



BrightnESS

Building a research infrastructure and synergies for highest scientific impact on ESS

H2020-INFRADEV-1-2015-1

Grant Agreement Number: 676548

brightness

Deliverable Report: D3.4, Tender Documents for PPI

1 Project Deliverable Information Sheet

BrightnESS Project	Project Ref. No. 676548	
	Project Title: BrightnESS - Building a research infrastructure and synergies for highest scientific impact on ESS	
	Project Website: brihtnness.se	
	Deliverable No.: D3.4.	
	Deliverable Type: Report	
	Dissemination Level: Public	Contractual Delivery Date: 31/05/2018
		Actual Delivery Date: 24/08/2018
	EC Project Officer: Mina Koleva	

2 Document Control Sheet

Document	Title: Tender documents for PPI	
	Version: 1	
	Available at: https://brihtnness.esss.se/about/deliverables	
	Files: -	
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3 List of Abbreviations

ESS – European Spallation Source ERIC
PICMG – PC Industrial Computer Manufacturers Group
MTCA.4 – Micro Telecommunication Computing Architecture specification 4
PPI – Public Procurement of Innovative solutions
PCP – Pre-Commercial Procurement
R&D – Research and Development
ICS – ESS Integrated Control Systems Division
SPL – ESS Supply, Procurement and Logistics Division
EPICS – Experimental Physics and Industrial Control System
PSI – Paul Scherrer Institut
CERN – Conseil Européen pour la Recherche Nucléaire
ITT – Invitation to Tender
OJEU – Official Journal of the European Union



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4 Executive Summary

The tender documents for PPI (deliverable 3.4) are the result of the work following the market consultation findings for task 3.3.2 “preparing the launch of one joint Public Procurement of Innovative solutions (PPI)”.

The schedule of this deliverable is directly connected with deliverable 3.3 “invitation to market consultation”. Delays in implementing deliverable 3.3 have consequently affected deliverable 3.4. Work following the market consultation held in April 2018 concluded with the final report on the market consultation, that was prepared by ESS and Addestino Innovation Management and finalized by the 20th of June 2018. Based on this timeline, the preparation of the tender documents could only start in August 2018. Furthermore, ESS is preparing to launch this procurement in October 2018 due to prioritization of ESS procurement plan, since this procurement project, unlike many others, is not ESS critical path for the construction phase.

ESS Supply, Procurement and Logistics (SPL), in collaboration with ESS Integrated Control Systems (ICS), has prepared the tender documents for a competitive procedure with negotiation in accordance with article 15 of the European Spallation Source ERIC Procurement Rules¹, which includes specific provisions for the case of procurements involving R&D activities (art. 15 (9)) applicable for PPI projects.

The choice of the competitive procedure responds to the following facts:

1. ESS conducts procurement activities regulated by the European Spallation Source ERIC Procurement Rules (the EU Public Procurement Directives do not apply to ESS). Furthermore, ESS is launching this procurement procedure independently since research facilities (PSI, CERN, ITER, Diamond Light Source) approached by ESS did not confirm their interest to join the procurement procedure. Otherwise, the choice of the procedure and the tender documents would have been drafted in light of the applicable procurement legal framework (EU Public Procurement Directives or any other legal framework applicable to international organizations).
2. This is the most suitable procedure available in the European Spallation Source ERIC Procurement Rules for procurements involving R&D activities, especially considering the need for negotiations during the product development phase.

5 Background

As detailed in deliverable report D3.3, ICS selected MTCA.4 as the platform for applications demanding high-speed data acquisition for ESS. While MTCA.4 can be considered a standard platform, its components require certain product developments in terms of stability, operation, interoperability and adaptation to new architectures. Based on this background, SPL recommended a PPI approach for the procurement MTCA.4 components. And the market consultation confirmed that the PPI approach as the most suitable procurement strategy for the procurement of MTCA.4 components.

“PPI is a public procurement in which public procurers act as a launch customer – also called early adopter – of innovative goods or services that are close or even already available on the market in small quantity but not yet deployed on a large scale commercial basis. PPI does not include the procurement

¹ The European Spallation Source ERIC Procurement Rules can be found on [ESS website](#).

of R&D but may include before the purchase of a test to verify if solutions on the market can conform with the deployment requirements, i.e. conformance testing.”²

PPI projects are implemented in accordance with the provision of the European Union Public Procurement Directives. However, the EU Public Procurement Directives do not apply to the ESS public contracts and ESS procurement activities are regulated by the European Spallation Source ERIC Procurement Rules³ as adopted by the Council of the European Spallation Source ERIC. Hence, ESS PPI projects are implemented according to the provision in the European Spallation Source ERIC Procurement Rules.

PPI projects involve the following steps:

1. Needs identification and verification,
2. State of the art assessment,
3. IPR search,
4. Regulatory, certification and standardization environment assessment,
5. Project feasibility study,
6. Market consultation,
7. Preparation of tender documents,
8. Procurement Procedure,
9. Contract Management.

ESS has completed steps 1-6 prior to the preparation of the tender documents. Activities related to steps 1-5 were performed by ICS in different stages of ESS design and construction phases. Activities related to step 6 were performed within the Brightness framework as reported in deliverable 3.3.

6 Report on Implementation Process and Status of Deliverable

The PPI for the award for the award of a framework agreement for the development, design, manufacturing, conformance testing and delivery of innovative MTCA.4 components will be done following the competitive procedure with negotiation in accordance with article 15 of the European Spallation Source ERIC Procurement Rules.

The procurement procedure will be implemented in three different phases: i) selection of candidates for negotiation; ii) negotiation; iii) invitation to tender and award of the contract.

In phase 1, ESS will select the most suitable candidates (maximum 5) based on professional, financial and technical capacities. Requirements regarding technical capacities is of especial relevance for this procedure. ESS will be assessing candidates’ experience in projects involving product development for MTCA.4 and high performance computing components as well as the skills, experience and qualifications of the R&D team in same or similar projects.

ESS will invite to negotiate the selected candidates (phase 2). The negotiations will be used to define conceptual designs addressing ESS requirements for a new generation of MTCA.4 components. During this phase, tenderers will also be required to present product mock-ups based on the conceptual

² European Assistance for Innovation Procurement/FAQ <http://eafip.eu/resources/faq/>.

³ The European Spallation Source ERIC Procurement Rules can be found on [ESS website](#).

designs. ESS will support the product development activities with a financial compensation of 10.000 EUR.

Following phase 2, ESS will consolidate the deliverables and results of the negotiation and will invite to tender (phase 3) to the tenderers that took part of the negotiation and delivered the required conceptual design and product mock-ups. The ITT documents will set the final requirements (including terms and conditions) of the contract for the final design, manufacturing and conformance testing, series manufacturing and delivery of MTCA.4 components. The ITT documents will also set the conditions and requirements for the assessment of tenders and the award of the contract.

SPL has drafted, in collaboration with ICS, tender documents for phase 1 of the procurement procedure. Tender documents for phase 3 will be drafted after phase 2.

The indicative schedule for this procedure can be found below:

Estimated date	Activity
15/10/2018	Contract notice published on the ESS website and the Official Journal of the European Union (OJEU). Tendering documents made available to the potential tenderers in ESS supplier portal.
09/11/2018	Deadline for sending a request for clarification to ESS
15/11/2018	Deadline for submission of requests to participate
16/11/2018	Opening of requests to participate and selection of candidates for negotiations
14/12/2018	Notification to unsuccessful candidates Invitation to selected candidates for negotiations
10/01/2019	Start of negotiation phase
31/05/2019	End of negotiation phase
08/10/2019	Invitation to tender
28/06/2019	Deadline for sending a request for clarification to ESS
05/07/2019	Deadline for submission of tenders
08/07/2019	Opening of tenders and evaluation
15/08/2019	Notification of the award decision to tenderers
26/08/2019	End of 10 day standstill period
02/09/2019	Contract signature

ESS is aiming to publish this procedure in October 2018 due to prioritization of ESS procurement activities. However, this procurement is not in ESS critical path and it may be further delayed in order to prioritize other ESS procurements.

7 Conclusion

The PPI approach has provided great value to this procurement procedure so far. The feedback obtained from industry during the market consultation helped confirming that ICS was in the right path with the MTCA.4 platform and required innovations. During the process, it also became clear that ESS would act

as a launch customer for the new generation of MTCA.4 components. Furthermore, the selection of the competitive procedure with negotiation and the tender documents are the outcome of the PPI strategy.

SPL and ICS are convinced that, thanks to the PPI approach, this procurement procedure will succeed in delivering the innovative technology required for ESS providing the best value for money and a great return on investment.

8 Annexes

1. Open Call for Tenders Micro Telecommunications Computing Architecture Components for ESS Ref. No. 121, and its annexes.

OPEN CALL FOR TENDERS
COMPETITIVE PROCEDURE WITH NEGOTIATION – PHASE 1
Ref. No.: 121
MICRO TELECOMMUNICATIONS COMPUTING ARCHITECTURE
COMPONENTS FOR ESS

EUROPEAN SPALLATION SOURCE ERIC



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ANNEX 1 – TENDER IDENTIFICATION FORM

ANNEX 2 – DECLARATION OF HONOUR REGARDING EXCLUSION CRITERIA

ANNEX 3 – MARKET CONSULTATION REGARDING INNOVATIONS ON MTCA.4 REQUIRED FOR ESS. FINAL REPORT

1. INTRODUCTION

1.1 Introduction to ESS

The European Spallation Source (ESS) is one of the largest science infrastructure projects being built in Europe today. Designed to generate neutron beams for science, ESS will benefit a broad range of research, from life science to engineering materials, from heritage conservation to magnetism.

Organised as a European Research Infrastructure Consortium, or ERIC, with Member Countries throughout Europe, this next-generation research facility is being built through the collective global effort of hundreds of scientists and engineers. Together, they have developed and specified a technical design of the facility, including the Accelerator, the Target Station, and instrument concepts. This collaboration resulted in the 2013 delivery of the ESS Technical Design Report and Project Specification. The construction of ESS formally began with the Groundbreaking Ceremony on September 2, 2014.

The facility is being built in Lund, Sweden, next to the world-leading synchrotron light source, MAX IV, and with the Data Management & Software Centre (DMSC) located in nearby Copenhagen. It is anticipated that two to three thousand guest researchers from universities, institutes and industry will participate in the ESS user program each year, making use of the facility's broad range of neutron instruments to answer their scientific questions.

Scientists, engineers, project managers, and builders are well into the construction of the most powerful neutron source in the world. ESS will provide the tools for analysis that will enable the next important discoveries in nanotechnology, life science, pharmaceuticals, materials engineering, and experimental physics. It is understood that ESS, both through the research that will be performed there and the establishment of the facility itself, will serve as an economic driver for all of Europe.

ESS is expected to deliver its first neutrons by the end of the decade, with the user program to follow in 2023.

1.2 Introduction to this call for tenders

1.2.1 Public Procurement of Innovative Solutions Background

This procurement procedure is the result of implementing a strategy based on a Public Procurement of Innovation Solutions (PPI) for the procurement of innovative micro telecommunications computing architecture specification 4 (MTCA.4) components for ESS.

"PPI is a public procurement in which public procurers act as a launch customer – also called early adopter – of innovative goods or services that are close or even already available on the market in small quantity but not yet deployed on a large scale commercial basis. PPI does not include the procurement of R&D but may include before the purchase of a test to verify if

solutions on the market can conform with the deployment requirements, i.e. conformance testing.”¹

PPI projects are implemented in accordance with the provision of the European Union Public Procurement Directives. However, the EU Public Procurement Directives do not apply to the ESS public contracts and ESS procurement activities are regulated by the European Spallation Source ERIC Procurement Rules² as adopted by the Council of the European Spallation Source ERIC. Hence, ESS PPI projects are implemented according to the European Spallation Source ERIC Procurement Rules.

1.2.2 Purpose of this call for tenders and information about the procedure

ESS is requesting suppliers to submit requests to participate in a competitive procurement procedure in order to conclude a framework agreement for the development, design, manufacturing, conformance testing and delivery of innovative MTCA.4 components.

This contract will be awarded following the competitive procedure with negotiation in accordance with article 15 of the European Spallation Source ERIC Procurement Rules³, which includes specific provisions for the case of procurements involving research and development activities (art. 15 (9)) applicable for PPI projects.

The procurement procedure will consist of the following three phases: i) selection of candidates for negotiation; ii) negotiation; iii) invitation to tender and award of the contract. This call for tenders document set the conditions and requirements relating to phase 1, selection of candidates for negotiation.

1.2.2.1 Phase 1: Selection of candidates for negotiation

Suppliers interested in this contract may submit a request to participate following the requirements stated in this document. Candidates will be assessed based on the selection criteria described in section 5.2 below.

ESS Procurement Evaluation Board (PEB) will select for negotiation the 7 candidates whose requests to participate obtained the 7 highest scores based on the selection criteria. Candidates not selected for the negotiation phase will be informed accordingly. Selected candidates will be invited to the negotiation phase.

1.2.2.2 Phase 2: Negotiation

ESS will send an invitation to negotiate to selected candidates including instructions regarding the date, address, location and agenda for the negotiations as well as the conditions under which the negotiations will occur. ESS will ensure that negotiations are conducted under the strict observance of the principles governing the European Spallation Source ERIC Procurement Rules.

During the negotiation phase, tenderers will, based on the input provided by ESS, be requested to develop and deliver conceptual designs and product mock-ups for the different MTCA.4

¹ European Assistance for Innovation Procurement/FAQ <http://eafip.eu/resources/faq/>.

² The European Spallation Source ERIC Procurement Rules can be found on [ESS website](#).

³ The European Spallation Source ERIC Procurement Rules can be found on [ESS website](#).

components. Tenderers participating in this phase shall be entitled to receive a financial compensation of 10.000 EUR (VAT excluded) for the work required in order to develop the conceptual designs and product mock-ups. ESS will place a purchase order with tenderers participating in the negotiation phase detailing the terms and conditions applying to this contractual relationship, which shall be based on ESS General Purchasing Conditions⁴.

Tenderers failing to participate in the negotiation phase and/or failing to deliver the conceptual designs and product mock-ups will not be considered for phase 3, invitation to tender (ITT) and award of the contract.

ESS will consolidate the deliverables and results of the negotiation phase in the requirements for phase 3. Tenderers shall note that ESS has full rights to use the results of the negotiation phase for defining the final requirements for phase 3, or any other purpose for the ESS project. Notwithstanding, confidential information provided by tenderers during this phase will not be disclosed to other tenderers.

1.2.2.3 Phase 3: Invitation to tender and award of the contract

ESS will invite to tender to the tenderers that took part of the negotiation and delivered the required conceptual design and product mock-ups. The ITT documents will set the final requirements of the contract for the final design, manufacturing and conformance testing, series manufacturing and delivery of MTCA.4 components.

The ITT documents will also set the conditions and requirements for the assessment of tenders and the award of the contract. The contract will be awarded to the tenderer submitting the tender representing the best value for money based on the award criteria below. The award criteria is provided in ranges and will be fixed in the ITT document:

1. Commercial award criteria (price): 30% – 40% of the total award criteria weighting.
2. Technical award criteria (quality of the tender): 60% – 70% of the total award criteria weighting.

ESS will notify the award decision to both the successful and the unsuccessful tenderers.

1.2.3 Preliminary information about the contract

ESS intends to conclude the Framework Agreement/s with 1 supplier per lot.

1.2.3.1 Lots

The Framework Agreement/s are expected to consist of the following lots:

1. Lot 1: Power Supply
2. Lot 2: Chassis
3. Lot 3: MTCA Carrier Hub

⁴ The European Spallation Source ERIC General Purchasing Conditions can be found on [ESS website](#).

1.2.3.2 Duration

The duration of the resulting Framework Agreement/s shall be 1 year from contract signature including 3 automatic extensions of 1 year (up to a total of 4 years).

1.2.3.3 Estimate budget

The estimate budget per lot taking into account the maximum contract duration of 4 years shall be as follows:

1. Lot 1, Power Supply: 500.000 EUR
2. Lot 2, Chassis: 1.000.000 EUR
3. Lot 3, MTCA Carrier Hub: 1.000.000 EUR

1.2.3.4 Other contract particulars

The Framework Agreement will be drafted after "phase 2, negotiation" and will be published as part of the ITT documents for "phase 3, ITT and award of the contract".

1.2.4 Indicative procedure timetable

The indicative timetable for the procurement process presented below is intended as a guide and, whilst ESS does not intend to depart from the timetable, it reserves the right to do so at any time.

Estimated date	Activity
15/10/2018	Contract notice published on the ESS website and the Official Journal of the European Union (OJEU). Tendering documents made available to the potential tenderers in ESS supplier portal.
09/11/2018	Deadline for sending a request for clarification to ESS
15/11/2018	Deadline for submission of requests to participate
16/11/2018	Opening of requests to participate and selection of candidates for negotiations
14/12/2018	Notification to unsuccessful candidates Invitation to selected candidates for negotiations
10/01/2019	Start of negotiation phase
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08/10/2019	Invitation to tender
28/06/2019	Deadline for sending a request for clarification to ESS
05/07/2019	Deadline for submission of tenders
08/07/2019	Opening of tenders and evaluation
15/08/2019	Notification of the award decision to tenderers
26/08/2019	End of 10 day standstill period
02/09/2019	Contract signature

2. INSTRUCTIONS ON HOW TO SUBMIT A REQUEST TO PARTICIPATE

2.1 Presentation and submission of the request to participate

Suppliers interested in participating in this call for tenders are requested to submit a request to participate with supporting documentation following the instructions provided in the supplier portal and in this section.

The requests to participate must be drafted **in English**. The application form available in the supplier portal shall responded addressing the selection criteria described in section 5.2

Forms and supporting documentation must be uploaded in the supplier portal and submitted as follows:

a) File 1:

- i. **Content:** annex 1 (Tender identification form) of this call for tenders.
- ii. **Format:** PDF.

b) File 2:

- i. **Content:** documents described in section 6.1.2 of this call for tenders, and it shall be named "Request to Participate".
- ii. **Format:** ZIP.

Only requests to participate submitted in this manner will be considered.

Non-compliance with the above formal requirements regarding the presentation of the requests to participate may lead to the exclusion from the award procedure for this contract.

2.2 Signature of the requests to participate

The signature of the authorised representative of the candidate (single candidate or lead partner in case of a joint requests to participate) in annex 1 will be considered as the signature of the requests to participate, binding the candidate to the terms included in this call for tenders document.

2.3 Communication during the procurement procedure

All communications concerning this call for tenders, including requests for clarification, must be made in writing in the supplier portal. Clarifications by ESS will be communicated, in a suitably anonymous form, to all candidates registered in the procurement procedure.

No approach of any kind in connection with this open call for tenders should be made to any person within, or associated with, ESS. Failure to adhere to this requirement may result in exclusion from the competition. Please note that ESS will not enter into a detailed discussion on the requested services at this stage.

3. DESCRIPTION OF THE WORK

This section describes the MTCA components and the required innovations for each lot.

3.1 Lot 1: Power Supply

Product	Specification
uTCA.4 PSU	• 90-264 VAC 50-60 Hz input • low noise power module double width; • 12V 8.4A/ch or more than 12.5A/ch in order to achieve the innovation requiremen of 150W per slot/ch; • 3.3V 0.2A/ch.

Innovations required for this product:

1. < 2mV peak-peak, 0 – 50 MHz ripple and noise,
2. Increase power to 150W per slot.

3.2 Lot 2: Chassis

Product	Specification
9U MTCA.4 SYSTEM FOR PHYSICS WITH RTM. EXCL. PSU. 19"-SYSTEM 9U-84HP WITH 12-SLOTS. INCL. JSM/JTAG SLOT	Support for: • 2 MCHs; • 4 Power Modules; • 12 AMCs; • 12 RTMs; • 2 cooling units (push/pull configuration); • 1 JSM.
3U MTCA.4 SYSTEM FOR PHYSICS WITH RTM. 6 SLOT. EXCL. PSU. 19"-SYSTEM 3U, 84HP, 375 MM DEEP, FRONT TO REAR AIR COOLING	Support for: • 1 MCH; • 2 Power Modules; • 6 AMCs (1 full size); • 4 RTMs; • 1 cooling units (push or pull configuration).

Innovations required for this product:

1. Increase the backplane throughput to 40 Gbps and 100 Gbps;
2. Increase power budget to 150 W per AMC slot.

3.3 Lot 3: MTCA Carrier Hub

Product	Specification
MTCA CARRIER HUB FOR MTCA.4 AND MTCA.4.1 APPLICATIONS LOW JITTER, LOW LATENCY CLOCK MODULE FOR PHYSICS APPLIANCES. PCIe ≥ Gen3 SWITCH PROVIDING AT LEAST 4 VIRTUAL PCIe CLUSTERS. SUPPORTS GbE and PCIe ≥ Gen3 SWITCHING	1. Management for: • 12 AMCs (optional AMC13 in 2nd MCH slot); • 2 cooling units; • 4 power modules (including N+1 redundancy); • Update channel to secondary MCH; • (4 eRTMs and 2 rear power modules via LLRF backplane). 2. GigaBit Ethernet switching (Fabric A) 3. PCI Express ≥ Gen3 switching (Fabrics D-G) 4. Front panel uplinks: • At least 1x 1GbE; • 2x SMA for external CLK support (bi-directional); • Serial (RS232) and USB console. 5. Clock generation and distribution 6. Configuration options: • Console (USB, RS232 or Telnet); • Script File; • Web browser. 7. User accessible CPU to allow backplane enumeration procedure when using PCIe protocol on the backplane

Innovations required for this product:

1. User accessible CPU to allow backplane enumeration procedure when using PCIe protocol on the backplane,
2. Decrease latency of PCIe,
3. Increase bandwidth of communication.

4. JOINT REQUESTS TO PARTICIPATE AND SUBCONTRACTING

A supplier may submit a request to participate as a single entity or collaborate with other entities to present a joint request to participate or through subcontracting. Requests to participate may also combine both approaches. The legal status and role of each legal entity shall be clearly described in the request to participate.

If the identity of the subcontractor is not known at the time of submitting the request to participate, the tenderer who is awarded the contract will have to demonstrate that the subcontractor(s) comply with the original selection requirements and seek ESS's prior written authorisation before entering into a subcontract. The total value of the subcontracted part of the services/supplies cannot represent the total value of the contract value.

5. ASSESSMENT OF CANDIDATES

The assessment of candidates will be done in accordance with the following subsequent steps:

- (1) Verification that the **candidate** is not in one of the situations covered by the exclusion criteria listed in Article 23 of European Spallation Source ERIC Procurement Rules⁵,
- (2) Verification and assessment of the **candidate** regarding relevant capacities to perform the contract on the basis of the selection criteria (only for those candidates that were not excluded on the basis of the exclusion criteria),

5.1 Exclusion criteria

Candidates shall provide a declaration of honour (annex 2), duly signed and dated, including a statement that they are not in any of the situations listed in Article 23 of European Spallation Source ERIC Procurement Rules. In case of a joint request to participate such declaration shall be submitted for each partner. The declaration shall also be submitted for the subcontractors, when relevant.

In addition to the submission of the signed declaration, the candidate undertakes to inform ESS, without delay, of any changes to his situation in this regard.

⁵ The European Spallation Source ERIC Procurement Rules can be found on [ESS website](#).

Candidates may be excluded from participation in the present procurement procedure if they are found to be in one of the situations for exclusion or fail to submit the abovementioned declaration.

5.2 Selection criteria

The selection of candidates for negotiation shall be done according to the selection criteria as listed below.

Selection criterion	Scoring/weighting	Minimum Threshold
Professional capacity	Pass/Fail	
Financial and economic standing	-	
Criterion 1, financial and economic standing	Pass/Fail	
Technical capacity	-	
Criterion 1, relevant experience	Maximum 50 points	50% of maximum score for this criterion
Criterion 2, relevant skills, experience and qualifications of key personnel	Maximum 50 points	50% of maximum score for this criterion
Criterion 3, quality assurance	Pass/Fail	
Criterion 4, sustainability	Pass/Fail	
Total maximum score	100 points	

Candidates will be evaluated against each selection criterion on the basis of the responses in the application form and the documentary evidence submitted by the candidate. Failure to submit the evidence requested may lead to a rejection of the request to participate.

Candidates will be evaluated with a view of either passing or failing regarding some of the selection criteria according to the table above. The rest of the selection criteria will be evaluated and marked according to the scoring and weighting in the table above.

Candidates who do not meet the "pass/fail" selection criteria will not have their requests to participate further evaluated. ESS will inform disqualified candidates accordingly.

Candidates who do meet the "pass/fail" selection criteria will have their requests to participate further evaluated regarding the "scored/weighted" selection criteria. Each of these selection criteria will be evaluated and marked as indicated above. Candidates not reaching the minimum threshold indicated above will not have their requests to participate further evaluated. ESS will inform disqualified candidates accordingly.

The three candidates obtaining the highest scores will be selected and invited for negotiation. Candidates not selected for the negotiation phase will be informed accordingly.

5.2.1 Professional capacity

Criterion	Enrolment in one of the professional or trade registers in the country of establishment
Requirement	Valid registration in the relevant professional or trade registry
Response and Documentary evidence	Declaration or certificate of enrolment in one of the professional or trade registers in the country of establishment

5.2.2 Financial and economic standing

Criterion 1	Sufficient financial and economic standing to guarantee continuous and satisfactory performance throughout the envisaged lifetime of the contract
Requirement	- Overall annual turnover of minimum 1M EUR for the last three financial years or an equivalent shorter period during which the operation has been conducted. - Liquidity with a current ratio $\geq 0,75$ for the last three financial years or an equivalent shorter period during which the operation has been conducted. Formula for calculation: <i>Current Ratio = Current Assets / Current Liabilities</i> - Solvency with a debt-to-equity ratio ≤ 3 for the last three financial years or an equivalent shorter period during which the operation has been conducted. Formula for calculation: <i>Debt to Equity Ratio = Total Liabilities / Total Equity</i>
Response and Documentary evidence	A copy of the most recent audited accounts for the candidate's organization that cover the last three years of trading or for the period that is available if trading for less than three years, including balance sheets and profit & loss statements.

	2. A statement of overall annual turnover for the last three financial years or an equivalent statement for such shorter period during which the operation has been conducted. 3. The ratios resulting from the calculation of current ratio for the last three financial years or an equivalent shorter period during which the operation has been conducted based on the formula provided above and the data in the audited accounts. 4. The ratios resulting from the calculation of debt-to-equity ratio for the last three financial years or an equivalent shorter period during which the operation has been conducted based on the formula provided above and the data in the audited accounts.
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5.2.3 Technical capacity

Criterion 1	Relevant experience of the candidate
Requirement	A list of projects involving product development in the relevant field (MTCA.4 and high performance computing components) provided over the past 5 years and/or currently being performed.
Response and Documentary evidence	Project name, scope definition, product developments, tests, results, publications, patents and/or any other relevant documentary evidence.

Criterion 2	Relevant skills, experience and qualifications of candidate's key personnel.
Requirement	A R&D team with experience in projects involving product development in the relevant field (MTCA.4 and high performance computing components) provided over the past 5 years and/or currently being performed.
Response and Documentary evidence	Competency Profile describing education, role and experience of key personnel in similar projects.

Criterion 3	Quality assurance
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Requirement	Conduct of business in line with a quality management system
Response and Documentary evidence	Description of (no more than 300 words) candidate's quality management system or submission of up-to-date certificate on ISO 9001:2008 issued by authorized bodies

Criterion 4	Sustainability
Requirement	Conduct of business in line with an environmental management system
Response and Documentary evidence	Description of (no more than 300 words) candidate's sustainability management system or submission of up-to-date certificate on ISO 14001:2004 or Eco-management and Audit Scheme (EMAS)

6. CONTENT OF THE REQUEST TO PARTICIPATE

6.1.1 Annex 1 – Tender identification form

Candidates are requested to fill in and submit the information requested in annex 1. In case of a joint request to participate, annex 1 shall be submitted for each partner. Annex 1 shall also be submitted for the subcontractors, when relevant.

6.1.2 Request to participate

The request to participate shall include the declaration of honour (annex 2), as described in section 5.1 above.

The application form shall be responded directly in the supplier portal.

The candidate shall include all necessary supporting documentation required to demonstrate the candidate's professional capacity, its financial and economic standing as well as technical capacity, consistent with the requirements defined in section 5.2 above.

In case of joint request to participate, all the partners (except the lead partner) shall submit a power of attorney, signed by an authorised representative of each partner, designating the lead partner to represent them and to sign the contract on their behalf in relation to this call for tenders.

The candidate shall provide a copy of the statutes of the legal entity and any other evidence concerning the appointment of the persons authorised to represent the candidate in dealings with third parties and in legal proceedings. These documents shall be provided by all the partners in case of a joint request to participate.

7. ADDITIONAL PROVISIONS

- Changes to requests to participate will be accepted only if they are received by the deadline for the submission of requests to participate.
- ESS will not reimburse any costs incurred by candidates in connection with preparation and submission of their requests to participate required in phase 1.
- ESS reserves the right to cancel the tendering procedure at any point. ESS shall not be liable for any compensation with respect to candidates whose requests to participate have not been accepted. Nor shall it be so liable if it decides not to award the contract.
- Direct or indirect canvassing of any ESS employee by an candidate concerning this call for tenders, or any attempt to obtain unfair advantage from any ESS employee, may result in the disqualification of the candidate from consideration for this call for tenders.
- ESS is concerned to avoid conflict of interest. Candidates should note that ESS reserves the right to disqualify candidates where there is an actual or potential conflict of interest.
- Any document submitted in reply to this call for tenders will become the property of ESS and will be regarded as confidential.
- The procurement procedure is conducted in accordance with the European Spallation Source ERIC Procurement Rules⁶.
- Appeals – The European Spallation Source ERIC Procurement Rules provide for aggrieved parties who have been harmed or are at risk of harm by a breach of the procurement rules to formally appeal procurement decisions within 14 days from the day on which they knew or ought to have known of the grounds of the appeal.

Formal appeals must be marked 'confidential' and submitted in writing to the following address:

Tenders Appeal Board
European Spallation Source ERIC
P.O Box 176
SE-221 00 Lund, Sweden

Email: tendersappealboard@esss.se

⁶ The European Spallation Source ERIC Procurement Rules can be found on [ESS website](#).

ANNEX 1 – TENDER IDENTIFICATION FORM

ESS ref.: *Micro Telecommunications Computing Architecture Components for ESS, Ref. No. 121*

IDENTIFICATION OF TENDERER / JOINT TENDERER / SUBCONTRACTOR	
Name	
Legal form	
Date of registration	
Country of registration	
Registration number	
VAT number	
Address	
Email	
Authorised representative(s)	

SIGNATURE	
<i>I, the undersigned, confirm</i> <i>the acceptance of the conditions in the call for tenders,</i> <i>that the information given in this request to participate is correct, and</i> <i>that ESS has full rights to use the results of the negotiation phase.</i>	
Place and date	
Signature	
Full name	

ANNEX 2 – DECLARATION OF HONOUR REGARDING EXCLUSION CRITERIA

ESS ref.: *Micro Telecommunications Computing Architecture Components for ESS, Ref. No. 121*

The undersigned confirms that, to the best of his/her knowledge,

_____ ¹ or its directors or any other person who has powers of representation, decision or control of the named organisation:

- a) has not been convicted of any of the following offences in the last three years: participation in criminal organisation; corruption; fraud; money laundering; terrorist offences or offences linked to terrorist activities; child labour or other forms of illegal trafficking in human beings;
- b) has not failed to comply with applicable environmental, social or labour laws in the last three years;
- c) is not guilty of grave professional misconduct, which renders the supplier or tenderer's integrity questionable;
- d) is not involved in or in the last three years has not been involved in collusion.

The undersigned confirms that, to the best of his/her knowledge, that

_____ ² is not in any of the following situations:

- e) has received an unfair advantage that may distort competition as a result of the prior involvement of the supplier or tenderer in the preparation of the procurement process, in accordance with Article 28(4) of the European Spallation Source ERIC Procurement Rules³,
- f) has been responsible for significant previous deficiencies in the performance of prior contracts awarded by ESS;
- g) is guilty of serious misrepresentation while supplying information required as part of the tender procedure;
- h) is bankrupt, or is the subject of insolvency or winding-up procedures or is in any equivalent situation arising from a similar procedure under the laws and regulations of any state;

¹ the applicant's/ subcontractor's name

² the applicant's/ subcontractor's name

³ The European Spallation Source ERIC Procurement Rules are available at <https://europeanspallationsource.se/procurement-rules>

The undersigned confirms that, to the best of his/her knowledge, that

_____ ⁴:

- i) has no conflict of interest in connection with the contract; a conflict of interest could arise in particular as a result of economic interests, political or national affinity, family, emotional life or any other shared interest;
- j) will inform ESS, without delay, of any situation considered a conflict of interest or which could give rise to a conflict of interest;
- k) has not granted and will not grant, has not sought and will not seek, has not attempted and will not attempt to obtain, and has not accepted and will not accept any advantage, financial or in kind, to or from any party whatsoever, where such advantage constitutes an illegal practice or involves corruption, either directly or indirectly, inasmuch as it is an incentive or reward relating to award of the contract;
- l) provided accurate, sincere and complete information to ESS within the context of this procurement procedure;

Applicant's/ subcontractor's name and VAT registration number	
Date and signature of the authorised representative	
Full name and position of the authorised representative	

⁴ the tenderer's/ subcontractor's name



EUROPEAN
SPALLATION
SOURCE

**Market Consultation regarding innovations on
Micro Telecommunications Computing Architecture
specification 4 (MTCA.4)
required for the European Spallation Source (ESS)
Final report**





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1 Context

The European Spallation Source ERIC (ESS) is one of the largest science infrastructure projects being built in Europe today. Its mission is to build the most powerful neutron source in the world. As a parallel activity, ESS is leading a project on capacity building in innovation procurement under the Horizon 2020 “BrightnESS” research and innovation program. ESS deliverables within this sub-project include a market consultation and tender documents for an innovation procurement procedure. Horizon 2020 BrightnESS action is a programme that involves 18 Consortium Partners supporting the construction and ensuring the maximum scientific and technological impact via spreading the knowledge to relevant stakeholders.

ESS has chosen MTCA.4 as the standard technology for high-speed data acquisition applications. MTCA (Micro Telecommunications Computing Architecture) originated from telecommunications hardware and was formally introduced by PICMG (PC Industrial Computer Manufacturers Group) in September 2006 as a standard describing a new class of modular computer systems. MTCA has evolved to become a standard for demanding applications in large-scale research facilities e.g. particle accelerators, high-energy physics, plasma fusion sources, etc.

While the MTCA is a standard, there is still room for development in terms of the stability, operation, interoperability and adaptation to new architectures. Potential areas of improvement in terms of innovation are: crate design (Improvement of mechanical design, air flow and heat dissipation, health monitoring and software infrastructure management), MTCA.4 Carrier Hub and CPUs (Adaptation to new AMC architectures, PCI bus management, etc.) and upgraded specifications (speed, power, etc).

Therefore, ESS aims to procure MTCA.4 components including innovations in the areas indicated above.

2 Objectives and way of working

2.1 Background and objectives

This final report describes the steps taken during the market consultation for MTCA.4 at ESS. It contains the results of the workshops as well as recommendation for the next steps. The goal of this final report is a recommendation for the most appropriate procurement procedure. To be able to achieve this ESS experts and the industry were brought together to collect knowledge, insights and concrete proposals from different points of view.

This final report answers following questions:

- What are the main requirements ESS has regarding MTCA and more specific the MTCA.4 extension?
- What are the timelines?
- Which procurement procedure should be followed for every requirement?
- How can these requirements become part of a new version of the MTCA.4 standard?

Addestino Innovation Management was selected by the European Spallation Source (ESS), as part of the Horizon 2020 BrightnESS action program, to guide the market consultation. Addestino's mission is to deliver innovation to its customers, end-to-end, from idea to result. This mission is achieved based on 3 central pillars:

- Addestino is a multidisciplinary team which is capable to realize innovation through business, strategy, technology and user experience.
- Addestino masters an iterative end-to-end methodology to reduce risk and to accelerate successful product delivery.
- Addestino contains in depth technology knowledge and uses this in a pragmatic way for multiple industry segments (telecommunication, healthcare, energy, transport, electronics, etc.) in a broad range of environments (start up, SME, multinationals, universities, research facilities and governmental)

During the market consultation Addestino has taken up the role as external moderator. In this role Addestino coordinated and facilitated the market consultation, guided and moderated the discussions and stimulated the interaction between multiple parties. As external moderator, Addestino has always guarded the common goals, with the alignment between the parties as main objective. Addestino also provided the needed expertise and insights in innovation. This was done by the use of a custom-tailored plan and using proven methodology to guide in depth discussions during the workshops.

The activities leading to the market consultation started in December 2017 and the market consultation was done in April 2018. The process consisted of 4 steps:

1. **The scoping session** with members of the project (ESS) to answer the key questions of the project. Which requirements are in scope and which requirements are out of scope? Which constraints to consider versus which degrees of freedom to offer? Which decisions/knowledge is already "fixed" versus what is variable? Which ambition-level versus which risk-level is tolerated? After this session the project goals were set.

2. **The requirement & use case gathering session** with members of the project team (ESS) and some domain experts from ESS to collect all requirements and use cases, functional and non-functional. Always with a clear understanding of the drivers behind these requirements. All the use cases were prioritized based on the value for ESS.
During this session a detailed plan with milestones and their according timing was made to make sure ESS will be able to have the new products on time.
3. **The market consultation** with the industry to obtain a clear understanding by the industry players of their solutions to deliver the requirements. Hence identify technical risks to meet all requirements. Prioritize technical risks in terms of innovation potential from a “technical perspective”, i.e. how novel is a requirement compared to the state-of-the-art.
4. **The final report** made by Addestino based on the information collected during all the sessions.

2.2 Participants during the market consultation

Due to the open character of the market consultation and for transparency all participating entities are listed below

Pentair Technical Solutions Nordic AB
Elma Electronic GmbH
Wiener Power Electronics GmbH
N.A.T. GmbH
VadaTech Ltd
Concurrent Technologies PLC
IOxOS Technologies
Struck Innovative Systeme GmbH
Creotech Instruments S.A.
RECAB
GMV
Evopro Innovation Ltd
Combitech AB
Thales Alenia Space Spain
European Spallation Source ERIC
Big Science Denmark
Technical University of Denmark
CERIC

3 Summary

This section is the summary of the workshops & market consultation regarding MTCA.4 at ESS. It contains the fully worked out results obtained during the process. A recommendation for the next steps, the advised procurement procedure on the short term, as well as a recommendation on how to incorporate the requirements in the MTCA standard on the long run are described in this document. The conclusions can be split up in short term and long term.

On short term, assessment has shown that all the use cases are relevant for ESS (and other research facilities) and that they can be achieved by the industry within the wanted timeframe. These use cases all fit within the area of Public Procurement of Innovative Solutions, not of the shelf, but definitely feasible.

On the long term, standardisation will bring ESS, and other research facilities, lots of benefits. However, to achieve this in time, ESS will need to take an active role in the MTCA.4 standardisation group (PICMG). This will require time from the MTCA.4 experts at ESS.

4 MTCA.4 at ESS explained

4.1 Technology selection

ESS has selected MTCA.4 as a way to replace VME and CompactPCI® in research because of its performance vs total cost of ownership. VME & CompactPCI® are legacy technologies and are not attractive for research facilities with a long forecasted lifetime. The main drivers for MTCA.4 are:

- very high reliability and redundancy
- a forecasted lifetime of 40 years
- a backplane architecture (LVDS) which accommodates future PCI Express & Ethernet
- possibility to customise
- the install & replace TCO (Total cost of ownership) massively exceeds the equipment CAPEX.

However, improvements are needed to fit the research needs.

4.2 Short & Long-term commitment

On the short term, ESS is already installing MTCA.4 equipment, as is shown in the picture below. However, the target is to install the improved MTCA.4 equipment in Q4 2019. These products will be MTCA.4 compliant products, but will contain the non-standardized improvements needed by ESS. On the long term, starting in 2022, the replacement wave will start which will replace the already installed equipment. The goal during this wave is to install products with the requirements as defined in this report, but as part of a new MTCA.4 standard. This planning is visualized in Figure 1.

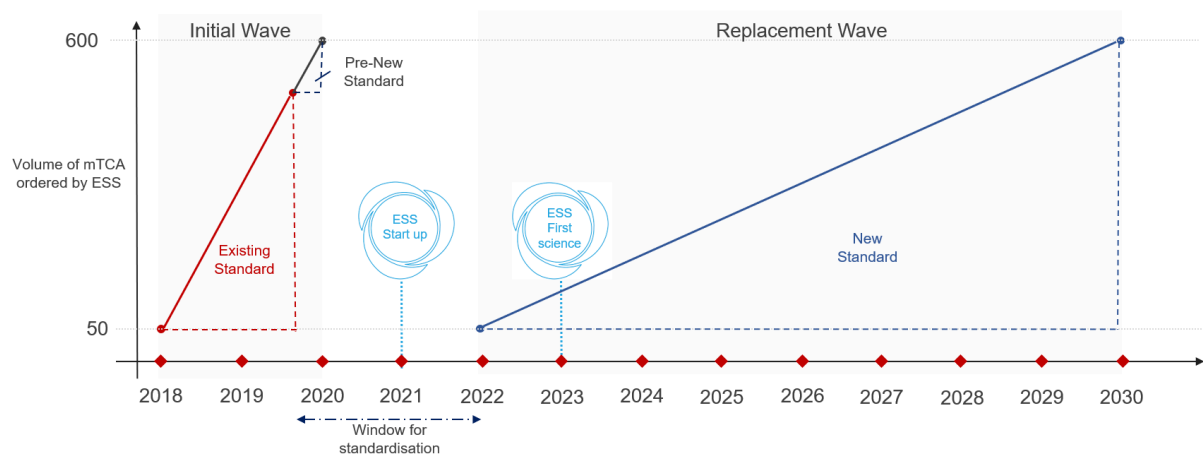


Figure 1: Short and long-term planning

In order to have pre-new standard MTCA.4's operational in initial wave, ESS is aiming to have the Contract Notice / Invitation to Tender out by end of June. This will give the industry 1 year for the necessary R&D and production of the first prototypes. Another 3 months will be available for the next production batch. These timings are visualised in Figure 2.

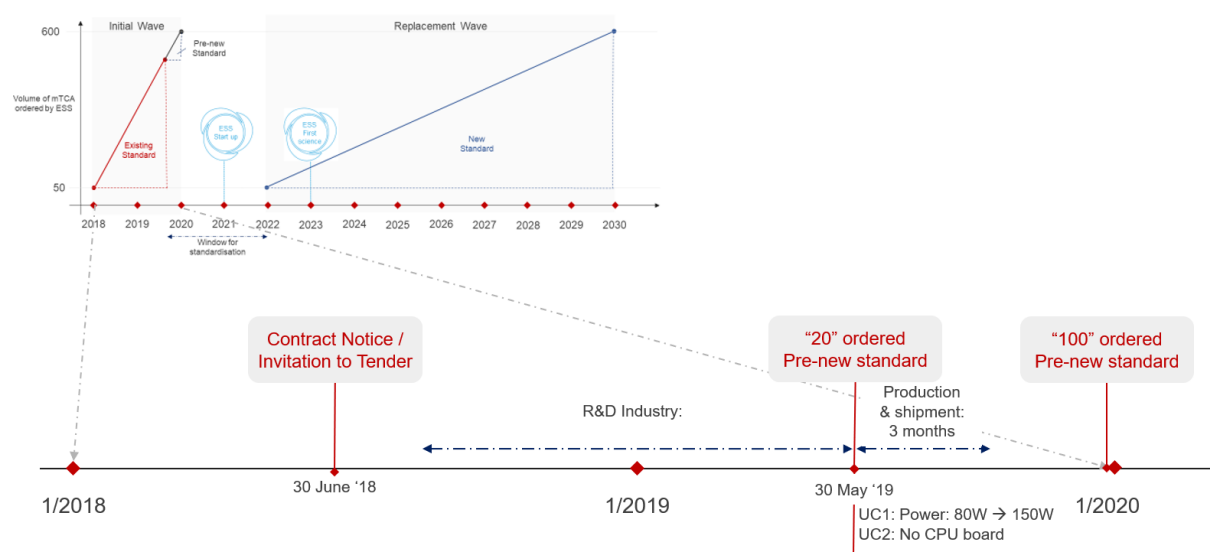


Figure 2: Plan for pre-standard MTCA.4

5 Requirements

5.1 Collection of the requirements

During the workshop with ESS a list of 7 requirements was created. These requirements are formatted as a use case. A use case contains who the requirement is for (as a...), what is needed (I can..) and why it is needed(so that...).

After the requirement gathering, the requirements were scored to define the value for ESS. When assessing the use cases, the value interpretation in Table 1 was used.

Score	Description
0	Couldn't care less, no added value.
2-3	Nice to have, if we have the time and resources
13	Must have!
20+	WOW! Homerun!

Table 1: scale for value

All use cases and their scoring can be found in Table 2.

ID	As a...	I can..	So that...	Value score
①	As a scientist	I can increase the power from 80W to 150W per slot	so that we can use the full processing power of the board (AMC) to support my latest and greatest algorithms	40
②	As a control system architect	I can eliminate the dependency on a central CPU board and replace it by an onboard controller on the MCH to do PCI bus enumeration and other housekeeping functions	so that we don't have to sacrifice a slot nor have to spend the money on a separate CPU	40
③	As a control system architect	I can install an MTCA.4 system where I can choose which direction the airflow goes (front/back, top/down, sideways, ?..)	so that I can fit the MTCA.4 system into the constraints of the rack space which is allocated to us	20
④	As a control system architect	I can increase the bandwidth of the backplane from 10Gbps to 40Gbps	so that I can keep up with technology evolution, and that we are not hitting a performance barrier for scientists in the future	13
⑤	As a control system architect	I can increase the bandwidth of the backplane from 10Gbps to 100Gbps	so that I can keep up with technology evolution, and that we are not hitting a performance barrier for scientists in the future	8
⑥	As a scientist	I can increase the quality of the power supply (< 2mV peak-peak, 0 - 50 MHz ripple and noise)	so that I can use it for more sensitive analog equipment such as for delicate proton beam positioning monitors	13
⑦	As a scientist	I can decrease the latency of the PCIe bus (33% lower latencies)	so that I can have faster acquisition rates and feedback loops	8

Table 2: List of use cases

5.2 Assessing the use cases for risk

During the industry session all use cases were assessed by the industry for risk using the planning poker methodology. The higher the risk, the less likely it will be feasible to deliver the requirement within a reasonable time frame. When assessing the use cases following value the interpretation in Table 3 was used.

Score	Description
0	No worries, off-the-shelf standard solutions exist.
2-3	A frequent problem, potentially some tricky cases, but certainly solvable.
5-8	Significant attention, effort and risk reduction required to be successful.
13	Absolutely not a standard problem. A solution requires important choices, thorough elaboration, and specific expert effort. Success can be achieved with significant time and effort.
100	Impossible, requires physical laws breakthroughs.
?	Don't know, no experience with this subject.

Table 3: scale for risk

Use Case 1: As a scientist I can increase the power from 50W to 150W per slot so that we can use the full processing power of the board (AMC) to support my latest and greatest algorithms.

Risk score: 3

Increasing the power is definitely feasible as it is already available in other standards (e.g. VME currently has 6KW). For MTCA.4 a non-standard power supply is already of the shelf available (Vadatech already provides a MTCA.4 PSU with 360W per slot). The biggest challenge will be cooling, as using more power will produce more heat. There might also be a need to change the connectors.

Another approach could be to reduce the power usage, which is an ongoing trend in the electronics industry.

Use case 2: As a control system architect I can eliminate the dependency on a central CPU board and replace it by an onboard controller on the MCH to do PCI bus enumeration and other housekeeping functions so that we don't have to sacrifice a slot nor have to spend the money on a separate CPU.

Risk score: 3

This use case has already been raised by the industry to certain vendors and has already been implemented. So it is definitely feasible. It can be done using a low power, low functionality and low-cost CPU or by using 1 core of a multicore CPU. A redesign might be needed however.

Use case 3: As a control system architect I can install an MTCA.4 system where I can choose which direction the airflow goes (front/back, top/down, sideways, ?..) so that I can fit the MTCA.4 system into the constraints of the rack space which is allocated to us.

Complexity differs if it is only front/back or top/down or the combination so the use case needs to be split up. This use case was assessed with following constraints for the crates: a height of 9U & fully loaded.

Use case 3a: As a control system architect I can install an MTCA.4 system where I can choose which direction the airflow goes top/down so that I can fit the MTCA.4 system into the constraints of the rack space which is allocated to us.

Risk score: 3

Changing the up/down direction is definitely feasible. It could be done by reversing the fans without replacement or by installing reverse fans. The biggest risk here is hot spots as boards are designed for a certain air flow. A redesign of the board could be needed.

Use case 3b: As a control system architect I can install an MTCA.4 system where I can choose which direction the airflow goes left to right or visa versa so that I can fit the MTCA.4 system into the constraints of the rack space which is allocated to us.

Risk score: 8

MTCA.4 is a vertically design system so a horizontal air flow will create some issues with hot spots. However horizontally designed systems already exists in the market (like MTCA.0). Redesign might be needed and will be more extensive compared to use case 3a. A way to easily identify hot spots will be useful.

Use case 3c: As a control system architect I can install an MTCA.4 system where I can choose which direction the airflow goes with full flexibility (vertical & horizontally) so that I can fit the MTCA.4 system into the constraints of the rack space which is allocated to us.

Risk score: 40

This use case will create a lot of issues. The space constraints won't be easy to fix & a lot of redesign to fix hot spots will be needed. Designing a system to be vertically & horizontally oriented will be extremely challenging.

Use case 4: As a control system architect I can increase the bandwidth of the backplane from 10Gbps to 40Gbps so that I can keep up with technology evolution, and that we are not hitting a performance barrier for scientists in the future.

Risk score: 8

Note: The 40Gbps is concatenated, so not per lane, but 4x10Gbps.

Currently the industry is already looking at this requirement. Other connectors might be needed for the AMC & the MCH, but these are currently available on the market. For the rest it is just a matter of standardisation.

Use case 5: As a control system architect I can increase the bandwidth of the backplane from 10Gbps to 100Gbps so that I can keep up with technology evolution, and that we are not hitting a performance barrier for scientists in the future.

Risk score: 13

On short term this can be achieved by emulating this speed between neighbouring boards using more pins, this does not provide the speed between all boards, but should be sufficient for most use cases.

On the long term it is probably feasible to have a full 4x25Gbps backplane. This has been verified in simulations. Doubts exist on the other hand that the connectors will be a blocking factor to have this speed between all boards. However, a full redesign of the full back plan will be needed, a PCB redesign will be needed, recertification will be needed, and so on. Also, an assessment on using a different backplane material needs to be done which will impact the price. And backwards compatibility also needs to be guaranteed. So, to achieve this speed, a full redesign of all components is needed. This will only be feasible if it is part of the standard.

Use case 6: As a scientist I can increase the quality of the power supply (< 2mV peak-peak, 0 - 50 MHz ripple and noise) so that I can use it for more sensitive analog equipment such as for delicate proton beam positioning monitors.

Risk score: 5

Currently power supplies with <10mV peak-peak @200MHz exist and <4mV peak-peak could definitely be done. <2mV peak-peak will need some redesign but is definitely doable as <2mV peak-peak is currently standard for detection supplies.

Use case 7: As a scientist I can decrease the latency of the PCIe bus (33% lower latencies) so that I can have faster acquisition rates and feedback loops.

Risk score: 8

The hardware is not the limiting factor for latency. Reducing the latency needs to be done on chip level. For this 2 possibilities exist.

1. New PCIe ASICs can be designed with lower latency. If there is enough push from the industry to reduce the latency this will be achieved by the ASIC manufacturers.
2. By using VHDL to program an FPGA, reduced latency on the PCIe bus is definitely feasible.

6 Conclusion

On short term ESS aims to procure the improved MTCA.4 products, on the long term the standardisation of these improvements is targeted. This section gives a recommendation on which procurement procedure to select for every use case. It also describes a path to succeed in the standardisation process. It is advised ESS works on short and long term goals in parallel.

6.1 Short term: Procurement of pre-standard MTCA.4 equipment

ESS uses 2 innovation procurement methods to buy not of the shelf available solutions: Public Procurement of Innovative Solutions & Pre-Commercial Procurement. For of the shelf solutions a standard procurement procedure is used. The feedback from the industry, as gathered during the market consultation, is used to select the appropriate procurement procedure.

The **Public Procurement of Innovative Solutions** is a procedure that can be used to procure innovative solutions:

- The procedure is selected if the solution is not yet commercially available but on/near the market.
- The procurer:
 - Will engage with suppliers in a staged approach using one of the standard procurement procedures
 - Will involve multiple alternative solution comparison
 - May perform/require conformance testing
 - Announces the intention to buy significant volumes
 - Will act as a first buyer
- The procedure will triggers market, knowledge and IPR development.

The **Pre-Commercial Procurement procedure** is a procedure that can be used in order to procure R&D services from industry:

- The procedure is selected for solutions that are not available in the market and require R&D services (> 50% of investment)
- The procurer:
 - Will engage with several suppliers in a staged procedure
 - Will work with the market based on risk-benefit sharing principle
 - Will involve alternative solution comparison
- A competitive development will be done in phases
- It is intended for the procurement of prototypes only (> 1, ideally)
- Implies significant knowledge transfer (IPR)
- May be followed by a subsequent procurement procedure (commercial solutions).

All use cases are mapped on the value risk matrix in Figure 3 and are grouped per appropriate procurement procedure. The vertical axis indicates the value for ESS. The horizontal axis describes the risk as assessed by the industry.

For ESS it only makes sense to invest in the use cases with a significant value.

Use cases with a low risk level can be procured with a standard procurement mechanism. If the risk level is limited, which is more or less between 3 & 13 a PPI is advised as this risk implies it is near/on the market. If the risk level is assessed as higher the Pre-Commercial Procurement procedure is advised as this implies some serious R&D is needed.

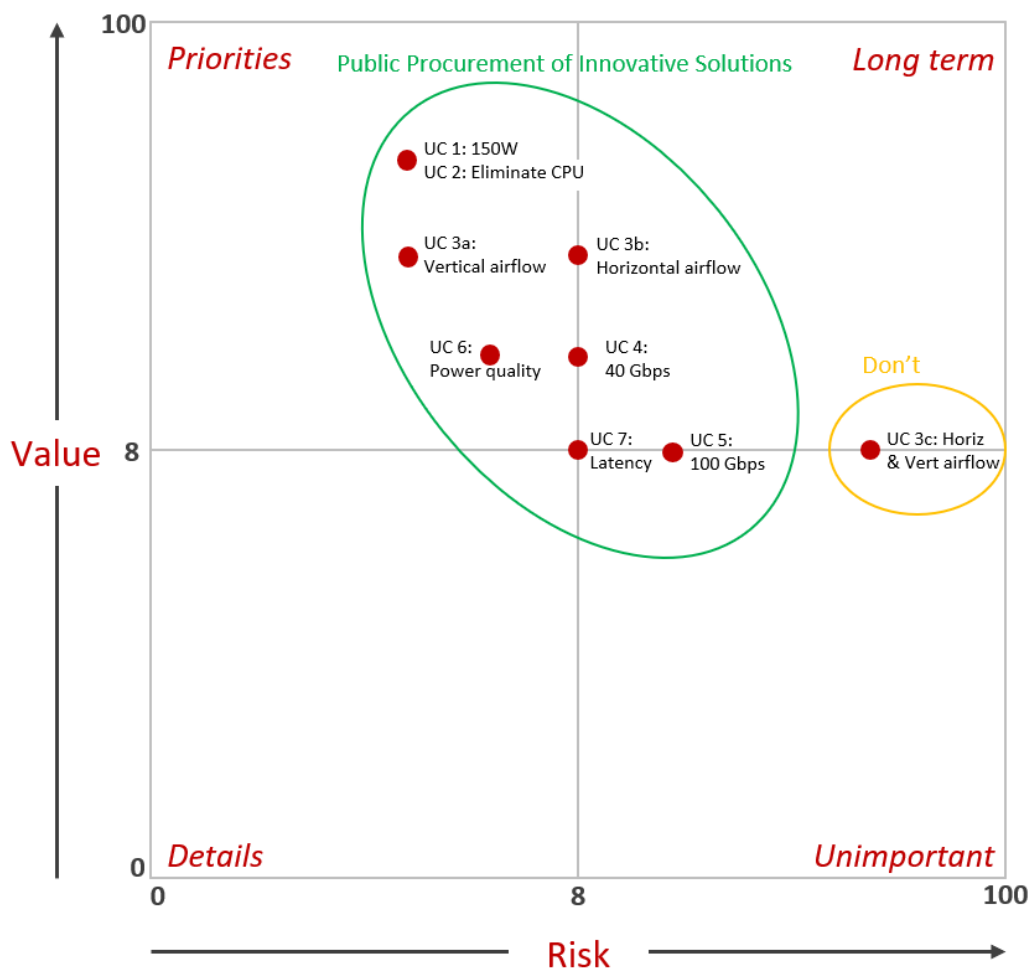


Figure 3: risk and value mapping of all use cases

On the value-risk matrix in Figure 3 on can easily see that a PPI should be done for all use cases. The only exception is use case 3c (horizontal & vertical air flow) which was assessed as to risky, and as the value for ESS is not high enough to start a PCP, the advice is to not take this use case in scope. For Use case 5 (100Gbps backplane) it is advised to only assess the emulation solution, as the full solution will only be possible after the standardisation.

6.2 Long term: Standardisation

For ESS it is very important that the use cases in this final report will become part of the MTCA standard for multiple reasons. First of all, ESS will have more purchasing freedom, as more vendors will support these features. Secondly, other research facilities have also shown interest in the enhanced MTCA.4 products. Standardization of MTCA.4 will enhance the ease of procurement and interest of other facilities, which leads to a bigger market for MTCA.4. In turn, this results in lower prices due to scale effects. Finally, use case 5 (100Gbps backplane) is only fully possible if the 100Gbps requirement is part of the standard as it requires a full redesign of all components.

The best way to form a new standard is when the market pushes for this standard. And, the stronger/bigger the market, the quicker the standardisation process will go. For reference: the current MTCA.4 specification exists due to the heavy push from Desy.

In order to achieve the market push, a broad alliance needs to be build. First ESS needs to enlarge its market power by onboarding other research facilities with comparable needs. Secondly, a workgroup with research facilities and the industry (preferably with the industry partners involved in phase 1) should be formed. This group should then be presented to the PICMG group to work on the standardisation. During this phase it will be the responsibility of the research facilities to keep the focus of the workgroup on the key requirements.

This will require heavy involvement from ESS employees.