

Market consultation

for: a fast turnaround fridge for Quantum Inspire

Contracting authority:

The Netherlands Organisation for Applied Scientific Research TNO

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1 Introduction

The document describes the organisation TNO, its content and objective of the market consultation, the schedule, preconditional and procedural matters.

TNO, department Quantum Technology intends to purchase a fast turnaround fridge for Quantum Inspire. TNO would like to gain more information from the market by conducting this market consultation. The gained information might be used as input for the formal tender process. Therefore, any party which is able to deliver such system for the purposes described in section 4 is invited to present the costs and (technical) possibilities of their fast turnaround fridge for Quantum Inspire.

After this market consultation TNO will decide which Tender procedure is the most appropriate choice to buy a fast turnaround fridge for Quantum Inspire.

1.1 TNO

TNO, the Netherlands Organisation for applied scientific research, was founded by law in 1932 to enable business and government to apply knowledge. As an organisation regulated by public law, we are independent: not part of any government, university or company.

TNO connects people and knowledge to create innovations that boost the competitive strength of industry and the well-being of society in a sustainable way. This is our mission and it is what drives us, the over 3,400 professionals at TNO, in our work every day. We work in collaboration with partners and focus on nine domains.

1.2 Organisational structure

TNO's high level of ambition demands an appropriate organisational structure and corporate culture. Staff must be given every support as they pursue innovation and productive cooperation. The current organisational structure is shown below

TNO STRUCTURE



1.2.1 Focus area

The focus area 'Industry' to which the Quantum Technology department belongs represents an essential link in the search for solutions to the major societal challenges that we face. We aim to help by using our specialist knowledge in the following focus areas:

- Nanofabrication for patterning and metrology, for example in the semiconductor sector
- Satellite instrumentation for earth observation and astronomy
- Precision instrumentation for scientific applications
- Thin-film electronics for a wide range of applications, from medical sensor systems to automotive applications in dashboards
- 3D printing processes for new applications, focusing on scaling up printing technology in serial production
- Quantum computers and quantum communication to strengthen computing power and secure communication flows
- Smart materials, bio-aromatics and electrification for a greener chemical industry.

If you would like further information about a domain or a specific subject, please take a look at: www.TNO.nl.

1.3 Quantum Technology department

Ultra-fast and microscopically small quantum systems, such as computers and sensors, are the focus of TNO's relatively new research area of quantum technology. To use the unique properties of quantum mechanics for practical applications, we support the emerging industry with the design, development and manufacture of quantum sensors, quantum devices and complete systems.

We work on a radically new technology with world-changing potential. Our mission is to develop scalable prototypes of a quantum computer and an inherently safe quantum internet, based on the fundamental laws of quantum mechanics. Quantum technology is among the most far-reaching and challenging technologies of our time. To address this challenge, we bring together scientists, engineers and industry in an inspiring environment. We are jointly creating the quantum future, because we believe that quantum technology can be a game changer in many social and economic sectors, including health, agriculture, climate and safety.

If you would like further information about this specific subject, please take a look at: [TNO – Quantum Technology](#)

1.4 Procurement

On behalf of TNO, the Procurement department supervises all procurement, purchasing and tendering procedures and works closely together with the Quantum Technology department in this market constellation. As part of the Finance, Procurement & Legal (FPL) division, the Procurement Department is also responsible for organizing and implementing all procurement processes in keeping with the corporate objectives of the organisation.

1.5 Purpose of the market consultation

Before proceeding with the preparation of a possible tender, TNO wants to consult the market on how this tender can best be structured (broadly speaking). Within the scope of the market consultation advice is sought to gain insight into the potential market for the delivery of a stitching interferometer for TNO. The market consultation is open to all players in the market.

With this market consultation TNO wishes to gain insight into what is technically feasible and/or available on the basis of the functional & technical specifications as specified in chapter 4. In this way we want to give parties the opportunity not only to get involved at an early stage but also to think along with us about what the best solution might be for TNO. After all, the insights obtained can be taken into consideration in the final formulation of the specifications for the (possible) future Tender, and allows participants to contribute to the success of the Tender.

The purpose of the market consultation is covering the following aspects:

- To gain more insights in the pricing models of the different available solutions;
- To gain more insight into the current possibilities on the market; to get a clear understanding of the visions, ideas and suggestions of market participants;
- To gauge market interest for this Tender;
- To decide which procurement strategy is best suited to our functional requirements in today's market.

Important considerations, where there has to be a certain attention to:

- Lead time is of the utmost importance, any lead time, longer than 9 months is not preferred.
- TNO has existing infrastructure that need to be interfaced with this equipment, which is explained in more detail in Section 4.

The information received may lead to more in-depth questions for TNO. Optionally, TNO may therefore decide to hold a second round of in-depth questions. For this second round of in-depth questions TNO will only invite those parties who also participated in the first round. In addition, TNO leaves the possibility open to invite market parties without justified reasons and to ask for an additional explanation of the answers received.

The results of the market consultation may be processed in the Tender documents, without being traceable of participants of this market consultation.

1.6 Schedule

No dialogue sessions are planned during this market consultation. However, if the input provided leads to additional questions at TNO, TNO will ask for a written and/or oral explanation.

The schedule of the market consultation is shown in the table below.

Deliverable / activity	Responsible	Date
Market Consultation document published by TNO	TNO	03-02-2022
Deadline for submitting your questions on the Market Consultation document	Subscriber	16-02-2022
Deadline for TNO to reply to the questions (anonymised) and publish any additional information or revision of this document on TenderNed	TNO	23-02-2022
Deadline for submitting your input	Subscriber	02-03-2022
Possibility for TNO to ask clarification to each party individually when necessary (information will be included in the summary)	Subscriber/TNO	until 11-03-2022
TNO summary of market consultation results on TenderNed	TNO	01-09-2022

2 Basic principles and preconditions

The basic principles and preconditions mentioned below apply to this market consultation:

- TNO observes the principles on non-discrimination and transparency when carrying out this market consultation;
- This document is solely intended for market consultation purposes and thus is not part of the possible Tender procedure. In short, just a consultation round;
- This market consultation does not serve to make a pre-selection from candidates or interested market parties in the context of the planned tender;
- Market participants who do not apply for this market consultation will not be excluded from participating in the (possible) final Tender. Similarly, market participants who join this market consultation will not be excluded or privileged from participation in the (possible) final Tender;
- This market consultation is non-binding, both for the participants and for TNO;
- Parties who may or may not participate in this market consultation cannot derive any mutual obligations or rights vis-à-vis TNO;
- Participating to this market consultation does not confer no entitlement at obtaining a contract award;
- TNO shall not reimburse any eventual costs in participating to this market consultation;
- Participating market parties agree that the information provided by them can be processed anonymized in the further elaborating program of requirements;
- In the context of the market consultation, provided information may differ from the information that will be provided in the (possible) Tender procedure;
- The contribution of participating Parties will be handled as much as possible with confidentiality and in any case TNO will take into account the legitimate interests of the parties;
- The official language during this market consultation will be English;
- TNO is in no way bound by the outcome of the market consultation or obliged to realise and/or put out to tender the desired investment to which the market consultation is linked;
- No claim will be honoured for the use of information, confidentiality, or request for compensation herewith;
- All documents submitted by the participating Parties are considered public documents and shall be copy-right free. If copyrights are applicable, TNO is protected by the participating Parties;
- No value judgment can be attributed to TNO's answers to questions given by you;
- TNO reserves the right to:
 - o perform the proposed procurement process in a different way, in terms of content and style, than the process that may have been communicated;
 - o to cease publication of the market consultation temporarily or permanently.
- Participating in this market consultation, constitutes the Parties unconditional approval of the procedure as stated in this document.

2.1 Form and content

The consultation is set up as follows:

2.1.1 Participation

For this market consultation, TNO has opted to use the online TenderNed system. Any interested market party who believes he/she is able to contribute to the market consultation should respond to the consultation document by using the TenderNed system. The completed Tender documents must be uploaded to the TenderNed secure document safe no later than the date as mentioned in paragraph 1.6.

2.1.2 Contact person and communication

All communication with respect to the Tender Procedure will only take place through TenderNed and in a manner other than prescribed in this Tender Instructions.

If legal contact with TNO is required / necessary, communication only takes place at TNO's contact point below, which communication must always be done in writing via the e-mail address mentioned below.

Name : Arjan Verhoeven
Position : Senior buyer
Department : Procurement
Correspondence : P.O. Box 96800, 2509 JE, The Hague
Email : **via TenderNed; questions and answers module of the related Tender**

Tenderers cannot derive rights from verbal statements, promises and suggestions from TNO employees or agents, made in connection with the Tender Procedure and / or tender documents. Tenderers can only rely on written information provided by or on behalf of TNO.

Failure to comply with the above conditions, or any attempt to influence the judgement or decisions of any person involved in the Tender procedure, will result in immediate disqualification.

In the heading of all documents, and in all future correspondence relating to this market consultation should be clearly mentioned 'Market consultation 2022 FPL/INK 020_Fast Turnaround fridge for Quantum Inspire'.

2.2 Intellectual property rights

Save for the exceptions provided by the law, nothing from this market consultation document may be reproduced (other than for the purpose of this document) in any form, by print, photocopy, DVD, CD-ROM, microfilm or other means, without the prior written permission of TNO.

2.3 Use of TNO logo

It is not permitted to copy, modify or otherwise use the TNO logo on any documents submitted by the Tenderer further to the Tender Procedure.

3 Background

As quantum technologies develop, it is important that new parties can enter the field without a lot of resistance. One of the initial hurdles to be overcome by newcomers is the need for expensive equipment for characterization. To help alleviate this, TNO is offering the use of its quantum technologies test facility – QITT to external parties.

One of the most important pieces of equipment in QITT is a dilution refrigerator – allowing cooling quantum devices to millikelvin temperatures.

One of the unique features that we use in our current fridge is the modular wiring as offered by BlueFors, this is illustrated in **Figure 3-1**. The wiring for the to-be-procured fridge should be compatible with this mechanism. This allows us to prepare wiring for experiments outside the fridge and move experiments from one fridge to another.

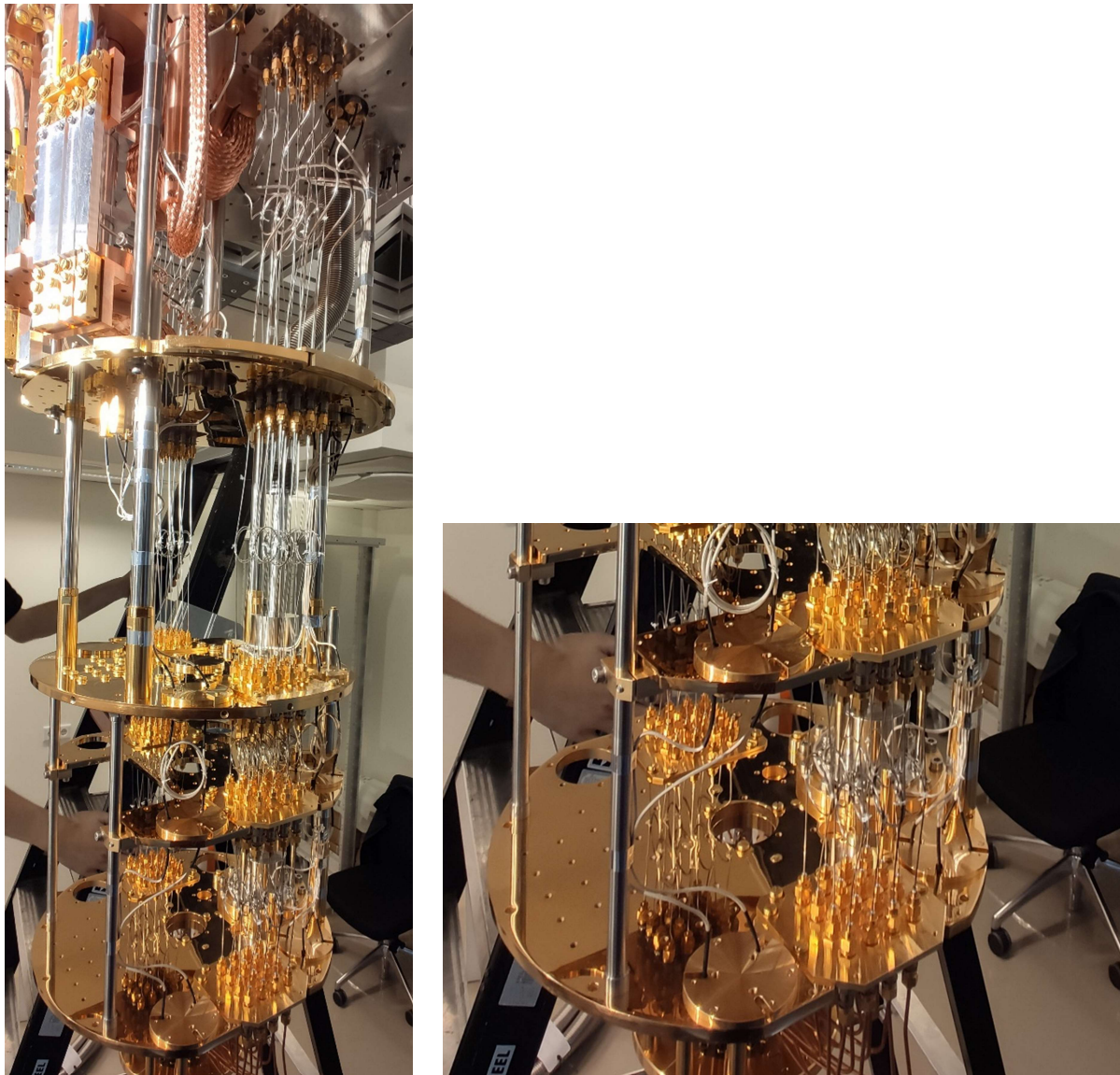


Figure 3-1 Inside of fridge showing wiring (left), close up of a modular wiring column (right)

4 Clarification of the functional & technical desired requirements

The requirements for such a dilution fridge are:

- Base temperature <20mK
- Sample should be brought to base temperature and room temperature in a controlled manner, significant ice forming on the sample when returning to room temperature is not allowed.
- Cooldown time should be less than 24hr
- Dilution refrigerator should have temperature stages separated by plates to which electrical components can be mounted. A plate at ~4K and at the base temperature and at the coldest stage are a minimal requirement.
- To accommodate control and readout lines for up to 20 qubits. 32 coax lines.
- Coax lines need to be in a modular side-loading setup, to allow for a new user experiment to be prepared outside the fridge, while the fridge is being used by the previous user.
 - The modular coax lines should be exchangeable with the coax modules of our current BlueFors LD400-SL fridge to reduce the amount of (expensive) wires needed
- Have the capability to operate for extended periods of time without maintenance.
- The lead time should not exceed 9 months for us to be able to reach our deadlines.

Unique technical specifications:

- TNO uses a per-day reservation schedule for commercial partners, and potentially scientific community. Also reservations for extended periods of time are needed sometimes. This leads to the following requirements:
 - Guaranteed continuous operation of the dilution fridge for >6 months, without need for maintenance.
 - A solution with a long-life cold trap is preferred.
 - Possibility to operate the dilution refrigerator without the need to refill cryogenic liquids, such as Nitrogen.
- System needs to be future-proof, allow to host diverse devices:
 - System should be modular, with an option to swap out coax columns to accommodate different customers.
 - In addition, to save cost the cable modules of the new and existing LD400-SL fridge the wiring columns should be exchangeable (hence cable trees can be shared between fridges).

Sample space:

- The sample space of most dilution refrigerators would be sufficient for our purposes. Since we are still in discussion with our users, a specification of sample space configurations would be interesting to receive.

Uptime and service:

- This refrigerator will be used for commercial purposes. Which means we have external contracts to fulfill, yielding operational losses in case of downtime. Although no specific service contracts are required, the supplier should be able to prove high system uptime and fast customer response in case of failure. This may be based on user testimonies within the EU.
- We need commercial equipment to be well supported by the supplier with short service and maintenance cycles.
- Response time to e.g. email should be typically within 1 working day.