

MRO Delay Line

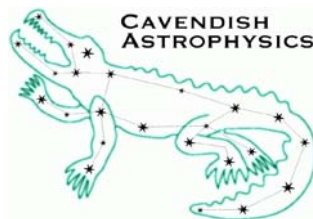
Specification of the Science and Metrology Windows for the MROI Delay Lines

INT-406-TSP-0004

The Cambridge Delay Line Team

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Change Record

Revision	Date	Author(s)	Changes
0.1	2009-05-27	MF	Initial draft
0.2	2010-01-26	MF	Corrections
0.3	2010-02-25	MF	Revised wave-front spec to be on transmitted beam rather than surfaces because Infrasil 301 can still have significant refractive index variations. Placed parallelism spec on metrology windows
1.0	2010-03-18	MF	Revised science window transmitted wave-front spec to 1/10 th wave to be consistent with optical budget. Revised metrology window parallelism to 1 arc-minute.
1.1	2010-04-20	MF	Added words to section 3.1 and a clear aperture of 40mm to the metrology window specifications.

Objective

To present the manufacturing specifications for the science and metrology windows for the MROI delay lines.

Scope

The specifications produced are for the science window and the two metrology windows of the delay line. The science window specification also covers the windows that would be introduced to preserve the vacuum when the removable section of the beam relay pipe is not installed. The science window specification also covers the window at the telescope end of the beam relay pipe.

Reference Documents

RD1 Top Level Requirements INT-406-TSP-0002

RD2 MROI Delay Line Derived requirements INT-406-VEN-0107

RD3 Draft window specifications for the MROI delay lines

RD4 Internal memo on parallelism requirement of science windows

Applicable Documents

AD1 Drawing of science window

AD2 Drawing of metrology window

Acronyms and Abbreviations

BCA Beam Combining Area

Interferometer

BCF Beam Combining Facility

MRAO Mullard Radio Astronomy Observatory

BRS Beam Relay System

NMT New Mexico Tech

DL Delay Line

OPD Optical Path Delay

DLA Delay Line Area

SCS Supervisory Control System

ICD Interface Control Document

TBC To be confirmed

ICS Interferometer Control System (now SCS)

TBD To be determined

MROI Magdalena Ridge Observatory

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1 Introduction

The science and metrology windows have differing requirements but are present here in one document. The science window is approximately 150mm in diameter and the metrology window is approximately 50mm in diameter. Both are subject to vacuum on one side and atmospheric pressure on the other. The science window must operate over a wide waveband while the metrology window need only operate at the laser wavelength and therefore the coatings are quite different. The science window specification is also suitable for the beam relay windows.

2 Science Window

2.1 *Science Window Requirements*

The requirements of the science window and the justification for most of the design parameters are presented in RD3. The requirement on parallelism of the window is set out in RD4 and further requirements are specified in RD2.

An additional requirement is placed on the tolerance of the thickness of the window in order to achieve a suitable vacuum seal from a single O-ring design. Although for reasons of longitudinal dispersion the windows should be matched to 0.5mm in thickness, the mechanical design of the window holder requires a tolerance of ± 0.1 mm to be adhered to. Note that normally just two science windows would be used giving a total of 30mm in thickness but at times a further two windows would be introduced, doubling this thickness, when a section of beam relay pipe is removed.

2.2 *Science Window Specifications*

The following subsections list the detailed manufacturing specifications for the science windows.

2.2.1 Dimensions

Circular with diameter 150mm ± 0.25 mm

Clear aperture required: 140mm

Thickness 15mm ± 0.1 mm

Chamfer 1mm at 45° both edges

2.2.2 Optical quality

Transmitted wave-front quality: $\lambda/10$ (633nm, peak-valley) over any 125mm diameter patch within the clear aperture.

Surface quality: 40-20 scratch dig, or better

Surface parallelism: 10 arc-seconds

Sub-surface damage: consistent with surface quality and safety for operation as a vacuum window.

2.2.3 Material

INFRASIL 301

2.2.4 Coating

No coating

2.2.5 Suitable suppliers

ICOS, OSL (see section 4)

3 Metrology Window

3.1 Metrology window requirements

Other than the specifications given below there are no particular requirements on the metrology windows. The tolerance on the thickness specification arises out of the design of the holder and vacuum seal rather than any optical considerations. It is intended that catalogue listed windows should be able to fulfil the requirements and the dimensions were chosen to suit this.

3.2 Metrology Window Specifications

3.2.1 Dimensions

Circular with diameter 50mm \pm 0.2mm
Clear aperture required: 40mm
Thickness 10mm \pm 0.1mm
Chamfer 0.5mm at 45° both edges unless stock item

3.2.2 Optical quality

Surface figure: $\lambda/10$ or better for each face
Surface quality: 60-40 scratch dig, or better
Surface parallelism: 1 arc-minute or better

3.2.3 Material

BK7 or fused silica

3.2.4 Coating

MgF₂ ¼ wave at 633nm

3.2.5 Suitable suppliers

Melles-Griot

4 Suppliers

IC Optical Systems Ltd
190-192 Ravenscroft Road
Beckenham
Kent BR3 4TW
United Kingdom

Optical Surfaces Limited
Godstone Road
Kenley
Surrey CR8 5AA
ENGLAND