EUROPEAN SOUTHERN OBSERVATORY

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

VLT PROGRAMME

VERY LARGE TELESCOPE

MACAO BEAM EXPANDER

Technical specifications and statements of work

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Change Record

Issue	Sections affected	Date	Description
1.0	***All***	***1/12/2000***	**first issue**

Table of Contents

1 Applicable documents

AD1	Beam expander	VLT-DWG-ESO-14710-134100
AD2	Box	VLT-DWG-ESO-14710-134100-0001
AD3	M1 R50 Parabola	VLT-DWG-ESO-14710-134100-0002
AD4	M2 R150 Parabola	VLT-DWG-ESO-14710-134100-0003

2 Scope

ESO is currently building for its 8 m telescopes, several adaptive optics facilities based on bimorph deformable mirror and “curvature sensor” wavefront analysis.
This document describes the technical specifications of the beam expander optics of the wavefront sensor and the work to be undertaken by the Contractor.

3 Statement of work

3.1 Contractor undertaking

The Contractor shall perform the following activities:

- Procurement of the mirror blanks
- Manufacturing of the mechanical structure
- Manufacturing of the mirrors
- Coatings
- Integration of the mirrors in the mechanical structure
- Acceptance tests
- Packing and transport to ESO Garching
- Documentation

3.2 Project planning

Kick-off meeting, place of contract	T0
Final Design Review (FDR)	T0 + 2 months
Provisional acceptance	T0 + 7 months
Final acceptance (end of warranty period)	T0 + 32 months

3.3 Deliverable items

The following items shall be supplied:

- 7 beam expander optics
- test reports
- transport boxes
-

3.4 Price inquiry replies:

The replies to the call for tender shall contain:

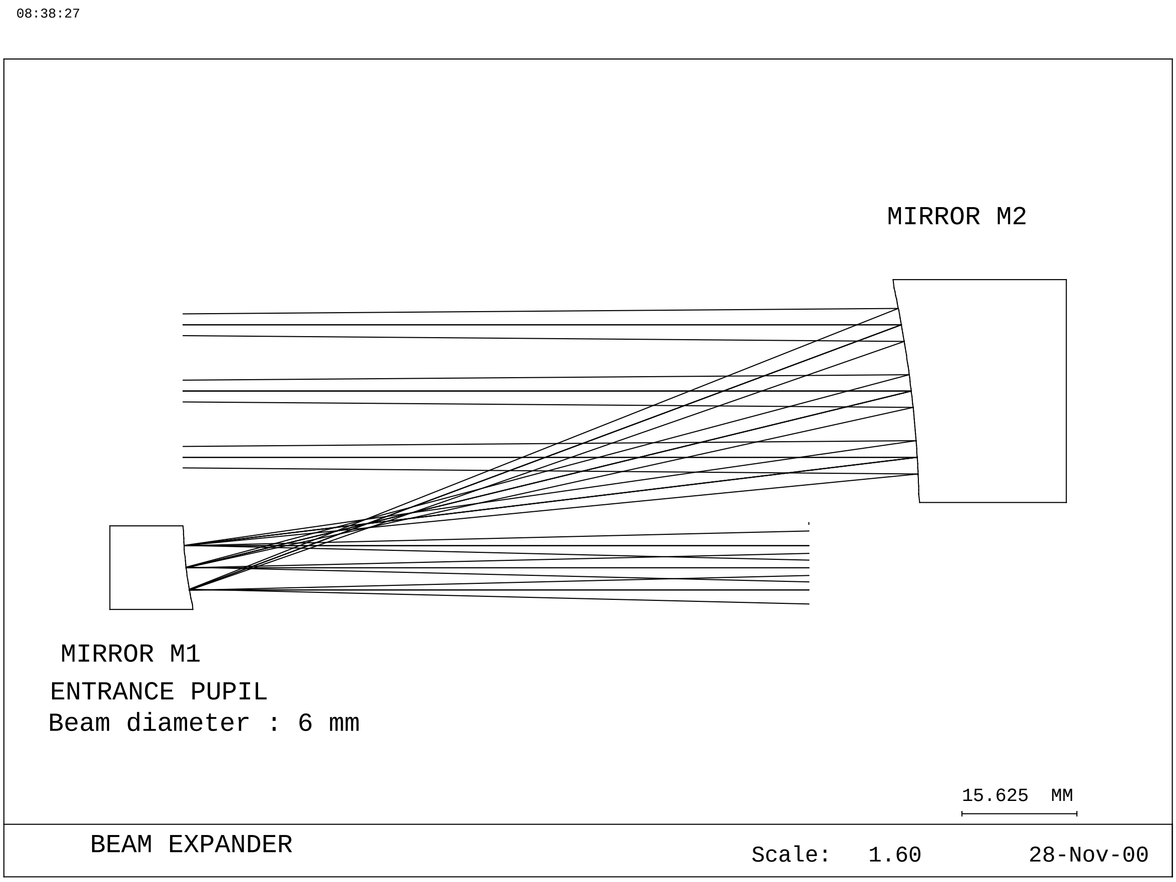
- Statement of compliance to the ESO technical specifications
- Data on lifetime of silver protected coatings on aluminium mirrors
- Cost of 7 beam expander units
- Cost of one additional beam expander unit
- Testing cost
- Project plan and delivery schedule
- Duration of warranty period

4 Technical Specifications

4.1 System description

The beam expander is made of 2 off-axis parabolas (mirror M1 and M2). The entrance pupil is placed on the first mirror. The beam expansion coefficient is 3.

The following figure shows the optical layout of the system:



4.2 System technical specifications

Drawing VLT-DWG-ESO-14710-0-134000 provides an opto mechanical overview of the beam expander unit

The following system specifications shall be met:

1st order optical specifications:

beam expansion : 3.0 +/- 0.1

Image quality specifications:

Wavefront error of the optics : 100 nm rms (wavefront error in single path)

Cosmetic specifications:

- Rms surface finished better than 3nm rms. If diamond turning is used, the grating effects resulting from this manufacturing process must be removed by post polishing.
- Scratch and dig: DIN 3140/7 5/2x0.040

System transmission:
All mirrors shall be coated with protected silver coatings. The following reflection shall be achieve:

- Wavelength range : 450 to 1000 nm
- Average efficiency (for each individual mirror): > 97%
- Absolute efficiency (for each individual mirror): > 95%

Mechanical Surface treatments:
All mechanical surfaces shall be black anodised excluding contact and coated surfaces (see drawing VLT-DWG-ESO-14710-0-134100-0001.

4.3 Optical prescriptions

Angular field of view: 1.5º radius

- M1
  - Shape: Off-axis parabola concave R=50.0 mm
  - conic constant : -1 (parabola)
  - off axis distance of the optical axis: -6.00 mm
  - Dimensions (see drawing): VLT-DWG-ESO-14710-0-134100-0002

- M2
  - Shape: Off-axis parabola concave R = 150.0 mm
  - conic constant : -1 (parabola)
  - Off axis distance of the optical axis: 18.00 mm
  - Dimensions (see drawing): VLT-DWG-ESO-14710-0-134100-0003

Air space M1-M2 : 100.00 mm

If diamond-turning process is chosen the following material shall be selected:
- Mirrors: ALMg1SiCu (6061)
- Housing: ALZnMgCu 1.5 F48 (7075)

4.4 Environmental specifications

The system specifications shall be met during operation or after transport under the following conditions:

Thermal

- Operation: 0 to 15°C.
- Storage (in storage box): -5°C to 30°C, with instantaneous gradients of 20°C applied to the outside of the box as this could happen when the box is taken from a heated laboratory to the telescope.
- Transport: the temperature range shall be restricted to that of storage, taking special precautions if necessary.

Relative humidity

5 to 100%

Maintenance

- The items shall not require periodic maintenance actions in particular regarding re-coating.
- Cleaning of optical surfaces and mechanical parts shall be possible using standard techniques.

Motion

The wavefront sensor unit will operate in all orientations.

Lifetime

The optical coatings and the mechanical surface painting must not degrade for 10 years.

5 Provisional acceptance tests

Provisional Acceptance shall cover the following requirements. The tests are executed at room temperature. Results shall be recorded in a test report. ESO representatives shall be present. The Contractor may propose alternative test methods, which, however, shall address all requirements

General items to be checked are:

Requirements	**Check/Test methods**
Material	Certificates of material quality
Dimensions	Check of conformity of mechanical dimensions and surface finish with interface and design drawings
Beam expansion Coefficient	The contractor is free to propose a measurement method.
Image quality	Interferometric measurement
Surface roughness	The contractor is free to propose a measurement method
Scratch and dig	Visual inspection
Transmission efficiency	Measurement can be done on samples