

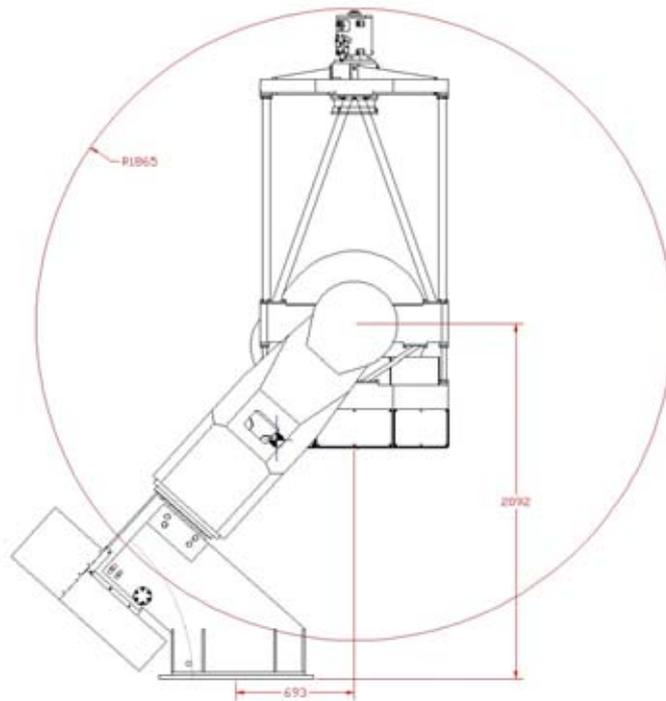
## *Offer 80cm RC with accessories*

<b>Position</b>	<b>Description</b>
<b>1. Telescope</b>	
Optics	<ul style="list-style-type: none"> <li>- LOMO 80cm Ritchey-Chretien f/8</li> <li>- Sital zero expansion optics</li> <li>- L/6 PtV, L/30 RMS or better</li> <li>- Interferogram and test protocol</li> </ul>
Tube	<ul style="list-style-type: none"> <li>- Truss tube design</li> <li>- fully baffled against stray light</li> <li>- Secondary mirror focusing with servomotor</li> <li>- Allows focus equipment of up to 30kg</li> <li>- Automatic focus correction on temperature changes</li> <li>- motorized telescope main mirror cover, can be controlled with Autoslew and ACL Protocol</li> </ul>
Mount	<ul style="list-style-type: none"> <li>- Equatorial fork mount</li> <li>- Friction Drive with very low back-lash</li> <li>- in-situ back lash correction with Heidenhain-Encoders</li> <li>- DC-Servomotors with high resolution encoders</li> <li>- Heidenhain Encoders on axis 0.01" resolution</li> <li>- Slew-Speed 0.3 degrees per second (software selectable)</li> <li>- Pointing accuracy &lt;8 arc seconds RMS for altitudes &gt; 25°</li> <li>- Differential pointing accuracy 0.5" RMS within 1 degree</li> <li>- Guiding accuracy &lt;0.4" RMS in 5 minutes</li> <li>- full automatic control via remote computer and Autoslew</li> <li>- full manual control via Hand-Paddle</li> <li>- Software limits via Autoslew selectable (hour angle, minimum altitude above horizon)</li> </ul>
Telescope Control System	<ul style="list-style-type: none"> <li>- Autoslew Telescope control system</li> <li>- operating system Windows XP</li> <li>- suitable &gt;2GHz Industrial PC Pentium-class computer and monitor, accessories</li> <li>- Heidenhain Counter card</li> <li>- Servo Driver Card</li> <li>- Additional 4x RS232 card</li> <li>- language English or German</li> <li>- including TheSky Astronomy Software</li> <li>- fully compatible with all Software Bisque Packages like Orchestrate and TheSky via TelescopeAPI or ACL.</li> <li>- Fully compatible with ACP, MaximDL, CCD Autopilot</li> <li>- Internet control possible with ACP or VNC</li> <li>- Ascom ActiveX to talk directly on same computer or via telescope driver and RS232 cable.</li> <li>- Dome control compatible with several domes (including Baader, ACE smart dome and others) and all ASCOM compatible Domes.</li> <li>- Robotic control of mirror cover</li> <li>- GPS timer</li> <li>- Wall mounted Enclosure 600x600x250mm with all electronics contained</li> </ul>
Finder	<ul style="list-style-type: none"> <li>- 80mm aperture Finder Telescope with brackets</li> </ul>
Field Flatteners	<ul style="list-style-type: none"> <li>2-Lens field flattener</li> <li>- 2 x 100mm Lens diameter</li> <li>- no focal length change</li> <li>- MC-Coating</li> <li>- Holder</li> <li>- Suitable for D=80mm field</li> </ul>
Reducer	<ul style="list-style-type: none"> <li>4-Lens Reducer</li> <li>- 4 Lenses with 74mm</li> </ul>

	<ul style="list-style-type: none"> <li>- Reduction of focal length to f/5.3</li> <li>- MC-Coating</li> <li>- Holder</li> <li>- Suitable for D=40mm Field</li> </ul>
<b>3. Installation</b>	<ul style="list-style-type: none"> <li>- Packaging</li> <li>- FOB Germany</li> <li>- Installation of telescope (2 persons)</li> <li>- system checks</li> <li>- polar alignment (if weather allows in 1 weeks installation period)</li> <li>- final optical alignment and setting into operation (if weather allows in 1 week installation period)</li> <li>- teaching of staff to operate the telescope</li> <li>- A suitable crane has to be organized by customer</li> </ul>
<b>4. Delivery time</b>	<ul style="list-style-type: none"> <li>- appr. 15 months from official order</li> </ul>

**All custom and import fees have to be covered by the customer !**

Payment condition: 30% down payment. 50% on notice that the telescope is ready for delivery (the telescope can be checked by customer in factory). Final 20% on performance check after installation. Alternative payment methods (like LC) can be discussed if more favorable for customer.



Size: Telescope can easily fit in a 5m dome

## Comments and further description (when necessary)

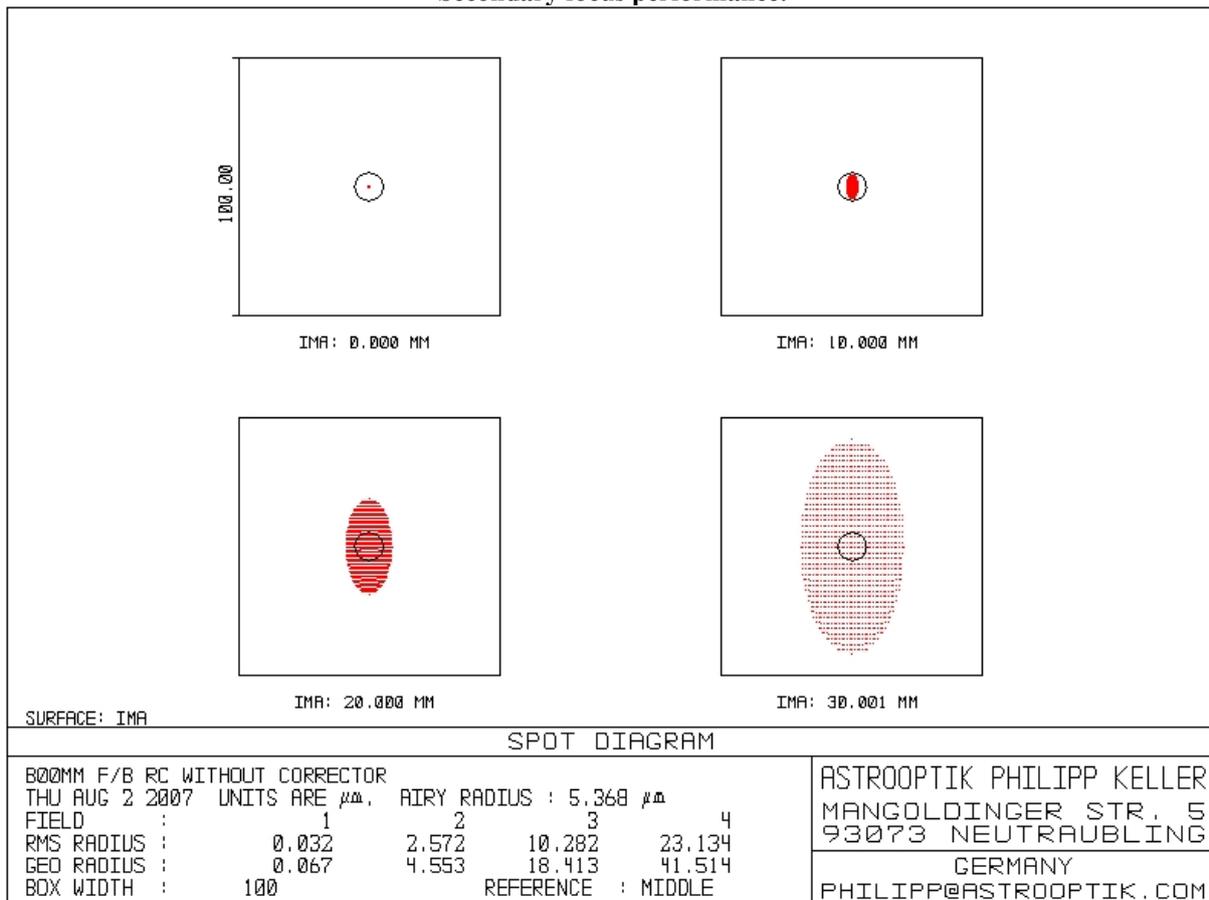
### 1. Telescope

#### Optics

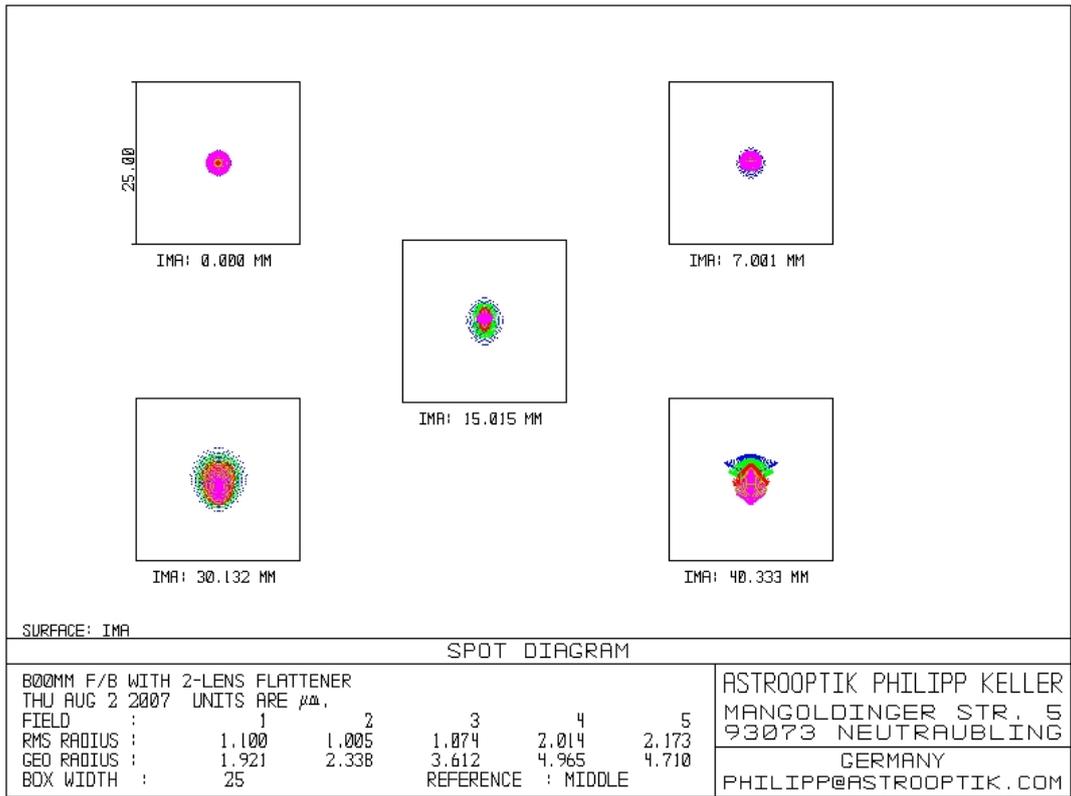
We use a f/3 primary mirror to keep central obscuration as small as possible. Our optics is the heart of the telescope and we can guarantee a very high quality. We deliver an interferogram and test-documents with the telescope. Final optic tests are made and given to the customer with the ready installed telescope.

Optical Type: RC (Ritchey-Chretien)  
 Main Mirror: outside diameter 800 (+3)mm, optical specified diameter >790mm  
 Hyperbolic  
 Secondary Mirror: outside diameter 290 (+1)mm, optical specified diameter >280mm  
 Hyperbolic  
 Optical accuracy: L/6 maximum Peak to Valley wavefront aberration at 632nm  
 L/24 maximum RMS wavefront aberration at 632nm  
 80% in 0.6 arc seconds  
 Surface quality: 100/60 scratch/dig or better according to PO #7091112001  
 Material: extra low expansion ceramics AstroSital, thermal expansion coefficient  
 < 0.1e-6/°C.  
 Coating: Al+SiO2 both mirrors, R>90%  
 System focal length: 6400 mm f/8  
 Back focus: 700mm

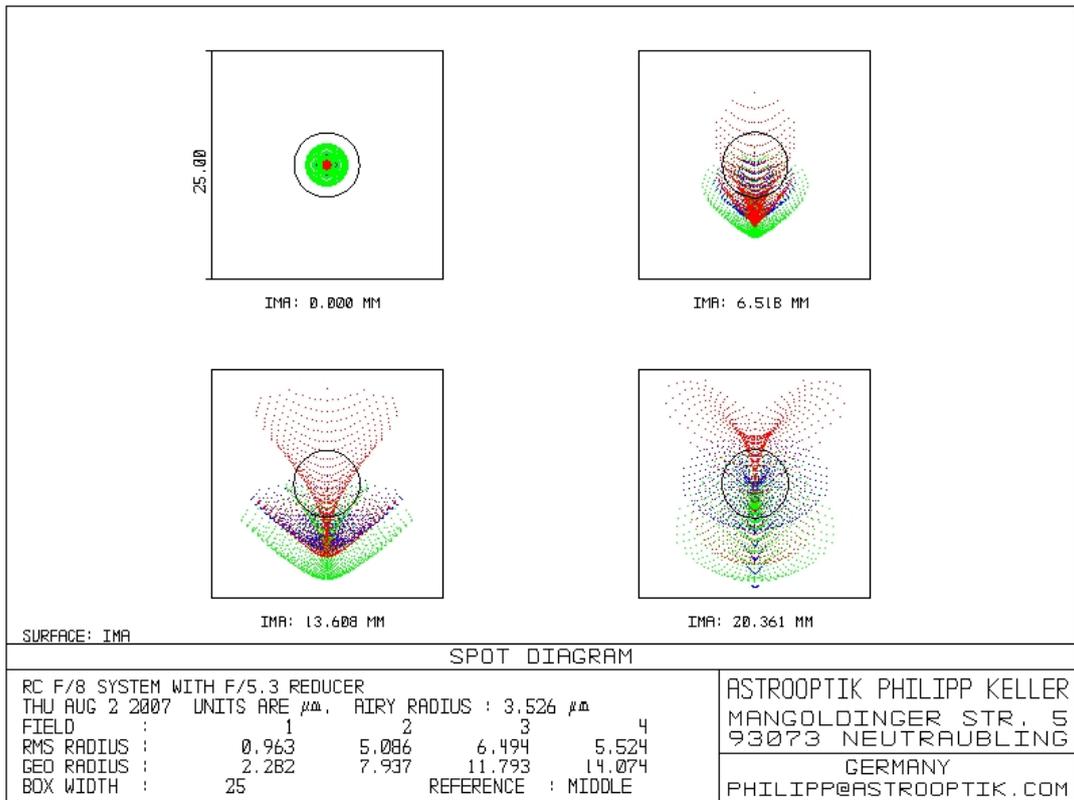
#### Secondary focus performance:



Spot diagrams for the 800mm RC without any corrector



Spot diagrams with the optional 2-lens field flattener (see accessories)



Spot diagrams with the optional Reducer (see accessories)

## Tube

The **tube** is a classical truss tube. The temperature of the truss tubes is measured and the focus position automatically corrected.

The **focusing** is done by moving the secondary with a DC-Servomotor. The movement is accurate to 0.01mm and without any image tilt. The control of the motofocus is manually with the hand-paddle or with the Autoslew-computer. The focus-position is displayed both on the hand-paddle and on the Autoslew-screen. Focus positions can be selected and slewed. If for example a filter is added the user only has to select the name of the filter from the focus list and the focus automatically slews to the desired focus position with an accuracy of better than 0.01mm. The focuser software is Ascom-Compatible and a Focuser Driver is part of the software package.

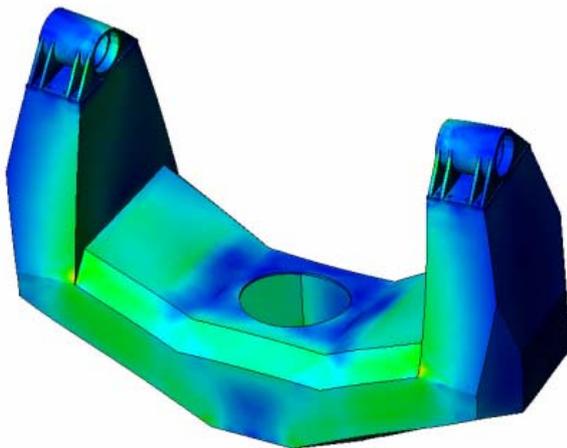
The **baffles** are computer optimized for a field of view of 80mm. The **paint** inside the tube is a special very low reflective dark black with a reflectivity of less than 2% independent from the angle of incidence.

The **mirror cell** is a very important point of a telescope. We found out, that Lasalle Systems have no advantage for 60cm telescope diameter and came back to conventional 9-point floating support. The residual surface error is less than 25nm.

## Mount

The mount is a equatorial fork mount (see pictures at references-chapter). The mounts are driven with oversized friction drives made from stainless steel.

To the left you can see a FEM calculation of one of our fork-mounts. Only these calculations that keep us light-years ahead of our competitors can guarantee a low flexure and high pointing accuracy



### Drives and Encoders

We use DC-Servomotors with 24V/10A maximum power. The electronic that drives the Servomotors use a PID-controller that is specially modified to make a very smooth tracking even at very low frequencies.

Limiting switches are directly connected to the electronics, so even a PC-failure cannot cause any accidents. If a certain torque is exceeded (if the telescope hits any resistance) there is also an emergency stop of the Servomotors.

We use a total of 2 encoders per axis to control the telescope and guarantee a safe operation:

#### a) Encoders at the Servo-axis

we have 4000 counts per revolution. Since we use a 4000 total gearing this corresponds to 0.08 arc seconds per count which enables a very smooth tracking without ripples.

#### b) Heidenhain Encoder ERA 780C

These Encoders with 460mm diameter are directly attached to the telescope axis and are the same that are used in the big-size professional ESO-telescopes. These encoders have 36.000 sin-waves that are further subdivided by a factor of 4096. This gives a theoretical resolution of 0.01 arc second. These encoders are used to make realtime-corrections of back-lash, wind-load and all gearing errors. Therefore, PEC or other software approaches are not needed (though possible)

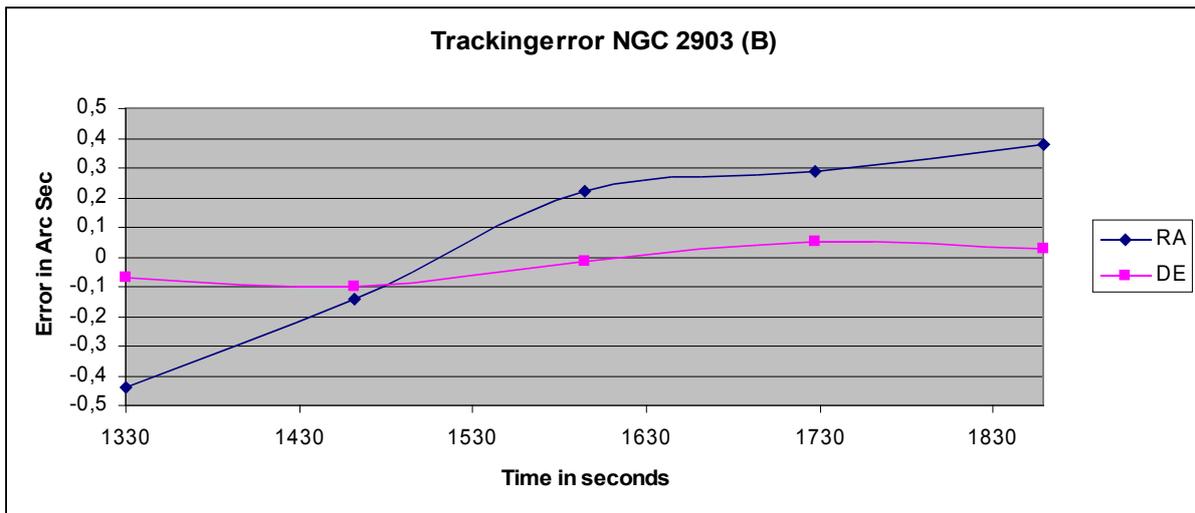
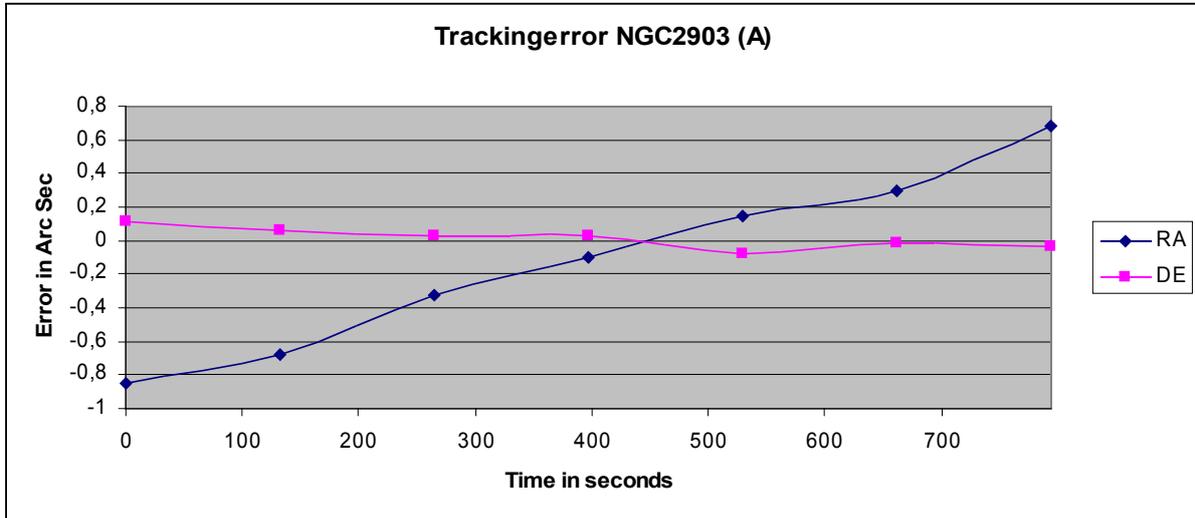
The encoders have reference marks in 5° distances.

## Tracking and Resolution report measured with the 80cm Telescope Britthheim in Primefocus

A total of 12 Luminance Exposures have been made with an exposure time of 2m each. There was no active tracking (autoguiding) used during the exposures.

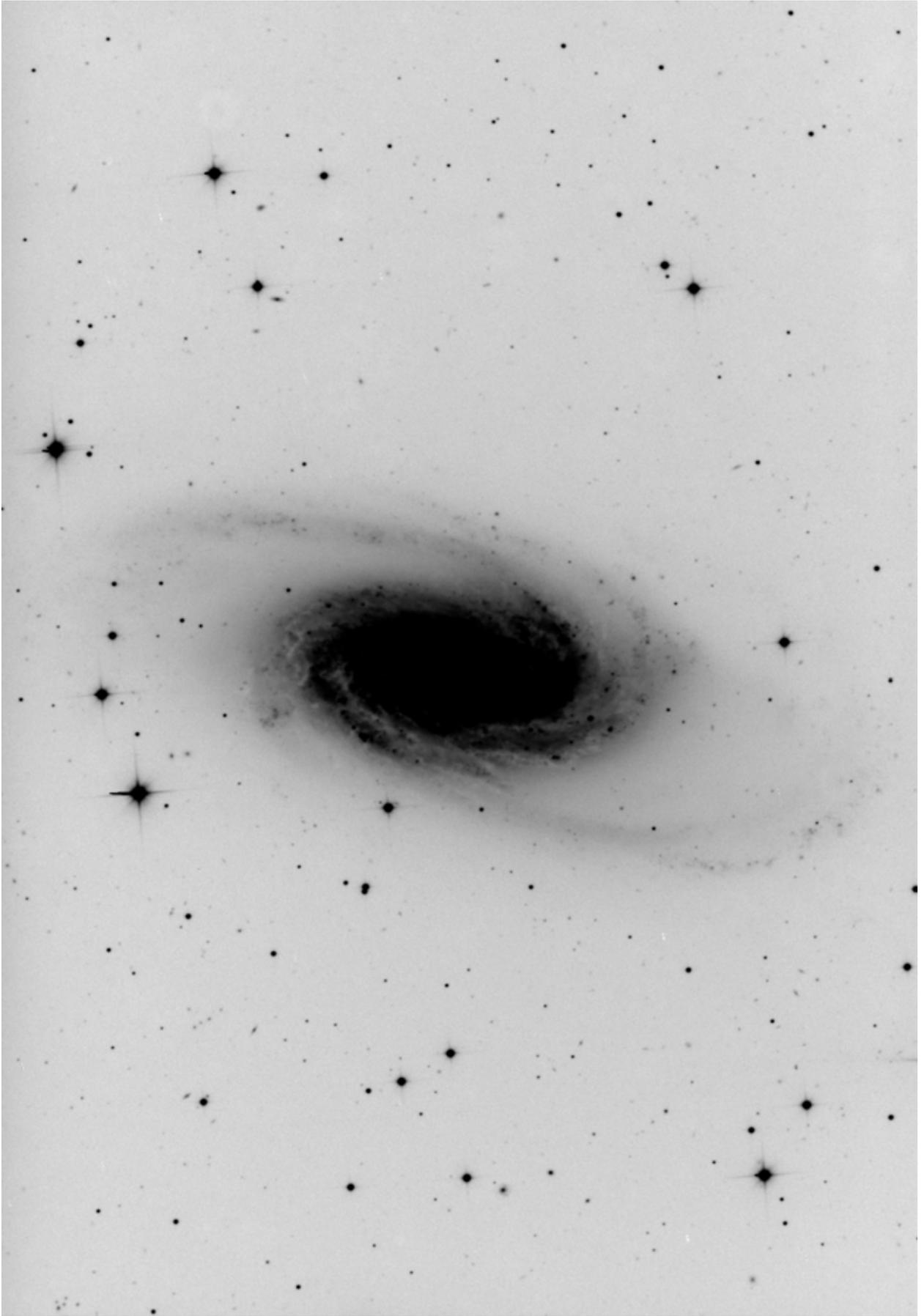
One time, the telescope had been moved to focus and repositioned on the object so the tracking report is divided in 2 parts (A and B).

The focal length in prime focus is 2664mm, we used a ST10XME (6.8 micron Pixel size).



The RMS Tracking Error is (RA=0.54, DE=0.06) arc seconds for Part A (during 13 minutes) of the measurement and (RA=0.34, DE=0.06) arc seconds for Part B (during 9 minutes).

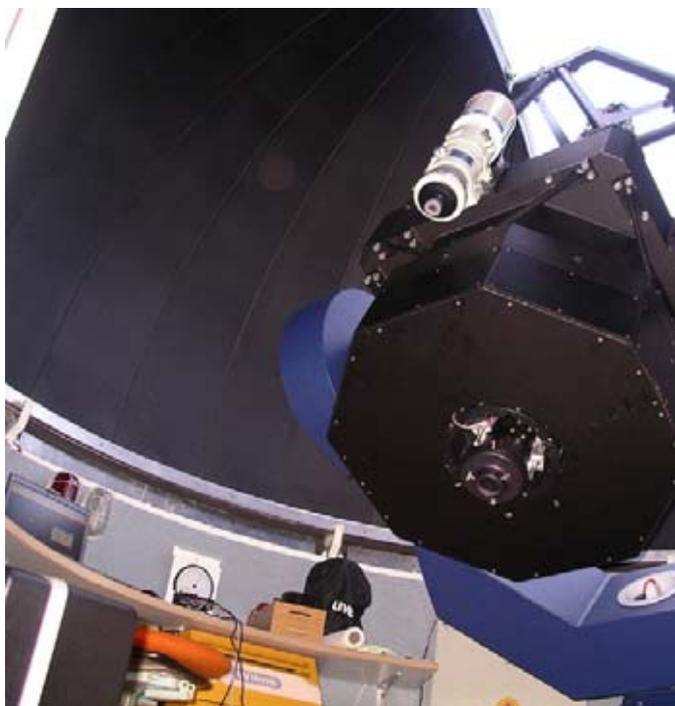
The FWHM star diameter is as good as it can get in optimum seeing conditions in Germany and shows that none of the exposures had any tracking problem during the 2 minutes of exposure time.



NGC 2903, no sharpening, only histogram stretch applied



The image below shows M104 imaged with the 1m Taiwan telescope without tracking corrections applied !



Pictures of our 80cm Systems.  
More images can be seen in our References.

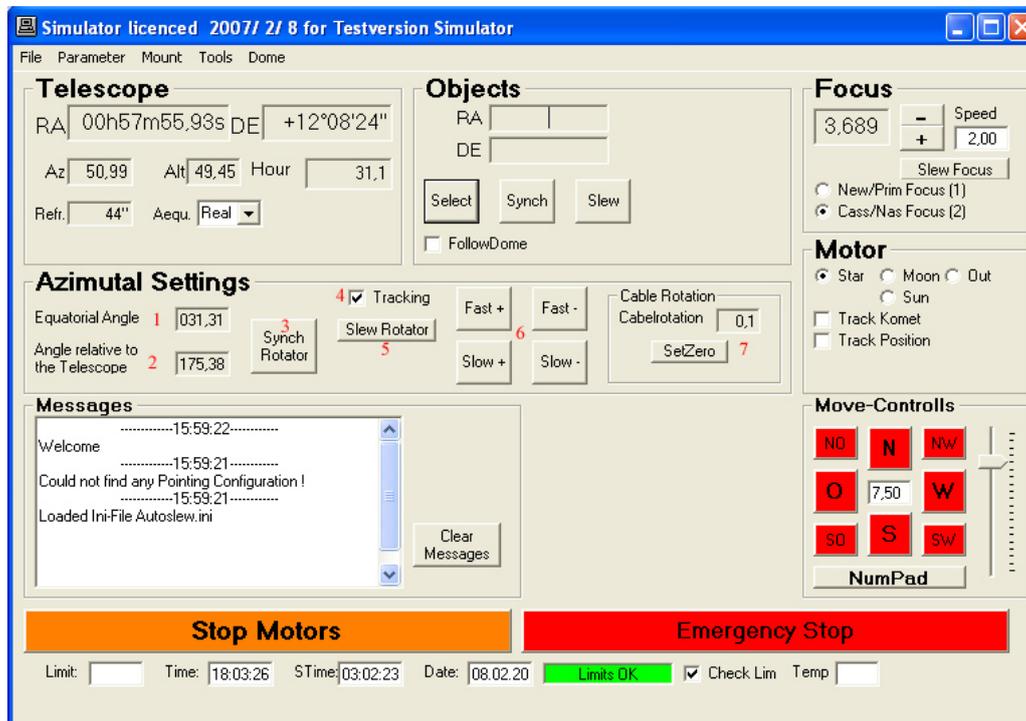
## Telescope Control System

The TCS (telescope control software) that we use is Autoslew. Autoslew is now running on more than 20 telescopes with aperture diameter above 60cm.

Some important features of Autoslew:

- ▶ 32-bit Windows-Software, latest tested Windows Version WinXP home or prof.
- ▶ Full slew, synch and track compatibility with TheSky.
- ▶ Full ASCOM compatible, tested with ACP, MaximDL, CCD Autopilot and others
- ▶ Fourier transform slewing optimization (increases pointing accuracy by a factor of 5)
- ▶ Hand-Paddle with LCD-Display, speed selector and focus control.
- ▶ Slewing speed up to 3°/second.
- ▶ Average pointing accuracy < 20 arc-seconds
- ▶ Automatic Dome-control with all ASCOM Domes and Baader Domes

On the next page you can see a typical view of the screen



We have concentrated our efforts to a very good compatibility to other Ascom programs. Although we have our own database in our software, it will be mostly used in link with other programs like MaximDL and ACP or other Ascom programs which can be purchased through us or separately. A lot of options can be setup in our ini-File to make the telescope work as robotic as possible, for example open covers on the ACP unpark command etc.

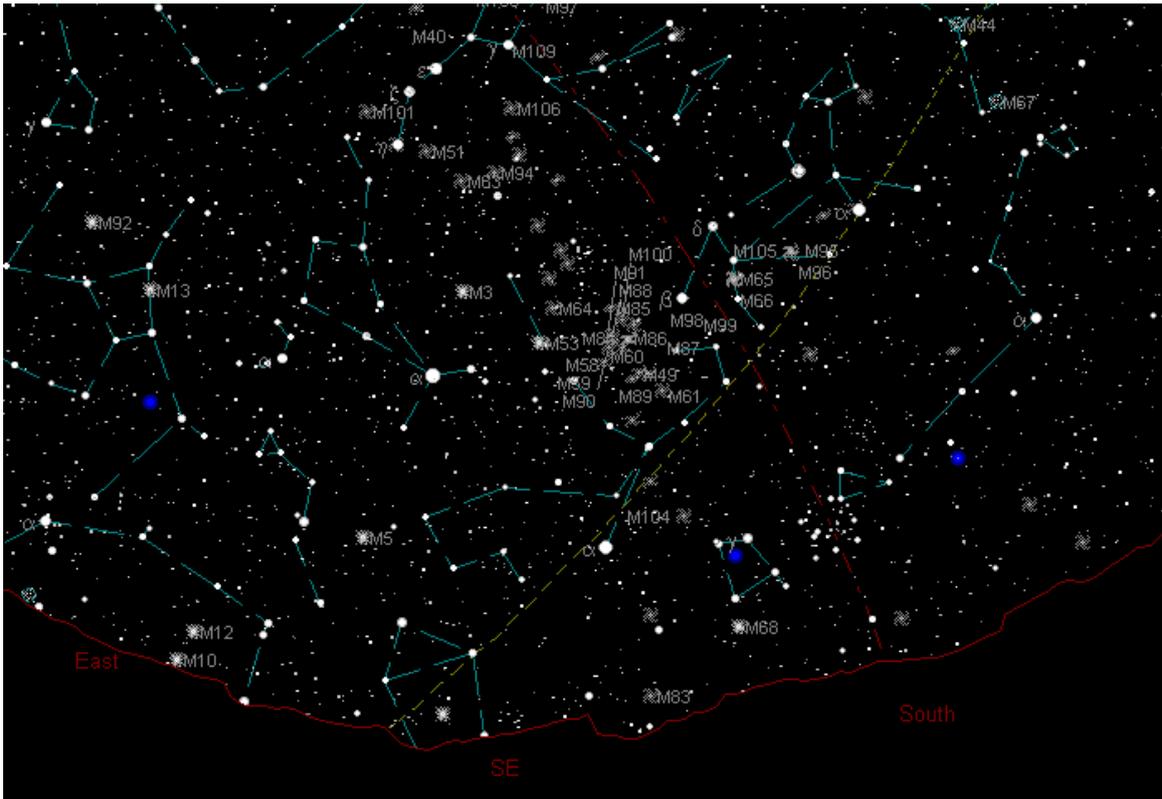
Other programs can connect to Autoslew either directly on the same computer via the Ascom ActiveX.exe or from another computer with our Ascom compatible telescope driver and a RS232 cable. It is also possible to directly use our native ACL protocol for programmers who like to write their custom software.

TheSky software can also be used on the same Autoslew computer or a remote computer either by selecting the ACL protocol or the telescopeAPI. TheSky and other Ascom-programs can simultaneously access Autoslew.

This has been made possible because the latest Autoslew telescope driver is not a DLL any more but an ActiveX exe file.

## Hand-Paddle

Our Hand-Paddle is very universal. It uses its own little micro-controller and LCD-Display. The goal was, that the user does not need to run to the computer to slew to the next object. He can input object numbers from any known catalogue or coordinates directly in the hand-paddle and star to slew the telescope. Of course, he can also move the telescope in all 4 directions with user-selectable speed and control the focus. Please note, that even the focus position is displayed at the hand-paddle.



## Electronics



There is a wall mounted enclosure delivered with the telescope that should be mounted within 10m from the telescope and contains the power supply, servo amplifiers and some additional micro controllers. The enclosure is made by professional electronic engineers and is according to all common standards.



*Crab Nebula with 600mm Cassegrain Telescope by Bernd Wallner*

### Supported ASCOM Commands

We checked with TheSky6.0, MaximDL, ACP, Focusmax, CCD Autopilot and it works with these programs. If you do your own programming, you may wish to know the supported features. Please check the ASCOM Telescope and Focuser Reference document if you need more information about the Telescope and Focuser properties and methods.

#### TELESCOPE:

PROPERTY	Read	Write	Comments
Alignmentmode	√		
Altitude	√		
AtHome	√		
Azimuth	√		
CanFindHome	√		
CanPark	√		
CanPulseGuide	√		
CanSetDeclinationRate	√		
CanSetGuideRates			
CanSetPark	√		
CanSetRightAscensionRate	√		
CanSetTracking	√		
CanSetGuideRates	√		
CanSetPierSide	√		
CanSlew	√		
CanSlewAsync	√		
CanSync	√		
CanUnPark	√		

Connected	√	√	
Declination	√		
DeclinationRate	√	√	
Description	√		
DoesRefraction	√		
DriverInfo	√		
IsPulseGuiding	√		
Name	√		
RightAscension	√		
RightAscensionRate	√	√	
SideOfPier	√	√	It will accept this Ascom command only if it can really flip the mount to the wished side. Mount limits set in Autoslew have always priority to this Ascom command. Otherwise it will do nothing
SiderialTime	√		
SiteElevation	√		
SiteLatitude	√		
SiteLongitude	√		
Slewing	√		
SlewSettleTime	√	√	
TargetDeclination	√	√	
TargetRightAscension	√	√	
Tracking	√	√	
UTCDate	√		
<b>METHODS</b>			
AbortSlew			
FindHome			
Park			In Autoslew you can set the covers to be automatically closed with Park
PulseGuide			Speed is currently 10arcsec per second
SetPark			
SetupDialog			
SlewToTargets			
SlewToTargetsAsync			
SlewToTarget			
SlewToTargetAsync			
SynchToCoordinates			
SynchToTarget			
Unpark			In Autoslew you can set the covers to be automatically opened with Unpark

## FOCUSER

PROPERTY	Read	Write	
Absolute	√		
IsMoving	√		
Link	√	√	
MaxIncrement	√		You should set this in Autoslew
MaxStep	√		You should set this in Autoslew
Position	√		
StepSize	√		Normaly 1 micron
TempComp	√		Autoslew does all the compensation So ignore all these settings
TempCompAvailable	√		Autoslew does all the compensation So ignore all these settings
Temperature	√		
<b>METHODS</b>			

Halt			
Move			
SetupDialog			

### Additional Telescope Commands not in Ascom-Standard

PROPERTY	Read	Write	
CanSetCovers	√	√	Read-only, Boolean
Epoch		√	Sets Epoch to 1950 or 2000 or other If Epoch=0 (default) that means Autoslew will expect current Epoch from ACL
Trackposition		√	Write only, Boolean Enables High Precision Tracking
GuideMoveRa		√	Write, Double Moves Mount with the amount in arc seconds in RA
GuideMoveDe			Write, Double Moves Mount with the amount in arc seconds in DE
<b>METHODS</b>			
CloseCover			Closes Cover if possible
OpenCover			Opens Cover if possible