thermoscientific

Apreo **2 S LoVac** Quotation for

Charles University in Prague

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Prepared By [redacted]

Thermo Fisher Scientific is a Total Solution Provider

Thermo Fisher Scientific's philosophy is to offer the total solution to you as a customer. That means we not only build and install the tools for you, but we also provide a wide array of solutions for all life cycle phases of the instruments. Training, application specialists, remote tool services, an upgrade portal and a trade-in program are just a few examples of what Thermo Fisher can offer. Below is an overview of the most important services that make us a true total solution provider:

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Proposed Solution

Line #	Part Number	Description	QTY	Amount
Apreo 2 S LoVac				
1	1229004	Apreo 2 S LoVac The core instrument (Apreo 2 S LoVac) includes: - Workstation with Windows 10 - 1 x 24'' widescreen LCD monitor - xT software - NICol electron column - 110 x 110 mm eucentric stage - Multi-purpose SEM holder - CCD IR camera - In-chamber Nav-Cam - Immersion Lens - In-lens detectors: Lower (T1) and Upper (T2) - T3 Detector - SE detector (ET-SED) - Low-Vacuum SED (LVD) - Oil-free pumping system - Integrated current measurement - Automatic aperture system - Automatic Pressure Limiting Aperture (PLA) Loader - Beam deceleration - Electron beam charge neutralizer (LoVac) - PivotBeam - Large table top with support	1	
Detectors				
2	1113152	Retractable DBS Detector	1	
3	1120429	Solid-state Detector Integration Kit	1	
4	1050312	Advanced Signal Selection	1	
Application Software				
5	1133679	Maps 3 for SEM	1	
Cooler / Compressor				
6	9432 909 96391	Compressor 230 V, 50 Hz with 4-liter Tank	1	
7	1072686	Air-cooled Water Chiller 230 V, 50/60 Hz	1	
Non-Standard Request(s)				
8	1252197	Apreo 2 - 400nA max current	1	
9	1047492	EDS detector - EDAX TEAM Basic EDS with Octane Pro	1	
Installation & Warranty				
10	4022 404 21230	Installation Labor Apreo 2 S LoVac Europe	1	
11	4022 404 02230	Installation Material Apreo 2 S LoVac Europe	1	
12	4022 404 23230	Warranty Labor Apreo 2 S LoVac Europe	1	
13	4022 404 04230	Warranty Material Apreo 2 S LoVac Europe	1	
Shipping				
14	4022 400 42631	DDP Brno / Named place of destination; receiving dock in Europe Zone 1 (T-3)	1	
		List Price Total		**Kč12.492.311**

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Pricing Summary (in CZK)		
List Price		[redacted]
Total Discount **Only one-time discount for Charles University, Faculty of Mathematics and Physics. Can't be used for future negotiations for other projects.**		
Sub-total including discount		
Taxes		
VAT / Estimated Duty		
Total Price		**Kč6.981.176**

The contracting entity for these goods is FEI Company and the PO should be issued to:

msd.sales.europe@thermofisher.com

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Solution Description

1229004 **Apreo 2 S LoVac**

Apreo 2 S LoVac is a Schottky Field Emission Scanning Electron Microscope (FESEM) that combines high- and low-voltage ultra-high resolution capabilities with an electrostatic lens design together with a low vacuum mode for charge compensation on non-conductive material. The instrument features beam deceleration and unique in-lens detection offering unprecedented contrast and versatility to researchers working with a variety of materials and devices.

The key enabling technologies are all integrated onto a single platform and comprise:

- Novel Field Emission Electron Optics optimized for both high current and high resolution meeting all imaging and analysis needs
- Trinity detection system for fast imaging, and easy collection of all available signals
- High-precision specimen goniometer with 110 mm travel along the x and y axes
- A Windows 10, 4-view “Beam per View” User Interface with User Guidance
- System architecture is optimized for automation, which is optionally available (e.g. *MAPS*™)

Features and specifications:

Vacuum

Apreo 2 S LoVac uses an entirely oil-free vacuum system, featuring:

- 1x 240 l/s turbomolecular drag pump
- 1x Scroll pumps
- 2x Ion Getter Pumps
- Integrated battery backup for IGPs on the electron column, a FEG safety mechanism (for recoverability after an unplanned power outage)
- Auto bake-out and Auto-start enable fast and easy maintenance of the FEG source
- Low vacuum mode up to 500 Pa for charge compensation of non-conductive samples
- Seamless switching between high vacuum and low vacuum with an automated mechanism for attachment of a pressure limiting aperture to the pole piece

Sample Navigation

Apreo 2 S LoVac is standard equipped with a 5-axes motorized x-y-z-tilt-rotate stage, providing movements:

- X and Y range: 110 mm (motorized); Z range: 65 mm (motorized)
- Tilt: -15 to +90 degrees (motorized)
- Eucentric tilt
- A unique standard specimen holder with labeled positions and unique stage mounting, allowing simultaneous loading of 18 standard samples (∅ 12 mm), three 45˚ pre-tilted samples, two row bars (one in horizontal and one in 52° pre-tilted position), and a spring-loaded clamp holder for mounting cross-sections.

A selection of additional sample holder kits is optionally available (including stub holders, additional TEM sample holders and vise specimen holders).

Joystick stage control is available as an option.

Stage control software includes standard facilities for:

- Store and recall of sample position
- Double-click-to-center and drag-to-zoom feature select functions

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- Multi-directional stage drive
- Compucentric rotation
- Compucentric tilt
- Image feature alignment to horizontal or vertical
- Navigation on image and navigation montage is supported with “Click-to-center” and “Drag-to-Zoom” functions
- External image import and registration for correlation.

Intuitive, photo-based sample navigation is provided by the Nav-Cam™. The Nav-Cam is a color optical camera, mounted directly to the chamber for acquiring an image of samples mounted on the specimen stage. Fully integrated in the user interface, the Nav-Cam allows for quick point-and-click navigation to the region of interest. Nav-Cam features:

- Automatic image acquisition with sample lighting
- 160 x 105 mm field of view
- 3072 x 2048 pixels or approximately 6 megapixels
- Digital zoom
- Image annotation
- Image save

Electron Optics

Apreo 2 S LoVac features a pre-aligned electron optical column, which is optimized for high resolution and for beam stability. Apreo 2 features SmartAlign technology which keeps the column aligned without manual intervention. The main elements of the electron optical system are:

Source: Field emission gun assembly with Schottky emitter source. The assembly is optimized for high brightness/high current, providing low-noise imaging. The pre-alignment of the FEG ensures no mechanical alignment is required. Easy gun installation and maintenance is provided with Auto bake-out and Auto Start capabilities.

Final Lens: Dual Objective combining field-free magnetic and electrostatic lenses, extended to a triple-mode compound electrostatic-magnetic final lens by the Immersion Lens. The pole piece has a 60° design.

Beam deceleration: Can be activated for getting higher surface sensitivity and contrast using low and very low landing energies. Beam deceleration is implemented as an additional degree of freedom to optimize contrast and surface sensitivity while improving the optical performance of the electron column

Voltage: 200 eV to 30 keV (20 eV landing energy possible with Beam Deceleration)

Beam Current: 1 pA to 50 nA (up to 400 nA available as option)

Resolution (optimal working distance):

High vacuum, field-free mode
- 0.7 nm at 30 kV (STEM)
- 0.9 nm at 15 kV (with beam deceleration)
- 1.2 nm at 1 kV
- 1.0 nm at 1 kV (with beam deceleration)
- 1.2 nm at 500 V (with beam deceleration)

High vacuum, immersion mode
- 0.9 nm at 1 kV

High vacuum, immersion mode with beam deceleration
- 0.5 nm at 15 kV
- 0.8 nm at 1 kV
- 1.0 nm at 1 kV, 10 mm WD
- 0.8 nm at 500 V
- 1.2 nm at 200 V

Low vacuum, field-free mode
- 1.2 nm at 15 kV
- 1.8 nm at 3 kV

Scanning system

High-resolution digital scanning engine controlled from the User Interface.

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- Pixel density 768 x 512, 1536 x 1024, 3072 x 2048, 6144 x 4096, selectable
- Minimum dwell time 25 ns/pixel; maximum 25 ms/pixel
- Electronic scan rotation by n x 360 degrees

Detection

Apreo 2 S LoVac features a high-vacuum secondary electron detector (Everhart-Thornley SED) and low-vacuum SED (LVD), optimized for use across the available kV, current and pressure range. The Trinity detection system is comprised of a segmented, lower in-lens detector (T1), an upper in-lens detector (T2) and an in-column detector (T3). Apreo 2 S LoVac also includes a dedicated Low Vacuum secondary electron detector to provide charge-free topographic contrast imaging of non-conductive samples. An integrated IR-CCD camera is standard for in-chamber viewing and the Nav-Cam color optical camera is used to take top-down images of samples for navigation. Optionally available are a retractable Directional Backscatter (DBS) detector and a STEM detector for imaging thin sections, powders or FIB-prepared specimen.

Imaging

Images are displayed in an area of 1536 x 1024 pixels, configurable for either single-frame or four-view display. Apreo 2 features FLASH technology, which automatically performs focus, lens alignment and stigmator alignment in a matter of seconds – all that is required is the push of a button. Images can be viewed live, averaged or integrated. Apreo 2 fully supports the SmartSCAN™ advanced scanning strategies which allow line averaging and interlaced scanning in addition to Drift Corrected Frame Integration (DCFI). Still images can be saved in TIFF, BMP, JPEG file formats, and in 8-bit, 16-bit or 24-bit depth, to the hard disk or LAN from the graphical user interface. Image printing is also available from the user interface. In addition, the system supports recording of AVI movies. This can either be done on the fly or by capturing a series of TIFF images at user-specified intervals. These TIFF images can then be combined into AVI's by using the included proprietary movie creator software.

The software includes a 4-view mode, in which the displays can be used for live display of electron images (SE, BSE), mixing of signals and display of the image of the standard infrared (IR-CCD) camera.

Look-up tables allow image contrast, brightness or gamma to be enhanced. Flexible databar selection is also provided. User-definition of preferred imaging parameter sets is available. Imaging parameters are stored in the TIFF image file as private data. Finally, image measurements and annotations can be performed live on the image and the results can be stored together with the images.

Selected area electron channeling imaging

Apreo S HiVac comes with PivotBeam™ functionality for selected area electron channeling. Also known as "rocking beam" mode, PivotBeam keeps the beam on a single area (<5 µm diameter) while scanning the incident angle. For crystalline materials, the resulting k-space image shows dark bands reminiscent of an EBSD pattern, indicating the angles with enhanced electron channeling. PivotBeam helps orienting the sample for Electron Channeling Contrast Imaging (ECCI) and imaging dislocations in the crystal.

System control

Apreo 2 S LoVac is controlled from an MS-Windows 10 graphical user interface running at a 1920 x 1200 screen resolution. The controller computer is based on an Intel Xeon W3520 Processor/ 2.66 GHz 8 MB cache, 12 GB system memory, one 500 GB hard drive, one 16x DVD+/-RW drive, integrated FireWire and USB ports and a 1 Gb LAN network card (computer specifications subject to change). The system includes a 24" LCD monitor, keyboard, optical mouse and a height-adjustable office desk. A USB manual user interface (for controlling magnification, contrast/brightness, beam shift and stigmators) and/or a Joystick (for control of stage movement) is optionally available.

The microscope controller is dedicated to its primary function, includes a DVD/RW and has a possibility to connect directly to a LAN. Optionally, a support computer can be connected for additional functionality such as MS-Office software suite, firewall, anti-virus and other non-instrument software.

RAPID

This instrument is RAPID-enabled. RAPID (Remote Access Program for Interactive Diagnostics) is a highly secure connectivity tool that enables Thermo Fisher Scientific's service engineers to connect directly to the instrument to address system issues remotely. RAPID can significantly speed up repair time and thus reduce

instrument downtimes, while improving Thermo Fisher Scientific's overall quality of service. Thermo Fisher Scientific's service engineers use RAPID to perform remote system diagnostics and repairs, support user operation and view images for enhancing system performance. However, customers maintain complete control of how and when RAPID is used -- each RAPID session must be initiated by the customer. RAPID requires a high-speed internet connection (> 5 MB/sec recommended, 1 MB/sec required). For full details please browse to the RAPID pages on the Thermo Fisher Scientific website

Installation requirements

Please refer to Apreo pre-installation guide.

1133679 Maps 3 for SEM/SDB

Thermo Scientific Maps is the system automation and correlative microscopy software suite for SEM and DualBeam systems. Maps provides automated acquisition of image mosaics via easy set up and offers complete control on location, resolution and imaging parameters. Maps makes it easy to set up multiple mosaic acquisitions on a single sample, or on multiple samples loaded in the chamber. Maps also makes it easy to re-align and collect data over multiple imaging sessions.

Specifications:

- The maximum pixel resolution is 40k x 40k per tile (depends on microscope type).
- Maps corrects for non-linear stage behavior to increase navigation accuracy.
- Maps supports batch acquisition, allowing the user to schedule acquisition of multiple areas in one job, saving supervised time.
- Microscope real-time stitching of tiled images can be carried out concurrent with image acquisition.
- Export of stitched tile sets or user defined areas to TIFF or HD View compatible formats.
- Maps image data can be saved in RAW formator TIFF format.

1072686 Air-cooled Water Chiller 230 V, 50/60 Hz

The recirculating chiller delivers guaranteed, continuous cooling between 5 and 40 °C with a high temperature stability of 0.1 °C. The chiller is air-cooled.

Cooling capacity:	up to 1100/1300 W
Dimensions:	61.5 x 37.7 x 50.0 cm (HxWxD)
Weight:	40 kg
Branch Circuit Reqs:	230 V, 50/60 Hz, 10 A

9432 909 96391 Compressor 230 V, 50 Hz with 4-liter Tank

The compressor is required when compressed air of 6 atm. is not available; compressed air is required for operating pneumatic valves and the microscope's leveling system. The compressor is connected to the mains supply unit of the microscope.

1050312 Advanced Signal Selection

The option Advanced Signal Selection includes a multiplexer that permits the simultaneous detection of signals from all detectors, and all segments of all detectors. It is automatically selected when the detector configuration requires it.

1113152 Retractable DBS

The Directional Back-scattered (DBS) detector is an ultra-sensitive, Solid State (SS) detector which is sensitive to emitted electrons from 500 V onwards. Using beam deceleration (sample bias to reduce the landing energy), images with beam landing energies down to 20 V are possible.

The retractable DBS detector features a flexible segmentation: either concentric (CBS mode) or in angular sectors (ABS mode). The active segmentation (CBS/ABS) is selected in the user interface.

In the concentric ring segmentation mode (CBS), separate detection of electrons emitted at different take-off angles is enabled. There are four concentric segments that may be acquired simultaneously and mixing based on adding / subtracting individual segments is possible. This way it is possible to select multiple contrasts (material and topographical) that can be optimized per application.

The second segmentation (ABS) offers three outer sectors plus a concentric central element. These three outer sectors are used to highlight topographical features through shadowing, while the inner concentric segment maintains pure materials contrast. As in the CBS mode, simultaneous acquisition as well as mixing is possible,

This detector is mounted on a software-controlled retractable arm and allows simultaneous EDS spectra acquisition for WD ≥ 10 mm.

This Retractable DBS detector (1113152) is available for Apreo and VolumeScope. It requires the presence of the Solid-State Detector Integration Kit (1120429) and Advanced Signal Selection (1050312).

1120429 Solid-state Detector Integration Kit
The Solid-state Detector Integration Kit is required to enable interfacing with one or more solid-state detectors such as the STEM, DBS and GAD detectors. It allows having all three solid-state detectors connected simultaneously and provides support for up to twelve signal channels. This allows access to all solid-state detector segments.

4022 404 21230 Installation Labor Apreo 2 S LoVac Europe
Installation Labor Apreo 2 S LoVac Europe

4022 404 02230 Installation Material Apreo 2 S LoVac Europe
Installation Material Apreo 2 S LoVac Europe

4022 404 23230 Warranty Labor Apreo 2 S LoVac Europe
Warranty Labor Apreo 2 S LoVac Europe

4022 404 04230 Warranty Material Apreo 2 S LoVac Europe
Warranty Material Apreo 2 S LoVac Europe

1252197 Apreo 2 - 400nA max current
This NSR exchanges the extractor aperture to enable a maximum beam current of 400 nA on Apreo 2. With this new aperture, the resolution specifications are as follows:

High vacuum, field-free mode
0.8 nm at 30 kV (STEM)
1.0 nm at 15 kV
1.3 nm at 1 kV
1.0 nm at 1 kV (with beam deceleration)

High vacuum, immersion mode (Apreo 2 S only)
0.7 nm at 15 kV
1.0 nm at 1 kV

High vacuum, immersion mode with beam deceleration (Apreo 2 S only)
0.8 nm at 1 kV
0.9 nm at 500 V
1.8 nm at 100 V

Low vacuum, field-free mode (Low vacuum models only)
1.2 nm at 15 kV
1.8 nm at 3 kV

Important: This NSR is for new systems only, cannot be retrofitted

1047492 EDS detector - EDAX TEAM Basic EDS with Octane Pro

4022 400 42631 DDP Brno / Named place of destination; receiving dock in Europe Zone 1 (T-3)
Delivered Duty Paid to named place of destination in Europe Zone 1 Incoterms 2020. The Seller's obligation is fulfilled when the goods have been made available at a specified point in the Buyer's country. With this term the Seller is also responsible for payment of duties, taxes and other customs clearance charges.

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