Market Consultation Document

(including Annexes)

August 2023

Open Market Consultation for the future Pre-Commercial Procurement of R&D services of an Interoperable electron Microscopy Platform for advanced RESearch and Services

(IMPRESS PCP)

Lead Procurer: Forschungszentrum Jülich GMBH

7 Public Buyers

The IMPRESS project has received funding from HORIZON EUROPE framework program for research and innovation under grant agreement n. 101094299.

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IMPRESS project receives funding under the European Union's Horizon Europe framework program for research and innovation under the grant agreement No 101094299. The EU is however not participating as a contracting authority in the procurement.

A Prior information notice, or PIN has been published in TED to announce the Open Market Consultation on potential future procurement activity (notice publication number: 405706-2023).

The original language of this market consultation is English.

Abbreviations and Acronyms

AI	Artificial Intelligence
ATA	Temporary Admission
CET	Central European Time
EAFIP	European Assistance for Innovation Procurement
e-CAT cartridge	e-DREAM, Correlative, Adaptable and Transferable cartridge
EOSC	European Open Science Cloud
EU	European Union
FAIR	Findable, Accessible, Interoperable and Reusable
FRAND	Fair, Reasonable and Non-Discriminatory
GDPR	General Data Protection Regulation
HE	Horizon Europe
IPRs	Intellectual Property Rights
NDA	Non-Disclosure Agreement
OMC	Open Market Consultation
PBG	Public Buyers Group
PCP	Pre-Commercial Procurement
PIN	Prior Information Notice
R&D	Research and Development
RFI	Request For Information
RIs	Research Infrastructures
SMEs	Small and Medium Enterprises
SOTA	State of the Art
TED	Tenders Electronic Daily
TEM	Transmission Electron Microscopy

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TRL	Technology Readiness Level
UHV	Ultra-High Vacuum

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Key Definitions

Consortium	Group of public and/or private entities (including public buyers and supporting organisations) that are part of the IMPRESS PCP project. For more information: https://e-impress.eu/consortium/
Contractor	A company or entity that has been awarded a contract under the PCP.
Lead Procurer	A Public Buyer who acts as a Procurer in the PCP and purchases the R&D services on behalf of itself and other Public Buyers (in this case, Forschungszentrum Jülich GMBH).
Public Buyer	A public entity who purchases goods or services from the market and is subjected to the public procurement regulation.
Technology vendor	A company or entity who develops and/or sells technology in the market.
Tenderer	A company or entity that submits an offer to participate in the PCP.

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Content

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1. Purpose of the Open Market Consultation

1.1. Scope and main objectives

This document describes the objectives and rules applicable to the Open Market Consultation (OMC) of the Project ***Interoperable electron Microscopy Platform for advanced RESearch and Services – Pre-Commercial Procurement (IMPRESS-PCP)*** as described in section 2.

The OMC begins on the date of the publication of the Prior Information Notice (PIN) in the EU's Supplement to the Official Journal (TED) and ends on the date indicated as such in this document, unless the Market consultation will be terminated prematurely.

Through this OMC, the Public Buyers Group of IMPRESS-PCP (identified in section 2) with Forschungszentrum Jülich GMBH as lead procurer, aims to inform market operators regarding the upcoming Pre-Commercial Procurement (PCP) of Research and Development (R&D) services for the design, development and testing of an Interoperable Platform for Transmission Electron Microscopy (TEM), which should be based on common interfaces and data formats and highly flexible and adaptable to meet the scientific needs of individual users, who will be able to define and develop innovative experiments to carry out research using different instruments and techniques across the spatial and temporal scales, and as such broadens the research fields compared to the actual situation. The cartridge-based concept in IMPRESS, forms a key part of the interoperable platform as explained in section 2.

The abovementioned scientific needs are tackling new research possibilities that, in this moment in time, are not possible with the existing components that are commercially available. With this PCP, technology vendors are also supporting the scientific users in gaining in-depth knowledge in unexplored natural and functional properties in different material systems and their interactions. Furthermore, the PCP aims to strengthen the EU research position in cutting-edge technologies (e.g., in green and sustainable technologies) and hence opening new market segments for technology providers. By participating in the PCP, technology vendors will be adequately positioned for potential follow-up Public Procurements of Innovative Solutions (PPI) throughout EU, and will benefit from the interaction with the IMPRESS community of users to finetune their existing R&D roadmaps.

In this context, the purpose of the OMC is to inform also relevant stakeholders, users and market players to gather their input about the IMPRESS PCP project for expanding the horizon of TEM to novel interoperable arrangements via a new generation of instrumentation based on:

- Open Standards to ensure compatibility and facilitate integration with analytical tools.
- Open Components to enable the creation of customized TEM arrangements.
- Open Interfaces to allow for a seamless exchange of components and data between TEM instruments.
- Open Knowledge to boost sharing, drive innovation and promote technological advances.

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Another objective of the OMC is to understand the market operators' capabilities to satisfy the public buyers' needs and to obtain their input on the viability of the procurement plans and conditions as described in this document and annexes.

In sum, the objectives of this OMC are to:

1) Validate the findings of the State-Of-The-Art (SOTA) analysis and the viability of the set of technical and financial provisions.
2) Raise awareness of the industry and relevant stakeholders (including other users) regarding the upcoming PCP.
3) Collect insights from the industry and relevant stakeholders (including users) to finetune the tender specifications.

This OMC is performed under the law of the lead procurer (Forschungszentrum Jülich GMBH), which is German law.

The contracting authorities involved in the IMPRESS PCP project are not legally bound in any way by the outcome of the OMC.

Starting an OMC does not mean that the contracting authorities in IMPRESS PCP will start a tendering or purchasing procedure. If this OMC is followed by a tendering procedure and/or purchasing procedure, the PBG reserves the right to adjust and/or supplement the solution described in this document on every element. No rights can be derived from statements and/or communications during this OMC in any future tendering procedure and/or purchasing procedure.

The OMC is not part of any pre-qualification or selection process. No advantage or disadvantage will be given to any supplier / group of suppliers to the detriment of others during the OMC and the subsequent competitive procedure for the award of contracts.

All information provided during the OMC and other background information will be published online in English.

Where appropriate, parts of the information received from market parties can be shared with the European Commission.

1.2. Who can participate?

The target groups of this OMC are users and technology vendors, including research technology organisations. All interested parties are invited to take part in the OMC. However, participation in the PCP will be restricted to technology vendors from GPA-WTO members and willing to perform the majority of R&D in Europe and Associate Countries. Technology vendors established in countries not

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eligible to participate in Horizon Europe Innovation Actions in any capacity are excluded from the participation in the PCP. It is possibility to form alliances of technology vendors.

Participation in the OMC is voluntary and non-binding, and is at the own expense and risk of market operators. A market operator cannot charge any costs to the PBG for participation in the OMC or for (re-)use of its information in the context of a future procurement procedure.

Participation in this OMC is not a condition for submitting a tender in the subsequent procurement, does not lead to any rights or privileges for the participants, and is not part of any pre-qualification or selection process. The provided input in this OMC will not be used to evaluate future proposals.

The event and webinars celebrated within the framework of the OMC could be recorded. In that case, by attending the physical event you will be consenting to be recorded. By using your video and microphone during the webinars you will be consenting to be recorded. If you do not want your voice and image to be recorded during the webinars, you may ask your questions using the chat. The IMPRESS PCP Consortium shall use those records for the purpose of the project only.

In addition, please be aware that photos may be taken during the meetings. The IMPRESS PCP Consortium shall use those photos for the purpose of the project only.

1.3. Activities

The market consultation will take place in the form of:

- **The announcement of the Open Market Consultation** at the Microscopy and Microanalysis (M&M) Event in Minneapolis (USA) in July 2023 where information about the project is provided.
- **A hybrid event** which will take place in Düsseldorf (Germany) in September 2023. This event will be carried out in English and broadcasted online.
- **A launching webinar** to be held in English in August 2023.
- **Other activities and questionnaires** as deemed necessary within the scope of the project.

The IMPRESS PCP Consortium is entitled to adjust the planned activities or to include new activities at any time according to the needs and responses of the market.

1.4. Registration

Parties interested in participating in the OMC activities are requested to register here: https://e-impress.eu/news/pcp-events/

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1.5. Timetable

The timetable of activities and required actions of the OMC is as follows:

Date	Event
1 July	Publication of the Prior Information Notice (PIN) on TED.
25 July	Supplier Event: Announcing the Open Market Consultation & providing project information in the Microscopy and Microanalysis (M&M) event in Minneapolis (USA).
1 August	Publication of the OMC documents on the project website (https://e-impress.eu/) and the EU Survey questionnaire (https://ec.europa.eu/eusurvey/runner/IMPRESS-PCP_2023). Publication of the recorded launching webinar (https://youtu.be/fMPNblLXiCY).
1 September	OMC Event: Hybrid meeting in Düsseldorf (Germany).
17 September	Deadline for the submission of questions via the OMC questionnaire (17:00 CET).
28 September	Publication of the OMC findings, including all questions and answers to the OMC questionnaire.
30 September	Closure of the OMC.

Table 1: OMC Timetable

The IMPRESS PCP Consortium is entitled to adjust the timetable above and to terminate the OMC for

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its own reasons at any time. In such a case, the IMPRESS PCP Consortium will publish such modifications or termination on TED and the project's website (www.e-impress.eu).

1.6. Procedure

The OMC starts on the date of its publication in the EU's Supplement to the Official Journal (TED) and ends on the date set in the timetable, unless terminated earlier.

Interested parties are requested to register through the EU Survey link provided above, in order to participate in the events and receive additional information of the project. The questionnaire should be filled out before the deadline indicated in the timetable above.

The IMPRESS PCP Consortium will be engaged in supporting interested parties throughout the whole OMC during the webinars and presential events, and by answering questions through a Q&A document which will be published in the project's website.

Additional written contributions in the form of a Request For Information (RFI) questionnaire or other questionnaires (via the EU survey platform) aiming to collect market information on innovative and commercial solutions may be requested.

The responses to the questionnaires should not contain any confidential information. As the questionnaire is intended to explore the market 'as is', there are no wrong or right answers. The answers provided will be used as input for the procurement strategy and contract conditions.

In case the information provided in this document and annexes needs further clarification, market operators may ask questions during the webinars, events, or via the contact email address provided above.

Market operators that wish to provide additional confidential information during this OMC can send this to the contact person (impress-pcp@fz-juelich.de). The information must be clearly marked as confidential. Confidential information will not be included in the OMC report.

1.7. Open Market Consultation report

After processing and analysing the answers, the IMPRESS PCP Consortium will disseminate the results to the widest possible audience. Nevertheless, all answers provided by market parties will be anonymized and treated as confidential. The IMPRESS PCP Consortium will therefore not provide information about specific answers from market operators. Only the general findings and a summary

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of the answers will be provided. The results of this OMC will in any case be published on the project's website.

1.8. Annexes

The following annexes are part of this document:

- Annex 1 – EU Survey
- Annex 2 – Open Science
- Annex 3 – Use Cases
  - **Use Case 1:** Functional requirements for the interoperable platform
  - **Use Case 2:** Corrective maintenance
  - **Use Case 3:** Community of Users
  - **Use Case 4:** Safety
  - **Use Case 5:** Adaptation

The annexes form an integral and inseparable part of this OMC document. In the event of any conflict between the provisions of this document and the annexes, the provisions of the OMC document shall prevail.

Please note that the questionnaire in EU Survey is expressly qualified as an annex to this OMC document and is not a stand-alone document, but is part of a set of documents.

2. The IMPRESS project

2.1. Context and objectives

IMPRESS (Interoperable electron Microscopy Platform for advanced RESearch and Services) aims to co-develop and deliver advanced Transmission Electron Microscopy (TEM) instrumentation, methods and tools that will revolutionize the way in which TEMs are used by all new and well-established scientific communities, integrate them with other instrumentation at analytical Research Infrastructures (RIs) and create new business opportunities for small and medium-sized enterprises.

The core of the project is the development of a standardized cartridge-based interoperable platform for TEM that is based on common interfaces and data formats, is flexible and adaptable and allows users to perform advanced and new correlative experiments using different instruments, and to co-

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develop methodological options that are not yet satisfied by commercially available electron microscopes. The solutions will be delivered at Technology Readiness Level (TRL) 8 through a Pre-commercial Procurement (PCP).

The project also involves the co-development of new electron sources, techniques based on adaptive optics and event-driven detectors, application-relevant in situ/operando sample environments and software for simulation of experiments and remote access based on artificial intelligence. By the end of the project, these developments will be integrated with the new cartridge-based platform, in order to make them available to all users of RIs and other TEMs owners.

An open knowledge and innovation hub for TEM will be created and a training programme will promote the new solution, to initiate RI staff in their use and to provide both materials and life science communities with optimized tools for tackling societal challenges, especially in the energy and health sectors. The project will exploit synergies and collaboration with five RIs of European dimension for the benefit of users from diverse scientific communities and will pave the way towards a new cooperative model for the development and operation of RIs for TEM.

The interoperable platform will be integrated with all other innovations of IMPRESS, which will focus on the development of:

- New electron source prototypes that will reduce aberrations in gun optics by at least one order of magnitude, improve brightness, intensity and energy spread and allow ultra-fast (GHz) beam modulation, providing orders of magnitude higher currents than current laser-induced pulsed guns;
- Advanced techniques based on adaptive optics and event-driven detectors for disruptive electron imaging and spectroscopy capabilities (programmable phase plates; dose reduction of >10 for imaging beam-sensitive biological samples; correlative meV-resolved spectroscopy with sub-ns temporal resolution);
- New application-driven sample environments that will provide access to material properties and behaviour of interest to end users at the five participating RIs of European dimension (including in situ/operando and correlative studies of batteries, catalysts, biological samples and ultra-fast transformations in materials);
- Software for instrument alignment and control, simulation of experiments, data acquisition and analysis and remote operation based on AI (common user interface for different microscopes).

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Figure 1: PERT chart illustrating the work package structure of IMPRESS

IMPRESS is an initiative of e-DREAM, the European Distributed REsearch infrastructure for Advanced electron Microscopy consortium (https://e-dream-eu.org/), which has recently been established to promote cooperation between European-level electron microscopy infrastructure providers, collaborative research and transnational user programmes.

2.2. PCP challenge and main requirements

TEM laboratories and RIs are currently hindered by limitations of their TEM instrumentation, including the inability to perform technical adaptations for specialized experiments and to perform correlative characterization using the combination of TEM and other techniques. These limitations result in large part from the difficulty of exchanging key components of the TEM in the sample and aperture planes, as well as from the constraints imposed by commercial TEM manufacturers to prevent such developments by end users.

In this context, IMPRESS seeks the development of an interoperable platform based on common interfaces and data formats and highly flexible and adaptable to meet the scientific needs of individual users, who will be able to define and develop innovative experiments to carry out research using

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different instruments and techniques across the spatial and temporal scales. It should be developed based on fully open-source/open-hardware designs and licences.

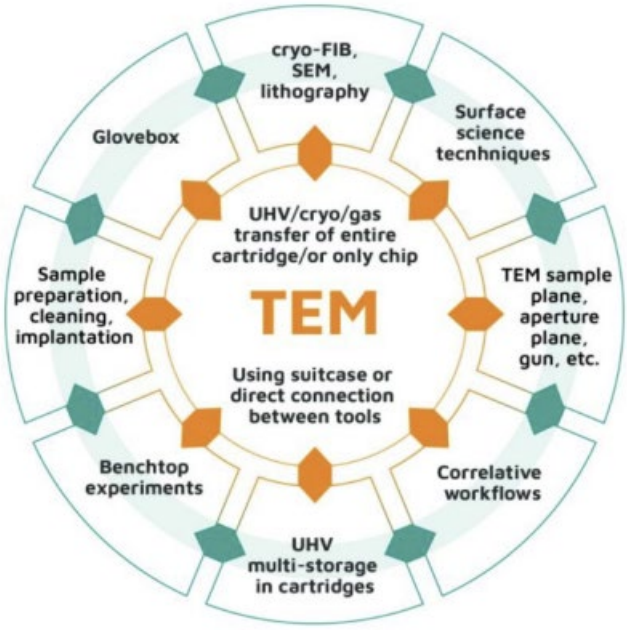

Figure 2: IMPRESS aims to achieve connectivity between TEM and other characterization techniques based on open hardware and software concepts.

The e-CAT cartridges that will be developed in IMPRESS will have a standardised interface so that they can be transferred between TEMs and other instruments. By relying on cooperation between TEM laboratories and companies, as well as on common standards, the platform will be user-adaptable and allow an operator to design and test an experiment on the bench before bringing it to a TEM.

Connections between TEM experts, industrial stakeholders, RIs and their user communities will establish an ecosystem in which technology can be adapted to users' needs, optimised for current and future instruments and applied to standard experiments and cutting-edge methodological developments. Instrument control will be established through a common open software interface, which will allow automation and remote operation based on AI, facilitating the preparation of experiments and training of users. It is important to emphasise that IMPRESS will realise a different concept from that used in interconnected workstations that integrate material growth, device fabrication and characterisation in single ultra-high vacuum (UHV) environments. Such clusters of instruments have not integrated advanced TEM characterisation into their workflows successfully, namely due to a lack of suitable interoperable cartridges and transfer solutions.

In order to ensure compatibility with existing TEMs, the simplest and smallest versions of the e-CAT

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cartridges will attach to the ends of modified side entry specimen holders, which will be adapted through the PCP to have the same interfaces as those on new designs of holder and aperture rods and other relevant instruments for characterisation, preparation and storage.

The e-CAT cartridges will be compatible with sample and aperture planes on each TEM column, so that devices such as novel phase plates, which are ultimately intended for use in specific aperture planes, can also be tested and used at other positions in the column, including the sample plane where a greater variety of imaging and analysis modes are available. The e-CAT cartridges will be designed so that they can be loaded in an automated or semi-automated way into TEM specimen and aperture holders and other instruments for preparation and characterisation, including surface science tools and transport measurements, microfocus X-ray tomography instruments and synchrotrons, while retaining sample cleanliness and the possibility for samples to be cooled, heated, in vacuum or in an inert gas across preparation methods and analytical techniques. For sample transfer and studies of non-standard geometries that do not fit through conventional goniometers or aperture barrels, the e-CAT cartridges will be compatible with vacuum transfer suitcases that can be attached to other available ports on TEM columns (in particular ports that are opposite to those conventionally used to insert sample holders and aperture rods) and with other correlative instruments and techniques. The feasibility of developing a cartridge-based system that can be used with a suitcase for the transfer of samples to a TEM has been confirmed in a proof-of-principle development at one of the project partners (FZJ-ERC).[1]

The requirements of IMPRESS are as follows:

a) Standardised hardware interfaces between holders/ rods and tips/ cartridges.
b) Standardised cartridge-in-cartridge concepts that are compatible with TEMs and correlative techniques.
c) Sample holder bodies with standardised hardware interfaces that are compatible with different TEMs.
d) Aperture rod bodies with standardised hardware interfaces that are compatible with different TEMs.
e) Standardised chip designs that are compatible with the cartridge-in-cartridge concepts.
f) Transfer suitcases with UHV, gas, cryogenic (nitrogen/ helium) and heating capabilities.
g) Sample loading chambers, reaction/ growth chambers and loading stations, also to correlative techniques.

The primary hardware requirements include:

a) Compatibility with side entry TEM specimen holder and aperture rod designs from all

[1] Zheng, F. (2020). “High spatial resolution and three-dimensional measurement of charge density and electric field in nanoscale materials using off-axis electron holography”. Forschungszentrum Jülich GmbH, Jülich, Germany, pp. 182 (978-3-95806-476-8).

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manufacturers.

b) Compatibility with holders and stages used for relevant sample preparation tools and correlative techniques.
c) Compatibility with sample transfer requirements and experiments for both materials science and biology.
d) Compatibility with UHV equipment and baking, including the possibility to maintain UHV during transfer.
e) Standardised interface and standardised chip and sample dimensions and designs for different applications.
f) Open source easily adaptable shared designs allowing for user-defined science-driven adaptations.
g) Heating and cooling of samples over the widest temperature range (4-1300 k) while allowing imaging and analysis at atomic resolution, including the possibility to maintain a chosen temperature during transfer.
h) Electrical feed-throughs with a target of >50 contacts allowing for high current and frequency experiments.
i) Double tilt and/or rotation capabilities (ideally with possibilities for internal piezo-controlled motion).
j) Flowing and static liquid/ gas, including the possibility to maintain gas reaction conditions during transfer.
k) Light injection (fibres or free space).
l) Multiple levels of registration and alignment markers for correlative experiments.
m) Possible internal accelerometer for real-time correction of sample drift and motion.
n) Possible independent monitoring of sample position and tilt angle to 5 nm and 0.1° accuracy respectively.
o) Possible built-in electron beam current and/ or magnetic field measurement.

Initial applications for existing TEMs will be based on side entry sample holders, but that for more advanced experiments on specialized TEMs it will be possible to insert cartridges and samples of different size from larger ports on columns, as well as between sample and aperture planes.

Software and control requirements for all of the components will be as follows:

- All components should be compatible with a fully automated and programmable instrument control system.
- In case a contractor only provides a subset of components, it should fulfil all requirements for a master control interface for the entire system.
- The control interface should be: i) open-source, ii) programmable and iii) able to communicate with other components, including sources, lenses, deflectors, stages and detectors from different manufacturers.

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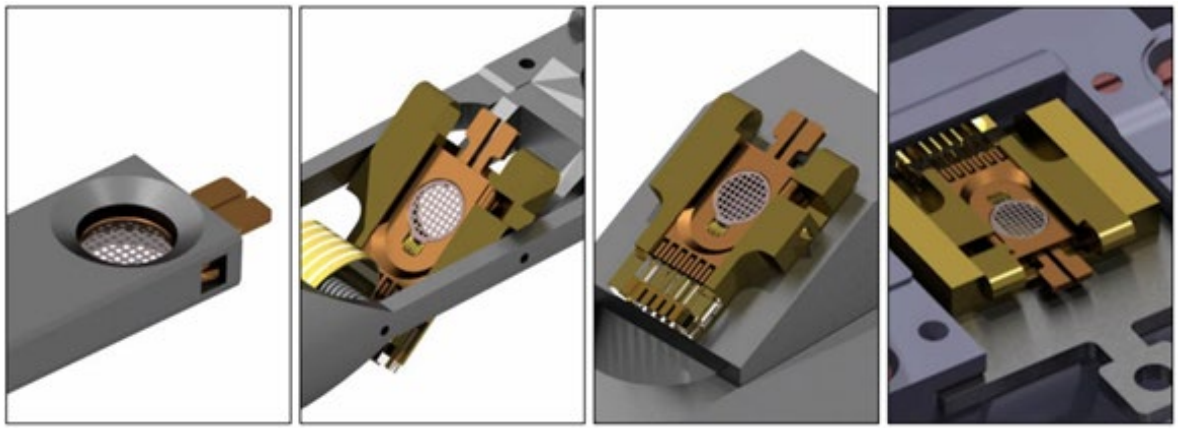

Figure 3: Design drawings of a small TEM sample carrier that can be transferred using a suitcase to the end of a simple side entry specimen holder; a holder that has a second tilt axis, a stage for a FIB workstation and a plate for surface science experiments.

The figure above shows drawings of a simple TEM sample carrier-that has electrical contacts and can be transferred using a suitcase to a side entry holder, a holder that has a second tilt axis, a stage for a FIB workstation and a plate for surface science experiments. In IMPRESS, much more sophisticated e-CAT cartridges will be designed that are compatible with larger numbers of electrical contacts, high currents, high frequency signals, gases, liquids and light. Figure 4 (below) shows a schematic diagram illustrating the concept that will be developed in IMPRESS of using different sizes of e-CAT cartridge that have standardised interfaces and can be transferred between TEMs and other instruments using specimen holders, rods or suitcases. The smaller e-CAT cartridges are proposed to be compatible with the dimensions of standard side entry specimen holders and aperture rods. Removable suitcases can be used to load the e-CAT cartridges via spare ports on the column so that they lock onto specimen holder rods, aperture rods or other mounting points in the TEM.

For more details about the use cases, please see Annex 3.

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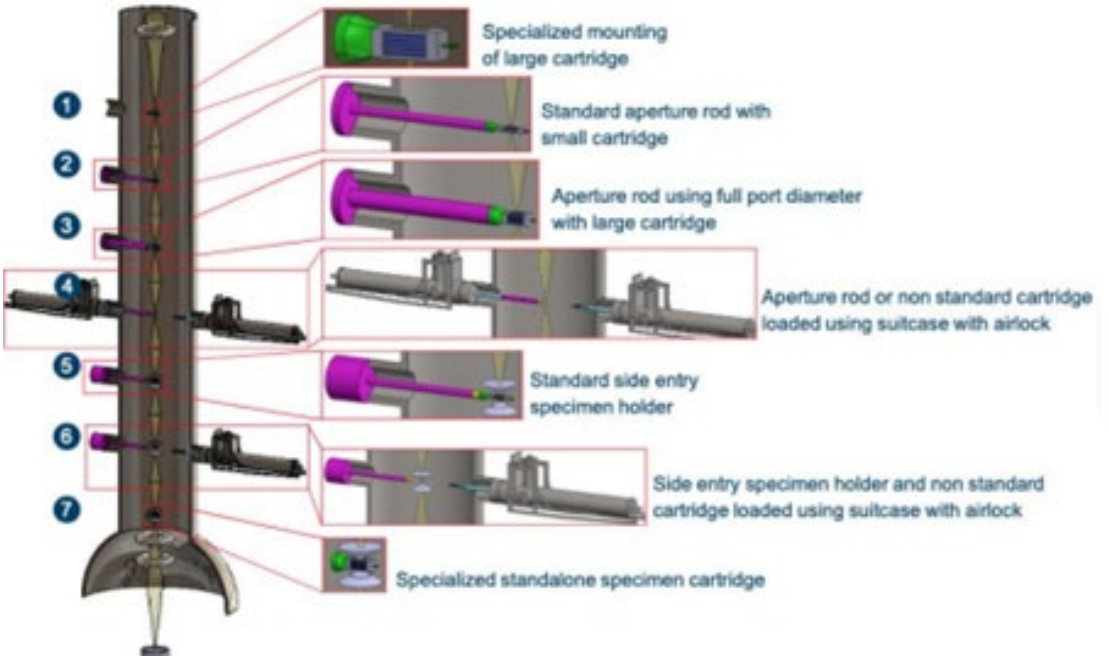

Figure 4: Schematic diagram illustrating the proposed development in IMPRESS of more sophisticated cartridge concepts that are compatible with larger numbers of electrical contacts, gases, liquids and light and can be inserted in different positions on a TEM column.

The Project – How / cartridge-based system

The interoperable platform consists of both **hardware and software components** based on a **modular and standardized e-CAT cartridge concept**.

Correlative Users will be able to plan, design and carry out **correlative experiments** by easily transferring specimens from TEMs to other instruments and vice versa.

Adaptable The IMPRESS platform will be **adaptable to the requirements** of users from different scientific domains.

Transferable The IMPRESS cartridge will be **transferable** between different **segments** of the electron microscope and across different **instrumentations**.

Figure 5: The e-CAT cartridge concept

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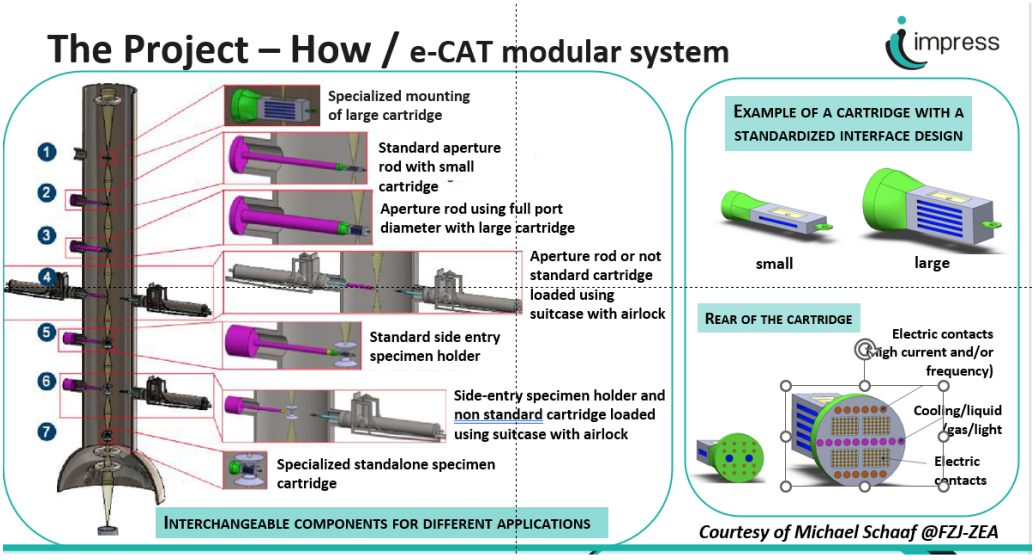

Figure 6: The e-CAT modular system

2.3. The Pre-Commercial Procurement (PCP) approach

This OMC concerns a future PCP of R&D services to be performed in their majority in the EU Member States or Associated Countries. The PCP process will require selected providers to locate the majority of the R&D activities, including the principal researcher(s) working for the PCP contract, in particular, in the Member States or Associated Countries. Any prototypes entering Europe's Schengen area will require a ATA Carnet document and will not be able to be modified after entrance. The prototypes coming from outside Europe's Schengen area should be returned to its origin after completing the testing. The value of the total amount of products covered by the contract must be less than 50 % of the total value of the PCP framework contract.

PCP is an approach that allows public procurers to buy R&D from several competing suppliers in parallel, to compare alternative solution approaches, and to identify the best value-for-money solutions that the market can deliver to address their needs. In PCP, there is a risk-benefit sharing under market conditions between the public procurer and the suppliers, and a clear separation between the PCP and the deployment of commercial volumes of end-products.

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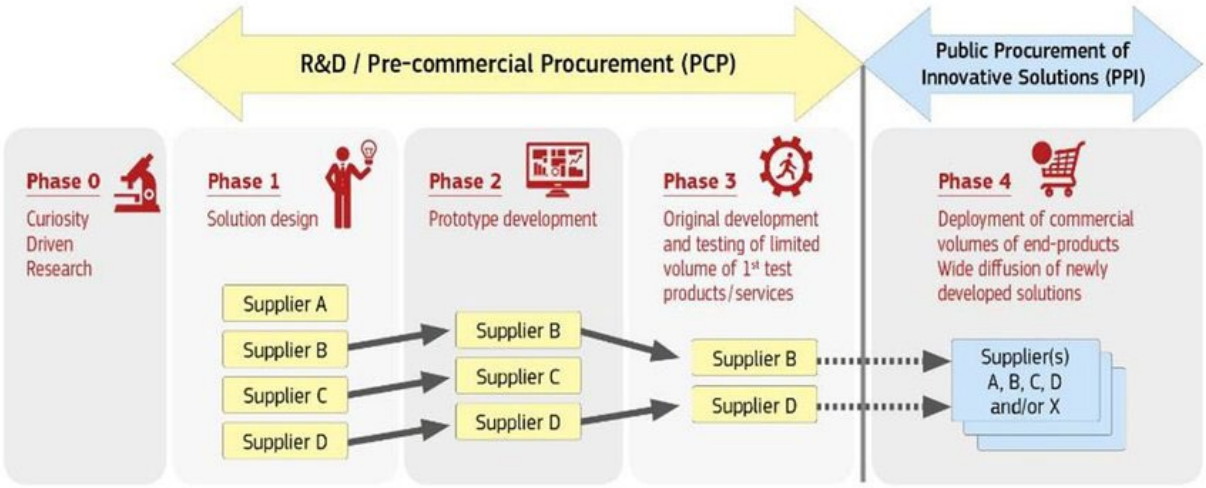

Figure 7: PCP and PPI, according to the European Commission (2016).
Based on "Pre-commercial procurement: driving innovation to ensure sustainable high quality public services in Europe", COM(2007) 799 final.

Along with the R&D services, the PCP allows to purchase some products providing that the value thereof is **less than 50 % of the total value of the framework contract.**

The PCP tender will start with the publication of the contract notice along with the request for tenders, the framework agreement, and the phase contracts. After evaluating the offers submitted by the market operators according to the rules established in the tender documents, the contracts will be awarded and a contract award notice will be published. The process will be monitored to ensure sound deployment, integration and validation of the PCP.

The PCP procedure is composed of three phases of solution design, prototype implementation, and validation and demonstration of the solutions.

- **Phase 1. Solution design:** During this Phase, the awarded R&D providers will be asked to describe the solution providing the complete architecture and design of the solution and verifying the technical, economic and organizational feasibility of their solution based on requirements for the interoperable platform from all procurers. The expected duration of this Phase will be 4 months.

- **Phase 2. Prototype implementation:** This Phase concerns the development of the first prototypes of the solutions, which will be tested. Qualified contractors will develop a first prototype based on the design documents delivered in the previous phase and test their solutions on TEMs at the procurers' premises under controlled conditions. The expected duration of this Phase will be 10 months. In Phase 2, the prototype shall be delivered and installed by technology vendors at Juelich. The acceptance of the prototype will be limited to

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the requirements of Phase 2. There is not a complete acceptance. After the acceptance of Phase 2, the issues that may arise from prototype installation shall be corrected and solved.

During Phase 2, it will be verified how well the prototype is compliant with the use cases requirements. The prototype installation and corrective maintenance shall take into account the safety according to the regulations of the test site, the nature of the prototype (e.g. adaptability) and the established criteria to work according to the functionalities.

The entrance point in Phase 2 is a minimum of 50% of prototype functionality, weighted on the basis of the to-be-defined methodology (e.g. KPIs). At the end of Phase 2, it is expected that a minimum of 80% of the prototype functionalities is installed and functioning at Juelich weighted on the basis of the to-be-defined methodology (e.g. KPIs).

Eight prototypes shall be tested at the test chamber in Juelich before sending them to other test sites in Phase 3 for adaptation.

- **Phase 3. Validation and demonstration of the solutions:** This Phase will deal with testing and validation of the selected solutions (at least two) in operational environments, including their compatibility with: (i) a multi-purpose bright electron sources and manipulation of the electron beam in the time domain in a TEM; (ii) a new electron optics and event-based electron detectors for users; and (iii) a multi-functional chips with specialised capabilities. The quality and maturity of the solutions will be tested with end users from the participating RIs within the framework of the project. During Phase 3, a feedback mechanism will be established between the Public Buyers Group and the selected contractors in order for the latter to receive requests for improvements directly from the end users. The Public Buyers will request from the contractors an Integration Report. Finally, a Field Acceptance Report related to the accomplishment that the two final solutions which have been deployed and that the validation tests have been successfully performed in a real operational environment will be requested. The expected duration of this Phase will be 6 months.

  The test will evaluate the ultimate performance of prototypes. The starting point shall be at least 80-85% of functionalities, weighted on the basis of the to-be-defined methodology (e.g. KPIs). The output of Phase 3 shall be 100% of the prototype installation and functioning. The prototypes shall be tested in all the test sites. The percentage to accomplish during Phase 3 will require adaptation and/or optimisation. Since other sites may have other requirements, it is important to ensure compatibility.

  Test sites in Phase 3 would include:

  a. All procurers' labs
  1. ER-C, Juelich
  2. Area Science Park, Trieste

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3. CNR-IMM, Bologna
4. UA, Antwerp
5. ICN2, Barcelona
6. IFW, Dresden
7. ELI

b. All IMPRESS experimental labs

1. CNRS-LPS, Orsay
2. UM, Maastricht

The prototypes will be distributed to different test sites to first check for their compatibility and then perform the scientific experiments.
The conditions and specific set-up of each testing site will be defined in due time. Some functionalities may be tested only in some sites. The hardware requirements shall be considered.
Each test site will provide in advance the applicable regulations and safety rules

After each phase, intermediate evaluations will be carried out to progressively select the best solutions. Contractors that are evaluated as successful after Phase 1 will be invited to bid for Phase 2 contracts. Likewise, contractors that are evaluated positively after Phase 2 will be invited to bid for Phase 3 contracts. During Phases 2 and 3, contractors will be invited to communicate with the IMPRESS PCP Consortium about the requirements for electronic control and a user interface for operation of the prototypes to ensure that the developments made within the project[2], including novel phase plates, sample chips and adaptors for correlative techniques, are compatible with the proposed solutions for the interoperable platform.

As a follow up of the PCP to procure R&D services, the public buyers may initiate a Public Procurement of Innovative solutions (PPI) to purchase the solutions based on the R&D results which have been brought to the market.

The law applicable to the IMPRESS PCP is German law.

[2] As described above, the interoperable platform developed and tested during the PCP needs to be compatible with: (i) a multi-purpose bright electron sources and manipulation of the electron beam in the time domain in a TEM; (ii) a new electron optics and event-based electron detectors for users; and (iii) a multi-functional chips with specialised capabilities.

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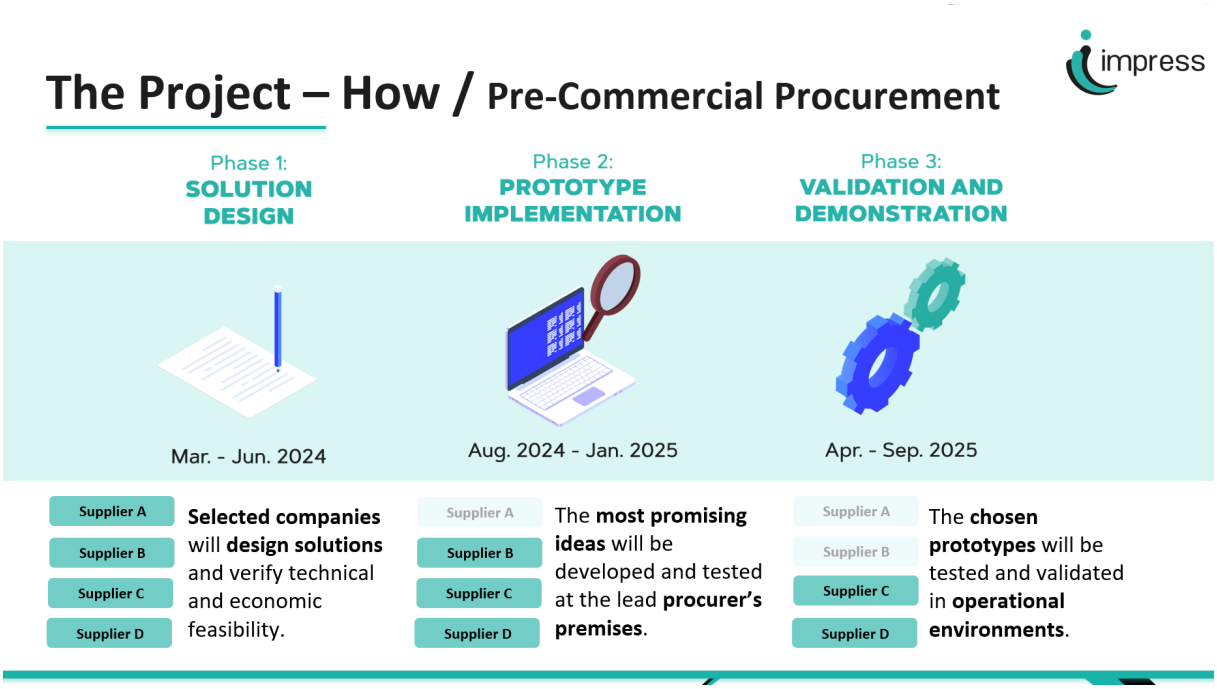

Figure 8: Successive phases of the PCP workflow in IMPRESS

Budget per phase

The table below presents an overview of the details of each PCP Phase. These details are purely indicative and may be reassessed based on the feedback resulting from the OMC.

PCP phase	N. of contractors	Subcontracting cost per contractor	Total subcontracting cost per phase
Phase 1 – Solution design	At least 4	75,000 €	300,000 €
Phase 2 – Prototype development	At least 3	400,000 €	1,200,000 €
Phase 3 – Operational validation	Al least 2	250,000 €	500,000 €

Table 2: Budget per phase

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For payment purposes, the technical committees will decide whether the results delivered by the contractors are non-satisfactory or satisfactory, and whether R&D providers achieved successful completion, after each phase. Only those who complete a phase successfully are eligible to pass to the next phase.

The participation in Phase 3 will be limited to a minimum of 2 contractors. The exact maximum budget will be defined based on the OMC results.

If there is leftover budget from the previous phases, it may be transferred to the next phase. Therefore, the total budget available for phases 2 and 3 may eventually be higher than stated. The IMPRESS PCP Consortium has the right – but not the obligation – to swift budgets. The total value of the contracts awarded can also be lower than initially expected.

Contracts implementation

During the implementation of IMPRESS PCP, effective tools will be used in order to monitor performance of the R&D suppliers and provide regular feedback during each phase. Each contractor will be assigned a main contact person (their supervisor) appointed by the procurers as the main point of contact.

More specifically the monitoring process will be divided in 3 set of activities:

- **Pre-monitoring:** A kick-off meeting per contractor will be scheduled at the beginning of each PCP Phase and the selected contractors will be requested to present their implementation schedule for the PCP Phase that they are entering in. During the same meeting, the supervisor will present the framework for the review. The objective is to establish a close and fruitful communication channel with the contractors, in order to ensure from the early beginning of the action that the project is implemented according to the needs of the buyers.

- **Monitoring:** Contract implementation will be monitored and reviewed against the expected outcomes for each phase. The intensity of monitoring and communication between the Public Buyers Group and the contractors will increase from Phase 1 to Phase 3. For instance, regular meetings with the contractors by videocall or face-to-face, on-site visits to the contractors' locations to check and discuss the status of the work and progress, or any other suitable way. Ad-hoc meetings and on-site inspections are also possible in the event that the R&D development has halted or slowed down.
  The contractors are mandated to present monthly the current status of the work and describe the progress made. All the documentation generated by the contractors will be reviewed and the ideas and recommended areas to pursue will be highlighted in post-review activities.

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- **Post-monitoring:** At the conclusion of the monitoring activities, the supervisor will provide written feedback for each contractor at each PCP Phase. This feedback will generally consist of overall comments and remarks about the contractor's outcomes under review. Monitoring activities will be continued after the PCP is completed. Specifically, it will be checked whether the contractors are successfully commercializing the R&D results within the call-back period defined in the PCP framework agreement. If that is not the case, the IMPRESS PCP Consortium will ask the R&D suppliers to give licenses under Fair, Reasonable And Non-Discriminatory (FRAND) terms to other third parties, or will ask to transfer back the ownership of results to the Public Buyers Group. Other contractual obligations of the contractors that go beyond the end of the PCP are, for instance, providing information or support to the Public Buyers' Group in connection with the PCP solution, contributing to standardization, obligations regarding publication of information about the contract, auditing/keeping data obligations, etc.

2.4. Testing strategy

IMPRESS PCP provides a unique possibility to amplify and enable multidisciplinary research and enhance reproducibility of results by testing the prototypes at the different facilities that are part of the Consortium. The effectiveness of IMPRESS will be demonstrated by the benefit that it will bring to existing and new user communities of European strategic interest. It will create a foundation for future research that will enable analytical facilities to react rapidly to changing research demands. Furthermore, it will strengthen the synergy between TEM laboratories and SMEs, foster cooperation with RIs of European dimension and integrate different communities in a consortium of scientific and technological excellence. In these ways, it will also create a sustainable operating model beyond the lifetime of the project.

The testing strategy will be developed by defining the selection, compliance and award criteria, performance conditions and IPR strategy. A verification and validation strategy has been developed, in order to summarise the technical verification and operational validation processes that will be followed for evaluating the companies. This takes into account external systems, applications, protocols and data formats for the development of the interoperability and integration strategy of the PCP solutions, as well as IPR clauses attached to the proposed solutions.

The contractors will be responsible for the provision of all geometric and dimensional information, as well as for the materials to be used to fabricate the interoperable platform(s). IMPRESS will provide the information about the cartridge / chips intended to be used. During the prototype testing the measures and materials will be validated.

2.5. The Public Buyers Group

The IMPRESS Consortium brings together 7 public buyers from Germany, Italy, Belgium, Spain and

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Czech Republic. For the purpose of the PCP, the Public Buyers Group will be represented by Forschungszentrum Jülich GMBH as lead procurer.

FORSCHUNGSZENTRUM JÜLICH GMBH

Forschungszentrum Jülich GMBH is a national research institution that pursues interdisciplinary research in the different fields.

The Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons (ER-C) was founded in 2004 as a joint facility operated by Forschungszentrum Jülich and RWTH Aachen University and as a national user facility for high-resolution transmission electron microscopy. On 1 January 2017, the ER-C attained the status of an independent scientific institute in Forschungszentrum Jülich.

The ER-C specialises in the development of techniques of high-resolution transmission electron microscopy and spectroscopy. It operates a wide range of state-of-the-art transmission electron microscopes, which are used to provide unique insight into the world of atoms. These instruments include the first chromatic aberration corrected transmission electron microscope in Europe, the Titan PICO, as well as other aberration corrected microscopes that are optimized for analytical, tomographic and in situ transmission electron microscopy. The ER-C places a strong emphasis on the methodological development of high-resolution transmission electron microscopy and spectroscopy and on the application of these techniques to topical scientific problems.

CONSIGLIO NAZIONALE DELLE RICERCHE (CNR)

The National Research Council (CNR) is the largest public research institution in Italy, the only one under the Research Ministry performing multidisciplinary activities.

Founded as legal person on 18 November 1923, CNR's mission is to perform research in its own Institutes, to promote innovation and competitiveness of the national industrial system, to promote the internationalization of the national research system, to provide technologies and solutions to emerging public and private needs, to advice Government and other public bodies, and to contribute to the qualification of human resources.

In the CNR's research world, the main resource is the available knowledge which means people, with their skills, commitment and ideas. This capital comprises more than 8.000 employees, of whom more than half are researchers and technologists. Some 4.000 young researchers are engaged in postgraduate studies and research training at CNR within the organization's top-priority areas of interest. A significant contribution also comes from research associates: researchers, from Universities or private firms, who take part in CNR's research activities.

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AREA DI RICERCA SCIENTIFICA E TECNOLOGICA DI TRIESTE (AREA)

AREA is a national Research Performing Organisation under the Italian Ministry of Research and University, in charge of managing the largest Italian science & technology park. It contributes to sustainable, knowledge-based socio-economic welfare and technology transfer to the market through more effective cooperation models with industries & enterprises.

LEIBNIZ INSTITUT FUR FESTKORPER UND WERKSTOFFORSCHUNG DRESDEN EV (IFW)

The Leibniz Institute for Solid State and Materials Research Dresden - IFW Dresden - is a research institute in which scientists and engineers work together. They explore the physics and chemistry of materials that might be suitable for new functionalities and devices. Many disciplines come together at IFW: experimental physics, theoretical solid-state physics, chemistry, materials research and electrical engineering.

The IFW Dresden is a legally independent, non-university research institution and member of the Leibniz Association. Its purpose of the association is fundamental and applied research in the fields of solid state and materials research as well as the training of young scientists and staff.

UNIVERSITEIT ANTWERPEN (UAntwerp)

The University of Antwerp is a young, dynamic and future-oriented university. It integrates the assets of its historical roots into its ambition to make a positive contribution to society. UAntwerp strives for a qualitative and relevant interpretation of its three academic core tasks: education, research, services. UAntwerp is the home ground for original thinkers and actors. Its research group EMAT – *Electron Microscopy for Material Science* – is one of the leading electron microscopy centers in the word.

FUNDACIO INSTITUT CATALA DE NANOCIENCIA I NANOTECNOLOGIA (ICN2)

The Institut Català de Nanociència i Nanotecnologia (Catalan Institute of Nanoscience and Nanotechnology) is a non-profit international research institute located close to Barcelona (Catalonia, Spain). It is devoted to the generation of knowledge, materials and devices in the broad fields of ICT, health, energy and the environment.

The expertise of the ICN2 lies at the nanoscale, where new properties, interactions and ways to exploit them in everyday life are being discovered. Among its goals is to bring together scientists from diverse backgrounds in the pursuit of better science, better training and better outreach to society, while also seeking out new ways to engage with local and global industry.

THE EXTREME LIGHT INFRASTRUCTURE (ELI) ERIC

ELI Beamlines Facility is a leading laser research centre and part of The Extreme Light Infrastructure

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ERIC, pan-European research Infrastructure hosting the world's most intense lasers. ELI provides unique tools of support for scientific excellence in Europe. ELI Beamlines has developed and operates four leading edge high-power femtosecond laser systems reaching unprecedent intensities. ELI Beamlines offers to its users unique femtosecond sources of X-rays and accelerated particles. These beamlines enable pioneering research not only in physics and material science but also in life science, laboratory astrophysics, chemistry with strong application potential.

Currently, several of the main laser beamlines are operational and are being expanded and upgraded to reach their full performance and maximum availability. Other laser beamlines are in commissioning and new cutting-edge laser sources are in the design and development phase. The ELI Beamlines Facility builds on 350 researchers, engineers and other professionals from more than 38 countries.

2.6. Intellectual Property Rights

Intellectual Property Rights (IPRs) are the rights that adhere to creations and grant the holder(s) thereof a monopoly on the use of that creation for a specified period and subject to certain exceptions. The underlying aim of granting such (temporary) monopoly is to incentivise creators to share their creation with the public, and to achieve the social benefits of increased creative activity.

Traditional IPRs – such as patent, copyright and trademark – are generally fully disclosed to the public domain, meaning that the essential qualities of the protected subject matter are made available for public inspection. Public and third party use of IPRs is however curtailed by the requirement of needing a 'license' to use the IPR productively.

We can distinguish between "background IPR", "sideground IPR" and "foreground IPR" depending on when they are generated.

"Background IPR" refers to the pre-existing intellectual property and trade secrets produced before the project and which the parties (public buyers and contractors) bring to the PCP, and which may be built-upon, modified or improved during the procurement. As a general rule, the background IPR remains the property of the party who generated it. Given this, access rights may need to be granted to the public buyers to ensure that they are able to conduct the activities they are involved in during the PCP (e.g., analysing and testing of solutions) and to use the PCP results that incorporate background IPR.

"Sideground IPR" refers to intellectual property produced during the period of the PCP but not in the activities covered by the PCP contract itself. In the vast majority of cases, the sideground IPR remains the property of the party who generated it. Given this, access rights may need to be granted to public procurers to ensure they are able to conduct the activities they are involved in during the PCP project (e.g., analysing and testing of solutions) and to use the PCP results, which incorporate the sideground IPR.

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"Foreground IPR" refers to the intellectual property and trade secrets produced in and during the PCP.

In IMPRESS PCP, the contractors will retain ownership of the IPRs that they will generate during the PCP and will be able to use them to exploit the full market potential of the developed solutions.

This solution fosters innovation and ensures that the public buyers will get better solutions at a good price, since the price will be lower than in the case that the public buyer retains the IPRs. In other words, the companies are expected to offer a price reduction in exchange of retaining the IPRs, according to the mechanism of ex-ante financial compensation. In addition to this and fully in line with the open science approach pursued by IMPRESS, companies will make their solutions (or part of them) publicly available in the FAIRcube. In addition, the IMPRESS Consortium is also committed to use the GitHub community on open-source software licences and Creative Common licences for hardware designed specifications. In addition, technology vendors are mandated to support this approach.

In case of non-exploitation of the results or abuse of the results against public interests or failure to commercialize the results, the Public Buyers Group will have the right to require the transfer of the IPRs generated by the company during the PCP (call back clause).

IMPRESS will disseminate the results according to open access rules and obligations, whilst safeguarding at the same time the IPRs of the members of the Consortium and the contractors (both background and foregrounds rights).

2.7. Confidentiality

The intention of the Public Buyers Group is that any information related to the solutions developed within the PCP will be confidential and will not be published or disclosed to third parties without the consent of the Public Buyers Group. This confidentiality obligation will remain until the end of the PCP.

In order to ensure that sensitive information keeps confidential, the participants in the PCP will be asked to sign, in any case, a Non-Disclosure Agreement (NDA) in due time to receive the detailed technical and functional specifications of the tender.

The OMC aims to explore the commitment of the market operators to co-develop and further commercialise the solutions resulting from the PCP.

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3. State-of-the-art analysis: Preliminary results

This section presents the preliminary result of the state-of-the-art (SOTA) analysis. In particular, this search focused on patents and literature of the technologies that exist in the market as well as the ones produced by the main companies that operate in the TEM field.

In this framework, the general patent landscape of more than 60 companies has been explored, using specific keywords such as “cartridge”, “TEM”, “specimen” and “electron” to identify existing technologies that can tackle the procurement challenges together with an analysis of the IPR of such technologies to assess existing patents, and to estimate the TRL.

Across the search, at first, electron-based microscope technologies appear to be mature. Not only the search found a considerable number of patents, but - from a first review - it seems that many solutions employing these technologies are widely available for various market segments.

For what concerns cartridge and cartridge-based solutions and technologies, which is the core of the IMPRESS project, the situation is more uncertain. On the one hand, there is a patenting activity that aims to provide some solutions. On the said sector, the number of patents is limited and does not cover the integrated approach of all the use cases/functionalities.

From a geographical perspective, the most important representatives from the demand side remain in the US, whose patenting activity is undisputed, with China, followed by Japan and South Korea while Europe remains a laggard with few exceptions. This geographical assessment may reveal that around these technologies there could be a higher regional TRL in North America, Eastern Asia and a lower in Europe.

Finally, it is worth mentioning that there is no widespread standardization in the field. This can be explained from the fact that there is a very high competition in the field with companies fighting for dominance, which can deter standardization efforts.

4. Business case and value calculations: Preliminary results

The Business Case and Costs Analysis (BC&CA) methodology is part of the PCP’s preparatory phase. It is designed to yield essential information regarding the procurer’s need for innovation and the industry’s abilities to meet this need. To establish the BC&CA, the following elements need to be studied:

- The targeted market, its situation (demand and supply side) and foreseen evolution.
- The expected benefits provided by the IMPRESS solution.
- The necessary calculations to demonstrate the financial viability of the investment.

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The current section presents an initial overview of the targeted market and the expected benefits at the time of the publication of this report based upon the results of the SOTA analysis. Following the input to be received during the OMC activities, the IMPRESS Consortium will finalise the last step related to the necessary value calculation.

Targeted Market Overview

The transmission electron microscopy market is estimated to grow at a CAGR of 10.2% until 2026 and the market is also expected to increase in size by €360 million in 2021-2026, based on a report from Technavio[3] .

In general, the electron microscopy product segment is the fastest growing among the microscopy market segments, owing to a growing global focus on nanotechnology and favourable government and corporate funding. Technological advancements such as high-throughput techniques, super resolution, and microscope digitization are the most important market drivers.

The key market challenges, however, are the high cost of advanced microscopes, the time-consuming sample preparation process, and the high level of technical expertise. On the other hand, the availability of customized microscopy solutions and superior microscopy customer support is regarded as the winning imperative. Another significant market restraint is the lack of open-source software for the TEM.

The market is considered fragmented with several players occupying the market share.

Demand Side & Expected benefits

Regarding the end users, the European microscopy market is categorised into academic institutions, industries and other government research institutes and private laboratories. The primary customer of the developed solution is the RIs that offer advanced analytical services. In this regard, the European Analytical Research Infrastructures (ARIE) amount to more than 110 European Analytical research infrastructures.

Equally relevant (secondary targeted users) are the academic scientists and industrial users, including their R&D and quality control departments. Industries that require access to TEM include, among others, catalyst developers, medicine manufacturers and semiconductor technology, which are critical for Europe. Analytical RIs play a vital role in supporting these industries through user support.

On global level, although it is difficult to define these numbers precisely, it is estimated that more than 5.000 TEMs are in active use, offering access to more 50.000 users annually.

[3] Transmission electron microscope market by application, end-user, and geography - Forecast and Analysis 2021-2025 (Nov 2021), Technavio, SKU: IRTNTR40642, https://www.technavio.com/report/transmission-electron-microscope-market-industry-analysis

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The most relevant market segments by application are:

- Material science
- Nanotechnology sector
- Environmental sciences
- Semiconductor sciences
- Cultural heritage
- Life sciences

Other secondary customers have been identified from further networks and institutions, which can expand the demand base. The following have been identified as of the interest of the IMPRESS PCP outcomes:

- ESTEEM 3
- NFFA-Europe Pilot
- Euro Nano Lab
- EOSC-Life
- Global BioImaging
- EMPIAR
- Battery 2030+
- ENRIITC
- LEAPS Innovation Pilot
- PaNOSC
- ExPaND
- European Microscopy Society
- International Federation of Societies for Microscopy
- InterAmerican Committee for the Societies for Microscopy
- Committee for Asia-Pacific Societies for Electron Microscopy (CAPSM)
- European Microbeam Analysis Society (EMAS)
- International Society for Stereology and Image Analysis

The Public Buyers Group has identified a number of impacts from the introduction of the e-CAT cartridges as well as the associated internal and external benefits to their operations. These are listed in the table below:

Internal Benefits	
Impact	**Benefit**
More flexible TEM instrumentation	Expand the TEM user base
Trans-disciplinary access to RIs -exchangeable sample cartridges Increase data sharing	Productivity increase

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Standardisation (harmonise experimental procedures across facilities)	Reduction of dedicated personnel to carry out the experiments
Ability to use advanced techniques / plan complex , multi-technique projects	Improvement of services (more experiments)
Sample Storage for future experiments Reduce the risk of sample damage	Improvement of services (easier experiments)
Automatic or semi-automatic loading into TEM	Saving time
Increase the possibility of interconnection between analytical techniques in a single platform	New scientific possibilities
Higher user satisfaction	Replacing costly equipment/procedures
Maintenance costs reduction	Cost reduction
Enhance cooperation capabilities	Advanced research potential to other uses.
- Easier to use for regular users and therefore spare RI staff time from repeated work to innovative development - Reduce the resource and effort from the community to develop same function for different platforms	Personnel cost reduction /More personnel time allocated to high value-added tasks
Promote community-driven development and troubleshooting	Reduction of development costs and time
Other external benefits related to the wider impact that the solution can introduce	
Avoid vendor lock in. RIs can freely choose column manufacturers for different projects based on their best performance rather than prone to select single manufacturer because they share the same sample entry interface	Increased competition contributing to lower costs and better services for RI
New research capabilities	Increase competition and components price reduction Creation of new job opportunities New scientific methodologies and workflows Creation of new markets
Push certain manufacturer to adapt their environment to the new universal multi-functional cartridges	More scientific capabilities Creation of new markets
Lower entry barrier for SMEs to enter TEM development market because of the open-access and universal interface	More scientific capabilities Creation of new markets

Table 3: Benefits of the IMPRESS PCP solution

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Following the identification of abovementioned added value of the IMPRESS PCP solution, the Public Buyers Group will conduct a Cost-Benefit Analysis to compare the current status with the future situation. Serving this goal, the Net Present Value (NPV) will be calculated to estimate the difference between the actual present value and the present value over a period of time.

The calculations of the NPV of the IMPRESS PCP solution will allow to define:

- The initial investment and the discount rate.
- The savings compared to an annual operational basis.
- The validity of assumptions made through a sensitivity analysis.

Supply side

In Europe, there are approximately 60 well-established companies that specialize in the manufacture of TEM instruments and related equipment. These firms create a variety of TEM models, including high-resolution TEM, scanning TEM (STEM), and analytical TEM. Some of the most prominent TEM manufacturers have headquarters or regional offices in Europe (for more details, please refer to the previous section), where they provide cutting-edge microscopy technology for research institutions, universities, and industrial laboratories.

It should be noted that, in addition to the manufacturers, there are distributors and dealers operating on a global scale, making TEM instruments more accessible to researchers and institutions in various regions. Distributors are critical in providing localized support, training, and services, as well as facilitating TEM instrument delivery and installation.

5. Questionnaire (Request for Information)

This survey is part of the OMC of IMPRESS PCP. It should provide IMPRESS Consortium with feedback from the market about the main challenges of the project. The OMC document related to this questionnaire can be found on the project's website (www.e-impress.eu).

Respondents are invited to answer all the questions in this survey (one survey per company). The results will be considered when drafting the IMPRESS PCP call for tenders, particularly concerning the design, the prototype testing and the evaluation of the solutions.

This survey can also be viewed online via the following link: https://ec.europa.eu/eusurvey/runner/IMPRESS-PCP_2023

Please note that taking part in this survey is not a prerequisite for the participation in the IMPRESS PCP call for tenders and does not give any advantage to any supplier. The meeting will be held in English and must ensure compliance with the principles of transparency and equal treatment. Therefore, no

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additional information will be disclosed in these meetings. The sole purpose of those meetings is to allow respondents to ask questions while protecting business confidentiality.

All information provided during the OMC and other background information will be anonymized, summarized and published online in English on the project's website.

Your personal data will be collected, processed, stored and used by the IMPRESS PCP Consortium with the only purpose of implementing the IMPRESS PCP project. Personal data will be treated as strictly confidential according to the General Data Protection Regulation (Regulation 2016/679 of the European Parliament and of the Council - GDPR). You may exercise your right to access your personal data and the right to rectify such data by contacting: impress-pcp@fz-juelich.de.

QUESTIONS FOR SUPPLIERS	
Requirements of IMPRESS PCP and planning	
1.	Do you have questions about the requirements of IMPRESS-PCP? If yes, please explain.
2.	Can you tackle all requirements of IMPRESS? Please explain.
3.	Are you missing requirements or specific information from IMPRESS? If yes, please explain.
4.	Do you see any risks, related to the IMPRESS requirements/specifications, budget and planning? Please explain.
5.	Taking into account that the budget cannot be modified, how can we mitigate these risks? E.g. by minimizing the required functionalities/requirements.
6.	Based on the use cases, what are preconditions (what needs to be fulfilled) for delivering the Interoperable Platform? Please explain.
State-of-the Art (SOTA) Analysis and TRL	
7.	Do you think there is room for development beyond the state of the art? In which specific area?
8.	What developments would you propose?
9.	Do you know the TRL of those solutions/developments?
10.	Do you know any certifications and/or standards that are relevant to the IMPRESS-PCP

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	project? If yes, please explain.
Testing strategy	
11.	In your opinion, are the timelines on installation and testing for phases 2 and 3 feasible?
Open software and hardware approach	
12.	Do you have any remarks regarding the intention to use an open software approach?
13.	Do you have any remarks regarding the intention to use an open hardware approach?
14.	Do you have any remarks on the use of Creative Commons licenses for software and hardware to be developed?
Miscellaneous	
15.	What information do you still need in order to make a good plan of action?
16.	What support do you expect from IMPRESS?
17.	What are the risks associated to the proposed cooperation between IMPRESS, technology vendors and research institutions?
18.	Do you have any experience in creating a community of users?
19.	Are there any omissions in these questions? Please explain
20.	Do you have any suggestions?
21.	You may provide suggestions applicable to any of the use cases: • **Use Case 1:** Functional requirements for the interoperable platform • **Use Case 2:** Corrective maintenance • **Use Case 3:** Community of Users • **Use Case 4:** Safety • **Use Case 5:** Adaptation

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QUESTIONS FOR USERS	
22.	Do you have specific requirements on the functionalities that IMPRESS-PCP should take into account? If yes, which ones?
23.	Can you indicate any use cases that you will be interested in which are not indicated by IMPRESS? If yes, which ones?
24.	Do you know any developments that IMPRESS needs to take into account? If yes, which ones?
25.	How could you contribute to IMPRESS? a) Developing instrumentation b) Share in-house developments c) Suggestions for further developments d) Knowledge e) Other
26.	Do you have any suggestions?

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Annexes

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ANNEX 1 - EU SURVEY

Available online via the link mentioned in Section 7.

https://ec.europa.eu/eusurvey/runner/IMPRESS-PCP_2023

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ANNEX 2 – OPEN SCIENCE

Open science consists in sharing knowledge, data and tools as early as possible in the R&I process, in open collaboration with all relevant knowledge actors, including academia, industry, public authorities, end-users, citizens and society at large. This approach increases the quality, efficiency and impact of R&I[4].

"Open source software" (or free software) refers to software whose source code is made publicly available, in a timely and user-friendly manner, in human- and machine-readable and modifiable format, under an open license that grants others the right to use, access, modify, expand, study, create derivative works and share the software and its source code, design or blueprint. The source code must be included in the software release and made available on openly accessible repositories and the chosen license must allow modifications, derivative works and sharing under equal or compatible open terms and conditions[5]. By combining copyright and licences to grant users the right to use the software, this approach facilitates collaboration between developers and users and promotes innovation[6].

"Open hardware" generally includes the design specifications of a physical object which are licensed in such a way that said object can be studied, modified, created and distributed by anyone, providing as many people as possible with the ability to construct, remix and share their knowledge of hardware design and function[7].

In the case of both open source software and open hardware, a community-driven process for contribution, attribution and governance is required to enable reuse, improve sustainability and reduce unnecessary duplication of effort[8].

IMPRESS PCP contributes to open science through the development of an interoperable platform for TEM which uses open software and open hardware based on interoperable e-CAT cartridges for correlative workflows. It goes beyond developments in instrumentation that are usually made by TEM column manufacturers and driven by market forces, creating a mechanism for realising science-driven technological developments that are required by individual users, laboratories and RIs. By encouraging

[4] European Commission (2021). *Horizon Europe, open science. Early knowledge and data sharing, and open collaboration*. Directorate-General for Research and Innovation, Brussels: Publications of the European Union.

[5] UNESCO (2021). *UNESCO Recommendation on Open Science*. Paris: United Nations Educational, Scientific and Cultural Organization, p. 10.

[6] European Commission (2020). *Open Source Software Strategy 2020 – 2023. Think Open*. Brussels, 21.10.2020 C(2020) 7149 final, p. 2.

[7] Blind, K., Böhm, M., Grzegorzewska, P., Katz, A., Muto, S., Pätsch, S. and Schubert, T. (2021). *The impact of Open Source Software and Hardware on technological independence, competitiveness and innovation in the EU economy. Final Study Report*. European Commission, Directorate-General for Communications Networks, Content and Technology. Luxembourg: Publications Office of the European Union, p. 29.

[8] UNESCO (2021). *UNESCO Recommendation on Open Science*, pp. 10-11.

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collaboration between researchers and promoting open sources, it bridges gaps between RIs, industry, and end-users.

In this context, the IMPRESS Consortium will establish the first open knowledge and innovation hub for TEM (termed “FAIRcube”), through which scientific, technological and operational data will be managed and shared in an accessible repository, building a novel approach that involves two additional components besides data in the FAIR approach: FAIR technology and FAIR documentation. This strategy will drive research and innovation, aligning IMPRESS towards the implementation of the European Open Science Cloud (EOSC) ecosystem and making IMPRESS data services interoperable with EOSC ones.

FAIRcube will contain documentation of the prototypes assembled and tested within the IMPRESS PCP. By doing so and in the spirit of co-design, the prototypes and all of the technologies can and will be further improved to incorporate ideas of the scientific communities outside the IMPRESS Consortium. In addition, companies will have the possibility to make their solutions (or part of them) publicly available in the FAIRcube. The exploitation strategy will observe the IPRs of the contractors involved in the PCP.

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PCP use case 1 - Functional Requirements

Topic	Description
Focus	R&D
Objective	To provide an interoperable platform with a full or partial set of prioritized functionalities.
Difficulty	Medium-high
Rationale	The concept of an interoperable platform describes multi-functional hardware components, which are based on standardized interfaces to holders and aperture rods for microscopes from different column manufacturers and are based on a cartridge-in-cartridge design. The interoperable platform should be compatible with suitcases that allow sample transfer between different preparation, characterization and/ or storage stations in desirable environments (*e.g.*, temperature or atmosphere). The interoperable platform should be compatible with fully automated and programmable instrument control systems. All physical parameters (*e.g.*, electrical bias, current, temperature, gas flow) should be independently addressable *via* software.
Prioritized functionalities	The technology vendor should design, fabricate, install, test, support and maintain a set of functionalities of the interoperable platform, including but not limited to the following items (at least two of which should be from items 1 to 5): 1. Compatibility of the sample atmosphere in the interoperable platform between deep UHV and ambient pressure, including associated requirements such as baking, sealing and vacuum transfer, based on the technical details. 2. Compatibility of the sample temperature in the interoperable platform between ultra low and elevated temperatures, including mechanical and thermal stability, based on the technical details.

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	3. Availability of electrical feedthroughs, with a target of >50 contacts that can be used to supply high current and high voltage, as well as to perform high precision and high frequency measurements, based on the technical details. 4. Internally-controlled motion using miniaturized motors of 1) the sample (with up to 5 axis movement and in-plane rotation), 2) up to two movable micro-probe(s) (with 3 axis movement) and 3) other components such as optical mirrors (with 2 axis movement) in the interoperable platform, providing high precision, fine increments and high reproducibility based on the technical details. 5. Isolated pipelines for gases and liquids (at least four), in order to provide controlled flow rates through channels of chosen dimension based on the technical details. 6. Access to the sample in the interoperable platform for laser injection and light collection using fiber optics or free space propagation based on the technical details. 7. Access to all functionalities (*e.g.*, set/read/measure temperature) through a complete portable application programming interface (API). 8. The API definition (headers and function stubs) should be open source without contamination clauses, in order to allow unrestricted interfacing with closed source and open source software by the user or third parties. An MIT license is an example of a license that fulfils this requirement. 9. The API and device operation should be clearly and fully documented. 10. The license for the API documentation should allow redistribution and commercial use in the sense of the Creative Commons license family. It should ideally allow the creation and distribution of derivative works. 11. The back-end implementation of the functionality exposed by the API can be closed source. However, the API should ensure unrestricted control of the back-end implementation. 12. All components should include a basic control interface that allows relevant functionality tests, setting of parameters and control of the component for simple, manual experimental use, *e.g.*, a simple graphical user interface (GUI). 13. The implementation of the basic control interface should be open source. 14. The basic control interface should be clearly and fully documented.

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	All of the above functionalities should be reproducible in different electron microscope instruments.
Costs	The technology vendor should bear, in full, the costs of development, fabrication and transfer of the interoperable platform(s) to the procurers' sites, as well as the costs of testing and training. The procurers should bear the costs of logistics, installation (*e.g.*, a support frame if required) and consumables for the interoperable platform(s) at their sites.
Participation conditions	1. Each technology vendor should commit to a full or partial list of the prioritized functionalities in their initial proposal. 2. Each technology vendor should commit to participate in each of the three PCP phases. 3. Each technology vendor should commit to the IMPRESS open hardware concept and to easily adaptable shared designs that allow for user-defined science-driven adaptations. 4. Each technology vendor should be solely responsible for all safety issues during transfer, installation, testing, training and operation of the interoperable platform according to Use Case No. 4. 5. Each technology vendor should be responsible for corrective maintenance of the interoperable platform(s) during transfer, installation, testing, training and operation according to Use Case No. 2. 6. Each technology vendor should be responsible for damage to the host instrument and procurer site during transfer, installation, commissioning, training and operation. 7. Each technology vendor should be responsible for adaptation of the components, *i.e.*, the interoperable platform, in phase 3 of the PCP according to Use Case No5 8. Each technology vendor should commit to IPR and confidentiality terms and conditions of the PCP. 9. Each technology vendor should follow the agreement on publication and dissemination resulting from the different PCP phases. The technology vendor should ensure full compliance with the Rules of Engagement with competition law and regulations, ensuring aggregated cross-border research demand needs, an open hardware approach and an open science approach, and support the concept of European autonomy and resilience.

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PCP use case 2 - Corrective maintenance

Topic	Description
Focus	R&D, Support and Service
Objective	To install, pass the acceptance tests, and achieve full commissioning of the interoperable platform prototypes in every procurer's site, including training the users, and providing (corrective) maintenance for the devices during the IMPRESS project. During the Pre-Commercial Procurement (PCP), different actions are needed for Phase 2 and Phase 3. Phase 2 shall require the installation of prototypes at Juelich to test and compare them under the same conditions, verifying compliance with the use case requirements and taking corrective maintenance measures, up to 80% of prototype functionality. In Phase 3 starts the validation of prototypes at the different testing sites up to the 100% of prototype functionality.
Difficulty	Medium-high
Rationale	The interoperable platform is a multi-functional hardware that introduces standardized interfaces between holders and apertures rod, and tips & cartridges from different microscope column manufacturers and different platforms of each TEM manufacturer based on a cartridge-in-cartridge concept. There will be eight prototypes with the same or different functionalities according to **use case 1 (functional requirements)**. These prototypes shall be installed and tested, first at Juelich in Phase 2, and in Phase 3 in different sites, with the purpose to verify compliance with the functionalities that make the possibility for advanced, new scientific experiments. Installation, training, corrective maintenance and service of the prototypes are the subject-matter of this use case.

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Test site and outcome of Phase 2	**<u>In Phase 2</u>**, the prototype shall be delivered and installed by technology vendors at Juelich. The acceptance of the prototype will be limited to the requirements of Phase 2. There is not a complete acceptance. After the acceptance of Phase 2, the issues that may arise from prototype installation shall be corrected and solved. During Phase 2, it will be verified how well the prototype is compliant with the use cases requirements. The prototype installation and corrective maintenance shall take into account the safety according to the regulation of the test site, the nature of the prototype (e.g. adaptability) and the established criteria to work according to the functionalities. The entrance point in Phase 2 is a minimum of 50% of prototype functionality, weighted on the basis of the to-be-defined methodology (e.g. KPIs). At the end of Phase 2, it is expected that minimum of 80% of the prototype functionalities is installed and functioning at Juelich weighted on the basis of the to-be-defined methodology (e.g. KPIs). **The prototypes shall be tested in Juelich under the same conditions in order to be able to compare them.** Eight prototypes shall be tested at the test chamber in Juelich before sending them to other test sites in Phase 3 for adaptation.
Test sites and outcome of Phase 3	**<u>In Phase 3</u>**, starts the prototype validation. The test will evaluate the ultimate performance of prototypes. The starting point shall be at least 80-85% of functionalities, weighted on the basis of the to-be-defined methodology (e.g. KPIs).. The output of Phase 3 shall be 100% of the prototype installation and functioning. The prototypes shall be tested in all the test sites. The % to accomplish during Phase 3 will require adaptation and/or optimisation. Since other sites may have other requirements, it is important to ensure compatibility. Test sites in Phase 3 would include: a. All procurers' labs, 1. ER-C, Juelich 2. Area Science Park, Trieste 3. CNR-IMM, Bologna 4. UA, Antwerp 5. ICN2, Barcelona 6. IFW, Dresden 7. ELI b. All IMPRESS experimental labs,

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	1. CNRS-LPS, Orsay 2. UM, Maastricht **The prototypes will be distributed to different test sites to first check for their compatibility and then perform the scientific experiments.** The conditions and specific set-up of each testing site will be defined in due time. Some functionalities may be tested only in some sites. The hardware requirements shall be considered. **Each test site will provide in advance the applicable regulations and safety rules, according to the conditions set in Use case No.4.**
Costs	The technology vendor shall bear in full the costs of installation, user training, corrective maintenance and required service actions of the prototypes in all of the test sites. The procurers and testers shall bear the costs of operation and consumables in each lab.
Participation conditions	1. Each technology vendor shall commit to the shipment, unpacking and installation of the prototypes at test sites. VAT aspects and other import/export conditions shall be taken into account. 2. Each technology vendor shall commit to the operation of the prototype(s) in the host instrument of each test site and gain approval of acceptance tests. 3. Each technology vendor shall commit to 2 full days training of a specialist in each test site. 4. Each technology vendor shall address every service report to be submitted by the main procurer, i.e., Juelich, with 72 hours remotely or via a site visit, and send back the service report to the main procurer. 5. Each technology vendor shall commit to the dismounting of the prototype from the host instrument, packing, and collection from each test site. The technology vendor shall ensure the full compliancy of the Rules of Engagement with competition law and regulations, ensuring the aggregated cross-border research demand needs, the open hardware approach, the open science approach and supporting the concept of European autonomy and resilience.

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PCP use case 3 - Community of Users

Topic	Description
Focus	R&D and product & service roadmap
Objective	To set up, maintain and support a structural Community of Users (CoU) intended to discuss user's experience, lessons learnt and forthcoming research needs and to discuss and agree on the technology vendor's product and service roadmap for the coming 3-10 years.
Difficulty	Low – medium
Rationale	The CoU should form the basis for the coming 3-10 years, on one side, for an aggregated cross-border research demand need and, on the other side, for matching the product and service development of the technology vendor. The CoU should create an added value both for the demand side (the research institutes) as well as for the supply side (the technology vendor) and as a result should contribute to continuously improve and/or speed up the R&D possibilities after the PCP
CoU group members	The CoU will consist of representatives of (at least) any and all IMPRESS research institutes, starting in PCP Phase 3 and continuing after the PCP, broadening the CoU group members with other non-IMPRESS research institutes, both from academia and industry.

Rules of Engagement	The technology vendor should set up, draw and maintain so-called rules of engagement, including - but not limited - to:
	- Entrance and exit terms and conditions:
	  ○ Only organisations (not individuals) can become a member of the CoU.
	  ○ A membership is restricted to academic research institutes and to industry research organisations.
	  ○ A membership is restricted to customers of the technology vendor and the IMPRESS consortium members.
	  ○ Academic research institutes members should not be outweighed by industry research organization members.
	- IPR and confidentiality
	- Publication and dissemination

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	- Governance structure and voting rules:
	  o The IMPRESS consortium members should act as a chair for the CoU during the PCP and for at least 5 years after the termination of the PCP.
	  o Each member has one vote only.
	  o Voting should be based upon a majority voting scheme (50% +1).
	  o In case of an equal voting outcome, the Chair should have the decisive vote.
	  o The technology vendor should act as a secretariat but will not have any voting rights.
	- Meetings of the CoU:
	  o A minimum of 2 meetings per annum, one of them on-site in the EU (hybrid).
	  o The other meetings will be on-line.
	
	The technology vendor should ensure the full compliancy of the Rules of Engagement with competition law and regulations, ensuring the aggregated cross-border research demand needs, the open hardware approach, the open science approach and supporting the concept of European autonomy and resilience.

Costs	The technology vendor should bear in full the costs of the CoU and its secretariat. The CoU group members should bear their own costs of attendance, travel and lodging.
Participation conditions	1. Each technology vendor should agree (as a pass/fail criterion) to the CoU use case as part of their initial proposal. 2. Each technology vendor who has been invited to submit a proposal for Phase 3 of the PCP should reconfirm its commitment to the CoU and should deliver a full detailed set of Rules of Engagement as a pass/fail criterion and/or as a weighted award criterion. 3. Separate clauses will be drafted as part of the PCP Framework Agreement to ensure the proper implementation of the CoU during PCP phase 3 (including KPI's and milestone(s)) and its continuation after the termination of the PCP. To safeguard the continuation, the proper functioning of the CoU will be linked to the so-called "draw back clauses" of the IPR and strengthened with the so-called "name & blame" clauses.

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PCP use case 4 - Safety

Topic	Description
Focus	Product and operation safety of the interoperable platform during the prototype phase (phase 2, phase 3) and later normal operation
Objective	Handling devices that are subjected to high voltages, rF fields, high energy electrons, X-rays, high pressures, laser radiation, and very low and high temperatures is dangerous and can lead to serious or fatal accidents. In order to reduce the risk for fatal or bad accidents or serious (occupational) illness, it is essential that all European- and national safety guidelines applicable to the devices are met. This document provides guidelines and standards that are required by the project partners and organizations involved. However, the manufacturer/vendor is obliged to check for the product to be developed and the specific applications whether the device falls under other EU- or national regulations that must be complied with.
Difficulty	Moderate
"Conformité européenne" CE declaration	For all devices of the interoperable platform a CE certification is mandatory (CE declaration, type plate, operating instructions/ user manual).
Properties of the delivery item and commitments	**With acceptance of the order, the following properties of the delivery item and commitments apply** - Compliance with the regulations applicable to the product for making it available on the EU market. These regulations are the relevant EU/EC directives. - Compliance with relevant EU harmonized norms. Typ-C norms (product norms) take precedence over Typ-B and Typ-A norms. - In absence of harmonized European norms, the vendor is obliged to comply with other applicable international or national norms or technical specifications and state-of-the-art regulations. - Technical solutions are based on the state of the art in science and technology.

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	The commitments include, among others: a) Performing a conformity assessment procedure or the procedure for instance according to article 13 of the Machinery Directive 2006/42/EC (in the case of incomplete machines), in accordance with the relevant EU/EC directives and regulations. b) CE-marking where required by the relevant EU-/EC directives and regulations c) Delivery of the EU-/EC declaration of conformity or extended declaration of installation (e.g. for incomplete machines) or declaration of performance (also in German language). d) Delivery of the operating instructions (manual) in accordance with the relevant regulations or use and operating instructions for products (in accordance with ProdSG §3(2), also in German language). The manual must contain: Creation/assembly, installation, operation, malfunction, decommissioning, disposal, drawings, circuit diagrams, standards, test periods, and residual risks. e) Provision of the technical documentation in accordance with the relevant regulations, including the risk assessment. f) Training and safety briefing of the employees g) Information on the required personal protective equipment (e.g. laser safety goggles) must be provided. **Further requirements, if applicable** Depending on the actual design and capabilities of the devices, the components/devices are required to be certified according to either the Machinery Directive (MRL 2006/42/EC) or the Low Voltage Directive (NSRL 2014/35/EU). The devices must comply with directive on electromagnetic compatibility of electrical and electronic products (EMV 2014/30/EU and EN 55011:2016+A1:2017). Appropriate certification is required. If high pressures, e.g. in a cartridge are used, the devices must comply with the pressure equipent directives (DGL 2014/68/EU) and 2014/29/EU. In this case, periodical inspections are required and the user manual must contain the inspection periods. For instance, as a technical measure, a relief valve or rupture disc has to be included. Devices that will involve laser irradation must comply with the DIN EN 60825 and DIN EN 12254 norms. In addition, devices must be constructed in such a way that the laser radiation (both, direct or scattered) which is

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	unintentionally escaping from the device does not exceed 1mW.
Risk assessment	Vendors are obliged to perform a risk assessment of their prototypes and devices and deliver the documents to the costumer.
Standards and norms	**Examples of standards and norms to be followed (if applicable):** 2006/42/EC: Machinery Directive (MD) 2014/35/EU: Low Voltage Directive (LVD) 2014/68/EU: Pressure Equipment Directive (PED) 2014/30/EU: Electromagnetic Compatibility EU 2013-59/EURATOM: Radiation Protection Basic Standard Directive of the EU EN 61010-1: Safety requirements for electrical measuring, control, regulating and laboratory devices DIN EN ISO 60204-1:2019: Electrical equipment of machines Part 1: General requirements (applicable to machines) DIN EN ISO 12100: Safety of machines - General. Design principles – risk assessment and risk reduction DIN EN 61439 VDE 660-600: Niederspannungs-Schaltgerätekombination EN 61000-3-2:2018: Harmonic current emission EN 61000-3-3:2013: Voltage changes, fluctuations and flicker EN 61000-6-1:2016: Electrostatic discharge immunity test EN 61000-6-1:2016: Radiated RF electromagnetic field immunity test EN 61000-6-1:2016: Electrical fast transients/burst immunity test EN 61000-6-1:2016: Surges immunity test EN 61000-6-1:2016: Immunity to conducted radio frequency electromagnetic disturbances EN 61000-6-1:2016: Power frequency magnetic field immunity test EN 61000-6-1:2016: Voltage dips, short interruptions and voltage variations immunity test EN 61010-1:2010: Safety requirements for electrical equipment for measurement, control and laboratory use. Part 1: General requirements IEC 60825-1:2014: Safety of laser products- Part 1: Equipment classification and requirements ISO 12100:2010: Safety of machinery- General principles for design- Risk assessment and risk reduction VDE 0100-600: Kapitel Erstprüfung VDE 0100-410: "Protective Measures" and Protection Goals

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	VDE 0105-100: “Operation and construction of electrical systens“: repetition checking inspection: inspection, testing, measurement DIN VDE 0100-600:2008-06: Installation of low-voltage systems
National regulations (Germany)	The devices must comply with the ProdSG law, the StrlSchG law, as well as the BetrSichV and StrlSchV regulations.
Cybersecurity	**Cybersecurity, if applicable** The vendors are obliged to follow the Guidelines of the European Union Agency for Cybersecurity, https://www.enisa.europa.eu/securesme/downloads The vendors are also obliged to follow the BSI IT-Grundschutz (IT baseline protection) security and the ISO/IEC 13335-2 “Managing and planning IT Security” directives. Furthermore, ISO/IEC 27043 regulations on application security and the ISO/IEC 15408 standard "Common Criteria for Information Technology Security Evaluation" should be followed. For IT security in industrial automation, the German VDI/VDE 2182 and the international ISA/IEC 62433 standards should be followed.
Phase 2 tests	The safety regulations defined above apply for Phase 2 tests
Phase 3 tests	The safety regulations defined above apply for Phase 3 tests
Costs	The technology provider bears the full cost of all required policy validations and certifications.

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PCP use case 5 - Adaptation

Topic	Description
Focus	R&D
Objective	To adapt the interoperable platform with the prioritized functionalities for analytical disciplines other than transmission electron microscopy.
Difficulty	Medium-high
Rationale	The interoperable platform is a multi-functional hardware that introduces standardized interfaces between holders and apertures rod, and tips & cartridges from different microscope column manufacturers and different platforms of each TEM manufacturer based on a cartridge-in-cartridge concept. The interoperable platform should own or be compatible with transfer suitcases to transfer the specimen in desirable environment, i.e. temperature and atmosphere, between different preparation, characterization and storage stations. The interoperable platform should also be compatible with a fully automated and programmable instrument control system, i.e. all of the physical parameters (electrical bias, currents, temperatures, liquid and gas flows) must be independently addressable via software.
Adaptation of prioritized functionalities	1. The technology vendor (in the third phase of PCP) should adapt the design, fabrication, installation, test, support and maintenance of the interoperable platform(s) based on the outcome(s) of the second phase of the PCP and according to the all other use-cases. 2. Each of the eight prototypes should be adapted with the dimensional, geometrical and functional capabilities of at least one of the Research Infrastructures (RIs) in the IMPRESS consortium. 3. The technology vendor should commit to transport an identical specimen in the adopted interoporable platform via a proper suitcase, from one of the test sites (listed in PCP phase 2) to at least one of the RIs in the IMPRESS consortium, in exactly the same invironment between both sites.

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	4. All adapted prototypes in the PCP phase 3 should have an identical interface with the interoporable platforms' standardised interface in the PCP phase two.
Costs	The technology vendor should bear in full the costs of the development, fabrication and transfer to and test and training of the interoperable platform(s) to the procurer sites. The procurers should bear the costs of logistics, installation (for example a support frame if required), consumables of interoperable platforms in their sites.
Participation conditions	10. Each technology vendor should commit to the full list or a part of the prioritized functionalities in the initial proposal. 11. Each technology vendor should commit to participate in each of the three PCP phases. 12. Each technology vendor should commit to the open hardware concept and easily adaptable shared designs allowing for user-defined science-driven adaptations. 13. Each technology vendor will be the sole responsible for all safety issues during the transfer, installation, test, training and operation of the interoperable platform according to Use case No. 4. 14. Each technology vendor will be responsible for corrective maintenance of the interoperable platform(s) during the transfer, installation, test, training and operation according to the Use case No. 2. 15. Each technology vendor will be responsible for any possible damage in the host instrument and procurer site during the transfer, installation, commissioning, training and operation according to the Use case No. 3. 16. Each technology vendor will be responsible for adaption of the components, i.e. interoperable platform, in the phase 3 of the PCP according to the Use case No. 4 17. Each technology vendor should commit on the IPR and confidentiality terms and conditions of the PCP. 18. Each technology vendor should follow the agreement on Publication and dissemination resulting from different phases PCP. The technology vendor should ensure the full compliancy of the Rules of Engagement with competition law and regulations, ensuring the aggregated cross-border research demand needs, the open hardware approach, the open

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	science approach and supporting the concept of European autonomy and resilience.

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