The SAS System

The Mixed Procedure

Model Information	
Data Set	WORK.STRENGTH_DATA
Dependent Variable	strength
Covariance Structure	Variance Components
Estimation Method	Type 3
Residual Variance Method	Factor
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	Levels	Values
machine	4	1 2 3 4
operator	3	1 2 3

Dimensions	
Covariance Parameters	4
Columns in X	1
Columns in Z	19
Subjects	1
Max Obs Per Subject	24

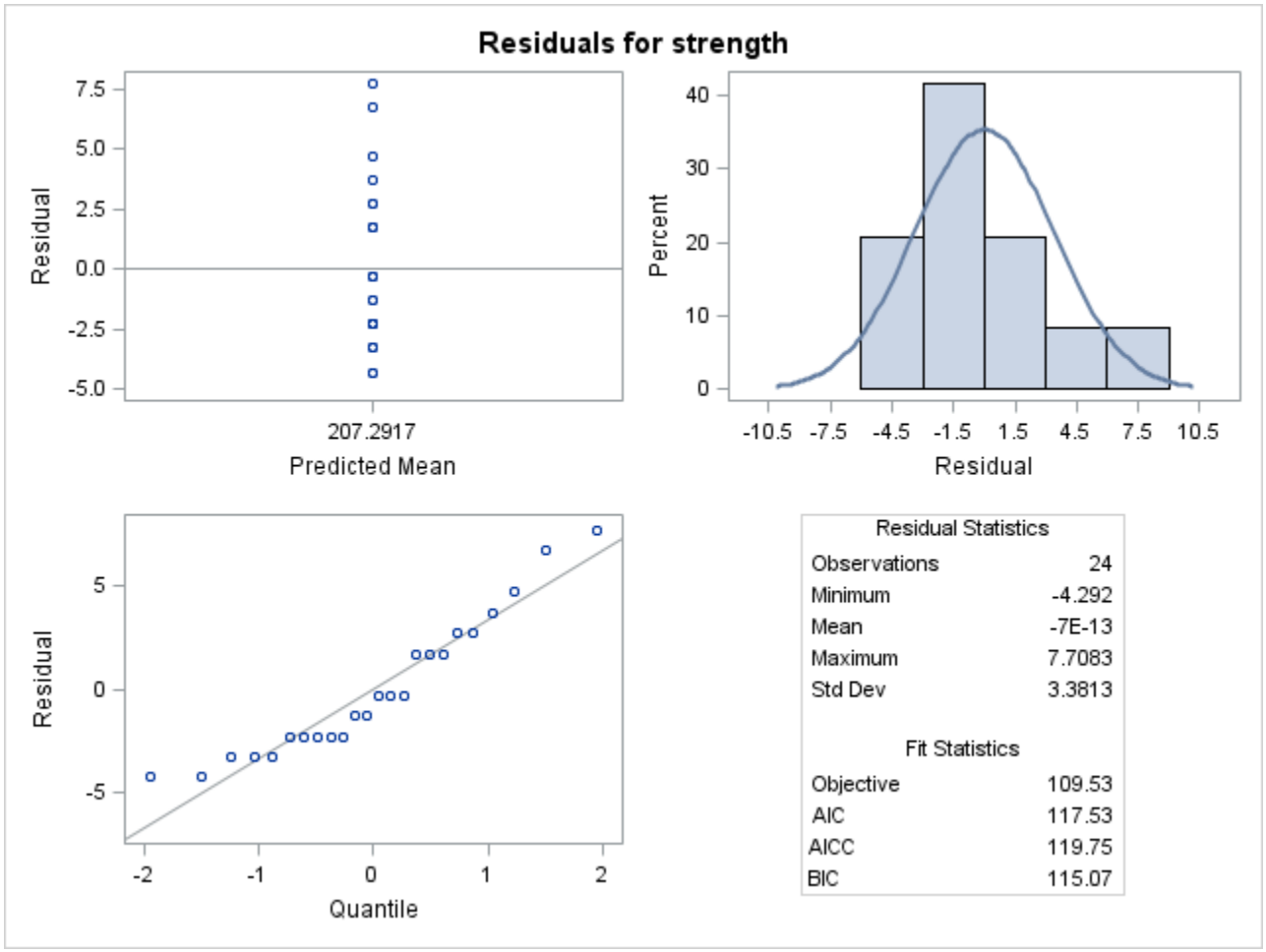
Number of Observations	
Number of Observations Read	24
Number of Observations Used	24
Number of Observations Not Used	0

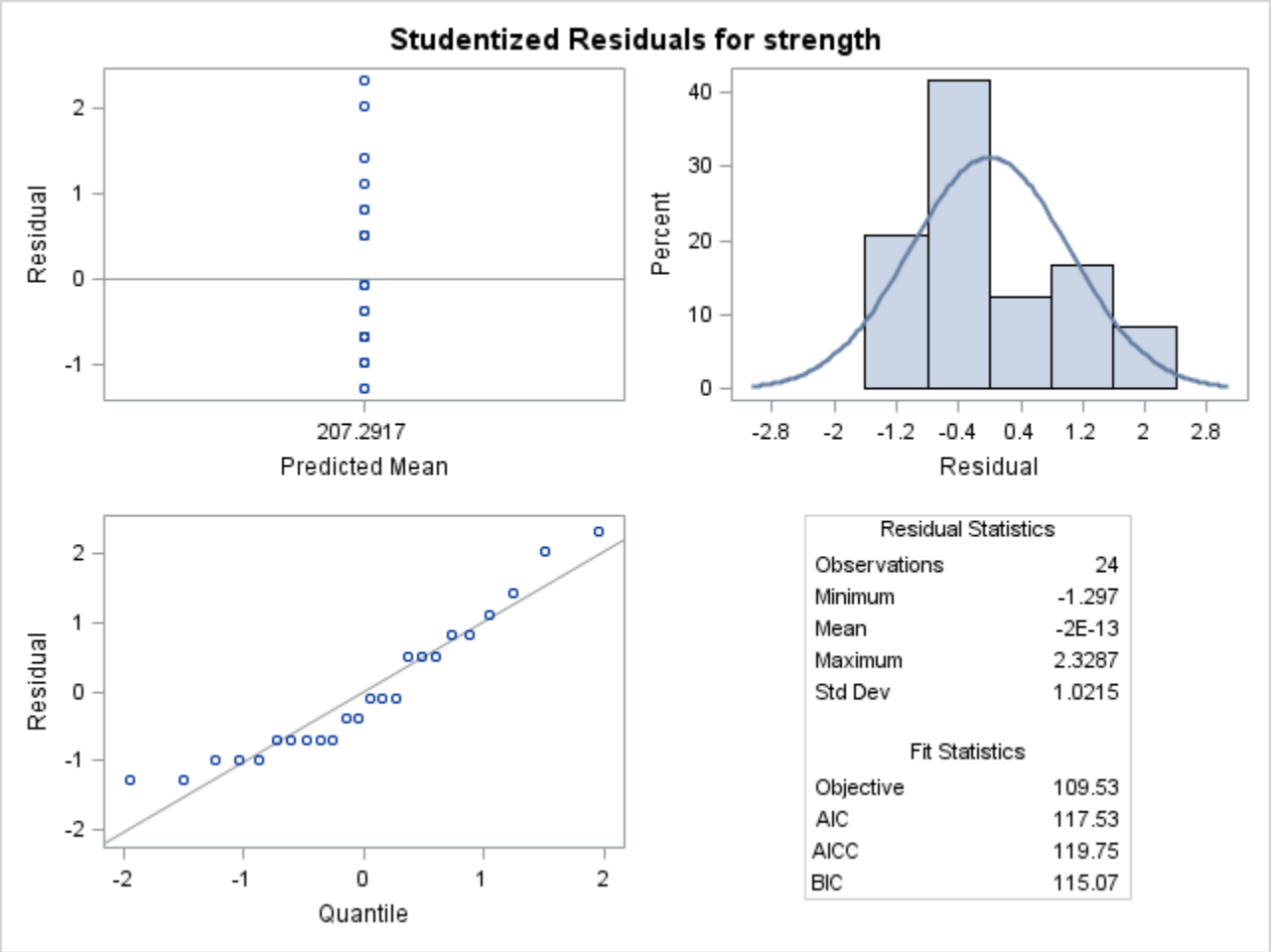
Type 3 Analysis of Variance							
Source	DF	Sum of Squares	Mean Square	Expected Mean Square	Error Term	Error DF	F Value	Pr > F
machine	3	12.458333	4.152778	Var(Residual) + 2 Var (machine*operator) + 6 Var (machine)	MS (machine*operator)	6	0.56	0.6619
operator	2	160.333333	80.166667	Var(Residual) + 2 Var (machine*operator) + 8 Var (operator)	MS (machine*operator)	6	10.77	0.0103
machine*operator	6	44.666667	7.444444	Var(Residual) + 2 Var (machine*operator)	MS(Residual)	12	1.96	0.1507
Residual	12	45.500000	3.791667	Var(Residual)	.	.	.	.

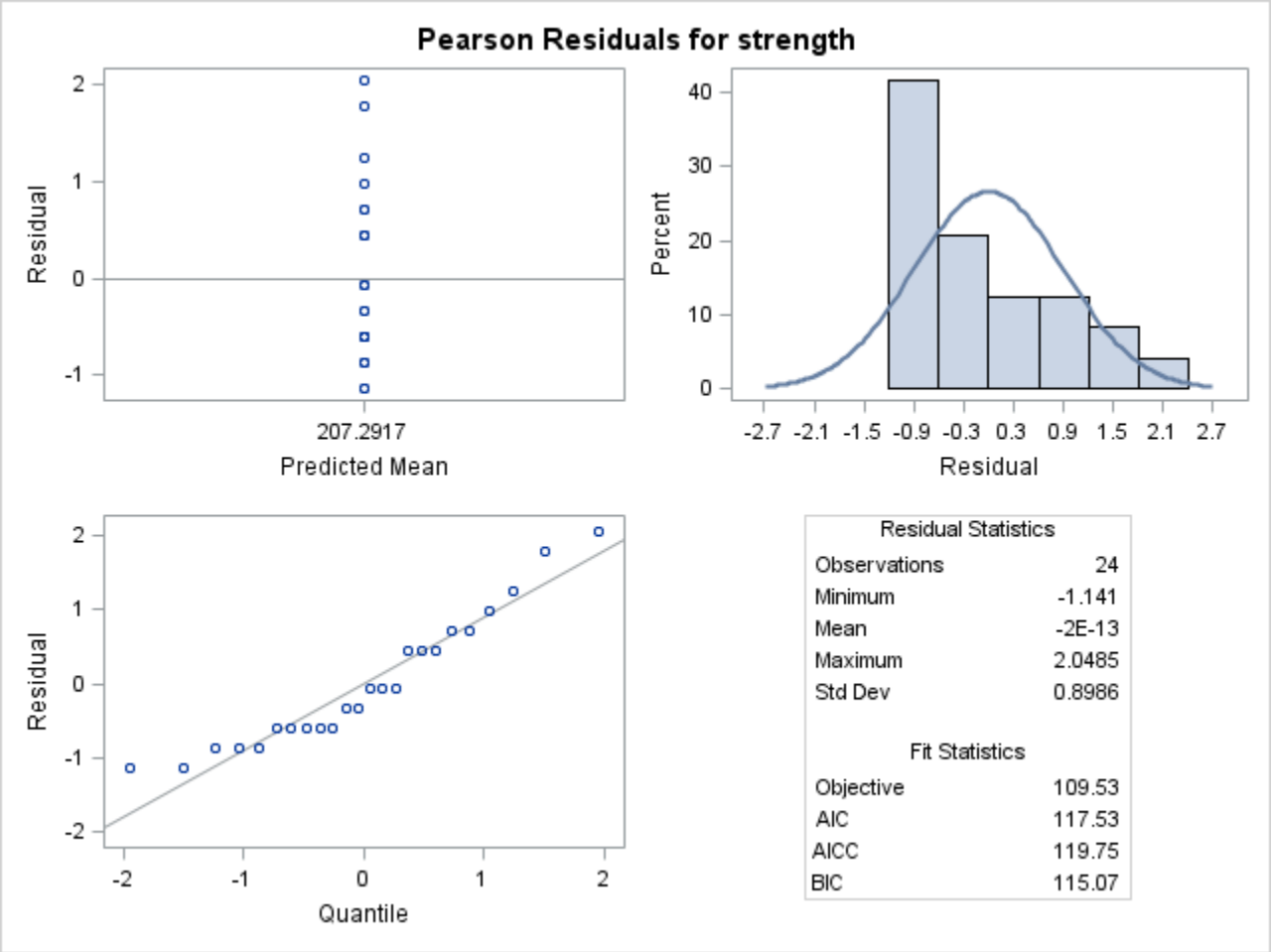
Covariance Parameter Estimates	
Cov Parm	Estimate
machine	-0.5486
operator	9.0903

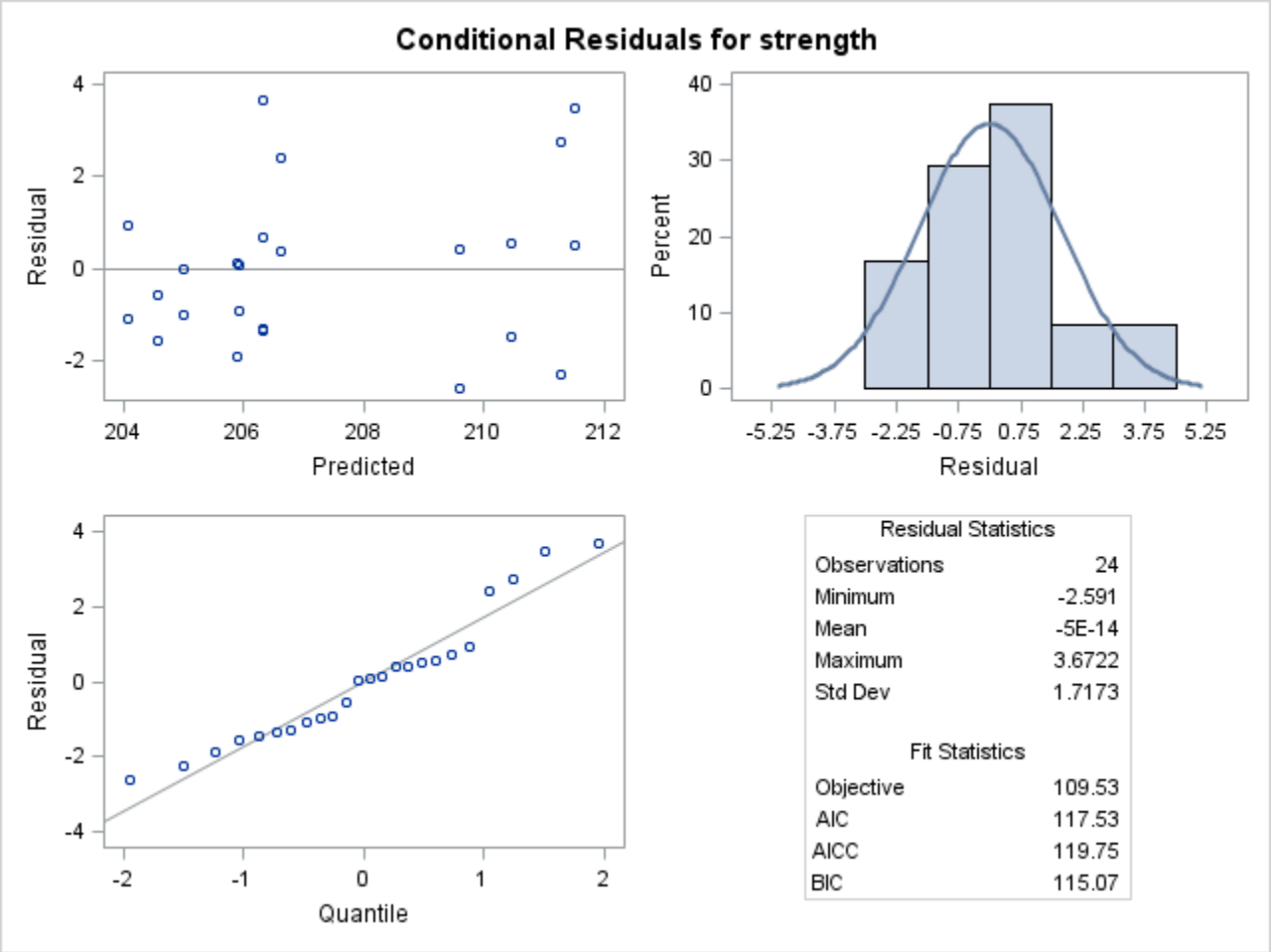
Covariance Parameter Estimates	
Cov Parm	**Estimate**
machine*operator	1.8264
Residual	3.7917

Fit Statistics	
-2 Res Log Likelihood	109.5
AIC (smaller is better)	117.5
AICC (smaller is better)	119.7
BIC (smaller is better)	115.1



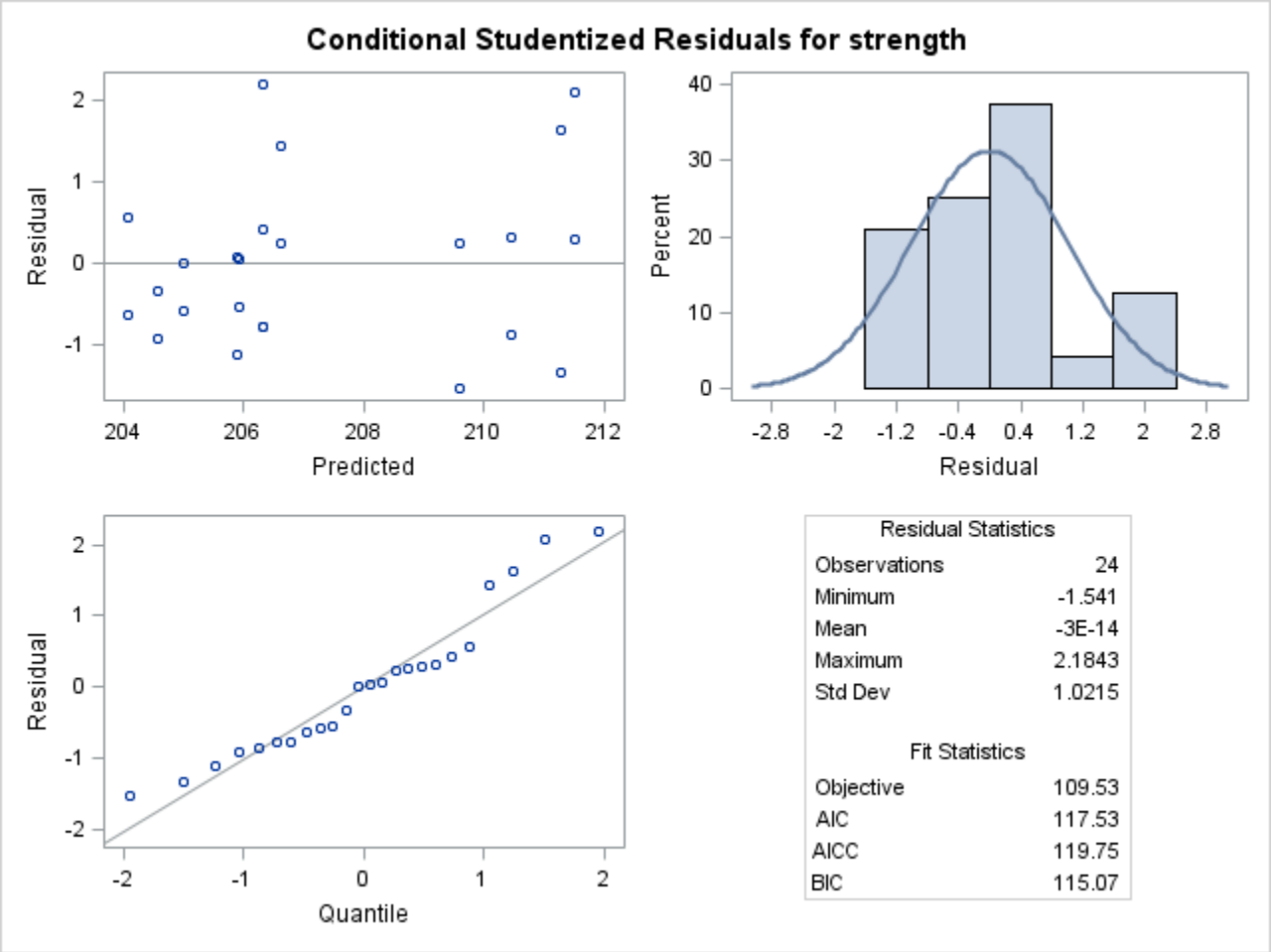

Studentized Residuals for strength
Residual
Predicted Mean
207.2917
Percent
Residual
Residual
Quantile
Residual Statistics
Observations 24
Minimum -1.297
Mean -2E-13
Maximum 2.3287
Std Dev 1.0215
Fit Statistics
Objective 109.53
AIC 117.53
AICC 119.75
BIC 115.07

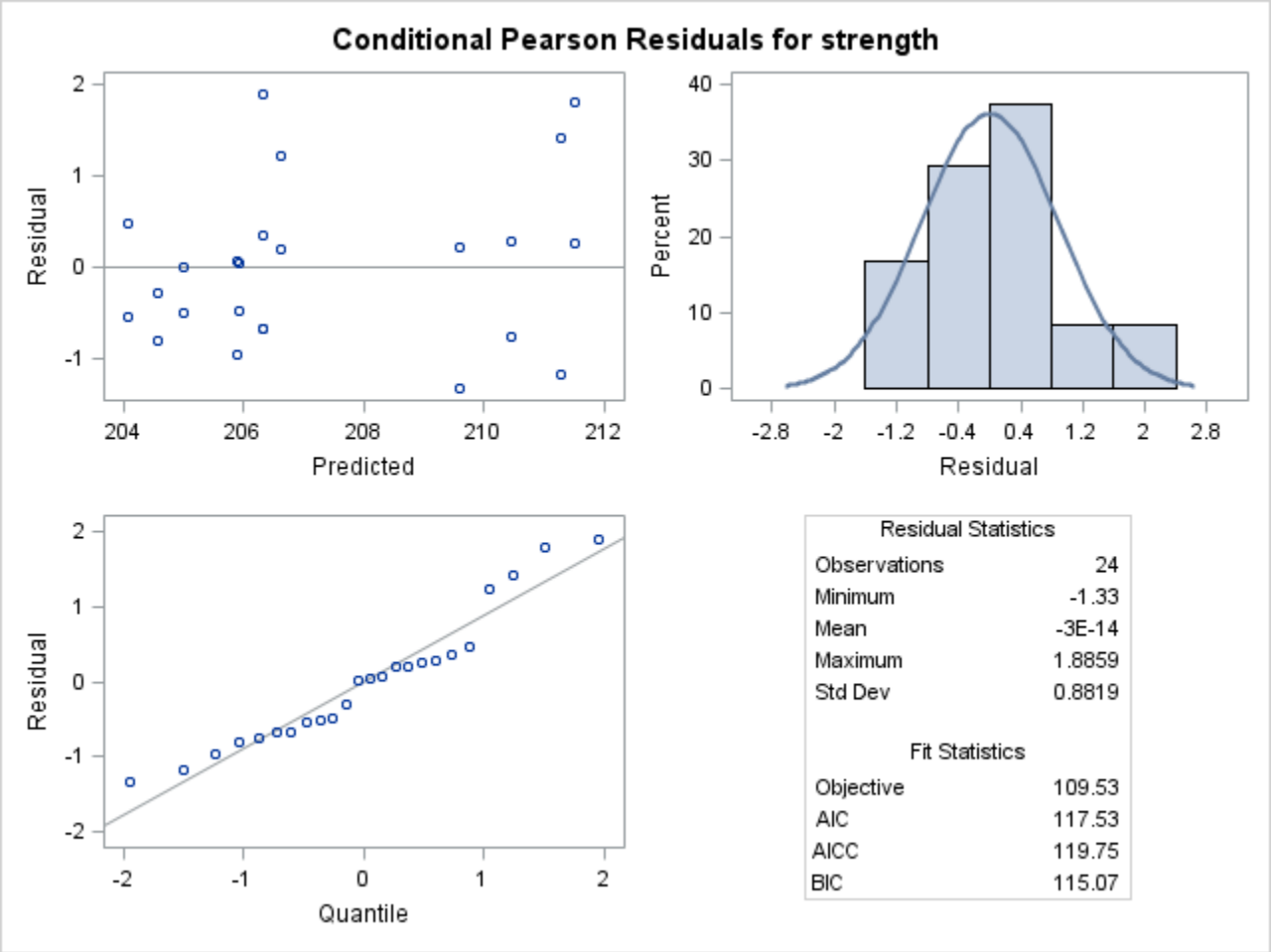

Pearson Residuals for strength
Residual
Predicted Mean
207.2917
Percent
Residual
Residual
Quantile
Residual Statistics
Observations 24
Minimum -1.141
Mean -2E-13
Maximum 2.0485
Std Dev 0.8986
Fit Statistics
Objective 109.53
AIC 117.53
AICC 119.75
BIC 115.07

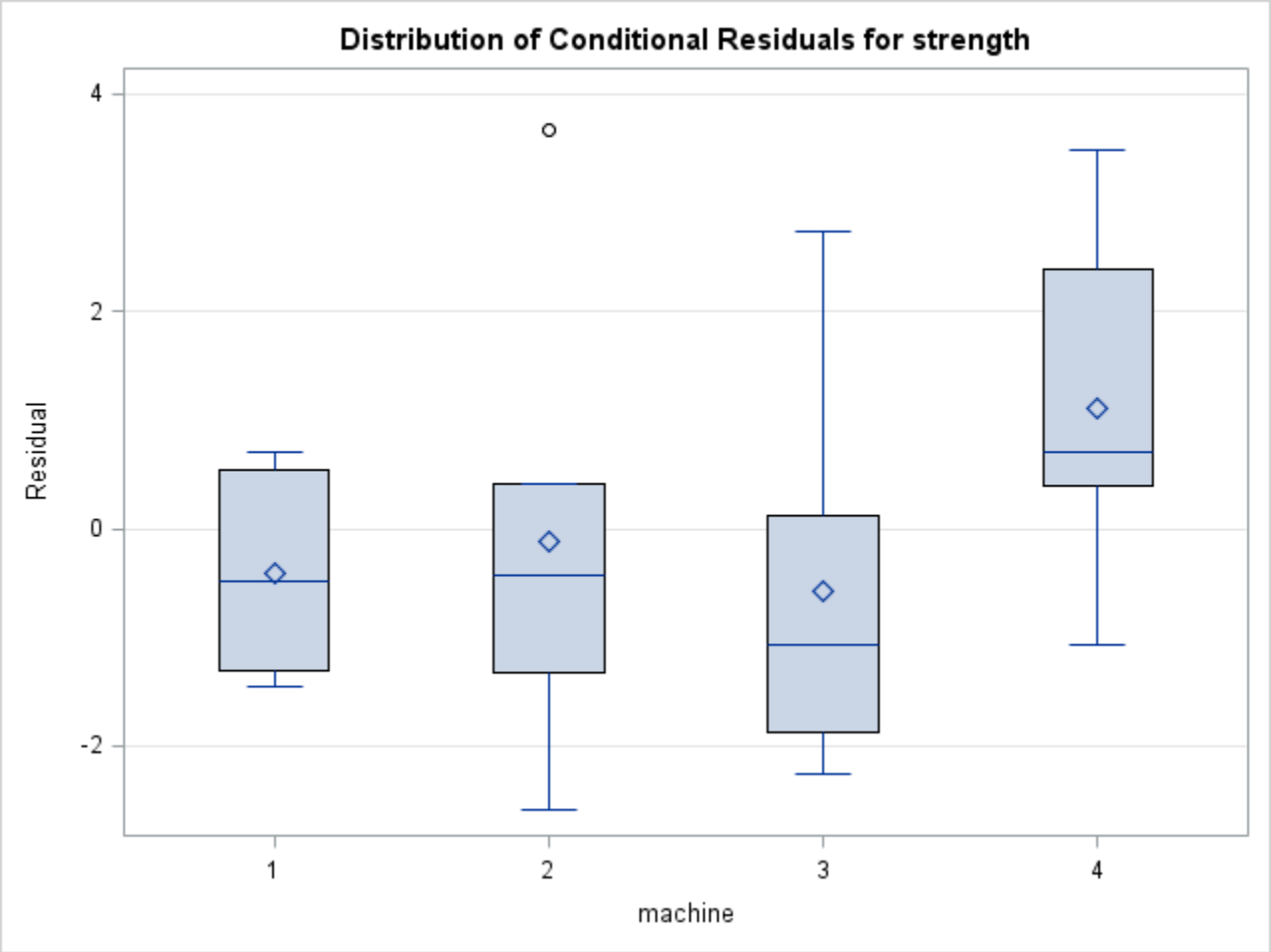


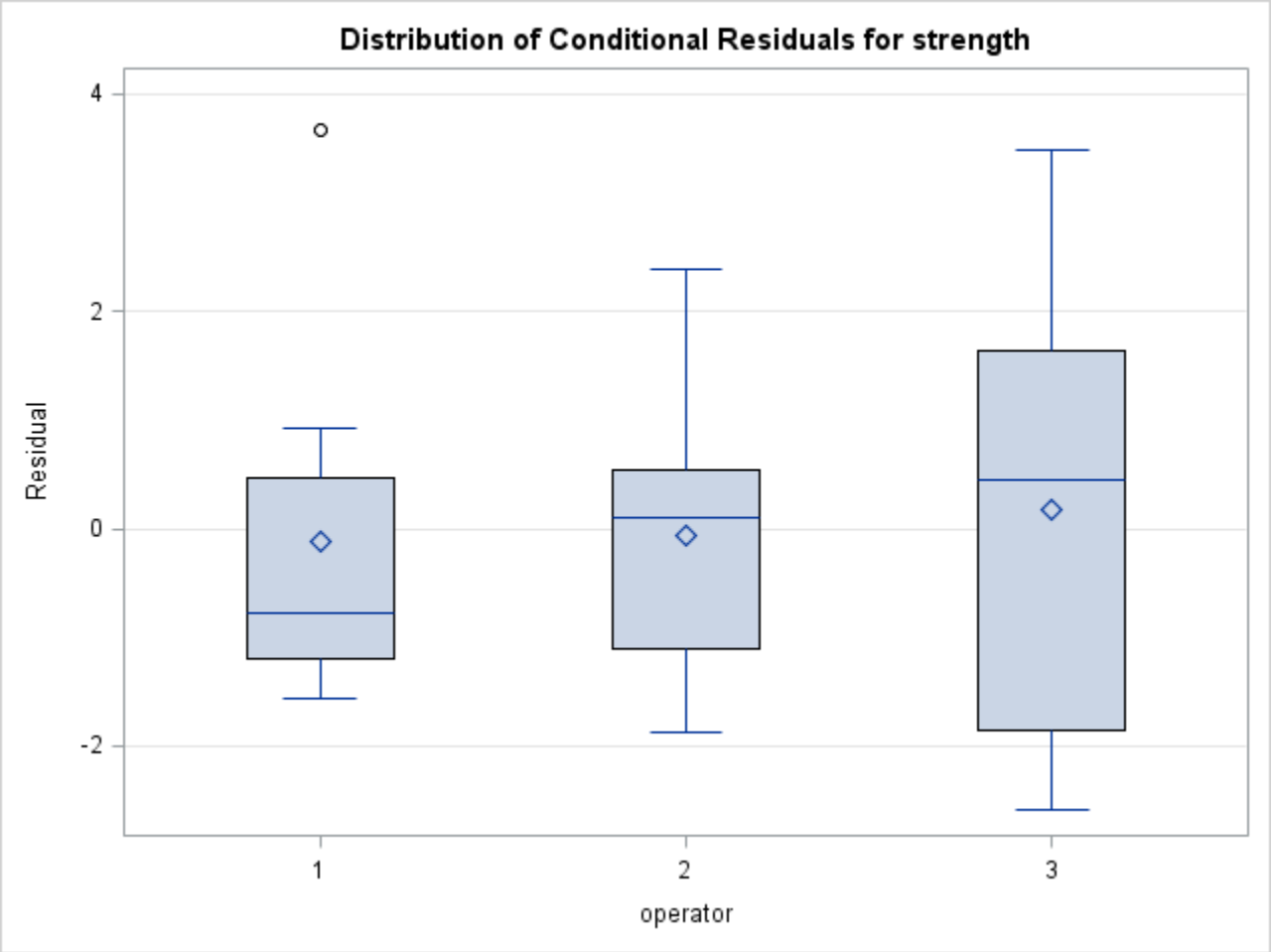
Residual Statistics	
Observations	24
Minimum	-2.591
Mean	-5E-14
Maximum	3.6722
Std Dev	1.7173

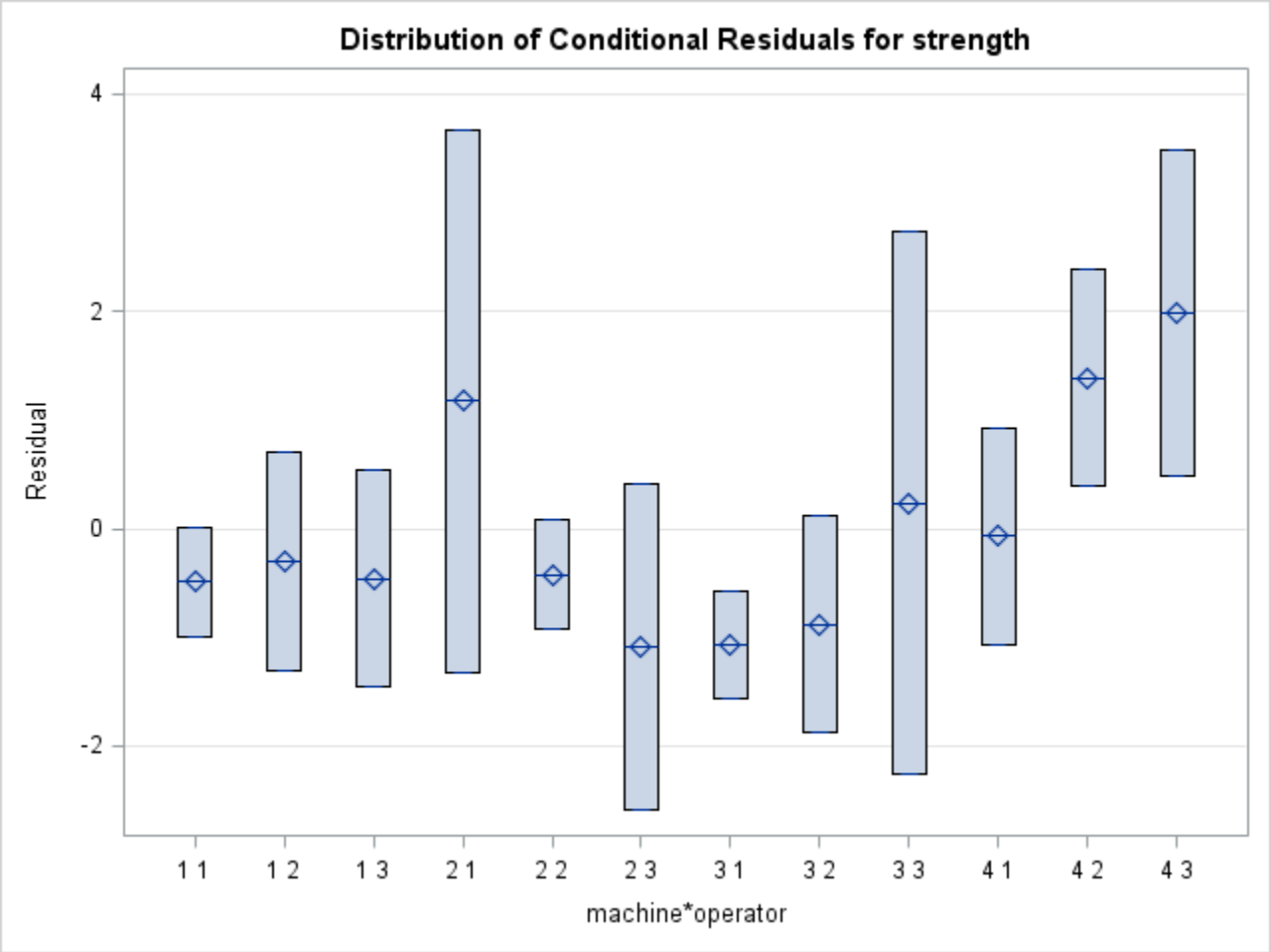
Fit Statistics	
Objective	109.53
AIC	117.53
AICC	119.75
BIC	115.07


Conditional Studentized Residuals for strength
Residual
Predicted
Percent
Residual
Residual
Quantile
Residual Statistics
Observations 24
Minimum -1.541
Mean -3E-14
Maximum 2.1843
Std Dev 1.0215
Fit Statistics
Objective 109.53
AIC 117.53
AICC 119.75
BIC 115.07


Conditional Pearson Residuals for strength
Residual
Predicted
204
206
208
210
212
2
1
0
-1
Percent
Residual
40
30
20
10
0
-2.8
-2
-1.2
-0.4
0.4
1.2
2
2.8
Residual
Quantile
-2
-1
0
1
2
Residual Statistics
Observations 24
Minimum -1.33
Mean -3E-14
Maximum 1.8859
Std Dev 0.8819
Fit Statistics
Objective 109.53
AIC 117.53
AICC 119.75
BIC 115.07


Distribution of Conditional Residuals for strength
Residual
4
2
0
-2
1
2
3
4
machine


Distribution of Conditional Residuals for strength
Residual
4
2
0
-2
1
2
3
operator


Distribution of Conditional Residuals for strength
Residual
4
2
0
-2
1 1
1 2
1 3
2 1
2 2
2 3
3 1
3 2
3 3
4 1
4 2
4 3
machine*operator

The SAS System

The Mixed Procedure

Model Information	
Data Set	WORK.STRENGTH_DATA
Dependent Variable	strength
Covariance Structure	Variance Components
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	Levels	Values
machine	4	1 2 3 4
operator	3	1 2 3

Dimensions	
Covariance Parameters	4
Columns in X	1
Columns in Z	19
Subjects	1
Max Obs Per Subject	24

Number of Observations	
Number of Observations Read	24
Number of Observations Used	24
Number of Observations Not Used	0

Iteration History			
Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	124.48875799	
1	3	109.85258730	0.00025935
2	1	109.84333612	0.00000208
3	1	109.84326553	0.00000000

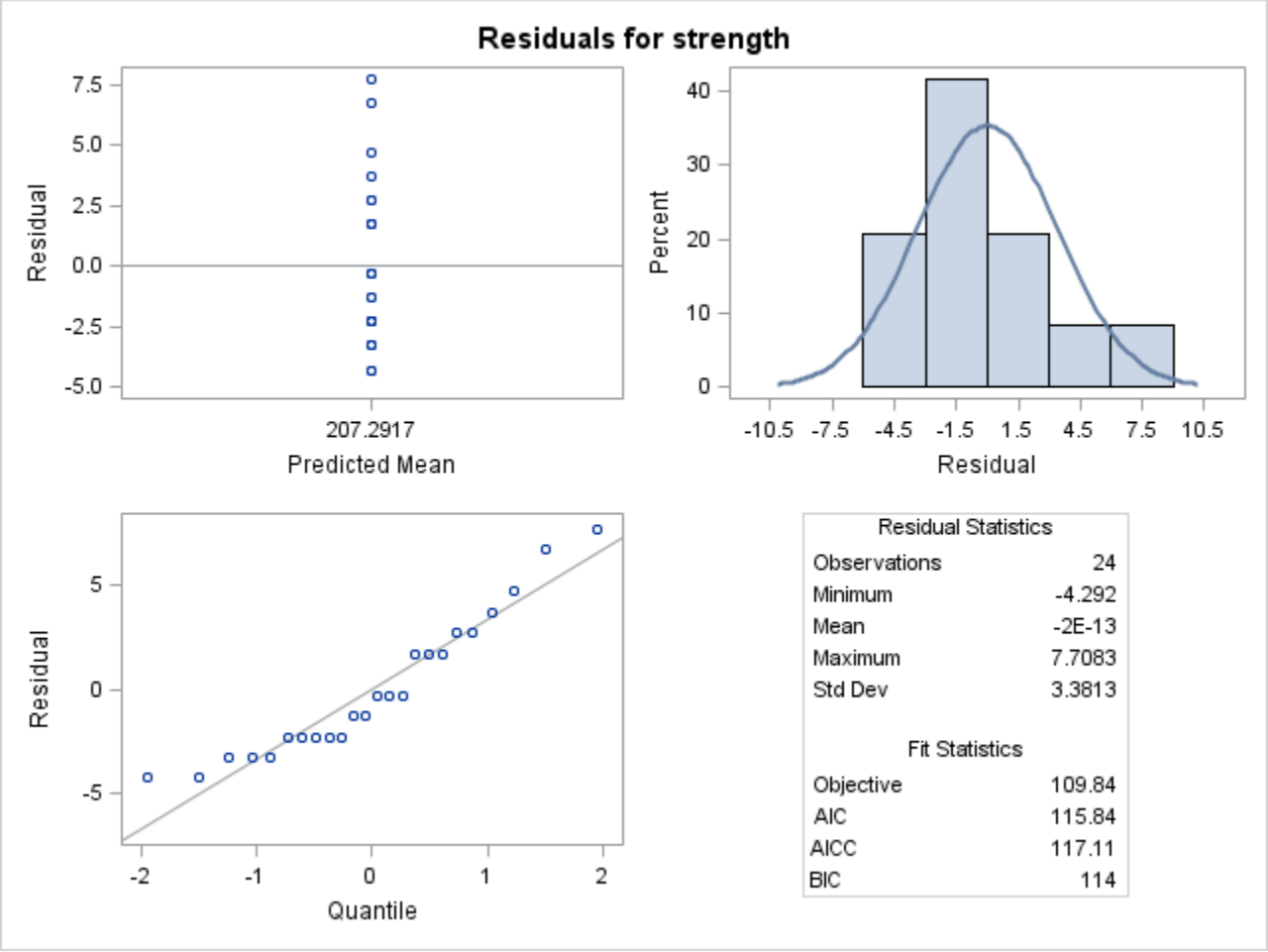
Convergence criteria met.

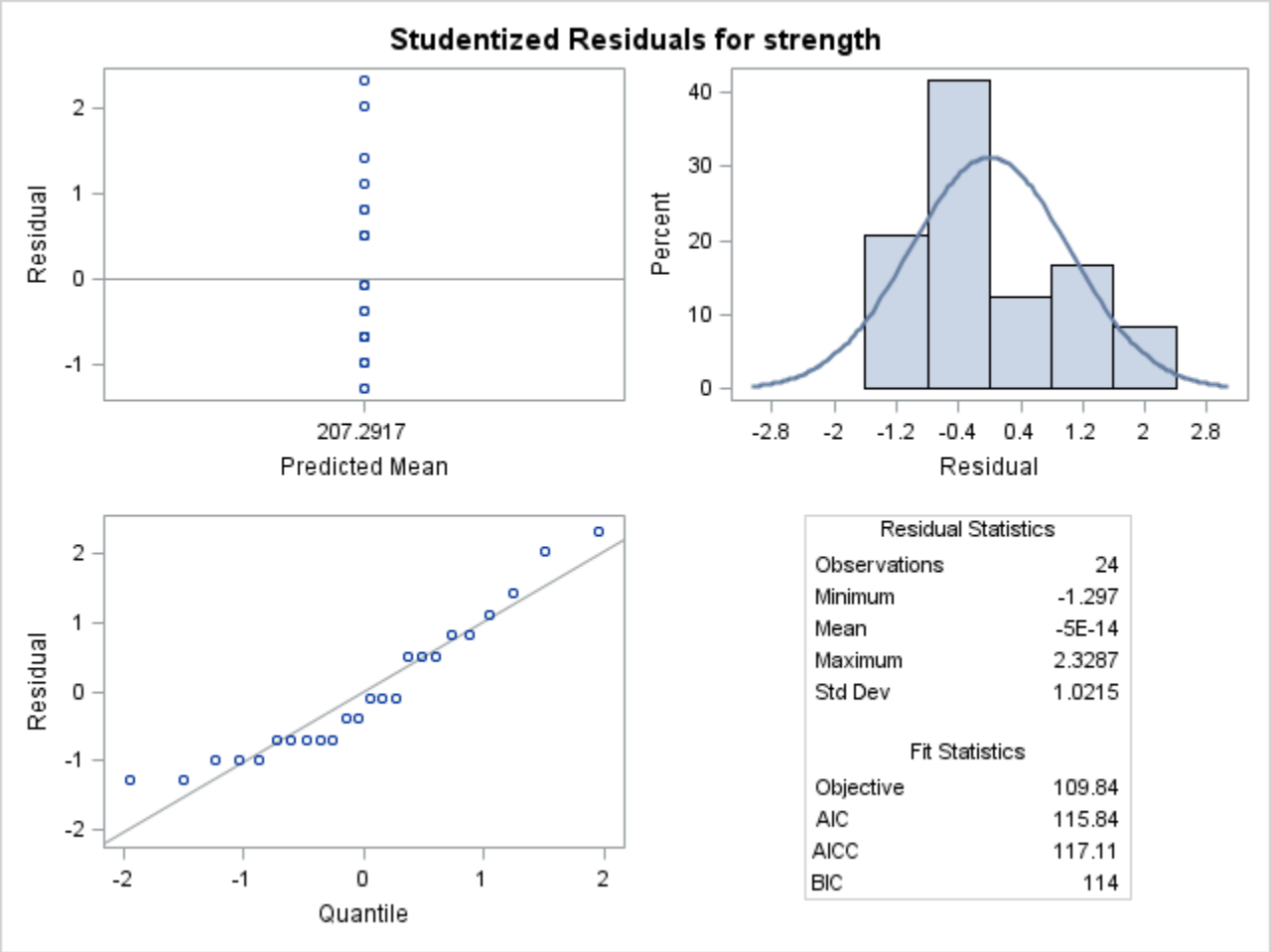
Covariance Parameter Estimates	
Cov Parm	Estimate
machine	0
operator	9.2275
machine*operator	1.2777

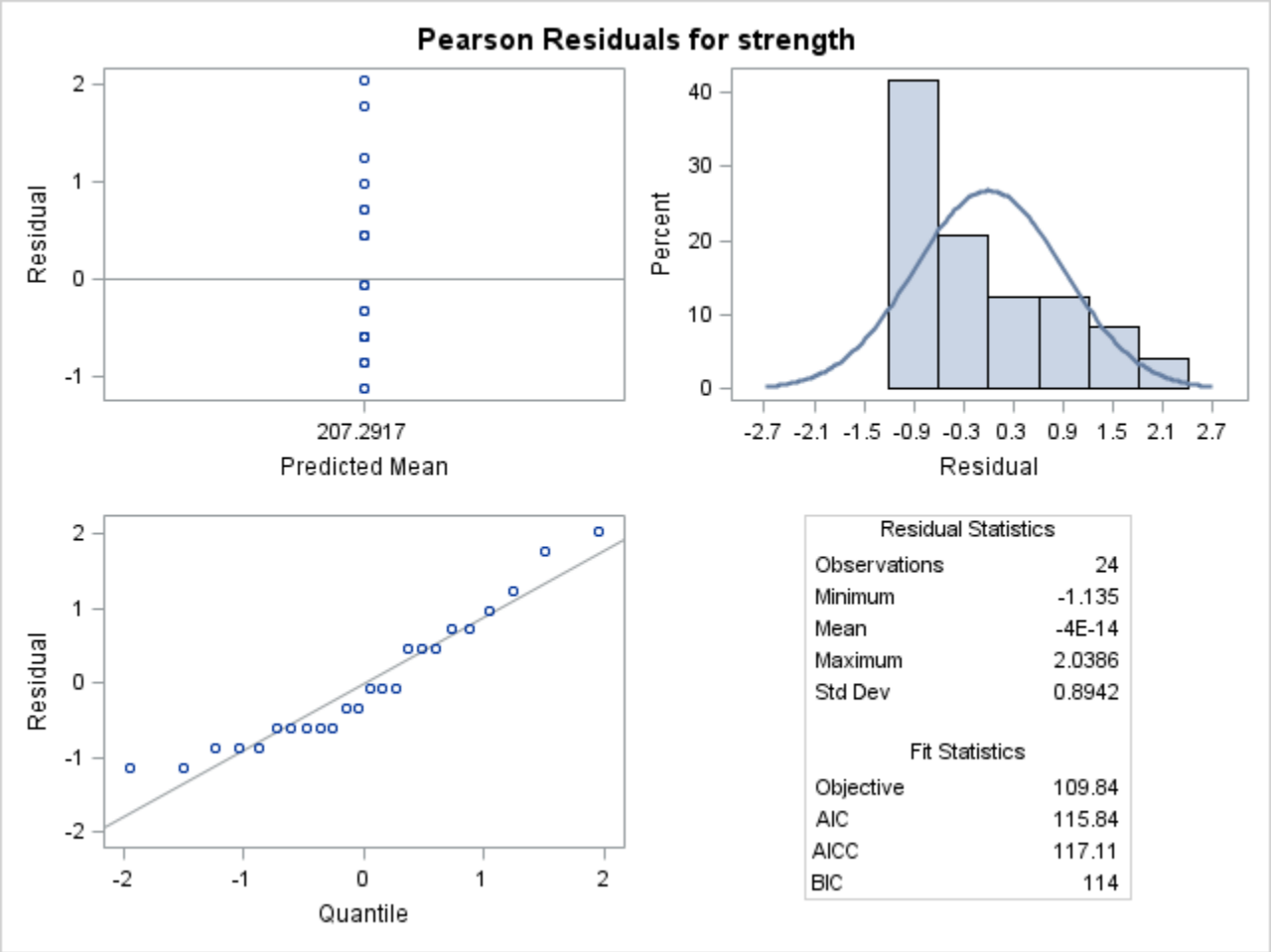
Covariance Parameter Estimates	
Cov Parm	**Estimate**
Residual	3.7917

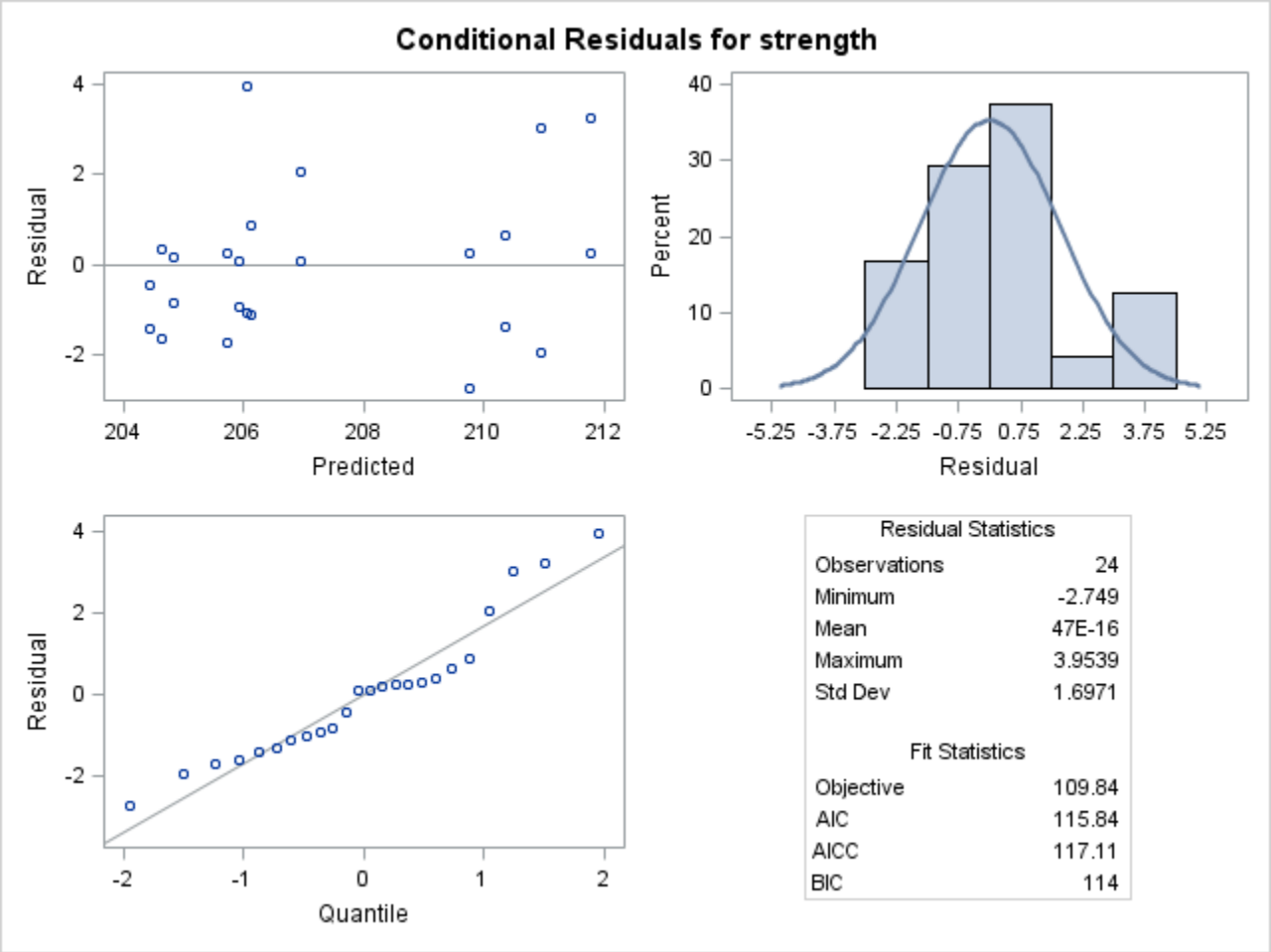
Fit Statistics	
-2 Res Log Likelihood	109.8
AIC (smaller is better)	115.8
AICC (smaller is better)	117.1
BIC (smaller is better)	114.0

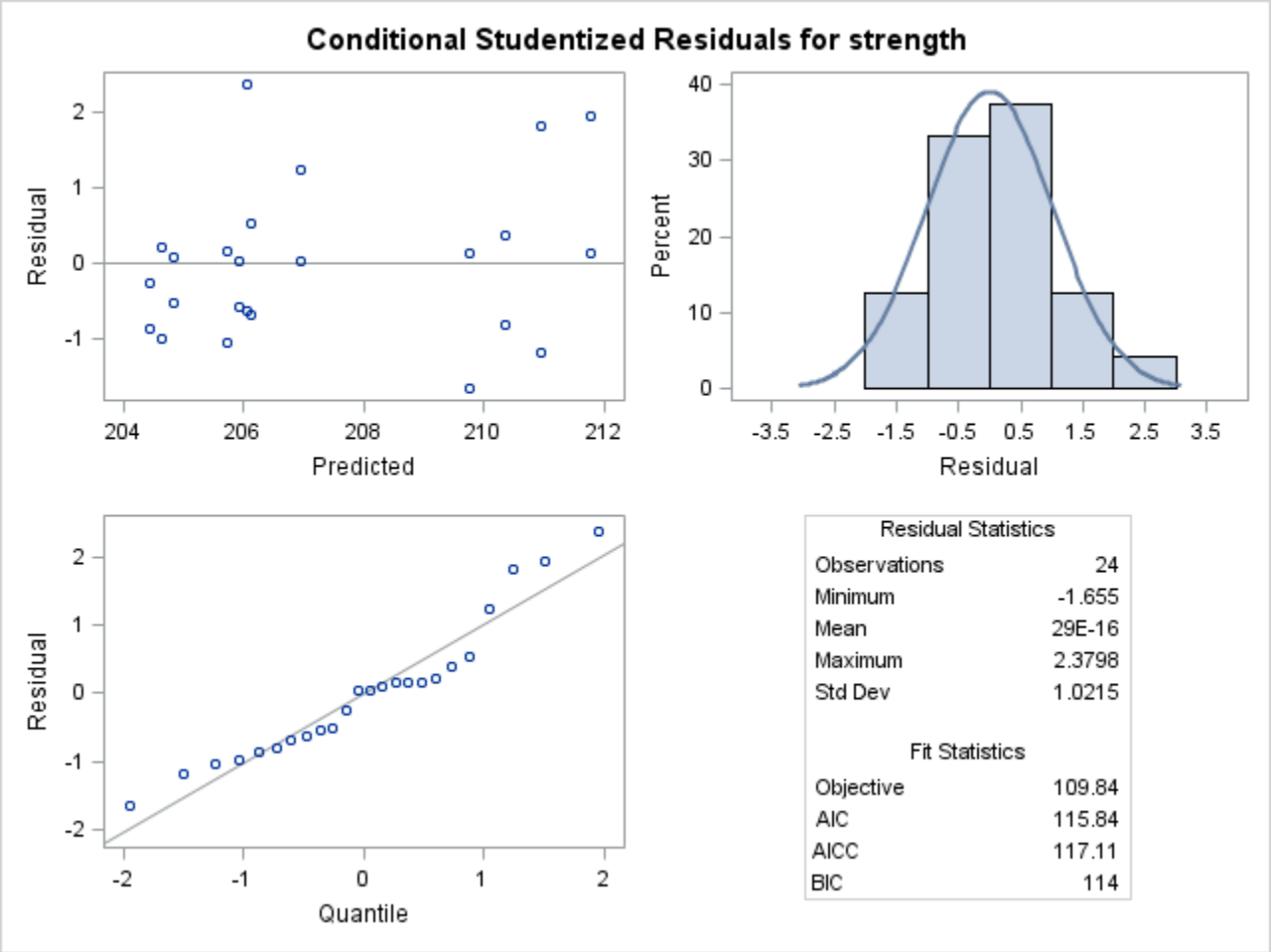
Estimates								
Label	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**
Avg. solder strength	207.29	1.8277	2	113.42	<.0001	0.05	199.43	215.16

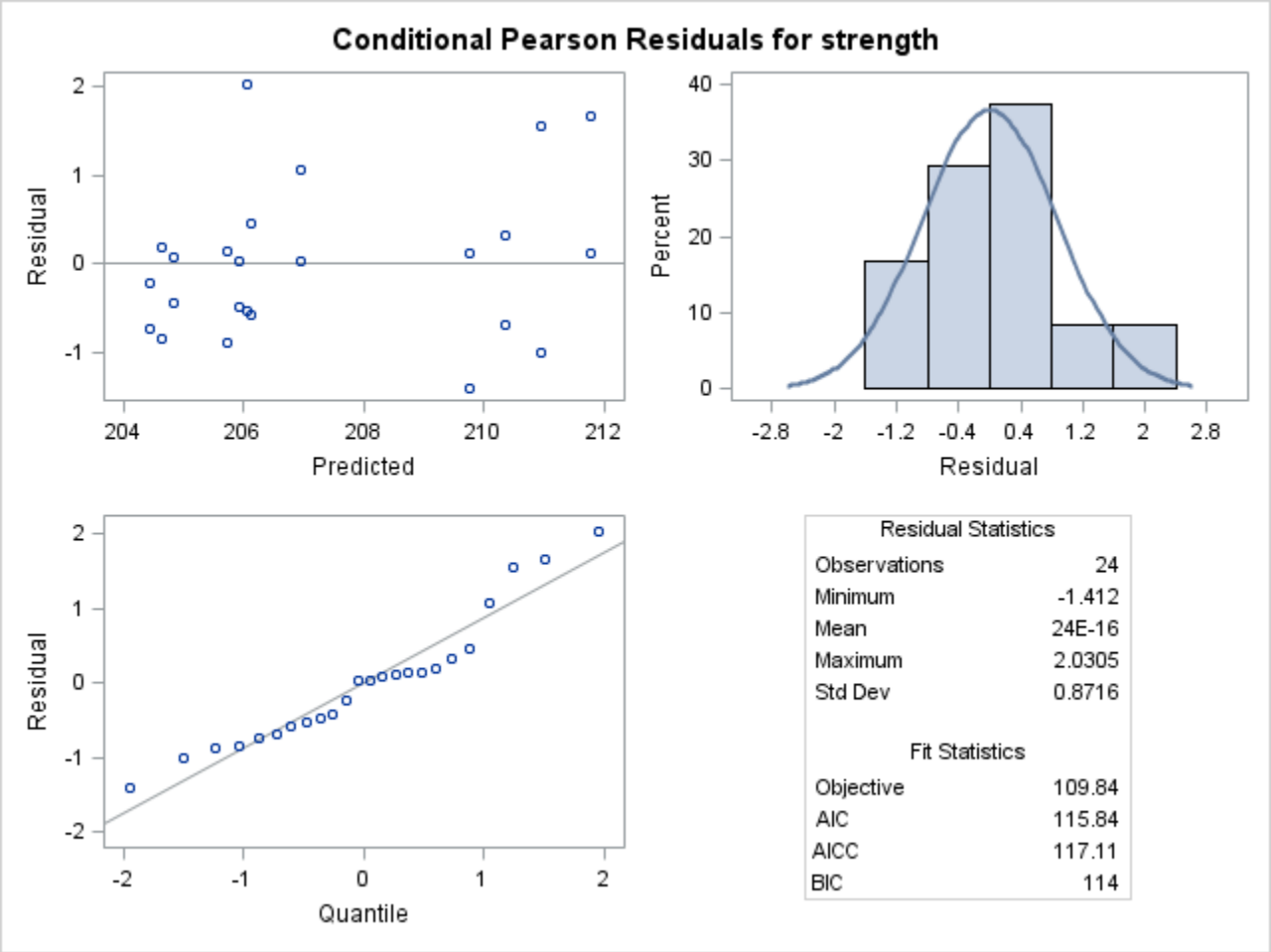


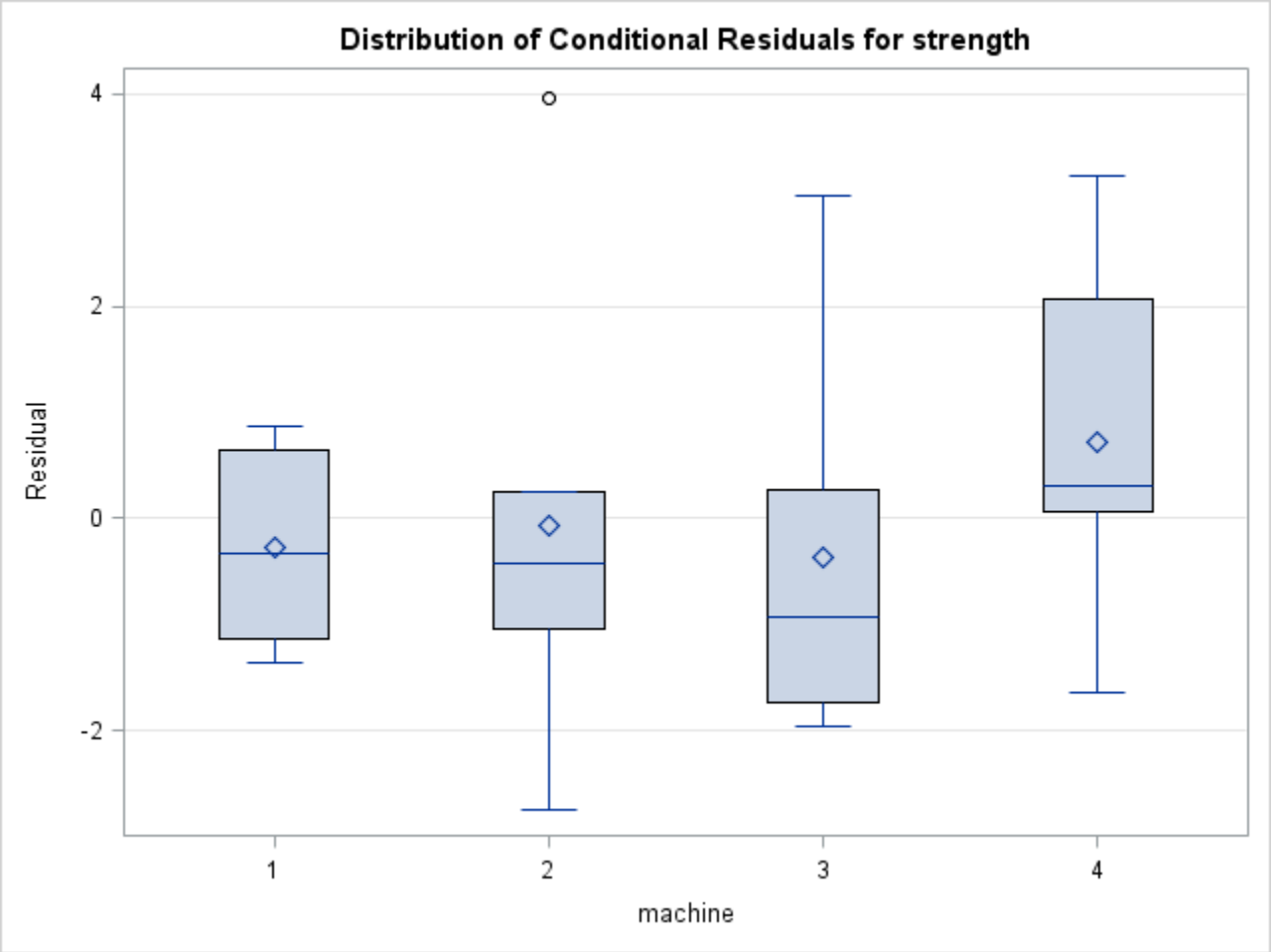

Studentized Residuals for strength
Residual
Predicted Mean
207.2917
Percent
Residual
Residual
Quantile
Residual Statistics
Observations 24
Minimum -1.297
Mean -5E-14
Maximum 2.3287
Std Dev 1.0215
Fit Statistics
Objective 109.84
AIC 115.84
AICC 117.11
BIC 114

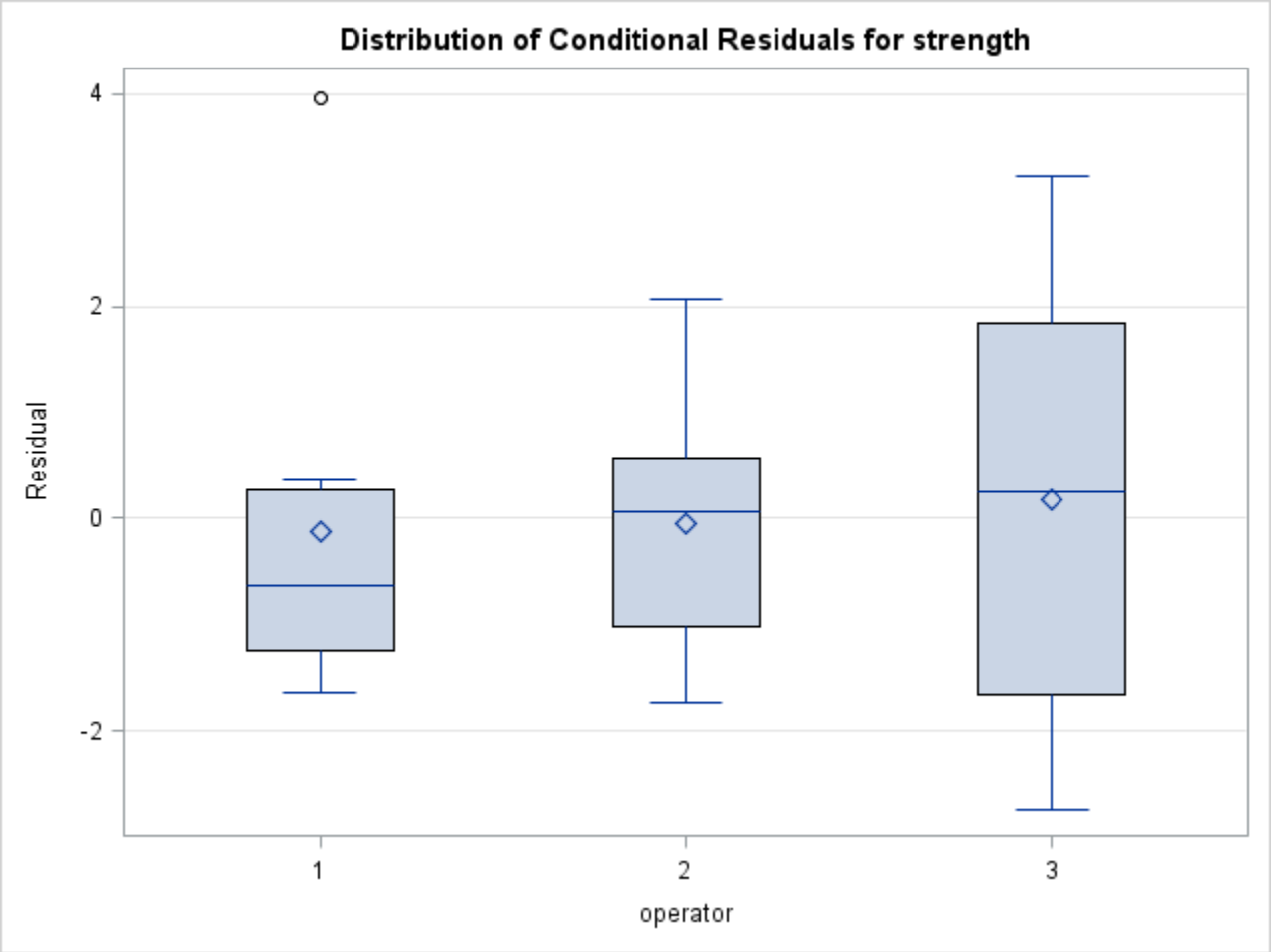

Pearson Residuals for strength
Residual
Predicted Mean
207.2917
Percent
Residual
Quantile
Residual Statistics
Observations 24
Minimum -1.135
Mean -4E-14
Maximum 2.0386
Std Dev 0.8942
Fit Statistics
Objective 109.84
AIC 115.84
AICC 117.11
BIC 114

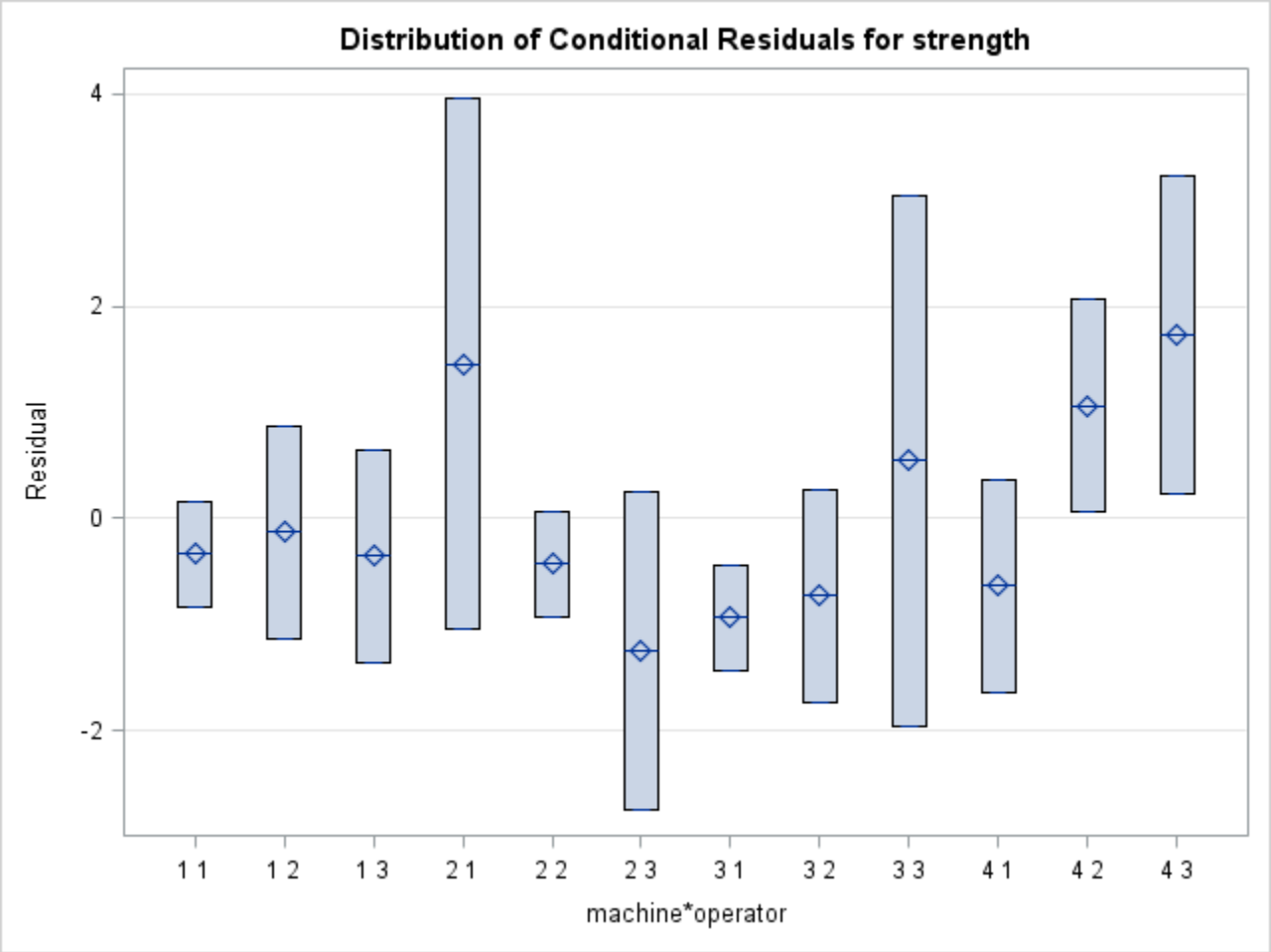

Conditional Residuals for strength
Residual
Predicted
Percent
Residual
Residual
Quantile
Residual Statistics
Observations 24
Minimum -2.749
Mean 47E-16
Maximum 3.9539
Std Dev 1.6971
Fit Statistics
Objective 109.84
AIC 115.84
AICC 117.11
BIC 114


Conditional Studentized Residuals for strength
Residual
Predicted
204
206
208
210
212
2
1
0
-1
Percent
Residual
40
30
20
10
0
-3.5
-2.5
-1.5
-0.5
0.5
1.5
2.5
3.5
Residual
Quantile
-2
-1
0
1
2
Residual Statistics
Observations 24
Minimum -1.655
Mean 29E-16
Maximum 2.3798
Std Dev 1.0215
Fit Statistics
Objective 109.84
AIC 115.84
AICC 117.11
BIC 114


Conditional Pearson Residuals for strength
Residual
Predicted
204
206
208
210
212
2
1
0
-1
Percent
Residual
40
30
20
10
0
-2.8
-2
-1.2
-0.4
0.4
1.2
2
2.8
Residual
Quantile
-2
-1
0
1
2
Residual Statistics
Observations 24
Minimum -1.412
Mean 24E-16
Maximum 2.0305
Std Dev 0.8716
Fit Statistics
Objective 109.84
AIC 115.84
AICC 117.11
BIC 114


Distribution of Conditional Residuals for strength
Residual
4
2
0
-2
1
2
3
4
machine


Distribution of Conditional Residuals for strength
Residual
4
2
0
-2
1
2
3
operator


Distribution of Conditional Residuals for strength
Residual
4
2
0
-2
1 1
1 2
1 3
2 1
2 2
2 3
3 1
3 2
3 3
4 1
4 2
4 3
machine*operator