Collaborative Research Agreement on SHARK-NIR

Between

L'Observatoire de Paris
French public academic and research institute, organized and existing under the laws of France and whose principal office is located at 61 Avenue de l'Observatoire, 75014 Paris, France.
Represented by its President, M. Claude CATALA
Hereinafter referred to as « OP »

Acting for and on behalf of the Laboratoire d'Etudes et Spatiales et d'Instrumentation en Astrophysique (LESIA, CNRS UMR8109), France (hereafter referred to as "LESIA"),

AND

INAF - **Osservatorio Astronomico di Padova**
Located at Vicolo dell'osservatorio 5, 35122 Padova, Italy,

Represented by its director, Prof. Roberto Ragazzoni for the purpose of this agreement,
Hereinafter referred to as « INAF »,

any or all of which are hereinafter referred to respectively as "Party" or as "Parties" to this Agreement.

RECITALS

A. WHEREAS part of the Parties' mission is to advance science and technology through bold and collaborative research.

B. WHEREAS the Parties recognize that they both have significant scientific and technical capabilities that are of potential benefit to their interest.

C. WHEREAS the Parties anticipate that the research contemplated by this Agreement will be of mutual interest and benefit to all of the Parties, and will further the instruction and research objectives of the Parties.

D. WHEREAS OP has the expertise to conduct the study and provide INAF with Four-Quadrant (FQPM) coronagraphs for the instrument SHARK-NIR.

Toward that end, the Parties hereby agree as follows:

ARTICLE 1 – Purpose of the Agreement

The Parties intend to collaborate on, and wish to define certain of their rights and obligations with respect to the Project entitled “FQPM for SHARK-NIR” described in the Statement of Work in Schedule 1 of this Collaborative Research Agreement (“this Agreement”).

The purpose of the Agreement is also to define the rules of the cooperation regarding the SHARK-NIR instrument.

Although the Parties will use reasonable endeavors to carry out the Project in accordance with schedule 1, the Parties do not undertake that any research will lead to any particular result, nor do they guarantee a successful outcome to the Project.

ARTICLE 2 – Scientific managers

Mr Pierre BAUDOZ, employee of OP Laboratory is the principal scientific manager of the Project. The principal scientific manager for INAF is Mr Jacopo FARINATO.

ARTICLE 3 – Meetings – Reports

The Parties’ principal scientific managers will provide to each other reports summarizing the progress of the Project and a confidential copy of all the Project Intellectual Property developed or invented at each Party.

Article 4 – Term

The Project will begin on January 1st 2018 and will continue for the duration of 5 years or until any later date agreed in writing between the Parties, or until this Agreement is terminated in accordance with article 7.

ARTICLE 5 – Confidentiality – Publications

Confidentiality:

5.1 Subject to clauses 5.4 and 5.5, each Party will use all reasonable endeavours not to disclose to any third party any Confidential Information nor use for any purpose except as expressly permitted by this Collaborative Research Agreement, any of another Party's Confidential Information.

5.2 No Party shall incur any obligation under clause 5.1 with respect to information which:

5.2.1 is known to the receiving Party before the start of the Project Period, and not impressed already with any obligation of confidentiality to the disclosing Party; or

5.2.2 is or becomes publicly known without the fault of the receiving Party; or

5.2.3 is obtained by the receiving Party from a third party in circumstances where the receiving Party has no reason to believe that there has been a breach of an obligation of confidentiality owed to the disclosing Party; or

5.2.4 is independently developed by the receiving Party; or

5.2.5 is approved for release in writing by an authorised representative of the disclosing Party; or

5.2.6 the receiving Party is specifically required to disclose in order to fulfil an order of any Court of competent jurisdiction.

Publications:

5.3.1 In accordance with normal academic practice, all employees, students, agents or appointees of the Parties (including those who work on the Project) shall be permitted:

5.3.1.1 following the procedures laid down in Clause 5.4, to publish results, jointly where applicable, obtained during the course of work undertaken as part of the Project;

The Parties agree for joint publications as outcomes of the first operations with the FQPM specified in the SOW in Schedule 1. Publications will be in a number of:

- 1 technical publication (with Observatoire de Paris member as leading author)
- 3 scientific publications 1 of which will have Observatoire de Paris member as leading author. A maximum of 10 members of Observatoire de Paris will be included for each of these publications.

The names of the main members of Paris Observatory to be included in these works are stated in the SOW in Schedule 1. Other members of Paris Observatory could be included in these works if necessary.

For the purpose of the agreed scientific publications, the targets to be observed will be jointly discussed and agreed between INAF and Observatoire de Paris, and

5.3.2.2 in pursuance of the Parties' academic functions, to discuss work undertaken as part of the Project in internal seminars and to give instruction within their organisation on questions related to such work.

5.4 Each Party will use all reasonable endeavours to submit material intended for publication to the other Parties in writing not less than thirty (30) days in advance of the submission for publication. The publishing Party may be required to delay submission for publication if in the other Party's opinion such delay is necessary in order for that other Party to seek patent or similar protection for material in respect of which it is entitled to seek protection, or to modify the publication in order to protect Confidential Information. A delay imposed on submission for publication as a result of a requirement made by the other Party shall not last longer than is absolutely necessary to seek the required protection; and therefore shall not exceed three (3) months from the date of receipt of the material by such Party, although the publishing Party will not unreasonably refuse a request from the other Party for additional delay in the event that property rights would otherwise be lost. Notification of the requirement for delay in submission for publication must be received by the publishing Party within thirty (30) days after the receipt of the material by the other Party, failing which the publishing Party shall be free to assume that the other Party has no objection to the proposed publication.

5.5 The provisions of Clause 5.1 and 5.2 shall survive for a period of three (3) years from the date of termination of this Agreement. The provisions of Clause 5.4 shall survive for a period of one year from the date of termination of this Agreement.

ARTICLE 6 – Intellectual Property Rights

6.1 For the avoidance of doubt all Background Intellectual Property used in connection with the Project shall remain the property of the Party introducing the same. No Party will make any representation or do any act which may be taken to indicate that it has any right, title or interest in or to the ownership or use of any of the Background Intellectual Property of the other Party except under the terms of this Collaborative Research Agreement. Each Party acknowledges and confirms that nothing contained in this Collaboration Agreement shall give it any right, title or interest in or to the Background Intellectual Property of the other Party save as granted by this Agreement. The Parties agree that any improvements or modifications to a Party's Background Intellectual Property arising from the Project which are not severable from that Background Intellectual Property will be deemed to form part of that Party's Background Intellectual Property.

6.2 Each Party grants the others a royalty-free, non-exclusive licence for the duration of the Project to use its Background Intellectual Property for the sole purpose of carrying out the Project. No Party may grant any sub-licence over or in respect of the other's Background Intellectual Property.

6.3 Each Party shall own the Arising Intellectual Property generated by its employees, students and/or agents under the Project and shall ensure that it secures ownership of such Arising Intellectual Property from its employees, students and agents. Subject to the terms of the Agreement, the Party owning any Arising Intellectual Property shall be entitled to use and exploit such Arising Intellectual Property as that Party sees fit, and subject always to Clauses 6.5 and 6.6

6.4 Each Party shall promptly disclose to the other all Arising Intellectual Property generated by it and each Party shall co-operate, where required, in relation to the preparation and prosecution of patent applications and any other applications relating to Arising Intellectual Property.

6.5 Where any Arising Intellectual Property is created or generated by the Parties jointly and it is impossible to segregate each Party's intellectual contribution to the creation of the Arising Intellectual Property, the Arising Intellectual Property will be jointly owned by those Parties in equal shares. The owners may take such steps as they may decide from time to time, to register and maintain any protection for that Arising Intellectual Property, including filing and prosecuting patent applications for any Arising Intellectual Property, and taking any action in respect of any alleged or actual infringement of that Arising Intellectual Property. If one of the owners does not wish to take any such step or action, the other owner may do so at its expense, and the owner not wishing to take such steps or action will provide, at the expense of the owner making the request, any assistance that is reasonably requested of it.

6.6 Any joint owner of any of the Arising Intellectual Property may commercially exploit the Arising Intellectual Property upon consultation and agreement with the other Party. In such circumstances, the Party which is commercially exploiting the Arising Intellectual Property will pay the other Party a fair and reasonable royalty rate/revenue on the value of any products or processes commercially exploited by it which incorporate any Arising Intellectual Property taking into consideration the respective financial and technical contributions of the Parties to the development of the Arising Intellectual Property, the expenses incurred in securing intellectual property protection thereof and the costs of its commercial exploitation and the proportionate value of the Arising Intellectual Property in any such product or process.

6.7 Each Party is hereby granted an irrevocable, non-transferable, royalty-free right to use all Arising Intellectual Property generated in the course of the Project for academic and research purposes, including research involving projects funded by third parties provided that those parties gain or claim no rights to such Arising Intellectual Property.

6.8 If any Party (the “Exercising Party”) requires the use of Background Intellectual Property of the other (the “Other Party”) in order to exercise its rights in Arising Intellectual Property (whether solely or jointly owned) then, provided the Other Party is free to license the Background Intellectual Property in question, the Other Party will not unreasonably refuse to grant or delay granting a licence to the Exercising Party so that the Exercising Party may use such Background Intellectual Property for the purpose of exercising its rights in Arising Intellectual Property.

ARTICLE 7 - Termination

7.1 Either Party may terminate this Agreement with immediate effect by giving notice to the other Party if:

7.1.1 the Project or this Agreement is no longer financially or scientifically feasible, or does not fit under that Party's mission or research strategy any longer;

7.1.2 an event of Force Majeure continues longer than ninety (90) days without a reasonable expectation of cessation;

7.1.3 the other Party is in breach of any provision of this Agreement and (if it is capable of remedy) the breach has not been remedied within thirty (30) days after receipt of written notice specifying the breach and requiring its remedy; or

7.2 Either Party may terminate this Agreement if at any time any of the Key Personnel appointed by that Party is unable or unwilling to continue to be involved in the Project. Within two (2) months after the date of the first notice informing the other Party of the discontinuation of Key Personnel, that Party will nominate a successor. The other Party will not unreasonably refuse to accept the nominated successor, but if the successor is not acceptable to the other Party on reasonable grounds, or if that Party cannot find a successor, either Party may terminate this Agreement by giving the other Party a second notice with immediate effect.

7.3 Notwithstanding the expiry of the Agreement or its early termination, under the case scenarios set forth in the article termination, the provisions set forth in articles 6 and 7 shall remain effective for the terms set forth in said section.

ARTICLE 8 – Liability

Pursuant to the Project, the employees of either Party who shall continue to be paid by their employer may be called upon to work in the other Party's premises. Said staff shall then comply with the by-laws of the host Party and with the technical instructions concerning the materials.

Nevertheless, each Party shall continue to be responsible for all the employer's social security contributions and tax obligations, and shall exercise, vis-à-vis its employee, all administrative management, responsibilities. The host Party provides any and all relevant information to the employer.

OP and INAF shall both cover their respective employees as regards accidents and occupational diseases.

ARTICLE 9 – Recipients for notice

Any notice to be given under this Agreement shall be in writing and delivered to the other Party at the address and marked for the attention of the named recipient, as stated below. All such notices will be served either (i) by hand or by courier (paid by the Party serving the notice) and shall be deemed to have been served when delivered; or (ii) in digital format sent by electronic mail and shall be deemed to be received on the Calendar Day of such transmission.

INAF's representatives for the receipt of notices are, until changed by notice given in accordance with this clause, as follows:

Name: Daniele Vassallo

Title: Astronomer - Responsible of coronagraphs design and procurement of SHARK-NIR instrument

Organisation: INAF - Osservatorio Astronomico di Padova

Address: Vicolo dell'osservatorio, 5 - 35122 Padova - Italy

Telephone: +39 0498293505

Email: daniele.vassallo@inaf.it

With copy to:

Name: Jacopo Farinato

Title: Astronomer - PI of SHARK-NIR instrument

Organisation: INAF - Osservatorio Astronomico di Padova

Address: Vicolo dell'osservatorio, 5 - 35122 Padova - Italy

Telephone: +39 0498293474

Email: jacopo.farinato@inaf.it

And to:

Name: Maria Bergomi

Title: Astronomer - Project manager of SHARK-NIR instrument

Organisation: INAF - Osservatorio Astronomico di Padova

Address: Vicolo dell'osservatorio, 5 - 35122 Padova - Italy

Telephone: +39 0498293428

Email: maria.bergomi@inaf.it

OP*'s* representatives for the purpose of receiving invoices, reports and other notices shall until further notice be:

Name: Pierre BAUDOZ
Title: Astronomer
Organisation: Observatoire de Paris
Address: 5, place Jules Janssen – 92195 Meudon - France
Telephone: +33 145 07 79 11
Email: Pierre.baudoz@obspm.fr

With copy to:
Name: Aurélie KASPRZAK
Title: Head of Contracts and Technology Transfer Office
Organisation: Observatoire de Paris
Address: 61, avenue de l'Observatoire – 75014 Paris - France
Telephone: +33 140 51 21 04
Email: srcv.obs@obspm.fr

ARTICLE 10 – Settlement of disputes

If any dispute arises out of this Collaborative Research Agreement the Parties will first attempt to resolve the matter informally through designated senior representatives of each Party to the dispute, who are not otherwise involved with the Project. If the Parties are not able to resolve the dispute informally within a reasonable time not exceeding two (2) months from the date the informal process is requested by notice in writing they will attempt to settle it in the French courts of Law.

ARTICLE 11 – Governing law

This Agreement is governed by French legislations and regulations.

ARTICLE 12 - Miscellaneous

12.1 Nothing in this Agreement shall create, imply or evidence any partnership or joint venture between the Parties or the relationship between them of principal and agent.

12.2 No Party shall use the name or any trademark or logo of any other Party or the name of any of its staff or students in any press release or product advertising, or for any other commercial purpose, without the prior written consent of the other Party.

12.3 This Collaborative Research Agreement and its Schedules (which are incorporated into and made a part of this Agreement) constitute the entire agreement between the Parties for the Project and no statements or representations made by any Party have been relied upon by the other in entering into this Agreement. Any variation shall be in writing and signed by authorised signatories for each Party.

12.4 If the whole or any part of any provision of this Agreement is void or unenforceable in any jurisdiction, the other provisions of this Agreement, and the rest of

the void or unenforceable provision, will continue in force in that jurisdiction, and the validity and enforceability of that provision in any other jurisdiction will not be affected.

12.5 No variation or amendment of this Agreement will be effective unless it is made in writing and signed by each Party's representative.

SIGNED for and on behalf of **OBSERVATOIRE DE PARIS (OP)**	**SIGNED** for and on behalf of **INAF-Osservatorio Astronomico di Padova**
Name:	Name:
Position:	Position:
Signature:	Signature:
Date:	Date:

SHARK-NIR

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Statement of Work and Technical Specifications for the Four-Quadrant Phase Mask

Doc. No. SHARK-NIR-INAFP-SoW-015-FQPM
ShortTitle SHARK-NIR SoW FQPM
Issue 0.2
Date 29-06-2018

Prepared	D. Vassallo, E. Carolo, M. Bergomi	29-06-2018
	Name	Date
Signature for INAF	J. Farinato	
	Name	Signature
Signature for LESIA-Observatoire de Paris	P. Baudoz	
	Name	Signature

Document Change Record

Issue	Date	Section/ Paragraph Affected	Reasons / Remarks
0.1	14-12-2017	All	New document
0.2	29-06-2018	1, 9	More details added

TABLE OF CONTENTS

1 Scope

This document has the purpose to specify the Statement of Work and technical specification for the Four-Quadrant Phase Mask (FQPM, hereafter) of SHARK-NIR, as well as to determine rules for the scientific publications related to the FQPM.

2 Applicable documents

No.	Title	Number & Issue
AD1	SHARK-NIR System Description and Overview	SHARK-NIR-INAFP-Overview-FDR-Issue0.2

3 Reference documents

No.	Title	Number & Issue
RD1	Proposal for a Coronagraph using extreme AO for the LBT: SHARK	February 2014
RD2	Update of the proposal for a Camera and Coronagraph using extreme AO for the LBT: SHARK NIR-Channel	September 2014

4 Acronyms and abbreviations

ADC	Atmospheric Dispersion Corrector
AO	Adaptive Optics
CDP	Conceptual Design Phase
CDR	Conceptual Design Review
CCD	Charge-Coupled Device
FDP	Final Design Phase
FDR	Final Design Review
FoV	Field of View
HW	Hardware
ICS	Instrument Control Software
IWA	Inner Working Angle
INAF	Istituto Nazionale di AstroFisica
IPAG	Institut de Planétologie et d'Astrophysique de Grenoble

LBT	Large Binocular Telescope
MPIA	Max Planck Institute für Astronomie
NIR	Near InfraRed
OAP	Off-Axis Parabola
OWA	Outer Working Angle
SW	Software
VIS	VISible
XAO	eXtreme Adaptive Optics

5 Introduction

SHARK-NIR is an instrument to be installed at the Large Binocular Telescope in Arizona (USA). The LBT consist of two telescopes (8.4m of diameter each) installed on a common mount, as it is shown in Figure 1.

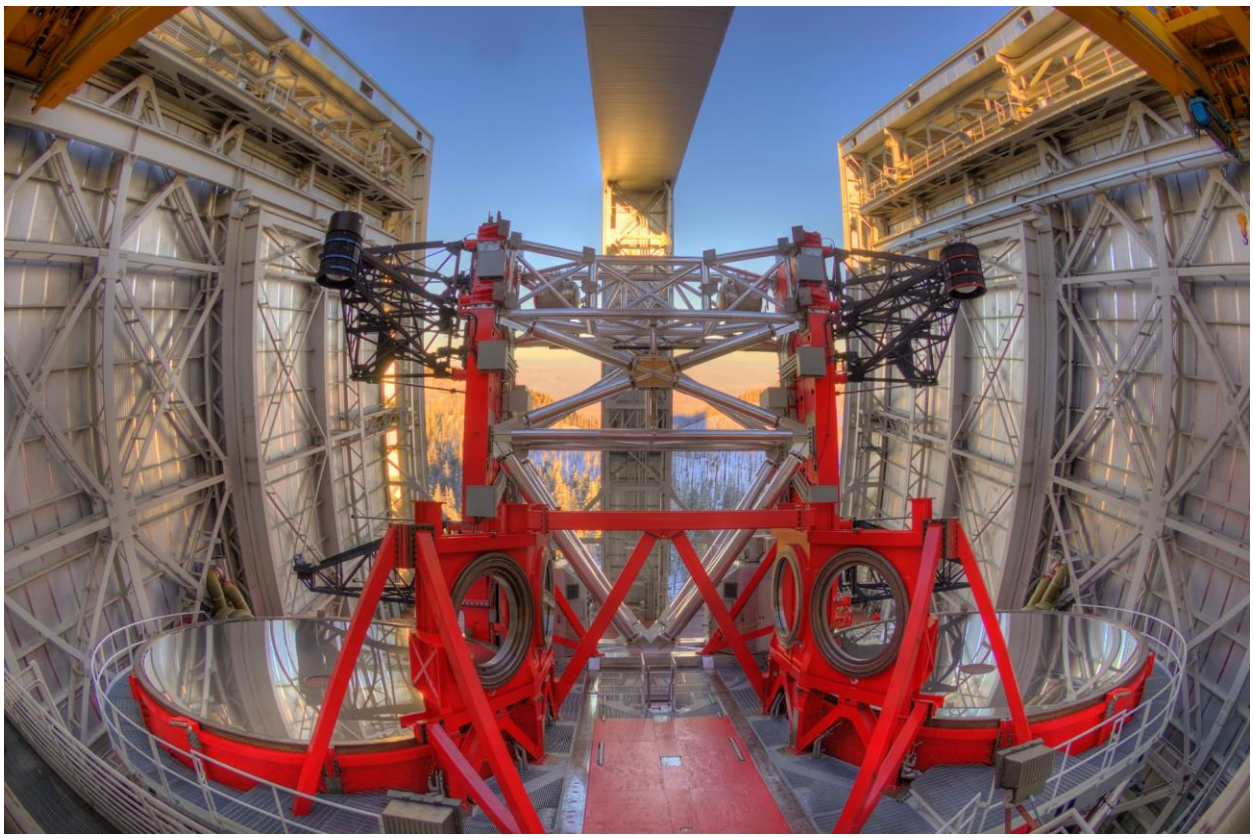

Figure 1: The Large Binocular Telescope

SHARK is an instrument proposed for LBT in the framework of the *"2014 Call for Proposals for Instrument Upgrades and New Instruments"* (see RD1). It is composed by two channels, a visible and a near infrared arm, to be installed one for each LBT telescope, and it will exploit, in its binocular fashion, unique challenging science from exoplanet to extragalactic topics with simultaneous spectral coverage from B to H band, taking advantage of the outstanding performances of the binocular XAO LBT capability. Furthermore, the spectral coverage can be extended to L and M bands thanks to the simultaneous support of LBTI LMIRcam.

Two channels are foreseen, a visible one (SHARK-Vis), operating from 0.5 µm to 1.0 µm, and a near infrared one (SHARK-NIR), operating between 0.96 µm to 1.7 µm. This document refers only to the SHARK-NIR channel.

The instrument successfully underwent a Final Design Review in January 2017, and it has been endorsed for final design and construction.

6 Opto-mechanical design

The optical design of SHARK-NIR is shown in Figure 2, while its opto-mechanical concept in Figure 3. The component subject of this manufacturing will be placed in the focal plane created by the second parabolic mirror (OAP2).

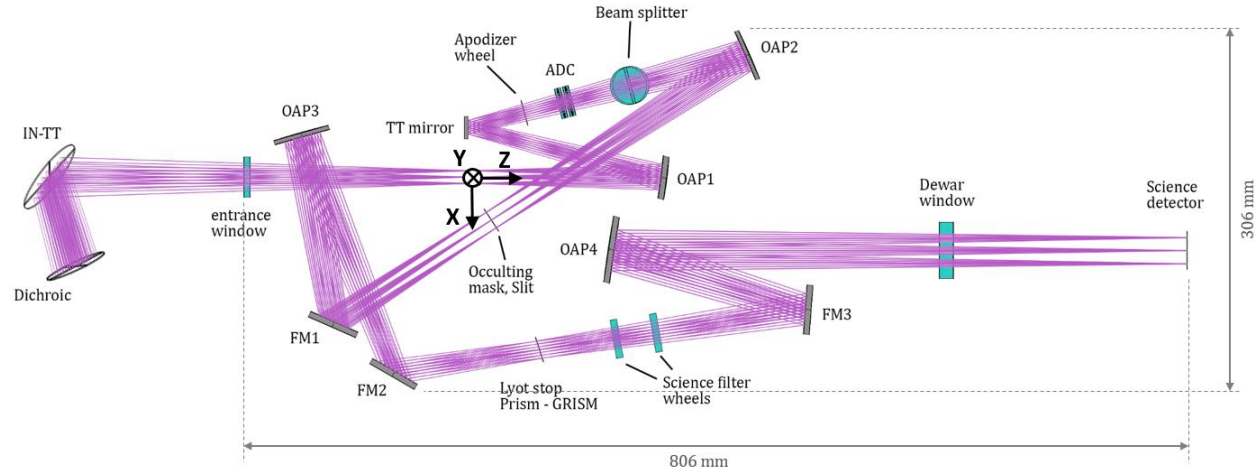

Figure 2: Optical layout of SHARK-NIR (top view of the optical bench). The light beam enters the instrument on the left side of the figure.

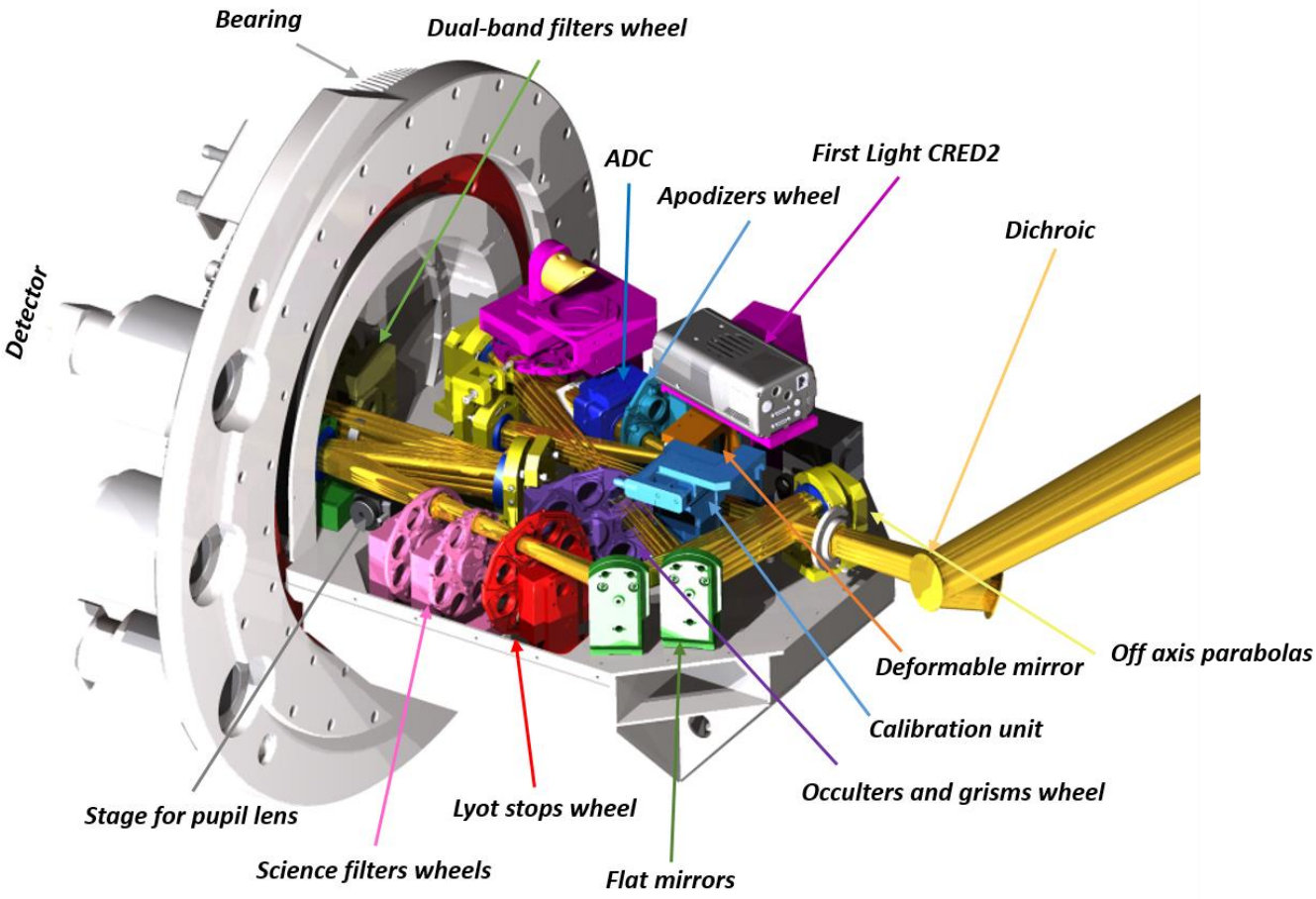

Figure 3: the opto-mechanical concept of the SHARK-NIR optical bench.

7 Environmental requirements

The LBT is located at Mount Graham, at an altitude of 3221m. The environmental specifications and general definitions, applicable for the overall SHARK-NIR instrument, are described in Table 1.

Item	Specification
Reference wavelength	0.6328 μm
Wavelength range	0.96 − 1.7 μm
Operating temperature	-15°C (-20°C goal) − +20°C
Assembly/Integration temperature	+15°C− +25°C
Storage temperature	-30°C − +50°C
Operating pressure	500 − 600 Torr
Storage pressure	500 − 700 Torr
Operating humidity	0% − 95% without condensation
Storage humidity	0% − 100%

Table 1: General definitions and environmental specifications

8 Specifications

8.1 Substrate

OP shall provide the blanks. Specifications are listed in Table 2. A mechanical drawing can be found in Appendix A. The drawing assumes a 3 mm thick substrate.

Glass substrate specifications	
(Preferred) substrate	Infrared Fused Silica
Diameter	25.9 mm
Tolerance on diameter	+0/-0.1 mm
Minimum Clear Aperture	24.0 mm
Thickness	≥ 1.5 mm (Goal 3 mm) *
Tolerance on thickness	± 0.1
Transmitted wavefront error	λ/30 rms
Flatness (per surface)	λ/50 rms
Wedge error	≤ 30 arcsec
Roughness	< 2nm rms (Goal < 1nm rms)
Angle of Incidence min-max [°]	0 – 3
Tolerance on AoI [°]	± 1
Scratch/dig	▪ MIL 20/10 (Goal 10/5) ▪ ISO10110: 5/3 x 0.05; L1 x 0.01; E0.5
Transmissivity	>98% (Goal >99%) on average across the working passband

Table 2: Specifications of the FQPM substrate.

*The optimal substrate thickness is 3 mm. However, thinner substrates can also be evaluated, depending on how performances, delivery times and/or costs are affected by this specification.

8.2 Manufacturing

The component will operate in combination with a broad-band filter with resolving power $\lambda/\Delta\lambda=8$, centered at 1.6 µm. The component shall be optimized for this wavelength.

The working f-number is 22.01, corresponding to an Airy disk of projected size ≈ 35 µm. The component is placed perpendicularly to the instrument optical axis. It shall deliver a total rejection of at least 100 under these conditions. Specifications are summarized in Table 3.

Manufacturing requirements	
Optimized wavelength [µm]	1.60
Tilt wrt the optical axis	No tilt
Total rejection factor	> 100

Table 3: Manufacturing requirements for the FQPM.

8.3 AR coating

The back surface of the component shall be anti-reflection coated with average reflectance less than 1% over the working bandpass 0.96-1.7 µm.

9 Scientific publications

Given the fact that OP is the scientific research institute Paris Observatory, we agree for access to observation data and joint publications as outcomes of the first operations with the FQPM specified in this document. Publications will be in a number of: 1 technical publication (with Observatoire de Paris as leading author) and 3 scientific publications (with Observatoire de Paris as leading author of 1 publication). The names of Paris Observatory members to be included in these works are the following: Pierre Baudoz, Elsa Huby, Raphaël Galicher, Anthony Boccaletti, Faouzi Boussaha, Josiane Firminy, Garima Singh. Their position and their presence in the publication author list will be jointly agreed between INAF and Observatoire de Paris.

For the purpose of the agreed scientific publications, the targets to be observed will be jointly discussed and agreed between INAF and Observatoire de Paris.

Finally, access to the acquired data for post-processing will be guaranteed strictly to the people included in this Project.

10 Quotation

If one of the specifications highly affects the quotation (or is not feasible by manufacturer), please specify two quotations, detailing the involved decreased spec.

11 Quantity & identification

Total of 2 pieces. Each optics shall be labeled with a serial number.

12 Milestones

The optics should be provided maximum 8 months after order is placed.

13 Deliverables

Interferograms showing overall surface quality and roughness.

Test report including the measured rejection achieved with the components together with a brief description of the experimental setup.

All physical dimensions must be measured.

All cleaning procedures should be detailed.

14 Warranty

OP does not guarantee any warranty on the items delivered.

15 Ultimate consignee and delivery point

INAF – Osservatorio Astronomico di Padova
Vicolo dell'Osservatorio, 5
35122 Padova – Italy

Reference person: Daniele Vassallo
Tel: +39 328 5771394

16 Contacts

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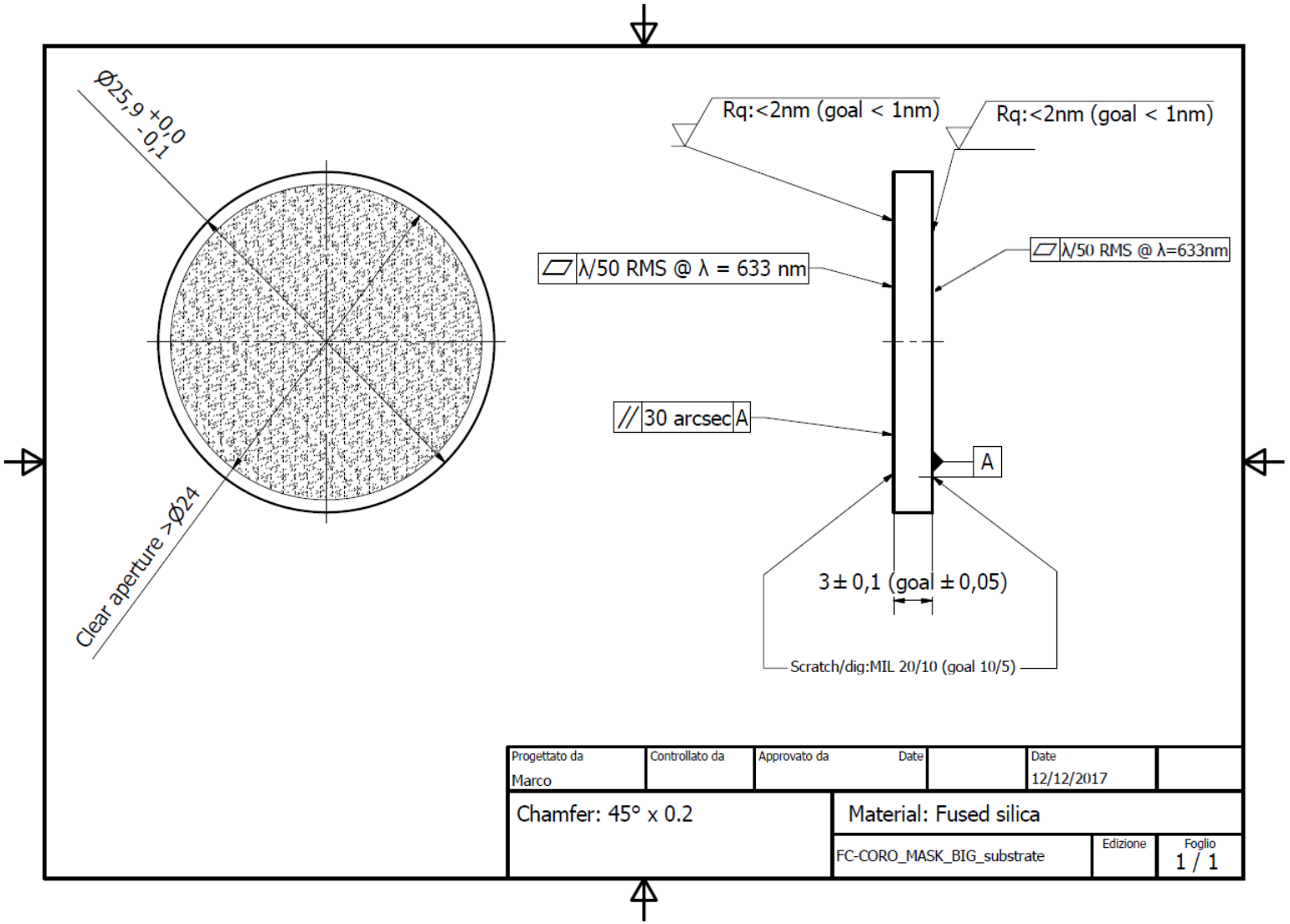
Vicolo dell'Osservatorio, 5
35122 Padova – Italy
Tel: +39 049 8293428
Email: daniele.vassallo@oapd.inaf.it; elena.carolo@oapd.inaf.it; maria.bergomi@oapd.inaf.it; jacopo.farinato@oapd.inaf

APPENDIX A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Rq:<2nm (goal < 1nm)
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λ/50 RMS @ λ=633nm
// 30 arcsec A
A
3 ± 0,1 (goal ± 0,05)
Scratch/dig:MIL 20/10 (goal 10/5)
Progettato da
Marco
Controllato da
Approvato da
Date
Date
12/12/2017
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FC-CORO_MASK_BIG_substrate
Edizione
Foglio
1 / 1