

INSTITUTE FOR PLASMA RESEARCH

# **Technical Specifications SECTION 'C'**

**Design, fabrication, assembling, testing and  
supply of Imaging Lens System**

---

**Design, fabrication, assembling, testing and supply of Imaging Lens System as per the following specifications.*****1. Design specifications for Imaging System-1 (For Aditya Thomson Scattering)***

The imaging system has to images 300 mm plasma length to a fiber array. The optical fibers have a core diameter of 2.0 mm and Numerical aperture of 0.5. The vendor has to design and fabricate an optical imaging system as per the specification given below.

Object height/ width	: ~ 300 mm
Location of the object with respect to Optical axis	: -150 to 150 mm
Distance the object from the first component of lens system	: 380 mm
Required minimum collection solid angle	: 30 mSr
Wavelength range	: 900 nm to 1100 nm
Imaging resolution in the object plane	: 10 mm (on a 2 mm fiber)
Magnification	: 0.2
Surface quality	: 40 –20 or better
Transmission	: >95 % (uniformity of better than 5 % over the entire object plane)
<b>AR coating</b>	<b>: 900 nm to 1100 nm</b>

**Design constraint**

Optical fiber Numerical aperture	: ~ 0.5
Minimum Collection Solid angle	: 30 msr
Minimum working distance between image plane and last optics	:80 mm

BK7 is preferred for the lens material, and non-magnetic Aluminium alloy has to be used for the chassis fabrication. The imaging system is to be placed in a magnetic environment of nearly 200 gauss field. The Temperature range at which this imaging system shall experience is from 10 to 50°C.

The vendor should submit the complete design report to IPR. The design report should contain:

1. Optical schematic of the system with all the dimensions
2. Average RMS spot diameter over entire image plane.
3. The variation of image diameter for a 12mm of object in the object plane
4. Projection of 2.0 mm fiber in the image plane to object plane
5. Arrangement of optical fibers for capturing the image
6. Complete specifications of all the components used in the imaging system and its relative positioning

**2. Design Specifications of the Imaging System-2 (for Helium Beam Diagnostics):**

Object height / width	: ~ 250 mm
Location of the object with respect to Optical axis	: -125 to 125 mm
Distance the object from the first component of lens system	: 200 mm (This is the closest point however designer can consider this higher than this , however a 100 CF view port has to be assumed at a distance of 200 m from the imaging location)
Required minimum collection solid angle	: 100 m Sr
Wavelength range	: 600 nm to 800 nm
Magnification	:1.0
Surface quality	: 40 –20 or better
Transmission	: >85 % (Uniform better than 7% along the whole image plane)
<b>AR coating</b>	<b>: 600 nm to 800 nm</b>

**Design constraint**

Optical fiber Numerical aperture	: ~ 0.22 (silica - silica fiber)
Minimum Collection Solid angle	: 100 msr
Minimum working distance between image plane and last optics	:80 mm

**General Design points**

BK7 is preferred for the lens material, and the chassis may be of nonmagnetic steel. Vendor should provide cooling water channels on the housing of the lens system. The Temperature range at which this imaging system shall experience while in use is from 10 to 40 ° C. However the system may experience a temperature up to 70 ° C, while the preparations for experiments. Which may last for 48 hours. The vendor should submit the complete design report to IPR. The design report should contain

1. Optical schematic of the system with all the dimensions
2. Average RMS spot diameter over entire image plane.
3. The variation of image diameter for a 2mm of object in the object plane
4. Projection of 2 mm fiber in the image plane to the object plane

5. Arrangement of optical fibers for capturing the image
6. Complete specifications of all the components used in the imaging system and its relative positioning

**Pre dispatch inspection of the imaging system at the vendor's site:**

The following tests has to be demonstrated at the vendors site prior to shipping the items to IPR

1. All the design parameter mentioned in the specification as well as the accepted design.
2. Intensity profile of image over the entire object plane
3. RMS spot size and its variation along the whole imaging plane
4. Transmission efficiency and uniformity

**Delivery Schedule**

1. Submission of design details - **Two months** from the purchase order date.
2. Final delivery at IPR - **Five months** from the date of approval of design by IPR

**Technical compliance sheet for imaging system for ADITYA Thomson scattering**

Specification	IPR requirement	Vendor Specification
Object height / width	: ~ 300 mm	
Location of the object with respect to Optical axis	: -150 to 150 mm	
Distance the object from the first component of lens system	: 380 mm	
Required minimum collection solid angle : 30 mSr		
Wavelength range	: 900 nm to 1100 nm	
Imaging resolution in the object plane	: 10 mm (on a 2 mm fiber)	
Magnification	0.2	
Surface quality	: 40 –20 or better	
Transmission	: >95 %	
<b>AR coating</b>	<b>: 900 nm to 1100 nm</b>	

**Technical compliance sheet for imaging system for Helium beam diagnostics**

Specification	IPR requirement	Vendor Specification
Object height / width	: ~ 250 mm	
Location of the object with respect to Optical axis	: -125 to 125 mm	
Distance the object from the first component of lens system	: 200 mm (This is the closest point however designer can consider this higher than this , however a 100 CF view port has to be assumed at a distance of 200 m from the imaging location)	
Required minimum collection solid angle	: 100 m Sr	
Wavelength range	: 600 nm to 800 nm	
Magnification	:1.0	
Surface quality	: 40 –20	
Transmission	: >85 %	
<b>AR coating</b>	<b>: 600 nm to 800 nm</b>	