contract No: S16/230E

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

Contract for Work

High pulse energy, thin-disk Yb:YAG based amplifiers for L1 pump laser system operating with repetition frequency of 1 kHz

Concluded in accordance with Section 2586 *et seq* of Act No. 89/2012 Coll., Czech Civil Code, as amended (hereinafter the " **Contract**")

I. CONTRACTUAL PARTIES:

1. Client:

Fyzikální ústav AV ČR, v. v. i.,
With its seat at: Na Slovance 2
Post code: 182 21 Praha 8
Represented by: prof. Jan Řídký, DrSc. - Director

Registered in the public research institutions registry maintained by the Ministry of Education, Youth and Sports of the Czech Republic,

ID No.: 68378271
VAT No.: CZ68378271

(hereinafter the "**Client**" or "**Contracting Authority**")

and

2. Contractor:

TRUMPF Scientific Lasers GmbH + Co. KG,
with its registered office at: Feringastr. 10a, 85774 Unterföhring, Germany
Id. No.: HRA 101914
registered in: Munich, Germany,
represented by: Dr. Knut Michel, Managing Director,
Bank: Baden- Württembergische Bank, Stuttgart
Tax Id. No.: DE 282770948

(Hereinafter the "**Contractor**"; the Client and the Contractor may be referred to herein jointly as the "**Contractual Parties**" or with respect to each individually as the "**Contractual Party**").

II. FUNDAMENTAL PROVISIONS:

1. The Client is the recipient of funding provided by the Ministry of Education, Youth and Sports of the Czech Republic for the Project "ELI: EXTREME LIGHT INFRASTRUCTURE – phase 2", reg. No. CZ.02.1.01/0.0/0.0/15_008/0000162, to be granted within the framework of the Operational Program Research, Development and Education ("**OP RDE**") (hereinafter the "**ELI-Beamlines Project**").

2. The aim of the ELI-Beamlines Project is to construct and operate an international research laboratory (research facility) using the latest generation of laser technology and to subsequently implement a number of future projects in basic and applied research.

3. The ELI-Beamlines Project is one of the pillars within the so-called ESFRI Roadmap created by the European Strategy Forum on Research Infrastructures which was formed at the behest of the European Commission to establish a network of pan-European research centres at the most advanced scientific levels whose aim is to facilitate, within the framework of specific scientific focus of each such research centre, a fully open access into these facilities to scientific workers exclusively on the basis of their scientific excellence (i.e. without regard to the legal or commercial status of institutions or corporations they may come from).

4. In order to successfully implement the ELI-Beamlines Project it will be necessary to execute certain work according to this Contract. The executed work shall form an integral part of the infrastructure for research, development and innovations of ELI-Beamlines in Dolní Břežany (hereinafter the "**ELI-Beamlines Infrastructure**" or "**ELI-Beamlines research centre**") and shall be further used to implement research projects in the area of interaction of highly intensive laser radiation with materials.

5. The Contractor was selected as the winner of a public procurement procedure announced by the Client in accordance with Sec. 23 Subsec. 5 letter a) Act No. 137/2006 Coll., on Public Procurement, as amended (herein after the "**Act**"), for the public contract called **"High pulse energy, thin-disk Yb:YAG based amplifiers for L1 pump laser system operating with repetition frequency of 1 kHz"** (hereinafter the "**Procurement Procedure**") and published in the information system in accordance with Sec. 17 letter g) Act, under the evidence number of the public contract 638513.

6. The documentation necessary for the execution of work consists of

   a) Technical specifications document (Requirement Specification Document) for the engagement hereunder, which forms an integral part hereof as its **Annex 1** (hereinafter the "**Technical specification**"). This Technical specification also formed a part of the tender documentation for the Procurement Procedure in the form of Annex No. 5;

   b) The Contractor's bid submitted for the Procurement Procedure in its part which lists and specifies the components comprised in the MP Amplifier Kit as specified hereby (hereinafter the "**Contractor´s Bid**"); the Contractor's Bid forms **Annex 2** to this Contract and an integral part hereof. In the case of discrepancy between the Contractor´s Bid and Technical specification the wording of the Technical specification shall prevail, unless the

Client and the Contractor expressly agree otherwise.

7. The Contractor acknowledges that the Client considers the Contractor's participation in the Procurement Procedure, provided that the Contractor complies with all qualification requirements, as the confirmation of the fact that the Contractor is capable, within the meaning of Sec 5(1) of the Civil Code, of providing performance under the Contract with such knowledge, diligence and care that is associated and expected of the Contractor's profession, and that the Contractor's potential performance lacking such professional care would give rise to corresponding liability on the Contractor's part. The Contractor is prohibited from misusing his qualities as the expert or his economic position in order to create or exploit dependency of the weaker party or to establish an unjustified imbalance in the mutual rights and obligation of the parties.

8. The Contractor acknowledges that the Client is not, in connection to the subject of this Contract, an entrepreneur, and also that the subject of this Contract is not related to any business activities of the Client.

9. The Contractor declares that he possesses all professional qualifications to execute the work, that he is authorized to carry out activities foreseen hereunder, and that there are no obstacles on his part that would prevent him from executing the work contracted hereunder.

10. The Contractor is fully aware that the deadlines for the execution of the work or its parts are vital for the Client with regard to the EU-Beamlines Project tie-in activities and the date by which this project has to be implemented, and that in the event of a failure to meet these deadlines, damage may arise to the Client. The Client has notified the Contractor what are the tie-in projects' deadlines specified hereunder in connection with the ELI-Beamlines Project deadlines – see www.eli-beams.eu.

III. SUBJECT AND EXTENT OF WORK:

1. The subject-matter hereof is namely:

   a) obligation of the Contractor to perform for the Client duly and on time, in accordance with the terms hereof, on its own account and liability, and within the deadlines agreed upon herein:

      (i) design, manufacture, assemble, test, deliver and install to the Client in the place of delivery hereof the regenerative amplifier (hereinafter as the "**R Amplifer** or **Deliverable 1**"), and

      (ii) design, manufacture, assemble, test, deliver and install to the Client in the place of delivery hereof components necessary for assembling and final installation of the multipass amplifier (hereinafter as the "**MP Amplifier Kit** or **Deliverable 2**"),

   the R Amplifier and the MP Amplifier Kit as both specified and reaching parameters stated in the Technical specification, in the Interface control document (pursuant para 6 of this Art. of the Contract) and Contractor´s Bid (jointly hereinafter also referred to as the "**Technology**") and provide for the Client out of warranty services as indicated below and other related services as specified herein (the Technology and all the related services

specified herein hereinafter also referred to as the "**Work**"),

b) the obligation of the Client to pay the Contractor, under the terms and conditions hereof, the agreed upon price for the execution of the Work.

2. The Contractor's obligations hereunder, performance of which has been included in the Price of the Work, shall also include:

   a) training in an extent described in para 2.4.8. of the Technical specification (hereinafter the "**training**");

   b) during the warranty period for the Technology provision of warranty service of the Technology in accordance with requirements stipulated in para 2.4.5. of the Technical specification;

   c) provision of service outside the existing warranty of the Technology, as stated in Art. XII Sec. 14 of this Contract, in the maximum extent of 5 service days (hereinafter the "**Out-of-Warranty Service**").

3. The Contractor also undertakes for the period of 5 years from delivery of the Technology to the Client, unless agreed otherwise, to deliver to the Client all Spare Parts to the Technology under conditions stated herein (mainly chapter 2.4.7. of the Technical specification) (hereinafter the "**Spare Parts**"). A price list of certain crucial Spare Parts is included in **Annex 3** (Price List) to this Contract which forms an integral part hereof.

   The Contractor also undertakes for the period of 1 year from fulfilment of Deliverable 2c), unless agreed otherwise, to deliver to the Client optional components to the MP Amplifier Kit as defined in para 2.2.4. of the Technical specification (hereinafter the "**Optional MP Components**"). A list of the Optional MP Components including prices is included in **Annex 3** to this Contract which forms an integral part hereof.

4. The Contractor's obligations hereunder, performance of which has been included in the Price of the Work, shall also include a proposal of a verification plan of the Technology, which shall the Contractor submit to the Client within ten (10) months from the execution hereof and which must fulfil at least Client's requirements listed in Technical Specification, in particular in chapter 6 of the Technical specification (hereinafter the „**Proposal of the verification plan of the Technology**"). The Contractor is obliged subsequently to supplement this document by information stipulated by the Client in the Technical specification and in dates mentioned herein.

5. The Client is obliged to submit to the Contractor within two months from the execution hereof a proposal of the interface control document pursuant para 5.2. of the Technical specification which shall be further updated by the Contractual Parties in accordance with the Technical Specification (mainly chapter 5.2. thereof) (hereinafter the "**Proposal of the Interface control document**"). The Contractor is obliged subsequently to supplement this document by information stipulated in para 5.2.1. of the Technical specification and in dates mentioned herein.

6. Both proposals of above mentioned documents pursuant para 4 and 5 of this Art. of the Contract including their supplements, i.e. the Proposal of the verification plan of the Technology as **Annex 4** (hereinafter the "**Verification plan**") and the Proposal of the interface control document as **Annex 5** (hereinafter the "**Interface control document**" or "**ICD**") shall

become integral parts of the Contract following written approval by the other Contractual party (i.e. by the party that did not propose the original proposal or any of its later updates).

IV. EQUIPMENT REQUIRED TO EXECUTE WORK:

The Contractor shall secure such equipment as may be required to execute the Work defined hereunder, unless the Contract stipulates otherwise.

V. PROVISION OF OUT-OF-WARRANTY SERVICE AND DELIVERY OF SPARE PARTS AND OPTIONAL MP COMPONENTS

1. Subject to compliance with mandatory Czech Public Procurement Law, for a period of five years (but only one year in case of Optional MP Components) from delivery of the Technology to Client and subject to agreement on the terms, for any longer period mutually agreed between the Contractual Parties, the service outside the existing warranty of the Technology and delivery of Spare Parts or Optional MP Components shall be provided by the Contractor for the Client upon individual written orders of the Client, in terms stated in accordance with Art. VIII hereof and at the price stated in Art. XI hereof and in annex No 3 (hereinafter the "**Order"** or the "**Orders**"). The individual contract pursuant this para. is concluded between Contractual Parties by acceptance of the Client´s Order by the Contractor.
2. The Client shall be entitled to cancel his Order at any time; in such an event the Client shall be obliged to pay to the Contractor that part of the price which will correspond to the applicable Contractor's standard fee for time spent and costs which were demonstrably and effectively expended by the Contractor by the time the Order will have been cancelled and costs which Contractor has to pay to a third party after cancellation, however always limited to the agreed Price of the Order. The Contractor shall be obliged to demonstrate what these costs were.
3. The Contractor acknowledges and agrees that the Client shall not be obliged hereunder to order performance from the Contractor in the value equal to the total amount of the price for Out-of-Warranty Service as defined in the Contractor's bid. The Contractor thus cannot claim on the Client that the Client makes any order or requires performance hereunder, nor claim on the Client any payment or compensation except for the price to be paid for the actually ordered and duly completed Orders. The Contractor hereafter acknowledges and agrees that the Client shall not be obliged hereunder to order Spare Parts or Optional MP Components from the Contractor.
4. Should an Order contain a requirement, which exceeds the framework agreed herein or in the tender documentation or the Contractor's bid submitted within the Procurement Procedure, which the Contractor has not agreed to perform, the Contractor shall be obliged to notify the Client of such excess requirement within five business days of receiving the Order, otherwise it shall be understood that the Contractor agrees with such additional performance, without a claiming to increase the price.

VI. INTENTIONALLY OMITTED

VII. ACCEPTANCE PROCEDURE AND FULFILMENT OF COVENANTS:

1. The Client shall accept the Technology on condition that tests pursuant the Verification plan are carried out firstly at the Contractor´s premises and then at the ELI-Beamlines research centre

laboratories in Dolní Břežany and achievement of the technical parameters of the Technology in accordance with the Contract, unless the Contract stipulates otherwise, i.e. the Client shall accept the R Amplifier upon due execution of Deliverable 1c) as defined in para 6.3.1. of the Technical Specification the MP Amplifier Kit upon due execution of Deliverable 2c) as defined in para 6.3.1. of the Technical Specification.

2. The Contractor shall invite the Client to participate at the testing sufficiently in advance of the contracted delivery date set herein, at least within 15 business days before the term of fulfilment hereof. The Client is not obliged to be present during the testing at the Contractor premises.

3. The Client shall be responsible that prior to the installation and testing of the Technology at its premises all requirements for the installation and testing notified to Client by Contractor (e.g., connections, power, clean space) reasonably in advance shall be available at the date of installation and testing. In accordance with mandatory public procurement laws, the Client shall reimburse to Contractor any costs (including costs for own personnel) associated with a delay for which Client is responsible.

4. Within the acceptance procedure shall be tested and verified the Technology with respect to its compliance with the Contract including all its annexes and other documents referenced therein. The Contractor shall prepare the VCD on the process of testing/verification of the Technology and hand it over to the Client, including reports and protocols, to which VCD refers. The Client is entitled to comment in writing results achieved which the Contractor shall be obliged to take into account, i.e. the Contractor shall accept all materially correct and justified comments and requirements of the Client. Should the Contractor consider some of the comments or requirements made by the Client as materially incorrect or unacceptable, the Contractor shall specify his reasons for refusing to accept such in writing.

5. The Client shall accept the Technology from the Contractor if free of Material defects and unfinished work, unless the Parties agree otherwise. About the acceptance of Technology will be drawn an acceptance certificate (hereinafter "**Acceptance Certificate**"). In the event that the Client will accept the Technology with non-Material defects and/or unfinished works the Contractor shall remove these non-Material defects and/or unfinished work of the Technology within the deadline specified in the Acceptance Certificate in accordance with para 7 and 8 below.

6. Deliverables 1 and 2 shall be deemed to be fulfilled by issuing of Acceptance Certificate by the Client as stipulated below with the exception of the Client's reservations made with respect to non-Material defects and non-Material unfinished work pursuant to para 7 and 8 below.

7. The Client shall issue to the Contractor, without undue delay, Acceptance Certificates on the proper fulfilment of the Deliverable 1 and Deliverable 2, respectively, provided that the following conditions have been simultaneously fulfilled:

   a) The Contractor invited the Client to participate at the testing pursuant the Contract;

   b) The Technology during the testing pursuant to the Verification plan fulfils all Material requirements defined in the Contract, unless the Parties agree otherwise; "Material" shall mean any requirement related to the proper functioning and operation of the Technology as part of the L1 beamline, such as namely pulse energy, beam quality and performance stability;

c) The Contractor has stipulated a deadline for the removal of any and all remaining defects or unfinished work within no longer than 3 months (unless a longer period is agreed upon by the Client due to objective reasons);

d) the Technology is installed (in the extent defined hereby) and finally verified in the place of delivery pursuant hereto; while

e) the results of testing recorded in VCD executed according to par VII.4. hereof demonstrate that the Technology fulfils all Material requirements defined in the Contract, unless the Parties agree otherwise;

f) the Contractor delivers to the Client the manual as specified in Technical specification in para 2.4.1.; and

g) training specified herein has been carried out by Contractor.

8. Out-of-Warranty Service and delivery of Spare Parts or Optional MP Components on the basis of Orders shall be considered fulfilled by confirming their due provision/ delivery in a delivery note by the Client.

9. Joint provisions for the acceptance procedure and fulfilment of obligations:

a) The Client shall not be obliged, during the course of the acceptance procedure, to verify the correctness of any calculations or details of the proposed technical solutions.

b) The assessment of and subsequent acceptance of the individual part of Work does not release the Contractor from his liability for the correctness and completeness of the entire Work. The acceptance of work with defects or unfinished work does not release the Contractor from its obligation to deliver the work in accordance with the specifications defined herein

c) The Contractor shall establish and maintain a non-conformance control system compatible with CSN EN ISO 9001: 2010 edition 2.

d) The Client is entitled to accept the Work also with Material defects or unfinished work in which case the provisions of this Article VII shall be used analogically and Article XII hereof shall govern the defect removal.

e) Should it be necessary to modify any part of the already accepted part of the Work in order to meet the parameters expected of the completed Work, the Contractor undertakes to perform such modifications and accepts that the costs related thereto are included in the Price as agreed in Article XI Section 1 hereof.

f) Each Contractual Party shall bear its expenditures related to their participation in meetings at the other Contractual party's registered offices; reasonable costs which would however arise due to error, faulty performance or breach of contractual provisions of the Contractual Parties shall be borne by that Contractual Party which caused such breach.

10. All submitted documents shall be well-structured and provided in such level of detail so that a professional in the given area shall be able to assess the correctness of the Contractor's approach in solutions used for each part of the Work and the possibility of achieving the required technical parameters defined in this Agreement and / or the Orders by the methods used.

11. All documents mentioned in this Article of the Contact shall be prepared l by the Contractor unless otherwise specified herein or agreed between the Contractual parties.

VIII. TERM, VIS MAJOR

1. The Contractor undertakes to fulfil the Deliverable 1 within the time limits specified in para 6.3.1 of the Technical specification**.**
2. The Contractor undertakes to fulfil the Deliverable 2 within the time limits specified in para 6.3.1 of the Technical specification**.**
3. **The Contractor undertakes to provide Out-of-Warranty Service to the Client at the latest** within the period of 30 (thirty) calendar days from acceptance of the Order by the Contractor with the exception of simple repairs/maintenance which shall be provided within 15 calendar days from acceptance of the Order by the Contractor, or within another time agreed by the Contractual Parties in the Order. The Contractor shall inform the Client in writing (if possible) within 10 days from the handover of complete information about the defect about the deadline for the provision of Out-of-Warranty service including substantiation of the type of repair and appropriate deadline pursuant hereto.
4. The Contractor undertakes to deliver Spare Parts and Optional MP Components to the Client as follows: i) Spare Parts listed in para 2.4.7., REQ-018938/A of the Technical specification / Annex 1 within 5 business days from acceptance of the Order by the Contractor, ii) other Spare Parts within 20 business days from acceptance of the Order by the Contractor or within another time agreed by the Contractual Parties in the Order and iii) Optional MP Components within time agreed by the Contractual Parties in the Order.
5. The Client is entitled to prolong in writing the terms of performance referred to in paragraph 1 or 2 of this Article to a maximum of three months in total in the case (a) unforeseeable circumstances hinder the timely performance or (b) acts or omissions on the Client´s side delay the Contractor's performance or (c) that the place of work of the Client shall not be ready for installation of the Technology. The Contractor is obliged to inform the Client about the change of the date of performance within at least 15 days before deadline stated in paragraph 1 or 2. Extension of term of performance by the Client under this paragraph hereof does not affect the Price of the Work under the Contract, nor does it impose any sanctions to any Contractual Party. In such cases the Client may decide that only the deadline for delivery is delayed and release payment for the specific deliverable in standard terms defined herein.
6. Circumstances precluding liability shall be deemed to have been constituted by (i) such circumstances / obstacles which arose independently of the will of the obliged Contractual Party, and which prevent fulfilment of that Contractual Party's obligation, provided that it could not be reasonably expected that the obliged Contractual Party could overcome or avert this obstacle or its consequences, and furthermore that such Contractual Party could foresee such obstacle when it entered into the respective covenants, (ii) by such circumstances / obstacles for which the other Contractual Party is responsible or (iii) if the party can prove that it has observed all reasonable diligence to avoid any damages (hereinafter "**Vis major**"). Liability cannot be precluded by obstacles in connection with its economic situation. The effects precluding liability shall be limited to the period during which the obstacles causing these effects persist. The Vis major occurrences under point (ii) above preclude liability only in the extent in which the other Contractual Party has contributed to the breach of obligations/damage. The Vis major occurrences under point (iii) only pertains to damage compensation liability.
7. Should a situation occur, which a Contractual Party could reasonably consider to constitute Vis

major, and which could affect fulfilment of its obligations hereunder, such Contractual Party shall immediately notify the other Contractual party and attempt to continue in its performance hereunder in a reasonably degree. Simultaneously, such Contractual Party shall inform the other of any and all its proposals, including alternative modes of performance, however, without consent of the other Contractual Party, it shall not proceed to effect such alternative performance.

8. If a situation constituting Vis major occurs, the deadlines imposed hereunder shall be extended by the period of the duration of the said Vis major event.

IX. PLACE OF DELIVERY:

Unless the Contract stipulates otherwise, the place of delivery of the Work or its part hereof shall be the address of the ELI-Beamlines research centre in Dolní Břežany – Za Radnicí 835, 252 41 Dolní Břežany, Czech Republic.

X. TRANSFER OF OWNERSHIP RIGHTS AND RISKS

1. Rights and duties of the Contractual Parties connected with delivery of the Technology to the place of delivery shall be governed by DAP clause (INCOTERMS 2010 rules) unless expressly stated herein otherwise.
2. The Client acquires the ownership rights to the subject-matter of the Contract at the moment of due execution of Deliverable 1b) regarding the R Amplifier and execution of Deliverable 2b) regarding the MP Amplifier Kit. The Client shall perform unpacking and visual inspection of the R Amplifier and the MP Amplifier Kit upon delivery to Client's premises.
3. Risks of damages and losses regarding the R Amplifier and the MP Amplifier Kit shall pass to Client at the moment of delivery thereof to the place of delivery by the carrier designated by the Contractor. The Client is entitled to refuse taking over the R Amplifier or the MP Amplifier Kit from the carrier if it is obvious that any damage to the R Amplifier and the MP Amplifier Kit occurred during transport. In such a case the Client shall immediately contact the Contractor and agree on next steps (including potential documentation of extent of damage) before the carrier leaves Client´s premises.

XI. PRICE OF WORK; INVOICING; PAYMENT:

1. The total (maximum) price of Work has been set forth on the basis of the Contractor's bid in the amount stipulated in **Annex 3** (Price List) hereto (hereinafter the "**Price of the Work**").
2. The price of individual parts of Work is for purposes of this Contract also stipulated in **Annex 3** (Price List) hereto.
3. The Price of the Work shall cover any and all performance provided by the Contractor in order to fulfil all of the Client's requirements to properly execute and deliver the Work hereunder, and includes all costs accrued by the Contractor during the execution of the Work and its handover at the registered offices of the Client incl. all fees, customs duties and insurance as well as all claims of the Contractor arising on the basis of intellectual property laws.

4. The Contractor undertakes to deliver to the Client crucial Spare Parts and the Optional MP Components for prices specified in Annex 3 hereto. The Contractor guarantees validity of prices of Crucial Spare Parts for 2 years and of Optional MP Components for 1 year from the date of acceptance (para XII. 5 hereof) of the Technology by the Client.

5. Contractual Parties have agreed that the Contractor shall be authorized to invoice the Price of the Work as follows:

   a) 30% of the R Amplifier Price upon signing hereof;

   b) 30% of the MP Amplifier Kit Price upon signing hereof;

   c) 70% of the R Amplifier Price upon due execution of Deliverable 1b);

   d) 70% of the MP Amplifier Kit Price upon due execution of Deliverable 2b);

   (hereinafter "Payment Schedule").

6. In the event that any defects will occur in the Technology upon the moment of unpacking and visual inspecting it within performing Deliverables 1b) and 2b) by the Contractor, the Contractor shall be entitled to invoice from the last payment under para 5 letter c) and d) of this Art. 4/5 of the respective instalment and the remaining 1/5 of this instalment after removing the defects.

   In case obvious heavy damage to the Technology occurred during transport the Client is entitled not to take over the Technology from the carrier, thus Deliverable 1b) (for the R Amplifier) or Deliverable 2b) (for the MP Amplifier Kit), respectively, would not be deemed fulfilled.

7. **Partly Payment Release Option.** In cases where the Deliverable criteria were not met (e.g. issue of the Acceptance certificate or delivery note according to Art. VII Section 7 and/or 8 hereof is delayed due to reasons on the part of Contractor) and when it will be necessary for the completion or implementation of the ELI-Beamlines Project or the Work, the Client shall be entitled, after notification of such information by the Contractor, to ask the Contractor to submit a claim only for a partial payment of the following scheduled payment. The amount shall be stipulated by the Client considering the following criteria: (i) value of the work performed towards completion of the corresponding and/or preceding Deliverables, (ii) plan submitted by the Contractor addressing anticipated completion of the corresponding and/or preceding Deliverables and (iii) risks connected with delay of payment with regard to fulfilling future Deliverables on time. This would provide a mechanism whereby funding for further development activities may be released whilst work continued towards completion of a delayed Deliverable, whilst demonstrating an appropriate level of governance of disbursement of public funds subject to satisfactory performance. As part of such solution, interim partial delivery of the respective Deliverable may be agreed.

8. The Contractual parties also agree that the Contractor shall be authorized to invoice the Out-of-Warranty Service Price and the price of Spare Parts or Optional MP Components in the amount stated in the Order always on the day following the fulfilment of the respective

obligation.

9. VAT shall be imposed on top of all payments made hereunder according to valid legislation.

10. The due date of all invoices issued hereunder shall be thirty (30) days from the date of their delivery to the Client (hereinafter the "**Due Date**"). A payment of the amounts invoiced shall be understood to be effected on the day such are remitted to the bank account of the Contractor. The tax documents – invoices issued by the Contractor hereunder shall comply with all applicable legal regulations of the Czech Republic include especially the following data:

    a) Commercial name and seat of the Client
    b) Tax identification number of the Client
    c) Commercial name and seat of the Contractor
    d) Tax identification number of the Contractor
    e) Number of the tax document – invoice
    f) Quantity (extent) and nature of performance supplied or services rendered
    g) the moment of the accounting transaction, if is not identical with the moment referred to in the point g) above,
    h) The day of the supply of goods or services or the date of the payment on account, whichever comes sooner, in so far as they differ from the date of issue of the tax document – invoice
    i) Due Date
    j) The price
    k) Statement that the performance is provided in connection with the Project “ELI: EXTREME LIGHT INFRASTRUCTURE – phase 2”, reg. No. CZ.02.1.01/0.0/0.0/15_008/0000162,

    and, furthermore, the tax documents – invoices shall also be in compliance with agreements on avoidance of double taxation, if applicable in particular cases.

11. The Contractor is obliged to issue invoices without unreasonable delay following meeting the requirements for issuing of invoices stipulated herein. The last invoice of each calendar year must be delivered by the Contractor to the Client´s mail room no later than on December 15 of that calendar year. Should a tax document – invoice not be issued in compliance with payment terms defined herein or should it not meet the statutory requirements, or if it should not be delivered to the Client by deadlines set hereunder, the Client is entitled to return the tax document-invoice back to the Contractor as incomplete, or incorrectly issued, for its correction, or re-issue, within five (5) business days from the date of its delivery to the Client. In such a case, the Client shall not be in default with the remittance of the Price of the Work or any portion thereof, and the Contractor shall issue a corrected invoice with a new identical due date which shall commence to run on the day of delivery of the corrected or re-issued tax document-invoice to the Client.

12. The Client’s invoicing details are given in Art. I hereof.

XII. WARRANTY, WARRANTY AND OUT-OF-WARRANTY SERVICE:

1. The Work shall be deemed to be defective if its implementation or its parts fail to correspond to the results defined herein.
2. The Contractor shall be liable for any defects on the Work or any of its parts at the time of its acceptance, as well as for defects that may be discovered on the Work or its parts during the entire warranty period (quality guarantee), except if the defect is caused on the part of the Client or is the result of (i) normal wear and tear, (ii) inadequate operation (e.g., misuse, false operation, insufficient monitoring,), (iii) use of parts or components not supplied by Contractor, (iv) modification of parts or components or the Technology made by Client or third parties without Contractor's prior written approval or (v) recommended maintenance standards have not been complied with. Any operation or any kind of use of the Technology by a person that has not been trained by the Contractor (with written confirmation of such training by the Contractor) shall be deemed inadequate operation.
3. The Contractor shall provide quality warranty for the Technology in the extent as specified in para 2.4.9. of the Technical specification.
4. The Contractor further provides warranty for the Spare Parts and Optional MP Components in the extent stated in para 3 hereof. Regarding the Spare Parts and Optional MP Components furbished with warranty certificates, the warranty period contained in these warranty certificates shall apply, however, shall not be less than the warranty period stipulated in the first sentence of this article hereof.
5. Warranty period on Deliverable 1 pursuant para 3 hereof starts running as of fulfilment of the Deliverable 1c) as stipulated in para 6.3.1. of the Technical specification. Warranty period on Deliverable 2 pursuant para 3 hereof starts running as of fulfilment of the Deliverable 2c) as stipulated in para 6.3.1. of the Technical specification. Warranty period for the Spare Parts and Optional MP Components starts running as of their delivery without defects and unfinished work.
6. Any requests to remove defects on the Work or its part during the warranty period shall be exercised in writing by the Client against the Contractor without undue delay after such were discovered, no later than on the last day of the warranty period (hereinafter the "**Warranty Claim**"). Warranty Claim transmitted by the Client even on the last day of the warranty period shall be deemed to have been exercised in time.
7. The Contractor undertakes to review all submitted Warranty Claims, notify the Client whether he recognizes the claim, and inform the Client in writing on the deadline for the removal of the defect within one week of the date on which the claim was delivered to him by the Client.
8. The Contractor undertakes to remedy any claimed defects on the Work or its parts free of charge and without undue delay.
9. Contractor shall make best efforts to remove a defect as quickly as possible, but latest within

30 business days from the date the Warranty Claim was notified to the Contractor, unless the Client and the Contractor agree otherwise and the nature of the defect makes it possible or the Contractor is able to substantiate that it is not possible to meet the deadline for reasons beyond under Contractor's reasonable control, e.g. (without limitation) because of components delivery deadlines, the nature of the defect being capable to be repaired, or logistic reasons. The above term as quickly as possible implies that simple defects should be removed within 15 days.

10. The Contractor shall be obliged to remove defects on the Work also in instance when the Contractor is of the opinion that he is not liable for such defects in the case that the costs for the removal of such defect do not exceed 10.000,- EUR without VAT (this sum covers all costs connected with a specific Warranty Claim). If it turns out that Contractor is not responsible for the defect, Client shall reimburse to Contractor the costs associated with the remedy of the defect based on time and material.
11. In the event that the Contractor shall not recognize legitimacy of the Warranty Claim then the Warranty Claim will be verified by an independent expert opinion, which shall be provided by the Client. In the event that the Warranty claim will be marked by an expert as justified, the Contractor shall bear the costs of the expert opinion.
12. Should the Parties fail to agree on a person of an expert within 15 days from raising the Warranty Claim and/or the Contractor shall not accept the defects of the Work and/or the Contractor shall not remove the defects within the deadline stipulated in paragraph 9 of this Article XII. hereof the removal of the defects of the Work by the Client does not release the Client from his claims from the defects of the Work towards the Contractor.
13. Removal/remedy of claimed defect shall be subject to a protocol in which the Contractual Parties confirm the defect's removal. The warranty period shall extend by any period that passed between the claim notification and removal of the defect.
14. By out-of-Warranty Service shall be understood as removal / remedy of defects during the warranty period in cases where the Contractor has no obligation to remove / remedy the defects within the framework of the warranty itself.
15. Acts of the Contractual Parties shall constitute claims pursuant to this Article if made in writing or by electronic means of communication by one of the representatives of the Contractual Parties appointed in Art. XVIII Section 1 and 2 hereof and delivered to the address of the other Contractual Party pursuant to Art. I or Art. XVIII. Section 3 hereof.

XIII. INTELECTUAL PROPERTY RIGHTS

1. The Contractor, while performing the Work in accordance herewith shall not act in breach of the rights of third parties, arising to such their parties from intellectual property rights namely author's rights pursuant to Act. No. 121/2000 Coll., on Copyrights, Rights Related to Copyright and on amendment of certain other Acts, as amended (hereinafter referred to as the

"**Copyright Act**") and from industrial rights pursuant to dedicated legislation of the Czech Republic and of other states as well as from International treaties on intellectual property rights protection.

2. In the event that in connection with the execution of this Contract the Technology as a whole or any part thereof shall constitute a copyrighted work within the meaning of the Copyright Act, such will be considered as the work under commission as defined in § 61 of the Copyright Act. In these cases the Contractor shall grant to the Client or to legal successor of the Client a non-exclusive, royalty-free licence to use the copyrighted work (or any of its parts) for the sole purposes of operation of the Technology and/or for the purposes of research and education activities, for the entire period of validity of copyright to copyrighted works on the territory of the entire world. Such right to use is limited to use for research and development activities solely if aimed for an improvement of the Technology, including necessary modifications to the Technology including software and handover of necessary documentation upon non-disclosure agreement to third parties for the purposes of undertaking experiments and commissioning, servicing, performance ramping up and system integration activities. The license above shall be non-transferrable and non- sub-licensable, except that (i) the license may be passed to any third party which is the owner or the operator of the Technology and (ii) system documentation may be passed upon strict non-disclosure and need to know basis to users of the Technology or developers of ancillary systems or system upgrades.

3. In the event that in connection with the execution of this Contract the Technology as a whole or any part thereof shall constitute a patent, utility model or subject of other industrial property rights, the Contractor shall grant to the Client or to legal successor of the Client a non-exclusive, royalty-free licence to use the Technology (or any of its parts) for the sole purposes of operation of the Technology and/or for the purposes of research and education activities, for the entire period of validity of the industrial property rights on the territory of their validity. Such right to use is limited to use for research and development activities solely if aimed for an improvement of the Technology, including necessary modifications to the Technology and handover of necessary documentation upon non-disclosure agreement to third parties for the purposes of undertaking experiments and commissioning, servicing, performance ramping up and system integration activities. The license above shall be non-transferrable and non- sub-licensable, except that (i) the license may be passed to any third party which is the owner or the operator of the Technology and (ii) system documentation may be passed upon strict non-disclosure and need to know basis to users of the Technology or developers of ancillary systems or system upgrades.

4. The intellectual property rights according to Art. XIII shall pass to the legal successor of the Client or operator of the ELI-Beamlines Infrastructure.

5. The Contractual Parties declare that they have agreed that the Contractor's remuneration for the provision of license pursuant to this Article, Section 1 and 2 hereof has already been included in the Price for the Work.

6. Spare parts and Optional MP Components are deemed to be a part of the Technology for the purposes of this article hereof.

XIV. PUBLICATION ACTIVITIES

1. Except for any application of intellectual property rights by Contractor, the Contractor shall refer all publications arising as a direct result of this Contract to the Client, at least 20 (twenty) calendar days before the publication is submitted to scientific journal, proceedings or other periodicals. Where both Client and Contractor agree, comments or amendments suggested by the Client will be added to the text of publication.
2. The Contractor shall acknowledge in the publications the present Contract and the ELI-Beamlines Project as the source of funding supporting the work reported, in the Acknowledgments section of the publication; the exact wording of the acknowledgment shall be provided by the Client to the Contractor after signature hereof.
3. The Contractor undertakes to observe any applicable regulations governing publicity arising from the binding documentations under OP RDE.

XV. RIGHTS AND OBLIGATIONS OF THE CONTRACTUAL PARTIES

1. The Contractor undertakes to fulfil all of its covenants entered into hereunder with professional care, at its own cost and risk, and to observe the deadlines imposed in Art. VIII hereof and for the Price of the Work set forth in Art. XI. hereof.
2. The Client undertakes to deliver to the Contractor any and all source documents, materials or other information, which are necessary for the execution of the Work and which the Contractor can reasonably request from the Client under the condition that the Contractor raised any such requirements with sufficient advance ensuring fulfilment of the deadlines for delivery of the Work as defined herein or in dates stipulated in this Contract.
3. The Contractor shall be obliged to inform the Client on the progress achieved in the Work's execution in accordance with para. 5.1 of the Technical Specification.
4. The Contractor undertakes, under the terms and conditions hereof, in accordance with instructions issued by the Client and using all necessary professional care, to:

   a) duly archive all written material prepared in connection with the execution of the Work hereunder and provide access to the Client and bodies inspecting the Client under reasonable terms until 2026 unless such access would be from the Contractor's perspective in violation of Contractor's intellectual property and/or confidential/business sensitive information rights.;

   b) cooperate during financial inspections carried out in accordance with Act 320/2001 Coll., on Financial Inspections, as amended, i.e. to allow the Managing Authority of the Operational Program Research, Development and Education (hereinafter the "**Sponsor**") to access also those portions of the tender (bid) submitted within the Procurement Procedure, the Contract, Orders and related documents which may be protected by special legal regulation,

given that all requirements set forth by legal regulation with respect to the manner of executing such inspections will have been observed; the Contractor shall bind any of its sub-contractors to comply with this obligation accordingly.

5. Where the Client sees a need to change the Technical Specifications, the Technology or the Device (hereinafter the "**Change**"), unless otherwise agreed, such Change will become effective only if made in accordance with the following change request procedure:

   a) Should the Client propose a Change, it shall submit such proposal to the Contractor in writing with reasonable details explaining the Change and the reason for such Change.

   a) Following the Client's request for a Change, the Contractor shall issue a written acknowledgement to the Client in a timely manner.

   b) the Contractor shall submit within a reasonable time a work change order to the Client setting forth its best judgment as to the probable effect on the work and the schedule and their estimated cost.

   c) Neither Party shall proceed with any such changes without prior written consent of the other and for the avoidance of doubt the Contractual Parties declare that they shall respect the limitation set forth by the valid Public Procurement Laws.

XVI. LIABILITY, SANCTIONS

1. In the case where the Contractor shall be in delay with deadline of fulfilment of the Deliverable 1C (as specified in para 6.3.1. of the Technical specification), the Contractor shall be obliged to pay contractual penalty (i) during the first three calendar months of delay in the amount of 0,02 % from the R Amplifier Price for each day of the delay and subsequently (ii) from the beginning of the fourth calendar month of delay in the amount of 0,05% from the R Amplifier Price for each day of the delay. In the case where the Contractor shall be in delay with deadline of fulfilment of the Deliverable 2C (as specified in para 6.3.1. of the Technical specification), the Contractor shall be obliged to pay contractual penalty (i) during the first three calendar months of delay in the amount of 0,02 % from the MP Amplifier Kit Price for each day of the delay and subsequently (ii) from the beginning of the fourth calendar month of delay in the amount of 0,05% from the MP Amplifier Kit Price for each day of the delay

2. Except for the event of Vis Major, in the case where the Contractor shall be in delay with the deadline of fulfilment stipulated by Art VIII para 3 hereof, i.e. with the provision of Out-of-Warranty service within the deadline of 15 calendar days from acceptance of the Order by the Contractor or within the agreed time in the Order, the Contractor shall be obliged to pay contractual penalty in the amount of 100 € for each day of delay.

3. Except for the event of Vis Major, in the case where the Contractor shall be in delay with the deadline of fulfilment stipulated by Art VIII para 4 hereof, i.e. with delivery of Spare Parts listed in para 2.4.7., REQ-018938/A of the Technical specification within 5 business days from acceptance of the Order by the Contractor and with the delivery of other Spare Parts within the deadline of 20 business days from acceptance of the Order by the Contractor or within

the agreed time in the Order or with delivery of Optional MP Components within the agreed time in the Order, the Contractor shall be obliged to pay contractual penalty in the amount of 50€ for each day of delay and case of delay.

4. Except for the event of Vis Major, in the case where the Contractor shall a) fail to remove defects and unfinished work of the Technology within the deadline stipulated by the Acceptance Certificate pursuant to Article VII para. 5, 7 and 8 hereof, and/or b) fail to remove the warranty-claimed defects within the period stipulated by Art. XII Sec. 9, the Contractor shall be obliged to pay contractual penalty in the amount of 50€ for each case of breach of such obligation for each day of delay.
5. The Client is entitled to set off any of its claims to contractual penalty in accordance with this Art. XVI hereof against any claims of the Contractor to payment of any part of the price in accordance herewith.
6. By the payment of contractual penalty in accordance with this Art XVI hereof, no claim of the Client to damage compensation shall be affected, application of Section 2050 of the Czech Civil Code is excluded.
7. The Parties have agreed that the maximal amount of contractual penalties shall be limited to 7.5% of the Price of the Work.
8. The Parties have furthermore agreed that from the damage compensation title, the Client is entitled to claim towards the Contractor a maximal sum of the Price for the Work pursuant hereto.

XVII. TERMINATION OF THE CONTRACT, VIS MAJOR:

1. This Contract may be terminated by its fulfilment / completion, by agreement of the Contractual Parties or by withdrawal from the Contract for reasons specified in law or in this Contract.
2. The Client shall be entitled to withdraw from the Contract without sanction should any of the below specified events occur:
   a) any expenditure or any part thereof, which may arise on basis of this Contract, are declared by the Sponsor or other controlling body to be ineligible, or
   b) the Client's financial support (aid) provided toward implementation of the ELI-Beamlines Projects is withdrawn;
   c) The Contractor, after having received a warning by Client has not remedied a second material breach of any material condition stated by this Contract within a period of 30 days and it cannot be reasonable expected from Client that Client shall continue the Contract ; or
   d) The reports pursuant Art. XV Sec 3 hereof provided by the Contractors clearly indicate that the Contractor shall not be able to materially fulfil requirements on Technology defined in

Technical specification and ICD; or the Technology during acceptance procedure does not materially fulfil requirements on Technology defined in Technical specification and ICD, even after three repetitions; and it cannot be reasonable expected from Client that Client shall continue the Contract.

3. In case of termination of the Contract due to reasons given in Section 2 of this Article, the Contractor shall be eligible for payment for the actually executed part of the Work for the Client, if such had been executed in accordance with the terms and conditions hereof.

4. In the event of termination of this Contract by the Client for other reasons than for the reasons of a breach of obligations on the part of the Contractor, the Contractor shall have the right to payment for work and material accrued in connection with the fulfilment of his obligations hereunder prior to the Contract termination by the Client based on time (Contractor's standard rates or rates used for the Contractor's bid, whichever is lower) and material , and any third party costs which could demonstrably not be cancelled in time and if such costs accrued by the Contractor are not covered from other sources, however, in no event more than the Price of the Work agreed in this Contract.

5. In case of termination in accordance with this Article XVII para. 2 letter c) and d) the Client is entitled to decide in the form of a written information to the Contractor which things, right and values shall be paid and kept by the Client and which shall be returned.

6. Things, rights and any other values, whose price was paid for by the Client to the Contractor according to Section 4 and 5 of this Article, shall pass, by payment, into the ownership of the Client and the Contractor shall be obliged to allow the Client to dispose with such accordingly.

7. The act of withdrawal from the Contract shall become effective on the day of delivery of the notification in writing from one Contractual Party to the other with consequences of the Contract termination effective in the "*ex nunc*" regime.

8. The Client is entitled to withdraw in accordance with this Article XVII also only with respect to the specific part of the Contract concerning the MP Amplifier Kit. In such case the contract shall be terminated only partially with respect to the Contractor's obligation to deliver the MP Amplifier Kit and Client's obligation to pay the MP Amplifier Kit Price. The provisions of this Art XVII shall be used analogically.

XVIII. REPRESENTATIVES, NOTICES:

1. The Contractor has appointed the following representatives responsible for the management and performance of the Work hereunder and communication with the Client:

   In technical matters:
   Dr. Thomas Metzger
   E-mail: thomas.metzger@de.trumpf.com
   Tel.: +49 89 9622888 0960

   In contractual matters:

Dr. Knut Michel
E-mail: knut.michel@de.trumpf.com
Tel.: +49 89 9622888 0950

2. The Client has appointed the following representatives responsible for communication with the Contractor for the purposes of realization of the Work:

   In technical matters:
   Ing. Pavel Bakule, DPhil.
   Tel: +420 266 052 871,
   Email: Pavel.bakule@eli-beams.eu

   In contractual matters:

   Prof. Jan Řídký, DrSc.
   Tel: +420 266 052 121,
   Email: ridky@fzu.cz

3. Any and all notices transmitted between the Contractual Parties hereunder must be made in writing and delivered to the other Contractual Party by an internationally recognized courier service (Federal Express, DHL, etc.), delivered in person (with a written confirmation of receipt), by a registered letter or in the form of electronic communication carrying electronic signature sent to epodatelna@fzu.cz for the Client and to knut.michel@de.trumpf.com for the Contractor.

4. In expert or technical matters (matters related to preliminary assessment of the delivery of Work, warranty claims etc.) electronic communication will be acceptable between the appointed representatives for technical matters to e-mail addresses as provided in Section 2 here above.

XIX. DISPUTES:

1. This Contract and any and all legal relations arising herefrom shall be governed by the laws and regulations of the Czech Republic.

2. The Contractual Parties acknowledge and recognize that areas not explicitly regulated hereby shall be regulated by the respective provisions of the Czech Act No. 89/2012 Coll., Civil Code, as amended.

3. Any and all disputes arising in connection herewith shall be resolved by the Contractual Parties by negotiations. In cases where a dispute cannot be resolved by negotiation within sixty (60) days, such a dispute shall be decided upon a motion of one of the Contractual Parties by a competent court in the Czech Republic.

XX. INSURANCE:

The Contractor declares that it is insured in compliance with standards in the industry. The Contractor shall submit to the Client the insurance contract at his request.

XXI. CONCLUDING AND OTHER COVENANTS:

1. This Contract represents a complete agreement between the Client and the Contractor.
2. In the event that any of the provisions of this Contract shall later be shown or determined to be invalid, putative, ineffective or unenforceable, then such invalidity, putativeness, ineffectiveness or unenforceability shall not cause the invalidity, putativeness, ineffectiveness, or unenforceability of the Contract as a whole. In such event the Contractual Parties undertake without any undue delay to subsequently clarify any such provision using Sec 553 (2) of the Civil Code, or to replace after mutual agreement such invalid, putative, ineffective or unenforceable provision of the Contract by a new provision, that in the extent permitted by the laws and regulations of the Czech Republic, relates as closely as possible to the intentions of the Contractual Parties to the Contract at the time of creation hereof.
3. This Contract becomes valid and comes into force on the date of its signature by the authorized representatives of both Contractual Parties.
4. This Contract may be amended or modified exclusively in the form of written and numbered amendments specifying the time and place thereof, and signed by the authorized representatives of the Contractual Parties. The Contractual parties expressly reject, within the bounds of Sec 564 of the Civil Code, modification of the Contract in any other manner.
5. This Contract was made out in English languages in four (4) counterparts, each having the force of original. Each Contractual Party shall receive two (2) counterparts.
6. The Annexes listed below form an integral part of this Framework Contract:

   Annex 1: Technical specification for the engagement (Requirements Specification Document)

   Annex 2: The Contractor's bid submitted within the Procurement Procedure

   Annex 3: Price List

   Annex 4: Verification plan (as of its completion and approval)

   Annex 5: Interface control document (as of its completion and approval)
7. By attaching their signature hereto the Contractual Parties express their consent with the content hereof in its entirety.

In Prague on 22.12.,2016

On behalf of: Fyzikální ústav AV ČR, v. v. i.

[redacted]

Name: prof. Jan Řídký, DrSc.

Function: Director

On behalf of: TRUMPF Scientific Lasers GmbH + Co. KG

[redacted]

Name: Dr. Knut Michel

Function: Managing Director

Annex 1: Technical specification for the engagement (Requirements Specification Document)

Confidentiality Level	*BL - Restricted for internal use*	**TC ID / Revision**	00141028/C
Document Status	*Document Released*	**Document No.**	N/A
WBS code	*3.1.2.2 - L1 Beamline Dev.,Inst. at ELI to PL3*		
PBS code	*RA1.L1.L1_1.PL.C*		
Project branch	*Engineering & Scientific documents (E&S)*		
Document Type	*Specification (SP)*		

[RSD product category C]

High pulse energy, thin-disk Yb:YAG based amplifiers for L1 pump laser system operating with repetition frequency of 1 kHz.

TP16_166

Keywords

N/A

	Position	Name
Responsible person	Deputy RP1 Leader	Pavel Bakule
Prepared by	Deputy RP1 Leader	Pavel Bakule

RSS TC ID/revision	RSS - Date of Creation	*RSS - Date of Last Modification*	*Systems Engineer*
010994/A.001	11.10.2016 16:44	11.10.2016 16:47	Aleksei Kuzmenko
010994/A.002	11.11.2016 11:00	11.11.2016 11:01	Aleksei Kuzmenko

Reviewed By			
Name (Reviewer)	*Position*	*Date*	*Signature*
Alice Hamalová	Clean room specialist	*N O T I C E*	
Bedřich Rus	Scientific Coordinator of Laser Technology (RP1)		
Daniel Kramer	Chief Optical Designer		
Ladislav Půst	Manager installation of technology		
Lubos Nims	Head of Electrical engineering		
Pavel Korouš	Chief Engineer	*N O T I C E*	
Petr Procházka	Safety Coordinator		
Tomáš Laštovička	Team Leader BIS	*N O T I C E*	
Viktor Fedosov	SE & Planning group leader; Quality Manager *(Appointed temporarily)*		

Approved by			
Name (Approver)	*Position*	*Date*	*Signature*
Bedřich Rus	Scientific Coordinator of Laser Technology (RP1)		

Revision History / Change Log				
Change No.	*Made by*	*Date*	*Change description, Pages, Chapters*	*TC rev.*
1	P.Bakule, A.Kuzmenko	10.10.2016	RSD draft creation	A
2	P.Bakule, A.Kuzmenko	07.11.2016	RSD update, version for review	B
3	P.Bakule, A.Kuzmenko	11.11.2016	RSD update, version for approval	C

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

Table of Content

FZÚ

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

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

1. Introduction

The Contracting authority is undertaking the ELI project with the objective of building a facility using cutting-edge laser technologies and to implement research and application projects in the field of laser-matter interaction using ultra-short laser pulses at high repetition rates and/or with high energy. Part of the project realization is the purchase and development of short pulse lasers operating with high pulse energy and a high repetition rate using diode-pumped technology. In particular, the ELI project is currently constructing an OPCPA based laser system (L1) designed to generate <20 fs pulses with pulse energy of 100 mJ and a high repetition rate of 1 kHz. Apart from the OPCPA, the main technological challenge is in the construction of the high average power pump lasers generating pulses with picosecond duration at 515 nm to pump the broadband OPCPA.

1.1. Block diagram showing the main subsystems of the pump laser system for OPCPA stage 7 (Figure 1).

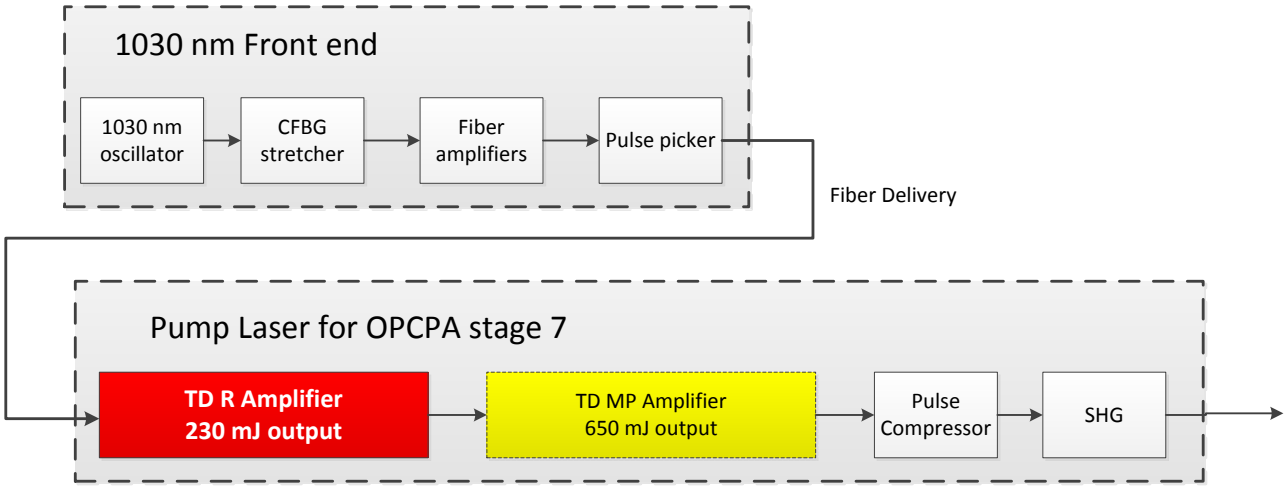

Figure 1: Block diagram showing the main subsystems of the pump laser system for OPCPA stage 7. The subject of this contract is the delivery of fully functioning "R Amplifier", highlighted in red, and the components required to construct MP Amplifier ("MP Amplifier Kit"), highlighted in yellow.

The aim of this public contract is to procure one thin disk based laser regenerative amplifier (in this text referred to as "R Amplifier") with pulse energy in single beam exceeding 230 mJ, and components for the construction of a subsequent multi-pass amplifier with >650 mJ output energy (in this text referred to as "MP Amplifier Kit"). These two systems will form part of the pump laser system for the OPCPA as illustrated in the Figure 1.
The construction of "MP Amplifier" will be carried out by the Contracting authority using the "MP Amplifier Kit" components and the "R Amplifier" as the seed laser. The

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

integration of the "R Amplifier" and "MP Amplifier" into the fully functioning OPCPA pump laser system will be carried out by the Contacting authority.
The function of the "R Amplifier" is to amplify nanojoule-level, frequency chirped pulses stretched to nanosecond pulse duration in a way that manages the gain narrowing, the dispersion and the B-integral to allow subsequent compression of the output pulses to <2 ps in a grating-based pulse compressor. The front end and the compressor are existing systems with fixed parameters and are not part of the delivery.
"MP Amplifier Kit" shall provide all the key components necessary for the construction of a high energy, high repetition rate amplifier capable of amplifying the output of "R Amplifier" to energies >650 mJ (potentially up to 1000 mJ) with excellent beam quality and stability.
The parameters of the front end pulse train delivered via fiber to the "R Amplifier" input are summarized in the Table 1. The desired parameters of the "MP Amplifier" are summarized in the Table 3.

1.2. Scope

This Requirements Specification Document (RSD) lists the technical requirements (functional, performance, safety, operational, design and quality requirements) and constraints for thin disk based laser amplifier, "R Amplifier", with high pulse energy in single beam exceeding 230 mJ and the requirements for components, materials, and documentation the "MP Amplifier Kit".
Chapter 6 describes the process and methods for verifying the requirements specified within this document.

1.3. Terms, Definitions and Abbreviations

For the purpose of this document, the following abbreviated terms apply:

Abbreviation	Meaning
ELI	Extreme Light Infrastructure
CA	Contracting Authority
R Amplifier	Thin Disk based regenerative Amplifier
MP Amplifier	Thin Disk based multi-Pass Amplifier
MP SUPPLY UNIT	Auxilliary unit incorporating power supplies, cooling and control systems of MP Amplifier in single cabinet.
ICD	Interface control document
GDD	Group Delay Dispersion
TOD	Third Order Dispersion
FOD	Fourth Order Dispersion
L1	ELI Laser 1 (1 kHz, 100 mJ, 20 fs)
RSD	Requirement Specification Document
FWHM	Full Width at Half Maximum
R	Review
FD	Functional demonstration

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

Abbreviation	Meaning
T	Test
VP	Verification Plan
VCD	Verification Control Document
I	Inspection
A	Analysis
MSS	Machine Safety System
PSS	Personal Safety System
FET	Full energy test
LTST	Long term stability test

1.4. Parameters of input pulse train to "R Amplifier" (Table 1).

The Table 1 below summarizes the input pulse train to "R Amplifier" delivered by fiber from the 1030 nm front end (see Figure 1).

Table 1: Parameters of input pulse train to "R Amplifier"

Description	Parameters
Pulse Energy	
Delivery	
Fiber connector type	
Spectral Peak	
Bandwidth	
Repetition Rate	
Pulse energy stability	
Pulse energy drift over 8 hours	
Polarization	
Stretcher parameters: • Group delay dispersion • Third order dispersion • Fourth order dispersion	

NOTE 1: Other values of pulse energy and repetition rate (e.g. 80 MHz) may be possible if agreed with the CA in ICD (Chapter 5.2) during contract execution.

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

2. Technical requirements

2.1. Deliverable 1 : "R Amplifier"

2.1.1. "R Amplifier" General requirements

REQ-018812/A

[redacted]

Verification method: R - review, I - inspection

REQ-018813/A

[redacted]

Verification method: R - review, I - inspection

REQ-018814/A

[redacted]

Verification method: I - inspection

REQ-018815/A

[redacted]

Verification method: T - test *(Simultaneous measurement of required parameters)*

REQ-018816/A

"[redacted]

Verification method: T - test *(Measurements carried out by the supplier)*

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

REQ-018817/A

[redacted]

Verification method: T - test

REQ-018818/A

[redacted]

Verification method: FD - functional demonstration *(Demonstration at the CA's site.)*

2.1.2. Performance requirements of "R Amplifier"

2.1.2.1. Parameters of amplified output pulse train from "R Amplifier"

REQ-018819/A

[redacted]

Verification method: I - inspection

REQ-018820/A

[redacted]

Verification method: T – test *(Measurement with spectrometer - overlapping spectra with input spectrum)*

REQ-018821/A

[redacted]

Verification method: T - test *(Photodiode measurement with sample beam)*

REQ-018822/A

[redacted]

Verification method: T – test *(Direct average power measurement combined with photodiode measurement of sample beam)*

REQ-018823/A

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

R AMPLIFIER

[redacted]

Verification method: T - test *(Measurement with spectrometer)*

REQ-018824/A

[redacted]

Verification method: T – test *(Compression of output beam sample in test compressor followed by an autocorrelation measurement)*

REQ-018825/A

[redacted]

Verification method: T – test *(Compression of output beam sample in test compressor followed by an autocorrelation measurement)*

REQ-018826/A

[redacted]

Verification method: T – test *(Measurement with beam profiler according to ISO 11146-1:2005)*

REQ-018827/A

[redacted]

Verification method: T – test *(Measurement with beam profiler according to ISO 11146-1:2005)*

REQ-018828/A

[redacted]

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

R AMPLIFIER

[redacted]

Verification method: T - test *(Measurement with beam profiler)*

REQ-018829/A

[redacted]

Verification method: T - test

REQ-018830/A

[redacted]

Verification method: T - test *(Polarization measurement)*

REQ-018831/A

[redacted]

Verification method: T – test *(Recording of sampled beam on photodiode energy meter at full repetition rate)*

REQ-018832/A

[redacted]

Verification method: T – test *(Relative average power measurement with thermal power meter. Data points taken at least every 100 sec.)*

REQ-018833/A

[redacted]

Verification method: T – test *(Appropriate measurement method to be agreed with the supplier)*

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

2.1.2.2. "R Amplifier" Performance tests

REQ-018834/A

[redacted]

Verification method: R – review *of FET and LTST results*

Table 2: List of parameters to be monitored during 24 hour long LTST

Parameter measured	*Verification of REQ*	*Comment*
Energy drift	[redacted]	[redacted]
Energy stability	[redacted]	[redacted]
Pointing stability	[redacted]	[redacted]

REQ-018835/A

[redacted]

REQ-018836/A

[redacted]

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

2.1.2.3. Adjustability of "R Amplifier" output pulse energy

REQ-018837/A

[redacted]

Verification method: FD - functional demonstration

REQ-018838/A

[redacted]

Verification method: FD - functional demonstration

REQ-018839/A

[redacted]

Verification method: T - test *(measurement of the energy resolution)*

REQ-018840/A

[redacted]

Verification method: FD - functional demonstration

REQ-018841/A

[redacted]

Verification method: FD - functional demonstration

2.1.2.4. Maximum material dispersion introduced by the "R Amplifier"

REQ-018842/A

[redacted]

Verification method: A - analysis *(Verified by calculation carried out by supplier)*

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

2.1.2.5. Optical isolation for "R Amplifier"

REQ-018843/A

"[redacted]

Verification method: R - review *(Manufacturers certificate)*

2.1.2.6. B-integral from "R Amplifier"

REQ-018844/A

[redacted]

Verification method: A - analysis *(Verified by calculation carried out by supplier)*

2.1.2.7. Output pulse jitter from "R Amplifier"

Introductory note:

[redacted]

Jitter verification note:

[redacted]

REQ-018845/A

[redacted]

Verification method: T - test *(Optional – see above)*

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

REQ-018846/A

[redacted]

Verification method: T - test *(Optional – see above)*

REQ-018847/A

[redacted]

Verification method: T - test *(Optional – see above)*

REQ-018848/A

[redacted]

Verification method: T - test *(Optional – see above)*

2.1.2.8. External triggers for "R Amplifier"

REQ-018849/A

[redacted]

Verification method: FD - functional demonstration

2.1.2.9. "R Amplifier" Dimensional constraints

REQ-018850/A

[redacted]

Verification method: R - review *(Review of ICD document),* T – test

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

REQ-018851/A

[redacted]

Verification method: T - test

REQ-018852/A

[redacted]

Verification method: R - review *(ICD document)*

REQ-018853/A

[redacted]

Verification method: T - test

2.2. Deliverable 2: "MP Amplifier Kit"

2.2.1. "MP Amplifier" design

REQ-018854/A

[redacted]

Verification method: R – review *(bid documentation)*

Table 3: Design parameters of the multipass amplifier assuming input beam with parameters corresponding to "R Amplifier" output

Description of [redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

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

REQ-018855/A

[redacted]

Verification method: R – review *(bid documentation)*

REQ-018856/A

[redacted]

Verification method: R – review *(bid documentation)*

REQ-018857/A

[redacted]

Verification method: R – review *(bid documentation)*

2.2.2. "MP Amplifier kit" components

REQ-018858/A

[redacted]

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

[redacted]

Verification method: I - inspection *(All components described fully and delivered)*

2.2.2.1. "MP DISK HEAD" requirements

REQ-018859/A

[redacted]

Verification method: I - inspection *(All components described fully and delivered)*

REQ-018860/A

[redacted]

Verification method: I - inspection

REQ-018861/A

[redacted]

Verification method: R – review *(bid documentation); Verification of offered parameters as part of factory verification before delivery*

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

2.2.2.1.1. "MP DISK set" requirements

REQ-018862/A

[redacted]

Verification method: R – review *(bid documentation); Verification of offered parameters as part of factory verification before delivery*

REQ-018863/A

[redacted]

Verification method: I - inspection

REQ-018864/A

[redacted]

Verification method: R – review *(bid documentation); Verification of offered parameters as part of factory verification before delivery*

2.2.2.2. "MP DIODES" requirements

REQ-018865/A

[redacted]

Verification method: FD - functional demonstration

REQ-018866/A

[redacted]

Verification method: FD - functional demonstration

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

REQ-018867/A

[redacted]

Verification method: R - review *(manufacturers' specification)*

2.2.2.3. "MP OPTICS" requirements

REQ-018868/A

[redacted]

Verification method: R – review *(bid documentation)*

Table 4: List of „MP Optics" delivered as part of „MP Amplifier Kit"

Item	Category	[redacted]	Quantity
KIT1	Mirrors	[redacted]	[redacted]
KIT2	Mirrors	[redacted]	[redacted]
KIT3	TFP	[redacted]	[redacted]
KIT4	Waveplate	[redacted]	[redacted]
KIT5	Waveplate	[redacted]	[redacted]
KIT6	Filter	[redacted]	[redacted]
KIT7	Mirrors	[redacted]	[redacted]

2.2.2.4. "MP SUPPLY UNIT" requirements

REQ-018869/A

[redacted]

Verification method: FD - functional demonstration

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

REQ-018870/A

[redacted]

Verification method: I - inspection

REQ-018871/A

[redacted]

Verification method: R - review *(ICD document)*

2.2.2.5. External triggers for "MP Amplifier kit"

REQ-018872/A

[redacted]

Verification method: FD - functional demonstration

2.2.2.6. "MP Cabling" umbilical connections

REQ-018873/A

[redacted]

Verification method: R - review *(ICD document)*

REQ-018874/A

[redacted]

Verification method: T – test

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

2.2.2.7. "MP Accessories" requirements

REQ-018875/A

[redacted]

Verification method: FD - functional demonstration

REQ-018876/A

[redacted]

Verification method: FD - functional demonstration

Table 5: List of additional components that must be included in the „MP Amplifier Kit"

Item	Category	[redacted]	Quantity
ACC1	Optomechanics	[redacted]	[redacted]
ACC2	Chemicals	[redacted]	[redacted]
ACC3	Optomechanics	[redacted]	[redacted]
ACC4	Beam dump	[redacted]	[redacted]

2.2.3. "MP Amplifier Kit" testing

REQ-018877/A

[redacted]

Verification method: FD - functional demonstration

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

2.2.4. Optional MP components

REQ-018878/A

[redacted]

Verification method: R - Review *(bid documentation)*

Item	Category	Description/Technical specifications	Quantity
OC01	Thin disk set	[redacted]	[redacted]
OC02	Diamond substrate	[redacted]	[redacted]
OC04	Mirrors	[redacted]	[redacted]
OC05	TFP mount	[redacted]	[redacted]
OC06	Mirror mount	[redacted]	[redacted]
OC07	Mirror mount	[redacted]	[redacted]
OC08	Rotational mount	[redacted]	[redacted]
OC10	Aperture	[redacted]	[redacted]
OC11	ASE absorber	[redacted]	[redacted]
OC12	Photodiode	[redacted]	[redacted]
OC14	Beam dump	[redacted]	[redacted]
OC15	Beam dump	[redacted]	[redacted]

Table 6: List of optional components; quantity represents the number of items that must be offered in the bid and represents a maximum number that CA can opt to buy during the contract execution

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

2.3. Functional requirements of "R Amplifier" and "MP Amplifier Kit"

2.3.1. Control system & interlocks (hardware)

2.3.1.1. Personnel safety interlocks

REQ-018879/A

[redacted]

Verification method: R - review

REQ-018880/A

[redacted]

Verification method: R - review, FD - functional demonstration

REQ-018881/A

[redacted]

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

Figure 2: Interlocking scheme for a single laser (NB: the circuit shown serves to indicate the required logic and interconnection scheme only and is not intended to be representative of a real laser source)

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

2.3.1.2. Machine safety systems

REQ-018882/A

[redacted]

Verification method: R - review

REQ-018883/A

[redacted]

Verification method: R - review, I - inspection

REQ-018884/A

[redacted]

Verification method: R - review, I - inspection

REQ-018885/A

[redacted]

Verification method: R - review, I - inspection

REQ-018886/A

[redacted]

Verification method: R – review *(of proposed mechanism)*, FD – functional demonstration

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

REQ-018887/A

[redacted]

Verification method: R - review, I - inspection

REQ-018888/A

[redacted]

Verification method: R - review, I - inspection

REQ-018889/A

[redacted]

Verification method: R - review, I - inspection

REQ-018890/A

[redacted]

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

[redacted]

REQ-018891/A

[redacted]

2.3.2. Control system interface (software)

REQ-018892/A

[redacted]

Verification method: I – inspection, FD - functional demonstration

REQ-018893/A

[redacted]

Verification method: I – inspection, FD - functional demonstration

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

REQ-018894/A

[redacted]

Verification method: I – inspection, FD - functional demonstration

REQ-018895/A

[redacted]

Verification method: I – inspection, FD - functional demonstration

REQ-018896/A

[redacted]

Verification method: I – inspection, FD - functional demonstration

REQ-018897/A

[redacted]

Verification method: R - review, I – inspection

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

2.3.3. Diagnostics

REQ-018898/A

[redacted]

Verification method: I - inspection, FD - functional demonstration

REQ-018899/A

[redacted]

Verification method: I - inspection, FD - functional demonstration

REQ-018900/A

[redacted]

Verification method: R - review, I - inspection

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

2.3.4. Control parameters

REQ-018901/A

[redacted]

Verification method: I - inspection, FD - functional demonstration

REQ-018902/A

[redacted]

Verification method: I - inspection, FD - functional demonstration

2.3.5. Use Counter

REQ-018903/A

[redacted]

Verification method: I - inspection

2.3.6. Environmental requirements

REQ-018904/A

[redacted]

Verification method: T – test *(Verified by "R Amplifier" operation under those environmental conditions)*

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

REQ-018905/A

[redacted]

Verification method: I – inspection

2.3.7. Electrical power and interface requirements

REQ-018906/A

[redacted]

Verification method: R – review *(ICD review)*, I – inspection *(Inspection of installed system)*

REQ-018907/A

[redacted]

Verification method: R – review *(Review of interface document)*, I – inspection *(Inspection of installed system)*

REQ-018908/A

[redacted]

Verification method: R - review

REQ-018909/A

[redacted]

Verification method: I - inspection *(Inspection of installed system)*

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

2.3.8. Cooling

REQ-018910/A

[redacted]

Verification method: A – analysis *(Qualified estimate based on system architecture as sum of heat dissipated to air by all subsystems)*

REQ-018911/A

[redacted]

Verification method: I – inspection *(Inspection of installed system)*

REQ-018912/A

[redacted]

Verification method: T - test

REQ-018913/A

[redacted]

Verification method: I – inspection *(Inspection of installed system)*

REQ-018914/A

[redacted]

Verification method: I – inspection *(Inspection of installed system)*

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

2.3.9. Noise emission

REQ-018915/A

[redacted]

Verification method: R – review *(Review of engineering documents)*, I – inspection *(Inspection of installed system)*

REQ-018916/A

[redacted]

2.4. Operational and Quality requirements of "R Amplifier" and "MP Amplifier Kit"

2.4.1. Documentation + extend of documentation

REQ-018917/A

[redacted]

Verification method: R – review, I – inspection

REQ-018918/A

[redacted]

Verification method: R – review, I – inspection

REQ-018919/A

[redacted]

Verification method: R – review, I – inspection

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

REQ-018920/A

[redacted]

Verification method: R – review, I – inspection

REQ-018921/A

All documentation must be in English or Czech language.

Verification method: R – review, I – inspection

2.4.2. Formats for data exchange

REQ-018922/A

All documentation must be delivered in hardcopy and digital format (pdf or MS Word format).

Verification method: R – review, I – inspection

REQ-018923/A

[redacted]

Verification method: I - inspection

REQ-018924/A

[redacted]

Verification method: I - inspection

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

2.4.3. Warm-up time

REQ-018925/A

[redacted]

2.4.4. Reliability

The "R Amplifier" will be used within the ELI project as a part of the laser facility used for scheduled user experiments. This places stringent requirements on its reliability.

REQ-018926/A

[redacted]

Verification method: A - analysis *(Evaluation of proposal by the CA)*

REQ-018927/A

[redacted]

Verification method: A - analysis *(Evaluation of proposal by the CA)*

REQ-018928/A

[redacted]

Verification method: A - analysis *(Evaluation of proposal by the CA)*

REQ-018929/A

[redacted]

Verification method: A – analysis *(Design analysis performed by supplier)*, T – test *(Practical demonstration)*

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

2.4.5. Servicing

The "R Amplifier" must be designed in such a way that:

REQ-018930/A

REQ-018931/A

REQ-018932/A

REQ-018933/A

REQ-018934/A

Verification method: I – inspection *(Inspection of documentation)*

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

2.4.6. Replacement of parts

REQ-018935/A

[redacted]

REQ-018936/A

[redacted]

2.4.7. Spare parts availability

[redacted]

REQ-018937/A

[redacted]

REQ-018938/A

[redacted]

Verification method: R – review *(Contractual commitment with penalty clause)*

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

REQ-018939/A

[redacted]

Verification method: R – review *(Assessment of tender bid documentation by the CA)*

2.4.8. Training of users

REQ-018940/A

[redacted]

Verification method: R – review *(Completion of training)*

REQ-018941/A

[redacted]

Verification method: FD - functional demonstration

2.4.9. System warranty

REQ-018942/A

[redacted]

Verification method: R – review *(Contractual liability)*

REQ-018943/A

[redacted]

Verification method: R – review *(Contractual liability)*

REQ-018944/A

[redacted]

Verification method: R – review *(Contractual liability)*

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

REQ-018945/A

[redacted]

Verification method: R – review *(Contractual liability)*

2.4.10. Damage protection

REQ-018946/A

[redacted]

Verification method: I – inspection

REQ-018947/A

[redacted]

Verification method: I – inspection *(System inspection)*

3. Delivery, Transportation and Installation requirements

REQ-018948/A

[redacted]

Verification method: I – inspection *(System delivery)*

REQ-018949/A

[redacted]

Verification method: R - review

REQ-018950/A

[redacted]

Verification method: R - review

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

REQ-018951/A

[redacted]

Verification method: R – review, I – inspection

REQ-018952/A

[redacted]

Verification method: R - review

REQ-018953/A

[redacted]

SAFETY

3.1. Handling and transport procedures

REQ-018954/A

[redacted]

4. General Safety Requirements

REQ-018955/A

[redacted]

Verification method: R – review

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

REQ-018956/A

[redacted]

Verification method: R - review

REQ-018957/A

[redacted]

Verification method: R - review, A - analysis

5. Communication during contract execution

5.1. Progress reporting

[redacted]

REQ-018958/A

[redacted]

Verification method: R – review

5.2. Interface control document (ICD)

[redacted]

REQ-018959/A

[redacted]

Verification method: R – review

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

5.2.1. Interface control document

Description	REQ number	Time limit (months after contract signature)	Responsibility
[redacted]	[redacted]	[redacted]	CA (ELI)
[redacted]	[redacted]	[redacted]	Supplier
[redacted]	[redacted]	[redacted]	Jointly
[redacted]	[redacted]	[redacted]	Supplier
[redacted]	[redacted]	[redacted]	Supplier
[redacted]	[redacted]	[redacted]	Supplier
[redacted]	[redacted]	[redacted]	Supplier
[redacted]	[redacted]	[redacted]	Supplier

Table 7: Time limits for supplying the information in the ICD

REQ-018960/A

[redacted]

Verification method: R - review

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

6. Verification process

6.1. General

REQ-018961/A

[redacted]

Verification method: Not To Be Tracked within VCD

6.2. Verification methods

6.2.1. General

REQ-018962/A

[redacted]

Verification method: Not To Be Tracked within VCD

REQ-018963/A

[redacted]

6.2.2. Review

Verification by Review (**R**) shall consist in using approved records or evidence that unambiguously shows that the requirement is met.

NOTE: Examples of such approved records are design documents and reports, technical descriptions, and engineering drawings, manuals and accompanying operation documentation.

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

6.2.3. Inspection

Verification by Inspection (**I**) shall consist of visual determination of physical characteristics.

NOTE: Physical characteristics include constructional features, hardware conformance to document drawing or workmanship requirements, physical conditions, software source code conformance with coding standards.

REQ-018964/A

The inspection results shall be recorded in an Inspection report.

Verification method: R - review

6.2.4. Test

Verification by Test (**T**) shall consist of measuring product performance and functions under representative simulated environments.

REQ-018965/A

The measurement results shall be recorded in a Test report.

Verification method: R - review

6.2.5. Functional demonstration

Verification via Functional demonstration (**FD**) is either test of the system's response to a subject of requirement, or demonstration of qualitative operational performance consistent with the requirement.

REQ-018966/A

The execution of functional demonstration shall be observed and results recorded in a Functional demonstration report.

Verification method: R - review

REQ-018967/A

All safety critical functions shall be identified and verified by functional demonstration.

Verification method: R - review

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

6.2.6. Analysis

Verification by Analysis (**A**) shall consist of performing theoretical or empirical evaluation using techniques agreed with the CA.

NOTE: Techniques comprise systematic, statistical and qualitative design analysis, modelling and computational simulation.

REQ-018968/A

The results of analysis shall be recorded in an Analysis report.

Verification method: R - review

6.3. Verification Control Document (VCD) and Verification plan (VP)

The Verification Control Document (VCD) is a document used jointly by the CA and the supplier to record results of requirement verification. The VCD lists for each requirement the selected method(s) of verification, overall verification result (pass/fail) and reference to relevant report where necessary. The VCD is a living (versioned) document and provides an overview of the mutually agreed verification methods during the project execution and overview of the results at the contract end to support the acceptance of the "R Amplifier".

The Verification Plan (VP) proposes how the methods of verification are most efficiently grouped together (e.g. measurement with beam profiler can verify multiple requirements such as beam diameter, M^2, intensity distribution etc.), and how they can be staged during system production and during on-site installation.

REQ-018969/A

All results of requirement verification shall be recorded in the VCD.

Verification method: R - review

REQ-018970/A

The contents of the initial issue of the Verification Control Document (VCD) shall be prepared by the CA based on technical consultations (REQ-018971/A below) and agreed with the supplier within the time limit specified in the Table 8. The VCD will also record agreement on which requirements are verified at the supplier site (factory verification before shipping) and which requirements are verified at ELI site after delivery.

Verification method: R - review

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

REQ-018971/A

The technical consultation between the supplier and the CA shall involve agreement on the methods, levels of verification, and verification tools to be used for verifying individual requirements specified in Chapters 1-4.

Verification method: R - review

REQ-018972/A

The supplier shall carry out "factory verification" of requirements (according to the VCD and the VP) and record the results in the VCD before shipping the system out of factory.

Verification method: R – review *(agreement by Contracting authority)*

REQ-018973/A

The supplier shall prepare the Verification Plans (VP) for "RA amplifier" and "MP Amplifier kit" prior to the respective "factory verification" and consult the plans with the CA.

Verification method: R – review *(agreement by Contracting authority)*

REQ-018974/A

The supplier shall carry out with support from the CA the final verification of requirements at ELI facility and record the results in the final VCD.

Verification method: R – review *(agreement by Contracting authority)*

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

6.3.1. Time limits for deliverables and for supplying the information for the VP and the VCD (Table 8)

Deliverable	Description of time limit	Requirement	Limit	Responsibility
	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted] Amplifier"			
	[redacted]	[redacted]	[redacted]	Supplier
Deliverable 1a	[redacted]	[redacted]	[redacted]	Supplier
Deliverable 1b	[redacted]	[redacted]	[redacted]	Supplier
Deliverable 1c	[redacted]	[redacted]	[redacted]	Supplier
	DELIVERABLE 2: "MP Amplifier" KIT			
	[redacted]		[redacted]	Jointly
	[redacted]	[redacted]	[redacted]	Supplier
	[redacted]	[redacted]	[redacted]	Jointly
Deliverable 2a	[redacted]	[redacted]	[redacted]	Supplier
Deliverable 2b	[redacted]	[redacted]	[redacted]	Supplier
Deliverable 2c	[redacted]	[redacted]	[redacted]	Supplier

Table 8: Time limits for deliverables and for supplying the information for the Verification plan (VP) and the verification control document (VCD)

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

6.4. Acceptance

REQ-018975/A

In the acceptance stage the verification shall demonstrate that the product is free of fabrication errors and is ready for the intended operational use.

Verification method: R - review

REQ-018976/A

Acceptance shall be carried out on the final hardware and software.

Verification method: Not To Be Tracked within VCD

REQ-018977/A

The basis for acceptance shall be completed Verification Control Document (Chapter 6.3) summarizing the overall verification results together with relevant reports supporting the verification.

Verification method: R - review

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

MINISTRY OF EDUCATION
YOUTH AND SPORTS

Annex 2: The Contractor's bid submitted within the Procurement Procedure

3.2 Deliverable 2: "MP Amplifier Kit"

3.2.1 "MP Amplifier" design

[redacted]

3.2.2 "MP Amplifier kit" components

[redacted]

REQ-018858/A

[redacted]

3.2.2.1 "MP DISK HEAD" requirements

[redacted]

REQ-018861/A

[redacted]

TRUMPF

[redacted]

[redacted]

[redacted]

[redacted]

REQ-018864/A

[redacted]

in

[redacted]

[redacted]

[redacted]

3.2.2.2 "MP DIODES" requirements

[redacted]

3.2.2.3 "MP OPTICS" requirements

[redacted]

REQ-018868/A

[redacted]

[redacted]

KIT2 (Mirrors): [redacted]

KIT3 (TFP): [redacted]

KIT4 (Waveplate): [redacted]

KIT5 (Waveplate): [redacted]

KIT6 (Filter): [redacted]

a) [redacted]

KIT7 (Mirrors): [redacted]

[redacted]

3.2.2.4 "MP SUPPLY UNIT" requirements

[redacted]

3.2.2.5 External triggers for "MP Amplifier kit"

[redacted]

3.2.2.6 "MP Cabling" umbilical connections

[redacted]

3.2.2.7 "MP Accessories" requirements

[redacted]

Annex 3: Price List

Price Bid Table

Item	Quantity (pieces/ mandays, etc.)	Price (EUR excl. VAT) per piece, manday, etc.	Price (EUR excl. VAT) per item
R Amplifier (according to art. III. 1. (i) of the CfW) **Price**	[redacted]	[redacted]	[redacted]
MP Amplifier Kit (according to art. III. 1. (ii) of the CfW and art. 2.2.2. of Technical Specifications) **Price:**			
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
MP Amplifier Kit Price total			[redacted]
Out-of-Warranty Service (according to art. III. 2. c) of the CfW) (Includes: transport, 1 night accomodation, daily allowance (meal, public transportation, etc.)	[redacted]	[redacted]	[redacted]
Price of the Work (according to art. XI.1. of the CfW, i.e. R Amplifier Price + MP Amplifier Kit Price + Out-of-Warranty Services price):			[redacted]
Spare parts (according to art. III. 3. of the CfW and REQ-018938/A, Technical specifications):			
[redacted]	1	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
Spare parts total:			[redacted]
[redacted]			
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
Optional MP Components total:			[redacted]
Total Bid Price = Price of the Work + Spare parts price + Optional MP Components price:			**1.339.000,00 EUR**