REQUISITI TECNICI

(TECHNICAL SPECIFICATIONS)

In relazione alla fornitura di interferometri per STILES, nell'ambito della proposta progettuale IR0000034 STILES "Strengthening the Italian leadership in ELT and SKA", ammessa a finanziamento nell'ambito degli "Interventi" previsti dalla "Missione 4", denominata "Istruzione e Ricerca", "Componente 2", denominata "Dalla Ricerca alla Impresa" ("M4C2"), "Linea di Investimento 3.1", denominata "Rafforzamento e creazione di Infrastrutture di Ricerca", del "Piano Nazionale di Ripresa e Resilienza" ("PNRR") – WP5000 – 5102-5103

CIG (LOTTO 1): B108779D97 CIG (LOTTO 2): B10877AE6A   CUP: C33C22000640006

PROJECT OVERVIEW

In the framework of the "Piano Nazionale di Ripresa e Resilienza" (PNRR) and within the project **STILES** ("**Strengthening the** Italian leadership in ELT and SKA") the INAF–Osservatorio Astrofisico di Arcetri (INAF-OAA hereafter) aims to procure the hardware components to allow the realization of two test benches dedicated to Research and Development (R&D) activities in the field of the next generation of Adaptive Optics systems.

Specifically, these are the AO-Cascading and AO-Petalometer test benches: the former dedicated to study the Extreme Adaptive Optics (XAO) technique for planet finding instruments at ELT and the latter dedicated to the solution of the piston control on the ELT segmented pupil.

Further details of the **STILES** project can be found on the webpage:

https://pnrr.inaf.it/progetto-stiles/

PROCUREMENT DESCRIPTION

The INAF–OAA aims to procure two state-of-art interferometers for the activities **5102-5103** of the **STILES** project.

The procurement consists of the supply of the following items:

Lot #	Lot description	Q.ty
1	Dynamic Fizeau interferometer, 100 mm beam aperture, including control workstation and associated accessories: ● 1x Fizeau interferometer compliant to the technical specification in the associated table; ● 1x 100 mm, Transmission Flat, 2%<Reflectivity<4%, lambda/10 PV ● 1x 100mm reference sphere, 5<F/# < 8 ● 1x 100mm Mounted Pellicle Attenuator (25%<attenuation<35%)	1
2	Dynamic Twyman Green interferometer, equipped with motorized controls, provided with control workstation and accessories: ● 1x Dynamic Twyman-Green interferometer, compliant to the technical specification in the associated table; ● 1x Test Mount #1: optics mount for 100 mm, three jaw chuck, tiptilt adjustment with micrometer ● 1x Test Mount #2: optics mount for 100 mm, three jaw chuck, 5 axis adjustment with micrometer ● 1x Optical bench guide for opto-mech mounts translation, 40 cm min length	1

PROPOSAL EVALUATION AND CRITERIA

The detailed description about proposal evaluation is given in "Disciplinare di gara". In particular, the analytical values associated with each requirement "Label" are indicated there, including the criteria to compute the proposal scoring.

REQUIREMENTS FOR LOT 1: Dynamic Fizeau interferometer and accessories

REQ #	REQ Description	Compliance Status	Label
	Mandatory Items		
1.1	System: The System shall be a Fizeau interferometer with test beam diameter 90mm<d<110mm and dynamic acquisition capabilities based on a single camera		M

1.2	Transmission Flat, same diameter, 2%<Refl<4%, lambda/10 PV		M
1.3	Reference sphere, 5<F/# < 8, same diameter		M
1.4	Mounted Pellicle Attenuator, same diameter (25%<att<35%)		M
	Critical Items		
1.5	System: the camera resolution shall be larger than 1kx1k		C
1.6	System: the internal source size shall be controllable (e.g. point source to extended, e.g. 1 mm diam.)		C
1.7	The digitization shall be 12 bit		C
1.8	Control: The pupil focusing shall be controllable remotely from the instrument		C
1.9	Control: Image zoom shall be controllable remotely from the instrument		C
1.10	SW: the sw shall allow the visualization of the modulation histogram		C
1.11	SW: the SW shall allow the selection of a modulation threshold (data points with lower modulation index will be discarded)		C
1.12	System: the device mass shall be lower than 20 kg		C
1.13	System: the device volume shall fit within 60 x 25 x 25 cm		C
1.14	System: the interferometer shall be equipped with a mechanical switch to block the laser output ("beam block")		C
1.15	The system (in the offered configuration) shall be an Off The Shelf item		C
1.16	The system (in the offered configuration) shall have a production and delivery record of at least 15 units		C
	Analytical Items		
1.17	System: The system shall operate with a laser of wavelength 632.8 nm		W
1.18	System: The digitization shall be modified with a configuration file		W
1.19	System: the camera resolution can be modified via SW or configuration file		W
1.20	The instrument shall be able to reconstruct the wavefront map when 300 fringes of equivalent tilt are detected by the camera at the lowest magnification.		W
1.21	The measurement precision shall be better than 0,5 nm RMS		W
1.22	The measurement repeatability shall be better than 0,5 nm RMS		W
1.23	Control: Camera exposure time/intensity shall be remotely controlled		W
1.24	Control: in temporal phase-shifting mode, the reconstruction algorithm shall be selectable by the user		W
1.25	It shall be possible to calibrate the phase-shifter device		W

1.26	The SW shall include a quality check of the phase-shifter calibration		W
1.27	The GUI shall allow the definition of a detector mask		W
1.28	It shall be possible to save/load a given detector mask		W
1.29	The GUI shall have a Zernike analysis worksheet		W
1.30	The GUI shall have a "continuous acquisition mode"		W
1.31	In "continuous acquisition mode" the GUI shall have a real time Zernike analysis worksheet		W
1.32	The GUI shall have a "live monitor" window		W
1.33	The GUI shall allow monitoring in real time the image intensity		W
1.34	It should be possible to process the raw frames with a downsampling of the CCD to speed up the procedure		W
1.35	The file format of the post processed data shall be .HDF5 or .FITS. If these formats are not available, proper libraries shall be provided to convert/read the data.		W
1.36	A scripting interface for the remote control and communication of the system shall be available		W
1.37	The remote scripting interface shall be programmable in Python		W
	The following functionalities shall be available with the remote scripting interface		
1.38	sc1: loading a configuration file		W
1.39	sc2: acquiring a wavefront map		W
1.40	The system can be stored safely in the temperature range 3°C to 35°C		W
1.41	The operational range shall be 18°C to 25°C		W
	DNHS, Certifications and Conformity Items (Mandatory)		
	Applicable to all electric/electronic items (e.g. instruments, workstations)		
1.42	- The OE provides the CE declaration of conformity		M
1.43	- The OE provides the EMC declaration of conformity		M

REQUIREMENTS FOR LOT 2: Dynamic Twyman Green and accessories

REQ #	REQ Description	Compliance status	Label
	Mandatory Items		
2.1	Interferometer: The System shall be a dynamic Twyman Green interferometer based on a single camera		M
2.2	The interferometer (in the offered configuration) shall be an Off The Shelf item, as demonstrated by a production and delivery record of at least 10 units		M
2.3	The interferometer shall include a fine adjustment mechanism for pupil focusing		M
2.4	The interferometer shall include a fine-adjustment of the fringe contrast		M
2.5	Test Mount #1: optics mount for 100 mm, three jaw chuck, tiptilt adjustment		M
2.6	Test Mount #2: optics mount for 100 mm, three jaw chuck, 5 axis adjustment		M
2.7	The opto-mechanical mounts shall have micrometers		M
2.8	Optical bench guide for opto-mech mounts translation, 40 cm min length		M
	Critical Items		
2.9	System: The frame rate shall be larger than 15 Hz at full resolution		C
2.10	System: The sampling frequency (in free run) can be set by the user.		C
2.11	System: the sampling shall be synchronized with an external trigger		C
2.12	System: The digitization of the camera shall be at least 10-bit.		C
2.13	System: it shall be possible to crop the camera to any user defined value (area and region-of-interest) via SW or configuration file		C
2.14	Control: if dynamic mode is not hardware default: switching to dynamic mode and dynamic mode calibration should be automatized		C
2.15	Control: The reference beam block shall be remotely controlled		C
2.16	Control: Camera exposure time shall be remotely controlled		C
2.17	Control: Camera Gain shall be remotely controlled		C
18	Control: pupil focusing shall be remotely controllable		C
19	Contro: fringe contrast shall be remotely controllable		C
2.20	Control: It shall be possible to load a given configuration file		C

2.21	The GUI shall allow the definition of a detector mask		C
2.22	It shall be possible to save/load a given detector mask		C
2.23	The GUI shall have a "continuous acquisition mode"		C
2.24	In "continuous acquisition mode" the GUI shall have a real time Zernike analysis worksheet		C
2.25	The GUI shall allow monitoring in real time the image modulation and intensity		C
2.26	It should be possible to acquire raw frames (i.e. the detector reading with no post processing)		C
2.27	It should be possible to process the raw frames with a downsampling of the CCD to speed up the processing		C
	Analytical Items		
2.28	System: The system shall operate with a laser of wavelength 632.8 nm		W
2.29	System: The test beam diameter shall be larger than 6 mm and smaller than 10 mm		W
2.30	System: The laser coherence length shall be greater than 100 m.		W
2.31	System: The minimum exposure time shall be lower than 100 μsec.		W
2.32	System: The digitization can be modified by the user with a configuration file		W
2.33	System: The camera resolution (full array) shall be 2kx2k		W
2.34	System: The frame rate shall increase when using a cropped array		W
2.35	System: The trigger input shall include an opto-coupled line		W
2.36	System: the measurement head shall be separated by the laser module		W
2.37	System: the laser source (if external) shall be connected to the measurement head by means of an armoured optical fiber, at least 5m lenght		W
2.38	System: the interferometer shall be smaller than 50 x 20 x 15 cm		W
2.39	System: the interferometer mass shall be lower than 7 kg		W
2.40	System: the laser source shall be powered up with a key or button		W
2.41	The instrument shall be able to reconstruct the wavefront map when 250 fringes of equivalent tilt are detected by the camera at the lowest magnification.		W
2.42	The measurement repeatability shall be better than 0,5nm RMS		W
2.43	The measurement precision shall be better than 1 nm RMS		W

2.44	It shall be possible to select the beam polarization (circular or linear)		W
2.45	Control: Image zoom or cropping shall be remotely controlled		W
2.46	Control: the reconstruction algorithm shall be selectable by the user		W
2.47	Control: the SW shall allow the user to select different reconstruction options or parameters to match the current test setup		W
2.48	Control: the SW shall include a functionality to reduce the cross-talk between the fringes pattern and the reconstructed wavefront		W
2.49	Control: It shall be possible to save the current instrument and SW configuration into a configuration file		W
2.50	The GUI shall allow the definition of an analysis mask		W
2.51	The GUI shall have a Zernike analysis worksheet		W
2.52	The GUI shall have a "live monitor" window		W
2.53	The file format of the post processed data shall be .HDF5 or .FITS. If these formats are not available, proper libraries shall be provided to convert/read the data.		W
2.54	The SW shall offer an island processing option to discard islands smaller than a given size (user-defined)		W
2.55	The SW shall offer a Zernike removal option on separated islands		W
2.56	A scripting interface for the remote control and communication of the system shall be available		W
2.57	The remote scripting interface shall be programmable in Python		W
	The following functionalities shall be available with the remote scripting interface (Sc)		
2.58	sc1: loading a configuration file		W
2.59	sc2: acquiring a wavefront map		W
2.60	sc3: collecting n raw frames and store them in the disk		W
2.61	sc4: post-process n raw frames into wavefront maps and save them onto the disk		W
2.62	sc5: enable/disable the trigger line		W
2.63	The system can be stored safely in the temperature range 3°C to 35°C		W
2.64	The operational range shall be 5°C to 30°C		W

2.65	The device can be operated at any orientation wrt gravity		W
	DNHS, Certifications and Conformity Items (Mandatory)		
	Applicable to all electric/electronic items (e.g. instruments, workstations)		
2.66	- The OE provides the CE declaration of conformity		M
2.67	- The OE provides the EMC declaration of conformity		M

PROCUREMENT AND BILLING REQUIREMENTS

The following requirements are applicable for both lots.

1. Packing, shipping and (optionally) insurance costs must be included in the lot(s).
2. As indicated in the "Disciplinare di gara", the proposal for each lot shall include all items with label (Mandatory), or the proposal will be discarded.
3. In case the contract is awarded, a separate invoice for each lot must be provided and the lot number must be clearly stated in the invoice.