200kV Ion Accelerator and associated accessories: Item No.*2, NIT 03/2012-13 dated 24-01-2013 due on 21-02-2013.

**TWO PARTS TENDER ITEM**

**Item No.*2 - 200kV Ion Accelerator and associated accessories.**

**Specifications:**

**200kV ION ACCELERATOR**

Air insulated 200 kV Heavy ion accelerator complete with Ion source, Electrostatic Einzel lens, 90° pre-injection analyzing magnet, mass defining slit, Beam position monitors, Faraday cups, Accelerator tube, HV power supply, Vacuum systems, Insulated support frame and the high voltage dome, beam line, implantation chamber and Computer control system as per detailed specifications given below:

**HIGH VOLTAGE SYSTEM**

**DOME VOLTAGE:**

The accelerator should have a dome voltage of 200 kV, which is continuously variable at minimum step of 1kV from 10 to 200 kV. The voltage stability should be better than +/-100V.

**HV Power Supply**

A suitable solid state power supply for generating the acceleration voltage should be supplied. The HV power supply should have a fast acting stabilization circuit that can be operated in a constant voltage mode. To control the external field and to minimize corona, the top of the high voltage power supply should be spherical shaped and equipotential rings should be provided to the insulating cylinder enclosing the voltage multiplier units and rectifier stack that are connected to the equipotential planes of the insulated support frame of the high voltage terminal. To minimize possible damage during transients the stored energy should be minimized and the unit should be short circuit protected.

**ISOLATION TRANSFORMER**

A suitably rated isolation transformer for supplying power to equipments at the high voltage dome should be supplied. Motor generator set is not suitable for this purpose in view of vibration considerations in the lab where the accelerator is proposed to be installed.

**MASS ANALYSING MAGNET**

A 90° double focusing mass analyzing magnet should be provided to carry out the mass analysis of the ions before injection into accelerating tube. The mass energy product should be 7.0 MeV AMU or higher to analyse all elements in the mass range of 1-230 amu at 30 kV (Max) extraction voltage. The Mass resolution (m/Δm) of the magnet should be better than 200.

A suitable high stability power supply should be provided for energizing the magnet. The facility for cooling the magnet and the power supply should be provided.
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**ION SOURCES**

Ion source should be provided to obtain beams of all ion species. Some of the typical ion species and the minimum current requirements are listed below.

<table>
<thead>
<tr>
<th>Ion species</th>
<th>Beam current (µA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{40}$Ar$^+$</td>
<td>100</td>
</tr>
<tr>
<td>$^1$H$^+$</td>
<td>100</td>
</tr>
<tr>
<td>$^3$He$^+$</td>
<td>100</td>
</tr>
<tr>
<td>$^{64}$Zn$^+$</td>
<td>30</td>
</tr>
<tr>
<td>$^{74}$Ge$^+$</td>
<td>30</td>
</tr>
<tr>
<td>$^{28}$Si$^+$</td>
<td>50</td>
</tr>
<tr>
<td>$^{16}$O$^+$</td>
<td>65</td>
</tr>
<tr>
<td>$^{11}$B$^+$</td>
<td>30</td>
</tr>
<tr>
<td>$^{197}$Au$^+$</td>
<td>40</td>
</tr>
<tr>
<td>$^{107}$Ag$^+$</td>
<td>50</td>
</tr>
<tr>
<td>$^{31}$P$^+$</td>
<td>70</td>
</tr>
<tr>
<td>$^{14}$C</td>
<td>25</td>
</tr>
<tr>
<td>$^{14}$N</td>
<td>40</td>
</tr>
<tr>
<td>$^{115}$In</td>
<td>75</td>
</tr>
<tr>
<td>$^{121}$Sb</td>
<td>40</td>
</tr>
<tr>
<td>$^{75}$As</td>
<td>30</td>
</tr>
<tr>
<td>$^{27}$Al</td>
<td>60</td>
</tr>
<tr>
<td>$^{120}$Sn</td>
<td>40</td>
</tr>
<tr>
<td>$^{121}$Sb</td>
<td>40</td>
</tr>
</tbody>
</table>

All the currents measurements indicated in the above table should be on a faraday Cup after acceleration. If the specifications do not exactly match with the standard models suppliers may also offer nearest standard models or customized versions to satisfy the technical specifications.

**Ion Source Power supplies**

Suitable power supplies for the ion sources should be supplied

**Source life**

One of the important considerations in the choice of the ion sources is the number of hours the source can run at the specified ratings before needing maintenance or replacement of charge material/filaments (if any). The desirable minimum source life is around 24 hours excluding the time of initial warm up conditioning.
ION OPTICAL ELEMENTS (inside the terminal)

Suitable lenses, steerers etc should be provided to effectively transport the beam through the mass analyzing magnet and subsequently through the accelerating tube with minimum beam loss so that beam currents on the target will be larger at 200 kV as well as 20 kV terminal voltages.

Mass Defining Slit
A mass defining slit, with adjustable width, should be located after the analyzing magnet at the position where the image is formed by the combined focusing action of the analyzing magnet and the ion source lenses to separate the defined ion species or isotope from the other components of the ion beam.

Beam Position Monitors
A beam position monitor should be located in the slit housing assembly to sense the beam components before and after the mass defining slit. The signals from the beam position monitor to be displayed on the computer screen and the height, width and position of the figure displayed should correspond respectively to the intensity, diameter and position of the beam. Facility for measurement of beam current before injection into the accelerating tube should be available.

Accelerator tube
The accelerating tube should be rated for the required accelerating voltage and suitable resistance stack running parallel to the accelerating tube should be provided for establishing the required voltage gradient. The design and construction materials of the accelerating tube should ensure
(a) Good vacuum ~10^{-7} mbar or better
(b) Low radiation back ground

Electrostatic quadrupole triplet lens
An electrostatic quadrupole triplet lens should be located at ground potential directly after the accelerator to focus the beam from the accelerator to obtain maximum beam transmission through the switching magnet and beam line(s) connected to the accelerator.

Implantation beam Line
1. An implantation beam line consisting of
   - Beam sweep system: Scan area (max) 2 inchx2 inch
     Uniformity: +/- 10%
   - Neutral trap to stop neutralized ions
   - Retractable Faraday Cup
   - Faraday cup and Current-meter and integrator
   - Beam monitoring system including:
     - Auto tracking system
     - Beam monitoring control
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- Retractable beam profile monitor

- Vacuum pumping system including:
  - Turbo molecular pump
  - Vacuum measuring equipment
  - All necessary valves

**Experimental Target Chamber**

- Standard components
- Transmission Faraday cup assembly with secondary electron suppressor
- A demountable transmission faraday cup for scan area of 1.5cm x 1.5cm
- View port
- Un-cooled multi sample carousel for 2 inches wafer size of choice
- Heatable target holder (800°C) for 2 inches wafer size of choice
- Coolable target (liquid nitrogen) holder for 2 inches wafer size of choice
- Vacuum pumping system including:
  - Fore pump
  - Vacuum measuring equipment
  - All necessary valves

**Vacuum pumping system**

Suitable vacuum pumping systems based on turbo-molecular pumps should be provided to achieve a vacuum of $10^{-7}$ mbar or better in the accelerator during operation. Gate valves for vacuum isolation should be provided at appropriate locations. Vacuum measuring units should be provided at the required locations for monitoring the vacuum in the accelerator at various locations. The vacuum readouts should be interlocked with the gate valve operation to ensure safe operation.

**Computer control system**

The Accelerator should be computer controlled. To ensure a safe and reliable operation of the computer control system it should be electrically isolated from the accelerator system; all analog and digital information is to be transferred via the fiber optic telemetry. The entire control of the accelerator other than opening any manual valves should be possible from the control console of the computer control system. The computer control system should make use of a modern IBM compatible PC. The following facilities should be available

(i) **Vacuum overview**

A vacuum layout with the status of valves, pumps, vacuum levels and Analog vacuum values should be available in one view. A layout of the complete machine should also be added. The user should be able to change the state of the controls by double clicking on them using a mouse.

(ii) **Auto Startup and shut down**

An automatic self start-up procedure should be added to allow the system to be started-up at a predefined time and date. It includes self start-up of ion source(s) and
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accelerator voltage. In addition an automatic system self-shutdown procedure should be added to allow the system to be shutdown at a predefined time and date.

(iii)  **Trending**
A facility for the continuous trending of all the analog readouts should be provided, by means of a separate Trending window. It should be possible to trend up to five analog channels simultaneously with user adjustable scale of the graphic display.

(iv)  **Logging**
The system should continuously log all Input and output channels. There should be a facility for the user to recall the log corresponding to any channel and view it.

(v)  **Tracing**
A trace facility should be available to make an X-Y display of a control and a read out, like analyzing magnet current and beam current measured at the Faraday cup.

(vi)  **BPM display**
The BPM display should be available on the control computer display

(vii) **Facilities for dose control, current integration, magnet calculations (magnet current for different masses/energies), Beam tracking etc should be available.**

(viii) **Interlocks**
Machine protection by means of interlocks should be available. The interlocks should prevent certain operation that compromise machine/personnel safety which should include

- Prevention of Access to area having open high voltage points
- Prevention of any operation before the appropriate vacuum levels are reached
- Warning and prevention of certain operations if necessary cooling, air pressure etc are not available

Over riding the interlocks should be possible only through a password and even while such operations are attempted under pass word authorization one warning should be given that a interlock is going to be bypassed.

(ix) **UPS for computer control system**
An UPS for supporting the computer control system for 30 minutes in case of power failure should be provided

(x) **Cooling system and associated pumps**
All the cooling systems for the ion source and magnets and circulation pumps of required capacity should be provided.

**Beam optics software**
As a special requirement, beam optics software (PBO Lab) for beamline development should be provided

**Layout**
The supplier should provide detailed layout of the accelerator and indicate the space requirements

**Services**
Requirements of services like compressed air etc should be indicated.

**Electrical Power**
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The accelerator should work on 415 (+ 10 %) V, 50Hz, three phase AC mains

Manuals
Detailed operation and service manuals in English should be supplied.

Spares
Spares and Consumables for 5 years operation should be quoted

Installation
The accelerator should be installed at site and commissioned by the supplier. The key performances like energy, Energy stability and beam current should be demonstrated. The supplier should also provide training for the users’ staff in the operation and maintenance of the accelerator.

Warranty
The supplier should offer a guarantee for the accelerator performance for a period of 18 months from the date of supply or one year from the date of installation
### Terms and Conditions

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tender in sealed cover duly superscribed &quot;Tender No. .... dt.... due on .....for ......... item .......... &quot; complete with all details, otherwise tender may not be opened/considered. If you are interested to quote more than one items, you shall submit the quotations in sealed cover separately. (*) items as mentioned in the Tender No. 03/2012-13 dt. 24-01-2013 must be quoted in two parts (Part A-Technical and Part B-Financial). The two parts show separate sealed covers.</td>
</tr>
<tr>
<td>2.</td>
<td>Price should be quoted CIP / CIF Mumbai &amp; Insurance up to Indore separately (As per INCOTERMS 2010). In case of local firms they should quote for delivery in premises of this office.</td>
</tr>
<tr>
<td>3.</td>
<td>Director, UGC-DAE CSR, Indore, reserves the rights of accepting in full or part /not accepting the tenders without assigning any reasons.</td>
</tr>
<tr>
<td>4.</td>
<td>The acceptance of tender, will rest with the Director, UGC-DAE CSR, Indore, who does not bind himself to accept the lowest tender and reserves to himself the authority to reject any or all of the tenders received without assignment of any reason.</td>
</tr>
<tr>
<td>5.</td>
<td>Delivery period must be mentioned.</td>
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<tr>
<td>6.</td>
<td>The tender shall remain open for acceptance for a period of 90 days from the date of receipt.</td>
</tr>
<tr>
<td>7.</td>
<td>The decision of the Director, UGC-DAE CSR, Indore, shall be final in all the cases.</td>
</tr>
<tr>
<td>8.</td>
<td>Director, UGC-DAE CSR, Indore, shall not be liable for postal delays. The incomplete tenders or the tenders received after due date will not be considered.</td>
</tr>
<tr>
<td>9.</td>
<td>Quote your offer along with literatures/catalogues, if any.</td>
</tr>
<tr>
<td>10.</td>
<td>We are exempted from the excise duty. The excise duty exemption certificate is issued by Department of Science &amp; Industrial Research (DSIR), Govt. of India, New Delhi under Notification No. 10/97-Central Excise dt. 1 March 1997. Our Registration No. is TU/V/RG-CDE(98)/2011 dt. September 13, 2011 &amp; valid up to 31-08-2016.</td>
</tr>
<tr>
<td>11.</td>
<td>Price should be quoted exclusive of Customs Duty. This institution will take care of Customs Duty.</td>
</tr>
<tr>
<td>12.</td>
<td>Sales Tax / VAT must be quoted separately.</td>
</tr>
<tr>
<td>13.</td>
<td>No claim for any tax or duty, not stipulated in the tender will be admitted at any stage.</td>
</tr>
<tr>
<td>14.</td>
<td>The tenderer should furnish the users list where similar equipment has been supplied recently.</td>
</tr>
<tr>
<td>15.</td>
<td>Special care should be taken to write the rates in figures as well as in words. No overwriting be done on the rates and units.</td>
</tr>
<tr>
<td>16.</td>
<td>Arbitration: &quot;in connection with the present contract shall be finally settled under the Rules of conciliation and arbitration of the International Chamber of Commerce&quot; should be replaced by &quot;between both parties in connection with the CONTRACT which cannot be settled amicably shall be exclusively &amp; finally settled by Arbitration under the rules of conciliation and arbitration of the International Chamber of Commerce, Mumbai&quot; by one or more Arbitrators appointed in accordance with the said Rules.</td>
</tr>
<tr>
<td>17.</td>
<td>No deviation from the stipulated terms and conditions will be allowed. Tenders should be unconditional.</td>
</tr>
<tr>
<td>18.</td>
<td>The equipment should be warranted for 12 months from the date of commissioning / installation.</td>
</tr>
<tr>
<td>19.</td>
<td>It will be obligatory on the part of the tenderer to sign on your offer.</td>
</tr>
<tr>
<td>20.</td>
<td>Subject to Indore Jurisdiction.</td>
</tr>
<tr>
<td>21.</td>
<td>For Imported goods, the payment will be made through Letter of Credit or after receipt of goods by sight draft. No advance payment will be made.</td>
</tr>
<tr>
<td>22.</td>
<td>For Indigenous goods no advance payment will be made.</td>
</tr>
<tr>
<td>23.</td>
<td>The Performance bank guarantee must be provided till the warranty period.</td>
</tr>
<tr>
<td>24.</td>
<td>The last date for submission of the tender documents is 21-02-2013 up to 16.00 hrs. Tender will be opened on 25-02-2013 at 11.30 hrs. Tenderer (s) / authorized representative(s) may attend on the opening of the tender bids.</td>
</tr>
</tbody>
</table>