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June 13th, 2024

Domestic Tender for a Glove Box with Integrated Dual-Chamber Thermal Evaporator

This is a Domestic RFQ (Request for Quote) for procuring a glove box with an integrated dual-chamber thermal evaporator system as part of a domestic tender for the Centre for Nano Science and Engineering (CeNSE) at IISc, Bangalore.

CeNSE is a multidisciplinary research department at IISc that houses a cleanroom of 14,000 sq. ft. and a characterisation facility used by 50 faculty members from various disciplines at IISc. CeNSE also runs a program called the Indian Nanoelectronics Users Program (INUP), which has allowed 4200 participants from more than 700 universities and institutes all over India to use the facilities at CeNSE. Consequently, any tool in CeNSE receives significant exposure to the scientific community at IISc and beyond. The vendors are requested to factor this exposure's value into their quotes.

1 Procedure

1. Vendors must submit technical and commercial proposals in **two separate sealed envelopes**. Only vendors who meet the technical requirements will be considered for the commercial negotiation.
2. **The deadline for submission of proposals is July 5th, 2024, 5:30 pm Indian Standard Time.** Proposals should arrive in hardcopy at the office of Prof. Sushobhan Avasthi, TF-06, Centre for Nano Science and Engineering, Indian Institute of Science, Bangalore 560012, India, by the above deadline.
3. The technical proposal should contain a technical compliance table with 5 columns.
    a. The first column must list the technical requirements in the order given in the technical requirement below.
    b. The second column should provide instrument specifications against the requirement. Please provide quantitative responses wherever possible.
    c. The third column should describe your compliance with a “Yes” or “No” only. Ensure that the entries in column 2 and column 3 are consistent.
    d. The fourth column should state the reasons/explanations/context for deviations, if any.
    e. The fifth column can contain additional remarks from the OEM. You can use this opportunity to highlight technical features, qualify responses to previous columns, or provide additional details.
4. Vendors are encouraged to highlight the advantages of their tools over comparable tools from the competitors.
5. If multiple systems can fulfil the requirements, vendors can submit multiple bids.
6. In the commercial bid, please provide itemised cost of the system and required accessories, such as software, power supply, etc.
7. As an option, please provide itemised cost for any suggested accessories/add-ons that may enhance the tool's usability, capability, accuracy, or reliability. Vendors are encouraged to quote for as many add-ons as their tool portfolio permits.
8. The quotes should include the cost of shipping as a separate line item.

9. Any questions can be directed to Prof. Sushobhan Avasthi, TF-06, Centre for Nano Science and Engineering, Indian Institute of Science, Bangalore 560012, India. (savasthi@iisc.ac.in)

2 Terms and Conditions

1. The decision of the purchase committee will be final.
2. The vendor is responsible for installing the system at the IISc campus.
3. The RFQ must include references to 3 previous installations in India. Please provide the names and contact addresses of the referees so that the committee can contact them independently. Details of such systems with model numbers and users should be provided. The reference letters can disqualify vendors with poor track records of service, build quality, system performance, or poor availability of spares.
4. The vendor must also submit a list of 5 customers who have installed similar systems.
5. The lead time for the delivery of the equipment should not be more than four months from the date of receipt of our purchase order.
6. The indenter reserves the right to withhold placement of the final order. The right to reject all or any of the quotations and to split up the requirements or relax any or all the above conditions without assigning any reason.
7. Wherever requested in this specifications sheet, data must be supplied along with technical compliance documents. Technical bids without supporting data will be deemed as technically non-compliant.
8. All guaranteed specifications must be demonstrated upon request in an active installation. Failure to demonstrate any promised specifications will be deemed as technical non-compliance.
9. Printed literature and published papers to support compliance to the prescribed specifications must be provided.
10. Technical evaluation by the institute may include a demonstration to verify the functionalities and capabilities of the system quoted. Any discrepancy between the promised specifications and demonstrated specifications will be deemed as technical non-compliance. If need arises, the vendor must be ready to physically visit IISc for a techno commercial discussion.
11. The **validity of commercial quotation should be at least 60 days** from the last date for the submission of tender.

2.1 GFR 2017 Requirements

This is a domestic tender as per GF2017.

12. Quote should come only from Indian Original Equipment Manufacturer (OEM) or their Indian authorized distributor.
13. The quotations should be on FOR-IISc Bangalore basis in INR only.
14. The Bidder should belong to either Class-1 or Class-2 suppliers distinguished by their "local content" as defined by recent edits to GFR. They should mention clearly which class they belong to in the cover letter.
    a. Class-1 supplier: Goods and services should have local content of equal to or more than 50%.
    b. Class-2 supplier: Goods and services should have local content of equal to or more than 20 % and less than 50%.

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15. The Bidder should belong to either Class-1 or Class-2 suppliers distinguished by their "local content" as defined by recent edits to GFR. They should mention clearly which class they belong to in the cover letter. a) Class-1 supplier: Goods and services should have local content of equal to or more than 50%. b) Class-2 supplier: Goods and services should have local content of equal to or more than 20 % and less than 50%.
16. Bidders offering imported products will fall under the category of non-local suppliers. They cannot claim themselves as Class-1 local suppliers/Class-2 local suppliers by claiming the services such as transportation, insurance, installation, commissioning, training, and other sales service support like AMC/CMC, etc., as local value addition.
17. Purchase preference as defined by the recent edits to GFR (within the "margin of purchase preference") will be given to the Class-1 supplier.
18. MSMEs can seek an exemption to some qualification criteria. IISc follows GFR2017 for such details.

3 Technical Requirements

3.1 System Arrangement

1. The glove box must be connected to an existing ProRes glovebox (On the left in Figure 1b). The new glovebox+evaporator must be interconnected to existing glovebox via a T-shaped ante chamber (see Figure 1b). Details can be provided to the winning bid. The intended specifications of Box 2 are provided below. The vendors must take complete responsibility of integration.

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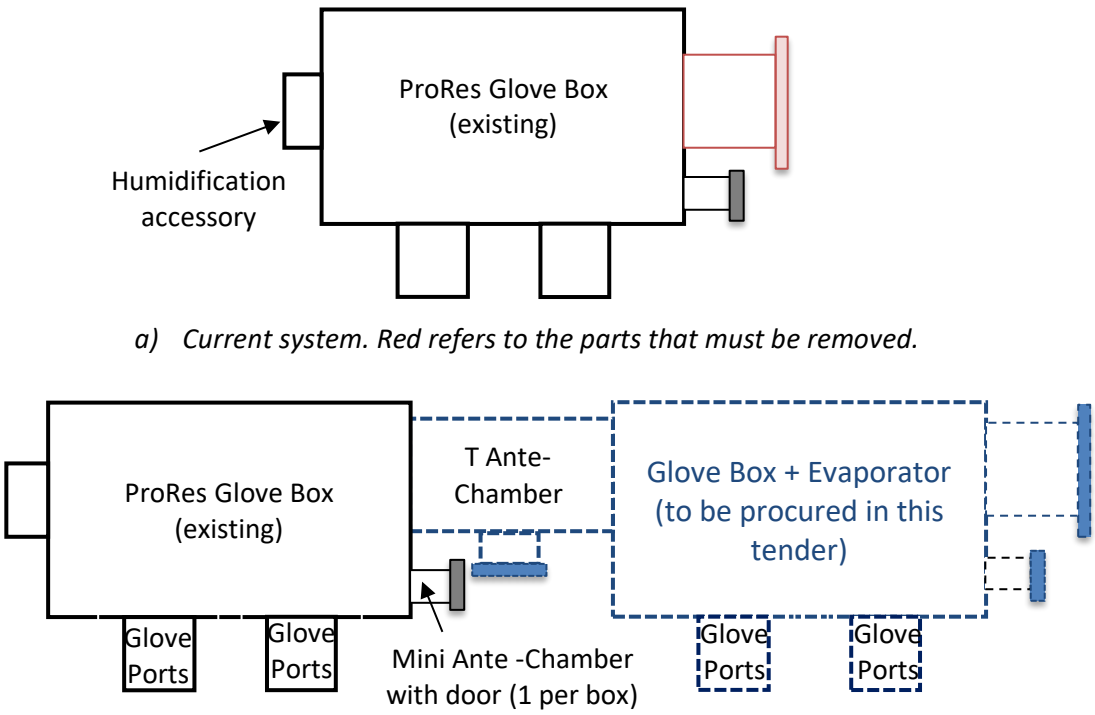

a) Current system. Red refers to the parts that must be removed.

b) Intended system. Blue refers to the parts that must be added.

Figure 1: Over schematic of the system being discussed in this tender. Not to scale.

3.2 Enclosure

2. The working space of each glove box should be at least 890 mm in height, 1200 mm in length and 760 mm in depth.
3. The window materials should be impact-resistant polycarbonate that is at least 4 mm thick.
4. Main body must be SS304 or SS316 brushed stainless steel, at least 3 mm thick.
5. The trays, rails and other components in the ante-chambers should also be of 304 grade or 316 grade or similar corrosion/chemical resistant grades of brushed stainless steel.
6. The external should either be coated with a chemical/abrasion resistant coating or be the brushed stainless steel of the same or better quality as the inners.
7. We *strongly* prefer a system in low footprint. As much as possible, integrate the instrumentation and catalyst on top of the globe box. The bottom can be used to house the controls for the evaporator.
8. Need a modular system that can be expanded further. The side-panels must be removable to accommodate future expansions.

3.3 Programmatic Logic Control

9. Glove box should be controllable with independent and fully integrated programmatic logic control (PLC), with a touch panel interface.

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10. The touch panel interface should serve as a central control unit for all glove box functions and procedures.
11. All glove box functions should be accessible via the touch panel.
12. The PLC should also enable plotting graphical trends of box pressure, oxygen and moisture levels over at least 24 hours. To prove the capability, vendors must attach plots of this data obtained from a similar system. The attached data must have been collected within the past six months.
13. Graphical display of the box pressure, O_2 and moisture levels should be available in the touch panel interface.
14. Automatic Box purge should be possible via PLC.
15. PLC should trigger an automatic box purge either due to high O_2 or moisture or both in the glove box or an automatic timer option to trigger box purge at a preset time for a preset duration. Touch panel implementations showing this should be provided. A copy of relevant documentation from the user manual should also be provided.
16. Gas (argon or nitrogen) flow rate of 200 liter/min or greater during purging should be possible.
17. The O_2 and moisture trigger set-point range for automatic box purging should be between 10-999 ppm. Touch panel implementations showing this should be provided. A copy of relevant documentation from the user manual should also be provided.

3.4 Purifier

18. Each glove box should have at least one independent purifier capable of purifying the glove box ambient to attain a purity of <1 ppm H_2O and O_2.
19. The removable capacity should be a minimum of 50 liters for oxygen and at least 2000 grams for moisture. Specification sheets or data sheets attesting to this must be provided.
20. The purifier should be fully regenerable with an automatic/programmed control using forming gas (5% H2 or lower) or Ar or N2.
21. The purification system of the glove box should be fully integrated with the heat exchanger and a gas circulation blower.
22. The gas circulation blower should be capable of a circulation rate of at least 100 m^3/hour. The maximum and minimum circulation rates of the blower should be provided.
23. The blower speed should be dynamically controlled via program logic based on the moisture and oxygen content in the glove box, to make the blower operation power efficient. Implementation diagrams or specifications that prove this is possible must be provided.
24. The purifier loop must have at least two dust filters (HEPA or ULPA filters) -- one for filtering inlet gas (nitrogen or argon) and one for filtering the box ambient before it goes out to the gas circulation system.
25. An additional pair of filters for each box should be supplied with the equipment.
26. Oil bubblers should NOT be used in any of the gas circulation lines. The mechanism for pressure regulation should be clearly mentioned.
27. NO component in the gas circulation line (except for the vacuum pumps) should use oil or oil containing parts.

3.5 Solvent Absorption Unit

28. Box must have an independent, fully regenerable solvent absorption unit, using N2 or Ar.
29. The solvent trap should be capable of absorbing volatile organic solvents like DMF, THF, methanol, toluene, IPA, acetone, methanol, DMSO, acetonitrile, Capacity of solvent trap must be 2000 cc of

methanol (or similar alcohols) or 2000 cc of THF (or similar aromatic esters) or 2000 cc of DMF or 2000 cc of chloroform or 2000 cc of toluene (or similar aromatic solvents).

30. Solvent absorption unit should be fully regenerable via PLC with a regeneration option provided in the touch panel controls. Touch panel implementations showing this should be provided. A copy of relevant documentation in a manual should also be provided.
31. The Solvent absorption unit should have both inline and bypass modes (**See Figure 2**).
32. **[Required Option]** The system should provide an option of attaching a solvent sensor, which indicates when to regenerate the solvent absorption unit. Touch panel implementations showing this should be provided. A copy of relevant documentation from the user manual should also be provided. This capability must be mentioned as a separate line item in the commercial bid as an option.

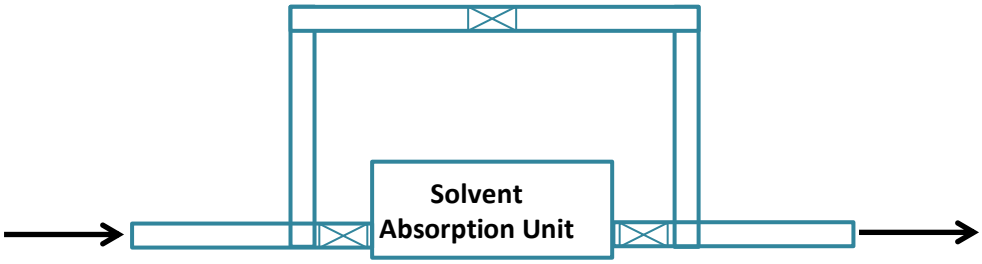

Figure 2. A schematic (not to scale) side-view of the circulation lines for the solvent absorption unit that shows the absorption unit by-pass and inline connections.

3.6 Sensors

33. A solid-state oxygen sensor capable of measuring oxygen levels from 0.1 ppm to 500 ppm should be provided with each box.
34. A solid-state moisture sensor capable of measuring moisture levels from 0.1 ppm to 500 ppm should be provided with each box.
35. A pressure sensor capable of recording box pressure should also be available for each box.
36. The vendor should provide a list of solvents compatible with the system being quoted. For example, the vendor must provide the list of solvents that the moisture and oxygen sensors are compatible with. Sensors must be compatible with DMF, THF, methanol, toluene, IPA, acetone, methanol, DMSO, acetonitrile and chloroform.
37. The PLC should be able to show instantaneous readings from the sensor and should also have the capability to record the readings for, at the least, a period of 24 hours. Documentation and data in support of this should be provided.

3.7 Box pressure

38. Box pressure should be controllable automatically (via programmatic logic) within a pressure range of -12 to 12 mbar.
39. The desired pressure should be settable via the touch panel interface. Touch panel implementations showing this should be provided. A copy of relevant documentation from the user manual should also be provided.

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3.8 Gloves and Glove Port Covers

40. There should be 2 polymer (polypropylene is preferred) glove ports for each box and butyl gloves should be provided for these glove ports.
41. The size of each glove port should be at least 9" in diameter.
42. The glove ports should be O-ring sealed against the gloves.
43. At least 1 additional pairs of butyl gloves should be supplied with the box. As an option, include the cost of one more pair of gloves in the commercial bid.
44. Must include at least one glove port cover.
45. The thickness of the butyl gloves should be a minimum of 0.4 mm.

3.9 T-shaped ante-chamber connecting the two boxes

46. The T-shaped ante-chamber that connects the two glove boxes should have three vacuum doors, one towards each for the two boxes and one exposed to atmosphere. The goal is to transport samples from atmosphere into the ante-chamber to one of the boxes, without breaking hermeticity (**see Figure 3**).
47. The ante-chamber should be cylindrical with a diameter of at least 380 mm and a length of at ~ 800 mm.
48. The doors should preferably be with a swing-type hydraulic-assisted opening mechanism to conserve working space.
49. There should also be a tray preferably mounted on telescopic rails, which can be slid back and forth. The tray should facilitate transfer for tools and chemicals from one glove box to the other.
50. The chamber must have a manual pump and purge system: with pressure gauge, manual valve and connection to vacuum pump.
51. **[Required Option]** The system should be upgradable to automatic pump and purge operations of the ante-chamber via a software controlled touch panel or computer. Touch panel implementations showing this should be provided. A copy of relevant documentation from the user manual should also be provided. This capability must be mentioned as a separate line item in the commercial bid as an option.

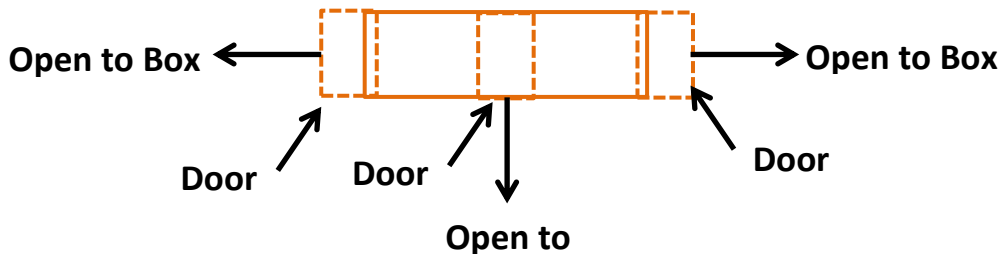

Figure 3. A schematic (not to scale) top-view of the T Ante-Chamber that connects the two glove boxes.

3.10 Mini ante-Chambers

52. The box must have one mini ante-chamber for sample transfer.
53. The ante-chamber should be at least 150 mm in diameter and 290 mm in length.
54. The ante-chamber should have a sliding tray to enable sample transfer.
55. The chamber must have a manual pump and purge system: with pressure gauge, manual valve and connection to vacuum pump.

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56. The ante-chamber should have a door that can seal the ante-chamber for evacuation.

3.11 Feedthroughs

57. The box should have at least 4 KF-40 feedthroughs. These can be connected to liquid, electrical or vacuum feedthroughs. The details of placement can be discussed at the time of ordering
58. The system must have at least 3 electrical feedthroughs with 15 A connectors that are compatible with 220 V – 240 V supply

3.12 Vacuum Pumps

59. The box should come with a mechanical pump (at least 20 m^3/hour capacity) with oil mist filter.
60. There should be automatic gas ballast control.
61. The pump ON/OFF should be controllable via the touch panel. Touch panel implementations showing this should be provided.
62. [Required option] The option of upgrading to an oil-less pump should be available and quoted.

3.13 Other

63. There must be a lamp inside, preferably LED. There must be a switch on the outside of the body or touchscreen to turn the light on/off.
64. The circulation system should make it possible to have positive pressure regulation without vacuum pump and should be fully integrated with the heat exchanger. Documentation supporting this should be provided.
65. A foot pedal for controlling box pressure should be provided.
66. At least two height-adjustable stainless-steel shelves of at least 1000 mm in length and at least 200 mm in depth should be provided. These should be centrally located so that any chemicals or tools are accessible from glove ports.
67. All electrical connections should comply with line power specifications in India. Single phase voltage range is 220-240 Vac and the three-phase voltage range is 415 - 440 Vac. The line frequency is 50Hz.
68. IISc requires 3 years warranty.
69. IISc shall not pay extra for installation and training. The base price must include this.

3.14 Evaporator

70. We need two evaporation chambers connected with a transfer rod. A conceptual design with front and top view is given in Figure 4 and 5. Common features for the chambers are:

3.14.1 Chamber 1 & 2

71. Sample size 1”x1”. Sample holder should be slightly bigger to accommodate fastening hardware.
72. Uniformity: 5% over the sample chamber in the confocal arrangement. Size the chambers and angle of sources, appropriately.
73. Sample rotation in each chamber, with control. Rotational feedthrough should be magnetically-coupled.
74. Sample up-down movement: Same to holder should move up-down over a certain range to tune uniformity.
75. Confocal Sources: 200A thermal resistive sources. The sources should be in a confocal arrangement, suitable for co-evaporation. Installed 3 but provision for 4 sources. The source must be backed by 3 power sources that can run concurrently (for co-evaporation). The two chambers can share power supply, controlled with manual or electronic relay.

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76. Space is limited. So, to the extent possible, integrate all electronics and control hardware on a rack underneath the glove box or evaporation chamber.
77. Thickness monitor. Each source should have a thickness monitor with controller. The two chambers can share the controller.
78. Automated shutter control for each source and sample.
79. Base vacuum of the chambers: 5e-7 torr or better.
80. Pumps: Rotatory main pump and secondary turbo pump with controllers. The two chambers can share the pumps. Chamber should reach 1e-6 vacuum in 1.5 hours of pumping.
81. Each chamber should have standard ports for viewing and vent; pressure gauges for full range of operation; feedthroughs for sample rotation, crystal monitor, power for sources, etc.
82. User interface: Need a semi-automated user panel or laptop where operations can be controlled from the front of the sytem. The user panel should be well labelled and use industrial grade controls. The laptop should be standard which can be replaced for repair with minimal fuss.
83. Fittings: Smaller valves should be electronically actuated. Large valves like gate valve can be manual.
84. Structure: Include cost of frames and supports.
85. Both chambers must have two doors. One in the front for loading/unloading samples during normal operation using a glovebox. One door in the back for servicing the chamber from ambient. Prefer sliding door that take less space.
86. [Mandatory option] Upgrade one or more of the evaporation sources to effusion cells with temperature control +/- 1C. Quote for each effusion cell + controller.
87. [Mandatory option] Additional 4th 200A resistive thermal source + controller. The 4th source can use the existing power supplies. We understand that this will mean only three sources can run concurrently. Also account for the extra crystal monitor.
88. [Mandatory option] Heated stage upto 150 C. Rotation and up-down movement should be supported. Transfer arm should work.
89. [Mandatory option] LN2-cooled stage for cryo deposition. No need for rotation or up-down motion. However, transfer arm must still work.

3.14.2 Transfer arm

90. Magnetic transfer arm to get sample from glove box to chamber 1 to chamber 2. The sample holder should interface with the transfer arm for reliable sample transfer. Please provide references of precious installation where transfer are was used.

3.14.3 Exhaust & Abatement

91. The deposition system is being used for evaporating Pb-based inorganic materials. The chamber exhaust must be designed with safety in mind. The system must have a carefully planned with appropriate exhaust and abatement system.
92. The installation location will have an exhaust but prior to that, the exhaust vapors should pass through an adsorption filter using activated charcoal or molecular sieve.
93. The filter should be field serviceable. We should be able the charcoal or molecular sieve during regular maintenance.
94. [Mandatory option] A water-bath based gas abatement system, where the adsorption filter is replaced with a water bath. The exhaust vapours are water soluble. The water bath must tolerate a pH of 3 to 11. The bath must have a integrated pH meter.

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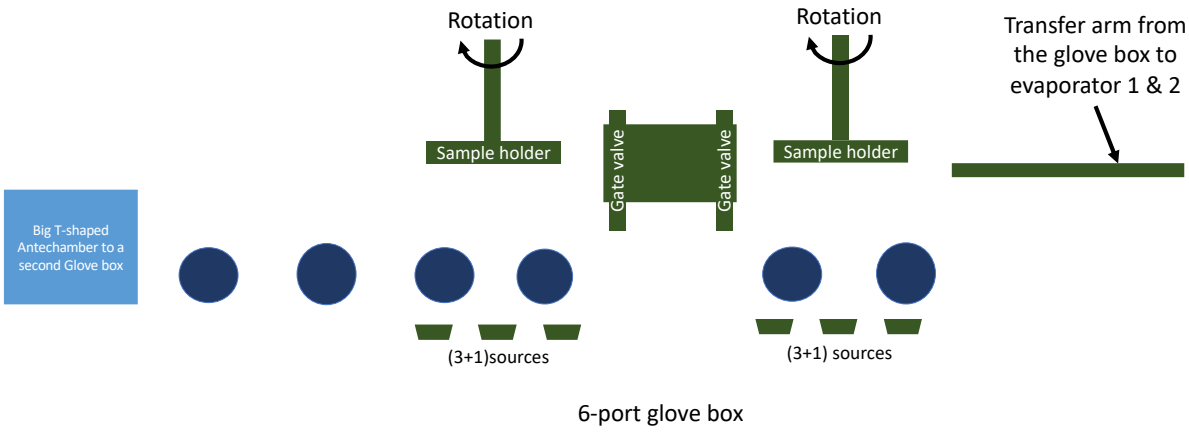

Figure 4: Front-view of the glovebox + evaporator system

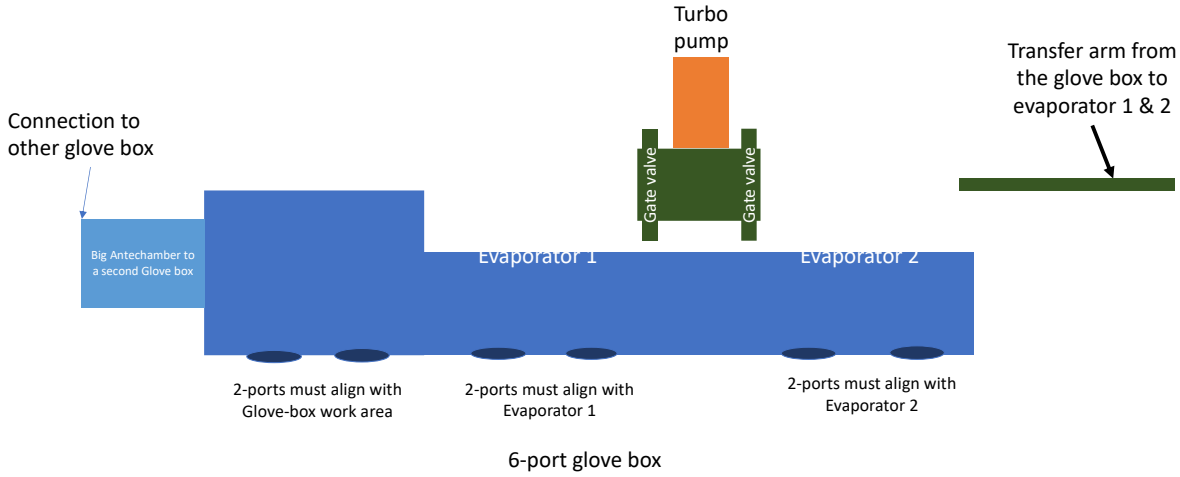

Figure 5: Top-view of the Glovebox + evaporator system

3.15 Acceptance Tests

95. IISc will expect acceptance tests, post installation. These can be recorded in the presence of representatives of the OEM. Inability to pass these tests will be a counted as a technical failure and breach of contract.

3.15.1 Glove box

96. Maintain <1 ppm of H2O and O2 for 24-hour period.
97. Demonstrate successful sample transfer from the two ante-chambers and T-ante-chamber. The contamination in the glove box should not increase above 2 ppm for with H2O or O2 at any point during the transfer.
98. Demonstrate automated routines for catalyst regeneration.
99. Demonstrate automated routines for maintaining target pressure.
100. Demonstrate solvent compatibility by opening bottle of anhydrous bottle of THF and DMF without impact or spurious reading on the H2O and O2 sensors.

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3.15.2 Evaporator

101. Pumping down and venting routines for both chambers. We shall monitor pumping time, gauge operation, valve operation, and base pressure.
102. Operation of all evaporation sources (or effusion cells)
103. Co-evaporation of PbI2 and methylammonium iodide in chamber 1, showing operation of crystal monitors, sample rotation, uniformity, and shutter operation.
104. Co-evaporation of C60 and C60 in chamber 2, showing operation of crystal monitors, sample rotation, uniformity, and shutter operation.

Thanking you,

Sushobhan Avasthi, Ph.D.