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Big DoE: Sequential and Steady Wins the Race?

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Imagine an experiment that has 5 categorical factors with 3, 4, 4, 8 and 12 levels, respectively. The combination of all of these in a full factorial experiment is 4,608 runs. Would you like to run all of those experiments? While you could if you had no restrictions on time, cost and sanity implications, this is not practical (especially if you consider adding levels or factors).

Instead you can carry out 48 runs in a 48 well plate. Perhaps the first experiment is obvious: use a Design of Experiments (DoE) platform to generate a 48-run design to estimate main effects. Fitting a model to the response (yield), you find that all factors are significant, as expected. So what should you do next? What is an efficient and effective approach to finding the optimum and having confidence in that result?

This is not a typical screening-then-optimisation sequential DOE situation, because there are no unimportant factors that can be dropped after the initial screening design. Also, 2nd-order (and higher) interactions are likely to be important, but estimating those models requires hundreds of runs.

In this paper, you will find out how we approached this problem using JMP to sequential approaches and machine learning methods to seek optimum regions in an overwhelmingly big possibility space, while also balancing that with maximizing learning.

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