



## 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) **Si.a.tel s.r.l.,**  
with its registered office at: **Via Malerba, 1 – 95030 Tremestieri Etneo (CT) Italy,**  
registration no.: **IT03375730870,**  
represented by: **Nicotra Paolo Francesco (Sole director)**  
(**"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 "**Automation of mechanical devices TP21\_040**", 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 electronics and software for the upgrade of ELIMAIA technology with high precision mechanics control 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) transport the Object of Purchase to the place of delivery;
  - b) 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;
  - c) carry out other activities specified in Annex 1 (*Technical Specification*); and
  - d) cooperate with the Buyer during the performance of this Contract
- (“**Related Activities**”).

## 2. THE PLACE OF DELIVERY

- 2.1 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 TIMELINE OF THE DELIVERY

- 3.1 The Seller shall deliver the Object of Purchase and shall carry out Related Activities within 4 months from the effectiveness of this Contract. The Buyer is entitled to postpone the time of delivery by 6 weeks, 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). In order for the Buyer to extend the time of delivery, the Seller must prove to the Buyer that such circumstances happened unless these are generally or publicly known. The Buyer 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 does not affect the right of the Buyer to withdraw from this Contract in accordance with the Article 10.



#### 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 128.000,- 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) 15 % of the Purchase Price shall be paid after the signature of this Contract; and
  - b) 85 % 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](mailto:efaktury@fzu.cz)
- 6. SELLER'S DUTIES**
- 6.1 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.
- 6.2 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.
- 6.3 All things necessary for the performance of this Contract shall procure the Seller, unless this Contract stipulates otherwise.
- 6.4 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.
- 7. HANDOVER AND ACCEPTANCE OF THE OBJECT OF PURCHASE**
- 7.1 The Object of Purchase shall be delivered to the place of delivery and handed over to the Buyer within the time stipulated in 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).



- 7.2 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.
- 7.3 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.
8. **WARRANTY AND TECHNICAL SUPPORT**
- 8.1 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.
- 8.2 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.
- 8.3 The Seller shall remove defects and deficiencies that occur during the warranty period free of charge and in the terms stipulated in this Contract.
- 8.4 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.
- 8.5 The Buyer notifies defects and deficiencies in writing via e-mail. The Seller shall accept notifications of defects on the following e-mail address: **siatel@siatel.it**. The Seller shall confirm within 24 hours from the receipt of the notification.
- 8.6 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 Buyer, however the Buyer shall take into consideration recommendation from the Seller.

- 8.7 The Seller shall remove the defect within 6 weeks from its notification, unless Parties agree due to the nature of the defect otherwise.
- 8.8 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.
- 8.9 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.
- 8.10 The warranty does not cover defects caused by unprofessional manipulation or by the failure to follow Seller's instructions for the operation and maintenance of the Object of Purchase.
- 8.11 In addition to warranty, the Seller shall provide remote technical support (over the internet or phone) during the period of 1 year (during regular working hours) from the signature of the acceptance protocol.

## 9. **PENALTIES**

- 9.1 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.
- 9.2 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.
- 9.3 The total amount that the Seller shall be obliged to pay on contractual penalties shall not exceed 10% of the Purchase Price.
- 9.4 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.



## 10. **RIGHT OF WITHDRAWAL**

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

- a) the Seller shall be in delay with the fulfilment of this Contract and such delay lasts more than 1 month;
- b) 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;
- c) the insolvency proceeding is initiated against the Seller; or
- d) 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.

## 11. **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 access 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.

## 12. **REPRESENTATIVES OF THE PARTIES**

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

In technical matters:

Name: Paolo Nicotra

E-mail: paolo.nicotra@siatel.it

Tel.: +393497603561

In contractual matters:

Name: Paolo Nicotra



EUROPEAN UNION  
European Structural and Investing Funds  
Operational Programme Research,  
Development and Education



MINISTRY OF EDUCATION,  
YOUTH AND SPORTS

E-mail: paolo.nicotra@siatel.it

Tel.: +393497603561

12.2 The Buyer appoints following representative for the communication with the Seller:

In technical matters:

Jméno: Francesco Schillaci

E-mail: Francesco.Schillaci@eli-beams.eu

The appointed representative 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 representative is also authorized to notify defects and execute (sign) all protocols foreseen by this Contract. The appointed representative of the Buyer are not entitled to change or supplement this Contract.

### 13. **SOCIAL, ECOLOGICAL AND INNOVATIVE ASPECTS**

13.1 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

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

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

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

13.1.4 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

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

### 14. **FINAL PROVISIONS**

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





- 14.2 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.
- 14.3 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.
- 14.4 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.
- 14.5 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.
- 14.6 All modifications and supplements of this Contract must be in writing.
- 14.7 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.
- 14.8 This Contract is executed in four (4) counterparts and every Party shall receive two (2) counterparts.
- 14.9 An integral part of this Contract is Annex 1 (Technical Specification). 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.
- 14.10 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:



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European Structural and Investing Funds  
Operational Programme Research,  
Development and Education



MINISTRY OF EDUCATION,  
YOUTH AND SPORTS

## **Seller**

Signature: \_\_\_\_\_

Name: Paolo Francesco Nicotra

Position: Sole director

Date:




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European Structural and Investing Funds  
Operational Programme Research,  
Development and Education



## **ANNEX 1**

### **TECHNICAL SPECIFICATION**

<b>Confidentiality Level</b>	<i>PU - Publish</i>	<b>TC ID / Revision</b>	00303071/D
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	<b>Position</b>	<b>Name</b>	
<b>Responsible person</b>	Senior Engineer	Francesco Schillaci	
<b>Prepared by</b>	Senior Engineer	Francesco Schillaci, Filip Grepl, Lorenzo Giuffrida	

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Viktor Fedosov	Group Leader of Quality and Planning		<a href="#">Via TC</a>
Pavel Bakule	Group Leader of L1 Allegra Laser		NOTICE ( <i>category B</i> )
Jiří Kubricht	Lawyer		<a href="#">Comments via e-mail</a>

<b>Approved by</b>			
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Daniele Margarone	Head of department of Ion Acceleration		<a href="#">Via TC</a>
F. Schillaci	Senior Engineer		<a href="#">Via TC</a>

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## 1. Introduction

### 1.1. Purpose

This Requirements Specification Document (RSD) lists the technical requirements and constraints on product applying in Department of Ion Acceleration and Applications of High Energy Particles (Dept. 87) of ELI Beamlines 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, safety and quality requirements for the product **Electronics and software for the upgrade of ELIMAIA technology with high precision mechanics control system** (further "Automation of mechanical devices") PBS: **E.E4.ELMA.ELMD**. This product is a product Category B according to the ELI – Beamlines categorization.

### 1.3. Terms, Definitions and Abbreviations

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

Abbreviation	Meaning
API	Application Programming Interface
CA	Contracting Authority
ELI	Extreme Light Infrastructure
ELIMAIA	ELI Multidisciplinary Applications of laser-Ion Acceleration
EPICS	Experimental Physics and Industrial Control System
OAP	Off-Axis Parabola
RSD	Requirements Specification Document

### 1.4. Referenced documentation

Number of document	Title of document
RD-01	00300575/A Manual for operation and maintenance of E4 technology

### 1.5. 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 and proves that the offer meets in an equivalent manner the standards or technical documents the CA shall not reject its bid.

## 2. Functional, Performance and Design requirements

Three devices are included in the scope of supplies, whose controls is a major upgrade of the local ELIMAIA control system. These devices are:

- 1- The **Plasma mirror system**, which consists of two target positioners, two OAP mounts and one mirror mount (subsystems)
- 2- The **Collimation and diagnostics system**, for the advanced Thomson Parabola Spectrometer, which consists of a double blade collimator and two CCD cameras
- 3- The **Target Tower**, which consist of a main target holder, a monitoring camera, a target conveyor and a loading mechanical arm (subsystems).

### 2.1. General requirements for the plasma mirror setup, the Target Tower and the Collimator with diagnostics system

The **Plasma mirror system**, the **Target Tower** and the **Collimation and diagnostics system** are high precision mechanical systems already designed and under manufacturing. The scope of supply is to realize a suitable electronics and software able to exploit the features of these mechanical systems. The systems and the required functionalities are described in the following.

The following description of the three systems lists also the device (actuators, limit switches and encoder) used in the mechanic. These devices are not in the scope of supply.

REQ-032148/A

The electronics (control hardware) of these two system shall be realized using the National Instrument devices provided by the CA:

- 5 (five) SB Rio processor
- 1 (one) IC 3120
- 2 (two) IC 3173

Cabling both in-vacuum and in-air.

*NOTE: The pin-out will be done by CA's technicians according specifications of the supplier. The vacuum feedthroughs used are MIL-C type.*

REQ-032149/A

The electronics (control hardware) shall be realized as an upgrade of the actual electronics devices installed in the 19" racks containing the controls of all other technology already in use

REQ-032150/A

The electronics (control hardware) shall be designed and realized in a suitable way to control the mechanics of the above mentioned mechanical devices.



REQ-032151/A

Control software shall be compatible with LabView and harmonized/integrated with already existing solutions. Taking into account interactions with other devices such vacuum chambers, magnets and mechanical components.

REQ-032665/A

Any custom software development shall be done in a form that is easy to integrate and maintain by ELI, using a language, development environment and platform that is compatible with ELI standard control systems.

REQ-032152/A

The controls (software and hardware) shall be based on the existing solution for operating the actual target tower, OAP mounts and mechanical devices in the beamline, as these systems are an upgrade of prototypes already developed and commissioned (see RD-01).

## 2.2. General requirements for the Integration

REQ-032666/A

The Supplier shall make a reasonable effort to provide EPICS integration for the delivered system, including publishing of the most important process variables and remote control of the most frequently used system operations, both for newly requested features and for existing features of the control system being modified.

*NOTE 1: The CA can provide open source software (LabVIEW 2019 SP1) including the APIs for EPICS to the Supplier, along with examples, training, assistance and documentation, to help them introduce these data interfaces directly into their code and host it on their controls hardware. The API supports most native LabVIEW datatypes and simple clusters, is fully LabVIEW-native and is compatible with most NI target types. An alternative method for EPICS integration of the system may also be used, subject to approval of the CA.*

*NOTE 2: The subject of this requirement is not mandatory for acceptance if fulfilling them will conflict with other mandatory requirements, delivery time and budget.*

REQ-032667/A

The Supplier shall make a reasonable effort to provide an interface to the CA's database for configuration management of all key system settings and parameters, both for newly requested features and existing features of the control system being modified.

*NOTE 1: The Supplier should ensure that all configuration parameters (e.g., axis settings or calibration data) are stored in a format compatible with being hosted, read and restored from an external database on demand.*

*NOTE 2: The CA can provide open source software (LabVIEW 2019 SP1) including the APIs for database access to the Supplier, along with*

examples, training, assistance and documentation, to help them introduce this interface directly into their code and host it on their controls hardware. The configuration database API can accept any LabVIEW variant datatype, is fully LabVIEW-native and is compatible with most NI target types. An alternative method for configuration database integration of the system may also be used, subject to approval of the CA.

NOTE 3: The subject of this requirement is not mandatory for acceptance if fulfilling them will conflict with other mandatory requirements, delivery time and budget.

REQ-032668/A

The Supplier shall make a reasonable effort to provide the original LabVIEW deployment projects and the source code files.

NOTE 1: The source code diagrams may be locked in order to protect the intellectual property of the Supplier. The CA does not require the ability to view the VI block diagrams, only update any dependencies, recompile, rebuild and redeploy the provided source code, e.g., to handle controller failures when there is an urgent deadline to resolve.

NOTE 2: The subject of this requirement is not mandatory for acceptance if fulfilling them will conflict with other mandatory requirements, delivery time and budget.

## 3. Plasma Mirror system requirements

### 3.1. General requirements for the plasma mirror setup

A scheme of the full **Plasma mirror system** is shown in the following Figure 1, where its 4 subsystem are marked.

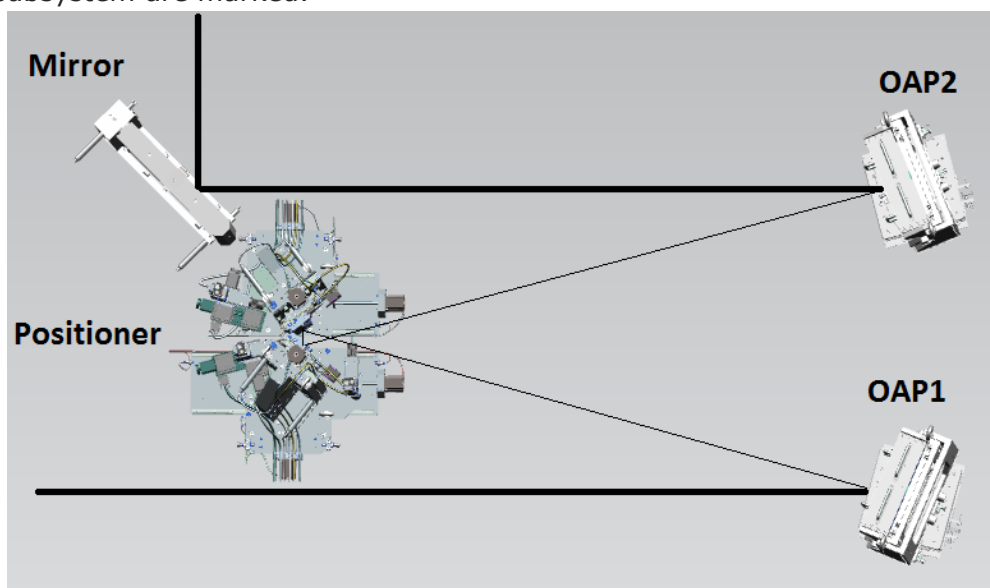
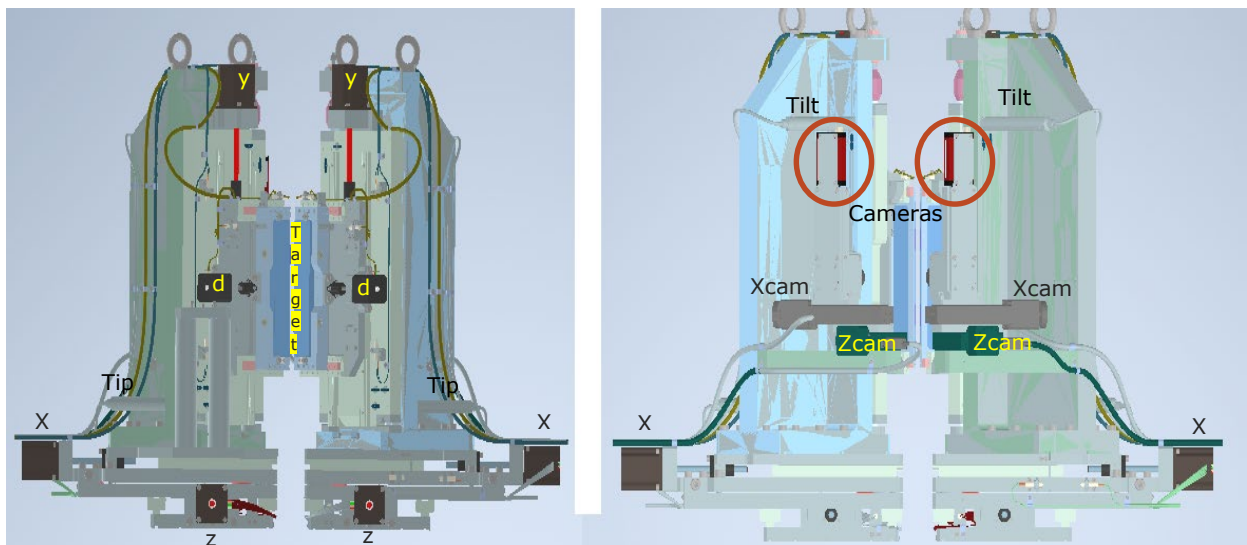


Figure 1: Plasma mirror setup with ideal laser path (black lines)

The plasma mirror consists of four subsystem and each of them is equipped with the following items:

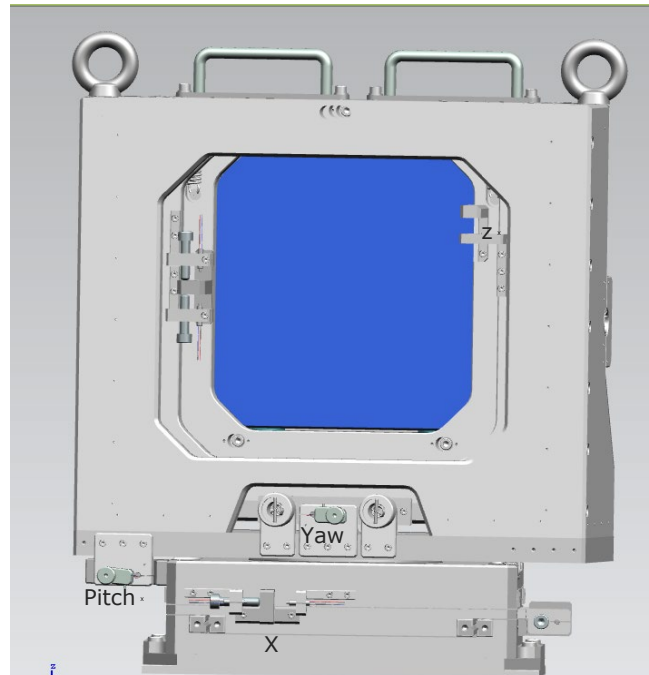
- **Subsystem1: the Positioner** (two twin target position towers), each of them has:
  - Haydon-Kerk E57H4A-12-A12 for Z axis (left Tower)
  - Haydon-Kerk E57H4A-12-A13 for X axis (both left and right tower)
  - Haydon-Kerk E43M4Y-12-A08 for d axis (both left and right tower)
  - Haydon-Kerk E57H42-12-A10 for Y axis (both left and right tower)
  - Haydon-Kerk E57H4A-12-A11 for Z axis (right tower)
  - PI Linear actuator L-220 1856 for Tilt axis (both left and right tower)
  - PI Linear actuator L-220 1858 for Tip axis (both left and right tower)
  - Two Manta camera G-319C for alignment
  - Linear stage Standa 8MT175V-50-VSS42 for Xcam axis (both cameras positioning)
  - Linear stage Standa 8MT175V-100-VSS423 for Zcam axis (both cameras focusing)
  - IRELEC limit switches SW3 for X, Y, Z and d axis (both towers)

A scheme of the twin position tower is in **Figure 2**, the left hand side shows a front view of the device, right hand side shows the back view. In the above list, the indication of left and right tower is according the left hand side of **Figure 2**.



**Figure 2: Front (left side) and back view (right side) of Positioner towers with axes designation**

- **Subsystem2: OAP1**, its mount is equipped with:
  - 5 LTAHSPV6 for x, y, z, pitch and yaw axes
  - 6 limit switches Metrol GN-PT5M3A for the x, y, z axes



**Figure 3: OAP1 Scheme with axes designations**

- **Subsystem3: OAP2**, its mount is equipped with:
  - 3 LTAHSPV6 for y, pitch and yaw axes
  - 2 limit switches GN-PT5M3A for the x, y, z axes
  - Two motors Haydon-Kerk E57H4A-12-A12One for x and z axes
- **Subsystem4: Mirror Mount**, its mount is equipped with
  - 2 LTAHSPV6 for tip and tilt axes
  - Stage for x and z two motors Haydon-Kerk E57H4A-12-A12One

REQ-032153/A

The control hardware shall be equipped with suitable drivers for controlling the actuators.

REQ-032154/A

The control hardware shall be able to control the two manta cameras (acquiring and storing images).

REQ-032155/A

The control hardware shall be realized in a compatible way with 19" racks and integrated with already existing control hardware.

REQ-032156/A

The control hardware shall be able to accept a trigger signal (24V, more details can be provided) and change position automatically sending a feedback.

*NOTE: See next section for functional specification of the software control. A possible scheme for trigger is shown in Figure 4.*

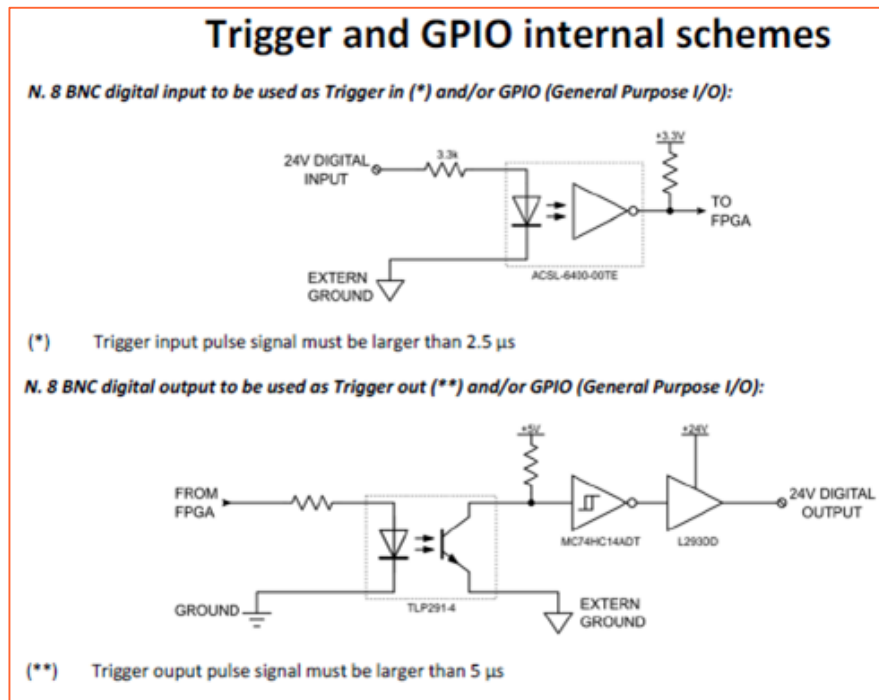


Figure 4: Trigger internal schemes

REQ-032157/A

The control hardware shall be equipped with ETH socket for communication with control PC where the software will be installed  
*NOTE: The control PC is not in the scope of supply.*

REQ-032158/A

A dry contact to inform that the system is in the „on beam position” shall be provided as an output.

REQ-032159/A

An RJ45 socket to install a small touch panel for local operation shall be provided.

### 3.2. General software control requirements for the plasma mirror setup

REQ-032160/A

The control software shall allow independent configuration of each axis present in the full system.

REQ-032161/A

The control software shall allow independent configuration of each limit switch present in the full system (NC or NO).

REQ-032162/A

Configuration of actuators and limit switches shall be done using a separated interface, integrated in the main software and protected by password.

REQ-032163/A

Each axis shall be enabled/disabled independently with a specific command present in the interface.

REQ-032164/A

An "enable/disable all" command shall be present for each subsystem of the plasma mirror setup.

REQ-032165/A

The control software shall be harmonized with the actual control software for the optomechanics used in the ELIMAIA local beam transport and the vacuum chamber where it will be installed.

### Control of the Positioner (Subsystem 1)

REQ-032167/A

The positioner shall have a control software able to allow the use of the two towers in a harmonized way (movement of one tower corresponds to the movement of another one) and with the functionalities described in the following.

REQ-032168/A

The functionality **Free mode of each axis** shall allow to move each axis using:

- Homing: homing of the actuators according the limit switches position
- Absolute position command: motion of the actuator to a certain position
- Relative position command: displacement of the actuator with respect to the actual position
- Stop function

REQ-032169/A

The GUI functionality shall show the following information for each axis:

- Disabled/Enabled: axis enabled/disabled
- Limit switch status
- Homing: axis is not referenced(red)/referenced(green)/ (yellow) for Homing in progress
- RUN: actuator is moving
- FAULT: driver is faulty
- ALARM: driver is in alarm

REQ-032170/A

The functionality **Auto movement** shall allow to program a series of positions for the Positioner and the execution of the displacement in series. It shall have two sub-functionalities: Automatic Control and Position Table.

## REQ-032171/A

The sub-functionality **Position Table**, used for creating a table of positions to be used in automatic sequence separately for each tower, shall specifically allow to:

- show the actual position of each axis and the motors status
- store a specific position of the all actuators on a table (text file visible on the GUI)
- set a specific position to move all the axes to a certain position stored previously
- decide if the position has to be used or discarded
- Position Table section:
  - The number of position is not limited and the sequence of different positions follows the order of the table.
  - load a previously saved position table
  - edit and enabling/disabling a certain set of coordinates
  - create a new empty table
  - open a pop-up window showing the location of the saved positions.

## REQ-032172/A

The sub-functionality **Automatic Control**, used for automatic management of the Positioner and can be used only if all the axes are referenced, shall allow to:

- load a file with position. This will populate the Position List present in the GUI and also the graphic representation section.
- select TRIGGER or MANUAL mode
- start the sequence according to the selected mode (Trigger/Manual) with the following specific behaviors:
  - In TRIGGER mode the system should go to the first set of coordinate on the table. Then the system will wait for the trigger signal to move to the second position, next trigger will move it to third position and etc.
  - In Manual mode the system will wait for the user to move to the next position when pressing the software button
- stop the automatic procedure when user press the software button

## REQ-032173/A

The Position control software shall allow to control, acquire and save images using the two Manta cameras that are used for alignment.

### 3.2.1. Control of the OAP1 and OAP2 (Subsystem 2 and 3)

REQ-032174/A

Three different functionalities shall be available for the OAP1: Free, Function and Oscillation.

*NOTE: These three modes affect the way of controlling the z axis as master and eventually the x axis as a slave.*

REQ-032175/A

**Free mode** shall allow moving each axis independently and with the same functionalities as in the Positioner (see section 3.2.1.).

REQ-032176/A

**Function mode** shall allow controlling the z axis as master and the x axis as a slave. The y, yaw and pitch axes are in the Free Mode under this modality.

REQ-032177/A

In Function mode the z and the x axes shall be linked by a gearing command: a certain ratio between the z and x displacement shall be defined and, when the z is moving the x displacement shall be according this ration.

If the ratio is set to 0 the x shall not move.

REQ-032178/A

**Oscillating mode** shall allow setting a range around which the z axis will be automatically moved and the speed of the movement as well. The Oscillating mode shall have the possibility to include the gearing of the x axis as described above.

REQ-032179/A

**Position table for OAP2:** This functionality shall allow to program a series of positions for the OAP2 and the execution of the displacement in series. This mode shall work for the x-axis and the z-axis in the same way as for the Positioner (see section 3.2.1).

### 3.2.2. Control of the Mirror Mount (Subsystem 4)

REQ-032180/A

For the Mirror Mount a free mode of the two tip and tilt axes shall be done with the same functionalities as in the Positioner case (see section 3.2.1).

REQ-032181/A

The functionality **Position table for x-axis** shall allow to program a series of positions for the mirror mount and the execution of the displacement in series. This mode shall work for the x-axis in the sme way as for Positioner (see section 3.2.1).



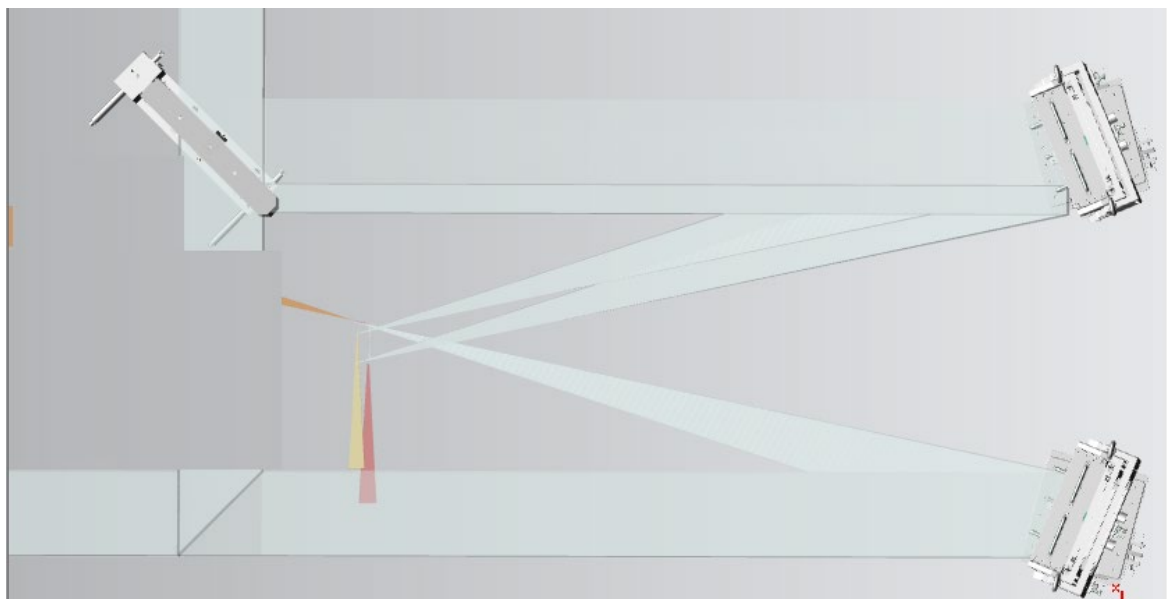
### 3.2.3. Matching of large displacement of OAP2 and Mirror Mount

The OAP2 has One double axis translation stage Haydon-Kerk E57H4A-12-A12One for x and z axes and the Mirror Mount has Stage for x and z Haydon-Kerk E57H4A-12-A12One.

REQ-032251/A

The control of the x and z axes shall be synchronized and harmonized in order to have the mirror always centered with respect to the OAP2 position (also in the auto-move mode).

*NOTE: The reason of this request is better explained using Figure 5. According to the specific position of the positioner, the real laser path can be shifted from the ideal path, this means that the OAP2 should be shifted accordingly and the position of the Mirror mount shall allow to have always the mirror perfectly aligned with the OAP2 to receive the beam and send it in the correct direction towards following beampath (not shown here). The angles marked in the Figure 5 shall be contained. Therefore the motion of the OAP2 and the mirror mount needs to be synchronized in all motion functionalities.*



**Figure 5: Laser beam path range**

## 4. Target tower system requirements

### 4.1. General technical requirements for the plasma mirror setup

A scheme of the full Target Tower system is shown in the following Figure 6.

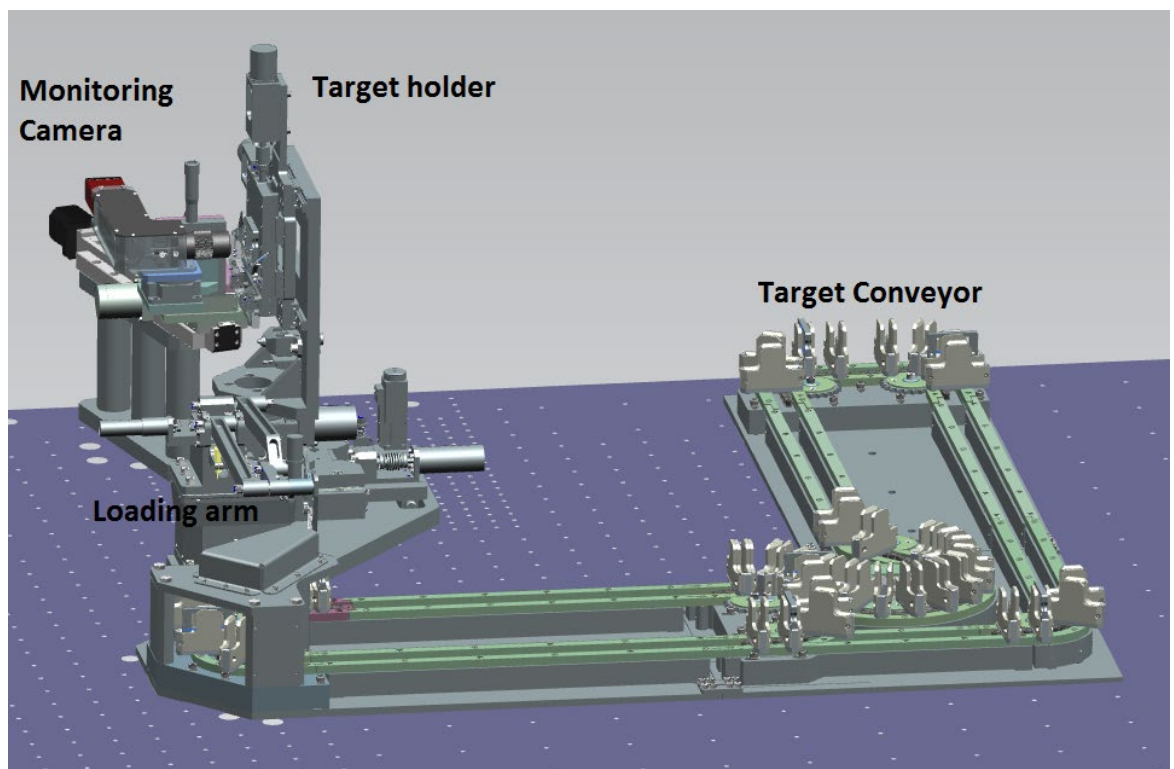
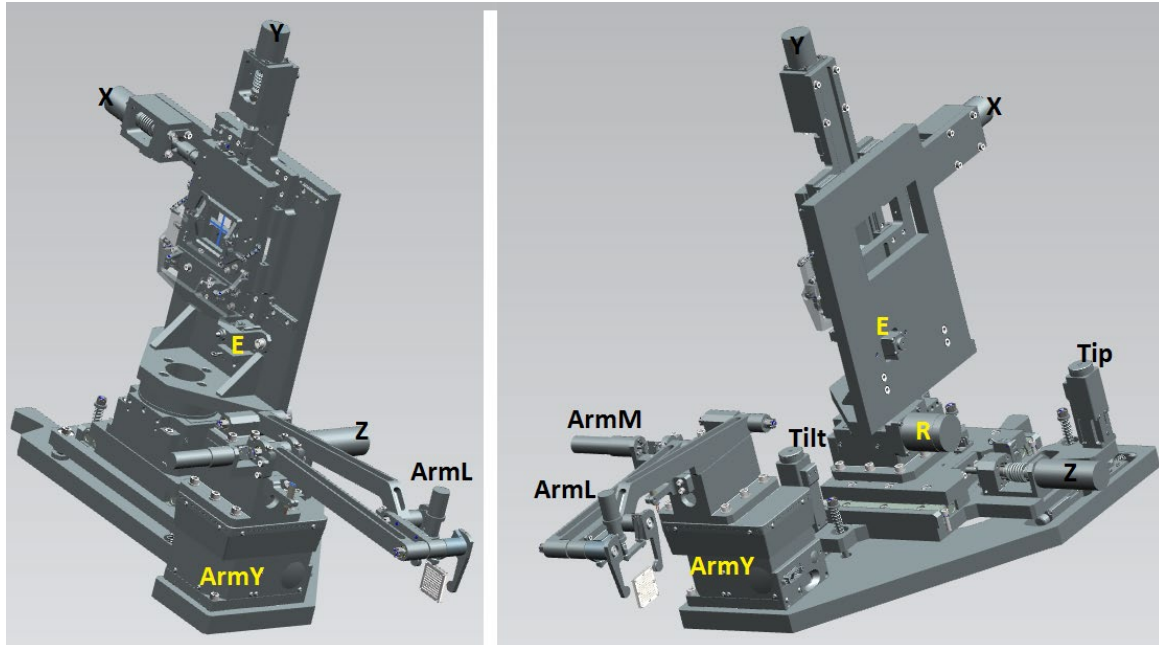


Figure 6: Target Tower system with sub-systems marked

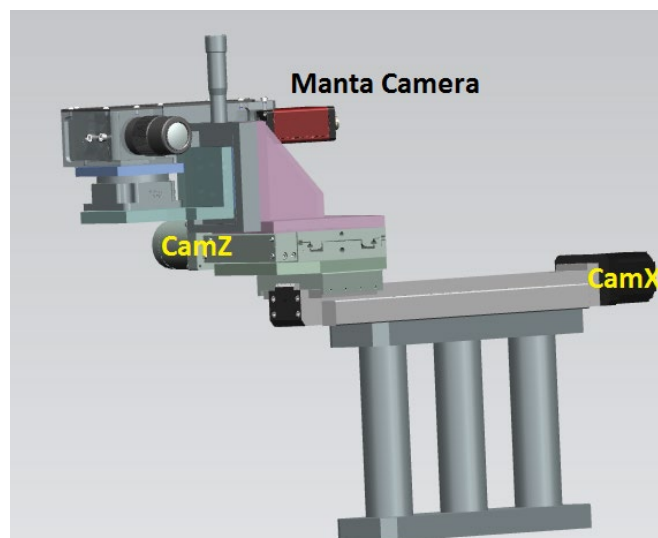
- The Target tower consists of four subsystem and each of them is equipped with the following items:
  - **Subsystem1: Target holder + loading arm**, is equipped with the following items:
    - Phytron-VSS32.200.1.2-UHVG for X and Y axes
    - Phytron-VSS32.200.1.2-UHVG+GearVGLP32 for Z axis
    - Standa 8CMA28-10 for Tip and Tilt axis
    - Standa 8CMA20-8-15 for E axis
    - Standa Rotational Stage 8MR190V-2-VSS42 for R axis
    - PI Zstage-L-310 for ArmY axis
    - Phytron-VSS-20.200.1.2+GearVGPL22 for ArmM axis
    - Phytron-VSS-17.200.1.2+GearVGPL16/48 for ArmL axis
    - Potentiometric encoders MicroEpsilon WDS40-MT-19-P for X, Y and Z axes
    - IRELEC limit switches SW3 for X, Y, Z, ArmL and ArmM axes

A scheme of the twin position tower is in Figure 7, the left hand side shows a front view of the device, right hand side shows the back view.



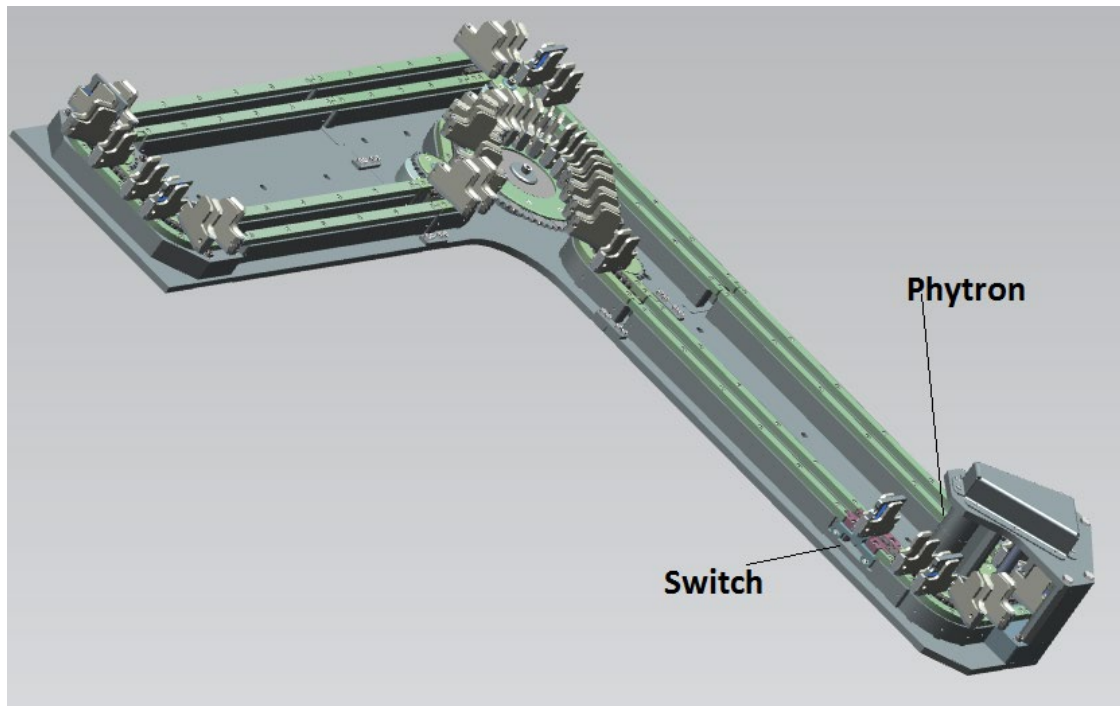
**Figure 7: Front (left side) and back view (right side) of Target Holder + Loading arm with axes designation**

- **Subsystem2: Monitoring Camera**, is equipped with:
  - Standa Linear Stage 8MT160-300 for CamX axis
  - Standa translation stage 8MT167V-25 for CamZ axis
  - Manta Camera C-235



**Figure 8: Monitoring Camera scheme with axes designations**

- **Subsystem3: Target conveyor**, is equipped with
  - Phytron VSS 42.2001.2+VGPL42/30 for changing the target on the loading position
  - Position switch GN-BP5MA-R to stop the motor when the fresh target is on the loading position



**Figure 9: Target conveyor**

REQ-032182/A

The control hardware shall be equipped with suitable drivers for controlling the actuators.

REQ-032183/A

The control hardware shall be able to control the two manta cameras (acquiring and storing images).

REQ-032184/A

The control hardware shall be realized in a compatible way with 19" racks and integrated with already existing control hardware.

REQ-032185/A

The control hardware shall be able to accept a trigger signal (24V, more details can be provided) and change position automatically sending a feedback. See next section for functional specification of the software control. A possible scheme for trigger is shown in Figure 4 (see section 3.1.)

REQ-032186/A

The control hardware shall be equipped with ETH socket for communication with control PC where the software will be installed  
*NOTE: The control PC is not in the scope of supply.*

REQ-032187/A

A dry contact to inform that the system is in the "on beam position" shall be provided as an output.

REQ-032188/A

An RJ45 socket to install a small touch panel for local operation shall be provided.

## 4.2. General software control requirements for the Target Tower

REQ-032189/A

The control software shall allow independent configuration of each axis present in the full system.

REQ-032190/A

The control software shall allow independent configuration of each limit switch present in the full system (NC or NO).

REQ-032191/A

Configuration of actuators and limit switches shall be done using a separated interface, integrated in the main software and protected by password.

REQ-032192/A

Each axis shall be enabled/disabled independently with a specific command present in the interface.

REQ-032193/A

An "enable/disable all" command shall be present for each subsystem of the plasma mirror setup.

REQ-032194/A

The control software shall be harmonized with the actual control software for the optomechanics used in the ELIMAIA local beam transport and the vacuum chamber where it will be installed.

REQ-032195/A

The control software shall take into account the presence of surrounding devices and avoid clashes, especially between the monitoring camera subsystem and the mechanical displacement system of the magnets, see Figure 10.

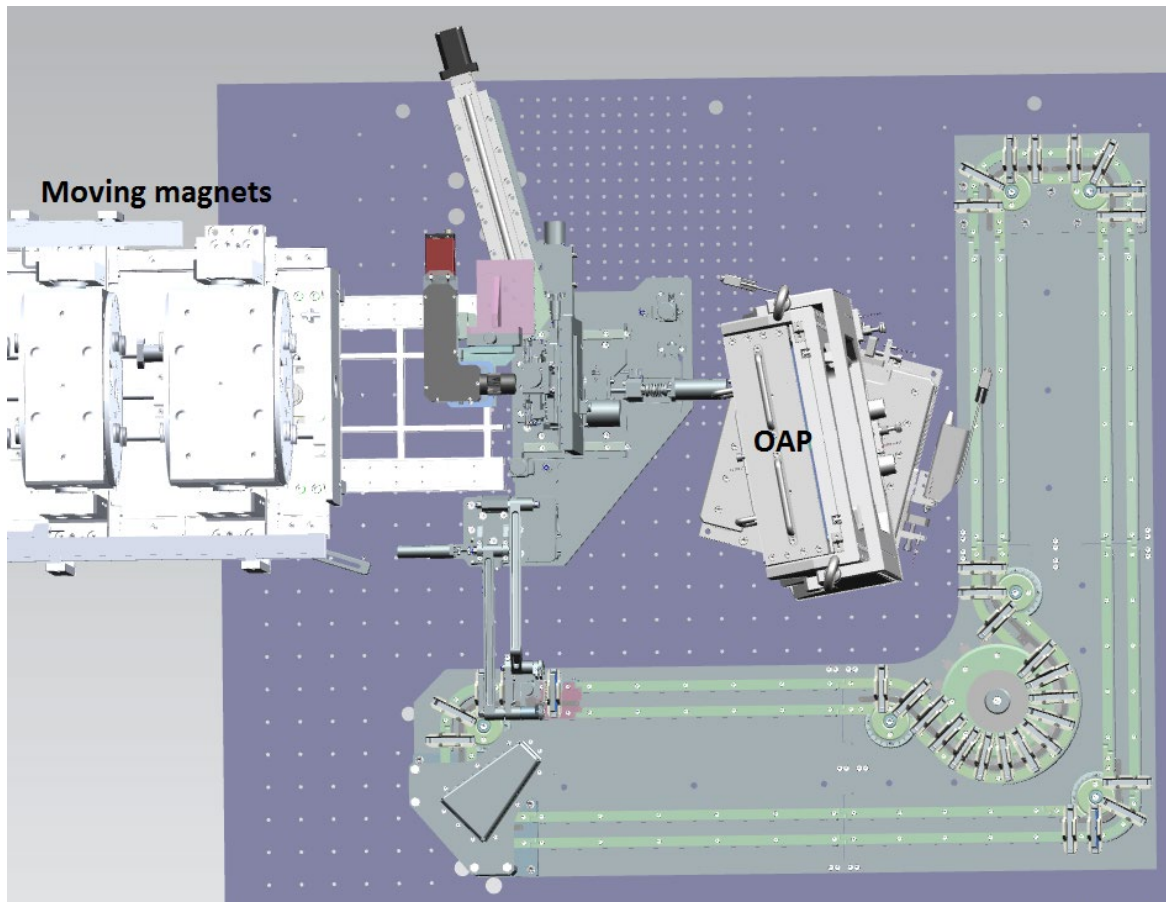


Figure 10: Target Tower with critical systems

#### 4.2.1. Control of the Target holder (Subsystem 1)

REQ-032196/A

The Target holder shall have a control software able to allow the use of the holder in a harmonized way and with the functionalities described in the following.

REQ-032197/A

The functionality **Free mode of each axis** shall allow to move each axis using:

- Homing: homing of the actuators according the limit switches position
- Absolute position command: motion of the actuator to a certain position
- Relative position command: displacement of the actuator with respect to the actual position
- Stop function

REQ-032198/A

The GUI shall show the following information for each axis:

- Disabled/Enabled: axis enabled/disabled
- Limit switch status
- Homing: axis is not referenced(red)/referenced(green), (yellow) for Homing in progress
- RUN: actuator is moving
- FAULT: driver is faulty
- ALARM: driver is in alarm

REQ-032199/A

The **Auto movement** functionality shall allow to program a series of positions for the Target Holder and the execution of the displacement in series. It shall have two sub-functionalities: Automatic Control and Position Table.

REQ-032200/A

The sub-functionality **Position Table**, used for creating a table of positions to be used in automatic sequence, shall specifically allow to:

- show the actual position of each axis and the motors status
- store a specific position of the all the actuators on a table (text file visible on the GUI)
- set a specific position to move all the axes to a certain position stored previously
- decide if the position has to be used or discarded
- Position Table section:
  - The number of position is not limited and the sequence of different positions follows the order of the table.
  - load a previously saved position table
  - edit and enabling/disabling a certain set of coordinates
  - create a new empty table
  - open a pop-up window showing the location of the saved positions.

REQ-032201/A

The functionality **Automatic Control**, which is used for automatic management of the Positioner and can be used only if all the axes are referenced, shall allow to:

- load a file with position. This will populate the Position List present in the GUI and also the graphic representation section
- select TRIGGER or MANUAL mode
- start the sequence according to the selected mode (Trigger/Manual) with the following specific behaviors:
  - In TRIGGER mode the system should go to the first set of coordinate on the table. Then the system will wait for the trigger signal to move to the 2nd position

- In Manual mode the system will wait for the user to move to the next position
  - stop the automatic procedure

## REQ-032202/A

The control software shall allow to control camera monitoring sub-system, bring the camera in a user defined position (focusing position), acquire and save images using the Manta camera which is used for alignment.

## REQ-032203/A

The control software shall control the loading arm and the conveyor with the following procedure:

- A single target frame is already loaded on the target holder and aligned for a number of laser shots defined by the user.
- When the number of shots defined by the user is completed, the frame is ejected using the E axis.
- The control software then starts the loading arm, which collects a fresh frame from the conveyor and loads it in the target holder.
- The conveyor rotates and put a fresh frame in the loading position.
- The load arm goes in the rest position, which is the collecting position.

## REQ-032204/A

The control software shall allow to control two different setup of the conveyor, in which the number of loaded frames is different (Figure 11).

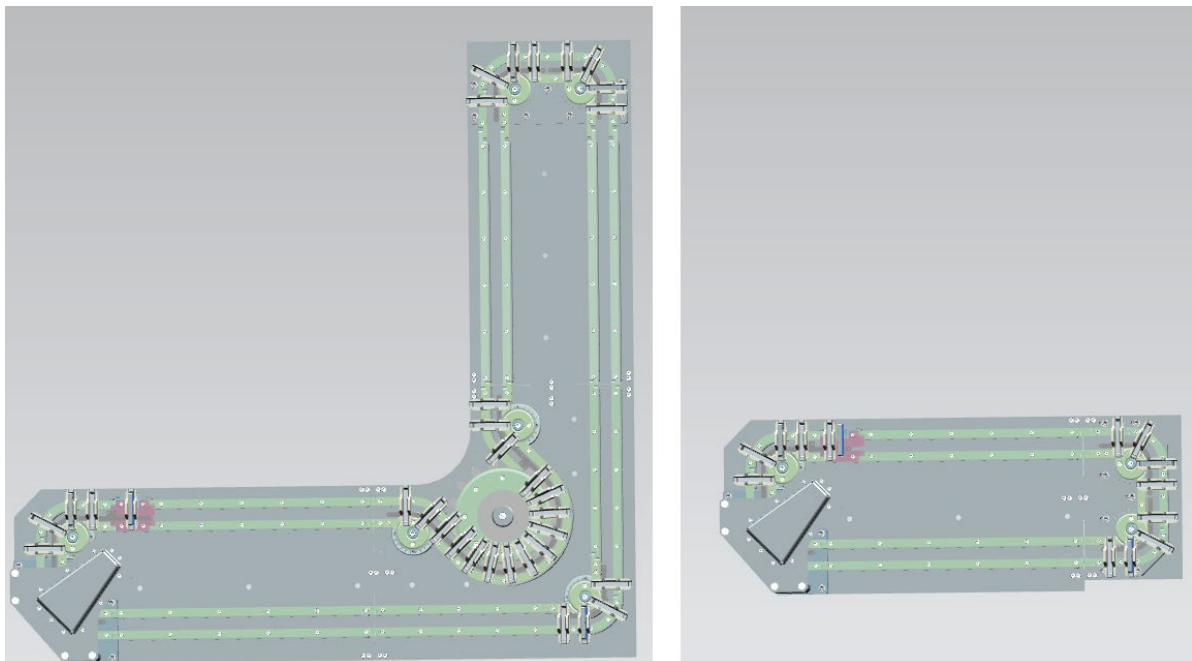


Figure 11: long and short conveyor setup



## 5. Collimation and diagnostics system

### 5.1. General requirements for the plasma mirror setup

A scheme of the full system is described in Figure 12, where the location of the two subsystems is shown.

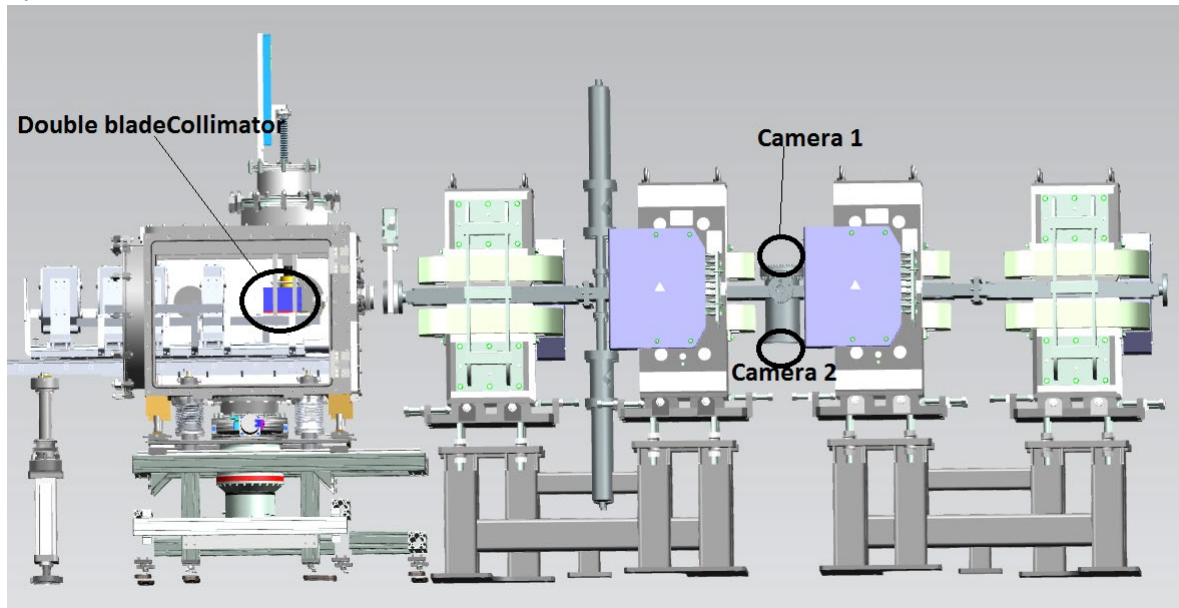


Figure 12: Scheme showing position of the collimator and the diagnostics

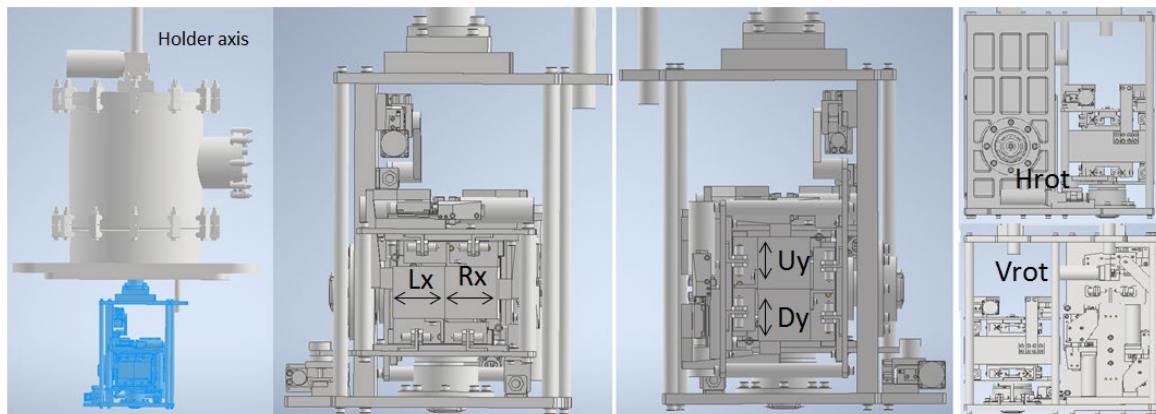
The full collimation and diagnostics systems consists of two subsystems: a **double blade collimator** and a **diagnostics acquisition system**.

The **diagnostics acquisition system** is made of two CCD cameras type Manta C235. They are used to acquire images during the experiment and they have to be controlled with the same interface allowing visualization and storing of the images including adjustment of main parameters such as gain, acquisition time. The two CCD cameras shall be turned on and off using the main interface and should be able to receive a trigger signal similar to the trigger described above.

The **double blade collimator** is a 7 axes system, as shown in Figure 13, where also the axes are indicated with their name.

The **double blade collimator** is equipped with the following items:

- MecVel HT05 with T56A actuator for Holder axis
- The other 6 axes are equipped with:
  - Phytron-VSS25.200.1.2-UHVG+GearVGLP26/3
  - IRELEC limit switches SW3
  - Microepsilon WDS-40-MT19-P draw-wire displacement sensors with potentiometric output



**Figure 13:** Starting from the left this set of images shows the full view of the system, detailed view of the front side, back side, and left and right sides with indication and naming of each axis.

REQ-032205/A

The control hardware shall be equipped with suitable drivers for controlling the actuators in a closed-loop mode.

REQ-032206/A

The control hardware shall be able to control the two manta cameras (acquiring and storing images).

REQ-032207/A

The control hardware shall be realized in a compatible way with 19" racks and integrated with already existing control hardware.

REQ-032208/A

The control hardware shall be able to accept a trigger signal (24V, more details can be provided) for CCD cameras acquisition.

REQ-032209/A

The control hardware shall be equipped with ETH socket for communication with control PC where the software will be installed  
*NOTE: The control PC is not in the scope of supply.*

REQ-032210/A

The hardware shall be provided with anti-collision system to avoid clashes between the collimator and the magnet system placed in front of it.

*NOTE: The Anti-collision can be eventually done in the control software if it involve invasive modification of the existing hardware.*

REQ-032211/A

An RJ45 socket to install a small touch panel for local operation shall be provided.

## 5.2. General software control requirements for the Collimation and diagnostics system

REQ-032212/A

The diagnostic subsystem shall have a control software able to visualize the two CCD cameras, acquire and store images continuously, at user request or according a trigger signal.

REQ-032213/A

The diagnostic subsystem shall have a control software allowing the user to adjust the cameras` settings.

REQ-032214/A

The diagnostic subsystem shall have a control software able to turn on and off the cameras.

REQ-032215/A

The double blade collimator shall have a control software able to allow the use of each axis in a harmonized way and with the functionalities described in the following.

REQ-032216/A

The **Free mode of each axis** functionality shall allow to move each axis using:

- Homing: homing of the actuators according the limit switches position
- Absolute position command: motion of the actuator to a certain position
- Relative position command: displacement of the actuator with respect to the actual position
- Stop function

REQ-032217/A

The GUI shall show the following information for each axis:

- Disabled/Enabled: axis enabled/disabled
- Limit switch status
- Homing: axis is not referenced(red)/referenced(green)/ (yellow) for Homing in progress
- RUN: actuator is moving
- FAULT: driver is faulty
- ALARM: driver is in alarm

REQ-032218/A

The holder axis shall work only in two position: on beam and out of beam.

REQ-032219/A

The other axes shall work in closed loop and the user shall be able to set the position which has to be set with the precision of 0.01mm.

## 6. Transportation and Installation Requirements

### 6.1. General Transportation and Installation Requirements

REQ-032220/A

Supplier shall provide procedures for installation of equipment (scheme of cabling and pinout).

REQ-032221/A

The technologies and instruments shall be delivered in the protective package preventing damage and contamination and shall be packed in a minimum of two plies separate clean packaging. The technologies shall be cleaned and packaged in clean environment of ISO class 7, if not agreed otherwise.

REQ-032222/A

The Supplier shall ensure the safe and clean transportation to the place of delivery.

REQ-032223/A

While preparing the contracted products to delivery, the Supplier shall ensure that the maximum dimensions of goods are 3000x2000x2000 mm (length x with x high).

*NOTE: The dimensions are the maximum to pass through experimental entrance area.*

REQ-032224/A

The Supplier shall define the methods of the unloading, transportation to the final position in the ELIMAIA hall, installation and final testing of the contracted device.

*NOTE: The works related to this requirement will be done by CA's Beamlines employees under the supervision and with the collaboration of the Supplier.*

### 6.2. Marking

REQ-032225/A

All Parts shall be identified according to the technical documentation.

## 7. Safety requirements

REQ-032226/A

The supplier shall supply a **Declaration of Conformity** for each product type if the appropriate legislation determines the supplier's obligation to have a Declaration of Conformity for the purposes of a Device sale in the Czech Republic. In such a case the Declaration of Conformity shall comply with:

- Act No. 90/2016 Coll., as amended
- Act No. 20/1997 Coll., as amended

- The equivalent legal regulation of another EU member state so that the conditions for the sale of the product in the Czech Republic are met, and/or
- the relevant EU/EC regulation

*NOTE: The compliance with these obligations will be demonstrated by the (EU/EC) Declaration of conformity, other relevant documents and the CE/CCZ marking, if required by the relevant regulations. If a delivered product is not required to assess conformity according to specific legislation, the supplier declares by concluding the contract that the product complies with the general safety requirement of EU Directive 2001/95 / EC on general product safety and that the supplier duly complies their obligations under this Regulation.*

## 8. Quality requirements

### 8.1. Documentation and data control

REQ-032227/A

The Supplier shall provide the **Product 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, disassembling and cleaning;
- installation and calibration (see REQ-032126/A and REQ-032135/A);
- safe operation, maintenance and disposal procedures;
- description of cable wires or connector pins (see REQ-032127/A);
- list of spare parts, specialized tools, equipment and materials for proper maintenance or repair (if relevant);
- user manual for the software or libraries and for communication protocols.

*NOTE: The manual can be supplied in the hardcopy or PDF formats.*

### 8.2. Nonconformity Control System

REQ-032229/A

The Supplier shall establish and maintain a nonconformity control system compatible with ČSN EN ISO 9001 (equivalent to EN ISO 9001) or equivalent.

### 8.3. Specific Quality requirements

REQ-032230/A

In case of a warranty repair of products by the Supplier, the Supplier shall redo necessary parts of the verification procedure (see chapt. 7). The results of this process shall be provided to the CA.

REQ-032231/A

The Supplier shall provide information of **outgoing check control of the Product**. At least this information shall comprise a report about execution of outgoing check and fulfillment of the technical requirements defined by the product RSD, and completeness of the product.

*NOTE: All tests shall be performed by the measuring instruments with valid metrological confirmation.*

### 8.4. Acceptance

Acceptance will be carried out by the CA upon delivery of the final complete product not obviously damaged during transport (see chapters 4 and 7.3.2).

The basis for acceptance will be completed delivery and documentation summarizing the overall test results together with relevant documentation supporting the verification (i.e. Product User Manual, Declaration of Conformity 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-032229/A).

REQ-032232/A

The Acceptance phase shall demonstrate the following:

- Final product has been successfully verified by the Supplier and the results of this process has been documented in an appropriate way
- All detected nonconformities have been solved in accordance with REQ-032229/A;
- Final product is free of fabrication errors and is ready for the intended operational use.