized chamber design ensuring heat homogeneity across the different fusion positions Pre-heat and shut-off timer to program heating periods and ensuring power saving Supercapacitor for safe closure of furnace door and continuation of fusion cycle in case of brief (< 30 seconds) power cut 	<ul style="list-style-type: none"> Absolute safety for the operator 2 fusion positions Optional exhaust adapter for minimum infrastructure requirements Casting dish sensors: no possible damage of the instrument related to pouring without the platinum mold Non-wetting agent pills injection for optimized fusion method efficiency Pause and inspection function to visualize the fusion process during the fusion cycle 	<ul style="list-style-type: none"> Synchronizes the sample preparation process and enables the samples to be ready just in time for the subsequent fusion and analysis steps 12 positions Saves 90% of labor time related to the weighing step Fully adaptable to your standard operating procedure (SOP) Eliminates data transfer errors because it is LIMS ready and has sample tracking option Self-installed 	What is special about this product?	

Ask about specials and automation!

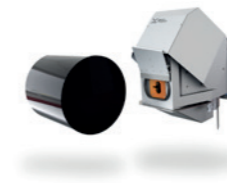
Elemental composition, film thickness



Product	Zetium	Epsilon 4	Epsilon 1	Epsilon Xflow	Epsilon Xline	Revontium	Automated sample changer	Product
What does it measure?	Elemental composition Film thickness	Elemental composition Film thickness	Elemental composition Film thickness	Elemental traces in liquids Continuous flow	Elemental composition in thin films and coatings	Elemental composition Film thickness	Automated measurement system for Epsilon and Aeris instruments	What does it measure?
Technologies used	X-ray fluorescence (XRF)	X-ray fluorescence (XRF)	X-ray fluorescence (XRF)	X-ray fluorescence (XRF)	X-ray fluorescence (XRF)	X-ray fluorescence (XRF)	Robotics	Technologies used
What is it used for?	<ul style="list-style-type: none"> Quantification of elements Be-Am with superior lowest limits of detection for most elements All materials in solid, powder or liquid form Detection and measurement of elements in thin films including film thickness measurement Small spot mapping for all elements across the range 	<ul style="list-style-type: none"> Quantification of elements B-Am with lowest limits of detection for most elements All materials in solid, powder or liquid form Detection and measurement of elements in thin films including film thickness measurement 	<ul style="list-style-type: none"> Quantification of elements from Na to Am with lowest limits of detection for most elements Online elemental analysis of solids, powders and liquids 	<ul style="list-style-type: none"> Elemental control for process optimization Purification control Error detection in early stage processing In process composition analysis of precursor solutions in cathode production Insights in leaching and solution extraction processes of hydrometallurgy black mass recycling processes 	<ul style="list-style-type: none"> Composition and elemental loading in coatings. Product validation Silicon mass loading in Si/ Graphite anodes Lithium mass loading in Li-containing cathodes Pt / IrO₂ concentration in electrolyzer and fuel cell membranes 	<ul style="list-style-type: none"> Quantification of elements B-Am with lowest limits of detection for most elements All materials, in solid, powder or liquid form Detection and measurement of elements in thin films including film thickness measurement 	<ul style="list-style-type: none"> 100 position tray with robotic arm for continuous loading Measurement control of large sample sets 	What is it used for?
What is special about this product?	<ul style="list-style-type: none"> Combination of ED and WD reduce measurement time up to 50% Batch automation Simple & Intuitive SuperQ software with the Virtual Analyst FastScan Omnia program standardless analysis Largest range of bespoke and in-house certified calibration standards Dust removal device minimizes contamination and maximizes instrument uptime SST R-mAX tube with CHI-BLUE window coating for increased X-ray tube durability and less drifting Small-volume airlock design for rapid cycling of samples into vacuum, or low He consumption for liquids analysis Supported by expertise and CRMs for all materials types 	<ul style="list-style-type: none"> Can handle a large variety of sample sizes, from less than a gram up to larger bulk samples, including irregularly shaped objects Small footprint allows it to be sited near to, or even next to, the production line for process control Automatable Close coupling of Tube-sample-detector for optimized sensitivity Automatic and builtin drift monitor for best accuracy Unique combination of 10 position sample changer with spinner Creating unlimited applications Automatic Program Selection (APS) for easy operation Supported by expertise and CRMs for all materials types 	<ul style="list-style-type: none"> All measurements in air. No need for helium or vacuum pump Highest analytical performance in its class Completely X-ray safe operation Built-in drift monitor for best accuracy and easy operation Creating unlimited applications Automatic Program Selection (APS) for easy operation Supported by expertise and CRMs for all materials types 	<ul style="list-style-type: none"> Pre calibrated Direct results Highly repeatable analysis Fully integratable Acid-solution capability 	<ul style="list-style-type: none"> Non-destructive technology with direct determination of mass loading Records average mass loading, including minimum and maximum measured Records where mass loading does not meet quality tolerances Continuous measurement in roll-to-roll production processes 	<ul style="list-style-type: none"> High sample throughput, speedy analysis, responsive feedback Can handle a large variety of sample sizes Small footprint allows it to be sited near to, or even next to, the production line for process control Automatable Close coupling of Tube-sample-detector for optimized sensitivity Automatic and builtin drift monitor for best accuracy Unique combination of 32 position sample changer with spinner Patented X-ray tube with ZETA technology Power consumption is only 200 watts Supported by expertise and CRMs for all materials types Cutting edge SuperQ software Smart Manager connectivity 	<ul style="list-style-type: none"> Automated sample changing for up to 100 samples Ability to add samples mid-run Sample tracking and instrument control with Samtracs software Integration into larger automation systems as part of Process Automation System (PAS) projects 	What is special about this product?



Thin film and single crystal orientation, layer composition, quality, and thickness



Product	Automated X'Pert ³ MRD (XL)	2830ZT Wafer analyzer	Omega/Theta	SDCOM	DDCOM	Wafer XRD 200	XRD OEM	Wafer XRD 300	Product
What does it measure?	Wafer orientation and quality Thin film strain, composition Multilayer thickness Epilayer integrity	Elemental composition layer thickness	The crystallographic orientation of boules, ingots or wafers.	The crystallographic orientation of boules, ingots or wafers.	The crystallographic orientation of boules, ingots or wafers	The crystallographic orientation of wafers with a diameter of max. 200 mm	The crystallographic orientation of boules or ingots	The crystallographic orientation of 300 mm wafers	What does it measure?
Technologies used	High-resolution X-ray diffraction (HR-XRD)	X-ray fluorescence	X-ray diffraction (XRD) using the azimuthal scan and rocking curve measurements	X-ray diffraction (XRD) using the azimuthal scan and theta scan measurements	X-ray diffraction (XRD) using the azimuthal scan	X-ray diffraction (XRD) using the azimuthal scan	X-ray diffraction (XRD) using the azimuthal scan	X-ray diffraction (XRD) using the azimuthal scan	Technologies used
What is it used for?	<ul style="list-style-type: none"> QC and R&D of thin film layers and substrates Semiconductor single-crystal epitaxial layers Multicrystalline electro ceramics PPM-resolution lattice parameter and lattice parameter strain measurements Monolayer precision thickness measurements epitaxial layers Phase purity and orientation distribution in sputter deposited films 	<ul style="list-style-type: none"> Elemental QC of thin films (including Si and electro ceramics) Alloy composition and film thickness High precision high throughput measurement Elemental composition (for Elements heavier than Be) 	<ul style="list-style-type: none"> QC and R&D measurements of the orientation of single crystals Crystal quality measurements Wafer mapping Preparing boules/ingots for cutting or grinding 	<ul style="list-style-type: none"> QC and R&D measurements of the orientation of single crystals. - Crystal quality measurements - Wafer mapping - preparing boules/ingots for cutting or grinding QC and R&D measurements of the orientation of single crystals Crystal quality measurements Wafer mapping Preparing boules/ingots for cutting or grinding 	<ul style="list-style-type: none"> QC measurements of the orientation of single crystals - Exact marking of crystallographic directions for e.g. wafer splitting 	<ul style="list-style-type: none"> QC measurements and sorting of 70-200 mm diameter wafers. Measures both the crystallographic orientation and the exact size and shape of the wafer features QC measurements of the orientation of single crystals Exact marking of crystallographic directions for e.g. wafer splitting 	<ul style="list-style-type: none"> <i>In-situ</i> orientation of boules or ingots before orientation-critical process steps like flat/notch grinding or ion implantation 	<ul style="list-style-type: none"> QC measurements on 300 mm diameter wafers. Measures both the crystallographic orientation and the exact size and shape of the wafer features 	What is it used for?
What is special about this product?	<ul style="list-style-type: none"> Can be used in both lab and fab versions (upgradable from lab version) Can access coplanar, skew and in-plane geometry 200mm wafer mapping capability GEN series compatible waferloading and automation Clean room ready AMASS analysis software, with 'any orientation - any spacegroup' capability The only platform that has a 180 deg Chi cradle The only platform that can reach extremely high incident angles on 8" wafers Motorized divergence and antiscatter slits for monochromators can automatically vary the X-ray beam height Microbeam collimators can reduce the X-ray beam size to as small as 100 x 100 microns 4 detection modes fully automated 	<ul style="list-style-type: none"> This tool can measure up to 300mm wafer size up to 25 wafers per hour Several channels of the same element can be equipped to boost the element sensitivity 	<ul style="list-style-type: none"> Rapid crystal orientation and a very wide range of accessories for e.g. 300 mm mapping or orientation transfer 	<ul style="list-style-type: none"> Rapid crystal orientation and a very wide range of accessories for e.g. mapping or orientation transfer 	<ul style="list-style-type: none"> No height alignment required Small foot print Only household electrical connection required 	<ul style="list-style-type: none"> Rapid semi-automated measurement of the crystallographic orientation, size and shape of wafers Measures 25 wafers in about 10 minutes 	<ul style="list-style-type: none"> This tool can be mounted inside other devices, like cutting, grinding or epitaxy machines 	<ul style="list-style-type: none"> Rapid fully automated crystallographic orientation, size and shape of 300 mm wafers Designed to be integrated with the wafer frontend of e.g. epitaxy machines 	What is special about this product?

Ask about specials and automation!

Support & Services

Unleash the full potential of your Malvern Panalytical solution

Setting up for success

Our high-precision analytical systems also come with comprehensive services to get started: Our **onboarding** starts with our **expert support engineers** on-site, or if you'd like to set up the instrument yourself, our **self-install** will guide you. Either way, a comprehensive **warranty** and a starter **training** program is complimentary. We'll make sure everything is set up for success, so you can get straight to your important analyses.

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Easily find manuals and our latest software versions online to benefit from new features and to stay up to date. malvernpanalytical.com/product-support

Webinars and App Notes

Access a comprehensive catalog of resources, such as recorded webinars, white papers, and app notes to support your analytical journey. malvernpanalytical.com/knowledge-center

Parts and Consumables

MyStore: Our online shop makes the access to your essentials more convenient and efficient. Parts, consumables, accessories and software are at your fingertips 24/7 – to check availability and pricing, self-service quotes and order on card or account. mystore.malvernpanalytical.com

Support Portal

Our professional service team is ready to assist you – fast-track your service request on Malvern Panalytical My Customer Support Portal or view your system details and service history at a glance. support.malvernpanalytical.com

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Malvern Panalytical instruments are built to last. Like all advanced and even the most robust technologies, they require maintenance and care to ensure continued peak performance.

Service Agreements build these into your schedule and budget – based on preventive maintenance and remote support – different levels include repair visits, response times and parts coverage as needed. OQ services, training and application consultancy can be added as well. malvernpanalytical.com/service-agreements

Smart Manager goes even further: Smart Manager is the future of service and support excellence at Malvern Panalytical, delivering total peace of mind. It's a set of digital monitoring services combined with insight from experienced service professionals. Smart Manager is your trusted guardian for instrument health and utilization management, ensuring unrivaled accuracy, reliability, and efficiency in your analyses – on time, all the time. malvernpanalytical.com/smartmanager

Advanced analysis and actionable insights

Basic User Training

Master the art of optimal usage and determine whether your measurements, sample preparation, and data are accurate and reliable – all while uncovering invaluable maintenance tips and tricks.

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Analytical and Consultancy Services

Our expert services places specialists and scientists at your disposal for method development, sample preparation, and certification. From trace and oxide analysis to screening and small-spot analysis, from particle sizing to molecular interaction – gain unparalleled analytical expertise.

malvernpanalytical.com/training

Please note that the exact details of our services and their availability are determined by a variety of customer-specific factors, such as product type, product configuration, or location.



About Malvern Panalytical

Malvern Panalytical is a global leader in the analytics of material and life sciences. We unleash the power of small things to make big things happen for our customers.

Our vision is to make the world cleaner, healthier, and more productive.

We partner with our customers to make their solutions possible through the power of precision measurements, our expertise, trusted data, and insights.

Our people are partners in discovery. We collaborate with our customers and with each other to discover new possibilities and achieve breakthroughs.

Our culture is a healthy, high-performance culture shaped by our values: Own it, Aim High and Be True.

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With over 2300 employees across the globe, we are part of Spectris plc, the world-leading precision measurement group.

Malvern Panalytical. We're big on small™

Service & Support

Malvern Panalytical provides the global training, service and support you need to continuously drive your analytical processes at the highest level. We help you increase the return on your investment, and ensure that as your analytical requirements grow, we're there to support you.

Our worldwide team of specialists adds value to your business processes by ensuring applications expertise, rapid response, and maximum instrument uptime.

- Proactive local and remote support
- Full and flexible range of service agreements
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- e-Learning training courses and web seminars
- Digital services, including MyStore and My Customer Support Portal
- Sample analysis, method development, and applications consultancy



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