PURCHASE CONTRACT

This purchase contract ("**Contract**") was concluded pursuant to section 2079 *et seq*. of the act no. 89/2012 Coll., Civil Code ("**Civil Code**"), on the day, month and year stated below by and between:

(1) **Institute of Physics of the Academy of Sciences of the Czech Republic, a public research institution,**

with its registered office at: Na Slovance 2, Praha 8, PSČ: 182 21,

registration no.: 68378271,

represented by: RNDr. Michael Prouza, Ph.D., director

("**Buyer**"); and

(2) **Danfysik A/S,**

with its registered office at: Gregersensvej 8, DK-2630 Taastrup, Denmark,

registration no.: 31934826,

represented by: Svend Dahl-Petersen

("**Seller**").

(The Buyer and the Seller are hereinafter jointly referred to as "**Parties**" and individually as "**Party**".)

WHEREAS

(A) The Buyer is a public contracting authority and the beneficiary of public grants for projects within the Operational Programme Research, Development and Education.

(B) For the successful realization of projects it is necessary to purchase the Object of Purchase (as defined below) in accordance with the act no. 134/2016 Coll., on public procurement, and Rules for the Selection of Suppliers within the Operational Programme Research, Development and Education.

(C) The Seller wishes to provide the Object of Purchase to the Buyer for consideration.

(D) The Seller's bid for the public procurement entitled "***REISSUE_3_Dipole correctors for momentum filter TP20_007/074***", whose purpose was to procure the Object of Purchase ("**Public Procurement**"), was selected by the Buyer as the most suitable.

IT WAS AGREED AS FOLLOWS:

1. **BASIC PROVISIONS**

1.1 Under this Contract the Seller shall hand over to the Buyer system (including all accessories) that is described in Annex 1 (*Technical Specification*) to this Contract in the quality described therein ("**Object of Purchase**") and shall transfer to the Buyer ownership right to the Object of Purchase, and the Buyer shall take over the Object of Purchase and shall pay the Seller the Purchase Price (as defined below), all under the terms and conditions stipulated in this Contract.

1.2 Under this Contract the Seller shall also:

a) prepare manufacturing drawings of the Object of Purchase as further described in Annex 1 (*Technical Specification*);

b) provide all materials needed for the manufacturing of the Object of Purchase;

c) manufacture, inspect, clean, test and assembly the Object of Purchase;

d) transport the Object of Purchase to the place of delivery;

e) provide support to the Buyer during the installation procedure in accordance with Annex 1 (*Technical Specification*);

f) to elaborate and hand over to the Buyer operational and maintenance manuals of the Object of Purchase in the extent specified in Annex 1 (*Technical Specification*) or other documents which are necessary for the proper takeover and use of the Object of Purchase in Czech or English language;

g) carry out other activities specified in Annex 1 (*Technical Specification*); and

h) cooperate with the Buyer during the performace of this Contract

("**Related Activities**").

1.3 The Seller and the Buyer are aware that the Object of Purchase consists of two main parts: The part no. 1 is described in RSD titled "Momentum filter for LUIS" and the part no. 2 is described in RSD titled "Dipole electro-magnet correctors for LUIS". The shall fulfill this Contract in such a manner that both main parts of the Object of Purchase are fully compatible.

2. **THE PLACE OF DELIVERY**

The place of delivery is at the address: Fyzikální ústav AV ČR v.v.i/ELI beamlines, Průmyslová 836, 252 41 Dolní Břežany, Czech Republic.

3. **THE TIME OF DELIVERY**

3.1 The Seller shall deliver the Object of Purchase within 12 months from the effectiveness of this Contract. The Buyer is entitled to postpone the time of delivery by 3 months, if the

premises at the place of delivery are not due to construction reasons prepared for acceptance of the Object of Purchase.

3.2 The Buyer shall extend the time of delivery at the request of the Seller, if the Seller is not able to fulfill this Contract due to circumstances that the Seller had no control over and such circumstances were hard to anticipate and are hard to overcome (e.g. covid-19 measures and/or impacts). In order for the Buyer to extend the time of delivery, the Seller must prove to the Buyer that such circumstances happened. The Byuer shall extend the time of delivery by the period corresponding to the time that is necessary for obstacles to disappear or to be overcome by the Seller. However, this doest not affect the right of the Buyer to withdraw from this Contract in accordance with the Article 13.

4. THE OWNERSHIP RIGHT

The ownership right to the Object of Purchase shall be transferred to the Buyer upon the signature of the acceptance protocol by both Parties.

5. PRICE AND PAYMENT TERMS

5.1 The purchase price for the Object of Purchase is **306 800,-** EUR ("**Purchase Price**") without value added tax ("**VAT**"). VAT will be paid in accordance with the applicable legal regulations.

5.2 The Purchase Price cannot be exceeded and includes all costs and expenses of the Seller related to the performance of this Contract. The Purchase Price includes, among others, all expenses related to the handover and acceptance of the Object of Purchase and execution of Related Activities, costs of copyright, insurance, customs, warranty service and any other costs and expenses connected with the performance of this Contract.

5.3 The Purchase Price for the Object of Purchase shall be paid in euro on the basis of a tax document – invoice, to the account of the Seller designated in the invoice. The Purchase Price shall be paid in the following manner:

a) 3 % of the Purchase Price shall be paid after the signature of this Contract;

b) 20 % of the Purchase Price shall be paid after the Buyer approves conceptual design of integrated setup (as defined in Annex 1);

c) 30 % of the Purchase Price shall be paid after the Buyer approves final technical design of integrated setup (as defined in Annex 1);

d) 37 % of the Purchase Price shall be paid after successful factory acceptance tests; and

e) 10 % of the Purchase Price shall be paid after the signature of the acceptance protocol. The copy of the acceptance protocol must be attached to the invoice.

5.4 The Buyer shall realize payments on the basis of duly issued invoices within 30 days from their receipt (maturity period). The invoice shall be considered to be paid for on the day when the invoiced amount is deducted from the Buyer's account on behalf of the Seller's account. To avoid any doubts Parties declare that if on the invoice is stated a maturity period that is shorter than 30 days, then such maturity period may be disregarded by the Buyer.

5.5 The invoice issued by the Seller as a tax document must contain all information required by the applicable laws of the Czech Republic. Invoices issued by the Seller in accordance with this Contract shall contain in particular following information:

a) name and registered office of the Buyer,

b) tax identification number of the Buyer,

c) name and registered office of the Seller,

d) tax identification number of the Seller,

e) registration number of the tax document,

f) scope of the performance (including the reference to this Contract),

g) the date of the issue of the tax document,

h) the date of the fulfilment of the Contract,

i) Purchase Price,

j) registration number of this Contract, which the Buyer shall communicate to the Seller based on Seller's request prior to the issuance of the invoice,

k) declaration that the performance of the Contract is for the purposes of a specific project (the number and the title of the project shall be communicated to the Seller based on Seller's request prior to the issuance of the invoice).

5.6 In case that the invoice shall not contain the above mentioned information, the Buyer is entitled to return it to the Seller during its maturity period and this shall not be considered as a default. The new maturity period shall begin from the receipt of the supplemented or corrected invoice to the Buyer.

5.7 The Buyer prefers electronic invoicing on the following email address: efaktury@fzu.cz

6. COPYRIGHT OF THE BUYER

6.1 Parties acknowledge that at the time of the conclusion of this Contract the Object of Purchase does not exist and the Seller must design, manufacture and assemble the Object of Purchase.

6.2 For the purposes of design and manufacture, the Buyer already provided (during the award procedure) drawings and conceptual designs of the Object of Purchase ("**Buyer's Drawings**"). The Seller acknowledges that Buyer's Drawings are protected by the act no. 121/2000 Coll., on Copyright and Rights Related to Copyright and on Amendment to Certain Acts ("**Copyright Act**") as an author's work. The Seller may use Buyer's Drawings only and solely for the purposes of the fulfilment of this Contract, i.e. for the manufacture and assembly of the Object of Purchase for the Buyer.

7. DESIGN AND MANUFACTURE OF THE OBJECT OF PURCHASE

7.1 The Seller, as a professional business entity, must verify whether the Buyer's Drawings have any deficiencies. The Seller must ensure that the Object of Purchase complies with all the requirements stipulated in this Contract and is fully functional. If any part of the Buyer's Drawings or any other requirement of the Buyer related to the Object of Purchase is not suitable or appropriate and there exists a more convenient solution for the Buyer, the Seller shall propose and realize such solution without any effect on the Purchase Price, if the Buyer consents to it.

7.2 The Parties acknowledge that the Seller has to create and prepare its own conceptual and final technical designs in accordance with Annex 1 (*Technical Specification*) to this Contract and other documents necessary for the manufacture and assembly of the Object of Purchase ("**Seller's Drawings**").

7.3 The Seller's Drawings must comply with this Contract and shall be approved by the Buyer prior to the manufacture and assembly of the Object of Purchase. If the Buyer suggests modifications to Seller's Drawings, the Seller shall incorporate such modifications or shall explain why it refuses to do so. By approving the Seller's Drawings, the Buyer does not accept any responsibility for the design flaws or deficiencies. The Seller is solely responsible for fullfing all the requirements stipulated in this Contract and its annexes.

7.4 The Seller shall hand over to the Buyer all Seller's Drawings.

7.5 The Seller's Drawings shall be prepared to such extent that the Buyer can reasonable verify that the technical requirements of this Contract are fulfilled or can be expected to be fulfilled.

8. COPYRIGHT OF THE SELLER

8.1 The Seller grants to the Buyer a right to use Seller's Drawings in the original or modified version, in connection with other work or independently ("**License**").

8.2 License is granted

a) free of charge;

b) as exclusive;

c) for all manners of use within the meaning of the Section 12(4) of the Copyright Act, as amended;

d) without any time restriction;

e) for the whole world (i.e. without any geographical restriction); and

f) under following conditions: i) the Buyer is entitled not to use the License, and ii) the Buyer is entitled to grant wholly or partially the License any third party (sublicense) or to transfer the License on a third person in case that the ownership of the Object of Purchase shall pass on such third person.

8.3 The Seller hereby grants permission to the Buyer to change or modify the Seller's Drawings. The Buyer is entitled to realize the changes or modifications alone, or with the assistance of third persons (contractors). The Buyer is entitled to combine Seller's Drawings with other drawings and designs, alone or with the assistance of third persons (contractors).

8.4 The Seller hereby represents and warrants to the Buyer that:

a) is entitled to use and enforce all author's rights to Seller's Drawings, in particular if the Seller's Drawings were created by employees or by more than one author, and, therefore, the Seller received all consents and permissions from authors and ensured that the Buyer may use the Seller's Drawing properly and without any interference;

b) all rewards to the authors of Seller's Drawings were provided;

c) did not grant license to Seller's Drawings to any other person in the extent that could disturb the License of the Buyer; and

d) is entitled to grant License to the Buyer in the extent specified in this Contract.

9. SELLER'S DUTIES

9.1 The Seller shall ensure that the Object of Purchase and Related Activities are in compliance with this Contract including all its annexes and applicable legal (e.g. safety), technical and quality norms.

9.2 During the performance of this Contract the Seller proceeds independently. If the Seller receives instructions from the Buyer, the Seller shall follow such instructions unless these are against the law or in contradiction to this Contract. If the Seller finds out or should have found out if professional care was exercised that the instructions are for any reason inappropriate or illegal or in contradiction to this Contract, then the Seller must notify the Buyer.

9.3 All things necessary for the performance of this Contract shall procure the Seller, unless this Contract stipulates otherwise.

9.4 The Seller is aware that the Buyer does not have at its disposal premises for the storage of packaging and, therefore, shall not store packaging of the Object of Purchase. The absence of original packaging cannot be an excuse for refusal of elimination of defects of the Object of Purchase.

10. HANDOVER AND ACCEPTANCE OF THE OBJECT OF PURCHASE

10.1 The Object of Purchase shall be delivered to the place of delivery and handed over to the Buyer within the time stipulated in Annex 1 (*Technical Specification*) to this Contract. The Object of Purchase shall be handed over to the Buyer along with delivery note or other similar document confirming the delivery. By delivering the Object of Purchase to the place of delivery the Buyer only takes custody of the Object of Purchase (i.e. the Buyer does not accept the Object of Purchase).

10.2 The acceptance of the Object of Purchase shall be realized on the basis of a acceptance protocol in accordance with Annex 1. The acceptance protocol must at least contain:

a) identification of the Parties;

b) the description of the Object of Purchase;

c) list of defects, if there are any.

The VCD shall be attached to the acceptance protocol.

10.3 If the Seller fails to duly carry out all Related Activities or if the Object of Purchase does not meet requirements of this Contract, the Buyer is entitled to refuse the acceptance of the Object of Purchase. In such a case the Seller shall remedy the deficiencies within ten (10) working days, unless Parties agree otherwise. The Buyer is entitled (but not obliged) to accept the Object of Purchase despite the above mentioned deficiencies, in particular if such deficiencies do not prevent the Buyer in the proper operation of the Object of Purchase. In such a case the Seller and the Buyer shall list the deficiencies in the acceptance protocol, including the manner and the date of their removal (remedy). If the Parties do not reach agreement in the acceptance protocol regarding the date of the removal, the Seller shall remove the deficiencies within ten (10) working days.

11. WARRANTY

11.1 The Seller shall provide a warranty of quality of the Object of Purchase for the period of 24 months. If on the warranty list or other document is the warranty period of longer duration, then this longer warranty period shall have priority over the period stated in this Contract.

11.2 The warranty period shall begin on the day of the signature of the acceptance protocol by both Parties. If the acceptance protocol lists any deficiencies, the warranty period shall be extended by the period, during which the Seller remedied the last deficiency.

11.3 The Seller shall remove defects and deficiencies that occur during the warranty period free of charge and in the terms stipulated in this Contract.

11.4 If the Buyer ascertains a defect or deficiency of the Object of Purchase during the warranty period, the Buyer shall notify such defect or deficiency without undue delay to the Seller. Defects and deficiencies may be notified on the last day of warranty period, at the latest.

11.5 The Buyer notifies defects and deficiencies in writing via e-mail. The Seller shall accept notifications of defects on the following e-mail address: **service@danfysik.dk.** The Seller shall confirm within 24 hours from the receipt of the notification.

11.6 In the notification the Buyer shall describe the defect or deficiency and the manner of removal of the defect. The Buyer has the right to:

a) ask for the removal of the defect by the delivery of new Object of Purchase or its individual parts, or

b) ask for the removal of the defect by repair, or

c) ask for the reasonable reduction of the Purchase Price.

The choice among the above mentioned rights belongs to the Seller.

11.7 The Seller shall remove the defect within 6 weeks from its notification, unless Parties agree otherwise.

11.8 Parties shall execute a protocol on the removal of the defect, which shall contain the description of the defect and the confirmation that the defect was removed. The warranty period shall be extended by a period of time that elapses between the notification of the defect until its removal.

11.9 In case that the Seller does not remove the defect within stipulated time or if the Seller refuses to remove the defect, then the Buyer is entitled to remove the defect at his own costs and the Seller shall reimburse these costs within 10 days after the Buyer's request to do so.

11.10 The warranty does not cover defects caused by unprofessional manipulation or by the failure to follow Seller's instructions for the operation and maintanence of the Object of Purchase.

12. PENALTIES

12.1 If the Seller fails to deliver the Object of Purchase in time stipulated in Article 3.1 of this Contract, the Seller shall pay to the Buyer a contractual penalty in the amlout of 0,1% of the Purchase Price for every (even commenced) day of delay.

12.2 If the Seller is in delay with the removal of the defect, the Seller shall pay to the Buyer a contractual penalty in the amount of 0,05% of the Purchase Price for every (even commenced) day of delay.

12.3 The Seller shall pay contractual penalties within fifteen (15) days from the day, on which the Buyer enumerated its claims. The payment of contractual penalties shall not affect the right of the Buyer to damages even to the extent to which such damages exceeds the contractual penalty.

12.4 The total amount that the Seller shall be obliged to pay on contractual penalties shall not exceed 10% of the Purchase Price.

12.5 The Buyer is entitled to unilaterally set off claims arising from the contractual penalties against the claim of the Seller for the payment of the Purchase Price.

13. RIGHT OF WITHDRAWAL

13.1 The Buyer is entitled to withdraw from this Contract without any penalties, if any of the following circumstances occur:

d) the Seller shall be in delay with the fulfilment of this Contract and such delay lasts more than 3 weeks;

e) The Object of Purchase shall not fulfil the requirements stipulated in this Contract, in particular in Annex 1 (*Technical Specification*) and such defects or deficiencies cannot be remedied;

f) the insolvency proceeding is initiated against the Seller; or

g) the Buyer ascertains that the Seller provided in its bid for the Public Procurement information or documents that do not correspond to the reality and that had or could have had impact on the result of the tendering procedure, which preceded the conclusion of this Contract.

14. SPECIAL PROVISIONS

By signing this Contract, the Seller becomes a person that must cooperate during the finance control within the meaning of Section 2 letter e) of the act no. 320/2001 Coll., on finance control in the public administration, and shall provide to the Directing Body of the Operational Programme Research, Development and Education or other control bodies acces to all parts of the bid, Contract or other documents that are related to the legal relationship formed by this Contract. This duty also covers documents that are subject to the protection in accordance with other acts (business secrets, secret information, etc.) provided that control bodies fulfil requirements stipulated by these acts. The Seller shall secure that all its subcontractors are also obliged to cooperate with control bodies in the above stipulated extent. The possibility of effective control must be preserved until the year 2033.

15. REPRESENTATIVES OF THE PARTIES

15.1 The Seller appoints following representatives for the communication with the Buyer:

In technical matters:

Name: Michael Nesager Pedersen

E-mail: mnp@danfysik.dk

Tel.: +45 72202351

In contractual matters:

Name: Svend Dahl-Petersen

E-mail: sdp@danfysik.dk

Tel.: +45 72203197

15.2 The Buyer appoints following representatives for the communication with the Seller:

In technical matters:

Jméno: Molodozhentsev Alexander

E-mail: Alexander.Molodozhentsev@eli-beams.eu

The appointed representatives of the Buyer are entitled to communicate with the Seller regarding all technical aspects of this Contract including issuing all the approvals foreseen by this Contract and signing the acceptance protocol. The appointed representatives of the Buyer are not entitled to change or supplement this Contract.

16. SOCIAL, ECOLOGICAL AND INNOVATIVE ASPECTS

16.1 The Buyer aims to conclude contracts with the suppliers that take into account and implement the principles of social responsibility, ecological sustainability and innovation. Therefore, the Seller shall ensure that

16.1.1 this Contract shall be fulfilled only by persons that are employed in accordance with the applicable legal regulations (no illegal or child workers);

16.1.2 while performing this Contract, all applicable health and safety regulations and rules at work place are observed;

16.1.3 all persons performing this Contract are employed under fair and non-discriminatory working conditions;

16.1.4 if presented with different manners of fulfilling this Contract, the Seller shall select the solution/process that is in accordance with the principles governing nature conservation and nature protection, ecological sustainability and ecological waste management; and

16.1.5 if presented with different manners of fulfilling this Contract, the Seller shall select the solution/process that is the most innovative.

17. FINAL PROVISIONS

17.1 This Contract is governed by the laws of the Czech Republic, especially by the Civil Code.

17.2 The terms and conditions of this Contract represent the whole agreement between the Parties regarding the subject matter of this Contract and any prior or oral agreements have been either consolidated into this Contract or are disregarded by the Parties.

17.3 Parties acknowledge that this Contract shall be published in the Register of Contracts in accordance with the Act no. 340/2015 Coll., on the Register of Contracts.

17.4 All disputes arising out of this Contract or out of legal relations connected with this Contract shall be preferable settled by a mutual negotiation. In case that the dispute is not settled within sixty (60) days, such dispute shall be decided by courts of the Czech Republic in the procedure initiated by one of the Parties.

17.5 The Seller is not entitled to set off any of its claims or his debtor's claims against the Buyer's claims. The Seller is not entitled to transfer its claims against Buyer that arose on the basis or in connection with this Contract on third parties. The Seller is not entitled to transfer rights and duties from this Contract or its part on third parties.

17.6 All modifications and supplements of this Contract must be in writing.

17.7 If any of provisions of this Contract are invalid or ineffective, the Parties are bound to change this Contract is such a way that the invalid or ineffective provision is replaced by a new provision that is valid and effective and to the maximum possible extent correspond to the original invalid or ineffective provision.

17.8 This Contract is executed in four (4) counterparts and every Party shall receive two (2) counterparts.

17.9 An integral part of this Contract is Annex 1 (*Technical Specification*) including all its annexes. If Annex 1 (*Technical Specification*) uses the term "Contracting Authority", it means Buyer and if it uses the term "Supplier", it means Seller. In case of any discrepancies between the text in the body of this Contract and the text in Annex 1 (*Technical Specification*), the text in the body of this Contract shall prevail. Annex 1 is formed by the following two documents:

- RSD titled "Momentum filter for LUIS" including its appendices
- RSD titled "Dipole electro-magnet correctors for LUIS" including its appendices

In case of any discrepancies between the text of this Contract and any of its annexes, the text of this Contract shall prevail.

17.10 This Contract shall be valid on the date of the signature of both Parties and effective on the day, on which it is published in the Register of Contracts.

IN WITNESS WHEREOF attach Parties their handwritten signatures:

Buyer

Signature: _____

Name: RNDr. Michael Prouza, Ph.D.,

Position: director

Date:

Seller

Signature: _____

Name: Svend Dahl-Petersen

Position: General Sales Manager

Date:

ANNEX 1

TECHNICAL SPECIFICATION

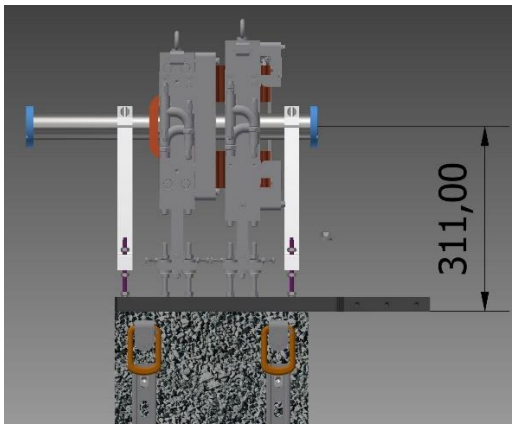
Confidentiality Level	*BL - Restricted for internal use*	**TC ID / Revision**	00261087/D
Document Status	*Document Released*	**Document No.**	N/A
WBS code	*5.1.4 - LUX Beamline*		
PBS code	E.E5.LUX.ELE.4.9		
Project branch	*Engineering & Scientific documents (E&S)*		
Document Type	*Specification (SP)*		

[RSD product category C]

Dipole electro-magnet correctors for LUIS

(Electron beam line)

TP20_074



Keywords

EM dipole magnets, EM dipole magnet control, EM dipole power supply

	Position	Name
Responsible person	LUX project leader	Alexander Molodozhentsev
Prepared by	LUX project leader	Alexander Molodozhentsev

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European Structural and Investing Funds
Operational Programme Research, Development and Education
MINISTRY OF EDUCATION YOUTH AND SPORTS

RSS TC ID/revision	RSS - Date of Creation	*RSS - Date of Last Modification*	*Systems Engineer*
020303/A.001	04.03.2020	04.03.2020	D. Hanusková
020303/A.002	10.03.2020	10.03.2020	D. Hanusková
020303/A.005	03.12.2020	03.12.2020	D. Hanusková

Reviewed By			
Name (Reviewer)	*Position*	*Date*	*Signature*
Lucie Kaletusová	Clean room specialist	*NOTICE*	
Lukáš Brabec	Group Leader of Vacuum and Cryogenics		
Ladislav Půst	Manager installation of technology		
Luboš Nims	Head of Electrical engineering		
Roman Kuřátko	Facility Manager	*NOTICE*	
Tomáš Laštovička	Team Leader BIS	*NOTICE*	
Veronika Olšovcová	Safety Coordinator		
Viktor Fedosov	SE & Planning group leader; Quality Manager		

Approved by			
Name (Approver)	*Position*	*Date*	*Signature*
Georg Korn	Science and Technology Manager, Scientific coordinator of RP2-6		

Revision History / Change Log				
Change No.	*Made by*	*Date*	*Change description, Pages, Chapters*	*TC rev.*
1	A.Molodozhentsev	28.02.2020	RSD draft creation	A
2	D. Hanusková, A. Molodozhentsev	10.03.2020	RSD update, version for internal review	B
3	D. Hanusková	31.03.2020	RSD update, final version	C
4	A.Molodozhentsev	03.12.2020	RSD updated due the author`s changes	D

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Table of Content

1. Introduction

1.1. Purpose

This Requirements Specification Document (RSD) lists the technical requirements and constraints on product applying in RA2 program of ELI project. This can lead to the identification of product interfaces with the ELI science based technology and ELI building facility. This RSD also acts as the parent document for the technical requirements that need to be addressed in lower level design description documents.

1.2. Scope

This RSD contains all of the technical requirements: functional, performance, operational & design, transportation & installation, safety & quality requirements for the following product (tender number: TP20_074): ***Dipole electro-magnet correctors with the beampipe for LUIS-PHASE2 setup*** (further "DEMC System").

The product is an integral part of the standalone technology "Laser Undulator Illuminating Source (**LUIS**)", in particular, PHASE2 development, and will be placed in the E5 hall. It is registered in the PBS software under the PBS code: E.E5.LUX.ELE.4.9.

1.3. Terms, Definitions and Abbreviations

For the purpose of this document, the following abbreviated terms are applied:

Abbreviation	Meaning
A	Analysis (as a verification method)
API	Application Programmers Interface
AR	Analysis Report
CA	Contracting Authority (Fyzikální ústav AV ČR, v. v. i.)
CDRR	Critical Design Review Report
DC	Direct current
DEMC	Dipole electro-magnet correctors
ELI	Extreme Light Infrastructure
PH2	Phase2 of the LUIS development
FD	Functional Demonstration (as a verification method)
FTR	Factory Test Report
GFR	Good Field Regions
I	Inspection (as a verification method)
NCR	Nonconformity Report
R	Review (as a verification method)
RA2	Research activity 2
RMS	Root Mean Square
RSD	Requirements Specification Document
RU	Rack Unit - unit of measure defined as 44.45 mm of vertical space that equipment occupies in the rack acc. to EIA-310.
T	Test (as a verification method)
VCD	Verification Control Document
VR	Verification Report

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1.4. Reference documents

Number of doc.	TC ID	Title of document / File
RD-01	*00261090*	*Sketch of Dipole Correctors with the beam-pipe.jpg*
RD-02	*00261090*	*Position and Dimension of the holes on the mounting plate.jpg*
RD-03	*00159948*	*ELI water cooling system - Technical specifications and requirements*
RD-04	*00261138*	*VCD_Dipole electro-magnet correctors for LUIS_TP20_074*

1.5. List of mentioned standards

Number of doc.	Title of document
ČSN EN ISO 2768	*General Tolerances For Linear And Angular Dimensions*
ČSN EN ISO 13920	*Welding — General tolerances for welded constructions*
ČSN EN ISO 1779	*Non-destructive testing. Leak testing. Criteria for method and technique selection*
ČSN EN ISO 14644	*Cleanrooms and associated controlled environments*
ČSN EN ISO 9001	*Quality management systems — Requirements*
ISO/TS 3669-2	*Vacuum technology - Bakable flanges: Dimensions of knife-edge flanges*

1.6. References to standards

If this document includes references to standards or standardized/standardizing technical documents, the CA allows/permits also another equal solution to be offered. If a supplier offers another equal solution the CA shall not reject its bid, once the supplier by appropriate means in the bid proves that the offered supplies, services or works meet in an equivalent manner the requirements including references to standards or technical documents.

2. General system requirements

REQ-028682/A

The Supplier shall deliver the following parts of the DEMC System:

- Dipole electromagnets (DEMC1, DEMC2, DEMC3, DEMC4) for PH2 in accordance with the technical specification, summarized below (see chapter 3);
- Each beam pipe assembled with the pair of the DEMC (see **RD-01**);
- Each DEMC magnet with individual alignment table;
- Mounting plate for each pair of the dipole electromagnets (DEMC1-DEMC2, DEMC3-DMC4) as shown in **RD-01**;
- Power supply systems for each DEMC with power cables connecting the DEMCs and power supply systems;

Verification method: I – inspection

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3. Functional, Performance and Design requirements

3.1. General requirements

REQ-028683/A

The final manufacturing drawings of the DEMC System shall be made by the Supplier in conformity with the requirements described in chapter 3.
Verification method: R - review

REQ-028684/A

At any stage of the design or manufacturing, if it is clear to the Supplier that an advantage could be gained by a modification of the original design, the Supplier shall inform the CA.
Verification method: Not To Be Tracked within VCD

REQ-029172/A

Any dimensional/design modifications that may arise as part of detailed manufacturing design shall be consulted with and approved by the CA. Such dimensional/design modifications are possible only if these are advantageous to the CA (e.g. offer more effective solution). The CA shall approve such a modification, if the advantage of doing so is undoubtedly demonstrated to the CA.
Verification method: R – review

REQ-028685/A

The DEMC elements shall have the field homogeneity dB/B0 better than 5e-3 for each DEMC within the Good Field Region of ±5 mm within the field range 10 % - 100 % of Bmax.
Verification method: A – analysis, T – test

REQ-028686/A

The Supplier shall perform the field measurements (see REQ-028685/A and chapter 3.2.1) and provide to the CA the results of this test (see REQ-028747/A). The results of the field measurements shall be delivered as a part of the technical documentations for each DEM.
Verification method: R – review, T – test, I – inspection

REQ-028687/A

The DEMC elements shall have accuracy ±0.1 % of measured integrated field gradient or better for each DEMC.
Verification method: R – review, T – test

REQ-028688/A

Each DEMC shall have four M8 holes to be used for mounting the magnet in the beam-line.
Verification method: R – review

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3.2. Dipole electromagnet (DEM) System

3.2.1. DEMs requirements

REQ-028689/A

The DEM1 shall comply with the following parameters:

- aperture gap = (25±0.2) mm;
- integrated (BL) field along the median plane = 0.010 T.m;
- total length of the magnet including winding ≤ 100 mm;
- main field component in the horizontal plane.

Verification method: R – review, T – test

REQ-028690/A

The DEM2 shall comply with the following parameters:

- aperture gap = (25±0.2) mm;
- integrated (BL) field along the median plane = 0.010 T.m;
- total length of the magnet including winding ≤ 100 mm;
- main field component in the vertical plane.

Verification method: R – review, T – test

REQ-028691/A

The DEM3 shall comply with the following parameters:

- aperture gap = (25±0.2) mm;
- integrated (BL) field along the median plane = 0.010 T.m;
- total length of the magnet including winding ≤ 100 mm;
- main field component in the horizontal plane.

Verification method: R – review, T – test

REQ-028692/A

The DEM4 shall comply with the following parameters:

- aperture gap = (25±0.2) mm;
- integrated (BL) field along the median plane = 0.010 T.m;
- total length of the magnet including winding ≤ 100 mm;
- main field component in the vertical plane.

Verification method: R – review, T – test

3.2.2. DEM water cooling system

REQ-028693/A

The DEM water cooling system shall correspond to the following requirements:

- Acceptable rise of the cooling water temperature for EMQs < 10 ^{0}C at the cooling water inlet temperature 25 ^{0}C.

Verification method: R – review, T – test

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REQ-028694/A

The requirements on the DEM water cooling system, determined by the Supplier, shall be compatible with the ELI water cooling system.
NOTE: The technical documentation of ELI water cooling system is provided to the Supplier (see RD-03).
Verification method: R – review

3.2.3. DEM alignment tables and mounting plate

REQ-028695/A

The individual DEM shall be mounted on the alignment table.
Verification method: I – inspection

REQ-028696/A

The DEM setup with 2 dipole magnets on the alignment tables and the beam-pipe shall be mounted on the mounting plate.
Verification method: I – inspection

REQ-028697/A

The geometrical axis of the assembled setup shall be at 311 mm with additional leveling ±10 mm from the bottom of the mounting plate (see **RD-01**).
Verification method: R – review, T – test

REQ-028698/A

The mounting plate shall have the pattern of the holes to mount the plate on the granite block (see **RD-02**). The dimensions of the mounting plate shall be discussed and accepted by CA after the preparation of the technical drawings.
Verification method: R – review, T – test

REQ-028699/A

The mounting plate shall have the holes to mount the alignment table of the individual dipole magnet. Flatness on bottom surface of the mounting plate shall be 0.2.
Verification method: R – review

3.2.4. Power supply systems

REQ-028700/A

The Supplier shall deliver the bipolar DC power supply system for each DEM, which shall be able to provide the required field parameters from the maximum values down to zero.
Verification method: R – review, I – inspection

REQ-028701/A

The power supply systems shall have stabilization of output power allowing the DEMs to provide required field quality.
Verification method: R – review

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REQ-028702/A

The power supply systems shall have the following output power parameters:

- for the DEMC1 < 1 kW;
- for the DEMC2 < 1 kW;
- for the DEMC3 < 1 kW;
- for the DEMC4 < 1 kW.

Verification method: R – review, T – test

REQ-028703/A

The Supplier shall deliver the power supply systems for the EMQs as a compact 19-inch rack mount module, assembled in one standard rack unit compatible with EIA-310.
Verification method: R – review, I – inspection

REQ-028704/A

The Supplier shall deliver the power supply systems for all the DEMCs with the RMS current ripple less than ±0.05 % for the whole range from zero to the maximum parameters.
Verification method: R – review, T – test

REQ-028705/A

The air cooling system of the DEMs power supply unit shall be compatible with ELI air cooling system.
Verification method: R – review

REQ-028706/A

The total maximum power consumption (i.e. input power consumption) of the DEMCs System shall not be more than 5 kW. The plug of the power supply system shall have 3 phases (3NPE, 230/400 V, 50 Hz).
NOTE: Final estimation of the power consumption of the DEM System shall be provided by the Supplier for approval by the CA before completion of the design phase.
Verification method: A – analysis, R – review, T – test

3.2.5. Vacuum compatibility

REQ-028707/A

The beam-pipes and flanges shall be UHV compatible and shall be able to be totally operated under vacuum level up to 10^{-7} mbar.
Verification method: R – review

REQ-028708/A

The cleaning procedure shall remove contaminants been adhered to the surface such as oils, greases, dirt, swarf, corrosion products, or finger prints.
Verification method: R – review

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REQ-028709/A

The Supplier shall provide to the CA the description of the vacuum cleaning procedure which will be reviewed and approved by the CA.
Verification method: R - review

REQ-028710/A

Clean components shall be handled wearing clean, dry, lint-free gloves.
Verification method: Not To Be Tracked within VCD

REQ-028711/A

Chemicals used in the cleaning process shall not affect the material properties or cause a colour change, corrosion or other damage.
Verification method: R – review

REQ-028712/A

The outgassing of vacuum components shall be free of hydrocarbons and the appropriate proofs shall be performed by Supplier using a sufficiently sensitive residual gas analyzer, usually equipped with a secondary electron multiplier (SEM).
NOTE: Components are considered as hydrocarbon free when the two conditions are fulfilled:

- *the leak-free system reaches a total pressure below 10^{-7} mbar;*
- *Amplitude of all peaks > 44 AMU are not higher than 1/100 of the 44 AMU peak;*
- *Peak at 43 AMU is not higher than 1/10 of the 44 AMU peak.*

Verification method: T – test (RGA report)

3.2.6. Vacuum leak tests

REQ-028713/A

The Supplier shall perform a leak test of the beam-pipes and the results provide the results of this test to the CA (see REQ-028747/A).

NOTE 1: Single leak test (spray test) shall be according to ČSN EN 1779 (equivalent to EN 1779; method A.3, or equivalent).
NOTE 2: Total leak test shall be according to ČSN EN 1779 (equivalent to EN 1779; method D2, or equivalent).

Verification method: T – test

REQ-028714/A

The measured single leak rate using calibrated He detector shall be less than **1.0E-9 mbar·l/s**.
Verification method: T – test

REQ-028715/A

The measured total leakage rate shall be better than **5.0E-4 mbar·l/s**.
Verification method: T – test

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3.2.7. Beam-pipes

REQ-028716/A

The beam-pipes shall be manufactured using the outer diameter of 22 mm with CF40 flanges at the edges of the beam-pipe (as shown in RD-01). No bellows are required for the beam-pipe.
Verification method: R – review, T – test

REQ-028717/A

The beam-pipe of the Momentum Filter System shall be designed and manufactured with the tolerance class **fH** according to ČSN EN ISO 2768 (equivalent to ISO 2768) or equivalent and with the tolerance class **AE** according to ČSN EN ISO 13920 (equivalent to ISO 13920) or equivalent.
The tolerance for the total length of the beam-pipe shall be ± 1 mm.
The dimensions of CF flanges shall be according to ISO/TS 3669-2 or equivalent.
Verification method: R – review, T – test

3.2.8. Control units requirements

REQ-028718/A

Each power supply shall be equipped with a serial interface for the remote control operation via following protocols: Ethernet, RS-232 or RS-485.
Verification method: I - inspection

REQ-028719/A

Supplier shall provide comprehensive communication protocol documentation (commands reference manual) for the dipole magnet power supplies
Verification method: R – review

3.2.9. Cable and water tubes requirements

REQ-028722/A

All power cables connecting to the DEMCs shall be compatible with the power supply systems and shall be delivered by the Supplier.
NOTE: Power cable connecting the power supply rack to the power socket in the experimental area will be provided by CA.
Verification method: R – review, I – inspection

REQ-028723/A

The length of the power cables connecting the power supply systems and the DEMCs shall not be less than 6 meters.
Verification method: R – review

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REQ-028724/A

All water tubes for the cooling system shall be assembled for each DEM and shall be delivered by the Supplier.
NOTE: The water tubes to connect the magnets water cooling system to water cooling hub in the CA experimental hall will be prepared by CA before the delivery of the items.
Verification method: R – review, I – inspection

REQ-028725/A

The water tube material of the DEMCs shall be compatible with ELI cooling system.
Verification method: R – review

4. Transportation and Installation requirements

4.1. General requirements

REQ-028726/A

The transportation of the assembled 2 dipole correctors and the beampipe to the final destination shall be conducted by the Supplier.
Verification method: R - review

REQ-028727/A

Each component of the DEMC System shall be cleaned and packaged in clean environment of class 7 according to ČSN EN ISO 14644 (equivalent to ISO 14644) or cleaner (or equivalent).
Verification method: R – review, I – inspection

REQ-028728/A

All components of the DEMC System shall be at least double wrapped with clean plastic foils and placed in an appropriate protective package preventing damage and contamination.
Verification method: I – inspection

REQ-031188/A

Before the Delivery the Supplier will provide the instruction for the proper connection of the magnet power supply systems and the magnets water cooling systems to the corresponding hubs in the CA experimental area.
Verification method: R - review

REQ-031189/A

Before the Delivery the Supplier will provide the instruction for the proper installation and final alignment for the dipole corrector setup , including the reference points for the laser tracker.
Verification method: R - review

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REQ-031190/A

Connection of the magnets water cooling system to the water cooling hub in the ELI-Beamlines experimental hall will be performed by the CA personal after delivery of the magnets to the CA side. The connection will be based on the instruction, submitted by the Supplier.
Verification method: I – inspection

REQ-031191/A

Connection of the rack with the magnets power supplies to the electrical power hub in the ELI-Beamlines experimental hall will be performed by the CA personal after delivery of the magnets to the CA side. The connection will be based on the instruction, submitted by the Supplier.
Verification method: I – inspection

REQ-031192/A

Final alignment of the assembled setup of the system in the experimental hall shall be performed by the CA under the supervision from the Supplier side. The final installation of the assembled setup will be based on the alignment instruction, submitted by the Supplier.
Verification method: I – inspection

REQ-031193/A

The transportation and installation procedures shall be discussed and can be reviewed by the CA's installation officer.
Verification method: R – review

REQ-031194/A

The Supplier shall check the proper cable and water-cooling connections in the CA experimental area and perform full-power electrical and thermo-test after the final installation of the dipole-correctors setup in the CA experimental area.
Verification method: T – test

REQ-031195/A

The vacuum components of the whole system shall be cleaned and packaged in clean environment of class 6 according to ČSN EN ISO 14644 (equivalent to ISO 14644) or cleaner (or equivalent).
NOTE: The ISO 14644 certification of the Supplier's cleanrooms is not required.
Verification method: R - review, I – inspection

REQ-031196/A

The non-vacuum components of the whole system shall be cleaned and packaged in clean environment of class 8 according to ČSN EN ISO 14644 (equivalent to ISO 14644) or cleaner (or equivalent).
NOTE: The ISO 14644 certification of the Supplier's cleanrooms is N/R.
Verification method: R – review, I – inspection

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5. Safety requirements

REQ-028729/A

The Supplier shall supply a **Declaration of Conformity** or any other equivalent document legally recognized and accepted by the Czech Republic legislation for each product type if the appropriate legislation determines the Supplier's obligation to have a Declaration of Conformity (or the equivalent document) for the purposes of a Device sale in the Czech Republic (requirements of 2001/95/EC directive or applicable Czech law).
Verification method: I – inspection

6. Quality requirements

6.1. Documentation and data control

REQ-028730/A

The Supplier shall provide the **Product User Manual** as part of the delivered system. Completeness of the Manual shall be approved by the CA. The Manual shall include the instructions and descriptions regarding the following procedures:

- transport, handling, storage;
- installation, alignment and cleaning;
- guide for the software and for communication protocol (see REQ-028720/A);
- safe operation and maintenance procedures.

Verification method: R - review, I - inspection

REQ-028731/A

The Supplier shall supply the following manufacturing documents:

- all manufacturing **drawings, 3D models** (if available) and **design supporting documentation** (i.e. technical documentation, see REQ-028752/A);
- all approved by the CA "**requests for deviation/wavier** from requirements described herein" (see REQ-028735/A).

Verification method: I - inspection

REQ-028732/A

Documentation shall be supplied in **hardcopy** and **PDF** formats.
Verification method: Not To Be Tracked within VCD

REQ-028733/A

The manufacturing documents shall include **accuracy of the manufacturing process**. This accuracy shall be also included in the corresponding **test reports** (see REQ-028747/A).
NOTE: The Supplier will specify what can be the maximal difference between specified parameters (in the chapter 3) and the parameters of the final DEM System.
Verification method: R - review

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REQ-028734/A

The Supplier shall use following data formats:

- *.JPG, *.PNG, *.TIFF, *.PDF/A, *.HTML
- CAD 2D: *.dwg
- CAD 3D: *.stp; *.ste; *.step or other 3D CAD formats agreed with the CA
- text processors *.doc, *.docx, OpenDocument Format
- spreadsheet processors *.xls, *.xlsx, OpenDocument Format
- presentations *.ppt, *.pptx; OpenDocument Format

Verification method: Not To Be Tracked within VCD

6.2. Nonconformity Control System

REQ-028735/A

The Supplier shall establish and maintain a nonconformity control system compatible with ČSN EN ISO 9001 (equivalent to EN ISO 9001) or equivalent.
Verification method: Not To Be Tracked within VCD

6.3. Specific Quality requirements

REQ-028736/A

In case of a warranty repair of the DEM System by the Supplier, the Supplier shall redo necessary parts of the verification procedure (see chapter 7). The results of this process shall be provided to the CA.
Verification method: Not To Be Tracked within VCD

REQ-028737/A

The manufacturing documents shall contain strictly the units which are used to define the requirements in the chapter 3.
Verification method: R - review

REQ-028738/A

All tests shall be performed by the measuring instruments with valid metrological confirmation.
NOTE: The CA can request the Supplier to provide the valid Calibration Certificates.
Verification method: Not To Be Tracked within VCD

7. Verification requirements for the Supplier

The verification process will be performed by the Supplier to demonstrate that the DEM System meets the specified requirements of the CA.

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7.1. General requirements

REQ-028739/A

The Supplier shall assign clear responsibility for the implementation of the verification process including the following activities:

1. **Verification planning** (via VCD, see chapter 7.2.3);
2. **Verification execution and reporting** (see chapters 7.2.2 and 7.3);
3. **Verification control and close-out** (see chapter 7.2.3, 7.3.3)

Verification method: R - review

REQ-028740/A

The verification process shall be accomplished by the Supplier through one or more of the following verification methods:

1. **Review**; Verification via Review **(R)** shall consist of using approved records (examples of such approved records are design documents and reports, technical descriptions, and engineering drawings, manuals and accompanying operation documentation) or evidence that unambiguously shows that the requirement is met.
2. **Inspection**; Verification via Inspection **(I)** shall consist of visual determination of physical characteristics including photographs taken by the Supplier and sent to the CA proving that the specific requirements have been met.
3. **Test** (including functional demonstration); Verification via Test (**T**) shall consist of measuring product performance and functions under realistic operating conditions. When the test objectives include the demonstration of qualitative operational performance (functional demonstration), the execution shall be observed and results recorded.
4. **Analysis**; Verification via Analysis **(A)** shall consist of performing theoretical or empirical evaluations (e.g. mathematical models, calculations and etc.).

Verification method: Not To Be Tracked within VCD

7.2. Verification documentation

7.2.1. General requirements

REQ-028741/A

The Supplier shall establish and maintain the system of verification process documentation (see REQ-028742/A and REQ-028743/A).
Verification method: Not To Be Tracked within VCD

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REQ-028742/A

Verification documentation shall consist of following basic types of documents:

- **Verification reports** (see chapter 7.2.2);
- **VCD, Verification Control Document** (see chapter 7.2.3).

Verification method: Not To Be Tracked within VCD

REQ-028743/A

The verification reports shall be submitted to the CA for the review as agreed with the CA after corresponding verification activity completion, within the time frame agreed with the CA.
NOTE: Verification activity can be design review and analysis during the DEM System development, test and inspection during the final DEM System implementation.
Verification method: Not To Be Tracked within VCD

7.2.2. Verification reports (VRs)

REQ-028744/A

The results of the analysis shall be documented in corresponding **Analysis Report** (further "**AR**") and tracked in the VCD (see the chapter 7.2.3).
Verification method: R - review

REQ-028745/A

The results of a review of design shall be documented in the **Critical Design Review Report** (further "**CDRR**") and tracked in the VCD (see chapter 7.2.3).
NOTE: The CA can provide to the Supplier the template of CDRR.
Verification method: R - review

REQ-028746/A

The results of the inspection shall be tracked in the VCD.
Verification method: R - review

REQ-028747/A

The results of the tests shall be documented in the appropriate **Factory Test Report** (further "**FTR**") and tracked in the VCD (see chapter 7.2.3).
Verification method: R – review

7.2.3. Verification Control Document (VCD)

The Verification Control Document (**VCD**) lists the requirements to be verified with the selected methods at the defined stages of the DEM System delivery (see chapter 7.3). The VCD is a living document which shall be used throughout the entire Contract delivery and its phases (see chapter 7.3. Phasing of the delivery). The VCD provides traceability during delivery phases (Qualification of Design, Manufacturing, Delivery and Acceptance, etc.).

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The VCD represents a formal tool of communication between the Supplier and the CA (formal record, reporting tool).

REQ-028748/A

The Supplier shall provide a **Verification Control Document** (further "**VCD**") for the reviews as agreed with the CA.
NOTE 1: Guidelines for VCD preparation see in RD-04.
NOTE 2: The form of VCD will be agreed between the CA and the Supplier based on the best commercial praxis used by the Supplier.
Verification method: R - review

REQ-028749/A

In the VCD the Supplier shall specify **HOW** and **WHEN** each requirement is planned to be verified.
Verification method: R - review

REQ-028750/A

The verification approach shall be submitted by the Supplier in the VCD and approved by the CA prior to implementation.
Verification method: Not To Be Tracked within VCD

7.3. Phasing of the delivery

This chapter is intended to briefly summarize basic milestones of the Contract delivery. These milestones represent gates (checkpoints) where the quality of the delivery is to be evaluated.
Delivery shall not proceed past these gates unless their satisfactory accomplishment is approved by the CA.
Delivery lifecycle shall contain at least the following phases (***quality gates***):

- **Qualification of Design;**
- **Manufacturing;**
- **Delivery;**
- **Acceptance** (performed by the CA).

7.3.1. Qualification of Design

Summary of what has to be provided by the Supplier in terms of documentation (technical documentation including manufacturing drawings and design supporting documentation, verification reports including CDRR and AR) before starting the manufacturing. The goal is to verify the **manufacturing drawings and design supporting documentation**.
Output of this phase is **Qualified Conceptual Design and agreed scope of technical documentation**.

REQ-028751/A

Before completion of the Conceptual Design phase the Supplier shall provide following information that shall be agreed by the CA:

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- structure and content of the verification reports (see chapter 7.2.2);
- structure and content of the VCD ready to be implemented (see chapter 7.2.3).

Verification method: R – review

REQ-028752/A

Before completion of the Conceptual Design phase the Supplier and the CA shall agree on:

- conceptual drawings of the integrated setup provided by the Supplier (see REQ-028555/A);
- acceptance results of the conceptual design verification submitted by the Supplier in the corresponding CDRR and AR (see REQ-028607/A and REQ-028563/A);
- detailed procedures related to the testing during Manufacturing and Installation phases (see chapters 7.3.2 and 7.3.3);

Verification method: R – review

7.3.2 Technical Design of Integrated Setup

The goal is to verify the **technical design of the integrated D setup, including final drawings for the production and supporting documentation**.
Summary of what shall be provided by the Supplier in terms of documentation (technical documentation including final drawings and supporting documentation) before starting the production of the integrated setup.

Output of this phase is **qualified Technical Design of the Integrated Setup and agreed scope of production of the setup**.

REQ-030761/A

Before completion of the Technical Design phase the Supplier and the CA shall agree on:

- final drawings of the integrated setup provided by the Supplier (see REQ-028555/A);
- acceptance results of the conceptual design verification submitted by the Supplier in the corresponding CDRR and AR (see REQ-028607/A and REQ-028563/A);
- detailed procedures related to the testing during Manufacturing and Installation phases (see chapters 7.3.2 and 7.3.3);

Verification method: R – review

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7.3.3 Manufacturing

The goal is to demonstrate that the manufactured and assembled DEM System meet all requirements specified herein.
This quality gate concerns primarily:

- **Inspection of the DEM System**;
- **Testing at the Supplier's site** (factory testing);
- **Cleaning, packaging and delivery**.

Output of this phase is the **Final DEM System**.

REQ-028753/A

The results of the Manufacturing phase of verification shall be recorded by the Supplier in the appropriate FTR (see REQ-028747/A) and overall results (including review of documentation/reports and inspection of the assembled DEM System) shall be recorded in the VCD (see chapter 7.2.3).
Verification method: R - review

REQ-028754/A

The final issue of the VCD shall be submitted to the CA after the approval of the last report before delivery.
Verification method: R – review

7.3.4 Delivery and Installation

The goal is to demonstrate that the delivered and installed final DEM System meets all requirements specified herein.

Verification of the final System is executed by the Supplier and the CA together after completion of each stage including delivery, transportation and installation.

This quality gate concerns primarily:

- **Inspection of delivered integrated System and required documentation**;
- **Transportation to the final destination** (ELI Beamlines E5 hall);
- **Inspection and on-site testing of whole installed System**.

Output of this phase is the **Verified delivered and installed Integrated System**.

REQ-030762/A

The results of the verification of delivered and installed DEM System shall be recorded by the Supplier in the appropriate STR (see REQ-028609/A) and overall results shall be recorded in the VCD (see chapters 7.2.3).
Verification method: R – review

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REQ-030763/A

The final issue of the VCD shall be submitted to the CA after the approval of the last report and before starting the Acceptance phase (see chapter 7.3.4).
Verification method: R – review

7.3.5 Acceptance

Acceptance will be carried out by the CA upon delivery of the final complete DEM System not obviously damaged during transport (see chapters 4 and 7.3.2) and final test.
The basis for acceptance will be completed VCD summarizing the overall verification results together with relevant documentation supporting the verification (i.e. VRs, approved manufacturing drawings and 3D model, Product User Manual and etc.).

In case of successful acceptance phase the CA will provide to the Supplier signed acceptance protocol. In case of unsuccessful acceptance stage the CA will provide to the Supplier Nonconformity Report (NCR) and ELI nonconformity control process will be applied (see REQ-028735/A).

REQ-028755/A

The Acceptance phase shall demonstrate the following:

- Final DEM System has been successfully verified by the Supplier and the results of this process has been documented in an appropriate way through VRs (see chapter 7.2.2) and VCD (see chapter 7.2.3);
- All detected nonconformity have been solved in accordance with REQ-028735/A;
- Final DEM System is free of fabrication errors and is ready for the intended operational use.

Verification method: Not To Be Tracked within VCD

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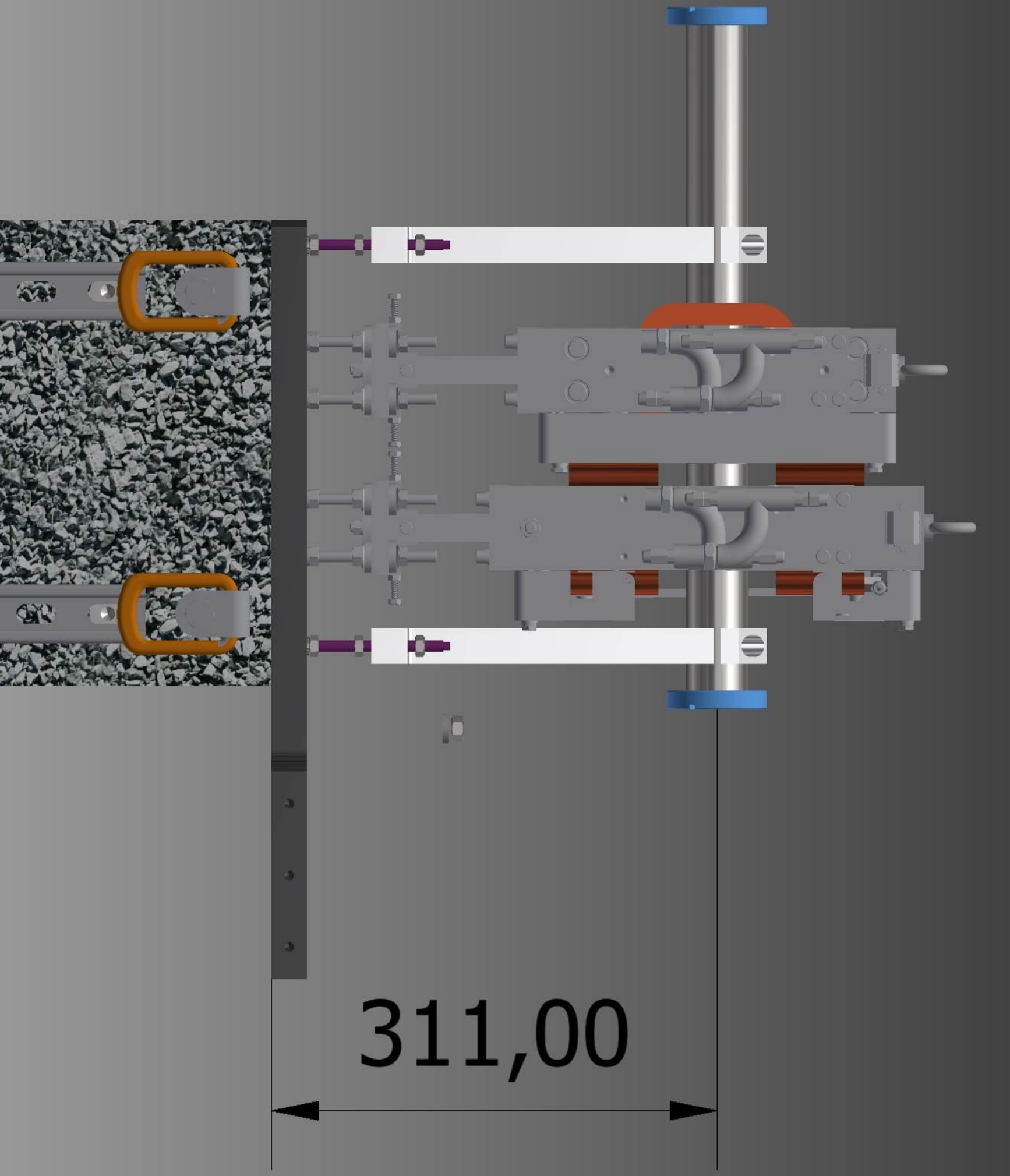
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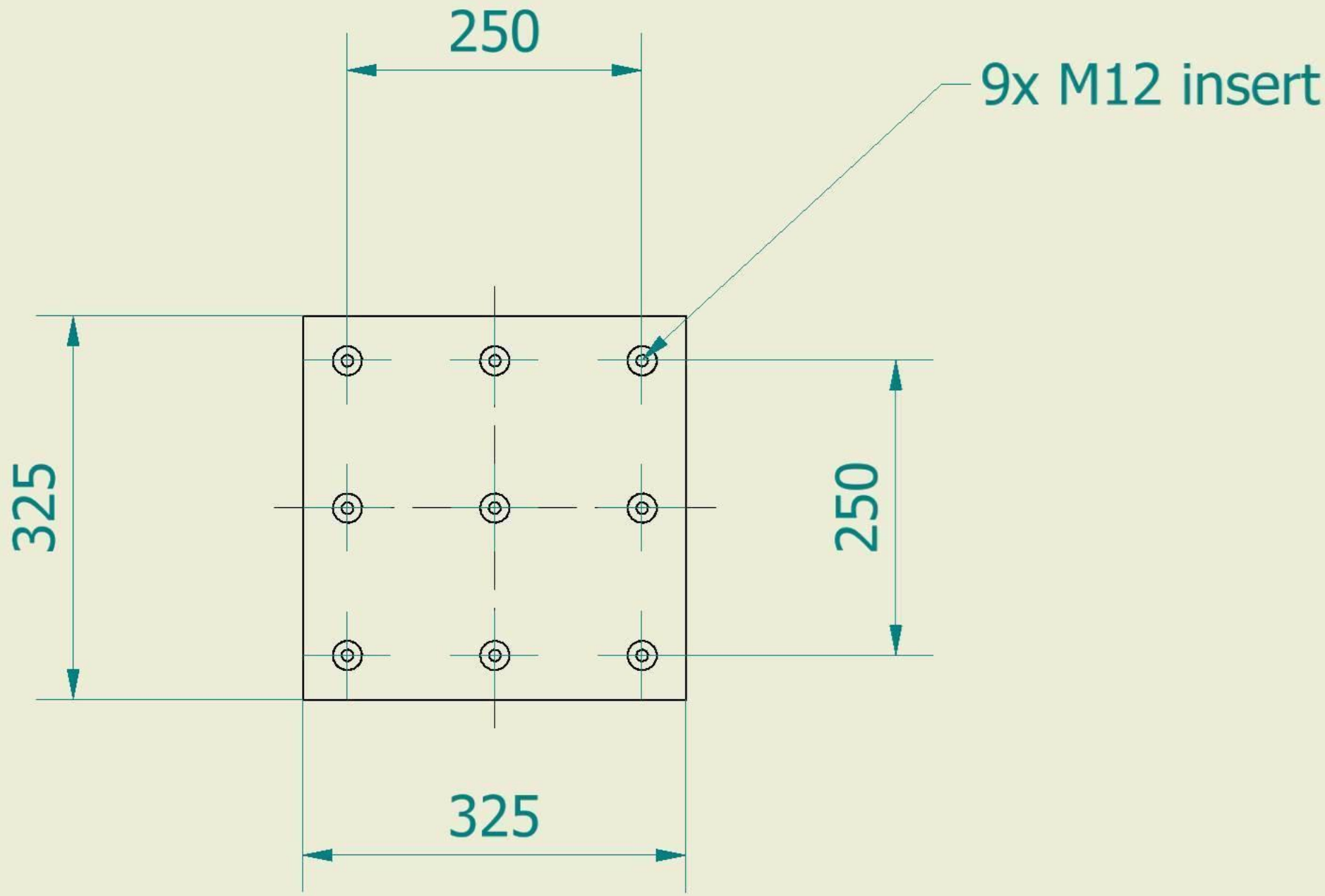
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ELI water cooling system on experimental floor (2. PP & 1. PP)

experimental halls E1 to E6, laser hall L4c, north and south plantrooms

Technical specifications and requirements

for Vendors / Suppliers

Table of Content

EVROPSKÁ UNIE
Evropské strukturální a investiční fondy
Operační program Výzkum, vývoj a vzdělávání

Date: 05.1.2018 | version: 2

1. Operational technical parameters

REQ-022673/A

Each device connected to the ELI cooling system in hall L4c, in halls E1 to E6 and/or in any plantroom on experimental floor (2. PP & 1. PP) must be designed to be operational in range of following parameters of the ELI cooling system:

- maximum operational gauge pressure on supply: 7 bar(g);
- maximum operational gauge pressure on return: 2 bar(g);
- maximum allowed gauge pressure ≧ 10 bar(g);
- operational differential pressure from 3 to 6 bar(g);
- temperature of supply: pre-set between 16 °C and 24 °C with long term stability ±2 °C and with possible short term (a few seconds) fluctuations in response to huge sudden thermal power change (if any) in range 12 °C to 35 °C.

Note 1: The real state of cooling system will be within these parameters and will be set in accordance with all other devices to able them work properly. For example the differential pressure will be chosen according the device with request for the highest one.

Note 2: The final short term thermal stability will be most probably much better (very close to long term stability) but it needs some fine tuning which will be possible after installation and commissioning of all devices which have to be connected to the ELI cooling system.

2. Operational cooling water quality

REQ-022674/A

Each device connected to the ELI cooling system in hall L4c, in halls E1 to E6 and/or in any plantroom on experimental floor (2. PP & 1. PP) must comply with cooling water quality with the worst operational parameters as follow:

- water resistivity range from 2 MΩ·cm to 18.6 MΩ·cm;
- content of water-soluble substances ≦ 10 mg/l;
- content of water-insoluble substances ≦ 10 mg/l;
- insoluble particles size ≦ 100 μm;
- index pH range from 6 to 9;
- hardness ≦ 10 ppm (mg $CaCO_3$/l);
- chlorine content ≦ 100 μg/l;
- iron content ≦ 100 μg/l;
- SiO_2 content ≦ 100 μg/l.

Note: Final operational parameters will be most probably better – in the sense of water purity.

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3. Flushing and conservation water quality (non-operational)

REQ-022675/A

The parameters of flushing and conservation water quality are as follow:

- water resistivity range from 1.5 kΩ·cm to 18.6 MΩ·cm (during longer unavailability time);
- flushing water pH index pH range from 4 to 12;
- conservation water pH index range from 7 to 12;
- insoluble particles size ≦ 100 μm;
- possible additives: Optishield, Optishield Plus, Optishield II, Optishield II Plus, Cetamine F365, max. 20 % of sodium hydroxide, Ferrocid 8580, Ultrasil 69, Ultrasil 130, or Ferrocid 4601.

Note 1: Vendor/Supplier must confirm or revoke compatibility with *each of additives above.*

Note 2: If quality of water is not suitable for flushing and/or conservation of the device, the device will be disconnected and flushing and/or conservation will be done separately according the instruction from vendor/supplier.

4. General requirements to Vendors (Suppliers)

REQ-022676/A

Operational cooling medium is high purity water (demineralized) and the device cooling system must be compatible with the medium and it must not contaminate the medium.

REQ-022677/A

Vendor/Supplier must provide detailed description of cleaning procedures of inner parts of the device cooling system (everything in touch with cooling medium).

NOTE 1: Water quality with possible additives and/or other solutions must be clearly and exactly specified.

NOTE 2: These cleaning procedures must be specified in the Product User Manual.

REQ-022678/A

Cooling connection must be made in the way to allow easy non-destructive temporal disconnection (with using standard manual tools usable in clean rooms, it means without the following activities: heating, drilling, cutting, welding, etc.).

NOTE: This is necessary for cleaning procedures of building cooling system infrastructure which may not be compatible with the device cooling

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system and also for cleaning procedures of the device cooling system which may not be compatible with building cooling system infrastructure.

REQ-022679/A

Vendor/Supplier must deliver the device with cleaned and dried inner parts of the device cooling system and treated against corrosion and all connectors must be sealed to prevent pollution get in.

NOTE: If drying of the inner parts is not feasible then other measures must be done to achieve cleanliness and protection against corrosion (like some kind of surface conservation or leave protective liquid inside and sealed with a plug).

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Program: LUIS
Subject: Dipole electro-magnet correctors for LUIS Verification Control Document (VCD)
Specification: TC 00261087/ TP20_074

Requirement TC ID	Revision	Requirement text	HW/SW code	Level	Verification Method	Close-out		VPD Verification Planning Document	VRD Verification Record Document	Comments
						Yes	No			
020303/A.003;Dipole electro-magnet correctors for LUIS_TP20_074										
REQ-028682	A.005	The Supplier shall deliver the following parts of the DEMC System:Dipole electromagnets (DEMC1, DEMC2, DEMC3, DEMC4) for PH2 in accordance with the technical specification, summarized below (see chapter 3);Each beam pipe assembled with the pair of the DEMC (see RD-01);Each DEMC magnet with individual alignment table;Mounting plate for each pair of the dipole electromagnets (DEMC1-DEMC2, DEMC3-DMC4) as shown in RD-01;Power supply systems for each DEMC with power cables connecting the DEMCs and power supply systems;Control system for each DEMC with required software.			I - inspection					
REQ-028683	A.005	The final manufacturing drawings of the DEMC System shall be made by the Supplier in conformity with the requirements described in chapter 3.			R - review					
REQ-029172	A.003	Any dimensional/design modifications that may arise as part of detailed manufacturing design shall be consulted with and approved by the CA. Such dimensional/design modifications are possible only if these are advantageous to the CA (e.g. offer more effective solution). The CA shall approve such a modification, if the advantage of doing so is undoubtedly demonstrated to the CA.			R - review					
REQ-028685	A.005	The DEMC elements shall have the field homogeneity dB/B0 better than 5e-3 for each DEMC within the Good Field Region of ±5 mm within the field range 10 % - 100 % of Bmax.			A - analysis, T - test					
REQ-028686	A.005	The Supplier shall perform the field measurements (see REQ-028685/A and chapter 3.2.1) and provide to the CA the results of this test (see REQ-028747/A). The results of the field measurements shall be delivered as a part of the technical documentations for each DEM.			R - review, T - test, I - inspection					
REQ-028687	A.005	The DEMC elements shall have accuracy ±0.1 % of measured integrated field gradient or better for each DEMC.			R - review, T - test					
REQ-028688	A.005	Each DEMC shall have four M8 holes to be used for mounting the magnet in the beam-line.			R - review					
REQ-028689	A.005	The DEM1 shall comply with the following parameters: aperture gap = (25±0.2) mm; integrated (BL) field along the median plane = 0.010 T.m; total length of the magnet including winding ? 100 mm;main field component in the horizontal plane.			R - review, T - test					
REQ-028690	A.005	The DEM2 shall comply with the following parameters: aperture gap = (25±0.2) mm; integrated (BL) field along the median plane = 0.010 T.m; total length of the magnet including winding ? 100 mm;main field component in the vertical plane.			R - review, T - test					
REQ-028691	A.005	The DEM3 shall comply with the following parameters: aperture gap = (25±0.2) mm; integrated (BL) field along the median plane = 0.010 T.m; total length of the magnet including winding ? 100 mm;main field component in the horizontal plane.			R - review, T - test					

REQ-028692	A.005	The DEM4 shall comply with the following parameters: aperture gap = (25±0.2) mm; integrated (BL) field along the median plane = 0.010 T.m; total length of the magnet including winding ? 100 mm;main field component in the vertical plane.			R - review, T - test					
REQ-028693	A.005	The DEM water cooling system shall correspond to the following requirements:Acceptable rise of the cooling water temperature for EMQs < 10 0C at the cooling water inlet temperature 25 0C.			R - review, T - test					
REQ-028694	A.005	The requirements on the DEM water cooling system, determined by the Supplier, shall be compatible with the ELI water cooling system.NOTE: The technical documentation of ELI water cooling system is provided to the Supplier (see RD-03).			R - review					
REQ-028695	A.005	The individual DEM shall be mounted on the alignment table.			I - inspection					
REQ-028696	A.005	The DEM setup with 2 dipole magnets on the alignment tables and the beam-pipe shall be mounted on the mounting plate.			I - inspection					
REQ-028697	A.005	The geometrical axis of the assembled setup shall be at 311 mm with additional leveling ±10 mm from the bottom of the mounting plate (see RD-01).			R - review, T - test					
REQ-028698	A.005	The mounting plate shall have the pattern of the holes to mount the plate on the granite block (see RD-02). The dimensions of the mounting plate shall be discussed and accepted by CA after the preparation of the technical drawings.			R - review, T - test					
REQ-028699	A.005	The mounting plate shall have the holes to mount the alignment table of the individual dipole magnet. Flatness on bottom surface of the mounting plate shall be 0.2.			R - review					
REQ-028700	A.005	The Supplier shall deliver the bipolar DC power supply system for each DEM, which shall be able to provide the required field parameters from the maximum values down to zero.			R - review, I - inspection					
REQ-028701	A.005	The power supply systems shall have stabilization of output power allowing the DEMs to provide required field quality.			R - review					
REQ-028702	A.005	The power supply systems shall have the following output power parameters:for the DEMC1 < 1 kW;for the DEMC2 < 1 kW;for the DEMC3 < 1 kW;for the DEMC4 < 1 kW.			R - review, T - test					
REQ-028703	A.005	The Supplier shall deliver the power supply systems for the EMQs as a compact 19-inch rack mount module, assembled in one standard rack unit compatible with EIA-310.			R - review, I - inspection					
REQ-028704	A.005	The Supplier shall deliver the power supply systems for all the DEMCs with the RMS current ripple less than ±0.05 % for the whole range from zero to the maximum parameters.			R - review, T - test					
REQ-028705	A.005	The air cooling system of the DEMs power supply unit shall be compatible with ELI air cooling system.			R - review					
REQ-028706	A.005	The total maximum power consumption (i.e. input power consumption) of the DEMCs System shall not be more than 5 kW. The plug of the power supply system shall have 3 phases (3NPE, 230/400 V, 50 Hz). NOTE: Final estimation of the power consumption of the DEM System shall be provided by the Supplier for approval by the CA before completion of the design phase.			A - analysis, R - review, T - test					
REQ-028707	A.005	The beam-pipes and flanges shall be UHV compatible and shall be able to be totally operated under vacuum level up to 10-7 mbar.			R - review					
REQ-028708	A.005	The cleaning procedure shall remove contaminants been adhered to the surface such as oils, greases, dirt, swarf, corrosion products, or finger prints.			R - review					
REQ-028709	A.005	The Supplier shall provide to the CA the description of the vacuum cleaning procedure which will be reviewed and approved by the CA.			R - review					

REQ-028711	A.005	Chemicals used in the cleaning process shall not affect the material properties or cause a colour change, corrosion or other damage.			R - review					
REQ-028712	A.005	The outgassing of vacuum components shall be free of hydrocarbons and the appropriate proofs shall be performed by Supplier using a sufficiently sensitive residual gas analyzer, usually equipped with a secondary electron multiplier (SEM).NOTE: Components are considered as hydrocarbon free when the two conditions are fulfilled:the leak-free system reaches a total pressure below 10-7 mbar;Amplitude of all peaks > 44 AMU are not higher than 1/100 of the 44 AMU peak;Peak at 43 AMU is not higher than 1/10 of the 44 AMU peak.			T - test (RGA report)					
REQ-028713	A.005	The Supplier shall perform a leak test of the beam-pipes and the results provide the results of this test to the CA (see REQ-028747/A). NOTE 1:Single leak test (spray test) shall be according to ČSN EN 1779 (equivalent to EN 1779; method A.3) or equivalent.NOTE 2:Total leak test shall be according to ČSN EN 1779 (equivalent to EN 1779; method D2) or equivalent.			T - test					
REQ-028714	A.005	The measured single leak rate using calibrated He detector shall be less than 1.0E-9 mbar?l/s.			T - test					
REQ-028715	A.005	The measured total leakage rate shall be better than 5.0E-4 mbar?l/s.			T - test					
REQ-028716	A.005	The beam-pipes shall be manufactured using the outer diameter of 22 mm with CF40 flanges at the edges of the beam-pipe (as shown in RD-01). No bellows are required for the beam-pipe.			R - review, T - test					
REQ-028717	A.005	The beam-pipe of the Momentum Filter System shall be designed and manufactured with the tolerance class fH according to ČSN EN ISO 2768 (equivalent to ISO 2768) or equivalent and with the tolerance class AE according to ČSN EN ISO 13920 (equivalent to ISO 13920) or equivalent. The tolerance for the total length of the beam-pipe shall be ± 1 mm. The dimensions of CF flanges shall be according to ISO/TS 3669-2 or equivalent.			R - review, T - test					
REQ-028718	A.005	Each power supply shall be equipped with a serial interface for the remote control operation via following protocols: Ethernet, RS-232 or RS-485.			I - inspection					
REQ-028719	A.005	Supplier shall provide comprehensive communication protocol documentation (commands reference manual) for the dipole magnet power supplies.			R - review					
REQ-028722	A.005	All power cables connecting to the DEMCs shall be compatible with the power supply systems and shall be delivered by the Supplier.NOTE: Power cable connecting the power supply rack to the power socket in the experimental area will be provided by CA.			R - review, I - inspection					
REQ-028723	A.005	The length of the power cables connecting the power supply systems and the DEMCs shall not be less than 6 meters.			R - review					
REQ-028724	A.005	All water tubes for the cooling system shall be assembled for each DEM and shall be delivered by the Supplier. NOTE: The water tubes to connect the magnets water cooling system to water cooling hub in the CA experimental hall will be prepared by CA before the delivery of the items.			R - review, I - inspection					
REQ-028725	A.005	The water tube material of the DEMCs shall be compatible with ELI cooling system.			R - review					
REQ-028726	A.005	The transportation of the assembled 2 dipole correctors and the beampipe to the final destination shall be conducted by the Supplier.			R - review					
REQ-028727	A.005	Each component of the DEMC System shall be cleaned and packaged in clean environment of class 7 according to ČSN EN ISO 14644 (equivalent to ISO 14644) or cleaner (or equivalent).			R - review, I - inspection					

REQ-028728	A.005	All components of the DEMC System shall be at least double wrapped with clean plastic foils and placed in an appropriate protective package preventing damage and contamination.			I - inspection					
REQ-031188	A.001	Before the Delivery the Supplier will provide the instruction for the proper connection of the magnet power supply systems and the magnets water cooling systems to the corresponding hubs in the CA experimental area.			R - review					
REQ-031189	A.001	Before the Delivery the Supplier will provide the instruction for the proper installation and final alignment for the dipole corrector setup , including the reference points for the laser tracker.			R - review					
REQ-031190	A.001	Connection of the magnets water cooling system to the water cooling hub in the ELI-Beamlines experimental hall will be performed by the CA personal after delivery of the magnets to the CA side. The connection will be based on the instruction, submitted by the Supplier.			I - inspection					
REQ-031191	A.001	Connection of the rack with the magnets power supplies to the electrical power hub in the ELI-Beamlines experimental hall will be performed by the CA personal after delivery of the magnets to the CA side. The connection will be based on the instruction, submitted by the Supplier.			I - inspection					
REQ-031192	A.001	Final alignment of the assembled setup of the system in the experimental hall shall be performed by the CA under the supervision from the Supplier side. The final installation of the assembled setup will be based on the alignment instruction, submitted by the Supplier.			I - inspection					
REQ-031193	A.001	The transportation and installation procedures shall be discussed and can be reviewed by the CA's installation officer.			R - review					
REQ-031194	A.001	The Supplier shall check the proper cable and water-cooling connections in the CA experimental area and perform full-power electrical and thermo-test after the final installation of the dipole-correctors setup in the CA experimental area.			T - test					
REQ-031195	A.001	The vacuum components of the whole system shall be cleaned and packaged in clean environment of class 6 according to ČSN EN ISO 14644 (equivalent to ISO 14644) or cleaner (or equivalent). NOTE: The ISO 14644 certification of the Supplier's cleanrooms is not required.			R - review, I - inspection					
REQ-031196	A.001	The non-vacuum components of the whole system shall be cleaned and packaged in clean environment of class 8 according to ČSN EN ISO 14644 (equivalent to ISO 14644) or cleaner (or equivalent). NOTE: The ISO 14644 certification of the Supplier's cleanrooms is N/R.			R - review, I - inspection					
REQ-028729	A.005	The Supplier shall supply a Declaration of Conformity or any other equivalent document legally recognized and accepted by the Czech Republic legislation for each product type if the appropriate legislation determines the Supplier's obligation to have a Declaration of Conformity (or the equivalent document) for the purposes of a Device sale in the Czech Republic (requirements of 2001/95/EC directive or applicable Czech law).			I - inspection					
REQ-028730	A.005	The Supplier shall provide the Product User Manual as part of the delivered system. Completeness of the Manual shall be approved by the CA. The Manual shall include the instructions and descriptions regarding the following procedures: transport, handling, storage; installation, alignment and cleaning; guide for the software and for communication protocol (see REQ-028720/A);safe operation and maintenance procedures.			R - review, I - inspection					

REQ-028731	A.005	The Supplier shall supply the following manufacturing documents:all manufacturing drawings, 3D models (if available) and design supporting documentation (i.e. technical documentation, see REQ-028752/A); all approved by the CA “requests for deviation/wavier from requirements described herein” (see REQ-028735/A).			I - inspection					
REQ-028733	A.005	The manufacturing documents shall include accuracy of the manufacturing process. This accuracy shall be also included in the corresponding test reports (see REQ-028747/A).NOTE: The Supplier will specify what can be the maximal difference between specified parameters (in the chapter 3) and the parameters of the final DEM System.			R - review					
REQ-028737	A.005	The manufacturing documents shall contain strictly the units which are used to define the requirements in the chapter 3.			R - review					
REQ-028739	A.005	The Supplier shall assign clear responsibility for the implementation of the verification process including the following activities:Verification planning (via VCD, see chapter 7.2.3);Verification execution and reporting (see chapters 7.2.2 and 7.3); Verification control and close-out (see chapter 7.2.3, 7.3.3)			R - review					
REQ-028744	A.005	The results of the analysis shall be documented in corresponding Analysis Report (further “AR”) and tracked in the VCD (see the chapter 7.2.3).			R - review					
REQ-028745	A.005	The results of a review of design shall be documented in the Critical Design Review Report (further “CDRR”) and tracked in the VCD (see chapter 7.2.3).NOTE: The CA can provide to the Supplier the template of CDRR.			R - review					
REQ-028746	A.005	The results of the inspection shall be tracked in the VCD.			R - review					
REQ-028747	A.005	The results of the tests shall be documented in the appropriate Factory Test Report (further “FTR”) and tracked in the VCD (see chapter 7.2.3).			R - review					
REQ-028748	A.005	The Supplier shall provide a Verification Control Document (further “VCD”) for the reviews as agreed with the CA.NOTE 1: Guidelines for VCD preparation see in RD-04.NOTE 2: The form of VCD will be agreed between the CA and the Supplier based on the best commercial praxis used by the Supplier.			R - review					
REQ-028749	A.005	In the VCD the Supplier shall specify HOW and WHEN each requirement is planned to be verified.			R - review					
REQ-028751	A.005	Before completion of the Conceptual Design phase the Supplier shall provide following information that shall be agreed by the CA:structure and content of the verification reports (see chapter 7.2.2);structure and content of the VCD ready to be implemented (see chapter 7.2.3).			R - review					
REQ-028752	A.005	Before completion of the Conceptual Design phase the Supplier and the CA shall agree on:conceptual drawings of the integrated setup provided by the Supplier (see REQ-028555/A);acceptance results of the conceptual design verification submitted by the Supplier in the corresponding CDRR and AR (see REQ-028607/A and REQ-028563/A);detailed procedures related to the testing during Manufacturing and Installation phases (see chapters 7.3.2 and 7.3.3);			R - review					
REQ-030761	A.002	Before completion of the Technical Design phase the Supplier and the CA shall agree on:final drawings of the integrated setup provided by the Supplier (see REQ-028555/A);acceptance results of the conceptual design verification submitted by the Supplier in the corresponding CDRR and AR (see REQ-028607/A and REQ-028563/A);detailed procedures related to the testing during Manufacturing and Installation phases (see chapters 7.3.2 and 7.3.3);			R - review					

REQ-028753	A.005	The results of the Manufacturing phase of verification shall be recorded by the Supplier in the appropriate FTR (see REQ-028747/A) and overall results (including review of documentation/reports and inspection of the assembled DEM System) shall be recorded in the VCD (see chapter 7.2.3).			R - review					
REQ-028754	A.005	The final issue of the VCD shall be submitted to the CA after the approval of the last report before delivery.			R - review					
REQ-030762	A.002	The results of the verification of delivered and installed DEM System shall be recorded by the Supplier in the appropriate STR (FTR) (see REQ-028747/A) and overall results shall be recorded in the VCD (see chapters 7.2.3).			R - review					
REQ-030763	A.002	The final issue of the VCD shall be submitted to the CA after the approval of the last report and before starting the Acceptance phase (see chapter 7.3.4).			R - review					

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[RSD product category C]

Momentum filter for LUIS

(Electron beam line)

TP20_007

Keywords

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1	A.Molodozhentsev	14.02.2020	RSD draft creation	A
2	A.Molodozhentsev, D. Hanusková	25.02.2020	RSD update, version for internal review	B
3	A.Molodozhentsev, D. Hanusková	31.03.2020	RSD update, final version for approval	C
4	A.Molodozhentsev	02.12.2020	RSD modified final version	D

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MINISTRY OF EDUCATION YOUTH AND SPORTS

1. Introduction

1.1. Purpose

This Requirements Specification Document (RSD) lists the technical requirements and constraints on product applying in RA2 program of ELI project. This can lead to the identification of product interfaces with the ELI science-based technology and ELI building facility. This RSD also acts as the parent document for the technical requirements that need to be addressed in lower level design description documents.

1.2. Scope

This RSD contains all of the technical requirements: functional, performance and design, transportation, safety and quality requirements for the following product: **Momentum filter for LUIS** (*tender № TP20_007*).

The product is an integral part of the standalone technology "Laser Undulator Illuminating Source (**LUIS**)" and is registered in the PBS software under the following PBS code: *E.E5.LUX.ELE.4.8 (1 pc)*. This product will be placed in the E5 hall.

1.3. Terms, Definitions and Abbreviations

For the purpose of this document, the following abbreviated terms are applied:

Abbreviation	Meaning
A	Analysis (as a verification method)
API	Application Programmers Interface
AR	Analysis Report
CA	Contracting Authority (Institute of Physics AV CR, v. v. i.)
CDRR	Critical Design Review Report
DC	Direct current
ELI	Extreme Light Infrastructure
EMQ	Electro Magnetic Quadrupoles
FD	Functional Demonstration (as a verification method)
FTR	Factory Test Report
GFR	Good Field Regions
I	Inspection (as a verification method)
IS	International standard
NCR	Nonconformity Report
R	Review (as a verification method)
RA2	Research activity 2
RD	Reference Documents
RMS	Root Mean Square
RSD	Requirements Specification Document

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Abbreviation	Meaning
RU	Rack Unit
STR	on-Site Test Report
T	Test (as a verification method)
UHV	Ultra-High Vacuum
VCD	Verification Control Document
VR	Verification Report

1.4. Reference documents

Number of doc.	TC ID	Title of document / File
RD-01	*00260907*	*RD-01_LUIS-Momentum-Filter-Setup-Sketch.pdf*
RD-02	*00260907*	*RD-02_Assembled setup on the support table (Sketch).pdf*
RD-03	*00260907*	*RD-03_Rail mounting system, implemented in the E5-LUIS experimental area*
RD-04	*00159948*	*ELI water cooling system - Technical specifications and requirements*
RD-05	*00260907*	*RD-05 Edge condition for the support table*
RD-06	*0260905*	*VCD - Verification control document*

1.5. List of mentioned standards

Number of doc.	Title of document
ČSN EN ISO 2768	*General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*
ČSN EN ISO 13920	*Welding — General tolerances for welded constructions — Dimensions for lengths and angles — Shape and position*
ČSN EN ISO 1779	*Non-destructive testing. Leak testing. Criteria for method and technique selection*
ČSN EN ISO 14644	*Cleanrooms and associated controlled environments*
ČSN EN ISO 9001	*Quality management systems — Requirements*
ČSN EN ISO 12944	*Paints and varnishes — Corrosion protection of steel structures by protective paint systems*
ČSN EN ISO 3834	*Quality requirements for fusion welding of metallic materials*
ISO/TS 3669-2	*Vacuum technology - Bakable flanges: Dimensions of knife-edge flanges*

1.6. References to standards

If this document includes references to standards or standardized/ standardizing technical documents the CA allows/permits also another equal solution to be offered. If a supplier offers another equal solution the CA shall not reject its bid, once the supplier by appropriate means in the bid proves that the offered supplies, services or works meet in an equivalent manner the requirements including references to standards or technical documents.

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2. General system requirement

REQ-028567/A

The Supplier shall deliver the following parts of Momentum filter system:

- Assembled electromagnetic quadrupoles (EMQ1, EMQ2, EMQ3, EMQ4) in accordance with the setup-sketch (see **RD-01**);
- Beam-pipe, integrated into the assembled setup of the EMQs (see **RD-02**);
- The collimator chamber with the separated horizontal/vertical controllable (motorized) slits;
- Alignment tables for the individual quadrupole magnet and the collimator chamber with the common support table;
- Power supply systems for each EMQ with power and thermos-switch cables;
- Power supply, motor controllers and encoders, including all necessary cables for the collimator motorization

Verification method: I – inspection

3. Functional, Performance and Design requirements

3.1. General requirements

REQ-028528/A

The final manufacturing drawings of the integrated Momentum filter system with the beam-pipe and the collimator chamber with the H/V motorized collimators shall be made by the Supplier in conformity with the CA conceptual sketch of the **RD-01**.

Verification method: R – review

REQ-028529/A

At any stage of the design or manufacturing, if it is clear to the Supplier that an advantage could be gained by a modification of the original design, the Supplier shall inform the CA.

Verification method: Not To Be Tracked within VCD

REQ-028530/A

To avoid trapped volumes in vacuum spaces which could result in virtual leaks, precautions shall be taken in the design of the vacuum components, and vacuum spaces shall be suitably vented.

Verification method: R – review

REQ-028531/A

Any dimensional/design modifications that may arise as part of detailed manufacturing design shall be consulted with and approved by the CA. Such dimensional/design modifications are possible only if

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these are advantageous to the CA (e.g. offer more effective solution). The CA shall approve such a modification, if the advantage of doing so is undoubtedly demonstrated to the CA.
Verification method: R – review

REQ-028568/A

The Momentum filter system field quality in the Good Field Regions shall be better than 5e-4 for each EMQ within the GFR radius for harmonics n=2÷10 for each quadrupole magnet.
The Good Field Region radius for each quadrupole magnet shall be 2 mm.
Verification method: A – analysis, T – test

REQ-028569/A

The evaluation of the field quality of each quadrupole magnet shall be based on the appropriate scaling, if it is not possible to measure the field quality directly. The evaluation of the field quality for the quadrupole magnets shall be discussed with and approved by the CA.
Verification method A – analysis, R – review

REQ-028570/A

The Supplier shall perform the field measurements of each separated quadrupole magnet (see REQ-028568/A and chapter 3.2.1) using the "rotating coil" or/and by the "stretched-wire" technique and shall provide to the CA the results of this tests (see REQ-028609/A) as a part of the technical documentation for each EMQ.
Verification method: T – test, I – inspection, R – review

REQ-028571/A

Each EMQ of the delivered assembled Momentum filter system with the beam-pipe and the collimator unit with the manipulators shall have accuracy ±0.1 % of measured integrated field gradient or better.
Verification method: T – test, R – review

REQ-028572/A

The assembled System shall have alignment precision ±100 μm or better for the axis of the magnetic field of the each EMQ.
Verification method: T – test, R – review

REQ-028573/A

After the assembling of the whole system at the Supplier site, the Supplier shall make the alignment verification using the 'stretched-wire' technique and include the results in the test report as a part of the technical documentation for the assembled Momentum filter system.
Verification method: R – review, T – test, I – inspection

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3.2. Momentum filter system requirements

3.2.1. EMQs requirements

REQ-028532/A

All four EMQs are identical (with the indexes: EMQ4, EMQ5, EMQ6, EMQ7). All four EMQs shall comply with the following parameters:

- aperture diameter = (25±0.2) mm;
- maximum integrated field along the axis = 8.5 T;
- total length of the magnet including winding ≤ 190 mm.

Verification method: R – review, T – test

3.2.2. EMQ water cooling system

REQ-028533/A

The EMQs water cooling system for all quadrupole magnets shall meet the following requirements:

- Acceptable rise of the cooling water temperature for EMQs < 10 ^{0}C at the cooling water inlet temperature 25 ^{0}C.

Verification method: R – review, T – test

REQ-028534/A

The requirements on the EMQ water cooling system, determined by the Supplier, shall be compatible with the ELI water cooling system.
*NOTE: For the technical documentation of the ELI water cooling system see **RD-04**.*
Verification method: R – review

3.2.3. EMQs alignment table and support frame

REQ-028535/A

The assembled EMQs setup with the beam-pipe and the collimator chamber shall be mounted on the alignment table.
Verification method: I – inspection

REQ-028536/A

The geometrical axis of the assembled setup shall be at 1300 mmm with additional leveling ±10 mm from the ground floor (see **RD-02**).
Verification method: R – review, T – test

REQ-028537/A

The support table for the whole assembled setup shall fit transversally the rail system in the experimental hall (see **RD-03**).
Verification method: R – review, T – test

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REQ-028538/A

The support frame shall have 4 holes with the inner diameter of **19 mm** for bolting the support frame to the floor in the experimental hall (**RD-03**). The holes shall be positioned 710 mm from the center to the center with tolerances of ±0.3 mm.
Verification method: R – review, T – test

REQ-028666/A

The frame shall be made of steel 1.0038. The frame shall follow the welding requirements according to the ČSN EN ISO 3834 (equivalent to ISO 3834) or equivalent. The welding tolerances shall follow the standard ČSN EN ISO 13920 AE (equivalent to ISO 13920) or equivalent.
Verification method: R – review

REQ-028667/A

The support frame shall be painted with Clean room ISO 7 compatible non-outgassing paint or equivalent. The frame shall have a color RAL 3003 matt.
Verification method: R – review

REQ-028668/A

The support frame shall have the corrosion resistance according to ČSN EN ISO 12944 (equivalent to ISO 12944) or equivalent. The paint shall have dry film thickness < 200um.
Verification method: R – review

REQ-028669/A

All sharp edges of the support frame shall follow the edge condition (see RD-05). The maximum deflection of the frame caused by the magnets weight shall be below 0.4mm. The assembled setup shall not have any resonant frequencies below 100 Hz.
Verification method: R – review

3.2.4. Power supply systems

REQ-028539/A

The Supplier shall deliver the unipolar DC power supply system for each EMQ, which shall be able to provide the required field parameters (see REQ-028532/A) from the maximum values down to zero.
Verification method: R – review, I – inspection

REQ-028540/A

The power supply systems shall have output power stabilization allowing the EMQs to provide required field quality.
Verification method: R – review

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REQ-028541/A

Each power supply system for each individual EMQ shall have the following output power parameters:

- for the EMQ4-EMQ5-EMQ6-EMQ7 < 10 kW.

Verification method: R – review, T – test

REQ-028574/A

The Supplier shall deliver the power supply systems for the EMQs as a compact 19-inch rack mount module, assembled in one standard rack unit compatible with EIA-310.

Verification method: R – review, I – inspection

REQ-028575/A

The Supplier shall deliver the power supply systems for all the EMQs with the RMS current ripple less than ±0.05 % for the whole range from zero to the maximum parameters.

Verification method: R – review, T – test

REQ-028576/A

The power supply system shall have an air-cooling system.

Verification method: R – review

REQ-028577/A

The total maximum power consumption (i.e. input power consumption) of the Momentum filter system shall not be more than 40 kW. The plug of the power supply system shall have 3 phases (3NPE, 230/400 V, 50 Hz).

NOTE: Final estimation of the Momentum filter system power consumption shall be provided by the Supplier for approval by the CA before completion of the design phase.

Verification method: A – analysis, R – review, T – test

3.2.5. Vacuum compatibility

REQ- 028578/A

All the vacuum components of the Momentum filter system (i.e. beam-pipe, flanges, collimator chamber and etc.) shall be UHV compatible and shall be able to be totally operated under vacuum level up to 10^{-7} mbar.

Verification method: R – review

REQ- 028579/A

The cleaning procedure shall remove contaminants been adhered to the surface such as oils, greases, dirt, swarf, corrosion products, or finger prints.

Verification method: R - review

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REQ- 028580/A

The Supplier shall provide to the CA the description of the vacuum cleaning procedure which will be reviewed and approved by the CA.
Verification method: R - review

REQ- 028581/A

Clean components shall be handled wearing clean, dry, lint-free gloves.
Verification method: Not To Be Tracked within VCD

REQ-028582/A

Chemicals used in the cleaning process shall not affect the material properties or cause a colour change, corrosion or other damage.
Verification method: R – review

REQ-028583/A

The outgassing of vacuum components shall be free of hydrocarbons and the appropriate proofs shall be performed by Supplier using a sufficiently sensitive residual gas analyzer, usually equipped with a secondary electron multiplier (SEM).
NOTE: Components are considered as hydrocarbon free when the two conditions are fulfilled:

- *the leak-free system reaches a total pressure below 10^{-7} mbar;*
- *Amplitude of all peaks > 44 AMU are not higher than 1/100 of the 44 AMU peak;*
- *Peak at 43 AMU is not higher than 1/10 of the 44 AMU peak.*

Verification method: T – test (RGA report)

3.2.6. Vacuum leak tests

REQ-028584/A

The Supplier shall perform a leak test of the beam-pipe and the collimator chamber and the results provide the results of this test to the CA (see REQ-028609/A).
NOTE 1: Single leak test (spray test) shall be according to ČSN EN ISO 1779 (equivalent to ISO 1779; method A.3) or equivalent.
NOTE 2: Total leak test shall be according to ČSN EN ISO 1779 (equivalent to ISO 1779; method D2) or equivalent.
Verification method: T – test

REQ-028585/A

The measured single leak rate using calibrated He detector shall be less than **1.0E-9 mbar·l/s**.
Verification method: T – test

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REQ-028586/A

The measured total leakage rate shall be better than **5.0E-4 mbar·l/s**.
Verification method: T – test

3.2.7. Beam-pipe and collimator chamber

REQ-028549/A

The beam-pipe of the Momentum filter system shall be manufactured using different outer diameter of 22 mm with CF40 and CF100 flanges at the edges of the beam-pipe (as shown in RD-01). The flanges of the collimator chamber shall be CF100. No bellows are required for the beam-pipe.
Verification method: R – review, T – test

REQ-028550/A

The beam-pipe of the Momentum filter system shall be designed and manufactured with the tolerance class **fH** according to ČSN EN ISO 2768 (equivalent to ISO 2768) or equivalent and with the tolerance class **AE** according to ČSN EN ISO 13920 (equivalent to ISO 13920) or equivalent.
The tolerance for the total length of the beam-pipe shall be ± 1 mm. The dimensions of CF flanges shall be according to ISO/TS 3669-2 or equivalent.
Verification method: R – review, T – test

REQ-028551/A

The design of the collimator chamber, integrated into the whole setup, shall be made by the Supplier in conformity with the CA conceptual sketch of the **RD-01, RD-02** (see chapter 1.4). The technical drawings of the collimator chamber with motorized horizontal and vertical jaws, including the required support structure on the alignment table, shall be approved by CA before the production for the acceptance.
NOTE: The maximum power of the lost beam in the collimator is less than 100W for an extreme case of the setup operation
Verification method: R – review

REQ-028552/A

The collimator chamber shall have motorized jaws for independent collimation of the electron beam in the horizontal and vertical planes. Each jaw shall be connected to the manipulator. The length of the jaw along the chamber axis shall be not less than 50 mm. The jaw of the collimator shall be produced using Tungsten material.
Verification method: R – review

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REQ-028587/A

The gap between the collimator jaws shall be changeable in the range from 0 up to 25 mm in both horizontal and vertical planes, leading to the variation of the distance from the chamber axis up to 12.5 mm for each jaw. The step of the gap variation shall be 20±2 μm, provided with the control using the independent encoders to control the motion in the horizontal and vertical planes.
Verification method: R – review, T – test

REQ-028588/A

The parallelism of the jaws in the horizontal and vertical planes shall be less than 25 μm for the whole range of the variable gap.
Verification method: R – review, T – test

3.2.8. Control units requirements

REQ-028542/A

Each power supply shall be equipped with a serial interface for the remote control operation via following protocols: Ethernet, RS-232 or RS-485.
Verification method: I - inspection

REQ-028543/A

Motion controller(s) for the collimator jaws shall be equipped with a serial interface allowing remote control operation via following protocols: Ethernet, RS-232 or RS-485.
Verification method: I - inspection

REQ-028544/A

Supplier shall provide comprehensive communication protocol documentation (commands reference manual) for both power supplies and motion controllers.
Verification method: R - review

3.2.9. Cable and water tubes requirements

REQ-028546/A

All power cables connecting to the EMQs shall be compatible with the power supply systems and the thermos-switch cables shall be delivered by the Supplier.
NOTE: Power cable connecting the power supply rack to the power socket in the experimental area will be provided by CA.
Verification method: I – inspection, R – review

REQ-028547/A

The length of the power cables interconnecting the power supply systems and the EMQs, including the thermos-switch cables, shall not be less than 6 meters.

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Verification method: R – review

REQ-028548/A

All water tubes for the cooling system shall be assembled for each EMQ and shall be delivered by the Supplier.
NOTE: The water tubes to connect the magnets water cooling system to water cooling hub in the CA experimental hall will be prepared by CA before the delivery of the items.
Verification method: R – review, I – inspection

REQ-028589/A

Power cables for the Collimator Jaw Motors shall not be less than 6 meters. It shall be delivered by the Supplier with the motors.
NOTE: Connection of the stepper-motors and stepper-motor drivers, mounted in the power supply rack by the Supplier, will be made by CA after the delivery as the part of the installation in the experimental area.
Verification method: R – review

REQ-028590/A

The water tube material of the EMQs shall be compatible with the ELI water cooling system.
Verification method: R – review

4. Transportation and Installation requirements

REQ-028592/A

The transportation of the whole assembled setup of the pre-aligned EMQs with the beam-pipe and the collimator chamber with the motorized collimator jaws to the final destination (ELI Beamlines experimental hall) and the installation of the whole setup at ELI-Beamline experimental hall shall be conducted by the Supplier.
Verification method: R – review

REQ-028593/A

The Momentum filter system shall be delivered in a protective package preventing damage.
Verification method: I – inspection

REQ-031182/A

Before the Delivery the Supplier will provide the instruction for the proper connection of the magnets/collimator power supply systems and the magnets water cooling systems to the corresponding hubs in the CA experimental area.
Verification method: R - review

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REQ-031183/A

Before the Delivery the Supplier will provide the instruction for the proper installation and final alignment for the momentum filter setup, including the reference points for the laser tracker.
Verification method: R - review

REQ-031184/A

Connection of the magnets water cooling system to the water cooling hub in the ELI-Beamlines experimental hall will be performed by the CA personal after delivery of the magnets to the CA side. The connection will be based on the instruction, submitted by the Supplier.
Verification method: I – inspection

REQ-031185/A

Connection of the rack with the magnets and motors power supplies to the electrical power hub in the ELI-Beamlines experimental hall will be performed by the CA personal after delivery of the magnets to the CA side. The connection will be based on the instruction, submitted by the Supplier.
Verification method: I – inspection

REQ-031186/A

Final alignment of the assembled setup of the Momentum filter system in the experimental hall shall be performed by the CA ~~and~~ under the supervision from the Supplier side. The final installation of the assembled setup will be based on the alignment instruction, submitted by the Supplier.
Verification method: I – inspection

REQ-028595/A

The Supplier shall ensure that the installation of the assembled setup will be performed without contaminating the place of installation unnecessarily. The premises include rooms with normal cleanliness and cleanrooms of class 7 according to ČSN EN ISO 14644 (equivalent to ISO 14644) or equivalent.
Verification method: I – inspection

REQ-028596/A

The transportation and installation procedures shall be discussed and can be reviewed by the CA's installation officer.
Verification method: R – review

REQ-031187/A

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The Supplier shall check the proper cable and water-cooling connections in the CA experimental area and perform full-power electrical and thermo-test after the final installation of the momentum filter setup in the CA experimental area.
Verification method: T – test

REQ-028599/A

The vacuum components of the whole system shall be cleaned and packaged in clean environment of class 6 according to ČSN EN ISO 14644 (equivalent to ISO 14644) or cleaner (or equivalent).
NOTE: The ISO 14644 certification of the Supplier's cleanrooms is not required.
Verification method: R - review, I – inspection

REQ-028600/A

The non-vacuum components of the whole system shall be cleaned and packaged in clean environment of class 8 according to ČSN EN ISO 14644 (equivalent to ISO 14644) or cleaner (or equivalent).
NOTE: The ISO 14644 certification of the Supplier's cleanrooms is N/R.
Verification method: R – review, I – inspection

REQ-028615/A

All transportation and installation tools and equipment entering the clean rooms shall be cleaned and reviewed by the CA's approved methods. The Supplier and the CA shall agree on the cleaning method to clean tools and equipment used at the installation without decreasing their performance or safety.
NOTE: Some tools can be provided by the CA upon agreement.
Verification method: I – inspection

5. Safety Requirements

REQ-028553/A

The Supplier shall supply a **Declaration of Conformity** or any other equivalent document legally recognized and accepted by the Czech Republic legislation for each product type if the appropriate legislation determines the Supplier's obligation to have a Declaration of Conformity (or the equivalent document) for the purposes of a Device sale in the Czech Republic (requirements of 2001/95/EC directive or applicable Czech law).
Verification method: I – inspection

6. Quality Requirements

6.1. Documentation and data control

REQ-028554/A

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The Supplier shall provide the **Product User Manual** as part of the delivered system. Completeness of the Manual shall be approved by the CA. The Manual shall include the instructions and descriptions regarding the following procedures:

- transport, handling, storage;
- installation, alignment and cleaning;
- guide for the software and for communication protocol (see REQ-028544/A);
- safe operation and maintenance procedures.

Verification method: R - review, I – inspection

REQ-028555/A

The Supplier shall supply the following relevant manufacturing documents:

- all manufacturing **drawings**, **3D models** (if available) and **design supporting documentation** (i.e. technical documentation, see REQ-028610/A) approved by the CA;
- all "**requests for deviation/wavier** from requirements described herein" (see REQ-028602/A) approved by the CA.

Verification method: I – inspection

REQ-028556/A

Documentation shall be supplied in **hardcopy** and **PDF** formats.
Verification method: Not To Be Tracked within VCD

REQ-028557/A

The manufacturing documents shall include the **accuracy of the manufacturing process**. This accuracy shall be also included in the corresponding **test reports** (see REQ-028555/A and REQ-028609/A). *NOTE: The Supplier will specify the maximal difference between specified parameters (in chapter 3) and the parameters of the final Momentum filter system with the beam-pipe and the collimator chamber with the motorized slits.*
Verification method: R – review

REQ-028601/A

The Supplier shall use following data formats:

- *.JPG, *.PNG, *.TIFF, *.PDF/A, *.HTML
- CAD 2D: *.dwg
- CAD 3D: *.stp; *.ste; *.step or other 3D CAD formats agreed with the CA
- text processors: *.doc, *.docx, OpenDocument Format
- spreadsheet processors: *.xls, *.xlsx, OpenDocument Format
- presentations: *.ppt, *.pptx; OpenDocument Format

Verification method: Not To Be Tracked within VCD

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6.2. Nonconformity Control System

REQ-028602/A

The Supplier shall establish and maintain a nonconformity control system compatible with ČSN EN ISO 9001 (equivalent to EN ISO 9001) or equivalent.
Verification method: Not To Be Tracked within VCD

6.3. Specific Quality Requirements

REQ-028603/A

In case of a warranty repair of the Momentum filter system with the beam-pipe and the collimator chamber with the motorized jaws by the Supplier, the Supplier shall redo necessary parts of the verification procedure (see chapter 7). The results of this process shall be provided to the CA.
Verification method: Not To Be Tracked within VCD

REQ-028605/A

All tests shall be performed by the measuring instruments with valid metrological confirmation.
NOTE: The CA can request the Supplier to provide the valid ***Calibration Certificates****.*
Verification method: Not To Be Tracked within VCD

7. Verification Requirements for the Supplier

The verification process will be performed by the Supplier to demonstrate that the whole system (assembled setup with 4 quadrupole magnets, the beam-pipe and the collimator chamber with the motorized jaws in the horizontal and vertical planes) meets the specified requirements of the CA.

7.1. General requirements

REQ-028558/A

The Supplier shall assign clear responsibility for the implementation of the verification process including the following activities:

1. Verification planning (via VCD, see chapter 7.2.3);
2. Verification execution and reporting (see chapters 7.3, 7.2.2 and 7.2.3);
3. Verification control and close-out (see chapter 7.3.4).

Verification method: R – review

REQ-028606/A

The verification process shall be accomplished by the Supplier through one or more of the following verification methods:

1. **Review**; Verification via Review **(R)** shall consist of using approved records (i.e. design documents and reports, technical

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descriptions, engineering drawings, manuals and accompanying operation documentation) or evidence unambiguously showing that the requirement has been met.

2. **Inspection**; Verification via Inspection **(I)** shall consist of physical characteristics visual determination including photographs taken by the Supplier and sent to the CA proving that the specific requirements have been met.
3. **Test** (including functional demonstration); Verification via Test (**T**) shall consist of measuring product performance and functions under realistic operating conditions. When the test objectives include the demonstration of qualitative operational performance (functional demonstration), the execution shall be observed and results recorded.
4. **Analysis**; Verification via Analysis **(A)** shall consist of performing theoretical or empirical evaluations (e.g. mathematical models, calculations and etc.).

Verification method: Not To Be Tracked within VCD

7.2. Verification documentation

7.2.1. General requirements

REQ-028560/A

The Supplier shall establish and maintain the system of verification process documentation (see REQ-028561/A and REQ-028562/A).
Verification method: Not To Be Tracked within VCD

REQ-028561/A

Verification documentation shall consist of following documents:

- **Verification reports** (see chapter 7.2.2);
- **VCD, Verification Control Document** (see chapter 7.2.3).

Verification method: Not To Be Tracked within VCD

REQ-028562/A

The verification report shall be submitted to the CA for the review as agreed with the CA after corresponding verification activity completion, within the time frame agreed with the CA.
NOTE: Verification activity can be design review and/or analysis during the Momentum filter system development, test and inspection during the final Momentum filter system implementation.
Verification method: Not To Be Tracked within VCD

7.2.2. Verification reports (VRs)

REQ-028563/A

The results of the analysis shall be documented in the corresponding **Analysis Report** (further "**AR**") and tracked in the VCD (see chapter 7.2.3).

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Verification method: R – review

REQ-028607/A

The results of a review of design shall be documented in the **Critical Design Review Report** (further "**CDRR**") and tracked in the VCD (see chapter 7.2.3).
NOTE: The CA can provide to the Supplier the template of CDRR.
Verification method: R – review

REQ-028608/A

The **results of the inspection** shall be tracked in the VCD.
Verification method: R – review

REQ-028609/A

The **results of the tests** shall be documented in the appropriate **Factory Test Report** (further "**FTR**") or **on-Site Test Report** (further "**STR**") and tracked in the VCD (see chapter 7.2.3).
Verification method: R – review

7.2.3. Verification Control Document (VCD)

The Verification Control Document (**VCD**) lists the requirements to be verified by the selected methods at the defined stages of the Momentum filter system delivery (see chapter 7.3).
The VCD is a living document which shall be used throughout the entire Contract delivery and its phases (see chapter 7.3). The VCD provides traceability during delivery phases (Qualification of Design, Manufacturing, Delivery&Installation, Acceptance,...).
The VCD represents a formal tool of communication between the Supplier and the CA (formal record, reporting tool).

REQ-028564/A

The Supplier shall provide **Verification Control Document** (further "**VCD**") for the reviews as agreed with the CA.
NOTE 1: Guidelines for VCD preparation see in RD-06.
NOTE 2: The form of VCD will be agreed between the CA and the Supplier based on the best commercial praxis used by the Supplier.
Verification method: R – review

REQ-028565/A

In the VCD the Supplier shall specify **HOW** and **WHEN** each requirement is planned to be verified.
Verification method: R – review

REQ-028566/A

The verification approach shall be submitted by the Supplier in the VCD and approved by the CA prior to implementation.
Verification method: Not To Be Tracked within VCD

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7.3. Phasing of the delivery

This chapter is intended to briefly summarize basic milestones of the Contract delivery. These milestones represent gates (checkpoints) where the quality of the delivery has to be evaluated.
Delivery shall not proceed past these gates unless their satisfactory accomplishment is approved by the CA.

Delivery lifecycle shall contain at least the following phases (**quality gates**):

- **Conceptual Design of Integrated Setup;**
- **Technical Design of Integrated Setup;**
- **Manufacturing;**
- **Delivery and Installation;**
- **Acceptance** (performed by the CA)

7.3.1. Conceptual Design of Integrated Setup

The goal is to verify the **conceptual design of the integrated setup, including main drawings and design supporting documentation**.
Summary of what shall be provided by the Supplier in terms of documentation (technical documentation including conceptual drawings and design supporting documentation) before starting the technical design of the integrated setup.

Output of this phase is **Qualified Conceptual Design of the Integrated Setup and agreed scope of technical design of the setup**.

REQ-028559/A

Before completion of the Conceptual Design phase the Supplier shall provide following information that shall be agreed by the CA:
structure and content of the verification reports (see chapter 7.2.2);
structure and content of the VCD ready to be implemented (see chapter 7.2.3).
Verification method: R – review

REQ-028610/A

Before completion of the Conceptual Design phase the Supplier and the CA shall agree on:

- conceptual drawings of the integrated setup provided by the Supplier (see REQ-028555/A);
- acceptance results of the conceptual design verification submitted by the Supplier in the corresponding CDRR and AR (see REQ-028607/A and REQ-028563/A);
- detailed procedures related to the testing during Manufacturing and Installation phases (see chapters 7.3.2 and 7.3.3);

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Verification method: R – review

7.3.2. Technical Design of Integrated Setup

The goal is to verify the **technical design of the integrated setup, including final drawings for the production and supporting documentation**.
Summary of what shall be provided by the Supplier in terms of documentation (technical documentation including final drawings and supporting documentation) before starting the production of the integrated setup.

Output of this phase is **qualified Technical Design of the Integrated Setup and agreed scope of production of the setup**.

REQ-030760/A

Before completion of the Technical Design phase the Supplier and the CA shall agree on:

- final drawings of the integrated setup provided by the Supplier (see REQ-028555/A);
- acceptance results of the conceptual design verification submitted by the Supplier in the corresponding CDRR and AR (see REQ-028607/A and REQ-028563/A);
- detailed procedures related to the testing during Manufacturing and Installation phases (see chapters 7.3.2 and 7.3.3);

Verification method: R – review

7.3.3. Manufacturing

The goal is to demonstrate that the manufactured and assembled Momentum filter system meets the specified technical requirements (RSD) of the CA.

This quality gate concerns primarily:

- Inspection of assembled System, which includes 4 electromagnetic quadrupole magnets with the integrated beam-pipe and the collimator chamber with motorized slits;
- Testing at the Supplier's site (factory testing);
- Cleaning and Packaging.

Output of this phase is the **Verified assembled Momentum filter system with the beam-pipe and the collimator chamber with the motorized jaws**.

REQ-028611/A

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The results of the Manufacturing verification phase shall be recorded by the Supplier in the appropriate FTR (see REQ-028609/A) and overall results (including review of documentation/reports and inspection of assembled Momentum filter system) shall be recorded in the VCD (see chapter 7.2.3).
Verification method: R – review

7.3.4. Delivery and Installation

The goal is to demonstrate that the delivered and installed final Momentum filter system meets all requirements specified herein.

Verification of the final System is executed by the Supplier and the CA together after completion of each stage including delivery, transportation and installation.

This quality gate concerns primarily:

- **Inspection of delivered integrated System and required documentation**;
- **Transportation to the final destination** (ELI Beamlines E5 hall);
- **Inspection and on-site testing of whole installed System**.

Output of this phase is the **Verified delivered and installed Integrated System**.

REQ-028612/A

The results of the verification of delivered and installed Integrated System shall be recorded by the Supplier in the appropriate STR (see REQ-028609/A) and overall results shall be recorded in the VCD (see chapters 7.2.3).
Verification method: R – review

REQ-028613/A

The final issue of the VCD shall be submitted to the CA after the approval of the last report and before starting the Acceptance phase (see chapter 7.3.4).
Verification method: R – review

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7.3.5. Acceptance

Acceptance will be carried out by the CA upon verification of the final Integrated System (see chapter 7.3.3). The basis for acceptance will be completed VCD summarizing the overall verification results together with relevant documentation supporting the verification (i.e. VRs, approved manufacturing drawings and 3D model, Product User Manual and etc.).

In case of successful acceptance phase, the CA will provide to the Supplier signed acceptance protocol. In case of unsuccessful acceptance stage, the CA will provide to the Supplier Nonconformity Report (NCR) and ELI nonconformity control process will be applied (see REQ-028602/A).

REQ-028614/A

The Acceptance phase shall demonstrate the following:

- Final Integrated System consisting of the 4 EMQs, the beam-pipe and the collimator chamber with the motorized jaws has been successfully verified by the Supplier and the results of this process has been documented in an appropriate way through VRs (see chapter 7.2.2) and VCD (see chapter 7.2.3);
- All detected non-conformities have been solved in accordance with REQ-028602/A;
- Final Integrated System is free of fabrication errors and is ready for the intended operational use.

Verification method: Not To Be Tracked within VCD

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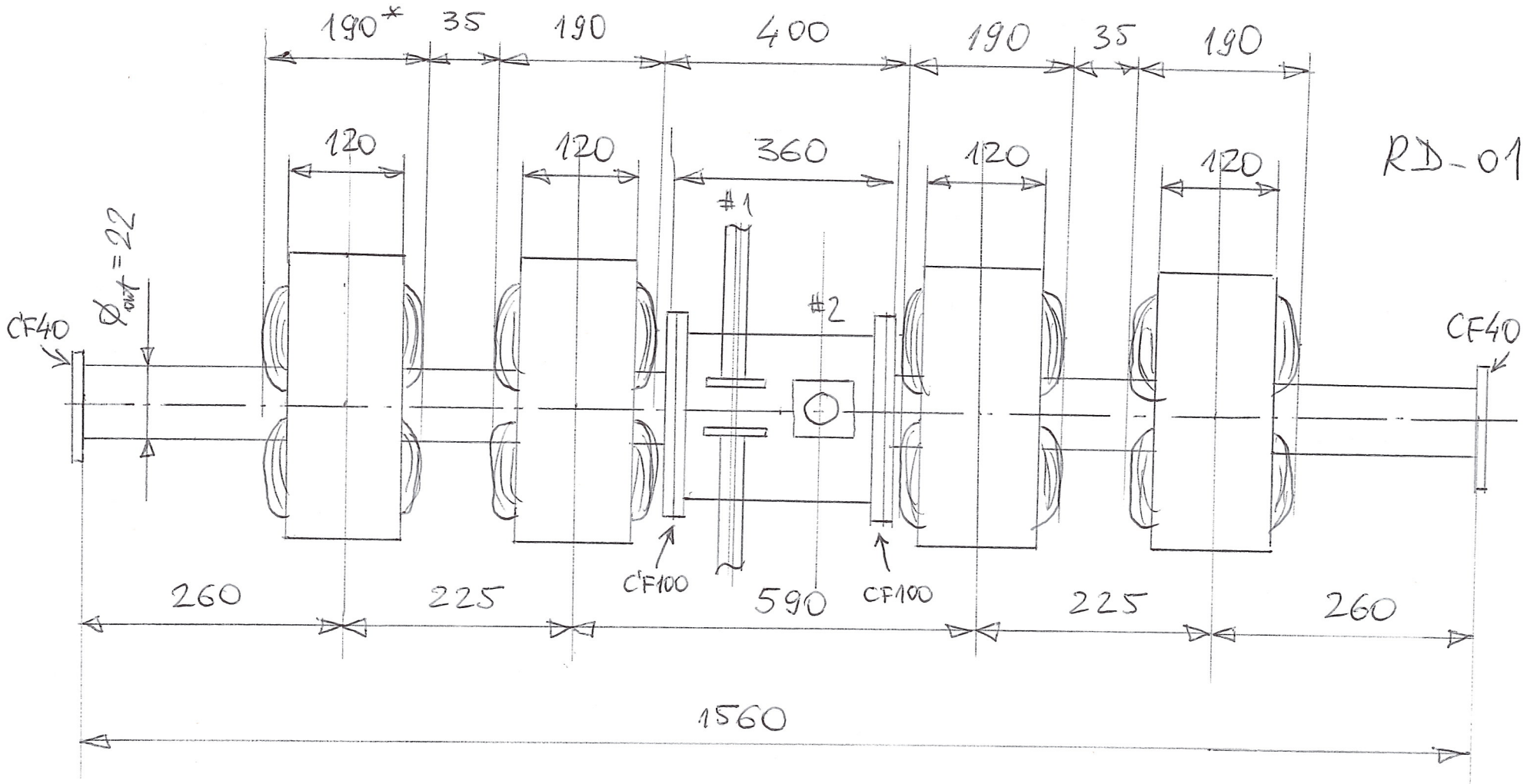


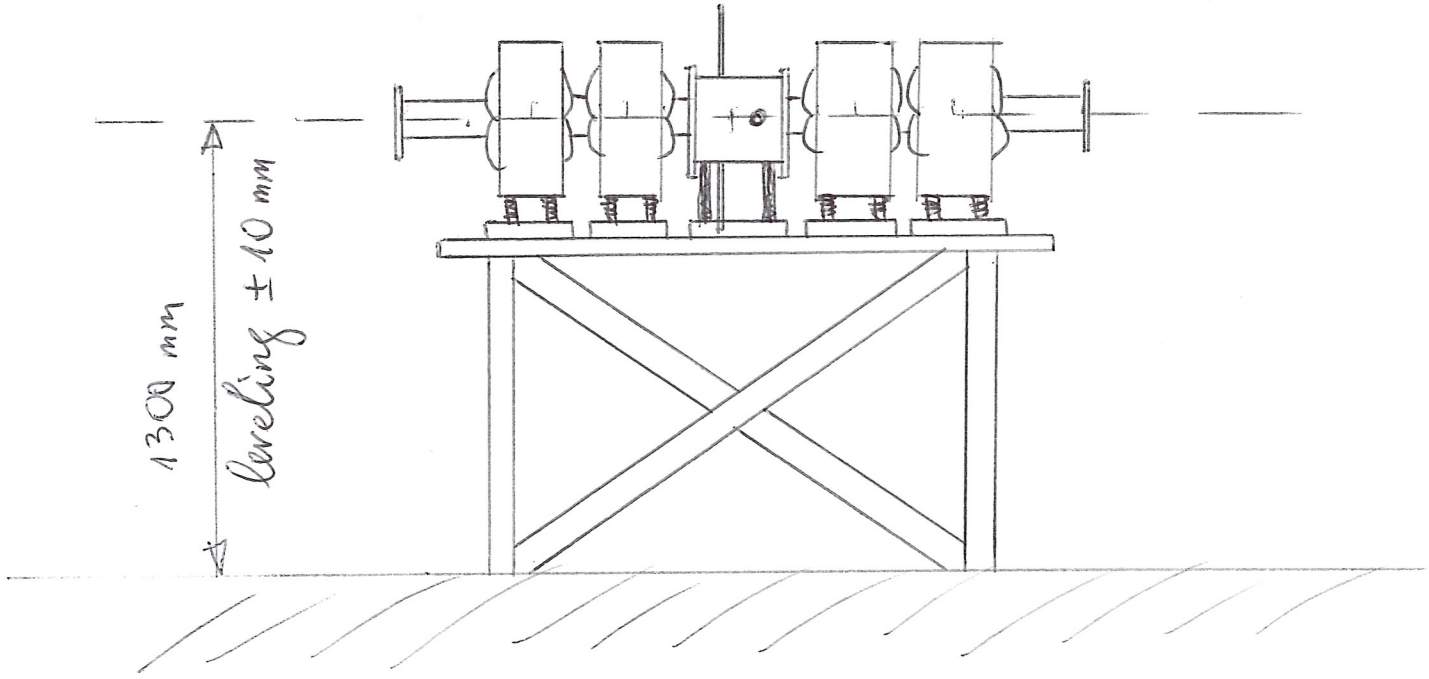
- ALL QM magnets are identical
- Effective length of QM is 120 mm

* Total length of QM including winding is ~ 190 mm

#1 Vertical manipulator

#2 Horizontal manipulator

RD-02



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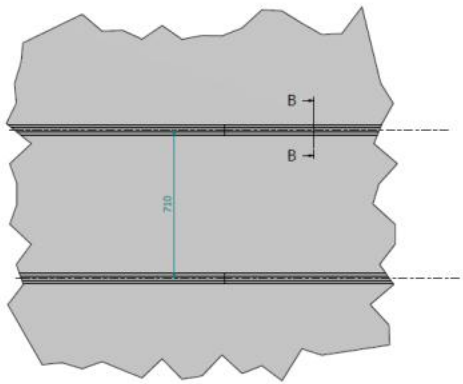

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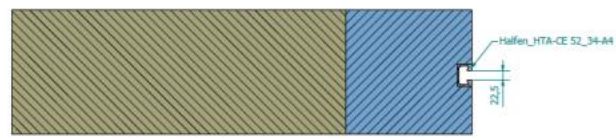

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ELI water cooling system on experimental floor (2. PP & 1. PP)

experimental halls E1 to E6, laser hall L4c, north and south plantrooms

Technical specifications and requirements

for Vendors / Suppliers

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1. Operational technical parameters

REQ-022673/A

Each device connected to the ELI cooling system in hall L4c, in halls E1 to E6 and/or in any plantroom on experimental floor (2. PP & 1. PP) must be designed to be operational in range of following parameters of the ELI cooling system:

- maximum operational gauge pressure on supply: 7 bar(g);
- maximum operational gauge pressure on return: 2 bar(g);
- maximum allowed gauge pressure ≧ 10 bar(g);
- operational differential pressure from 3 to 6 bar(g);
- temperature of supply: pre-set between 16 °C and 24 °C with long term stability ±2 °C and with possible short term (a few seconds) fluctuations in response to huge sudden thermal power change (if any) in range 12 °C to 35 °C.

Note 1: The real state of cooling system will be within these parameters and will be set in accordance with all other devices to able them work properly. For example the differential pressure will be chosen according the device with request for the highest one.

Note 2: The final short term thermal stability will be most probably much better (very close to long term stability) but it needs some fine tuning which will be possible after installation and commissioning of all devices which have to be connected to the ELI cooling system.

2. Operational cooling water quality

REQ-022674/A

Each device connected to the ELI cooling system in hall L4c, in halls E1 to E6 and/or in any plantroom on experimental floor (2. PP & 1. PP) must comply with cooling water quality with the worst operational parameters as follow:

- water resistivity range from 2 MΩ·cm to 18.6 MΩ·cm;
- content of water-soluble substances ≦ 10 mg/l;
- content of water-insoluble substances ≦ 10 mg/l;
- insoluble particles size ≦ 100 μm;
- index pH range from 6 to 9;
- hardness ≦ 10 ppm (mg $CaCO_3$/l);
- chlorine content ≦ 100 μg/l;
- iron content ≦ 100 μg/l;
- SiO_2 content ≦ 100 μg/l.

Note: Final operational parameters will be most probably better – in the sense of water purity.

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3. Flushing and conservation water quality (non-operational)

REQ-022675/A

The parameters of flushing and conservation water quality are as follow:

- water resistivity range from 1.5 kΩ·cm to 18.6 MΩ·cm (during longer unavailability time);
- flushing water pH index pH range from 4 to 12;
- conservation water pH index range from 7 to 12;
- insoluble particles size ≦ 100 μm;
- possible additives: Optishield, Optishield Plus, Optishield II, Optishield II Plus, Cetamine F365, max. 20 % of sodium hydroxide, Ferrocid 8580, Ultrasil 69, Ultrasil 130, or Ferrocid 4601.

Note 1: Vendor/Supplier must confirm or revoke compatibility with *each of additives above.*

Note 2: If quality of water is not suitable for flushing and/or conservation of the device, the device will be disconnected and flushing and/or conservation will be done separately according the instruction from vendor/supplier.

4. General requirements to Vendors (Suppliers)

REQ-022676/A

Operational cooling medium is high purity water (demineralized) and the device cooling system must be compatible with the medium and it must not contaminate the medium.

REQ-022677/A

Vendor/Supplier must provide detailed description of cleaning procedures of inner parts of the device cooling system (everything in touch with cooling medium).

NOTE 1: Water quality with possible additives and/or other solutions must be clearly and exactly specified.

NOTE 2: These cleaning procedures must be specified in the Product User Manual.

REQ-022678/A

Cooling connection must be made in the way to allow easy non-destructive temporal disconnection (with using standard manual tools usable in clean rooms, it means without the following activities: heating, drilling, cutting, welding, etc.).

NOTE: This is necessary for cleaning procedures of building cooling system infrastructure which may not be compatible with the device cooling

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system and also for cleaning procedures of the device cooling system which may not be compatible with building cooling system infrastructure.

REQ-022679/A

Vendor/Supplier must deliver the device with cleaned and dried inner parts of the device cooling system and treated against corrosion and all connectors must be sealed to prevent pollution get in.

NOTE: If drying of the inner parts is not feasible then other measures must be done to achieve cleanliness and protection against corrosion (like some kind of surface conservation or leave protective liquid inside and sealed with a plug).

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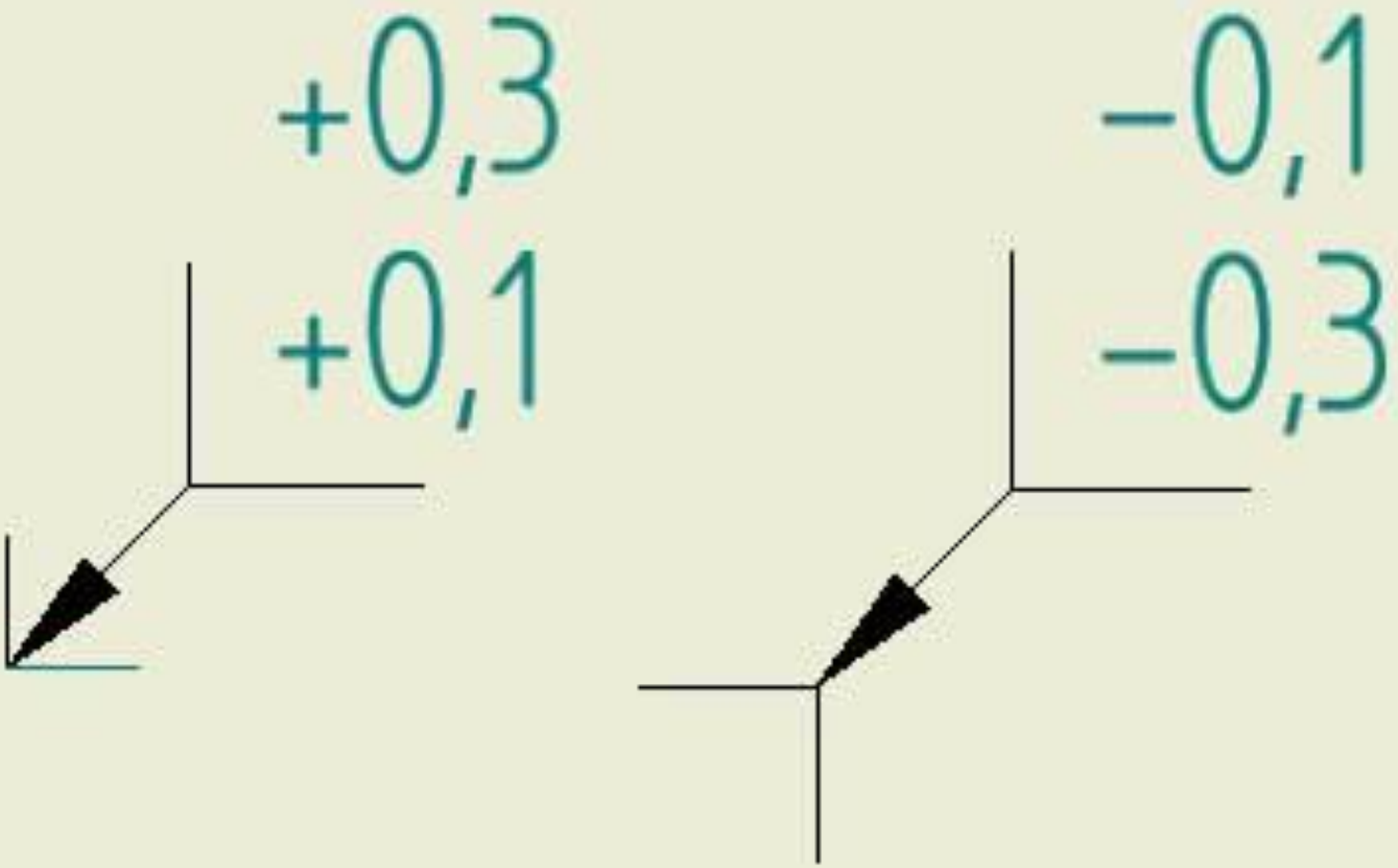
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Program: 5.1.4. - RP2 Laser Undulator Illuminating Source
Subject: Momentum Filter System for LUX. Verification Control Document (VCD)
Specification: TC ID # 00260220 - RSD_Momentum Filter System for LUX_TP_20_007

Requirement TC ID	Revision	Requirement text	HW/SW code	Level	Verification Method	Close-out		VPD Verification Planning Document	VRD Verification Record Document	Comments
						Yes	No			
020220/A;Momentum Filter System for LUX_TP_20_007										
REQ-028567	A.010	The Supplier shall deliver the following parts of Momentum filter system:Assembled electromagnetic quadrupoles (EMQ1, EMQ2, EMQ3, EMQ4) in accordance with the setup-sketch (see RD-01);Beam-pipe, integrated into the assembled setup of the EMQs (see RD-02);The collimator chamber with the separated horizontal/vertical controllable (motorized) slits;Alignment tables for the individual quadrupole magnet and the collimator chamber with the common support table;Power supply systems for each EMQ with power and thermos-switch cables;Power supply, motor controllers and encoders, including all necessary cables for the collimator motorization			I - inspection					
REQ-028528	A.010	The final manufacturing drawings of the integrated Momentum Filter System with the beam-pipe and the collimator chamber with the H/V motorized collimators shall be made by the Supplier in conformity with the CA conceptual sketch of the RD-01.			R - review					
REQ-028530	A.010	To avoid trapped volumes in vacuum spaces which could result in virtual leaks, precautions shall be taken in the design of the vacuum components, and vacuum spaces shall be suitably vented.			R - review					
REQ-028531	A.010	Any dimensional/design modifications that may arise as part of detailed manufacturing design shall be consulted with and approved by the CA. Such dimensional/design modifications are possible only if these are advantageous to the CA (e.g. offer more effective solution). The CA shall approve such a modification, if the advantage of doing so is undoubtedly demonstrated to the CA.			R - review					
REQ-028568	A.010	The Momentum Filter System field quality in the Good Field Regions shall be better than 5e-4 for each EMQ within the GFR radius for harmonics n=2÷10 for each quadrupole magnet. The Good Field Region radius for each quadrupole magnet shall be 2 mm.			A - analysis, T - test					
REQ-028569	A.010	The evaluation of the field quality of each quadrupole magnet shall be based on the appropriate scaling, if it is not possible to measure the field quality directly. The evaluation of the field quality for the quadrupole magnets shall be discussed with and approved by the CA.			R - review, A - analysis					
REQ-028570	A.010	The Supplier shall perform the field measurements of each separated quadrupole magnet (see REQ-028568/A and chapter 3.2.1) using the “rotating coil” or/and by the “stretched-wire” technique and shall provide to the CA the results of this tests (see REQ-028609/A) as a part of the technical documentation for each EMQ.			T - test, I - inspection, R - review					
REQ-028571	A.010	Each EMQ of the delivered assembled Momentum Filter System with the beam-pipe and the collimator unit with the manipulators shall have accuracy ±0.1 % of measured integrated field gradient or better.			T - test, R - review					
REQ-028572	A.010	The assembled System shall have alignment precision ±100 μm or better for the axis of the magnetic field of the each EMQ.			T - test, R - review					

REQ-028573	A.010	After the assembling of the whole system at the Supplier site, the Supplier shall make the alignment verification using the ‘stretched-wire’ technique and include the results in the test report as a part of the technical documentation for the assembled Momentum Filter System.			R - review, T - test, I - inspection					
REQ-028532	A.010	All four EMQs are identical (with the indexes: EMQ4, EMQ5, EMQ6, EMQ7). All four EMQs shall comply with the following parameters: aperture diameter = (25±0.2) mm; maximum integrated field along the axis = 8.5 T; total length of the magnet including winding ? 190 mm.			R - review, T - test					
REQ-028533	A.010	The EMQs water cooling system for all quadrupole magnets shall meet the following requirements:Acceptable rise of the cooling water temperature for EMQs < 10 0C at the cooling water inlet temperature 25 0C.			R - review, T - test					
REQ-028534	A.010	The requirements on the EMQ water cooling system, determined by the Supplier, shall be compatible with the ELI water cooling system.NOTE: For the technical documentation of the ELI water cooling system see RD-04.			R - review					
REQ-028535	A.010	The assembled EMQs setup with the beam-pipe and the collimator chamber shall be mounted on the alignment table.			I - inspection					
REQ-028536	A.010	The geometrical axis of the assembled setup shall be at 1300 mmm with additional leveling ±10 mm from the ground floor (see RD-02).			R - review, T - test					
REQ-028537	A.010	The support table for the whole assembled setup shall fit transversally the rail system in the experimental hall (see RD-03).			R - review, T - test					
REQ-028538	A.010	The support frame shall have 4 holes with the inner diameter of 19 mm for bolting the support frame to the floor in the experimental hall (RD-03). The holes shall be positioned 710 mm from the center to the center with tolerances of ±0.3 mm.			R - review, T - test					
REQ-028666	A.006	The frame shall be made of steel 1.0038. The frame shall follow the welding requirements according to the ČSN EN ISO 3834 (equivalent to ISO 3834) or equivalent. The welding tolerances shall follow the standard ČSN EN ISO 13920 AE (equivalent to ISO 13920) or equivalent.			R - review					
REQ-028667	A.006	The support frame shall be painted with Clean room ISO 7 compatible non-outgassing paint or equivalent. The frame shall have a color RAL 3003 matt.			R - review					
REQ-028668	A.006	The support frame shall have the corrosion resistance according to ČSN EN ISO 12944 (equivalent to ISO 12944) or equivalent. The paint shall have dry film thickness < 200um.			R - review					
REQ-028669	A.006	All sharp edges of the support frame shall follow the edge condition (see RD-05). The maximum deflection of the frame caused by the magnets weight shall be below 0.4mm. The assembled setup shall not have any resonant frequencies below 100 Hz.			R - review					
REQ-028539	A.010	The Supplier shall deliver the unipolar DC power supply system for each EMQ, which shall be able to provide the required field parameters (see REQ-028532/A) from the maximum values down to zero.			R - review, I - inspection					
REQ-028540	A.010	The power supply systems shall have output power stabilization allowing the EMQs to provide required field quality.			R - review					
REQ-028541	A.010	Each power supply system for each individual EMQ shall have the following output power parameters:for the EMQ4-EMQ5-EMQ6-EMQ7 < 10 kW.			R - review, T - test					
REQ-028574	A.010	The Supplier shall deliver the power supply systems for the EMQs as a compact 19-inch rack mount module, assembled in one standard rack unit compatible with EIA-310.			R - review, I - inspection					
REQ-028575	A.010	The Supplier shall deliver the power supply systems for all the EMQs with the RMS current ripple less than ±0.05 % for the whole range from zero to the maximum parameters.			R - review, T - test					

REQ-028576	A.010	The power supply system shall have an air-cooling system.			R - review					
REQ-028577	A.010	The total maximum power consumption (i.e. input power consumption) of the Momentum Filter System shall not be more than 40 kW. The plug of the power supply system shall have 3 phases (3NPE, 230/400 V, 50 Hz). NOTE: Final estimation of the Momentum Filter System power consumption shall be provided by the Supplier for approval by the CA before completion of the design phase.			A - analysis, R - review, T - test					
REQ-028578	A.010	All the vacuum components of the Momentum Filter System (i.e. beam-pipe, flanges, collimator chamber and etc.) shall be UHV compatible and shall be able to be totally operated under vacuum level up to 10-7 mbar.			R - review					
REQ-028579	A.010	The cleaning procedure shall remove contaminants been adhered to the surface such as oils, greases, dirt, swarf, corrosion products, or finger prints.			R - review					
REQ-028580	A.010	The Supplier shall provide to the CA the description of the vacuum cleaning procedure which will be reviewed and approved by the CA.			R - review					
REQ-028582	A.010	Chemicals used in the cleaning process shall not affect the material properties or cause a colour change, corrosion or other damage.			R - review					
REQ-028583	A.010	The outgassing of vacuum components shall be free of hydrocarbons and the appropriate proofs shall be performed by Supplier using a sufficiently sensitive residual gas analyzer, usually equipped with a secondary electron multiplier (SEM).NOTE: Components are considered as hydrocarbon free when the two conditions are fulfilled:the leak-free system reaches a total pressure below 10-7 mbar;Amplitude of all peaks > 44 AMU are not higher than 1/100 of the 44 AMU peak;Peak at 43 AMU is not higher than 1/10 of the 44 AMU peak.			T – test (RGA report)					
REQ-028584	A.010	The Supplier shall perform a leak test of the beam-pipe and the collimator chamber and the results provide the results of this test to the CA (see REQ-028609/A). NOTE 1:Single leak test (spray test) shall be according to ČSN EN ISO 1779 (equivalent to ISO 1779; method A.3) or equivalent.NOTE 2:Total leak test shall be according to ČSN EN ISO 1779 (equivalent to ISO 1779; method D2) or equivalent.			T - test					
REQ-028585	A.010	The measured single leak rate using calibrated He detector shall be less than 1.0E-9 mbar?l/s.			T - test					
REQ-028586	A.010	The measured total leakage rate shall be better than 5.0E-4 mbar?l/s.			T - test					
REQ-028549	A.010	The beam-pipe of the Momentum Filter System shall be manufactured using different outer diameter of 22 mm with CF40 and CF100 flanges at the edges of the beam-pipe (as shown in RD-01). The flanges of the collimator chamber shall be CF100. No bellows are required for the beam-pipe.			R - review, T - test					
REQ-028550	A.010	The beam-pipe of the Momentum Filter System shall be designed and manufactured with the tolerance class fH according to ČSN EN ISO 2768 (equivalent to ISO 2768) or equivalent and with the tolerance class AE according to ČSN EN ISO 13920 (equivalent to ISO 13920) or equivalent. The tolerance for the total length of the beam-pipe shall be ± 1 mm. The dimensions of CF flanges shall be according to ISO/TS 3669-2 or equivalent.			R - review, T - test					

REQ-028551	A.010	The design of the collimator chamber, integrated into the whole setup, shall be made by the Supplier in conformity with the CA conceptual sketch of the RD-01, RD-02 (see chapter 1.4). The technical drawings of the collimator chamber with motorized horizontal and vertical jaws, including the required support structure on the alignment table, shall be approved by CA before the production for the acceptance. NOTE: The maximum power of the lost beam in the collimator is less than 100W for an extreme case of the setup operation			R - review					
REQ-028552	A.010	The collimator chamber shall have motorized jaws for independent collimation of the electron beam in the horizontal and vertical planes. Each jaw shall be connected to the manipulator. The length of the jaw along the chamber axis shall be not less than 50 mm. The jaw of the collimator shall be produced using Tungsten material.			R - review					
REQ-028587	A.010	The gap between the collimator jaws shall be changeable in the range from 0 up to 25 mm in both horizontal and vertical planes, leading to the variation of the distance from the chamber axis up to 12.5 mm for each jaw. The step of the gap variation shall be 20±2 µm, provided with the control using the independent encoders to control the motion in the horizontal and vertical planes.			R - review, T - test					
REQ-028588	A.010	The parallelism of the jaws in the horizontal and vertical planes shall be less than 25 µm for the whole range of the variable gap.			R - review, T - test					
REQ-028542	A.010	Each power supply shall be equipped with a serial interface for the remote control operation via following protocols: Ethernet, RS-232 or RS-485.			I - inspection					
REQ-028543	A.010	Motion controller(s) for the collimator jaws shall be equipped with a serial interface allowing remote control operation via following protocols: Ethernet, RS-232 or RS-485.			I - inspection					
REQ-028544	A.010	Supplier shall provide comprehensive communication protocol documentation (commands reference manual) for both power supplies and motion controllers.			R - review					
REQ-028546	A.010	All power cables connecting to the EMQs shall be compatible with the power supply systems and the thermos-switch cables shall be delivered by the Supplier.NOTE: Power cable connecting the power supply rack to the power socket in the experimental area will be provided by CA.			I - inspection, R - review					
REQ-028547	A.010	The length of the power cables interconnecting the power supply systems and the EMQs, including the thermos-switch cables, shall not be less than 6 meters.			R - review					
REQ-028548	A.010	All water tubes for the cooling system shall be assembled for each EMQ and shall be delivered by the Supplier. NOTE: The water tubes to connect the magnets water cooling system to water cooling hub in the CA experimental hall will be prepared by CA before the delivery of the items.			R - review, I - inspection					
REQ-028589	A.010	Power cables for the Collimator Jaw Motors shall not be less than 6 meters. It shall be delivered by the Supplier with the motors.NOTE: Connection of the stepper-motors and stepper-motor drivers, mounted in the power supply rack by the Supplier, will be made by CA after the delivery as the part of the installation in the experimental area.			R - review					
REQ-028590	A.010	The water tube material of the EMQs shall be compatible with the ELI water cooling system.			R - review					
REQ-028592	A.010	The transportation of the whole assembled setup of the pre-aligned EMQs with the beam-pipe and the collimator chamber with the motorized collimator jaws to the final destination (ELI Beamlines experimental hall) and the installation of the whole setup at ELI-Beamline experimental hall shall be conducted by the Supplier.			R - review					
REQ-028593	A.010	The Momentum Filter System shall be delivered in a protective package preventing damage.			I - inspection					

REQ-031182	A.001	Before the Delivery the Supplier will provide the instruction for the proper connection of the magnets/collimator power supply systems and the magnets water cooling systems to the corresponding hubs in the CA experimental area.			R - review					
REQ-031183	A.001	Before the Delivery the Supplier will provide the instruction for the proper installation and final alignment for the momentum filter setup, including the reference points for the laser tracker.			R - review					
REQ-031184	A.001	Connection of the magnets water cooling system to the water cooling hub in the ELI-Beamlines experimental hall will be performed by the CA personal after delivery of the magnets to the CA side. The connection will be based on the instruction, submitted by the Supplier.			I - inspection					
REQ-031185	A.001	Connection of the rack with the magnets and motors power supplies to the electrical power hub in the ELI-Beamlines experimental hall will be performed by the CA personal after delivery of the magnets to the CA side. The connection will be based on the instruction, submitted by the Supplier.			I - inspection					
REQ-028595	A.010	The Supplier shall ensure that the installation of the assembled setup will be performed without contaminating the place of installation unnecessarily. The premises include rooms with normal cleanliness and cleanrooms of class 7 according to ČSN EN ISO 14644 (equivalent to ISO 14644) or equivalent.			I - inspection					
REQ-028596	A.010	The transportation and installation procedures shall be discussed and can be reviewed by the CA's installation officer.			R - review					
REQ-031187	A.001	The Supplier shall check the proper cable and water-cooling connections in the CA experimental area and perform full-power electrical and thermo-test after the final installation of the momentum filter setup in the CA experimental area.			T - test					
REQ-028599	A.010	The vacuum components of the whole system shall be cleaned and packaged in clean environment of class 6 according to ČSN EN ISO 14644 (equivalent to ISO 14644) or cleaner (or equivalent). NOTE: The ISO 14644 certification of the Supplier's cleanrooms is not required.			R - review, I - inspection					
REQ-028600	A.010	The non-vacuum components of the whole system shall be cleaned and packaged in clean environment of class 8 according to ČSN EN ISO 14644 (equivalent to ISO 14644) or cleaner (or equivalent). NOTE: The ISO 14644 certification of the Supplier's cleanrooms is N/R.			R - review, I - inspection					
REQ-028615	A.010	All transportation and installation tools and equipment entering the clean rooms shall be cleaned and reviewed by the CA's approved methods. The Supplier and the CA shall agree on the cleaning method to clean tools and equipment used at the installation without decreasing their performance or safety.NOTE: Some tools can be provided by the CA upon agreement.			I - inspection					
REQ-028553	A.010	The Supplier shall supply a Declaration of Conformity or any other equivalent document legally recognized and accepted by the Czech Republic legislation for each product type if the appropriate legislation determines the Supplier's obligation to have a Declaration of Conformity (or the equivalent document) for the purposes of a Device sale in the Czech Republic (requirements of 2001/95/EC directive or applicable Czech law).			I - inspection					
REQ-028554	A.010	The Supplier shall provide the Product User Manual as part of the delivered system. Completeness of the Manual shall be approved by the CA. The Manual shall include the instructions and descriptions regarding the following procedures: transport, handling, storage; installation, alignment and cleaning; guide for the software and for communication protocol (see REQ-028544/A);safe operation and maintenance procedures.			R - review, I - inspection					

REQ-028555	A.010	The Supplier shall supply the following relevant manufacturing documents:all manufacturing drawings, 3D models (if available) and design supporting documentation (i.e. technical documentation, see REQ-028610/A) approved by the CA; all “requests for deviation/wavier from requirements described herein” (see REQ-028602/A) approved by the CA.			I - inspection					
REQ-028557	A.010	The manufacturing documents shall include the accuracy of the manufacturing process. This accuracy shall be also included in the corresponding test reports (see REQ-028555/A and REQ-028609/A).NOTE: The Supplier will specify the maximal difference between specified parameters (in chapter 3) and the parameters of the final Momentum Filter System with the beam-pipe and the collimator chamber with the motorized slits.			R - review					
REQ-028558	A.010	The Supplier shall assign clear responsibility for the implementation of the verification process including the following activities:Verification planning (via VCD, see chapter 7.2.3);Verification execution and reporting (see chapters 7.3, 7.2.2 and 7.2.3); Verification control and close-out (see chapter 7.3.4).			R - review					
REQ-028563	A.010	The results of the analysis shall be documented in the corresponding Analysis Report (further “AR”) and tracked in the VCD (see chapter 7.2.3).			R - review					
REQ-028607	A.010	The results of a review of design shall be documented in the Critical Design Review Report (further “CDRR”) and tracked in the VCD (see chapter 7.2.3).NOTE: The CA can provide to the Supplier the template of CDRR.			R - review					
REQ-028608	A.010	The results of the inspection shall be tracked in the VCD.			R - review					
REQ-028609	A.010	The results of the tests shall be documented in the appropriate Factory Test Report (further “FTR”) or on-Site Test Report (further “STR”) and tracked in the VCD (see chapter 7.2.3).			R - review					
REQ-028564	A.010	The Supplier shall provide Verification Control Document (further “VCD”) for the reviews as agreed with the CA.NOTE 1: Guidelines for VCD preparation see in RD-06.NOTE 2: The form of VCD will be agreed between the CA and the Supplier based on the best commercial praxis used by the Supplier.			R - review					
REQ-028565	A.010	In the VCD the Supplier shall specify HOW and WHEN each requirement is planned to be verified.			R - review					
REQ-028559	A.010	Before completion of the Conceptual Design phase the Supplier shall provide following information that shall be agreed by the CA:structure and content of the verification reports (see chapter 7.2.2);structure and content of the VCD ready to be implemented (see chapter 7.2.3).			R - review					
REQ-028610	A.010	Before completion of the Conceptual Design phase the Supplier and the CA shall agree on:conceptual drawings of the integrated setup provided by the Supplier (see REQ-028555/A);acceptance results of the conceptual design verification submitted by the Supplier in the corresponding CDRR and AR (see REQ-028607/A and REQ-028563/A);detailed procedures related to the testing during Manufacturing and Installation phases (see chapters 7.3.2 and 7.3.3);			R - review					
REQ-030760	A.003	Before completion of the Technical Design phase the Supplier and the CA shall agree on:final drawings of the integrated setup provided by the Supplier (see REQ-028555/A);acceptance results of the conceptual design verification submitted by the Supplier in the corresponding CDRR and AR (see REQ-028607/A and REQ-028563/A);detailed procedures related to the testing during Manufacturing and Installation phases (see chapters 7.3.2 and 7.3.3);			R - review					

REQ-028611	A.010	The results of the Manufacturing verification phase shall be recorded by the Supplier in the appropriate FTR (see REQ-028609/A) and overall results (including review of documentation/reports and inspection of assembled Momentum Filter System) shall be recorded in the VCD (see chapter 7.2.3).			R - review					
REQ-028612	A.010	The results of the verification of delivered and installed Integrated System shall be recorded by the Supplier in the appropriate STR (see REQ-028609/A) and overall results shall be recorded in the VCD (see chapters 7.2.3).			R - review					
REQ-028613	A.010	The final issue of the VCD shall be submitted to the CA after the approval of the last report and before starting the Acceptance phase (see chapter 7.3.4).			R - review					