



Purchase Contract

(hereafter the "Contract")

1. CONTRACTUAL PARTIES

1.1 Fyzikální ústav AV ČR, v. v. i.,

with seat: Na Slovance 1999/2, 182 21 Praha 8,
represented by: RNDr. Michael Prouza, Ph.D., Director,
registered in the Register of public research institutions of the Ministry of Education, Youth and Sports
of the Czech Republic.

Bank: [REDACTED]

Account No. [REDACTED]

ID No.: 68378271

Tax ID No.: CZ68378271

(hereinafter the "Buyer")

and

1.2 OptiXs, s. r. o.

with seat: Křivoklátská 37, 199 00 Praha 9
represented by: Ing. Martin Klečka, CEO
registered in Municipal Court in Prague, C 212 818

Bank: [REDACTED]

Account No. [REDACTED]

ID No.: 02016770

Tax ID No.: CZ02016770

(hereinafter the "Seller"),

(the Buyer and the Seller are hereinafter jointly referred to as the "Parties" and each of them
individually as a "Party").



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2. **FUNDAMENTAL PROVISIONS**

- 2.1 The Buyer is a public research institution whose primary activity is excellent scientific research in the area of physics, especially elementary particles physics, condensed systems, plasma and optics.
- 2.2 The Buyer wishes to acquire the subject of performance hereof in order to perform Pulsed Laser Deposition of metal and oxides films.
- 2.3 The Buyer is the beneficiary of the subsidy for the project "**Solid state physics for the 21st century (SOLID 21)**", Reg. No CZ.02.1.01/0.0/0.0/16_019/0000760 (hereinafter the "**Project**"), within the Operational Program Research, Development and Education (hereinafter the "**OP RDE**") of the provider Ministry of Education, Youth and Sports of the Czech Republic. The subject of public procurement will be co-financed by the EU Structural Funds.
- 2.4 The Seller was selected as the winner of a public procurement procedure announced by the Buyer in accordance with Act No. 134/2016 Coll., on Public Procurement, as amended (hereinafter the "**Act**"), for the public contract called "**Laser-MBE UHV deposition system**" (hereinafter the "**Procurement Procedure**"). Both the Procurement Procedure and the Contract shall be governed by the Rules for applicants and beneficiaries of OP RDE, which are publicly accessible and are binding on the Parties.
- 2.5 The documentation necessary for the execution of the subject of performance hereof consist of
- 2.5.1** Technical specifications of the subject of performance hereof attached as **Annex No. 1** hereto.
- 2.5.2** The Seller's bid submitted within the Procurement Procedure in its parts which describe the subject of performance in technical detail (hereinafter the "**Sellers's Bid**"); the Sellers's Bid forms **Annex No. 2** to this Contract and is an integral part hereof.
- In the event of a conflict between the Contract's Annexes the technical specification / requirement of the higher level / quality shall prevail.
- 2.6 The Seller declares that he has all the professional prerequisites required for the supply of the subject of performance under this Contract, is authorised to supply the subject of performance and there exist no obstacles on the part of the Seller that would prevent him from supplying the subject of this Contract to the Buyer.
- 2.7 The Seller acknowledges that the Buyer considers him capable of providing performance under the Contract with such knowledge, diligence and care that is associated and expected of the Seller's profession, and that the Seller's potential performance lacking such professional care would give rise to corresponding liability on the Seller's part. The Seller 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.

- 2.8 The Seller acknowledges that the Buyer 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 Buyer.
- 2.9 The Seller acknowledges that the production and delivery of the subject of performance within the specified time and of the specified quality, as shown in Annexes No. 1 and 2 of this Contract (including invoicing), is essential for the Buyer.
- 2.10 The Parties declare that they shall maintain confidentiality with respect to all facts and information, which they learn in connection herewith and / or during performance hereunder, and whose disclosure could cause damage to either Party. Confidentiality provisions do not prejudice obligations arising from valid legislation.

3. SUBJECT-MATTER OF THE CONTRACT

- 3.1 The subject of this Contract is the obligation on the part of the Seller to deliver and transfer into the Buyer's ownership:

the Laser-MBE UHV deposition system

(hereafter the "**Equipment**")

and the Buyer undertakes to take delivery of the Equipment and to pay to the Seller the agreed upon price.

- 3.2 The following activities form an integral part of the performance to be provided by the Seller:
 - 3.2.1 Formulation of conditions which are recommended to be met at the place of Buyer in order to install the Equipment;
 - 3.2.2 Transport of the Equipment incl. all accessories specified in Annexes 1 and 2 of the Contract to the place of delivery, un-packaging and control thereof;
 - 3.2.3 Installation of the Equipment including connection to installation infrastructure at the site;
 - 3.2.4 Execution of the acceptance test: The output energy and stability of the laser will be verified. As part of the acceptance test, the fulfilment of all parameters of the deposition system given in Annex No. 1 will be verified. During installation, a growth experiment will be performed. A SrTiO₃ (STO) film will be grown on single crystalline STO substrate. Film growth is monitored



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with Reflective High Energy Electron Diffraction (RHEED). Previous to the experiment, the sample will be outlined with respect to the electron beam such that a well-defined 1-st order out-of-plane symmetric diffraction pattern of the STO substrate is obtained. The pattern will show "signature" features of a single terminated substrate, including a brighter specular spot with respect to the 1st-order in-plane diffraction spots, and Kikuchi lines. During growth the intensity of the specular spot is monitored. Growth parameters and conditions including substrate temperature, background gas pressure, laser fluence and spot-size will be set such that the specular spot intensity shows oscillating behaviour corresponding to a layer-by-layer growth mode. At least 10 oscillations will be shown, corresponding to 10 STO monolayers. Details of the exact form of each constituent part of the acceptance test will be specified by the Seller and communicated to the Buyer no later than 4 months before the planned installation of the Equipment.

- 3.2.5 Delivery of detailed instructions and manuals for operation and maintenance, including list of spare parts - all in Czech or English language, in electronic or hardcopy (printed) versions;
 - 3.2.6 Training of operators at the site (at least 2-day training of 3 operators);
 - 3.2.7 Free-of-charge warranty service including service inspections;
 - 3.2.8 Provision of technical support in the form of consultations.
- 3.3 The subject of performance (Equipment) is specified in detail in Annexes No. 1 and No. 2 hereto.
- 3.4 The Seller shall be liable for the Equipment and related services to be in full compliance with this Contract, its Annexes and all valid legal regulation, technical and quality standards and that the Buyer will be able to use the Equipment for the defined purpose. In case of any conflict between applicable standards it is understood that the more strict standard or its part shall always apply.
- 3.5 The delivered Equipment and all its parts and accessories must be brand new and unused.

4. PERFORMANCE PERIOD

- 4.1 The Seller undertakes to manufacture, deliver, install and handover the Equipment to the Buyer within **12 (twelve) months** of the conclusion of this Contract.
- 4.2 The performance period shall be extended for a period during which the Seller could not perform due to obstacles on the part of the Buyer.



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5. PURCHASE PRICE, INVOICING, PAYMENTS

- 5.1 The purchase price is based on the Seller's submitted bid and amounts to **13 219 000,- CZK** (in words: třináct milionů dvě stě devatenáct tisíc korun českých) excluding VAT (hereinafter the "**Price**"). VAT shall be paid by the Buyer and settled in accordance with the valid Czech regulation.
- 5.2 The Price represents the maximum binding offer by the Seller and includes any and all performance provided by the Seller in connection with meeting the Buyer's requirements for the proper and complete delivery of the Equipment hereunder, as well as all costs that the Seller may incur in connection with the delivery, and including all other costs of expenses that may arise in connection with creation of an intellectual property and its protection.
- 5.3 The Parties agreed that the Seller shall be entitled to invoice the Price as follows:
- 5.3.1 The Seller is entitled to issue the first advance invoice corresponding to 30 % of the Price excluding VAT after the conclusion of the Contract;
- 5.3.2 The Seller is entitled to issue the second advance invoice corresponding to 60 % of the Price excluding VAT when the Equipment is delivered to the place of performance.
- 5.3.3 The Seller is entitled to invoice the Price after the handover protocol in accordance with Section 10.4 will have been signed. In case the Equipment will be delivered with minor defects and / or unfinished work, the Price shall be invoiced after removal of these minor defects and / or unfinished work.
- 5.4 All invoices issued by the Seller 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:
- 5.4.1 name and registered office of the Buyer,
- 5.4.2 tax identification number of the Buyer,
- 5.4.3 name and registered office of the Seller,
- 5.4.4 tax identification number of the Seller,
- 5.4.5 registration number of the tax document (invoice),
- 5.4.6 scope of the performance (including the reference to this Contract),





- 5.4.7 the date of the issue of the tax document (invoice),
- 5.4.8 the date of the fulfilment of the Contract,
- 5.4.9 purchase Price,
- 5.4.10 registration number of this Contract, which the Buyer shall communicate to the Seller based on Seller's request before the issuance of the invoice,
- 5.4.11 declaration that the performance of the Contract is for the purposes of the project "Solid state physics for the 21st century (SOLID21)", Reg. No. CZ.02.1.01/0.0/0.0/16_019/0000760

and must comply with the double taxation agreements, if applicable.

- 5.5 The Buyer prefers electronic invoicing, with the invoices being delivered to efaktury@fzu.cz. All issued invoices shall comply with any international double taxation agreements, if applicable.
- 5.6 Invoices shall be payable within thirty (30) days of the date of their delivery to the Buyer. Payment of the invoiced amount means the date of its remittance to the Seller's account.
- 5.7 If an invoice is not issued in conformity with the payment terms stipulated by the Contract or if it does not comply with the requirements stipulated by law, the Buyer shall be entitled to return the invoice to the Seller as incomplete, or incorrectly issued, for correction or issue of a new invoice, as appropriate, within five (5) business days of the date of its delivery to the Buyer. In such a case, the Buyer shall not be in delay with the payment of the Price or part thereof and the Seller shall issue a corrected invoice with a new and identical maturity period commencing on the date of delivery of the corrected or newly issued invoice to the Buyer.
- 5.8 The Buyer shall be entitled to unilaterally set off any of his payments against any receivables claimed by the Seller due to:
 - 5.8.1 damages caused by the Seller,
 - 5.8.2 contractual penalties.
- 5.9 The Seller shall not be entitled to set off any of his receivables against any part of the Buyer's receivable hereunder.

6. **OWNERSHIP TITLE**

- 6.1 The ownership right to the Equipment shall pass to the Buyer by handover. Handover shall be



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understood as delivery and acceptance of the Equipment duly confirmed by Parties on the Handover Protocol in accordance with Section 10.4.

7. PLACE OF DELIVERY AND HANDOVER OF THE EQUIPMENT

- 7.1 The place of delivery and handover of the Equipment shall be the building "New Pavilion" of the Fyzikální ústav AV ČR, v. v. i., at Na Slovance 1999/2, 182 21 Praha 8, Czech Republic.

8. PREPAREDNESS OF THE PLACE OF DELIVERY AND HANDOVER

- 8.1 The Seller shall communicate all technical conditions necessary for the installation and operation of the laser and UHV deposition system at least 4 months prior of installation (e.g. the connection of cooling water, compressed air, technical gases required for the operation of the laser, and specified consumables materials necessary for acceptance test etc.).
- 8.2 The Seller shall notify the Buyer in writing of the exact date of installation of the Equipment at least 60 days prior to such date, ensuring that the deadline for the performance hereunder is maintained.
- 8.3 The Buyer shall be obliged to allow the Seller, once the deadline set forth in Section 8.1 hereof expires, to install the Equipment at the place of delivery and handover.

9. COOPERATION OF THE PARTIES

- 9.1 The Seller undertakes to notify the Buyer of any obstacles on his part, which may negatively influence proper and timely delivery of the Equipment.

10. DELIVERY, INSTALLATION, HANDOVER AND ACCEPTANCE

- 10.1 The Seller shall transport the Equipment at his own cost to the place of delivery and handover. If the shipment is intact, the Buyer shall issue delivery note for the Seller.
- 10.2 The Seller shall perform and document the installation of the Equipment and launch experimental tests in order to verify whether the Equipment is functional and meets the technical requirements of Annexes No. 1 and 2 hereof.
- 10.3 Handover procedure includes handover of any and all technical documentation pertaining to the Equipment, user manuals and certificate of compliance of the Equipment and all its parts and



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accessories with approved standards.

10.4 The handover procedure shall be completed by handover of the Equipment confirmed by the Handover Protocol containing specifications of all performed tests. The Handover Protocol shall contain the following mandatory information:

10.4.1 Information about the Seller, the Buyer and any subcontractors;

10.4.2 Description of the Equipment including description of all components and their serial numbers;

10.4.3 Description of executed tests according to Section 3.2.4 of the Contract: type of test, duration and achieved parameters;

10.4.4 List of technical documentation including the manuals;

10.4.5 Confirmation on training, its participants and extent;

10.4.6 Eventually reservation of the Buyer regarding minor defects and unfinished work including the manner and deadline for their removal and

10.4.7 Date of signature of the Equipment Handover Protocol.

10.5 Handover of the Equipment does not release the Seller from liability for damage caused by its defects.

10.6 The Buyer shall not be obliged to accept Equipment, which would show defects or unfinished work and which would otherwise not form a barrier, on their own or in connection with other defects, to using the Equipment. In this case, the Buyer shall issue a record containing the reason for his refusal to accept the Equipment.

10.7 Should the Buyer not exercise his right not to accept the Equipment with defects or unfinished work, the Seller and the Buyer shall list these defects or unfinished work in the Handover Protocol, including the manner and deadline for their removal. Should the Parties not be able to agree in the Handover Protocol on the deadline for removal of the defects, it shall be understood that any defects shall be removed / rectified within 30 days from the handover of the Equipment.

11. TECHNICAL ASSISTANCE – CONSULTATIONS

11.1 The Seller shall be obliged to provide to the Buyer free-of-charge technical assistance by phone or e-mail relating to the subject-matter hereof during the entire term of the warranty period. The Seller undertakes to provide to the Buyer paid consultations and technical assistance relating to the subject-



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matter hereof also after the warranty period expires.

12. REPRESENTATIVES, NOTICES

12.1 The Seller authorized the following representatives to communicate with the Buyer in all matters relating to the Equipment delivery:

██████████
e-mail: ██████████
tel. ██████████

12.2 The Buyer authorized the following representatives to communicate with the Seller in all matters relating to the Equipment delivery:

██████████
e-mail ██████████
tel.: ██████████

12.3 All notifications to be made between the Parties hereunder must be made out in writing and delivered to the other Party by hand (with confirmed receipt) or by registered post (to the Buyer's or Seller's address), or in some other form of registered post or electronic delivery incorporating electronic signature (qualified certificate) to epodatelna@fzu.cz in case of the Buyer and to info@optixs.cz in case of the Seller.

12.4 In all technical and expert matters (discussions on the Equipment testing and demonstration, notification of the need to provide warranty or post-warranty service, technical assistance etc.) electronic communication between technical representatives of the Parties will be acceptable using e-mail addresses defined in Sections 12.1 and 12.2.

13. TERMINATION

13.1 This Contract may be terminated early by agreement of the Parties or withdrawal from the Contract on the grounds stipulated by law or in the Contract.

13.2 The Buyer is entitled to withdraw from the Contract without any penalty from the Seller in any of the following events:

13.2.1 The Seller is in delay with the delivery of the Equipment longer than 8 weeks after the date



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pursuant to Section 4.1 hereof.

- 13.2.2 Technical parameters or other conditions required in the technical specification defined in Annexes No. 1 and 2 hereto and in the relevant valid technical standards will not be achieved by the Equipment at acceptance.
- 13.2.3 Facts emerge bearing evidence that the Seller will not be able to deliver the Equipment.
- 13.2.4 The Seller will not meet the qualification criteria set within the Procurement Procedure.
- 13.3 The Seller is entitled to withdraw from the Contract in the event of the Buyer being in default with the payment for more than 2 months with the exception of the cases when the Buyer refused an invoice due to defect on the delivered Equipment or due to breach of the Contract by the Seller.
- 13.4 Withdrawal from the Contract becomes effective on the day the written notification to that effect is delivered to the other Party. The Party which had received performance from the other Party prior to such withdrawal shall duly return such performance.

14. INSURANCE

- 14.1 The Seller undertakes to insure the Equipment against all risks, in the amount of the Price of the Equipment for the entire period commencing when transport of the Equipment starts until duly handed over to the Buyer. In case of breach of this obligation, the Seller shall be liable to the Buyer for any damage that may arise.
- 14.2 The Seller is liable for the damage that he has caused. The Seller is also liable for damage caused by third parties undertaken to carry out performance or its part under this Contract.

15. WARRANTY TERMS

- 15.1 The Seller shall provide warranty for the quality of the Equipment
 - 15.1.1 for a period of **36 months** (or 1-billion pulses, whatever comes first) in case of the Laser;
 - 15.1.2 for a period of **24 months** in case of the UHV system and
 - 15.1.3 for a period of **12 months** in case of the following parts of the UHV system: electronics and power supplies, electron gun, heating parts, pumps, valves and motors.



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- 15.2 The warranty term shall commence on the day following the date of signing of the Handover Protocol pursuant to Section 10.4 hereof. The warranty does not cover consumable things.
- 15.3 Should the Buyer discover a defect, he shall notify the Seller to rectify such defect using the e-mail address: servis@optixs.cz. The Seller is obliged to notify the Buyer without delay about any change of this email address. The Seller shall be obliged to review any warranty claim within 3 business days of receipt and propose a solution and, if necessary, arrange a technician visit of a technician within 5 business days of receipt of the warranty claim, unless agreed otherwise by the Parties.
- 15.4 During the warranty period, the Seller shall be obliged to rectify any claimed defects within 30 days from receipt of the Buyer's notification. In cases of unusual defects, the Seller shall be obliged to rectify the defect in the period corresponding to the nature of the defect and to define the deadline for the handover of the rectified Equipment.
- 15.5 During the warranty period, any and all costs associated with defect rectification / repair including transport and travel expenses of the Seller shall be always borne by the Seller.
- 15.6 The repaired Equipment shall be handed over by the Seller to the Buyer on the basis of a protocol confirming removal of the defect (hereinafter the "**Repair Protocol**") containing confirmations of both Parties that the Equipment was duly repaired and is defect-free.
- 15.7 The repaired portion of the Equipment shall be subject to a new warranty term in accordance with Section 15.1 which commences to run on the day following the date when the Repair Protocol was executed.
- 15.8 If the Equipment show defects for which it cannot be demonstrably used in full for more than 60 days (defect period) within six or less consecutive months of the warranty period, the Seller is obliged to remove the defect by delivering new Equipment without defect within 90 days from the date of dispatch of the invitation to deliver, unless the Parties agree otherwise.
- 15.9 The Seller declares that he shall ensure paid post-warranty [out-of-warranty] service for the period of 10 years after the expiration of the warranty; the service terms shall be identical to those of Sections 15.3 and 15.4.
- 15.10 The Seller undertakes to provide the Buyer with updates of the software controlling the Equipment for the entire term of warranty service.

16. CONTRACTUAL PENALTIES

- 16.1 The Buyer shall have the right to a penalty in the amount of 0.05 % of the Price for each commenced



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day of delay with the performance pursuant to Sections 4.1 and 15.8 hereof.

- 16.2 The Buyer shall have the right to a penalty in the amount of 0.05 % of the Price for each commenced day of delay with rectifying of defects claimed within the warranty period.
- 16.3 In case of default in payment of any due receivables (monetary debt) under the Contract, the defaulting Buyer or Seller (the debtor) shall be obliged to pay a contractual penalty in the amount of 0.05 % of the owed amount for each commenced day of delay with the payment.
- 16.4 The Buyer shall be entitled to claim a contractual penalty against the Seller in the amount of 30 % of the Price, in case it will subsequently take advantage of the opportunity to withdraw from the Contract pursuant to Section 13.2.1 and 13.2.2.
- 16.5 Contractual penalties are payable within 30 days of notification demanding payment thereof.
- 16.6 Payment of the contractual penalty does not prejudice the rights of the Parties to claim damages.
- 16.7 Payment of the contractual penalty cannot be demanded if the breach of the contractual obligation causes force majeure. Circumstances related to the Covid-19 epidemic shall be considered as force majeure cases despite the fact the epidemic is already underway at the date of this Contract.

17. DISPUTES

- 17.1 Any and all disputes arising out of this Contract or the legal relationships connected with the Contract shall be resolved by the Parties by mutual negotiations. In the event that any dispute cannot be resolved by negotiations within sixty (60) days, the dispute shall be resolved by the competent court in the Czech Republic based on application of any of the Parties; the court having jurisdiction will be the court where the seat of the Buyer is located. Disputes shall be resolved exclusively by the law of the Czech Republic.

18. ACCEPTANCE OF THE PROJECT RULES

- 18.1 The Seller, using all necessary professional care, shall cooperate during financial inspections carried out in accordance with Act No. 320/2001 Coll., on Financial Inspections, as amended, or during other financial inspections carried out by any auditing entities (particularly by the Managing Authority of the Operational Program Research, Development and Education) and shall allow access also to those portions of the bid submitted within the Procurement Procedure, the Contract and related documents



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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.

19. **FINAL PROVISIONS**

- 19.1 This Contract represents the entire agreement between the Buyer and the Seller. The relationships between the Parties not regulated in this Contract shall be governed by the Act No. 89/2012 Coll., the Civil Code, as amended (hereinafter the "**Civil Code**").
- 19.2 In the event that any of the provisions of this Contract shall later be shown or determined to be invalid, ineffective or unenforceable, then such invalidity, ineffectiveness or unenforceability shall not cause invalidity, ineffectiveness or unenforceability of the Contract as a whole. In such event the Parties undertake without undue delay to subsequently clarify any such provision or replace after mutual agreement such invalid, 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.
- 19.3 This Contract may be changed or supplemented solely by means of numbered amendments in writing, furnished with the details of time and place and signed by duly authorised representatives of the Parties. The Parties expressly reject modifications to the Contract in any other manner.
- 19.4 The Parties expressly agree that the Contract as a whole, including all attachments and data on the Parties, subject-matter of the Contract, numerical designation of this Contract, the Price and the date of the Contract conclusion, will be published in accordance with Act No. 340/2015 Coll. on special conditions for the effectiveness of some contracts, publication of these contracts and Contract Register, as amended (hereinafter the "**CRA**"). The Parties hereby declare that all information contained in the Contract and its Annexes are not considered trade secrets under § 504 of the Civil Code and grant permission for their use and disclosure without setting any additional conditions.
- 19.5 The Parties agree that the Buyer shall ensure the publication of the Contract in the Contract Register in accordance with CRA.
- 19.6 This Contract becomes effective as of the day of its publication in the Contract Register.
- 19.7 The following Annexes form an integral part of the Contract:
- Annex No. 1: Technical specification on the subject of performance
- Annex No. 2: Technical description of the Equipment as presented in Seller's bid



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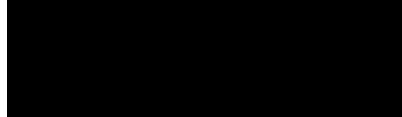
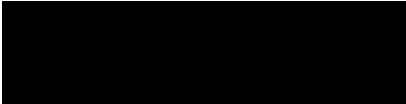
19.8 The Parties, manifesting their consent with the entire contents of this Contract, attach their signature hereunder.

In Prague

In Prague

For the Buyer:

For the Seller:



RNDr. Michael Prouza, Ph.D.
Director

Ing. Martin Klečka
CEO



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Annex No. 1 - Technical specification on the subject of performance

The Equipment must meet the technical conditions and include components listed in this table.

No.	Description and minimum specification of the Equipment as defined by the Buyer	Description and specification of the Equipment offered by the Seller	Complies YES/NO
1	UHV PLD Chamber	UHV PLD-MBE Chamber with frame	YES
a	PLD chamber with all metal-sealed ports and base pressure smaller than 1×10^{-9} mbar	PLD chamber with stainless-steel frame and all metal-sealed ports, the base pressure will be better than 1×10^{-9} mbar	YES
b	Complete system for baking of the PLD chamber that allows maintaining the specified base pressure in a long term, the chamber will be placed on a fully bakeable stainless steel support.	Complete system for baking of the PLD chamber consisting of heaters and bake-out tent, which allows maintaining the specified base pressure in a long term. The chamber will be placed on a fully bakeable stainless steel support.	YES
c	Deposition direction Horizontal / Vertical specify	Deposition direction Horizontal / Vertical – final design will be approved by the enduser after signing the contract	YES
d	Two standard viewports	Two standard viewports will be implemented	YES
e	Laser entry viewport made of UV-grade quartz with DN63CF	Laser entry viewport will be made of UV-grade quartz with DN63CF flange	YES
f	Ports for RHEED and for a load-lock	Ports for RHEED and for a load-lock	YES
g	Additional ports for ellipsometry - 2x CF40	2x CF40 ports for ellipsometry	YES
h	Additional ports for evaporators - 2x CF40	2x CF40 additional ports for evaporators	YES
i	Additional ports for vacuum suitcase connection - 2x CF40 – for wobble stick and vacuum suitcases	2x CF40 additional ports for vacuum suitcase connection – for wobble stick and vacuum suitcases	YES
j	Ports for capacitance (baratron) vacuum gauge (not included) and gas inlet - 2x CF16	2x CF16 ports for capacitance (baratron) vacuum gauge and gas inlet	YES
k	Full range pressure gauge	Full range pressure gauge	YES
2	Pump system for UHV PLD chamber	Turbo pump system for UHV PLD chamber	YES
a	Air cooled turbo drag pump with capacity of with pumping speed at least 700 l/s	Turbo drag pump with capacity of with pumping speed at least 700 l/s, air cooled	YES
b	The turbo pump is equipped with a vibration damper to minimise noise during RHEED experiments	The turbo pump will be equipped with a vibration damper to minimise noise during RHEED experiments	YES
c	System is prepared for future IGP and TSP upgrade with an additional CF150 port in the	System will be prepared for future IGP and TSP upgrade with an additional	YES



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	pumpline	CF150 port in the pumpline	
d	Pressure with only turbo drag pump after bake $<10^{-8}$ mbar	Pressure with only turbo drag pump after bake out will be $<10^{-8}$ mbar	YES
e	Pressure with additional IGP/TSP $<10^{-9}$ mbar	Pressure with additional IGP/TSP will be $<10^{-9}$ mbar	YES
f	A manual gate valve between the chamber and the turbo pump line	A manual gate valve will be between the chamber and the turbo pump line	YES
g	Parallel to this gate valve a by-pass line with a stepper-motor-controlled butterfly valve between the main chamber and the turbo pump, this gate is used for controlling the process pressure.	A by-pass line with a stepper-motor-controlled butterfly valve (parallel to the manual gate valve) will be between the main chamber and the turbo pump This gate will be used for controlling the process pressure.	YES
h	A foreline with an approximately $6\text{m}^3/\text{hr}$ scroll pump	There will be a foreline with a $6\text{m}^3/\text{hr}$ scroll pump	YES
i	Manual gate valve between the laser entry viewport and the vacuum chamber to allow removing the viewport without the need for venting the complete chamber. Connections to allow venting and pumping down of the space between the valve and the viewport, this pumping down will be carried out via a connection to the load-lock, so that no additional pump nor pressure gauge are required, the pressure between the valve and the viewport can be controlled via SW.	Manual gate valve will be between the laser entry viewport and the vacuum chamber. It allows removing the viewport without the need for venting the complete chamber. Connections to allow venting and pumping down of the space between the valve and the viewport, this pumping down will be carried out via a connection to the load-lock. So, no additional pump nor pressure gauge will be required, the pressure between the valve and the viewport will be controlled via SW.	YES
j	Pump line including all necessary components to connect a vacuum suitcase to the chamber. This includes a CF40 gate valve, turbo pump and backing pump including electronics. The specification of the suitcase is available on the request.	Pump line will include all necessary components to connect a vacuum suitcase to the chamber. It will include a CF40 gate valve, turbo pump, backing pump and electronics.	YES
k	All valves in the system with exception of the butterfly valve are manually operated.	All valves in the system with exception of the butterfly valve will be manually operated.	YES
l	All required electronics and cables for controlling the pumps, the gate valve and the pressure readings are included in this item.	All required electronics and cables for controlling the pumps, the gate valve and the pressure readings will be part of delivery.	YES
3	Load-lock for loading and unloading samples	Load-lock for loading and unloading	YES





	to the main chamber	samples to the main chamber	
a	Small load-lock chamber used for loading and unloading of samples and targets to the main deposition chamber	Small load-lock chamber will be used for loading and unloading of samples and targets to the main deposition chamber	YES
b	The load-lock is connected via a DN100CF (6" O.D. Conflat) gate valve to the main chamber, this valve is manually operated	The load-lock will be connected via a DN100CF (6" O.D. Conflat) gate valve to the main chamber, this valve will be manually operated	YES
c	Magnetic manipulator for sample and target transfer between the load-lock and the main chamber	Magnetic manipulator will be used for sample and target transfer between the load-lock and the main chamber	YES
d	A viewport in main chamber is included to look at the sample during loading and unloading	A viewport in main chamber will be included to look at the sample during loading and unloading	YES
e	The load-lock is equipped with a full range pressure gauge to check the pressure	The load-lock will be equipped with a full range pressure gauge to check the pressure	YES
f	Pump system for the load-lock by turbo drag pump with minimum pumping speed 70 l/s backed by a 0.9 m ³ /hr diaphragm pump	Pump system for the load-lock will consist of a 70 l/s turbo drag pump backed by a 0.9 m ³ /hr diaphragm pump	YES
g	The load-lock is equipped with fast entry door	The load-lock will be equipped with fast entry door	YES
4	Combined resistive and laser heater system	Combined resistive and laser heater system	YES
a	The heater holder includes a thermocouple for measuring the temperature inside the heater, power connections for the heater, and a centring pin for easy loading and unloading	The heater holder will include a thermocouple for measuring the temperature inside the heater, power connections for the heater, and a centring pin for easy loading and unloading	YES
b	The system has an open rear for access for the heating laser beam and pyrometer readout	The system will have an open rear for access for the heating laser beam and pyrometer readout	YES
c	Two heater elements with temperature of 900°C or higher	Two heater elements with temperature of ≤ 900°C will be part of delivery	YES
d	The heater will have a protruding front to allow access of the sample by the electron beam for RHEED	The heater will have a protruding front to allow access of the sample by the electron beam for RHEED	YES
e	Manually controlled XYZ-stage with +/- 12.5 mm travel in X and Y and 100 mm travel in Z	Manually controlled XYZ-stage with +/- 12.5 mm travel in X and Y and 100 mm travel in Z will be part of delivery.	YES
f	Rotation (Tilt) stage with about 100 degrees	Rotation (Tilt) stage with about 100	YES





	rotation, the rotation is manually controlled	degrees rotation will be part of system, the rotation will be manually controlled	
g	Additional azimuthal rotation around the substrate normal, this rotation is stepper-motor controlled with resolution < 0.01 degree	There will be an additional azimuthal rotation around the substrate normal. This rotation will be stepper-motor controlled, the resolution of rotary motion will be < 0.01 degree	YES
h	Electronics enclosure for control of the heater system, including a temperature controller to control the output of the power supply to the heater	Electronics enclosure for control of the heater system will be part of system. It includes a temperature controller to control the output of the power supply to the heater.	YES
i	A separate power supply for supplying the current for the heaters	A separate power supply will be used for supplying the current for the heaters	YES
j	Additional diode-type heating laser with corresponding sample carriers, the sample carriers load onto the same sample acceptor stage. Only by using a different sample holder, the operator can switch between resistive and laser heating.	There will be an additional diode-type heating laser with corresponding sample carriers, the sample carriers load onto the same sample acceptor stage. The operator can switch between resistive and laser heating by using a different sample holder only.	YES
k	The laser heater system with a power supply and a pyrometer system with feedback control to measure and control the sample temperature. Maximum sample temperature will be in excess of 1100 degrees C.	There will be a 110 W laser heater system with a power supply and a pyrometer system with feedback control to measure and control the sample temperature. Maximum sample temperature will be in excess of 1100 degrees C.	YES
l	The sample carriers are compatible with omicron flag style sample plates	The sample carriers will be compatible with omicron flag style sample plates	YES
m	Wobble stick for flag-style sample plate handling and transfer between suitcase and the system, connected to the PLD chamber or load-lock	Wobble stick for flag-style sample plate handling and transfer between suitcase and the system will be connected to the PLD chamber or load-lock	YES
n	The stage is prepared for DC/RF biasing of the sample stage	The stage will be prepared for DC/RF biasing of the sample stage	YES
5	Target stage	Target stage	YES
a	Target system with scanning motion possibility for minimum 5 targets	Target system will be designed for 5 targets with scanning motion possibility	YES
b	All targets will be mounted on a target carousel that can be loaded and unloaded via the load-lock or quick access door, target	All targets will be mounted on a target carousel that can be loaded and unloaded via the load-lock / quick	YES





	selection can be done in-situ and is stepper motor controlled	access door. Target selection can be done in-situ and will be controlled by a stepper motor	
c	Targets are rastered via a zig-zag pattern during deposition using two stepper motors, the size and speed of the rastering can be set by the operator	Targets will be rastered via a zig-zag pattern during deposition by using two stepper motors. The size and speed of the rastering can be set by the operator	YES
d	The system comes with all required electronics for the target selection and scanning motion	The system will come with all required electronics for the target selection and scanning motion	YES
e	The computer control of target selection also opens the possibility of depositing multi-layers by automated selection and laser control	The computer control of target selection will also open the possibility of depositing multi-layers by automated selection and laser control	YES
6	Gas panel and inlet into the deposition system	Gas panel and inlet into the deposition system	YES
a	Gas panel for controlling the gas flows into the deposition chamber	Gas panel for controlling the gas flows into the deposition chamber will be part of supplying	YES
b	The panel contains minimum 2 mass flow controllers with a maximum flow of 20 SCCM and shut off valves	The panel will contain 2 mass flow controllers with a maximum flow of 20 SCCM and shut off valves	YES
c	One line for flushing the chamber (typically with oxygen) and a vent line for nitrogen	There will be one line for flushing the chamber (typically with oxygen) and a one vent line for nitrogen	YES
d	Gas flows are set on the Mass Flow Controllers using the software interface	Gas flows will be set on the Mass Flow Controllers using the software interface	YES
e	The shut off valves are electro-pneumatically controlled	The shut off valves will be electro-pneumatically controlled	YES
7	High-pressure reflection high electron energy diffraction (RHEED) for PLD	High-pressure reflection high electron energy diffraction (RHEED) for PLD	YES
a	30 keV RHEED gun with control electronics	30 keV RHEED gun with control electronics will be part of system	YES
b	RHEED-gun extension tube for using RHEED at high pressures up to 50 Pa with integrated tilt stage, manually controlled, which allows the electron beam to reach all positions available to the heater	RHEED-gun extension tube for using RHEED at high pressures up to 50 Pa with integrated tilt stage will be manually controlled. This allows the electron beam to reach all positions available to the heater	YES
c	Additional valve for protecting the RHEED-gun during venting, the valve is electro-pneumatically operated	There will be an additional valve for protecting the RHEED-gun during venting. The valve will be electro-	YES





		pneumatically operated	
d	Pump system for RHEED-gun and a pump line for the extension tube, with a Pirani pressure gauge – minimum pumping speed 70 l/s turbo with drag pump	Pump system for RHEED-gun and a pump line for the extension tube will include a 70 l/s turbo with drag pump and a Pirani pressure gauge	YES
e	Phosphor screen for obtaining RHEED-images	Phosphor screen for obtaining RHEED-images will be used	YES
f	Camera system for RHEED-imaging and data acquisition full version software	Camera system for RHEED-imaging and data acquisition full version software (kSA400 full version) will be part of supplying	YES
g	Personal computer for RHEED data acquisition	Personal computer for RHEED data acquisition will be part of the system	YES
8	PC and SW with laser trigger	PC and SW with laser trigger	YES
a	PC with current operating system equipped with flat screen monitor, mouse, and keyboard	PC with current operating system equipped with flat screen monitor, mouse, and keyboard will be part of supplying	YES
b	Additional serial ports for communication with the system and serial cables	There will be an additional serial ports for communication with the system and serial cables	YES
c	Software for system control. The software allows for the control of all automated features of the system, such as heater control, target control, pressure read-out, etcetera	Software for system control will be part of the system. The software will allow for the control of all automated features of the system, such as heater control, target control, pressure read-out, laser operation etc.	YES
d	The software has the possibility to write small "recipes", macro-like programs that automate (parts of) the process	The software will have the possibility to write small "recipes", macro-like programs that automate (parts of) the process	YES
e	The laser has to be controlled from within the software	The laser will be controlled from the software	YES
9	Bake-out system	Bake-out system	YES
a	A bake-out system consisting of heaters and a bake-out tent	A bake-out system will consist of heaters and a bake-out tent	YES
b	The pressure gauge on the system can be replaced by a bakeable version and the pressure read-out can be replaced by a unit that also controls the bake-out process	The pressure gauge on the system can be replaced by a bakeable version and the pressure read-out can be replaced by a unit that also controls the bake-out process	YES
10	Optics system for PLD	Optics system for PLD	YES





a	An optical rail including supporting legs onto which the required optical components can be placed	An optical rail will include supporting legs onto which the all optical components can be placed	YES
b	All necessary holders/carriers are provided	All necessary holders/carriers will be provided	YES
c	A mirror to deflect the beam into the PLD chamber	A mirror to deflect the beam into the PLD chamber will be used	YES
d	A pinhole holder and 4 metal plates with various pinholes to filter out the homogeneous part of the laser beam	A pinhole holder and 6 metal plates with various pinholes to filter out the homogeneous part of the laser beam will be supplied	YES
e	The whole optical rail and all components will be enclosed in an enclosure that blocks the ultraviolet laser radiation, the enclosure will be made of an aluminium frame with transparent plates and comprises various doors for easy access to the optical components	The whole optical rail and all components will be enclosed in an enclosure that blocks the ultraviolet laser radiation. The enclosure will be made of an aluminium frame with transparent plates and will comprise various doors for easy access to the optical components	YES
f	Separate lens system attached to PLD-chamber	Separate lens system will be attached to PLD-chamber	YES
g	The lens for the focusing the laser beam onto the target with appropriate focal length	The lens for the focusing the laser beam onto the target will have an appropriate focal length (around 50 cm)	YES
h	The lens is sitting on an optical rail with 50 cm motion possibility along the laser beam line, this optical rail is fixed to the deposition chamber	The lens will be sitting on an optical rail with 50 cm motion possibility along the laser beam line. The optical rail will be fixed to the deposition chamber	YES
i	The lens can be moved perpendicular to this line over 13 mm	The lens can be moved perpendicular to this line over 13 mm	YES
j	Bake-out system	Bake-out system	YES
k	The optical system and software have to allow in the future the connection with an automatic motorized attenuator	The optical system and software will allow in the future the connection with an automatic motorized attenuator	YES
11	Excimer laser	Excimer laser	YES
a	Excimer laser with output wavelength of 248nm	Excimer laser with output wavelength of 248nm, model COMPex 205 F	YES
b	Minimum pulse energy 750 mJ	Pulse energy \geq 750 mJ	YES
c	Average power 30 W	Average power \geq 30 W	YES
d	50 Hz repetition rate	50 Hz repetition rate	YES
e	Energy stability < 0,75 %	Energy stability < 0,75 %	YES
f	Pulse duration max. 25 ns	Pulse duration \leq 25 ns	YES





g	Beam pointing stability max. 50 microradian	Beam pointing stability ≤ 50 microradian	YES
h	Computer control of the laser triggering, number of pulses and their frequency	Computer control allows to set the laser triggering, number of pulses and their frequency	YES
i	Alignment laser with visible output for optical path adjustment	Alignment laser with visible output for optical path adjustment will be part of system	YES
j	Temperature stabilization module for optimal laser head cooling and output stability	Temperature stabilization module for optimal laser head cooling and output stability will be part of the system	YES
k	Computer control of the laser triggering, number of pulses and their frequency	Computer control allows to set the laser triggering, number of pulses and their frequency	YES
l	Gas cabinet equipped with all necessary gases for laser operation is not part of delivery	Gas cabinet equipped with all necessary gases for laser operation will not be part of delivery	YES

(Bidder shall fill in the columns "Description and specifications of the Equipment offered by the Seller" and "Complies YES / NO")



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Annex No. 2

The Seller's bid in the extent it describes technical parameters of the Equipment

Laser-MBE UHV deposition system

Technical description:

The subject of delivery would be Laser-MBE UHV deposition system – complete pulsed laser deposition system from TSST, which will include all required parts.

The list of delivered parts would be :

- UHV PLD-MBE chamber with stainless steel frame
- Pump system for UHV PLD chamber with a 700 l/s turbo, prepared for IGP and TSP
- Loadlock for loading and unloading samples to the main chamber
- Pump system for loadlock
- Combined resistive and laser heater system with 5 axes manual motion and 2 resistive + 2 laser sample holders
- Scanning type target stage
- Gas panel and inlet into the deposition system
- RHEED system for Pulsed Laser Deposition
- PC and software with laser trigger
- Bake-out system with tent
- Optics system for PLD
- Valve on laser entry viewport
- Pumpline for suitcase connection
- Wobble stick with sample plate handling
- Excimer laser COMPex 205 F
- Temperature Stabilization Module
- Alignment laser with mirrors for both lasers (aiming laser and excimer laser)
- All necessary hardware like as cables, power supplies
- Operation manual and instructions in English
- Installation on site
- User training, testing and system demonstration on site
- Shipment and insurance



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We will provide the complete system contain all the components required for the operation of the system and all its parts, except the gas infrastructure (excimer laser gas and process gas). System will comply with all safety rules.

General description :

➤ **UHV PLD-MBE chamber with stainless steel frame** - True UHV chamber for MBE-like Pulsed Laser Deposition will have all metal-sealed ports; the base pressure of the chamber will be better than 10^{-9} mbar if equipped with suitable UHV pumps and bake-out system. Pressure measurement is by means of a baratron for process pressure range, Pirani for high pressure range and an Ion Gauge for low pressure range, all bakeable. The deposition direction will be horizontal or vertical based on the final design approval. The chamber will be placed on a fully bakeable stainless steel support. Two standard viewports will be implemented and a laser entry viewport (DN63CF) made of UV-grade quartz. The system will have ports for RHEED and for a loadlock. Furthermore the system will have additional ports for future upgrades: two 2xCF40 for ellipsometry and two CF40 for evaporators.

➤ **Pump system for UHV PLD chamber with a 700 l/s turbo, prepared for IGP and TSP** - Pumping system for Vacuum chamber consists of the following items:

A turbo drag pump with a capacity of 700 l/s, air cooled. The turbo pump is equipped with a vibration damper to minimise noise during RHEED experiments.

System is prepared for future IGP and TSP upgrade with an additional CF150 port in the pumpline. Pressure with only turbo drag pump after bakeout is $<10^{-8}$ mbar, with additional IGP/TSP $<10^{-9}$ mbar.

A manual gate valve between the chamber and the turbo pump line. Parallel to this gate valve a by-pass line with a stepper motor controlled butterfly valve between the main chamber and the turbo pump. This gate is used for controlling the process pressure.

A foreline with a 6m³/hr scroll pump

All valves in the system with exception of the butterfly valve are manually operated.

All required electronics and cables for controlling the pumps, the gate valve and the pressure readings are included in this item.

➤ **Loadlock for loading and unloading samples to the main chamber** - Small landlock chamber used for loading and unloading of samples and targets to the main deposition chamber.

The loadlock is connected via a DN100CF (6" O.D. Conflat) gate valve to the main chamber. This valve is manually operated.



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A magnetic manipulator will be used for the transfer.
A viewport is included to look at the sample during loading and unloading.
The loadlock is equipped with a full range pressure gauge to check the pressure.

➤ **Pump system for loadlock** - Pump system for the loadlock, consisting of a 70 l/s turbo drag pump backed by a 0.9 m³/hr diaphragm pump.
The turbo pump will be equipped with a vibration damper to minimize mechanical vibrations during RHEED operation. The turbo pump will be air cooled.

➤ **Combined resistive and laser heater system with 5 axes manual motion and 2 resistive + 2 laser sample holders** - Heater holder, suspended from the top of the chamber. The heater holder includes a thermocouple for measuring the temperature inside the heater, power connections for the heater, and a centering pin for easy loading and unloading. The system has an open rear for access for the heating laser beam and pyrometer readout

Two heater elements with a maximum temperature: 900°C. Higher temperatures are possible (up to 950°C), but severely reduce the lifetime of the heater. The heater will have a protruding front to allow access of the sample by the electron beam for RHEED.

Manually controlled XYZ-stage with +/- 12.5 mm travel in X and Y and 100 mm travel in Z. Rotation (Tilt) stage with about 100 degrees rotation possibility. The rotation is manually controlled.

Additional azimuthal rotation around the substrate normal. This rotation is stepper-motor controlled. The resolution of the rotary motions is better than 0.01 degree.

Electronics enclosure for control of the heater system, including a temperature controller to control the output of the power supply to the heater.

A separate power supply for supplying the current for the heaters.

Additional diode-type heating laser with corresponding sample carriers. The sample carriers load onto the same sample acceptor stage. Only by using a different sample holder, the operator can switch between resistive and laser heating.

The 110 W laser heater system comes with a power supply and a pyrometer system with feedback control to measure and control the sample temperature. Maximum sample temperature will be in excess of 1100 degrees C.

The sample carriers are compatible with omicron flag style sample plates.

The stage is prepared for DC/RF biasing of the sample stage.

➤ **Scanning type target stage** - Target system for maximum 5 targets with scanning motion possibility. All targets will be mounted on a target carousel that can be loaded and unloaded via the loadlock or quick access door. Target selection can be done in-situ and is stepper motor controlled.

Targets are rastered via a zig-zag pattern during deposition using two stepper motors. The





size and speed of the rastering can be set by the operator.

The system comes with all required electronics for the target selection and scanning motion.

The computer control of target selection also opens the possibility of depositing multi-layers by automated selection and laser control.

➤ **Gas panel and inlet into the deposition system** - Gas panel for controlling the gas flows into the deposition chamber. The panel contains two mass flow controllers with a maximum flow of 20 SCCM and shut off valves. In addition one line for flushing the chamber (typically with oxygen) is present, as well as a vent line for nitrogen. The shut off valves are electropneumatic controlled. Gas flows are set on the Mass Flow Controllers using the software interface.

➤ **RHEED system for Pulsed Laser Deposition** - High-pressure RHEED system for UHV-PLD consists of a 30 keV RHEED gun with control electronics. RHEED-gun extension tube for using RHEED at high pressures (up to 0.5 Torr, or 65 Pa) with integrated tilt stage, manually controlled. This allows the electron beam to reach all positions available to the heater. Additional valve for protecting the RHEED-gun during venting. The valve is electro pneumatically operated. Pump system for RHEED-gun. This includes a 70 l/s turbo-drag pump for the RHEED-gun and a pump line for the extension tube, with a pirani pressure gauge. Phosphor screen for obtaining RHEED-images. Camera system for RHEED-imaging and data acquisition software, specifically kSA400 Full version. Personal computer for RHEED data acquisition.

➤ **PC and software with laser trigger** - PC with flat screen monitor, mouse, and keyboard. Operating system: Microsoft Windows 7, or better. Additional serial ports for communication with the system and serial cables. Software for system control. The software allows for the control of all automated features of the system, such as heater control, target control, pressure read-out, etcetera. The software has the possibility to write small "recipes", macro-like programs that automate (parts of) the process. The laser can be controlled from within the software.

➤ **Bake-out system with tent** - A bake-out system consisting of heaters and a bake-out tent will be added to the system. The pressure gauge on the system will be replaced by a bakeable version and the pressure read-out will be replaced by a unit that also controls the bake-out process.

➤ **Optics system for PLD** - An optical rail will be provided, including supporting legs





onto which the required optical components can be placed. All required holders/carriers will also be provided. The components included are:

A mirror to deflect the beam into the PLD chamber.

A pinhole holder and 6 metal plates with various pinholes. These are used to filter out the homogeneous part of the laser beam.

The whole optical rail and all components will be enclosed in an enclosure that blocks the ultraviolet laser radiation. The enclosure will be made of an aluminum frame with transparent plates and comprises various doors for easy access to the optical components.

Separate lens system attached to PLD-chamber. The lens is used to focus the laser beam onto the target. Focal length is around 50 cm. The lens is sitting on an optical rail with 50 cm (20 inch) motion possibility along the laser beam line. This optical rail is fixed to the deposition chamber. The lens can be moved perpendicular to this line over 13 mm (0.5 inch).

➤ **Valve on laser entry viewport** - Between the laser entry viewport and the vacuum chamber a manual gate valve is placed, such that the viewport can be removed from the system without the need for venting the complete chamber.

At the same time connections will be made to the current system to allow venting and pumping down of the space between the valve and the viewport. This pumping down will be carried out via a connection to the loadlock, so that no additional pump nor pressure gauge are required.

The valve for the connection to the loadlock will be manually operated.

In the software the procedures for venting and pumping down the loadlock can be used to control the pressure between the valve and the viewport.

➤ **Pump line for suitcase connection** - Pump line including all necessary components to connect a vacuum suitcase to the chamber. This includes a CF40 gate valve, turbo pump and backing pump including electronics.

➤ **Wobble stick with sample plate handling** - Wobble stick for flag-style sample plate handling and transfer between suitcase and the system, connected to the PLD chamber or load lock.

➤ **Excimer laser Compex 205F** – excimer laser is highly effective light sources, featuring a compact design and easy operation, new ceramic preionization, more than 750 mJ output and unmatched pulse-to-pulse stability. The COMPex also comes with an improved gas processor that extends both gas and optics lifetimes.

The next generation COMPex lasers come with superior pulse energy and unrivalled pulse stability (0.75% at 248 nm), ultimate laser pulse control, and unsurpassed safety and



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supply structure in a standard setting footprint. Built on the same fundamental architecture as the field-proven legacy model, the COMPex features industrial NovaTube with superior CleanFlow optics protection and MultiColumn twin-type precipitator to deliver market-leading window and gas fill intervals. Additionally, new control electronics in conjunction with fast-photodiode monitoring of each individual laser pulse, extends the pulse control capabilities way beyond simple energy setting & stabilization statistics. With newly introduced functionalities such as PowerLok, the user gains the ultimate control over time delay and output energy of each and every laser pulse including instant energy level switching.

In order to ensure compatibility and reproducibility of laser ablation and PLD results, both output beam geometry and temporal pulse shape of the next generation COMPex are excellent. Flexible interfacing via Ethernet, USB and RS232 connectors facilitates system integration.

Temperature Stabilization Module optimizes the colling process inside the laser head based on the operation condition to keep the laser output parameters stable and in optimal performance.

There will be also alignment laser including upgrade of mirrors to be compatible with the alignment laser wavelength.

Installation, warranty and service :

The system will be installed and tested on-site. Furthermore, a 2-day training of staff involved is included. For the installation it is mandatory that the installation site complies fully with the Site Requirements to be supplied by TSST ultimately 2 months before installation takes place.

The warranty for the supplied system will be following :

- a period of 36 months (or 1-billion pulses, whatever comes first) for the laser (note : consumables like as halogen filter for excimer laser is not part of warranty)
- a period of 24 months in case of the UHV system

Note regarding warranty: 2 year applies on all parts with exception of electronics and power supplies, electron gun, heating parts, pumps, valves and motors. On these parts 1 year warranty applies, wear within normal use excluded.

The warranty will begin on the date of signing the Handover Protocol.

The warranty service response will be within 3 days by e-mail or phone, or within 5-days by visit of service technician, service repair within 30 days from the defect notification, unless parties agree otherwise.



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