Telescopi Italiani s.r.l. Web: www.italiantelescopes.net
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Telescope Model: TI-45 f/4

Overall description:

The TI 45 is a new generation astrograph born after in-depth and extensive studies lasted five years. It combines a number of innovative features and special solutions.
The design was carried out by a professional team driven by an aerospace engineer. Mechanical design was performed in a 3D environment and FEM analysis have driven the sizing of the components for less weight and less deformation.
From optical, mechanical, electronic and design point of view, the TI45 Astrograph is the most advanced telescope which you can find on the world market.

The TI 45 f/4 astrograph, is derived from the configuration Harmer-Wynne (designed for the first time and published in 1976 – Royal Astronomical Society, Monthly Notices, vol. 177, Oct. 1976, p. 25P-30P). The Harmer-Wynne instruments have the particularity of combining a parabolic primary mirror with a spherical secondary mirror and obtain a corrected wide field with the aid of a two elements corrector.

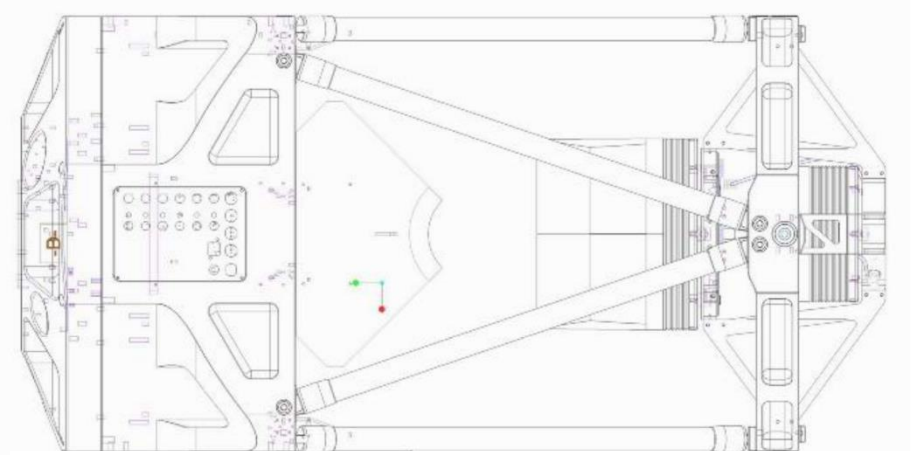

Figure 1 - TI45 DFL model

In our TI Astrographs, it is introduced a further refractive element correction (in ED glass) – this 3th lens introduction was done by Leonardo Priami in late 2010 - , reaching a real diffraction limited corrected field of over 80 mm in diameter without introduce color aberrations (from 400 nm to 1,6 micron of wavelength). These performances of very fast and very corrected optics allows to this optics to be used with success both in narrow band filter imaging and in Near Infrared imaging.

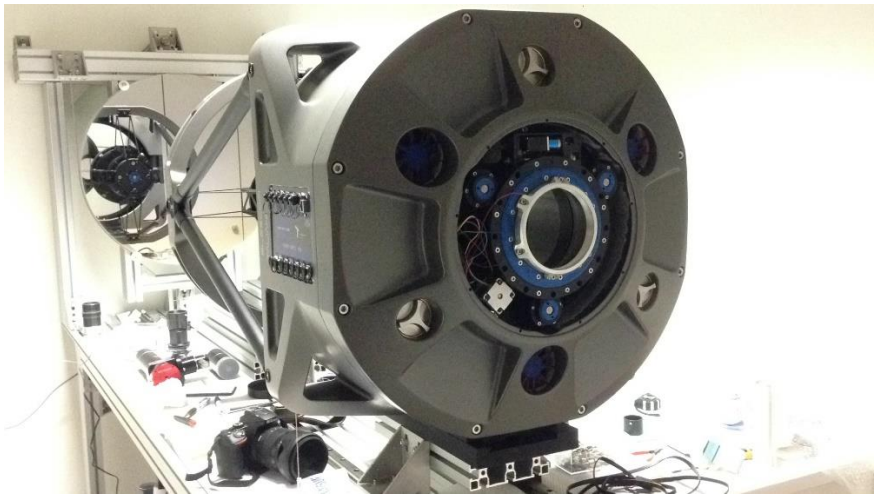

Figure 2 – TI 45 under test on our optical test bench

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Dimensions and weight:

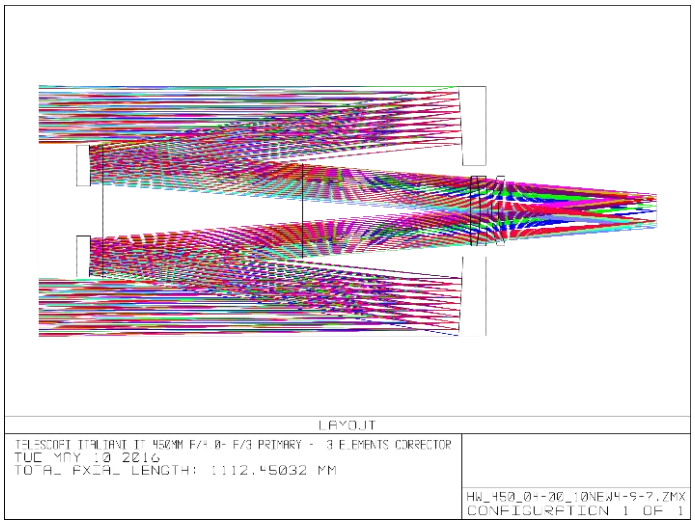
Overall length: 1.100 mm
Overall diameter: 560 x 560 mm
Expected weight: about 41 kg (4" field rotator and electronic focuser included)
Back Focus from primary vertex (mm): 347 mm
Back Focus from rear flange (mm): 182 mm – 192 mm (4" field rotator and electronic focuser included)

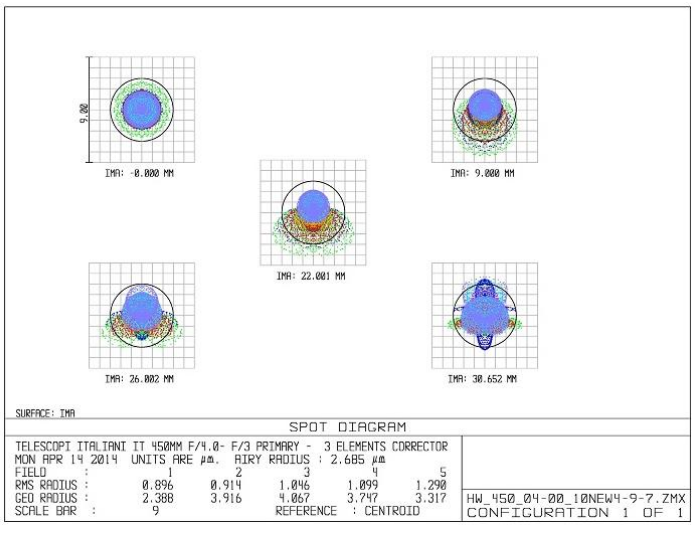
Optical Characteristics:

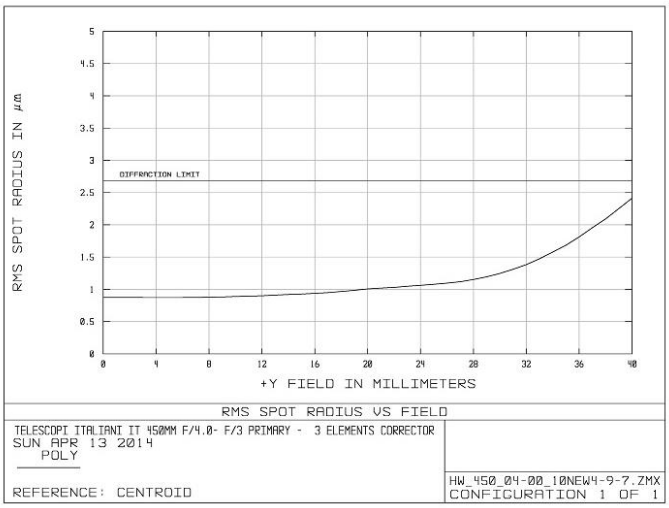
- *Primary mirror:*
  Overall diameter: 456 mm
  Clear aperture: 450 mm
  Thichness: 50 mm
  Shape: Parabolic
  Material: Schott Suprax
  Coatings: Aluminium enhanced >94%
- *f/4 Group Lenses (Corrector):*
  Lens number: 3 – **ED element**
  Lens diameter: 126 mm
  Coatings: Multylayers 400-900 nm
- *Secondary mirror:*
  Overall diameter: 238 mm
  Clear Aperture: 234.5 mm
  Thichkness: 25 mm
  Shape: Spherical
  Material: Schott Suprax
  Coatings: Aluminium enhanced >94%

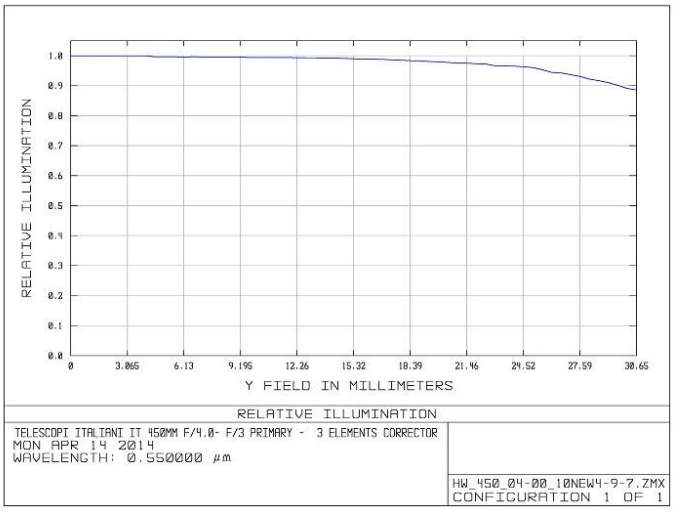
f/4 Optical Performances:

- Real Diffraction Limited field diameter (mm) (considering Polychromatic 400/700 nm): 83 mm
- Spot Diagram RMS Diameter @ 26 mm from axis - Poly 400-700 nm (micron): 2.20μm
- Spot Diagram RMS Diameter @ 30 mm from axis - Poly 400-700 nm (micron): 2.58 μm
- Total Effective Obstruction: 54.4 %
- Light incoming (% of aperture area): 70.0 %
- Loss of light (vignetting) @ 26 mm from axis (%): 5.0 %
- Loss of light (vignetting) @ 30 mm from axis (%): 11.0 %









Mechanical characteristics:

- *Overall structure:* Full carbon truss structure – The best structure stiffness, light weight and thermal stability
  - rear body: carbon sandwich
  - front ring: carbon sandwich - integrated 6068-T6 aluminium alloy inserts for truss structure.

- *Primary mirror cell:* Lightweighted FEM optimized Aluminium alloy cell, 18 pivoting points. With six lateral aluminium adjustable support double point each, three conical pivot bronze spring loaded adjustable screws for optical collimation and to avoid any lateral movement of the cell

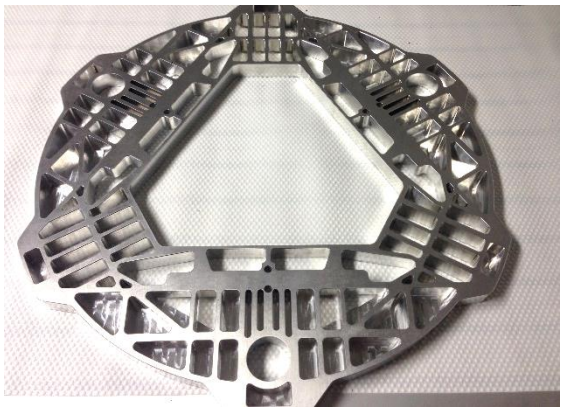


Figure 4 - Primary mirror plate cell

Figure 3 -Frontal ring

- *Secondary mirror cells:* 2011-S Aluminium alloy, external surface excavated with conical surfaces in order to minimize reflected light. Adjustment system: two precision adjustable screws (100 TPI by Thorlabs) for a real x-y mirror collimating movements. This system allows to avoid axial movement of the mirror during tilt adjustment, thanks to the spherical joint near the backplate of the mirror. This solution allows also to not have tilt movement when axial adjustment is performed. So we have movement not reciprocally influenced like

conventional three screws system has. The primary-secondary mirror distance is (must be) a fixed parameter optimized in each optical design and we do not think it should be varied neither for focusing, neither during collimation.

- *Secondary mirror cell vane: pre-loaded* double vane spider (AISI 3014 stainless steel 0.8 mm thick) for the best stiffness and low diffraction effects

Figure 5 - Secondary mirror cell anti-reflective surface

- *Primary mirror baffle:* carbon tube with internal circular baffling

- *Secondary mirror baffling:* **suspended conical carbon baffling**. This shape allows best baffling without adding obstruction

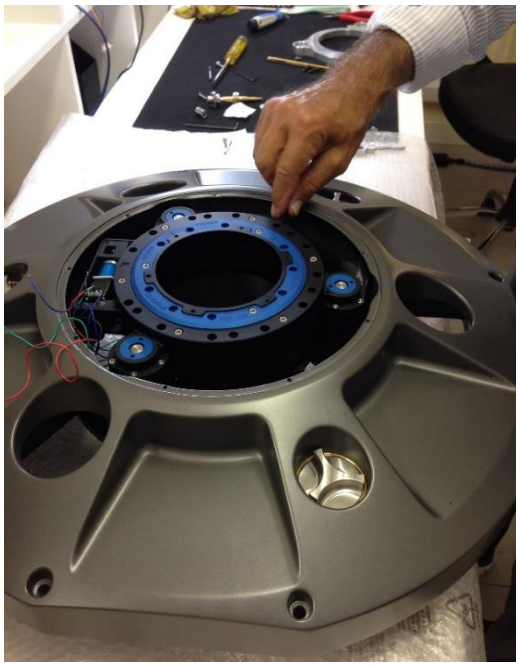


Figure 6 - Focuser and 110 mm field rotator integration - DFL model

INCLUDED:

- ***110mm Field Rotator: 110 mm clear aperture rotator***
  integrated into the back plate, 160 mm warm wheel with a precision stepper motor drives **high precision preloaded steel cross roller bearing** for a stiff and precision rotation (0.64”/step) and **extremely Low axial/radial runout error** (less than 6 micron). It carries tens of kg payload, with no effect.

- ***Electronic Secondary Focuser System:*** integrated into central spider hub, it deliveries extremely accurate focusing by moving axially the secondary cell. The optical configuration allows a camera to rear flange distance tolerance of +/- 2 mm with respect the nominal distance to remain within the diffraction limit and a +/- 3.5 mm in the “real” condition with no detectable effect on the image. Moreover, this system allow to good compensate primary mirror axial offset with respect the nominal position by +/- 4 mm with no effect on the image. Nominal resolution: 51 nm/micro-step. Travel: +/- 5 mm.

- ***Primary mirror dust cover:*** four integrated motorized carbon cover will cover the rear body (and the primary mirror inside it) when needed.

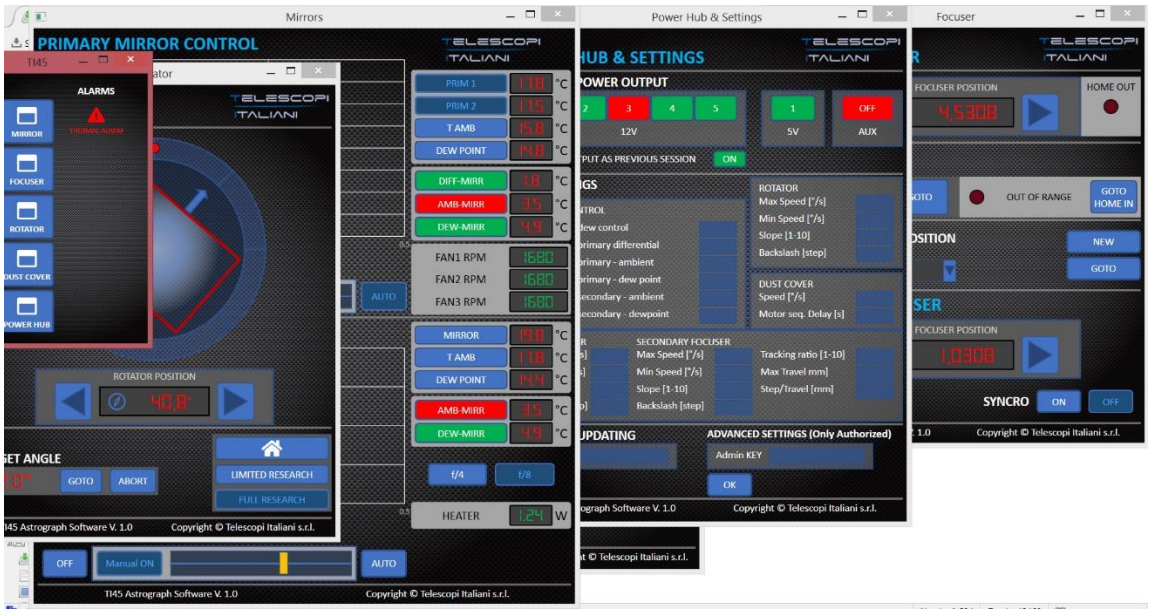
Electronics, control and software:

All our Astrographs have a built in high-end electronic system and a a complete software Suite based of the new standard ASCOM Alpaca. The **full control of the telescope is via WIFI**, so wireless.

- ***Electronic boards****:*
  Our Astrographs have a built in high-end electronic board. It is integrated into the rear body thickness and full accessible for check and dismounting.
- ***Active temperature control****:* Three high quality fans PWM controlled will keeps the primary mirror temperature controlled avoiding both high temperature difference between air temperature and high temperature gradient within the mirror itself (thanks the two sensors installed close to the cooler area ant the other near the warmer area). A special air flow path allow the main parts of air to flow out from back without damaging the quiet air above the mirror. A full customized silicon secondary mirror heater with extremely low power density and PWM driven, will maintain the secondary mirror just above the dewpoint if needed.
- ***Sensors installed****:*
  - Primary mirror: two temperature sensors
  - Secondary mirror: temperature sensor
  - Air temperature sensor
  - Air relative humidity sensor

- ***Electronic panels****:* in the lateral sides of the rear body two control panels will allow to simplify all cable connections between OTA and PC and same useful action. Here the characteristics:
  - *Six USB input with IP 65 screwed connection*
  - *Five 12V Output IP 65 3.5 mm jacks – with red led to detect if jack is powered*
  - *One 5V Output – IP 65 3.5 mm jacks– with red led to detect if jack is powered*
  - One Aux Output – IP65 *3.5 mm jacks – it allow to power instrument with a specific tension.*
  - One Aux Input – IP65 *3.5 mm jacks – where you have to arrive with your specific tension.*
  - *Two buttons to open/close manually the primary dust covers (IP 65)*
  - *One button to switch on/off a Green LASER for star pointing (IP 65)*
  - *One button to switch on/off a LED inside the rear body in case of maintenance (IP 65)*
  - *One connector to power the OTA (12 and 5 V powered with our external power supply) (IP 65)*
  - *One USB connector to connect to PC (IP 65)*
  - One connector to an external focuser (IP 65) – This output can drive a stepper motor for aux focuser system. It is used on our off-axis guider with a stepper helical focuser built-in, in order to synchronize the guide camera focus with the main camera focuser, in case of change of focus (i.e. in case of different thickness of filter glasses).
- ***Hardware Safety****:* all the onboard electronics are protected by over current thanks the use of two fuse. All the external hardware powered by our power hub has inside its own fuse that can be installed with the right current limitation in according to the hardware current rating.
- ***Wireless connection****:* the onboard electronic has its wireless connection to allow most important actions from your smartphone or ipad. We think the features for example to allow focuser and rotator command when the operator need to stay close to the telescope.

- ***Software Suite**:* the package include a software able to control all the functions and to connect it via ASCOM driver to MaxIm and other commercial software. The software will have:
  - *Window 1:* **Temperature controls**
    Where you ca see themperature graphs, fan speed, heater power, decide if manually or auto comand the fan and the heater
  - *Window 2:* **Focuser controls**
    Where you ca see the focuser absolute position, move in/out focuser, see if reach the limits, load/store/rename focuser position, go to a target focuser position, go to home position, save temperature/focuser point for compensation curve, switch on/off temperature compensation, see secondary focuser position, move in/out secondary focuser, goto home for secondary focuser, syncro on/off secondary focuser to the main focuser.
  - *Window 3:* **Field Rotator controls**
    Where you can see the absolute rotator position, goto target angle, research home (limited – full options)
  - *Window 4:* **Dust cover / Laser controls**
    Where you can open/close the dust cover, stop the procedure, switch on/off the laser pointer
  - *Window 5:* **Power Hub and Settings**
    Where you can switch on/off power relé on each power output (n. 5 12V, n. 1 5V, n. 1 Aux Volt), select to set power outputs as previous session, modify user setting parameters, make the firmware updating, access to the advanced setting (only authorized)



We emphasize that from OTA toward the PC only two cables are connected: power 12 / 5V (possibly to our optional TI power supply) and USB signal, while all other cables are internal to the structure or connect the electronic board to the external instrumentation: CCD camera, filter wheel or a guide camera. Since external cables are very short and screwed over IP65 sockets, the system is free from entanglement problems or crushing during the movement of the mount, as well as disconnections or bad contacts. This solution is very important and useful for remote observatory use.

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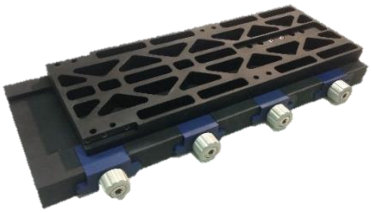
- **OPTIONS:**
  - **TI-112 dovetail system** + adjustable saddle plate
    Heavy duty 112 mm, 400 mm length dovetail system allows a precise balance in the declination axes, only with a screw wrench and one person. Saddle plate: four clamps heavy duty saddle with +/- 120 mm of adjustable position travel. Suitable for Paramount, AP and 10Micron Mounts.




  - **TI-106 Off Axis Guider**:
    - Smallest backfocus: 30 mm (1.18")
    - Extremely wide Central opening: 106 mm (4.17") for very fast optics and very big sensor
    - Big High quality Prism:
      - 15 mm - N-BK7 AR Coated Legs (350 - 700 nm) for more illuminated guider sensor
      - Surfaces Flatness: λ/10
    - Helical focuser for easy focuser – stepper motorized option: add € 390,00
    - Spacers to place pick-off optic further into the light beam
    - All parts CNC machined and lightweight design
    - Very low reflectance anodization


  - **Camera Adapters:**
    - custom built adapter from our TI45 to the TI106-OAG and from TI106-OAG and your camera to precisely match back focus distance. Ultra dark matte anodization.


Guarantee: 5 Years on optics and mechanical parts. 2 Years on electronic components.