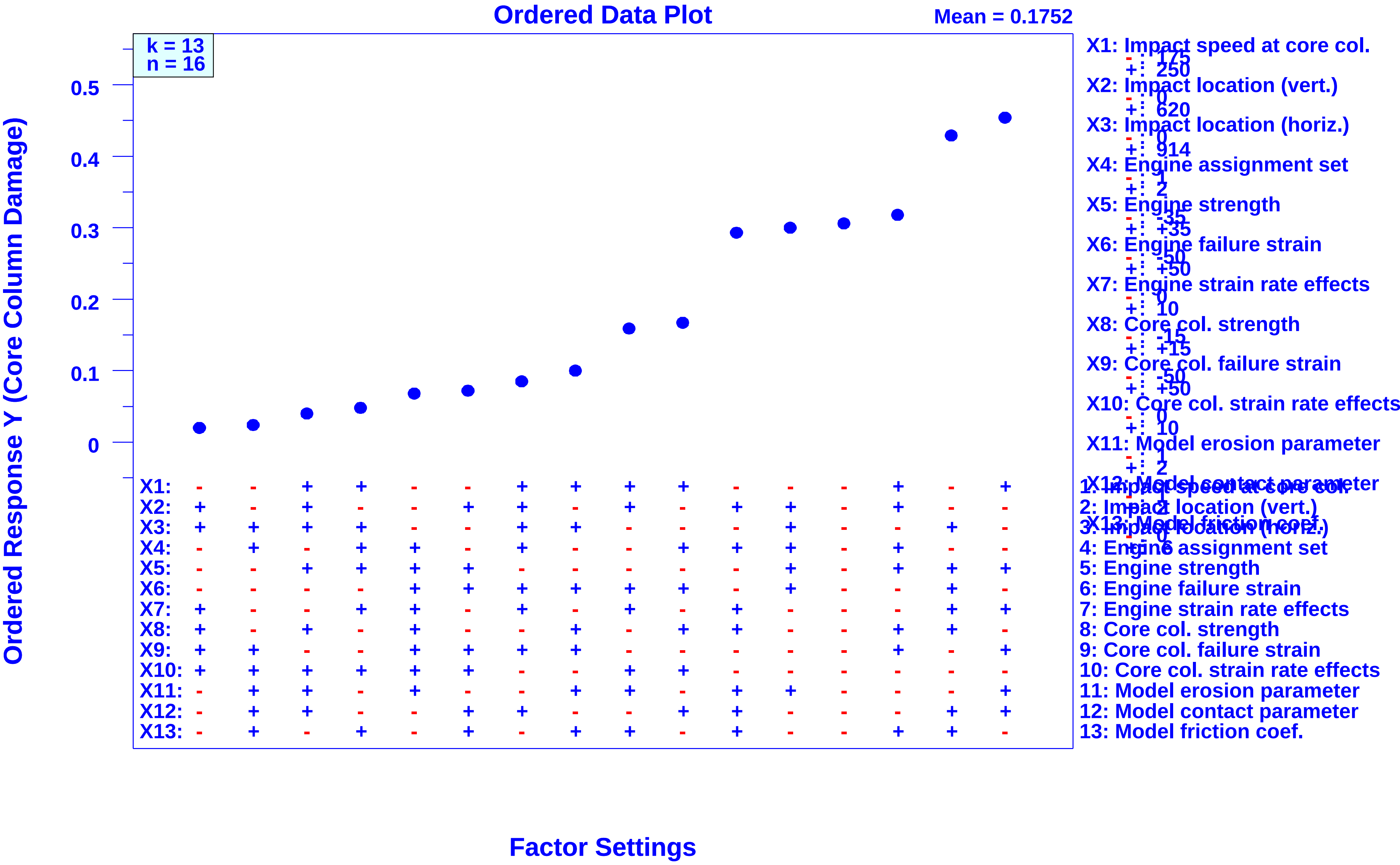
Factors Affecting World Trade Center Inner Core Column Damage
Design: 2**(13-9) (k=13,n=16)

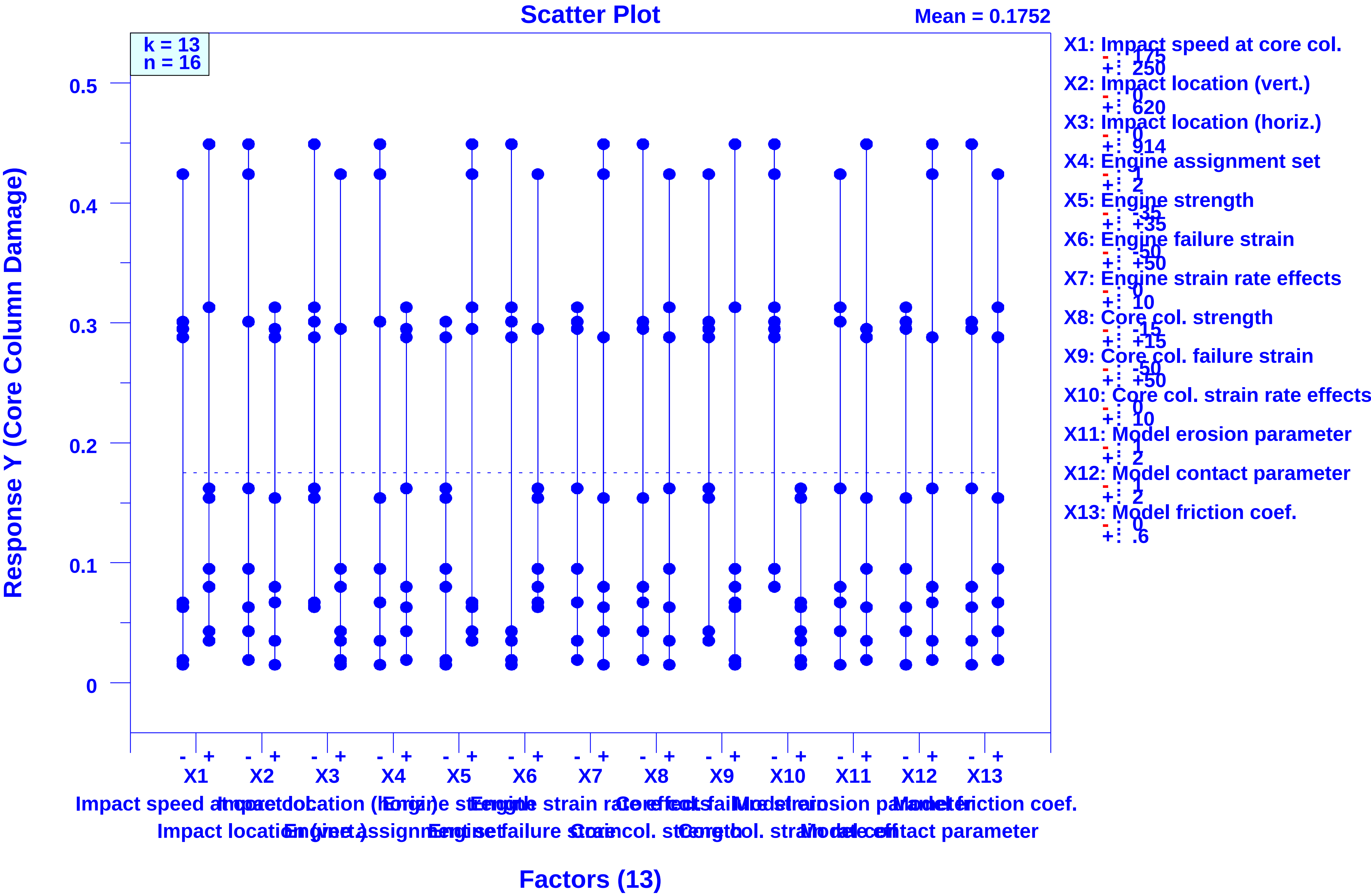
Ordered Data Plot



X1:	-	-	+	+	-	-	+	+	+	+	-	-	-	+	-	+	1: Impact speed at core col.
X2:	+	-	+	-	-	+	+	-	+	-	+	+	-	+	-	-	2: Impact location (vert.)
X3:	+	+	+	+	-	-	+	+	-	-	-	+	-	-	+	-	3: Impact location (horiz.)
X4:	-	+	-	+	+	-	+	-	-	+	+	+	-	+	-	-	4: Engine assignment set
X5:	-	-	+	+	+	+	-	-	-	-	-	+	-	+	+	+	5: Engine strength
X6:	-	-	-	-	+	+	+	+	+	+	-	+	-	-	+	-	6: Engine failure strain
X7:	+	-	-	+	+	-	+	-	+	-	+	-	-	-	+	+	7: Engine strain rate effects
X8:	+	-	+	-	+	-	-	+	-	+	+	-	-	+	+	-	8: Core col. strength
X9:	+	+	-	-	+	+	+	+	-	-	-	-	-	+	-	+	9: Core col. failure strain
X10:	+	+	+	+	+	+	-	-	+	+	-	-	-	-	-	-	10: Core col. strain rate effects
X11:	-	+	+	-	+	-	-	+	+	-	+	+	-	-	-	+	11: Model erosion parameter
X12:	-	+	+	-	-	+	+	-	-	+	+	-	-	-	+	+	12: Model contact parameter
X13:	-	+	-	+	-	+	-	+	+	-	+	-	-	+	+	-	13: Model friction coef.

Factors Affecting World Trade Center Inner Core Column Damage

Design: 2**(13-9) (k=13,n=16)

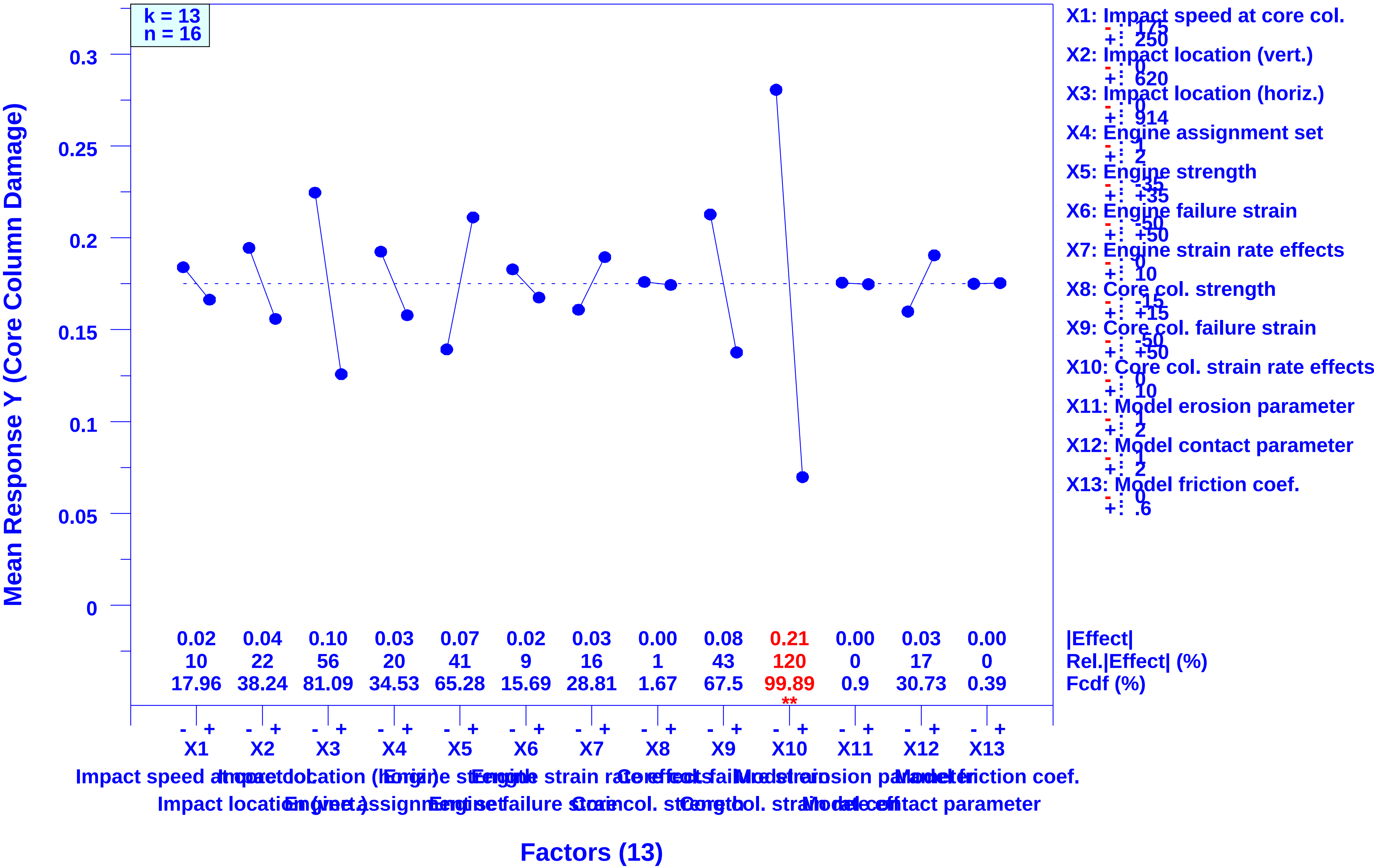


wtc_13_16.dp
Datafile: wtc_13_16.dat

Factors Affecting World Trade Center Inner Core Column Damage

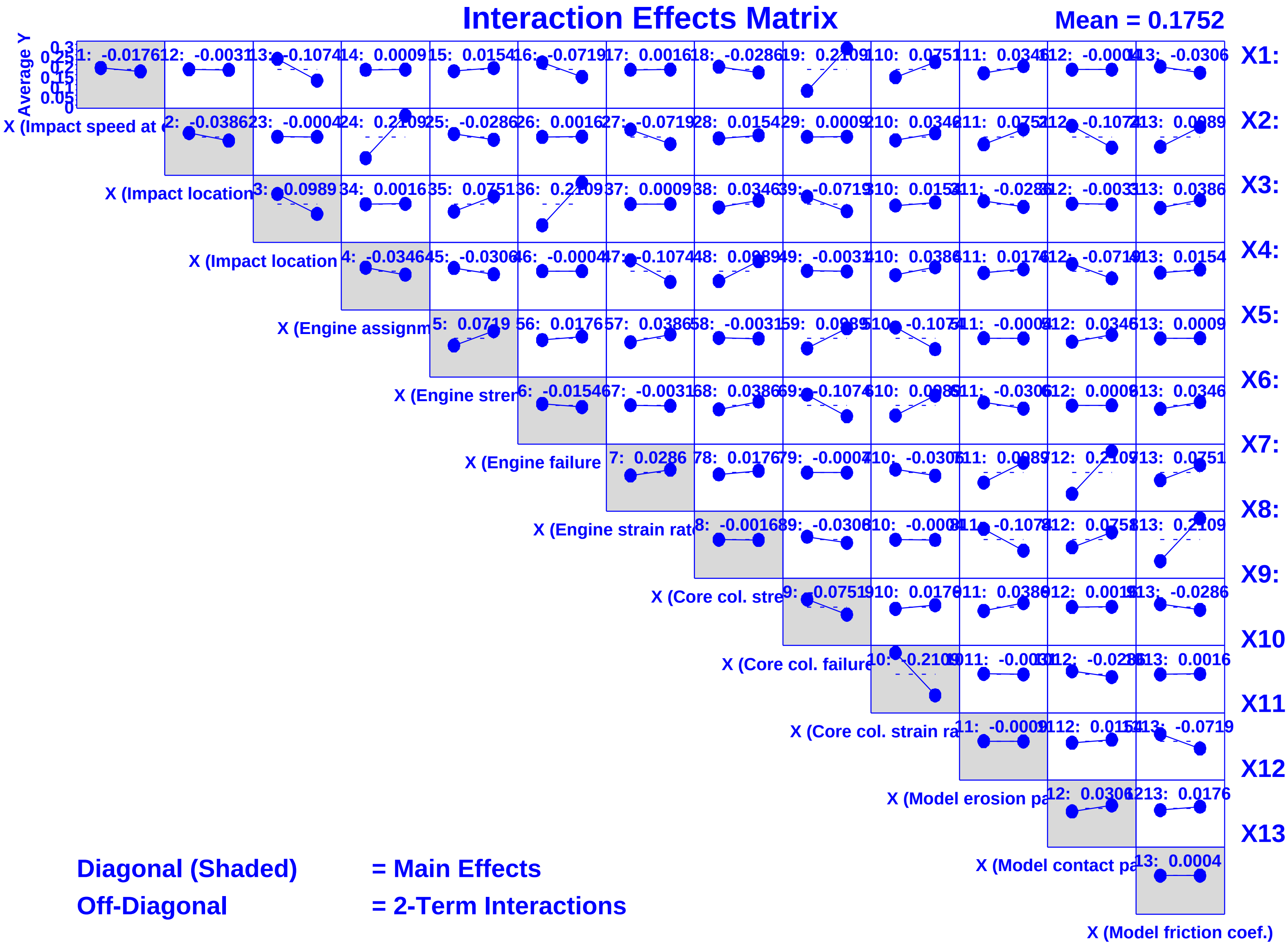
Design: 2**(13-9) (k=13,n=16)

Main Effects Plot



wtc_13_16.dp
Datafile: wtc_13_16.dat

Factors Affecting World Trade Center Inner Core Column Damage
Design: 2**(13-9) (k=13,n=16)



X1: Impact speed at core col.
- : 175
+: 250

X2: Impact location (vert.)
- : 0
+: 620

X3: Impact location (horiz.)
- : 0
+: 914

X4: Engine assignment set
- : 1
+: 2

X5: Engine strength
- : -35
+: +35

X6: Engine failure strain
- : -50
+: +50

X7: Engine strain rate effects
- : 0
+: 10

X8: Core col. strength
- : -15
+: +15

X9: Core col. failure strain
- : -50
+: +50

X10: Core col. strain rate effects
- : 0
+: 10

X11: Model erosion parameter
- : 1
+: 2

X12: Model contact parameter
- : 1
+: 2

X13: Model friction coef.
- : 0
+: .6

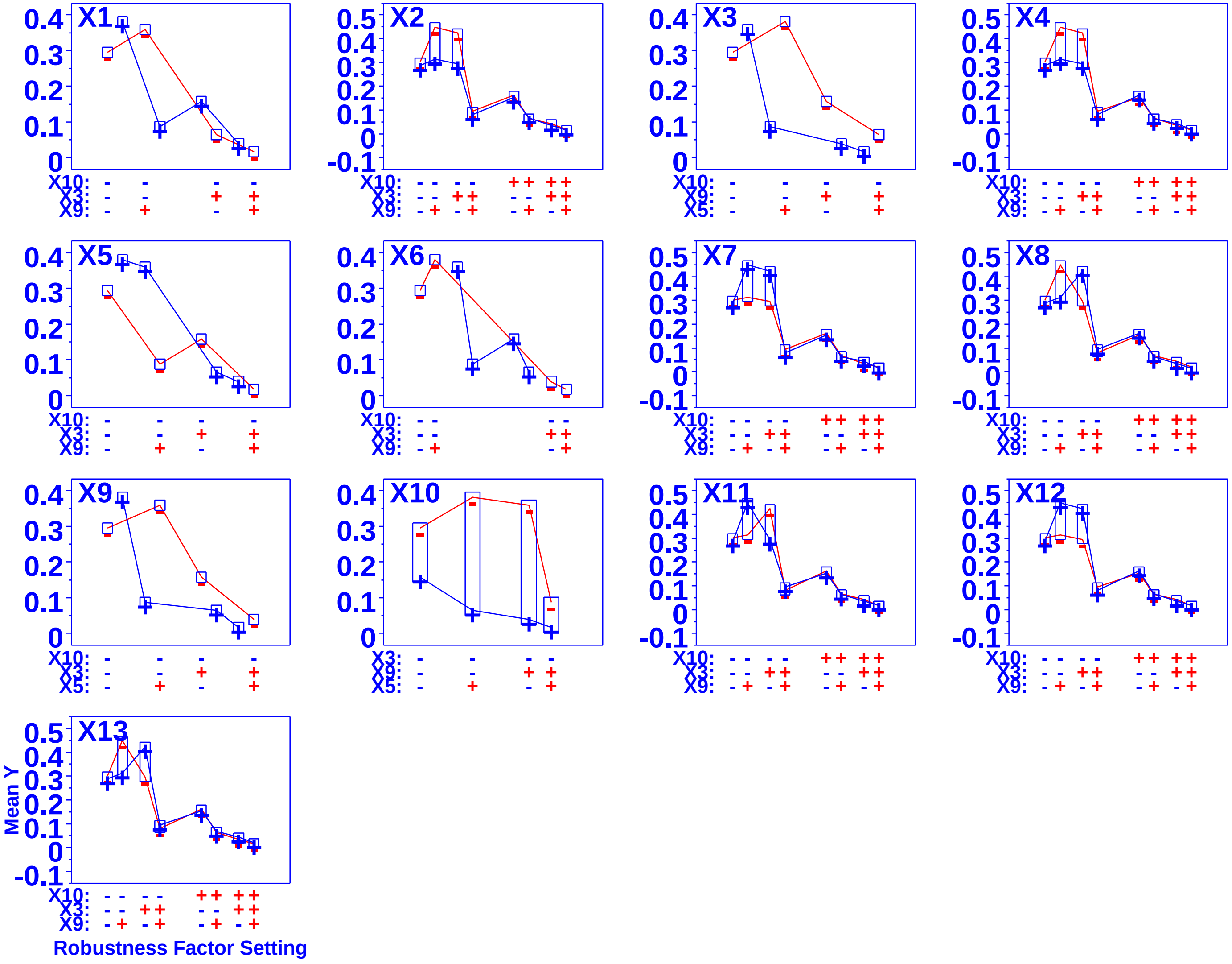
Diagonal (Shaded) = Main Effects

Off-Diagonal = 2-Term Interactions

wtc_13_16.dp
Datafile: wtc_13_16.dat

Factors Affecting World Trade Center Inner Core Column Damage
Design: 2**(13-9) (k=13,n=16)

Block Plot



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- : 175
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- : 0
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X3: Impact location (horiz.)
- : 0
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X6: Engine failure strain
- : -50
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X7: Engine strain rate effects
- : 0
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- : 1
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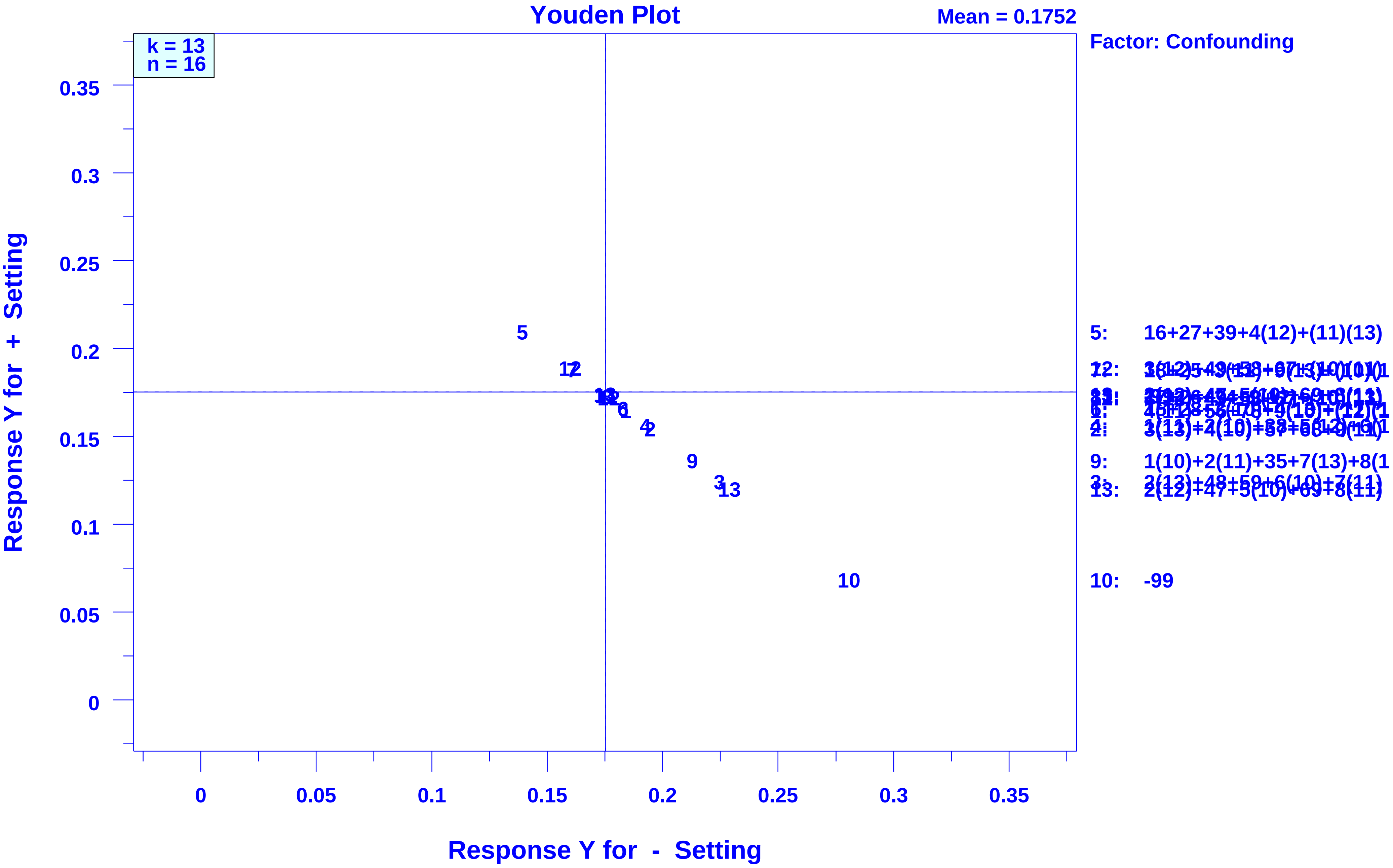
- : 1
+: 2

X13: Model friction coef.
- : 0
+: .6

Factors Affecting World Trade Center Inner Core Column Damage
Design: 2**(13-9) (k=13,n=16)

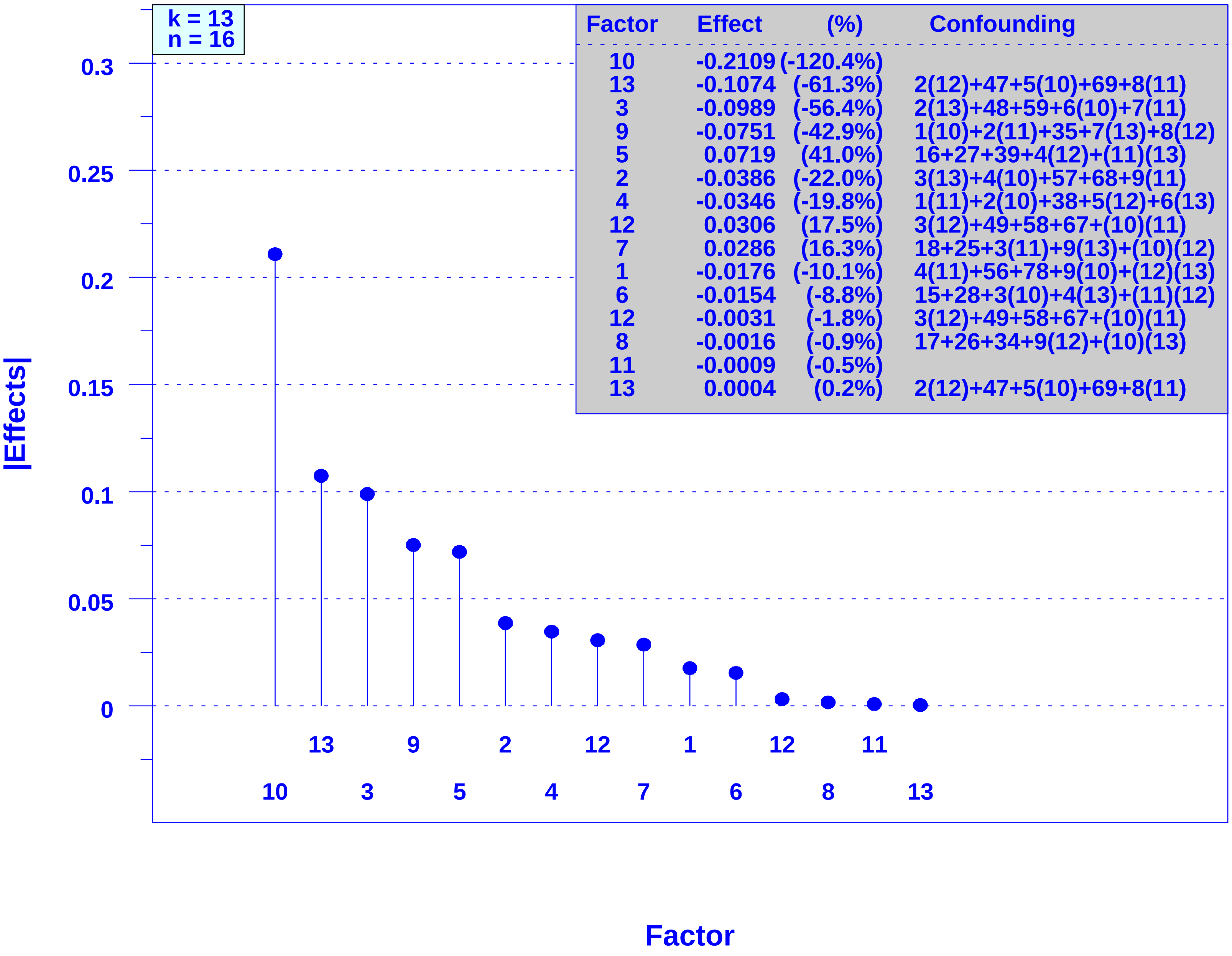


wtc_13_16.dp
Datafile: wtc_13_16.dat

Factors Affecting World Trade Center Inner Core Column Damage
Design: 2**(13-9) (k=13,n=16)

|Effects| Plot

Mean = 0.1752



Factor	Effect	(%)	Confounding
10	-0.2109	(-120.4%)	
13	-0.1074	(-61.3%)	2(12)+47+5(10)+69+8(11)
3	-0.0989	(-56.4%)	2(13)+48+59+6(10)+7(11)
9	-0.0751	(-42.9%)	1(10)+2(11)+35+7(13)+8(12)
5	0.0719	(41.0%)	16+27+39+4(12)+(11)(13)
2	-0.0386	(-22.0%)	3(13)+4(10)+57+68+9(11)
4	-0.0346	(-19.8%)	1(11)+2(10)+38+5(12)+6(13)
12	0.0306	(17.5%)	3(12)+49+58+67+(10)(11)
7	0.0286	(16.3%)	18+25+3(11)+9(13)+(10)(12)
1	-0.0176	(-10.1%)	4(11)+56+78+9(10)+(12)(13)
6	-0.0154	(-8.8%)	15+28+3(10)+4(13)+(11)(12)
12	-0.0031	(-1.8%)	3(12)+49+58+67+(10)(11)
8	-0.0016	(-0.9%)	17+26+34+9(12)+(10)(13)
11	-0.0009	(-0.5%)	
13	0.0004	(0.2%)	2(12)+47+5(10)+69+8(11)

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X3: Impact location (horiz.)
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X10: Core col. strain rate effects
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X12: Model contact parameter
- : 1
+ : 2

X13: Model friction coef.
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+ : .6

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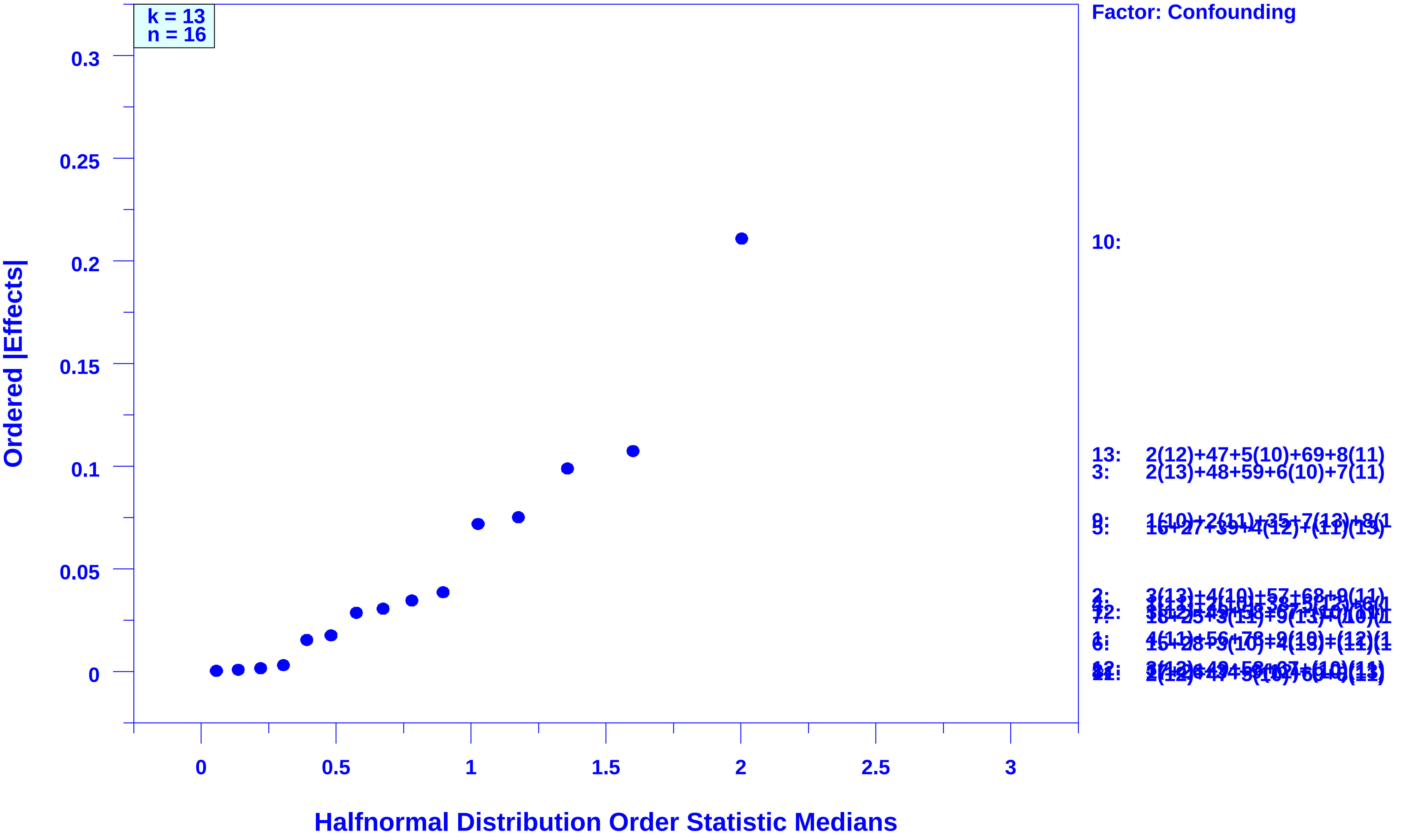
Factors Affecting World Trade Center Inner Core Column Damage
Design: 2**(13-9) (k=13,n=16)

Halfnormal Probability Plot of |Effects|

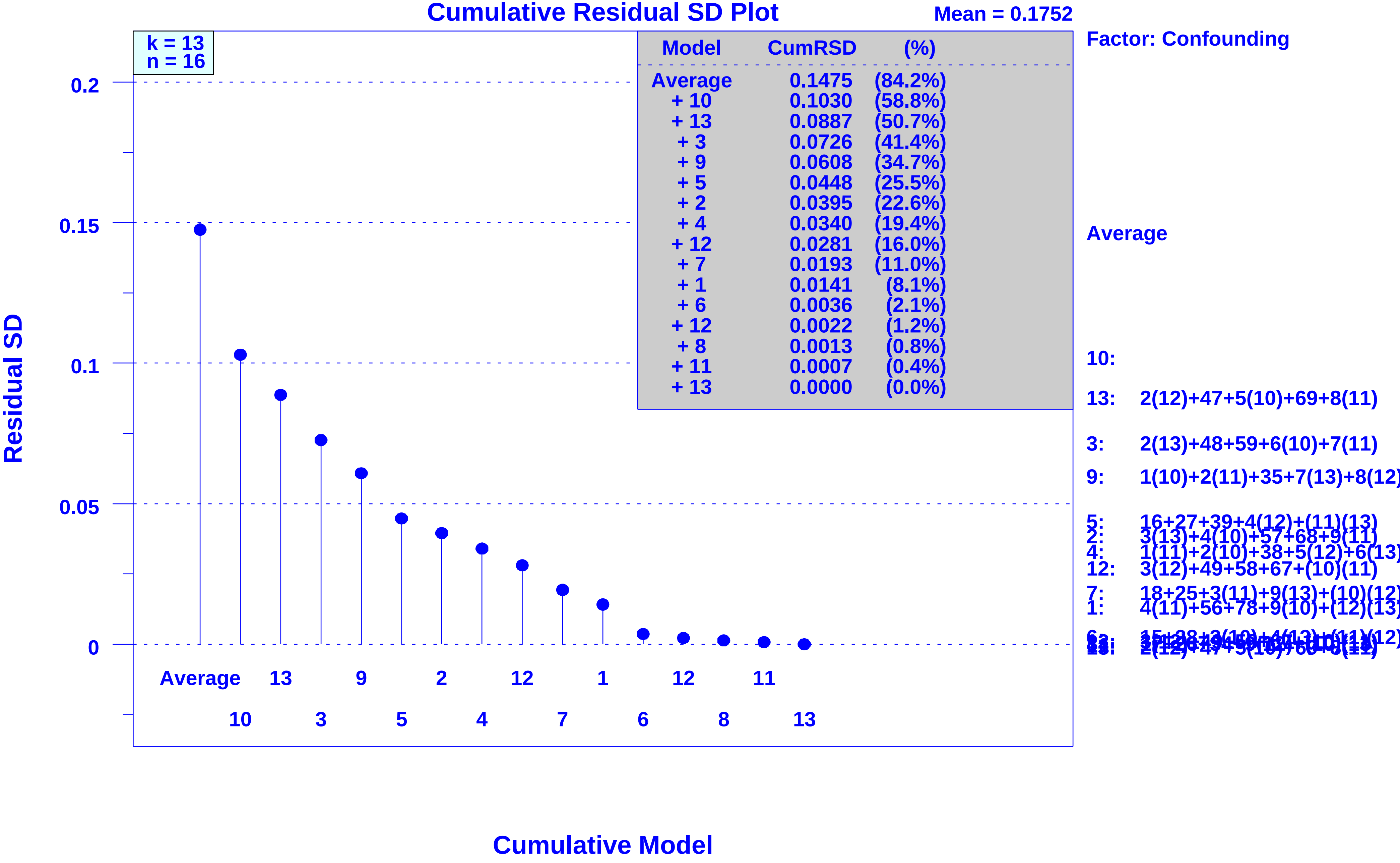


wtc_13_16.dp
Datafile: wtc_13_16.dat

9

Factors Affecting World Trade Center Inner Core Column Damage
Design: 2**(13-9) (k=13,n=16)

Cumulative Residual SD Plot



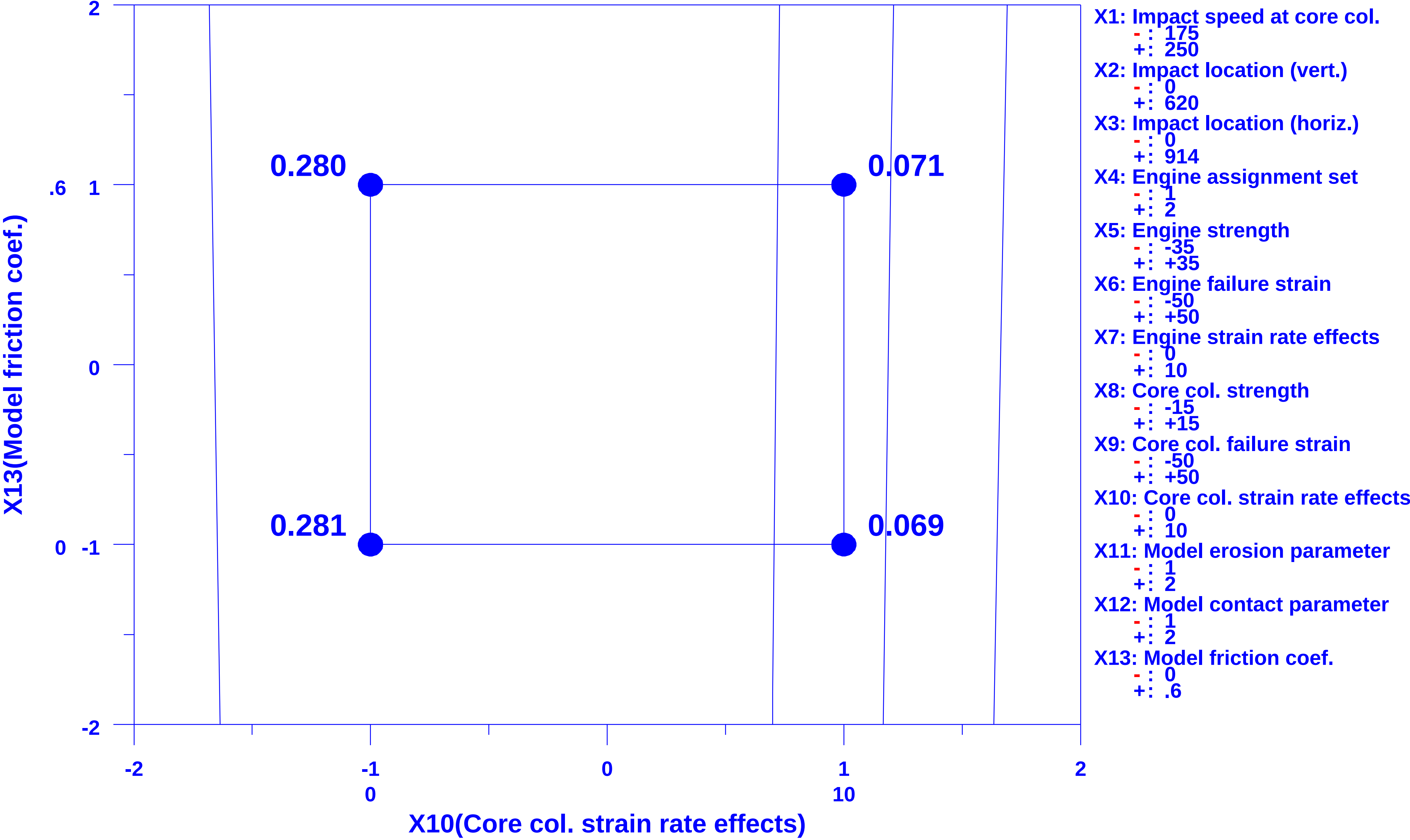
Model	CumRSD	(%)
Average	0.1475	(84.2%)
+ 10	0.1030	(58.8%)
+ 13	0.0887	(50.7%)
+ 3	0.0726	(41.4%)
+ 9	0.0608	(34.7%)
+ 5	0.0448	(25.5%)
+ 2	0.0395	(22.6%)
+ 4	0.0340	(19.4%)
+ 12	0.0281	(16.0%)
+ 7	0.0193	(11.0%)
+ 1	0.0141	(8.1%)
+ 6	0.0036	(2.1%)
+ 12	0.0022	(1.2%)
+ 8	0.0013	(0.8%)
+ 11	0.0007	(0.4%)
+ 13	0.0000	(0.0%)

wtc_13_16.dp
Datafile: wtc_13_16.dat

Factors Affecting World Trade Center Inner Core Column Damage

Design: 2**(13-9) (k=13,n=16)

Contour Plot of 2 Dominant Factors: X10 (Core col. strain rate effects) & X13 (Model friction coef.)



Center-Point Predicted Value (From 2-Factor Edge-based Model) = 0.1752

wtc_13_16.dp
Datafile: wtc_13_16.dat