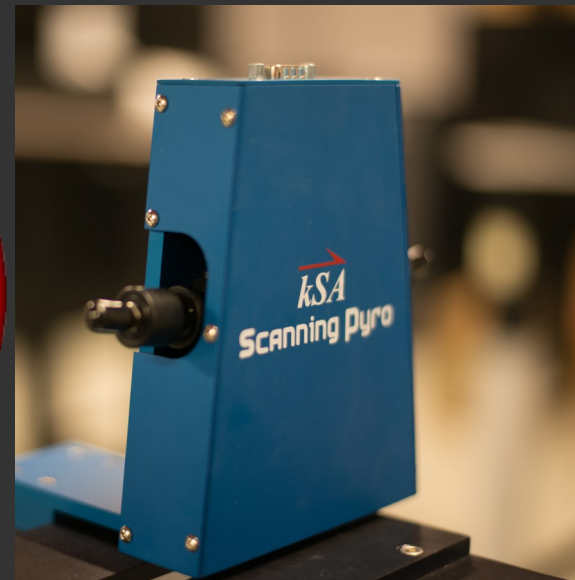
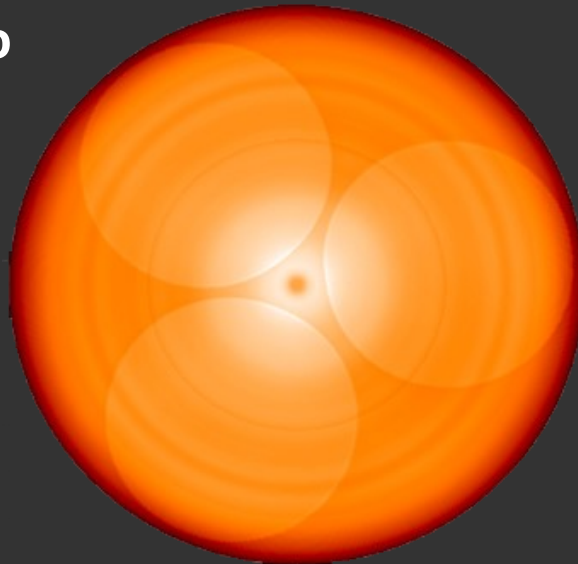




## kSA ScanningPyro

Full Carrier  
Temperature  
Maps at the  
Click of a Button!



The kSA ScanningPyro metrology tool is designed to quickly, easily, and accurately generate full wafer carrier temperature maps on Veeco K465i and EPIK 700 production MOCVD reactors. The kSA ScanningPyro utilizes simultaneous temperature measurement from two sensor heads while scanning across the optical viewport, allowing for a full temperature map from platen center to platen edge in a single scan.

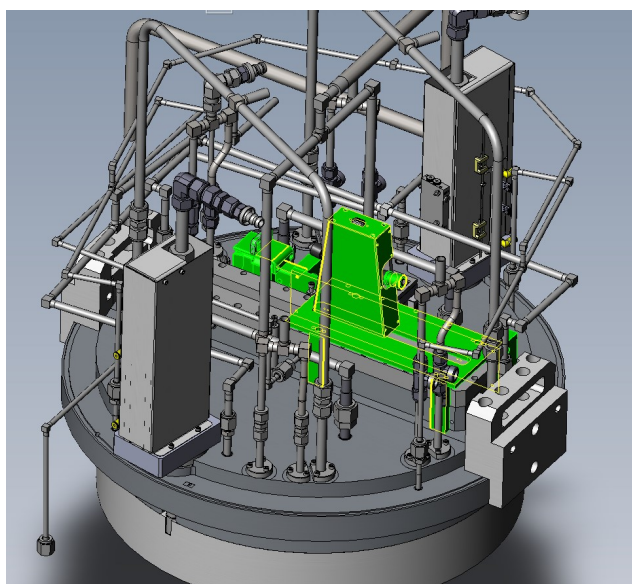
Quickly generate a full temperature map of your wafer carrier to determine temperature uniformity, adjust heater zones, and determine hot and cold spots. Easy-to-use k-Space software allows you to perform full carrier scans, or select any subset of a full scan, with selectable scanning resolution.

The kSA ScanningPyro optics head and scanning stage easily mounts above the right side viewport of the K465i or EPIK 700 reactor. The ScanningPyro pyrometers can either be calibrated to a known temperature set point, or calibrated to absolute temperature using the kSA SpectraTemp temperature measurement tool.



## kSA ScanningPyro Functional Specifications

Scanning Pyro Models and Compatible MOCVD reactors	SPYRO-465 for Veeco K465i and SPYRO-700 for Veeco EPIK 700
Scan Range	Full carrier, or any subset specified by the user
Temperature Range	530 - 1250°C (higher temperature range units available upon request, e.g. for AlN applications)
Temperature Resolution	530 - 700 °C: ±1.0 °C 700 - 1250 °C: ± 0.3 °C
Scan Resolution	User selectable, typical radial scan step size: 1mm, angular resolution: 0.3° or better
Scan Time	Depends on carrier rotation speed. For example, at a carrier speed of 600 rpm, for a full carrier scan on a K465i with 1mm radial step size, the full scan time is 93s.
Scan Schedule	User definable scan schedule to allow data acquisition at predetermined times for systematic correlation with growth recipes.
Temperature Analysis	Fully configurable analysis templates, as defined by the user. Automatic statistical analysis of min, max, average, and standard deviation of individual pockets, cumulative pockets, and web regions. Exclusion regions definable within the template. Full statistical analysis of user definable watch radii for direct comparison with Veeco Realtemp pyrometer measurements. Crosshair analysis with full rotation capability.



*Mechanical drawing of the kSA SPYRO-465 footprint and a photograph of the kSA SPYRO-465 on a k465i reactor.*

## kSA ScanningPyro System Specifications

### Controller

The kSA ScanningPyro is supplied with a fully configured, Windows 10 multi-core CPU, 3U rack mounted computer controller. User must have space and facilities for a computer controller and supplied 22" LCD monitor, keyboard and mouse within 3m of the front of the reactor. Please refer to the kSA Computer Product Specifications for the latest controller configuration. k-Space does not recommend customers substitute or update their own computer for the controller.

### Electrical Specifications

System Power: 120VAC with 10A max or 230VAC with 5A max, 50/60Hz compatible.

Power Connections: Requires a total of three power connections for the computer controller (2m power cable), the computer monitor (2m power cable), and the linear scanning stage (3m power cable).

### Control Hardware and Cabling

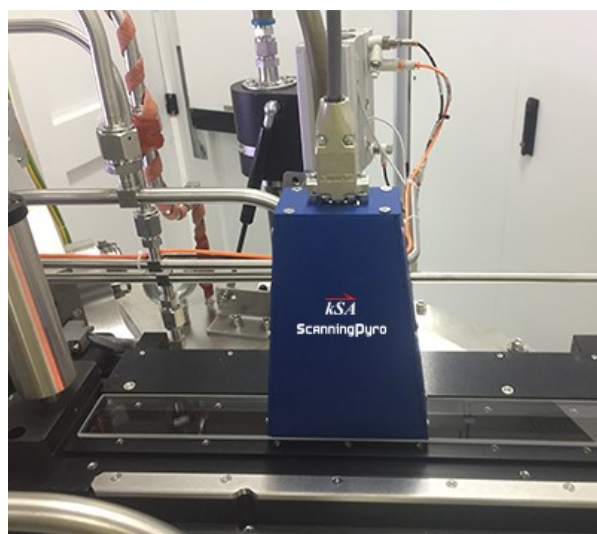
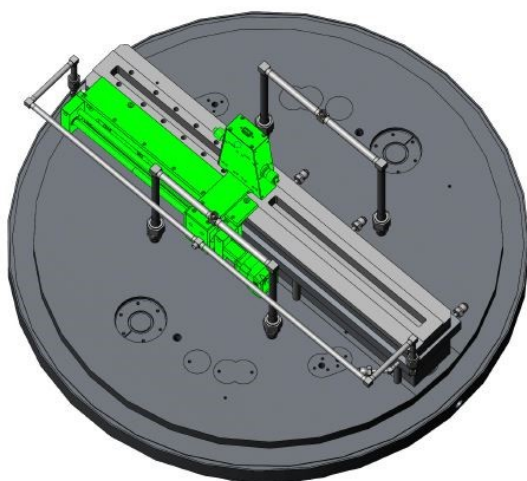
The systems computer controller is connected to 1) system power (2m power cable), 2) optical head (9-pin D-sub to USB, 3m) , 3) rotational trigger (hardwired to trigger sensor and pigtail connection to controller with 9-pin D-sub for power and BNC for trigger signal input, 3m), 4) linear scanning stage motor (ribbon cable to USB, 3m), 5) monitor (2m power cable), 6) mouse, and 7) keyboard. All cables provided.

### Installation and Training

A minimum of 1-2 days of on-site customer installation and training are required with system purchase.

### Warranty

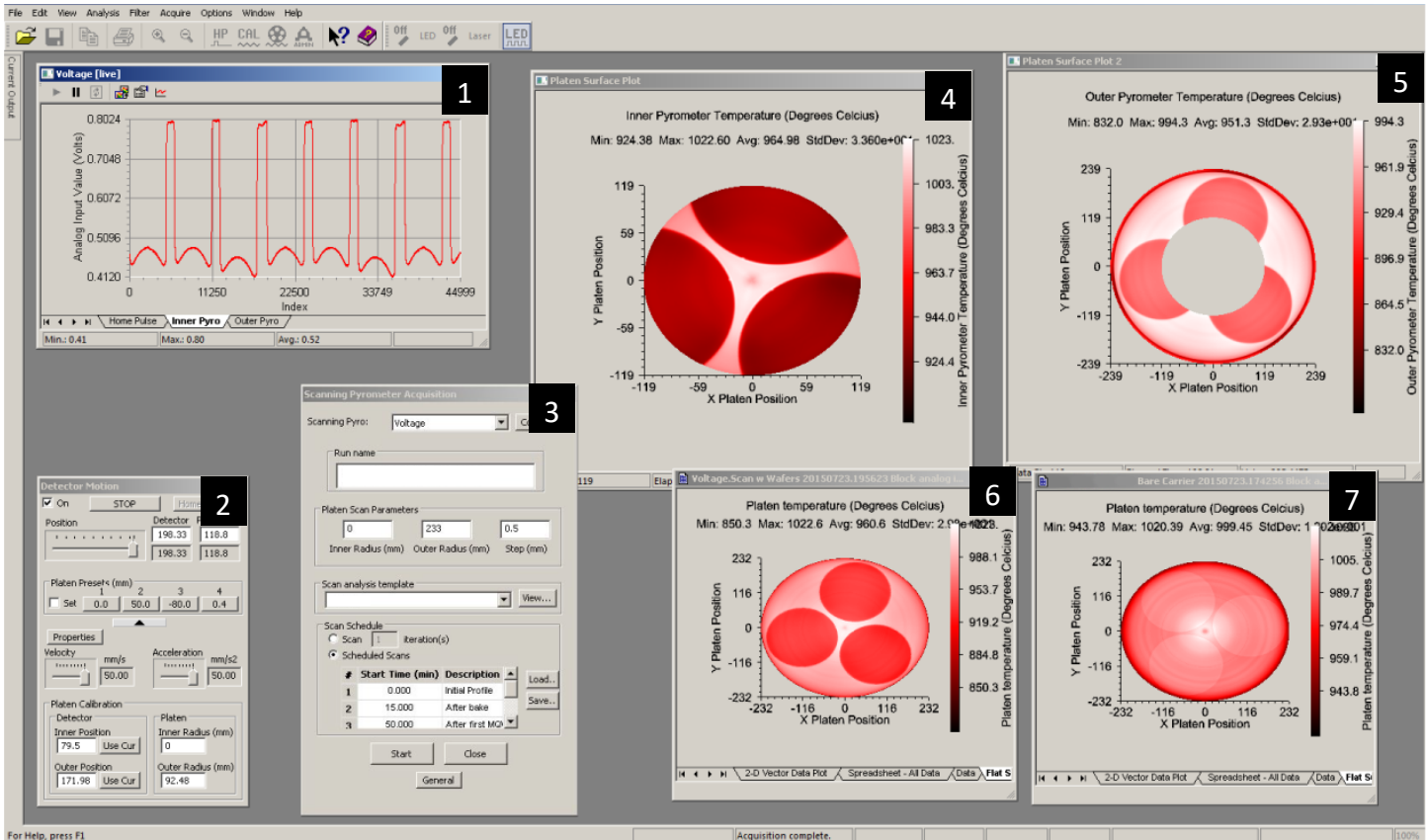
All kSA systems and integrated components are warranted against defective materials and workmanship for a period of ONE YEAR from the date of delivery to the original purchaser.



*Mechanical drawing of the kSA SPYRO-700 footprint and a photograph of the kSA SPYRO-700 on an EPIK 700 reactor.*

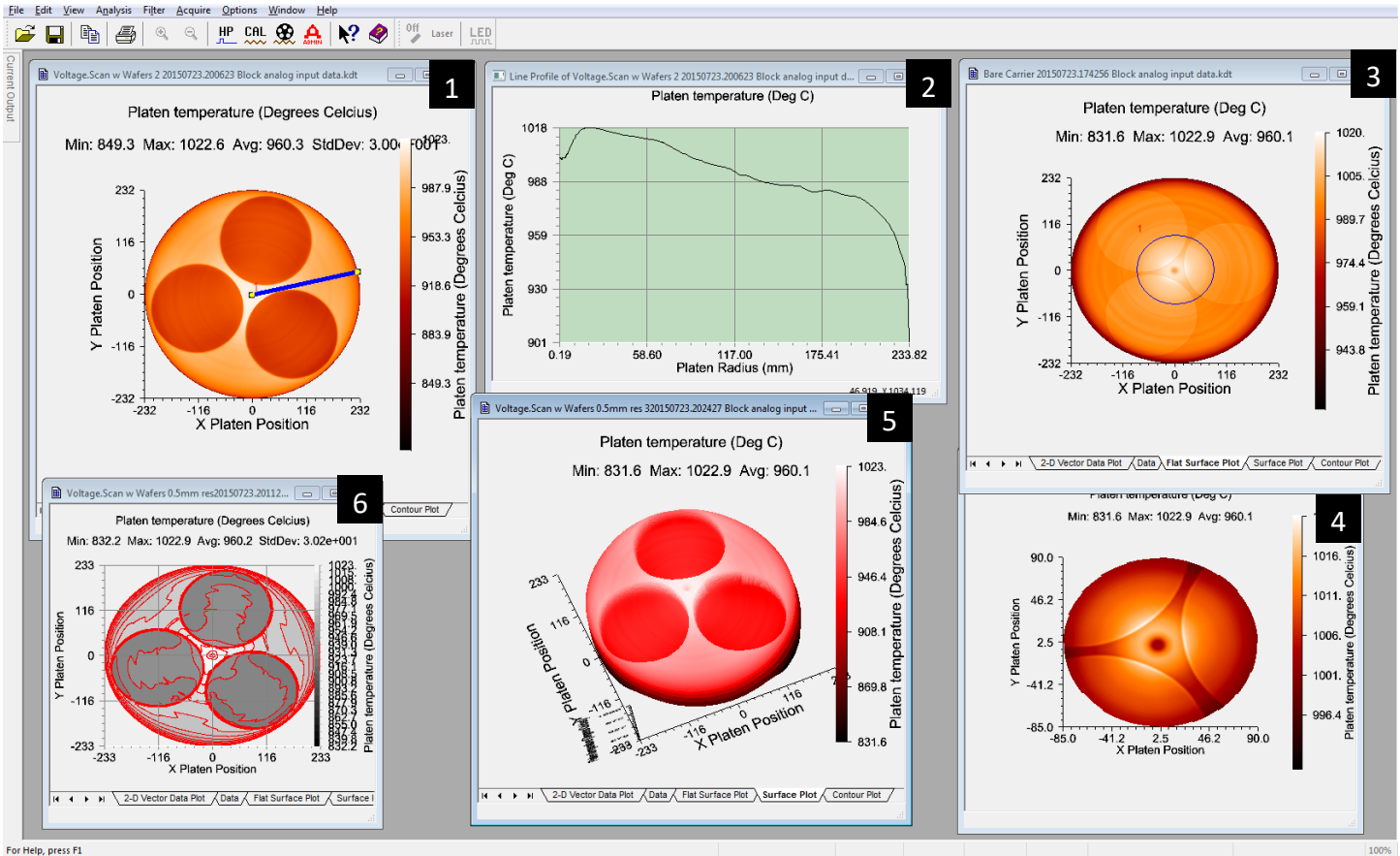


# kSA ScanningPyro Data Acquisition Screen



Window	Description
1	Live data acquired from inner and outer pyrometers.
2	Linear motion controller. The user can set up fully automated scans, or can move to any radius on the carrier and manually acquire data.
3	Scanning acquisition dialog. The scan parameters, including starting and stopping carrier radius and scan resolution, are user-selectable. The user may also define a time-based scan schedule.
4	The inner pyrometer acquires data on the inner half of the carrier. Notice the high resolution of the scanner: the wafer notches are clearly visible in this scan.
5	The outer pyrometer acquires data on the outer half of the carrier.
6	The inner and outer pyrometer data are combined to provide a complete carrier map in a single scan. A full scan on the K465i carrier takes 93s with a 1mm step size at 600 RPM.
7	Full scan of an empty carrier (no wafers).

## kSA ScanningPyro Data Analysis



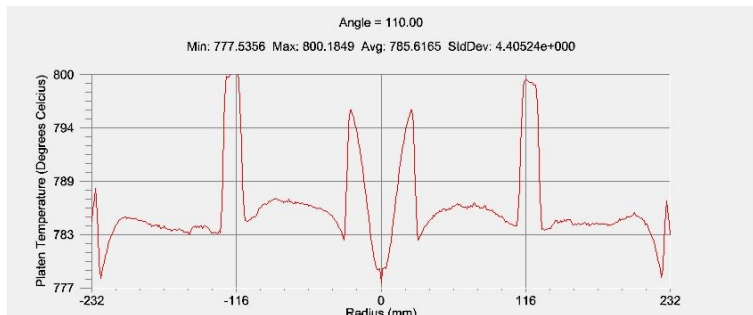
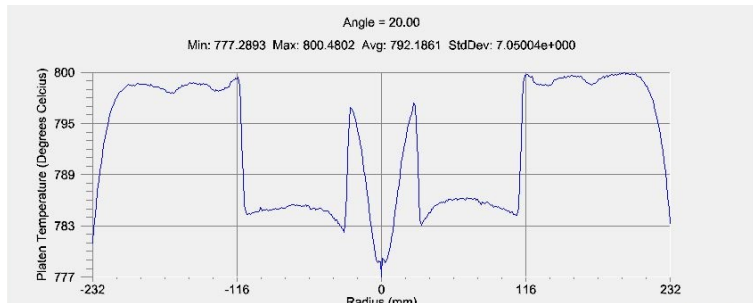
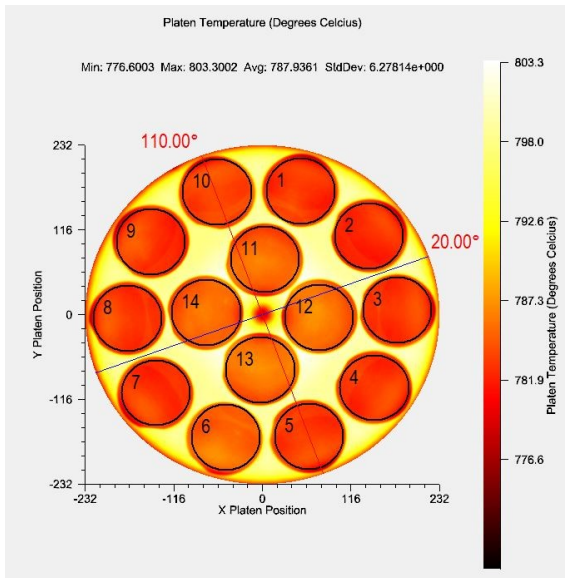
Window	Description
1	Full platen map with line profile selection tool (line plot shown in window 2). User can place the line profile at any position, length, and line width.
2	Temperature line profile as a function of platen radius. Data plot of line profile selection tool is shown in window 1.
3	Full platen map of empty carrier (no wafers). The user defined circle selects a new, zoomed in surface plot; see window 4.
4	Zoom in of central area of full platen map shown in window 3. This data shows a hot zone at the inner edges of the wafer pockets, and towards the center of the carrier. The spindle keeps the carrier cooler at the very center.
5	3D surface plot of full carrier map.
6	Contour plot of full carrier map.



# kSA ScanningPyro Analysis Features

## Line Scan Capability:

User-defined lines on carrier maps generate line profiles and crosshair profiles for further analysis. The example below shows crosshair line profiles. In this case, there are wafers in the pockets. The wafer temperature appears lower than that of the wafer carrier due partially to the difference in the emissivity of the wafers and the carrier.



## Web and Pocket Analysis:

A user-defined wafer template may be used to automatically generate a Platen/Carrier Report at the completion of the scan. A 14x4" wafer template is shown in the adjacent carrier map, with each wafer/pocket labeled 1-14. This analysis tool determines the wafer/pocket and web temperature statistics over the entire web and pocket regions and for the individual pocket regions. The user may also define exclusion regions for this analysis as well as specify acceptance specification criteria for the measured parameter. This can be used to track specific wafer/pocket temperatures for each growth.

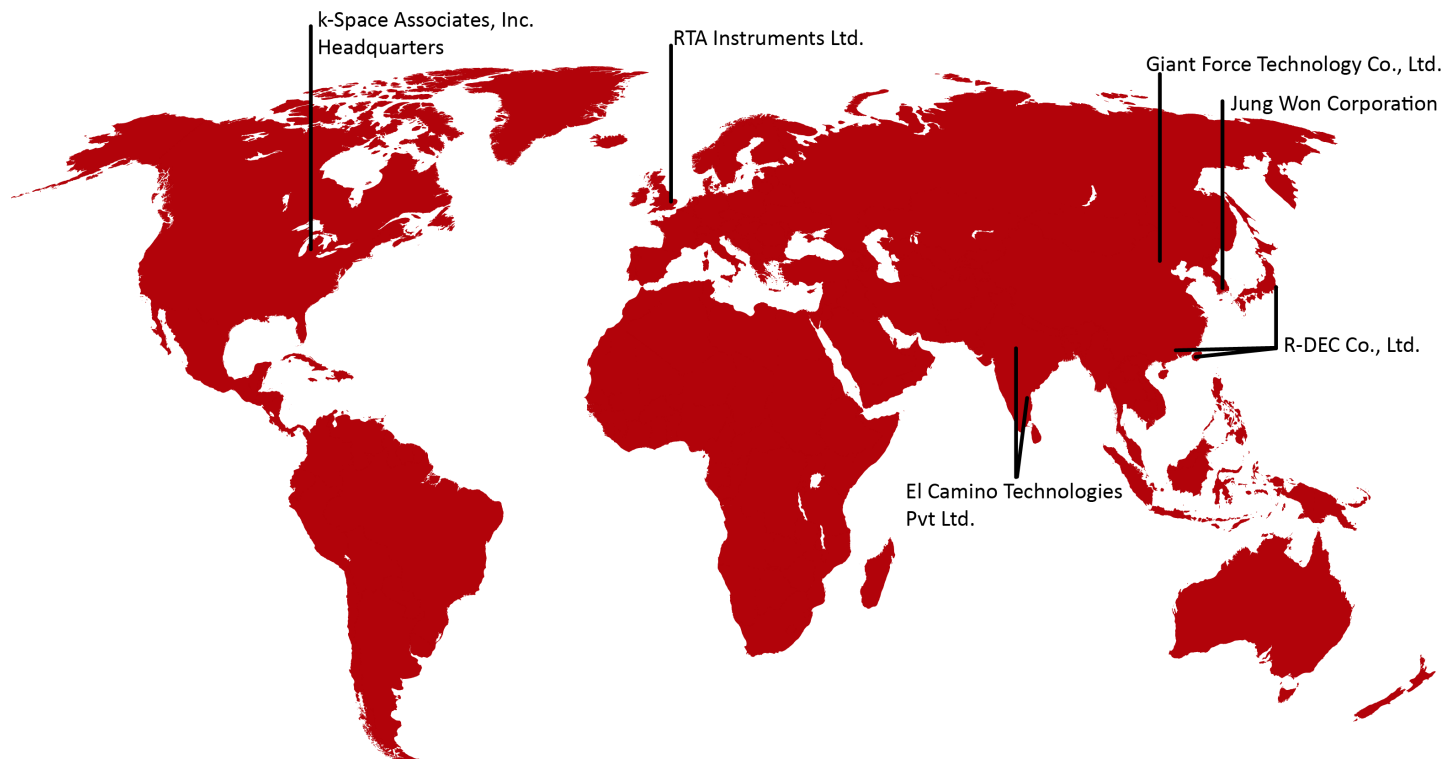
### Platen Report - 14 x 4 Scanning Pyro Rev3 01

Platen Temperature (Degrees Celcius)    Acceptance Spec: 780.900 - 787.000

Total Pocket Statistics					Individual Pocket Statistics					
Min.	Max.	Avg.	StdDev.	Out of Spec.(%)	Min.	Max.	Avg.	StdDev.	Out of Spec.(%)	Pocket
780.8158	787.7318	784.3839	1.41419	1.246	780.8158	784.8764	783.0735	0.66848	0.079	1
					780.9633	784.2073	782.4575	0.60727	0.000	2
					781.0270	784.6094	783.0709	0.59766	0.000	3
					781.1664	784.5945	783.0626	0.64519	0.000	4
					780.8314	784.8401	783.3339	0.60571	0.080	5
					783.6962	787.2644	785.2419	0.75498	2.010	6
					781.4850	784.9023	782.9548	0.71933	0.000	7
					781.3655	785.1684	783.1715	0.66799	0.000	8
					780.9826	785.1674	783.0782	0.91024	0.000	9
					781.1337	785.1066	783.7576	0.52485	0.000	10
					782.7192	786.9319	785.1805	0.79550	0.000	11
					782.4881	787.7318	785.7096	0.90735	5.952	12
					782.9824	787.3779	785.8022	0.81418	3.197	13
					782.2192	786.9515	785.1648	0.69797	0.000	14

Carrier Web Statistics				
Min.	Max.	Avg.	StdDev.	Out of Spec.(%)
776.6003	803.3002	791.8368	7.05733	74.698



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### About k-Space Associates, Inc.

k-Space Associates, Inc., is a leading metrology supplier to the semiconductor, surface science, and thin-film technology industries. Since 1992, we've delivered the most advanced thin-film characterization tools and software, thanks to close collaboration with our worldwide customer base. We realize the best products are developed with our customers' input, so we're good listeners. For your real-time surface analysis, curvature/stress, temperature, deposition rate, or custom project, we look forward to helping you with your thin-film characterization needs.

*Specifications are subject to change without notice. While due caution has been exercised in the production of this document, possible errors and omissions may occur.*