PURCHASE CONTRACT

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

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

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

registration no.: 68378271

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

(„**Buyer**"); and

(2) iXblue

with its registered office at: 34, Rue de la croix de fer - 78 100 Saint Germain en Laye, France

registration no.: 433 185 121

represented by: Philippe Griveau

enrolled in the commercial registered kept by R.C.S Versailles

(„**Seller**").

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

WHEREAS

(A) The Buyer is a public contracting authority and the beneficiary of a grant of the Ministry of Education, Youth and Sports of the Czech Republic within the Operational Programme Research, Development and Education. The Buyer carries out a project financed by the grant specified herein in this provision („**Project**").

(B) For the successful realization of the Project it is necessary to purchase the Object of Purchase (as defined below) in accordance with the Rules for the Applicants and Recipients within the Operational Programme Research, Development and Education.

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

(D) The Seller's bid for the public procurement entitled „**Fibre-Based Seed Laser System"**, whose purpose was to procure the Object of Purchase („**Public Procurement**"), was selected by the Buyer as the most suitable.

(E) The Seller acknowledges that the Buyer is not, in connection to the subject matter of this Contract, an entrepreneur, and also that the subject matter of this Contract is not related to any business activities of the Buyer.

(F) The documentation necessary for the execution of the Contract is

- Technical Specification, which forms an integral part hereof as its Annex No. 1 (hereinafter the "TS"); this TS also formed a part of the procurement documentation for the Public Procurement in the form of Annex No. 1 of the procurement documentation;
- The Seller´s bid submitted fot the Public Procurement (hereinafter the "Seller´s bid"); the Seller´s bid forms Annex No. 2 of this Contract

IT WAS AGREED AS FOLLOWS:

1. BASIC PROVISIONS

1.1 Under this Contract the Seller shall deliver and install for the Buyer a device as described and defined in Annex 1 (Technical Specification) and Annex 2 (Seller´s bid) to this Contract in the required quality, and with the properties and related performance described therein („**Object of Purchase**") and shall transfer to the Buyer ownership right to the Object of Purchase, and the Buyer, shall take over the Object of Purchase and shall pay the Seller the Purchase Price (as defined below), all under the terms and conditions stipulated in this Contract.

1.2 Under this Contract the Seller shall also carry out the following activities („**Related Activities**"):

a) Transport and delivery the Object of Purchase to the place of delivery (Art. 2.2 of the Contract);

b) Setup and installation of the Object of Purchase including performance of site acceptance test of the Object of Purchase; and

c) Cooperate with the Buyer anytime during the performance of this Contract.

2. THE TIME AND PLACE OF DELIVERY

2.1 The Seller shall deliver the Object of Purchase and shall carry out Related Activities within **four (4) months** from the effectiveness of this Contract, unless stipulated otherwise in this Contract. A full breakdown of the delivery schedule will be provided within 1 month of the effectiveness of the Contract.The time of delivery is stipulated herein in favour of the Buyer. The Buyer is entitled to prolong the time for delivery Object of Purchase and for carrying out Related Activities for two (2) more months, should there be important reasons for that on the side of the Buyer, such as, but not only, impossibility to take over the Object of Purchase at the premises agreed in this Contract (place of delivery in Art. 2.2 of this Contract) due to reconstruction works taking place there.

2.2 The place of delivery shall be HiLASE Centre Za Radnicí 828, 252 41 Dolní Břežany, Czech Republic ("Place of delivery") or any other address, which the Buyer communicated to the Seller prior to the delivery of the Object of Purchase.

2.3 The Object of Purchase setup, installation and site acceptance test under Art. 1.2.b.) of this Contract shall take place on the last day of delivery, unless Buyer and Seller agree otherwise.

2.4 The Seller acknowledges that the deadlines stated in this Article are of essential importance to the Buyer with respect to the timeline of the Project with respect to the deadline by which the Project are to be implemented, and that the Buyer could incur damage as a result of failure to meet the above stipulated deadlines.

3. THE OWNERSHIP RIGHT

The ownership right to the Object of Purchase shall be transferred to the Buyer upon the signature of the Hand – over protocol (delivery note).

4. PRICE AND PAYMENT TERMS

4.1 The purchase price for the Object of Purchase is **130 000 EUR** („**Purchase Price**") **excluding VAT.** VAT shall be set and paid in accordance with respective legislation.

4.2 The Purchase Price cannot be exceeded and includes all costs and expenses of the Seller related to the performance of this Contract. The Purchase Price includes, among others, duties, all expenses related to the handover of the

Object of Purchase and execution of Related Activities, costs of copyright, insurance, customs, warranty service and any other costs and expenses connected with the performance of this Contract.

4.3 The Purchase Price for the Object of Purchase shall be paid on the basis of a tax document – invoice, to the account of the Seller designated in the invoice. The Purchase Price shall be paid only after the Hand – over protocol is signed by the Seller and the Buyer.

4.4 The Buyer shall realize payments on the basis of duly issued invoice within thirty (30) calendar days from their receipt. If the Seller stipulates any shorter due period of the invoiced amount in the invoice, such different due period shall not be deemed relevant and the due period stipulated herein prevails. The invoice shall be issued only after the Hand – over protocol signature.

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

a) Name and registered office of the Buyer,

b) Tax identification number of the Buyer,

c) Name and registered office of the Seller,

d) Tax identification number of the Seller,

e) Registration number of the tax document,

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

g) Date of the issue of the tax document,

h) Date of the fulfilment of the Contract,

i) Purchase Price,

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

k) Declaration that the performance of the Contract is for the purposes of the Project; the exact details of the Project including name and reg. number will be communicated to the Seller based on Seller´s request which shall be sent to the Buyer to following e-mails: xxxxxxxxxx and xxxxxxxxxx before an invoice is issued. Seller shall issue an electronic invoice and send it to

following e-mails xxxxxxxxxx and xxxxxxxxxx for preliminary check. After the preliminary check the Seller shall send the final electronic invoice to xxxxxxxxxx,

and must also comply with any double taxation treaties applicable to the given case.

4.6 The last invoice in each calendar year must be delivered by the Seller to the Buyer's no later than by December 15 of the given calendar year. In case that the invoice shall not contain the above mentioned information or the invoice does not comply with the requirements stipulated by law or the invoice is delivered to the Buyer later than by December 15 of the given calendar year, the Buyer is entitled to return it to the Seller during its maturity period and this shall not be considered as a default. The new maturity period shall begin from the receipt of the supplemented or corrected invoice to the Buyer.

4.7 The Buyer's invoicing details are set out in provision (1) hereof.

5. SELLER'S RIGHTS AND DUTIES

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

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

5.3 All things necessary for the performance of this Contract shall be procured by the Seller, unless this Contract stipulates otherwise.

5.4 Buyer hereby declares and Seller hereby acknowledges that after the Object of Purchase is delivered to the Place of delivery and all the Related Activities are carried out and fulfilled, the Object of Purchase may be afterwards transported to the premises of Buyer´s partner in the Project (hereinafter "Central Laser Facility" or "STFC") which is seated at Rutherford Appleton Laboratory Chilton, Didcot, OX11 0QX, UK , for further operation. STFC shall operate the Object of Purchase fully in line with Seller´s instructions contained in its bid (Annex 2) as well as Buyer´s technical specification (Annex 1).

6. HANDOVER OF THE OBJECT OF PURCHASE

6.1 Handover and takeover of the Object of Purchase shall be realized on the basis of hand-over protocol ("**Hand – over protocol**") which shall be signed only after the Object of Purchase setup, installation and site acceptance test is over and which shall contain following information:

- identification of the Seller, the Buyer and all subcontractors, if there are any,
- description of the Object of Purchase,
- the list of defects and deficiencies of the Object of Purchase, if there are any, and the deadlines for their removal,
- the signature of the Seller and the Buyer and the date of the hand-over.

6.2 Instructions and manuals related to all items of the Object of Purchase shall be attached to the Hand-over protocol at the latest.

6.3 If the Seller fails to duly carry out all Related Activities or if the Object of Purchase does not fully meet requirements of this Contract, the Buyer is entitled to refuse the takeover of the Object of Purchase. In such a case, the Seller shall remedy the deficiencies within thirty (30) calendar days, unless Parties agree otherwise. The Buyer is entitled (but not obliged) take over the Object of Purchase despite the above mentioned deficiencies, in particular if such deficiencies do not prevent the Buyer in the proper operation of the Object of Purchase. In such a case, the Seller and the Buyer shall list the deficiencies in the Hand-over protocol, including the manner and the date of their removal (remedy). If the Parties do not reach agreement in the Hand-over protocol regarding the date of the removal, the Seller shall remove the deficiencies within fourteen (14) calendar days.

6.4 Parties hereby exclude application of section 2126 of the Civil Code.

7. WARRANTY

7.1 The Seller hereby provides a warranty of quality of the Object of Purchase for the period of **thirty-six** (36) months.

7.2 The warranty period shall commence on the day of the signature of the Hand-over protocol by both Parties. However, if the Object of Purchase is taken

over with defects or deficiencies, the warranty period shall commence on the date of the removal of the last defect or deficiency by the Seller.

7.3 The Seller shall remove defects that occur during the warranty period free of charge.

7.4 If during the warranty period the Buyer, or on his behalf STFC´s representative), ascertains a defect of the Object of Purchase, the Buyer shall notify such defect without undue delay to the Seller ("**Warranty Claim**"). Defects may be notified on the last day of warranty period, at the latest; an e-mail is considered an adequate way to initiate a Warranty Claim. Warranty Claim sent by the Buyer on the last day of the warranty period shall be deemed to be made in time.

7.5 The Buyer notifies defects in writing via e-mail. The Seller shall accept notifications of defects on the following e-mail address: xxxxxxxxxx

7.6 In the Warranty Claim the Buyer shall describe the defect and the manner of removal of the defect. The Parties shall agree on the manner of defect´s/defects´ removal. If the Parties do not reach the agreement, the Buyer or Buyer´s representative further assembling the Object of Purchase has the right to:

a) request removal of the defect/defects by the delivery of Object of Purchase or its individual parts, or

b) request removal of the defect/defects by repair, or

c) request adequate discount from the Purchase Price.

The choice among the above mentioned rights shall be made by the Buyer or Buyer´s representative based in the Place of delivery. However, in case of a removable defect/defects that occur/occurs for the first time the Buyer or Buyer´s representative further assembling the Object of Purchase shall not request removal of the defect by delivery of new Object of Purchase or its individual parts.

7.7 The Seller shall remove the defect within thirty (30) calendar days from the date on which the Warranty Claim was notified to the Seller, at the latest, unless the Buyer or STFC´s representative and the Seller agree otherwise. Should warranty defect be ascertained during the time period when the Object of Purchase is operated at STFC and provided the nature of such warranty defect does not exclude a warranty repair based on Warranty Claim to be carried out at the STFC´premises, the Seller shall be obliged to carry out warranty repair and cover all the costs related hereto (including, but not only, transporation costs) at the place where such defective Object of Purchase is being operated;

the same applies in case a warranty defect is asertained during the time period when the Object of Purchase is operated at the Buyers´s premises. The Seller should take into account the obligation stated herein in this Article within the Purchase Price stipulated in Art. 4.1.

7.8 The Seller shall remove defect/defects of the Object of Purchase within periods stated in the Contract also in the instances when the Seller is of the opinion that he is not liable for such defects. In cases when the Seller will not recognize the defect and the Buyer or STFC´s representative will not agree with such conclusion, the validity of the Warranty Claim shall be ascertained by an expert, which is to be commissioned by the Buyer or STFC´s representative but with whom the Supplier also must agree. In the event the expert declares the Warranty Claim as justified, the Seller shall bear the costs of the expert's assessment. If the Warranty Claim is raised unjustly according to expert's assessment, the Buyer shall reimburse the Seller all reasonably incurred costs associated with removing the defect/defetcs.

7.9 Parties shall execute a protocol on the removal of the defect, which shall contain the description of the defect/defects, the confirmation that the defect/defects was/were removed and signature of the Buyer or on his behalf the STFC´s representative. The warranty period shall be extended by the time that expires from the date of exercising the Warranty Claim until the defect/defects is/are removed in cases where it was not possible to use the Object of Purchase for its intended purpose.

7.10 In case that the Seller fails to remove the defect/defects within time stipulated in this Contract or if the Seller refuses to remove the defect/defects, then the Buyer or STFC´s representative is entitled to remove the defect/defects at Buyer´s own costs and the Seller shall reimburse these costs within thirty (30) calendar days after the Buyer's request to do so.

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

7.12 Parties exclude application of the section 1925 (the sentence behind semi-colon) of the Civil Code.

7.13 The Seller shall provide to the Buyer or STFC´s representative technical support (consultation of operational, maintenance and other issues regarding the Object of Purchase) free of charge on the phone no.: xxxxxxxxxx

8. TERMINATION, RIGHT OF WITHDRAWAL, CONTRACTUAL PENALTIES

8.1 This Contract may be terminated by completing the performance required hereunder, by agreement of the Parties or by withdrawal from the Contract on the grounds stipulated by law or in the Contract.

8.2 The Buyer is entitled to withdraw from this Contract, if any of the following circumstances occur:

(a) the Seller has materially breached obligations imposed by the Contract, specifically by being in delay with the fulfilment of this Contract and such delay lasts more than 4 weeks; or

(b) the Seller has materially breached obligations imposed by the Contract, specifically Object of Purchase fails to meet technical parameters and qualities or other requirements defined in the Annex 1 (Technical Specification);

(c) the insolvency proceeding is initiated against the Seller´s assets;

(d) the fuding body providing finances for the Project ("Financial subsidy") or any other control body determines that the expenditures or part of the expenditures incurred on the basis of this Contract are ineligible;

(e) the Financial subsidy for implementation of the Project is withdrawn from the Buyer; or

(f) should it become apparent that the Seller provided information or documents in the Seller's bid, which were not true and which could, therefore, influence the outcome of the Procurement Procedure leading to the conclusion of this Contract (Section 223(2)(b) of the Act No. 134/2016 Coll., on public procurement).

8.3 The Seller is entitled to withdraw from the Contract in the event of material breach of the Contract by the Buyer and in case of events outside the control of the Seller (e.g. natural disasters, etc.).

8.4 In the event the Seller is in delay with term of delivery as stipulated in Art. 2 herein, the Seller shall pay to the Buyer the contractual penalty in the amount of 0.1% of the Purchase Price for each, even commenced calendar day of delay.

8.5 In the case where the Seller fails to remove defects within the periods stipulated in the Contract, the Seller shall pay to the Buyer a contractual

penalty in the amount of 100 EUR for each defect and for each calendar day of delay.

8.6 If the Buyer fails to pay the Purchase Price within the deadlines set out in this Contract, the Buyer shall pay the Seller interest on delay in the amount set forth by the law for each day of delay unless the Buyer proves that the delay with the payment of the Purchase Price was caused by late release of the Financial subsidy for the Project by the funding body.

8.7 The obliged Party must pay any contractual penalty/penalties to the entitled Party not later than within fifteen (15) calendar days of the date of receipt of the relevant claim from the other party.

8.8 Payment of the contractual penalties pursuant to this Article shall in no way prejudice the Buyer's right to claim compensation for damage incurred by the Buyer as a result of the Seller's breach of obligations to which the penalty applies.

8.9 The Parties have agreed that the maximal amount of contractual penalties shall be limited to 10% of the Purchase Price.

8.10 The Buyer is entitled to set off by unilateral declaration any of its recievable or part of its recievable resulting from contractual penalty/contractual penalties against Seller´s claim to pay Purchase Price.

9. SPECIAL PROVISIONS

By signing this Contract, the Seller becomes a person that must cooperate during the finance control within the Act no. 320/2001 Coll., on finance control in the public administration, as amended, and shall provide to the Directing Body of the Operational Programme Research, Development and Education or other control bodies (such as, but not only, European Commission, European Court of Auditors) acces to all parts of the bid, Contract or other documents that are related to the legal relationship formed by this Contract. This duty also covers documents that are subject to the protection in accordance with other acts (business secrets, secret information, etc.) provided that control bodies fulfil requirements stipulated by these acts. The Seller shall secure that all its subcontractors are also obliged to cooperate with control bodies in the above stipulated extent. The Seller shall secure that all its subcontractors are also obliged to cooperate with control bodies in the above stipulated extent. The Seller is obliged to duly archive all written material prepared in connection with the execution of this Contract and to provide access to the Buyer to these archived documents until 2027; any finance control may also be carried out until year 2027.

10. FINAL PROVISIONS

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

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

10.3 All modifications and supplements of this Contract must be carried out in writing as numbered amendment/amendments.

10.4 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 invalidity, putativeness, ineffectiveness or unenforceability of the Contract as a whole. In such event the Parties undertake without 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 Parties to the Contract at the time of creation hereof.

10.5 The Parties agree that the Seller shall not be entitled to set off any part of its receivable, or receivable of its sub-debtor against the Buyer or any of his receivables, unless this Contract stipulates otherwise. The Seller shall not be entitled to assign any receivable arising in connection herewith to a third party. The Seller shall not be entitled to assign any rights or obligations arising to him hereunder or any of its parts to third parties.

10.6 The Parties declare that they accept the "risk of changed circumstances" within the meaning of Sec 1765(2) of the Civil Code.

10.7 The Parties declare that they shall maintain confidentiality with respect to all facts and information they learned in connection with the Contract or during the performance of the Contract, and the disclosure of such facts or information could cause damage to the other Party. This confidentiality provision does not affect duties of Parties with respect to applicable legislation.

10.8 This Contract shall constitute complete agreement of the Parties on the Contract subject matter including the Object of Purchase and shall substitute

any and all possible previous discussons, negotiations and agreements of the Parties related to the Contract subject matter including the Object of Purchase.

10.9 The following Annexes form an integral part of the Contract:

- **Annex No. 1:** Technical Specification Document (if Annex 1 uses the term "Contracting Authority" or "contracting authority" it means Buyer. If Annex 1 uses the term "Supplier" or "supplier", it means Seller);
- **Annex No.** 2: The Seller´s bid submitted fot the Public Procurement; the Seller´s bid forms Annex 2 of this Contract.

In case of any discrepancies between this Contract and any of its annexes, the provisions of this Contract shall prevail. In case of any discrepancies between Annex No. 1 and Annex No. 2, the Annex No. 1 shall prevail except for those provisions of Annex No. 2, which were evaluated within Public Procurement under Suitability and Quality Performance evaluation sub-criterion and are also listed in Annex No 3 of the Seller´s bid

10.10 The Parties agree to publish the full text of this Contract, including its annexes, in the Register of Contracts pursuant to Act No. 340/2015 Coll., on Special Conditions for the Effectiveness of Certain Contracts, the Disclosure of These Contracts and the Register of Contracts, as amended (Act on the Register of Contracts).

10.11 This Contract shall become valid on the date of the signature of both Parties. The Contract shall become effective on the date of its publication at Register of Contracts.

11. Representatives of the Parties

11.1 The Seller has appointed the following authorised representatives for communication with the Buyer in relation to the subject of performance hereunder:

In technical matters: xxxxxxxxxx

11.2 The Buyer has appointed the following authorised representatives for communication with the Seller in relation to the subject of performance hereunder:

In technical matters: xxxxxxxxxx

Should any procedures related to warranty claims as these are described in the Contract be carried out by the STFC´s representative following representative shall be approached and contacted: xxxxxxxxxx

IN WITNESS WHEREOF attach Parties their handwritten signatures:

Buyer	**Seller**
Signature: _____	Signature: _____
Name: RNDr. Michael Prouza, Ph.D.	Name: Philippe Griveau
Position: director	Position: Regional Sales Manager
Date:	Date:

ANNEX 1

TECHNICAL SPECIFICATION

(NOTE: Annex No. 4 to the Procurement documetnation shall be attached hereto by the Contracting Authority before signature hereof by the Contracting Authority after the Public Procurement procedure is finished)

Annex No. IV to Procurement Documentation

Specification for Fibre-Based Seed Laser System

1. Introduction

This document describes the technical specification required to produce a fibre based seed laser system (in the following called the System) that produces shaped ns-pulses to seed a diode pumped Yb:YAG laser amplifier chain. In this amplifier chain, the pulses will be amplified in to an energy of 10 J at a repetition rate of 100 Hz.

The Yb:YAG laser system is being developed by the Science and Technology Facilities Council and the HiLASE Facility. It will initially be installed and commissioned in a laser laboratory at the Rutherford Appleton Laboratory, UK, before moving to a laboratory at the HiLASE Facility in the Czech Republic.

2. Scope of contract

The proposals shall cover delivery of all components necessary, including:

- A tuneable, single frequency, continuous wave (cw) Master Oscillator. It shall be possible to use an alternative Master Oscillator, supplied by the customer, instead. For details see Section 3.1.
- An optical Pulse Shaping Unit including appropriate fibre amplifiers and modulators.
- An arbitrary waveform generator (AWG) to drive the pulse shaping modulator.
- All necessary ancillary equipment like power supplies and driver units for the individual components.
- Integration of all components into one or several rack-mountable units.
- Factory demonstration of System performance.
- Installation at site of STFC and demonstration of performance to specification.
- Operator training by a dedicated engineer
- Documentation in English

3. Overview of System

Figure 1 shows a schematic diagram of the System outlining the major sub-systems, and the interfaces with the Customer's equipment. The diagram is indicative only and does not prescribe how the internal components should be partitioned or housed.

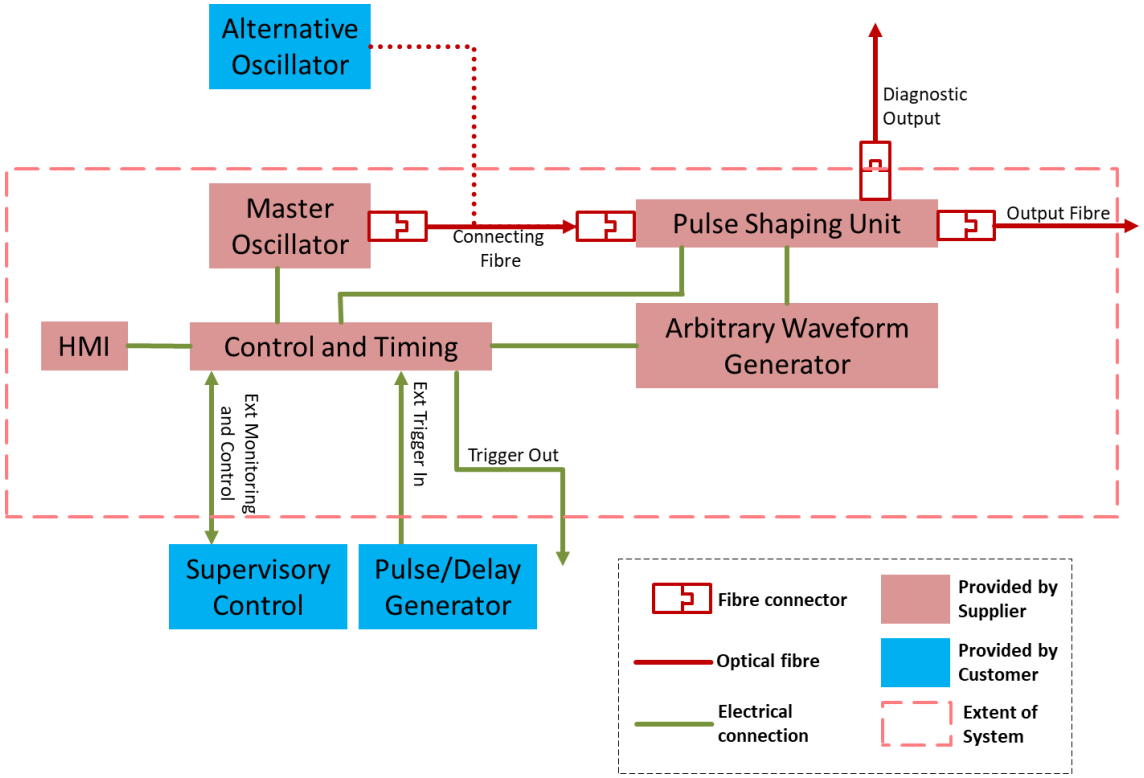


Figure 1: Block diagram of System. For details see text. HMI stands for human-machine interface

- For details concerning the alternative oscillator see Section 3.1.
- For detailed output requirements see Section 4.
- For details regarding the diagnostic output see Section 5.
- For details regarding local and external control, trigger in and outputs, and the HMI see Section 6.

3.1 Alternative Oscillator

As outlined in Figure 1, the supplied Master Oscillator shall be connected to the rest of the System through an externally accessible fibre. The system shall function with an alternative, customer supplied, oscillator; to facilitate this it shall be possible to disconnect the master oscillator fibre to connect the alternative, customer supplied oscillator. The alternative oscillator will have the following output properties:

- Temporal: cw
- Spectral: narrow-band or broadband, but always within ± 1 nm of λ_o (as defined in Section 4.1).
- Power: up to 20 mW, maximum power can be limited as directed by the Supplier.
- Delivery through single-mode PM980 fibre, with PER of around 20 dB, with polarisation axis as directed by the Supplier. For information on connectors see Section 8.

4. PERFORMANCE SPECIFICATION FOR FIBRE SEED SOURCE

The output of the System shall be delivered by optical fibre (for details see Section 4.5). Unless stated otherwise, performance of the System will be measured at the output of this fibre and compared against the criteria detailed below. This means that specifications, unless stated otherwise, apply to the optical output pulses, and not to the electrical RF pulses produced by the AWG.

It is encouraged that data, including measurements undertaken in the past and how they were obtained, are provided by bidders to show capability to meet the specification.

The performance shall be demonstrated using the single frequency Master Oscillator delivered by the Supplier.

As mentioned in Section 3.1, the System will be capable to work with an alternative, customer-supplied oscillator, the "handover" between seed sources must be demonstrated. The Customer will make this alternative oscillator available to the Supplier for testing.

4.1 Spectral properties

The spectral properties, determined by the Master Oscillator, shall be as follows.

- The centre wavelength λ_o shall be 1029.8 nm (measured in vacuum) equivalent to 1029.5 nm (measured in air).
- The wavelength shall be tuneable by at least ±0.5 nm around λ_o.
- The wavelength shall be adjustable by the operator, in increments of 50pm, with a target of 10 pm.
- The information about the Master Oscillator the supplier intends to use shall be provided as part of the bid, ideally backed up by evidence such as datasheets. This shall include information on:
    - Spectral width, which shall be no more than 20 MHz.
    - Side-mode suppression which shall be better than 30 dB.
    - Wavelength stability which shall be better than ±10 pm over 6 hours.

4.2 Temporal properties

- The pulse repetition rate shall be at 10 kHz.
- The temporal pulse duration shall be programmable between 1 to 20 ns.
- The temporal pulse shape shall be arbitrarily controllable with a temporal resolution (step size) of no more than 125 ps.
- The jitter between the externally supplied electrical trigger pulse and the optical output pulse shall be no more than 50 ps RMS. See also Section 6.3 regarding timing and triggering.
- The pulse rise/fall times (10-90%) shall be less than 200 ps, with a target of 150 ps.

4.3 Amplitude control

- The temporal extinction ratio shall be at least 30 dB, measured within a time window of ± 15 ns relative to the centre of the output pulse.
- The minimum temporal extinction ratio shall be met for Master Oscillator wavelengths in the range of λ_o ± 0.5 nm. It is desirable that it will also be met for wavelengths in a range of λ_o ± 1.0 nm.
- The minimum temporal extinction ratio must be maintained without operator intervention for at least three months. At longer time intervals, when required, suitably trained operators must be able to make adjustments, using commonly available instrumentation and without having to open the housing of the System.
- The resolution with which the amplitude of the pulse can be controlled shall be at least 10 bit.
- For a square output pulse, ripples in the plateau region of the pulse, shall not exceed ± 2 % peak-to-peak of the pulse amplitude.

4.4 Energy, power and stability

- The maximum peak power shall be at least 300 mW, meaning the pulse energy for a square pulse will be at least 0.3 nJ at 1 ns duration, and 3 nJ at 10ns duration.
- The system will be used to seed a laser system operating at 100 Hz, therefore pulse-to-pulse energy stability shall be measured at that rate, i.e. by an instrument that is triggered at one-hundredth of the System's internal repetition rate. The pulse-to-pulse energy stability for 100 % of pulses, measured in this way, over 1 minute (equal to 6000 pulses), will be better that ± 1 % peak-to-peak. The RMS stability (or standard deviation) within that time frame will be better than 1 %.
- The stability of average power will meet the criteria listed in the following. The method to measure the average power shall be agreed during the kick-off meeting.
    - The average power will be stable within ± 1 % peak-to-peak over a period of 15 min.
    - The average power will be stable within ± 2.5 % peak-to-peak over a period of 8 h, provided the ambient temperature does not vary by more than ± 1.0 °C.

4.5 Polarisation and output delivery

- The output shall be delivered through a single-mode PM980 panda fibre. For connectors, length and sheathing see Section 8.
- The output shall be linearly polarised along the slow axis direction of the output fibre.
- The polarisation extinction ratio (PER) shall be better than 20 dB.

5. Diagnostics

The seed source shall provide an additional optical output signal that it is optically split (at the few-% level) from the main output and that is made available through a fibre port, such that an external, SM-fibre coupled photodiode can be connected.

6. Electronics & Control

6.1 Local and supervisory control

The System shall contain its own local control and data acquisition system, including an HMI (human-machine interface, also called user interface), so the System can be controlled locally and operated stand-alone.

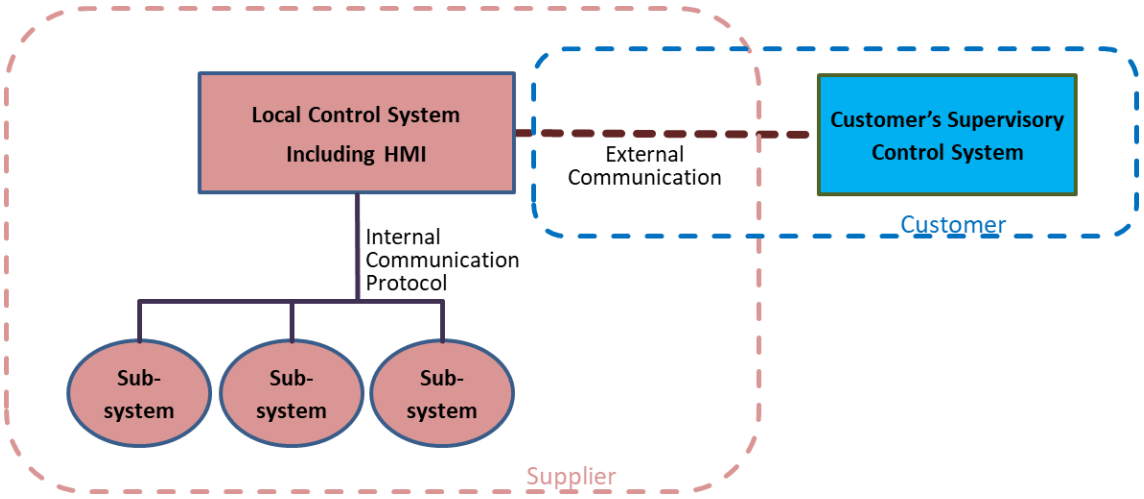


Figure 2: Illustration of control system architecture, indicating areas of responsibility of the Supplier, of the Customer, and where an interface needs to be agreed.

Once delivered, the System shall allow full integration into an overarching supervisory control system developed by STFC. The supervisory control system will be developed using EPICS (see https://epics.anl.gov/), an open-source distributed control system framework used in many large-scale science facilities, such as particle accelerators or synchrotron light sources.

To this end, the local control system shall provide an interface, for remote control and monitoring of the System, which is compatible with EPICS. Ideally, the local control system will provide an EPICS driver. Alternatively but, less desirable, the local control system shall then expose an interface (for example Telnet, raw TCP, RS232, Modbus, CAN-bus) to allow for a full integration of the device into the supervisory control system. Details of the Application Programming Interface (API) can be worked out collaboratively and iteratively with STFC.

'Remote Desktop' solutions such as VNC, or replicating the local HMI on a remote PC, are not acceptable as they do not provide the level of integration expected and required by STFC's supervising control system.

Providing remote access/control of the System directly (i.e. bypassing the local control system) and/or to low-level hardware communication software libraries is also not acceptable; the whole System must be seen as a black-box from the supervisory control system with at least the following functionality:

- The control functionality needs to include everything required for day-to-day operations of the System. Advanced functions that would only be used during set-up or maintenance of the System do not need to be made available to the supervisory control system.
- All data, including errors/faults/alarms that is acquired by the local control system should also be available for the supervisory control system.
- A "health signal" to indicate whether the System is OK or not.
- A command indicating what error was last produced.
- The ability to set the IP address for external communication

6.2 Functionality of local control system

The functionality of the local control system shall include at least the following:

6.2.1 Control and monitoring of basic functions

- Control of System operation (turning the System on and off).
- Control of the output power.
- Control of the wavelength.
- Displaying of basic set and, if available, actual values such as wavelength, Master Oscillator cw power, output peak power, alarms and faults (e.g. interlock fault, see also Section 7.1).
- Further requirements can be included and should be discussed with STFC.

6.2.2 Pulse shape control

- During operation, the System shall provide the capability to make adjustments to the active pulse shape, meaning that for individual samples of the AWG wave form (if possible also groups of samples) the signal level can be changed 'on the fly', such that this will not cause dropped pulses or significant fluctuations in the output energy, other than the energy change caused by the adjustment itself.
- The System shall further provide the capability to save pulse shapes to and load them back from non-volatile internal memory that can hold at least 100 different shapes. The shapes shall be stored in a human-readable ASCII format and it shall be possible to

download files from and upload them to the local control system, e.g. using a USB flash drive.

- It is acceptable for optical output pulses to be dropped while a new pulse shape is loaded, however, no optical output shall be generated which consist of only part of the new pulse shape.
- It is desirable for the local control system to provide a tool to create simple pulse shapes such as squares and triangles.

6.3 Triggering

The System will be triggered at the rate of 10 kHz from the customer's external pulse/delay generator during normal operations. The trigger signal will be a TTL-type signal.

The System shall only require a single external trigger signal, required additional timing signals shall be generated internally.

An RF-clock signal (80 MHz sinusoidal signal) can also be provided by the customer if it is required to meet the jitter specification detailed in Section 4.2.

7. Safety & self-protection

7.1 Laser safety & interlock

The System shall comply with the European laser safety standard BS EN 60825 and shall be CE certified. Bidders are entitled to offer another solution which is equivalent to requirements stipulated above in this Art. 7.1.

The System shall contain an interlock connector for personnel safety. Details will be specified during the design phase of the contract. The requirements will include the following:

- An interlock signals will be provided by STFC/HiLASE through a potential free contact which the System needs to constantly monitor using appropriate hardware qualified to the appropriate safety standards.
- The safety interlock system design must demonstrably (by means of fault tree or failure mode effects analysis) minimise the probability of failure to danger. This is achieved through the appropriate selection of certified components (such as self-monitoring safety relays, safety PLCs etc.). Details of the safety interlock system design with justification of component choices must be supplied to STFC to enable STFC to complete a full analysis of the safety system including STFC supplied components.

7.2 Self-protection

The System shall be tolerant to the following conditions and not suffer immediate damage or accelerated long-term degradation.

- The presence of optical feedback from external components, against which a reasonable degree of optical isolation shall be provided at the output.
- Sudden loss of Oscillator power and sudden activation of Oscillator, in particular if an alternative oscillator is used that is not integrated into the local control system. It is acceptable if the Pulse Shaping Unit shuts itself down if insufficient Oscillator input is detected and that it can only be restarted when Oscillator input is restored.
- Changes in external trigger rate, dropped trigger pulses or total loss of external trigger. Again, it is acceptable for the Pulse Shaping Unit to shut down in such circumstances.

8. Mechanical

- All components shall come in 19" rack mountable units. Separate units or a single integrated solution are both acceptable.
- The type of fibre connectors used within the system shall be agreed during the kick-off meeting, except the connector at the end of the output fibre which shall be FC/APC.
- The output fibre will be in a protected sheath and > 10 m in length.

9. Electrical

- All modules requiring mains power shall have an IEC 60320, C14 inlet (commonly found on personal computers etc.), so that cables with different mains connectors, e.g. for the UK and for the Czech Republic, can be fitted.
- The System shall be capable of withstanding a failure of the mains electrical supply without causing, or increasing the likelihood of, damage or deterioration of any electrical or optical component.

10. Quality Assurance and testing

The Supplier will provide the full contact details of its Quality Manager, or member of staff responsible for quality approval and processes no later than two weeks after the signing of the contract.

A quality plan will be generated by the Supplier and this documentation will be made available to the Customer. The Plan should be based around the 'Bill of Materials' for the complete deliverable which shows the detail concerning the inspection and testing criteria of each individual part. The plan must also indicate details concerning the documented processes and quality control records that will be used and made available to the Customer.

The Supplier will grant access to its work premises for the Customer to undertake periodic quality control inspections as required. These events will generally be associated with the completion of elements of the order where milestone payments are due and during testing and certification of product.

The Supplier shall notify the Customer of such events providing a minimum of 14 calendar days' notice.

11. Documentation and manuals

The Supplier shall provide:

- Installation manuals, in English in reproducible form – in advance of delivery/after design review.
- Operating and Maintenance manuals, in English in reproducible form.
- Full documentation of the control system including details of the API with a list of the protocols and examples of their usage
- Copies of technical construction files used for CE marking to ensure compliance with relevant directives.
- A certificate of conformity to this specification, with procedures for this testing to be agreed.
- Agendas and minutes of kick off, technical meetings and design reviews/approvals.
- Factory Acceptance Test (FAT) and Site Acceptance Test (SAT) documents – templates at least 1 month ahead of testing.
- A list of suggested spare parts shall be provided including the lead time and cost of each part.

12. Warranty, lifetime and support

A two year warranty is required as a minimum.

The Supplier shall quote a price for the extension of the warranty for a further year over and above this.

13. Schedule, milestones, reviews

The maximum delivery schedule is 4 months from award of contract. A full breakdown of the delivery schedule will be provided within 1 month of award of contract.

The quality plan and schedule must be provided and accepted at the kick off meeting which will constitute a project milestone with an associated payment.

A Factory Acceptance Test (FAT) demonstrating conformity with this specification shall be carried out at the Suppliers factory. A test schedule will be proposed for agreement within three months of the contract being awarded. The successful completion of the FAT constitutes another milestone with associated payment.

A Site Acceptance Test (SAT) of the system will be required following installation at STFC. This shall be a repeat of the FAT. The successful completion of the SAT constitutes a further milestone with associated payment.

The acceptance of the documentation indicated in Section 11 will also constitute a milestone with an associated payment.

The Supplier shall bring their own equipment to demonstrate the system performance during the SAT. This equipment includes:

- Tools
- Instrumentation and ancillary equipment for testing, for example power meter, spectrometer etc.

ANNEX 2

SELLER´S BID

Part 2 of the Bid – Quality Assurance Plan is confidential.

iXblue Cover Bid - Fibre-Based Seed Laser System - VZ0061186

Open Tender
Name: Fibre-Based Seed Laser System
ID: VZ0061186
System Number: P18V00149948

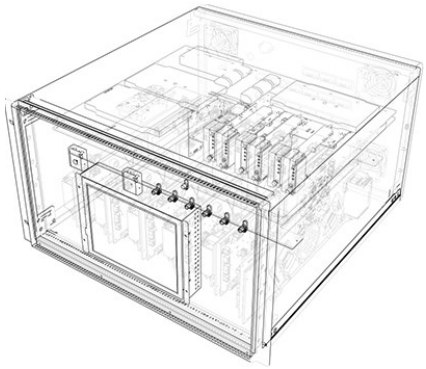
This purchase contract:
Institute of Physics of the Academy of Sciences of the Czech Republic,
Registered office at: Na Slovance 2, Praha 8, 182 21, Czech Republic
Registration no.: 68378271
Represented by: RNDr. Michael Prouza, Ph.D. – director

Supplier:
iXblue
[redacted]
Identification number : R.C.S. Versailles 433 185 121
D0058777
Address: 34, Rue de la croix de fer - 78 100 Saint Germain en Laye
Registered Number and Office: 7B100002671, ICA
Company Identification No.: 433 185 121

Date: January, 17th 2019

iXblue is an industrial group that is recognized worldwide for the design, development and manufacture of innovative, industrial optical modulation solutions. Our integrated modulation ModBox industrial systems are mostly dedicated to the Sub-nanosecond optical pulses generation for fibres lasers, to high power or energetic application.

Our integrated modulation ModBox systems are Optical Transmitter solutions based on external modulation. With in-depth knowledge in Photonics, RF and hyper-frequency, electronics and interfacing, iXblue has the inter-disciplinary expertise to integrate complex electro-optical systems and sub-systems. As such, we stand ready to assist our customers with the selection, definition, procurement, installation, and configuration – hardware and software - of the ModBox for optimal performance.

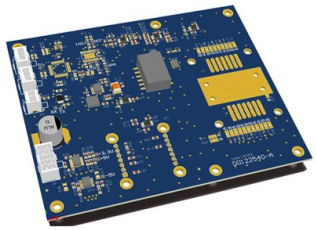


The Photonics is the core of our technology. iXblue masters the entire chain of $LiNbO_3$ modulators manufacture, from the chip design to the packaging. The ModBox uses the best, the cream of our modulators; they are screened and selected for their best performance: low insertion loss, high extinction ratio, high optical output, wide bandwidth, low drift, etc… The ModBox ensures the best optical performances from our $LiNbO_3$ modulators.

The modulation cannot operate without electronic and RF signals generation and management. A dedicated specialized staff is allocated to the RF and hyper-frequency domains.

iXblue designs its own RF amplifiers built with a cascade of MMIC's (Monolithic Microwave Integrated Circuit) based on the Gallium Arsenide (GaAs) technology.

Our electronics competence is used to electrically feed, monitor, control all the optical and RF components embedded into the ModBox. These PCB boards are developed internally, using the state of the art multi-layers PCB and class 4 to class 6 waveguides.



For any new system, a bespoke software is developed to accommodate a customer's particular preferences and expectations, featuring such as application monitoring, control and supervision, data-transfer, setting, etc… For the communication to EPICS framework, iXblue has competences on Python.

iXblue technical proposal is fully compliant with Annex No. 4 Technical Specification of this open tender. iXblue filled-in all the Requirement Affirmation on Suitability and Quality Performance. Ixblue provides in additiona a complete and very details technical documentation. This ModBox-FE specification is provided by the general Technical sheet named "**1- MODBOX-FE-1030nm-AWG-40dB Technical Data-sheet**". A simplified schematic is provided and coming with a very detailed table sheets. All the specifications, values are fully compliant with the Invitation to Quote, and some parameters (such as jitter, pulse rise / fall times, extinction ratio, optical power level, power and energy stabilities,…) are above customer's values expectation. The System will be implemented into EPICS platform. A new Software is already developed, it is compatible with the EPICS frameworks. The functionalities are developed in this data-sheet A dedicated engineering team has been built-up to manage the new Software development. iXblue is now very open to collaborate on the functions, controls,…, to be remotely monitored.

A Quality control plan is provided, "**2- Quality Assurance Plan**". This document describes the provisions ensuring that iXblue fulfils the requirements of the customer in the development and supply of equipment and services.

The lead-time of the system is a very important parameter. A detailed Project Schedule/ Program of Work is provided. The main manufacturing steps are provided, "**3 - Schedule**".

ModBox-FE-1030nm-AWG-40dB

Fibre-Based Seed Laser System
ID VZ0061186 Num P18V00149948
iXblue D0058777 - 433 185 121

MODBOX

Non contractual picture

The ModBox-FE-1030nm-AWG-40dB is an Optical Modulation Unit to generate short shaped pulses with high extinction ratio at 1030 nm. It generates highly stable 10 kHz high ER optical pulses with tunable length ranging from 1 ns to 20 ns and a width step of 125 ps. The system may generate optical pulses as a standalone unit or alternatively the system may accept trigger signals to produce synchronous optical pulses.

FEATURES

- Optical waveform flexibility
- Low jitter
- Low rise & fall times
- Very high extinction ratio
- Proven solution
- Ethernet control

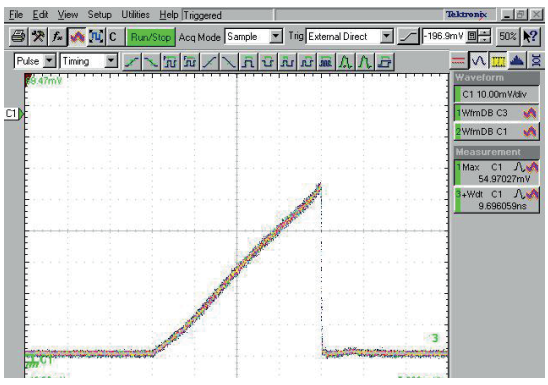
APPLICATIONS

- Inertial confinement fusion
- Interaction of intense light with matter
- Laser plasma interaction
- Laser implosion
- Interaction of ion beam with HP laser
- Laser peening

Performance Highlights

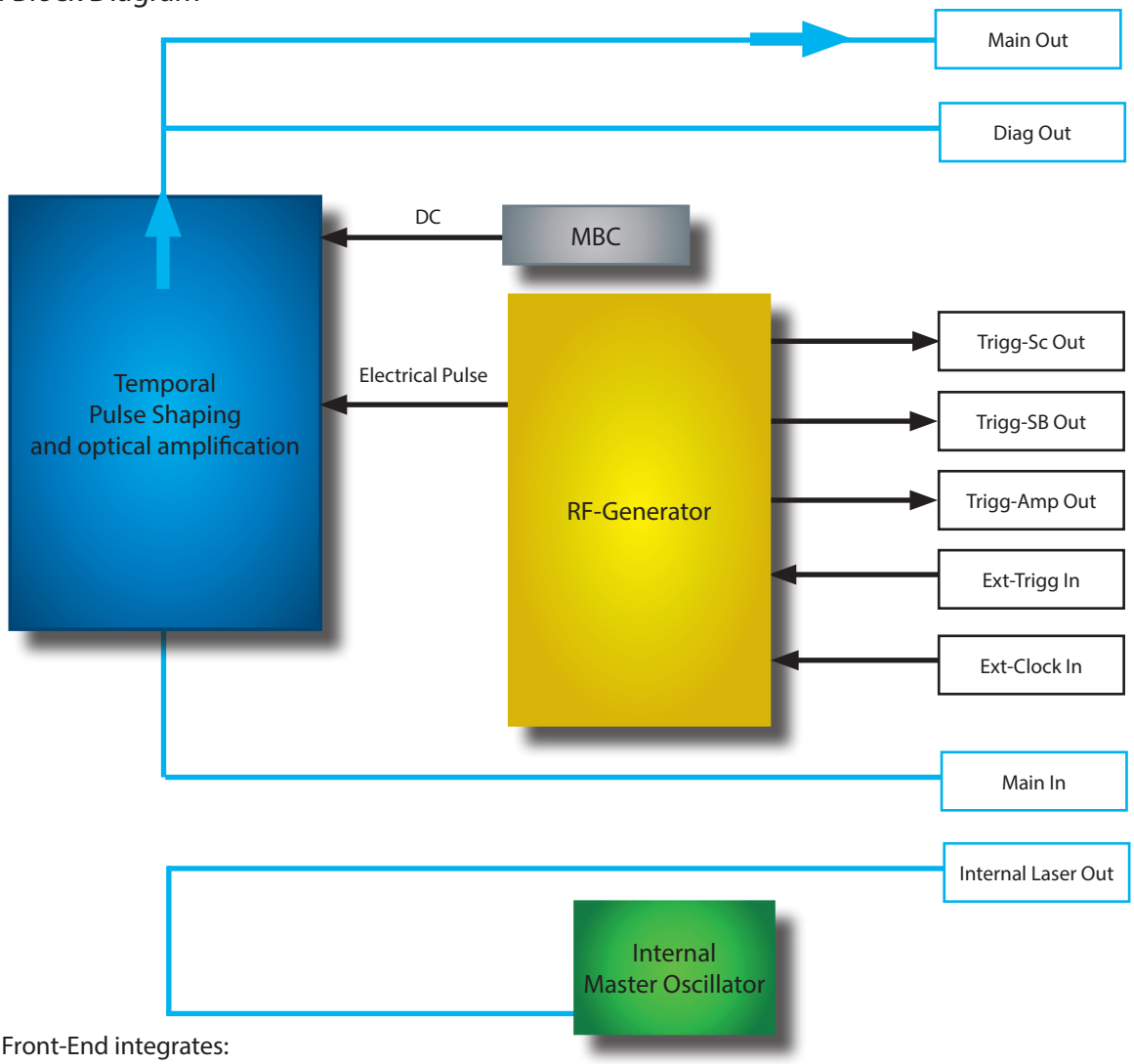
Parameter	Min	Typ	Max
Operating wavelength		1029.8 nm	
Pulse contrast		> 35 dB	
Pulse waveform		Arbitrary, user adjustable	
Pulse width		> 125 ps	
Rise / Fall times		50 ps	
Energy		> 500 pJ @1 ns	

Electrical & Optical Pulse Diagrams



Typical 20 ns ramp waveform optical pulse

Functional Block Diagram



The ModBox Front-End integrates:

- a temporal pulse shaping block based on a modulator set to ensure a very high optical pulse extinction ratio and flexible pulse shaping,
- an automatic Modulator Bias Control circuitry (MBC) to garantee high extinction ratio stability over time,
- a RF-Generator with an arbitrary waveform capability,
- Two optical isolators: after the optical amplifier (unique one in the system), and at the main output port.
- a master oscillator.

The ModBox offers several electrical outputs and input:

- a "Trigg-Sc" : for scope synchronization,
- a "Trigg-SB" : for pulse synchronization with the ModBox-Spectrum-Broadening,
- a "Trigg-Amp" : for optical amplifier synchronization,
- an "Ext-Trigg In" : external trigger input,
- an "Ext-Clock In": external clock input.

The ModBox offers several optical outputs and input:

- a "Internal Laser Out" : internal laser output port,
- a "Main In" : modulator input port,
- a "Diag Out": monitoring output port.

Input Specifications

Sp#	Parameter	Symbol	Condition	Min	Typ	Max	Unit
			Electrical Input Specifications				
1	External Trigg input	Ext Trigger In	TTL signal (1)	0	10	100	kHz
2	External Clock Input	Ext Clock In	50 % of duty-cycle	-	10 or 80	-	MHz
			Optical Input Specifications				
3	Wavelength	λ	Vacuum	-	1029.8		nm
4	Wavelength acceptance	-	-	-	±1	-	nm
5	Power	OP_{in}	CW Signal	5	-	20	mW
6	Polarisation Extinction Ratio	PER	-	20	-	-	dB

(1): Programmable threshold (0.1 V to 5 V) - Polarity positive or negative - Prescaler up to 2^{16}-1

Electrical Output Specifications

SP#	Parameter	Symbol	Condition	Min	Typ	Max	Unit
			Trigg-Sc / Trigg-SB / Trigg-Amp outputs				
7	Delay range	-	-	0	-	10	s
8	Delay resolution	R	Trigg-Amp / Trigg-SB	-	1	-	ps
9	Delay RMS jitter	J_{RMS}	Internal trigger w/o additional delay	-	10	-	ps
			External trigger w/o additional delay	-	-	25	ps
10	Delay accuracy	-	-	-	-	150	ps
11	Trigger delay	-	(Insertion delay)	-	-	100	ns

Optical Output Specifications - Internal Master Oscillator

SP#	Parameter	Symbol	Condition	Min	Typ	Max	Unit
12	Operating wavelength	λ	In vacuum	-	1029.8	-	nm
13	Wavelength tunability	Δλ	By temperature	-	±0.5	±1	nm
14	Wavelength tunability step	-	-	-	5	10	pm
15	Line-width	δλ	-	-	10	20	MHz
16	Wavelength stability	-	6 hours	-	-	±8	pm
17	Side Mode Suppression Ratio	SMSR	-	30	40	-	dB
18	Power stability	ΔP	> 8 hours	-	-	±1	%rms

Optical Output Specifications - General Specification

SP#	Parameter	Symbol	Condition	Min	Typ	Max	Unit
19	Wavelength	λ	Vacuum	-	1029.8	-	nm
20	Output pulse shapes	Qty	Registered waveforms capability	100	-	-	-
		-	Waveforms	Arbitrary			
21	Vertical resolution	-	Optical	16	-	-	bits
22	Ripples	-	Peak to peak, square pulse	-	-	±1	%pp
23	Pulse width	PW	Remotly adjustable	125 p	-	100 n	s
			Optimized value	1 to 20			ns
24	Frequency repetition rate	FRR	Adjustable by the trigger frequency	1	-	100 k	Hz
			Optimized value	10			kHz
25	Output Energy	E	1 ns square Pulse	500	600	-	pJ
26	Output power	P	Peak power	500	600	-	mW
27	Pulse energy stability	ΔE	Pulse to pulse energy stability over 1 minute as described in section 4.4 of the Technical Specification.	-	-	0.1	%rms
				-	-	±1	%pp
28a	Average power stability	ΔP	Average power over 15 minutes as described in Section 4.4 of the Technical Specification.	-	-	0.26	%rms
				-	-	±0.75	%pp
28b			Average power over 8 hours as described in Section 4.4 of the Technical Specification.	-	-	0.3	%rms
				-	-	±1.2	%pp
29	Pulse extinction ratio	SER	1029.8 nm	35	40	-	dB
			1029.8 nm ±1 nm	33	35	-	dB
30	Extinction ratio stability	ΔSER	Over 12 hours	-	-	0.3	dBrms
			3 months @1029.8 nm	30	-	-	dB
31	Rise time / Fall time	t_r/t_f	10 % - 90 %	38	-	50	ps
32	RMS jitter	J_{RMS}	Internal trigger, FRR < 20 kHz	-	5	8	ps
33	Polarisation extinction ratio	PER	-	20	25	-	dB
34	Isolation	ISO	Optical amplifier, main outputs	28	-	-	dB
	Monitoring Output Specification						
35	Diagnostic	Diag Out	-	-	2	-	mWpeak

Panels

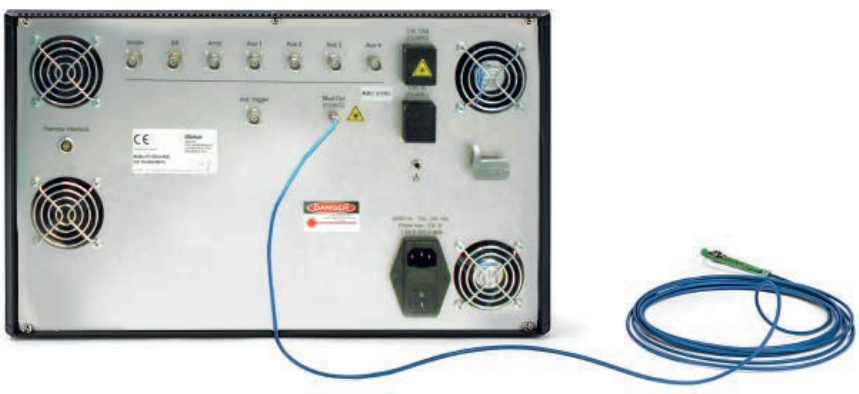
	Parameter	Condition	Min	Typ	Max	Unit
		Front Panel				
36	Local supervisory control	Human-machine interface	Touch-screen user interface / Embedded windows PC			
		Remote	Ethernet port - Compatible with EPICS framework			
		LEDs indicator	LED reports On/Off operation, Alarms			
		USB port	Keyboard, mouse, memory stick (to download waveforms)			
		Rear panel				
37	Optical ports	"Main Out"	Isolated, cable gland, armed cable, 10 meters fiber length, FC/APC			
		"Main In"	Cable gland, armed cable, 1 meter fiber length, FC/APC			
		"Diag Out", "Internal Laser Out"	FC/APC			
38	Optical fiber	-	Polarization maintaining fiber, Corning PM 98-U25A			
39	Trigg output connectors	"Trgg-SB", "Trigg-Sc", "Trigg-Amp"	BNC			
40	Trigger & Clock input connectors	"Trigg In", "Clock In"	BNC			
41	Main power socket	-	IEC 60320, C14 inlet			

Compliance and safety

	Parameter	Condition	Min	Typ	Max	Unit
42	Compliance	-	BS EN 60825 - CE certified			
43	Interlock response time	From laser system	-	-	1	ms
44	Remote interlock	-	LEMO controlled with a safety relay			

Dimensions

	Parameter	
45	Size	19 inches 6U
46	Weight	8 kg
47	Power supply	100 - 120 V / 220 - 240 V automatic switch, 50 - 60 Hz



ModBox Electrical and Optical Outputs:

Equipment used: Oscilloscope Agilent 86100B, with InGaAs Photodiode, iXblue ModBox-DER (CEA patent).

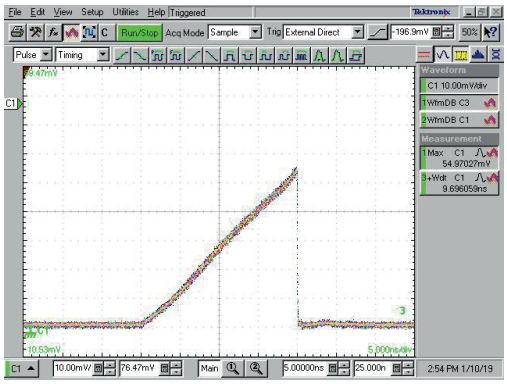


Fig1: 20 ns optical pulse - Ramp waveform

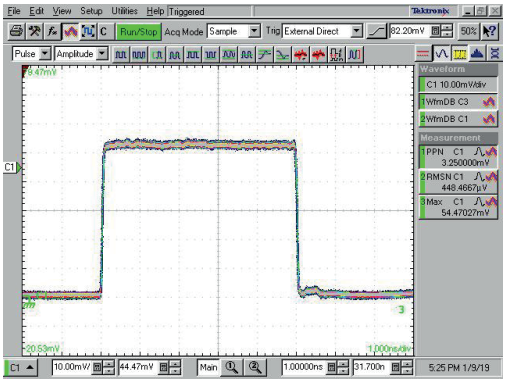


Fig2: 5 ns optical pulse - Square waveform

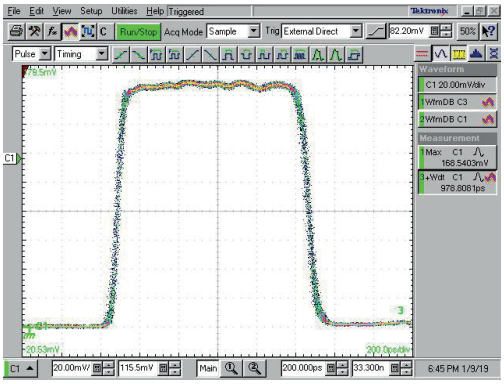


Fig3: 1 ns optical square pulse

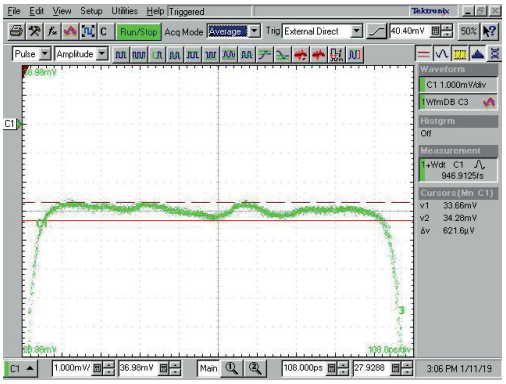


Fig4: Ripple

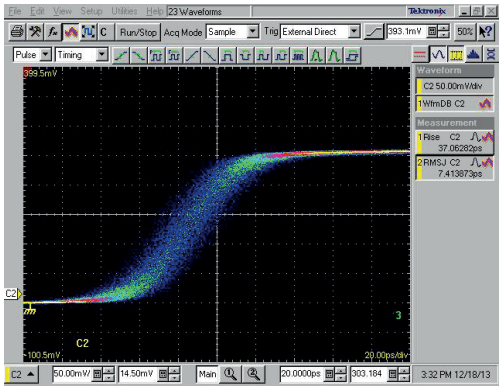


Fig5: Optical jitter and rise time @10 ns, 10 kHz

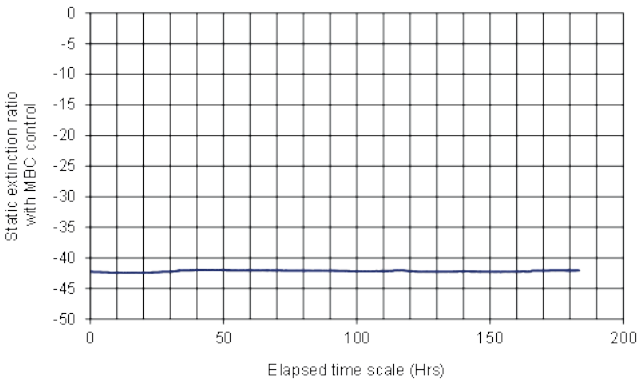


Fig6: Extinction ratio and stability over time

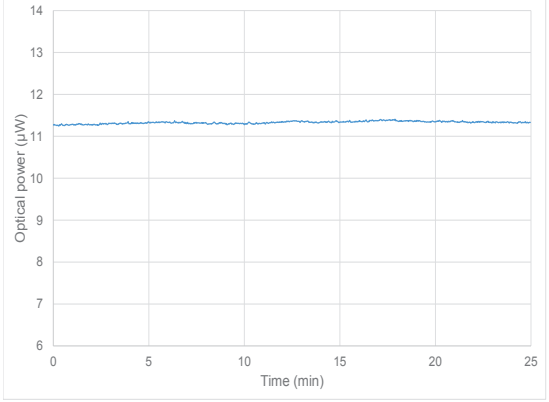


Fig7: Power stability over 15 minutes

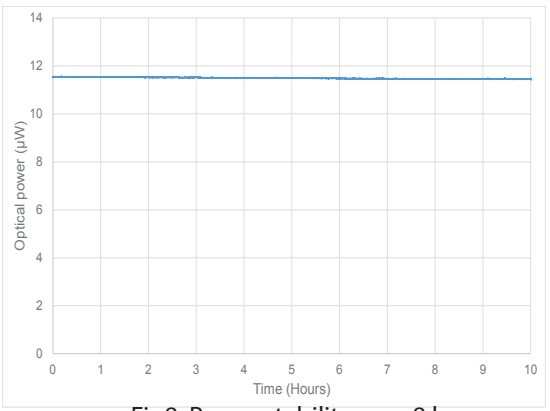


Fig8: Power stability over 8 hours

EPICS Protocol

Protocol description :
EPICS utilizes the Channel Access (CA) Network Protocol. Channel Access protocol is an application layer built on top of TCP/IP that allows many devices to communicate at high speeds on the same network.

Process Variables:
A non exhaustive list of the process variable names and types that can be used to control the ModBox using EPICS is provided. The naming is not definitive.

MODBOX:NETWORK
- o Type: String (max 40 characters)
- o Description: Get or set the network configuration (IPv4 Address, Netmask, Default gateway).

MODBOX:ERROR_LOG
- o Type: String (max 4096 characters)
- o Description: Get the last error message. It is recommended to subscribe to this PV to receive each error update.

MODBOX:AWG.WAVEFORM
- o Type: Integer array (size: 800)
- o Description: Get or set the whole waveform with 800 samples. Each sample value must be in the range [0; 4095]. Using less that 800 values will default the non-specified values to 0. Setting the waveform this way will make the AWG stop outputting a signal for a while (less than a few seconds). For sample updates without interruption, see the MODBOX:AWG. SAMPLE Process Variable.

MODBOX:AWG.SAMPLE
- o Type: Integer array (size: 2)
- o Description: Get or set an individual sample of the waveform. To update a sample, use a two-sized array [sample_ index, sample_value] (e.g. to set the 301st sample to 4023, you may use caput MODBOX:AWG.SAMPLE -a 2 301 4023).

To read a specific sample's value, you must first write either a one-sized array containing the sample's index, or write directly the sample's index (e.g. caput MODBOX:AWG.SAMPLE 302). The process variable will then update to an array containing the sample's index and the queried sample's value.

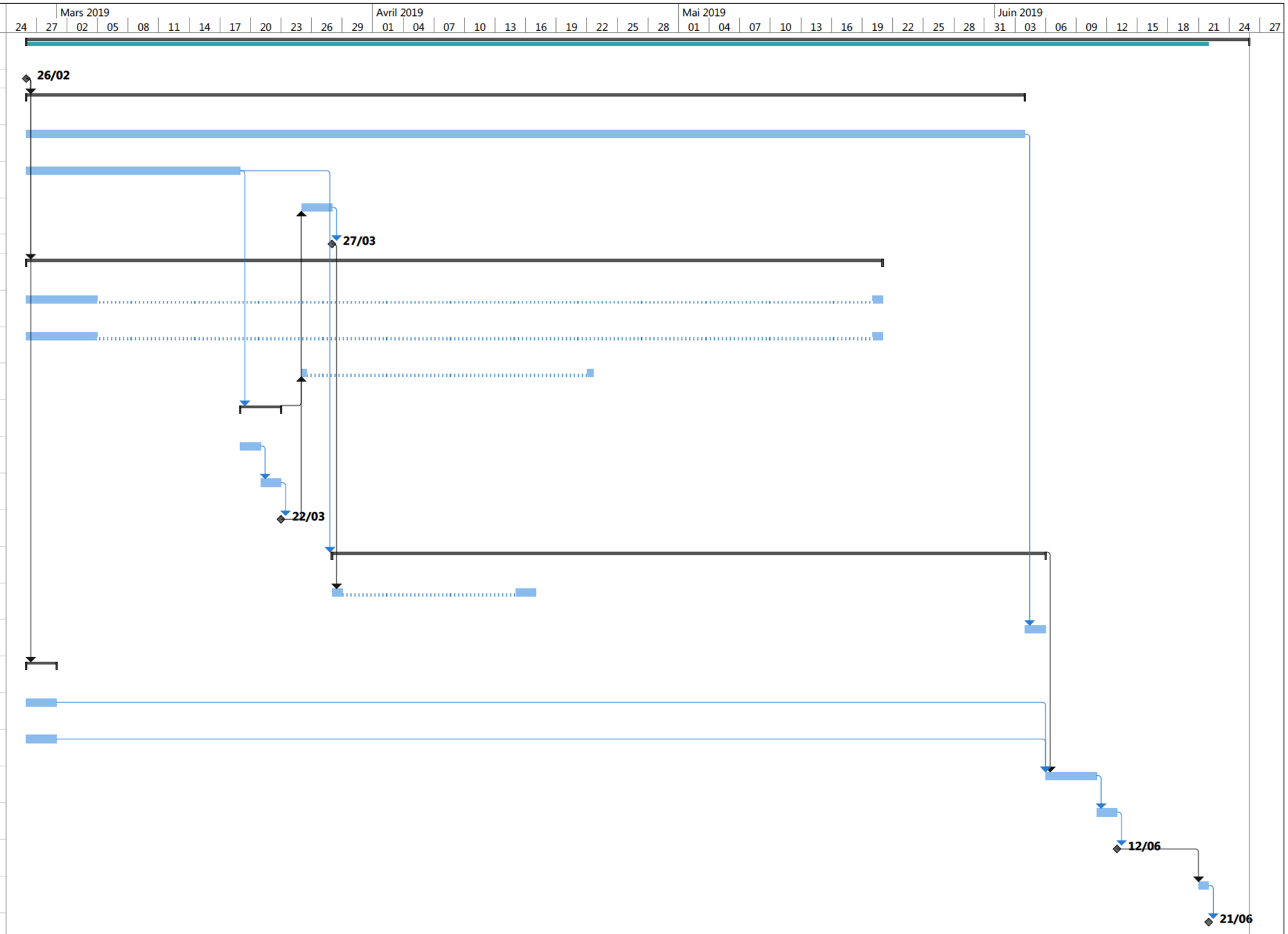
MODBOX:AWG.STEP_DELAY
- o Type: Integer
- o Description: Get or set the AWG's step delay (in picoseconds).

MODBOX:AWG.STEP_AMP
- o Type: Integer
- o Description: Get or set the AWG's step amplitude (in millivolts).

MODBOX:AWG.STEP_WIDTH
- o Type: Integer
- o Description: Get or set the AWG's step width (in picoseconds).

QU_1901_25079-ID VZ0061186 Num P18V00149948-STFC&HiLASE

N°		Nom de la tâche	Durée
1		**ModBox FE 1030 nm**	**86 jours**
2		Kick off	0 jour
3		**ModBox specific components order**	**70 jours**
4		long delivery delay components	70 jours
5		short delivery delay	15 jours
6		Mechanical integration (CAO)	3 jours
7		design review	0 jour
8		**Documentation**	**60 jours**
9		Manuals	6 jours
10		Technical documentation	6 jours
11		Tests definition	1 jour
12		**Electro-optics setup validation**	**4 jours**
13		Extinction ratio	2 jours
14		output power	2 jours
15		Test before integration	0 jour
16		**ModBox production**	**50 jours**
17		Phase 1	3 jours
18		Phase 2	2 jours
19		**Software developpement**	**3 jours**
20		Specific functionnalities	3 jours
21		GUI	3 jours
22		ModBox optimisation	3 jours
23		Factory test	2 jours
24		Factory acceptance test	0 jour
25		ModBox installation	1 jour
26		Site acceptance test	0 jour



Projet : schedule.mpp
Date : Ven 11/01/19

Tâche	Récapitulatif du projet	Tâche manuelle	Début uniquement	Échéance
Fractionnement	Tâche inactive	Durée uniquement	Fin uniquement	Avancement
Jalon	Jalon inactif	Report récapitulatif manuel	Tâches externes	Progression manuelle
Récapitulative	Récapitulatif inactif	Récapitulatif manuel	Jalons externes	

Annex No. 2 – Affirmation on Suitability and Quality Performance

Affirmation on Suitability and Quality Performance

„Fibre-Based Seed Laser System"

Economic operator Business Name incl. Legal Form: [iXblue]
Registered Office: [Saint Germain En Laye]
Company Identification No.: [433 185 121]
Authorized Representative: [iXblue]

Requirement	Points	Values/methods offered by the bidder
Qu REF 1.1: What is the smallest individual increment available to alter the wavelength?	10pm or less: **2 points** less than 50 pm but greater than 10 pm: **1 point** 50 pm: **0 point**	Specification 14 from the "1-MODBOX-FE-1030nm-AWG-40dB Technical Data-sheet" page 4: max 10 pm. The laser is wavelength adjustable by temperature. The Wavelength tuning range is 2 nm using 16 bits resolution allowing a step variation less than 10 pm.
Qu REF 1.2: What is the smallest step size to control the temporal pulse shape?	50 ps or less: **4 points** less than 125ps but greater than 50ps: **2 points** 125ps: **0 point**	Specification 23 from the "1-MODBOX-FE-1030nm-AWG-40dB Technical Data-sheet" from page 4 : ≥ 125 ps Note: iXblue offers 50 ps step size AWG, but this option makes the project cost out of the open tender budget.
Qu REF 1.3: What is the expected jitter?	20ps or less: **3 points** less than 50ps and more than 20 ps: **2 points** 50ps: **0 point**	Specification 32 from the "1-MODBOX-FE-1030nm-AWG-40dB Technical Data-sheet" page 4: < 8 ps A measurement is given at page 6 Fig 5.
Qu REF 1.4: What is the expected rise/fall time (10-90%)?	150 ps or less: **4 points** less than 200 ps and more than 150 ps: **2 points** 200ps: **0 point**	Specification 31 from the "1-MODBOX-FE-1030nm-

		AWG-40dB Technical Data-sheet": < 50 ps. A measurement is given at page 6 Fig 5.
Qu REF 1.5: Over what wavelength range can the temporal extinction ratio of 30dB be met?	over at least ±1 nm: **4 points** over at least ± 0.5 nm: **0 point**	Specification 29 from the "1-MODBOX-FE-1030nm-AWG-40dB Technical Data-sheet": > 33 dB A measurement is given at page 6 Fig 6.
Qu REF 1.6: What is the resolution with which the amplitude can be controlled?	at least 16 bit: **2 points** at least 12 bit: **1 point** at least 10 bit: **0 point**	Specification 21 from the "1-MODBOX-FE-1030nm-AWG-40dB Technical Data-sheet": 16 bits The AWG electrical pulse amplitude is controlled over 12 bits. This signal is then amplified by a RF amplifier. The driver gain's is digitally controlled within a 16 bits range resolution.
Qu REF 1.7: For a square pulse what is the peak to peak amplitude of ripples seen in the plateau region of a square pulse?	the peak to peak amplitude of ripples on a square pulse are less than ±1 %: **2 points** the peak to peak amplitude of ripples on a square pulse are less than ±2 %: **0 point**	Specification 22 from the "1-MODBOX-FE-1030nm-AWG-40dB Technical Data-sheet": < ±1 %: A measurement is given at page 6 Fig 4.
Qu REF 1.8: What is the maximum peak power of the system?	greater than 500mW: **3 points** greater than 300mW and less than 500mW: **2 points** 300mW: **0 point**	Specification 26 from the "1-MODBOX-FE-1030nm-AWG-40dB Technical Data-sheet": 500 mW with a target value at 600 mW.
Qu REF 1.9: What is the pulse to pulse energy stability of the system over 1 minute as described in section 4.4 of the Technical Specification?	±1% or better: **4 points** ±1.5% or better: **2 points** ±2% or better: **0 point**	Specification 27 from the "1-MODBOX-FE-1030nm-AWG-40dB Technical Data-sheet": < ±1 %:

Qu REF 1.10: What is the stability of the average power over 8 hours as described in Section 4.4 of the Technical Specification?	better than ± 1.0 %: **4 points** better than ± 1.8 %: **2 points** better than ± 2.5 %: **0 point**	Specification 28b from the data-sheet: < 0.3 %: Two measurements are given at page 6 Fig 8.
Qu REF 1.11: Please provide details as to how the system protects against back-reflections? It is advised that supplier lists each occurrence of isolation and provide details regarding how and where isolation is provided throughout the system.	isolation will be placed following each amplifier stage and at the output to protect from optical feedback from subsequent stages: **3 points** isolation will be at the output only: **0 point**	Specification 34 from the "1-MODBOX-FE-1030nm-AWG-40dB Technical Data-sheet": > 28 dB Two isolators will be disposed at the following stages: - One isolator at the optical amplifier output (unique amplifier in the set-up) - Isolator at the main output
Qu REF 1.12: How you propose to implement the control system interface?	EPICS driver provided or Telenet or raw TCP interface provided: **2 points** interface provided via RS232 or Modbus: **1 point** interface by other methods including CAN-bus: **0 point**	EPICS driver. EPICS functionality is already available and developed,for the ModBox-Front-End
Qu REF 1.13: What format will you provide the commands for remote control?	ASCII based Commands: **3 points** library provided for commands: **2 points** binary format: **1 point** any other method: **0 point**	iXblue will provide the ASCII commands. Please refer to the "3-ModBox_EPICS_protocol" to get a summary how to control; the ModBox element.

In [Saint Germain en Laye] On [January 17th, 2019]

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[Mr Philippe Griveau – Regional Sales Manager]

Annex No. 3 – Cover Bid Note

Cover Bid Note

Public Contract Name:

„Fibre-Based Seed Laser System"

Contracting authority	**Institute of Physics of the Czech Academy of Sciences, public research institution**
Registered Office:	Na Slovance 2,182 21 Prague 8, Czech Republic
Company Identification No.:	683 78 271
Tax Identification No.:	CZ68378271
Person authorised to act on behalf of the Contracting authority:	RNDr. Michael Prouza, Director

Economic operator Business Name incl. Legal Form: [iXblue]

Registered Office: [S]
Company Identification No.: [433 185 121]
Tax Id. No.: [FR 09 433 185 121]
Small / Medium-sized enterprises (in accordance with the Recommendation 2003/361/ES): [YES]
Person authorized to represent the participant: [Philippe Griveau - iXblue]
Contact person: [Philippe Griveau - iXblue]
Contact address: [34, rue de la croix de fer – F-78100 St Germain en Laye]
Tel: [xxxxxxxxxx]
E-mail of the Contact Person: [xxxxxxxxxx]

Total Bid Price:

Total bid price (in EUR without VAT)	VAT	Total bid price (in EUR including VAT)
[130 000]	[N/A]	[130 000]

Warranty length (in calendar months): [36 months]

The Economic operator hereby fully and without reservations accepts the business and technical conditions stated in the draft of Purchase Contract, which were the integral parts of the Procurement documentation.

In [Saint Germain en Laye] On [January 17th, 2019]

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[Mr Philippe Griveau – Regional Sales Manager]