

Wavefront sensor Entrance Window procurement

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Change Record

Issue	Date	Section/ Paragraph Affected	Reasons / Remarks	Name
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1 Scope

The document resumes the characteristics and the specifications of the ARGOS wavefront sensor (WFS) Entrance Windows (EW). These informations have been provided by the customer (ARCETRI Observatory) to different manufacturers. Custom Scientific, Inc. has been selected as the best competitor and they will be commissioned with the production of 7 units of the EW, in the text it will be referred as producer.

2 Applicable documents

No.	Title	Number & Issue
AD 1	ARGOS_FRD_015b_Wfs	
AD 2	Custom Scientific offer	Qi-8579E

3 Introduction

The EW of the wavefront sensor (WFS) are placed close to the laser guide star (LGS) focal plane. They are used to feed the light from/to the different sub-systems of the WFS (see Figure 1). They act as:

- Field stop for the LGS beams. They transmit to the WFS a field of 4.7 arcsec.
- Their back side is used as reflecting surface: it has to feed the light from the internal calibration unit to the WFS.
- The first surface has to reflect an annular field of view (FoV) of 60 arcsec to the WFS patrol cameras.

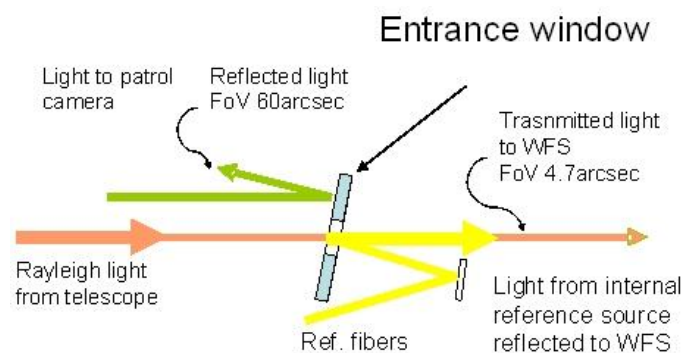


Figure 1. Sketch of the working principle of the ARGOS WFS Entrance Windows. The telescope light is coming from left. Depending on the incoming angle of the light the beam can be transmitted inside the WFS module or it can be reflected toward the WFS patrol cameras. The rear surface of the EW is used to reflect few percent of the WFS internal calibration source toward the detector.

4 Customer specifications

Figure 2 shows the design of the EW. This optic is composed by two elements: the first one is a 4mm thick plane-parallel window drilled in the center of the front surface. The second one is a 6mm thick wedged window. The optical surfaces (OS) of the EW are described in detail.

- OS 1: it is drilled with a thru-hole of (3.0 ± 0.1) mm diameter. The hole axis is inclined by (21.0 ± 0.1) deg with respect to the normal to the OS 1. It is polished to ensure a $\lambda/4$ surface quality over the clear aperture. It is dielectric coated to ensure a reflectivity of $>95\%$ at 532nm.
- OS 2: the rear surface of the first element of the EW is commercially polished and black-painted to block the few percent of light transmitted from OS 1 to reach the WFS. This surface is wedged by (1.0 ± 0.1) deg with respect to OS1.
- OS 3: it is polished to ensure a $\lambda/10$ surface quality and it is coated to ensure a $T > 99.5\%$ at 532nm over a 30mm diameter patch, centered on the optical axis.
- OS 4: same polishing and coating of OS 3. It is wedged by 1deg with respect the OS 3.

It is expressly asked to mark on top (see Figure 2) each one of the two elements of the EW to ease the procedure of integration of the EW in the WFS module.

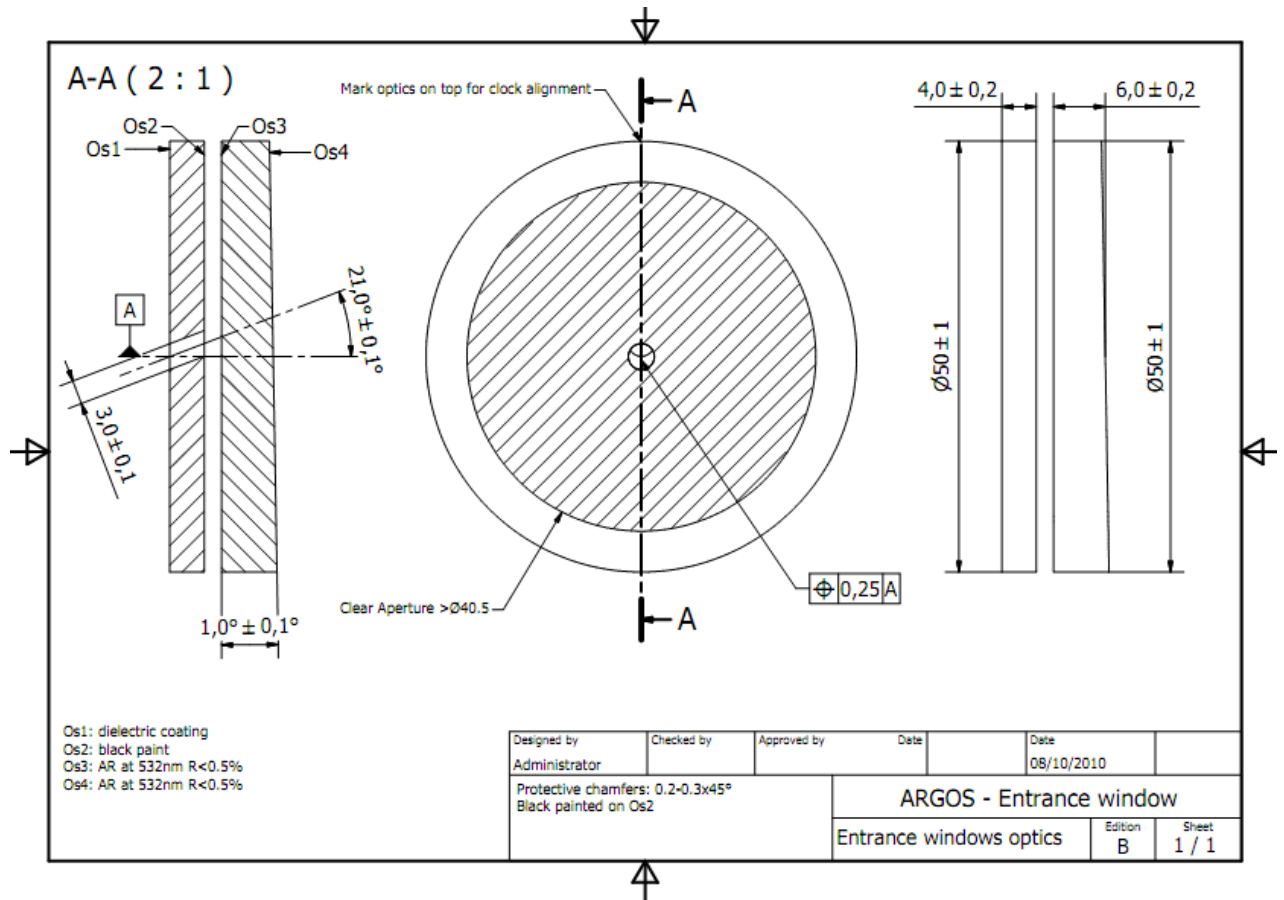


Figure 2. Drawing of the EW. The manufacturing and coating specifications are described in the text. The angles tolerance here is 0.1deg that corresponds to the customer goal specification. A 0.3deg tolerance can be acceptable as baseline.

Table 1 resumes the detailed specifications provided by the customer for the EW.

In addition the environmental specifications that have to be considered choosing the proper substrates are:

- Storage temperature range: -30 to 80°C.
- Working temperature range: -20 to 25°C.
- Humidity: up to 95%.
- Pressure: 650 to 1300mb.

Req	Geometry and material	Specification	Notes
1	Material	BK7	Or equivalent for both element 1 and 2.
2	Shape and dimension	Circular, D=(50.0±1.0)mm	For both elements.
3	Optical area (clear aperture)	Circular, D=40.5mm minimum	If the physical dimension is not big enough to provide a 40.5mm optical area the dimension can be increased.
4	Thru-hole shape and dimension	Circular, D=(3.0±0.1)mm minor diameter	
5	Thru-hole axis inclination	(21.0±0.3)deg <i>baseline</i> (21.0±0.1)deg <i>goal</i>	Rotation with respect to the optical axis (see Figure 2).
6	Thru-hole chamfers	Minimum	On both OS 1 and 2.
7	Element 1 thickness	(4.0±0.2)mm	
8	Element 2 thickness	(6.0±0.2)mm	Central thickness.
9	OS 1 shape and irregularity	Flat, $\lambda/4$ ptv across clear aperture	
10	OS 2 shape and irregularity	Flat, commercial polish	
11	OS 3 shape and irregularity	Flat, $\lambda/10$ ptv across any 10 mm dia. circle within the central 30 mm dia. circle.	The 2 nd element is placed on the LGS focal plane. The beam footprint on OS 3 is less than 1mm in diameter. The surface quality can be checked on patches of 1mm diameter a central area of 30mm diameter.
12	OS 4 shape and irregularity	Flat, $\lambda/10$ ptv across any 10 mm dia. circle within the central 30 mm dia. circle.	See note of Req. 11.
13	OS 3 wedge wrt OS 4	(1.0±0.3)deg <i>baseline</i> (1.0±0.1)deg <i>goal</i>	
14	Scratches and digs	40/20	
15	Working angle	21deg	
16	Maximum distance between OS 1 center and thru-hole center	0.25mm	
17	OS 1 coating	R>95% @ 532nm	Dielectric coating is preferred for its resistance to environmental aging.
18	OS 2 coating	Black-paint	A sample of black-paint must be provided once the order is placed.
19	OS 3 and OS 4 coating	T>99% @ 532nm	High transmission V-coating, only on the central part of 30mm diameter.
20	# of units to produce	7	

Table 1. Summary of the customer specifications for the WFS Entrance Windows.

5 Procurement

The procurement of the WFS EW consists of the following items:

1. Sketch of the EW from the producer for acceptance from the customer.
2. 2 float glasses with samples of the black-paint of Req. 18.
3. 7 units of the EW (2 elements each).
4. Freight and handling in a proper box to avoid contamination from humidity and dust.

All the items must be addressed to:

Lorenzo Busoni
INAF - Osservatorio Astrofisico di Arcetri
Largo E. Fermi 5
50125 Firenze
Italy
Tel: +39.055.27.52.202
Fax: +39.055.27.52.292
e-mail: lbusoni@arcetri.astro.it

The delivery time for the items 1 and 2 is fixed to 2 weeks after the placing of the order. The term for the delivery of items 3 and 4 is 9-14 weeks customer's sign-off on final dimensions.

6 Payment plan

- Payment due upon 30 days from receiving of the items 3 and 4.
- Payment by bank transfer.
- Customer is responsible for bank transfer fees, import duties and custom fees.

End of document