Ref. No.: IISc/CEaS/Tender/2022/Global/ICP-MS Facility

Date: 12th July 2022

Global Tender Notification for the Supply, Installation, Commissioning & Training of an Inductively Coupled Plasma Mass Spectrometry Facility for Determination Elemental Concentration and Isotope Ratio At the Indian Institute of Science, Bangalore

Last Date for Submission: 1st August 2022 (5:00 pm IST)

GTE Approval No. IISc-GTE-2022-165 and IISc-GTE-2022-166

This is a Request for Quote (RFQ) for the establishment of a plasma source mass spectrometry facility at the Centre for Earth Science, Indian Institute of Science, Bangalore. All tenders should be submitted in two separate sealed envelopes: one containing the technical bid and the other containing the commercial bid, both of which should reach us, duly signed on or before 5:00 PM on 1st August 2022.

The bids should be addressed to the Chairperson, CEaS, IISc

Mailing Address:
The Chairperson,
Prof. Binod Sreenivasan
Centre for Earth Sciences
Indian Institute of Science,
Malleshwaram,
Bangalore 560012,
Karnataka, India.

Chair's Email Address
chair.ceas@iisc.ac.in

Email Addresses for any technical clarifications:
ramananda@iisc.ac.in
sambuddha@iisc.ac.in

1. Procedure:

I. The decision of purchase committee will be final.

II. **Each bid should be submitted in two separate sealed envelopes – one containing the "Technical bid" and other containing the "Commercial bid. Both envelops should be clearly marked.**

III. The primary interest of the Centre is in the procurement of a multi collection ICP-MS. **Any vendor(s) who are not manufacturers of MC-ICP-MS should NOT quote for a single collection ICP-MS independently.** However, such vendor(s) are allowed/encouraged to quote for their SC-ICP-MS in collaboration with a MC-ICP-MS manufacturer. In all cases, the pricing for the instrument(s) as a stand-alone purchase and as a bundle-purchase should be clearly indicated in the financial bid.

IV. If a vendor manufactures multiple instruments that fulfils the technical criteria then the vendor must submit separate bids, consisting of both the technical and commercial documents, for each System. To summarise, vendors must submit a set of technical and commercial documents in separate sealed envelopes, for each of the Systems. Supporting documents like company info, date of incorporation, "Blacklist-declaration", etc. can be common.

V. Please label the envelopes carefully so each of the envelopes can be traced. For example, "Technical bid for System A" or "Commercial bid for System B".

VI. Incomplete bids will be summarily rejected.

VII. Only vendors who meet the technical requirement will be considered for the commercial negotiation.

VIII. **The deadline for submission of proposals is the 1st August 2022, 5:00 pm Indian Standard Time. Proposals should arrive at the main office of Centre for Earth Science, Indian Institute of Science, Bangalore 560012, India, by the above deadline.**

IX. The technical bid should contain a compliance table with 5 columns. The first column must list the technical requirements, in the order that they are given in the technical configuration below. The second column should describe your compliance in a "Yes" or "No" response. If "No" the third column should provide the extent of the deviation (please provide quantitative responses). The fourth column should state the reasons for the deviation, if any. The fourth column can be used to compare your tool with that of your competitors or provide details as requested in the technical requirements table below.

X. Any additional capabilities or technical details, that you would like to bring to the attention of the purchase committee, can be listed at the end of the technical table.

XI. Vendors are encouraged to highlight the advantages of their instrument over comparable instruments

XII. **C.I.P. Bangalore basis (by Air Freight only). The quotation should mention the terms of delivery, delivery schedule, estimated delivery date, and payment terms.**

XIII. The commercial bid must indicate detailed component-wise and itemized price breakup and must include optional items/accessories.

XIV. As an option, please provide itemized cost for any suggested accessories/add-ons that may enhance the usability, capability, accuracy or reliability of the tool. Vendors are encouraged to quote for add-ons which may augment the performance of the instrument.

XV. **Commercial bids must be valid for 90 days.**

XVI. Commercial bids should indicate the terms and conditions of delivery, delivery schedule, entry tax, payment terms, warranty coverage, etc.

XVII. The Bidder's firm should have existed for a minimum of 5 years. (Enclosed Company Registration Certificate)

XVIII. The Bidder should have qualified technical service personnel for the instrument(s) based in India.

XIX. If the Bidder is a local distributor/dealer/Agent, attaching an authorization certificate with the technical bid from the original equipment manufacturer is mandatory.

XX. The bidder should sign and submit the declaration for Acceptance of Terms and Conditions as per -Annexure 1.

XXI. The Bidder must not be blacklisted/banned/suspended or have a record of any service-related dispute with any organization in India or elsewhere. A declaration to this effect has to be given as per Annexure 2.

XXII. **The Institute reserves the right to accept or reject any bid and to annul the bidding process and reject all bids at any time prior to the award of the contract, without thereby incurring any liability to the affected bidder or bidders or any obligation to inform the affected bidder or bidders.**

XXIII. Any questions can be directed to Dr. Sambuddha Misra, Centre for Earth Science, Indian Institute of Science, Bangalore 560012, India. (sambuddha@iisc.ac.in).

2. Technical Specifications:

2. A. Multi Collection Inductively Coupled Plasma Mass Spectrometer:

A magnetic sector MC-ICP-MS for determination of elemental isotope ratio in liquid samples through direct nebulization, and in solid samples by in-situ laser ablation. This magnetic sector instrument should be capable of measuring the isotopic abundance of select elements (as tabulated below) with high precision and accuracy. The instrument should either utilize physical resolution or chemical resolution for separation of isobaric inferences (viz. $^{40}Ar^{16}O$ from ^{56}Fe and $^{40}Ar^{1}H$ from ^{41}K). The utilization of the instrument will not be restricted to the measurement scheme below, but research and development of new isotope systematics, determination techniques, and analytical methodology. Bidders are requested to highlight additional features of their instrument that would enable the users at IISc to utilize the instrument to establish cutting-edge isotope analyses methods. Following are some of the isotope systematics we intend to measure, both in solution and Laser Ablation mode:

ISOTOPE SYSTEMATICS OF PRIMARY INTEREST	
Systematics	**Masses to be measured**
U-Th Series Dating	228, 229, 230, 232, 234, 235, 238
Pb Geochronology (with Hg and Bi)	202, 204, 205, 206, 207, 208, 209
Hf Isotopes	180, 179, 178, 177, 176, 175, 174, 173, 172, 171
Sm-Nd Isotopes (with Ce)	140, 142, 143, 144, 145, 146, 147, 148, 150
Ba Isotopes (with Xe)	131, 134, 135, 136, 137, 138
Mo Isotopes	100, 99, 98, 97, 96, 95, 94, 92
Sr Isotopes (with Rb and Kr)	83, 84, 85, 86, 87, 88
Cu Isotopes	63, 65
Zn Isotopes (with Ni)	62, 63, 64, 65, 66, 67, 68, 70
Ni Isotopes (With Fe)	56, 58, 60, 61, 62
Fe Isotopes (with Cr and Ni)	52, 53, 54, 56, 57, 58, 60
Cr Isotopes (with Ti)	49, 50, 51, 52, 53, 54, 56
Ca Isotopes	42, 43, 44, 46, 48 (and if possible, mass 40)
K Isotopes	39, 41
Si Isotopes	28, 29, 30
Mg Isotopes	24, 25, 26
B Isotopes	10, 11
Li Isotopes	6, 7

I. Description for Instrument(s) Capable of Elemental Isotope Ratio Determination:

This specification describes any mass spectrometer, preferably a magnetic sector kind that is equipped with inductively coupled plasma (ICP) ion source and capable of measuring isotopic ratios and / or abundances of multiple elements in solid and liquid samples. The instrument should be equipped with an electrostatic analyser (ESA) for focussing the ions on energy as part of a double focussing system or provided with some means for reducing the spread in ion energy of the focused ion beam. The mass spectrometer must have more than one detector. The preferred configuration for isotope ratio determination will be at least 9 Faraday detectors and 1 ion counting multiplier in the focal plane, this is to permit dynamic and static multi-collector analysis of isotopes across the mass spectrum (4 to 310 amu), employing both multiple ion-counting devices and multiple-Faraday cups used exclusively and together; whereas, for elemental abundance determination the ability to switch between ion counting and Faraday Cup will be preferable.

Other Specifications: If the mass spectrometer has fixed dispersion, the multiple collectors should be externally adjustable for movement along the focal plane; if the detectors are fixed position simultaneous ion

current measurements may be achieved via electrostatic zoom optics. The collector system must permit the egress of the axial or near-axial ion beam in order for the beam to be recorded by a high sensitivity detector and amplifier. Sample introduction to the plasma source shall be via nebulizer and pumped spray chamber, desolvation or hydride generation nebulizer system in the case of liquids and be via laser ablation in the case of solids. Further, the sample introduction system should have a means of removing waste solutions, via a peristaltic pumping system or other. The mass spectrometer should be equipped with high resolution features to permit the measurement of 'interference' free isotopes of elements such as iron and silicon. The mass resolution settings should allow for low ($m/\Delta m \sim 400$), medium ($m/\Delta m \sim 6000$) and high ($m/\Delta m \sim 8000$) resolution analyses. Appropriate figures of merit for chemical resolution should be provided for collision cell equipped mass spectrometer.

II. ICP-MS sample introduction setup:

Sample introduction system for solution mode should have standard & complete nebulizer system including:

1. **Peristaltic pump** with software controlled variable uptake speed
2. **Self-aspirating PFA nebulizers** with sample flow rates of 35, 50, 100 and 200 microliters/minute with and without PEEK/Teflon reinforced sample uptake probe.
3. **Desolvating nebulizer** for isotope ratio measurement with integrated gas and temperature controllers.
4. **Spray chambers** (preferably one each of cyclonic, Scott-type, and double pass) of quartz and PFA make that are compatible to the instrument should be quoted.
5. **Micro-cyclonic spray chamber** (Quartz & PFA) with low internal volume (if available).
6. **Hydride generator** for determination of elements with high ionization potential
7. **Auto sampler:** A compact auto sampler with small footprint, short sample path (essential for smaller sample size) and a protective cover to prevent sample contamination. The autosampler should be compatible and integrated with the instrument software.
8. **The plasma torch** should be of the standard Fassel design mounted horizontally. The torch position should be under remote control in the x, y and z axes ensuring rapid and reproducible optimization of the plasma position; a viewing port shall be provided that allows direct observation of the plasma torch.
9. **The Mass Flow controllers of ICP torch and nebulizer gas supplies** should permit tuning for optimum stability and precision; there should be the capacity to add at least two additional flow controllers (e.g., for helium, nitrogen or argon). Preferably 5 MFCs (plasma, auxiliary, sample, additional-1, and additional-2) should be present. One of these MFCs could be a micro-flow MFC for N2 or He introduction.

III. ICP-Source:

1. The ICP-Source should NOT be air cooled.
2. The inductively coupled plasma ion source shall be a high efficiency source incorporating a field-proven solid state RF generator with a stability of better than 1% and an automatic RF matching network ensuring low reflected RF power at all times.
3. Automated software-controlled alignment facility of plasma torch with X-Y-Z movement for optimal positioning for maximum analyte signal sensitivity.
4. ICP source should be compatible with alternate sample introduction system that is commercially available (laser ablation)

IV. Ion Extraction Interface

Standard and high sensitivity combination of outer sampler cone and an inner skimmer cone should be provided for maximum sensitivity, stability, and precision. The interface should come equipped with high efficiency ion transmission features for improved sensitivity.

V. Magnet and Mass Analyzers (applicable primarily for isotope ratio determination)

1. The mass spectrometer should be capable of scanning mass: charge ratio ($^{m}/_{z}$) from 4 up to 310 along the axis.
2. **Mass Analyzer:** Double focusing-type Mass Analyzers consisting of electrostatic analyzer (ESA) and electromagnetic analyzer providing high resolution capability for obtaining flat-top peaks for various isotopes.
3. **Magnet:** Should preferably be a low hysteresis laminated magnet with efficient temperature control and

compensation to achieve stable high resolution. The magnet power supply shall be controlled via field regulation. Capabilities shall include scanning of the magnet field via computer, both up and down at selected speed and step size, over a narrow mass region (less than 1 mass unit) as well as over the entire mass range from masses 4 to 310 amu. Scanning can be done using the high voltage and magnetic field, with variable speed and mass range window, both up- and down-mass. The mass position ($^{m}/_{z}$) readings shall be automatically calculated using latest mass calibration and displayed on the computer monitor with milli-mass resolution. Furthermore, the mass spectrometer shall be capable of operating at reduced accelerating voltage. Seller should specify magnet settling time for normal peak jump operation the magnet over small mass range (viz. 88-86-88). And large mass range (viz. 187-39-187) Seller should specify system stability, including HV and magnet operation, over a 1-hour period.

4. **Minimum required mass resolution:** Mass resolving power (at 10% valley definition) as the ratio (M/ΔM) of the instrument should be selectable at least in three categories - Standard (low), Medium and High. Resolution as a function of relative ion transmission should preferably be as follows:

Resolution	**M/ΔM**	**Ion transmission (relative)**
Standard (low)	≥400	100%
Medium	≥4000	≥10%
High	≥8000	≥5%

Equivalent figure of merit specific for a model of mass spectrometer should be clearly specified.

5. **Resolving Power:** The instrument should be able to achieve high resolution with resolving power of >8000 (e.g., mass ^{56}Fe, which can resolve the molecular interference from ArO isotopes with demonstrated flat-top peak). The specification should clearly mention the relative transmission for various resolving powers.
6. **Chemical Resolution:** For sector field mass spectrometers utilizing chemical resolution (collision reaction cell) a potential list of gases to be utilized in collision and / or reaction mode operation should be provided. A standard set of MFCs for these gases should be included in the quotation.
7. **Stability:** The instrument shall have a system stability, which is measured as peak stability, including drift of magnetic field and electric field < 50 ppm/hr (Measured at Nd mass range).

VI. Detector specifications (applicable primarily for isotope ratio determination)

1. A minimum of nine (9) Faraday cups (FC) and an axial ion counting devices in the detector block with necessary electronics and amplifiers should be part of the mass spectrometer. A suitable combination of Faraday Cups and Ion Counting devices should be provided to cater the needs of simultaneous collection of ions of different masses required in a wide range of applications of isotope systematics as tabulated above. The ion optical system shall consist of a sector magnet with an "extended geometry" configuration. The ion optics must provide for magnetic field focussing of the ion beam in the vertical ("Z") direction as well as in the plane of curvature. The magnet, flight tube and collector array shall be adequate for the simultaneous mass range of 17% or higher (i.e., ^{202}Hg to ^{238}U or ^{6}Li to ^{7}Li). The positions of the off-axis collectors should be adjustable to allow for a range of possible mass separations, unless this can be achieved by use of an electrostatic zoom lens. Where collector positions are movable, multi-collector positioning should be achieved via computer control including in situ position read-back and the precision of cup movements should be < 10um.
2. **Faraday cups:** Dynamic Detection Range of ≥50V, preferably up to 100V, when fitted with 10^{11} Ω resister; Noise levels: ≤ 20 μV at 4 or 5 second integration time or better; Detection Signal Decay: ≤10 ppm after 2 seconds or better.
3. **Amplifiers and resistors:** The instrument should have both 10^{11} and 10^{13} Ω resistors (or equivalent), including gain calibration ability. Additional options like Daly Detectors in addition to or instead of 10^{13} Ω resistors are welcome provided there is demonstrated ability to determine ion beam sizes smaller 100mV with a 2s precision comparable to that of 10^{13} Ω resistors.
4. The seller should specify the noise of these amplifiers at integration times of 5 seconds or less. Using 10^{11} ohm and 10^{13} ohm amplifiers should generate dynamic ranges of at least 0.5 and 50V, respectively. Seller should specify the respective noise on these amplifiers. The amplifiers should be enclosed in a

temperature-controlled environment with temperature fluctuations ≤±0. 1°C. A current source shall be provided for automatically calibrating the inter-channel gain factors. Sellers should specific the maximum noise level of the head amplifiers over a 5 second integration time including resistor and amplifier input noise

5. There should be provision that any combination of faraday cup and amplifier can be selected on a routine basis through software, or there should be provision for enough Faraday Cups and amplifiers that multiple isotope systematics over a dynamic concentration range can be determined. Faraday cups and associated amplifier system should have minimum calibration error (cup bias). Configuration with higher dynamic range of signal measurement will be preferred. All the amplifiers for the Faraday detector should preferably be placed in an evacuated and temperature-controlled enclosure to ensure their performance independent of external environment.
6. The seller should be able to perform mass calibration, ion counter efficiency and gain calibration from the operating software. The seller should also specify amplifier calibration stability within a 24-hour period.
7. Electron Multiplier: The Seller sensitivity detection system (electron multiplier): sellers should specify the linearity, dark noise, peak flatness (over 200ppm) and the relative stability of the counting efficiency in a 1-hour period. Additionally, the Seller should specify the relative counting efficiency (in %) of secondary electron multiplier (SEM) at their optimal operating voltage (which should also be defined).

VII. Abundance sensitivity:

1. Abundance sensitivity should be ≤ 5ppm (without any application of retardation / RPQ / WARP filters) and should be such it can be improved to 500 ppb or better by applying retardation filter without losing a significant amount of transmission.
2. Retardation/deceleration filters: To improve the abundance sensitivity for analysis of certain isotope systematics (viz. Isotopes of U: 237U w.r.t. 238U mass should be ≤ 5ppm).

VIII. Vacuum System

1. The vacuum pumping systems MUST be able to achieve vacuum levels of: (i) ≤ 2×10-8 mbar in the collector area and (ii) ≤ 10-7 mbar in the electrostatic analyzer area. The following are the vacuum specifications:
    i. Expansion chamber (between cones): <4 mbar
    ii. Extraction region: $<10^{-3}$ mbar
    iii. ESA region: $<10^{-7}$ mbar
    iv. Analyser region: $<2 \times 10^{-8}$ mbar during operation
    v. Analyser region: $<5 \times 10^{-9}$ mbar ultimate pressure
2. Isolation valves should be placed and operable by the software and manually to ensure minimum vacuum loss during accidental power loss or scheduled maintenance.

IX. Electronic Components:

All electronic modules necessary for full operation shall be provided; they shall be mounted in the instrument or in auxiliary rackmounts. State-of-the-art solid-state control electronics shall be used throughout. Electronic boards, or their components, where applicable should be readily replaceable in the event of failure. Vacuum gauges and display devices to monitor all pumps in the system shall be provided and mounted in a position easily readable from the front of the instrument. The source and analyzer pressures shall be measured independently. A display of important instrumental parameters shall be provided on the video display of the computer, including turbo and ion pump status. Software should also incorporate a "status OK" display for pressures and pump speeds/temperatures.

X. Computer and Software:

1. **Operating Computer:** The instrument(s) should come with a dedicated computer system with the latest available configuration, and a secondary hard-drive, is integrated in the CPU, that duplicates the operation hard-drive in real time. The computer system must include a dual layer DVD writer with double layer capability for archiving, a minimum eight number of USB ports, and wireless network cards. The computer system should be supplied with a twin monitor (27" LED screen each).

2. **Printer:** A laser color printer with USB as well as ethernet connectivity; Automatic Duplex printing (both side printing); 1200 X 1200 print quality or better should be supplied.
3. **Software:** The operational software should be capable fully integrated operation of the mass spectrometer and the sample inlet systems. It should also support other peripheral systems (such as third-party laser ablation, peri-pumps, and auto-sampler). Software upgrades should be supported for at least for 10 years at no additional cost.

XI. INSTRUMENT PERFORMANCE GUARANTEE:

The quotation MUST include full performance figures of merit of the instrument, including sensitivity, accuracy and precision for short- and long-term analyses of standard solutions of Li, B, Sr, Nd, Pb, and U. Following are a select few performance guidelines that the supplier must guarantee to demonstrate on the proposed machine.

(i) The sensitivity, accuracy, and precision, determined on standards recognized by the geochemical community / high purity ICP-MS concentration standards, of isotope determination performed at 200 ppb or less concentration should be demonstrated for the following:

$^{238}U/^{235}U$ (± 50 ppm, 2s)
$^{206}Pb/^{204}Pb$ (± 0.15%, 2s)
$^{143}Nd/^{144}Nd$ (± 50 ppm, 2s)
$^{87}Sr/^{86}Sr$ (± 50 ppm, 2s)

(ii) The sensitivity, accuracy and precision, determined on standards recognized by the geochemical community / high purity ICP-MS concentration standards, of isotope determination performed at 10 ppb or less concentration should be demonstrated for the following:

$\delta^{11}B$ (± 0.25‰, 2s)
$\delta^{7}Li$ (± 0.35‰, 2s)

(iii) The tender should include the best sensitivity, internal precision (2s), and external precision (2s) for the elements listed below in the format tabulated below from any representative instrument. The values for the parameter can be quoted from published results in any recognized peer reviewed journal or from a factory instrument with an undertaking from the company. For reporting of the sensitivity, the exact sample introduction setup should be mentioned, and for internal- and external precision the exact number of ratios determined (cycle / block) and the number analyses averaged (n) should be quoted. The total mass of analyte consumed per analyses and detector / amplifier utilized must be mentioned.

Elements of Interest: Li, B, Mg, Si, K, Cr, Fe, Sr, Nd, Hf, Pb, and U. If more than one instrument is part of the quotation, then the elemental sensitivity for each instrument should be quoted separately. If any instrument is to be primarily utilized for elemental abundance determination, then the internal and external precision for isotope ratio determination need not be quoted.

Element	Isotope Ratio	Front-end Configuration	Sensitivity (V/ppm)	Analyte Mass per Analysis (ng)	Analysis Protocol	Internal Precision (2s)	External Precision (2s)

X. Instrument Performance:

1. Quotation should include full specification of mass spectrometer performance, including both internal and external precision in measurement for most of the isotope systems mentioned above. The service engineer should carry out various performance parameters of the instrument(s) according to those mentioned in the brochure and/or quoted in the technical bid submitted by the vendor, whichever is better both at factory before delivery and at IISc after delivery. Towards this the supplier should provide test certificates.
2. Quotation to include clear, unambiguous statements of expected routine performance of the various preparation systems in combination with the mass spectrometers. It should state the overall precisions derived from analyses of multiple replicate samples of standard materials, with a clear indication of any effects in relation to sample size.

XI. Accessories and Spares:

The offer should include all of the required accessories/ spares/ consumables for seamless performance of

the system and its peripherals. A list of spares and consumables should be provided.

XII. ADDITIONAL REQUIREMENTS:

1. The technical specifications listed above are a minimum indicative. The ease of operation and maintenance, the ability to integrate latest technology, and after sales service facilities are some of the key factors in the evaluation process.
2. **The details, credentials, and experience of individuals who are factory trained service engineers of the quoted model of mass spectrometer and is currently on roll in India or at the nearest service hub should be submitted with the offered quotation.**
3. Quotation should include all cost including logistics required to complete the installation at IISc.
4. The Vendor should certify and confirm availability of spares, service support and, both hardware and software upgradation for at least 10 years from the year of installation.
5. List of select user laboratories of an instrument of similar configuration and scientific application must be provided with the contact details (e-mail) of the person-in-charge of the instrument, model and date of installation.
6. IISc may opt for demonstration of any technical specifications and performance of the quoted model, at any available user site in India or at the factory / preferred demonstration site for the company, as a part of technical evaluation.

XIII. Training

After the successful installation of the mass spectrometer and its peripherals, selected personnel from IISc should be provided with hands-on and in-depth training on the operation, maintenance and application of the instrument by factory engineer. The cost of an on-site training session should be part of the quotation.

XIV. Warranty (to be quoted as a separate item)

Supplier should provide comprehensive onsite warranty (including parts and labor) for 5 years (60 months), to be executed in a 1-year (manufacturer warranty) + 4-year (extended warranty) fashion, including all locally supplied items after successful installation of the system. The supplier should also quote for annual service maintenance contract (breakdown visits and two preventative service visits) for the next five years after the warranty period.

XV. Pre-installation Guideline

A comprehensive guideline/list of requirements for site preparation, installation of pre-installation infrastructure with their specifications is to be provided by the manufacturer.

XVI. Installation:

The complete installation of the supplied INSTRUMENT system should be carried out by the factory engineer. All the expenses including travel, accommodation etc. towards this should be included in the quote. It is the responsibility of the vendor to ensure that all of the required accessories and ancillary items are included in the quotation for carrying out the installation, standardization, optimization and calibration of the instrument. The supplied system should be complete in itself in all respect to take up the sample analysis at the IISc premises.

2. B. Single Collection Inductively Coupled Plasma Mass Spectrometer:

A SC-ICP-MS for determination of elemental concentration in liquid samples through direct nebulization, and in solid samples by in-situ laser ablation.

Sample introduction, ion source, RF plasma:

- Sample Introduction Kit including Peltier Cooled Spray Chamber (Temp Range -10 to 20 Deg C), PFA/ Glass/Quartz Nebulizer, Ni (or Pt) Sample and Skimmer cones.
- Complete set Suitable Accessory along with organic kit and MFC for oxygen to aspirate organic samples directly.
- Computer controlled 27 MHz RF generator operating from 400 to 1600 watts for automatic control of torch ignition, shutdown, and system warm up.
- The system should be able to change over from normal Plasma conditions to cool Plasma with direct control from software.
- The Plasma torch should have provision for software-controlled alignment for horizontal position, vertical position and sampling depth.
- Standard large orifice Ni sampling (1.1 mm ID) and skimming (0.5 mm ID) cones with suitable diameters.
- The ion deflection system should have efficient mechanism for removing all neutrals from the Ion path.
- The Ion path must be maintenance free

Gases, Cell technology and mass flow controllers:

- System should have dedicated MFCs to control plasma, auxiliary, nebulizer, additional / dilution gas, reaction gases, collision gases, high TDS & oxygen for organic samples.
- The system must either have chemical or physical resolution to separate polyatomic and isobaric interreferences from the following masses: 39K, 52Cr, 55Mn, 56Fe, 75As, 78Se, and 80Se in both HNO3 and HCl matrices.
- For chemical resolution: The system should have reaction and collision cell with controlled reaction capability to carry out mass shift reactions.
- For physical resolution a range of ΔM/M of 300 to 1200 is desirable.
- ICPMS shall incorporate Cell offering operation: Standard Mode, Collision Cell (He) Mode with KED and Reaction mode for interference removal in a single analytical method simultaneously.
- Cell must be Non-consumable with zero maintenance. If consumable, then additional 2 cell should be quoted along with main system.
- There should be Four gas specific mass flow controllers for collision and reaction gas for He, H_2, NH_3, O_2 etc. in a safe premix or pure form and compliant manner. The offered instrument should have factory fitted MFCs as a standard feature. System should have the capability to handle an additional of min 15 CRC gases based on request.

Mass Analyser:

- User definable resolution for improved dynamic range and extended sensitivity
- Minimum Unit mass (1 amu) resolution capability
- Mass calibration assessed and automatically updated.
- The Mass range should be from 4-290 u or better
- Scan speed: >3700 u/sec or better at 40 mass intervals
- Mass stability: ≤ 0.025 amu per day or more.

Detection and performance specifications:

- The ion detector should be a dual mode discrete dynode electron multiplier (or equivalent system with analogue and/or digital mode of operation) with 10 order or more magnitude of dynamic range
- The dual-mode detector assembly must come standard with the system.
- Minimum dwell time of 100 µs or better in pulse and analog.
- Sensitivity specifications (must be demonstrated during installation):

Sensitivity (Mcps/ppm):

- Li/Be: ≥ 65
- In/Y: ≥ 280
- U/Tl: ≥ 330

Detection limits (ppt):

- Li/ Be: < 0.50
- In/ Y: < 0.1
- U/ Bi: < 0.1
- 32S (as SO+) : < 200
- 31P (as PO+) : < 50
- 78Se : < 1
- Oxide ratio: CeO/Ce <2% or better
- Ba++ or Ce++/ Ba or Ce <2% or better
- Background mass 4.5/9/220: No gas <1 cps
- Short Term Stability ≤2% RSD or better
- Long Term Stability <3% RSD or better
- Mass Stability < ± 0.025 u per day

Software and control PC

- Suitable Data Station with all Software controls & future upgrade controls with Instrument software.
- Software should provide comprehensive functionality for analysis through fully automated process with auto tuning.
- The software should have data handling and data management, Data security and access control with 21 CFR part 11 environment supports, compliance management and customizable reporting etc.
- The system should have Server connectivity and should be capable of 21 CFR Part 11. There should be facility for automatic data transfer from ICPMS PC to central server.
- Minimum 2 offline software licenses must be provided as standard
- The software must be a 64 bit application for future upgradeability.
- The future software upgradeable should be free of cost.
- System should be upgradable with suppressor-based separation system using integrated single window-based software operation for all the modules connected with MS.
- Branded HP/Dell Personal Computer should be supplied along with instrument from manufacturer.

Consumables:

- A complete set of essential and comprehensive accessories/consumables/spares/sample should be quoted for 3 years of operation. These include Ni sampler and skimmer cones, PFA nebulizer (with both detachable and integrated probe), spray chambers, plasma torch, injectors, preventive maintenance kits, etc.
- Any other consumable required for smooth operation of system must be quoted separately. (List of comprehensive and essential consumable must be mentioned in tabular form with individual cost of the item)

Other requirements:

- Details of installation-site requirements maintenance and service support should be described
- Details of gases, regulators, cylinders necessary for both solution ICPMS and laser ablation ICPMS should be provided and maybe quoted separately
- Operation and service manual shall come with the equipment.
- Suitable UPS with 30 min Backup
- Autosampler of minimum sample vial holding capacity of 200 positions or more should be offered. It should be metal free and should have independent X-Y-Z movement.

- Vendor must give list of references in India and elsewhere in the world where the quoted system is working satisfactorily (both for solution ICPMS and laser ablation ICPMS)
- Vendor has to give 5 days on site training after the installation for practical demonstration for both solution ICPMS and laser ablation ICPMS.

Warranty

- Warranty service that includes parts and labour for at least 24 months, which shall begin after successful commissioning of the equipment. Please also quote subsequent (i) comprehensive maintenance cost (parts & labour) and (ii) maintenance cost (labour only) after expiry of the warranty period.
- The warranty should cover all laser components that are not considered consumables. Spare of beam path optics that are consumables and replacement dependent on number of laser shots and energy applied for back-up should be provided.
- Equipment installation, commissioning tests and training should be included in the tendered price.

Support Service

- Online support includes phone, e-mail and internet-based remote access within 24-48 hours of initial contact.
- On-site service is included, as deemed necessary, following online evaluation. Goal to provide on-site service within 48 hours once a service call has been entered based on engineer availability.