



***Delivering the Full Benefits of Maskless Lithography
and Adaptive Patterning with Comprehensive
Design Automation***

Gaurang Gunde

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Introduction

Current Role:

AP Studio Software Manager at Deca Technologies

Responsibilities:

Develop comprehensive design automation and integrate with leading EDA tools to support Deca's Adaptive Patterning technology

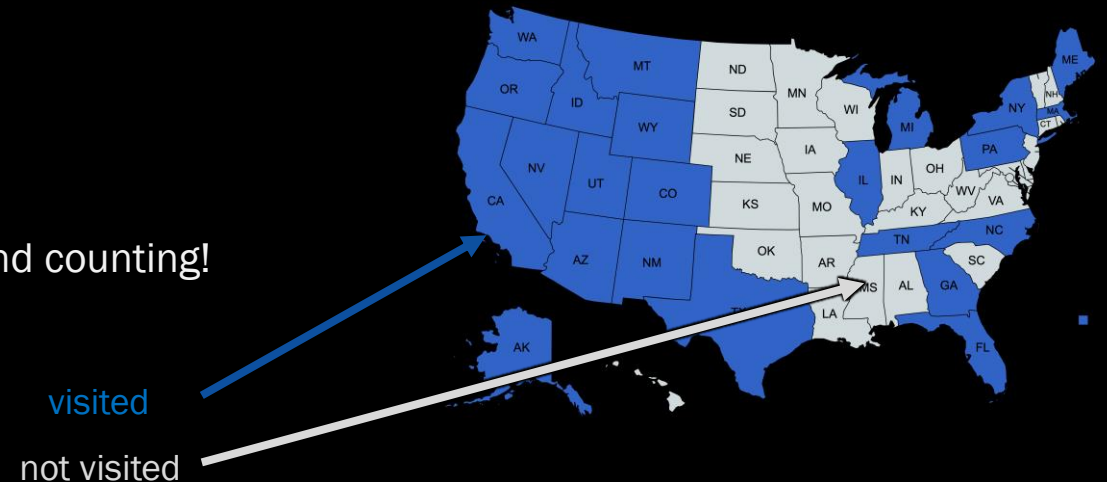
Past:

Worked at Microchip Technologies Inc. for 7 years as a Senior Applications Engineer

MS in Computer Engineering – Arizona State University

Hobbies:

Travelling – I have been to 25 states in the United States and counting!



Agenda

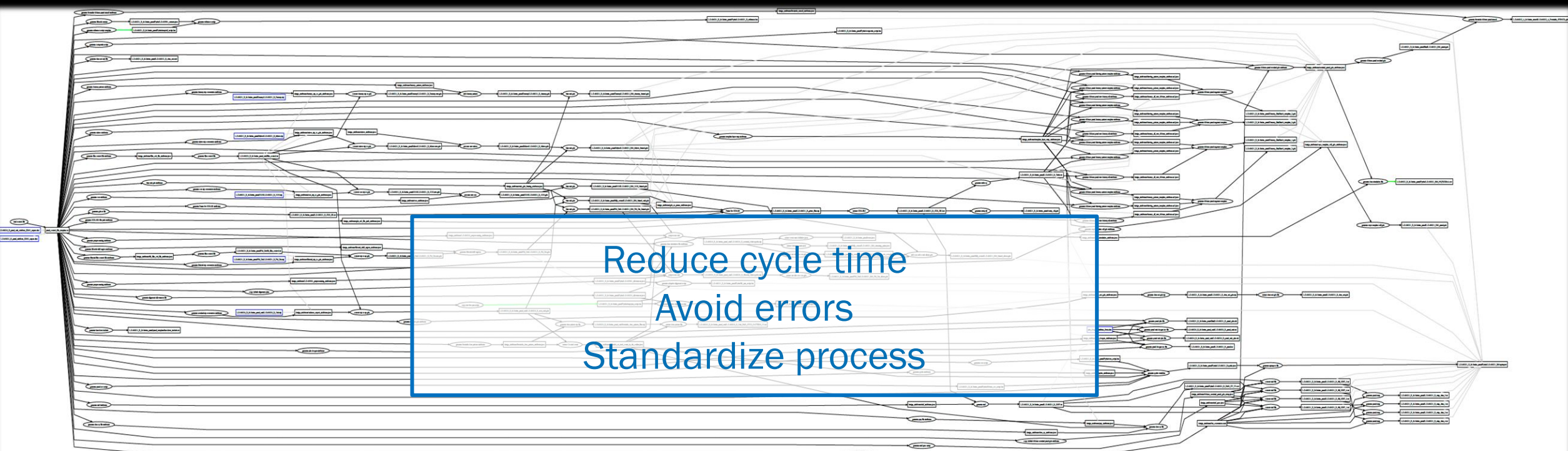
- Why is design automation necessary?
- How is the design automation flow managed at Deca?
- Design automation flow
- Creation of final design bundle
- Summary

Why is Design Automation necessary?

26 Design bundle artifacts

48 Intermediate files

107 Total process steps



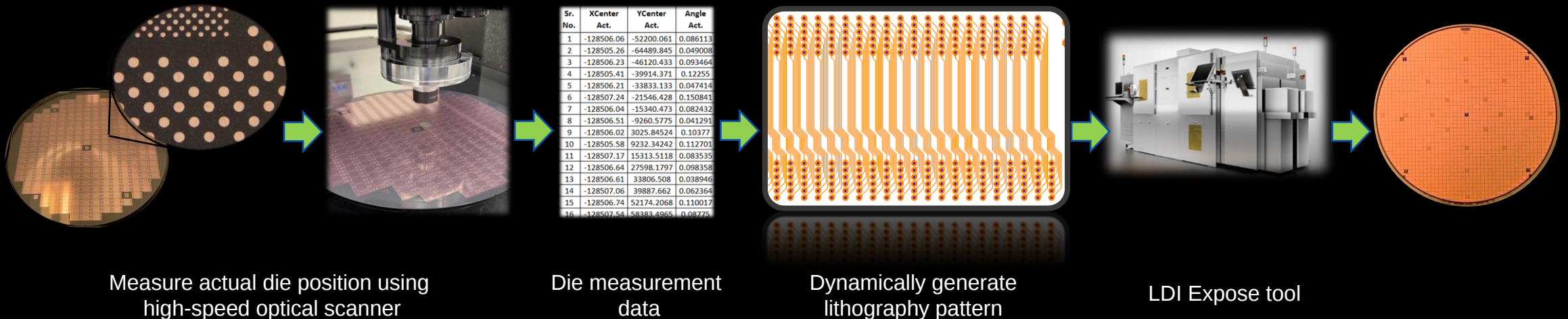
Reduce cycle time
Avoid errors
Standardize process

Solving die shift with Adaptive Patterning™ (AP)



→ Unique lithography pattern optimized to ensure ideal contact and high-resolution interconnect on the industry's highest density advanced packaging

Adaptive Patterning Process Flow



Design for Maskless Lithography

Traditional EDA tools

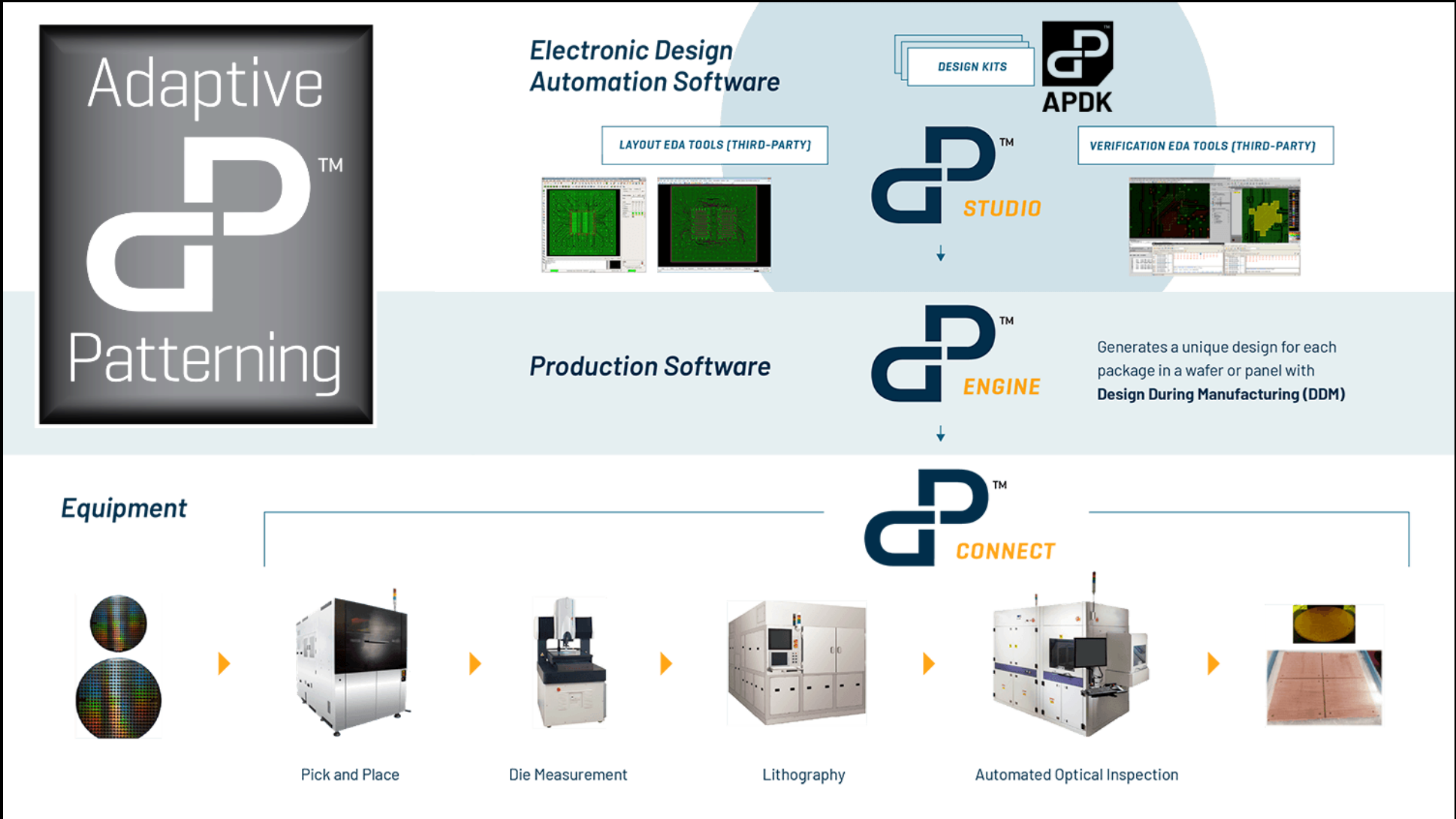
+ Adaptive Patterning

+ Fab Data Generation

=

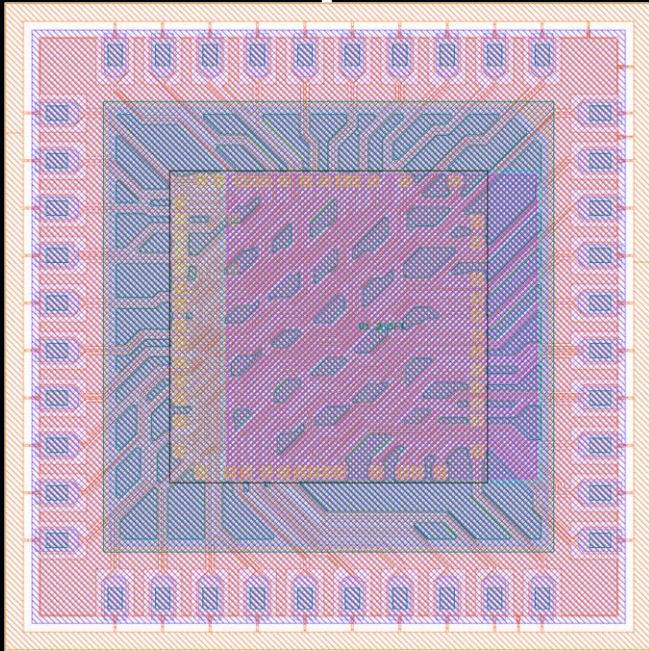
Iterative and Rapid Design Cycle

How is the design automation flow managed at Deca?



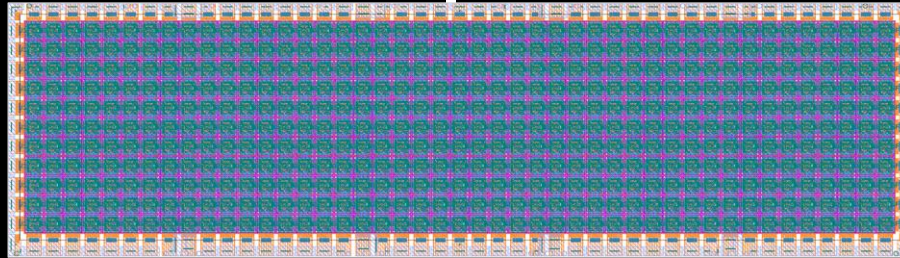
Design Automation Flow

Package Design



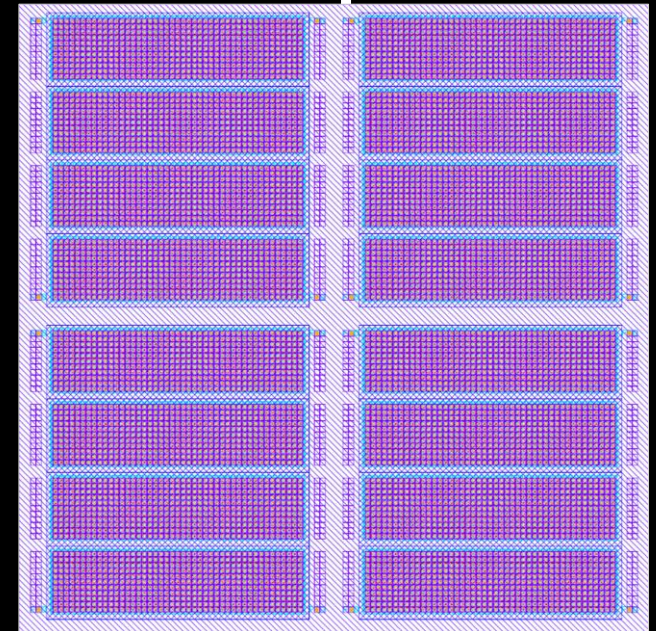
- Layout
- Adaptive Patterning setup
- Simulation and verification

Segment Layout



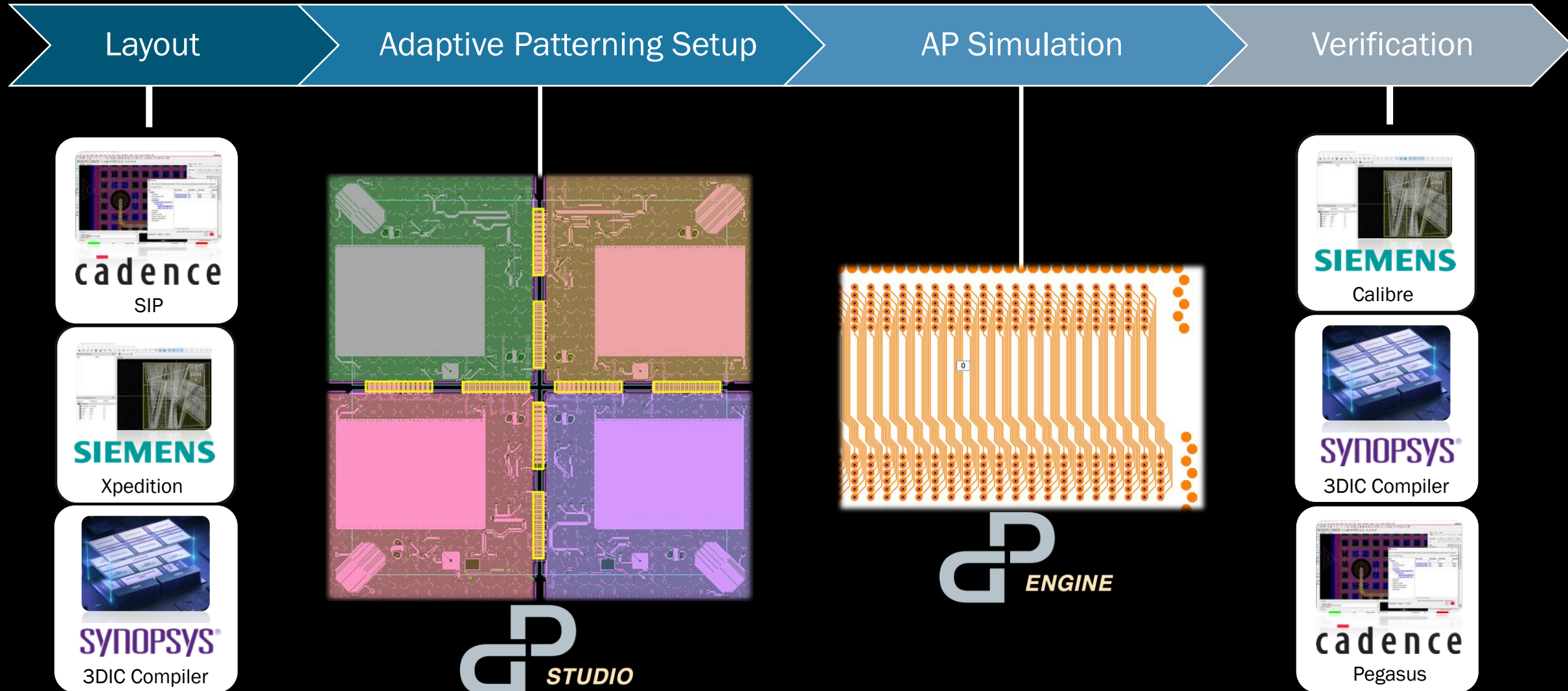
- Step and repeat
- 2D code and OCR definition
- Typically, 600mm panel with four 300mm segments
- Strips can be created as well

Panel Layout



- Segment placement
- Fab data generation

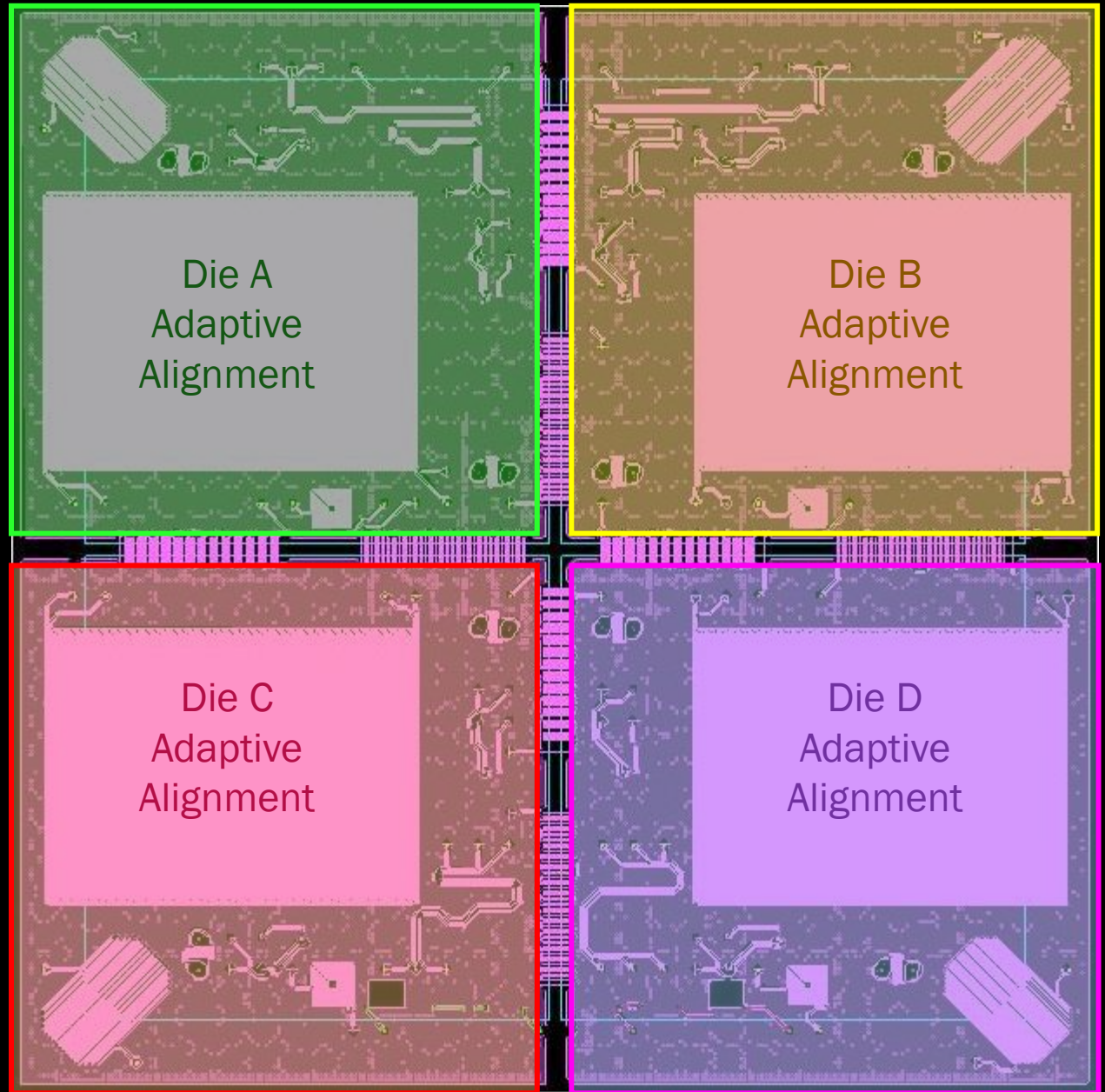
Design Automation Flow - Package



Draw Adaptive Alignment Regions

- Simple additional layer in the layout CAD tool
- Adaptive Patterning will align the features within each region to its die
- AP Studio automatically extracts the geometry

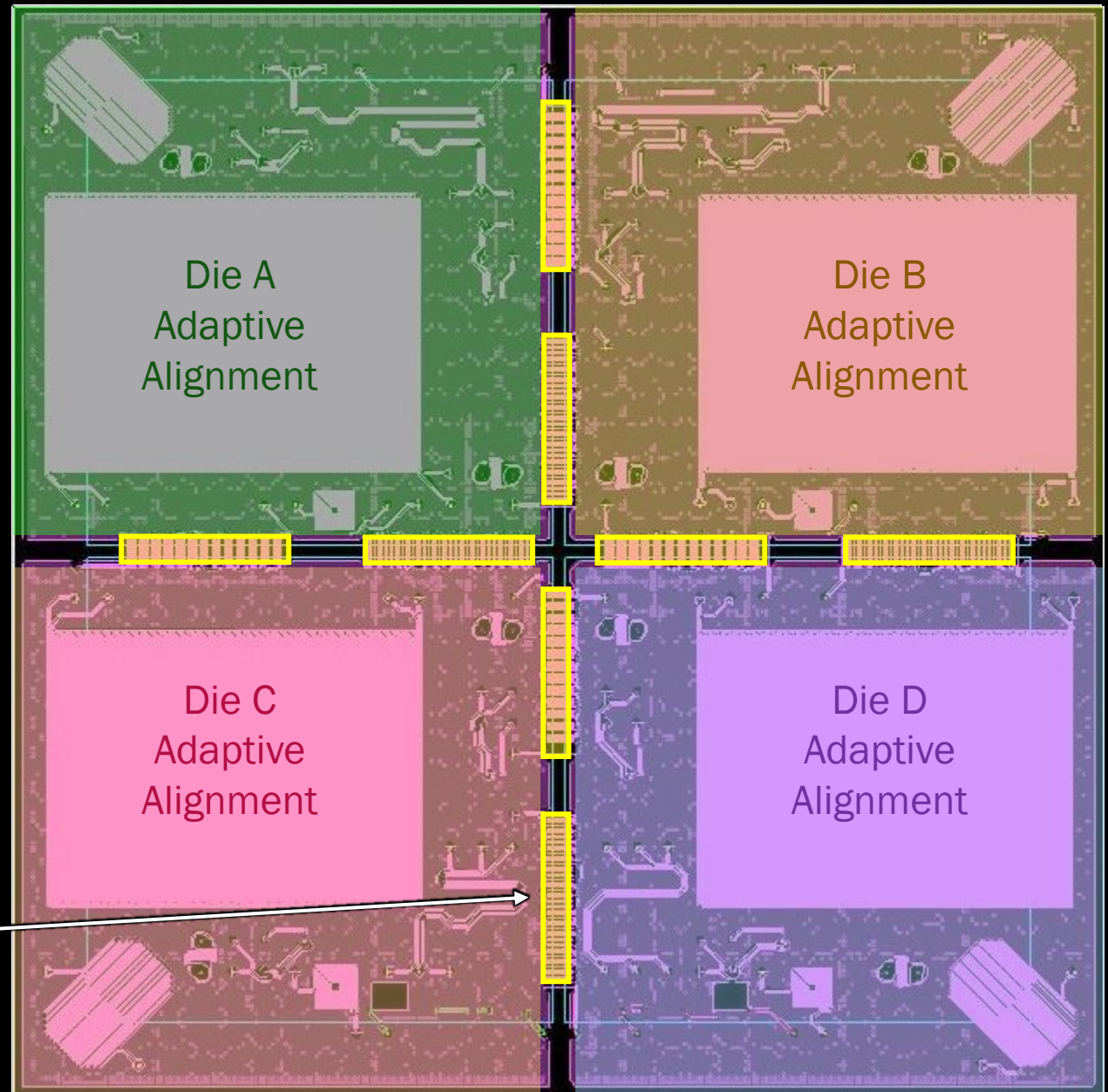
Example alignment regions for 4 dies



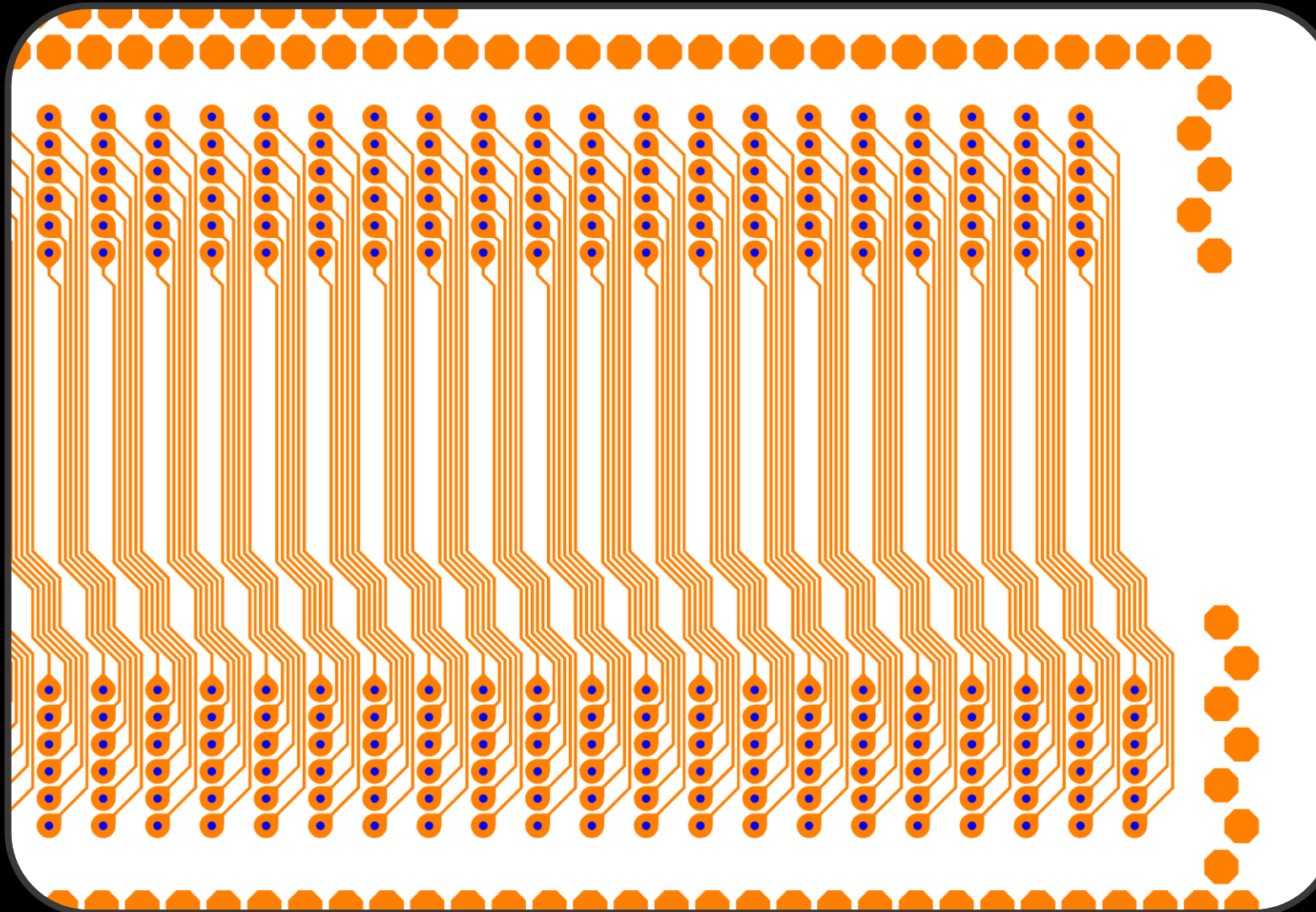
Draw Adaptive Routing Regions

- Another simple layer in the layout CAD tool
- Adaptive Patterning will adjust traces for die shift within the drawn regions
- AP Studio automatically detects and validates traces in each region

Adaptive Routing
Region



Simulation Result with Adaptive Patterning



Full die shift range
simulated and verified
(e.g. $\leq 25 \mu\text{m}$ for this design)

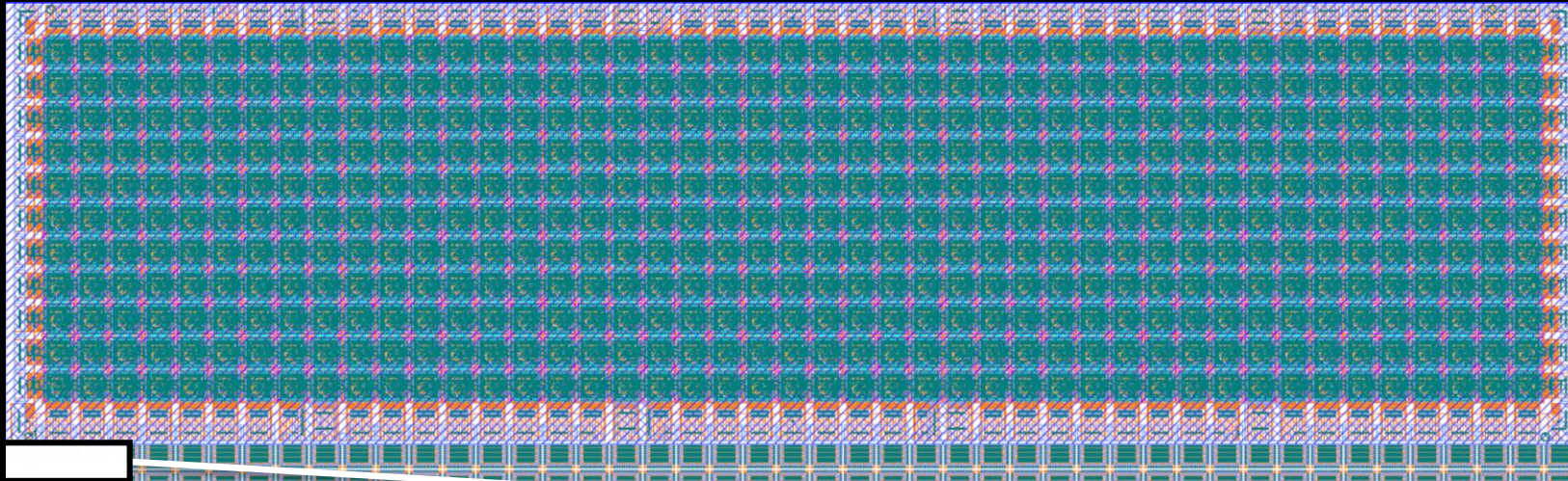
Deterministic in production



Simulation
example

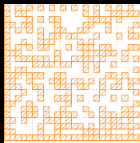
For example,
Signal integrity extraction done for
UCle Adv. x64 16 – 32 Gbps
over die shift range

Panel Segment – 2D code and OCR text placement



Panel segment flow
assembles packages
into sub-panel blocks,
called segments

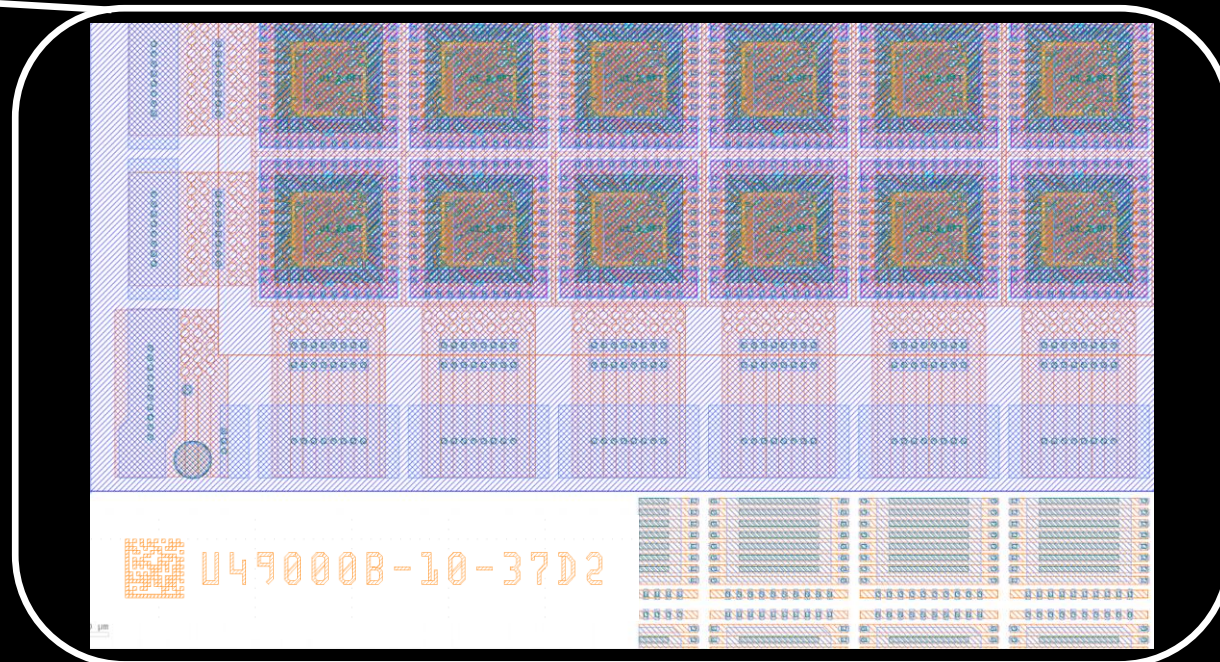
2D Code



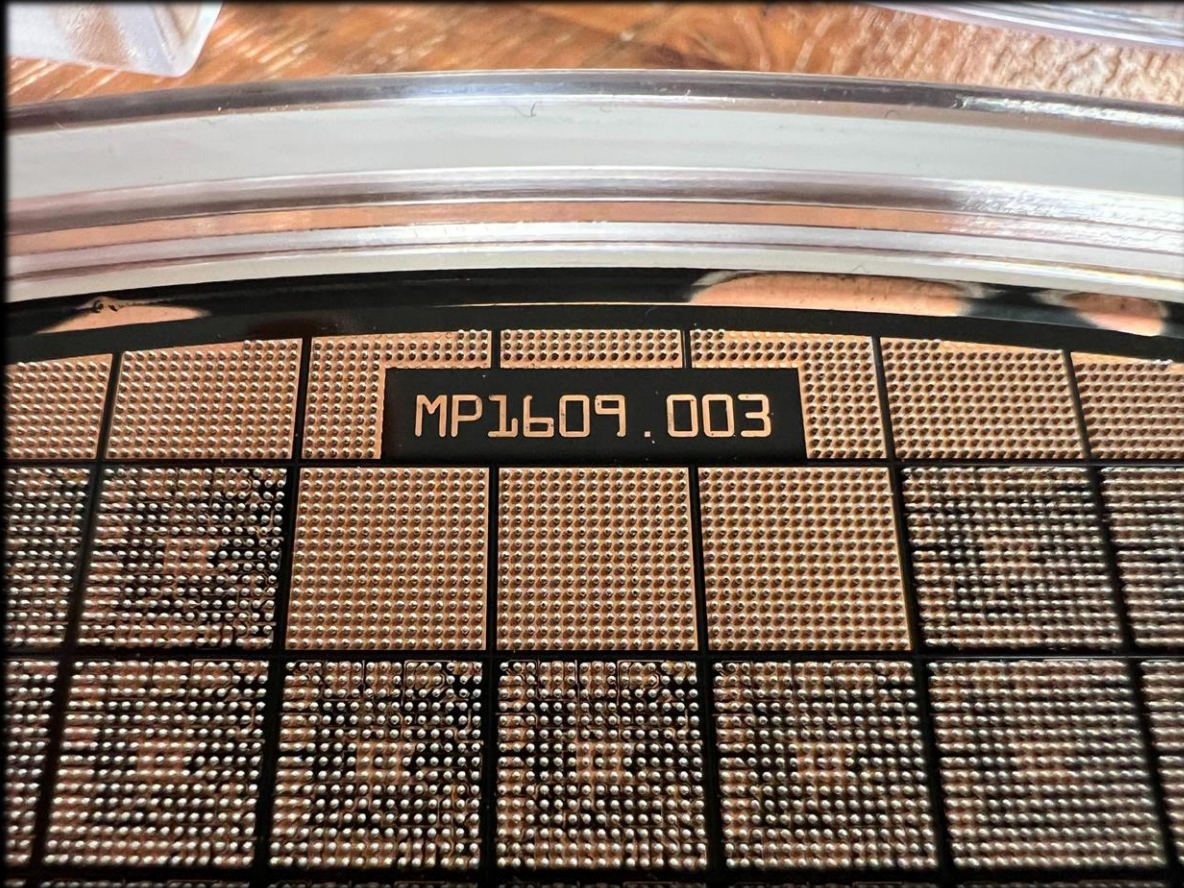
OCR



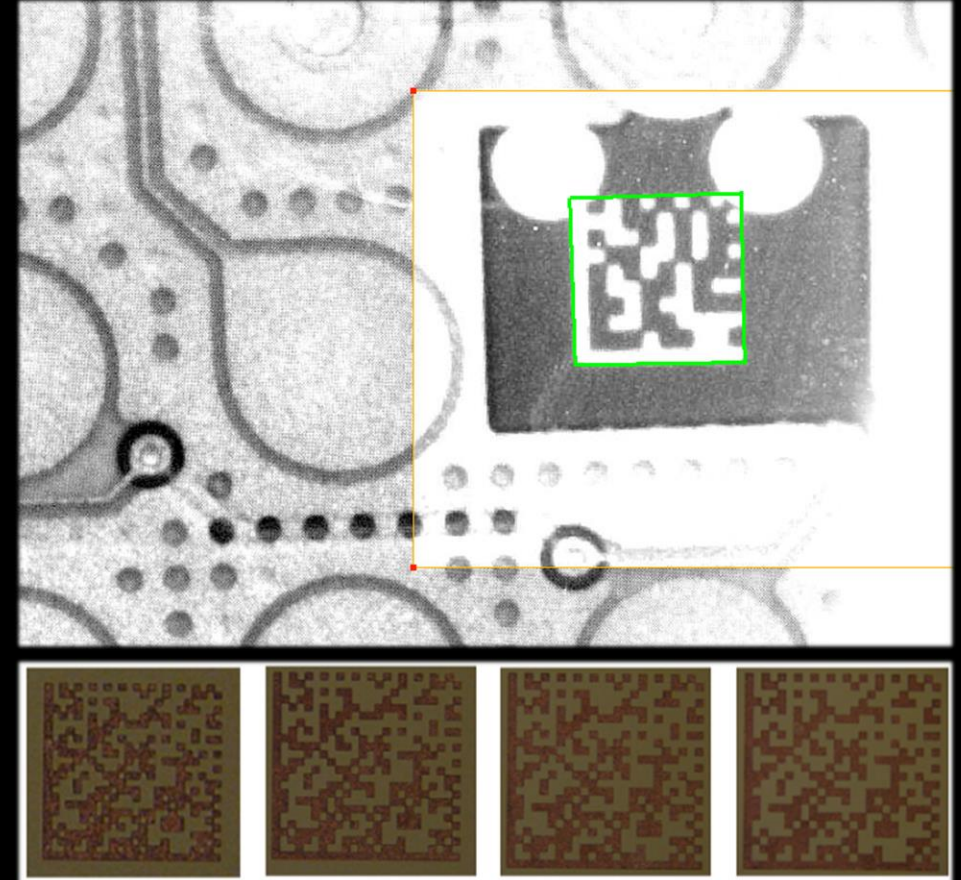
Created per segment in RDL metal using
Adaptive Patterning, not laser marked



Panel Segment – 2D code and OCR text placement



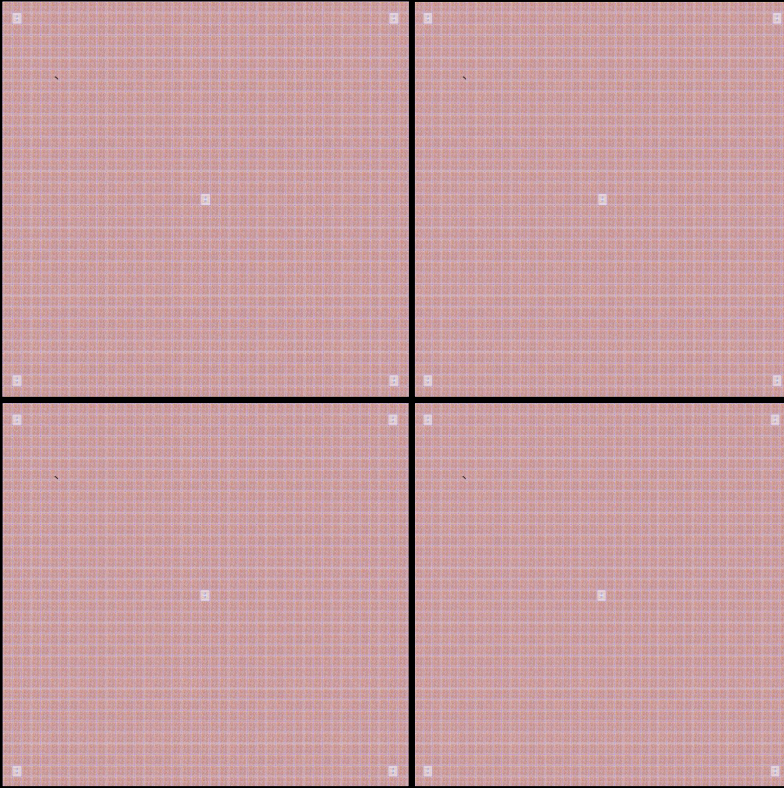
Optical Character Recognition (OCR) code



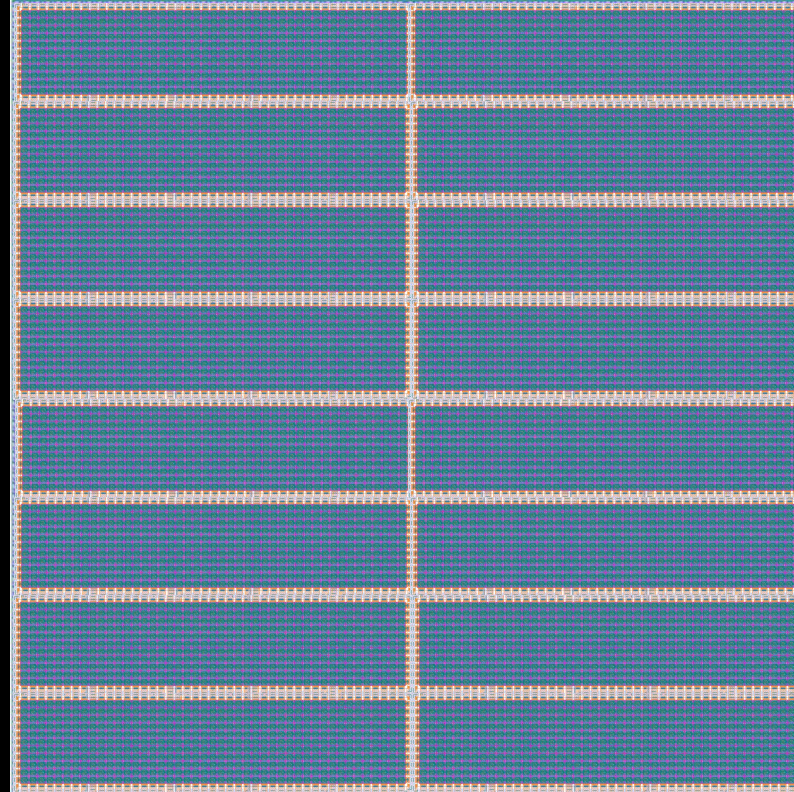
ECC200 data matrix (2D) code

Placement of segments on 600mm panel

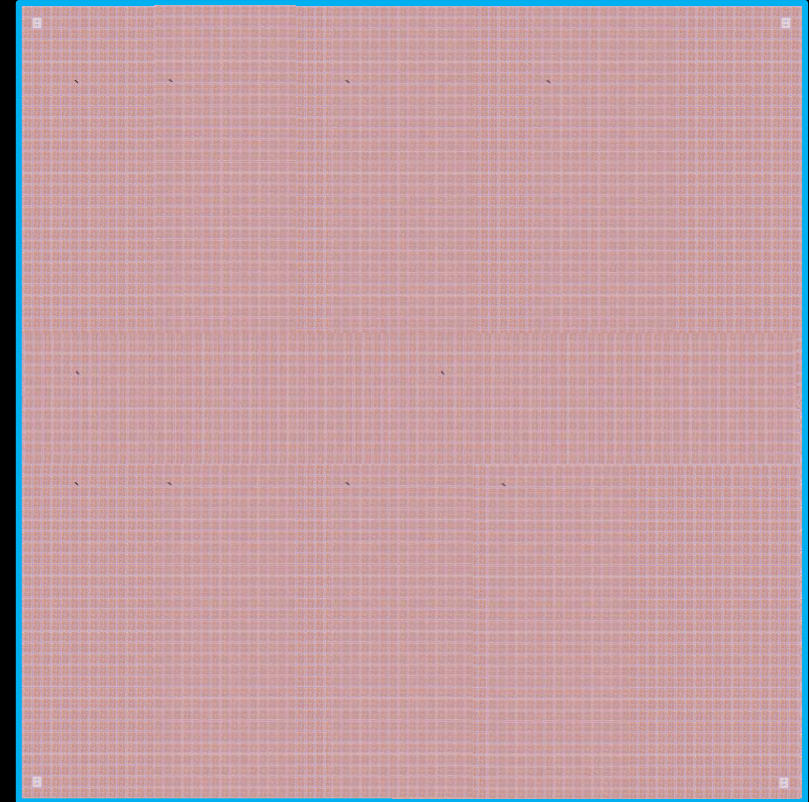
Quadrant Based or 4 segments



QFN Strip Format



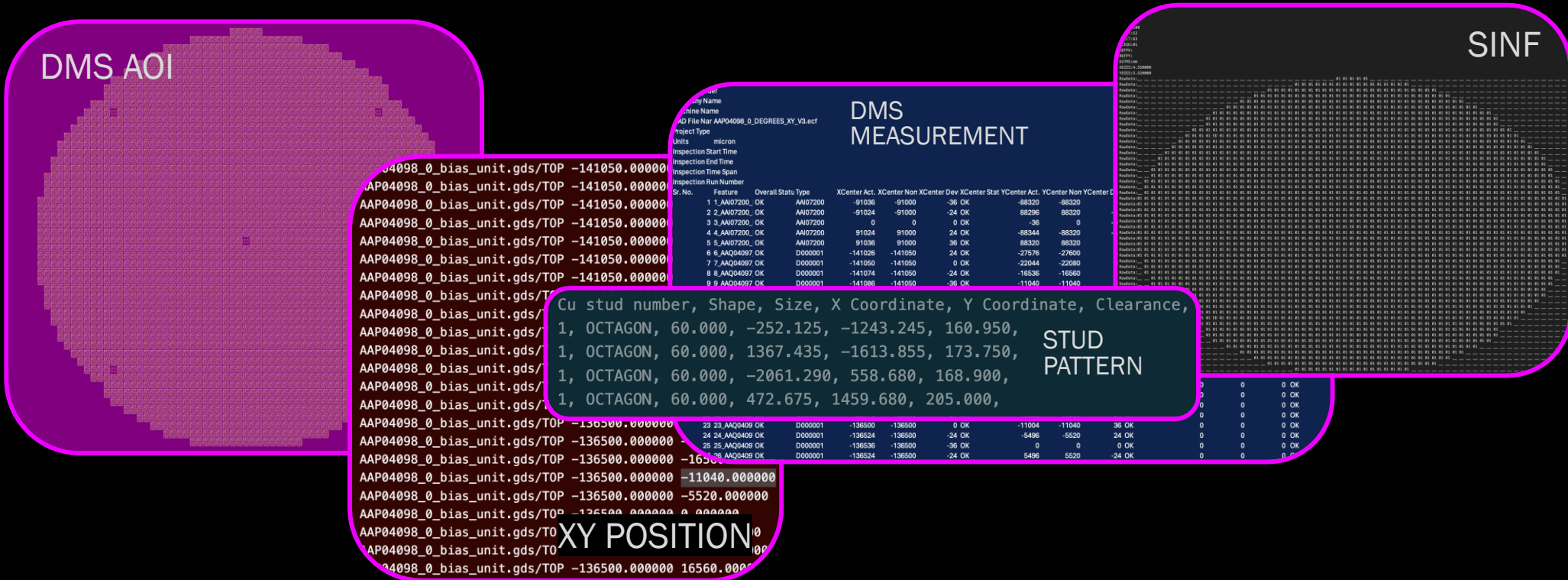
Single Segment for Maximum Die Utilization



Creation of final design bundle



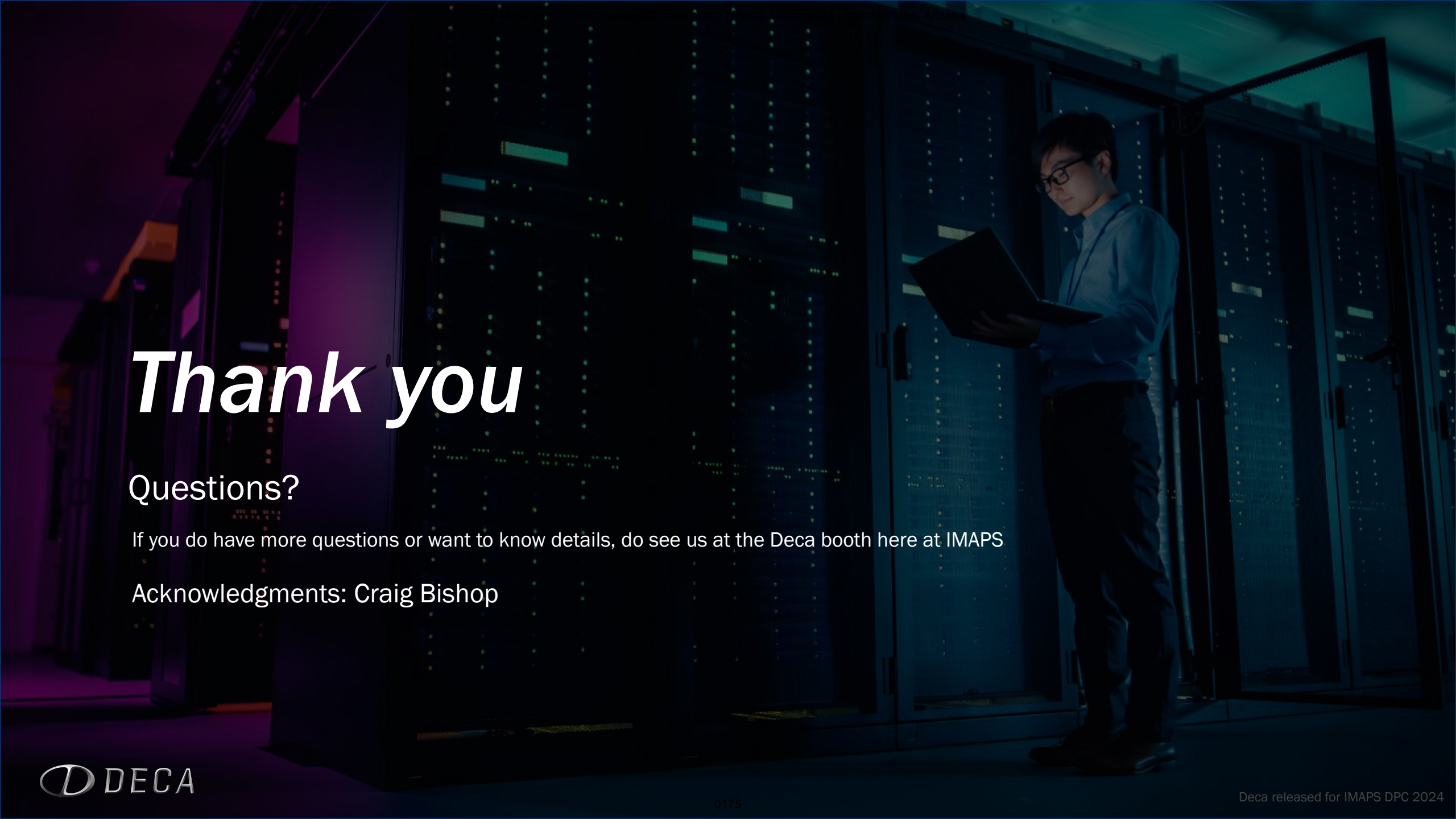
And many more artifacts,



Conclusion and Summary

- Adaptive Patterning helps solve the die shift problem
- Maskless Lithography is amazing and results in a rapid design cycle
- Numerous input files are required along with panel level data
26 Design bundle artifacts, 48 Intermediate files, 107 Total process steps
- Comprehensive design automation helps make the process of artifact creation seamless



A man in a blue shirt and glasses is standing in a server room, looking at a laptop. The room is filled with rows of server racks, and the lighting is dim with some green and blue hues. The text "Thank you" is overlaid on the left side of the image.

Thank you

Questions?

If you do have more questions or want to know details, do see us at the Deca booth here at IMAPS

Acknowledgments: Craig Bishop