

XPS Systems on the World Market

XPS Systems on the Market in the World

Low End Systems

- Kratos
 - Amicus
- JEOL
 - JPS 9200
- VG Scienta
 - Component based systems
- Omicron
 - Component based systems
- Specs
 - 150 mm Sage
- VSW
 - ESCABase
- Staib
 - Component based systems
- Refurbished (used) systems
 - RBD Enterprises

High End Systems

- Kratos
 - Nova
 - Ultra
 - Axis 165
- PHI
 - VersaProbe
 - Quantera
 - Quantum 2000
- VG
 - K-Alpha
 - 250i-XL
 - Theta-Probe
 - Theta-Probe 300 mm
- JEOL
 - JPS 9200
- Specs
 - 300 mm Sage
- Revera
 - Revera-XPS

XPS Systems on the Market in the World

Common Name

Kratos
PHI
VG
JEOL
Specs
Shimadzu
Revera
VG Scienta
Staib Instruments
Omicron Nanotechnology

Parent Company

Shimadzu
Ulvac-PHI
Thermo Electron
Japan Electron Optics Lab.
Specs
Shimadzu
Revera

System Produced in:

USA, England, Japan
USA, Japan
USA, England
Japan
Germany
Japan
USA
Sweden
USA
Germany

XPS Systems by Maker, Main Features, Users & Price

<u>Instrument Maker</u>	<u>Main Features</u>	<u>Main Users</u>	<u>Base Price (USD)</u>
1. Kratos Nova Ultra Axis 165 (multi-technique) HSi Amicus	mono, imaging, mag, automated mono, multi-technique, mag, AES, automated mono, imaging, mag, automated non-mono, simple, low cost, automated ??	research research (industry) industry	\$ 550,000 na na \$ 200,000
2. VG K-Alpha 250i-XL Theta-Probe Theta-Probe 300 mm	mono, mapping, fully automated, auto Flood-Gun mono, imaging, mag, automated mono, AR-XPS, mapping, automated mono, AR-XPS, 300 mm, mapping, automated	all industry research metrology	\$ 500,000 \$ 650,000 \$ 730,000 \$ 1,500,000
3. PHI Quantera Quantum 2000 Omicron component systems	mono, 200 mm, mapping, automated non-mono, component-based, STM, AES, manual	metrology research	\$ 790,000
4. Omicron Components based system	non-mono, component-based, STM, AES, manual	academia	na
5. VacGen (VG) Components based system	non-mono, component based, AES, manual	academia	na
6. Specs 150 mm Sage 300 mm Sage	non-mono, 150 mm, automated non-mono, 300 mm, automated	industry industry	\$ 287,000 \$ 490,000
7. VSW ESCABase	non-mono, STM, AES, manual	academia	\$ 270,000
8. GammaData Scientia as components	mono, HSA	synchrotron	(\$ 800,000)
9. Refurbished systems RBD Enterprises	used PHI, VG, SSI systems	industry	\$ 100-250,000
10. JEOL JPS 9200	non-mono, imaging, mag, automated	research	???

Used XPS System Market

- Used PHI
- Used VG
- Used SSI

Price range: \$100,000 to \$250,000

XPS Market based on Current Level of Sales

1st Tier

- #1 Shimadzu - Kratos
- #2 Thermo Electron - VG Scientific
- #3 Ulvac - PHI


2nd Tier

Omicron – PHI Team
Specs – Lesker Team
JEOL

3rd Tier

VSW
Staib
VG Scienta

Structure of XPS Market based on Installations

- 
- #1 Ulvac-PHI 500+ Worldwide
 - #2 Thermo Electron-VG Scientific 400+ Worldwide
 - #3 Shimadzu-Kratos 500-900 Worldwide

Business Overview & Strategies of the 3 Major Players

- **Kratos financially supported by Shimadzu**
 - Selling at discount rate to capture market share
 - Treats most customers with great care
 - Carefully controls info released
 - New SMA method developed to compete with VG imaging
 - Has excellent charge compensation system
 - Said to have 10 Amicus systems in build monthly
 - Software running on Unix
 - Service record is good
 - Has Demo and Application Lab in New York state

- **PHI decided to focus on Semiconductor market**
 - Tends to discount systems and recover \$ via service
 - Well known for strong sales and marketing efforts
 - Claims to have true 10 micron spot
 - Extensive and well respected service system
 - Has Demo and Applications Lab in Minnesota
 - Has extensive access to prospects via Evans Analytical Group
 - Released Versa-Probe

- **VG still leading in new XPS technology**
 - Attempting to penetrate future projects for large wafers
 - Released Theta-Probe - advanced Parallel AR-XPS system
 - Released K-alpha – fully automated affordable XPS
 - Excellent (best) imaging technology
 - Now backed by Thermo name but without financial assistance
 - Weakest of the 3 for marketing
 - Software now Windows NT based
 - Service system in US is growing stronger

Questions to Ask about XPS System

- Advantage/merit of newly developed lens ?
- What is maximum size of monochromatic beam?
- What other mono beam sizes are guaranteed?
- How can we change the analysis area?
- Is there automated control of the analysis area ?
- Is rotation axis motor-controlled?
- Is the limit of tilting: +/- 10 degrees?
- Is manual control of XY possible?
- Can the voltage of charge neutralizer be controlled automatically?
- Precision of motor controlled positioning?
- Is there a parking stage for outgassing samples?
- Is there a parking stage in UHV option?
- What is lens field of view at 0 eV (KE) and 1480 eV (KE)?

Software Features to See Demonstrated

- Software controls stage
- Software controls source
- Wide and narrow scans
- Depth profiling
- Mapping with stage scan
- Smoothing & differentiation
- BG subtraction (or fitting)
- Charge compensation
- Add/subtract 2 spectra
- Peak deconvolution (or peak-fitting)
- Satellite removal
- Quantitative analysis (RSFs)
- Windows NT based
- Peak info
- ISO 14976-VAMAS export
- ASCII export
- Bitmap image (export)
- Automated Depth Profile Analysis (TFA)
- Sample tilting – AR-XPS
- Automatic multi-point analysis
- Automatic multi-sample analysis

Questions about Software Capabilities

- Sophisticated high-speed curve fitting software ?
- Azimuthal sample rotation while depth profiling?
- Line profiling?
- BG subtraction or fitting?
- Can bitmaps be exported?
- Target Factor Analysis?
- What is Tilt Analysis?
- # of data points max?
- Map-based depth profiles?

- Need to test Software to provide better feedback on Software.

- NOTE:
Software capabilities are now >60% of the value of the system.

Position based on Key Technical Features



<u>Rank</u>	<u>Maker</u>	<u>Score</u>	<u>Price Range (USD)</u>
■ 1	Kratos - Ultra	10	550,000 – 600,000
	■ Kratos – Nova	9	???
■ 2.	VG – 250i-XL	9	650,000 – 700,000
	■ Thermo – K-Alpha	9	???
■ 3-A.	PHI – Quantera	8	790,000 – 840,000
■ 3-B.	VG – ThetaProbe	8	730,000 – 850,000
■ 4-A.	JEOL – JPS 9200	5	500,000

- Score is based on the total number of key features that most often decide purchase plus features that are especially beneficial or are technically superior.

Projected Market Size for XPS Systems in World

- Kratos
- VG projects 13-15 XPS systems per year
- PHI
- Specs projects 10-15 XPS systems per year

Market Potential for XPS Systems

- Depends on initial pricing strategy and need for ROI
- Depends on industries approached
- Depends on marketing methods
- Depends on demonstration quality and location
- Depends on software performance and ease of use
- Depends on perceived ability to service
- Depends on economy and government spending

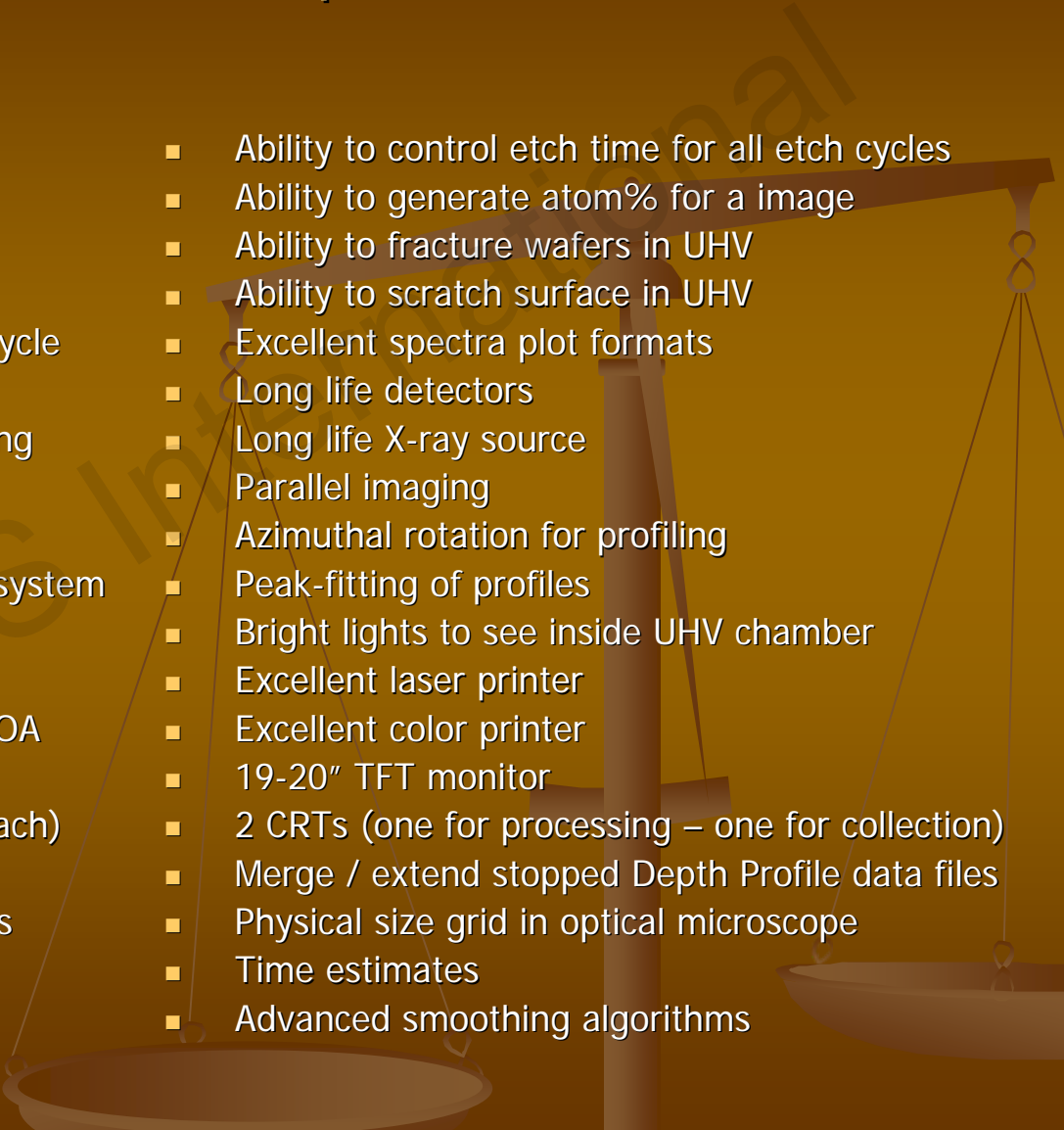
- Assuming that the US market size is 15 instruments/year, the XXX has the potential to capture 1-2 sales in Fiscal Year 2003. If aggressive marketing is done in 2003, then the potential for Fiscal 2004 should be 2-3 sales. Until the performance is improved the maximum sales will be 3-4 per year. If performance equals the main competitor sales might increase to 4-5.
- On a Percentage Basis:

1-2 systems =	6-13%	(in Fiscal 2003)
2-3 systems =	13-20%	
3-4 systems =	20-25%	(after Fiscal 2005)

Is this XPS System Competitive?

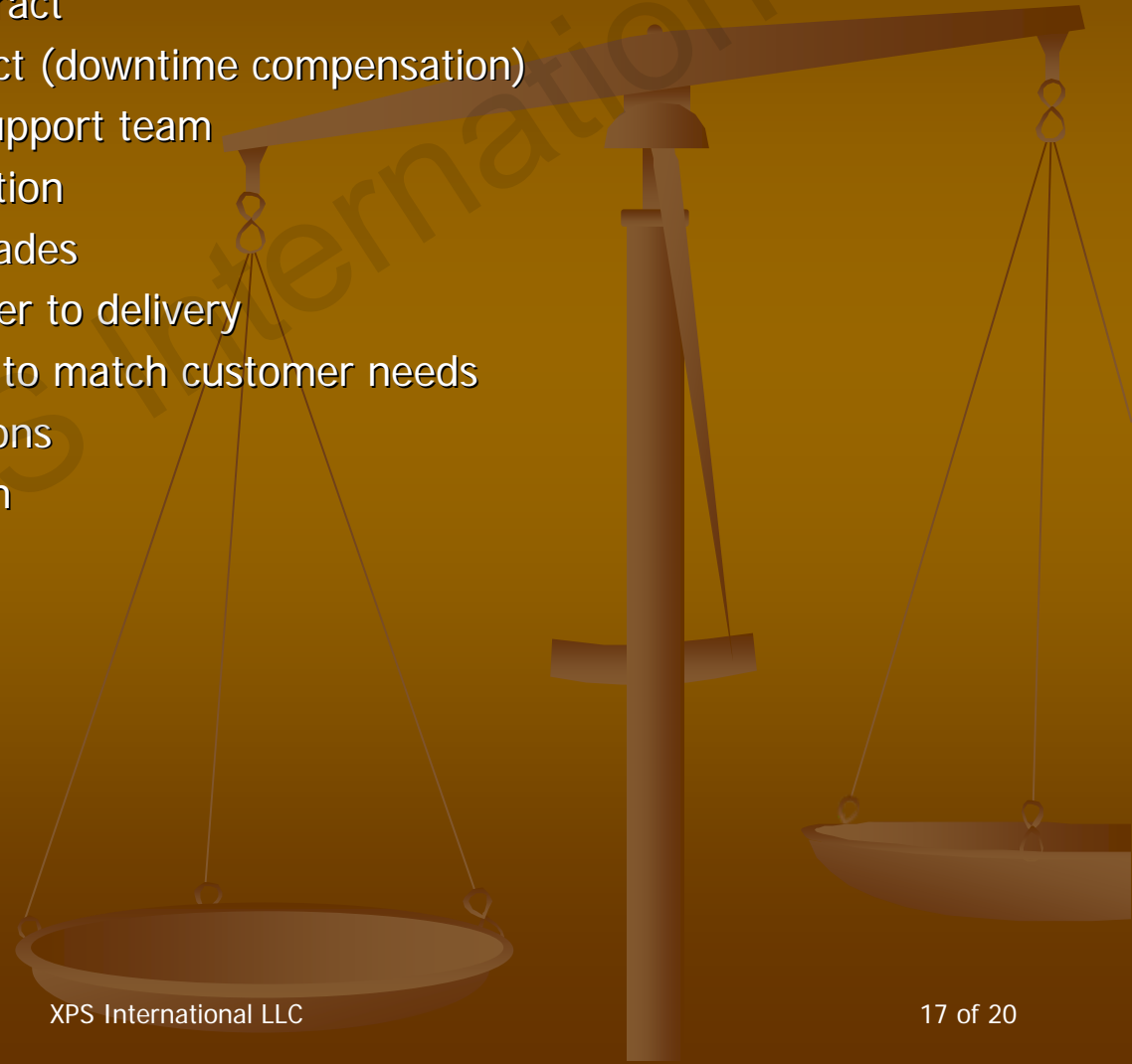
- Simple Answer: XXX is competitive with Kratos-165
- To compete with VG 250i-XL, Kratos-Ultra and PHI-Quantera the XXX needs to have better performance in various areas.
- The XXX has some useful features (auto-bake) that are not really considered when comparing instruments.
- XXX is a new technique that has not yet been proven as useful.
- In today's market the outcome of a demo depends on the ease of use of the software and the overall capabilities of the software. DTP is now a major need for users. Help with data processing, especially peak-fitting and chemical state assignments is lacking in most software packages.

Features Needed to Compete or to Win

- 
- Accept tall samples (10-15 mm)
 - Excellent DTP features
 - Highest count rate using Mono
 - Depth profile maps
 - Capture movies of profiles per cycle
 - Auto-focusing
 - Macros for collecting & processing
 - On-line BE data-base
 - Handbook with mono spectra
 - Excellent charge compensation system
 - Excellent Find & ID routine
 - Table generation routine
 - Correction of T(E) vs Electron TOA
 - 2-3 years free service contract
 - Self-training videos (5-10 min each)
 - Advanced AR-XPS software
 - Include film thickness algorithms
 - Include Quases software
 - Ability to control etch time for all etch cycles
 - Ability to generate atom% for a image
 - Ability to fracture wafers in UHV
 - Ability to scratch surface in UHV
 - Excellent spectra plot formats
 - Long life detectors
 - Long life X-ray source
 - Parallel imaging
 - Azimuthal rotation for profiling
 - Peak-fitting of profiles
 - Bright lights to see inside UHV chamber
 - Excellent laser printer
 - Excellent color printer
 - 19-20" TFT monitor
 - 2 CRTs (one for processing – one for collection)
 - Merge / extend stopped Depth Profile data files
 - Physical size grid in optical microscope
 - Time estimates
 - Advanced smoothing algorithms

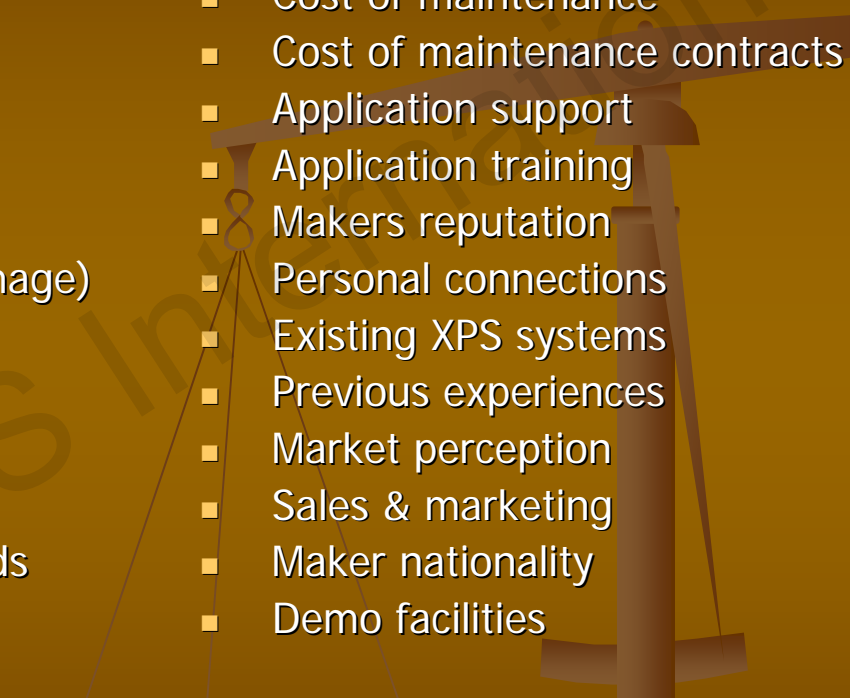
Details not Disclosed in Some Specification Sheets

- Warranty contract
- Service contract (downtime compensation)
- Applications support team
- Demo lab location
- Software upgrades
- Time from order to delivery
- Customization to match customer needs
- FE-AES & options
- 300 mm option



Key Factors that Affect New Sales

(perceived, promised or standard)

- 
- Hardware
 - Software
 - Specs & Performance
 - Sample throughput
 - Ease of use
 - Design (sample size/damage)
 - System Price
 - Downtime
 - Service
 - Quality / reliability
 - Customer's analysis needs
 - Available funding
 - Options
 - Cost of maintenance
 - Cost of maintenance contracts
 - Application support
 - Application training
 - Makers reputation
 - Personal connections
 - Existing XPS systems
 - Previous experiences
 - Market perception
 - Sales & marketing
 - Maker nationality
 - Demo facilities

Reasons-Justifications to buy a “NEW” XPS

Academic or Industrial

- Old electronics too hard to maintain
- Computer OS hard to maintain
- Old software too poor – no DTP
- Electron count rate too slow
- Need to network system
- Need better energy resolution – mono
- Need to avoid damage – mono
- Need to process data faster – mono – no X-ray satellites or BG
- Charge control now “simple”
- Mono source now fast enough
- Need <100 micron spot
- Imaging now fast enough
- Need chemical state imaging
- Need large sample analysis
- Need higher throughput
- Quant. accuracy now +/- 10%
- Database of BEs now reliable
- Received un-expected budget

Reasons-Justifications to buy “First” XPS System

Academic or Industrial

- Can analyze elements in top 1-10 nm
 - FT-IR and EDX can not
- Can analyze insulators – AES can not
- Can analyze chemical states directly
- Can measure empirical formula
 - Quantitative accuracy about +/- 10%
- Can study electronic states
- Can solve corrosion problems
- Can study mineral processes
- Can solve contamination problems
- Can measure chemical states as a function of depth
- Can analyze adhesion failures
- Can solve printing problems
- Can measure surface homogeneity
- Can analyze plasma induced changes
- Can analyze catalysts
- Can measure ionic nature
- Can analyze wear tracts
- Can measure effects of solar radiation
- Can measure X-ray induced damage
- Can measure heat induced damage
- Can measure laser beam damage
- Can analyze surface of paper & wood