



1 m Telescope Specifications

1. Optics

Optical system

- The optical system will be a 1-m Ritchey-Chrétien
- The effective focal ratio will be F/8 or F/10
- There must be enough space for instruments below the mounting flange
- Certification of optical quality should be provided
- RMS wave-front error should be better than $1/14$ at 633nm
- Peak to Valley wave-front error less than or equal to 0.25λ at 633nm
- Strehl Ratio to be greater than or equal to 0.80
- Unvignetted field of view (FOV) should be indicated
- All mirrors to have zero expansion substrate, ZeroDur or equivalent quality.
- Coating with an average reflectance not worse than 96% in the visible spectrum.
- Primary and secondary light shields must be provided to fully shield the specified FOV. The baffles to be coated with low reflective dark black paint with reflectivity of less than 2% independent from the angle of incidence.
- The primary mirror and secondary mirror covers must be remotely controllable.
- Results of the optical shop testing must be supplied.

Focusing

The focus motions and focus position to be precisely encoded and displayed. The telescope control system (TCS) shall automatically correct focus variations as a result of temperature changes. Focusing system shall operate with minimum heat generation.

Maintenance

Documentation describing the proper maintenance of the optics and the procedures for their removal, cleaning, servicing and re-installation shall be provided. A suitable crate should be supplied in order for the mirror to be sent to coating facility.

2. Telescope Structure

Mount Type and Pier

The telescope mounting shall be an equatorial fork mount designed for the latitude of Bakirlitepe (36° 50'). The technical info, detailed drawings and necessary tools&material for the pier construction (mounting and anchoring bolts structure) should be provided by the telescope manufacturer.

Drive System

Right ascension and declination axes to be driven by high-precision zero-lash drive systems

Optical Tube Assembly (OTA)

- The OTA shall be an open tube truss structure, support trusses to be manufactured from materials of near zero thermal expansion
- A 10-15 cm diameter finder telescope with projection reticule and an integrated low light CCTV monitoring system must be provided.
- The instrumentation mounting flange must be capable of supporting loads in up to 50kg at Cassegrain focus.
- Counterweight mounts and accessories shall be provided to allow for proper balancing of the OTA.
- The OTA shall provide access to clean the mirror in place.
- The primary mirror cell must have machined reference surfaces to allow mechanical alignment measurements of the primary mirror within the cell.
- Operations/Maintenance manual must include a written optical collimation procedure for the primary and the secondary mirrors, a scaled drawing specifying the positions of the bolts, reference and setting points.
- 220 VAC power outlet shall be available at an easily accessible position (preferably near to instrument mounting flange) on OTA.
- An auxiliary power box mounted on the lower surface of the center section shall provide 5 low voltage power outlets to be used for various applications

Slewing

- The telescope shall point to any part of the sky down to 80 degrees zenith distance (ZD) and track normally down to at least a ZD of 75 degrees.
- The telescope mount must provide different sets of slew velocities with maximum rate of 10 degrees per second which can be defined by the end user.
- The telescope must be capable of surviving structural accelerations necessary for normal slewing.

Acquisition

Fine and coarse telescope slew rates and accelerations during acquisition, and fine and coarse rates while tracking must be available.

Pointing

Position encoders must provide telescope pointing information with a resolution of at least 1 arc second. The absolute pointing accuracy must be less than 5 arc-seconds, and the relative pointing accuracy less than 1 arc-seconds over a field of 2 degree. A software for the automatic construction, maintenance and administration of the pointing model must be provided.

Tracking

The telescope must be able to track on an object in its operational range with a stellar tracking error without any optical feedback (auto-guider) less than +/- 1 arc second for 4 minutes. The telescope must be able to be controlled with an auto-guider to track within +/- 0.25 arc seconds or better. The telescope must be capable of tracking at non-sidereal rates and must track any solar system object with a known set of orbital elements.

Temperature Range

The telescope must be able to operate in the range -10 or preferably lower to 30 °C

Humidity

The telescope must be able to operate within 5-95% non-condensing relative humidity.

Wind Load

The telescope must be fully operational for unprotected wind loads up to at least 12 meters/second and should have an integrated weather alert system (tasks) to protect the system against excessive wind conditions.

3. Observatory Control System (Software & Hardware)

Preferably the system should have a

- Telescope Control System (TCS)
- Instrument Control System (ICS)
- Data Acquisition System (DAS)
- Dome Control System (DCS)
- Environment Control System (ECS)

which is integrated in one software package running preferably on a LINUX PC. The software packages which will control the observatory system should include, if available, all the necessary drivers, libraries, source codes, and development kits.

Operational Modes

Operational modes for local users, administrative users, remote users must be available.

Safety and Security

Safety features, including the use of acoustic warning signals, strongly enforced motion limits, and software-level all-stop commands, software emergency stops, hardware emergency stop buttons, motor detent torque that brakes all axes when the telescope is not powered, and additional safety features that work independently of the software must be provided.

Computers

A computer system fulfilling the minimum hardware requirements should be defined and provided by the telescope manufacturer. All software and hardware requirements (licenses, device drivers, hardware interfaces, controller boards etc. and their manuals) should be clearly defined and documented.

System Interfaces

- The system must be able to interface to the dome driving and control hardware and to a meteorological station.
- Interfacing to a primary CCD camera, an auto-guider camera, a filter wheel and other instrumentation must be provided.

4. Instruments

Auto-guider

A suitable off-axis universal auto-guider system must be provided.

5. Miscallenous:

- Weather Station: Telescope system must include a weather station as part of the control systems to monitor and react to weather conditions such as temperature, humidity, wind, and rain.
- Dome video monitoring system (low light CCTV system with wide angle lens)
- Vital spare parts and special tools (Electronics & Mech.)
- A proposal including drawings of the ***required pier and dome to interface to the telescope*** must be provided by the telescope manufacturer soon after the contract has been signed.

6. Shipping and Delivery

The telescope and all its instruments should be shipped to

TUBITAK National Observatory(TUG)
Akdeniz Universitesi Yerleskesi
07058 Antalya/Turkey

Delivery of the telescope must be detailed and a delivery guarantee must be provided.

7. Installation and Training

Telescope should be installed at the observatory at Bakirlitepe together with the observatory technical personnel. Basic Training at Bakirlitepe must be provided.

8. Acceptance Test

Two persons from the observatory will visit the telescope factory when the telescope and the Telescope Control System is ready for assembly and testing at the factory. The performance of the telescope and its software should be tested at the observatory and all the test details should be documented for the use of the observatory.

10. Warranties

The telescope.

The telescope as whole must be covered by a comprehensive warranty for at least a year. The mechanical parts, including bearings, all drives, focus assembly, collimation mechanisms, mirror supports, baffles, and pedestal should be covered for a period of at least two years. The warranty should begin after the full acceptance test.

The software

The software should permit interactive, remote and autonomous use of the telescope, dome and auxiliary equipment. The software should perform all the tasks reliably described by the authorized user of the telescope. Free software updates should be provided for a period of not less than 90 days after the acceptance test.

**11. Items, if supplied, for which separate quotations are required
(Please advise if not supplied)**

- Filter wheel with minimum 8 positions, fully integrated with control software.
- *Imaging CCD camera (Back Illum., TE Cooled, 2Kx2K, 13 micrometer pixel, Grade1 CCD chip)*
- 50mm UBVRI and uvby filter sets
- Dome, suitable to be fully integrated with DCS.
- Other options