

INSTITUTE FOR PLASMA RESEARCH

Technical Specifications SECTION 'C'

Design, Fabrication,
assembly, testing and
supply of Filter
polychromators &
associated components and
demonstration of
performance tests a IPR site

This is a two part tender: The technical part and commercial part need to be submitted in a separate sealed envelopes. Party should quote the cost per filter polychromator assembly, mentioned in this document.

1.0 Introduction

The Filter polychromator is an instrument for spectral dispersion of scattered light from plasma. The instrument is designed for getting maximum transmission with easy alignment options. A high precision opto mechanical engineering work is required for success full completion of this work. This work involves maintaining multiple optical components and detectors with extremely high precision and accuracy maintaining the parallelism and distance constant and the optical spot sizes (1 -1.5 mm) with in an accuracy of 0.1 mm over a distance of ~1.5 meter.

This part of tender document contains the scope of work, technical specifications for design, fabrication and testing of Filter polychromators. The fabrication and testing of Filter polychromator should be carried out strictly according to the specification and arrangement and assembly drawings given in this part of the tender document in view to keep the final accuracy as mentioned. Institute for Plasma research (IPR) is already having a basic instrument fully operational, so the party can visit IPR with a prior appointment for getting a better insight about its complexities, additions or modification to be made, operation and assembly before preparing the quotation.

2.0 Scope of work:

The scope of work includes making of a detailed engineering drawing for fabrication, from the provided arrangement and assembly drawing along with the specification sheet. The engineering drawing and assembly drawing should be submitted to IPR for approval prior to beginning the work. After the approval, the vendor should finish the fabrication of one complete Filter polychromator and demonstrate its performance at the site of vendor to IPR representative. If the performance of this unit is not satisfactory, required corrective measures has to be included in the design and drawing and the improved unit should be tested again. Upon the success full demonstration the prototype, fabrication of all Filter polychromators shall be initiated. The vendor has to submit the fabrication drawing of all items to IPR for approval before initiating the work (If received the purchase order). The vendor should do the material procurement as per the standards mentioned and it is required to submit the material test certificates to IPR for approval. The fabrication activities has to be carried out by the vendor at vendor's site. There will be a pre-dispatch inspection at the Vendors site prior to the shipment of items to IPR. The final acceptance test will be performed at IPR site. If the vendor fail to show the performance of fabricated item in the stipulated time then the order will be cancelled. The vendor is responsible for showing all performance tests at IPR site for the final acceptance of the fabricated polychromator. The performance test involves demonstrating the instrument with a white light source attached in the entrance port and the light should

fall in the detector location of the detector block with a precision of 0.1 mm using the aspheric condenser lens.

The vendor should also design and fabricate an instrumentation rack for stacking the polychromator in the lab. This rack should be of a rigid rack capable of housing 5 filter polychromators in one rack. In an instrumentation rack a minimum 5-filter polychromators should be contained and the height should not be more than 6 feet.

Another trolley arrangement is required to easily lift and position the filter polychromators on to the rack or to remove it from the rack. The trolley should have the height adjustment options and a single person should be able to lift and position the polychromators in to the rack.

2.1 A. Scope of work at vendor's site: Scope of work at vendor's site includes:

- a) Preparation of fabrication drawings from supplied arrangement and assembly design drawings and take the approval from IPR.
- b) Vendor will have to procure all the materials required for the fabrication of Filter polychromator. Vendor will have to submit material test report to IPR for approval before starting any fabrication.
- c) Fabrication of all the components strictly as per the main drawings, specifications and tolerance, variations any required should be informed and taken the approval from IPR.

2.2 B. Scope of the work at IPR by the vendor:

- a) All the components will be inspected /tested at IPR site as it was done at vendor's site. After this tests only, the Filter polychromator will be accepted.
- b) Replace or repair of any components not satisfying the final acceptance tests and subsequent repetition of all acceptance tests.

The assembly and components should conform to the technical specifications and drawings to the satisfaction of IPR.

3.0 General terms and conditions:

1. Any deviation/discrepancy/change from the tender drawings shall be brought out in separate sheet by the vendor
2. Vendor will have to submit list of material, inspection plan, quality assurance plan, material procurement schedule, manipulating schedule and fabrication drawings to IPR.
3. The vendor has to prove his ability in fabrication of opto-mechanical component, if found required, by making a part of the design asked by IPR at the time of evaluation of quotation.

4.0 Codes and Standards to be followed:

1. Material should be according to ASTM.
2. Tolerance: The angle tolerance in parallality between the optics holding bars of the Optics block should be less than 5 seconds. Also the angle tolerance in

holding the optics and arrangement of translators also should be less than 5 seconds.

3. The components fabrication should be within the tolerance to meet the specified tolerance of 0.1mm at the last port.

5.0 List of drawings:

Following arrangement and assembly drawings are attached along with this document

1. Diagram-1: Schematic drawing of Filter polychromators with all required components.
2. Diagram-2: Scheme of assembly of Optics Block.
3. Diagram-3: Dimensional drawings of detector block and sections.

6.0 Black Anodization and water-cooling:

All the components and enclosure inner surface should be black anodized. The Filter polychromator enclosure should be tested for light tightness. There should not be any leakage of light into the enclosure. For maintaining the temperature, water-cooling channels should be provided on the optics holding bars on both the sides of the instrument.

7.0 Inspection:

- a) All the fabrication drawings complete with dimension and tolerances will be checked by IPR authority and duly after approval of these drawings by IPR the Filter polychromator fabrication should start.
- b) After fabrication of all the components shall be inspected by IPR representatives for dimensional requirements and performance requirements as per drawings and specifications.
- c) Standard components shall be checked for interchangeability and ease of assembly.
- d) The vendor has to demonstrate the functioning of each filter polychromators using a light source and mirrors. The focal spot sizes at the respective detector location should not deviate ± 0.1 mm over a period of 2 hours.
- e) IPR representative will witness inspection at vendor's site as well as IPR site.
- f) The components shall be delivered only after issue of "dispatch clearance" by IPR
- g) IPR authority /representative shall have access to all manufacturing facilities, inspection and testing facilities, tools, drawings etc., during all stages of manufacturing
- h) Vendor shall specify the plan to be used before, during and after the manufacturing and get approval of the same from IPR.

8.0 Acceptance tests:

- a) Testing for water leakage, when water at 20 atm is sent. It should be water leak proof
- b) All the optomechanical components will be tested to check their performance to meet the requirement. The effective tolerance should not be exceed more than 0.15 mm at any location inside the instrument.
- c) Testing for matching the optical axis of Filter polychromator with fixed opto-mechanical components on breadboard.
- d) The components should be assembled as per the tolerances mentioned in the drawings.
- e) Complete functional testing of the instrument will be performed prior to issuing the dispatch clearance. (Optics required for the testing will be provided by IPR)
- f) A He-Ne laser will be sent through the dump opening, by mounting it on Diode-laser mount. Beam should fall at the center of all five filters and exit through fiber holder hole, within a tolerance of 0.5mm with respect to the center of fiber holder.

9.0 Packing and transport:

All the components should be packed with the proper packing material to avoid damages to them while on transit. In case of any damage while transit the vendor has to replace the damaged part with a fresh one, only after that the final acceptance test in IPR may happen.

10.0 Guarantee / Warranty:

Vendor will have to guarantee the performance of the fabricated components for 12 months from the date of final acceptance at IPR. During this period, if any fault occurs the vendor will have to rectify at no extra cost.

11.0 Intellectual Property Right:

This design of filter polychromators is the sole property of IPR. All the rights to use of the design and engineering documents are completely reserved for IPR. If anyone required using this design then prior permission should be taken from IPR for that.

12. Delivery Schedule:

The delivery schedule has to be as follows:

- a) Submission of drawing for Approval to IPR – 1 month from the receipt of LOI/Purchase order.
- b) Inspection of first prototype -1.5 month from the date of approval of drawing by IPR.
- c) Final inspection of all polychromators -2 months from the date of approval of first prototype

Specifications for parts in the assembly

Detector block

This is a block to house the aspheric condenser lens and APD detector. The lens is positioned at a fixed position and shall be locked with a locking ring. Then the Detector has to be positioned on another adjustable and stable module. The whole unit has to be mounted to the optics block of the polychromators at the angle as shown in the drawing.

Number of units required on one polychromators – 05 numbers

Mounting tolerance on optics block 0.1 mm this is a crucial part as the mounting has to be matched with the threading of the optics block.

Material of fabrication - Brass (prt No-1,4,6)and Aluminium (part No-3,4)

Fiber Collimator

This unit is to couple the optical fiber to the Optics block at the required angle of 4.8 degree. The distance of the fiber tip has to be adjustable to match the Numerical aperture. The adjustment has to have X-Y-Z and also the angle.

Adjustment required in x and y direction	5.0 mm
Resolution required	0.1 mm
Distance of adjustment for Z direction-	40 mm to 70 mm
Resolution of Z adjustment	0.1 mm
Range of angle adjustment required	$\pm 4^{\circ}$
sensitivity	<20arc sec precession.
Material to be used	Brass/Aluminium.
Quantity required	1 unit per polychromators

Optics Block

This is the crucial part of the instrument which houses the band pass filters, Detector block and the fiber collimator. This unit has to be water cooled to maintain the temperature of the unit to avoid any undesired deformation of this block, which may lead to misalignment. This unit has to be parallel such that the light rays should be able to pass through the optics (mirror/Filters) and should reach to the last port with in 0.1 mm accuracy. The optics block has to be compact and also the holders for Optics has to be well designed to access the optics. Required ring locks and tools to tighten and Loosen has to be provided along with the polychromators.

Length Between the optic mounting Bars of the Block-	335.0 mm
Angle of entry and cascading-	4.8 degree
Material	Aluminium
Finish	Anodized
Quantity	one unit per polychromators

Lightweight optical breadboard

Top material 5 mm thick SS nonmagnetic
Bottom material 5 mm thick MS / SS
Core material Aluminium, 0.25mm thick Honey comb based structure.

6mm foamed tapped holes forming 25mm grid should be provided. Nylon cups at each tapped hole.

Dimensions: ~ 800mmX 425mm X 50mm

Maximum thickness of core material: -50mm

Quantity : 1No's per Filter polychromator.

Translation stage for dump:

Translation stage for dump material: (External access required for moving the Dump, with out opening the polychromator cover)

Dump should be moved 55mm vertically up with 1 mm accuracy.

Material Aluminium alloy

Operating screws (80 TPI with dust free protection)

It should be completely black anodized.

Dimensions of dump

Dump diameter : 2" (50.8mm)

Dump thickness : ~10mm

Material : Carbon block.

Quantity : 1 No's per Filter polychromator.

Filter polychromator enclosure box:

An enclosure box for preventing the light to enter in the instrument should be provided. The enclosure should have provisions to open the both sides on hinges for doing the minor alignment of the detector units. The cover also should capable of holding a weight of 40 Kg. The side panels should have provisions to mount the required BNC communications to the detectors. Also this side panels of the cover has to have flexibility to replace in parts for future modifications in connections. If required only a part of the panel removed and machined in the required connections.

Specifications:

Dimensions of box enclosing the Filter polychromator: Matching the size of Optical bread board and the height of Optics block.

Structure to support top plate should be able to withstand 40kg.

Method of openings for box. : Hinge /sliding locking mechanism and should be light tight.

Material of plates : Aluminium alloy with black anodization finish.

Instrumentation Rack for filter polychromator

The instrumentation rack is for stacking the polychromator in the lab.

Type: : Modular
Material : Powder coated MS or aluminium
Size : Matching for the fabricated filter polychromator.
Maximum height : 6 feet
Number of polychromator on a rack: 5
Number of racks Required- 3 Numbers.

Trolley and lifting arrangement

A trolley should be designed and fabricated to easily lift and place the Filter polychromators to the compact rack with out disturbing the alignment of the filter polychromators. The trolley must be compact enough to slide in to the rack and hold one polychromators weighing 40 to 50 Kg and smoothly coming out for aligning and rectification.

Type of trolley	Movable with Castor wheels and lockable.
Height	Variable to meet the height of the rack
Weight handling capacity	Weight of Polychroator + 15 Kg
Finishing	Powder coated or Anodised
Quantity Required	One

Technical Compliance Sheet

Detector block

This is a block to house the aspheric condenser lens and APD detector. The lens is positioned at a fixed position and shall be locked with a locking ring. Then the Detector has to be positioned on another adjustable and stable module. The whole unit has to be mounted to the optics block of the polychromators at the angle as shown in the drawing.

Specification	IPR requirement	Vendor Specification
Number of units required per polychromators –	05 numbers	
Mounting tolerance on optics block	0.1 mm this is a crucial part as the mounting has to be matched with the threading of the optics block.	
Material of fabrication	- Brass (part No-1,4,6) and Aluminium (part No-3,4) in drawing 3	

Fiber Collimator

This unit is to couple the optical fiber to the Optics block at the required angle of 4.8 degree. The distance of the fiber tip has to be adjustable to match the Numerical aperture. The adjustment has to have X-Y-Z and also the angle.

Specification	IPR requirement	Vendor Specification
Adjustment required in x and y direction	5.0 mm	
Resolution required	0.1 mm	
Distance of adjustment for Z direction-	40 mm to 70 mm	
Resolution of Z adjustment	0.1 mm	
Range of angle adjustment required	$\pm 4^0$	
sensitivity	<20arc sec precession.	
Material to be used	Brass/Aluminium.	
Quantity required	1 unit per polychromators	

Optics Block

This is the crucial part of the instrument which houses the band pass filters, Detector block and the fiber collimator. This unit has to be water cooled to maintain the temperature of the unit to avoid any undesired deformation of this block, which may lead to misalignment. This unit has to be parallel such that the light rays should be able to pass through the optics (mirror/Filters) and should reach to the last port with in 0.1 mm accuracy. The optics block has to be compact and also the holders for Optics has to be well designed to access the optics. Required ring locks and tools to tighten and Loosen has to be provided along with the polychromators.

Specification	IPR requirement	Vendor Specification
Length Between the optic mounting Bars of the Block-	335.0 mm	
Angle of entry and cascading-	4.8 degree	
Material	Aluminium	
Finish	Anodized	
Quantity	one unit per polychromators	

Lightweight optical breadboard

Specification	IPR requirement	Vendor Specification
Top material	5 mm thick SS nonmagnetic	
Bottom material	5 mm thick aluminium	
Core material	Aluminium, 0.25mm thick Honey comb based structure.	
Dimensions:	~ 800mmX 425mm X 50mm	
Maximum thickness of core material	-50mm	
Quantity	1No's per Filter polychromator.	

6mm foamed tapped holes forming 25mm grid should be provided. Nylon cups at each tapped hole.

Translation stage for dump:

Translation stage for dump material: (External access required for moving the Dump, with out opening the polychromator cover)

Dump should be moved 55mm vertically up with 1 mm accuracy.

Specification	IPR requirement	Vendor Specification
Operating screws	80 TPI with dust free protection	
Finish	It should be completely black anodized.	
Dump diameter	2" (50.8mm)	
Dump thickness	~10mm	
Material	Carbon block.	
Quantity	1 No's per Filter polychromator.	

Filter polychromator enclosure box:

An enclosure box for preventing the light to enter in the instrument should be provided. The enclosure should have provisions to open the both sides on hinges for doing the minor alignment of the detector units. The cover also should capable of holding a weight of 40 Kg. The side panels should have provisions to mount the required BNC communications to the detectors. Also this side panels of the cover has to have flexibility to replace in parts for future modifications in connections. If required only a part of the panel removed and machined in the required connections.

Specifications:

Specification	IPR requirement	Vendor Specification
Dimensions of box enclosing the Filter polychromator	Matching the size of Optical bread board and the height of Optics block.	
Weight the top plate of the Structure need to support	40kg	
Method of openings for box.	Hinge /sliding locking mechanism and should be light tight.	
Material of plates	Aluminium alloy with black anodization finish.	
Light Tightness	Required completely checked in side a dark room with a light source kept inside	

Instrumentation Rack for filter polychromator

The instrumentation rack is for stacking the polychromator in the lab.

Specification	IPR requirement	Vendor Specification
Type:	Modular	
Material	Powder coated MS	
Size	Matching for the fabricated filter polychromator.	
Maximum height	6 feet	
Number of polychromators on a rack	5	
Number of racks Required	3- Numbers.	

Trolley and lifting arrangement

A trolley should be designed and fabricated to easily lift and place the Filter polychromators to the compact rack with out disturbing the alignment of the filter polychromators. The trolley must be compact enough to slide in to the rack and hold one polychromators weighing 40 to 50 Kg and smoothly coming out for aligning and rectification.

Specification	IPR requirement	Vendor Specification
Type of trolley	Movable with Castor wheels and lockable.	
Height	Variable to meet the height of the rack	
Weight handling capacity	Weight of Polychroator + 15 Kg	
Finishing	Powder coated or Anodized	
Quantity Required	One	