Clear Fields

UCF | Procurement Services

SOLE SOURCE CERTIFICATE AND POSTING NOTICE

(Greater than $150,000)

A sole source procurement is when you make a request to purchase product(s) and/or service(s) without competition when competition is otherwise required. This means that product/service is unique and that the supplier is the only supplier that can provide the product or service. In accordance with the authority granted under applicable Florida law and UCF Regulation 7.130, the following documentation is submitted in support of this request.

This form and related documentation shall be submitted through Workday Help using case type Waivers and Sole Source. Please do not attach to a requisition or send via email for review and approval.

WD case subject title should have common structure for easy tracking, to include:

- Exemption type (Sole Source)
- Supplier name
- Purchase amount

The completed sole source must be approved in the following order. **Please be sure to obtain all required signatures before submitting the form to Procurement Services.**

- PI/Researcher/Director/Chair
- President/Vice President/Dean
- Procurement Specialist
- Procurement Services Manager or Associate Director
- Assistant Vice President for Tax, Payables & Procurement, who will review and provide a recommendation to approve or disapprove the sole source to:
- Chief Financial Officer, who will either directly approve or disapprove the sole source, or forward it to the Provost and Executive Vice President for goods/services related to academia for input prior to making the final decision.

Once the completed sole source is received, Procurement Services in collaboration with kNEXT reviews the documentation provided and determines whether the sole source is valid or if there are additional suppliers that may be able to provide the requested product or service. The sole source review and approval process varies based on the nature of the product/service being requested and the information provided in the requestor's justification, among other factors, so please keep this in mind when submitting the form.

Contingent upon the approval of all the officers/individuals listed, the sole source shall be posted on the UCF Procurement Services website for seventy-two (72) hours. Upon expiration of said posting period, Procurement Services will process a purchase order upon receipt of the requisition.

The usual bidding process shall be conducted if sole source approval is not granted.

PART I: DEPARTMENT AND SUPPLIER INFORMATION

Department Name: ECE

Contact & Phone: Piotr Kulik

Product/Service Cost: $292,500

✓ One Time Purchase __Term Contract: _____

__ Multiple Purchases __ Duration: _____

Company Name: Neocera, LLC

Email: kolagani@neocera.com

Contact Person: Solomon Kolagani

Title: General Manager

Product and/or Service: Custom Neocera Pioneer180 PLD system

PART II: SOLE SOURCE JUSTIFICATION (see pages 4-5)

Only justifications submitted on this form and in the below format will be reviewed for approval. All the listed points MUST be fully answered on the following pages and any additional attached pages as needed. Failure to submit justification as outlined in the format below will result in the form being returned without review.

PART III: SOLE SOURCE CERTIFICATIONS

A. In my professional opinion, this is the only product or service that can reasonably meet my requirement(s)/specification(s), and this is the only supplier who can provide the product or service. I further certify that the information contained herein is true and correct to the best of my knowledge and belief and would withstand any audit or supplier protest.

B. I, the undersigned, certify that I and/or the user do not have a financial interest in the above named supplier or contractor, and that I am unaware of any conflict of interest related to this purchase.

Piotr Kulik Digitally signed by Piotr Kulik Date: 2025.05.05 13:42:56 -04'00'	Piotr Kulik, Principal Investigator	5/5/2025
Signature	**Printed Name and Title (PI/Researcher/Director/Chair)**	**Date**
michaelg Digitally signed by michaelg Date: 2025.05.09 10:23:34 -04'00'	Michael Georgiopoulos	5/9/2025
Signature	**Printed Name and Title (President/Vice President/Dean)** (Delegations not allowed; emails from absent approvers are acceptable)	**Date**

I, the undersigned, hereby concur with the above justification and support a sole source approval for the above product(s) and/or service(s). Approvals may be documented and supported via email.

See below email approval		
Signature	**Printed Name and Title (Procurement Specialist)**	**Date**
See below email approval		
Signature	**Printed Name and Title (Procurement Services Manager or Associate Director)**	**Date**
See below email approval		
Signature	**Printed Name and Title (Asst. Vice President for Tax, Payables & Procurement)**	**Date**

See below email approval

Signature | **Printed Name and Title (Chief Financial Officer)** | **Date**

POSTING NOTICE

05/21/2025 at 11:00am EST	05/26/2025 at 11:00am EST	SS# 2513	Trinh Nguyen
Date/Time Posted	**Posting End Date**	**UCF Control No.**	**Procurement Specialist**

SOLE SOURCE JUSTIFICATION

Please answer the questions below and attach additional documentation if needed.

1. Describe the product(s) and/or service(s) and anticipated use thereof in layman's language.

We are acquiring a custom-built Neocera Pioneer180 Pulsed Laser Deposition (PLD) system. This equipment is used to create very thin, high-quality layers of materials—particularly metal oxides—on surfaces, much like building up ultra-thin coatings one layer at a time. These layers are essential in making advanced electronic, magnetic, and optical devices. The system is especially useful for growing complex structures with multiple layers, called heterostructures and superlattices, which are needed for cutting-edge technologies. The machine is uniquely designed to take up less space while still offering top-tier performance.

2. Describe the required specifications or requirements and why are they essential to the accomplishment of your work.

The system must be capable of growing ultra-thin films with precise control over thickness, composition, and crystal structure. This level of control is critical for our work, which focuses on creating advanced materials for next-generation electronics, sensors, and energy devices.Key requirements include:High-vacuum and oxygen-controlled atmosphere: This ensures clean growth environments and is essential for making high-quality oxide films.Multi-target carousel: Needed to quickly switch between different materials during deposition, which allows us to build complex multilayer structures without breaking vacuum.Heated substrate stage with precise temperature control (up to ~900°C): Accurate temperature control is crucial for growing films with the correct crystal orientation and properties.In-situ monitoring (e.g., RHEED): Real-time feedback during film growth helps us optimize material quality and understand growth mechanisms.Compact footprint: The custom design reduces the system's physical space, which is important for integration into our lab without requiring major renovations.

Provide the names of other suppliers, products and/or services that you have investigated and explain why they do not meet the required specifications or requirements. It may be helpful to present your information in a table like the one below.

Required Specifications	Supplier 1	Supplier 2	Supplier 3	Supplier 4
	Y/N	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N	Y/N

PVD Products is another vendor and they quoted the system at a much higher price of $393,750, however the work to be done at UCF does not require all their capabilities. Furthermore their system is much larger than the one by Neocera.

3. State in detail why only this and no other product(s)/service(s) will satisfy the department's requirements. Description may include unique features, compatibility, specifications, availability, delivery time frame etc. (For example, please list the features or special conditions that are unique and only available from one supplier. Note: Price is not a valid reason.)

Unique features:
1. The foot-print of the entire PLD system including the laser is within 79 inches x 48 inches (6.5 feet x 4 feet).
2. Deposition Chamber design: The PLD System is pre-engineered not only to meet the current needs of the PLD researcher in its base configuration, but also for future upgrades. The PLD system has several ports at strategic locations to allow these future add-ons onsite, with minimal downtime. In addition to insitu diagnostics such as RHEED, researchers also have the option to add RF/DC sputter sources. This upgradability is unique to Neocera.
3. Substrate Heater design: Pioneer 180 PLD System integrates unique substrate heater design allowing a wide range of process pressures (UHV to atmosphere), while using corrosive gases like oxygen, at high temperatures (850C max). The heater coil design allows minimization of magnetic fields close to the substrate, an important feature when PLD systems are integrated with RHEED diagnostics. Substrate can rotate continuously at 1-30 rpm as needed. A proprietary electrical contact scheme guarantees long life for the heater coil when used optimally.

4. Are there resellers or distributors? If yes, please list names and contact information.

No reseller as this is a custom built tool to the specifications of the requred material.

5. Will this purchase obligate UCF to this vendor for future purchases such as maintenance, licensing, or continuing need? ___ Yes ✓ No

If yes, please provide details regarding future obligations and/or needs to include number of years and total spending amount of obligations:

6. What efforts have been made to obtain the best pricing available? Please provide an explanation to support the belief that the price is fair and reasonable.

We obtained a formal quote from PVD Products for their PLD/MBE-2300 System, which is often used in research environments for similar thin-film deposition work. We compared that quote against the custom Neocera Pioneer180 PLD system. The PVD Products PLD/MBE-2300 System, while robust, includes features tailored for dual PLD/MBE (Molecular Beam Epitaxy) use, which are not essential for our oxide-focused research. These additional capabilities significantly increase the cost and complexity without providing meaningful benefits for our specific applications. Additionally, the system had a larger physical footprint and more extensive facility requirements, which would require further infrastructure investment on our end.In contrast, the Neocera Pioneer180 PLD system is a streamlined, oxide-focused platform customized specifically for our thin-film research needs. It provides all the essential features—multi-target capability, high-temperature substrate heating, precise plume control, and compatibility with epitaxial oxide film growth—at a significantly reduced price compared to the PLD/MBE-2300. Neocera also accommodated a custom compact design to fit within our current lab space without renovations, which further reduces overall costs.After technical discussions and evaluation of both systems' capabilities, we determined that the Pioneer180 offers the best price-to-performance ratio for our research objectives. This conclusion is supported by:Direct pricing quotes and specification sheets from both vendorsConsultation with researchers who have operated both systemsConsideration of total cost of ownership (space, utilities, and maintenance)Therefore, we believe the pricing for the Pioneer180 system is fair and reasonable, and it is the most cost-effective solution tailored to our specific research and space constraints.

From: Gerald Hector
To: Joel Levenson
Cc: Brian Sargent; Trinh Nguyen
Subject: Re: Procuring a Pulsed Laser Deposition System Request - C0127150 SS, Neocera, $292,500
Date: Tuesday, May 20, 2025 8:37:40 PM
Attachments: image001.png
image002.png

Joel:

I approve this sole source request.

Regards,

Gerald

Sent from my iPhone

> On May 20, 2025, at 9:23 AM, Joel Levenson <Joel.Levenson@ucf.edu> wrote:
>
> Good morning Gerald,
>
> I support this sole source as well. This is another laser system with specifications the PI has documented in their request along with a comparison of suppliers who can / can not meet the requirements. Additionally, the Department of the Navy has awarded a sole source to this supplier for the equipment the department is looking to purchase.
>
> If you agree to this sole source, reply all to this email and indicate as such. If you have additional questions, let me know.
>
> Thank you,
>
> ---
>
> **From:** Brian Sargent <Brian.Sargent@ucf.edu>
> **Sent:** Monday, May 19, 2025 1:34 PM
> **To:** Joel Levenson <Joel.Levenson@ucf.edu>
> **Cc:** Trinh Nguyen <Trinh.Nguyen@ucf.edu>
> **Subject:** FW: Procuring a Pulsed Laser Deposition System Request - C0127150 SS, Neocera, $292,500
>
> Hi Joel,
>
> I also support this sole source request submitted by ECE for a specialized Laser System. Neocera is the only source that meets all the departments requirements, including size requirements and temperature control (up to ~900°C).
>
> Also, the Naval Information Warfare Center approved a sole source for the same product in 2023.
>
> Please approve/disapprove and let me know if you have any questions.

Regards,
Brian

From: Trinh Nguyen <Trinh.Nguyen@ucf.edu>
Sent: Monday, May 19, 2025 11:16 AM
To: Brian Sargent <Brian.Sargent@ucf.edu>
Subject: FW: Procuring a Pulsed Laser Deposition System Request - C0127150 SS, Neocera, $292,500

Hi Brian,

Happy Monday! I have reviewed the attached sole source and can support it for the following reasons. Can you please also review to see if you agree or not?

Vendor: Neocera, LLC
Product: Custom Neocera Pioneer180 PLD System
Total Amount: $292,500
Dept: ECE

Requirement: The department wants to purchase a custom-built pulsed laser deposition System (PLD) to create very thin, high-quality layers of materials to make advanced electronic, magnetic, and optical devices. The required specifications are listed below.

Research Conducted: The PI confirmed that to the best of his knowledge, these are the two suppliers out in the marketplace that can provide comparable products but only the one from Neocera can meet all the below requirements.

Specifications Requirements	Custom Neocera Pioneer180 PLD system	PVD Products PLD/MBE-2300 System
The system must be capable of growing ultra-thin films with precise control over thickness, composition, and crystal structure.	Yes	Yes
Must have high-vacuum and oxygen-controlled atmosphere	Yes	Yes
Heated substrate stage with precise temperature control (up to ~900°C). System integrated with RHEED Diagnostics.	Yes	No
Real-time feedback during film growth	Yes	Yes
The custom design reduces the system's physical space, which is important for integration into our lab without requiring major renovations. Footprint is within 79 inches X 48	Yes	No

Inches		
Future upgradability to the system	Yes	Unknown

- The Neocera system can heat substrates with precise temperature control up to ~900°C, whereas the PVD product can't .
- The minimum required physical space for the system is 85 mm by 80 mm. This is the required small footprint that's only available from Neocera.
- There are no resellers/distributors for this customized laser system.

Price is fair and reasonable: The price is deemed fair and reasonable given that the Neocera system can meet all the above requirements. In addition, Neocera can also accommodate a custom compact design to fit within the department's lab space constraints without renovation. It was noted that the PVD Products PLD/MBE-2300 System, while robust, includes features tailored for dual PLD/MBE (Molecular Beam Epitaxy) use, which are not essential for the lab oxide-focused research.

GovSpend: There's a Sole Source Notice for the Neocera Pioneer 180 Pulsed Laser Deposition System (PLD) in November of 2023 from the Department of the Navy for the exact same system required for ECE.
https://www.bidnetdirect.com/public/supplier/solicitations/statewide/2464215502/abstract

<image002.png>

Thanks,
Trinh

From: Piotr Kulik <Piotr.Kulik@ucf.edu>
Sent: Monday, May 12, 2025 9:58 AM
To: Trinh Nguyen <Trinh.Nguyen@ucf.edu>
Subject: RE: Procuring a Pulsed Laser Deposition System Request

Confirmed. Small footprint is only Neocera.

Thank you,
Piotr

From: Trinh Nguyen <Trinh.Nguyen@ucf.edu>
Sent: Monday, May 12, 2025 8:37 AM
To: Piotr Kulik <Piotr.Kulik@ucf.edu>
Subject: RE: Procuring a Pulsed Laser Deposition System Request

Thanks, Piotr, for confirming which supplier can meet each required specs below. Can you also confirm that to the best of your knowledge, the two suppliers (Neocera and PVD Products) are the only ones out in the marketplace that can provide this type of equipment?

Thanks,
Trinh

From: Piotr Kulik <Piotr.Kulik@ucf.edu>
Sent: Friday, May 9, 2025 3:39 PM
To: Trinh Nguyen <Trinh.Nguyen@ucf.edu>
Subject: RE: Procuring a Pulsed Laser Deposition System Request

Specifications Requirements	Custom Neocera Pioneer180 PLD system	PVD Products		
The system must be capable of growing ultra-thin films with precise control over thickness, composition, and crystal structure.	Yes	Yes		
Must have high-vacuum and oxygen-controlled atmosphere	Yes	Yes		
Heated substrate stage with precise temperature control (up to ~900°C). System integrated with RHEED Diagnostics	Yes	No		
Real-time feedback during film growth	Yes	Yes		
The custom design reduces the system's physical space, which is important for integration into our lab without requiring major renovations. Footprint is within 79 inches X 48 Inches	Yes	No		
Future upgradability to the system	Yes	Unknown		

From: Trinh Nguyen <Trinh.Nguyen@ucf.edu>
Sent: Friday, May 9, 2025 3:33 PM
To: Piotr Kulik <Piotr.Kulik@ucf.edu>
Subject: FW: Procuring a Pulsed Laser Deposition System Request
Importance: High

Hi Piotr,

Can you please confirm that I've captured the required specifications needed for the pulsed laser deposition system below? Please fill in if PVD Products can meet these required specifications or not. Provide edits to the table if I've missed something or got something wrong. Please also confirm that the two suppliers (Neocera and PVD Products) listed in the sole source are the only suppliers out in the marketplace that can provide this type of equipment? Are there others?

Specifications Requirements	Custom Neocera Pioneer180 PLD system	PVD Products		
The system must be capable of growing ultra-thin films with precise control over thickness, composition, and crystal structure.	Yes	?		
Must have high-vacuum and oxygen-controlled atmosphere	Yes	?		
Heated substrate stage with precise temperature control (up to ~900°C). System integrated with RHEED Diagnostics	Yes	?		
Real-time feedback during film growth	Yes	?		
The custom design reduces the system's physical space, which is important for integration into our lab without requiring major renovations. Footprint is within 79 inches X 48 Inches	Yes	No		

Future upgradability to the system	Yes			

Thanks,
Trinh Nguyen
Procurement Specialist
Knights Experience Team (kNEXT)
University of Central Florida
Trinh.Nguyen@ucf.edu
☏ 407-823-5889
ucf.edu ● kNEXT.ucf.edu ● Workday Help

From: Trinh Nguyen <Trinh.Nguyen@ucf.edu>
Sent: Friday, May 9, 2025 1:54 PM
To: Piotr Kulik <Piotr.Kulik@ucf.edu>; Brian Sargent <Brian.Sargent@ucf.edu>
Cc: Procurement Services <Procurement@ucf.edu>
Subject: RE: Procuring a Pulsed Laser Deposition System Request

Hi Piotr,

Do you have the quote to provide? I'll review the SS and will reach out with any questions or information needed.

Thanks,
Trinh Nguyen
Procurement Specialist
Knights Experience Team (kNEXT)
University of Central Florida
Trinh.Nguyen@ucf.edu
☏ 407-823-5889
ucf.edu ● kNEXT.ucf.edu ● Workday Help

From: Piotr Kulik <Piotr.Kulik@ucf.edu>
Sent: Friday, May 9, 2025 12:23 PM
To: Brian Sargent <Brian.Sargent@ucf.edu>
Cc: Procurement Services <Procurement@ucf.edu>; Trinh Nguyen <Trinh.Nguyen@ucf.edu>
Subject: RE: Procuring a Pulsed Laser Deposition System Request

Hi Brian,

Attached are the required signatures. In Workday do you mean to create a request?

Can you explain how to do it?

Thank you,
Piotr Kulik

From: Brian Sargent <Brian.Sargent@ucf.edu>
Sent: Tuesday, May 6, 2025 10:42 AM
To: Piotr Kulik <Piotr.Kulik@ucf.edu>
Cc: Procurement Services <Procurement@ucf.edu>; Trinh Nguyen <Trinh.Nguyen@ucf.edu>
Subject: FW: Procuring a Pulsed Laser Deposition System Request

Good morning Piotr,

Sole source requests must be submitted as a help case in Workday. Below is the procedure for reference. I will assign this to Trinh (cc'd) to get her review started as soon as possible, but please let us know when the case has been created.

Please let me know if you have any questions.

Regards,
Brian

<image001.png>

From: Procurement Services <Procurement@ucf.edu>
Sent: Monday, May 5, 2025 2:50 PM
To: Brian Sargent <Brian.Sargent@ucf.edu>
Cc: Piotr Kulik <Piotr.Kulik@ucf.edu>
Subject: FW: Procuring a Pulsed Laser Deposition System Request

@Brian Sargent
Please assist Dr. Kulik
Thanks

From: Piotr Kulik <Piotr.Kulik@ucf.edu>
Sent: Monday, May 5, 2025 2:02 PM
To: Procurement Services <Procurement@ucf.edu>
Subject: Procuring a Pulsed Laser Deposition System Request

Hi,

I am in the process of procuring a pulsed laser deposition system using funds from a recent internal award from the Office of Research. The system I intend to purchase exceeds $150,000. I have prepared a sole source justification document (Sole-Source_Neocera_PK) and have also gathered three quotes that split the purchase of each component to be under 150,000 (which are three different parts of the system), including a competing system quote for comparison from PVD (02025-01 UCF PLDMBE).
This is my first time completing a purchase of this scale, and I am currently under time pressure, as the Office of Research requires the funds to be spent by May 15th. Could you please advise me on which procurement method would allow the purchase order to be issued most efficiently, given the deadline?

Thank you,
Piotr Kulik

Piotr Kulik, Ph.D.
Assistant Professor
Advanced Integrated Magnetics & Sensors Laboratory
Department of Electrical and Computer Engineering
Joint Faculty Department of Materials Science and Engineering
University of Central Florida
Research I, Office 356
Orlando, FL 32816
Phone: 407.823.1443

<Sole-Source_Neocera_PK.pdf>
<020625-01 UCF PLDMBE 2300.pdf>
<214026 P180 PLD SS Laser UCF.pdf>
<214032 P180 UCF.pdf>
<214033 PSH3R and SZ100 UCF.pdf>
<214034 SS Laser Optics UCF.pdf>

PVD PRODUCTS

To: **University of Central Florida** Date: 2/6/2025
Attn: **Piotr Kulik** Valid for: 60 days
Email: piotr.kulik@ucf.edu

To place an order please email: sales@pvdproducts.com

QUOTATION 020625-01: PLD/MBE-2300 SYSTEM

PVD Products is pleased to present this quote to the University of Central Florida for a PLD/MBE-2300 laser deposition system.

Part No.	Description	Price
J00P2336	PLD/MBE-2300 System	$437,500
	10% University Discount	($43,750)
	Shipping EXW	$0

Total: $393,750

System Options		
Part No.	**Description**	**Price**
J0510040	Dual Wafer Loadlock	$37,500
J0423006-03	UHV Upgrade Package (must order J0510040 at same time)	$21,500
J1500006	Additional MFC's (non-toxic, non-explosive)	$4,200 @
J0406046-03	STAIB High Pressure TORR RHEED Package with k-Space 400 DAS	$125,500
J0409015-04	Film Sense In-Situ Ellipsometer (Four Color)	$29,500
J0409015-08	Film Sense In-Situ Ellipsometer (Eight Color)	$38,000
J0420010-03	Flange Mounted Veeco Atomic Oxygen Source with RF Power Supply	$79,500
J0420010-04	Flange Mounted Veeco Atomic Nitrogen Source with RF Power Supply	$79,500
J0411242-01	2" Flange Mounted Magnetron, HV, 500-Watt DC Power Supply	$22,500
J0411242-02	2" Flange Mounted Magnetron, HV, 300-Watt RF Power Supply	$23,750
J0411243-01	2" Flange Mounted Magnetron, UHV, 500-Watt DC Power Supply	$23,750
J0411243-02	2" Flange Mounted Magnetron, UHV, 300-Watt RF Power Supply	$25,250
J0401119-03	RF Bias on Substrate	$19,750
J0410051-03	K&R 4-cm Gridded DC Ion Source	$36,500
J0405025-03	Pyrometer Package	$11,150
J0403073-02	COMPex PRO 102 Laser Package with Premix Gas Cabinet	$104,250
J0403074-02	COMPex PRO 110 Laser Package with Premix Gas Cabinet	$123,750
J0403116-02	COMPex PRO 201 Laser Package with Premix Gas Cabinet	$124,000
J0403088-02	COMPex PRO 205 Laser Package with Premix Gas Cabinet	$137,850

To: **University of Central Florida** Date: 2/6/2025
Attn: **Piotr Kulik** Valid for: 60 days
Email: piotr.kulik@ucf.edu

To place an order please email: sales@pvdproducts.com

Delivery: ~7.5 Months ARO, depends on configuration ordered and supply chain at time of order

Shipping Terms: EXW; Other arrangements are available.

Payment Terms:

30% due on order
35% due 14 weeks ARO
25% due net 30 days upon shipment
10% due net 30 days upon installation and training

Warranty Terms:

12 months from installation or 14 months from shipment, whichever occurs first.

Attachments: Terms and Conditions of Sale, End User License Agreement

To: **University of Central Florida** Date: 2/6/2025
Attn: **Piotr Kulik** Valid for: 60 days
Email: piotr.kulik@ucf.edu

To place an order please email: sales@pvdproducts.com

J00P2336: PLD/MBE-2300 System

Purpose

The field-proven PLD/MBE-2300 is used for growth of epitaxial and multilayer complex oxides and other materials. The system handles wafers up to 2" in diameter or multiple small samples, offers optional sputtering capability, and is high pressure RHEED compatible.

PLD/MBE-2300 with optional loadlock and laser

System Layout

Cylindrical chamber mounted on support frame with casters and leveling pads. Electronic racks provide support tables for laser and enclosed optical train.

Deposition Chamber and Frame Assembly

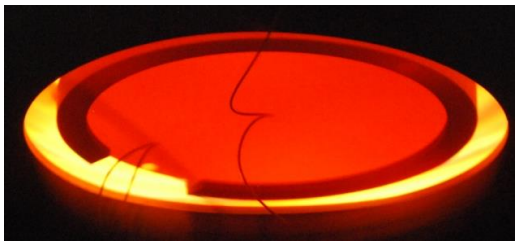
- Cylindrical chamber made from 304 SS with large top flange that seals via Viton O-ring. Dimensions 17" (432 mm) ID x 14" (355 mm) H. Includes an electric hoist to lift the top flange to provide easy access to internal components.
- Internal set of removable SS shields for easy periodic cleaning. Spare set of shields included. Note: It is much easier to clean removable shields than to clean the internal surfaces of a spherical vacuum chamber.
- Chamber mounted on painted steel support frame with dual bay electronic racks and metal tabletop. Includes heavy duty casters and leveling pads. Electronic racks also include the system Power Distribution box.
- Tabletop provides support for optional excimer laser.
- CF flange ports for turbo and roughing pumps, gas inlet and vent valve, vacuum gauges, with multiple viewports.
- Additional ports on the chamber for optional loadlock, High Pressure RHEED, ellipsometry, pyrometry, optical emission spectroscopy, and RGA's.
- The 2300 also has three 6" (DN100) CF flange ports on the back wall for integration of magnetrons, ion, or atom sources.
- These flanges are at an AOI of 40° with respect to the substrate normal.

Vacuum Pumping and Gauging

- A Kashiyama NeoDry 7G pump is provided to rough chamber and back turbo pump (also used to rough out the optional loadlock chamber and back loadlock turbo pump).
- An all-pneumatic package for valve control (except gate valve - see below).
- A Pfeiffer HiPace 700 680 l/sec turbo pump with splinter screen is provided to pump the chamber.
- A VAT Series 642 closed-loop gate valve isolates the turbo pump from the main chamber and provides closed-loop pressure control during the deposition process.

- An InstruTech Hornet Ion gauge and two convection gauges are provided for standard vacuum pressure measurement.
- An MKS 250 mTorr full scale Capacitance Manometer is provided for pressure measurement during the PLD process. When coupled with the VAT Series 64 gate valve this package provides closed-loop pressure control with ±1 mTorr stability from ~5 to 250 mTorr.
- A single programmable MKS MFC calibrated for 50 SCCM for oxygen gas (others on request) with pneumatic shut-off valve is provided. Note: PVD provides an MFC not an inaccurate needle valve.
- The main chamber pumps down to below 1 x 10^{-6} Torr in 45 minutes or less for clean/dry chamber.
- Base pressure of main chamber below 5 x 10^{-7} Torr guaranteed.
- Note: The turbo pump is not located on bottom of chamber where all sorts of particles and parts can fall into it.

Oxygen Resistant, Rotating Substrate Holder



Calibration of Nano heater with Inconel disc and two TC's

- A high temperature substrate heater reaches 900°C for Silicon and other non-transparent substrates.
- No Silver paste required.
- RHEED compatible DC power supply driving a bank of four high intensity IR lamps housed in a gold-coated water-cooled copper block.
- Type K TC and PID temperature controller will provide ramp, dwell and temperature profiles with ±1°C stability.
- The Target to Substrate distance is variable from 50 to 100 mm via a motor-controlled Z-stage.
- A motorized substrate rotation stage is included with programmable rotation speeds up to 40 RPM.
- A pneumatic Z-stage provided to insert and remove substrate holders via the quick access door or optional loadlock.
- Two sets of Inconel substrate holders per customer requirements. Examples include two 2" wafer holders and two holders that handle four 1 cm^2 samples.
- Note: Lamps are easy to change in the field and are stocked at PVD Products. Other vendor heaters require a new substrate heater which can take months to obtain.

Programmable 6-Position Target Manipulator

- A target carousel that can handle six 2" diameter targets. Smaller targets can be accommodated via provided inserts.
- Targets held via gravity only and can easily be changed by opening the front chamber door. Note: other vendor targets must be silver pasted to pedestals making target changes very time consuming and risk breaking targets.

- An electroless nickel-plated water-cooled plate with slot sits above the targets to keep the gears and bearings cooled during substrate heating.
- Two motorized Ferro fluidic rotator feedthroughs provide continuous target rotation up to 50 RPM and very quick target indexing for multi-layer film growth.
- Target toggling or rastering is also possible but PVD Products recommends laser beam rastering noted below.
- Ferro seal feedthroughs provide much longer life than bellow sealed feedthroughs found on other vendor tools.
- NOTE: PVD Products strongly recommends two-inch diameter targets. The target lifetimes are much longer than 1" diameter targets and they do not require constant target resurfacing the way small targets do after each deposition.

Target carousel with six 2" diameter target pedestals

Programmable Optical Train with Laser Beam Rastering

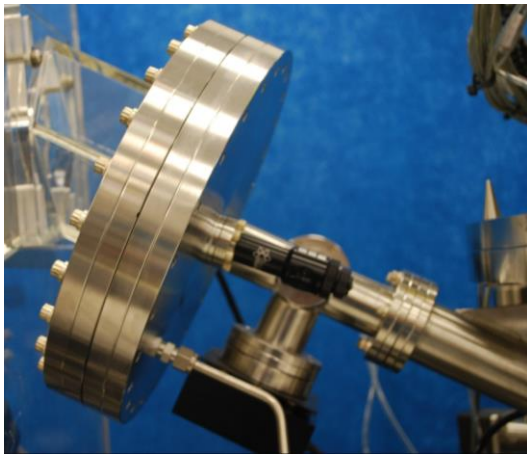
- A complete optical train designed for 248-nm (KrF) radiation is provided.
- A beam forming aperture with adjustable X-Y slits is provided to clip the edges of the raw beam coming out of the laser.
- A high-quality focus lens AR coated on both sides is provided for laser beam focusing. The lens is placed on an optical rail for easy positioning of the lens for optimal spot size.
- Includes three 2" diameter HR coated beam turning mirrors mounted on kinematic mounts for fine alignment of laser beam.
- The final kinematic mirror mount includes a programmable actuator that provides the ability to raster the laser beam across the target surface. Laser beam rastering (developed in the 1980's by PVD Products personnel) provides for both excellent film uniformity and target utilization. It also reduces the stress on the feedthroughs when conducting "target rastering" which can cause fatigue and vacuum failure of cheap bellows sealed feedthroughs.
- Beam attenuation package with five fused silica plates, each reducing the beam energy by ~8% providing attenuation of up to 64% of incident beam.

PVD Products enclosed optical train with shutter, XY aperture, focus lens and mirrors. Also seen is the raster actuator and Intelligent Window described below

- The entire optical train is enclosed in a laser-safe box with interlocked hinged door. It the door is opened the laser will shut off.
- PVD Products optical train also includes a pneumatic actuator that will automatically open and close the laser shutter upon startup or end of deposition. Other vendors do not offer this feature.
- The Angle of Incidence of the laser on the target is 60^{o}. This AOI provides for a much cleaner optical train over time (Please ask for PVD's Tech Note on this subject).

PLD/MBE-2300 Intelligent Window:

- Unique device designed to keep the optical beam path clean for extended periods of time. Developed in the 1990's by PVD Products personnel.
- Incorporates a 196 mm diameter UV grade fused silica disc mounted on manual rotary feedthrough.
- Using a molybdenum aperture only a small section of the disc is exposed to backscattered materials.
- When the exposed section of the disc reduces beam fluence by ~10% the customer can easily rotate the disc to expose a new section of the disc. Increases the number of runs that can be conducted before an optics cleaning by 100 times.
- Includes high quality AR coated 2" diameter fused silica window for low optical loss (2%). This optic does not get coated with backscattered material.
- A pneumatic actuator with a beam splitter is provided to reflect the radiation that has traversed the entire optical beam path back out of the chamber to a joule meter. Thus, the energy that enters the chamber for each run can be properly measured and adjusted by the user.
- A spare disc is provided. Discs can easily be repolished or chemically cleaned and used multiple times.



PVD Products Unique Intelligent Window

Computer Control and Combinatorial Thin Film Software

- The system comes with PVD Products PLD PRO III Software package.
- Includes current model Dell computer with Windows 11 and a 64-bit microprocessor.
- Software controls all pneumatic valves and actuators, substrate, and target rotation speed, selects active target, sets MFC flow rate and deposition pressure, laser raster and temperature control programs, etc. Controls all relevant laser functions.
- Includes the ability to write single or multi-layer thin film recipes. Recipes can easily be stored, recalled, and saved with a new name.
- Provides full data logging of all relevant deposition parameters. Data written to a .csv file which can be easily imported to an EXCEL spread sheet for analysis.
- Software is provided to grow gradient combinatorial thin films.

- Allows for continuous binary, ternary and quaternary compositional spreads across 2” diameter substrates by indexing both the target and substrate in the appropriate fashion.
- Combinatorial recipes can easily be stored and recalled as noted above.
- Auto pump/vent features for chamber and optional loadlock.
- Opens and closes laser shutter when required.
- Remote log-in to diagnose problems or upload software upgrades.

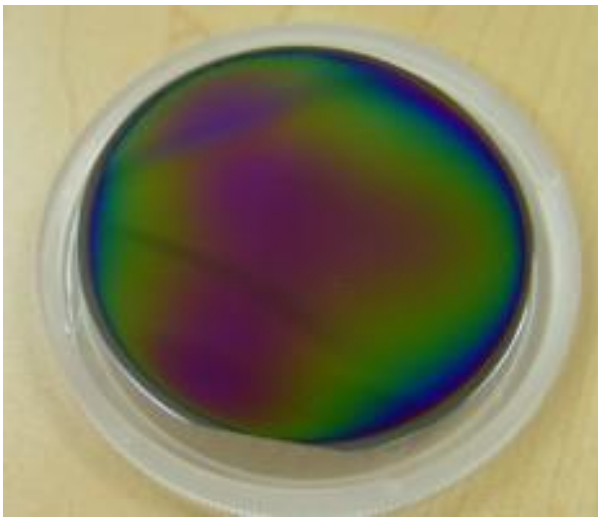


Photo of a Combinatorial Wafer with 200 nm thick $BaTiO_3$, $SrTiO_3$, and Nb films made in 147 layers all via computer control.

On-Site Installation

- A PVD Products engineer will come to the customer site to complete installation and provide training. On site time 5 days.
- The customer must provide all necessary facilities including targets, excimer laser, and process gases, He for leak testing, solvents, clean room gloves and wipes.
- It is expected the customer will be ready for installation within six weeks of shipment of the tool. If not, then final payment of the tool is due and warranty period will start.
- The customer or personnel to be trained must be present during the hours set by the PVD Products engineer.

Facilities and Safety

- A complete facilities list will be provided ~12 weeks ARO.
- The system includes its own power distribution box wired for local code, pressure regulators for compressed air and dry nitrogen.
- A water manifold is provided with a water flow switch for all parts that need water cooling.
- Includes two EMO buttons.
- All viewports include proper UV grade shielding (not Plexiglas)
- Power is shut down to laser and heater if the door is opened.

Shipping/Receiving and Incoming Inspection

- Systems are typically shipped EXW Factory. Other shipping arrangements may be made at the time of order.
- The system will be professionally crated and will include Tip-and-Tell shock monitors.
- At time of receipt at the customer loading dock the customer is responsible for inspecting these monitors.
- Monitors turn from RED to Blue if the crates have been mishandled.
- If any monitor or damage is noted, please notify the shipper and PVD Products immediately.

To place an order please email: **sales@pvdproducts.com**

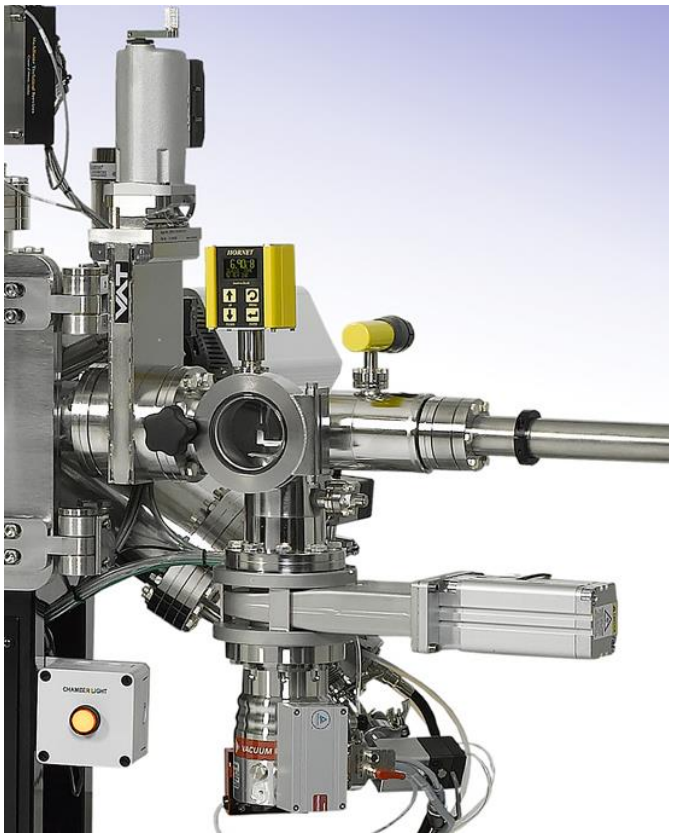
Customer Responsibility upon Receipt of the PLD/MBE 2300 System:

- Uncrate the PLD system and remove it from the pallet with a fork truck.
- Move the system and optional laser to the laboratory.
- Place the system in the desired operational location.
- Place laser onto system frame and align with optical box.
- Connect the main electrical line to the system.
- Connect compressed air and dry nitrogen to the system.
- Connect process gasses to system with SS lines.
- Connect the premix and purge gas lines to the excimer laser.
- Connect cooling water to water manifold and to excimer laser (required for 30 and 33 W lasers).
- Connect proper house exhaust lines to the laser and the gas cabinet.

STANDARD PLD/MBE-2300 SYSTEM OPTIONS

J0510040: Dual Position Loadlock

- Loadlock chamber with quick access door and viewport.
- Pneumatic gate valve isolates the loadlock from the main chamber.
- Pfeiffer HiPace 80 70 l/sec turbo pump with pneumatic gate valve
- Rough valve connected to Kashiyama dry pump noted in main section.
- Pneumatic vent valve
- Ion gauge and convection gauge
- Two-position wafer transfer mechanism to remove a wafer from heater and insert a new wafer all in one pump-down cycle. Greatly increases system throughput.
- Manual magnetic transfer arm and wobble stick
- Reaches a pressure of 1 x 10^{-6} Torr in ~ 10 minutes.
- Base pressure low 10^{-7} Torr
- Auto pump/vent sequences integrated into software package.
- The PLD/MBE-2300 system base pressure will be guaranteed to be lower than 5 x 10^{-8} Torr with the addition of the loadlock assembly.



PVD Products Dual-Position Loadlock

J0423006-03: UHV Upgrade Package

- Adds second Viton O-ring to top flange, IW, and quick access door. The gap between all these O-rings is differentially pumped by the Kashiyama dry pump.
- The VAT Series 64 gate valve will include a metal bonnet and the actuator will be differentially pumped.
- The ion gauge on the main chamber will be replaced with an InstruTech Flex Rax vacuum gauge controller, a nude ion gauge.
- A set of internal IR Lamps will be provided with a PID temperature controller to provide system bakeout.
- Base pressure will be below 7.50 x 10^{-9} Torr after bakeout and cool down.

To: **University of Central Florida** Date: 2/6/2025
Attn: **Piotr Kulik** Valid for: 60 days
Email: piotr.kulik@ucf.edu

To place an order please email: sales@pvdproducts.com

J1500006: Additional MFC's

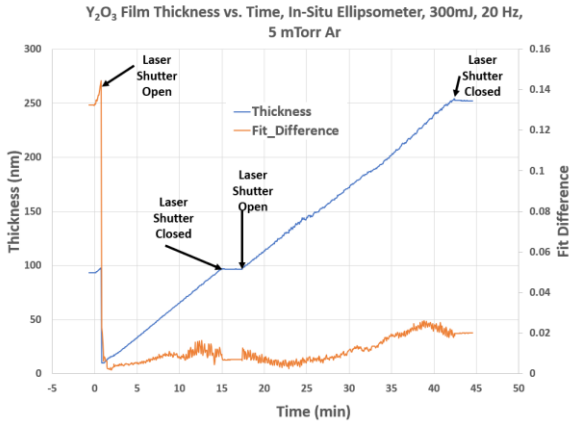
- Additional MFC's for non-toxic or explosive gases can be easily integrated into the system. Each MFC will include a pneumatic shut-off valve and be computer controlled. Toxic or explosive gases quoted on request.

J0406046-03: High Pressure Staib Torr RHEED System with k-Space Lite 400

- Re-entrant STAIB RHEED Electron gun with ±2^{o} of mechanical tilt.
- 35 keV power supply and all necessary cables
- Beam spot adjustable from 100 microns to 1 mm (at normal incidence).
- Dual stage differential pumping package with two Pfeiffer HiPace 80 turbo pumps, one cold cathode/Pirani gauge to measure pressure in electron beam source chamber.
- UHV pneumatic gate valve to protect RHEED gun during main chamber venting.
- 6" CF flange with 4.5" viewport and re-entrant RHEED screen and manual shutter
- Lead glass inserts on all PLD chamber viewports to protect the customer from X-rays.
- k-Space 400 LITE K-700 12-bit DAS. Includes a 12-bit CCD camera, frame grabber, video monitor for image display, zoom lens and all cables.
- Second computer and k-Space LITE software package.

J0409015-34: Four-Color Film Sense FS-4 In-Situ Ellipsometer

- Film Sense FS-4 ellipsometer will be integrated into the system.
- Spectral range 450-660 nm
- Four high intensity LED Sources at 450, 525, 595, and 660-nm.
- Provides film thickness measurements of materials with the proper optical properties up to 5 microns for transparent films, and up to 200-nm for absorbing semiconductor films.
- Four wavelengths and wide spectral range provide for enhanced measurement capability for multilayer film stacks.
- Excellent thickness precision better than 0.01 nm for many samples with 1 second acquisition
- Gimbals mounted.
- Includes software and real-time readout of film thickness.
- Includes two fused silica viewports on chamber.



In-Situ Ellipsometry Data for a Y2O3 Thin Film

To place an order please email: sales@pvdproducts.com

J0409015-38: Eight-Color Film Sense FS-8 In-Situ Ellipsometer

- Film Sense FS-8 ellipsometer will be integrated into the system.
- Spectral range 370-950 nm
- Eight high intensity LED Sources at 370, 450, 525, 595, 660, 735, 850, and 950-nm
- Provides film thickness measurements of materials with the proper optical properties up to 5 microns for transparent films, and up to 200-nm for absorbing semiconductor films.
- Eight wavelengths and wide spectral range provide for enhance measurement capability for multilayer film stacks.
- Excellent thickness precision better than 0.01 nm for many samples with 1 second acquisition
- Gimbals mounted.
- Includes software and real-time readout of film thickness.
- Includes two fused silica viewports on chamber.

J0420010-02: Flange Mounted Veeco Atomic Oxygen Source:

- Veeco flange mounted atomic oxygen source.
- Mounted on 4.5” CF Flange.
- Quartz tube assembly.
- 600-Watt RF power supply.
- RF Automatic Matching Unit.
- All necessary cables.

J0420010-02: Flange Mounted Veeco Atomic Nitrogen Source:

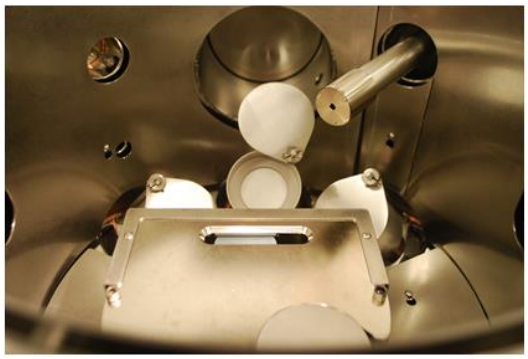
- Veeco flange mounted atomic nitrogen source.
- Mounted on 4.5” CF Flange.
- PBN tube assembly.
- 600-Watt RF power supply.
- RF Automatic Matching Unit.
- All necessary cables.

To place an order please email: sales@pvdproducts.com

Magnetron Sputter Sources and Power Supply Packages:

- Flange mounted two-inch sputter source with pneumatic shutter assembly. Overall length designed for PLD/MBE 2300.
- Comes in HV or UHV versions, with DC or RF Power supplies.

PVD Part Number	HV/UHV	RF/DC Power Supply
J0411242-01	HV	500-Watt HVC DC Power Supply
J0411242-01	HV	300-Watt Seren RF Power supply with auto matching network
J0411243-01	UHV	500-Watt HVC DC Power Supply
J0411243-02	UHV	300-Watt Seren RF Power supply with auto matching network



Three magnetrons mounted in a PLD/MBE 2300 system

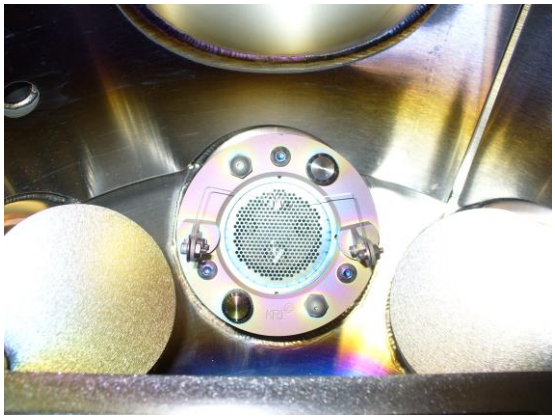
J0401119-03: RF Bias Added to Substrate Heater:

- A Seren 100-Watt RF power supply will be integrated into the substrate holder.
- Can be used for precleaning substrates and/or reactive sputter deposition.
- Includes auto-tuner and all necessary cables.
- Computer controlled.

To place an order please email: sales@pvdproducts.com

J0410051-03: Kaufman and Robinson KDC 40 Gridded Ion Source:

- K&R KDC 40 4-cm ion source.
- Mounted on 6" CF Flange.
- Collimated grid set.
- Connected to Ar MFC. Does not work with oxygen.
- Hot filament neutralizer.
- Power supply, all feedthroughs and necessary cables.
- Provides beam energies from ~100 to 1,200 eV with maximum current of ~120 mA.
- Computer controlled.

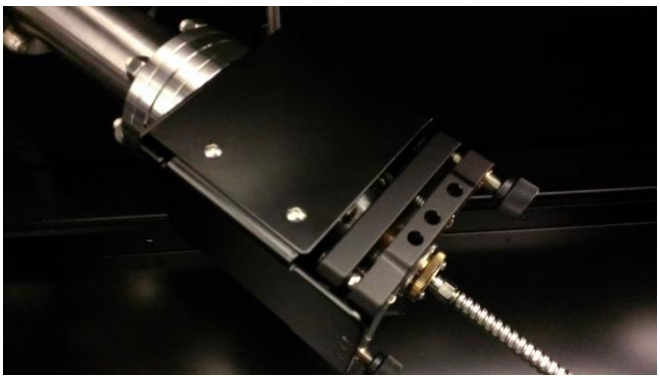


4 cm Gridded Ion Source.

a

J0405025-03: Advanced Energy Fiber Optic Pyrometer Package

- An Advanced Energy fiber optic pyrometer will be mounted to a CF flange viewport.
- The pyrometer will be gimbals mounted for fine adjustment of measurement location.
- Wavelength designed for Si measurements (spectral response 880 nm).
- Temperature range from 400°C to over 1,100°C.
- Can be tied into the PID temperature controller to control temperature instead of the heater thermocouple.



Advanced Energy Fiber Optic Pyrometer.

To: **University of Central Florida** Date: 2/6/2025
Attn: **Piotr Kulik** Valid for: 60 days
Email: piotr.kulik@ucf.edu

To place an order please email: sales@pvdproducts.com

Excimer Laser Packages:

- PVD Products provides the following excimer lasers along with a Linde Gas Cabinet designed for a #3 cylinder with proper gas regulator for laser gas premix and Helium including CGA or DIN connectors as required. **Prices noted above include laser with special aperture (see below) and gas cabinets.**
- A local Coherent representative will provide commissioning, training, and technical support.
- PVD Products can help you locate a vendor to provide premix gas in your area.
- The excimer lasers noted above come with a 36-month warranty FROM TIME OF SHIPMENT FROM COHERENT FACTORY, or 1 billion pulses- whichever comes first.

PVD Products Part Number	Coherent Laser	Maximum Pulse Energy* @ 248 nm (KrF)	Maximum Power* @ 248 nm (KrF)	Maximum Repetition Rate	Rep Rate at Max Pulse Energy
J0403073	COMPex PRO 102	400 mJ	8 Watts	20 Hz	20
J0403074	COMPex PRO 110	400 mJ	30 Watts	100 Hz	30
J0403116	COMPex PRO 201	750 mJ	7.5 Watts	10 Hz	10
J0403088	COMPex PRO 205	750 mJ	33 Watts	50 Hz	44

*Data from Coherent. PVD Products strongly suggests the insertion of a special aperture into the excimer laser that provides a more focused laser beam with more focused energy on the target. However, this aperture reduces the maximum pulse energy and power by 15% of that shown above. Thus, for instance the COMPex Pro 110 laser would provide about 340 mJ and 25.5 Watts. The price of the aperture is included in the laser package price. Lasers providing 30 watts or more require water cooling. Please request a Coherent Data Sheet if desired. Customers are to provide the proper premix and UHP He gases for laser purging at time of installation and training. Pricing valid till March 1, 2025.

Besides the options noted above PVD Products can provide the following options to enhance your PLD/MBE 2300 System on request:

- Effusion cells
- Ozone generators
- Laser heaters

To: **University of Central Florida** Date: 2/6/2025
Attn: **Piotr Kulik** Valid for: 60 days
Email: piotr.kulik@ucf.edu

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PVD Products, Inc., Introduction

PVD Products was founded in 2000 to provide custom thin film deposition systems that provide higher performance and more flexibility than currently available standardized systems. The company is heavily staffed with highly skilled physicists and engineers that work collaboratively with the customer through the design, manufacturing, installation, and after-sales support phases of a project. In this way, PVD provides a customer experience that will ensure cutting-edge technical results for our customers for decades. This statement is supported by the fact that more than 50% of our business comes from satisfied, repeat customers.

PVD has produced 100's of custom and standardized deposition systems for the world's leading research institutions and manufacturers utilizing thin film technology. Our systems incorporate many field proven components and sub-assemblies for high temperature substrate heating, pulsed laser deposition, substrate transfers, magnetron sputtering, atom, and ion sources, pumping packages, and a wide array of in situ diagnostics. PVD Products provides deposition technologies include Sputtering, Pulsed Laser Deposition, Evaporation, IBAD, Ion Beam Milling, GLADS, PECVD, CVD, and other novel techniques.

PVD Products is located north of Boston in a 17,000 sq. ft. facility. Staffing is ~15 people.

35 Upton Drive, Wilmington, MA

Portion of Manufacturing Floor

TERMS AND CONDITIONS OF SALE: V7.1

PVD Products, Inc. ("PVD") accepts orders only on the following terms and conditions. PVD rejects and objects to any additional or different terms on Buyer's purchase order, order form(s), contract terms and conditions, or other forms and offers these terms and conditions as a counteroffer. By accepting delivery of PVD's equipment, and rendering payments, partial or full, Buyer accepts and agrees to these terms and conditions, which shall form the basis of the contract between Buyer and PVD, and none which can be modified or canceled without the written consent of both parties.

1. **Terms of Payment** - On orders greater than $50,000, unless otherwise noted on the quotation or the parties otherwise agree in writing, a nonrefundable advance payment of 35% of the total purchase price noted on the quotation shall be due upon acceptance of the order, 30% of the total purchase price shall be due when the equipment is 50% complete or 12 weeks from the date of order, whichever is earlier, 25% of the total purchase price shall be due when the equipment is ready for shipment (to be paid in advance of shipment) and the final 10% payment shall be due when the equipment is installed or 8 weeks after equipment shipment, whichever is earlier. Unless otherwise noted on the quotation, the first payment is due immediately on order. All other payments are due net 30 days of invoice. All past due payments shall accrue interest at the lesser of (i) 12% per annum or (ii) the highest amount allowed by law, from and after the date it becomes due. In the event the unpaid invoice is sent to collections (whether or not suit is filed), or if the amount owed is collected by suit or legal proceedings or through bankruptcy proceedings, Buyer shall pay in addition to all amounts owed, all reasonable attorneys' fees and expenses incurred in any action to collect the unpaid amounts. In the event of Buyer's bankruptcy or insolvency, PVD reserves the right to cancel or stop work on any outstanding order and to receive reimbursement for its cancellation charges.

2. **Prices, Taxes, Title** – All sales are EXW PVD Products, Wilmington MA, USA, unless otherwise indicated. All prices are exclusive of taxes and duties that may be assessed, or levied on, or on account of materials sold hereunder to the Buyer. Buyer is responsible for the ultimate payment of such taxes. Title to the equipment and risk of damages pass to Buyer upon departure of the equipment from PVD. Prices are quoted in US currency, and payment is to be made in US currency.

3. **Packing** - Equipment shall be packed for shipment in a manner suitable to the method of shipment specified by Buyer or to the method selected by PVD in the absence of instructions.

4. **Shipping Method -** Due to the nature of the equipment, shipment shall be by electronics compatible air-ride transporter, or by air. The carrier acts as Buyer's agent and Buyer must file all claims of damage with the carrier. Buyer shall inspect the shipment immediately upon receipt and notify PVD and the carrier of any damage or activated sensors. Failure to inspect the shipment upon receipt and notify PVD of any damage or activated sensors shall be deemed a representation by Buyer to PVD that shipment was received without damage or activated sensors.

5. **Insurance, Risk of Loss -** Buyer is responsible for insuring shipments once the freight has left PVD's shipping dock. Risk of loss or damage in transit is upon Buyer.

6. **Delivery** - Shipment schedules are approximate and are based on conditions at the time of purchase order and production. PVD will make every effort to deliver the shipment to the carrier in sufficient time to meet the delivery date indicated on its quotation, assuming timely payment, but assumes no responsibility for loss or damage by reason of delay or inability to ship caused by acts of God, fires, floods, wars, embargoes, labor disputes, acts of sabotage, riots, accidents, delays of carriers, subcontractors or suppliers, voluntary or mandatory compliance with any governmental act, regulation or request, shortage of labor, materials or manufacturing facilities, or any other cause or causes beyond PVD's control. In the event of any of these things, PVD shall have the right to prorate the available supply in such a manner as it, in its discretion, determines. Deliveries suspended or not made by reason of this section shall be cancelled without liability to PVD, but this contract shall otherwise remain in effect.

7. **Site Preparation**—Buyer shall prepare the installation site in accordance with the PVD facility specification drawings and site preparation manual before PVD installs the equipment. If site preparation is not complete and multiple visits are required for installation, Buyer shall pay travel expenses and $2000/day for these subsequent visits.

8. **Inspection on arrival and upon installation** – For equipment requiring no installation or to be installed by Buyer, Buyer shall install, if applicable, inspect and test the equipment and notify PVD of any defects or nonconformity within thirty (30) days after delivery. For equipment that is to be installed by PVD, Buyer shall inspect and test the equipment and notify PVD of any defects or nonconformity immediately after installation and in no event later than ten (10) days after PVD completes the installation. If Buyer notifies PVD that its facilities are not ready for equipment installation by PVD at or before the time of delivery, Buyer shall have forty-five (45) days from the date of shipment to inspect and test the equipment and give notice to PVD of any defect or non-conformity. The time for making final payment for the equipment, however, shall remain the same. If Buyer fails to give timely notice of any defects or nonconformity as required herein, or if Buyer uses the equipment before inspection and testing, Buyer shall have unqualifiedly accepted the equipment and waived all claims and remedies it may have, including those provided under UCC Section 2, including but not limited to Section 2-607 and 2-608.

9. **Cancellation** –Buyer must provide written notice of cancellation and pay a cancellation fee to PVD at the time of cancellation. Buyer must pay the greater of (x) the amount set forth in Section 1 of these Terms and Conditions and (y) the cancellation charges set forth below. The following cancellation charges cover costs of materials and parts and are prorated based upon the amount of time remaining before scheduled shipment of the product:

Days before Delivery	Percentage of Purchase Price
0-30 days	90%
31-60 days	80%
61-90 days	60%
More than 90 days	40%

10. **Changes** – Prices quoted are for the materials, equipment, products and delivery schedules described in the quotation. PVD charges for any changes, additions, deletions or delays on a basis of time and materials plus fee, unless there is a written change order signed by PVD and Buyer. In the event PVD's cost of materials increases in excess of ten percent (10%) of the applicable cost on the order date, PVD shall have the right to pass such increased costs to Buyer.

11. **Licensing** – PVD owns, solely and exclusively, any and all proprietary rights, including copyright, trade secrets, patent, know how, and other rights related to PVD equipment, and to all related software. No unauthorized use or disposition may be made without the written consent of PVD. PVD grants Buyer a terminable, nonexclusive, non-transferable license to use the software supplied with each system solely in connection with the operation of such system. The rights and remedies of PVD set forth in these Terms and Conditions are not exclusive and are in addition to all of the rights and remedies afforded to a seller in law or in equity.

12. **Warranty** - Except as otherwise indicated, upon receipt of all payments owing and due hereunder, PVD shall warrant to Buyer that the items of equipment sold by it hereunder are free from defects in material and workmanship and materially meet applicable specifications for a period or fourteen (14) months from the date of shipment or twelve (12) months from the date of installation, whichever occurs first the "Standard Warranty"). This Standard Warranty shall not apply in the event of Buyer's use of radioactive and/or toxic materials (the "Materials"), even if PVD has been advised of such use, to the extent that the use of the Materials is a cause of the warranty claim. In discharge of this warranty, PVD agrees to either repair or replace at the customer's site, as it may elect, any part or parts which under proper and normal use proves defective in material or workmanship. Such repair or replacement shall be PVD's sole obligation hereunder. Excluded from the Standard Warranty are Spare parts, which are warranted for ninety (90) days. Some components and accessories, by virtue of their purpose and design, are consumable parts and are not intended to function for a

full year. If such components and accessories fail to give reasonable service for a reasonable period of time, as determined solely by PVD, PVD will at its election replace or repair them.

This Warranty is void if PVD equipment is not installed in the customer's facility in accordance with specifications provided in PVD facility specification drawings or if Buyer modifies the equipment or its installation after delivery and installation without PVD's approval.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. TO THE EXTENT THAT ANY IMPLIED WARRANTY OF MERCHANTABILITY EXCEEDS OR EXTENDS BEYOND THE EXPRESS WARRANTY GIVEN ABOVE, SUCH IMPLIED WARRANTY OF MERCHANTABILITY IS DISCLAIMED**.** NO ONE IS AUTHORIZED TO EXTEND OF ALTER THESE WARRANTIES ON PVD'S BEHALF EITHOUT EXPRESS WRITTEN AUTHORITY FROM PVD'S GENERAL MANAGER.

13. **LIMITATIONS ON LIABILITY, NO CONSEQUENTIAL DAMAGES -** THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. PVD SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OR ECONOMIC LOSSES (EVEN IF FORESEEABLE) ARISING OUT OF THE SALE, INSTALLATION, SERVICE OR USE OF THE EQUIPMENT SOLD HEREBY OR FOR ANY DELAYS ASSOCIATED WITH ANY OF THE ABOVE. PVD SHALL NOT BE HELD LIABLE FOR ANY LIABILITIES RELATING TO PRODUCT OR INTELLECTUAL PROPERTY RIGHTS ARISING FROM PRODUCTS PROCESSED IN PVD SYSTEMS. IN NO EVENT SHALL PVD'S LIABILITY EXCEED THE LESSER OF (X) THE AMOUNT PAID BY BUYER TO PVD FOR THE EQUIPMENT OR (Y) THE PURCHASE PRICE OF THE EQUIPMENT, WHICH IS THE SUBJECT OF THE CONTRACT OF SALE.

12. **Indemnification of PVD Products -** Buyer will protect and indemnify PVD against all claims for personal injury or property damage or other loss, damage or harm, including (without limitation) economic loss or lost profits arising from infringement of patents, designs, copyrights, or trademarks with respect to all goods manufactured, either in whole or in part to Buyer's specification. Buyer agrees to indemnify and hold PVD, its officers, directors, employees, independent contractors, representatives, agents, shareholders, successors and assigns (the "Indemnities") harmless from and against any and all claims, demands, liabilities, suits, administrative orders, other governmental or judicial actions or requirements, costs and expenses including but not limited to reasonable costs, attorneys' fees and expert consultant fees arising from or related to its use of the Deposition System, the Materials, and equipment operation required in Buyer's specifications and equipment contained in the Deposition System.

13. **Indemnification of Buyer –** PVD agrees to indemnify Buyer against any claims against Buyer in respect to personal injury or loss of or damage to tangible property, but not otherwise, up to the limits of PVD's insurance policy per occurrence, as a result of any negligent act or omission of PVD'S employees during performance of any work at Buyer's plant that PVD has agreed to provide hereunder.

14. **Applicable laws -** This contract shall be construed in accordance with the UCC (Uniform Commercial Code) and the laws of the State of Massachusetts without reference to the choice of law provisions thereof. Any litigation between PVD and Buyer relating to the purchase or sale of PVD equipment shall be brought only in the Federal or State Court located in the State of Massachusetts. Buyer consents to the jurisdiction of such courts in connection with any such litigation. These Terms and Conditions shall be binding upon both parties, their successors and assigns.

15. **Assignment** – Buyer shall not assign this order or any part thereof without the prior written consent of PVD.

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END USER LICENSE AGREEMENT

Note to user: In this document, "You" and "Your" refers to the Licensee of the PVD Software and "PVD" refers to PVD Products, Inc., the Licensor of the PVD Software.

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11. Governing Law. This Agreement shall be governed by the laws of the Commonwealth of Massachusetts without regard to its conflicts of law provisions. Neither the Uniform Computer Information Transaction Act ("UCITA") nor the provisions of the United Nations Convention on the International Sale of Goods shall apply to this Agreement. Any disputes shall be brought only in a court in the Commonwealth of Massachusetts and You hereby consent to the exclusive personal jurisdiction and venue of such court over You. If any provision of this Agreement is found invalid or unenforceable by a court of competent jurisdiction, it will be severed from this Agreement and the rest of the Agreement will remain in full force and effect. This Agreement constitutes the entire agreement between the parties with respect to the subject matter hereof and may not be waived or modified except in writing by a duly authorized PVD representative.

PVD Products, Inc.

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Wilmington, MA 01887

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Fax: (978)694-9477

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kolagani@neocera.com

Sales Quotation

Dr. Piotr Kulik
University of Central Florida
Research I, Office 356
Orlando, FL 32816

Quote date: 04/25/25
Quote #: 214026
Quoted by: Solomon Kolagani

Ship via : Best Way
EXW: Factory
Terms: 50% with PO; 40% at Shipping; 10% at Installation.

Ship date: 7- 8 Months ARO or sooner, subject to availability of parts

Line #	Part #	Description	Price (USD)	Qty	Extend(USD)
1	P180-PLD	Neocera Pioneer 180 PLD system is a stand-alone PLD system, designed for depositing epitaxial films, multilayer heterostructures and superlattices of a variety of materials on a variety of substrates.This system is most optimally configured for depositing metal-oxide films. - Deposition Chamber:The deposition chamber is a 304 stainless steel 18-inch diameter spherical chamber. The chamber is UHV compatible and will have numerous ports ideally designed and configured for PLD, High-Pressure RHEED,DC/RF Sputtering, DC ion source and substrate load-lock etc for future upgrades. The laser is incident at an angle of 45 degrees with respect to the target normal. The vacuum chamber integrates an automated (Labview 2018) 6-target carousel (with six 1-inch or three 2-inch diameter targets) for deposition of single layers, multilayers and superlattices; and a programmable rotating substrate heating stage for 2" diameter wafers. - Vacuum pumping package: The chamber will be pumped by a Pfeiffer HiPace turbomolecular pump backed by a scroll pump. Both the pumps are oil-free, dry pumps. The minimum base pressure in the chamber will be will be 5x 10^-7 Torr or lower. An MKS cluster gauge or equivalent will be integrated for measuring the vacuum from atmosphere to the base pressure. - Oxygen compatible Substrate heater/Substrate stage: Radiative heating stage will provide substrate heating of up to 850º C. The maximum substrate size is 2" in diameter and the substrate carrier can accommodate smaller substrate sizes (1 inch x 1 inch size for example) by using special adopters available as options.The substrate carrier is load-lockable. The 360 degree substrate rotation is driven by a motor and can be controlled by computer.	$179,500.00	1	$179,500.00

Line #	Part #	Description	Price (USD)	Qty	Extend(USD)
		- Multi-target carousel: Fully automated (LABVIEW 2018) 6- target carousel. Six 1-inch diameter or three 2-inch diameter targets can be mounted on the carousel. The carousel is computer controlled with target rastering (30degrees.sec max), target selection and target rotation (20 RPM max) features for the deposition of single layers, multilayers and superlattices. - Process Gas flow control: One mass flow controller (200 SCCM maximum flow) for process gas control is integrated. Process gas is Oxygen. The turbospeed can be controlled using the system software and by controlling the turbospeed and the flow rate of the process gas using MFCs, optimum process gas pressure is established through a closed-loop pressure control.. - System Mainframe:The PLD System mainframe includes 4 inch swivel casters and leveling feet; cooling fan is provided in one of the panels to prevent heat build-up within the frame. Electronics are mounted into an integral electronics rack on the frame. A manifold panel is used to mount all gas manifolds and controls. Electrical distribution and interconnections are integrated in the main frame.			
2	PLD-software	System Software: A Windows 10 computer with pre-loaded software and flat screen monitor will be provided. Neocera's software is written in the language LabVIEW 2018 from National Instruments. The software is flexible enough to handle many different hardware configurations and can communicate with a variety of instruments and motors. The software is user-friendly and permits the PLD System-user easy access to several control windows such as laser control, target control, heater control, vacuum and pressure control etc. Some of the hardware components controlled by the system software are listed here. - Pulsed Laser Control - The software externally triggers the laser by creating a pulse train at a user specified repetition rate and number of pulses. - Motor Control - Substrate rotation, target rotation, target rastering are all controlled by the motion control software. - Temperature Control - Neocera utilizes Eurotherm temperature controller on their PLD systems. The software communicates with the controller via serial communication, and the user can control the temperature by ramping at a specific rate, ramping by time, or by set-point control.	Included	1	

Line #	Part #	Description	Price (USD)	Qty	Extend(USD)
		- Vacuum and Pressure Control - The software communicates with a Pfeiffer turbo via serial communication. Pressure feedback can be via serial communication to an MKS or equivalent cluster gauge. In the standard PLD configuration, pressure control is accomplished by reducing the turbo speed to about 20% of the maximum value via the computer and adjusting the gas flow through the Mass flow controllers (MFC). - Gas Control - Neocera uses MKS controllers for mass flow control of the gasses in the chamber, and the software uses serial communication to control the MFCs.			

Line #	Part #	Description	Price (USD)	Qty	Extend(USD)
		.			
3	SZ100	Substrate Z stage. This allows the Target to Substrate distance adjustability of 90mm. The distance can be adjusted anywhere between 75 mm and 165mm (total 90mm throw distance). In cases where RHEED is used, the Z stage facilitates easy adjustment of the RHEED electron beam incidence angle with respect to the sample surface. The Z stage is motorized and controlled by System software	$19,500.00	1	$19,500.00
4	SS266	Frequency quadrupled Nd: YAG pulsed Solid State Laser. Model: Q-Smart 850 from Quantel Lasers. The Laser is integrated with second and fourth harmonic generators and dichroics for deliverng 266nm as the output. - Lasing Medium: Nd:YAG - Maximum pulse energy at 266nm: 100mJ - Pulse repetition rate: 10Hz - Pulse width: 5 ns - Flash lamp lifetime: 100 million pulses - Service requirements: 100-240VAC/50-60Hz/Single phase	$69,500.00	1	$69,500.00

Line #	Part #	Description	Price (USD)	Qty	Extend(USD)
5	SOP-266	Optics Package - 2- inch diameter, 45 degree incidence angle, Laser Mirror for 266 nm. - 2- inch diameter, 22.5 degree incidence angle laser mirror for 266 nm. - 2-inch diameter Spherical lens of 40/50 cm focal length for 266 nm. - Adjustable Aperture. - Anodized aluminum breadboard for mounting the optics. - Stable 2-inch mounts for the mirrors with maximum clear aperture and wide angular range. This mirror mounts provide accurate positioning of the laser spot on the target surface. - Stable 2-inch diameter lens mount. - A complete set of mounting rods, base plates - UV safe enclosure for optics.The enclosure will have a large door for adjusting optics when needed.	$16,500.00	1	$16,500.00
6	Installation	Installation and onsite training - Installation of P180 PLD system and all options chosen. (example: RHEED) - Integration of P180 PLD system with solid state laser - Optics alignment - Software training - Demonstration of standard oxide films to validate system functionality - Deposition of multilayers to validate all software functions.	$7,500.00	1	$7,500.00

Warranty: Neocera warrants that its systems and accessories will be free of manufacturing defects for a period of one year from Installation date. This warranty does not cover consumables and damage caused by misuse or neglect.

Total: $292.500.00

This quotation is valid for 30 days

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Sales Quotation

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Orlando, FL 32816

Quote date: 05/01/2025
Quote #: 214032
Quoted by: Solomon Kolagani
Ship via : Best Way
EXW: Factory
Terms: 50% with PO; 40% at Shipping; 10% at Installation.
Ship date: 7- 8 Months ARO or sooner, subject to availability of parts

Line #	Part #	Description	Price (USD)	Qty	Extend(USD)
1	P180-PLD	Custom Neocera Pioneer180 PLD system designed for the deposition of epitaxial films, and a variety multilayer heterostructures and superlattices. This system is most optimally configured for depositing metal-oxide films. The custom design focuses on smaller foot-print of the PLD module. - Deposition Chamber:The deposition chamber is a 304 stainless steel 18-inch diameter spherical chamber. The chamber is UHV compatible and will have numerous ports ideally designed and configured for PLD, High-Pressure RHEED,DC/RF Sputtering, DC ion source and substrate load-lock etc for future upgrades. The laser is incident at an angle of 45 degrees with respect to the target normal. The vacuum chamber integrates an automated (Labview 2018) 6-target carousel (with six 1-inch or three 2-inch diameter targets) for deposition of single layers, multilayers and superlattices. - Vacuum pumping package: The chamber will be pumped by a Pfeiffer HiPace turbomolecular pump backed by a scroll pump. Both the pumps are oil-free, dry pumps. The minimum base pressure in the chamber will be will be 5x 10^-7 Torr or lower. An MKS cluster gauge or equivalent will be integrated for measuring the vacuum from atmosphere to the base pressure.	$125,000.00	1	$125,000.00

Line #	Part #	Description	Price (USD)	Qty	Extend(USD)
		- Multi-target carousel: Fully automated (LABVIEW 2018) 6- target carousel. Six 1-inch diameter or three 2-inch diameter targets can be mounted on the carousel. The carousel is computer controlled with target rastering (30degrees.sec max), target selection and target rotation (20 RPM max) features for the deposition of single layers, multilayers and superlattices. - Process Gas flow control: One mass flow controller (200 SCCM maximum flow) for process gas control is integrated. Process gas is Oxygen. The turbospeed can be controlled using the system software and by controlling the turbospeed and the flow rate of the process gas using MFCs, optimum process gas pressure is established through a closed-loop pressure control.. - System Mainframe:The PLD System mainframe includes 4 inch swivel casters and leveling feet; cooling fan is provided in one of the panels to prevent heat build-up within the frame. Electronics are mounted into an integral electronics rack on the frame. A manifold panel is used to mount all gas manifolds and controls. Electrical distribution and interconnections are integrated in the main frame.			
2	PLD-software	System Software: A Windows 10 computer with pre-loaded software and flat screen monitor will be provided. Neocera's software is written in the language LabVIEW 2018 from National Instruments. The software is flexible enough to handle many different hardware configurations and can communicate with a variety of instruments and motors. The software is user-friendly and permits the PLD System-user easy access to several control windows such as laser control, target control, heater control, vacuum and pressure control etc. Some of the hardware components controlled by the system software are listed here. - Pulsed Laser Control - The software externally triggers the laser by creating a pulse train at a user specified repetition rate and number of pulses. - Motor Control - Substrate rotation, target rotation, target rastering are all controlled by the motion control software. - Temperature Control - Neocera utilizes Eurotherm temperature controller on their PLD systems. The software communicates with the controller via serial communication, and the user can control the temperature by ramping at a specific rate, ramping by time, or by set-point control.	Included	1	

Line #	Part #	Description	Price (USD)	Qty	Extend(USD)
		- Vacuum and Pressure Control - The software communicates with a Pfeiffer turbo via serial communication. Pressure feedback can be via serial communication to an MKS or equivalent cluster gauge. In the standard PLD configuration, pressure control is accomplished by reducing the turbo speed to about 20% of the maximum value via the computer and adjusting the gas flow through the Mass flow controllers (MFC). - Gas Control - Neocera uses MKS controllers for mass flow control of the gasses in the chamber, an d the software uses serial communication to control the MFCs.			

Warranty: Neocera warrants that its systems and accessories will be free of manufacturing defects for a period of one year from Installation date. This warranty does not cover consumables and damage caused by misuse or neglect.

Total: $125.000.00

This quotation is valid for 30 days

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Sales Quotation

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Quote date: 05/01/2025
Quote #: 214033
Quoted by: Solomon Kolagani
Ship via : Best Way
EXW: Factory
Terms: 50% with PO; 40% at Shipping; 10% at Installation.
Ship date: 7- 8 Months ARO or sooner, subject to availability of parts

Line #	Part #	Description	Price (USD)	Qty	Extend(USD)
1	PSHR-2	Radiative Substrate Heater Oxygen compatible Substrate heater/Substrate stage: Radiative heating stage will provide substrate heating of up to 850º C. The maximum substrate size is 2" in diameter and the substrate carrier can accommodate smaller substrate sizes (1 inch x 1 inch size for example) by using special adopters available as options.The substrate carrier is load-lockable. The 360 degree substrate rotation is driven by a motor and can be controlled by computer.	$74,000.00	1	$74,000.00
	SZ100	Substrate Z stage This stage allows the Target to Substrate distance adjustability of 90mm. The distance can be adjusted anywhere between 75 mm and 165mm (total 90mm throw distance). In cases where RHEED is used, the Z stage facilitates easy adjustment of the RHEED electron beam incidence angle with respect to the sample surface. The Z stage is motorized and controlled by System software	Included	1	
		Total			$74,000.00

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Sales Quotation

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Quote date: 05/01/2025
Quote #: 214034
Quoted by: Solomon Kolagani
Ship via : Best Way
EXW: Factory
Terms: 50% with PO; 40% at Shipping; 10% at Installation.
Ship date: 7- 8 Months ARO or sooner, subject to availability of parts

Line #	Part #	Description	Price (USD)	Qty	Extend(USD)
1	SS-266	Frequency quadrupled Nd: YAG pulsed Solid State Laser. Model: Q-Smart 850. The Laser is integrated with second and fourth harmonic generators and dichroics for deliverng 266nm as the output. - Lasing Medium: Nd:YAG - Maximum pulse energy at 266nm: 100mJ - Pulse repetition rate: 10Hz - Pulse width: 5 ns - Flash lamp lifetime: 100 million pulses - Service requirements: 100-240VAC/50-60Hz/Single phase	$93,500.00	1	$93,500.00
2	Optics 266	Optics Package - 2- inch diameter, 45 degree incidence angle, Laser Mirror for 266 nm. - 2- inch diameter, 22.5 degree incidence angle laser mirror for 266 nm. - 2-inch diameter Spherical lens of 40/50 cm focal length for 266 nm. - Adjustable Aperture. - Anodized aluminum breadboard for mounting the optics. - Stable 2-inch mounts for the mirrors with maximum clear aperture and wide angular range. These mirror mounts provide accurate positioning of the laser spot on the target surface. - Stable 2-inch diameter lens mount. - A complete set of mounting rods, base plates - UV safe enclosure for optics. The enclosure will have a large door for adjusting optics when needed	Included	1	

Line #	Part #	Description	Price (USD)	Qty	Extend(USD)
6	Installation	Installation and onsite training - Installation of P180 PLD system and all options chosen. (example: RHEED) - Integration of P180 PLD system with solid state laser - Optics alignment - Software training - Demonstration of standard oxide films to validate system functionality - Deposition of multilayers to validate all software functions.	Included	1	

Warranty: Neocera warrants that its systems and accessories will be free of manufacturing defects for a period of one year from Installation date. This warranty does not cover consumables and damage caused by misuse or neglect.

Total: $93.500.00

This quotation is valid for 30 days