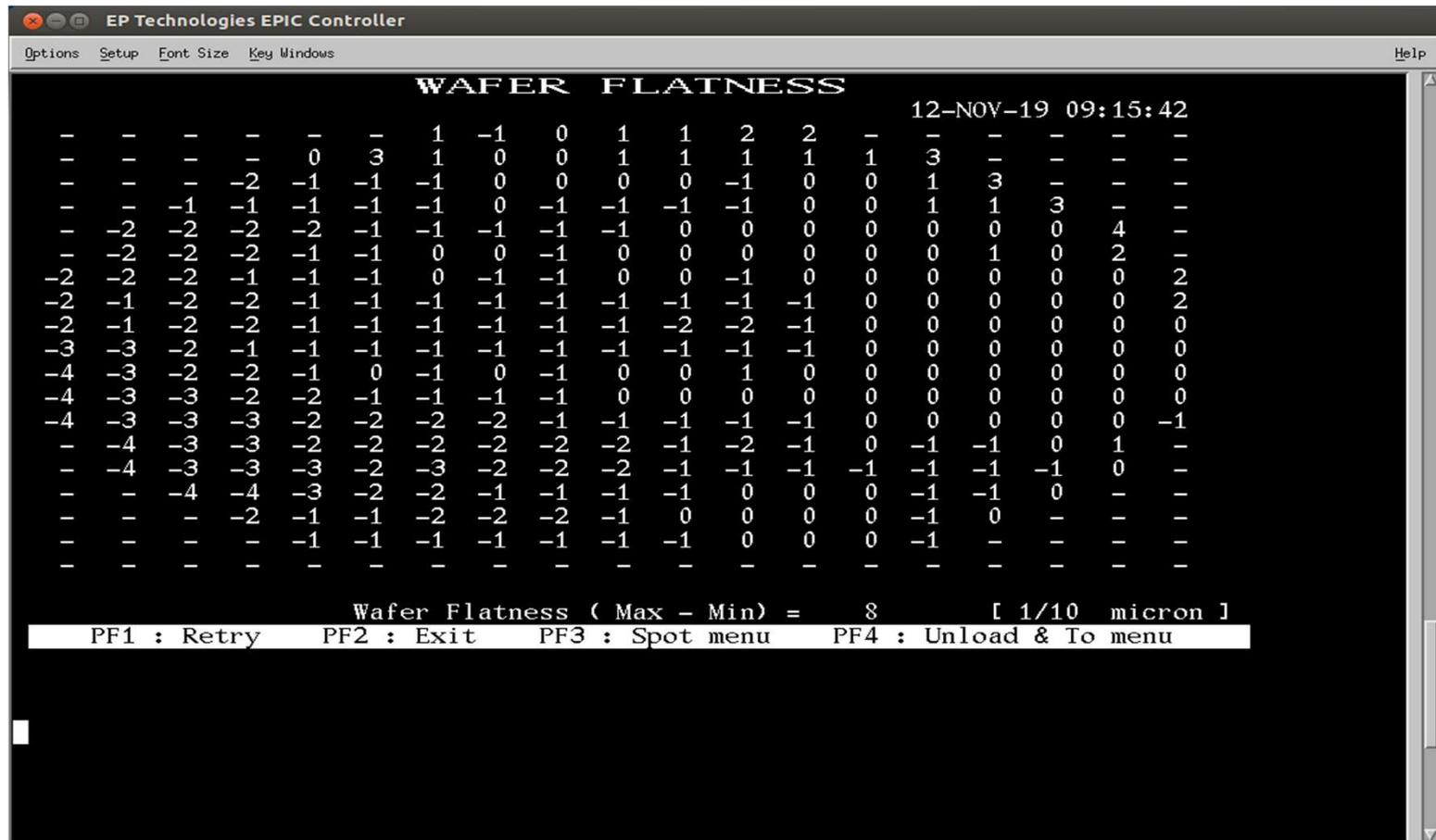


# RESOLUTION

VISUAL MICROSCOPE INSPECTION MEETS SPECIFICATIONS

# Wafer Flatness with Ceramic Chuck

Spec : < 2.5  $\mu\text{m}/150\text{mm}$



# Lens Distortion

Spec:  $\leq \pm 0.55\text{nm}$

```
EP Technologies EPIC Controller
Options Setup Font Size Key Windows Help

- .023 - .015 - .016
- .001 - .006 - .018

.006 - .013 - .033
- .005 - .019 - .019

.020 - .008 - .000
- .002 - .029 - .000

.004 - .004 - .005
- .014 - .029 - .009

.036 - .036 - .024 .005 - .009 - .000
- .010 - .004 - .001 .008 .004 - .009 .000

.011 - .010 - .017
.001 - .012 - .028

.036 - .006 - .014
- .009 - .006 - .010

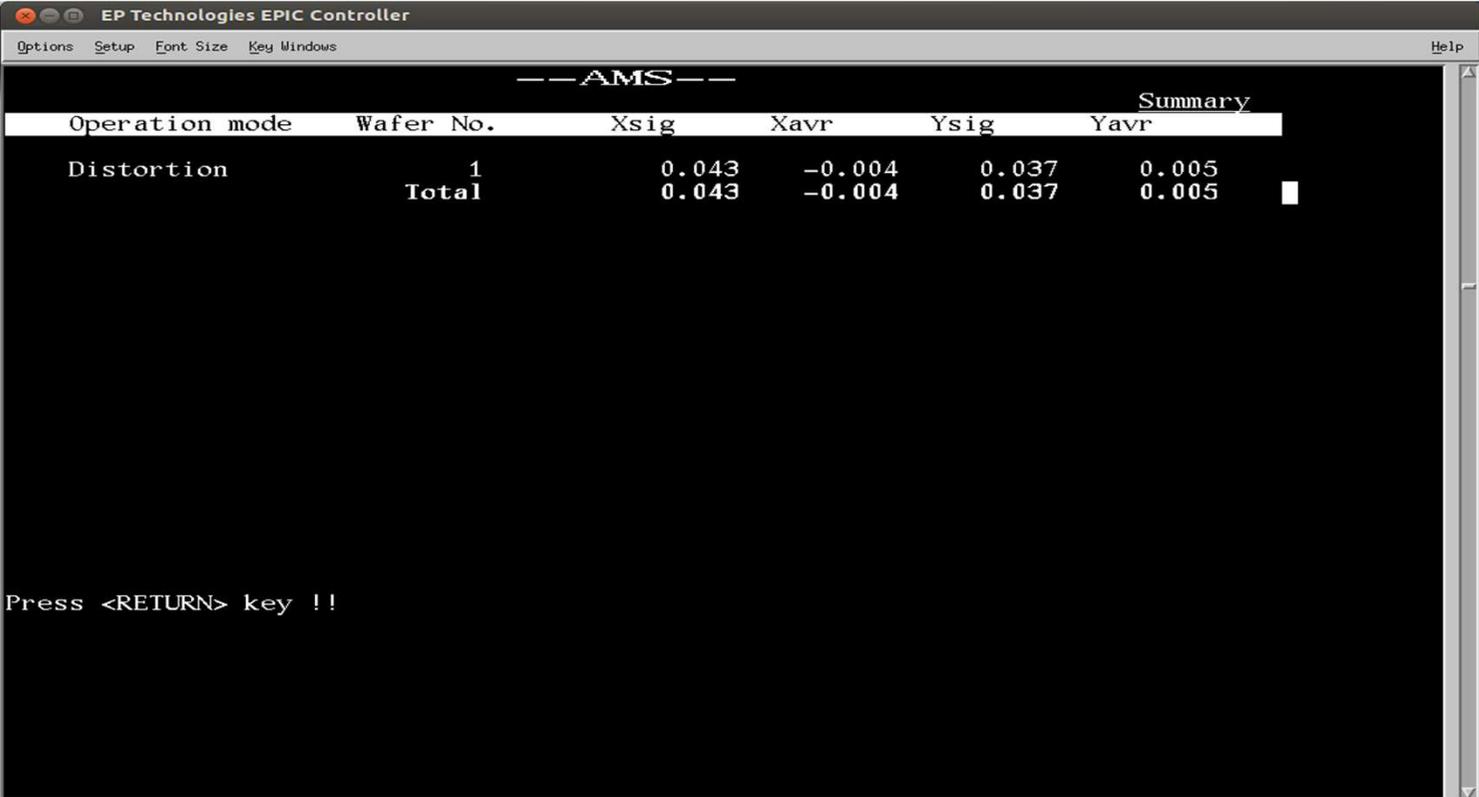
.037 - .010 - .005
- .032 - .002 - .000

.034 - .011 - .028
- .022 - .000 - .040
```

```
<<CALCULATE RESULTS>>
Date : 13-NOV-2019 15:32
Name : EPTDIS9
Mac.: Pr:

Size: 22mm Points: 36
Data file:EPTDIS9
Address file:22DIS
Reticle file:2205HDIS
Reticle err :On
Rotat. mode :Vector
Rotation = 0.029um
Target rotation =-0.026um
Right-Left rot. = 0.013um
Max X= 0.041 Y= 0.033um
Min X=-0.023 Y=-0.040um
Diff. X= 0.064 Y= 0.073um
Mx-Mn X= 0.064 Y= 0.062um
|S|max = 0.058um
Shift-X=-0.010 Y= 0.000um
```

# Lens Distortion Spec: $\leq \pm 0.55\text{nm}$



The screenshot shows a terminal window titled "EP Technologies EPIC Controller". The window contains a table of lens distortion data for wafer 1. The table has columns for Operation mode, Wafer No., Xsig, Xavr, Ysig, Yavr, and Summary. The data shows a total distortion of 0.043 nm in the X-axis and 0.037 nm in the Y-axis, with a maximum distortion of 0.005 nm.

Operation mode	Wafer No.	Xsig	Xavr	Ysig	Yavr	Summary
Distortion	1	0.043	-0.004	0.037	0.005	0.005
	Total	0.043	-0.004	0.037	0.005	0.005

Press <RETURN> key !!

# Lens Distortion

Spec:  $\leq \pm 0.55\text{nm}$

EP Technologies EPIC Controller

Options Setup Font Size Key Windows Help

**CALCULATE RESULTS**

Date: 13-NOV-2019 15:32 Name: EPTDIS9 M.name: Pr.:  
Size: 22[mm] Points: 36 Data file: EPTDIS9  
Address file: 22DIS Reticle file: 2205HDIS

Page 1/ 2

No.	Address [um]		Data [um]		No.	Address [um]		Data [um]	
	X	Y	X	Y		X	Y	X	Y
1	-4000	4000	0.003	-0.014	13	7000	0	-0.005	-0.009
2	0	4000	-0.004	-0.029	14	-7000	-7000	0.036	0.009
3	4000	4000	-0.005	-0.029	15	0	-7000	0.006	-0.006
4	-4000	0	0.005	0.008	16	7000	-7000	0.014	-0.010
5	4000	0	-0.009	0.004	17	-10000	10000	0.006	-0.005
6	-4000	-4000	0.011	0.001	18	0	10000	0.013	-0.019
7	0	-4000	0.010	-0.012	19	10000	10000	0.038	-0.019
8	4000	-4000	0.017	-0.028	20	-10000	0	0.036	-0.004
9	-7000	7000	0.020	-0.002	21	10000	0	0.001	0.008
10	0	7000	0.000	-0.029	22	-10000	-10000	0.037	0.032
11	7000	7000	0.008	-0.022	23	0	-10000	0.018	-0.002
12	-7000	0	0.024	-0.001	24	10000	-10000	0.035	-0.030

PF1: Exit PF2: Spot menu

-->

# Lens Distortion

Spec:  $\leq \pm 0.55\text{nm}$

EP Technologies EPIC Controller

Options Setup Font Size Key Windows Help

**CALCULATE RESULTS**

Date: 13-NOV-2019 15:32 Name: EPTDIS9 M.name:  
Size: 22[mm] Points: 36 Data file: EPTDIS9  
Address file: 22DIS Reticle file: 2205HDIS Pr.:  
Page 1/ 2

No.	Address [um]		Data [um]		No.	Address [um]		Data [um]	
	X	Y	X	Y		X	Y	X	Y
1	-4000	4000	0.003	-0.014	13	7000	0	-0.005	-0.009
2	0	4000	-0.004	-0.029	14	-7000	-7000	0.036	0.009
3	4000	4000	-0.005	-0.029	15	0	-7000	0.006	-0.006
4	-4000	0	0.005	0.008	16	7000	-7000	0.014	-0.010
5	4000	0	-0.009	0.004	17	-10000	10000	0.006	-0.005
6	-4000	-4000	0.011	0.001	18	0	10000	0.013	-0.019
7	0	-4000	0.010	-0.012	19	10000	10000	0.038	-0.019
8	4000	-4000	0.017	-0.028	20	-10000	0	0.036	-0.004
9	-7000	7000	0.020	-0.002	21	10000	0	0.001	0.008
10	0	7000	0.000	-0.029	22	-10000	-10000	0.037	0.032
11	7000	7000	0.008	-0.022	23	0	-10000	0.018	-0.002
12	-7000	0	0.024	-0.001	24	10000	-10000	0.035	-0.030

PF1: Exit PF2: Spot menu

-->

# Magnification Control Accuracy Data Run

≤ ±20NM

EP Technologies EPIC Controller

Options Setup Font Size Key Windows Help

**set PROCEDURE**

sequence number = **5**

Exp. (F/M)	Idl. (H/C)	Time	Exp. (F/M)	Idl. (H/C)	Time		
No. 1	• FOCUS	• COOL	5	No. 2	• MAGNI	• HEAT	60
No. 3	• MAGNI	• HEAT	20	No. 4	• FOCUS	• COOL	60
No. 5	• FOCUS	• COOL	5	No. 6	• MAGNI	• ----	0
No. 7	• ----	• ----	0	No. 8	• ----	• ----	0
No. 9	• ----	• ----	0	No. 10	• ----	• ----	0
No. 11	• ----	• ----	0	No. 12	• ----	• ----	0
No. 13	• ----	• ----	0	No. 14	• ----	• ----	0
No. 15	• ----	• ----	0	No. 16	• ----	• ----	0
No. 17	• ----	• ----	0	No. 18	• ----	• ----	0
No. 19	• ----	• ----	0	No. 20	• ----	• ----	0
No. 21	• ----	• ----	0	No. 22	• ----	• ----	0
No. 23	• ----	• ----	0	No. 24	• ----	• ----	0

PF1 : Save PF2 : Quit PF3 : Previous page PF4 : Next page

EXPLC 24D

EP Technologies EPIC Controller

Options Setup Font Size Key Windows Help

**The data of LC**

No.	AC-room Pressure		B-room Pressure		Chamber data	
	st/en	Target : Present	Target : Present	Target : Present	Press [mmHg]	Temp [°c]
1		747.32 747.32	746.07 746.07	747.32 23.23		
1		747.34 747.34	746.08 746.12	747.34 23.25		
2		747.32 747.32	746.07 746.09	747.32 23.22		
2		747.32 747.32	746.06 746.07	747.32 23.22		
3		747.54 747.54	744.65 744.64	747.54 23.3		
3		747.55 747.55	744.7 744.72	747.55 23.28		
4		747.81 747.81	744.73 744.72	747.81 23.31		
4		747.9 747.9	744.9 744.91	747.9 23.3		
5		748.47 748.47	746.6 746.62	748.47 23.17		
5		748.46 748.46	746.59 746.59	748.46 23.19		
6		748.43 748.43	746.58 746.57	748.43 23.17		
6		748.42 748.42	746.56 746.57	748.42 23.17		
0		0 0	0 0	0 0		
0		0 0	0 0	0 0		

PF1 : Exit PF2 : Exit PF3 : Previous page PF4 : Next page

EXPLC 24D

# Magnification Control Accuracy

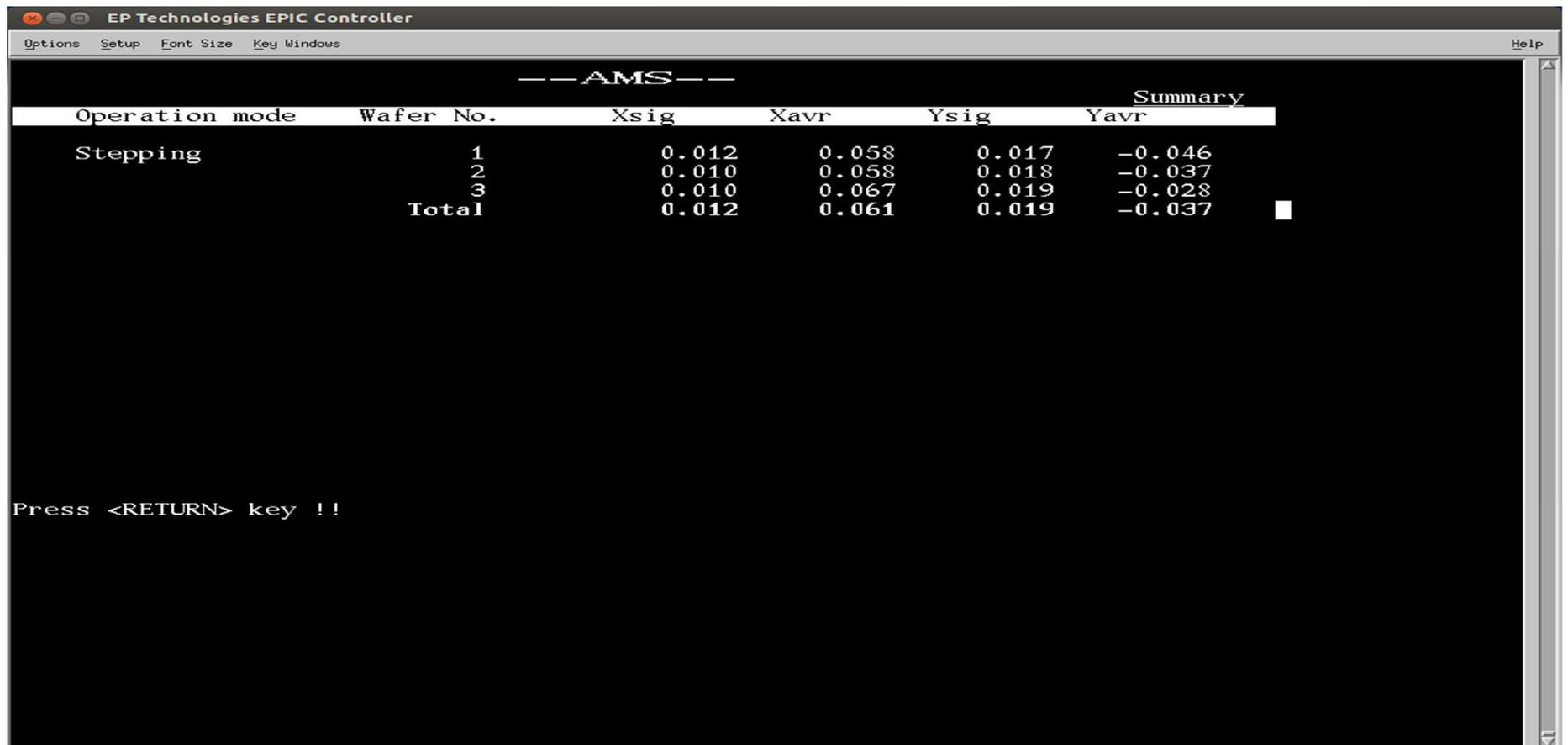
$\leq \pm 20NM$

- LENS MAGNIFICATION TESTING DATA

	X	Y
• INITIAL	.012	.019
• HEAT	.010	,018
• COOL	,010	,019

# Magnification Control Accuracy

$x = 12\text{nm}$   $y = 19\text{nm}$   $\leq \pm 20\text{NM}$



The screenshot shows the EP Technologies EPIC Controller interface. At the top, there is a menu bar with 'Options', 'Setup', 'Font Size', 'Key Windows', and 'Help'. Below the menu bar, the text '--AMS--' is displayed. A table with the following columns: 'Operation mode', 'Wafer No.', 'Xsig', 'Xavr', 'Ysig', and 'Summary' (with sub-column 'Yavr'). The table contains data for three wafers and a total row. Below the table, the text 'Press <RETURN> key !!' is displayed.

Operation mode	Wafer No.	Xsig	Xavr	Ysig	Summary	
					Yavr	
Stepping	1	0.012	0.058	0.017	-0.046	
	2	0.010	0.058	0.018	-0.037	
	3	0.010	0.067	0.019	-0.028	
	<b>Total</b>	<b>0.012</b>	<b>0.061</b>	<b>0.019</b>	<b>-0.037</b>	

Press <RETURN> key !!

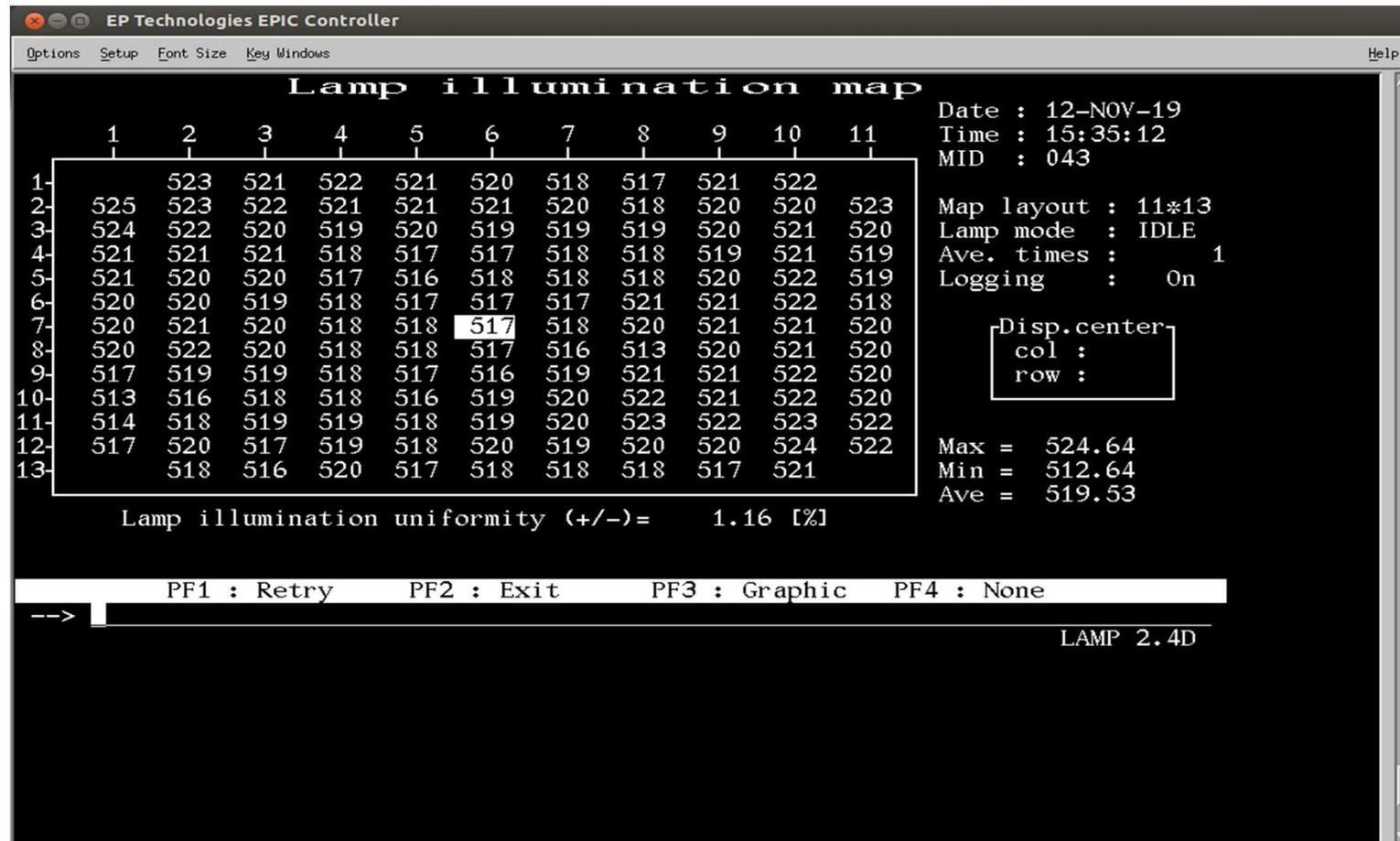
## Reticle Blinds Accuracy

Spec: +0.4mm to +0.8 mm (on reticle)

Reticle Blinds Maximum Exposure Field

**Visual Inspection - Passed**

# Maximum Power and Illumination Uniformity



# Integrated Exposure Control

EP Technologies EPIC Controller

Options Setup Font Size Key Windows Help

--- EXPOSURE STABILITY ---

< Table1 > Date : 13:50:28 11-NOV-19

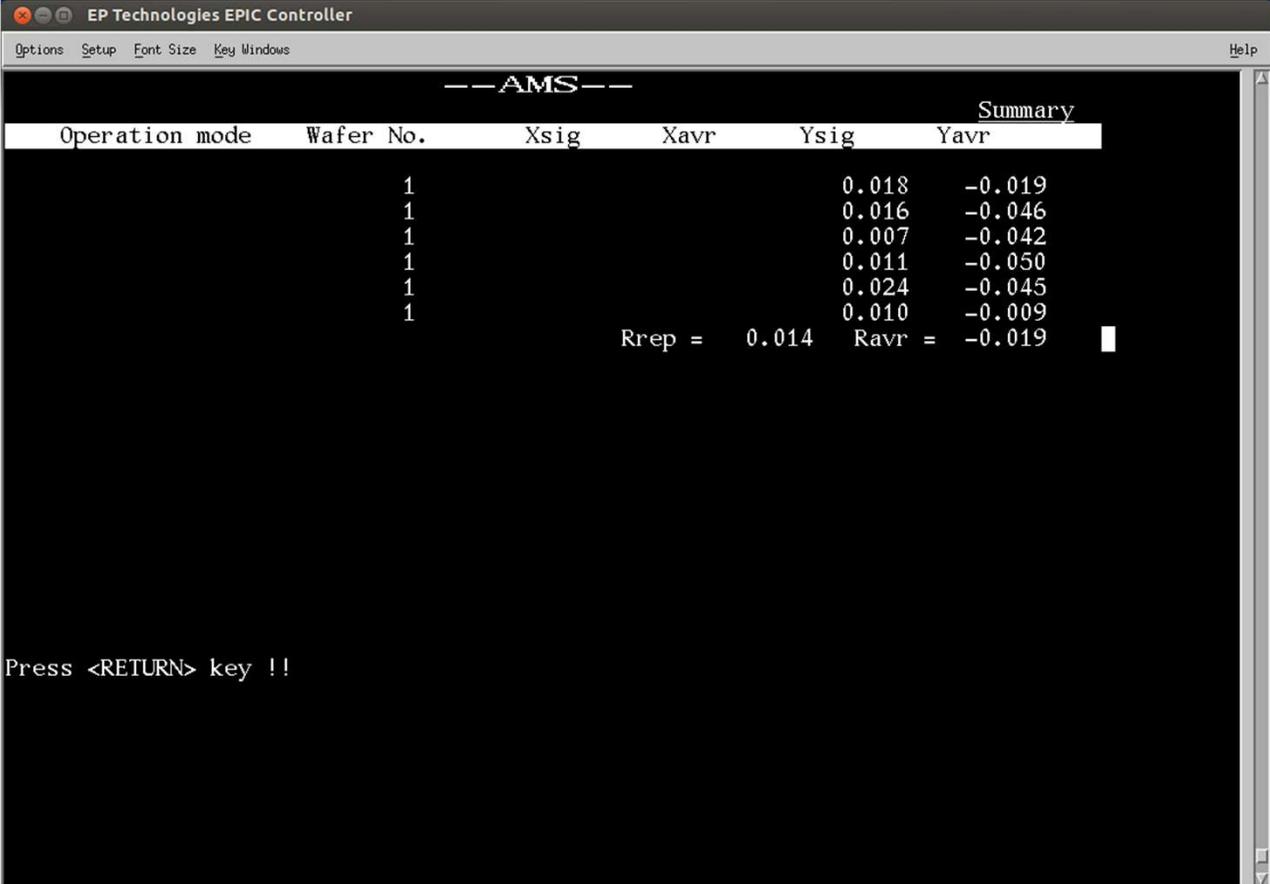
Machine No, : Comment :  
 Machine Type : Lamp life time = 0 Lamp power [I,F] = 0, 0

E. time set	Idle			Flash						
	Exp. time [ms]	Energy [mj/cm2]	Bias [%]	Exp. time [ms]	Energy [mj/cm2]	Bias [%]				
	mes	ideal		mes	ideal					
800	969	0	398.58	400	-0.35	970	0	398.72	400	-0.32
400	488	0	200.18	200	0.09	488	0	200.16	200	0.08
200	246	0	100.86	100	0.86	246	0	100.86	100	0.86
100	126	0	51.34	50	2.68	125	0	51.44	50	2.88
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0

PF1 : None PF2 : Spot menu PF3 : Previous page PF4 : Next page

-->

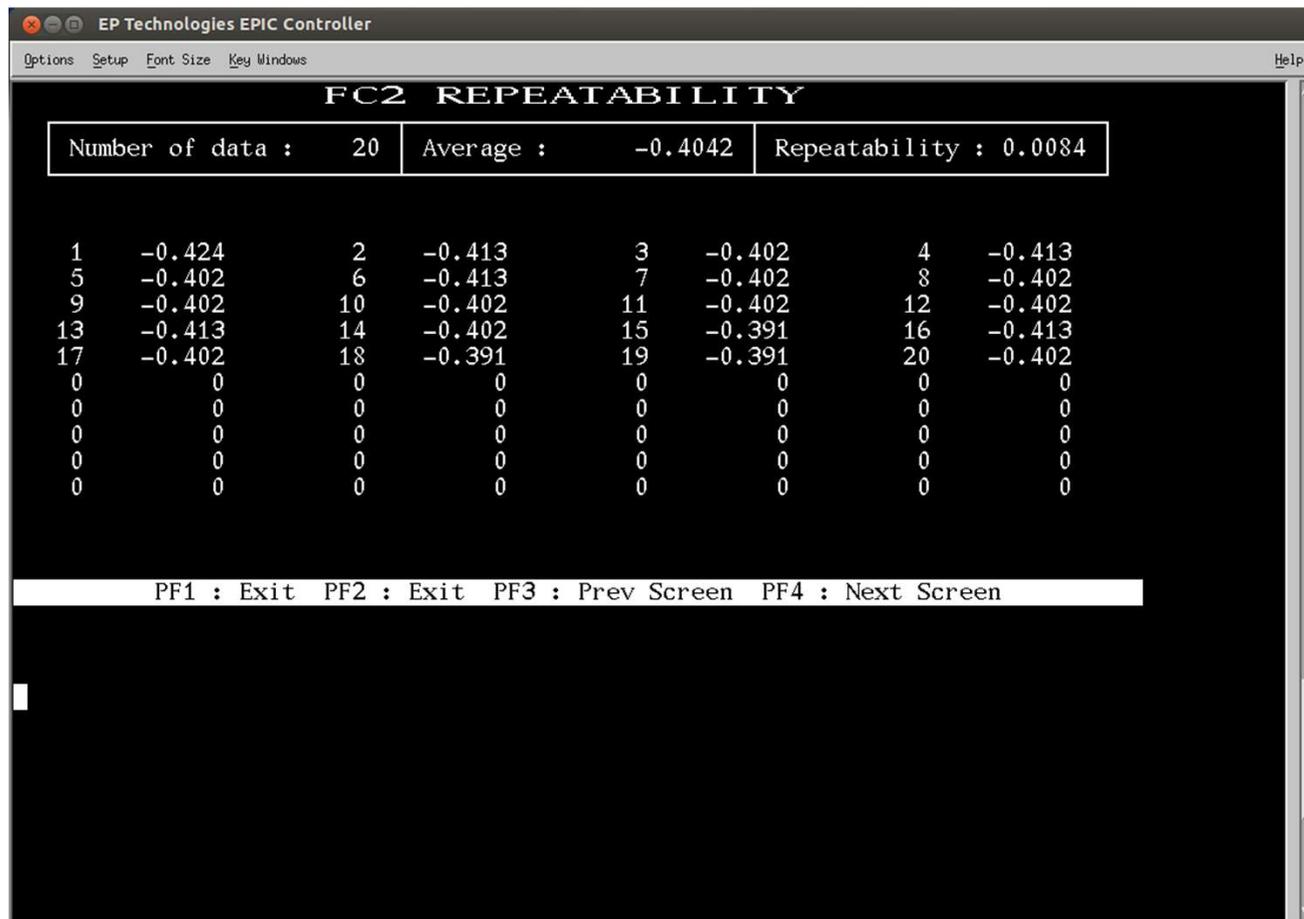
# RETICLE ROTATION



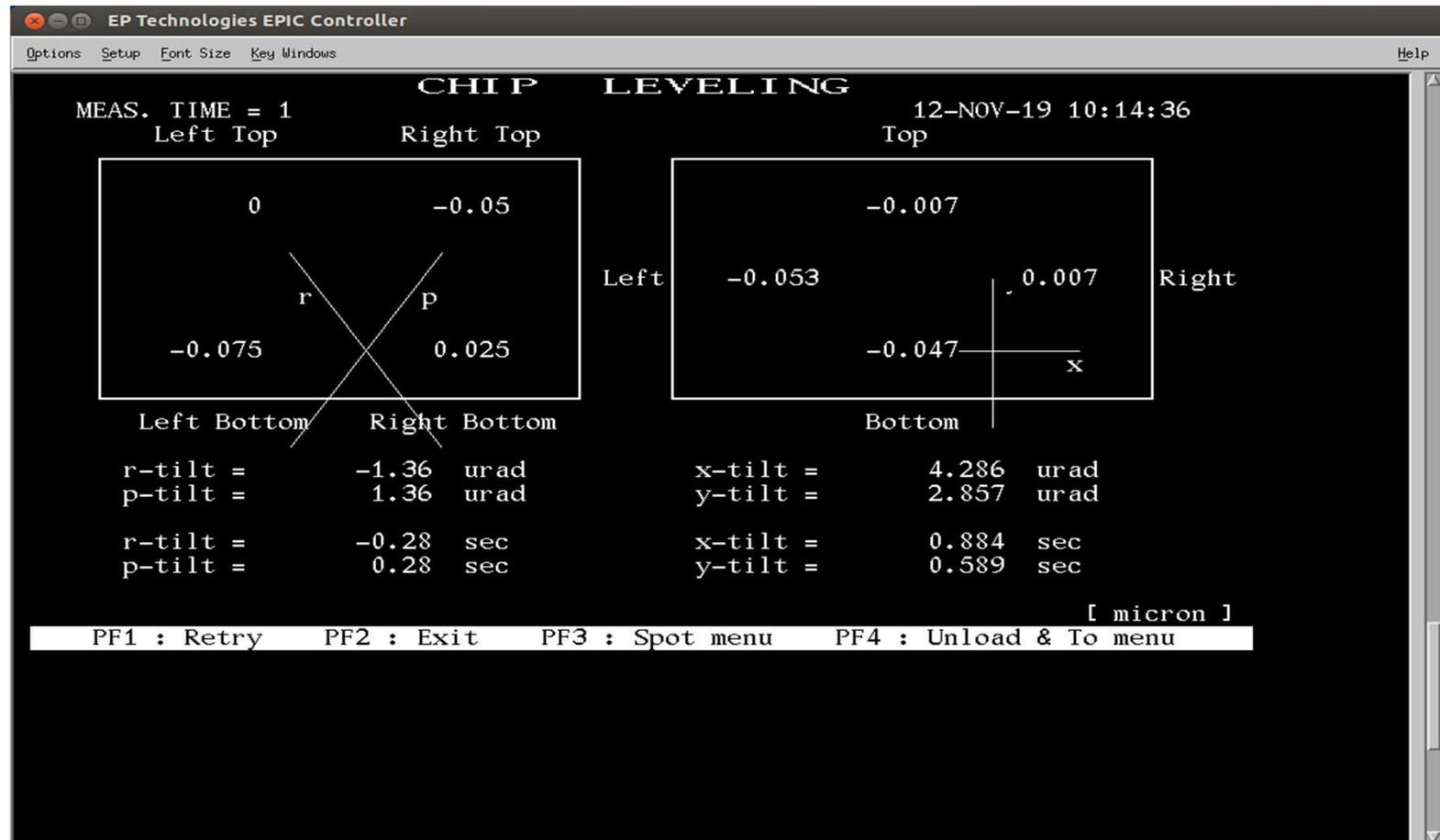
```
EP Technologies EPIC Controller
Options Setup Font Size Key Windows Help
--AMS--
Summary
Operation mode Wafer No. Xsig Xavr Ysig Yavr
1 0.018 -0.019
1 0.016 -0.046
1 0.007 -0.042
1 0.011 -0.050
1 0.024 -0.045
1 0.010 -0.009
Rrep = 0.014 Ravr = -0.019
Press <RETURN> key !!
```

The screenshot shows a terminal window titled "EP Technologies EPIC Controller". The window has a menu bar with "Options", "Setup", "Font Size", "Key Windows", and "Help". The main content area displays a table of data under the heading "--AMS--" and "Summary". The table has six columns: "Operation mode", "Wafer No.", "Xsig", "Xavr", "Ysig", and "Yavr". There are seven rows of data, each with "1" in the first two columns and numerical values in the last four. At the bottom of the table, there are summary statistics: "Rrep = 0.014" and "Ravr = -0.019". Below the table, the text "Press <RETURN> key !!" is displayed.

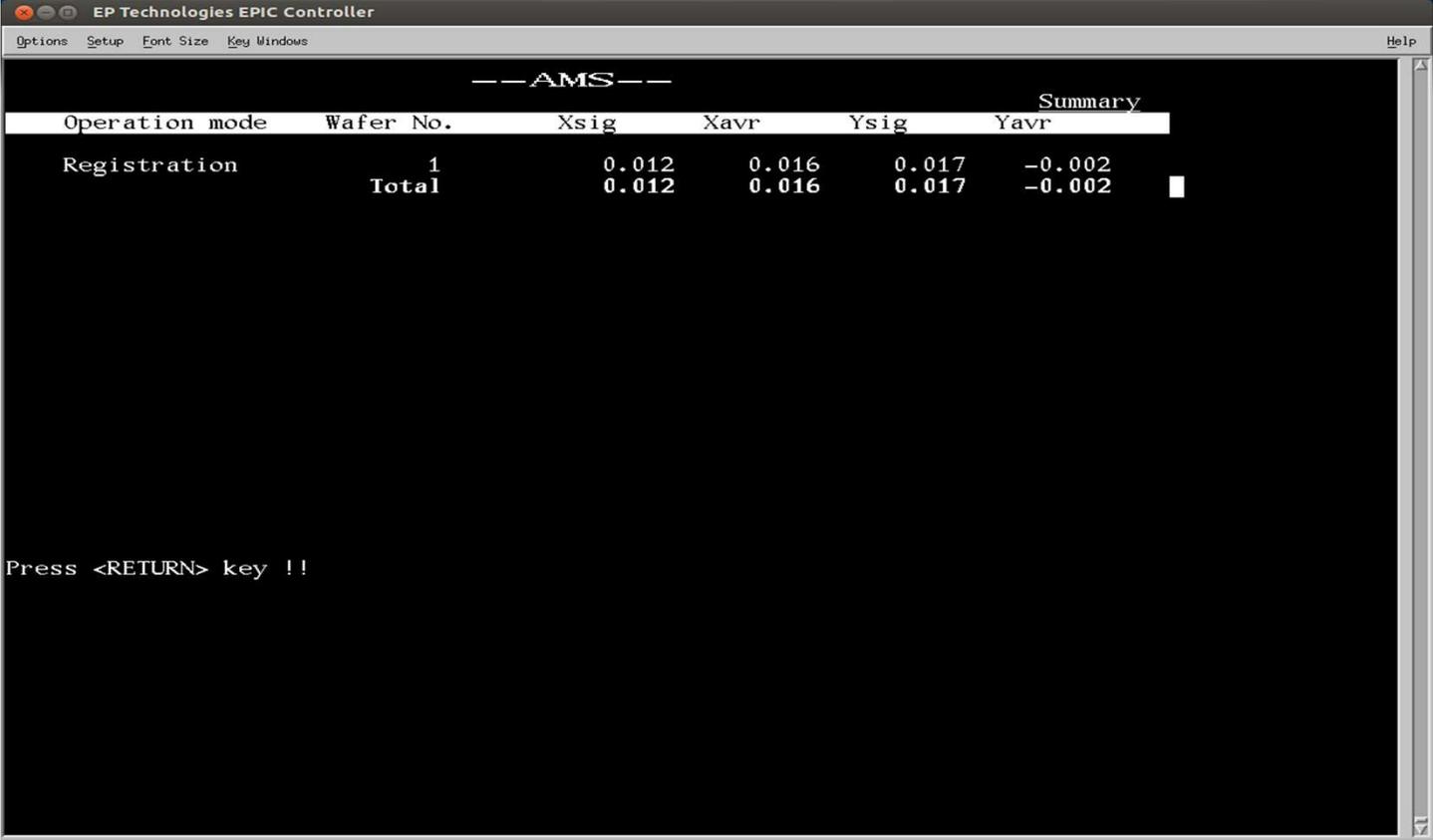
# FOCUS CALIBRATION REPEATABILITY



# Wafer Leveling Accuracy Spec: $\leq 1.5\text{sec}$



# FIA Alignment AccuracySpec: $|M|+3\sigma \leq 90\text{nm}$



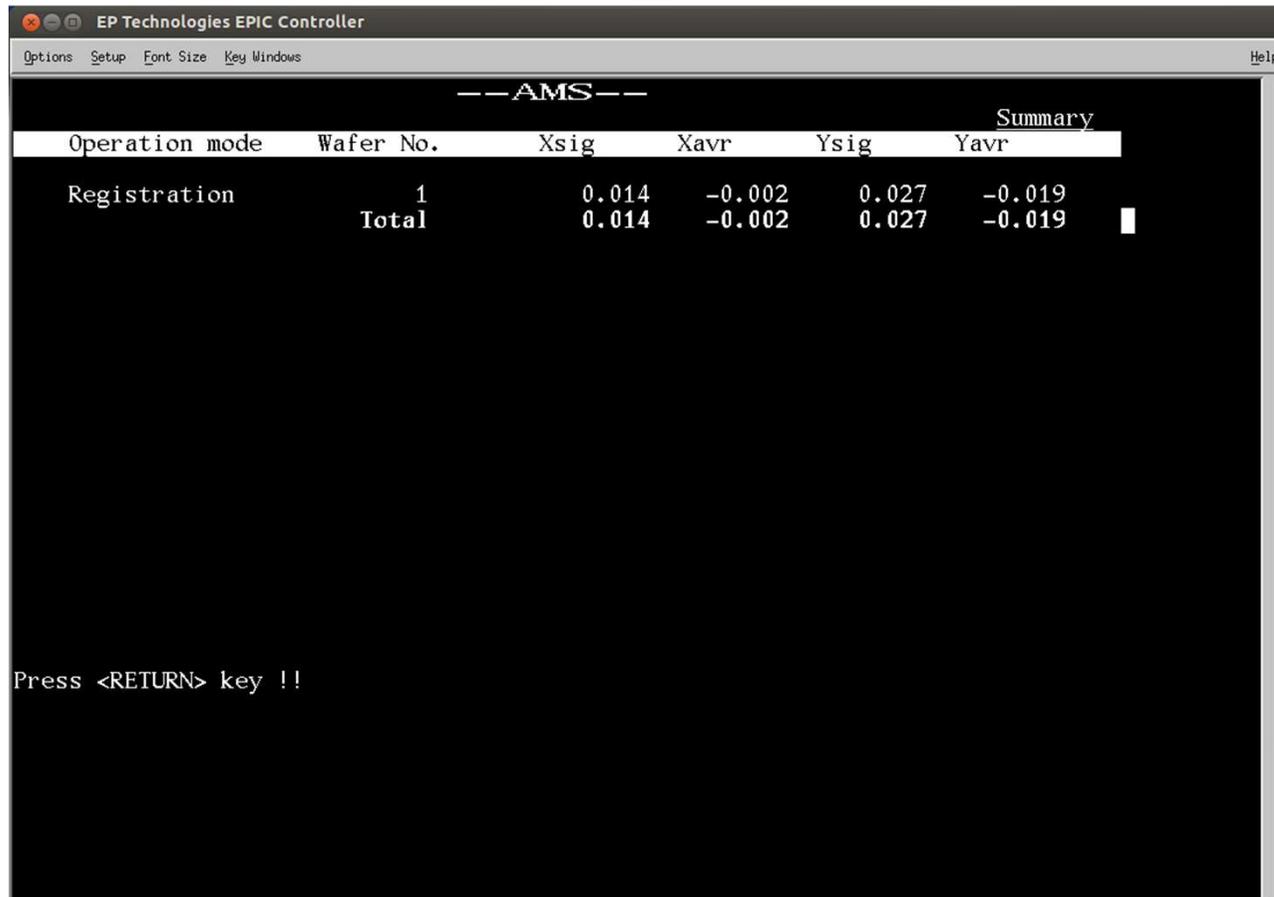
The screenshot shows a terminal window titled "EP Technologies EPIC Controller" with a menu bar containing "Options", "Setup", "Font Size", "Key Windows", and "Help". The main display area shows the following data:

```
--AMS--
```

Operation mode	Wafer No.	Xsig	Xavr	Ysig	Yavr	Summary
Registration	1	0.012	0.016	0.017	-0.002	
	Total	0.012	0.016	0.017	-0.002	

Press <RETURN> key !!

# LSA Alignment Accuracy Spec: $|M|+3\sigma \leq 90\text{nm}$



The screenshot shows a terminal window titled "EP Technologies EPIC Controller" with a menu bar containing "Options", "Setup", "Font Size", "Key Windows", and "Help". The main display area shows the following text:

```
--AMS--
```

Operation mode	Wafer No.	Xsig	Xavr	Ysig	Yavr	Summary
Registration	1	0.014	-0.002	0.027	-0.019	
	<b>Total</b>	<b>0.014</b>	<b>-0.002</b>	<b>0.027</b>	<b>-0.019</b>	

Press <RETURN> key !!

# Orthogonality

$$\text{Orth} = (1.20 + -1.28 = -.08 \text{ Rad}/4.8 \text{ ( Spec } 0.48 \text{ Rad} = .1 \text{ Sec )} = -0.017$$

The image displays two side-by-side screenshots of the EP Technologies EPIC Controller software interface. Both windows show the 'EGA MONITOR' screen for 'Shot No. = 42'. The interface includes a menu bar (Options, Setup, Font Size, Key Windows, Help) and a status bar (PF1: temp. exit, PF2: perm. exit, PF3: prev. page, PF4: next page). The main display area contains a table of data for 32 channels, organized into two columns of 16 channels each. Each channel entry includes a channel number, C and R values, and x and y coordinates. Below the table, summary statistics are provided: Scal. (x,y), Offset(x,y), Orthog., and Rot. values.

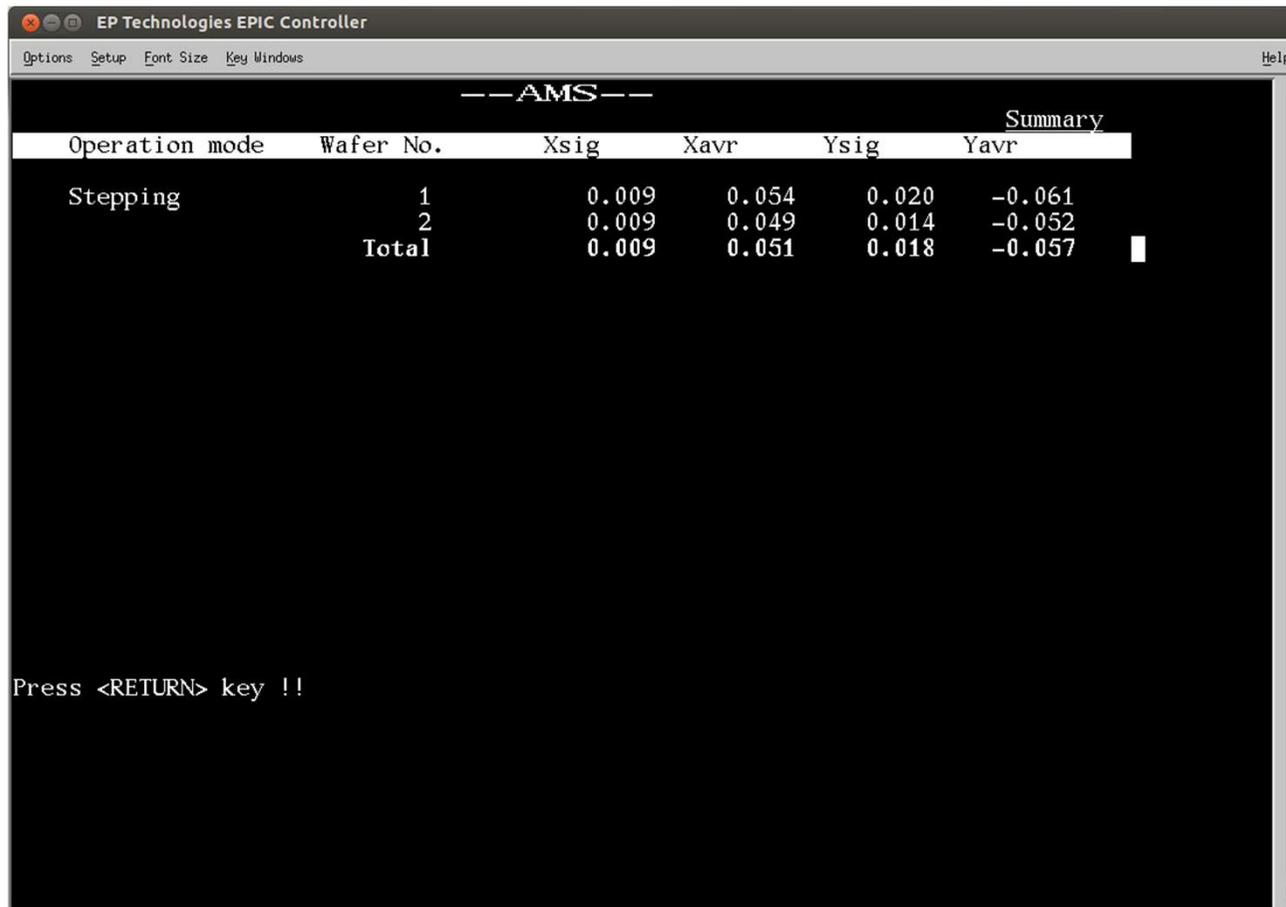
No.	C	R	x	y	No.	C	R	x	y
1	9	6	0.76	-2.69	17	12	1	1.45	-2.56
2	6	6	0.74	-1.76	18	13	1	1.45	-2.61
3	1	9	0.48	-1.29	19	14	2	0.92	-3.23
4	1	6	0.66	-1.26	20	14	3	0.85	-3.24
5	1	5	0.76	-1.27	21	14	4	0.78	-3.22
6	1	4	0.86	-1.30	22	14	5	0.74	-3.23
7	1	3	0.87	-1.32	23	14	6	0.67	-3.21
8	1	2	0.92	-1.33	24	14	9	0.51	-3.27
9	2	1	1.46	-1.89	25	14	10	0.44	-3.24
10	3	1	1.47	-1.95	26	14	11	0.37	-3.24
11	4	1	1.49	-2.03	27	14	12	0.34	-3.23
12	5	1	1.48	-2.09	28	14	13	0.28	-3.27
13	6	1	1.46	-2.14	29	13	14	-0.35	-2.60
14	9	1	1.47	-2.33	30	12	14	-0.32	-2.57
15	10	1	1.44	-2.44	31	11	14	-0.34	-2.53
16	11	1	1.49	-2.48	32	10	14	-0.35	-2.46

Summary statistics for the left screenshot:  
 Scal. (x,y) = ( -0.05, 0.29) Orthog. = 1.20 Rot. = -15.32  
 Offset(x,y) = ( 0.56, -2.29)

Summary statistics for the right screenshot:  
 Scal. (x,y) = ( -0.24, -0.22) Orthog. = -1.28 Rot. = -15.20  
 Offset(x,y) = ( 0.60, -2.17)

# Stage Stepping Precision

## Spec: $3\sigma \leq 60\text{nm}$



The screenshot shows a terminal window titled "EP Technologies EPIC Controller" with a menu bar containing "Options", "Setup", "Font Size", "Key Windows", and "Help". The main content area displays a table with the following data:

--AMS--					
Operation mode	Wafer No.	Xsig	Xavr	Ysig	Yavr
Stepping	1	0.009	0.054	0.020	-0.061
	2	0.009	0.049	0.014	-0.052
	<b>Total</b>	<b>0.009</b>	<b>0.051</b>	<b>0.018</b>	<b>-0.057</b>

Press <RETURN> key !!

# Wafer Prealignment Repeatability

The screenshot shows a terminal window titled "EP Technologies EPIC Controller" with a menu bar containing "Options", "Setup", "Font Size", "Key Windows", and "Help". The main display area has a black background with white text. At the top, it reads "WAFER LOADER REPEATABILITY RESULT". To the right, it shows "Date : 25-OCT-19" and "Time : 11:33:01". Below this, the unit "[micron]" is indicated. A table with four columns and four rows is displayed. The columns are labeled "60 Times", "Y", "THETA", and "X". The rows are labeled "Mean", "Sigma (n-1)", and "Maximum-Minimum". The table data is as follows:

60 Times	Y	THETA	X
Mean	-4.12	-16.2	-11.76
Sigma (n-1)	5.77	6.61	4.54
Maximum-Minimum	26.34	24.96	14.25

Below the table, a white bar contains the text "PF1 : Exit PF2 : Exit PF3 : None PF4 : Next Page". At the bottom right of the terminal, the text "WLRPTW24B WLRPTX24C" is displayed. A cursor is visible on the left side of the terminal window.