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EUROPEAN SOUTHERN OBSERVATORY

Organisation Européenne pour des Recherches Astronomiques dans l'Hémisphère Austral

Europäische Organisation für astronomische Forschung in der südlichen Hemisphäre

LA SILLA OBSERVATORY

LED / Optics

FEROS on 2p2 Telescope

New ADC Mode

Technical Report

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1 Purpose.

After moving the Feros instrument from the 1m50 telescope to the 2m20, the instrument is now using a sky aperture of 1.8 arcsec equivalent to 0.15 mm. For larger telescope Zenithal Distance (ZD) the atmospheric dispersion effect is larger and part of the star light will be lost. An Atmospheric Dispersion Corrector (ADC) is required and we present on this document a possible and simple way to design it.
This document will be used as conceptual design to be reviewed accordingly.

2 Requirements

2.1 Conditions

For ZD larger than 35 deg, the dispersed light of the star is as long as the aperture diameter and losses will occur forward. The ADC required is in fact a single prism element with rotation ability to match the telescope parallactic angle. The ADC correction range will concern ZD angles from 35 deg to 65 deg.
Due to a reduced available space for the ADC mounting, the prism must be as small as possible correcting only the dispersion for the science aperture of the fiber head.
The prism will require two functions to be added on the present adapter, an in/out and a rotation ability. The rotation precision requires only a 1deg position error.

2.2 Conceptual design.

Three constraints on the design:

- smaller size : 15mm diameter for a F/8 beam of 8mm not covering the second aperture hole at 16mm
- small distance from the fiber head: 54mm from the exit prism surface.
- defocus compensated to avoid telescope focus correction for in/out ADC.

Several ADC prism designs have been done in the past and the glass combination selected has been fully tested on other designs. The instrument wavelength range is not reduced by the glass selected, the UBK7 and LLF6.
The prism position angle has to be adjusted according the parallactic angle of the telescope available on the TCS. A tracking in rotation is required following the angle variation at variable speed according the Zenithal Distance. Close to zenith observations will not require the ADC. An automatic mode will have to be implemented to insert the ADC for ZD higher than 35 deg with the proper rotation speed adjusted from the TCS parallactic angle calculation.

3 Design

The prism sizes 15mm diameter with an on axis thickness of 6mm. The position is 54 mm in front of the fiber head (from the exit surface). The last surface is curved with a radius of 766.35 mm to compensate the prism defocus. The prism angle is 17 deg for an optimum correction at 55 deg Zenithal distance.
The prism is decentered by 8mm to fit the science aperture of the fiber head. The corresponding field offset is 1 arcmn 34 arcsec.
The opto-mechanical design must be with a minimum obstruction on the Prism area and not produce vignetting on the optical beam from M3. The WFI field must be also un-vignetted when the ADC support will be in park position.
A delay of 4 months at least must be expected for the prism delivery.

The lens data prescription of the ADC is presented below:

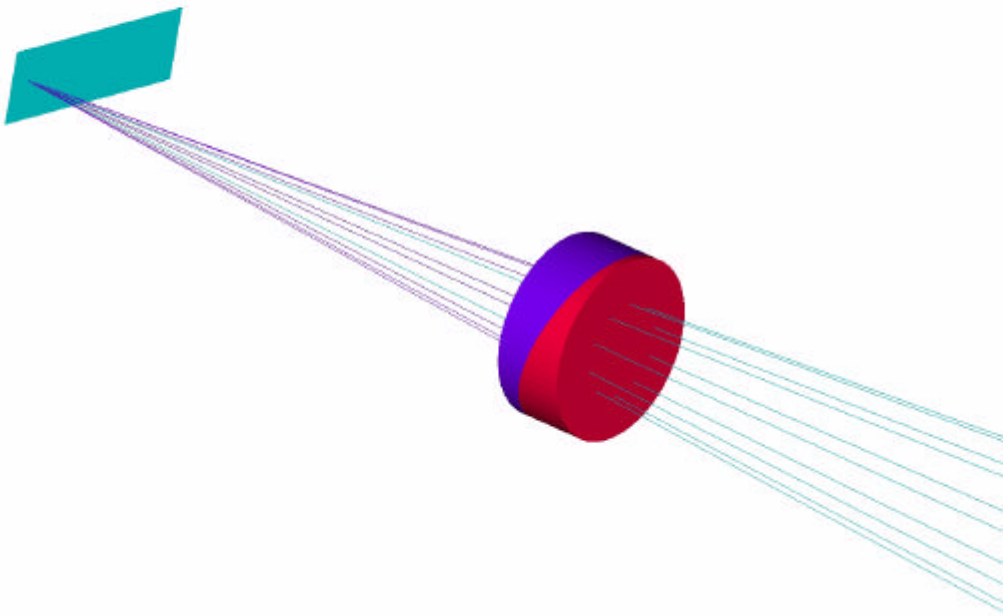
LENS NOTES:

Feros Adapter with ADC Prism

SURFACE DATA SUMMARY:

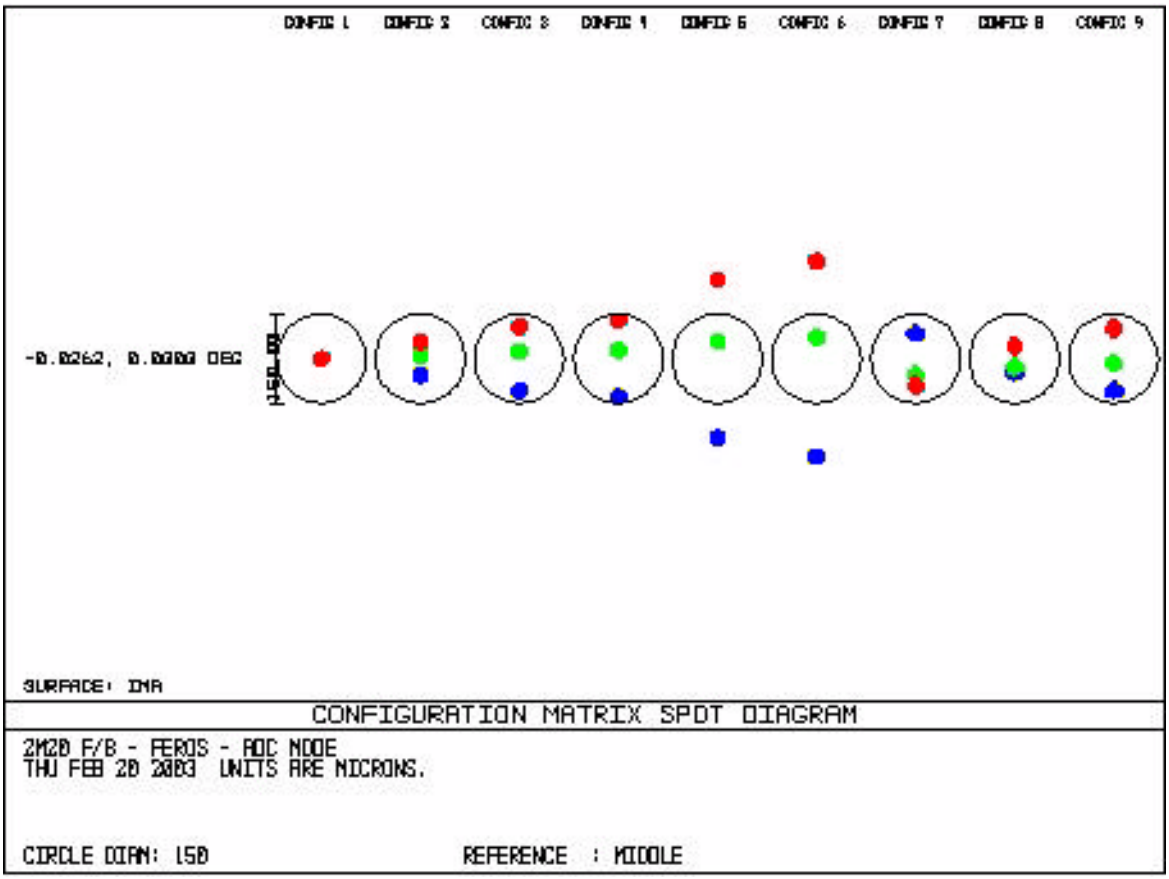
Surf	Type	Comment	Radius	Thickness	Glass	Diameter
OBJ	STANDARD		Infinity	Infinity		0
1	ATMOSPHR	ATMOSP. DISP	Infinity	0		2304.564
2	STANDARD		Infinity	5000		800
STO	STANDARD	MAIN MIRROR	-13200	-4475.071	MIRROR	2210
4	STANDARD	M2	-6816	5084.647	MIRROR	800
5	STANDARD	NEW SPACER	Infinity	20		0
6	STANDARD	M3	Infinity	-480	MIRROR	100
7	COORDBRK		-	0		-
8	STANDARD	ADC PRISM	Infinity	-3	UBK7	15
9	TILTSURF		-	-3	LLF6	15
10	STANDARD		766.353	0		15
11	COORDBRK		-	-54		-
IMA	STANDARD		Infinity			16.03038

We also present below a shaded model view of the prism and fiber head area:



The two prism are clearly presented above. Only the science beam reaching the science fiber aperture on the head is presented.

On the next figure, the corrective effect of the prism is presented.



9 different configurations of the prism setting are presented.
The first 6 ones show the dispersion effect from the atmosphere at the 2m20 without the ADC prism corrector.
The simulation is done for a temperature of 20degC, a Pressure 780 mbar as nominal condition for la Silla.
Since the first to the sixth simulations the telescope Zenithal distance change from 0, 20, 35, 40, 60 and 65 deg. The top spot corresponds to 920nm meanwhile the middle and lower matches 500 and 350 nm.
The circle corresponds to the aperture of the fiber head as 0.15 mm or 1.8 arcsec as defined on the requirements.
Until a ZD of 35 deg, no losses of wavelength range will occurs.
Starting at 40 deg ZD, part of the spectral range will be lost as expected without the ADC prism.
The configuration 7 to 9 shows the prism corrective effect for ZD variation from 40, 60 and 65 deg. The prism correction inverse the dispersion around 55 deg ZD, over correction below this value and under correction above.
This single ADC prism must be used for ZD higher than 35deg.

4 Conclusion

A single ADC prism can be used for the atmospheric dispersion correction. The unit is quite simple requiring an in/out mode as well as rotation to adjust the dispersion correction aligned with the parallactic angle.

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