**Technical specification**

**Laser Ablation Inductively Coupled Plasma Time-of-Flight Mass Spectrometer (LA-ICP-TOF-MS)**

**PURPOSE AND SUBJECT MATTER OF THE PUBLIC PROCUREMENT**

The subject of this public procurement is the supply of a laser ablation inductively coupled plasma mass spectrometry system (LA-ICP-MS) equipped with a Time-of-Flight (TOF) analyzer. The system must enable simultaneous (parallel) detection of all elements of the periodic table in real time, without the need for sequential scanning, which is essential for spatially and temporally resolved analysis of complex and heterogeneous samples.

The instrument will be used for elemental imaging in biological and geological materials, with emphasis on high spatial resolution and analytical sensitivity. In the biomedical field, the instrument will support research on tissue distribution of metal-based drugs, monitoring of trace elements, and biomarkers relevant to pharmacology and toxicology. In geosciences, the system will be used for trace element mapping in minerals, zoning and inclusion analysis, as well as mineral dating based on isotopic composition. In addition, it will allow for fundamental research on laser–sample interactions, including the study of ablation mechanisms, elemental fractionation, and optimization of analytical methods for various geological matrices.

The system will also be used for the characterization of nanoparticles and microplastics, including the determination of elemental composition, particle size distribution, and surface properties. Furthermore, it will support research on targeted drug delivery systems by evaluating the efficiency and distribution of active pharmaceutical ingredients.

The instrument must comply with current analytical and laboratory standards and will be used for research, education, and development activities at the Faculty of Pharmacy, Masaryk University. It will also serve as a training platform for PhD students, particularly in the fields of pharmacology, toxicology, environmental sciences, and materials research, and will contribute to the development of analytical methodologies applicable to pharmaceutical, biomedical, environmental, and geoscientific research.

The subject of the supply is complete, new, and fully functional equipment, including complete installation and operational qualification (IQ/OQ), documentation, commissioning, and operator training at the delivery site.

The offer must meet all the requirements and parameters specified by the Contracting Authority. In the case of parameters defined by a minimum or maximum level or range of values, the offer must meet at least the specified required level.

**MINIMUM TECHNICAL REQUIREMENTS**

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| **Parameter** | Parameter offered by the supplier |
| Manufacturer | *The supplier specifies the manufacturer.* |
| Type/Model | *The supplier specifies the type and model.* |

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| **Minimum required technical specifications** | **Technical parameters offered by the supplier\*** |
| Inductively Coupled Plasma Time of Flight Mass Spectrometer – ICP-TOFMS | |
| For space reasons, the offered instrument must be suitable for placement on a laboratory bench and have a weight of up to 300 kg. | *The supplier indicates YES/NO and offers a technical solution/specification* |
| The ICP-TOFMS offers hard- and software integration for fast laser ablation mapping (for use with a laser operating at a frequency of 300–1000 Hz). | *The supplier indicates YES/NO and offers a technical solution/specification* |
| The water-cooled vacuum interface is designed to allow for easy access to sampler and skimmer cones as well as the extraction lens for routine maintenance. | *The supplier indicates YES/NO and offers a technical solution/specification* |
| The instrument must be equipped with Collision and Reaction Cell (CCT) technology enabling the removal of interferences caused by argon species and other spectral overlaps. The instrument must allow CCT operation both with and without gas. | *The supplier indicates YES/NO and offers a technical solution/specification* |
| Technology must be provided to reduce the signal intensities of ionic species originating from the sample matrix that cannot be removed by chemical reactions in the CCT. | *The supplier indicates YES/NO and offers a technical solution/specification* |
| The detector must offer a linear dynamic range from 1 to min. 1 000 000 cps. It must have a robust design that does not exhibit signal drift during long-term laser ablation mapping experiments. Both major and trace elements must be measurable in a single run without the need to measure them separately. | *The supplier indicates YES/NO and offers a technical solution/specification* |
| The detection system must allow for the acquisition of full mass spectra over extended time of typical laser ablation mapping experiments (minimum 1 hour)  Complete mass spectra including peak shape and base line information with a time resolution of 2 milliseconds or better.  Integrated peak information with a time resolution of 50 microseconds or better. | *The supplier indicates YES/NO and offers a technical solution/specification* |
| The instrument sensitivity and mass resolution must meet the needs for planned mapping experiments (biological and geological materials, analysis of individual cells, nanoparticles, and microplastics).  The following specifications must be verified at installation in a single experiment.  Experimental conditions:  Use of a standard sample introduction for liquid samples.  Instrument running without gas in the CCT.  Instrument tuned for oxide formation <2.5 % (CeO+/Ce+).  Mass Resolving Power: min. 3000 (238U).  Aspiration of 1 ppb multi-element solution  Minimum Sensitivities (in cps/ppb)   * Uranium: 50 000 (238U) * Indium: 20 000 (115In) * Cobalt: 10 000 (59Co) | *The supplier indicates YES/NO and offers a technical solution/specification* |
| * The data must be compatible with the needs of scientific research(biological and geological materials, analysis of individual cells, nanoparticles, and microplastics It must be provided in an open format that allows direct processing in software for subsequent analysis of laser ablation data. The delivery must also include advanced mathematical or statistical software, compatible with this data format, enabling further analysis. This software must be supplied by the instrument vendor as an integral part of the offer. | *The supplier indicates YES/NO and offers a technical solution/specification* |
| Laser ablation (LA) | |
| Laser Source Performance   * Wavelength: 193 nm * Repetition rate: 1–1 000 Hz, * Pulse-to-pulse energy stability: <2 % RMS * Pulse energy: minimum 4 mJ * Pulse duration: 5–10 ns | *The supplier indicates YES/NO and offers a technical solution/specification* |
| Laser Energy Density Control   * Ability to control laser fluence on the sample in the range of 0.05 to ~15 J/cm² * Adjustable in steps of 0.01 J/cm² * Energy control without affecting spot size or pulse stability | *The supplier indicates YES/NO and offers a technical solution/specification* |
| Laser Beam Shaping   * Spot size range: from submicron up to 160 µm * Adjustable in <1 µm increments within the 0.5–10 µm range * Ability to select various spot shapes including square spots (5–120 µm) and others (numbers or marks for sample labeling) * Real examples of ablation marks are required as part of the installation of the instrument. | *The supplier indicates YES/NO and offers a technical solution/specification* |
| Uniform Cross-Sectional Energy   * The beam must be homogenized to produce a uniform energy distribution across the beam profile * Resulting craters must have steep walls and flat bottoms * The homogenizing system must eliminate “hot spots” between pulses | *The supplier indicates YES/NO and offers a technical solution/specification* |
| Video Zoom Microscope   * On-axis microscope perpendicular to sample surface with one final objective lens shared bewteen laser beam and microcope. * Must have mechanical optical zoom enabling variable zoom magnification from 60x to 5x and the ability to distinguish features down to 1-2 microns in size on the sample. * Must have computer-controlled variable illumination including transmitted, reflected and ring sources. | *The supplier indicates YES/NO and offers a technical solution/specification* |
| Sample Chamber   * Motorized sample stage min. 100 × 100 mm, movement speed up to 10 mm/s * Configurable sample drawer with three magnetic positions for precise reproducible positioning * Adjustable aerosol washout speed: the minimum washout time must be less than 5 ms and the maximum time up to ~2 s (without the need to change the internal geometry of the chamber). * Ability to dynamically adjust the height of the aerosol extraction nozzle without affecting laser focus | *The supplier indicates YES/NO and offers a technical solution/specification* |
| Footprint and Mobility   * Must be on locking castors for easy movement between ICP-MS systems. * Must fit through doors <700 mm widh. * Footprint < 6000 cm2 | *The supplier indicates YES/NO and offers a technical solution/specification* |
| Safety   * Laser must be Class I, including during alignment * Enclosed gas cabinet with fume extraction * Regulators and components suitable for use with halogen gases * Includes filtration systems for gas exchange | *The supplier indicates YES/NO and offers a technical solution/specification* |
| The software must include:   * Laser control and triggering compatible with ICP-MS instruments (TTL interface, contact closures, script, or plug-in) * Creation of mosaic maps of the entire sample area and import of external image files (brightfield, fluorescence, SEM, etc.) * Ability to overlay layers and accurately target regions of interest * Sequence planning, adjustment of laser and microscope parameters, logging, and export of logs | *The supplier indicates YES/NO and offers a technical solution/specification* |
| Data processing:   * Import of laser logs and ICP-MS data * Bulk quantification, mapping, and image analysis * Geochronology | *The supplier indicates YES/NO and offers a technical solution/specification* |

**\* The supplier is required to indicate YES/NO and provide the requested information.**

**The supplier is obligated to submit, in addition to the technical specification provided in this table, its technical specification or description of the equipment.**