We are analyzing the process of blending active pharmaceutical ingredient (API) with other powder excipients in a tumble type blender. The goal is to create a blend of the powders with uniform distribution of the API. The output parameter of interest is “Blend Uniformity”. It is measured by taking 10 samples of the blend from different locations within the blender, analyzing then for the API content, and then calculating %RSD for the sample data. That %RSD is what we call Blend Uniformity (BU) – and we would like to minimize that parameter.

The process engineer thinks that three process parameters may affect the BU values achieved: Batch volume (total volume of powders loaded into the blender), Rotation speed (RPM) and Blending Time.

The ranges of those 3 parameters that we would like to investigate are:

Batch volume: 6,000 to 8,000 L

Rotation speed 12 to 16 RPM

Blending time 15 to 20 minutes

The questions we need to answer are:

* Which variables affect the BU most?
* How big an effect do they have?

1. Create a Design of Experiment table for the Blend Uniformity study using Full Factorial Design approach (3 factors at 2 levels). Use 3 replications for the experiments. No blocks and no center points are needed.
2. Once you have the DOE table, add a column “BU” for recording the results and then pretend to “conduct” the experiment virtually and fill the “observed” BU numbers into that column. Just make up some numbers (typically BU would be in the range of 2 to 10 % or so).
3. Analyze your “experimental” results using the “Analyze Factorial Design” tool in Minitab and create the plots for the main and interaction effects using “Factorial Plots” tool.
4. Based on the Minitab outputs, what can you say about the effects of the volume, RPM and time on the Blend Uniformity? Which combination of the three input variables you would select for your process based on the DOE results?

**Note**: pay attention to the p-values showing the significance of the factors you analyze.  Pareto Chart may also be useful for seeing which factors and interactions are significant.