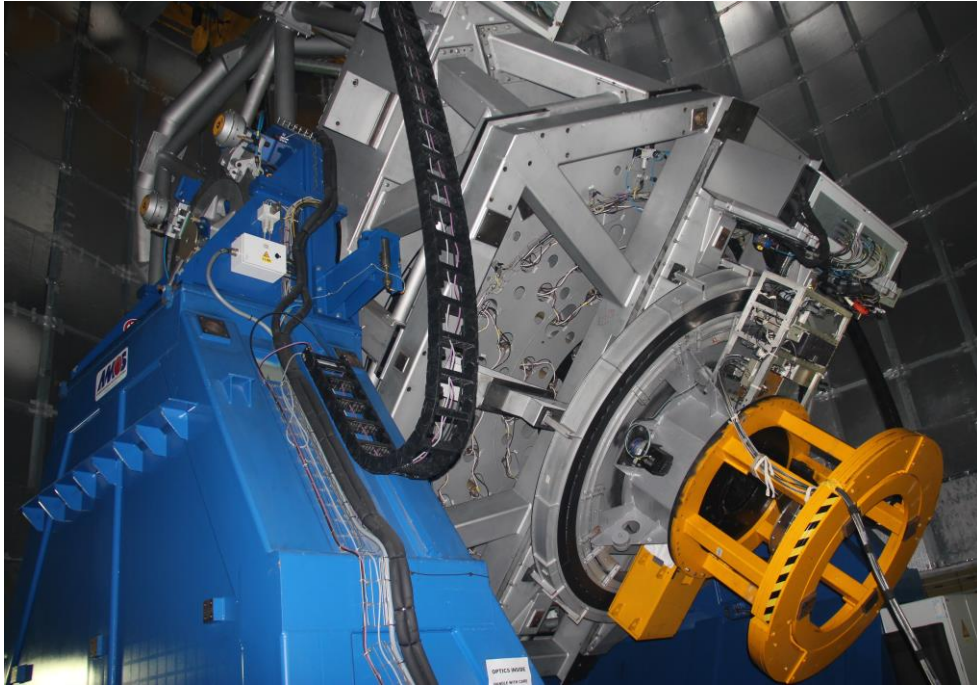


## **Mechanical Mounting Procedure of a TIRCAM2 Camera On Side Port of 3.6 Meter Devasthal Optical Telescope**



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**Introduction:** - The 3.6 meter **Devasthal Optical Telescope (DOT)** has been built by **Aryabhata Research Institute of Observational Sciences (ARIES)** in collaboration with Belgian firm Advanced Mechanical & Optical System (AMOS) and this telescope located in the Devasthal Observatory site near Nainital in Uttarakhand India at an altitude of 2450 meters.

**TIFR Near Infrared Imaging Camera-2 (TIRCAM2)** has imaging capability from 1-3.6  $\mu\text{m}$  refer figure (1). The camera has InSb FPA having 512 x 512 pixels and operates at 35K temperature, cooled by closed cycle cry cooler.

Many successful science observations were done with this camera from the main (axial) port of DOT. After arrival of the new instruments like TRANSPEC and other ARIES instruments it was decided to shift the TIRCAM2 camera to the side port of the 3.6-meter telescope at DOT. For this we had designed a new TIRCAM-2 mounting rack in January 2019 and a document was generated for **TIRCAM2 camera Interface on the Side port of the 3.6 Meter Devasthal Optical Telescope. Please refer document no. TIFR Tech. Rep. No. /TIFR/DAA/IRA/2019/1.**

There were some modifications suggested by the Telescope team at ARIES due to obstruction and very little clearance between the telescope rings and TIRCAM-2 camera side port mounting rack. The TIRCAM2 side Port Rack structure was modified as per the requirement and a document was generated for the same on December 2019. The document is attached as an **annexure-1**.

Here in this document (Document no.: TIFR Tech. Rep. No./TIFR/DAA/IRA/2020/01) Mechanical mounting procedure of a TIRCAM2 Camera on side port of 3.6 meter Devesthal telescope is shown in detail. It is an updated and modified version of document generated last year (Ref no. TIFR Tech. Rep. No. / TIFR / DAA / IRA /2019/1). The procedure to assemble the rack is as follows: -

## **A. Mechanical Assembly of Rack with TIRCAM-2 on Ground floor:**

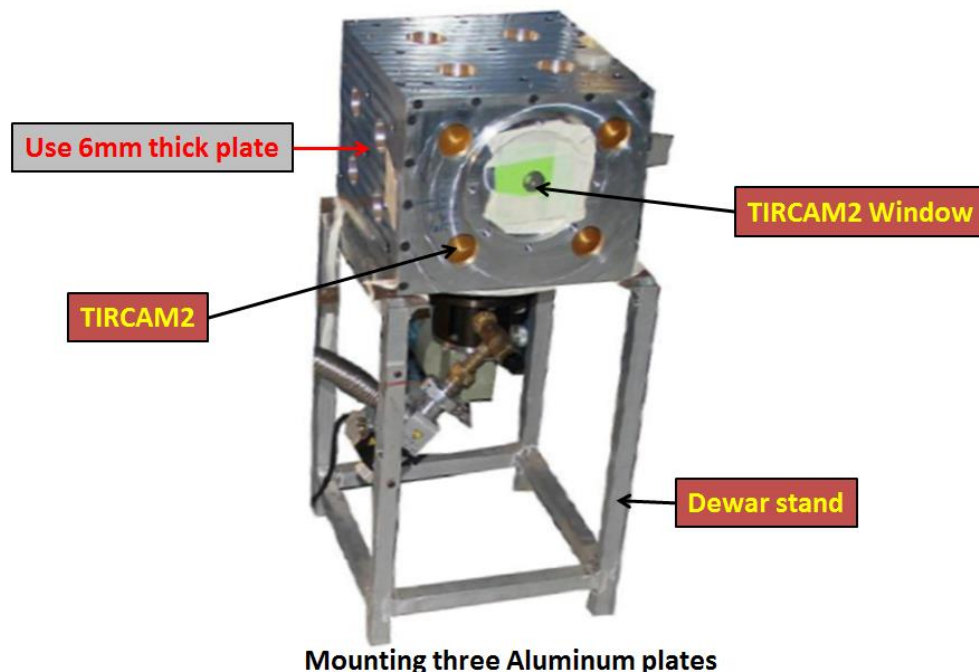


Figure-1

- 1) Ensure the Dewar vacuum port manual valve should be closed.
- 2) Check the TIRCAM2 camera window. If any dust is found on window, blow it using manual air bulb. **Don't touch Dewar window directly.**
- 3) Mount three aluminum plates around the Dewar by using high tensile CSK screws of size M6. One of the plate thickness is reduced to 6mm for avoiding any obstruction with the telescope main port mounting ring and it is a special requirement when the TIRCAM-2 is mounted on the telescope side port. Locations of the plates are clearly shown in the picture above.
- 4) Mount the filter motor and encoder on Dewar and keep the Dewar ready for mounting on the rack made for telescope side port mounting.
- 5) Nomenclature for the plates are as follows: -
  - a) Telescope rack base plate/Side port Instrument Flange
  - b) Telescope rack top plate
  - c) Telescope plate bottom plate (With a cutout on top side for Dewar)
  - d) Telescope plate side plates 2 nos.
  - e) Telescope middle plate-1
  - f) Telescope middle plate-2
  - g) Telescope back plate

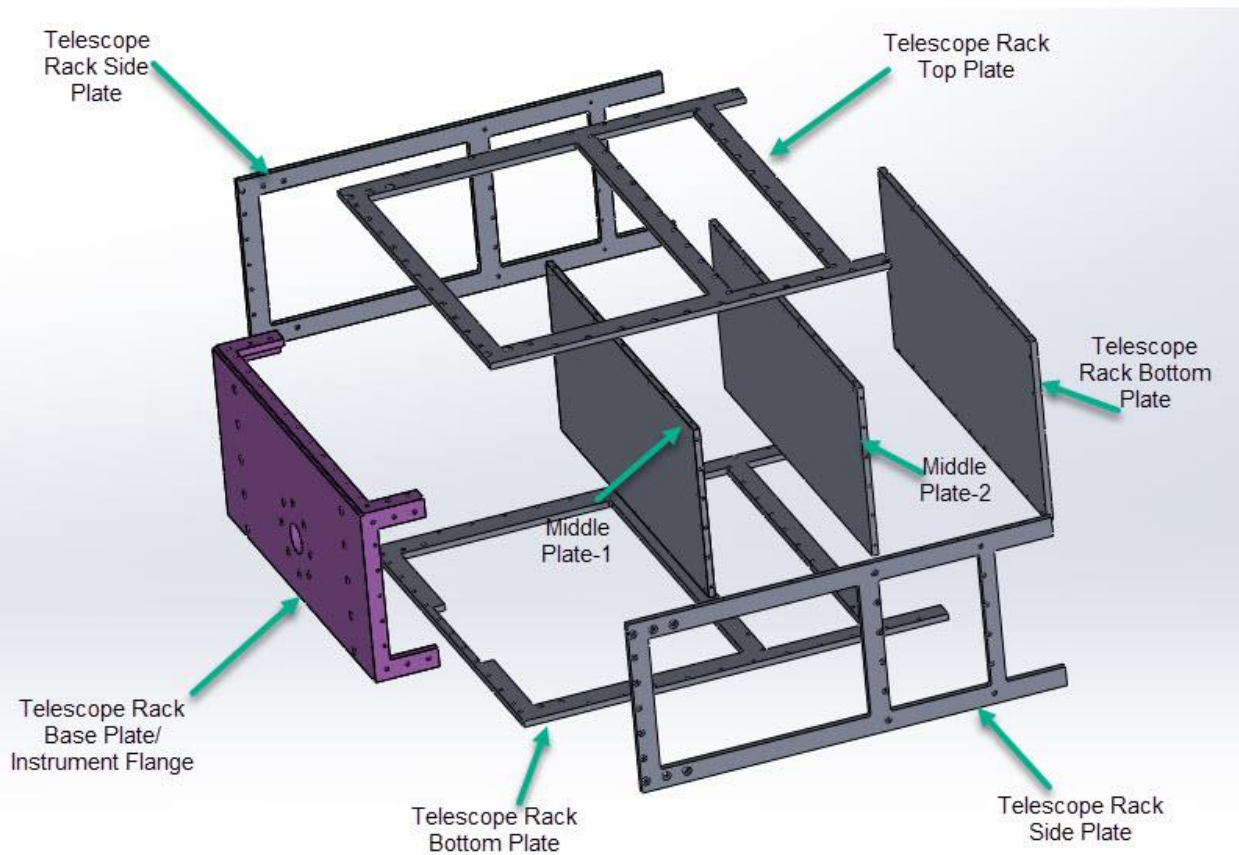


Figure-2

Identifications of various plates are as follows: -

- a) Telescope Rack Base plate/ Instrument flange has Telescope interface holes of size M16 and Dewar mounting holes. It also has four legs that interfaces with four nos. of Rack Plates by using M8 Screws.
  - b) Telescope Rack Top Plate: - Size of the top plate is 802 mm x 813 mm x 13 mm thick. It easily can be identified due to its shorter length than the bottom plate. It is made shorter to avoid interference with the telescope ring.
  - c) Telescope Rack Bottom Plate: - Size of the bottom plate is 802 mm x 862 mm x 13 mm thick. It has a cutout on top side to accommodate Dewar mounting plate
  - d) Telescope Race Side plates: Size of the Telescope rack side plate is 360 mm x 862 mm x 13 mm thick. Both side plates are identical.
  - e) Telescope Middle Plate-1: - Size of the middle plate -1 is 359 mm x 775 mm and it has helicoil tapped holes of size M6 on all its sides to interface it with other plates.
  - f) Telescope Middle Plate-2: - Size of the middle plate -2 is 359 mm x 775 mm and it has helicoil tapped holes of size M6 on its longer sides and size M4 helicoil tapped holes on its shorter side to interface it with other plates.
  - g) Telescope Rack Bottom Plate: The Size of the bottom plate is slightly bigger than the middle plates and it has size M6 clear CSK holes on its faces.
- 6) Start assembling the telescope in following order: -
- a) Mount black painted Telescope Base plate/Instrument flange to the camera. (**Note: Remove camera window cover**) During mounting use jack for support the instrument flange. Use Size M8 CSK screws to mount the Dewar with the instrument flange.



Figure-3



- b) Assemble the other plates of TIRCAM-2 mounting rack by aligning all four side plates and middle plates in their correct position.
- c) Carefully lift the instrument flange with Dewar and mount on the rack.
- d) Then assemble all the plates by using screws. **Do not connect the back plate with the rack without mounting Leach Controller power supply and lead bricks on it.** First all lead bricks and instruments to be mounted on the back plate (Refer figure-4) then it is to be connected to the rack.
- e) There are 12 nos. of size M8 screws to be used to mount the base plate to all 4 plates of the rack. The top and bottom plate have 59 nos. (each plate) size M6 CSK screws to connect it with other plates except back plate.
- f) Back Plate to be fastened by using 6 nos. of M6 screws to the rack after mounting all instruments on it.
- g) Connect all electronics and balance weight/lead bricks as mentioned in the Annexure-1 given below.

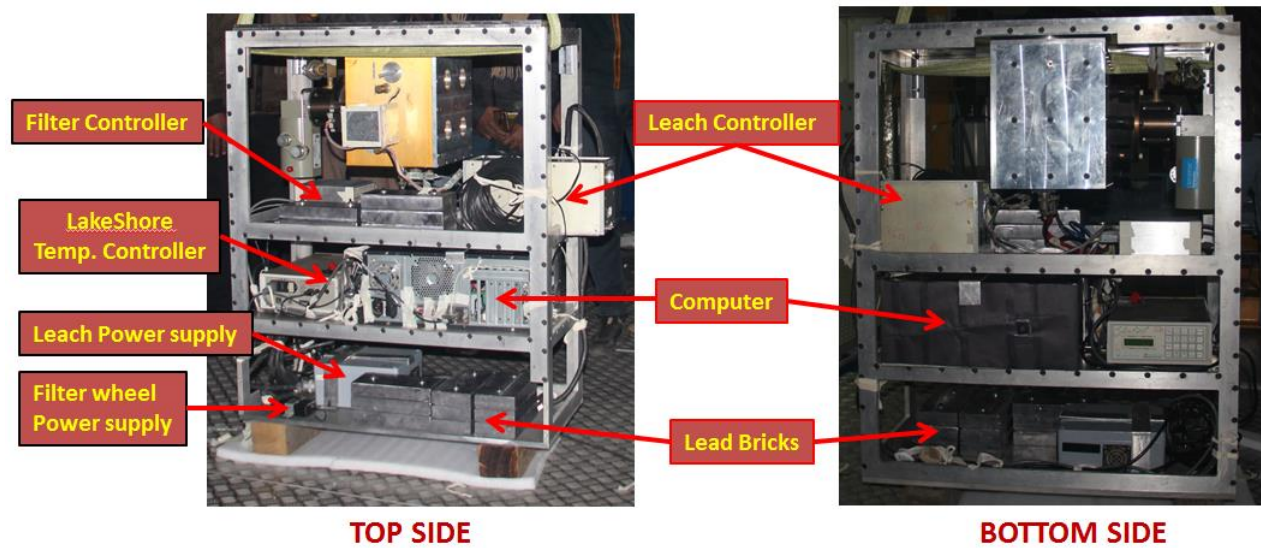
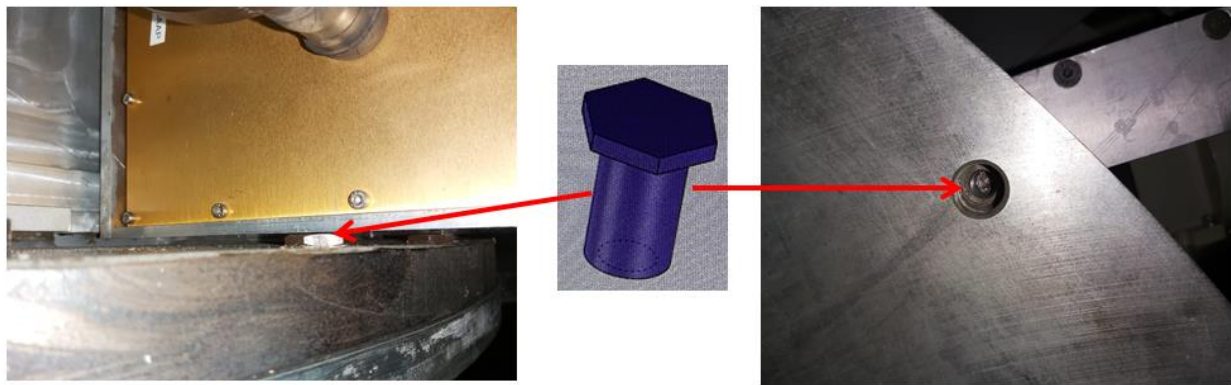


Figure-4

- h) Before mounting the side port rack on the telescope please ensure that all electronics is working satisfactorily.

## B. Mounting of complete TIRCAM-2 assembled rack on the Telescope side port

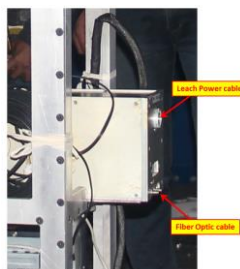
- 1) First insert five collared threaded bush (Refer Figure-5) in the main port of the telescope just below the side port before mounting the TIRCAM-2 on the side port.



**Thin collared threaded bush with M12 internal threading**

**Figure-5**

- 2) During mounting remove Leach controller power cable and fiber optic cable.



- 3) Remove the TIRCAM2 window cover (Ensure the optical path should be cleared)
- 4) Mount the assembled rack on the side port.

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List of other usefull documents for the TIRCAM2 Camera mounting on 3.6 m Telescope at DOT.

- 1) ***TIFR Tech. Rep. No. / TIFR / DAA / IRA /2019/1***
- 2) ***TIRCAM2 Installation procedure including electronics and cryogenic assembly.***
- 3) ***TIRCAM2 Manual: Installation and operation of TIRCAM2 at DOT.***

## Annexure-1

### Report on Modification done on TIRCAM-2 mounting structure for mounting it on side port of 3.6 m Devasthal Telescope and a Solution to the holes getting obstructed on the main port due to mounting of TIRCAM-2 on the side port.

11/12/2019

**History: -** The Devasthal Optical Telescope (DOT) provides three cassegrain ports for mounting the instrument, one is main axial port and two side ports. The available side port envelop size is 500 mm X 380 mm X 1000 mm (H x W X L) for mounting the instrument. One of the side port is being used for mounting TIRCAM-2. Considering the envelop size, mass & focal plane of the side port, we designed the instrument interface plate and rack for mounting the TIRCAM2 camera and related electronics equipment on the side port of the DOT telescope, as shown in the figures 1 below. ARIES Engineers were facing some difficulty in mounting and unmounting the TIRCAM-2 rack from the telescope due to its length obstructing with some telescope part. It was asked by ARIES Engineers to reduce the size of the rack.

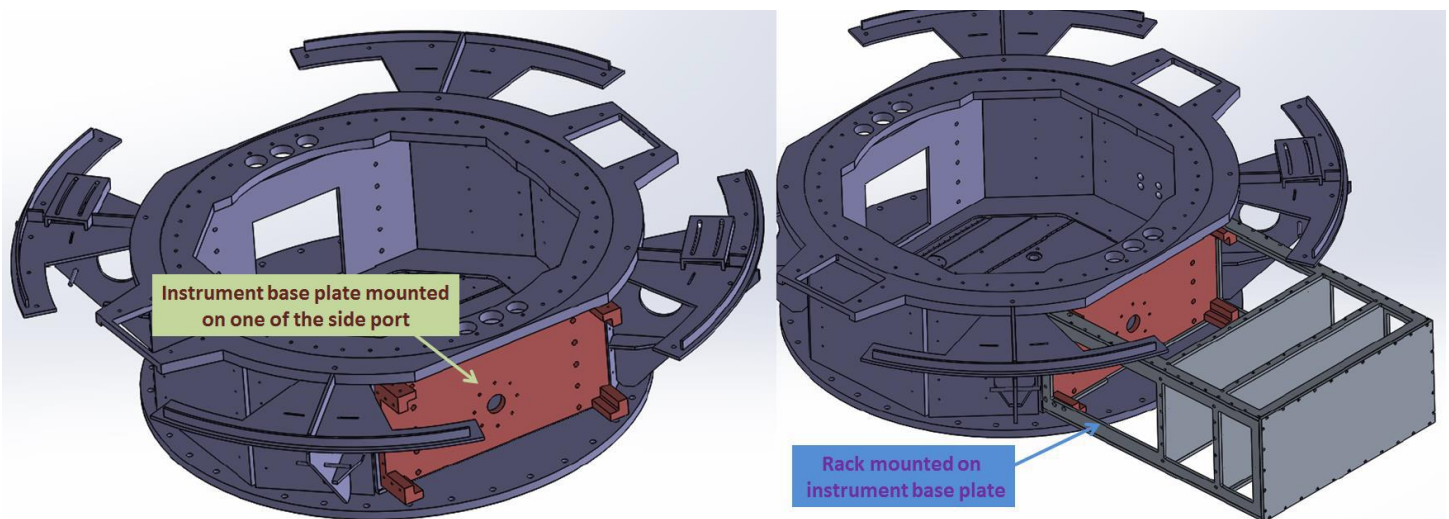
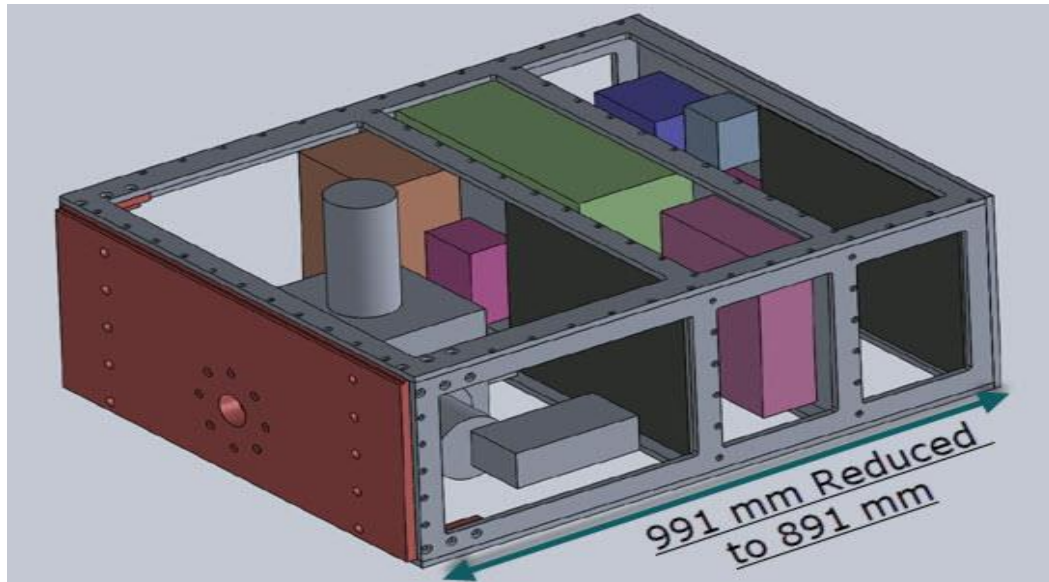


Figure-1

- **Modification of TIRCAM-2 Side port Rack:** - There was a requirement from ARIES Engineers to reduce the size of TIRCAM-2 mounting rack by 100- 150 mm, so that it can be accommodated easily on the side port. Here TIFR engineers have looked at this requirement and tried to optimized the size of the rack. TIFR engineer could manage to get it reduced by 100 mm. Further reduction in length of the rack is not possible due to only few millimeters gap available after mounting the electronics package on the rack. TIFR engineer visited 3.6 m telescope at Devasthal Observatory during December 5<sup>th</sup> to December 10<sup>th</sup> and discussed it with ARIES Scientists and Engineers available at 3.6 m DOT site. It was decided to take the plates to ARIES Mechanical workshop to alter the length of the TIRCAM2 Rack. TIFR Engineer with the

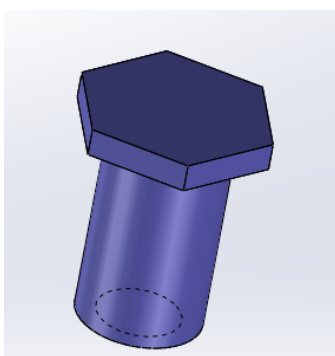
help of ARIES Engineers at ARIES Mechanical workshop carried out the machining work by reducing all four side plates, by 100 mm then they made new helicoil tapped holes to fix the bottom plate. Earlier the overall length of the TIRCAM2 Rack was 991 mm and now it is reduced to 891 mm. See the figure-2 below: -



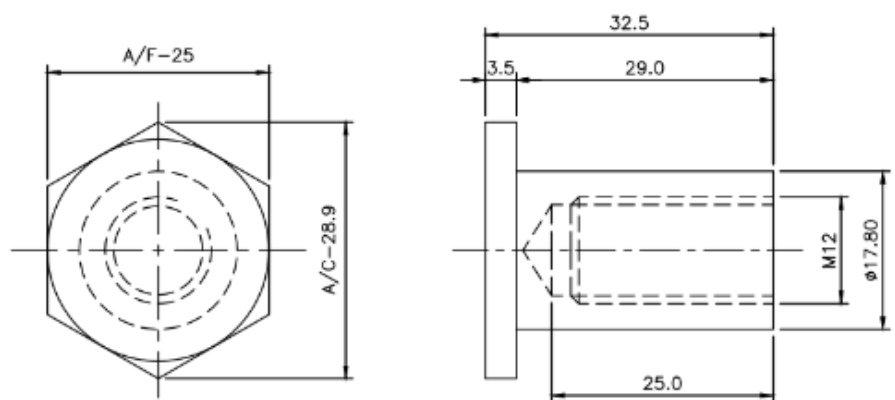
**Figure-2**

Now with this modification, we hope that the mounting of the TIRCAM-2 Rack on the side port of the telescope would be much easier than the earlier.

- Another area of concern was that after mounting the TIRCAM-2 on the side port, there was a very little gap left between the TIRCAM-2 and Telescope main port mounting plate just below the TIRCAM-2. There were total 5 locations on the main port were not having access for inserting M16 nut. To overcome this problem TIFR Engineers has suggested to use collared threaded bush with internal blind threading of 12 mm and outside diameter 17.8 mm on these 5 locations. The picture of the threaded bush is shown below: -



Thin Collared threaded bush with M12 internal threading and outside diameter is 17.8 mm

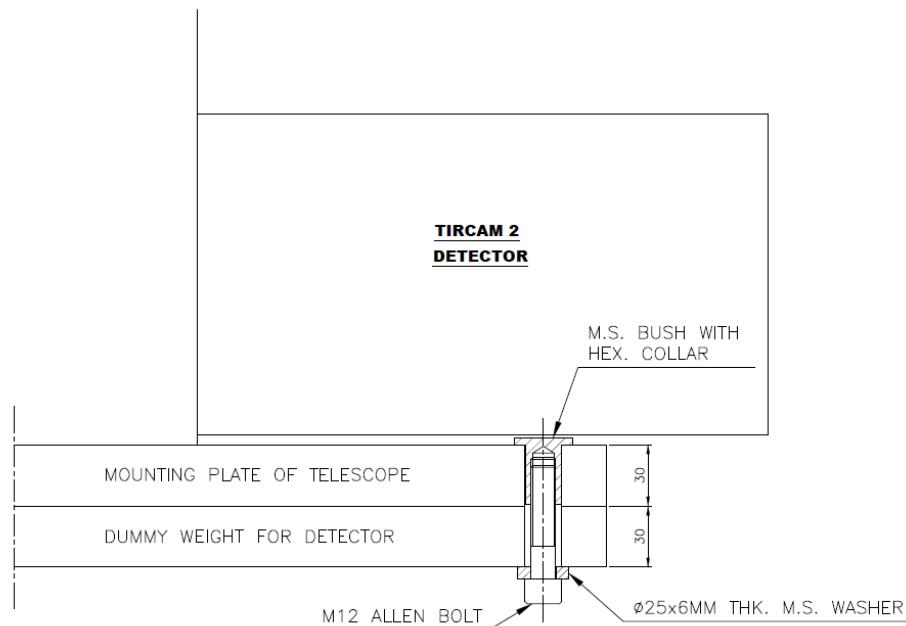


**Figure-3**



Assembly procedure of the threaded bush is as follows: -

- 1) First Insert the Collared bush on the Telescope main port interface plate from Top on those 5 locations where TIRCAM-2 is obstructing.
- 2) Mount TIRCAM-2 on the Side port.
- 3) For mounting any other instrument on the main port while TIRCAM-2 is mounted on side port use these threaded bush by inserting M12 thick washer and M12 High Tensile bolts from the bottom and hold the collar of the bush from the top by using Special thin spanner supplied by TIFR and tighten the bolt. Bolts of three different lengths were supplied by the TIFR along with the threaded bush.
- 4) A section view is shown below (Figure 4) for the configuration of the threaded bush on the telescope main port.



The above configuration was explained to the Scientist and Engineers available at 3.6 m Devasthal Observatory and handed over following materials.

- 1) High Tensile bolts in following size
 

M12 x 50 mm long Cap screws-----	10 nos.
M12 x 55 mm long Cap screws-----	10 nos.
M12 x 60 mm long Cap screws-----	10 nos.
- 2) Allen Key of Size 10 for M12 bolts---- 1 no.
- 3) Thin Flat Spanner for holding the Collared bush----- 1 no.
- 4) Threaded collared bushes----- 10 nos.
- 5) 6 mm thick washer size M12----- 11 nos.

With these above solutions we think that TIFR could fulfill the requirements of the Telescope and now mounting of TIRCAM-2 would be much easier than the earlier. In case of any queries, TIFR Scientists and engineers may be contacted.

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