The Power Analysis module in SilveR is available from the Statistics drop-down menu entitled "Power Analysis".

SilveR calculates samples size and power assuming the test that will be used by the scientist to analyse future data is the t-test. The t-test may not be as powerful as the test that the scientist intends to use, i.e. using an ANOVA approach, but this implies SilveR does not give unduly small sample sizes. We contend it is better to have sample sizes that are slightly conservative rather than failed experiments because the sample size was too small.

1   Analysis procedure

Using SilveR involves a series of stages:

1.1   Calculating the variability

The user needs to decide if they want to enter a control mean and an estimate of the variability, that they have calculated previously, or let SilveR calculate this from a dataset.
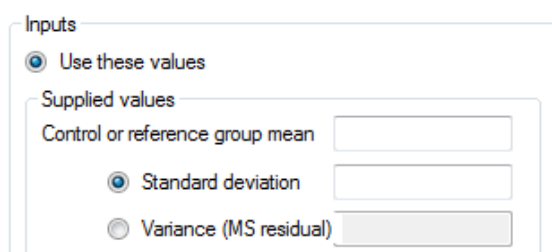
Note from the ANOVA table

$$Variance = Residual\ SS\ /\ Residual\ DF$$

where *SS* = sums of squares and *DF* = degrees of freedom
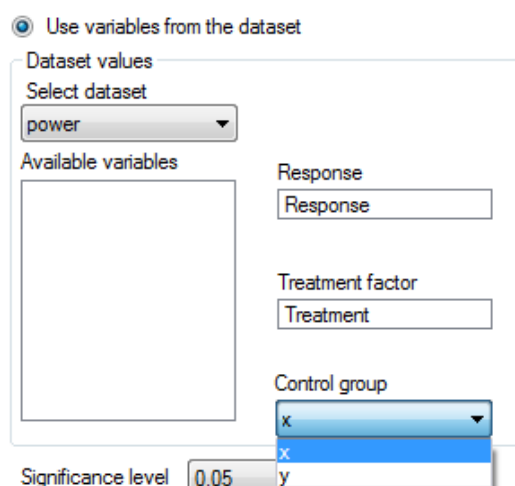
$$Standard\ deviation = \sqrt{Variance}\ .$$

The variance can be obtained from any ANOVA table; it is the Mean Square Error term. Other software, such as EXCEL, also has the functionality to calculate the standard deviation and the variance.
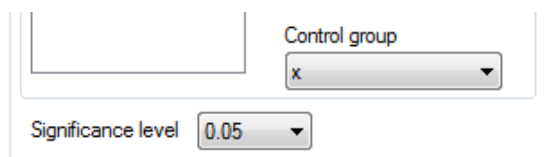
The user can also let SilveR calculate the variance of a parameter of interest. Once the dataset has been loaded into SilveR, then they should select the "Use variables from the dataset" option. The response variable is selected by drag and dropping into the response box. They then have the option of selecting a single treatment factor. This is recommended if there is a single treatment factor in the experiment that may artificially increase the variance estimate if it is ignored.

The user can also select a control group from the levels of the treatment factor. This is required if the user wishes to investigate biological differences that are a percentage change from control.

1.2 Selecting the significance level

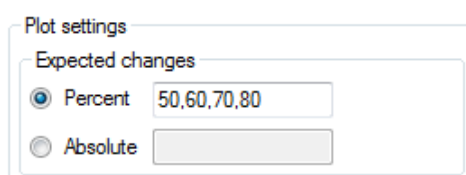The user can select a significance level. The default is 5%.

1.3 Plot settings – Expected changes

The user will need to decide if they want to calculate power for a "percentage change from control" (Percent) or an "actual change from control" (Absolute). In each case multiple differences can be selected, each difference separated by a comma, i.e.
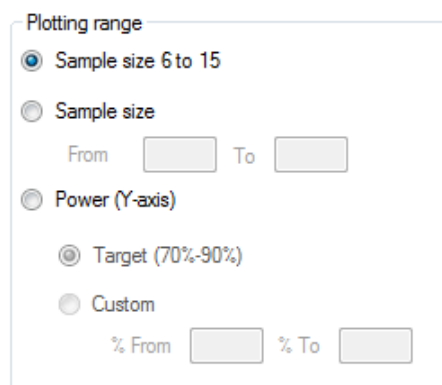
In order to select the percentage change, then the user must have specified either a control group mean (Supplied values) or a control group (Dataset values).

1.4 Plot settings – Plotting range

The user has various options concerning the final appearance of the power graph. The graph can be drawn for a range of sample sizes (recommended). The default is 6 to 15, although the user may select other values. Alternatively SilveR will calculate the range of sample sizes (for the given difference) that achieve a desired power. This option can be useful if the user wishes to find out how many animals would be required to achieve a suitable power, given the variability of the data and a user defined biologically relevant difference.
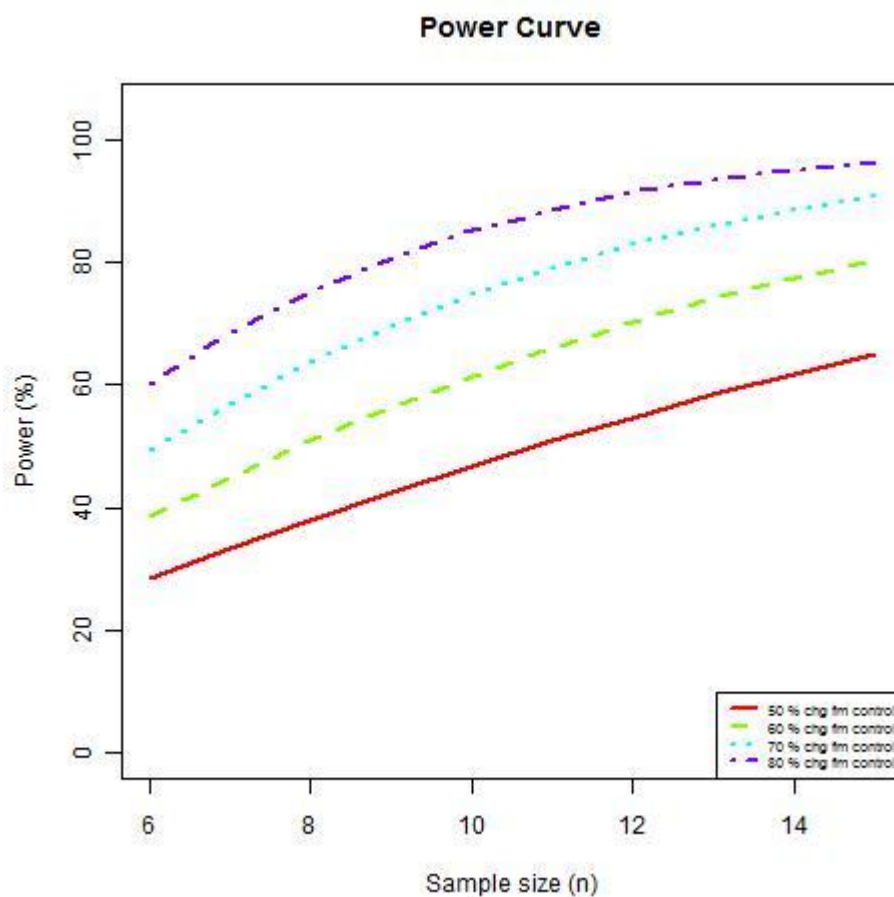
1.5 Graph title

The user can select a title for the plot.

Graph title [   ]

2   Sample output

SilveR Power Analysis

Power curve plot

Power Curve

Note: Power calculations made by SilveR assume the statistical analysis will be performed using the two sample t-test. This may lead to slightly conservative estimates of sample sizes and statistical power.

Selected results

Assuming the significance level is set at 5%, and the sample size is 6, the power of the experiment to detect a biologically relevant 50% change from control is 29%.

Assuming the significance level is set at 5%, and the sample size is 10, the power of the experiment to detect a biologically relevant 50% change from control is 47%.

Assuming the significance level is set at 5%, and the sample size is 15, the power of the experiment to detect a biologically relevant 50% change from control is 65%.

Definitions

Power: The chance of achieving a statistically significant test result from running an experiment, assuming there is a real biological effect to find.

Significance level: The chance that the experiment will give a false-positive result.

Biologically relevant effect: The size of effect that is of scientific interest.

Statistical references

Harrison, DA and Brady, AR (2004). Sample size and power calculations using the noncentral t-distribution. The Stata Journal, 4(2), 142-153.

R references

R Development Core Team (2008). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org.

Lecoutre, Eric (2003). The R2HTML Package. R News, Vol 3. N. 3, Vienna, Austria.