

POLYHEDRON LABORATORIES®, INC.

PLASTICS, POLYMERS and RUBBER TESTING

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April 16, 2014

PO: 1410636

Monterey Bay Aquarium Research Institute (M.B.A.R.I.)

7700 Sandholdt Road

Moss Landing, CA 95039

Attn: Mr. Farley F. Shane

Analytical Report

Tensile Properties by ASTM D 638

Sample	Tensile Strength		% Elongation		Tangent Modulus (psi)
	at Yield (psi)	at Break (psi)	at Yield	at Break	
#1 Horizontal	-	4612.6	-	5.3	219,106.5
		3985.5		7.0	211,682.2
		4865.6		5.4	192,561.8
		4084.9		7.7	262,257.2
		<u>4119.6</u>		<u>6.2</u>	<u>205,769.6</u>
		AV = 4333.6		AV = 6.3	AV = 218,275.5
		± 384.0		± 1.0	± 26,439.3
#2 Vertical	-	3475.4	-	5.2	134,902.5
		3418.0		4.6	197,519.7
		3479.4		5.7	162,761.8
		3553.3		4.9	124,884.0
		<u>3562.9</u>		<u>4.0</u>	<u>165,241.8</u>
		AV = 3498.2		AV = 4.9	AV = 157,062.0
		± 60.7		± 0.6	± 28,560.0
#3 Horizontal XHD	5702.7	5656.8	4.6	10.7	259,352.8
	5169.3	5133.6	5.2	10.5	230,239.3
	5100.7	5157.5	4.7	12.7	268,191.8
	5606.3	5581.7	4.9	10.6	256,562.0
	<u>5296.6</u>	<u>5272.0</u>	<u>4.6</u>	<u>12.5</u>	<u>248,653.3</u>
	AV = 5375.1	AV = 5360.3	AV = 4.8	AV = 11.4	AV = 252,599.8
	± 266.7	± 243.5	± 0.2	± 1.1	± 14317.6


Howard Kaye, Ph.D., FAIC
Director

HK/dr

All samples will be discarded within two months.

POLYHEDRON LABS Lab #34297

Sample : 1HORIZONTAL
Run # : 1
Range : 5

FORCE vs. EXTENSION
TENSILE TESTING
Speed in/min: 0.2

Sample
Length : 2.000 in.
Width : 0.516 in.
Thickness : 0.123 in.

Tensile Force
at Yield : 291.79 lbs
at Break : 292.75 lbs

Elongation
at Yield : 0.101 in.
at Break : 0.106 in.

Tensile Strength
at Yield : 4597.5 psi
at Break : 4612.6 psi

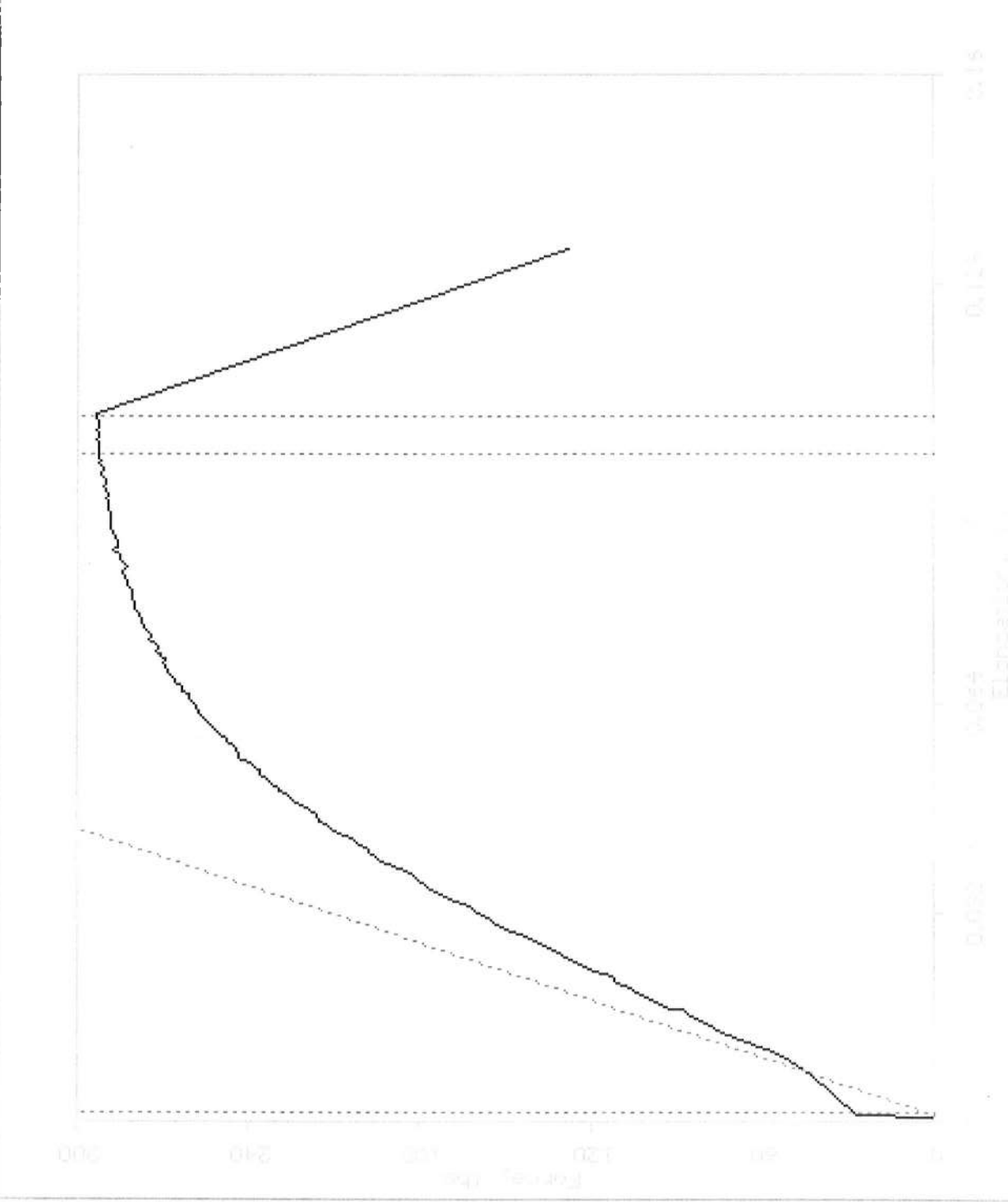
Elongation
at Yield : 5.0 %
at Break : 5.3 %

Tangent Modulus:
219106.5 psi

100% Modulus:
0.0 psi

---(150)---

Select :
T - print tear result
L - draw lines
R - current result
C - change labels
P - print graph
Q - quit



POLYHEDRON LABS Lab #34297

Sample : 1 HORIZONTAL

Run # : 2

Range : 5

Speed in/min: 0.2

Sample
Length : 2.000 in.
Width : 0.516 in.
Thickness : 0.123 in.

Tensile Force
at Yield : 250.31 lbs
at Break : 252.95 lbs
Elongation
at Yield : 0.106 in.
at Break : 0.140 in.

Tensile Strength
at Yield : 3943.9 psi
at Break : 3985.5 psi

Elongation
at Yield : 5.3 %
at Break : 7.0 %

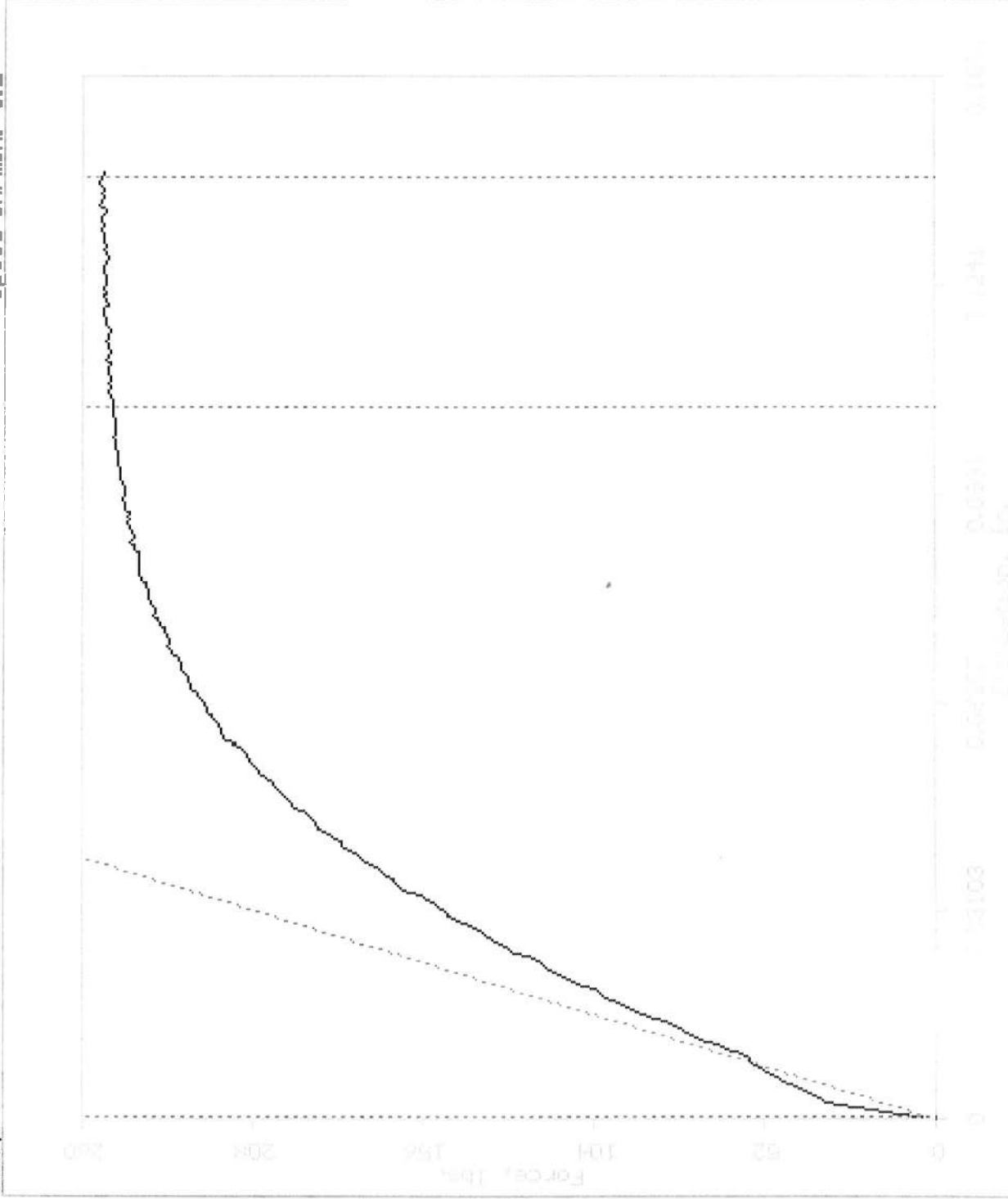
Tangent Modulus:
211682.2 psi

100% Modulus:
0.0 psi

---(150)---

Select :

T - print tear result
L - draw lines
R - current result
C - change labels
P - print graph
Q - quit



POLYHEDRON LABS Lab #34297

FORCE vs. EXTENSOMETER
TENSILE TESTING
Speed in/min: 0.2

Sample : 1HORIZONTAL
Run # : 3
Range : 5

Sample
Length : 2.000 in.
Width : 0.516 in.
Thickness : 0.122 in.

Tensile Force
at Yield : 306.90 lbs
at Break : 306.30 lbs

Elongation
at Yield : 0.105 in.
at Break : 0.107 in.

Tensile Strength
at Yield : 4875.1 psi
at Break : 4865.6 psi

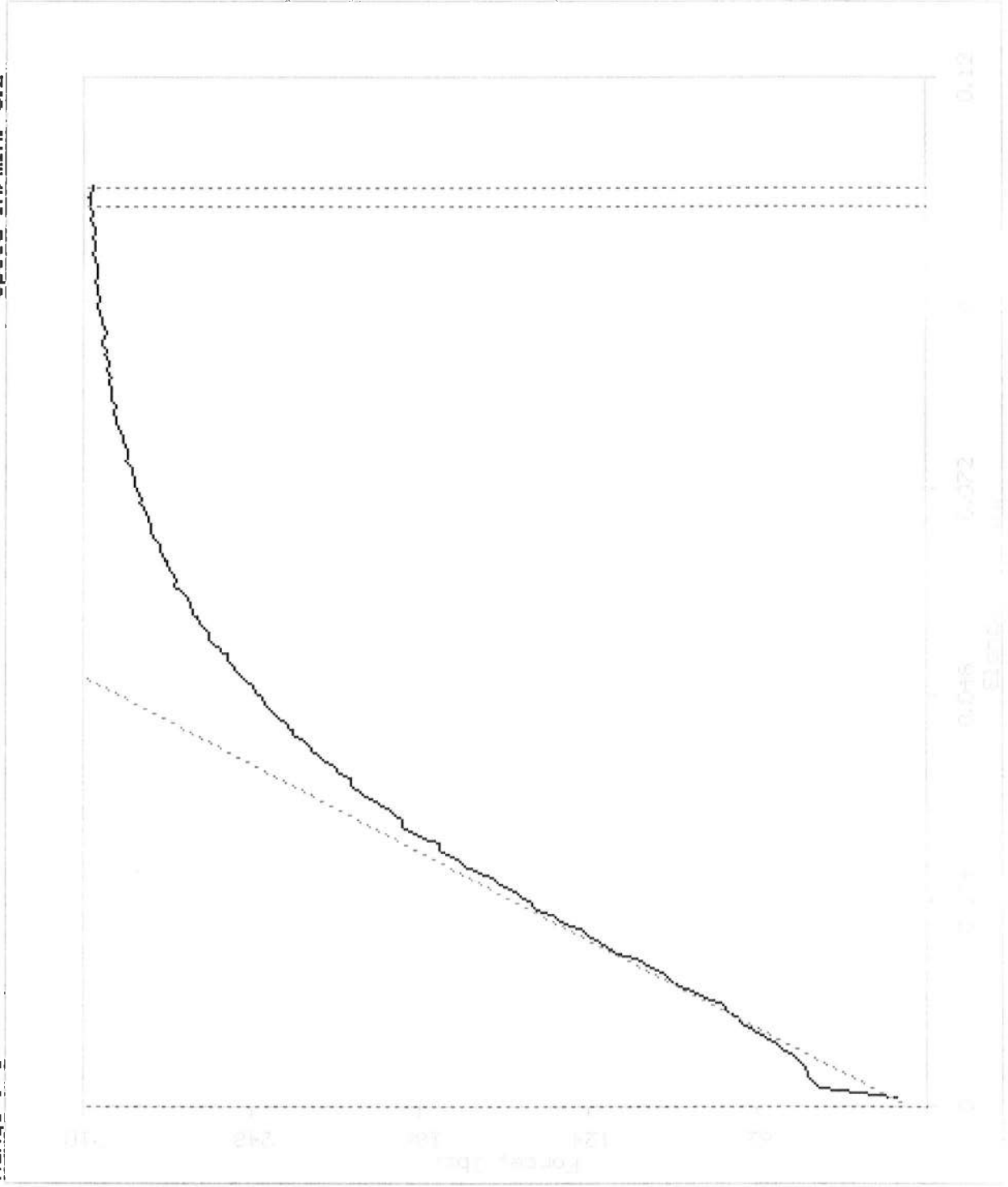
Elongation
at Yield : 5.2 %
at Break : 5.3 %

Tanqent Modulus:
192560.8 psi

100% Modulus:
0.0 psi

---(150)---

Select :
T - print tear result
L - draw lines
R - current result
C - change labels
P - print graph
Q - quit



POLYHEDRON LABS Lab #34297

FORCE vs. EXTENSIONMETER
TENSILE TESTING
Speed in./min: 0.2

Sample : 1HORIZONTAL
Run # : 4
Range : 5

Sample
Length : 2.000 in.
Width : 0.516 in.
Thickness : 0.122 in.

Tensile Force
at Yield : 256.31 lbs
at Break : 257.15 lbs

Elongation
at Yield : 0.122 in.
at Break : 0.154 in.

Tensile Strength
at Yield : 4071.5 psi
at Break : 4084.8 psi

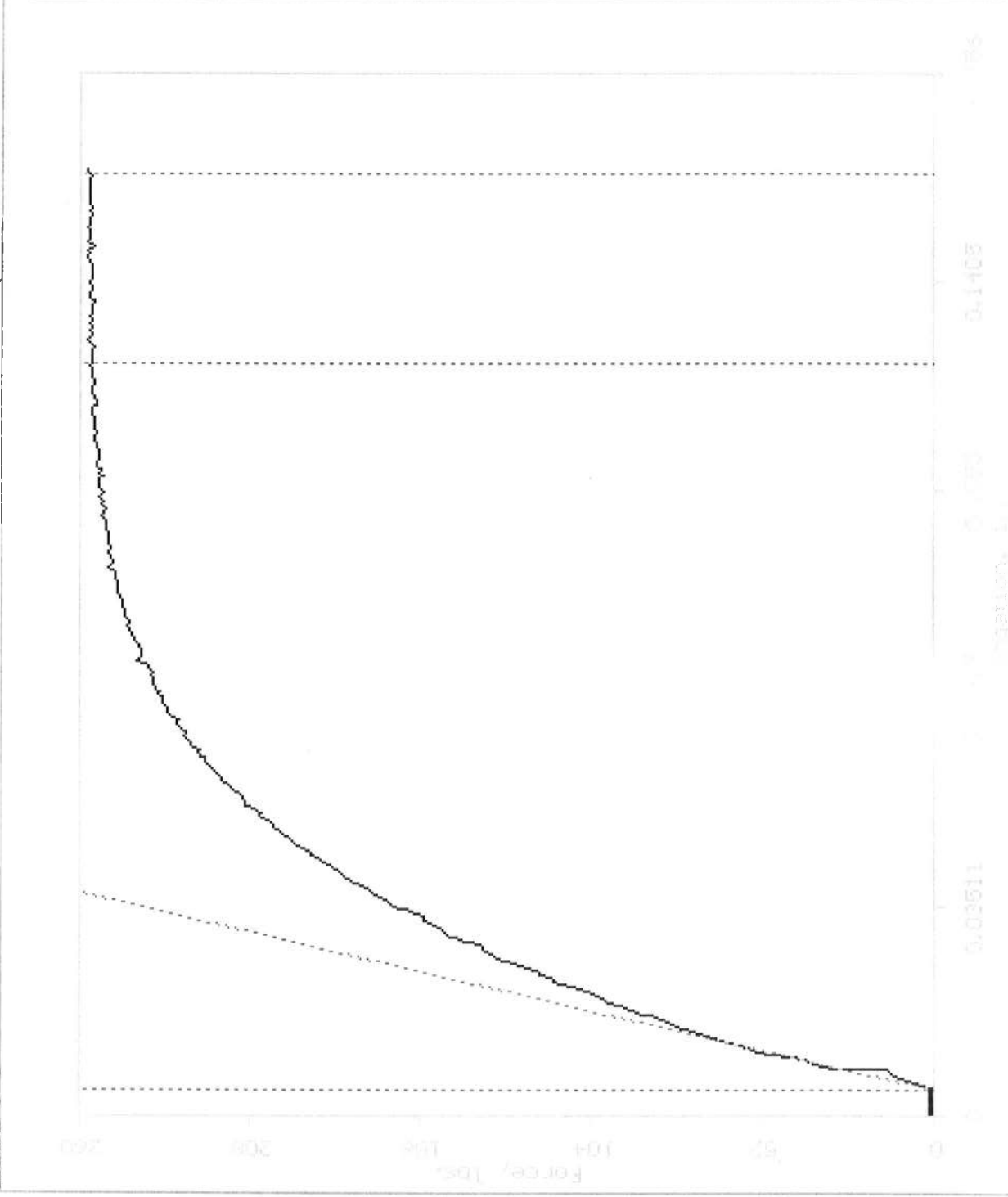
Elongation
at Yield : 6.1 %
at Break : 7.7 %

Tangent Modulus:
252257.2 psi

100% Modulus:
0.0 psi

---(150)---

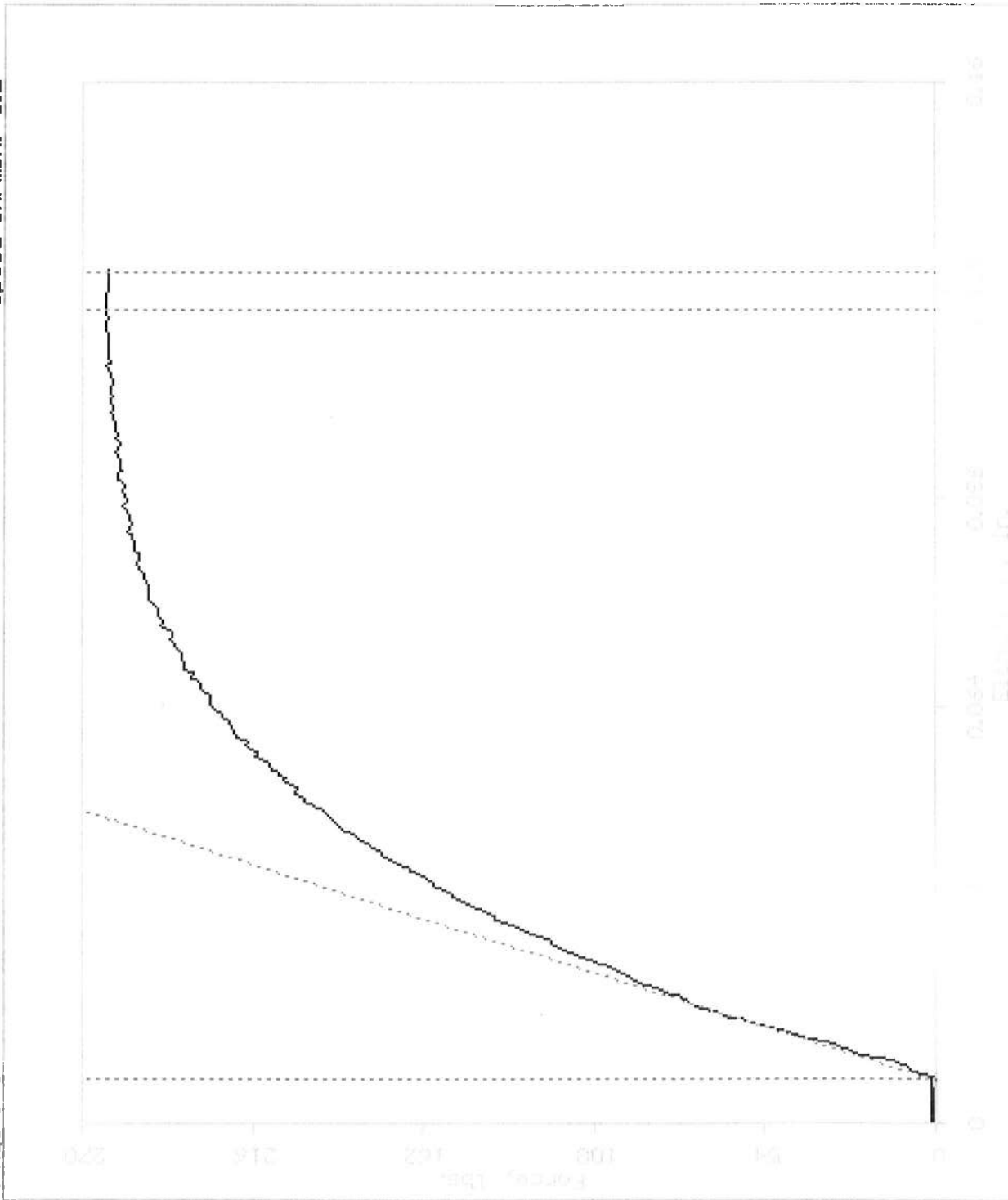
Select :
T - print tear result
L - draw lines
R - current result
C - change labels
P - print graph
Q - quit



POLYHEDRON LABS Lab #34297

Sample : 1/4 HORIZONTAL
Run # : 5
Range : 5

FORCE vs. EXTENSOMETER
TENSILE TESTING
Speed in/min: 0.2



Sample Length : 2.000 in.
Width : 0.516 in.
Thickness : 0.123 in.

Tensile Force
at Yield : 261.46 lbs
at Break : 261.46 lbs
Elongation
at Yield : 0.119 in.
at Break : 0.124 in.

Tensile Strength
at Yield : 4119.6 psi
at Break : 4119.6 psi

Elongation
at Yield : 5.9 %
at Break : 6.2 %

Tanqent Modulus:
205769.6 psi

100% Modulus:
0.0 psi

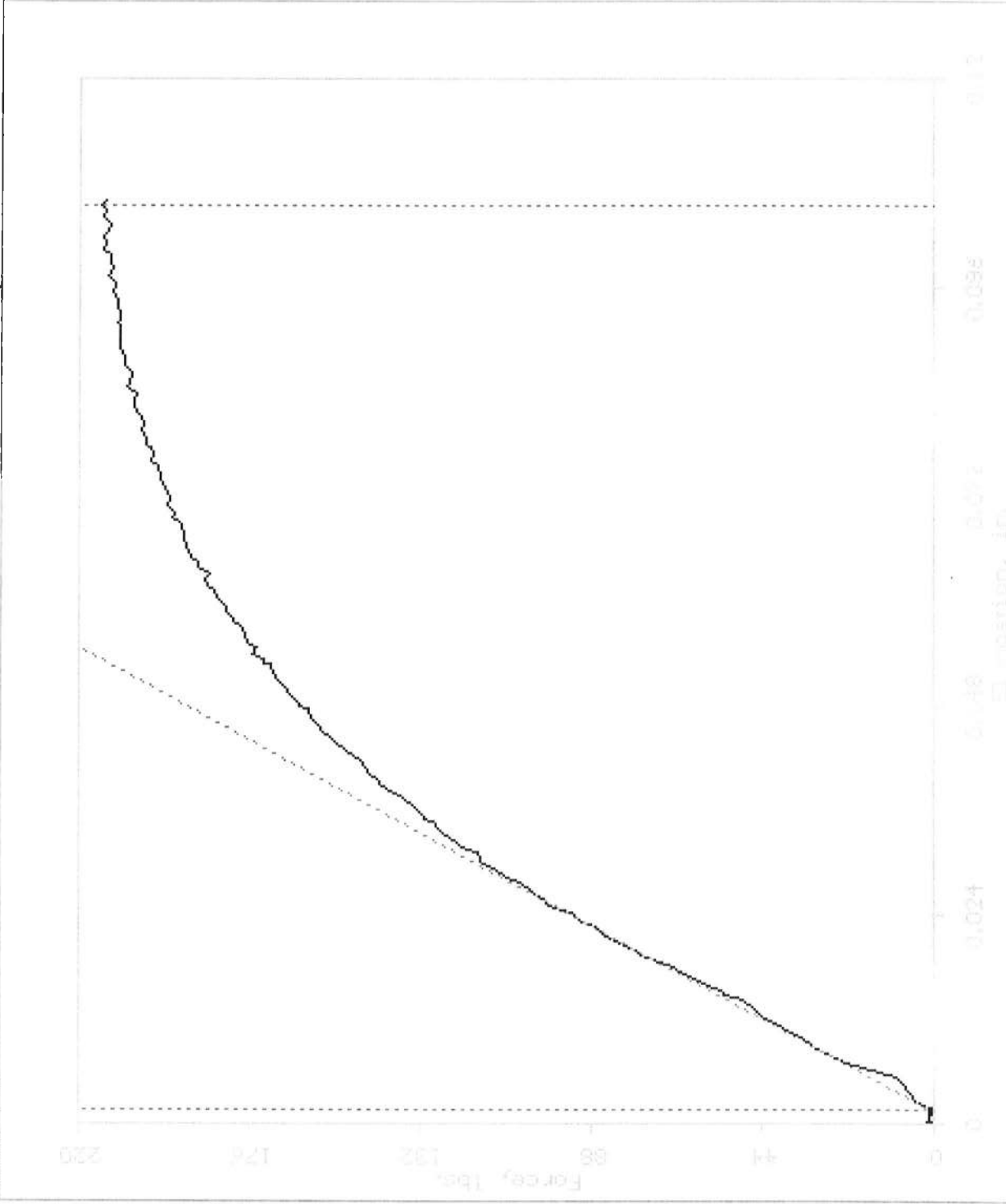
---(150)---

Select :
T - print tear result
L - draw lines
R - current result
C - change labels
P - print graph
Q - quit

POLYHEDRON LABS Lab #34297

Sample : 2 VERTICAL
Run # : 1
Range : 5

FORCE vs. EXTENSOMETER
TENSILE TESTING
Speed in./min: 0.2



Sample
Length : 2.000 in.
Width : 0.510 in.
Thickness : 0.121 in.

Tensile Force
at Yield : 214.47 lbs
at Break : 214.47 lbs
Elongation
at Yield : 0.104 in.
at Break : 0.104 in.

Tensile Strength
at Yield : 3475.4 psi
at Break : 3475.4 psi

Elongation
at Yield : 5.2 %
at Break : 5.2 %

Tangent Modulus:
134902.5 psi

100% Modulus:
0.0 psi

---(150)---

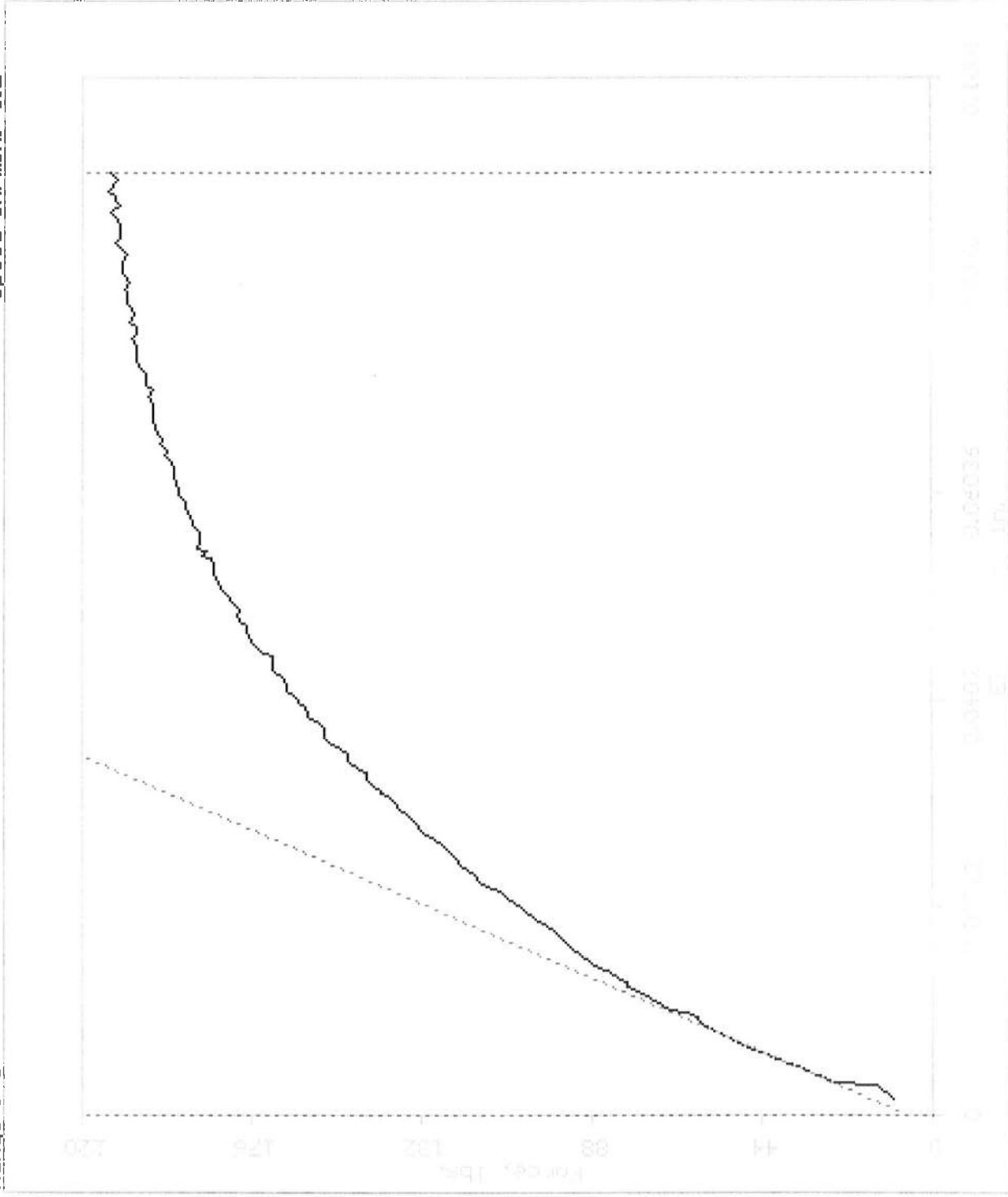
Select :

- T - print tear result
- L - draw lines
- R - current result
- C - change labels
- P - print graph
- Q - quit

POLYHEDRON LABS Lab #34297

Sample : 2 VERTICAL
Run # : 2
Range : 5

FORCE vs. EXTENSOMETER
TENSILE TESTING
Speed in./min: 0.2



Sample Length : 2.000 in.
Width : 0.510 in.
Thickness : 0.122 in.

Tensile Force
at Yield : 212.67 lbs
at Break : 212.67 lbs
Elongation
at Yield : 0.091 in.
at Break : 0.091 in.

Tensile Strength
at Yield : 3418.0 psi
at Break : 3418.0 psi

Elongation
at Yield : 4.6 %
at Break : 4.6 %

Tangent Modulus:
197519.7 psi

100% Modulus:
0.0 psi

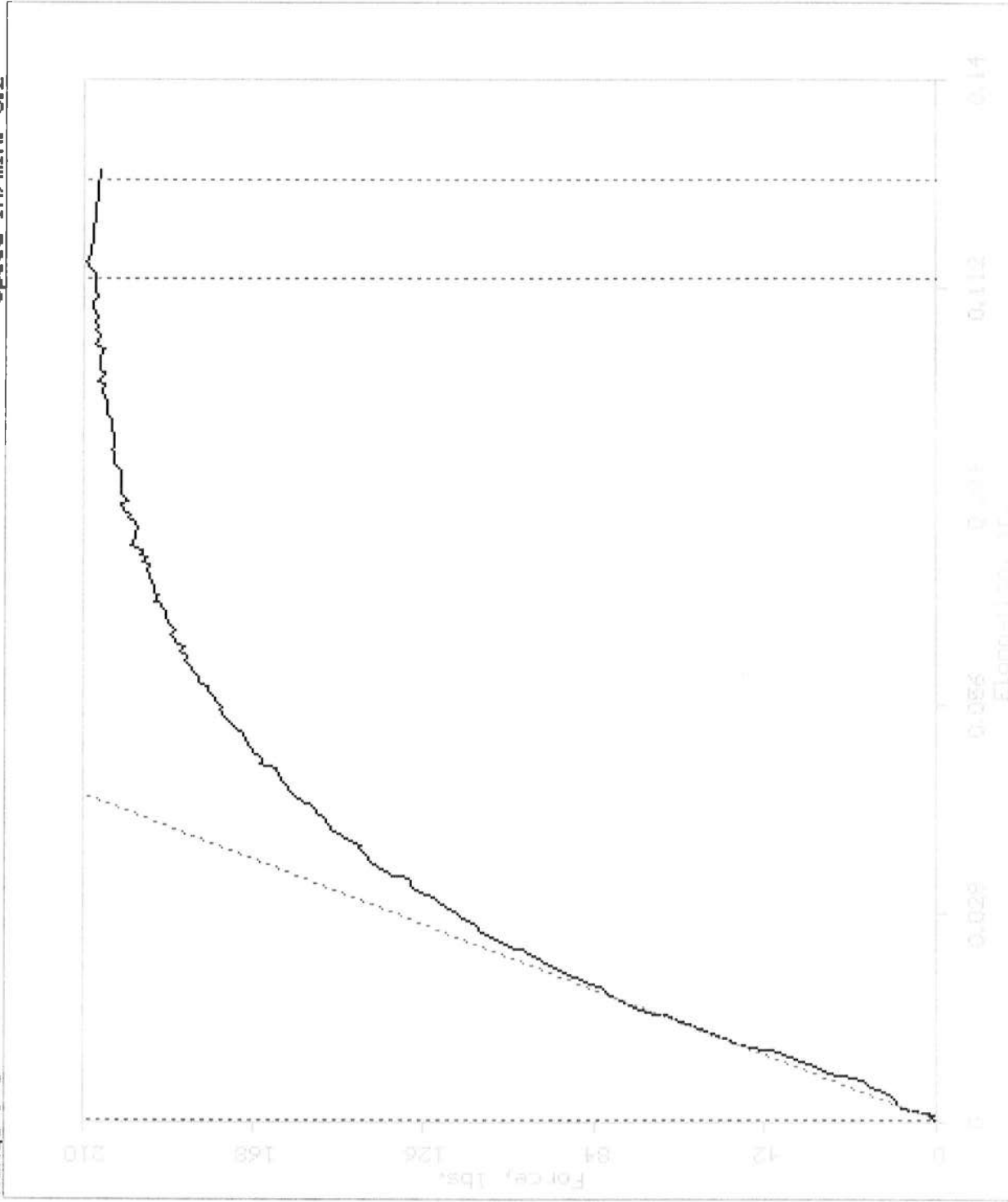
---(150)---

- Select :
- T - print tear result
 - L - draw lines
 - R - current result
 - C - change labels
 - P - print graph
 - Q - quit

POLYHEDRON LABS Lab #34297

Sample : 2 VERTICAL
Run # : 3
Range : 5

FORCE vs. EXTENSION
TENSILE TESTING
Speed in/min: 0.2



Sample
Length : 2.000 in.
Width : 0.508 in.
Thickness : 0.117 in.

Tensile Force
at Yield : 206.80 lbs
at Break : 205.60 lbs

Elongation
at Yield : 0.113 in.
at Break : 0.126 in.

Tensile Strength
at Yield : 3479.3 psi
at Break : 3459.1 psi

Elongation
at Yield : 5.6 %
at Break : 6.3 %

Tangent Modulus:
162761.8 psi

100% Modulus:
0.0 psi

---(150)---

Select :
T - print tear result
L - draw lines
R - current result
C - change labels
P - print graph
Q - quit

POLYHEDRON LABS Lab #34297

Sample : 2 VERTICAL

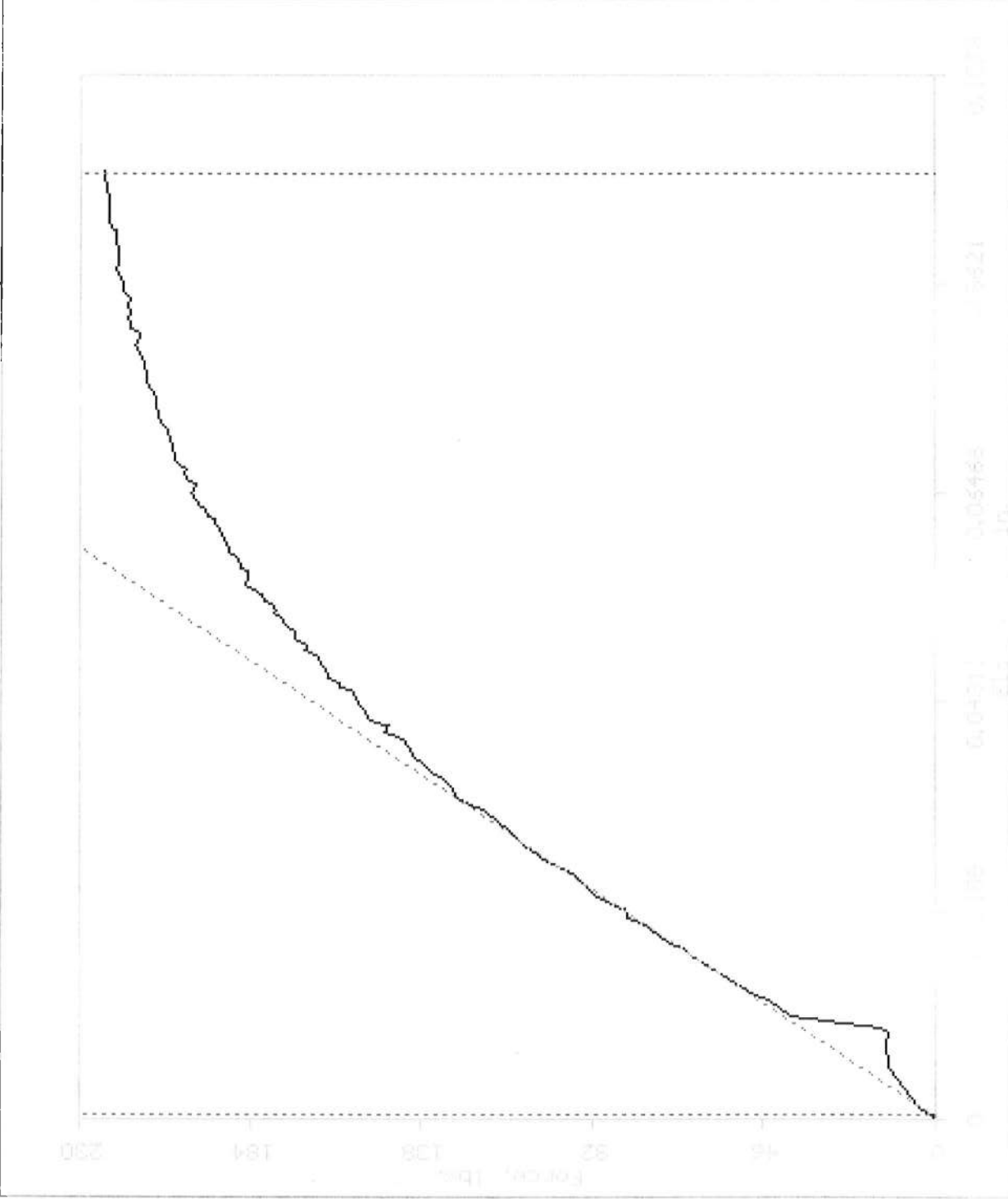
Run # : 4

Range : 5

FORCE vs. EXTENSIONOMETER

TENSILE TESTING

Speed in/min: 0.2



Sample
Length : 2.000 in.
Width : 0.511 in.
Thickness : 0.123 in.

Tensile Force
at Yield : 223.46 lbs
at Break : 223.46 lbs
Elongation
at Yield : 0.097 in.
at Break : 0.097 in.

Tensile Strength
at Yield : 3555.3 psi
at Break : 3555.3 psi

Elongation
at Yield : 4.9 %
at Break : 4.9 %

Tangent Modulus:
124884.0 psi

100% Modulus:
0.0 psi

---(150)---

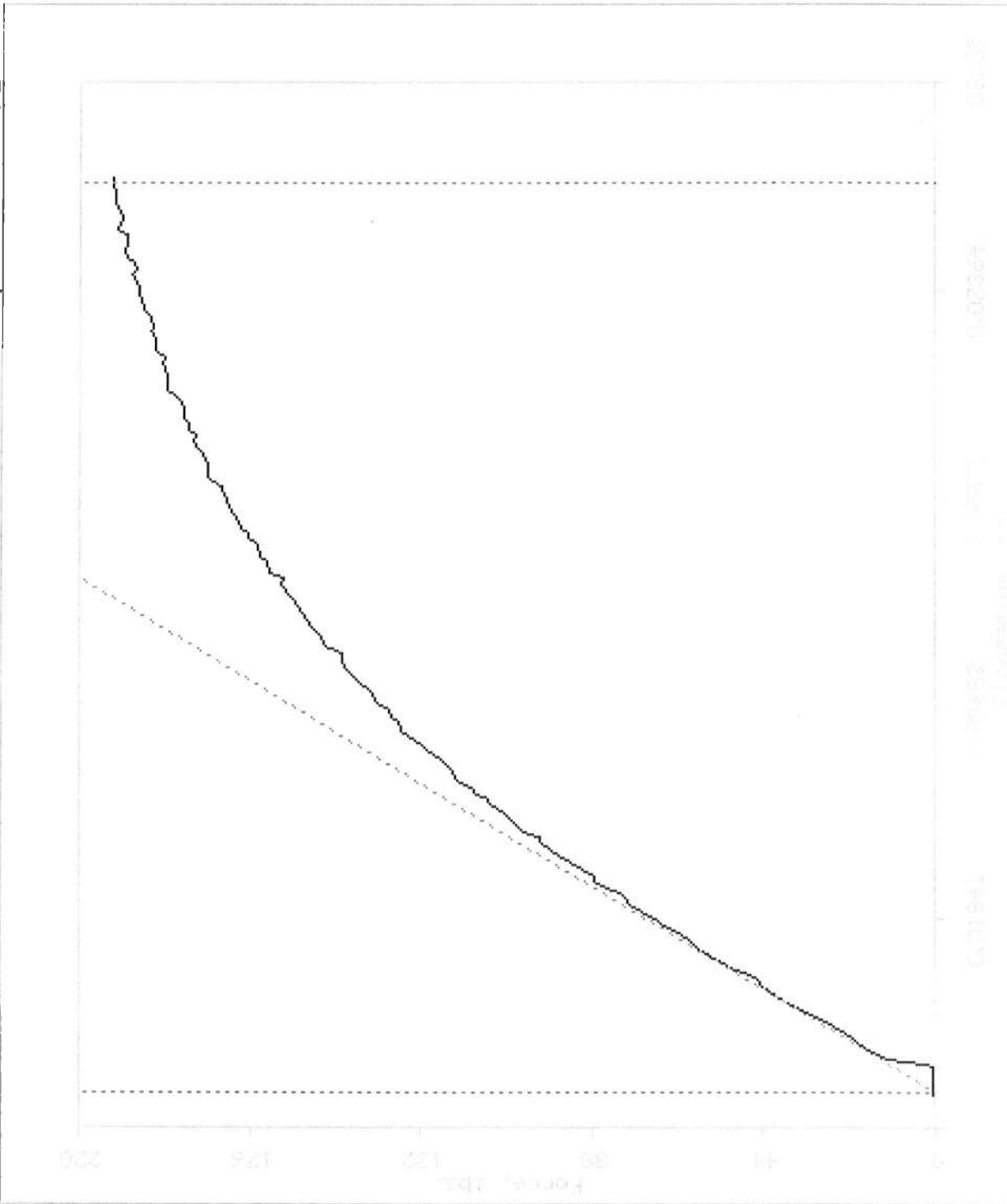
Select :

- T - print tear result
- L - draw lines
- R - current result
- C - change labels
- P - print graph
- Q - quit

POLYHEDRON LABS Lab #34297

Sample : 2 VERTICAL
Run # : 5
Range : 5

FORCE vs. EXTENSOMETER
TENSILE TESTING
Speed in/min: 0.2



Sample
Length : 2.000 in.
Width : 0.507 in.
Thickness : 0.117 in.

Tensile Force
at Yield : 211.35 lbs
at Break : 211.35 lbs
Elongation
at Yield : 0.080 in.
at Break : 0.080 in.

Tensile Strength
at Yield : 3563.0 psi
at Break : 3563.0 psi

Elongation
at Yield : 4.0 %
at Break : 4.0 %

Tangent Modulus:
165241.8 psi

100% Modulus:
0.0 psi

---(150)---

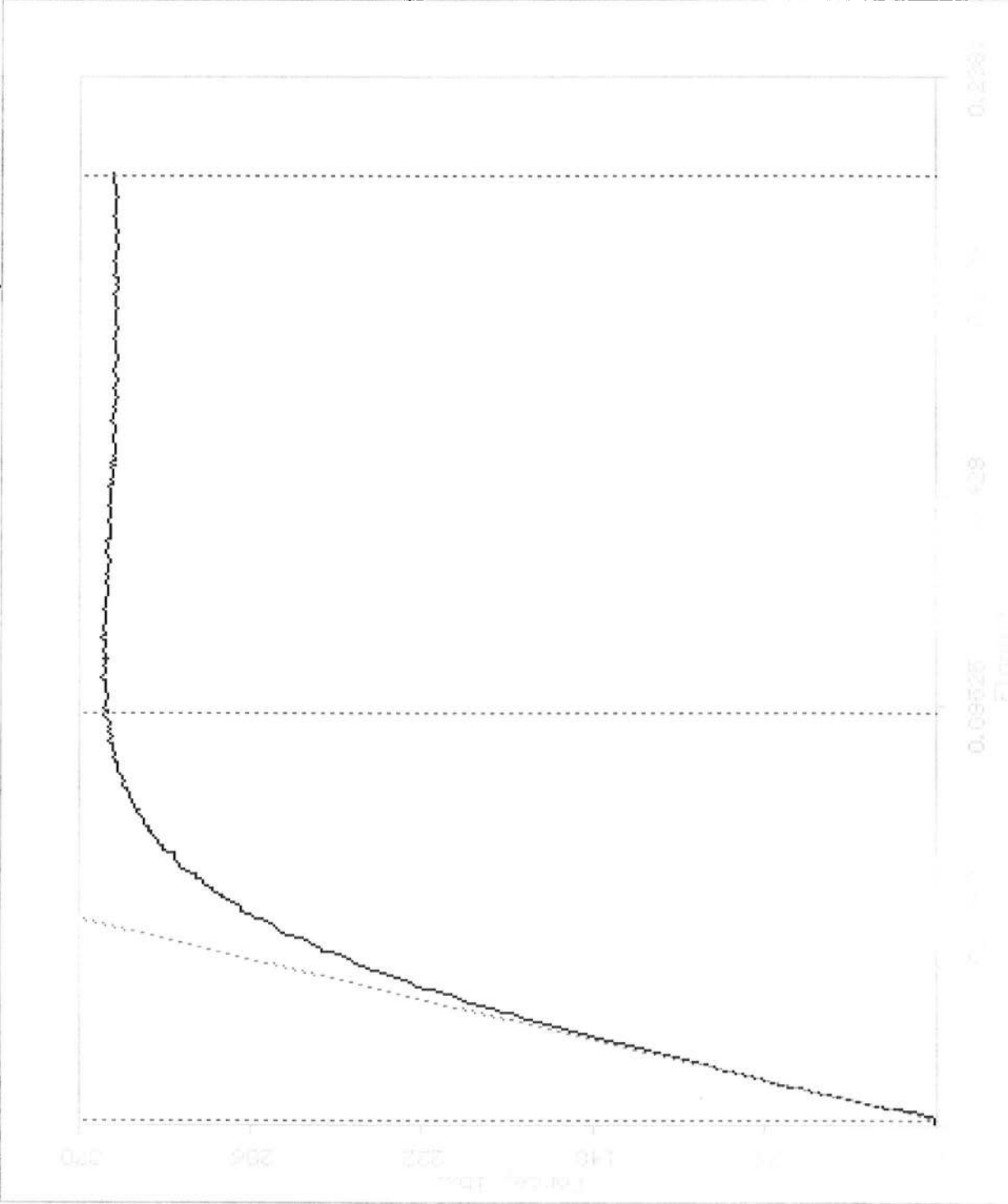
Select :

T - print tear result
L - draw lines
R - current result
C - change labels
P - print graph
Q - quit

POLYHEDRON LABS Lab #34297

Sample : 3 HORIZONTAL XHD
Run # : 1
Range : 5

FORCE vs. EXTENSOMETER
TENSILE TESTING
Speed in/min: 0.2



Sample
Length : 2.000 in.
Width : 0.510 in.
Thickness : 0.123 in.

Tensile Force
at Yield : 357.73 lbs
at Break : 354.85 lbs
Elongation
at Yield : 0.092 in.
at Break : 0.214 in.

Tensile Strength
at Yield : 5702.6 psi
at Break : 5656.8 psi

Elongation
at Yield : 4.6 %
at Break : 10.7 %

Tangent Modulus:
259352.8 psi

100% Modulus:
0.0 psi

---(150)---

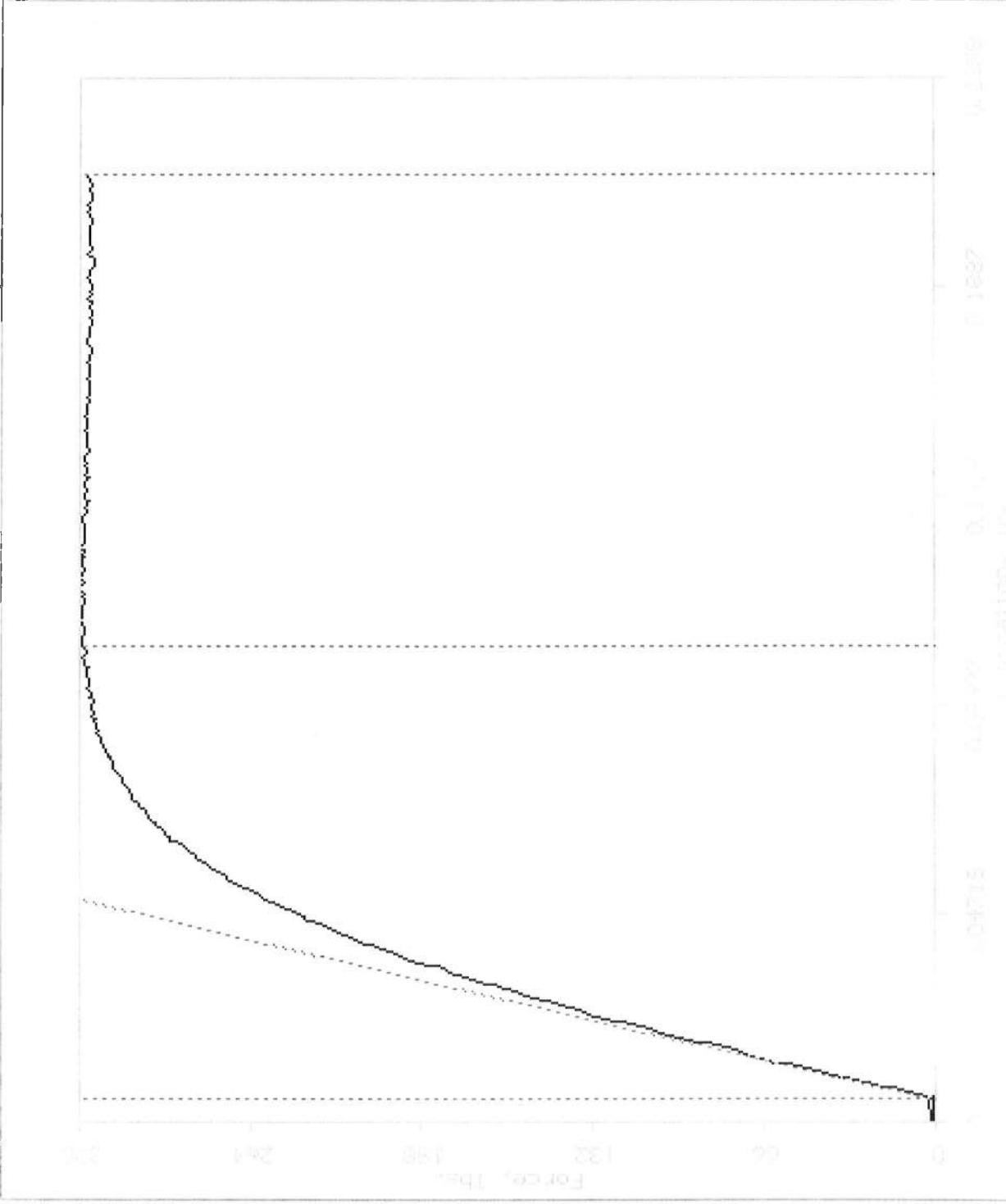
Select :

- T - print tear result
- L - draw lines
- R - current result
- C - change labels
- P - print graph
- Q - quit

POLYHEDRON LABS Lab #34297

Sample : 3 HORIZONTAL XHD
Run # : 2
Range : 5

FORCE vs. EXTENSION
TENSILE TESTING
Speed in/min: 0.2



Sample

Length : 2.000 in.
Width : 0.513 in.
Thickness : 0.124 in.

Tensile Force

at Yield : 328.83 lbs
at Break : 326.56 lbs

Elongation

at Yield : 0.103 in.
at Break : 0.209 in.

Tensile Strength

at Yield : 5169.4 psi
at Break : 5133.6 psi

Elongation

at Yield : 5.1 %
at Break : 10.4 %

Tangent Modulus:

230239.3 psi

100% Modulus:

0.0 psi

---(150)---

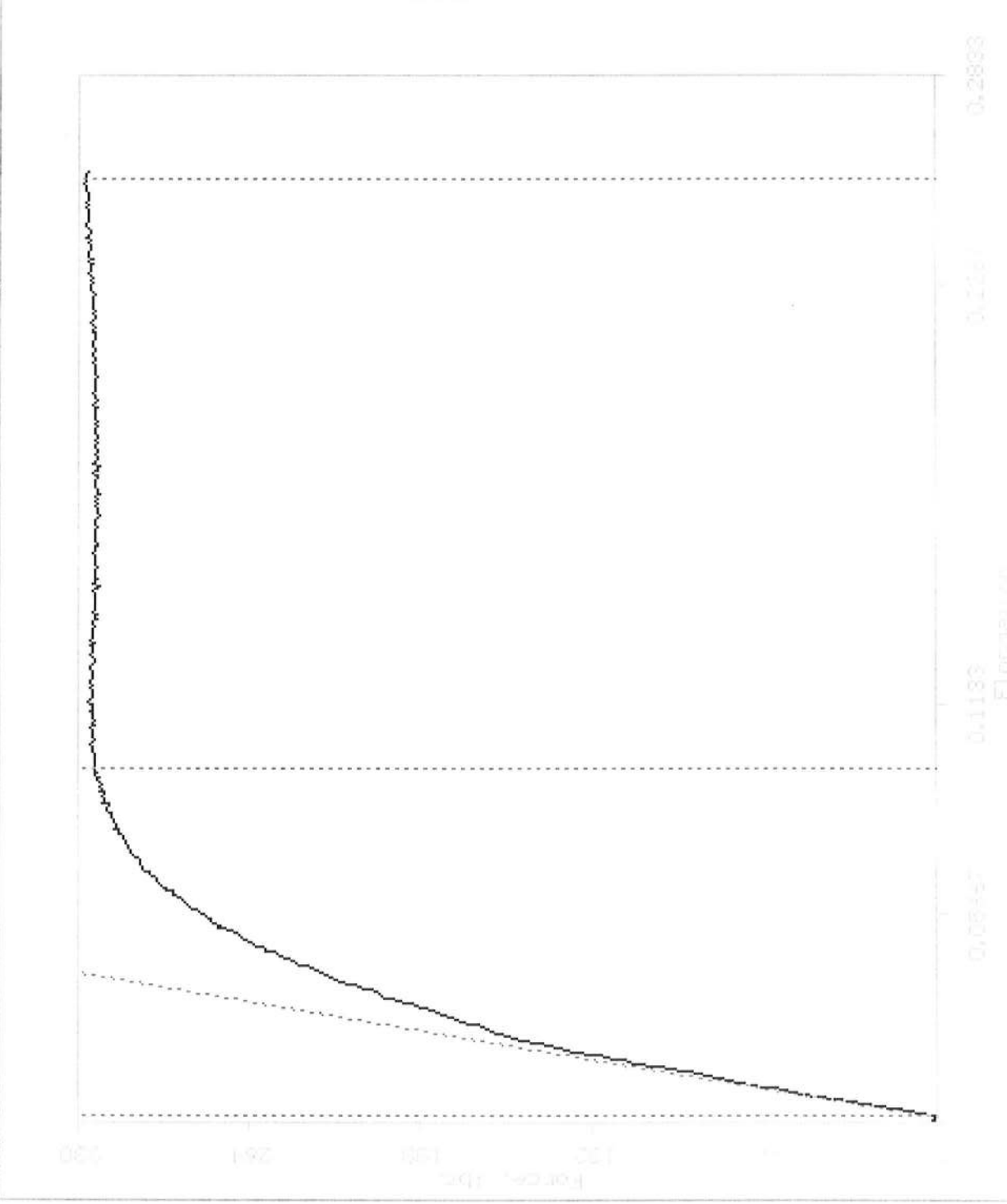
Select :

- T - print tear result
- L - draw lines
- R - current result
- C - change labels
- P - print graph
- Q - quit

POLYHEDRON LABS Lab #34297

Sample : 3 HORIZONTAL XHD
Run # : 3
Range : 5

FORCE vs. EXTENSION
TENSILE TESTING
Speed in/min: 0.2



Sample
Length : 2.000 in.
Width : 0.511 in.
Thickness : 0.124 in.

Tensile Force
at Yield : 323.20 lbs
at Break : 326.80 lbs
Elongation
at Yield : 0.094 in.
at Break : 0.254 in.

Tensile Strength
at Yield : 5100.7 psi
at Break : 5157.4 psi

Elongation
at Yield : 4.7 %
at Break : 12.7 %

Tangent Modulus:
268191.9 psi

100% Modulus:
0.0 psi

---(150)---

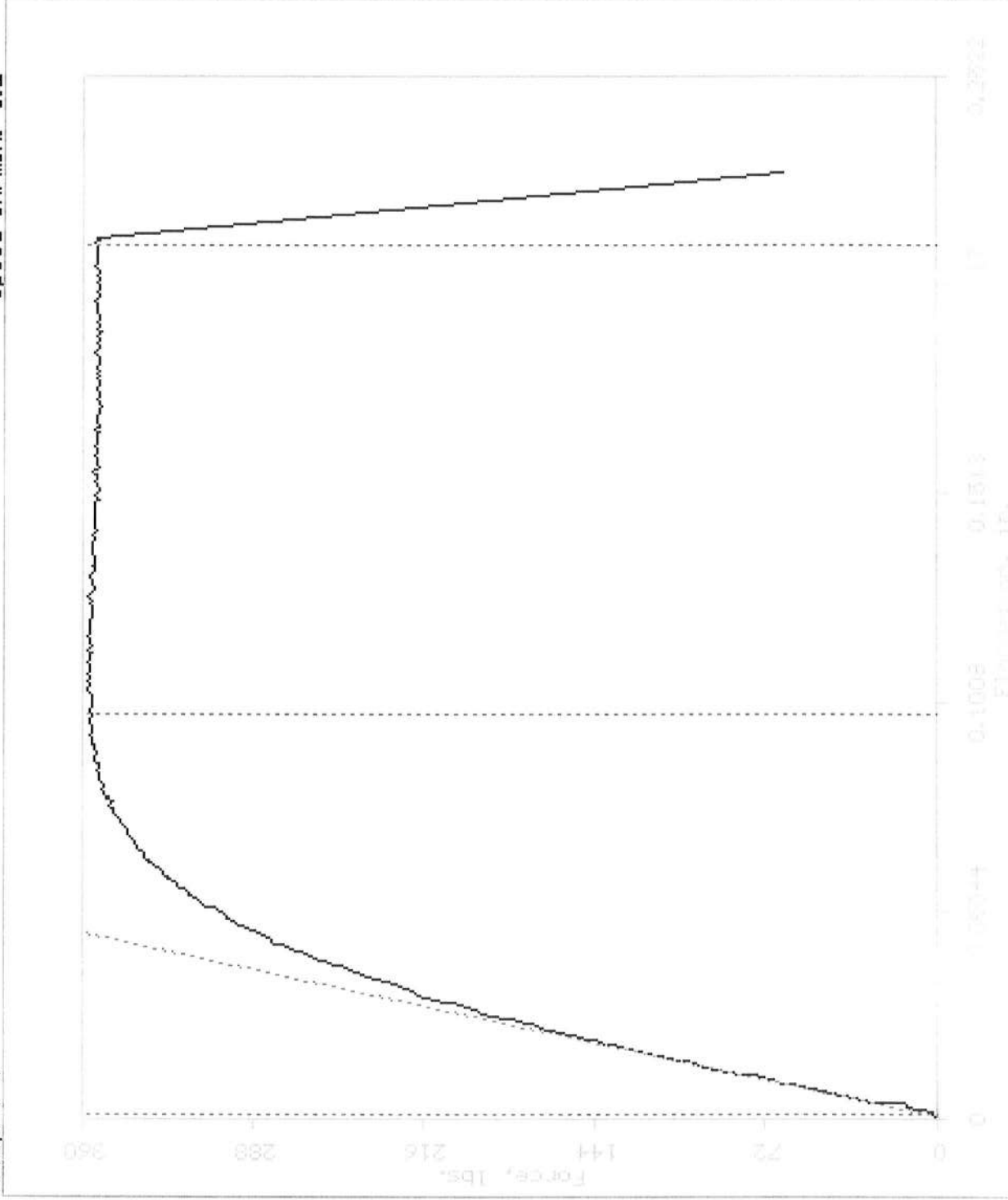
Select :

- T - print tear result
- L - draw lines
- R - current result
- C - change labels
- P - print graph
- Q - quit

POLYHEDRON LABS Lab #34297

Sample : 3 HORIZONTAL XHD
Run # : 4
Range : 5

FORCE vs. EXTENSIONMETER
TENSILE TESTING
Speed in/min: 0.2



Sample
Length : 2.000 in.
Width : 0.512 in.
Thickness : 0.124 in.

Tensile Force
at Yield : 355.93 lbs
at Break : 354.37 lbs
Elongation
at Yield : 0.097 in.
at Break : 0.211 in.

Tensile Strength
at Yield : 5606.2 psi
at Break : 5581.7 psi

Elongation
at Yield : 4.8 %
at Break : 10.5 %

Tangent Modulus:
256562.0 psi

100% Modulus:
0.0 psi

---(150)---

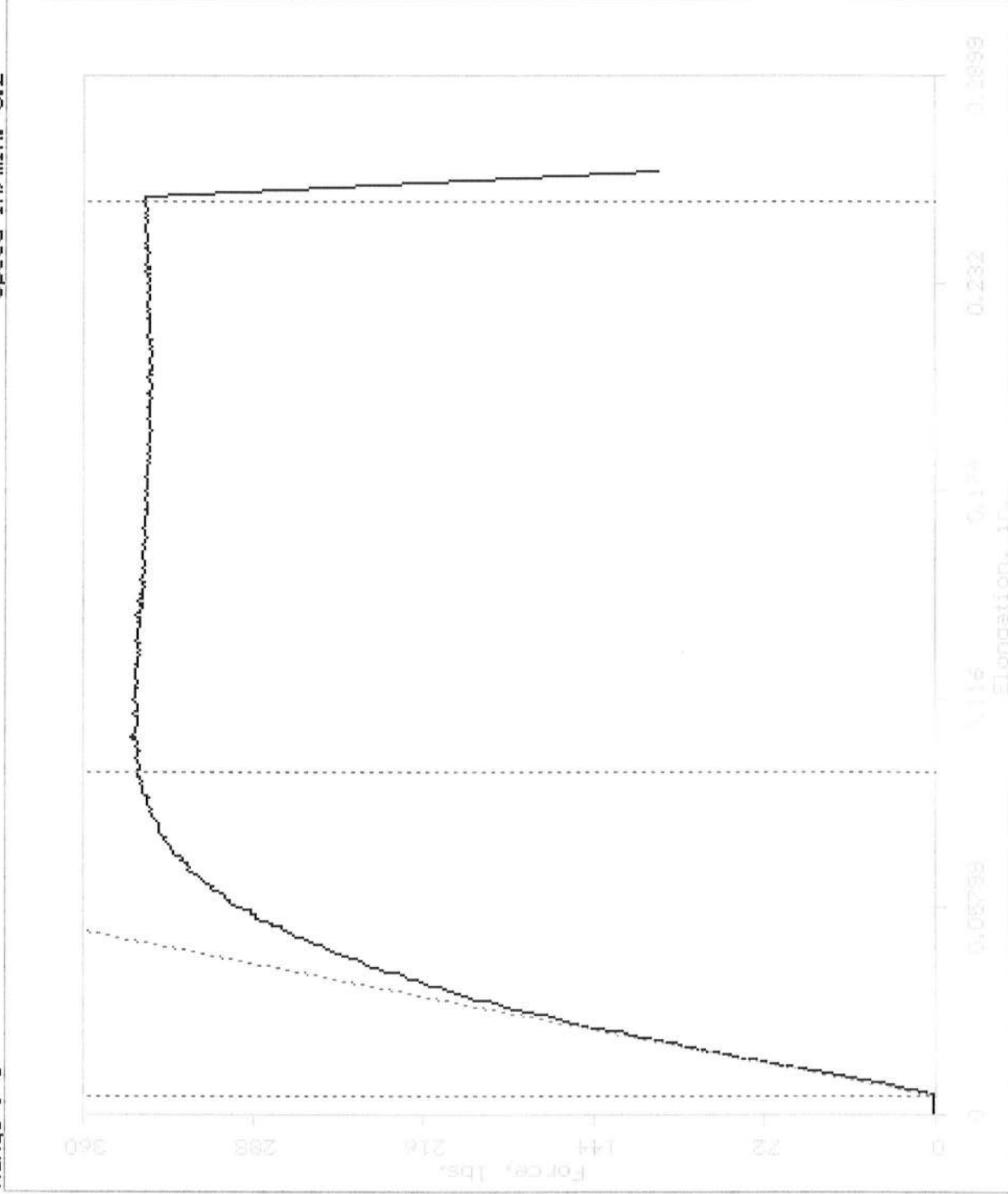
Select :

- T - print tear result
- L - draw lines
- R - current result
- C - change labels
- P - print graph
- Q - quit

POLYHEDRON LABS Lab #34297

Sample : 3 HORIZONTAL XHD
Run # : 5
Range : 5

FORCE vs. EXTENSOMETER
TENSILE TESTING
Speed in/min: 0.2



Sample
Length : 2.000 in.
Width : 0.512 in.
Thickness : 0.124 in.

Tensile Force
at Yield : 336.27 lbs
at Break : 334.71 lbs
Elongation
at Yield : 0.091 in.
at Break : 0.249 in.

Tensile Strength
at Yield : 5296.5 psi
at Break : 5272.0 psi

Elongation
at Yield : 4.5 %
at Break : 12.4 %

Tangent Modulus:
248653.3 psi

100% Modulus:
0.0 psi

---(150)---

Select :

- T - print tear result
- L - draw lines
- R - current result
- C - change labels
- P - print graph
- Q - quit