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Abstract

The document describes the qualification and selection procedure for the E-TEST Silicon suspension tender.

Document Status

Revision	Date	Comment	Reviewed by	Approved by
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Revision History

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0	27/11/2021	Document initiated

1 Documentation and Acronyms

1.1 Abbreviations/Acronyms

Abbreviation	Description
SPDT	Single Point Diamond Turning
E-TEST	Project about site study and technology development for the Einstein Telescope
EMR	Euregio Meuse-Rhine
CSL	Centre Spatial de Liege
HCB	Hydroxide Catalysis Bonding
ET-LF	Einstein Telescope Low Frequency interferometer

2 Introduction to the E-TEST project

The E-TEST project, funded by INTERREG Euregio Meuse-Rhine, has two main objectives: 1) to carry out a detailed geological and seismological study of the Meuse-Rhine cross-border region to support its candidacy to host the Einstein Telescope, 2) to tackle challenging engineering and technological aspects of the Einstein Telescope design concerning vibration isolation, cryogenics and optics.

In the framework of E-TEST a technology demonstrator, coined Prototype, will be built and put in operation at the Centre Spatial de Liege (CSL). In the Prototype (see CAD view of the setup in Fig.1), a 100-kg mass monocrystalline silicon mirror, cooled down to 25K by radiation heat exchange, will be suspended from a multistage vibration isolation system, reproducing the configuration of the Einstein Telescope Low Frequency (ET-LF) interferometers.

A more detailed description of the E-TEST project can be found in <https://www.etest-emr.eu/>

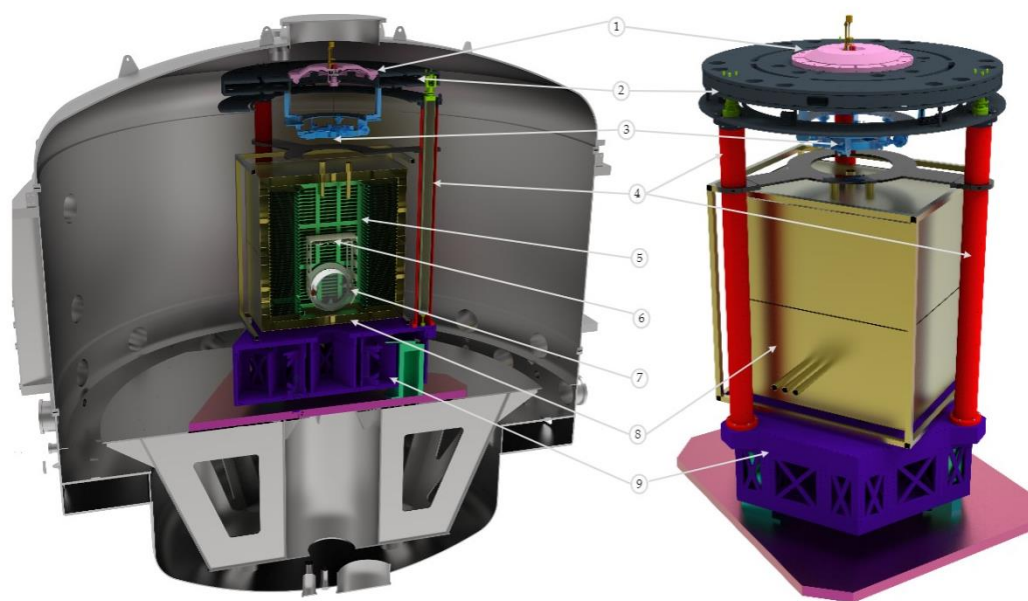


Figure 1

*Artist impression of the E-TEST technology demonstrator. A 100-kg mass **silicon mirror** (7) is housed inside a cryostat consisting of an 80K outer thermal tent (8), cooled by liquid nitrogen, and a 20K inner heat shield (5) cooled by gaseous helium. The mirror is connected by means of thin rods made of monocrystalline silicon to a heat exchanger (6), together with which it forms the cryogenic payload. The payload is suspended from a multistage vibration isolator operating at room temperature and consisting of: a steering stage (3), a passive attenuator with an inverted pendulum (2,4) and a geometric anti-spring (GAS) vertical filter (1), a six degrees of freedom active isolation stage (9).*

3 Content of the tender

The tender is ultimately intended for the procurement of the **monocrystalline silicon machined rods** needed for suspending the E-TEST Prototype mirror inside its cryostat (An impression of the conceptual design of the mirror suspension stage is presented in Fig.2).

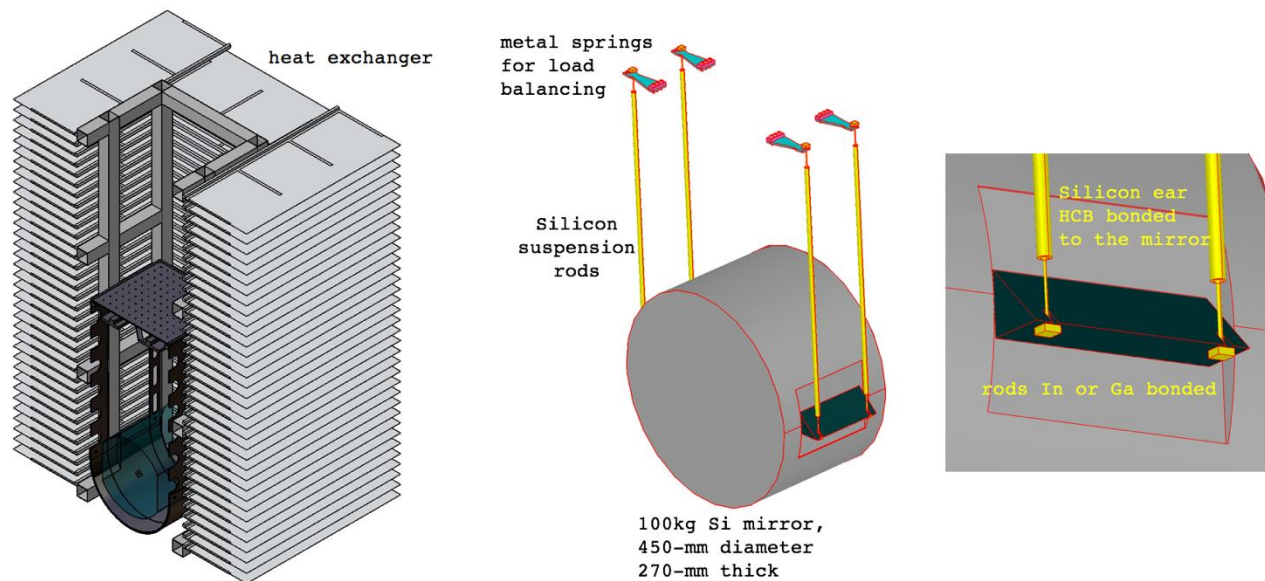


Figure 2

*Detail of the mirror suspension stage in the E-TEST Prototype. The **silicon mirror** is suspended like a pendulum by means of four monolithic crystalline silicon rods (yellow) providing a high thermal conductivity, ultralow mechanical hysteresis interface to the radiation heat exchanger. The rods are bonded to the mirror and to load balancing metal springs by means of low temperature In or Ga brazing.*

Given the peculiarity of the parts to be fabricated, the procurement will follow a phased approach in which a feasibility study will precede the production of the final components. We will proceed to the second phase only in case of success of the feasibility study. Timeline and deliverables for the different phases of the procurement are described in Section 3.1 and summarized in Table 1.

3.1 Phases, timeline and deliverables

PHASE A: FEASIBILITY STUDY

The goal of the feasibility study is to establish if the **single point diamond turning (SPDT)** technology is a suitable method for fabricating the E-TEST Prototype mirror suspension structures.

The study will consist of a sample production phase and an evaluation phase. In the first one, the contracting company will manufacture samples according to the Technical specifications document. In the second one, Nikhef will conduct a scientific evaluation of the properties of the samples and deliver

to the contracting company a Technical Report with a description of the results obtained and with a detailed discussion of the recommendations drawn regarding whether to proceed or not with the production phase.

PHASE B: PRODUCTION OF THE E-TEST MIRROR SUSPENSION RODS

In the case of a positive outcome of the feasibility study **-and only then-**, the procurement will be completed with the production of the suspension rods for the mirror of the E-TEST Prototype. The final manufacturing drawings will still be based on the concept illustrated in the Technical Specifications Document; any changes resulting from the findings of the feasibility study will be discussed and agreed with the contracting company before starting the production.

The timeline of the procurement is summarized in Table 1. Duration must be interpreted as the maximum one.

Task	Predecessor	Duration	Responsibility
Phase A – Samples production	Raw material available	8 weeks	contractor
Phase A – Test of samples	Samples received by Nikhef	12 weeks	Nikhef
Phase A – Test Technical Report	Test completion	2 weeks	Nikhef
Decision point about proceeding to Phase-B	Technical report received by the contracting company	2 weeks	Nikhef
Phase B- Manufacturing drawings update	Phase B approval	2 weeks	Nikhef
Phase B-Procurement of raw material	Manufacturing drawings updated	8 weeks	Nikhef
Phase B – Production of the suspension rods	Raw material available	10 weeks	contractor

Table 1 – Procurement timeline

4 Tender general conditions

This tender is issued on behalf of Nikhef (National Institute for Subatomic Physics), an institute of the NWO-I Foundation ('Stichting Nederlandse Wetenschappelijk Onderzoek Instituten).

- The content of the Tender Response must comply with the following conditions:
- The Tender response and all further communications must be in the English language.
- The General Government Purchase Conditions 2018 are applicable i.e. ARIV_2018 conditions as published here: https://www.nwo-i.nl/wp-content/uploads/2019/11/ARIV_2018-mei2018_0-2.pdf;
- The Tender response must be irrevocable for at least 60 days after the closing date of this procurement procedure.
- All amounts must be stated in euros excluding VAT.
- Nikhef reserves the right to check the accuracy of all data and to contact the persons designated with regard to competence requirements. If that information is found to be missing, Nikhef may decide to request it, provided that competition is not thereby damaged. Nikhef is in no way obliged to do this.
- The submission of a Tender response signifies that the Tenderer agrees to the proposed procedure and the provisions of this Descriptive Document (including Appendices).

Other conditions:

- Nikhef reserves the right at all times not to award the contract (in full or in part) and to discontinue the procurement procedure.
- The Dutch Public Procurement Act (Dutch Official Journal 2012, 542), is not applicable to this tender.

5 Delivery of supply

Samples and suspension rods shall be delivered to:

Nikhef
Science Park 105
1098XG Amsterdam
The Netherlands

6 Tender: material to be submitted

The following documents need to be submitted:

A. Two prices:

- A1: The price (in Euro, excluding VAT) for Phase A (PA)
- A2: The price (in Euro, excluding VAT) for the total procurement (PT)

Tenderer should be aware that an indicative budget of 80.000 euro has been foreseen for the total procurement.

B. A descriptive document (Quotation Annex), containing:

- B1: The development and manufacturing plan;
- B2: The quality of test and machining equipment available to the company;
- B3: Reference projects: a list of projects and customers, showing experience in SPDT of crystalline materials. Reference letters of customers should be provided, if so requested by Nikhef.

The content is specified in the Technical Specifications document.

The offer and documents should be submitted in English:

- The price (A1 and A2) should be submitted as a separate document (PDF).
- The Quotation Annex (B1, B2, B3) may be combined in a single document (PDF).

Your offer should be submitted via Tenderned, **ultimately 4 February, 17:00 CET**.

All offers are treated confidentially. Incomplete offers will not be accepted. After evaluation of the bids, the bidders will be informed about the score for their bid. Participation in the tendering procedure does not entail any obligations.

7 Tender: awarding criteria

The awarding criterion is the quality-price ratio in the proportion 60:40. Points will be awarded according to the following scheme:

Price – a maximum of 40 points will be awarded based on the formula

$$points = 15 \times \frac{HPA - PA}{HPA} + 25 \times \frac{HPT - PT}{HPT}$$

where PA and HPA are respectively the bid and the highest submitted bid for Phase-A, while PT and HPT are respectively the bid and the highest submitted bid for whole procurement.

Quality – a maximum of 60 points will be awarded based on the evaluation of the Quotation Annex that the bidder is asked to submit.

Specifically, they will be awarded

- a maximum of 30 points for the development and manufacturing plan
- a maximum of 15 points for the quality of test and machining equipment available to the company
- a maximum of 15 points for the proven experience in SPDT of crystalline materials

The tender will be awarded to the bidder with the highest score.

8 Planning

Until 21 January 2022, 17:00	Questions on the tender can be posted on Tendered.
28 January, 17:00	Answers on questions will be provided.
4 February 2022, 17:00	Offers should be received.
11 February 2022	Provisional awarding
25 February 2022	Final awarding

9 Annexes

- A. E-TEST Silicon suspensions tender: technical specifications
- B. Silicon_suspension.zip: drawings and STP files