ARGOS White light source

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Change Record

Issue	Date	Section/ Paragraph Affected	Reasons / Remarks	Name
1.0	08.11.2010	all	created	Peter

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1 Scope

2 Applicable documents

No.	Title	Number & Issue
AD 1	ARGOS FDR documentation	1.0
AD 2	led_532nm_rev2_nr1_3nm	1.0

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3 Introduction

The ARGOS Calibration Unit is used for several applications

1. As light source for a system test during day time
2. To calibrate the laser interaction matrices
3. To measure non-common path aberrations.

In order to fulfill the tasks stated above a white light source to illuminate LUCIFER and the FLAO is used. This source is also used for the alignment of the Calibration unit itself. The white light source is launched in the center of the ASM and then reflected off the first surface of the calibration unit.

3.1 Light source requirements

From the FDR documentation [AD1] the following requirements for the light source can be extracted:

Fiber size	10 µm
Brightness*	
wavelength	600-1600 nm

* The necessary brightness is calculated for the FLAO as on LUCIFER the requirements are much less as the integration times are much longer:

-Number of subapertures of the WFS *N*: 700
-Number of photons per subaperture *S*: 1500
-readout time *t*: 1 ms
-Energy per photon (hc/λ@800nm) *E*: $2.5 * 10^{-19}$ J
- Light reflected off CalUnit *C*: $(0.14 * 1m/0.014m)^2 = 0.01$
- Reflectivity of CalUnit *R*: 0.04
-assumed telescope transmission *T*: 0.5

→ total power needed at detector *P*: $P=NSE/t=2.6 * 10^{-10}$ W
→ total power needed at laser *L*: $L=P/CRT=2.6\ 10^{-10}$ W/0.01/0.04/0.5=**1300 nW**

The total power needed from the light source within the range of 600-1000 nm (FLAO filter) is **1300 nW**.

3.2 Measurement of the light source and consequences thereof

As light source we plan to use a 20 W halogen lamp. Two options are there:

- A self-made lamp steered by a commercial power supply
- An Ocean optics 20 W lamp which is remotely dimmable

In order to decide the output of the self made lamp and of the Ocean optics LS1 (6.5 W) lamp which is in house is tested. The measurement was done with a PM100 powermeter from Thorlabs and the PM122 sensorhead. The measurement was performed with 5 different wave length positions of the powermeter : 700nm, 775nm, 850nm, 925nm, 1000nm.
Note that this is NOT a measurement for the power at the specific wavelength but a measurement of the total power IFF the power was emitted at this wavelength.
The regime of emitted light was limited by a Thorlabs Filter FGB25 (see Figure) and the sensitivity of the sensor head (700-1800 nm).

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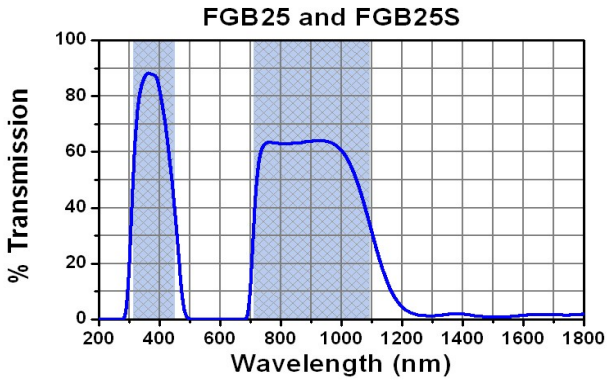

Figure 1: Transmission of the Thorlabs FGB25 Filter

Wavelength [nm]	Light source off [nW]	Light source on [nW]	Difference [nW]
700	2500	3450	950
775	1690	2330	640
850	1182	1628	446
925	892	1231	339
1000	713	981	268

From the spectrum of a halogen lamp (Figure) the relative parts of the power contributions for the different wavelength are: 0.248,0.283,0.248,0.163,0.057

so in total the power P is:

P = 0.248*950 nW+0.283*640 nW+0.248*446 nW+0.163*339 nW+0.057*268 nW=598 nW.

Taking the filter into account :

P = 598 nW/0.62 = 964 nW

For a 20W lamp this makes **2966 nW**.

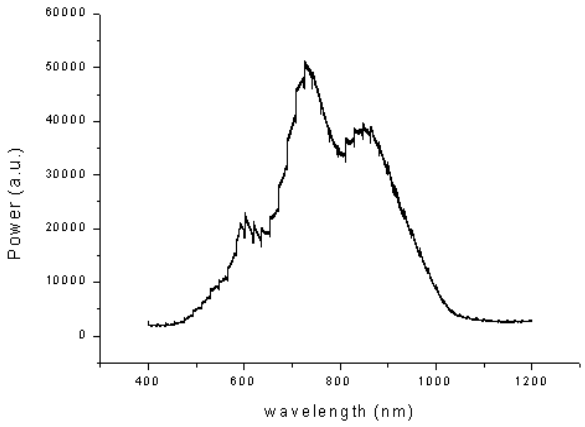

Figure 2: Spectrum of a halogen lamp

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The prototype of the self made lamp is a factor 3 less performant.

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