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# FAST, Reliable PROCESS Setup

with Minimal Resource

# Possible?



FAST, Reliable PROCESS Setup  
with Minimal Resource  
Possible?



## ● CONTENTS

1. The Problems in Patterning
2. The classical develop process
3. How to apply DOE to patterning process?
4. The caution when applying DOE

## THE PROBLEMS in Patterning

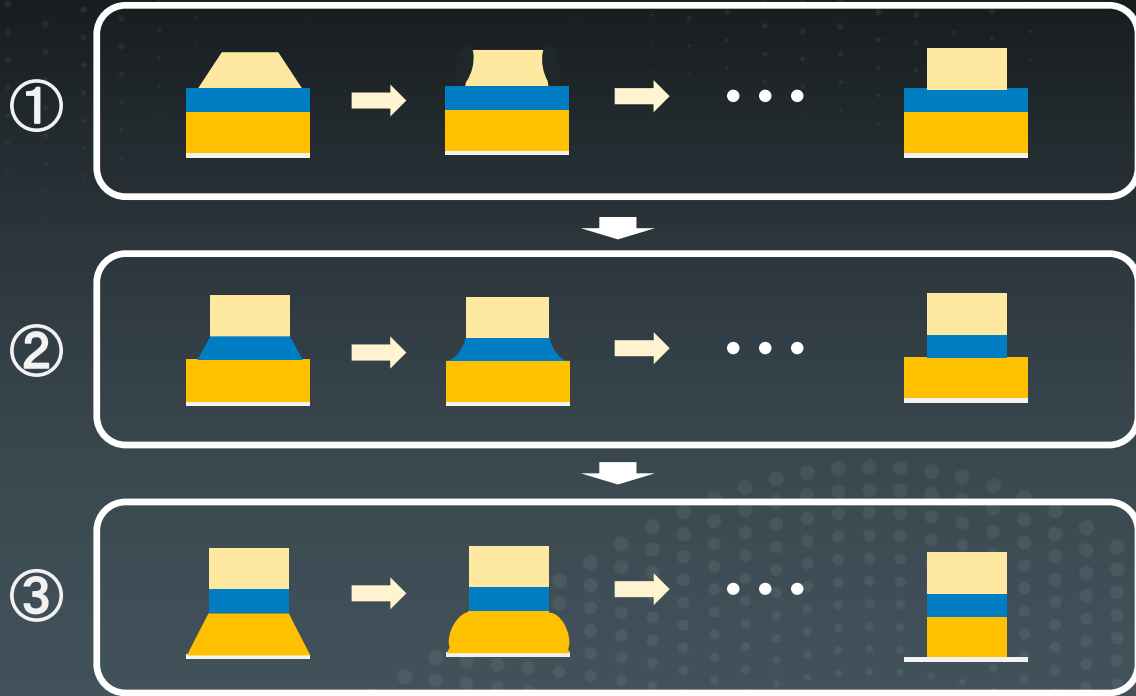
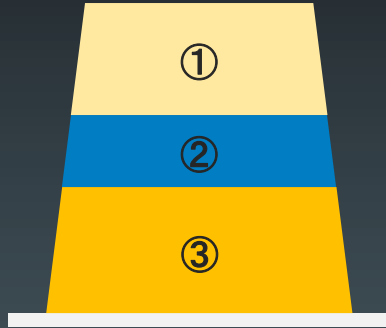
- More High Selectivity condition
- More High Etch Rate in smaller, deep pattern space
- Controllable Side/Bottom Passivation
- Marginal Process recipe



# CASE : Slope Profile



# HOW to develop PROCESS, Normally?



## Classical Process Develop

- TEST based on previous condition, **one parameter by one**
- TEST proceed based on **Engineer experience**
- Repeat this process if there is a change
- The difficulty in New Concept, New Material

Long Time

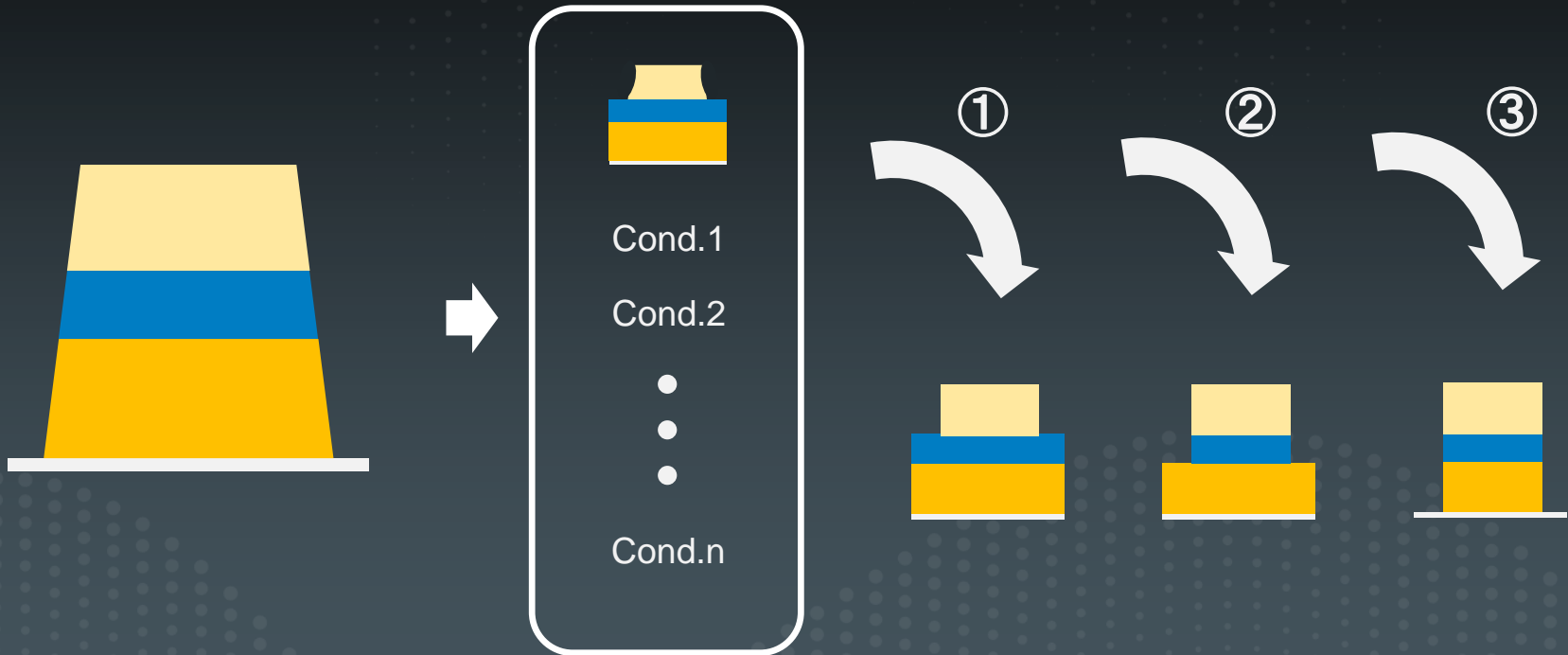
Well Trained

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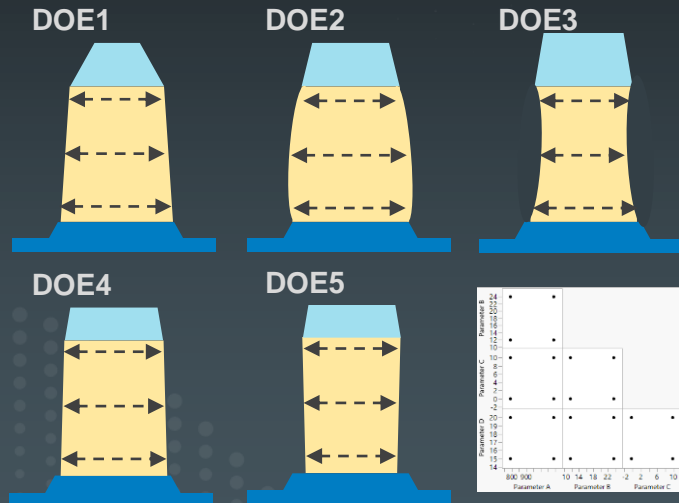
# HOW to apply DOE to Fast Process Setup ?



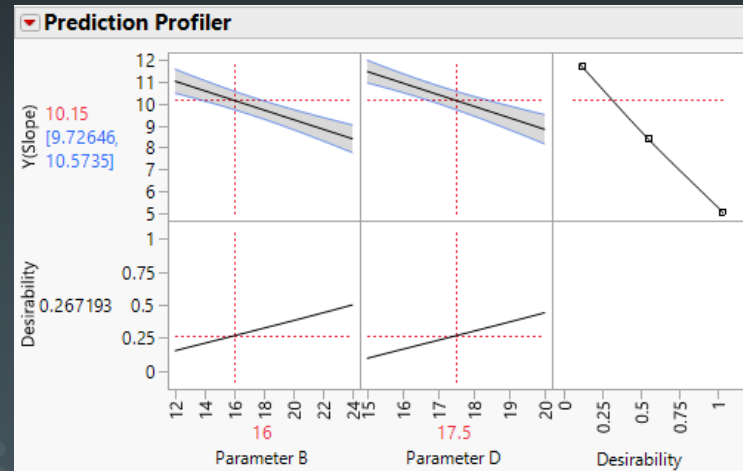
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# Sample 1.

Run	Parameter A	Parameter B	Parameter C	Parameter D	Y(Slope)
1	1100	12	0	20	10.7
2	1100	24	0	15	11.7
3	800	24	10	20	5.1
4	800	12	0	15	11.4
5	1100	12	10	15	11.3



## Minimized Split ! (consider major effect)

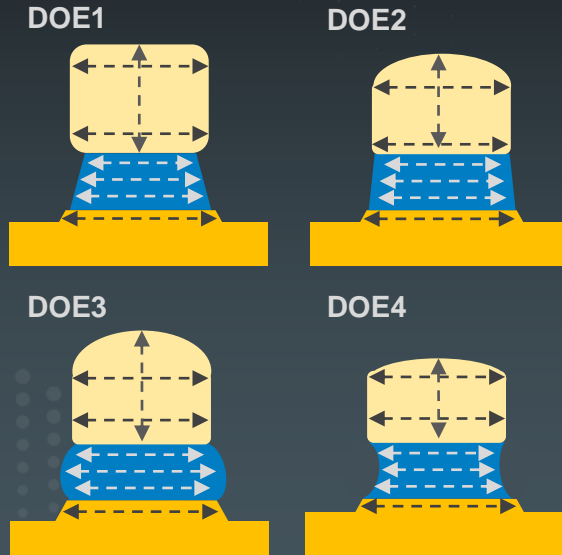


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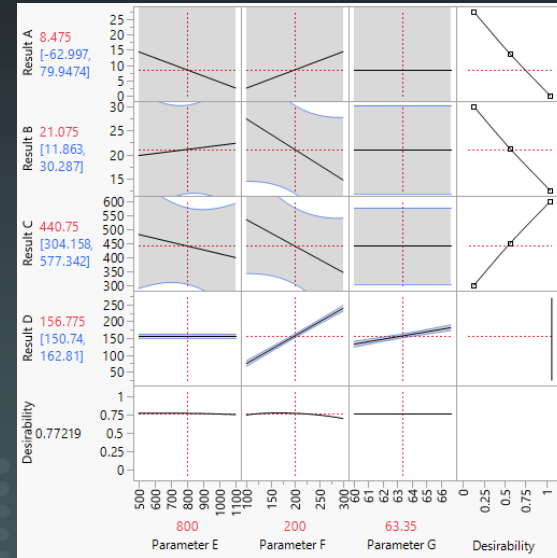
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# Sample 2.

	Parameter E	Parameter F	Parameter G	Result A	Result B	Result C	Result D
1	1100	300	60	2.9	16.7	316	214
2	500	100	60	2.8	26.9	587	50.5
3	500	300	66.7	26	12.7	377	264
4	1100	100	66.7	2.2	28	483	98.6



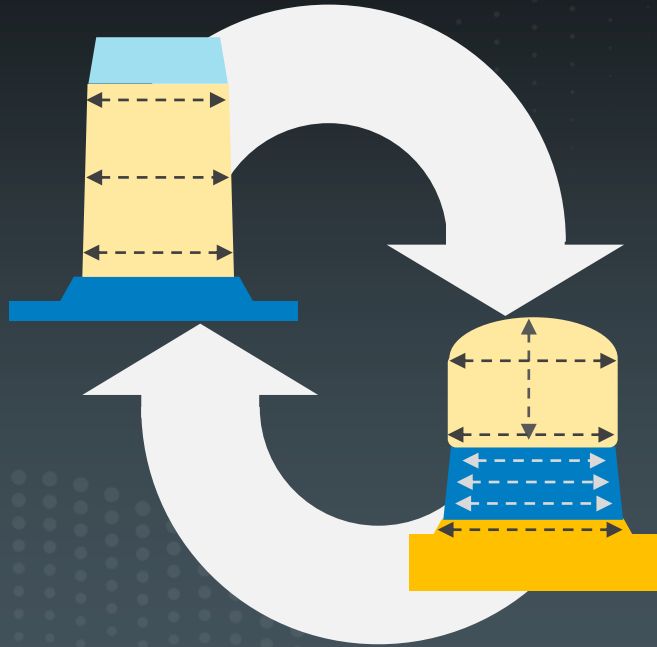
## Measure all !



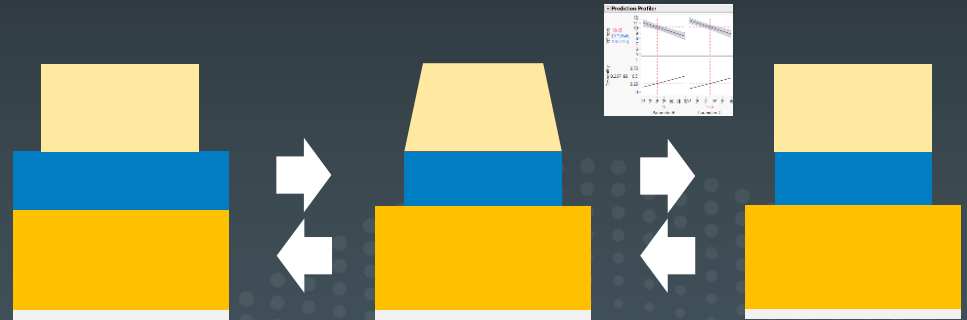
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# Sample 3.



## Re-calculate (calculate after-effect)



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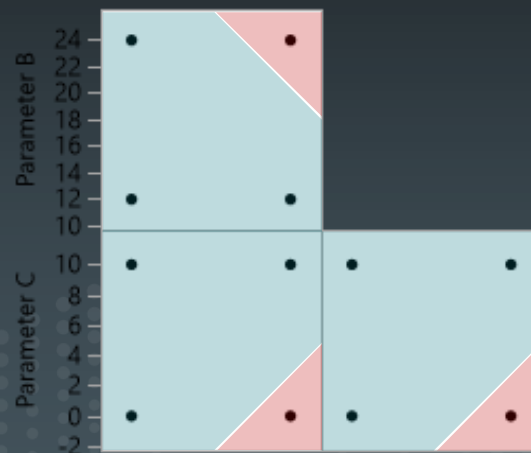
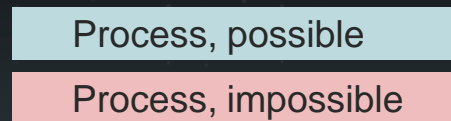
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## Design of Experiment in Patterning

- Calculate all parameters in complex test condition
  - ➔ Useful in deep, high Single or Multi Layer Setup
- Relatively Low dependence on Engineer experience
- Help predicting parameter at Non-TEST Area

## THE Caution with Custom Design

- Check The **Gray point**, First
  - . Gray1. No PROCESS Margin
  - . Gray2. No H/W Margin



✓ The Gray Point : Impossible condition to test

# THANK YOU

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