E U R O P E A N S O U T H E R N O B S E R V A T O R Y

Organisation Européenne pour des Recherches Astronomiques dans l'Hémisphère Austral
Europäische Organisation für astronomische Forschung in der südlichen Hemisphäre

LA SILLA OBSERVATORY

FEROS ADC FINAL DESIGN REVIEW

Doc. No.: LSO-MIN-ESO-60400-0001

Issue: 1.0

Date: 12 – October - 2004

Prepared: J. Alonso

Name Date Signature

Approved: H. Dekker

Name Date Signature

Released: J. Melnick

Name Date Signature

CHANGE RECORD

Revision	Date	Section/Paragraph	Remarks
Issue 1	12/10/2004	All	First Issue

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1. INTRODUCTION

1.1. PURPOSE AND SCOPE

This document is intended to serve as a formal statement for the FEROS ADC FDR held at La Silla Observatory on 6, July 2004. References to the design documents presented for review as well as the outcome of the meeting in the form of the minutes and actions required for approval, are herein included together with the final verdict of our external reviewer.

1.2. REFERENCE DOCUMENTS

[RE1] "FEROS-II User Requirements" Doc. No. LSO-URS-ESO-22400-0002 Issue 1.1 J. Pritchard September 8, 2003.
[RE2] "Implementation of ADC for FEROS User Requirements" Doc. No. LSO-URS-ESO-90400-0002 Ivo Saviane April 11, 2003.
[RE3] "FEROS ADC CONCEPTUAL DESIGN" Doc. No. 2p2-DSD-ESO-60400-0002 Issue 1 J. Alonso W. Eckert A. Gilliotte. February 28, 2004.
[RE4] "FEROS-II Operation Plan" Doc. No. 2p2-PLA-ESO-90100-0001 Issue 1.1 J. Pritchard June 22, 2004.
[RE5] "ADC Prism Drive Error Analysis" J. Alonso July 8, 2004.
[RE6] "Degradation of ADC correction due to positioning errors of the prisms" I. Saviane July 19, 2004.

1.3. APPLICABLE DOCUMENTS

[AP1] "FEROS ADC Optical Design" Doc. No. 2p2-DSD-ESO-60400-0003 Issue 1.0 and 1.1 A. Gilliotte July 16, 2004.
[AP2] "FEROS ADC Control Electronics" Doc. No. 2p2-DSD-ESO-60400-0001 Issue 1.0 J. Alonso April 18, 2004.
[AP3] "FEROS ADC Mechanical Design" Doc. No. 2p2-TRE-ESO-70400-0001 Issue 1.0 W. Eckert May 5, 2004.

1.4. ACRONYMS & ABBREVIATIONS

ADC	Atmospheric Dispersión Corrector
AVI	Assembly Verification Integration
FEROS	Fibre-fed Extended Range Optical Spectrograph
FDR	Final Design Review

2. FDR RESULTS

The Verdict of the external reviewer: Hans Dekker, was that the project is:

On hold pending the outcome of action items related to:

1. Prism rotational positioning tolerance.
2. Prism/Fibre-head distance tolerance.
3. Documentation of AVI Commissioning procedure.
4. Corrections and additions to Optical Drawings.
5. F-ratio change calculation and impact study.

Of these five action items only (1) is felt to be a potential serious show stopper, but one is enough. Therefore the project is on hold pending the successful resolution of the above items. Should one or several items not be successfully resolved, further design review(s) will be required.

A review board consisting of Hans Dekker and John Pritchard will review the action items and decide on the successful resolution or otherwise. The deadline for completion of the review is August 12th (due to vacations of people involved).

Additional action items not affecting the final verdict but required to be completed in due course:

6. Documentation of SWC ADC implementation.

For details on the FDR meeting please refer to 4.1 MINUTES.
For the original sign-off e-mail from the reviewer please refer to 4.2 Sign off.

3. ACTION ITEMS

3.1. Prism rotational positioning tolerance

HDE: This issue is not in my scope, but I believe that it has been satisfactorily resolved.

JPT: Ivo has clearly demonstrated that the prism angle positioning tolerance can be relaxed to as much as 3 degrees per prism without compromising the target efficiency. Please refer to [RE6] for details.

JPT: Jaime has measured the backlash for the belts, and when combined with the stated backlash errors of the gears he arrives at a total foreseeable positional backlash error of 1.25 degrees per prism. Well within the tolerance. Please refer to [RE5] for details.

JPT: Under the agreement of the FDR that this item was the only potential "show-stopper", and given the above results which clearly show that this is NOT a show stopper, I recommend that the result of the FDR can immediately be upgraded to: "PASSED with Actions"

3.2. Prism/Fibrehead distance tolerance

HDE: The updated optical design report by Alain clarifies the issue in a good way. Please refer to [AP1] Issue 1.1.

3.3. Documentation of AVI Commissioning Procedure

HDE: The updated optical design report by Alain clarifies the issue in a good way. Please refer to [AP1] Issue 1.1.

3.4. Corrections and additions to Optical Drawings

HDE: The updated optical design report by Alain clarifies the issue in a good way. Please refer to [AP1] Issue 1.1.

3.5. F-Ratio change calculations and impact study

HDE: On this issue, which is related to the way the defocus introduced by ADC is compensated, the report lists the consequences of either choice, and an alternative, but makes no recommendation (see [AP1] Issue 1.1 p. 16). My view is as follows:
I consider the F/ratio due to a curved surface on the ADC change important since the faster F/7.6 beam will be at least partially vignetted in the spectrograph. The amount of vignetting depends on the extent to which the spectrograph accepts a faster beam than the nominal one. Changing the F/no will thus affect flux calibration. If the spectrograph fully accepts the faster beam, there will be no vignetting, but there may be an issue of changing spectrograph PSF because the beam on the detector with ADC in, is faster than without. In practice one is likely to get a combination of both effects. With a single set of ADCs, the use of plane ADCs and refocusing the telescope to bring the object in focus on the fiber will cause a defocused sky on the sky fiber. As long as there is really only sky on this fiber, this will have no effect on sky subtraction accuracy and one set of ADCs will be fully adequate. Apart from the photometric light loss in the ADC, there are no consequences for flux calibration and also the spectrograph PSF is not affected.
The alternative mentioned by Alain to install a second set of ADC prisms in the free ADC position is especially useful if you want to perform nod and shuffle, and use both

fibers as object fibers in an alternating fashion. Even if this is not being planned now, it seems a good idea to order two or even three sets, also in view of the low cost of the ADCs.

JPT: Based on the previous experience poor efficiency caused by we believe focal ratio degradation in the fibres, it seems clear to me that we should avoid at ALL costs changing the F/ratio of the input beam, therefore the clear choice to me is the plane parallel prisms option with prisms installed in BOTH OBJ and SKY beams so as to permit both the possibility to observe with either aperture AND the field of view being in focus over the maximum area of the TCCD which is of course important for guiding on a field star, therefore:

“As FEROS Instrument Scientist and Project Scientist for this ADC project, my recommendation based on the information and opinion provided by Hans and our previous experience is that we adopt the plane parallel prisms solution.”

I believe Alain should now prepare the final version of the Optical Design document where the adopted solution is stated, rather than presenting the two possible options. I also think it would be useful to retain the curved surface information in the document in a "rejected option" section or appendix for example.

3.6. Documentation of SWC ADC Implementation

In the following document is the information about the available parameters for ADC in the FEROS INS Sw. It corresponds to the Base ICS User Manual pages 86 - 87:

ftp://ftp.eso.org/pub/vlt/vlt/pub/releases/APR2004/vol-5c/VLT-MAN-ESO-17240-0934.pdf

To check the parameters used in HARPS, cmmCopy the hamcfg module and check the INS.ADC*.* keywords in hamcfgINS.cfg.

Besides the configuration keywords, there are other parameters related with the location of the instrument (latitude and longitude) which have to be updated for the 2.2m. Those parameters are located in module fei, file dbl/feiEnv1.db. Both values are in radians.

NOTE (for SOF): In fei module, file dbl/feiEnv1.db the table values for both ADC is not necessary anymore. I think with APR2004, the max and min speed can be entered via configuration keywords.

Juan Carlos Guzman Tanaka September 8, 2004.

4. APPENDIX

4.1. MINUTES

FEROS ADC Final Design Review

Date: 2004-July-6 @ 08:30AM CLT

Held at: La Silla + video conference link with Garching and Vitacura

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Minutes

Presence:

La Silla: J. Alonso (Eng), G. Andreoni (Eng), A.Gilliotte (Opt), J.C. Guzman (SWC), J. Pritchard (Project Scientist)

Garching: H. Dekker (External Reviewer)

Vitacura: I. Saviane [SciOps]

Apologies: W.Eckert [Mec] (sick)

Notes on Proceedings:

Author J.D. Pritchard

Question from HDe: Who is reviewing who?

Clarification: it was agreed that the purpose of this review was to primarily review the opto-mechanical implementation, for which HDe was himself the primary responsible, since the science issues had already been addressed during the Conceptual Design Review (external reviewer L.Pasquini).

Presentation by AGi: ADC optical design.

The principal features of the optical design were described by AGi. He also discussed the implications of the physical limitations caused by the available space in which to install the ADC. During the presentation the following issues were clarified:

(i) AR Super Triolin coating: HDe reminded that the AR Super Triolin coating is superior to the previously proposed MgF2 coating over the range 350-950nm but significantly worse outside this range. He was concerned that SciOps would want to operate outside this range. His concern was acknowledged but it is unwarranted since FEROS has a fixed instrument configuration and is only ever operated within the above range. Moreover the AR Super Triolin coating is used in other components of FEROS so even if the ADC used some other

broader range coating it would be pointless since FEROS is already constrained by the other components which do use the AR Super Triolin coating.

(ii) Science Fibres: A basic description of the FEROS Science fibres was provided for HDe in order to familiarize him better with the FEROS instrument. Also discussed was the relative efficiency of the Science Fibres and the fact that it may be necessary to change the definition of OBJECT and SKY fibres at a future date (e.g. if a new fibrehead is installed) according to which fibre has the best ACTUAL efficiency.

(iii) Prism size clarified: 12.5mmx2x3mm.

(iv) Number of prisms to be purchased clarified: 4

(v) Total transmission losses due to ADC optics clarified: less than 8% across the entire 350-950nm range.

(vi) Requested Manufacturers Quality Assurance clarified: measured transmission curves and waveform deformations will be required from the manufacturer.

Review of questions regarding the documentation raised by HDe prior to the FDR. Below each point is addressed, according to the responses made prior to the FDR by various parties via email, and according to the discussions during the review:

Note: HDE-001 to HDE-003 has no relation with the ADC but since these issues are part of the FEROS User Requirements document our external reviewer kindly commented on them.

HDE-001
Document: User requirements 22400-0002 (issue 1.1)

My understanding is that we're only reviewing the ADC. Still, I have some other comments, for what they're worth:

p. 5/6 and 10 Stabilized LED

Comment: On UVES and Giraffe we use a 10 W current-feedback halogen lamp with a 20 nm filter centered at 450 nm. After a 10-min warm-up, it is stable to 1% which is OK for testing detector gain and linearity. Since one of the main purposes is to detect contamination, one must work in the blue and with a suitably placed flat-field screen. Desired illumination homogeneity is 10% or better all over the chip. A point source is less well suited to check for contamination. Why do you need 3 different colors/wavelengths?

Reply:

The LED system (along with most of the rest of the FEROS-II project) is already implemented, and is working well. You can see the results of CCD tests, with all three sets of LEDs plus BetaLight system for comparison, at:

http://www.ls.eso.org/lasilla/sciops/2p2/E2p2M/FEROS/CCDTests/index.html

In particular see the results for the Red LEDs for the 225kHz, 1, low readout mode, which we have been taking on an almost daily basis for several months now.

The stability during a ~1hr period and the illumination homogeneity are not known at this moment but I will endeavour to measure them during my current tourno, and possibly before the ADC FDR.

Each colour of ADC is in fact a set of three, mounted on a ring installed in front of the FEROS camera. The plastic covers have been roughened to diffuse the light, so we hope that this is better than a point source.

We decided to implement the three different colours of LED as a test case basis. Since this is a relatively new technique which we may consider implementing for other instruments we decided to try to test it over a broad range of configurations.

The mounting ring does not produce any vignetting to the beam and so can be left installed permanently. The LEDs are remotely controlled. Thus there is no longer any need to enter the FEROS Climate Control Room to install and remove the BetaLight system previously used for CCDTests, though we can do so and will continue making BetaLight tests on a long term basis as a means of long term comparison.

HDe reiterated the benefits of using the CCDTest flats to monitor for contamination and to use the bluest available light source since blue light is more sensitive to contamination than red. JPr agreed to take both points into consideration for an update of the FEROS
Commissioning plan.

By: J.D.Pritchard

HDE-002
Document: User requirements 22400-0002 (issue 1.1)
Page: 5, 10

Comment: Why do lamps have to be pre-warmed? How long? This is not done on UVES.
Here, the lamp is just switched on first, then slides are moved in, detectors wiped etc. For repeated exposures, it is better to leave the lamp on at the end of the first exposure to avoid need for warm-up again and only to switch of at the end of the series.

Reply:

We have been pre-warming the lamps since I became FEROS instrument scientist. I had no good reason, it just seemed like a good idea to me, commonsense if you like...

However, it turns out that it is well known that minute variations in fibre position, temperature, light injection geometry and wavelength cause "Modal noise" in fibre fed high resolution spectrographs (see Baudrand & Walker, 2001, PASP, 113, 851). One regular FEROS observer (H.Hensberge whom you probably know well) has detected what appear to be variations in blaze profile from flatfield to flatfield (obtained just
minutes apart) which we are currently thinking maybe due to modal noise.
Certainly warming up the lamps might be helping to minimize this effect. In the daily Standard Calibrations obtained during daytime when we have "plenty" of time, we warm up the lamps for 5mins before using them and indeed leave them on while we acquire multiple exposures with the same lamp. Both a warmup delay and leaving the lamps on are handled with in the observing sequence files.

Unfortunately, due to the configuration of the FEROS Calibration Unit it is not possible to keep the lamps on while different lamps are being used since the lamps would contaminate each other.

There is also a small amount of light leak in SCIENCE exposures when the calibration lamps are left on during science exposures so we do not recommend to do so. Moreover we do not have a budget to supply enough lamps for continuous usage (the way for example it is done with HARPS).

JPr also agreed to provide HDe results of investigations into lamp stability vs. warmup time, should such an investigation eventually be made...

By: J.D. Pritchard

HDE-003
Document: User requirements 22400-0002 (issue 1.1)

Page: 7, warning system

Comment: A beeper on the instrument is not sufficient and anyway, the standard Pulpo beeper is very weak. One must have a way of calling the engineer who is on duty and normally not in the dome. Alarming him should not rely on SW. This can be used for monitoring, but not for alarms.

Reply:

GAn clarified that at LSO (unlike PO) the warning system is indeed already implemented via the observatory PAGER system, and apologized for any confusion caused by the use of the word beeper (instead of pager) in the User Requirements.

By: G. Andreoni

HDE-004
Document: User requirements 22400-0002 (issue 1.1)

Page: 11

Comment: The maximum image decentering of 0.2 arcsec seems a very tight requirement that should be reconsidered if it compromises the optical or mechanical design.

Replies:

We discussed this issue in the CDR and agreed to relax the constraint to the limit actually achievable by the proposed opto-mechanical design.

By: J. Pritchard

This looks like turning things around. I suppose that the main driver is scientific output, not the design. If you have reasons to relax the constraints, I'd welcome them very much. However, it seems to me that there is no point in having something that is technically easier but does not improve the instrument.
The 0.2 arcsec comes from some calculations I did (and confirmed by Donnelly et al.), actually 0.25 is the latest limit. This is to have a flux loss of less than 5%, but of course if we want to tolerate a larger loss, then the limit becomes less stringent.
You were not in the recipients of an earlier email where I explained this, so I'll send it to you soon afterwards.

BTW, I repeated the computations for a 0.5" FWHM seeing, see the attached graph, which is the same as the previous one, but replacing the 1.0" FWHM panel with the 0.5" FWHM.

This can be used to compare with Alain's simulation. For such a small seeing you need to displace the image by as much as ~ 0.6" to see a flux loss of 5%.

By: I. Saviane

HDe, if the requirement does not compromise the mechanical and optical design it is fine however I am not happy with this requirement.

HDE-005
Document: User requirements 22400-0002 (issue 1.1)

Page: 11 point 5

Comment: Why do you need a mode "preset to mean parallactic angle". Who would ever use it?

Reply:

Uhmmmm... don't know... at the time we wrote the ADC requirements, we simply tried to cover all possibilities. We have since agreed (private communication between Juan Carlos Guzman and myself) that we will accept "the standard VLT ADC implementation" which I understand to be "continuous" (i.e. with an update period of about 10sec) positioning.

By: J.D. Pritchard

HDE-006
Document: User requirements 22400-0002 (issue 1.1)

Page:15, 16

Comment: dispersion depends on P, T and RH. Will you use meteo monitor data to drive the ADC? If not, what will be the error you make by assuming "standard conditions". Is this error larger or smaller than the 0.2 arcsec that is your spec?

Reply:

See
http://www.ls.eso.org/lasilla/sciops/feros/Projects/ADC/index.html
where I did computations for a large range of parameters. For conditions typical of La Silla (relative humidity between 0% and 100%, temperature between 0 C and 20 C, and pressure between 765 and 775 hPa), the relative effects on the atm. diff. refraction are smaller than 0.2".

By: I. Saviane

The possibility to set the ADC according to actual environment conditions is already built into the standard VLTSW ADC implementation. It can be turned off by setting the relevant parameters to zero, which indeed is what is done for HARPS.

By: J.C. Guzman

SWC must provide documentation describing all parameters of the SWC ADC implementation so that SciOps can provide the relevant information for the definition of such parameters. This information should be provided well in advance (at least one month) of the final implementation of the system.

By: J. Pritchard

SWC is in the process of documenting this information for HARPS. The exact same information will be applicable to FEROS so that HARPS documentation can be consulted in due course.

By: J.C. Guzman

The relevant FEROS documentation will also need to be updated appropriately in due course.

By: J. Pritchard

HDE-007
Document: ADC optical design document 60400-0003

Page: 9, 10

Comment: My concern is stray light in WFI due to out of field objects being able to illuminate metallic surfaces of the fiber system, or other surfaces in the adapter. If this is not already planned, I recommend to paint all surfaces with optical black paint (black anodization is NOT sufficient) except those that must remain unpainted (e.g.spindles or drive belt).

- Place concentric baffles where possible, at least at the entrance of the adapter and before the 1st lens of WFI. The ideal is that each pixel in WFI can see only the rear side of a baffle, for this one may have to place more baffle rings.

Reply:

It is planned in a slightly different way ... baffles, black velvet have been already used to decrease the stray light on the FEROS adapter with good success All mechanical parts close to the beam will need the same Pinhole test will be done to check.

By: A. Gilliotte

HDE-008
Document: ADC optical design document 60400-0003

Page: 10

Comment: "the use of ADC for ZD < 30 deg will be recommended". I thought it is permanently in the beam?

Reply:

No it must be removable since it clashes with one of the other components of the adapter (the Sliding Calibration Selection Mirror).

By: J.D. Pritchard

HDE-009
Document: ADC optical design document 60400-0003

Page: 15

Comment: Super Triolin is a good choice but one should realize that the slopes outside the passbands are very steep. Anyway, the same coating is used in FEROS so this should be no problem.

Reply:

Choice made according to the recommendations of HDe.

By: A. Gilliotte

HDE-010
Document: ADC optical design document 60400-0003

Page: 16

Comment: Please explain the philosophy behind the requirements on prism rotation (2 deg) and tilt prism angle (1 deg). Do you mean that tolerances are +/- or total range?

Reply:

The two deg is in rotation on both prisms to adjust correction according ZD expecting a prism relative angle error of 4 deg. The +/-1deg is the tolerance for mechanics to ensure the prism mounting with respect the beam. These are tolerances NOT total ranges.

By: A. Gilliotte

HDE-011
Document: ADC optical design document 60400-0003

Page: 16 manufacture

Comment: I would have expected prism manufacturing drawings. What are the tolerances on surface flatness/radius, prism angles, clear apertures etc.

Reply:

Drawings created and supplied via email, to be added to design document. Also an error in the prism diameter was detected (12.0mm, but should be 12.5mm) and it was pointed out that tolerances on the prism angles should be included in the drawings.

By: A. Gilliotte

HDE-012
Document: ADC optical design document 60400-0003

Page: Acceptance tests of prisms.

Comment: The document does not explain the acceptance criteria and tests that will be done on the prisms by Fichou or at La Silla, before AIV of the complete unit. How do you know that you got what you ordered? What is the design wavelength (undeviated wavelength) of the prisms? Do you intend to measure it; what will be the effect if this is not the design wavelength?
Reply:

We will do a check here with collimated light and UG1 filter measuring the distance between both corresponding images according design using a lens of focal 100 or 300. Both prisms in opposite angle positions will give blue/red images on axis. Between ZD 0 and 60 deg and the ADC correction with counter-rotating prism the image moves within the parallactical angle by 2.5 arcsec meanwhile a ZD fixed to zenith and parallactic angle rotation the image doesn't moves. But with a differential guiding (as used on ADC) the image displacement should be compensated by the guiding. With the rotation I could not answer about undeviated wavelength.... it is changing by prism rotation. The phenomenon of image wobble was also discussed. Imperfections in the manufacturing meaning the prism angle is not precise and/or imperfections in the glasses themselves will mean that the stellar image will in general be offset from the expected on-axis position. A tolerance on the decentering caused by this effect should be established. And of course this effect must be characterized and verified to be within the defined tolerance during AVI commissioning.

By: A. Gilliotte

HDE-013
Re.: AIV procedures for ADC

Comment: A description of the AIV procedure is missing, both for the prisms but also for the complete facility. Before you order the prisms you should know how you will perform the following tests:

- Image quality and focus location.
- Image wobble when rotating prisms.
- Direction and alignment of prisms dispersion axes, relation with encoder values.

Reply:

ADC prism will be integrated on the support arm on the lab. The prism angle position (dispersion axes) is required to manufacturer to be marked on each unit. The orientation mark will be used for mounting. Simulation on lab will allow the dispersion axes check for different ZD values the same collimated light test bench mentioned above could be also used with one and two mounted prisms. The mounting of the ADC support arm on the adapter will be done at the theoretical back focal lens position for the prism. An F/8 beam using a sighting telescope will be aligned on M3 center and fiber spot to simulate the telescope beam the prism rotation wobbling effect has to be check for zenith prism
angle (no correction) rotating both prisms on the same direction with the same offset. The Harps setting will be used with the calculated prism position. The M3 field inversion on the reflection plane will reverse N/S dispersion effects.

By: A. Gilliotte

It was agreed that the AVI commissioning procedure must be included in the Optical design document. An action item will be created to follow up on this.

HDE-014
Re.: Commissioning of ADC

Comment: You may want to (temporarily?) install a filter like UG1 in the viewer. This has two passbands, at 350 nm and 750nm. In good seeing, this will produce a double or elongated image, if the ADC is not working correctly. An alternative is to compare image location in U and R filters, but I do not know if the slit viewer has a filter wheel and in that case the filters should be highly accurate (no wedge). Using filters will be a more sensitive method than merely measuring the wavelength-dependent flux at the fiber output, although of course this is the ultimate test. Filters will also be helpful to debug the SW to drive the ADC.

Reply:

The UG1 solution will be appropriate, since we do not have a filter wheel. The Fibre head viewing technical CCD can be used to test alignment once installed in the telescope.

By: J.D. Pritchard

Beam footprint at ADC:

HDe asked what will be the beam footprint at the prism. AGi responded that the beam size at the first prism surface (in terms of the light path from the telescope) i.e. the entrance surface, will be 6.9mm, while at the exit surface it will be 6.0mm.

Prism rotation:

JPr commented that on page 4 of the mechanical design document (2p2-TRE-ESO-70400-0001) it is stated that "The prisms can rotate endlessly but only in one direction". This is incompatible with the requirements of operation since as ZD decreases the prisms must be rotated in one direction and as ZD increase they must be rotated in the other.

It was explained by JAl that this property results from the desire to avoid backlash, which is expected to be of the order of 1 degree for the non "zero backlash" gears used in the current mechanical design, which were chosen over the zero backlash gears due to space constraints.

It was agreed that the resolution of this problem would be handled by an action item which would follow the following procedure:

1) ISa will verify the required prism rotation accuracy. The current user requirement specifies an accuracy of +/- 1 degree, which constrains light losses to less than 5%. He will check on light losses for an accuracy of +/- 2degrees.

2) Depending on the outcome of ISa's study, JPr will decide on the final user requirement for the prism rotation accuracy.

3) Meanwhile JAl will make a complete prism rotation accuracy error budget analysis for the currently proposed solution.

If the error budget derived by JAl is within the final user requirement no further action will be required.

If not the MEC design will need to be reconsidered, probably it will be necessary to find a way to implement the zero backlash gears.

If neither of these two possible solutions can be reached, a redesign and further Design Review(s) will be required.

HDe raised concerns over the tolerance of the ADC to Fibrehead distance.

The optical design document (2p2-DSD-ESO-60400-0003) states a tolerance of 0.2mm. HDe feels this to be unnecessarily restrictive. AGi states that the tight tolerance is due to small radius of curvature of the prism surface used to correct for the de-focusing caused by the prism optics. Resolution of this item will be made following the procedure below.

It was also noted that the curved surface will cause a change in the focal ratio of the beam exiting the ADC (and hence arriving at the fibrehead). This phenomenon should be documented in the Optical design document, along with an impact study describing the resulting effect on the optical system.

1) AGi and HDe will together derive the ADC/Fibrehead distance tolerance upon which they both agree.

2) Meanwhile JAl will verify if achieving the currently defined tolerance (or the new tolerance derived by AGi and HDe should it be less than the currently defined one) is practical from the mechanical perspective.

3) Meanwhile JPr will verify if the curved surface for focus correction is actually justified. The issue is after applying the necessary M2 focus offset to correct for the de-focus caused by flat prisms, will the image quality in the TCCD field be suitable for
guiding on field stars.

If there is no signifcant mechanical problem to achieve the currently defined tolerance (or the new tolerance derived should it be less than the currently defined one) then the action item is resolved.

Otherwise if the M2 focus change is acceptable then the optical design can be changed to remove the curved surface.

If neither of these two possible solutions can be reached, a redesign and further Design Review(s) will be required.

4.2. Sign off

Dear John,

Here is my "sign off" on the Action Items:

(i) Prism rotational positioning tolerance
(ii) Prism/Fibrehead distance tolerance
(iii) Documentation of AVI Commissioning procedure
(iv) Corrections and additions to Optical Drawings
(v) F-ratio change calculation and impact study

Issue (i) is not in my scope, but I believe that is has been satisfactorily resolved.

The updated optical design report by Alain clarifies the issues (ii) to (iv) in a good way.

On issue (v), which is related to the way the defocus introduced by ADC is compensated, the report lists the consequences of either choice, and an alternative, but makes no recommendation (see p. 16).

My view is as follows:

I consider the F/ratio due to a curved surface on the ADC change important since the faster F/7.6 beam will be at least partially vignetted in the spectrograph. The amount of vignetting depends on the extent to which the spectrograph accepts a faster beam than the nominal one. Changing the F/no will thus affect flux calibration. If the spectrograph fully accepts the faster beam, there will be no vignetting, but there may be an issue of changing spectrograph PSF because the beam on the detector with ADC in, is faster than without. In practice one is likely to get a combination of both effects.

With a single set of ADCs, the use of plane ADCs and refocusing the telescope to bring the object in focus on the fiber will cause a defocused sky on the sky fiber. As long as there is really only sky on this fiber, this will have no effect on sky subtraction accuracy and one set of ADCs will be fully adequate. Apart from the photometric light loss in the ADC, there are no consequences for flux calibration and also the spectrograph PSF is not affected.

The alternative mentioned by Alain to install a second set of ADC prisms in the free ADC position is especially useful if you want to perform nod and shuffle, and use both fibers as object fibers in an alternating fashion. Even if this is not being planned now, it seems a good idea to order two or even three sets, also in view of the low cost of the ADCs.

Best regards, Hans

September 3, 2004