

Engineering Project 3: Virtual DOE:Yield vs Process Window Optimizer

Problem statement

- Build a virtual Design of Experiments (DOE) framework that learns the relationship between process parameters and yield, and automatically identifies optimal process windows using machine learning regression.

The problem this project solves

- Physical DOE runs are expensive, time-consuming, and limited in coverage of the full parameter space.
- Engineers often lack a fast way to quantify nonlinear interactions between process knobs and their combined impact on yield.
- This project replaces brute-force experimentation with a data-driven model that predicts yield and proposes high-yield recipes under constraints.

Applications

- Process window development and optimization during R&D and ramp phases.
- Rapid what-if analysis to evaluate yield sensitivity to RF power, pressure, temperature, gas flow, and time.
- Screening and prioritization of candidate recipes before committing wafers to the tool.
- Foundation for closed-loop optimization when connected to real DOE or inline process data.

Why it's important

- Reduces experimental cost and cycle time by focusing hardware runs on the most promising conditions.
- Improves yield learning velocity by capturing complex, multivariable interactions that are difficult to infer manually.

- Enables scalable, repeatable decision-making for process optimization as tool complexity and data volume increase.