



INSTITUTE FOR DEFENSE ANALYSES

JEDIS Briefing and Tutorial for DATAWorks 2018

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March 2018

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IDA

JEDIS

JMP Experimental Design Iterative Solver



March 2018

What is JEDIS?

JEDIS is a JMP Add-In for automating
Design of Experiments (DOE) power calculations

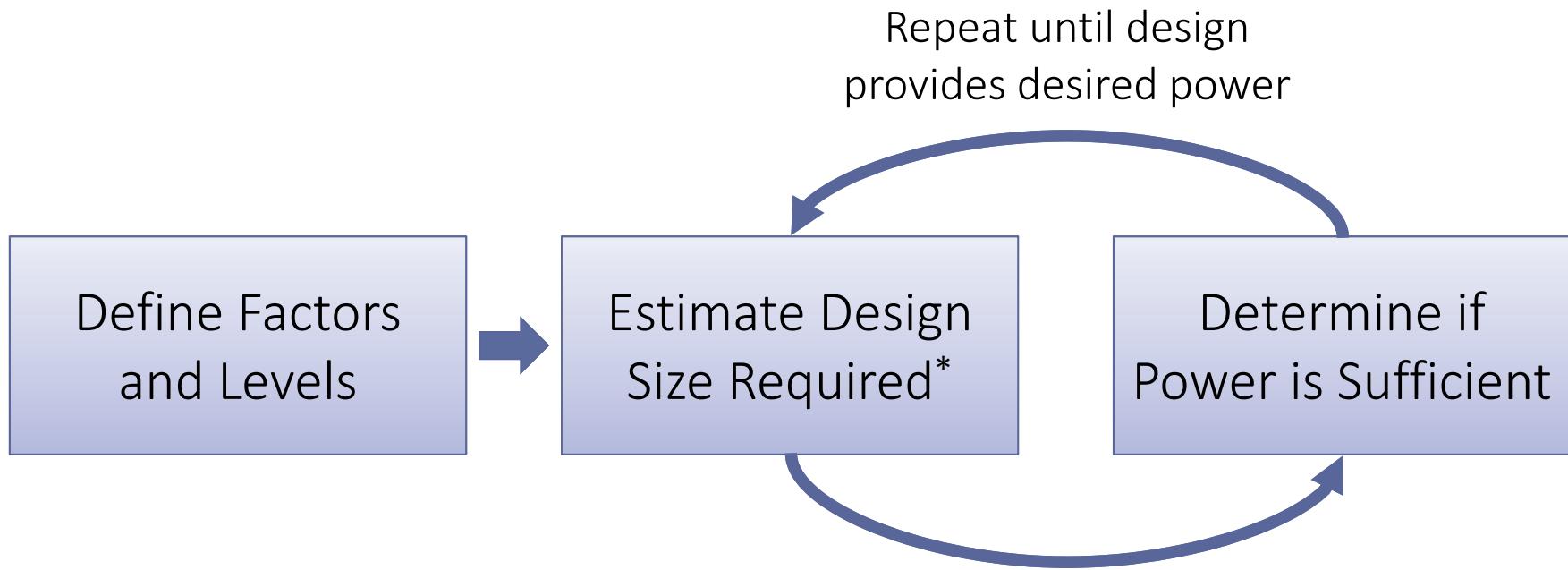
JEDIS simplifies answering questions like the following:

How many runs does my
DOE need for 90% power
across my factor-space?



Typical Researchers

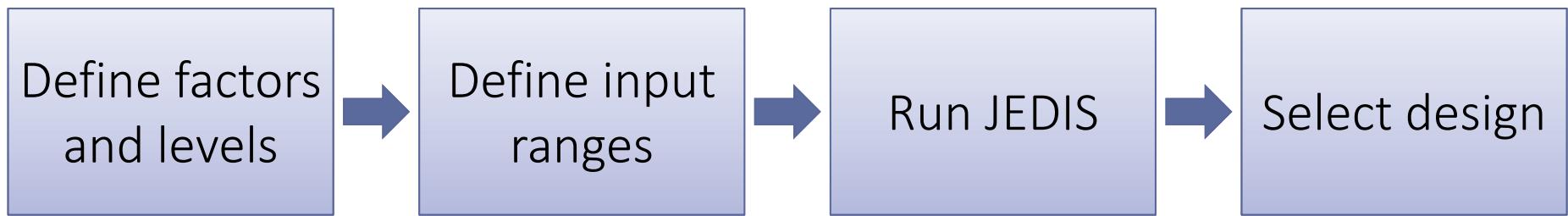
Traditional DOE methods require iterative estimation to size a design for a specific power



* For factorial designs: the number of design replications

For optimal designs: the number of individual samples

JEDIS iterates through designs for you

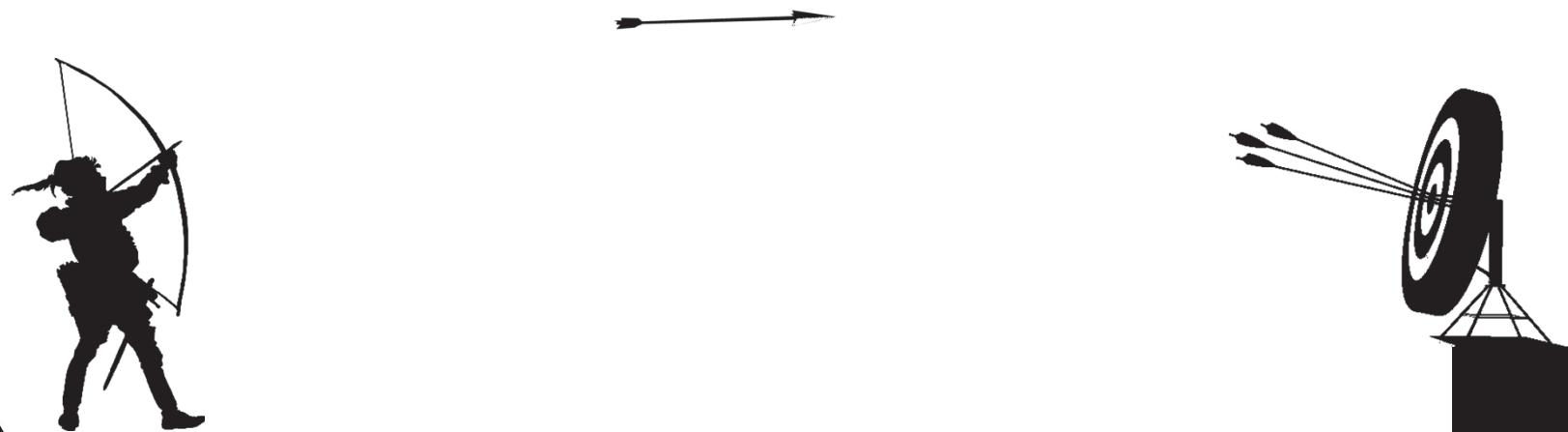


Input Ranges:

Number of replicates/runs
Signal-to-Noise Ratio
Alpha (1-Confidence)

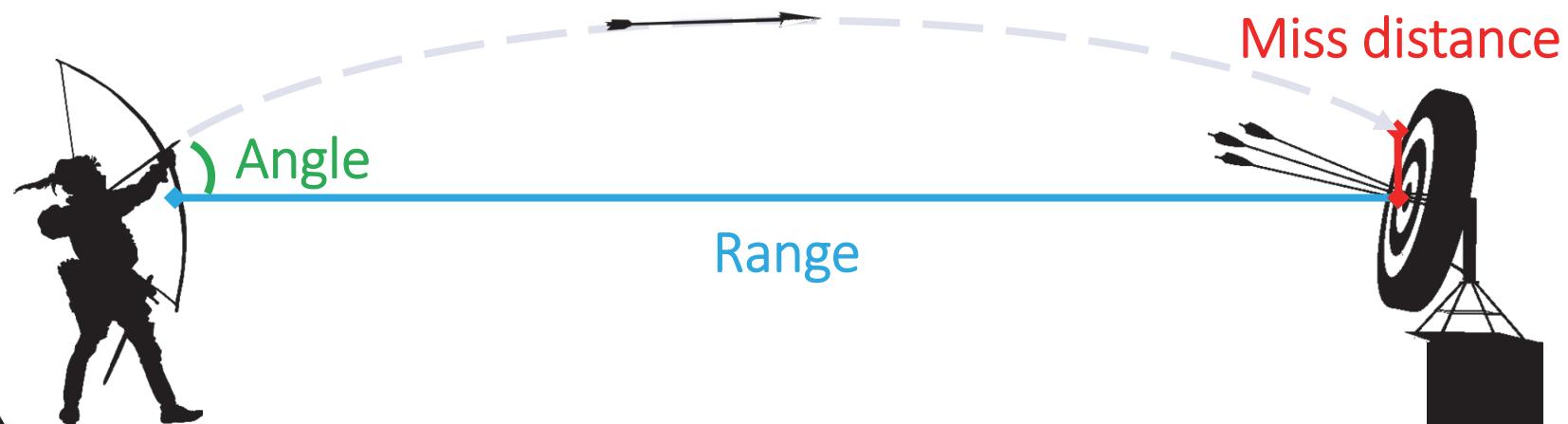
Consider this motivational problem:

How many shots must the archer take to show, with confidence, his ability to hit the target's center under varying conditions?



The first step for all DOEs is defining factors and levels

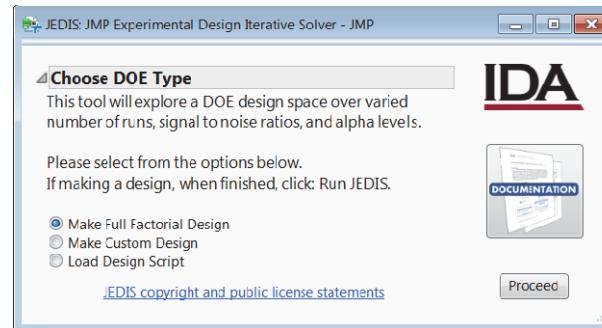
Response	Factors	Levels
	Range from target	10 m
		30 m
		50 m
Miss distance from center	Angle of shot	15°
		30°
		45°
		60°



Let's walk through JEDIS for this example archery DOE

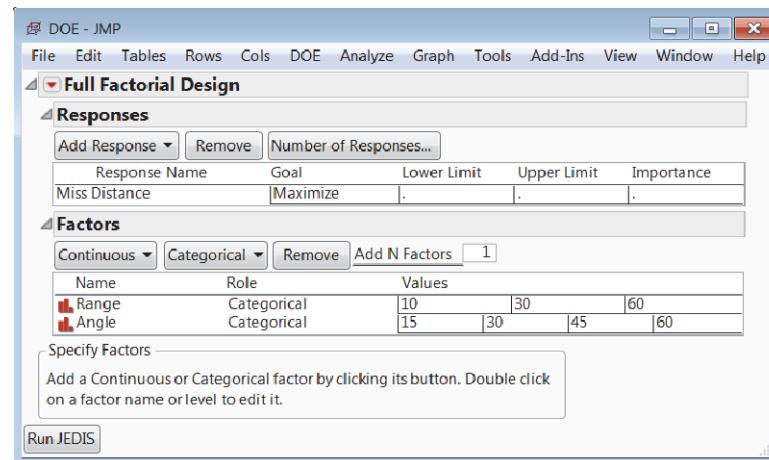
Step 1

Open JEDIS and choose
“Make Full Factorial Design”



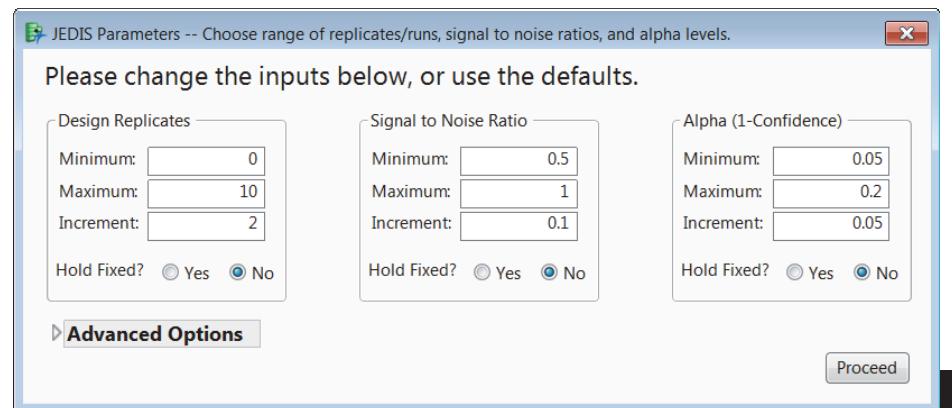
Step 2

Construct DOE by adding factors
and levels as normal in JMP

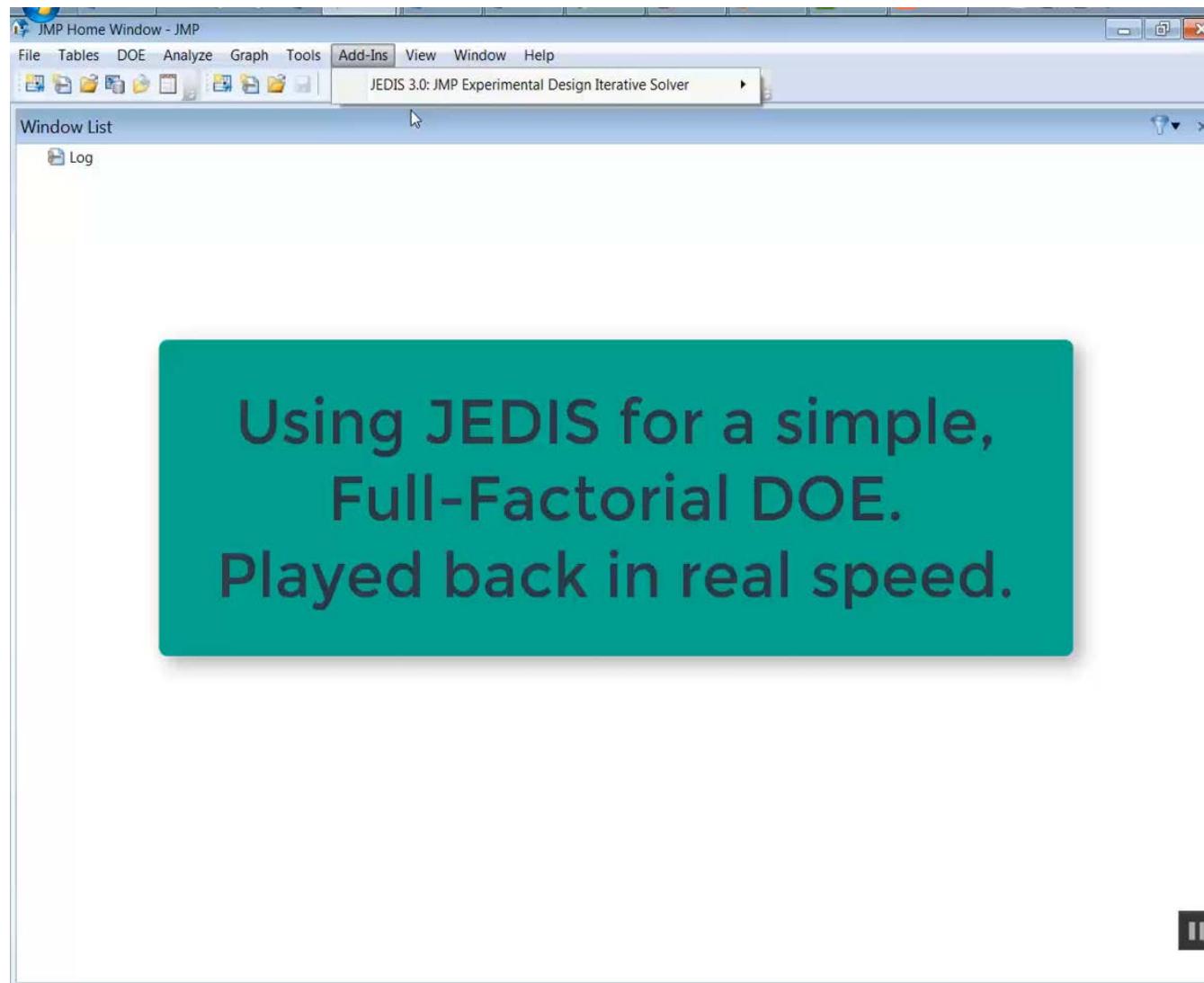


Step 3

Specify ranges for parameters
and then let JEDIS run



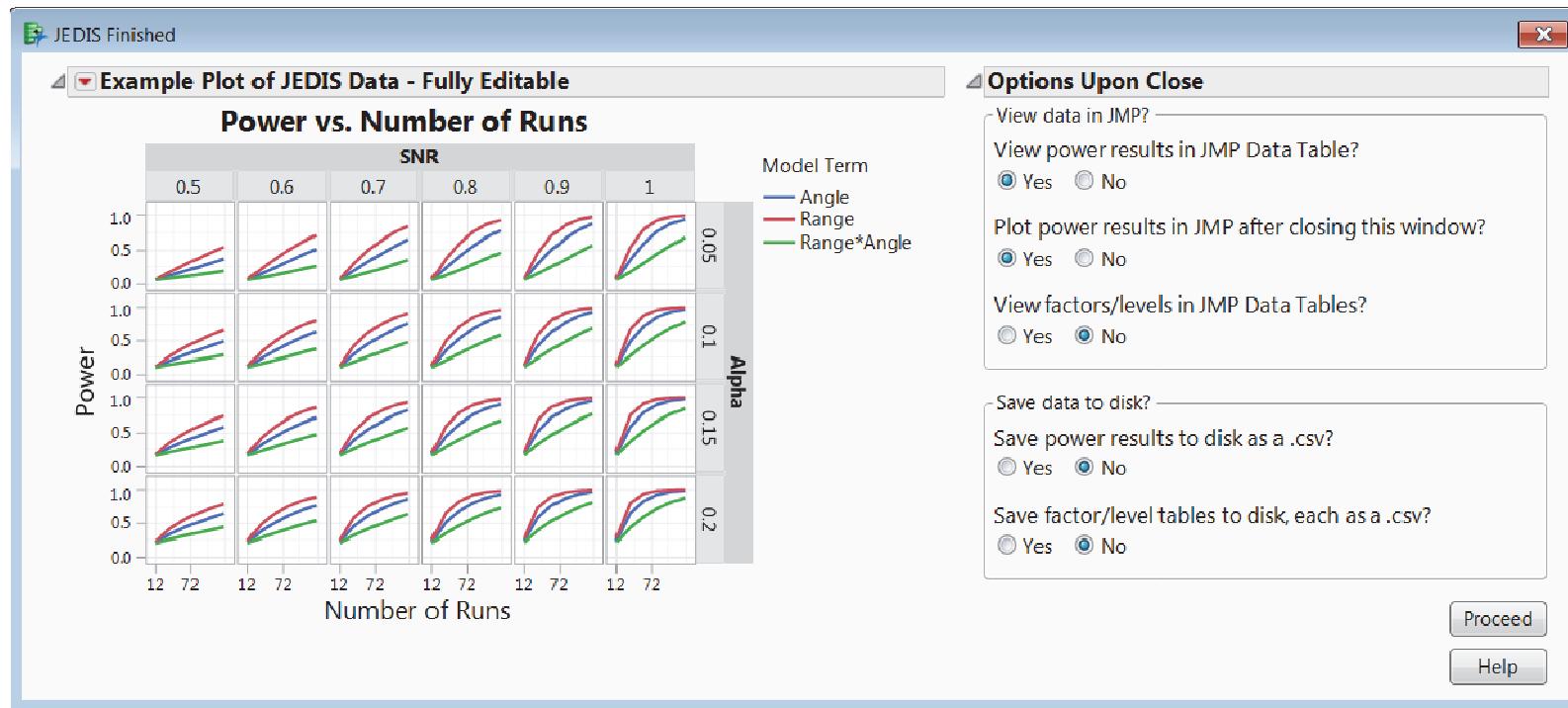
Video demo of JEDIS for archery DOE, in real time



IDA



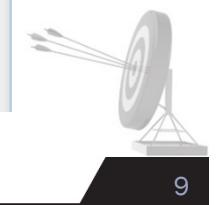
JEDIS has several options for viewing and saving data



Data saved in Tidy format

One variable per column &
One observation per row

	Replicates	Number of Runs	SNR	Alpha	Model Term	Power
1	0	12	0.5	0.05	Range	0.05604594
2	0	12	0.5	0.05	Angle	0.05306127
3	0	12	0.5	0.05	Range*Angle	0.05103187
4	0	12	0.5	0.1	Range	0.1119925
5	0	12	0.5	0.1	Angle	0.10608252
6	0	12	0.5	0.1	Range*Angle	0.10205319
7	0	12	0.5	0.15	Range	0.16774077
8	0	12	0.5	0.15	Angle	0.15902356
9	0	12	0.5	0.15	Range*Angle	0.15305326



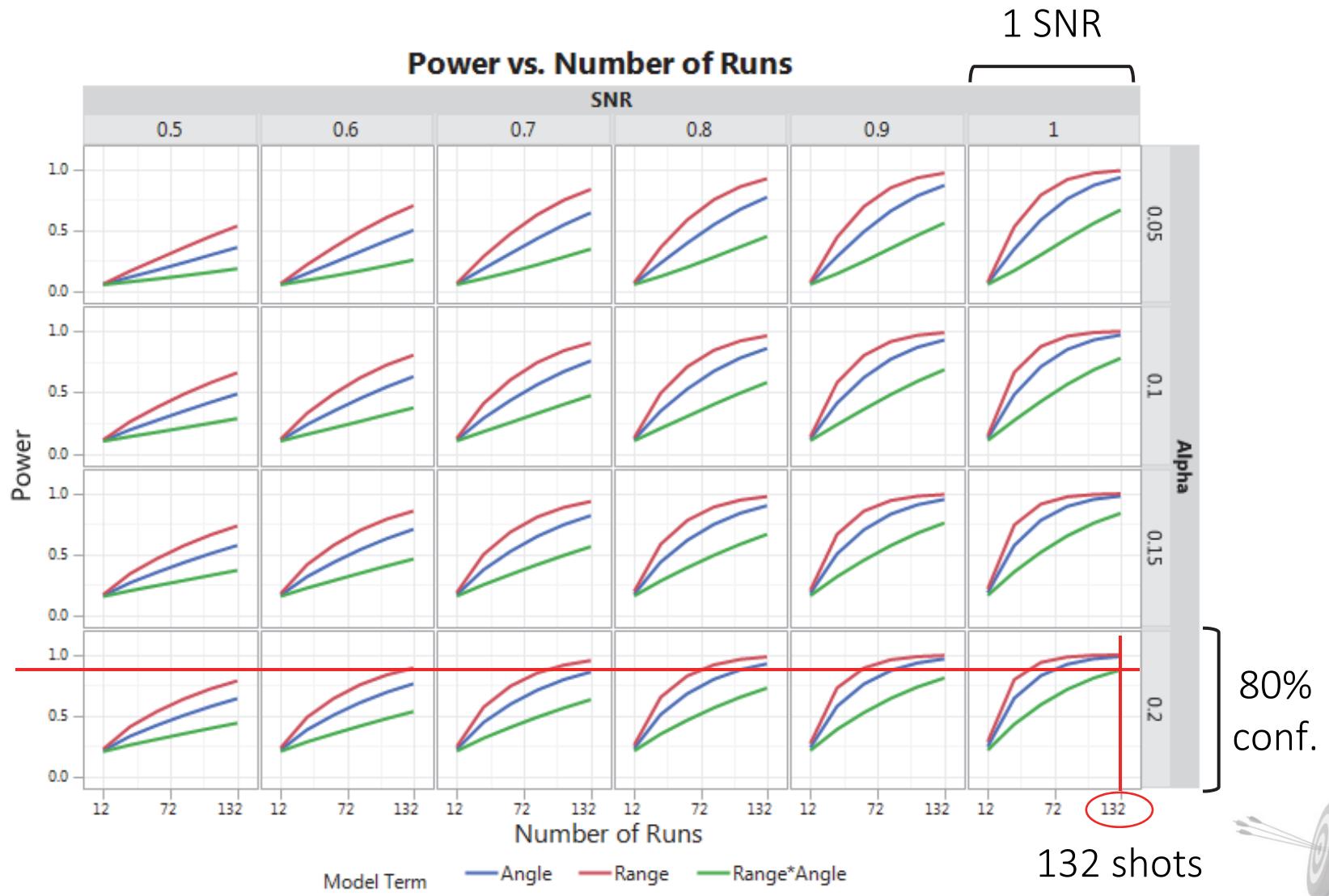
Recall our original motivation for JEDIS:

How many runs does my
DOE need for 90% power
across my factor-space?

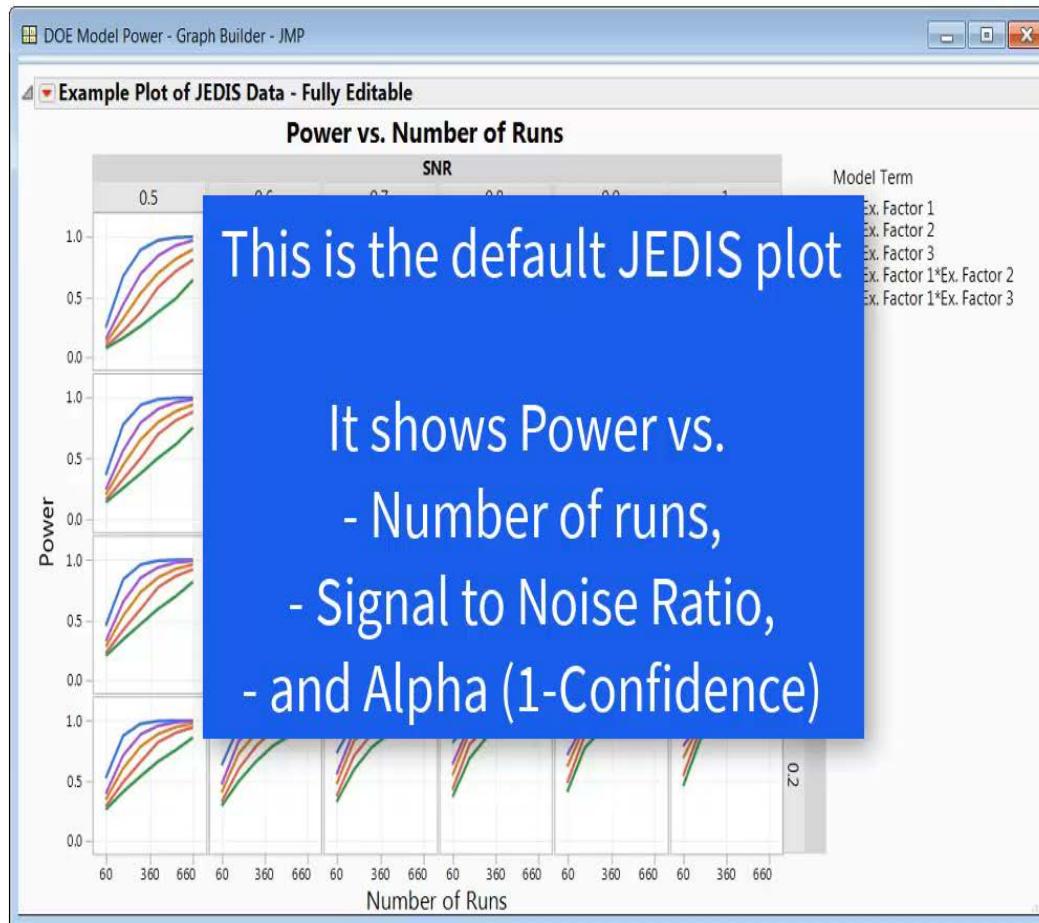


Typical Researchers

For this example, 90% power across all factors is possible at 80% confidence with 132 shots for an SNR of 1



Lets explore the default JEDIS plot and some other plotting options available to you in JMP

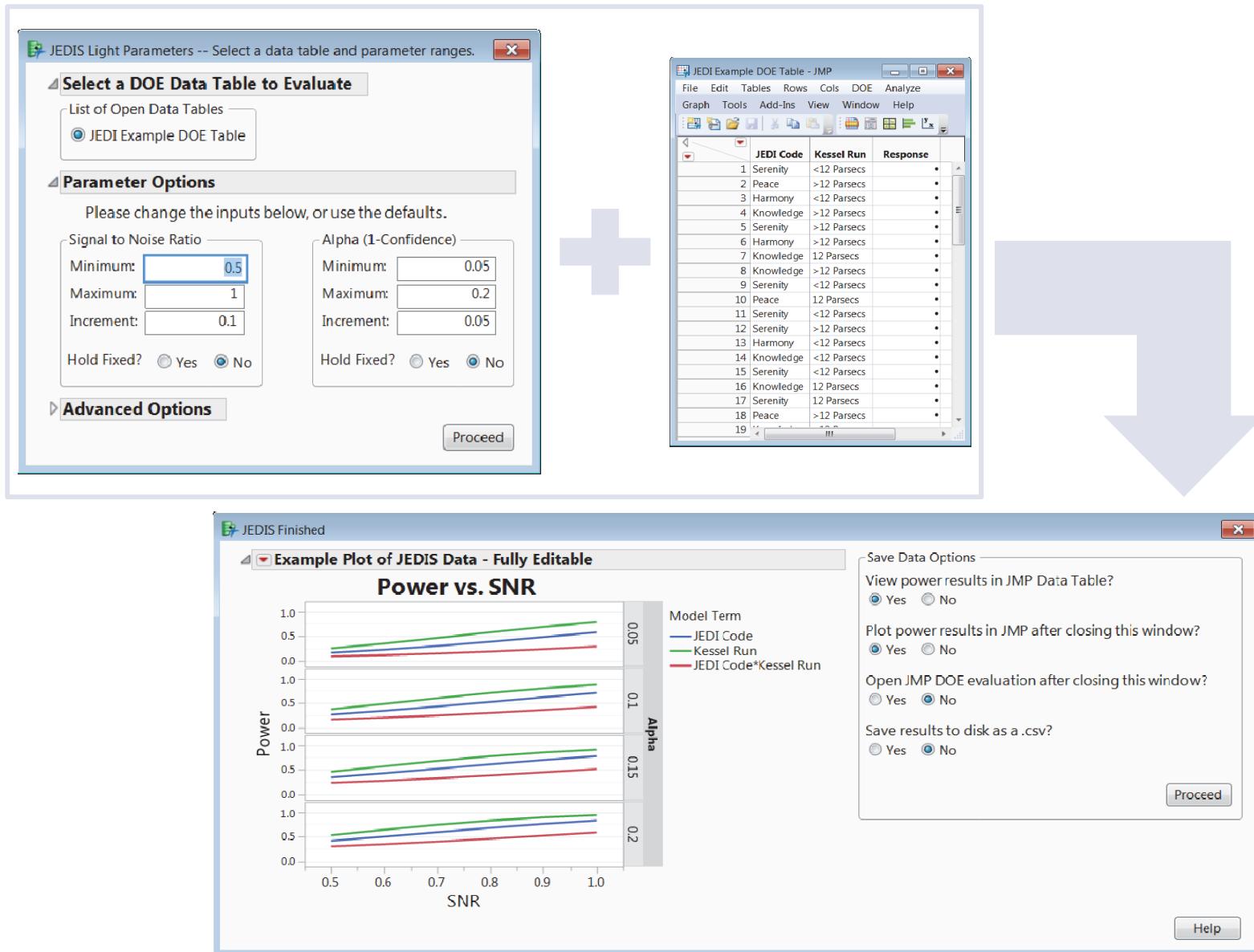


JEDIS (Light) also works for pre-made designs

Perhaps you read a design in a test-planning document and you'd like to explore it over a range of SNR and Alpha

Factors		Conditions		Levels		Design		Pro	
JEDI Code		Peace	Knowledge	<12 Parses	>12 Parses	Vary (4)	Characterize	Log	Demo (1)
Kessel Run		Benign	Disruptive	<12 Parses	>12 Parses	Vary (3)	Fix @ Benign	Log	Demo (1)
Star Interference		Han	Greedo	<12 Parses	>12 Parses	Fix @ Han	# Events	Log	Demo (1)
Who shot first		Full Factorial (4 ³)		5 Replications		Test Design Information		Design Type	
Design Purpose		Demonstrations		# Events		60		60	
Characterize		Characterize		Characterize		Characterize		Characterize	
Problem ID		Pellentesque		Pellentesque		Pellentesque		Pellentesque	
Cras faucibus condimentum odio. Sed ac ligula. Aliquam at eros. Etiam at ligula et tellus interdum quis nibh nec nisl. Ut tincidunt volutpat urna. Mauris eleifend nulla eget mauris. Sed cursus quam id felis. Curabitur posuere quam vel nibh. Cras dapibus dapibus nisi. Vestibulum quis dolor a felis congue vehicula. Maecenas pede pene pluri, tristique ac, tempus eget, egestas quis, mauris. Curabitur non eros. Nullam hendrerit bibendum justo. Fusce facilis, est quis lacuna pretium, pede metus molestie lacus, at gravida wisi ante at libero. Nunc ac magna. Maecenas odio dolor, vulputate vel, auctor ac, accumsan id, felis. Pellentesque cursus sagittis felis.									

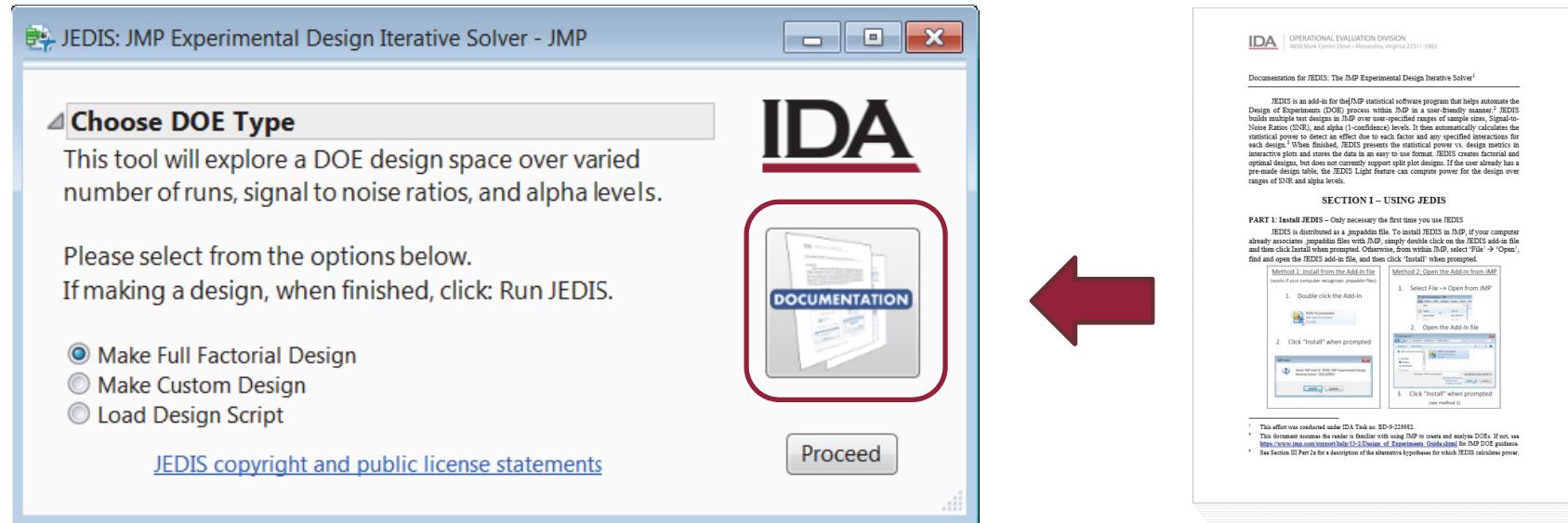
JEDIS Light follows the same general procedure as JEDIS



Wrap up: JEDIS is an easy-to-use tool for DOE automation

- ✓ Fully GUI based
- ✓ Enables exploration of design replicates, SNR, and alpha
- ✓ Allows DOE construction on-the-fly or loading from script
- ✓ Handles full factorial, D/I/ α -optimal, and disallowed combinations
- ✓ Writes results in easy-to-use format (Tidy data)
- ✓ Automatically generates interactive data visualizations

Step-by-step instructions and detailed documentation accessible from JEDIS main menu

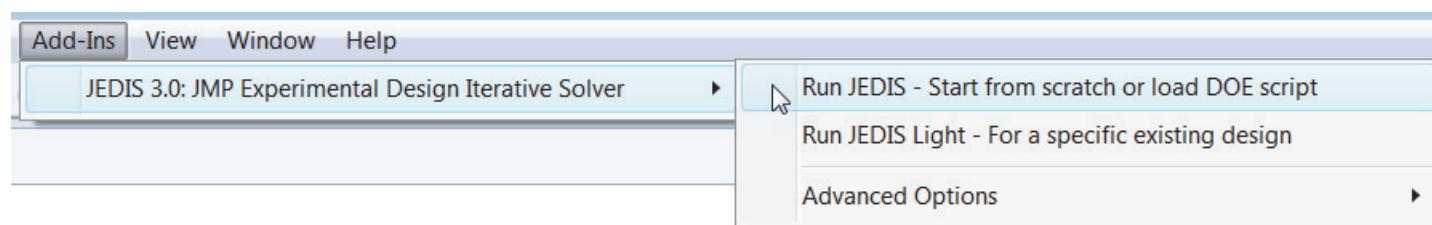


Questions?

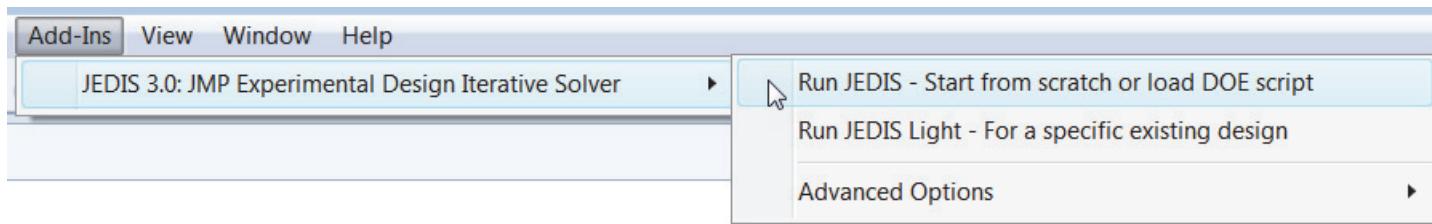
Remaining slides are back up.

JEDIS how-to and extra notes.

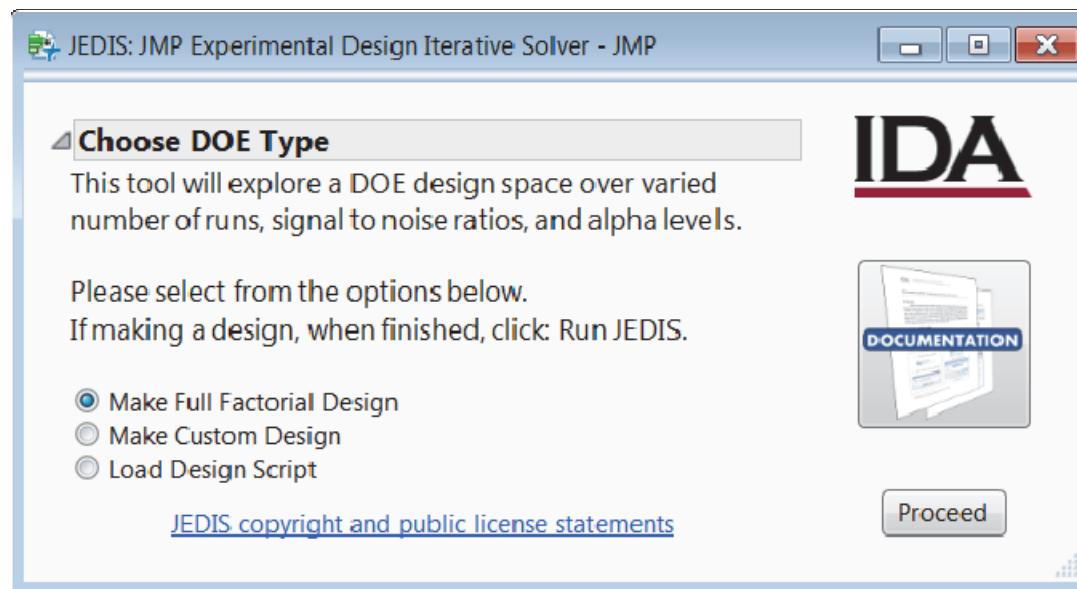
How to use JEDIS



Step 1: Select JEDIS from JMP Add-Ins menu*

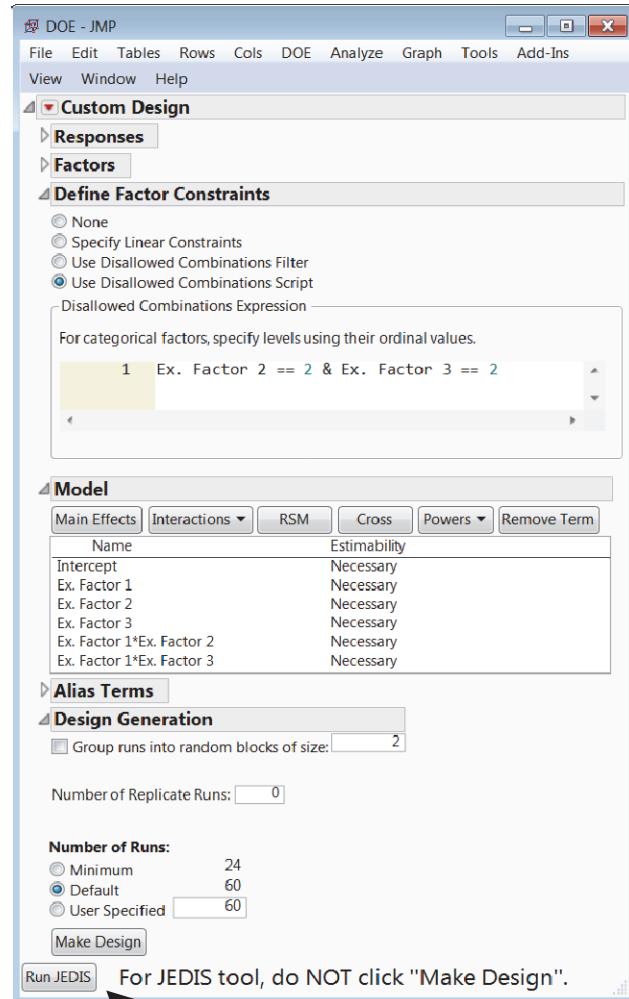


Step 2: Choose type of DOE to run, or load a design script



Step 3: Follow normal JMP procedures to set up DOE

- Factors
- Levels
- Model Terms
- Disallowed combinations



The screenshot shows the 'Define Factor Constraints' and 'Model' sections of the JMP DOE interface. The 'Use Disallowed Combinations Script' option is selected. The 'Model' section displays a table of terms and their estimability status.

Name	Estimability
Intercept	Necessary
Ex. Factor 1	Necessary
Ex. Factor 2	Necessary
Ex. Factor 3	Necessary
Ex. Factor 1*Ex. Factor 2	Necessary
Ex. Factor 1*Ex. Factor 3	Necessary

Clicking 'Make Design' will run the JMP design builder, not JEDIS.
Click 'Run JEDIS' instead.

Step 4: Specify parameters for power calculations

JEDIS Parameters -- Choose range of replicates/runs, signal to noise ratios, and alpha levels. X

Please change the inputs below, or use the defaults.
For custom designs, the optimal design is recomputed for each number of runs increment.

Number of Runs

Minimum:	60
Maximum:	660
Increment:	120

Hold Fixed? Yes No

Signal to Noise Ratio

Minimum:	0.5
Maximum:	1
Increment:	0.1

Hold Fixed? Yes No

Alpha (1-Confidence)

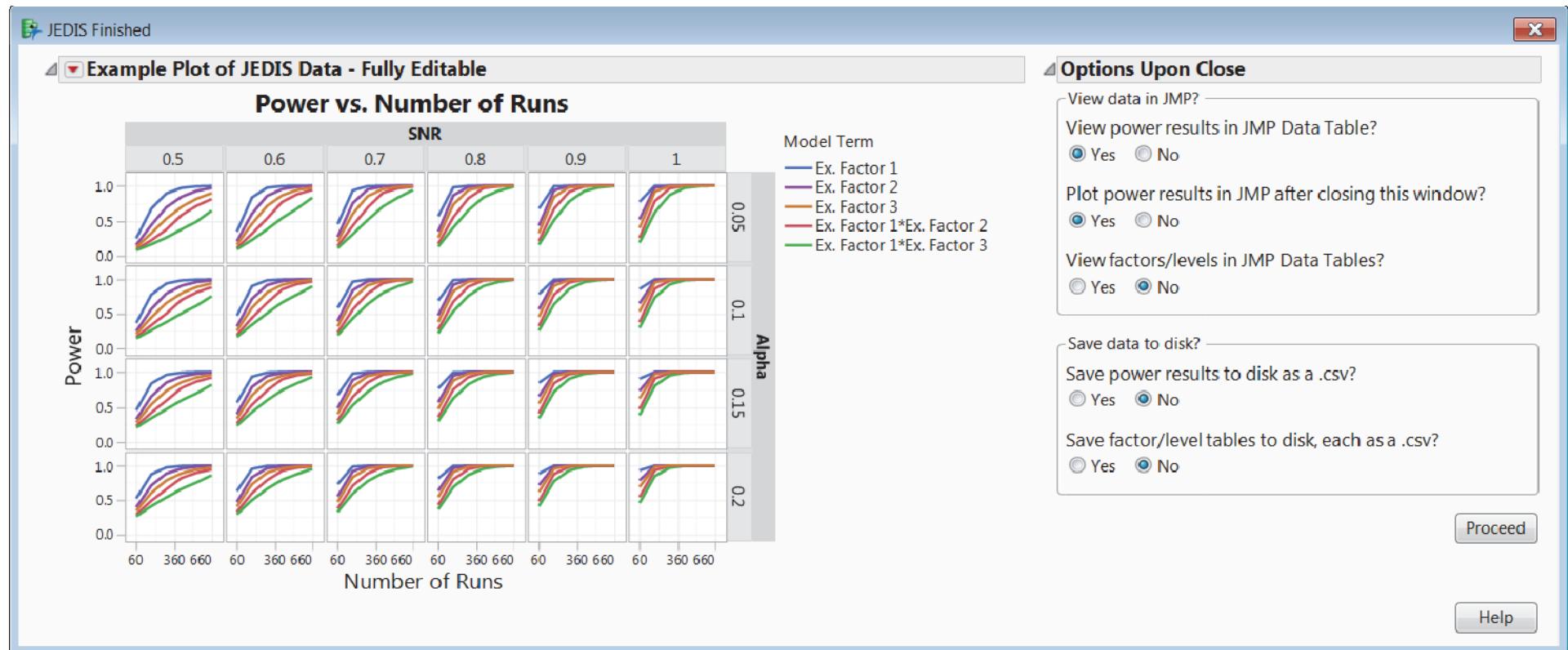
Minimum:	0.05
Maximum:	0.2
Increment:	0.05

Hold Fixed? Yes No

Advanced Options

Proceed

Step 5: After running, view and save results



Step 6: Now you have your data – explore as you please!

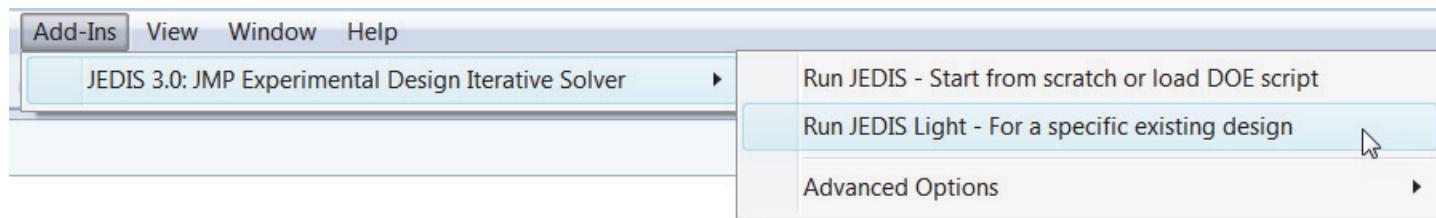
Data saved in Tidy format

One variable per column &
One observation per row

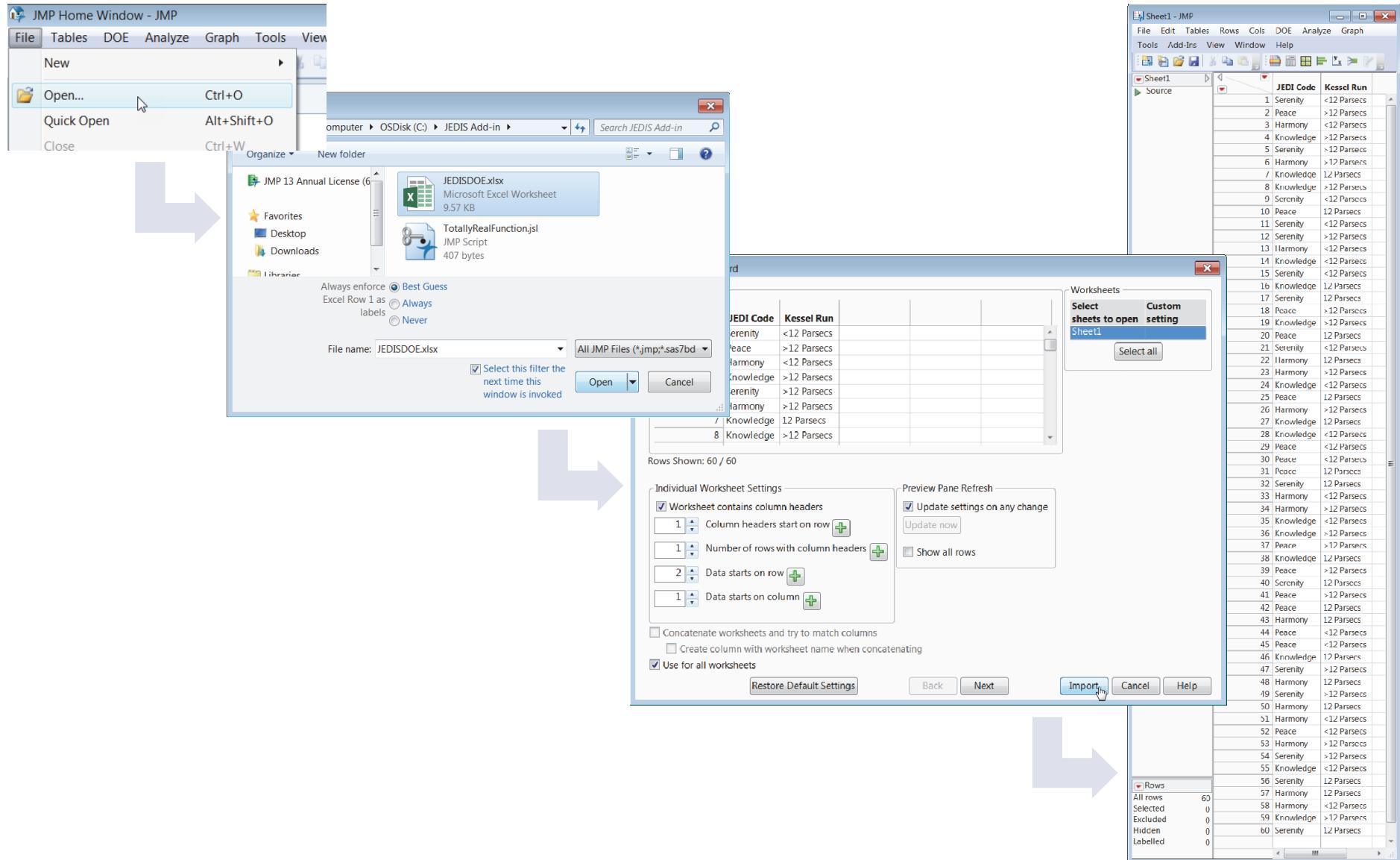
	Number of Runs	SNR	Alpha	Model Term	Power
1	60	0.5	0.05	Ex. Factor 1	0.249464
2	60	0.5	0.05	Ex. Factor 2	0.153095...
3	60	0.5	0.05	Ex. Factor 3	0.121283...
4	60	0.5	0.05	Ex. Factor 1*Ex. Factor 2	0.090728...
5	60	0.5	0.05	Ex. Factor 1*Ex. Factor 3	0.077795...
6	60	0.5	0.1	Ex. Factor 1	0.367420...
7	60	0.5	0.1	Ex. Factor 2	0.248665...
8	60	0.5	0.1	Ex. Factor 3	0.206339...
9	60	0.5	0.1	Ex. Factor 1*Ex. Factor 2	0.163339...
10	60	0.5	0.1	Ex. Factor 1*Ex. Factor 3	0.144239...

711	660	1	0.15	Ex. Factor 1	1
712	660	1	0.15	Ex. Factor 2	1
713	660	1	0.15	Ex. Factor 3	0.999999...
714	660	1	0.15	Ex. Factor 1*Ex. Factor 2	0.999999...
715	660	1	0.15	Ex. Factor 1*Ex. Factor 3	0.9999574
716	660	1	0.2	Ex. Factor 1	1
717	660	1	0.2	Ex. Factor 2	1
718	660	1	0.2	Ex. Factor 3	0.999999...
719	660	1	0.2	Ex. Factor 1*Ex. Factor 2	0.9999998
720	660	1	0.2	Ex. Factor 1*Ex. Factor 3	0.999978...

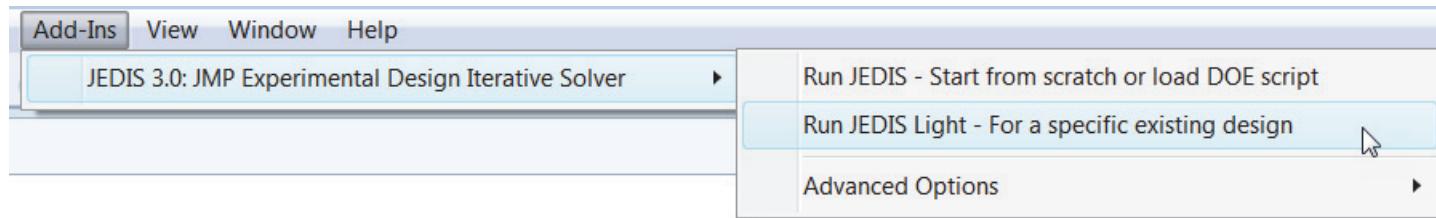
How to use JEDIS Light



Step 1: Open your design table in JMP



Step 2: Run JEDIS light from JMP Add-Ins menu

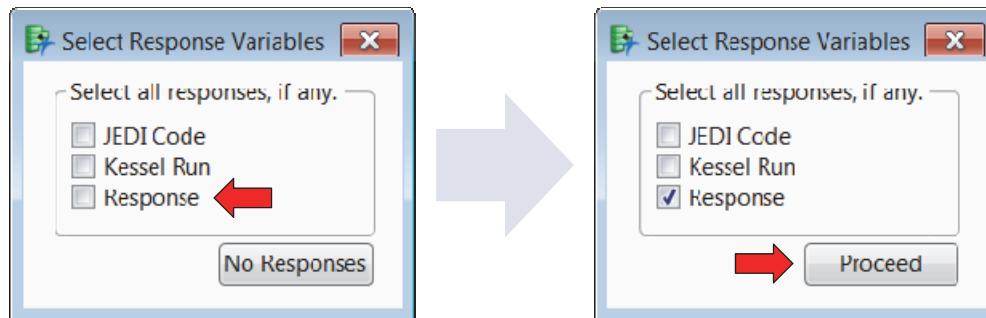


Step 3: Select table and specify parameters

The screenshot displays two windows. On the left is the 'JEDIS Light Parameters -- Select a data table and parameter ranges.' dialog box. It shows a list of open data tables with 'JEDI Example DOE Table' selected. Below this are sections for 'Parameter Options' (Signal to Noise Ratio and Alpha (1-Confidence) settings), 'Advanced Options', and a 'Proceed' button. On the right is the 'JEDI Example DOE Table - JMP' window, which contains a table with columns: JEDI Code, Kessel Run, and Response. The table data is as follows:

	JEDI Code	Kessel Run	Response
1	Serenity	<12 Parsecs	.
2	Peace	>12 Parsecs	.
3	Harmony	<12 Parsecs	.
4	Knowledge	>12 Parsecs	.
5	Serenity	>12 Parsecs	.
6	Harmony	>12 Parsecs	.
7	Knowledge	12 Parsecs	.
8	Knowledge	>12 Parsecs	.
9	Serenity	<12 Parsecs	.
10	Peace	12 Parsecs	.
11	Serenity	<12 Parsecs	.
12	Serenity	>12 Parsecs	.
13	Harmony	<12 Parsecs	.
14	Knowledge	<12 Parsecs	.
15	Serenity	<12 Parsecs	.
16	Knowledge	12 Parsecs	.
17	Serenity	12 Parsecs	.
18	Peace	>12 Parsecs	.
19			

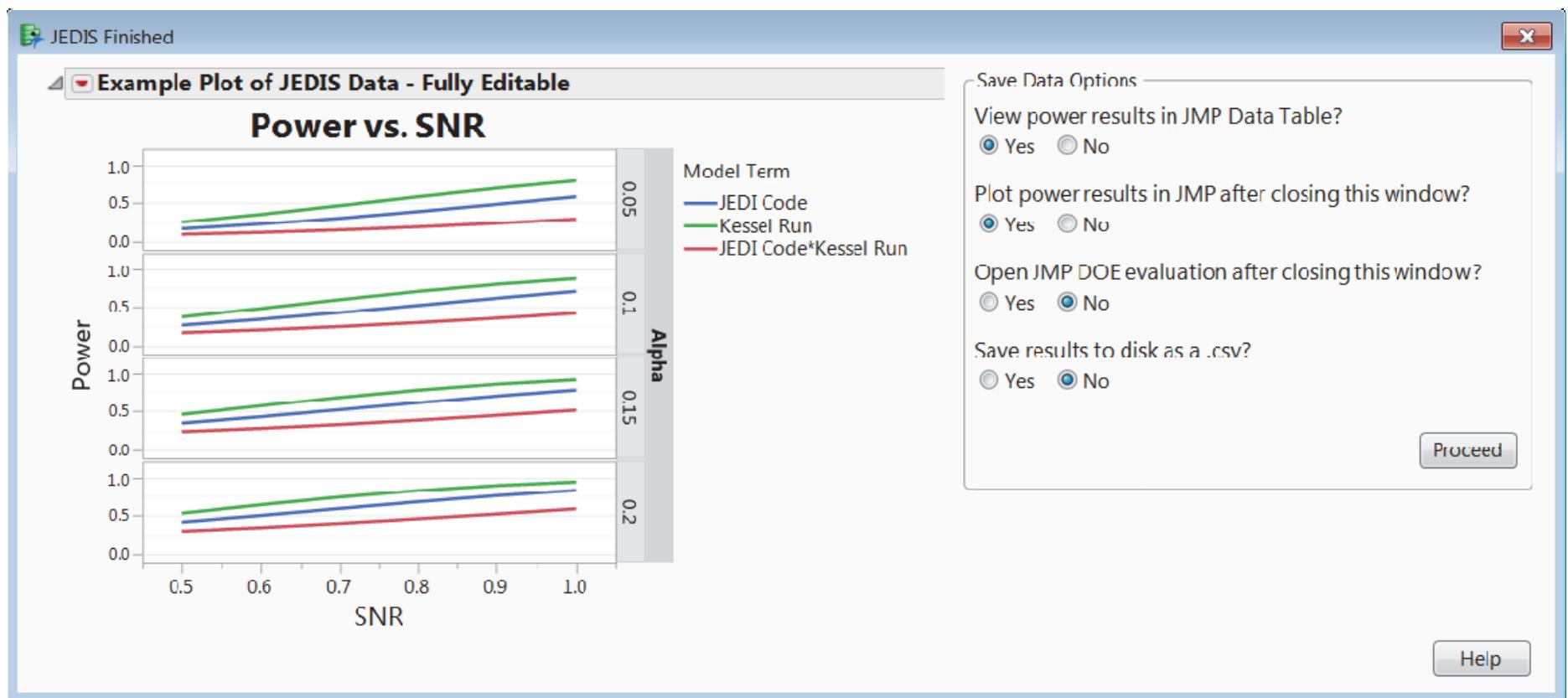
Step 4: Identify response variables, if any.



Step 5: Specify the model, add interactions if desired

The image shows the JMP software interface titled "Sheet1 - Evaluate Design of Response - JMP". The main window has a tree view on the left with nodes like "Evaluate Design", "Factors", and "Model". Under "Model", there are buttons for "Main Effects", "Interactions", "RSM", "Cross", "Powers", and "Remove Term". The "Interactions" button is currently selected. A dropdown menu is open under "Interactions" with options "2nd", "3rd", "4th", and "5th". To the left of the dropdown, there is a list of terms: "Intercept", "JEDI Code", and "Kessel Run", with "JEDI Code" and "Kessel Run" being checked. At the bottom, there is a message box: "Specify Model, then click to resume JEDIS design evaluation".

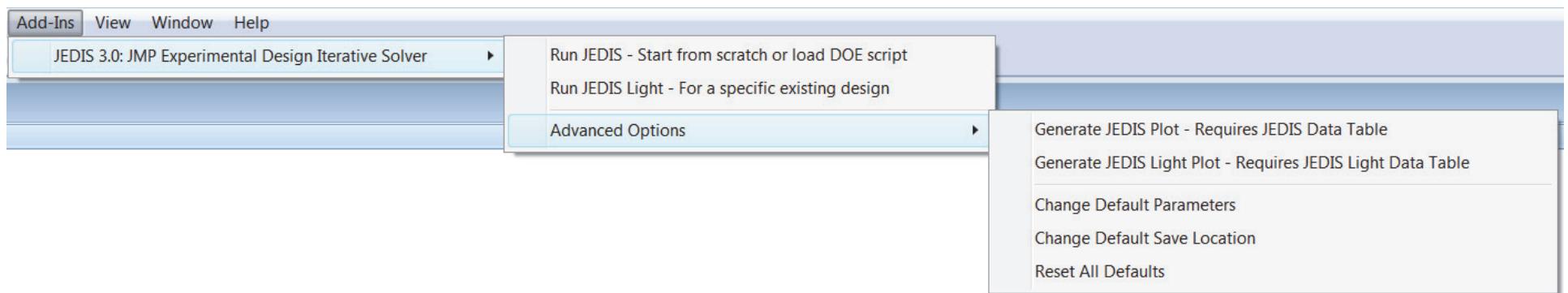
Step 6: View and save results, just like in JEDIS



Extra Notes and Tips

JEDIS Add-Ins Menu Advanced Options

From the JEDIS Advanced Options menu
you can replot any saved JEDIS data
and modify any default JEDIS parameters



JEDIS Parameter Advanced Options

The screenshot shows the 'Advanced Options' section of the JEDIS Parameter dialog. It includes three main sections: 'Change Anticipated Coefficients?', 'Set Random Seed?', and 'Adjust Custom Design Search Time:'.

- Change Anticipated Coefficients?**
 - Default JMP coefficients
 - AMCP Fast — can overestimate power for unbalanced designs
 - AMCP Robust — slow, but consistent for unbalanced designs
- Set Random Seed?**
 - Yes
 - No

1235143439
- Adjust Custom Design Search Time:**

10

Change Anticipated Coefficients

Allows you to select the alternative hypotheses with which JEDIS will test your DOE

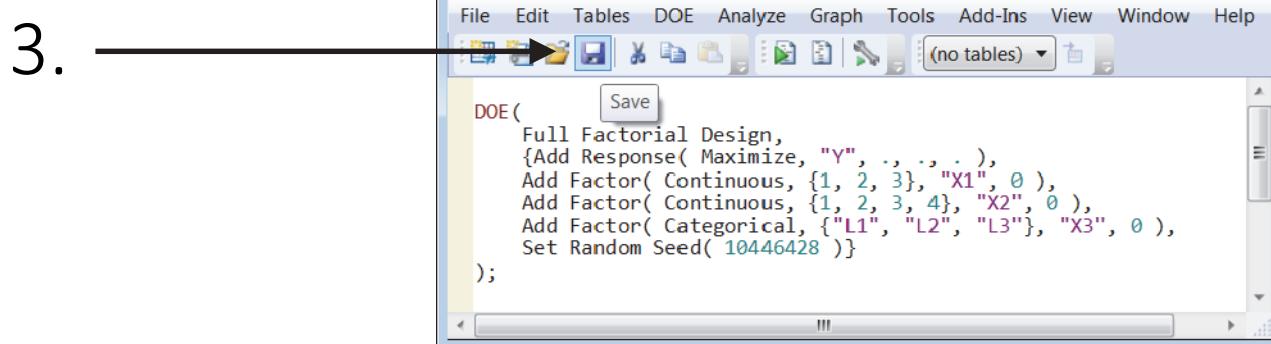
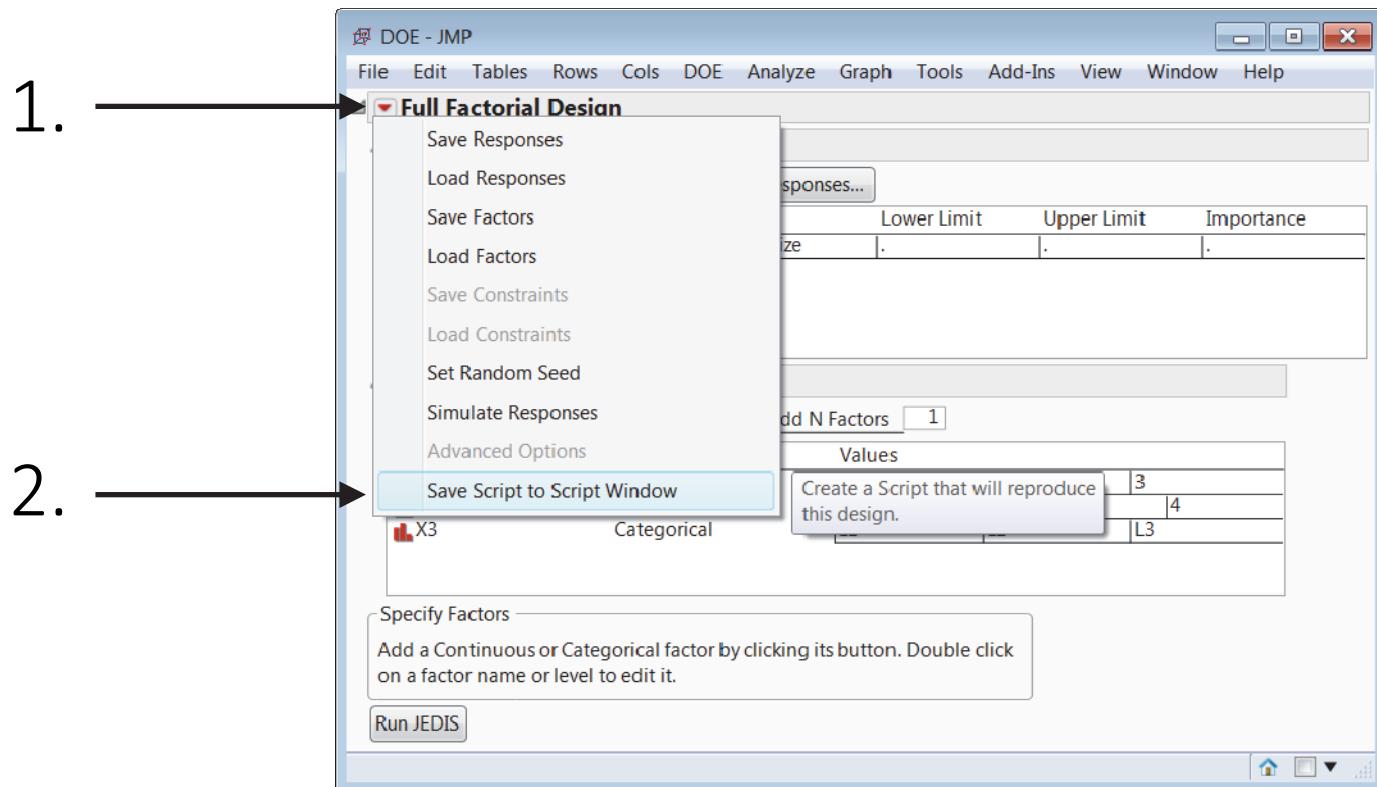
Set Random Seed

Allows you to specify the random seed used for design generation

Adjust Custom Design Search Time

Allows you to specify how long JMP will search for an optimal solution to a design

How to save a DOE script in JMP in three clicks



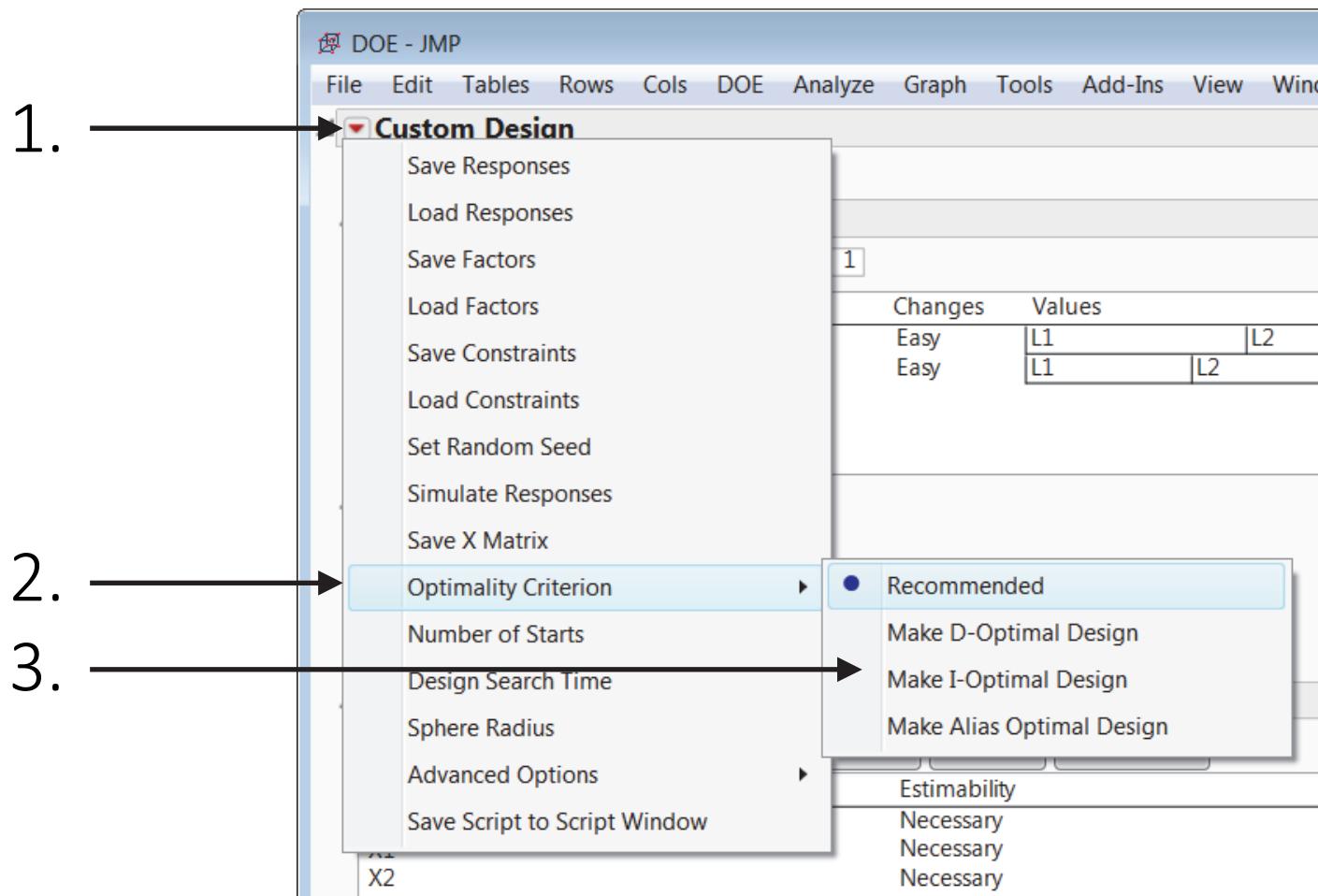
Notes About Saving Scripts

Saving must be done before pressing the “Run JEDIS” button!

Saving a script is a JMP feature available in ANY window.

Saving scripts is not specific to JEDIS, but right now it is the only way to save a DOE for later use.

How to change JMP's custom design optimality criterion



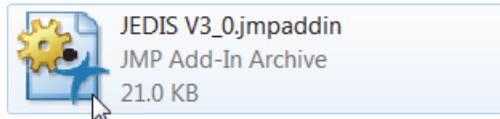
JEDIS uses JMP's recommended optimality criterion by default, but you can select the type you want when you construct your DOE.

How to install the JEDIS JMP add-in

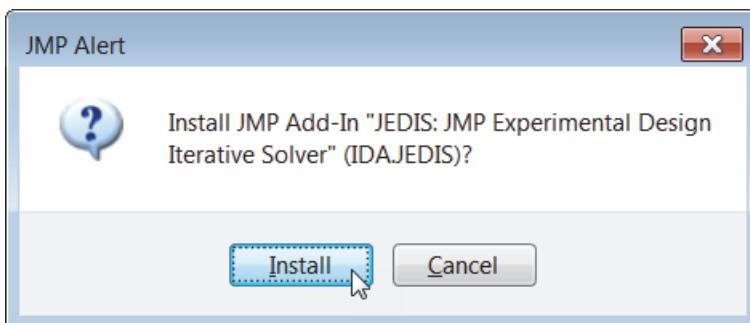
Method 1: Install from the Add-In file

(works if your computer recognizes .jmpaddin files)

1. Double click the Add-In

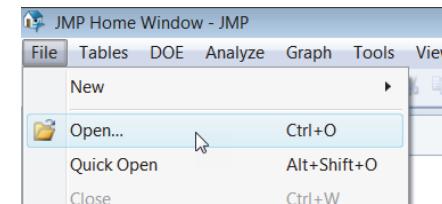


2. Click “Install” when prompted



Method 2: Open the Add-In from JMP

1. Select File → Open from JMP



2. Open the Add-In file



3. Click “Install” when prompted
(see method 1)