## Analysis of Split-plots (JMP v. 15)

Many industrial experiments are run without complete randomization (factors may be difficult to change, circumstances don't allow for, there is a desire to economize or a desire to partition the Noise). This restriction on randomization needs to be accounted for in the analysis. Make sure the restrictions (an appropriate assignment of noise) are noted on your experiment plan (FRD). Assign the partitioned degrees of freedom to the FRD.

To perform the analysis, start with your typical analysis by entering a saturated model and run the fit model platform (**Analyze>Fit Model**). Using the output, right click on **Parameter Estimates** section and **Make into Data Table**.

Parame	ter Estima	ates				
Term	Estimate	Std Error	t Ratio	Prob> t		
Intercept	3.446875					
S	1.334375					
P	-0.165625					
S*P	0.096875					
V	0.603125					
S*V	0.103125					
P*V	0.065625					
S*P*V	0.140625					
Т	0.553125					
S*T	0.153125					
P*T	-0.459375					
S*P*T	-0.084375					
V*T	-0.015625					
S*V*T	-0.128125					
P*V*T	0.071875					
S*P*V*T	0.184375					
t	0.265625			Table Style		
S*t	0.003125			Columns		
P*t	-0.109375			columns		
S*P*t	0.003125			Sort by Col	umn	
V*t	-0.040625			Make into	Data Table	
S*V*t	-0.040625			IVIANC IIILO		
P*V*t	0.009375			Make Com	bined Data Table	
S*P*V*t	0.034375					
T*t	0.034375			Make Into	Iviatrix	
S*T*t	-0.040625			Format Co	lumn	
P*T*t	-0.040625					

Delete the first **row** (Intercept). Rename the **Std Error** column **Plot** and assign the terms to the correct plot (WP=1, SP<sub>1</sub>=2, SP<sub>2</sub>=3...) as identified on the FRD.



Also rename the **t Ratio** column **ABS** (absolute value of the estimates column). Right click on the column ABS and create a formula for the absolute value of the estimate column (**Numeric** $\rightarrow$ **Abs** $\rightarrow$ double click on **Estimate**).

ABS - JAP Pro         Columns (4/1)         Set 1         Set 1<			Untitled 21	۹				
Abs - MP Pro <ul> <li></li></ul>					Term	Estimate	Plot	ABS
Columns (4/1)     Columns (4/1)     Columns (4/1)     Sypt 0.003125     Columns     Columns (4/1)     Columns (				1	S	1.334375	1	1.33
ABS-MMPPo <ul> <li>Columns (4/1)</li> <li>Strutt</li> <li>Strut</li> <li>Strut</li></ul>				2	P	-0.165625	1	0.17
				3	S*P	0.096875	1	0.10
				4	V	0.603125	1	0.60
				5	S*V	0.103125	1	0.10
				6	P*V	0.065625	1	0.07
				7	S*P*V	0.140625	1	0.14
				8	Т	0.553125	2	0.55
10       P*T       -0.459375       2       0.46         Image: Columns (4/1)       11       S*P*T       -0.084375       2       0.08         Image: Columns (4/1)       11       S*P*T       -0.015625       2       0.02         Image: Columns (4/1)       S*V*T       -0.128125       2       0.03         Image: Columns (4/1)       S*V*T       -0.128125       2       0.03         Image: Columns (4/1)       S*V*T       0.0184375       2       0.03         Image: Columns (4/1)       S*V*T       0.0184375       2       0.03         Image: Columns (4/1)       S*V*T       0.0184375       2       0.03         Image: Columns (4/1)       S*V*T       0.03125       2       0.00         Image: Columns (4/1)       S*V*T       0.003125       2       0.00         Integrate Modulo       S*D**T       0.034375       2       0.01         Round       S*D**T       0.034375       2       0.03         Integrate Modulo       S*D**T       0.034375       2       0.03         Statistical       Constants       Constants       2       0.04         Image: Constants       Constants       Constants       2 <td< td=""><td></td><td></td><td></td><td>9</td><td>S*T</td><td>0.153125</td><td>2</td><td>0.15</td></td<>				9	S*T	0.153125	2	0.15
Columns (4/1)       11       SrPT       -0.084375       2       0.08         Modulo       ABS       -				10	P*T	-0.459375	2	0.46
Image: Solutions       Image: Solutions       Image: Solutions       Image: Solutions         Image: Solutions       Image: Solutions       Image: Solutions       Image: Solutions       Image: Solutions         Image: Solutions			Columns (4/1)	11	S*P*T	-0.084375	2	0.08
			💼 Term 🙉 🛠	12	V*T	-0.015625	2	0.02
Prote       14       P*VT       0.071875       2       0.07         ABS-JMP Pro       -       -       -       ABS       15       S*P*V*T       0.184375       2       0.18         Image:       -       -       -       -       -       -       16       t       0.265625       2       0.27         Abs       -       -       -       -       -       -       17       S*t       0.003125       2       0.00         10       S*P*V*T       0.040625       2       0.01       -			Estimate	13	S*V*T	-0.128125	2	0.13
• AB5 - JMP Pro           • Company				14	P*V*T	0.071875	2	0.07
Filter         16         t         0.265625         2         0.27           Abs Celling Floor Integrate Modulo Round         Pot Abs Centrational Prob> 1         Image: Comparison Prob> 1         Image: Comparison Prob	🙀 ABS - JMP Pro	- 🗆 X		15	S*P*V*T	0.184375	2	0.18
Now       Yem       Image: Constants	Filter 5 Columns			16	t	0.265625	2	0.27
A Numeric Abs: Abs: Abs: Hords-Itil Floor Integrate Modulo Round Tingsondential Tingsondential Probability Comparison Conditional Probability Discrete Probability Discrete Probability Discrete Probability Discrete Probability Discrete Probability Discrete Probability Discrete Probability Discrete Probability Discrete Probability Probability Discrete Probability Discrete Probability Parametric Model Parametric Model Parametric Model Parametric Model Parametric Model Parametric Model       Image: Comparison Probability Discrete Probability Discrete Prob	▶ Row			17	S*t	0.003125	2	0.00
Abs       -Abs       -Abs       -Abs	Numeric     Plot			18	P*t	-0.109375	2	0.11
Floar       100 10       100 000025       100 0000025       100 0000025       100 0000025       100 0000025       100 0000025       100 0000025       100 0000025       100 0000025       100 00000025       100 00000025       100 0000000000000000000000000000000000	Abs ABS Ceiling Probalt			19	S*P*+	0.003125	2	0.00
Modiulo       Round       21       S*V*t       -0.040625       22       0.04         Promotice       Promotice       -0.040625       2       0.04         Comparison       Comparison       23       S*P*V*t       0.034375       2       0.03         Conditional       Probability       Discrete Probability       Statistical       25       S*T*t       -0.040625       2       0.04         Discrete Probability       Discrete Probability       Statistical       2       0.04       26       P*T*t       -0.040625       2       0.04         P Robability       Discrete Probability       Statistical       2       0.04       26       P*T*t       -0.040625       2       0.04         P Robability       Statistical       2       0.04       26       P*T*t       -0.040625       2       0.04         P Rametric Model       2       S*V*T*t       0.040625       2       0.04         P Row State       0       1       2       0.04       29       S*V*T*t       0.040625       2       0.04         P Sametric Model       1       2       0.04       30       P*V*T*t       0.003125       2       0.04	Floor			20	V*t	-0.040625	2	0.04
Round       Image detail       Image detailing detail	Modulo			21	S*V*t	-0.040625	2	0.04
Trigonomia       Canada       Canada <td>Round</td> <td></td> <td></td> <td>22</td> <td>D*\/*+</td> <td>0.009375</td> <td>2</td> <td>0.01</td>	Round			22	D*\/*+	0.009375	2	0.01
Constraiter       22       Trt       0.034375       22       0.03         Portability       Probability       25       STTt       -0.040625       2       0.04         Portability       Discrete Probability       26       PiTt       -0.040625       2       0.04         Parametric Model       27       S*P*Tt       0.109375       2       0.11         Parametric Model       2       2       0.04       20       S*V*Tt       0.040625       2       0.04         Parametric Model       2       2       0.04       2       0.04       2       0.04       2       0.04       0       0       0       1       2       0.01       0 <td><ul> <li>Trigonometric</li> </ul></td> <td></td> <td></td> <td>23</td> <td>S*P*V*t</td> <td>0.034375</td> <td>2</td> <td>0.03</td>	<ul> <li>Trigonometric</li> </ul>			23	S*P*V*t	0.034375	2	0.03
Conditional P Probability       Conditional P Discrete Probability       Conditional P Conditional P Discrete Probability       Conditional P Conditio P Conditional P Conditional P Conditional P C	Character     Comparison	Estimate		24	T*+	0.034375	2	0.03
▶ Probability         ▶ Discrete Probability         ▶ Statistical         ▶ Random         > Date Time         ▶ Constants ▼         > Random         > Date Time         > Constants ▼         > Assignment         1         2         > Finance         2         0         1         2         1         2         * Finance         2         * Finance         2         * Row State         0         1         2         * Row State         0         1         2         2         1         2         2         30         P*V*T*t         0.003125         2         0.000	<ul> <li>Conditional</li> </ul>			25	C*T*+	-0.040625	2	0.03
200     Pit     0.040625     2     0.04       > Random     27     S*P*T*t     0.109375     2     0.11       > Date Time     28     V*T*t     -0.121875     2     0.12       > Assignment     1     2     2     0.040625     2     0.04       > Parametric Model     2     2     0.04     2     0.040625     2     0.04	Probability			25	D*T*+	0.040625	2	0.04
P Random         27         5 PT t C         0.109373         2         0.11           P Date Time	<ul> <li>Statistical</li> </ul>			20	C*D*T*+	0.100275	2	0.04
Bow State         Constants         V         Constants         Z         O.12         O.12 <tho.12< th=""> <tho.< td=""><td>Random     Date Time</td><td></td><td></td><td>27</td><td>3 F I L</td><td>0.109375</td><td>2</td><td>0.13</td></tho.<></tho.12<>	Random     Date Time			27	3 F I L	0.109375	2	0.13
> Asignment         0         ^         29         5/0°1°t         0.040025         2         0.04           > Parametric Model         1         30         P*V*T*t         0.003125         2         0.00	Row State			28	C#1/8T84	-0.1218/3	2	0.12
Finance 2 30 PVV1t 0.003125 2 0.00	Assignment     O     Assignment     D	· · · · · · · · · · · · · · · · · · ·		29	D*1/PT*1	0.040025	2	0.04
21 C*D*L/TT*L 0.000275 2 0.01	▶ Finance 2		1	30	C+D+L/TT+L	0.003125	2	0.00

Make sure the Term column has a label symbol next to it. If it does not, right click on the column **Term** and select **Label/unlabel.** 

Create normal plots for the Estimate: **Analyze** $\rightarrow$ **Distribution**. Put Estimate in the **Y**, **Column** window and **Plot** in the **By** window and select OK.



This will provide normal plots for each plot (Whole plot and sub plot) on your FRD. You can add **Quantile** plots to assist in the interpretation.



0.0- 0.5 -0.67- 0.3 -1.28- 0.1 -1.64- 0.05

1.5

1

H0H•

0

-0.5

٠

0.5

Next create Pareto plots for practical significance: Analyze $\rightarrow$ Quality and Process $\rightarrow$ Pareto Plot: Place Term in the Y, Cause box, ABS in the Weight box and Plot in the By box.

Select Columns	Cast Selected Column	Action	
✓ Lerm Estimate	Y, Cause	🔥 Term	ОК
ABS	X, Grouping	optional	Cancel
Threshold of Combined Causes	Weight	ABS	Remove
Per Unit Analysis	Freq	optional numeric	Recall
(requires sample size)	Ву	Plot optional	Help



You can add your own reference line where practical significance is met.