“A Comparison of Scrub Marks & Contact Resistance Between Cantilever Type and New MEMS Type Probe Cards”

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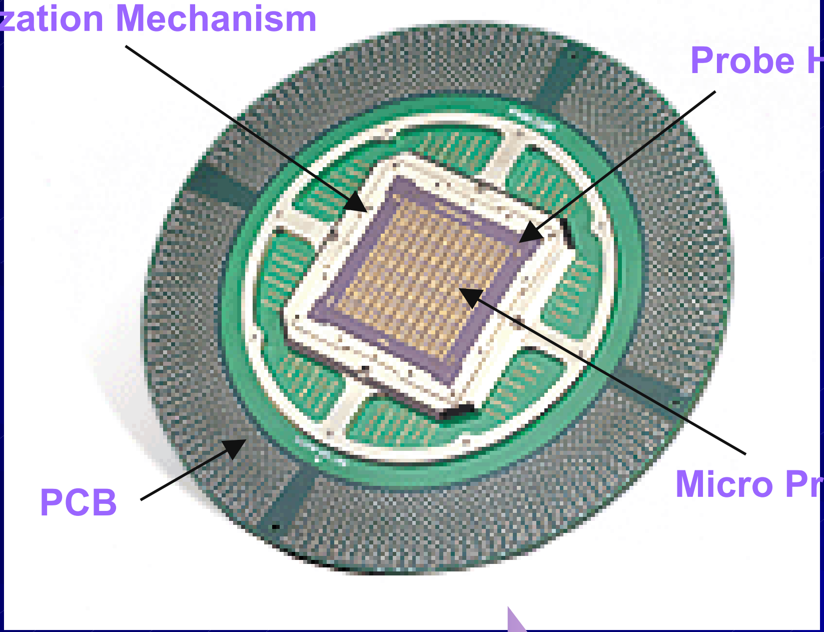
Probe Card Comparison Criteria

- **1. MEMS PROBE CARD**
- **2. Pin Force**
- **3. Probe Planarity**
- **4. Scrub Mark Width/Depth**
- **5. Probe X,Y Alignment**
- **6. Path Resistance**
- **7. Life Time (Number of touchdowns)**
- **8. Bandwidth**
- **9. Specification**

1. MEMS PROBE CARD

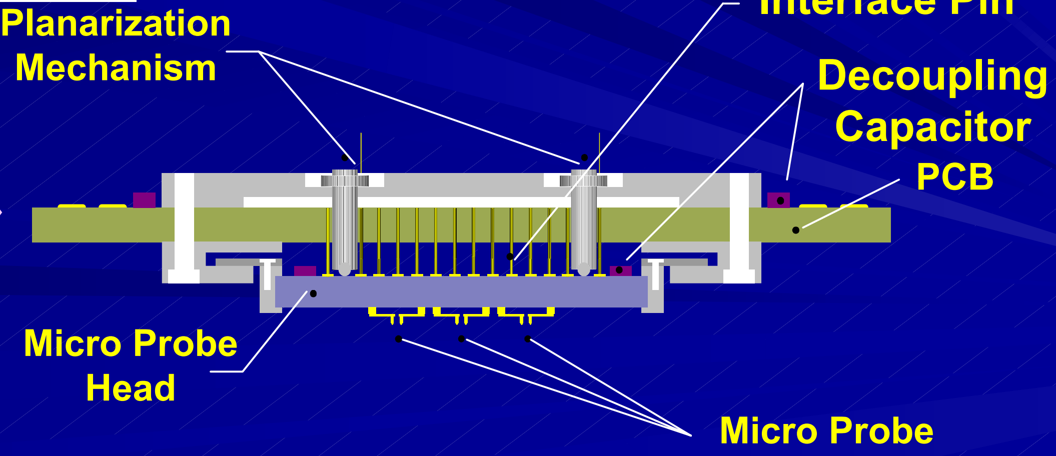
- **Manufactured by MEMS Technology**
- **Vertical Micro Probe**
- **High Multi-DUT**
- **Optional Tip Structure**

MEMS Probe Card View

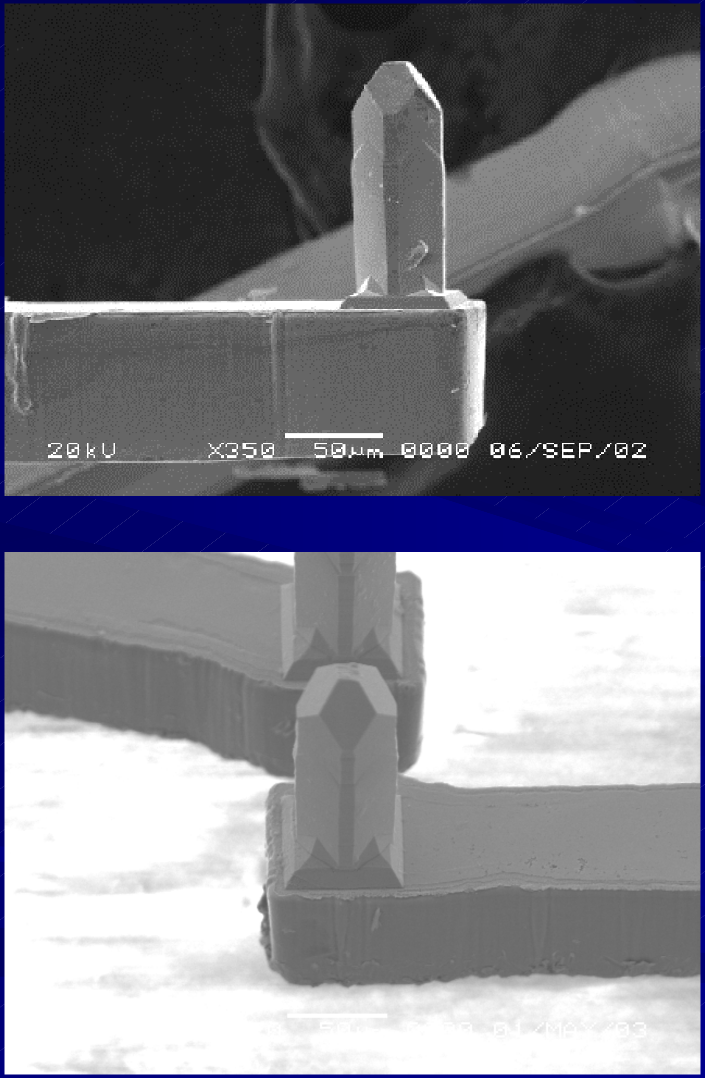


**MEMS Probe Card
- Manufactured by MEMS technology**

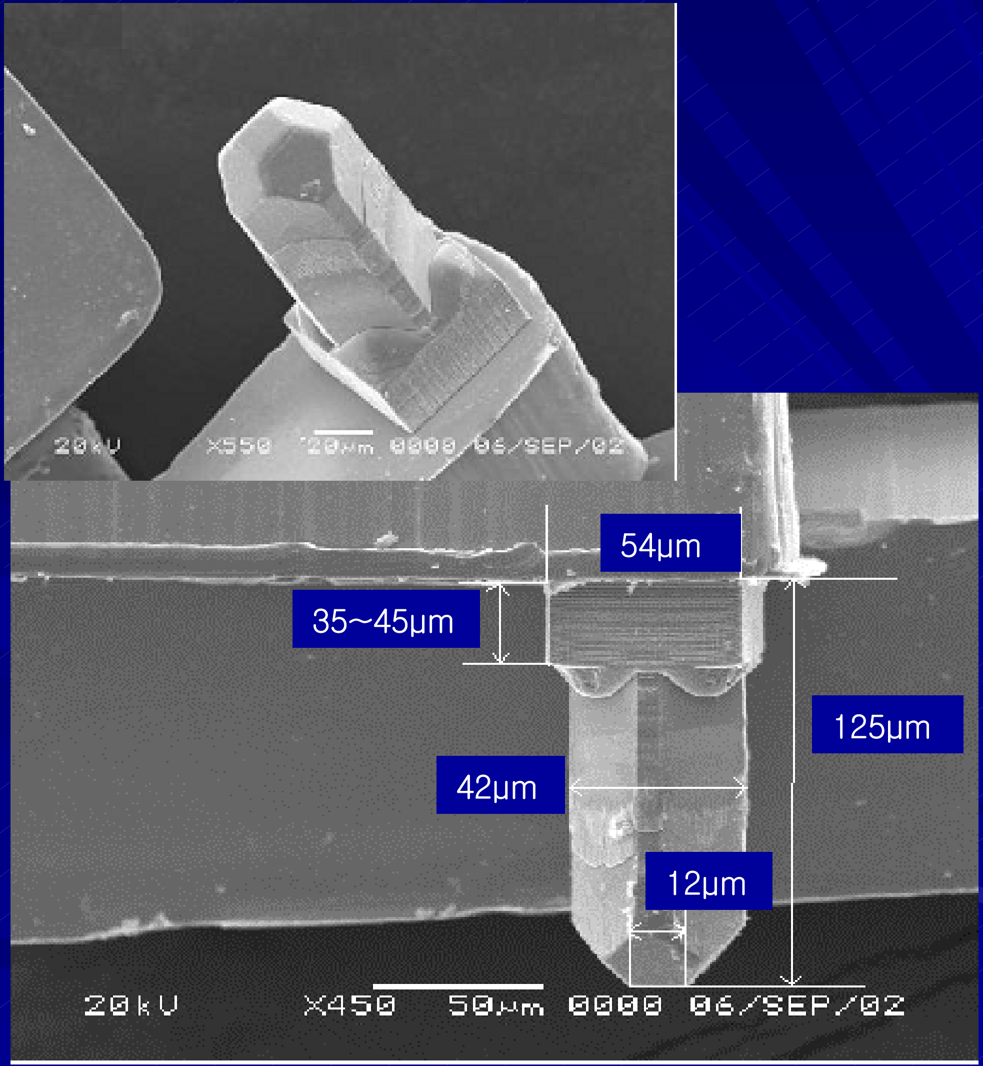
**MEMS Probe Card
side view**



Micro Probe Tips of MEMS



MEMS PT1 Type



MEMS PT2 Type

2. Pin Force

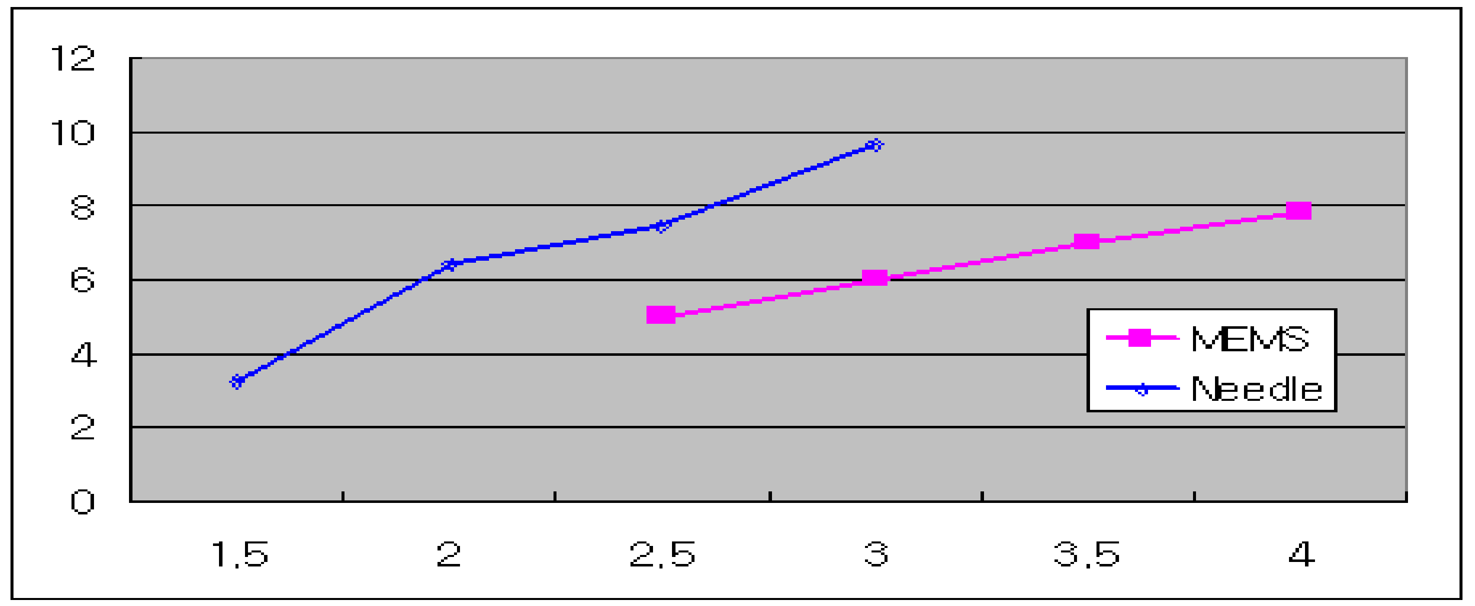
- Overdrive Vs Contact Force

(Unit:gf/mil)

O.D Value	1.5mil	2mil	2.5 mil	3 mil	3.5 mil	4 mil
MEMS P/C	-	-	5.0	6.0	7.0	7.8
Needle P/C	4.6	6.4	7.4	9.7	-	-

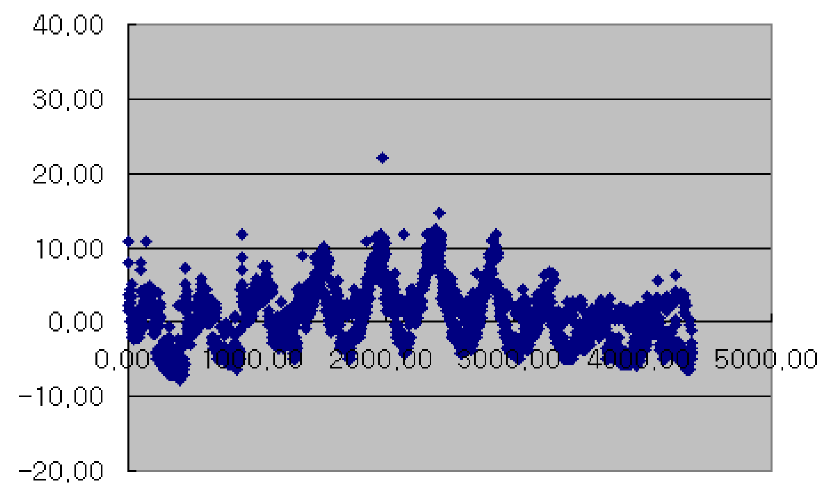
- Graph

(Unit:gf/mil)



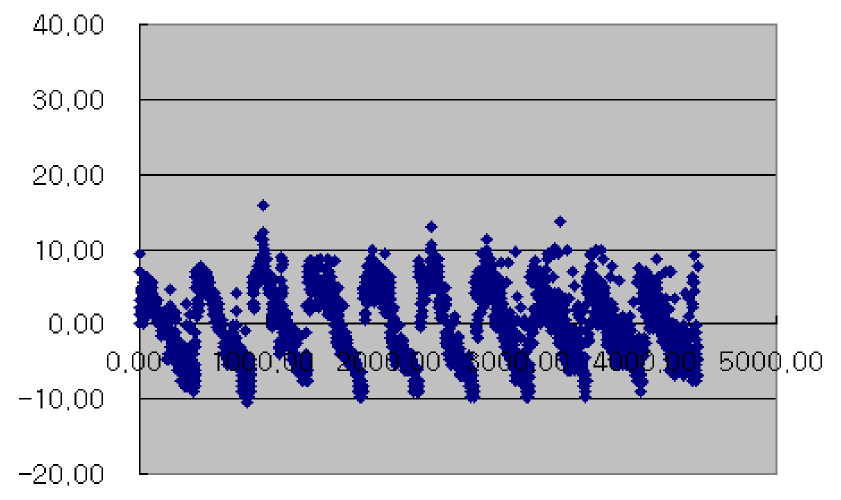
3. Probe Planarity (MEMS P/C 64 DUT)

- The planarity after 29,600 touchdowns
- T/D is real contact number on production line



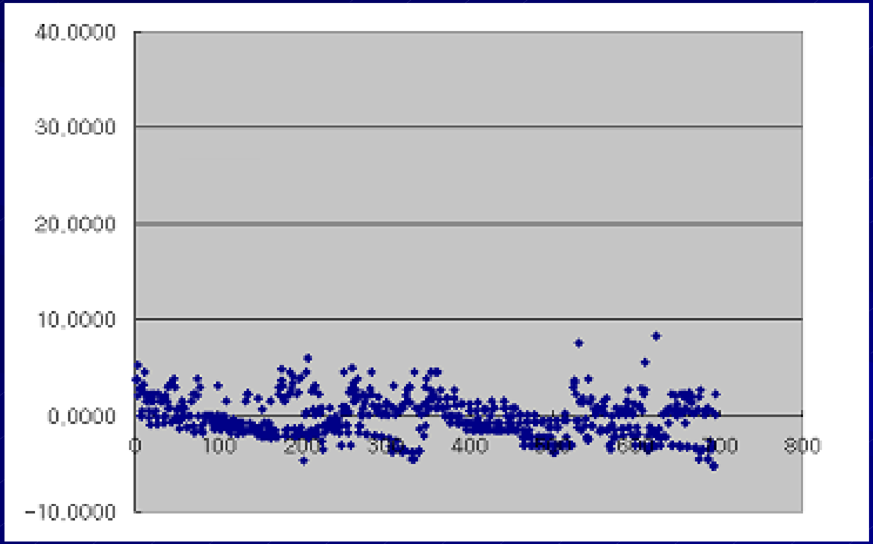
Before TDS

After 29600 TDS (Unit:um)



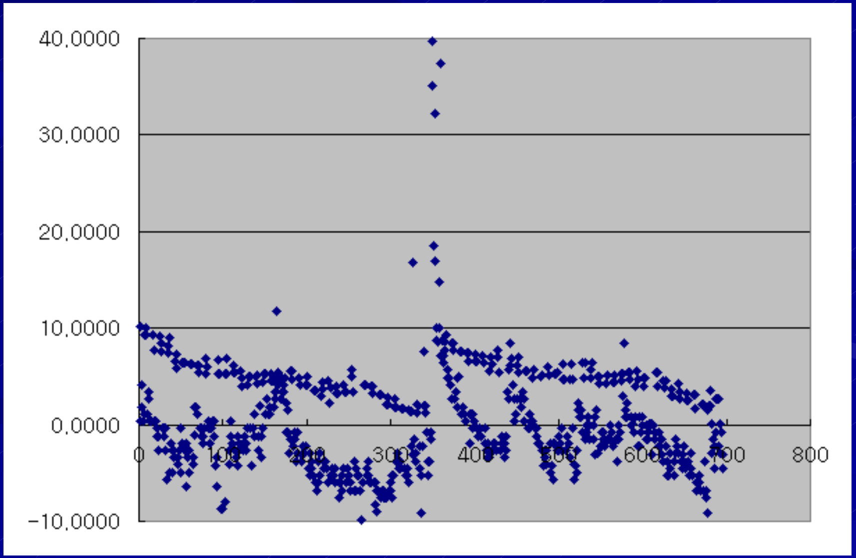
Probe Planarity (NEEDLE TYPE P/C)

- **The Planarity after 29,600 Touchdowns**
- **Touchdown Test in EG 4090 Prober System without Signal**



Before TDS

After 29600 TDS **(Unit:um)**



Probe Planarity (PRVX)

- Touchdowns Vs Planarity (Max.-Min.).

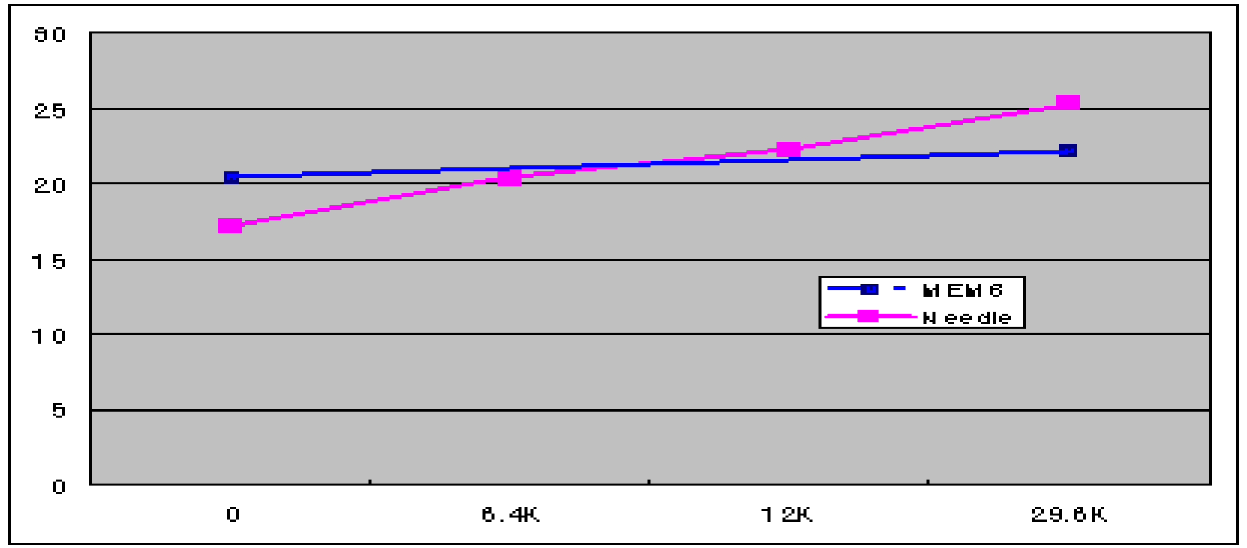
Measure the Pin Planarity after touchdowns

TD of MEMS P/C is real contact number on production line

TD of Needle P/C is internal test data on EG 4090 Prober

(Unit:um)

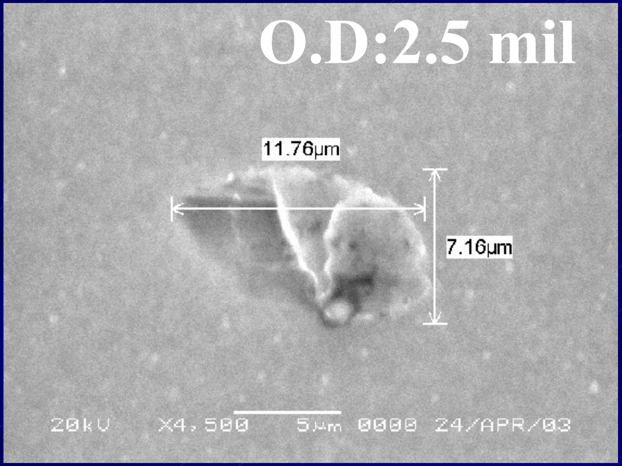
TDS	0	6.4K	12K	29.6K
MEMS P/C	20.3564			22.1466
Needle P/C	17.2214	20.3249	22.2424	25.2181

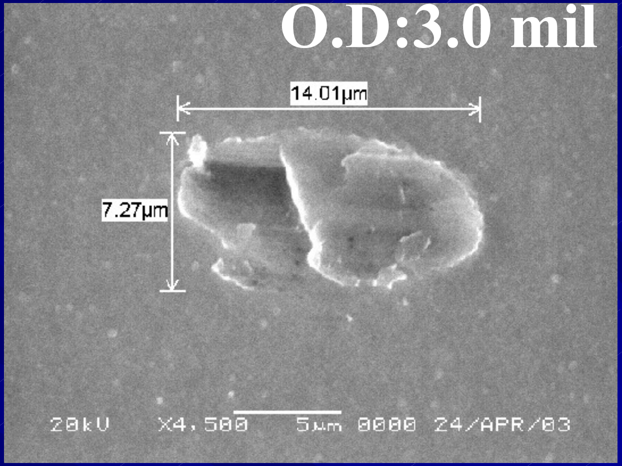


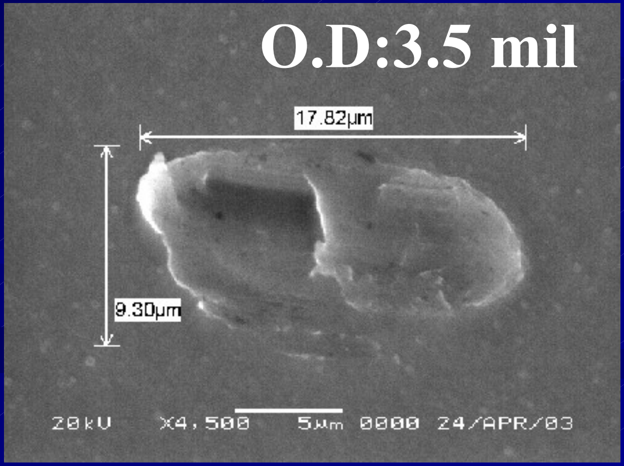
4. Scrub Mark Width/Depth

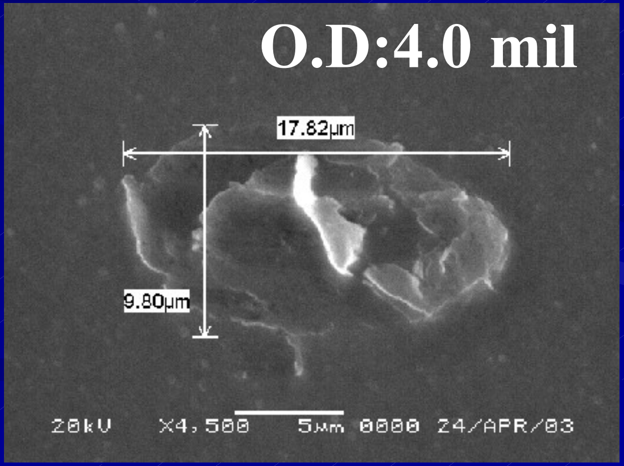
- PT1 Tip Scrub Mark Width/Depth
- PT2 Tip Scrub Mark Width/Depth
- Needle Scrub Mark Width/Depth

PT1 Tip Scrub Mark Width (SEM)

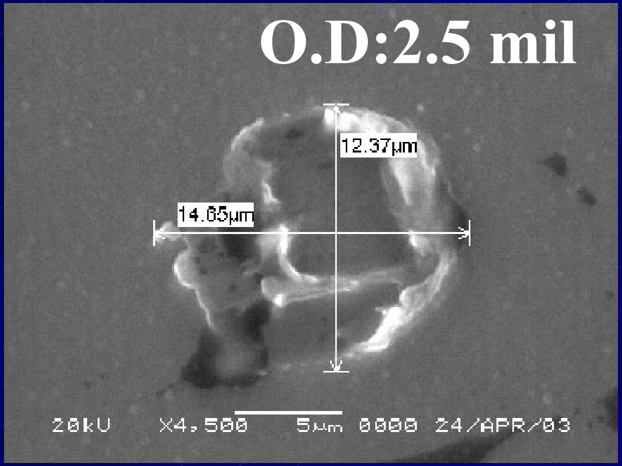

O.D:2.5 mil


O.D:3.0 mil

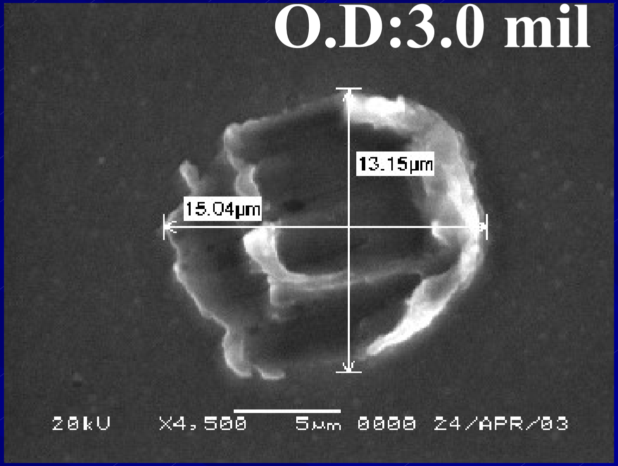

O.D:3.5 mil


O.D:4.0 mil

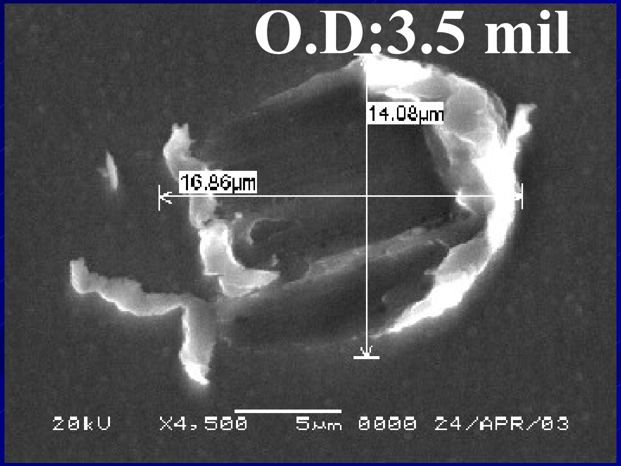
PT2 Tip Scrub Mark Width (SEM)



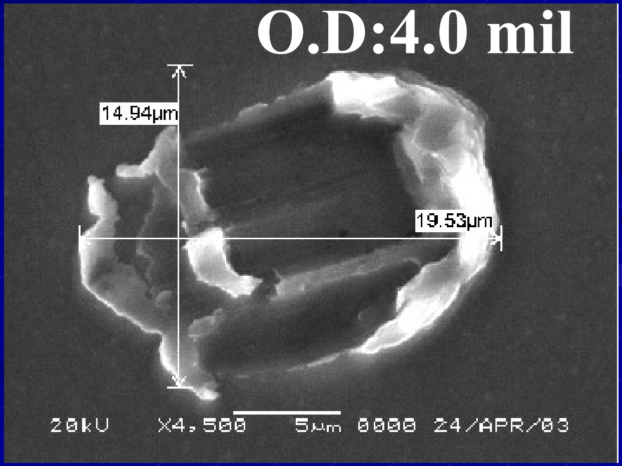
O.D:2.5 mil



O.D:3.0 mil

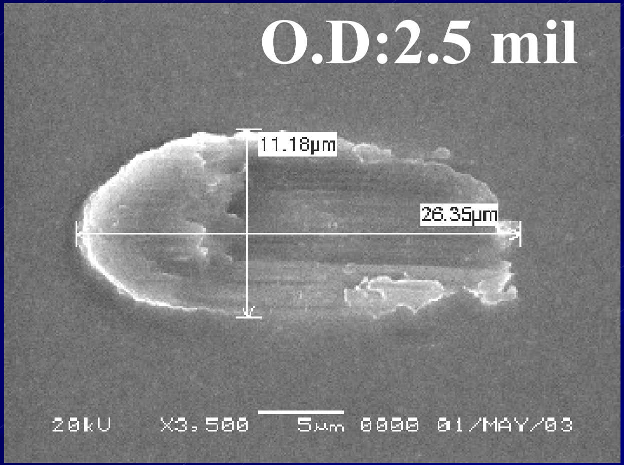


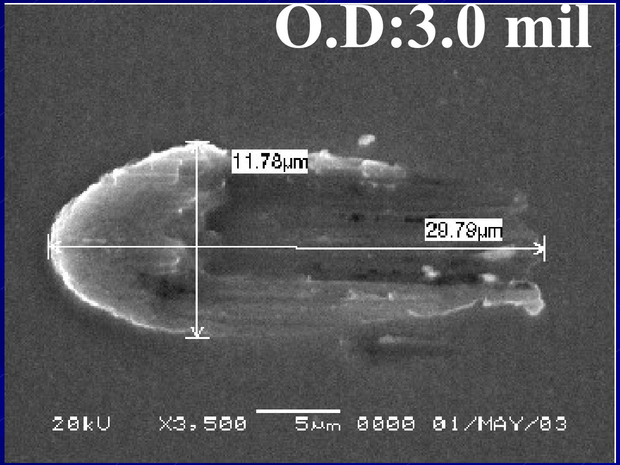
O.D:3.5 mil

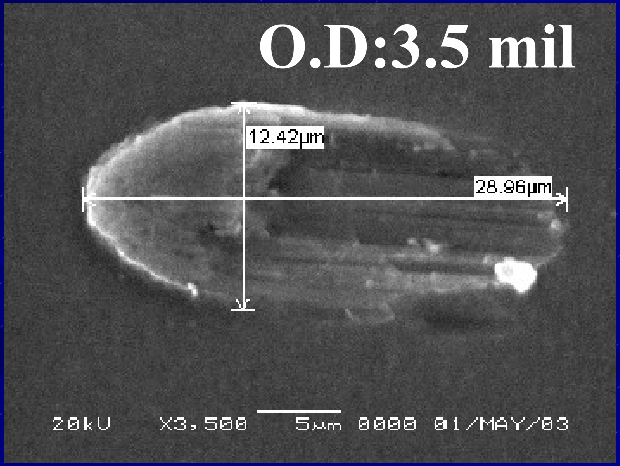


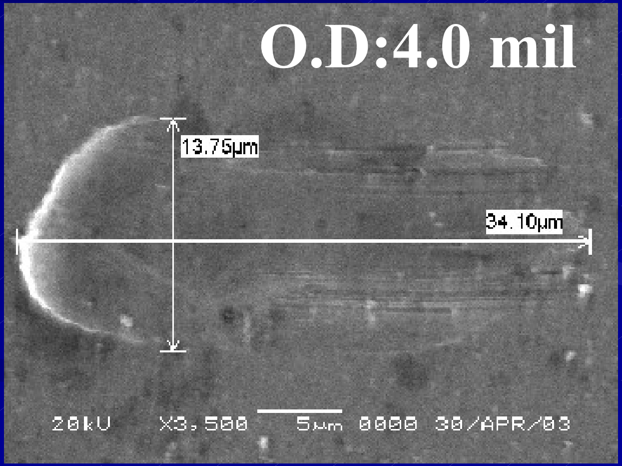
O.D:4.0 mil

Needle Scrub Mark Width (SEM)

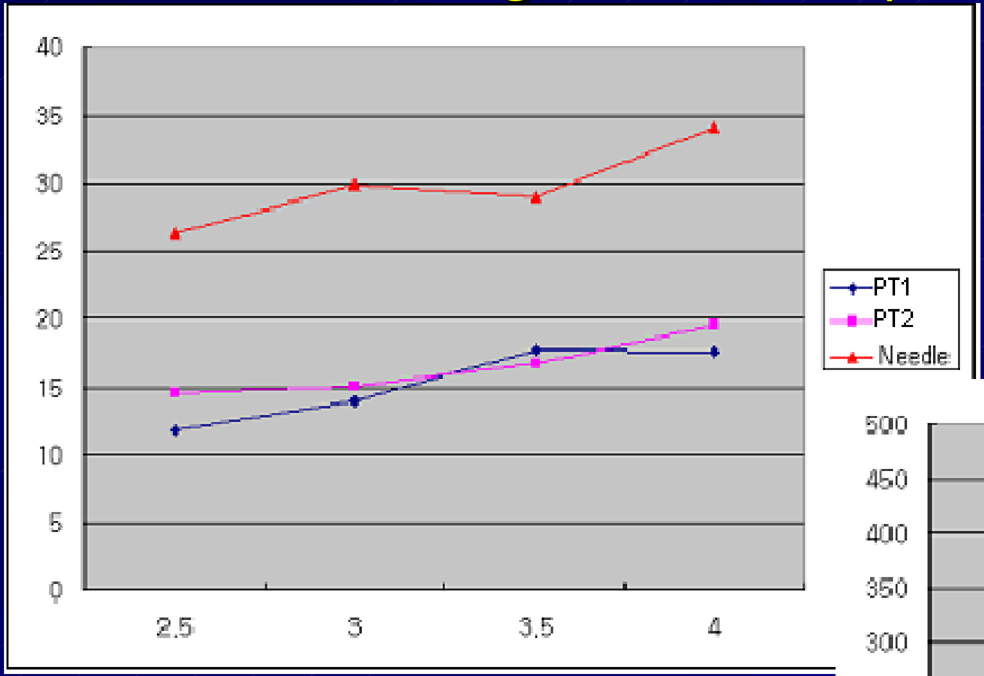

O.D:2.5 mil


O.D:3.0 mil

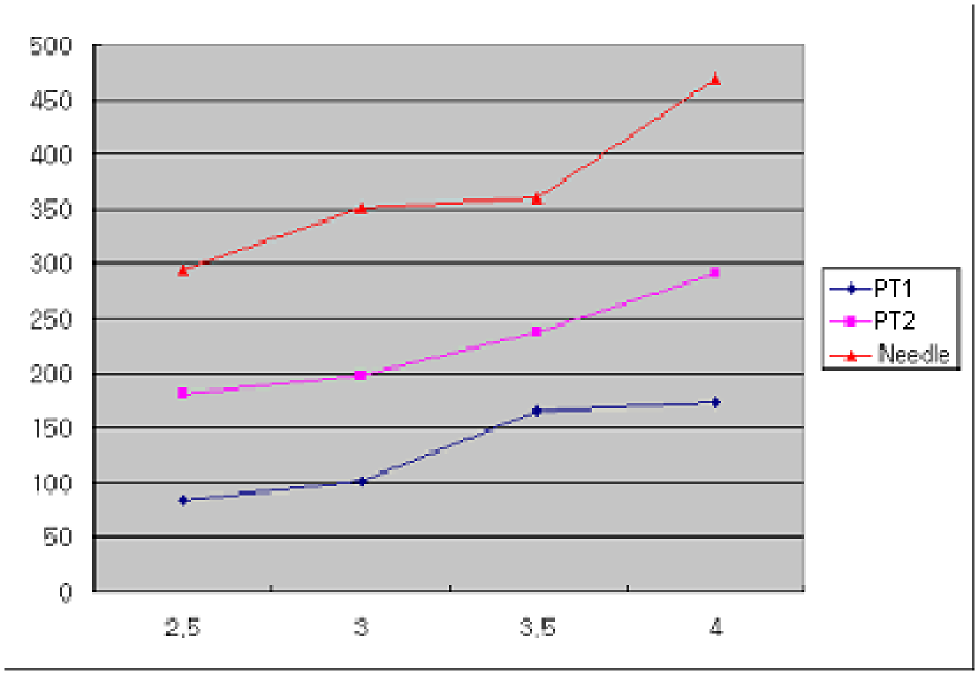

O.D:3.5 mil


O.D:4.0 mil

Scrub Length & Area (all types are compared)



Scrub Mark X trend



Scrub Mark X*Y trend

Scrub Mark Depth Measurement Equipment

Model: SIS-1200

Interscan System

Z-Resolution : EPSI 1nm

PSI 0.1nm

Lateral Resolution :MAX0.64um

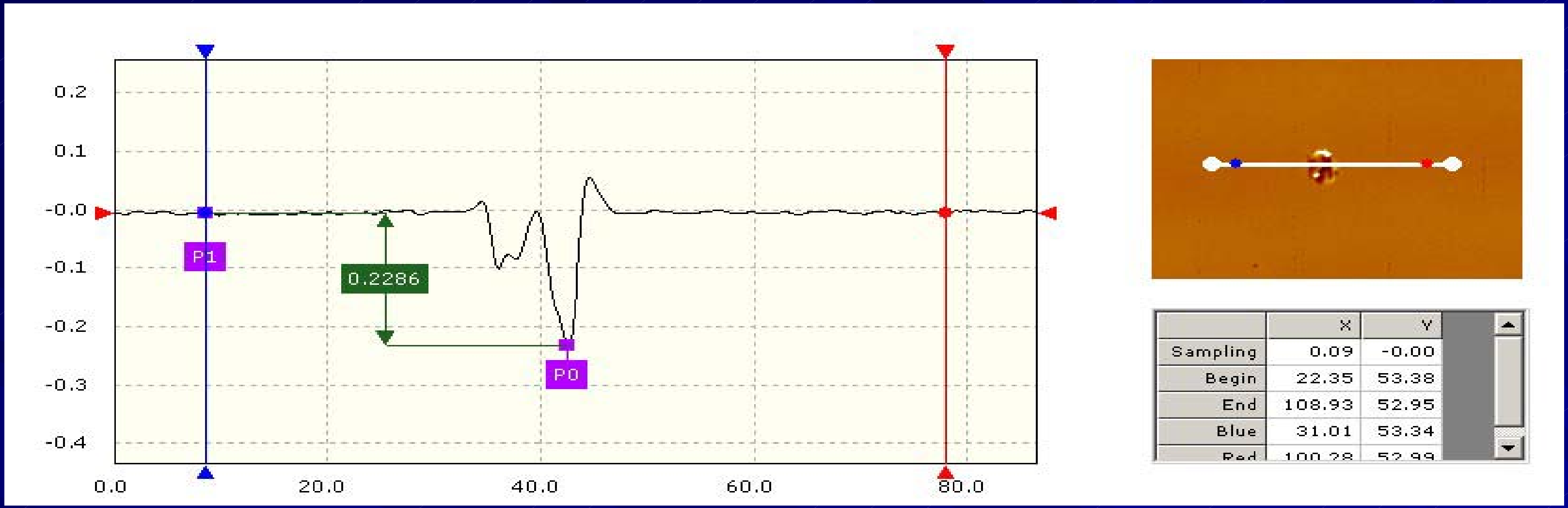
Lens : 50X

L/R:0.64um

Field of View : 0.14 x 0.10mm

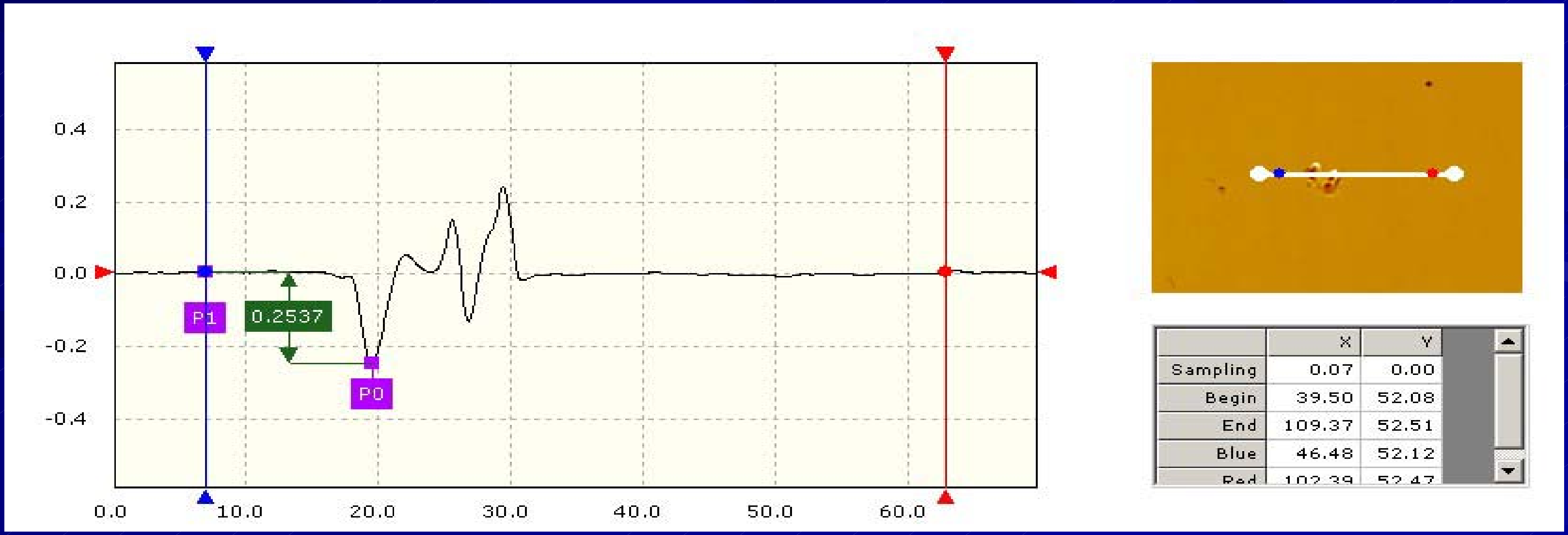
PT1 Tip Scrub Depth

O.D:2.5 mil



	X	Y
Sampling	0.09	-0.00
Begin	22.35	53.38
End	108.93	52.95
Blue	31.01	53.34
Red	100.28	52.99

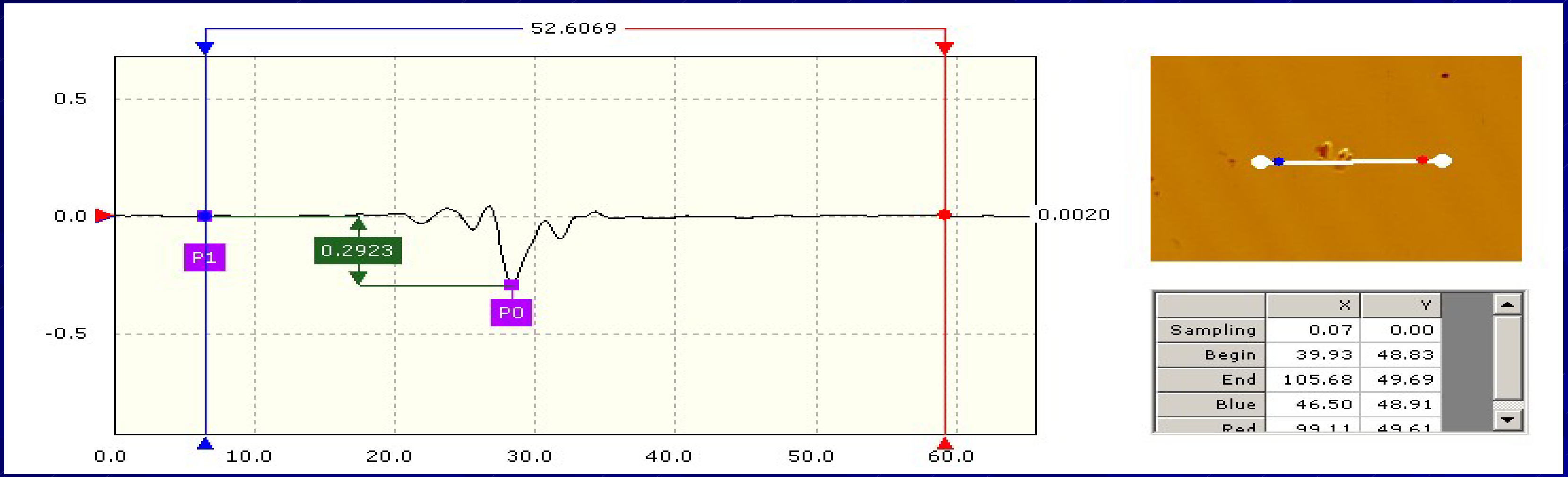
O.D:3.0 mil



	X	Y
Sampling	0.07	0.00
Begin	39.50	52.08
End	109.37	52.51
Blue	46.48	52.12
Red	102.39	52.47

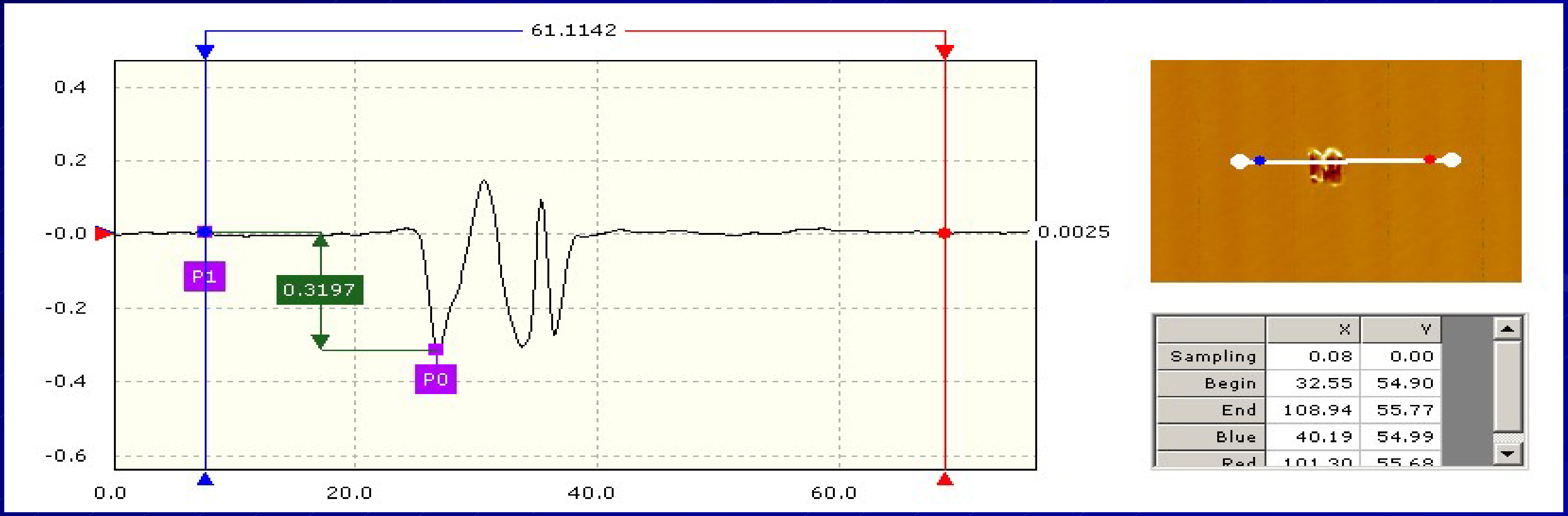
PT1 TIP Scrub Depth

O.D:3.5 mil



	X	Y
Sampling	0.07	0.00
Begin	39.93	48.83
End	105.68	49.69
Blue	46.50	48.91
Red	99.11	49.61

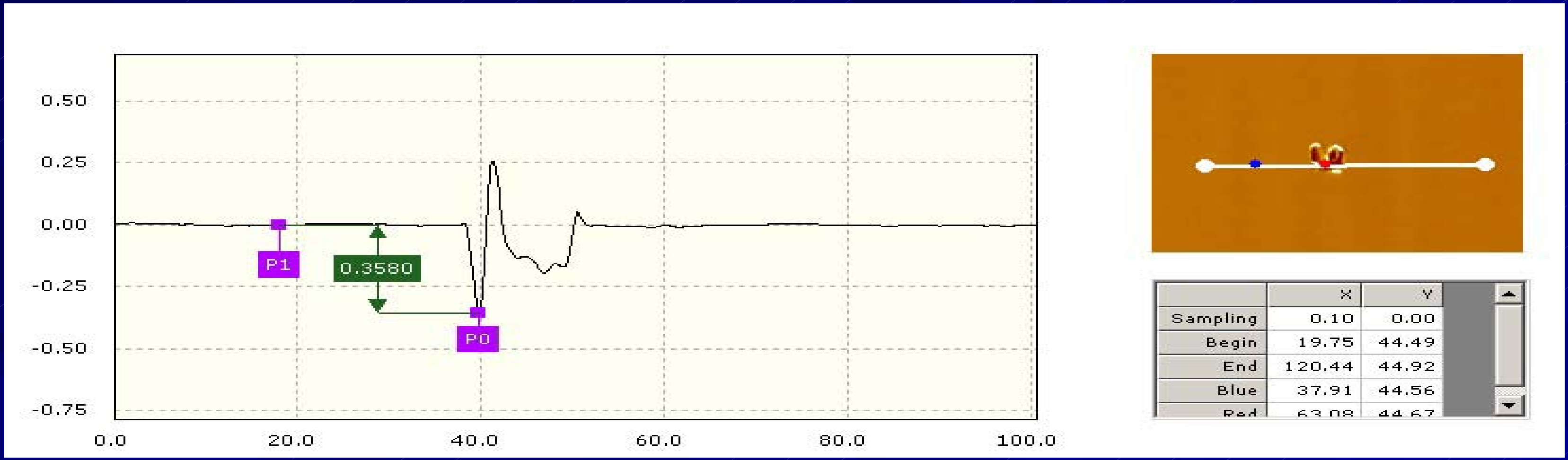
O.D:4.0 mil



	X	Y
Sampling	0.08	0.00
Begin	32.55	54.90
End	108.94	55.77
Blue	40.19	54.99
Red	101.30	55.68

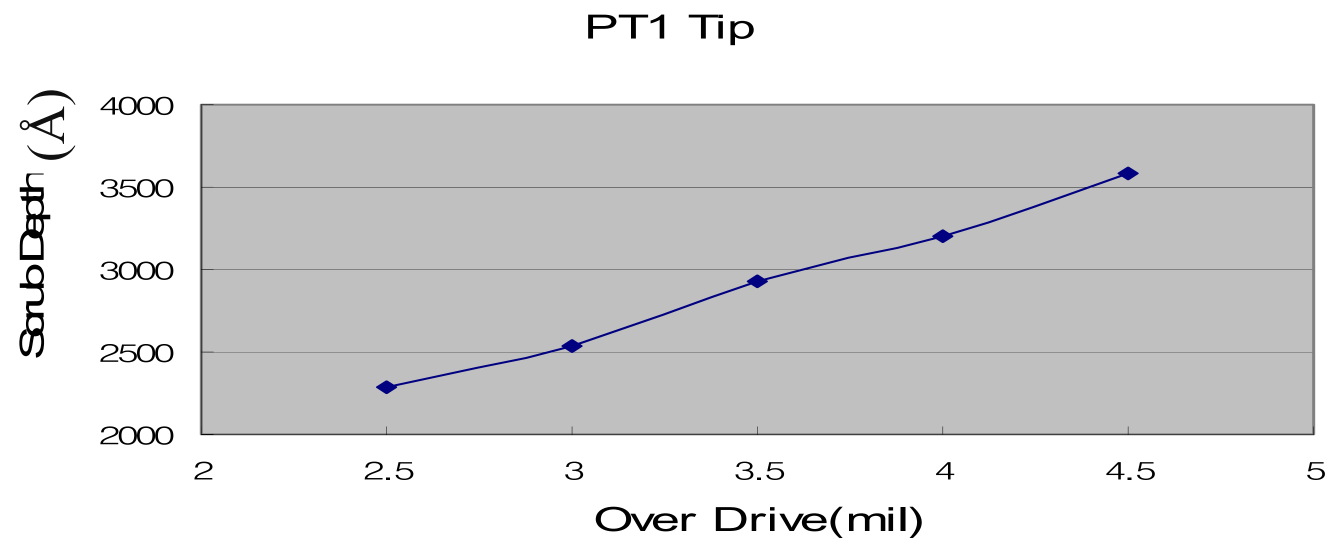
PT1 Tip Scrub Depth

O.D:4.5 mil



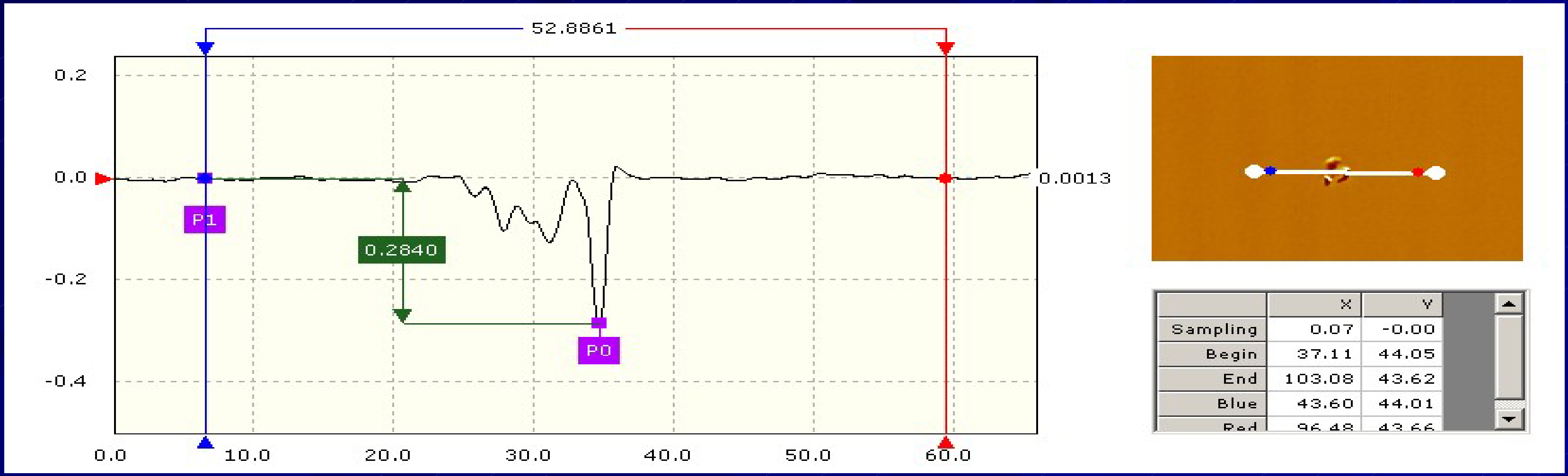
	X	Y
Sampling	0.10	0.00
Begin	19.75	44.49
End	120.44	44.92
Blue	37.91	44.56
Red	63.08	44.67

PT1 Tip Scrub Depth Trend



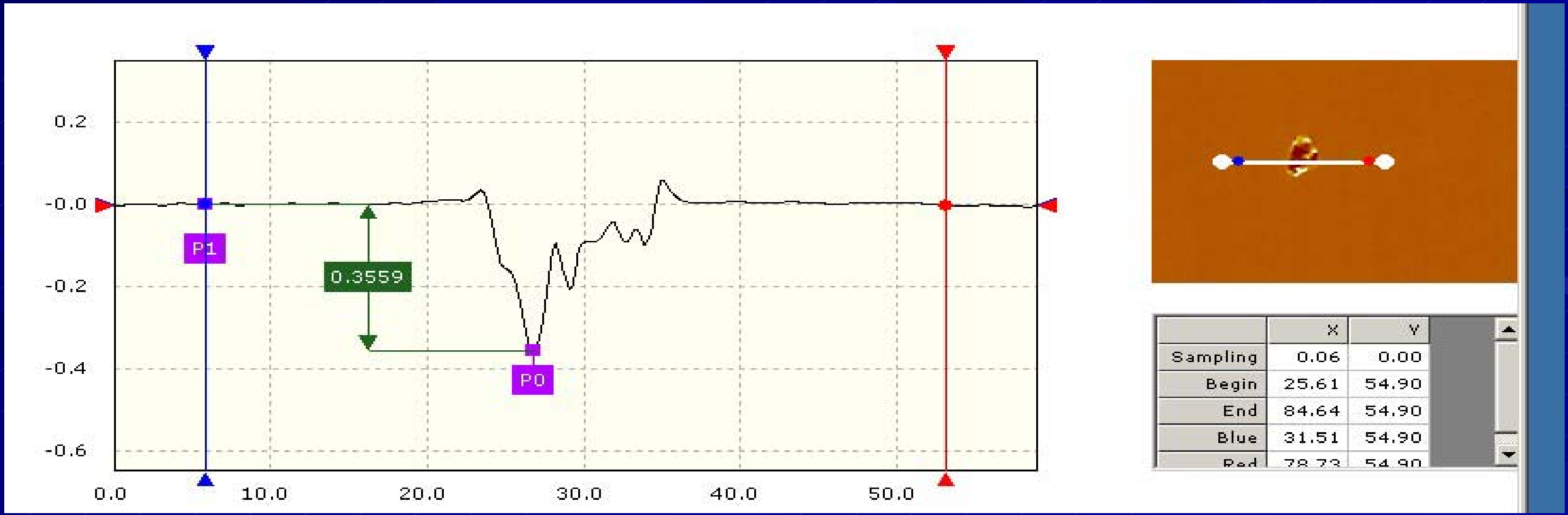
PT2 Tip Scrub Depth

O.D:2.5 mil



	X	Y
Sampling	0.07	-0.00
Begin	37.11	44.05
End	103.08	43.62
Blue	43.60	44.01
Red	96.48	43.66

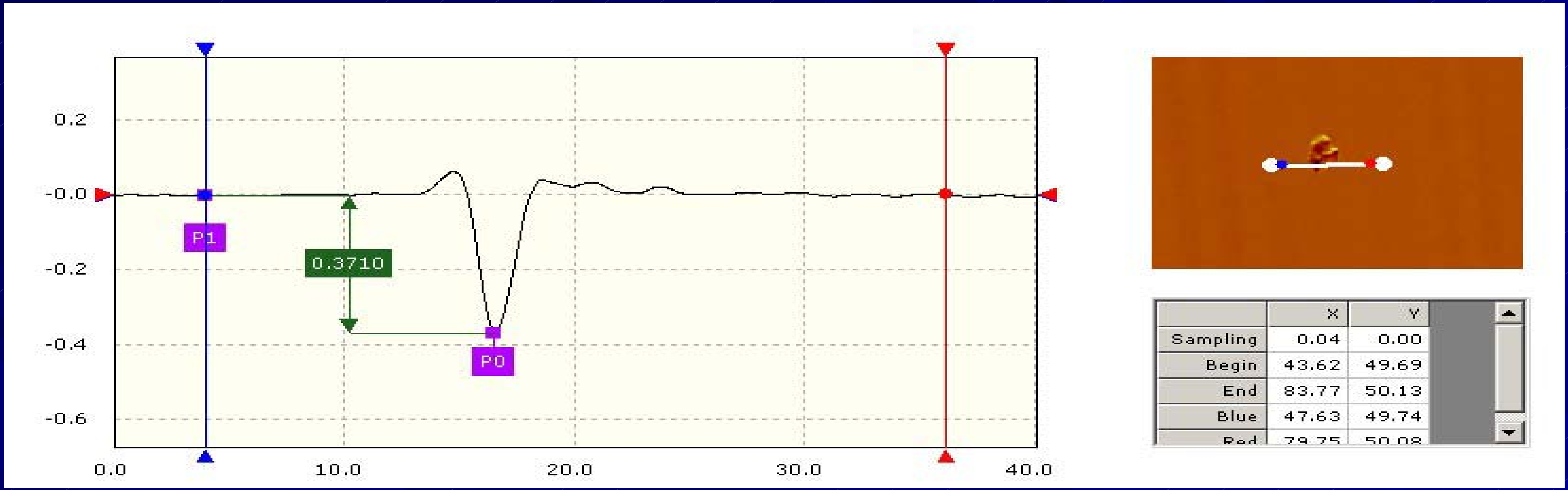
O.D:3.0 mil



	X	Y
Sampling	0.06	0.00
Begin	25.61	54.90
End	84.64	54.90
Blue	31.51	54.90
Red	78.73	54.90

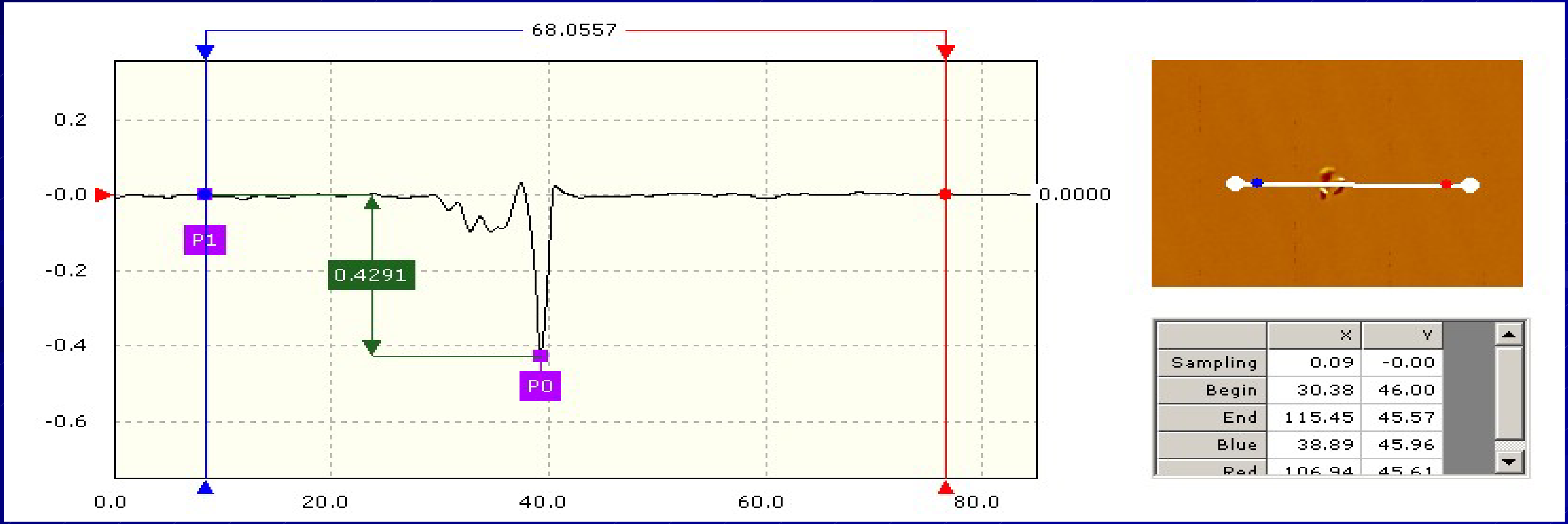
PT2 Tip Scrub Depth

O.D:3.5 mil



	X	Y
Sampling	0.04	0.00
Begin	43.62	49.69
End	83.77	50.13
Blue	47.63	49.74
Red	79.75	50.08

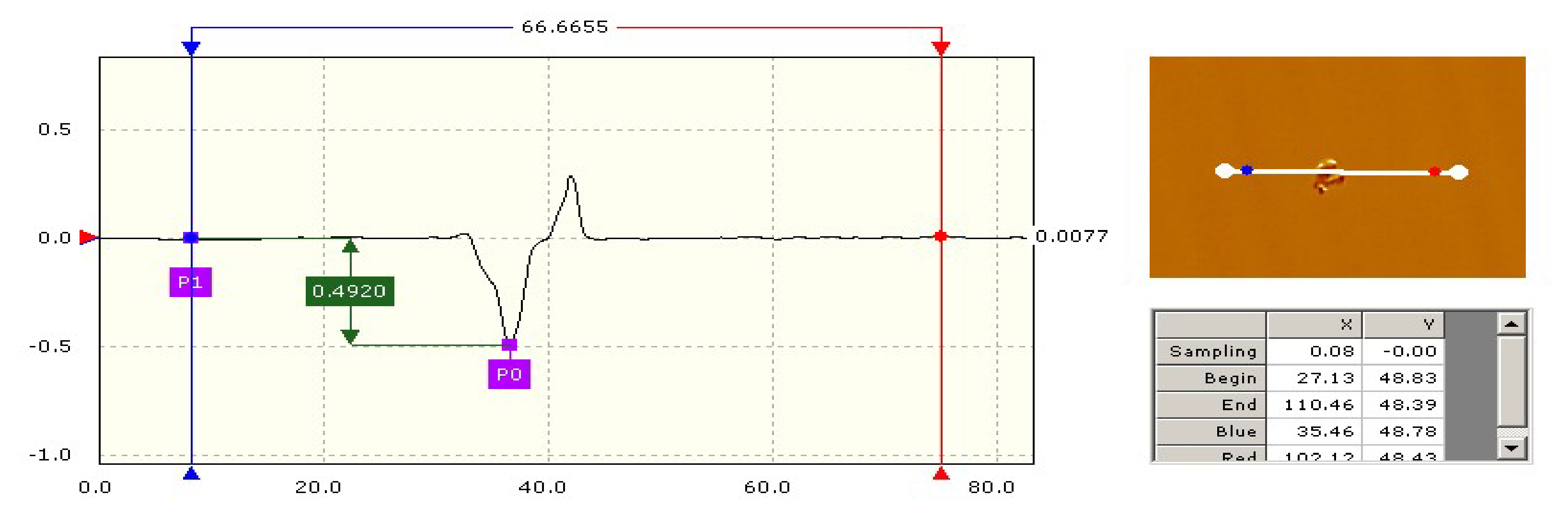
O.D:4.0 mil



	X	Y
Sampling	0.09	-0.00
Begin	30.38	46.00
End	115.45	45.57
Blue	38.89	45.96
Red	106.94	45.61

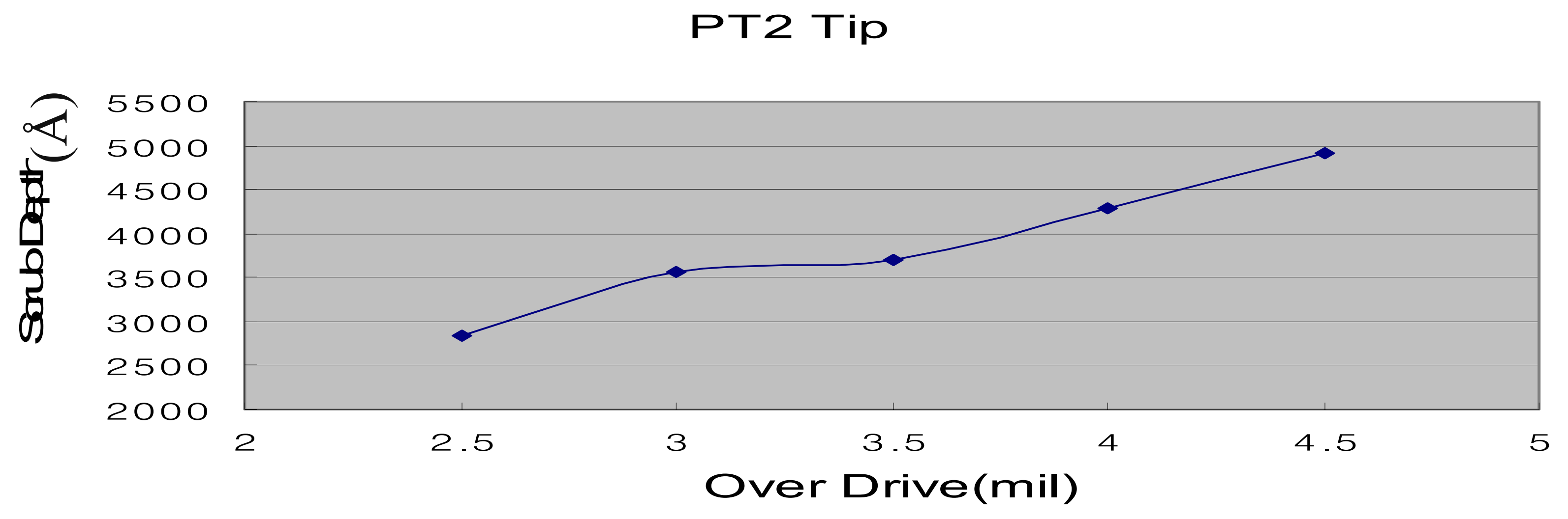
PT2 Tip Scrub Depth

O.D:4.5 mil



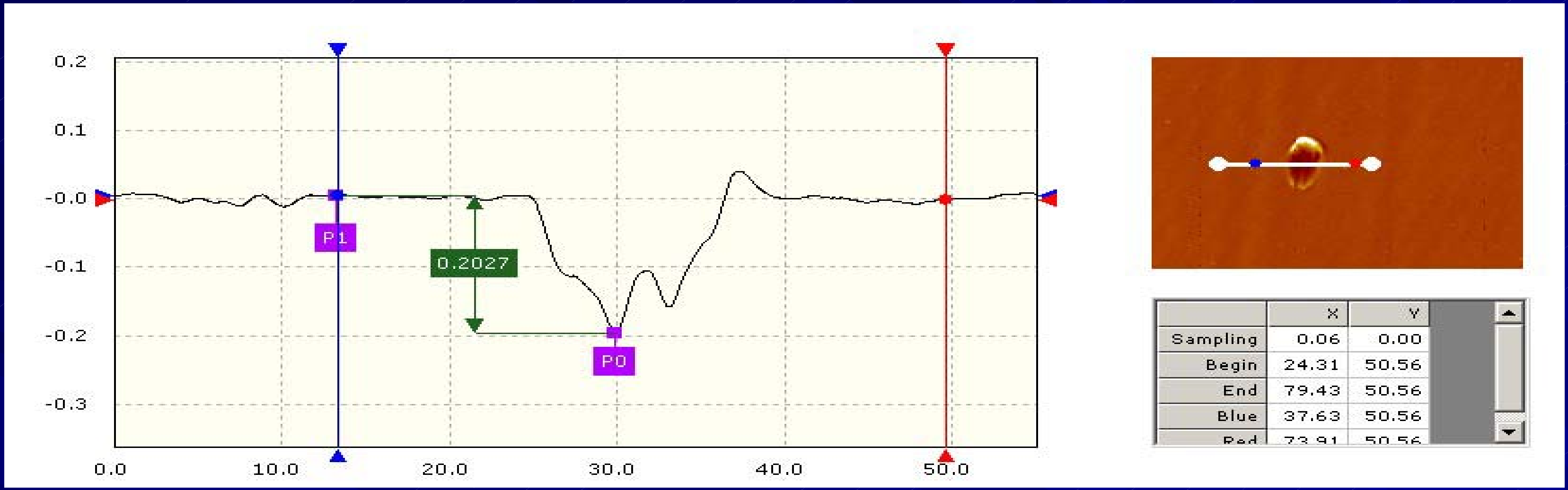
	X	Y
Sampling	0.08	-0.00
Begin	27.13	48.83
End	110.46	48.39
Blue	35.46	48.78
Red	102.12	48.43

PT2 Tip Scrub Depth Trend



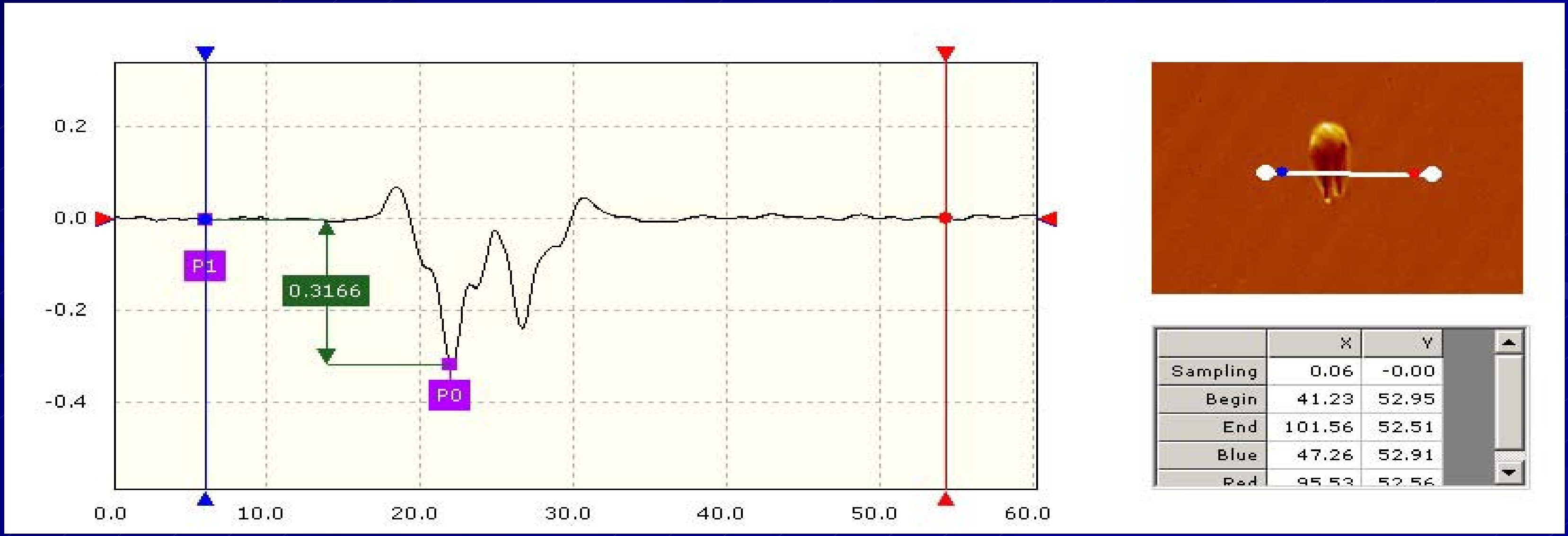
Needle Scrub Depth

O.D:2.5 mil



	X	Y
Sampling	0.06	0.00
Begin	24.31	50.56
End	79.43	50.56
Blue	37.63	50.56
Red	73.91	50.56

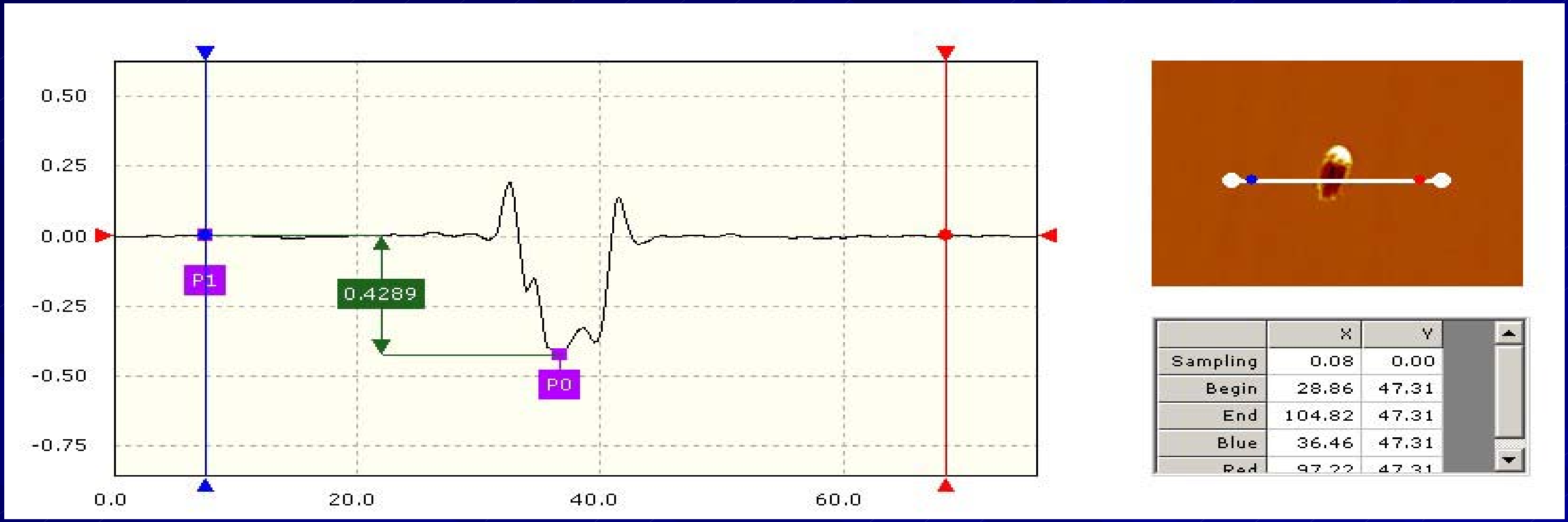
O.D:3.0 mil



	X	Y
Sampling	0.06	-0.00
Begin	41.23	52.95
End	101.56	52.51
Blue	47.26	52.91
Red	95.53	52.56

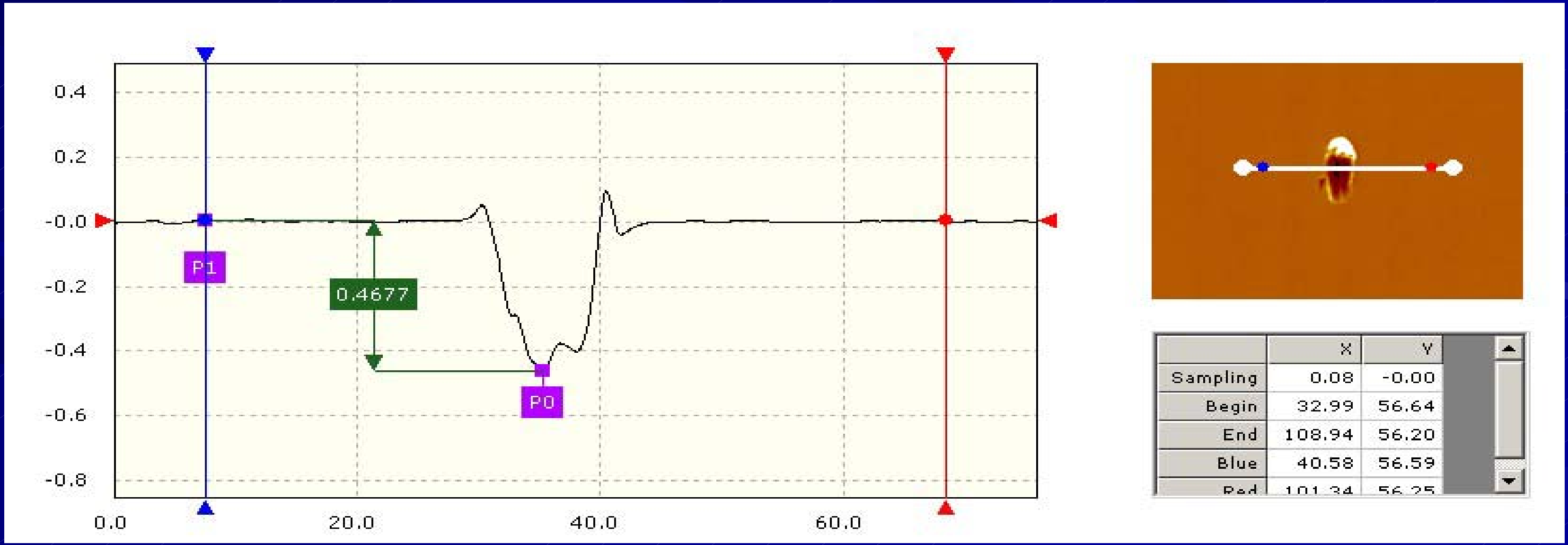
Needle Scrub Depth

O.D:3.5 mil



	X	Y
Sampling	0.08	0.00
Begin	28.86	47.31
End	104.82	47.31
Blue	36.46	47.31
Red	97.22	47.31

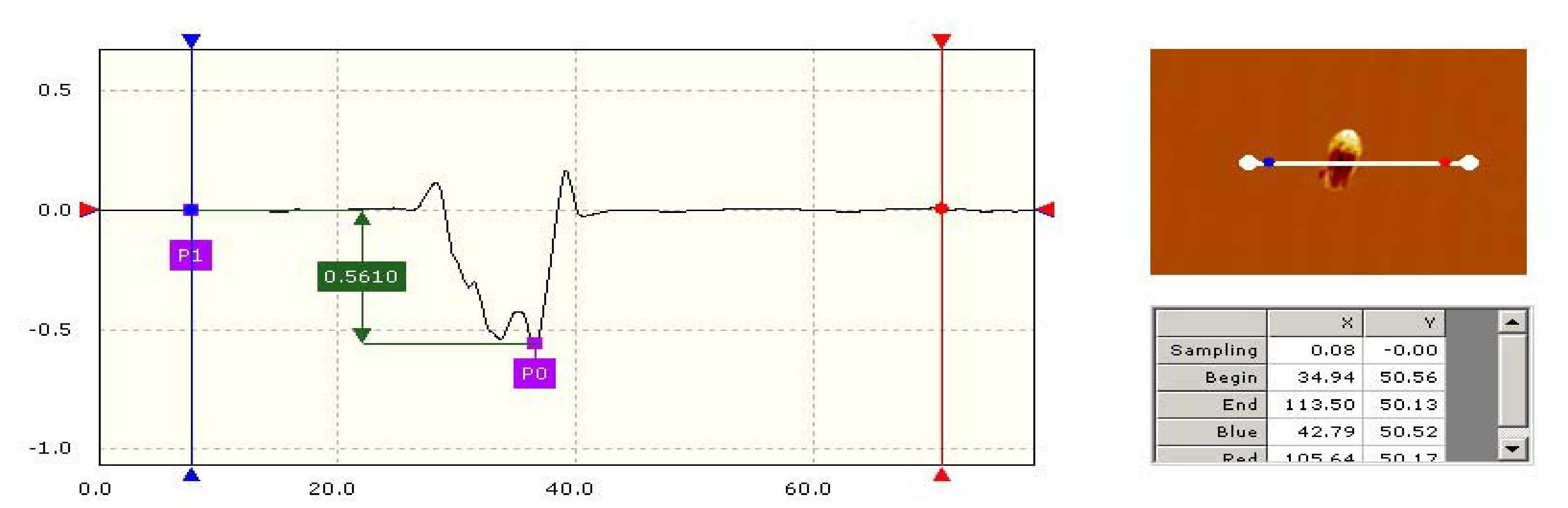
O.D:4.0 mil



	X	Y
Sampling	0.08	-0.00
Begin	32.99	56.64
End	108.94	56.20
Blue	40.58	56.59
Red	101.34	56.25

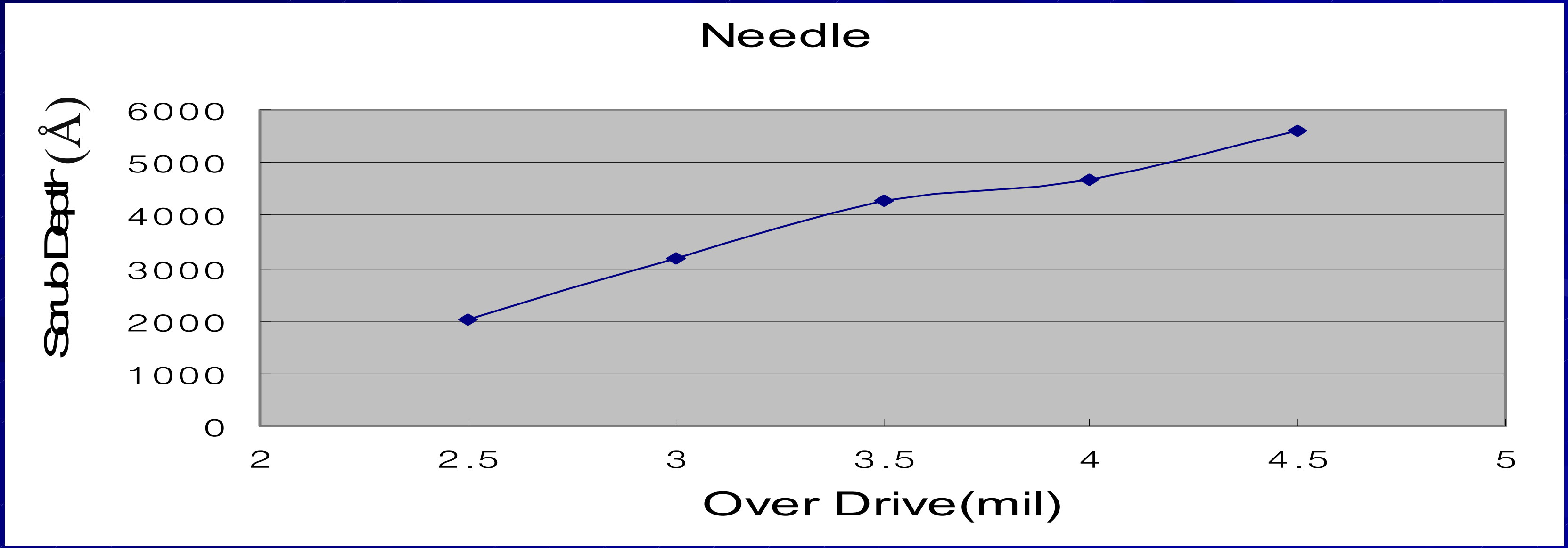
Needle Scrub Depth

O.D:4.5 mil

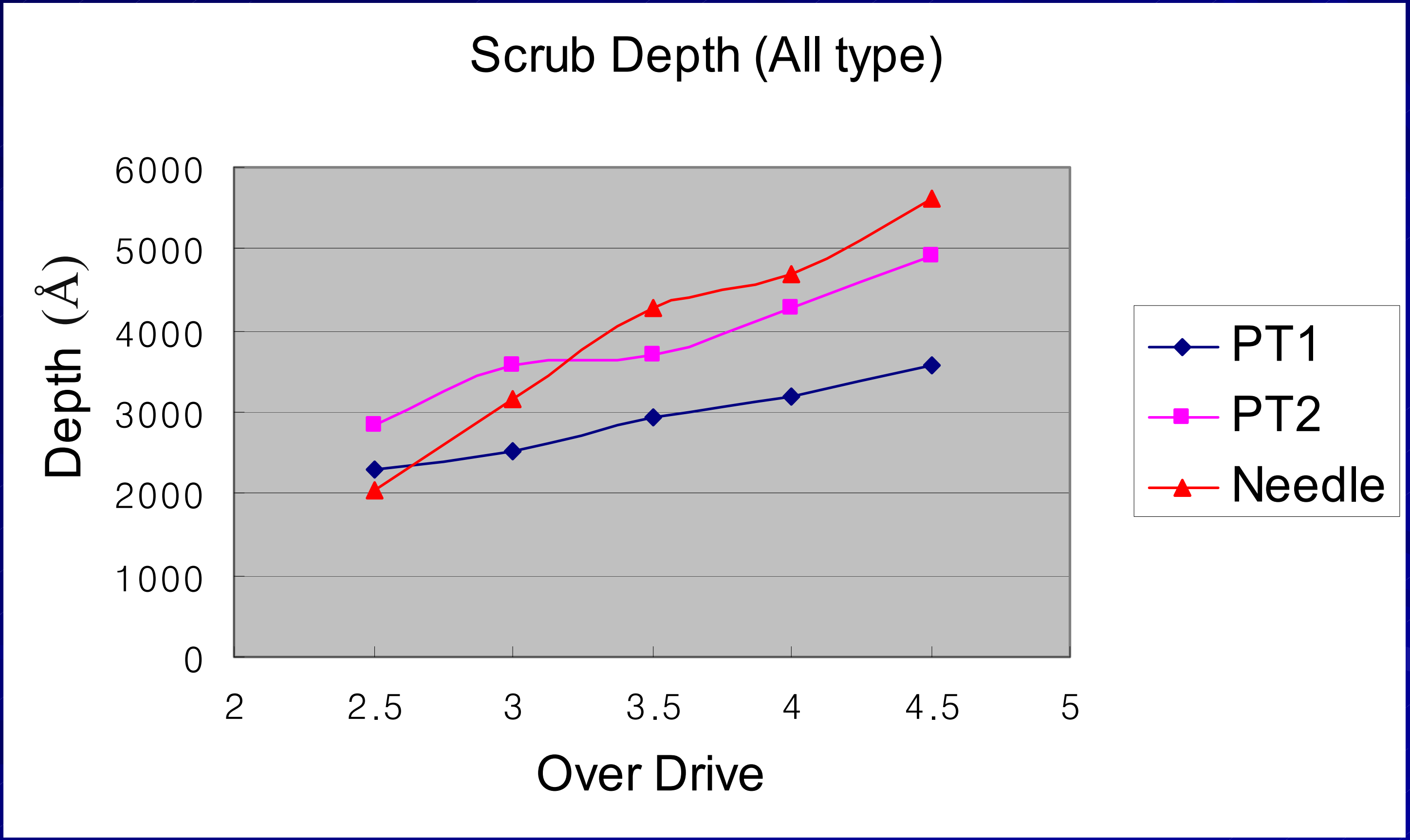


	X	Y
Sampling	0.08	-0.00
Begin	34.94	50.56
End	113.50	50.13
Blue	42.79	50.52
Red	105.64	50.17

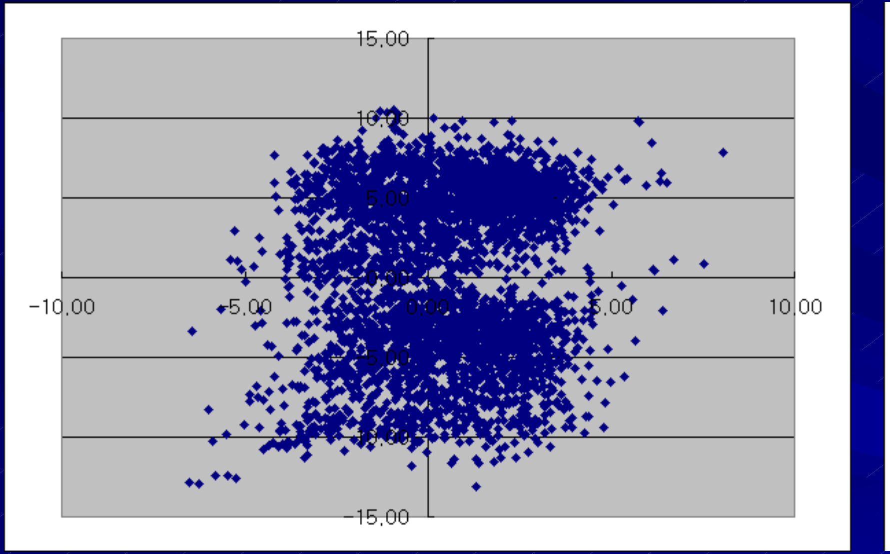
Needle Tip Scrub Depth Trend



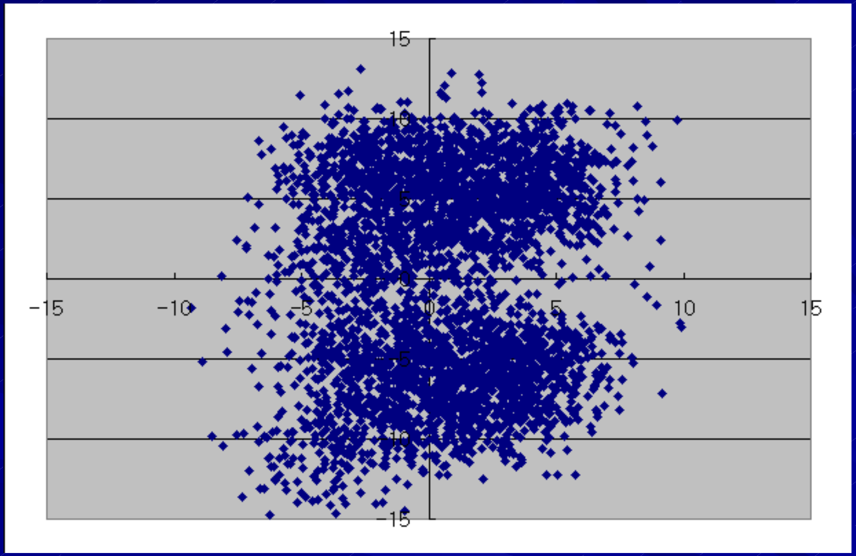
Scrub Depth (all types are compared)



5. Probe X,Y Alignment (MEMS)



Before TDS



After 29600 TDS

Real contact number on production line

PHICOM
MOEMS TECHNOLOGIES PROVIDER

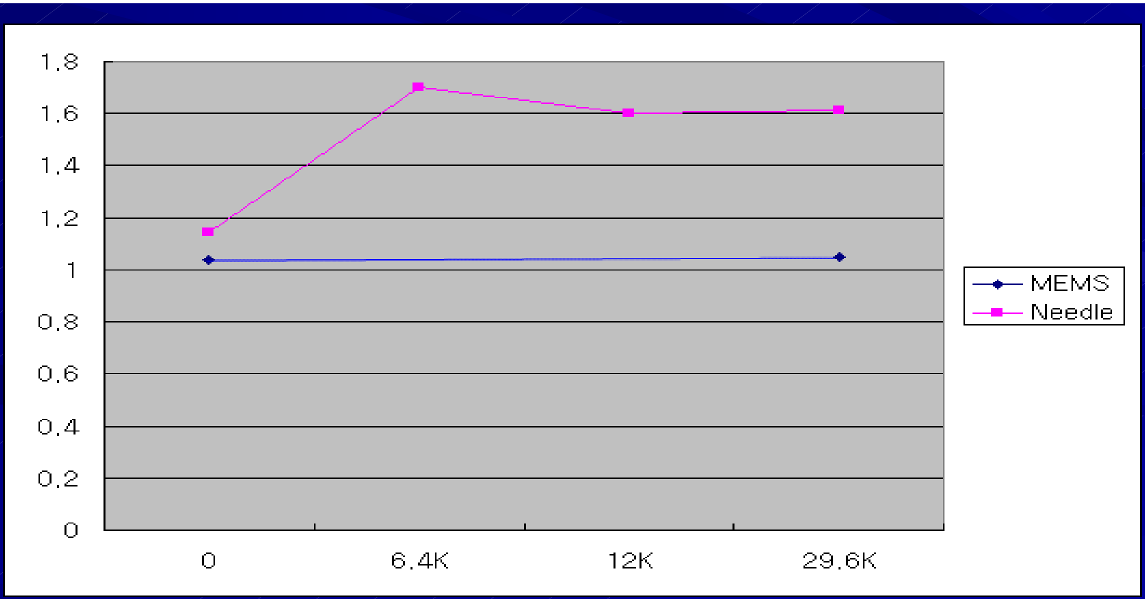
6. Path Resistance

- Touchdown Vs Path Resistance (Average)

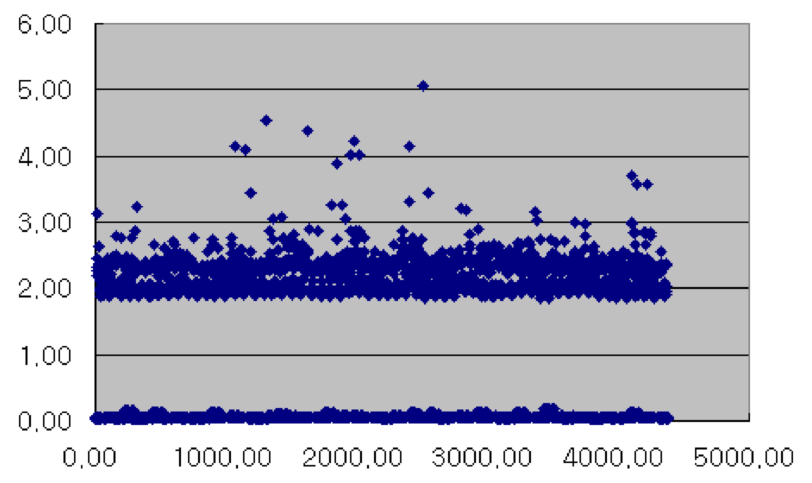
(Unit:Ohm)

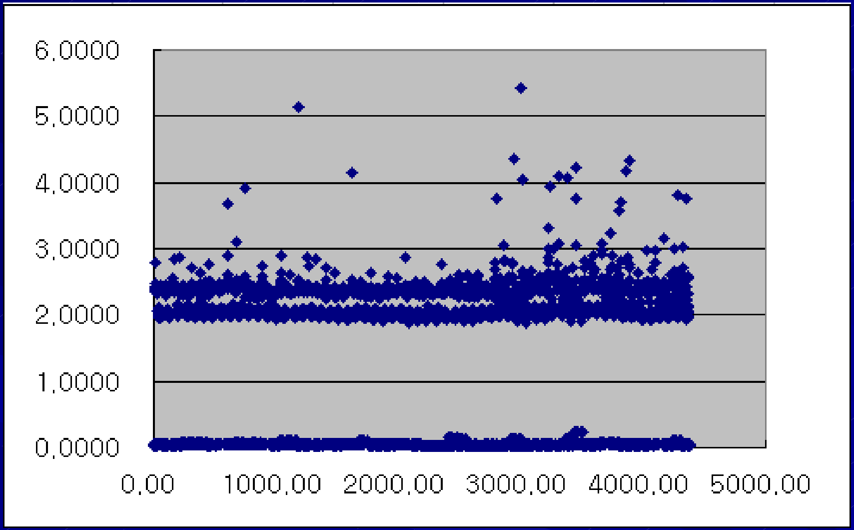
TDS	0	6.4K	12K	29.6K
MEMS P/C	1.04			1.05
Needle P/C	1.1437	1.6981	1.6012	1.6121

- Graph



MEMS P/C Path Resistance Trend

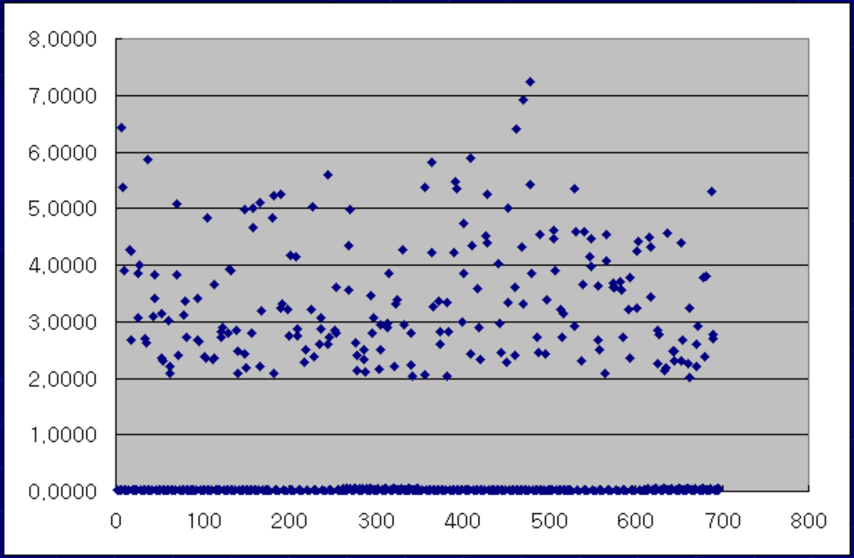


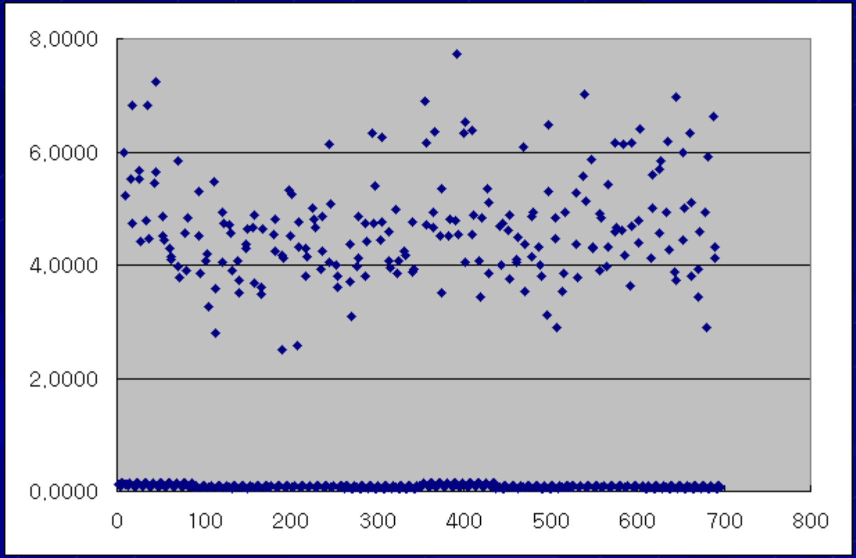


Before TDS **After 29600 TDS without Cleaning**

Real contact number on production line

Needle P/C Path Resistance Trend



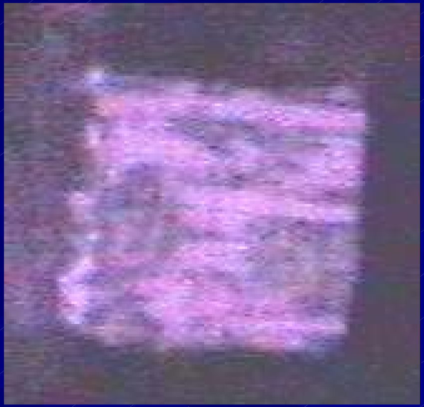


Before TDS **After 29600 TDS without Cleaning**

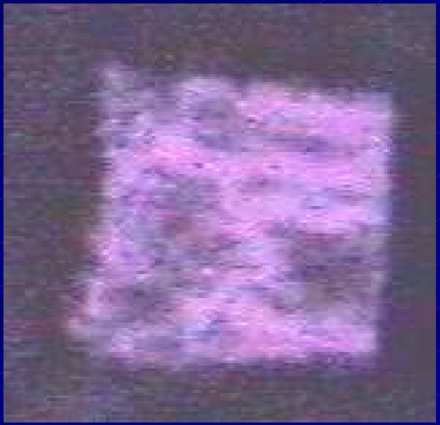
Phicom Test Data

7. Probe Life Time

- Life Time (Number of Touchdowns)



32,000TDS



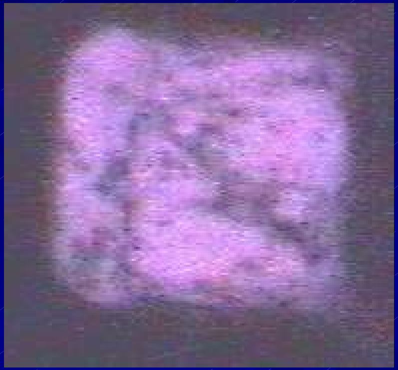
64,000TDS

120,000TDS

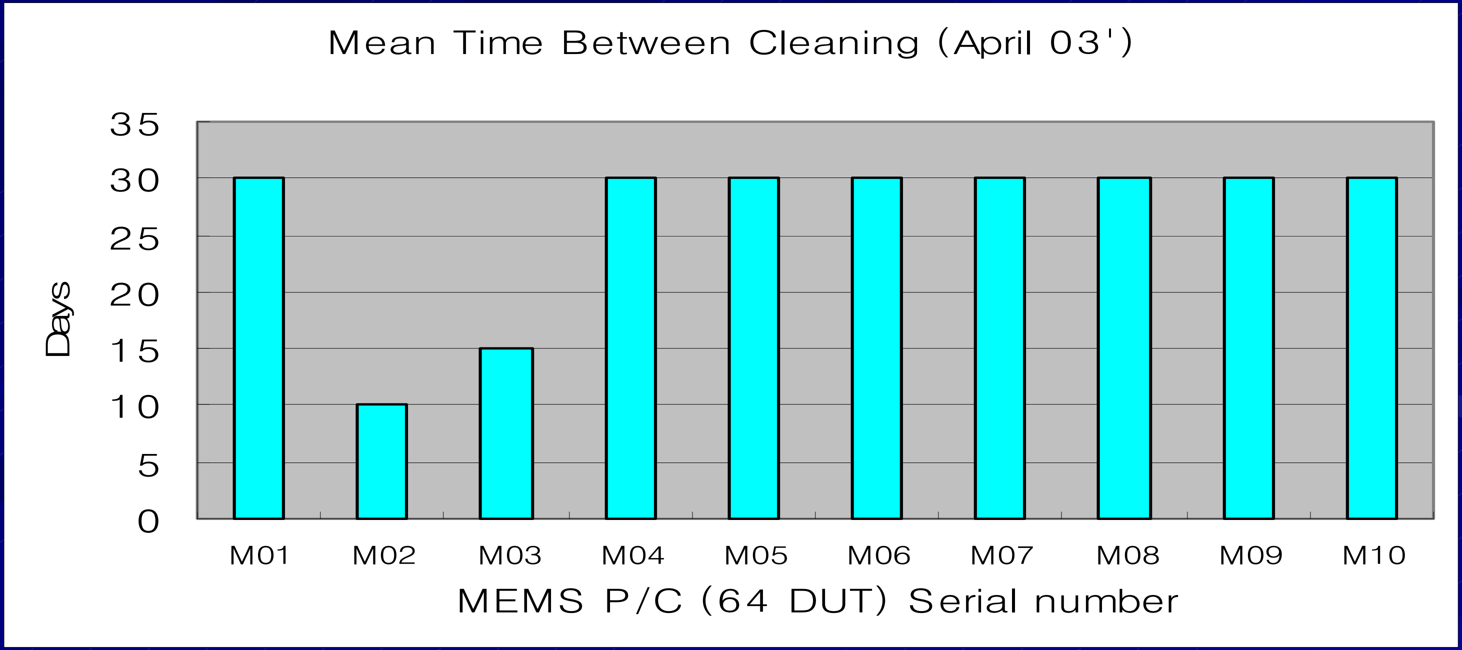
- Cleaning Period

Initial

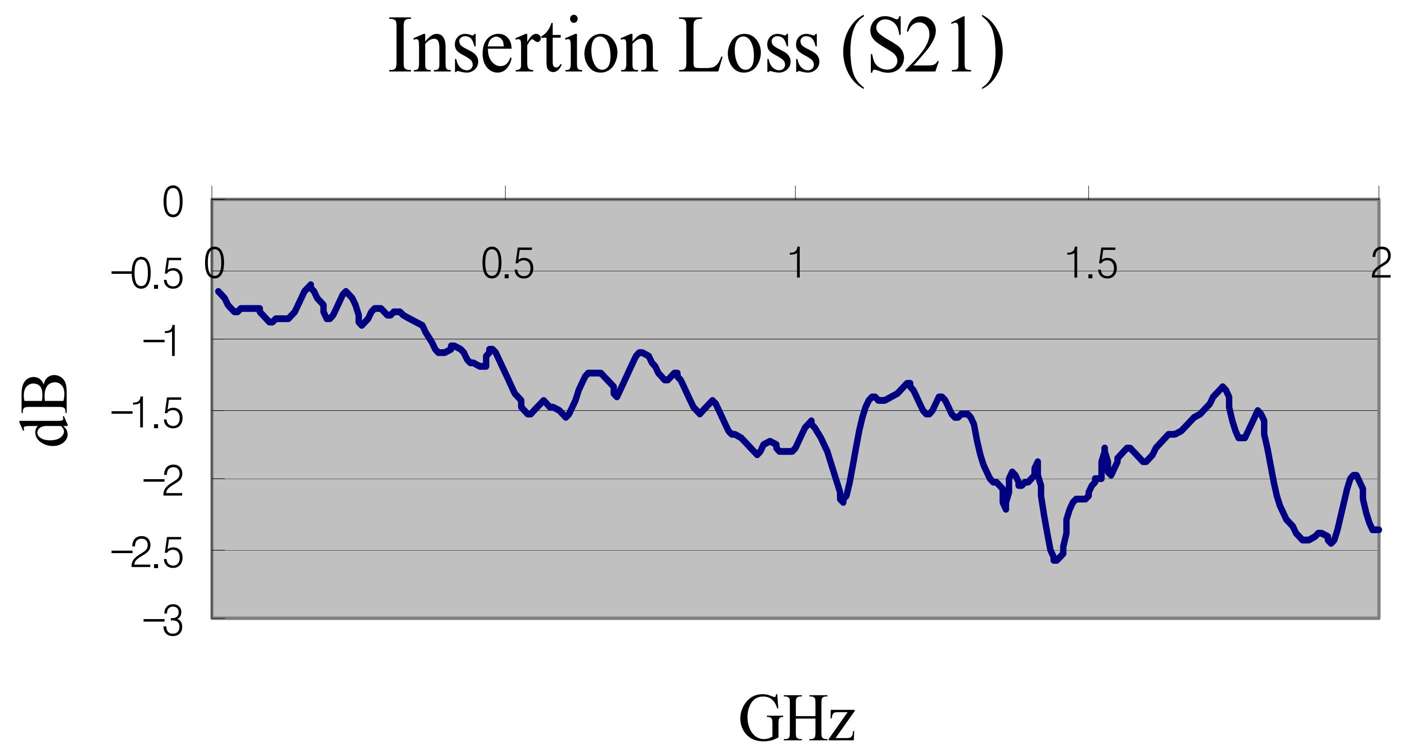
30000TDS



Cleaning



8. MEMS Probe Card Bandwidth



9. MEMS Probe Card Specification

Measurement Items		Specification		
		System	Value	Unit
Planarity		3D	15 ~ 20	um
		PRVX	25 ~ 30	um
Leakage			<5	nA
Contact Resistance			<5	Ohm
Vxerr			80 overlay	%
Vyerr			80 overlay	%
Scrub			10	um
Tscrub			25	um
Diameter			<18	um
Tip Diameter (Changeable)		SEM	< 13	um
Scrub Area (Based on O.D 75um)			<13x24	um2
O.D.	Normal		75	um
	Maximum		110	um
Impedance		Polar	50 (±10%)	Ohm
Max Current			600	mA
Pin Force			2.5(±20%)	gf/mil
Probe Depth			8.8	mm
Cleaning Period			> 15,000	TDs
Life Time		Prober	1 Million	TDs

Summary

- Enough Pin Force to penetrate Al2O3
- Stable Planarity
- Stable X.Y Alignment Status
- Low Pad Damage With Enough Scrub Mark
- Constant Path Resistance
- Long Cleaning Period
- Long Life Time
- Uniform Probe Tip Shape