

**CEMENT AND CONCRETE REFERENCE LABORATORY**  
**PROFICIENCY SAMPLE PROGRAM**

**Final Report**  
**Blended Cement Proficiency Samples**  
**Number 53 and Number 54**

April 2004

**CEMENT AND CONCRETE REFERENCE LABORATORY**

AT THE  
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY  
GAITHERSBURG, MARYLAND 20899  
(301) 975-6704

SPONSORED BY  
COMMITTEE C-1 ON CEMENT  
COMMITTEE C-9 ON CONCRETE AND  
CONCRETE AGGREGATES  
AMERICAN SOCIETY FOR TESTING AND MATERIALS

100 Bureau Dr., Stop 8618  
Fax: 301-975-2243  
e-mail: ccrl@nist.gov

May 7, 2004

**To: Participants in the CCRL Blended Cement Proficiency Sample Program**

**SUBJECT: Final Report on Blended Cement Proficiency Samples No. 53 and No. 54**

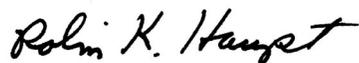
Enclosed is your copy of the final report, on the test results for the current pair of CCRL **Blended Cement** Proficiency Samples which were distributed in February 2004.

This report consists of a Table of Results for individual laboratory data, a statistical Summary of Results, a set of general Scatter Diagrams, and associated detailed information.

The CCRL Proficiency Sample Programs are intended for internal use by the laboratory as a tool to identify potential problems in laboratory procedures or test equipment and to initiate remedial actions. These programs are designed to complement the CCRL Laboratory Inspection Program as part of a total quality system. Care should be taken when using this program for any other use.

It is presently anticipated that the next Blended Cement Proficiency Samples will be distributed in February 2005.

Sincerely,



Robin K. Haupt  
Supervisor, Proficiency Sample Programs  
Cement and Concrete Reference Laboratory

Enclosure

**TO: Participants in the CCRL Blended Cement Proficiency Sample Program**

**FROM: Robin K. Haupt, Supervisor, PSP**

**SUBJECT: Explanation of Final Report on Results of Tests for Blended Cement Proficiency Samples No. 53 and No. 54**

This letter, and the material included with it, constitute the final report, and summary of results for the current pair of Blended Cement Proficiency Samples, which were distributed in February 2004. This material includes a Table of Results for individual laboratory data, a statistical Summary of Results, and a set of general Scatter Diagrams. Your unique laboratory number is displayed at the top of the individualized Table of Results.

An explanation of the program is contained in the paper: "Statistical Evaluation of Interlaboratory Cement Tests" by J. R. Crandall and R. L. Blaine, and "Statistical Aspects of the Cement Testing Program" by W.J. Youden, which can be found in Volume 59, Proceedings of the 62<sup>nd</sup> Annual Meeting of the Society, June 25, 1959, American Society for Testing and Materials.

Each laboratory receives an individualized Table of Results. The Table of Results shows the test title and the reporting unit in the first two columns. After that it lists in order, the laboratory's results for the odd and even numbered samples, overall averages for the odd and even numbered samples, and the laboratory's ratings for the odd and even samples. (See reverse for an explanation of the scatter diagrams.)

Laboratory ratings, shown in the Table of Results for the individual laboratory, were determined in the manner described by Crandall and Blaine using a rating scale of 1 to 5 instead of 0 to 4. The ratings have no valid standing beyond showing the difference between the individual laboratory result and the average for a particular test.

The following table details the relationship between the ratings and the averages.

<b>Ratings</b>	<b>Range (Number of Standard Deviations)</b>	<b>Number (Per 100) of Laboratories achieving the rating <sup>1</sup></b>
5	Less than 1	69
4	1 to 1.5	18
3	1.5 to 2	9
2	2 to 2.5	3
1	Greater than 2.5	1

The sign of the rating merely shows whether the result reported was greater or less than the average obtained.

Participants subscribing to the chemical analysis portion of this report should note that the statistics were calculated using data obtained by wet methods, and rapid methods of chemical analysis.

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<sup>1</sup>Youden, W.J., "Statistical Aspects of the Cement Testing Program", Volume 59, *Proceedings of the 62<sup>nd</sup> Annual Meeting of the Society, June 25, 1959, American Society for Testing and Materials.*

Please note that individual laboratory ratings were not given for the flow of air content mortar (test no. 190) and compressive strength mortar (test no. 230). Air content flows in the range of  $87.5 \pm 7.5$  are satisfactory. Similarly, the compressive strength flows in the range of  $110 \pm 5$  are satisfactory. Labs with flow values outside these ranges will be flagged as a “Labs Eliminated” on the scatter diagram. Averages, standard deviations, and a scatter diagram are provided for your information. This information may be a helpful indicator of a problem with flow table apparatus or mortar mixing procedures. Flow values of 151 were assigned to laboratories reporting a mortar flow off the flow table top.

In cases where some laboratories' results are eliminated, averages, standard deviations, coefficients of variation, and the ratings of the other laboratories' results, are recalculated using the data remaining after the elimination. Since the laboratory ratings given are the results from this one series of tests, you need not attach too much significance to a single low rating, or pair of ratings, from this one series. A continuing tendency to get low ratings on several pairs of samples should lead a laboratory to consider the types of error, systematic and random, contribute to ratings that are low. Systematic error, which is indicated by low ratings with the same signs on each pair of samples, means a consistent error is occurring in equipment and/or test procedures. One indication of random error is low ratings on both samples with different signs. Since systematic error occurs with more regularity, its cause is generally easier to find than the cause of random error.

### **Summary of Results - General**

The Summary of Results provide the statistical summary for each test. Each line lists the test, the number of participants represented, the averages, standard deviations and coefficients of variations. When necessary the data from the test is represented in two lines, one line with all results reported, and then a second line with outlying results omitted. Sometimes two or more recalculations are required to eliminate all outliers from the test. In these cases, all of the laboratories omitted in previous recalculations are also omitted in subsequent ones. Results omitted are values that are more than three standard deviations from the mean of one or both samples. Often, elimination of these outlying results has little effect on the average, but may have a more pronounced effect on the standard deviation and coefficient of variation.

### **Scatter Diagrams**

General scatter diagrams are supplied with this report. Crandall and Blaine describe the manner of preparing scatter diagrams, and their interpretation, in the paper published in the 1959 ASTM Proceedings.

Using the results received from each laboratory, a scatter diagram is generated for each test method by plotting the value for the odd numbered samples on the *X*, or horizontal axis, against the value for the even numbered samples on the *Y*, or vertical axis. Vertical and horizontal dashed lines, which divide the diagrams into four sections or quadrants, place the average values for the odd and even numbered samples, respectively. The first line of print under the diagram includes the test number, as given on the data sheet, the test title, and the number of data points on the diagrams. The number of plotted points may not agree with the total number of data pairs included in the analysis because a few points may be off the diagram, and some points may represent several data pairs, which are identical. Laboratories whose points are off the diagram will have a rating of  $\pm 1$  for that particular test.

As described in Crandall and Blaine, a tight circular pattern of points around the intersection of the median lines is the ideal situation. Stretching out of the pattern into the first (upper right) and third (lower left) quadrants, suggests some kind of bias, or tendency for laboratories to get high or low results on both samples. Examination of the scatter diagrams indicates strong evidence of bias on many tests.

CCRL PROFICIENCY SAMPLE PROGRAM  
 Blended Cement Proficiency Samples No. 53 and No. 54  
 Final Report - May 7, 2004  
 Chemical Results

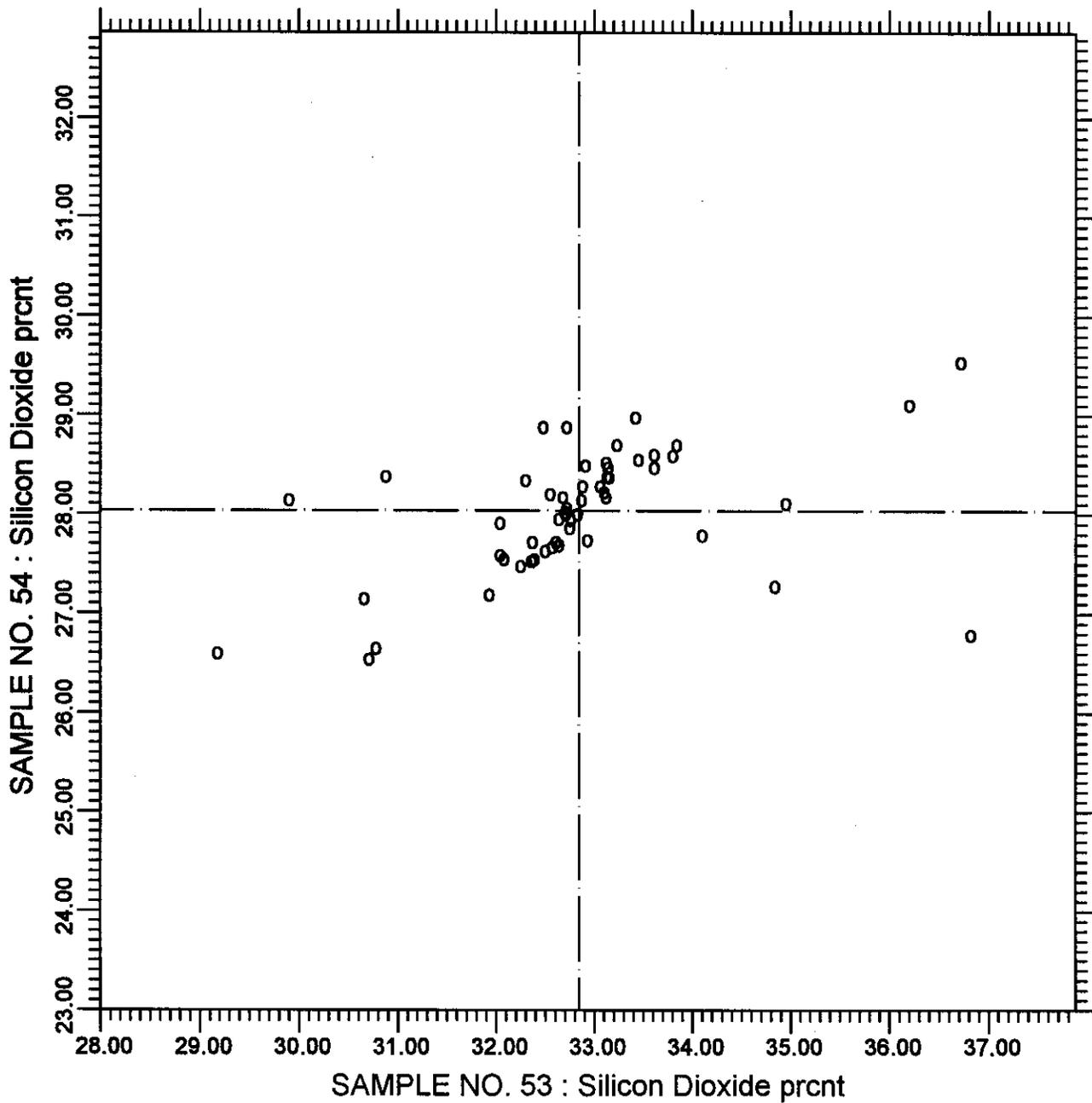
SUMMARY OF RESULTS

Test		#Labs	Sample No. 53			Sample No. 54		
			Average	S.D.	C.V.	Average	S.D.	C.V.
Silicon Dioxide	prcnt	56	32.81	1.38	4.20	27.97	0.77	2.74
Silicon Dioxide	prcnt *	55	32.84	1.37	4.16	28.03	0.62	2.22
Aluminum Oxide	prcnt	52	4.27	0.29	6.72	5.31	0.25	4.73
Aluminum Oxide	prcnt *	47	4.20	0.18	4.40	5.25	0.16	3.16
Ferric Oxide	prcnt	55	3.20	0.23	7.27	2.04	0.18	9.04
Ferric Oxide	prcnt *	53	3.23	0.12	3.86	2.04	0.11	5.50
Calcium Oxide	prcnt	56	53.56	0.88	1.65	53.28	1.00	1.88
Calcium Oxide	prcnt *	54	53.56	0.74	1.38	53.28	0.94	1.77
Magnesium Oxide	prcnt	57	0.94	0.16	17.4	2.37	0.41	17.3
Magnesium Oxide	prcnt *	53	0.96	0.14	14.47	2.37	0.17	7.10
Sulfur Trioxide	prcnt	59	1.97	0.19	9.85	2.96	0.16	5.46
Sulfur Trioxide	prcnt *	54	1.94	0.11	5.84	2.95	0.10	3.57
Loss on Ignition	prcnt	59	2.12	0.11	5.29	4.10	0.14	3.33
Loss on Ignition	prcnt *	57	2.13	0.061	2.89	4.10	0.074	1.82
Phosphorus Pent	prcnt	41	0.24	0.035	14.9	0.19	0.030	16.0
Phosphorus Pent	prcnt *	38	0.23	0.022	9.33	0.19	0.018	9.33
Titanium Dioxide	prcnt	42	0.33	0.035	10.5	0.19	0.030	15.8
Titanium Dioxide	prcnt *	39	0.34	0.030	9.10	0.19	0.018	9.59

\* ELIMINATED LABS: Data over three S.D. from the mean

Silicon Dioxide	309
Aluminum Oxide	1 176 126 309 413
Ferric Oxide	3 80
Calcium Oxide	38 169
Magnesium Oxide	14 36 51 1251
Sulfur Trioxide	38 47 159 497 2191
Loss on Ignition	3 24
Phosphorus Pentoxide	44 176 2190
Titanium Dioxide	47 50 1799

CCRL PROFICIENCY SAMPLE PROGRAM  
 Silicon Dioxide  
 BLENDED CEMENT SAMPLES NO. 53 & NO. 54



TEST NO.10

Silicon Dioxide

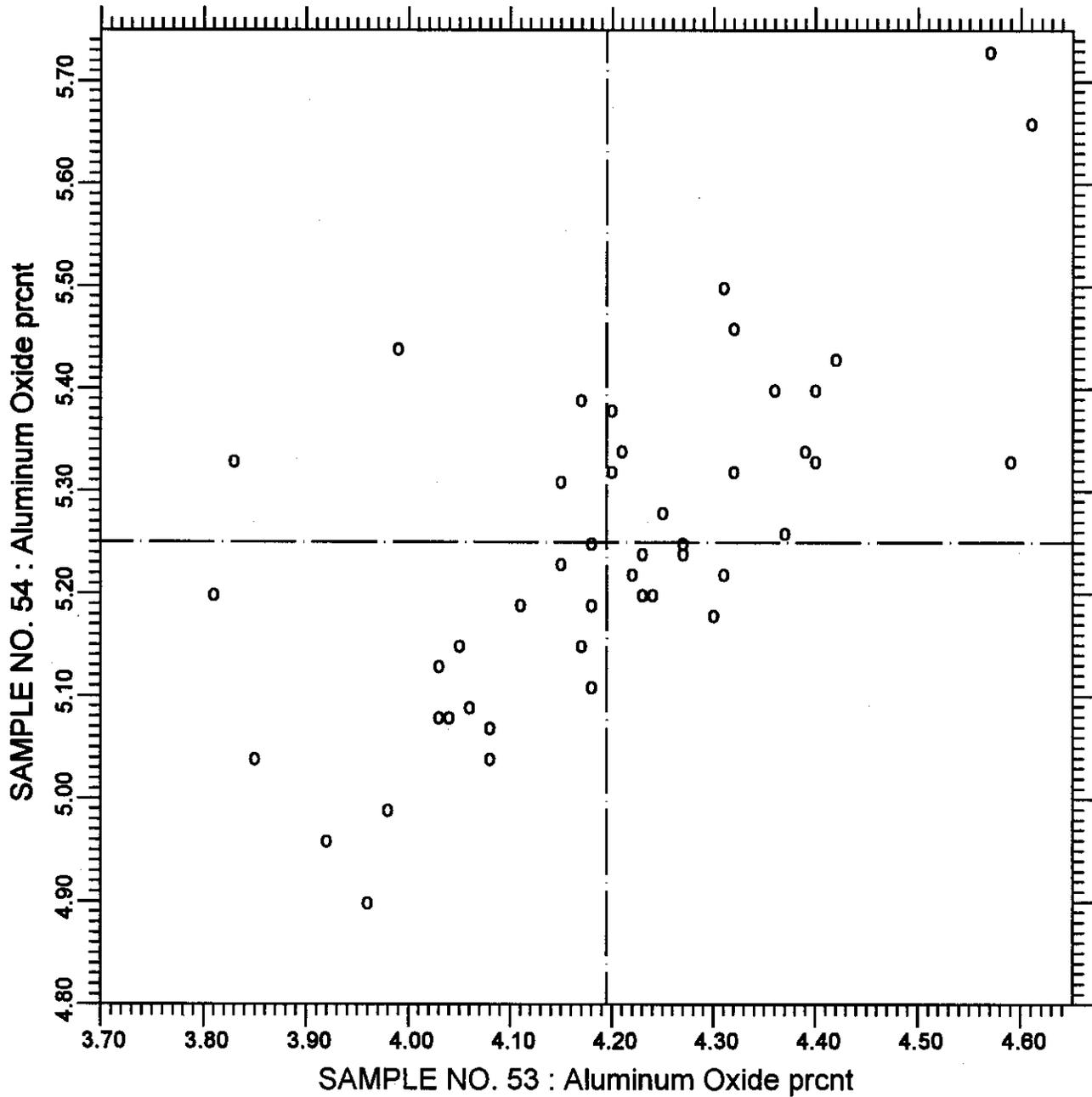
55 POINTS

SAMPLE NO. 53 AVE 32.844 S.D. 1.37 C.V. 4.16

SAMPLE NO. 54 AVE 28.033 S.D. 0.62 C.V. 2.22

LABS ELIMINATED 309

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Aluminum Oxide - wo/minor oxides**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.21**

**Aluminum Oxide**

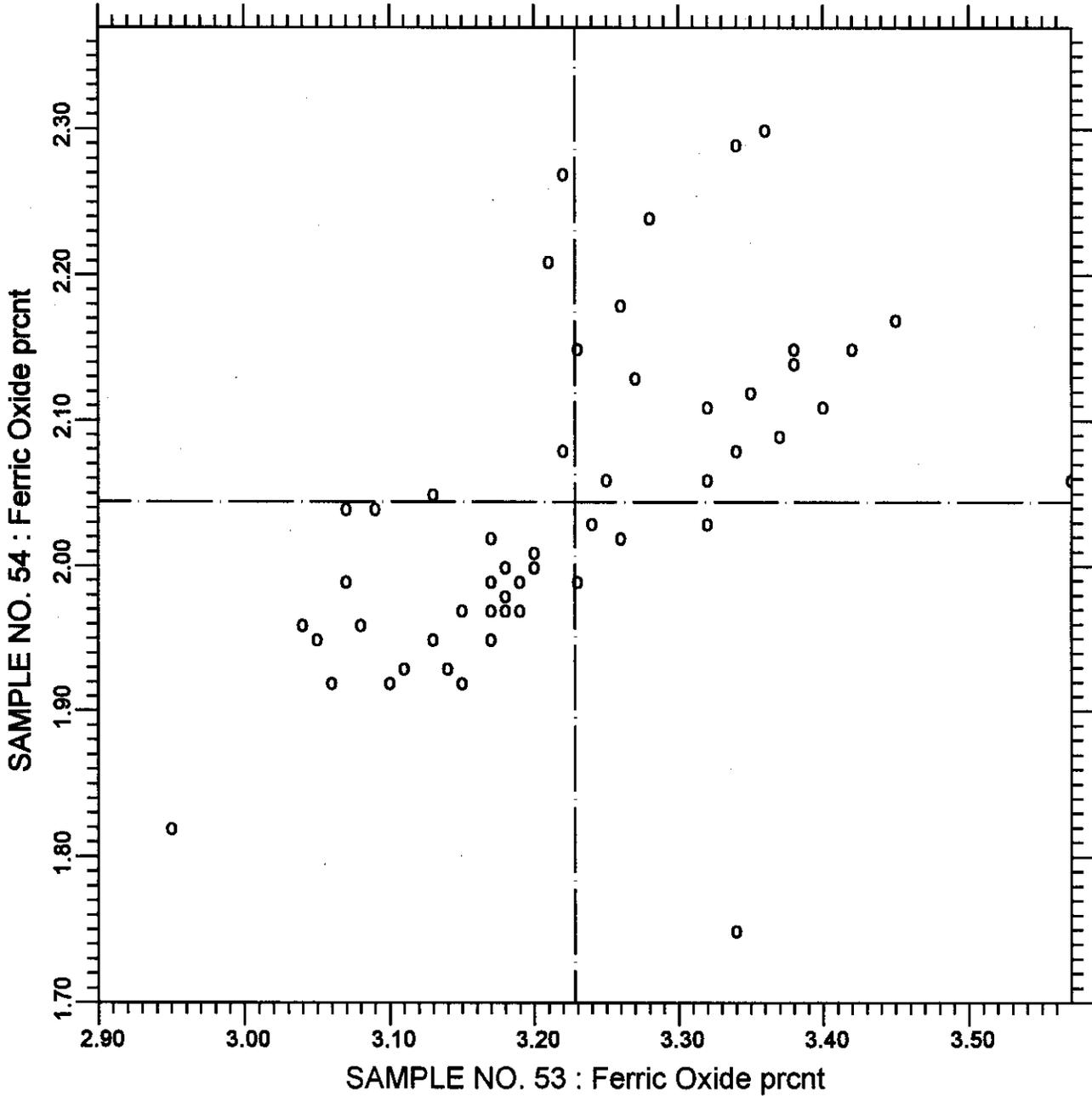
**47 POINTS**

**SAMPLE NO. 53 AVE 4.195 S.D. 0.18 C.V. 4.40**

**SAMPLE NO. 54 AVE 5.250 S.D. 0.16 C.V. 3.16**

**LABS ELIMINATED 1 176 126 309 413**

CCRL PROFICIENCY SAMPLE PROGRAM  
 Ferric Oxide  
 BLENDED CEMENT SAMPLES NO. 53 & NO. 54



TEST NO.30

Ferric Oxide

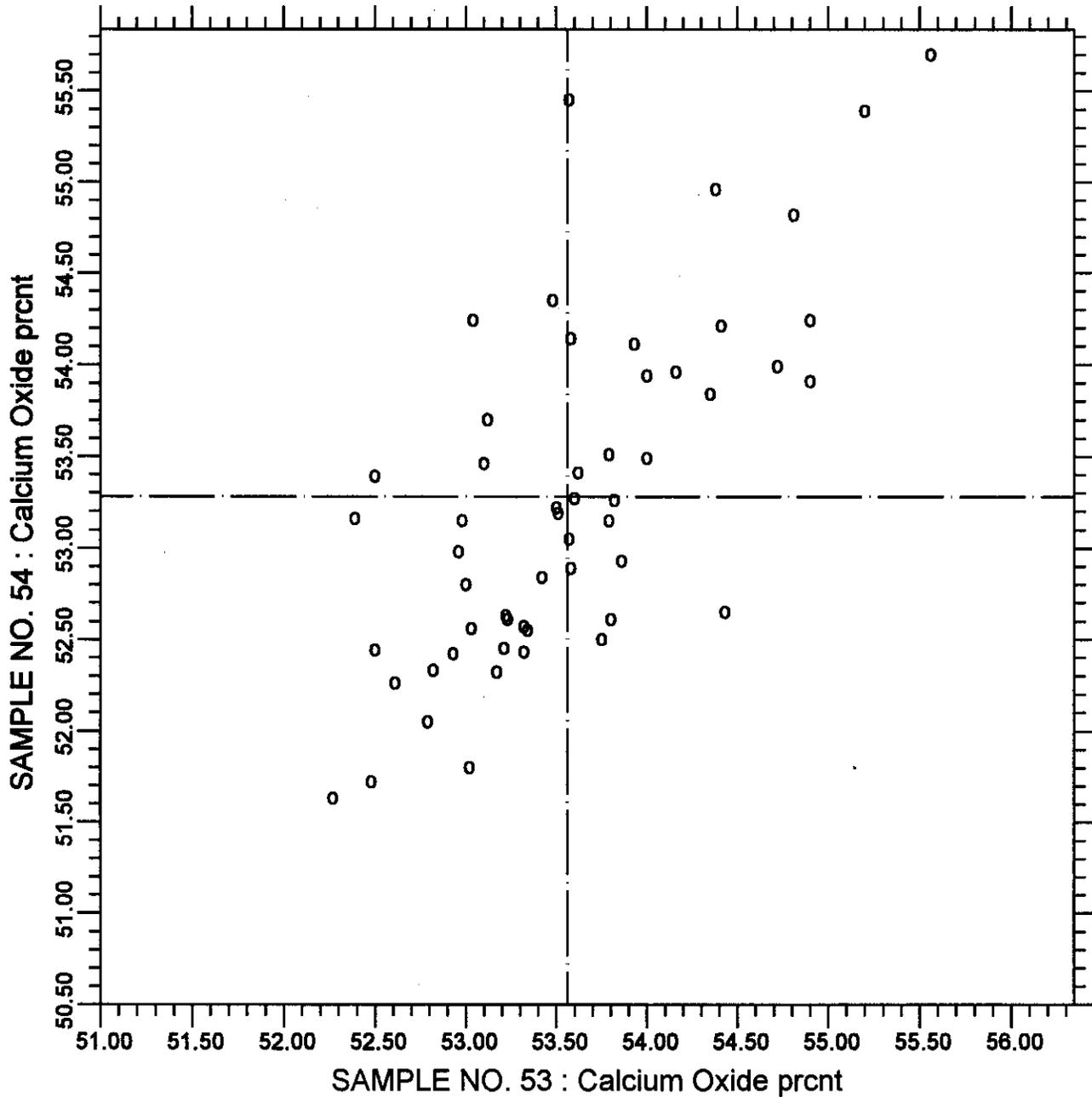
53 POINTS

SAMPLE NO. 53 AVE 3.228 S.D. 0.12 C.V. 3.86

SAMPLE NO. 54 AVE 2.044 S.D. 0.11 C.V. 5.50

LABS ELIMINATED 3 80

CCRL PROFICIENCY SAMPLE PROGRAM  
 Calcium Oxide  
 BLENDED CEMENT SAMPLES NO. 53 & NO. 54



TEST NO.40

Calcium Oxide

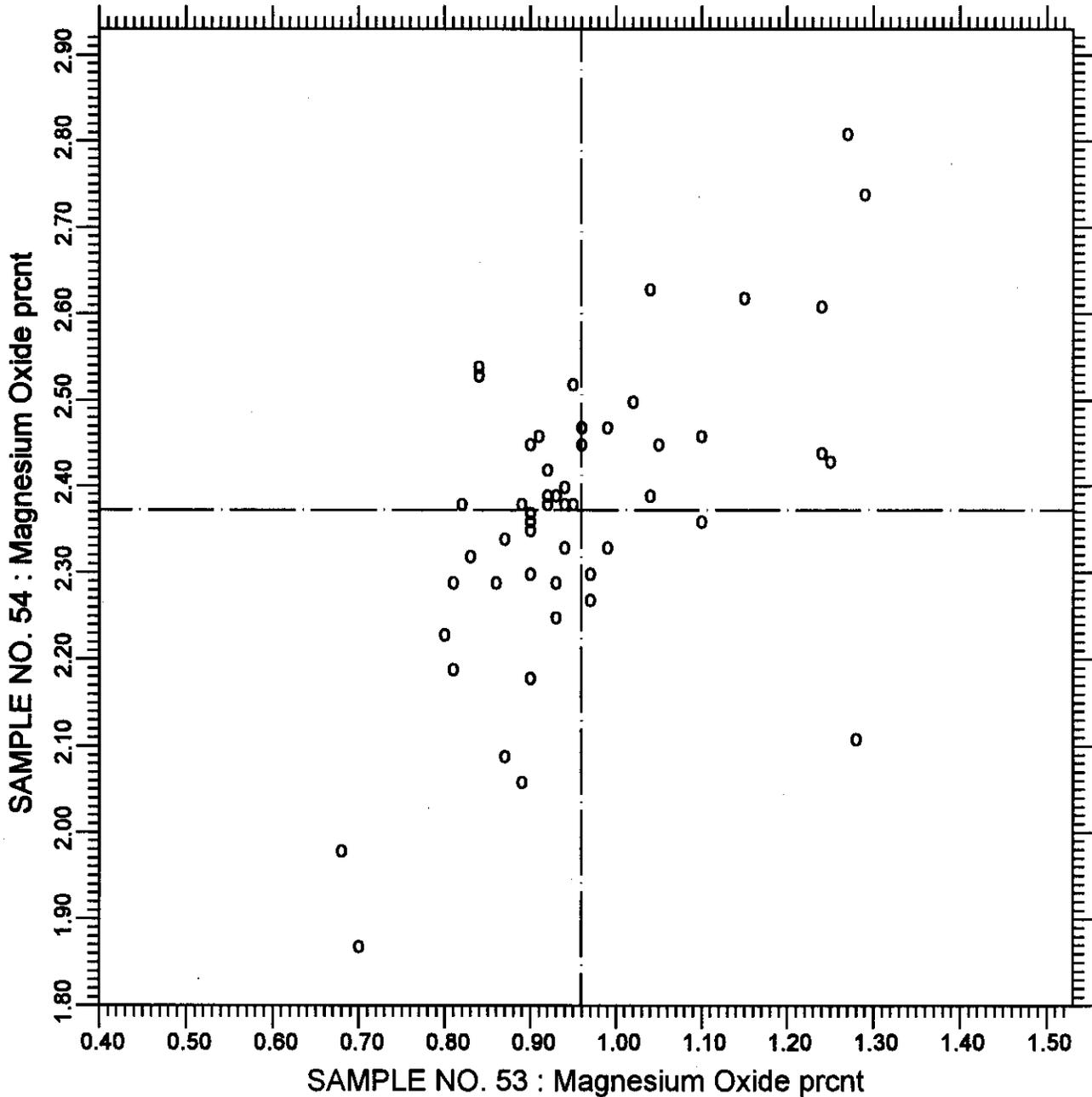
54 POINTS

SAMPLE NO. 53 AVE 53.56 S.D. 0.74 C.V. 1.38

SAMPLE NO. 54 AVE 53.28 S.D. 0.94 C.V. 1.77

LABS ELIMINATED 38 169

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Magnesium Oxide**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.50**

**Magnesium Oxide**

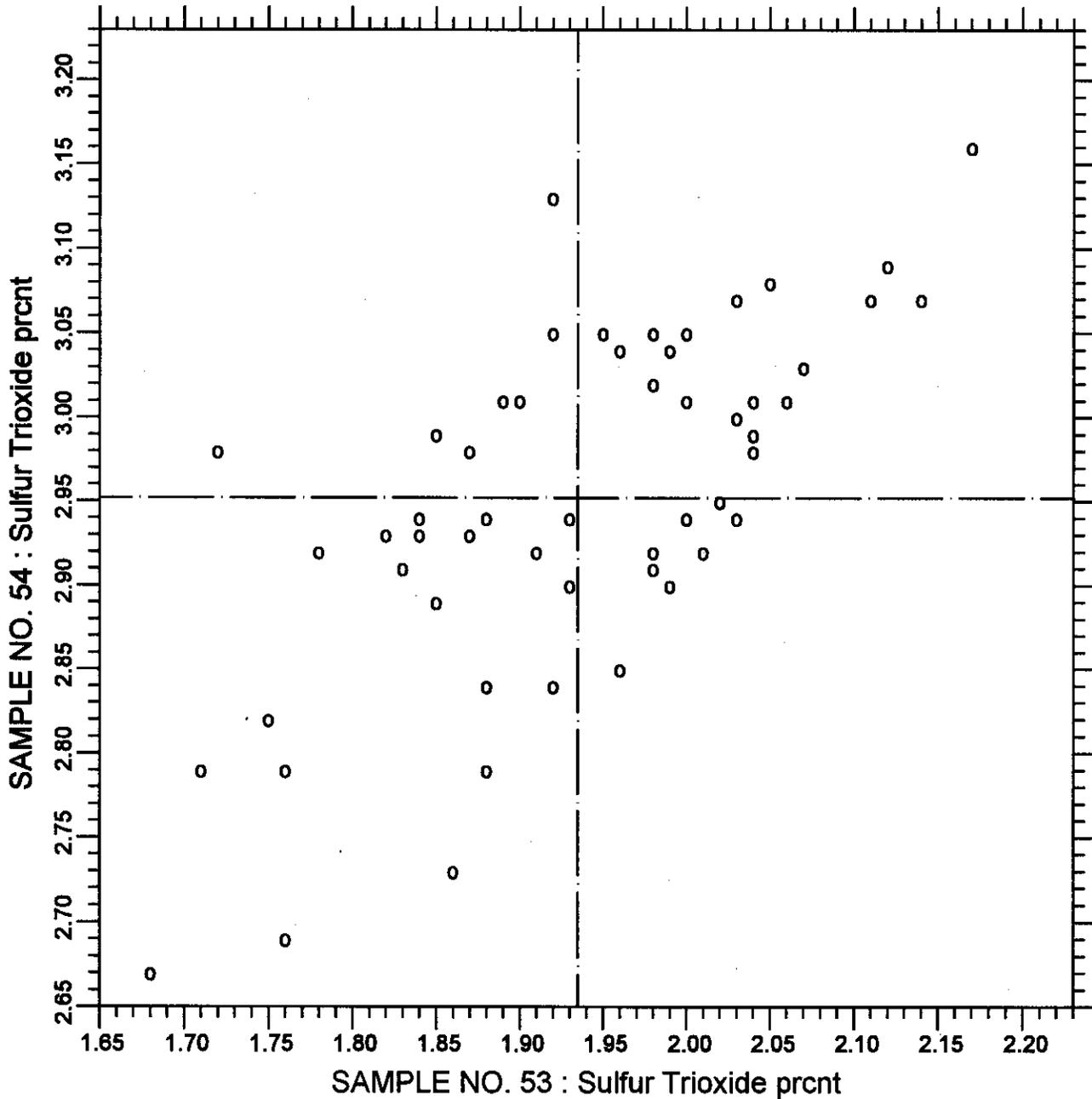
**53 POINTS**

SAMPLE NO. 53 AVE 0.960 S.D. 0.14 C.V. 14.47

SAMPLE NO. 54 AVE 2.372 S.D. 0.17 C.V. 7.10

LABS ELIMINATED 14 36 51 1251

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Sulfur Trioxide**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.60**

**Sulfur Trioxide**

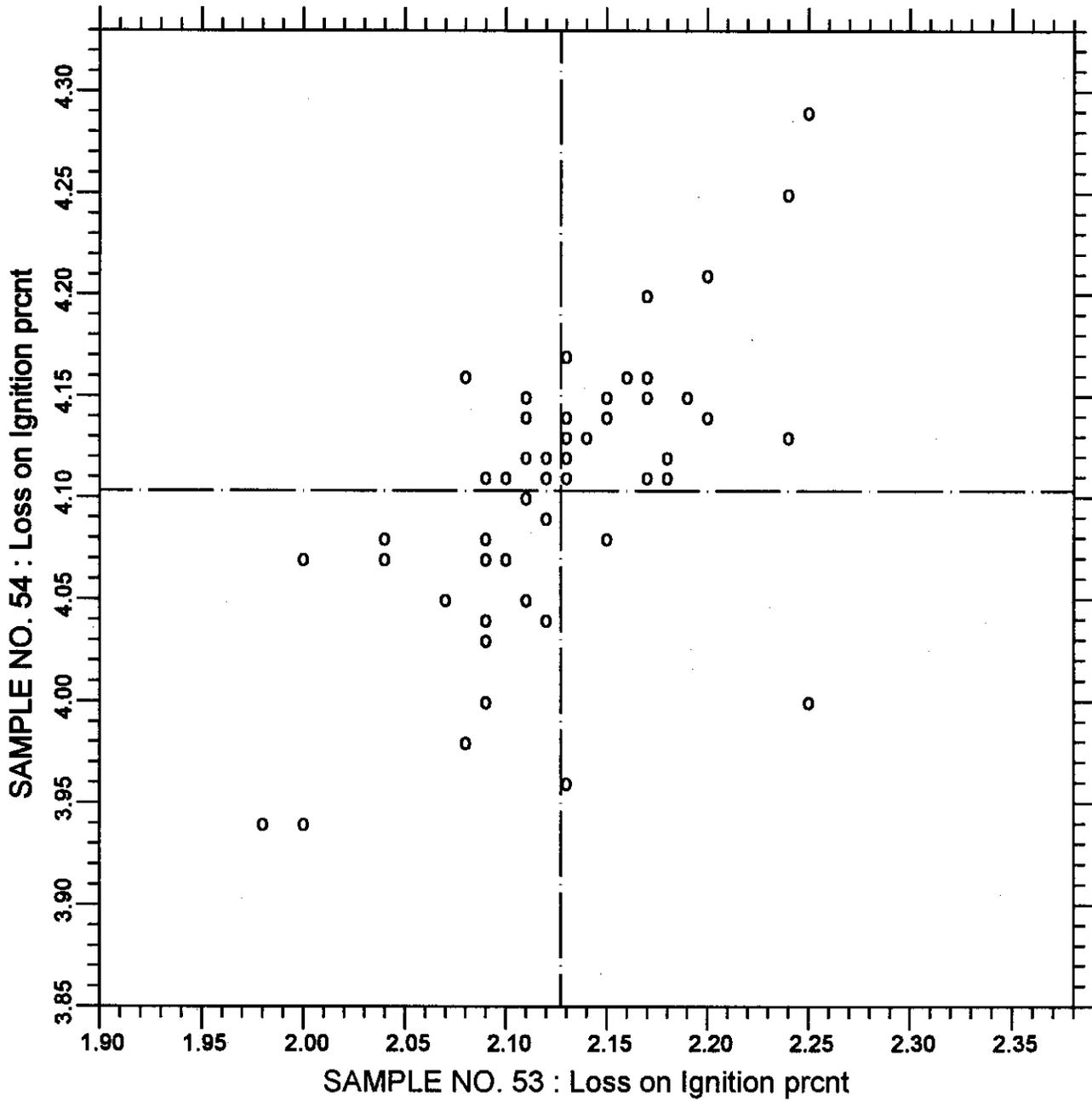
**54 POINTS**

SAMPLE NO. 53 AVE 1.935 S.D. 0.11 C.V. 5.84

SAMPLE NO. 54 AVE 2.952 S.D. 0.10 C.V. 3.57

LABS ELIMINATED 38 47 159 497 2191

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Loss on Ignition**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.70**

**Loss on Ignition**

**56 POINTS**

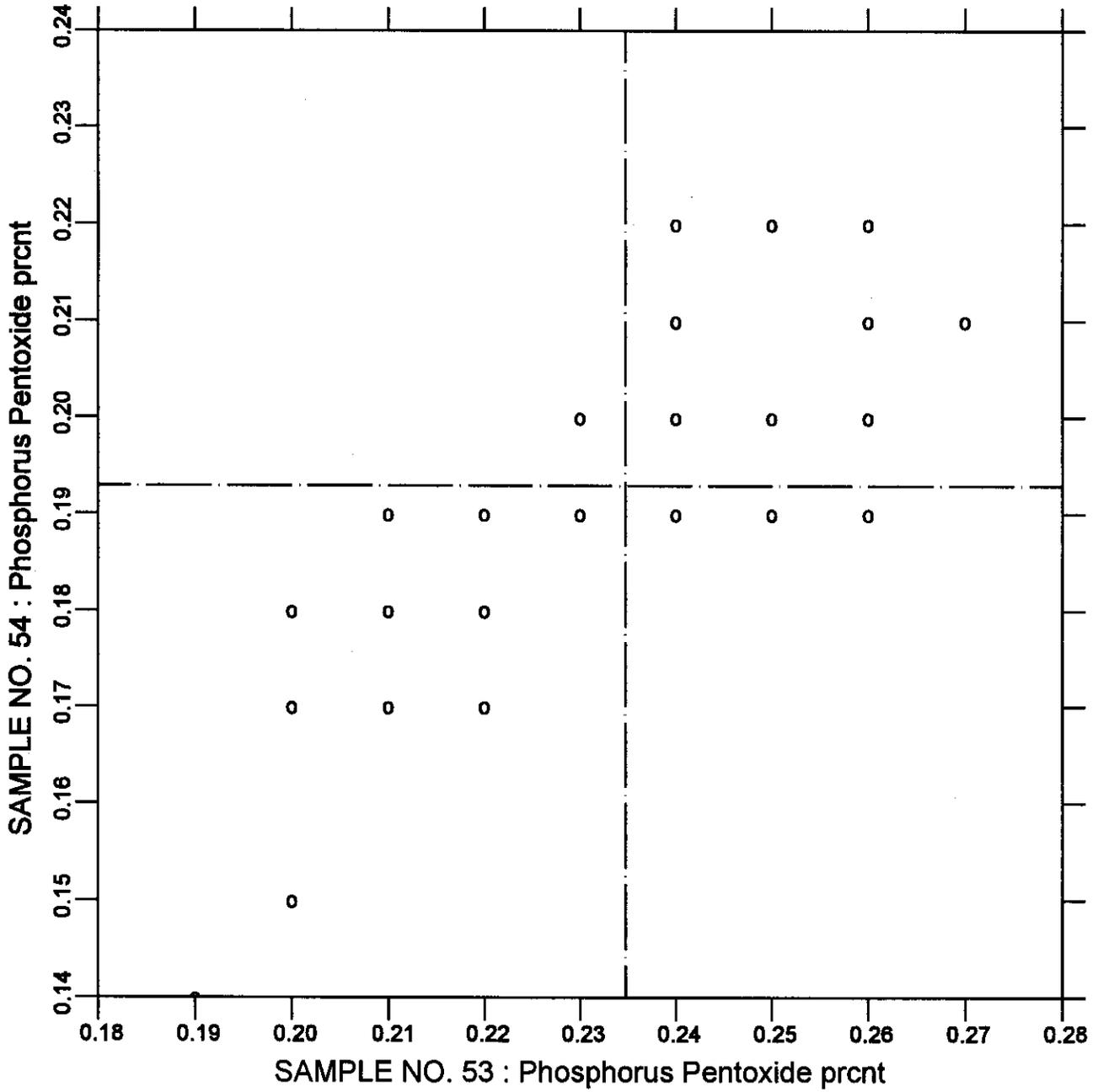
SAMPLE NO. 53    AVE 2.1272    S.D. 0.061    C.V. 2.89

SAMPLE NO. 54    AVE 4.1030    S.D. 0.074    C.V. 1.82

LABS ELIMINATED 3 24

LABS OFF DIAGRAM 1251

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Phosphorus Pentoxide**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.102**

**Phosphorus Pentoxide**

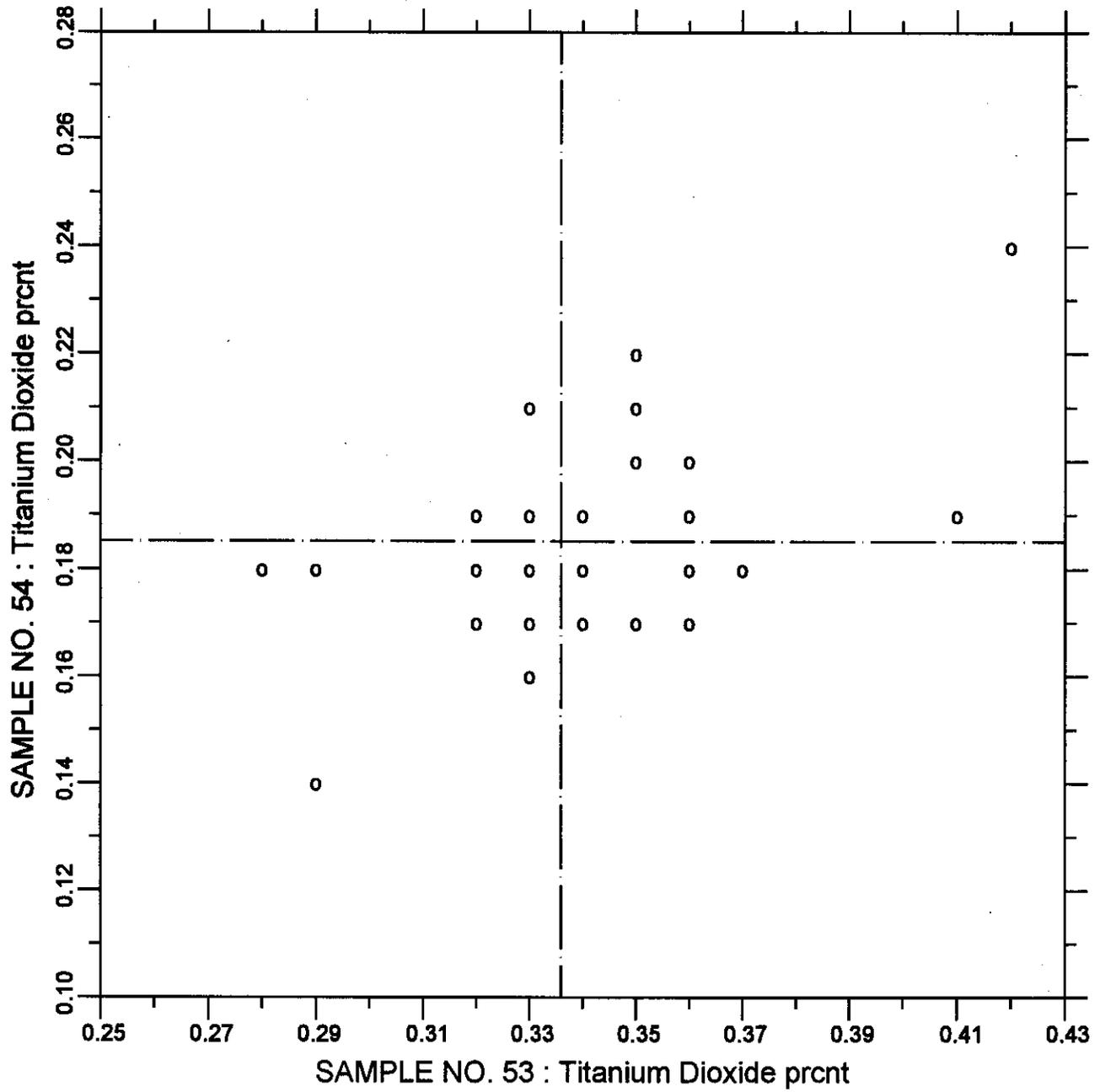
**38 POINTS**

SAMPLE NO. 53    AVE 0.2347    S.D. 0.022    C.V. 9.33

SAMPLE NO. 54    AVE 0.1929    S.D. 0.018    C.V. 9.33

LABS ELIMINATED 44 176 2190

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Titanium Dioxide**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.103**

**Titanium Dioxide**

**38 POINTS**

SAMPLE NO. 53 AVE 0.3359 S.D. 0.030 C.V. 9.10

SAMPLE NO. 54 AVE 0.1851 S.D. 0.018 C.V. 9.59

LABS ELIMINATED 47 50 1799

LABS OFF DIAGRAM 176

CCRL PROFICIENCY SAMPLE PROGRAM  
Blended Cement Proficiency Samples No. 53 and No. 54  
Final Report - May 7, 2004  
Physical Results

SUMMARY OF RESULTS

Test		#Labs	Sample No. 53			Sample No. 54		
			Average	S.D.	C.V.	Average	S.D.	C.V.
N.C. Water	prcnt	68	29.5	2.5	8.37	27.2	2.6	9.76
N.C. Water	prcnt	* 65	29.2	0.74	2.54	26.9	0.45	1.66
Vicat TS Initial	minute	67	194	26.6	13.7	158	17.9	11.3
Vicat TS Final	minute	64	299	41.1	13.7	276	39.0	14.2
Autoclave Expan	prcnt	65	-0.003	0.021	-797.7	0.004	0.024	594.2
Autoclave Expan	prcnt	* 63	-0.004	0.017	-407.8	0.001	0.014	2207.0
Air Content	prcnt	62	5.9	1.1	18.0	7.4	1.1	14.4
AC Mix Water	prcnt	62	69.1	3.1	4.55	68.7	3.2	4.69
AC Mix Water	prcnt	* 61	69.4	1.8	2.63	69.0	1.9	2.78
AC Flow	prcnt	62	88	3.5	3.96	88	3.5	4.01
AC Flow	prcnt	* 61	88	3.4	3.84	88	3.4	3.85
Spec Gravity		53	3.46	3.7	106	3.44	3.6	106
Spec Gravity		* 50	2.96	0.033	1.10	2.95	0.030	1.02

CONTINUED ON NEXT PAGE

\* ELIMINATED LABS: Data over three S.D. from the mean

N.C. Water	37 74 289
Autoclave Expansion	51 1251
Air Content Mix Water	1038
Air Content Flow	169
Specific Gravity	43 126 2116

CCRL PROFICIENCY SAMPLE PROGRAM  
 Blended Cement Proficiency Samples No. 53 and No. 54  
 Final Report - May 7, 2004  
 Physical Results

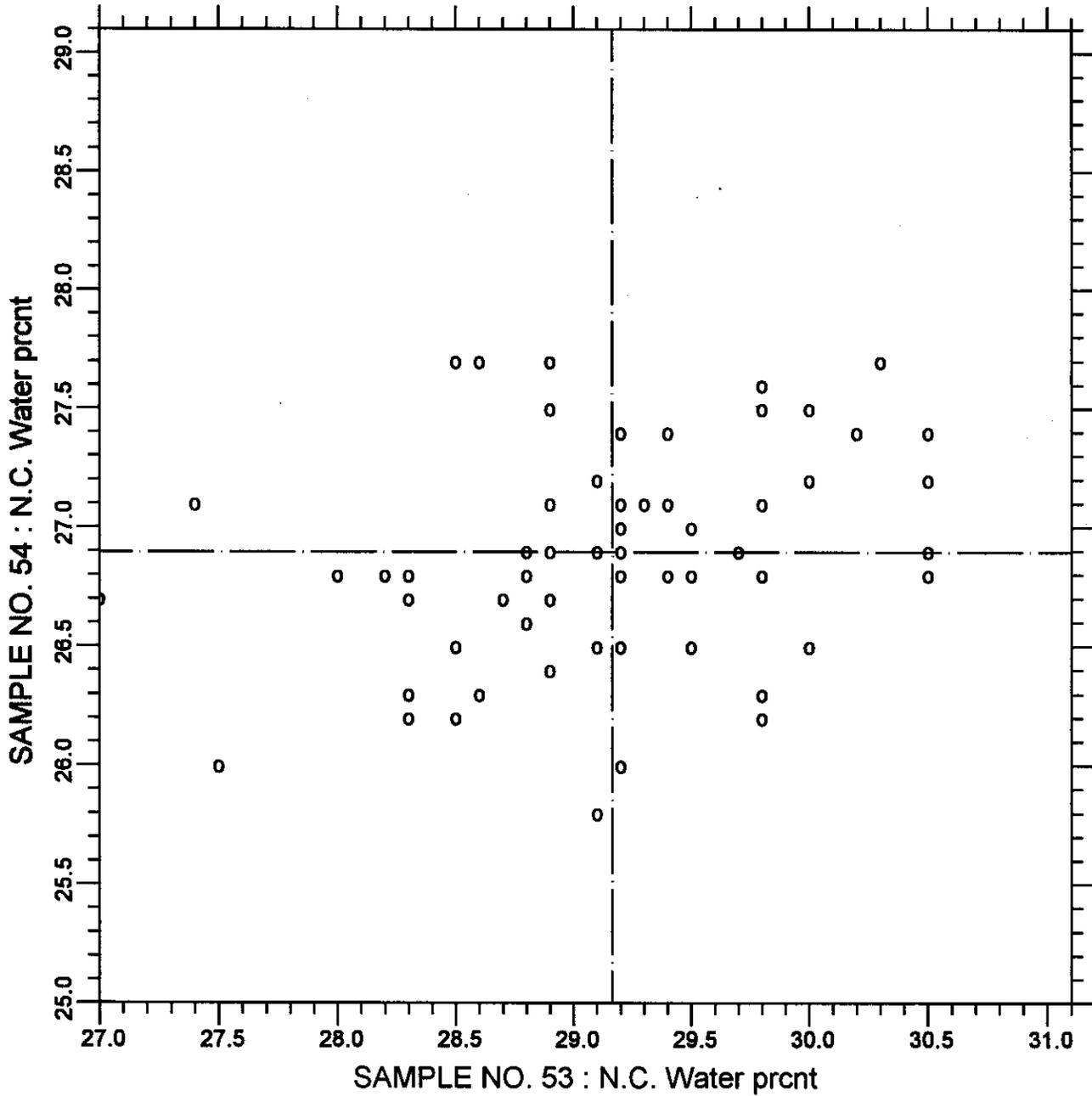
SUMMARY OF RESULTS

Test		#Labs	Sample No. 53			Sample No. 54		
			Average	S.D.	C.V.	Average	S.D.	C.V.
Comp Str, 3 day	psi	69	2504	192.7	7.70	3008	268.0	8.91
Comp Str, 7 day	psi	69	3514	290.0	8.25	3787	307.0	8.10
Comp Str, 7 day	psi	* 67	3535	262.3	7.42	3800	278.8	7.34
Comp Str, 28 day	psi	57	6576	545.7	8.30	4995	349.6	7.00
Comp Str, 28 day	psi	* 56	6611	482.8	7.30	5001	350.3	7.00
CS Mix Water	prcnt	66	48.3	2.6	5.29	48.2	3.1	6.43
CS Mix Water	prcnt	* 64	48.6	1.2	2.37	48.4	1.1	2.23
Com Str Flow	prcnt	67	109	4.4	4.08	110	4.2	3.84
Com Str Flow	prcnt	* 61	109	2.6	2.34	110	2.8	2.49
Fineness AP	cm <sup>2</sup> /g	66	4988	683.4	13.7	4682	638.3	13.6
Fineness AP	cm <sup>2</sup> /g	* 65	4930	499.8	10.14	4625	444.9	9.62
45µm Sieve	prcnt	64	98.580	0.36	0.360	95.471	0.98	1.027
45µm Sieve	prcnt	* 61	98.602	0.32	0.320	95.470	0.65	0.684

\* ELIMINATED LABS: Data over three S.D. from the mean

Comp Strength, 7 day      2 413  
 Comp Strength, 28 day    20  
 Comp Strength Mix Water 2 19  
 Comp Strength Flow      159 43 218 289 22 169 416  
 Fineness Air Permeability 52  
 45µm Sieve                34 176 413

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Normal Consistency - % Water**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.110**

**N.C. Water**

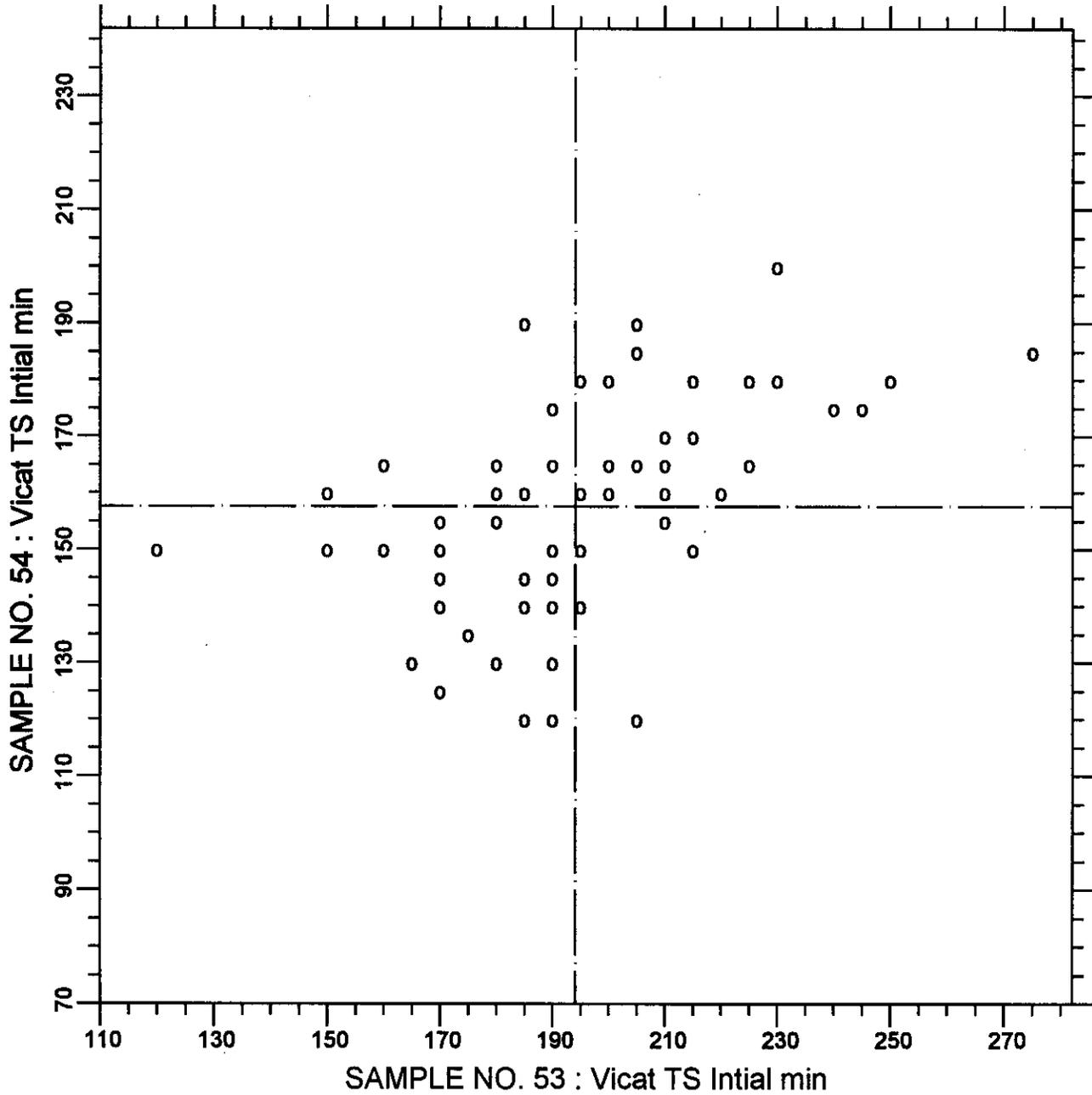
**65 POINTS**

**SAMPLE NO. 53 AVE 29.165 S.D. 0.74 C.V. 2.54**

**SAMPLE NO. 54 AVE 26.895 S.D. 0.45 C.V. 1.66**

**LABS ELIMINATED 37 74 289**

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Vicat Time of Set - Initial**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



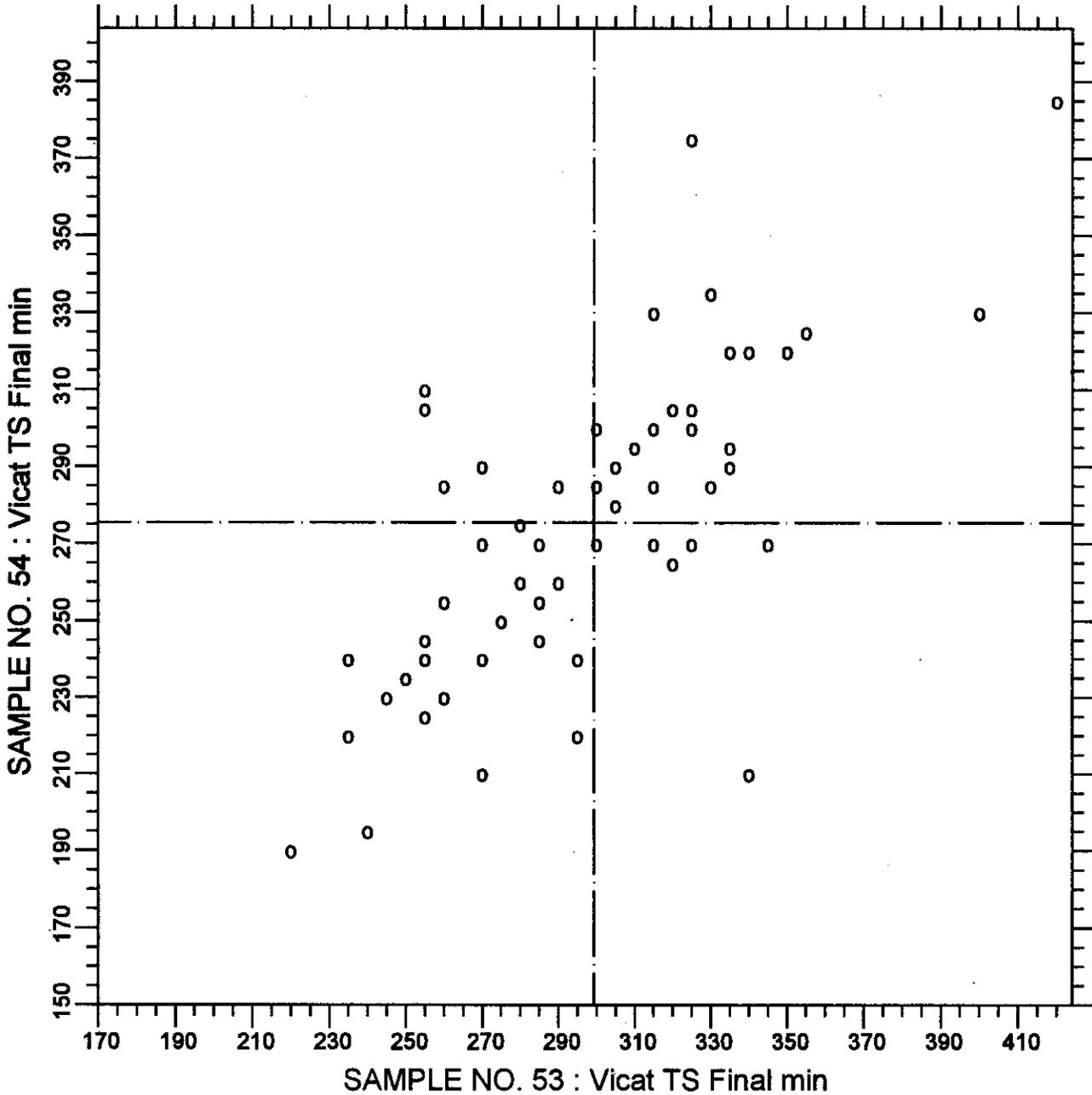
**TEST NO.120**

**Vicat TS Intial**

**67 POINTS**

SAMPLE NO. 53	AVE	194.1	S.D.	26.6	C.V.	13.7
SAMPLE NO. 54	AVE	157.6	S.D.	17.9	C.V.	11.3

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Vicat Time of Set - Final**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.121**

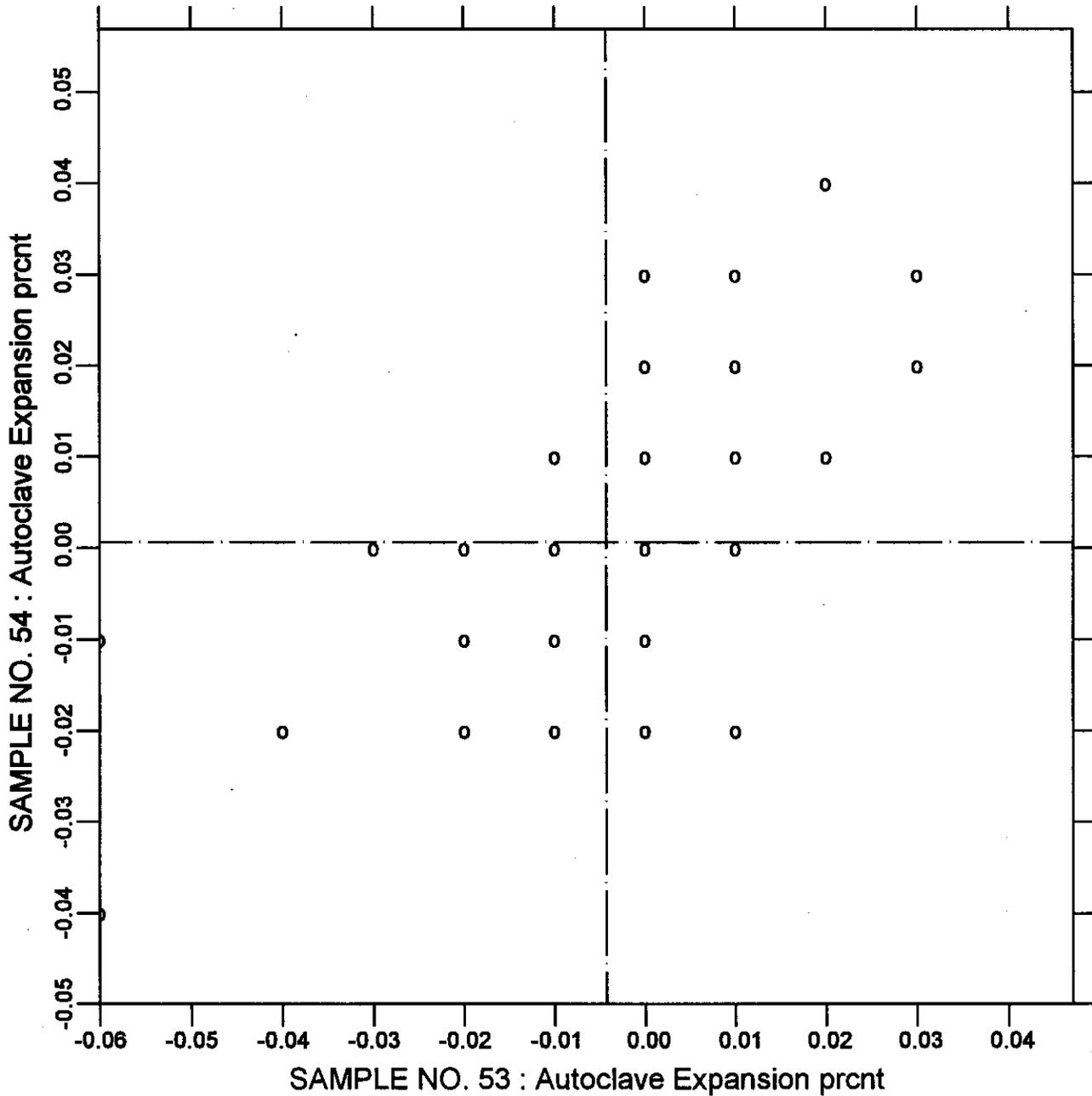
**Vicat TS Final**

**63 POINTS**

SAMPLE NO. 53	AVE	299.4	S.D.	41.1	C.V.	13.7
SAMPLE NO. 54	AVE	275.5	S.D.	39.0	C.V.	14.2

**LABS OFF DIAGRAM 176**

CCRL PROFICIENCY SAMPLE PROGRAM  
Autoclave Expansion  
BLENDED CEMENT SAMPLES NO. 53 & NO. 54



TEST NO.160

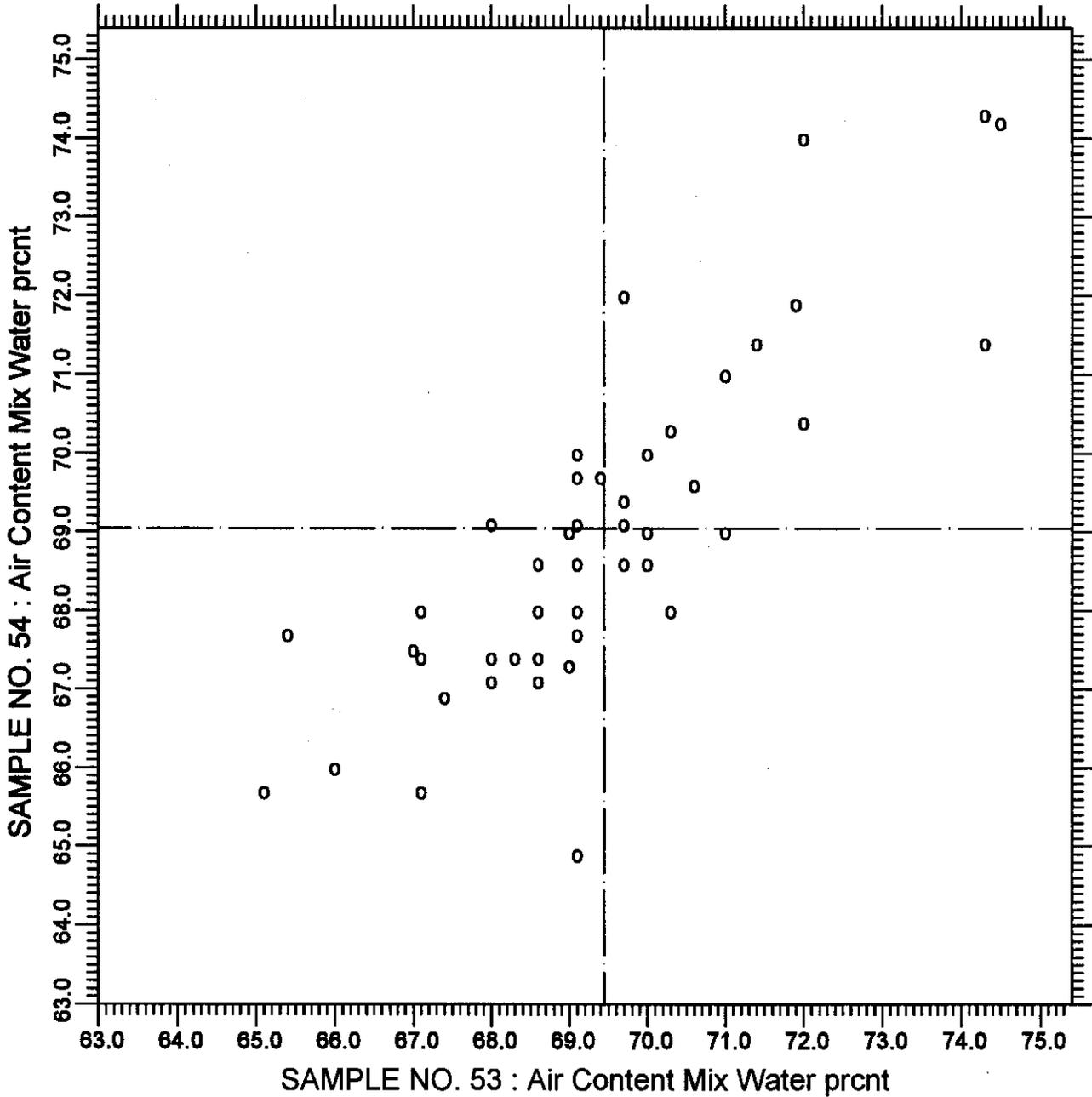
Autoclave Expansion

63 POINTS

SAMPLE NO. 53 AVE -0.0043 S.D. 0.017 C.V. -407.853  
 SAMPLE NO. 54 AVE 0.0006 S.D. 0.014 C.V. 2207.050  
 LABS ELIMINATED 51 1251



**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Air Content - % Water**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.180**

**Air Content Mix Water**

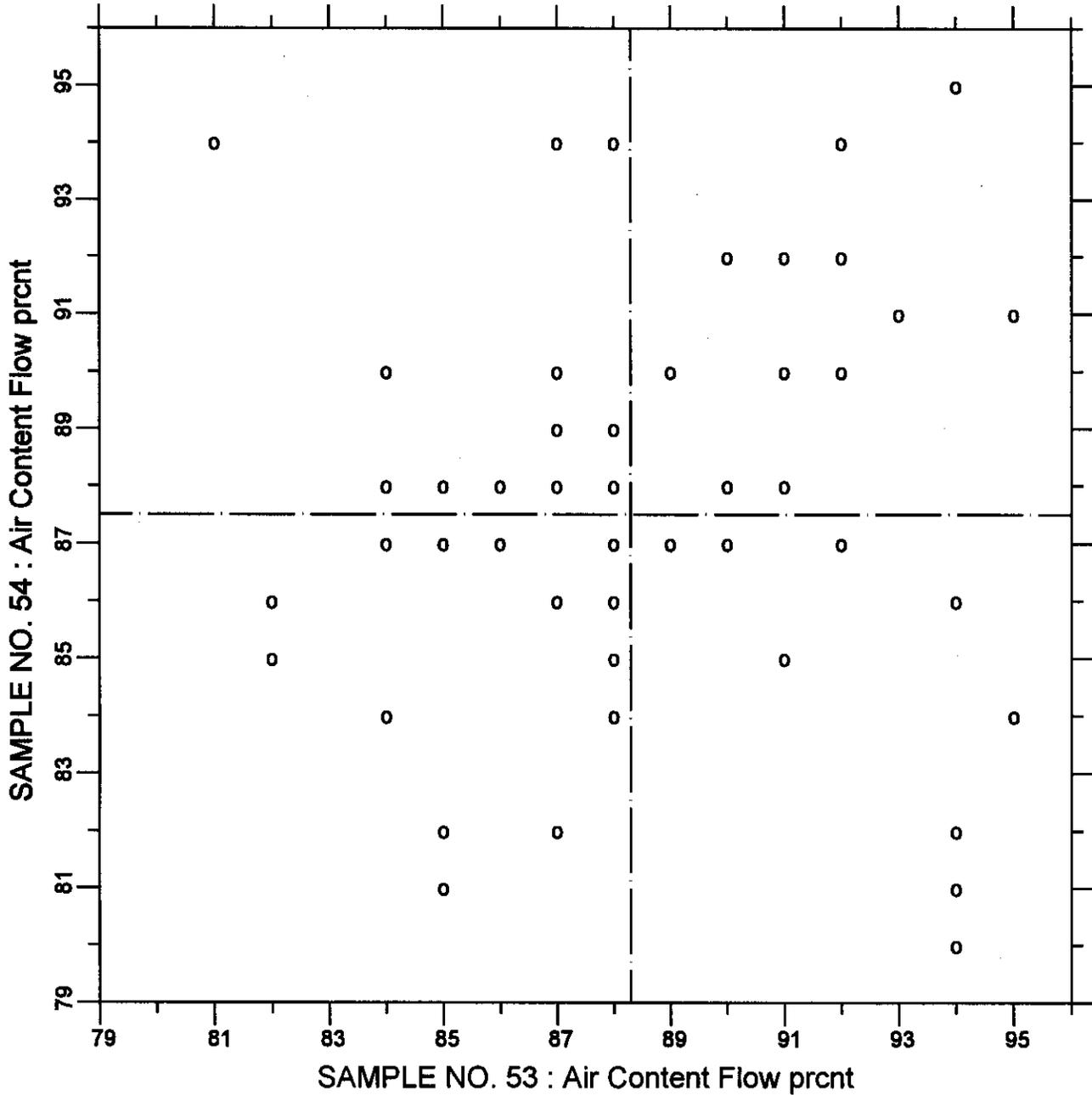
**61 POINTS**

SAMPLE NO. 53 AVE 69.44 S.D. 1.8 C.V. 2.63

SAMPLE NO. 54 AVE 69.04 S.D. 1.9 C.V. 2.78

LABS ELIMINATED 1038

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Air Content - Flow**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.190**

**Air Content Flow**

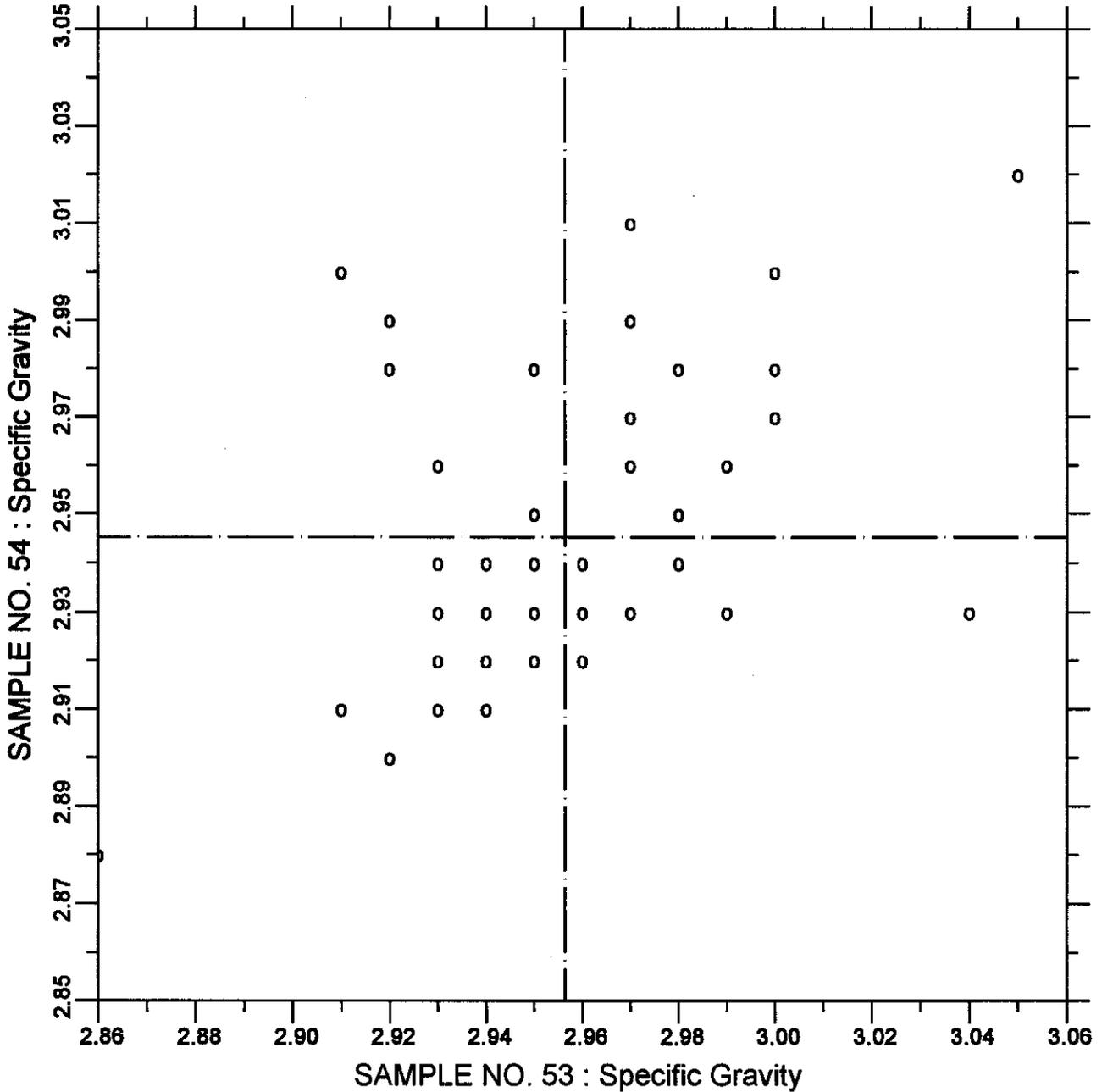
**61 POINTS**

**SAMPLE NO. 53 AVE 88.30 S.D. 3.4 C.V. 3.84**

**SAMPLE NO. 54 AVE 87.51 S.D. 3.4 C.V. 3.85**

**LABS ELIMINATED 169**

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Specific Gravity**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.310**

**Specific Gravity**

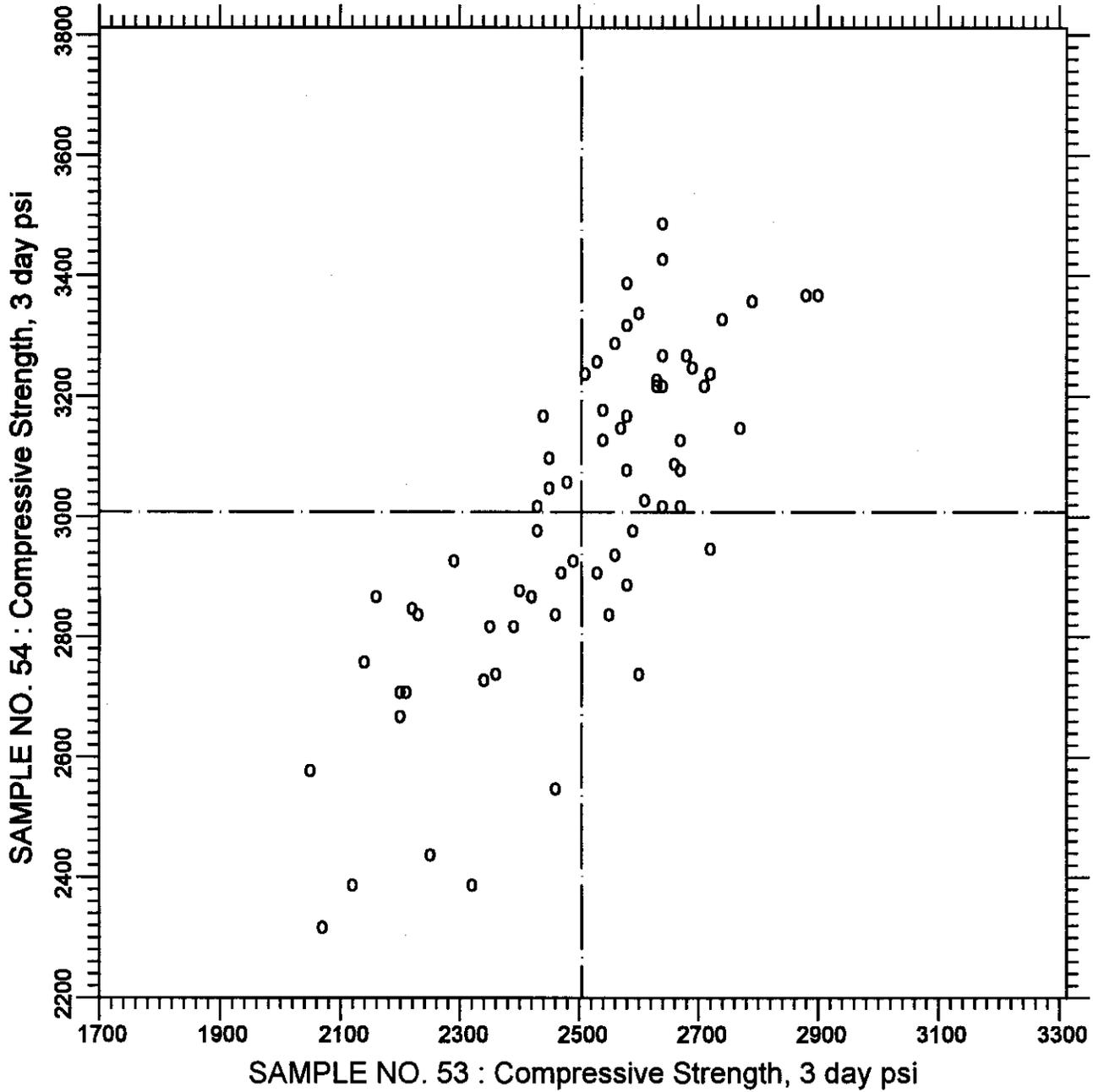
**50 POINTS**

SAMPLE NO. 53 AVE 2.9564 S.D. 0.033 C.V. 1.10

SAMPLE NO. 54 AVE 2.9452 S.D. 0.030 C.V. 1.02

LABS ELIMINATED 43 126 2116

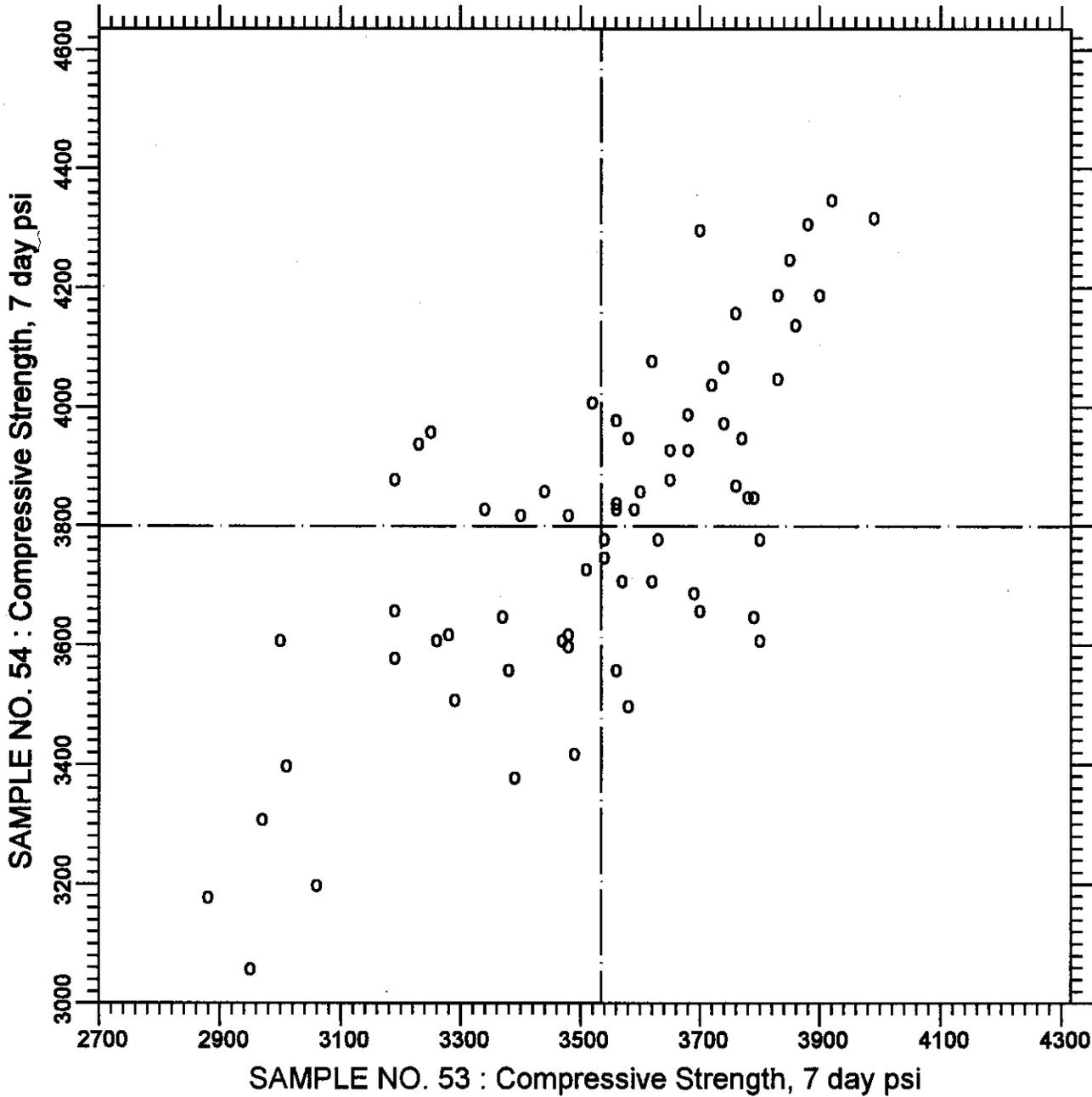
**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Compressive Strength - 3 day**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.200      Compressive Strength, 3 day      69 POINTS**

SAMPLE NO. 53    AVE 2504.5    S.D. 192.7    C.V. 7.70  
 SAMPLE NO. 54    AVE 3008.0    S.D. 268.0    C.V. 8.91

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Compressive Strength - 7 day**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



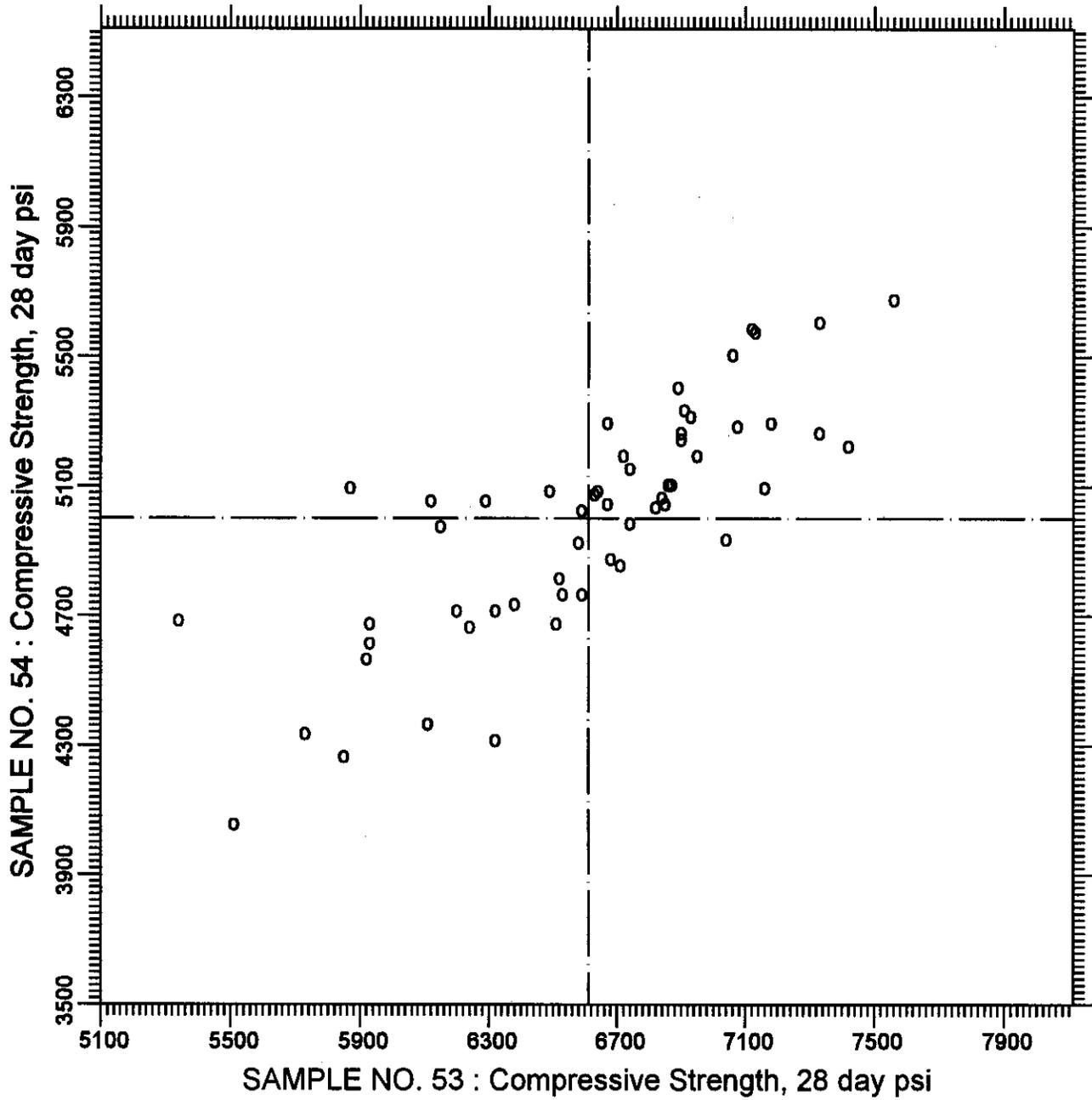
**TEST NO.210      Compressive Strength, 7 day      67 POINTS**

SAMPLE NO. 53    AVE 3535.4    S.D. 262.3    C.V. 7.42

SAMPLE NO. 54    AVE 3799.6    S.D. 278.8    C.V. 7.34

LABS ELIMINATED 2 413

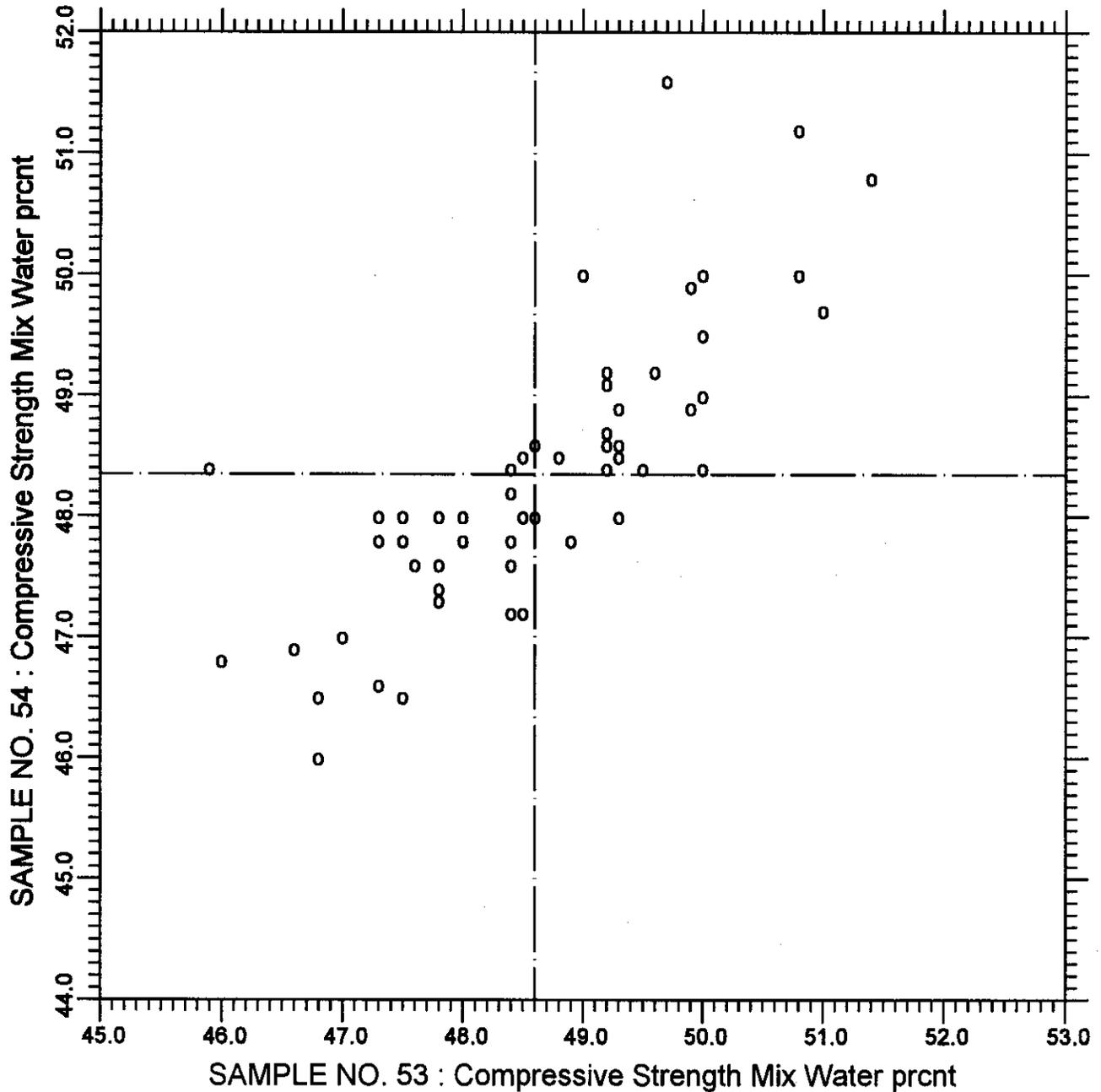
**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Compressive Strength - 28 day**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.211    Compressive Strength, 28 day    56 POINTS**

SAMPLE NO. 53	AVE	6610.8	S.D.	482.8	C.V.	7.30
SAMPLE NO. 54	AVE	5000.9	S.D.	350.3	C.V.	7.00
LABS ELIMINATED 20						

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Compressive Strength - % Water**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.220 Compressive Strength Mix Water 64 POINTS**

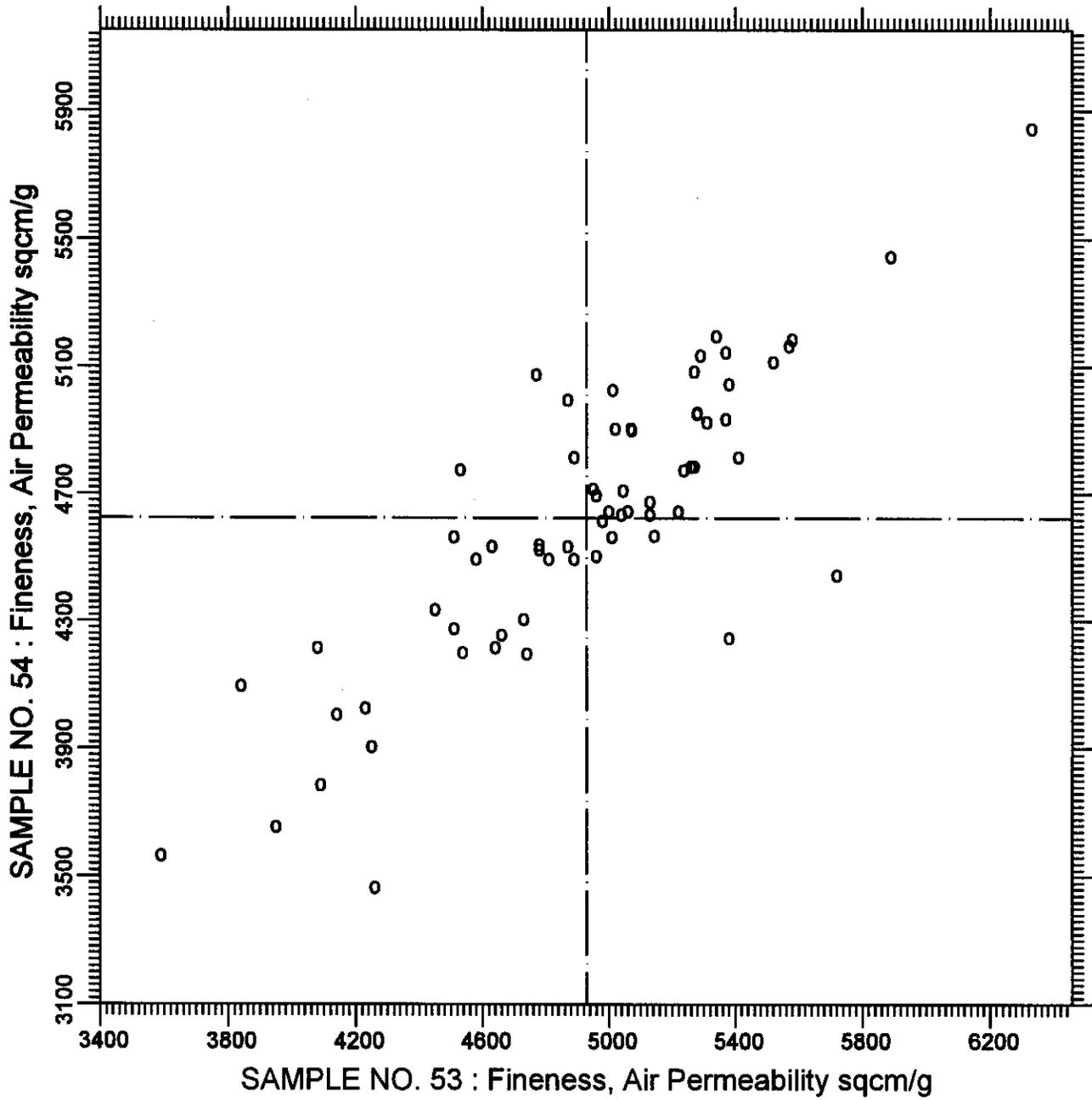
SAMPLE NO. 53 AVE 48.60 S.D. 1.2 C.V. 2.37

SAMPLE NO. 54 AVE 48.35 S.D. 1.1 C.V. 2.23

LABS ELIMINATED 2 19



**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Fineness - Air Permeability**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



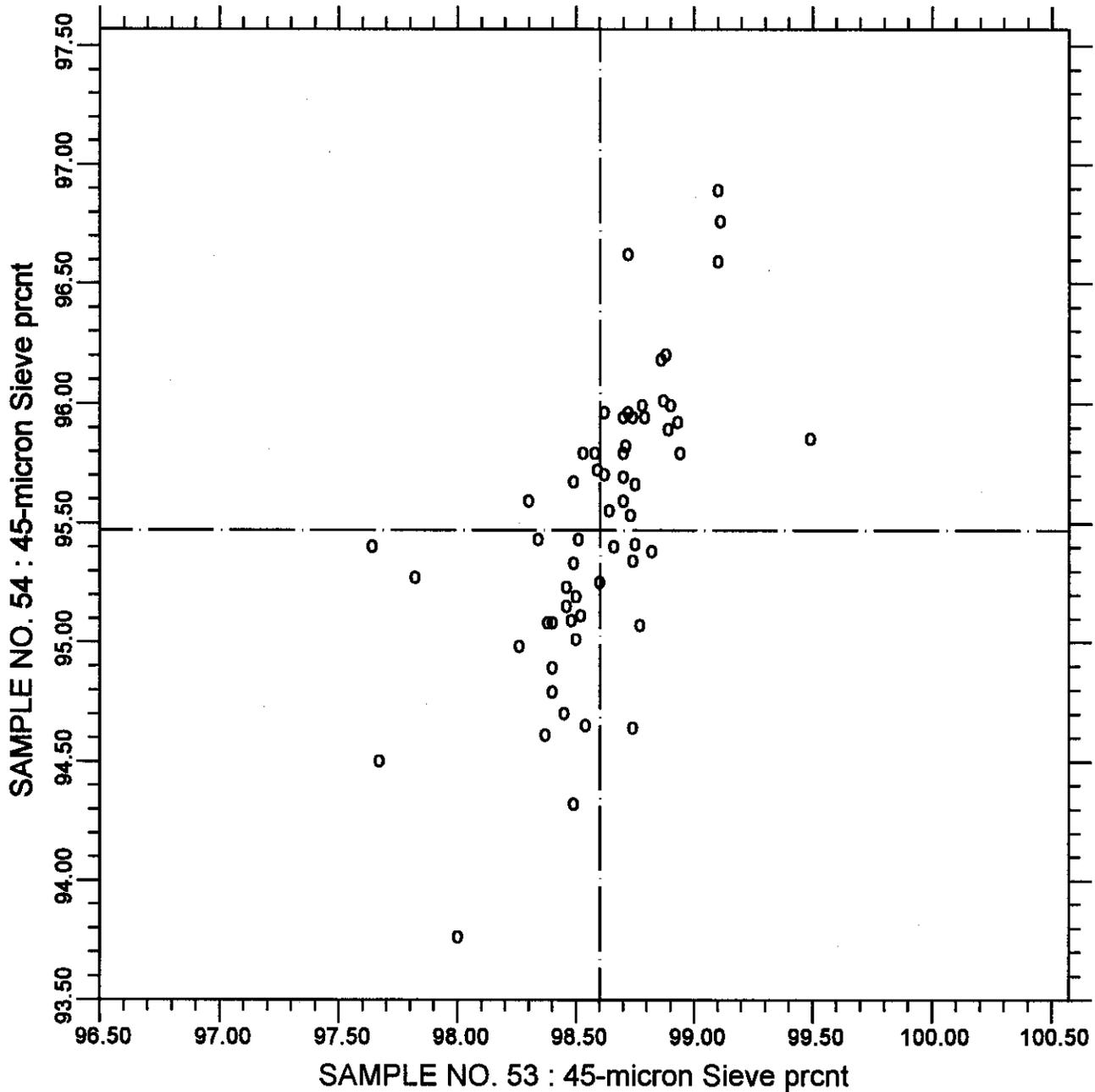
**TEST NO.270      Fineness, Air Permeability      65 POINTS**

SAMPLE NO. 53    AVE 4930.2    S.D. 499.8    C.V. 10.14

SAMPLE NO. 54    AVE 4625.1    S.D. 444.9    C.V. 9.62

LABS ELIMINATED 52

**CCRL PROFICIENCY SAMPLE PROGRAM**  
**45-micron Sieve - % Passing**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.281**

**45-micron Sieve**

**60 POINTS**

SAMPLE NO. 53    AVE 98.602    S.D. 0.32    C.V. 0.320

SAMPLE NO. 54    AVE 95.470    S.D. 0.65    C.V. 0.684

LABS ELIMINATED 34 176 413

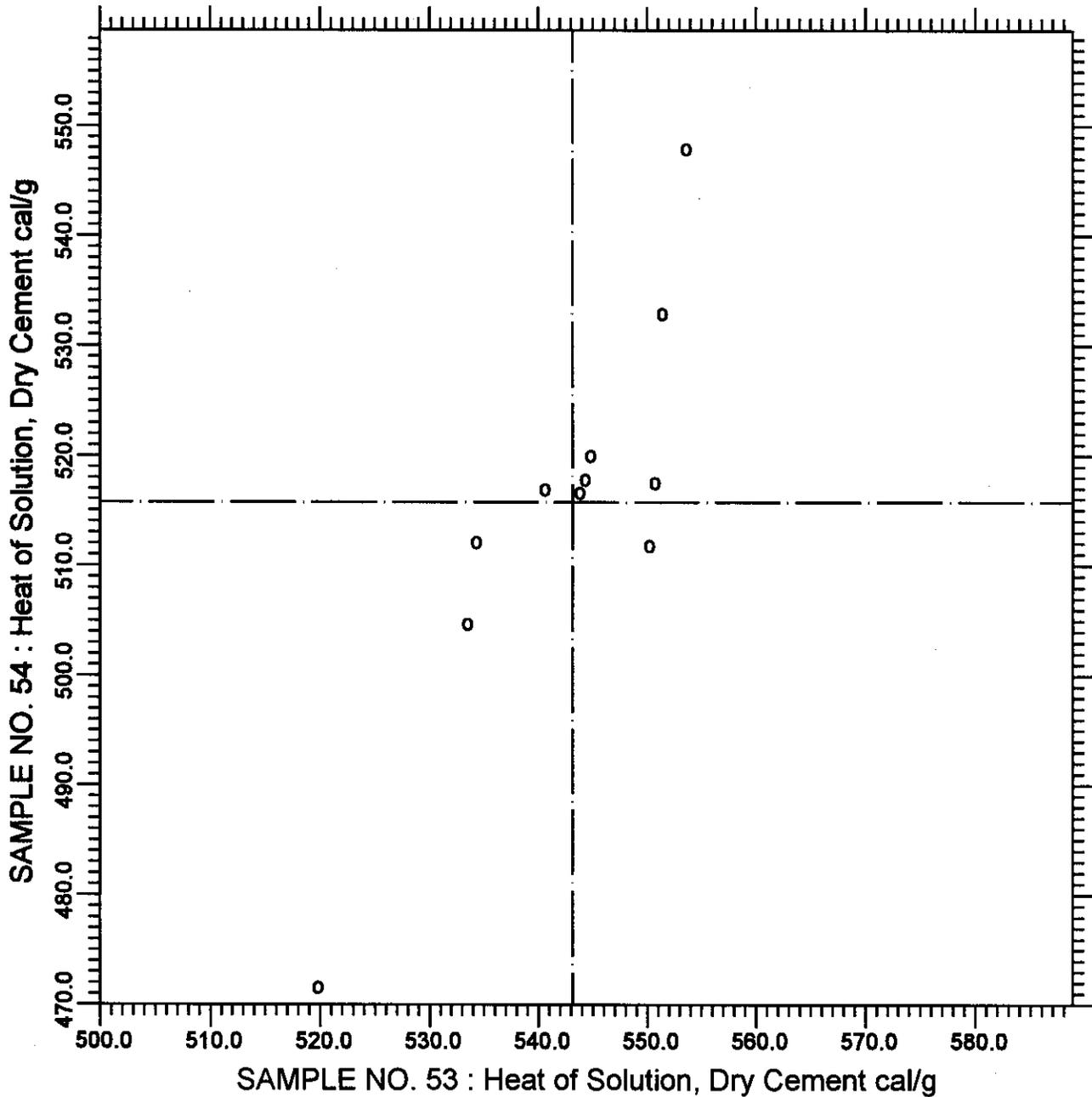
LABS OFF DIAGRAM 126

CCRL PROFICIENCY SAMPLE PROGRAM  
 Blended Cement Proficiency Samples No. 53 and No. 54  
 Final Report - May 7, 2004  
 Heat of Hydration Results

SUMMARY OF RESULTS

Test	#Labs	Sample No. 53			Sample No. 54		
		Average	S.D.	C.V.	Average	S.D.	C.V.
Heat Solution Dry cal/g	12	543.1	9.8	1.81	515.7	17.7	3.44
Heat Sol, 7 day cal/g	12	477.9	12.4	2.59	444.2	11.3	2.54
Heat Sol, 28 day cal/g	5	452.1	28.9	6.38	409.5	31.5	7.70
Heat Hyd, 7 day cal/g	12	65.7	15.2	23.1	71.6	13.6	18.9
Heat Hyd, 28 day cal/g	5	91.7	15.6	17.1	101.5	26.0	25.6

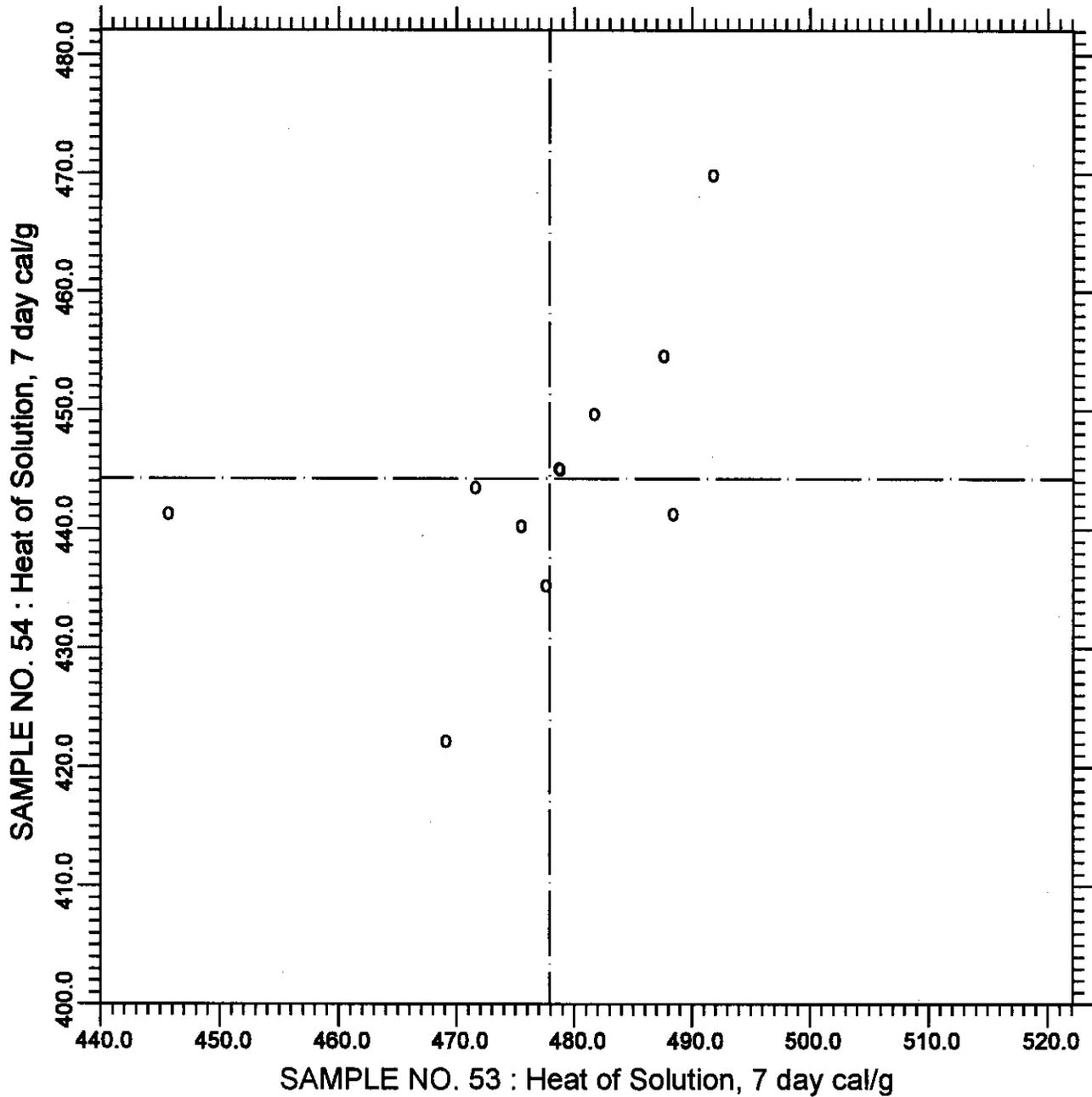
**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Heat of Solution - Dry Cement**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.291    Heat of Solution, Dry Cement    12 POINTS**

SAMPLE NO. 53    AVE 543.1    S.D. 9.8    C.V. 1.81  
 SAMPLE NO. 54    AVE 515.7    S.D. 17.7    C.V. 3.44

CCRL PROFICIENCY SAMPLE PROGRAM  
Heat of Solution - 7-day  
BLENDED CEMENT SAMPLES NO. 53 & NO. 54



TEST NO.292

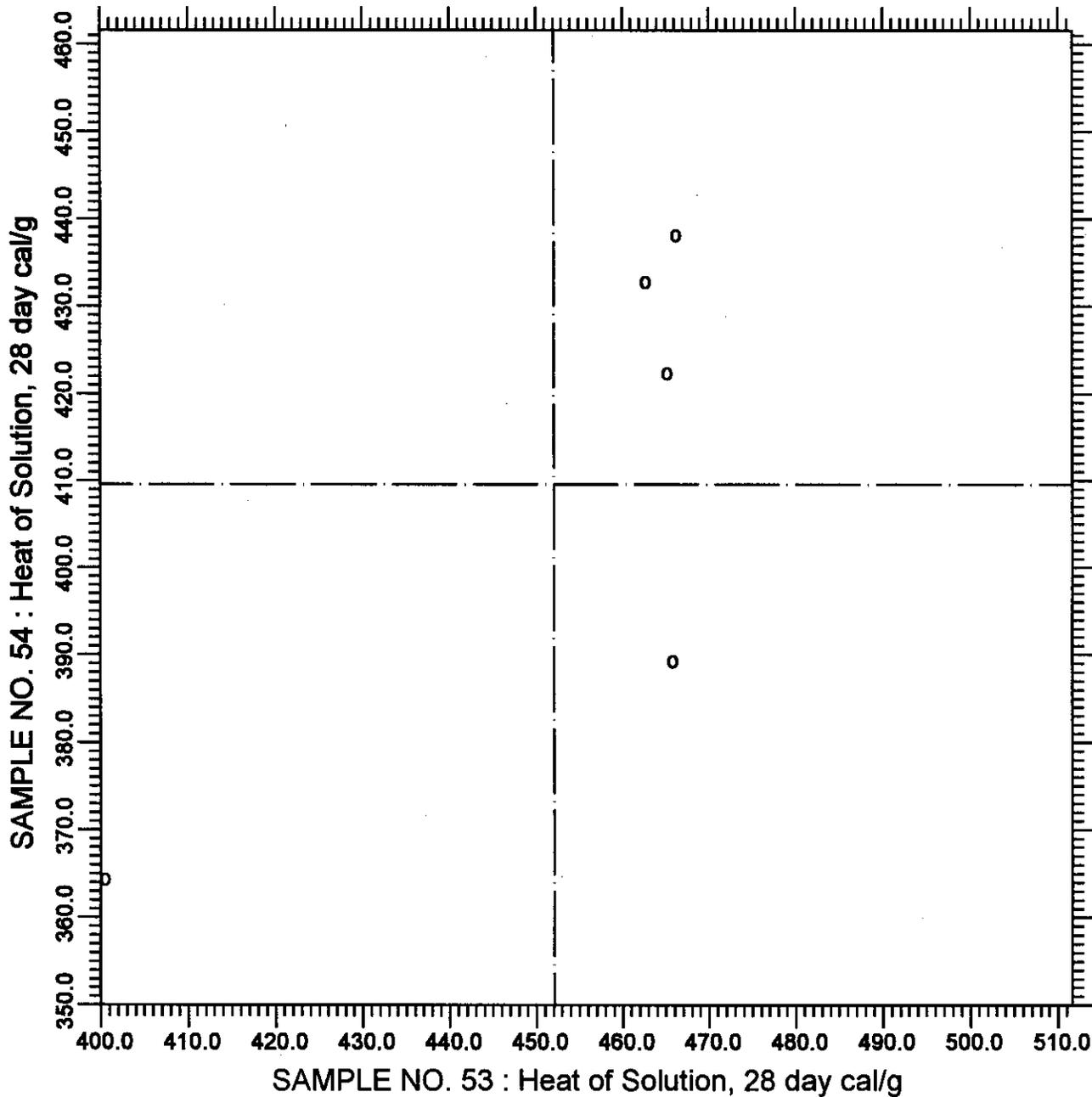
Heat of Solution, 7 day

12 POINTS

SAMPLE NO. 53 AVE 477.9 S.D. 12.4 C.V. 2.59

SAMPLE NO. 54 AVE 444.2 S.D. 11.3 C.V. 2.54

CCRL PROFICIENCY SAMPLE PROGRAM  
Heat of Solution - 28-day  
BLENDED CEMENT SAMPLES NO. 53 & NO. 54



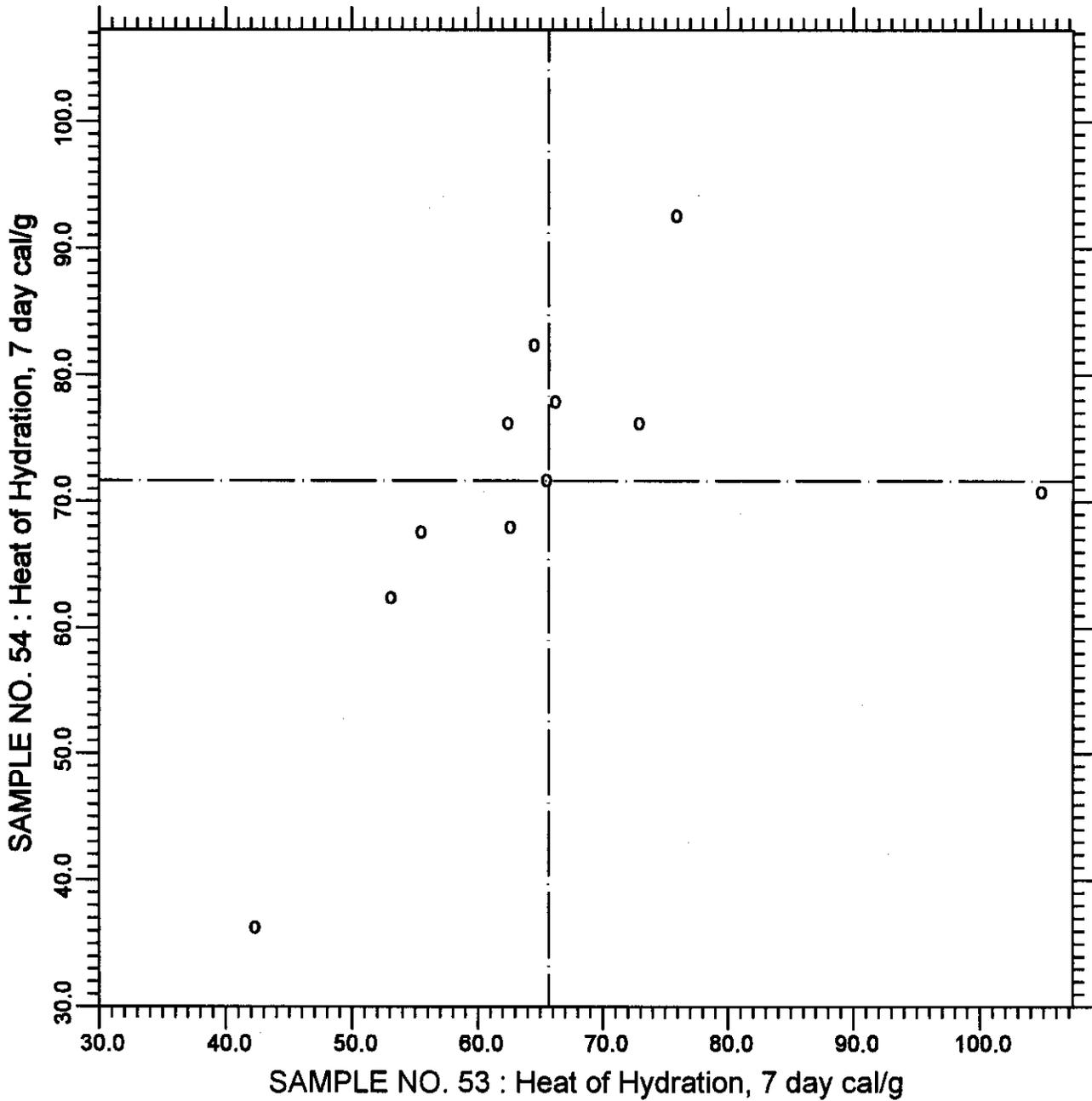
TEST NO.301

Heat of Solution, 28 day

5 POINTS

SAMPLE NO. 53	AVE 452.1	S.D. 28.9	C.V. 6.38
SAMPLE NO. 54	AVE 409.5	S.D. 31.5	C.V. 7.70

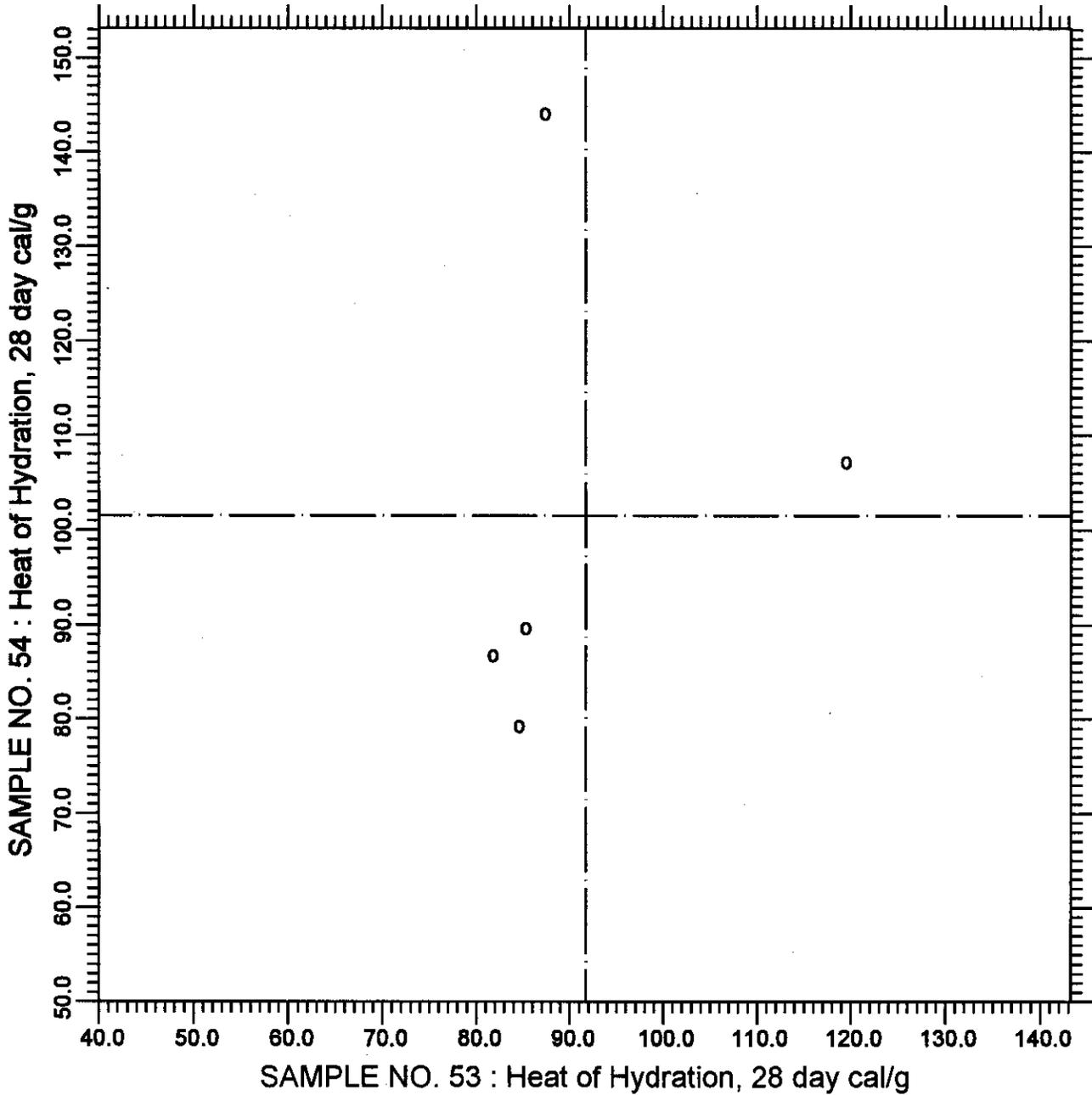
**CCRL PROFICIENCY SAMPLE PROGRAM**  
**Heat of Hydration - 7-day**  
**BLENDED CEMENT SAMPLES NO. 53 & NO. 54**



**TEST NO.290                      Heat of Hydration, 7 day                      12 POINTS**

**SAMPLE NO. 53    AVE 65.7    S.D. 15.2    C.V. 23.1**  
**SAMPLE NO. 54    AVE 71.6    S.D. 13.6    C.V. 18.9**

CCRL PROFICIENCY SAMPLE PROGRAM  
Heat of Hydration - 28-day  
BLENDED CEMENT SAMPLES NO. 53 & NO. 54



TEST NO.300      Heat of Hydration, 28 day      5 POINTS

SAMPLE NO. 53    AVE 91.7    S.D. 15.6    C.V. 17.1  
SAMPLE NO. 54    AVE 101.5    S.D. 26.0    C.V. 25.6