



# Use of AI/ML in Electronic Design Automation and Engineering Simulation

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SVP Innovation, Synopsys

ISPD 2026



# AGENDA



**Silicon to Systems**

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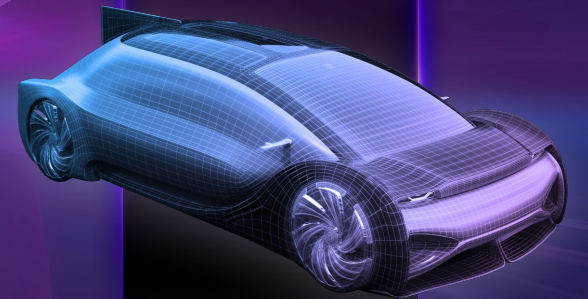
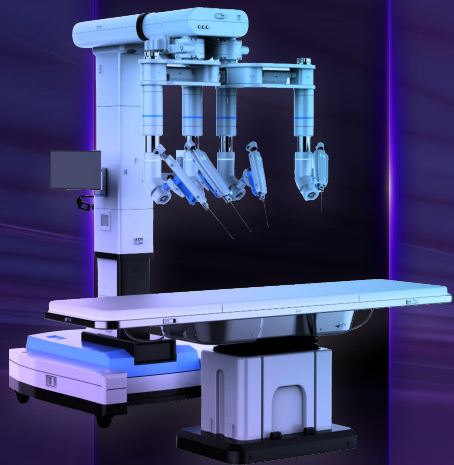
**AI/Machine Learning in  
Engineering Simulation**

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**AI/Machine Learning in EDA**

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# Intelligent Systems are All Around Us!



# Intelligent Systems: Si-Powered, SW-Defined, AI-Enabled



## Digital & Mission Engineering

MBSE, Environments, Models, Simulation

## Aeronautical Design

Flight characteristics, rotor efficiency

## AI Model Development

Object, detection and avoidance

## Software Development

Flight planning, motor control, battery management, communication

## Mechanical Design

Weight, stress forces, crash survivability

## Thermal Design

Heating/cooling

## Silicon Development

Providing required performance with lowest power usage

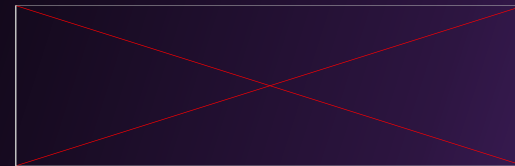
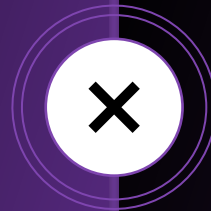
## Electrical Design

Batteries, PCB, power supply efficiency

# CREATING THE LEADER in Engineering Solutions from Silicon to Systems



Leader in Silicon Design



Leader in Simulation & Analysis

## PROVIDES

comprehensive solutions  
for the entire silicon design process including  
multi-die simulation & analysis

## EXTENDS

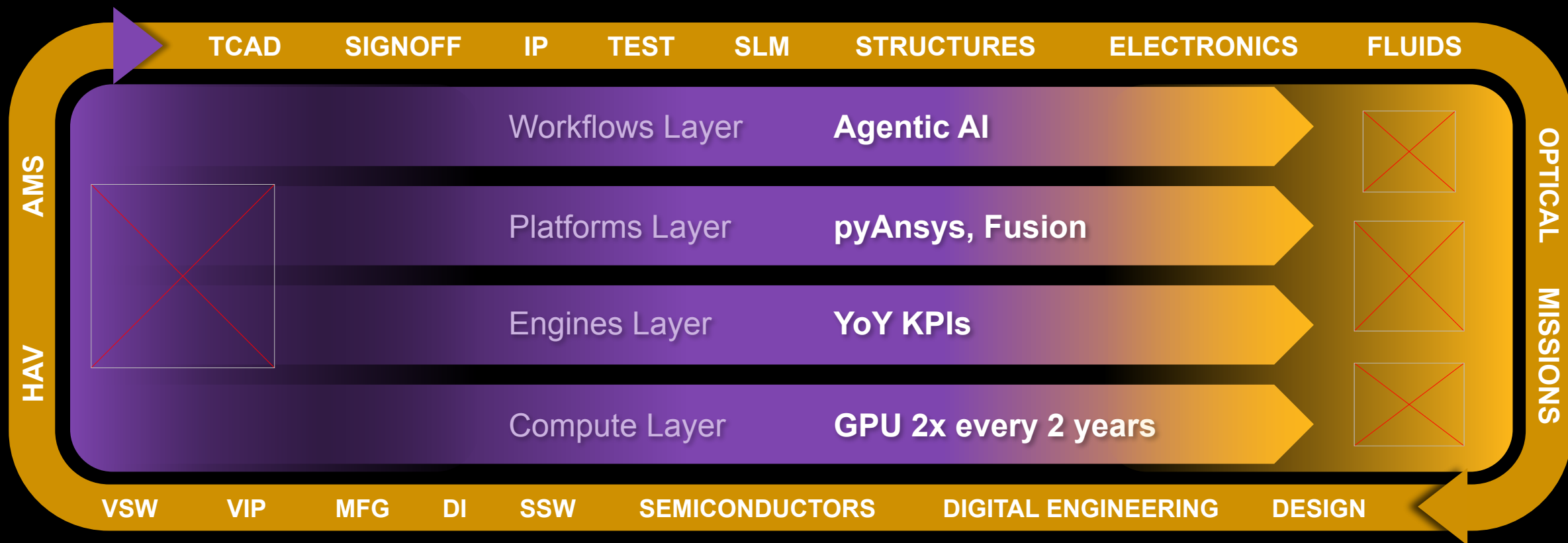
AI leadership in EDA  
and simulation to accelerate  
customers' innovation

## ACCELERATES

creation of intelligent products by  
bringing silicon expertise across systems  
verticals



# Chips to Systems Revolution



Drive Need-Moving Innovation at Every Layer, In Every Product, and Every Hyperconvergence Opportunity

# AGENDA

Use solvers to train AI/ML models to speed up simulation

Design space exploration

Generate new models

Foundational models to speed up simulation

Hybrid digital twins

**Silicon to Systems**

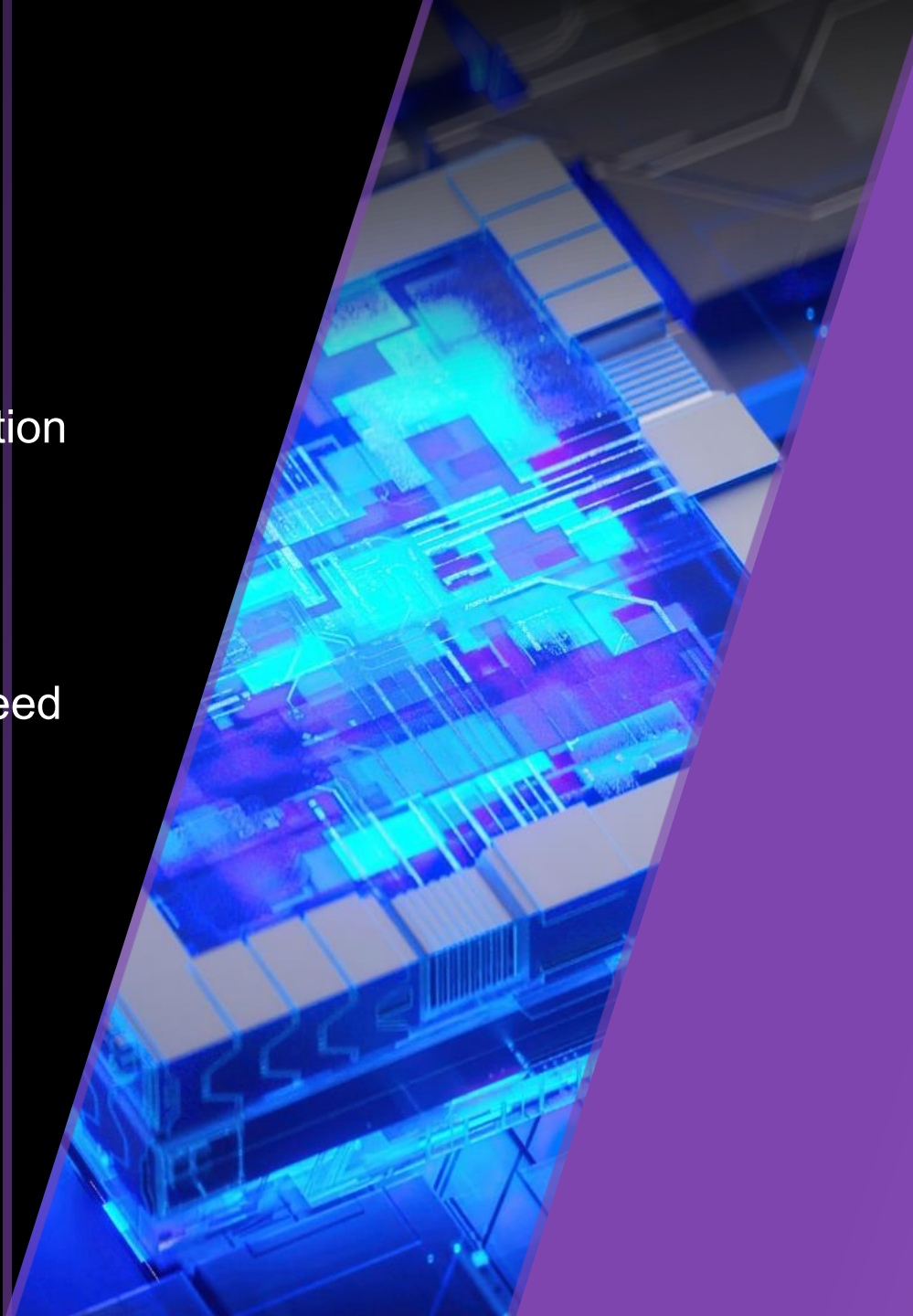
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**AI/Machine Learning in Engineering Simulation**

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**AI/Machine Learning in EDA**

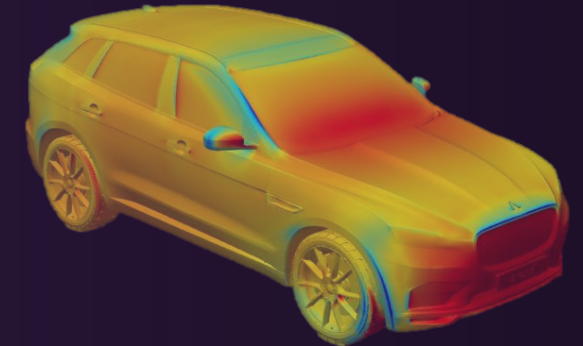
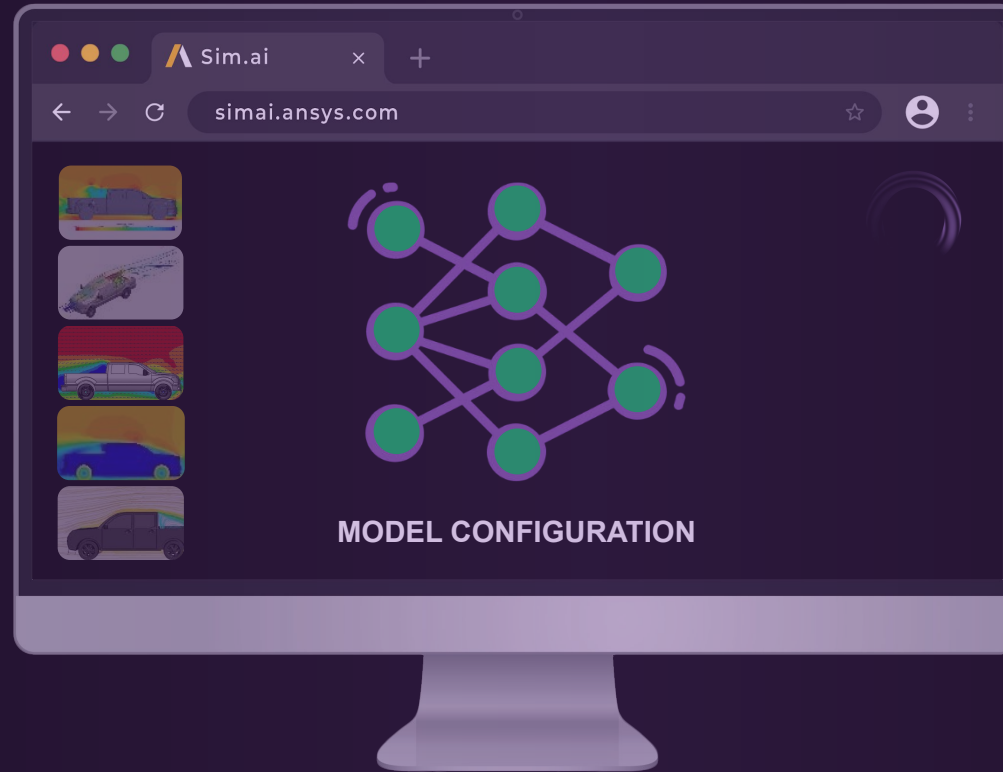
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# Predict at the Speed of AI



NEW DESIGN



PERFORMANCE PREDICTION

1

**UPLOAD**  
Your Past Data

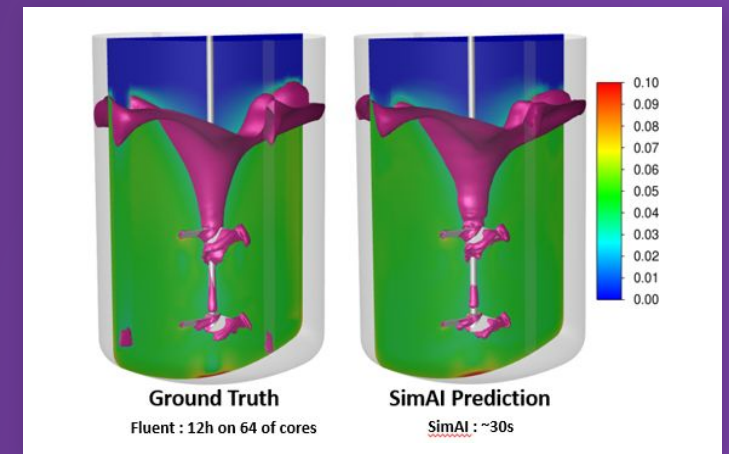
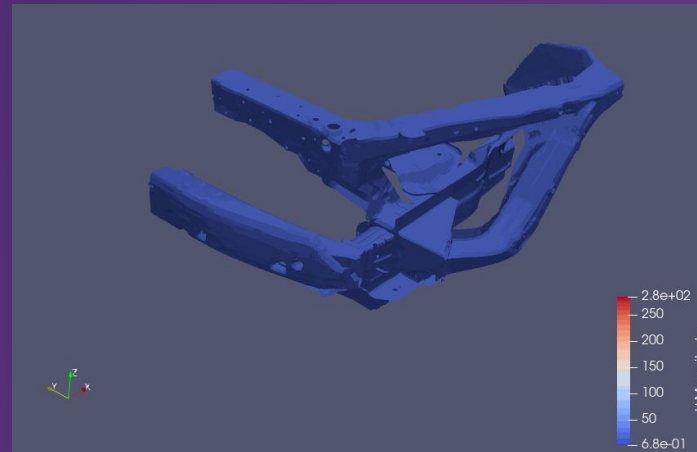
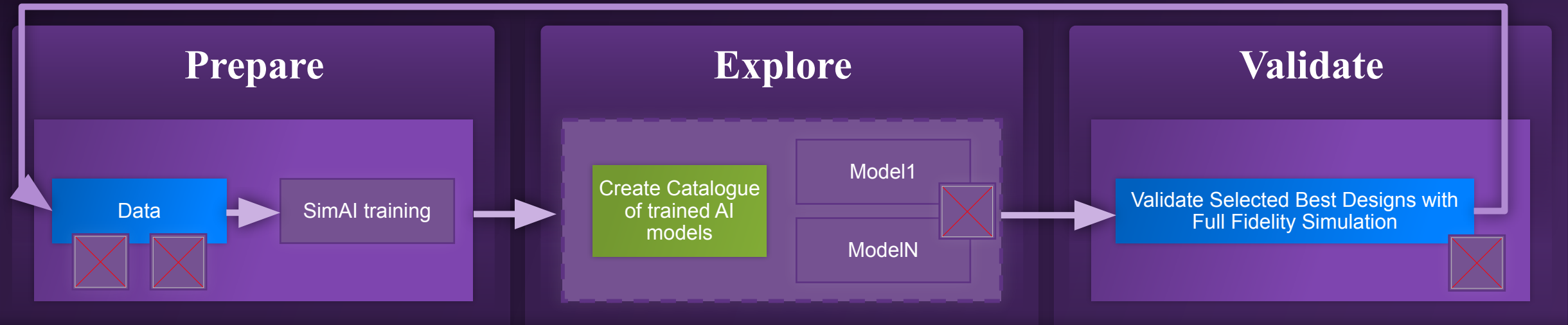
2

**TRAIN**  
Your AI Model

3

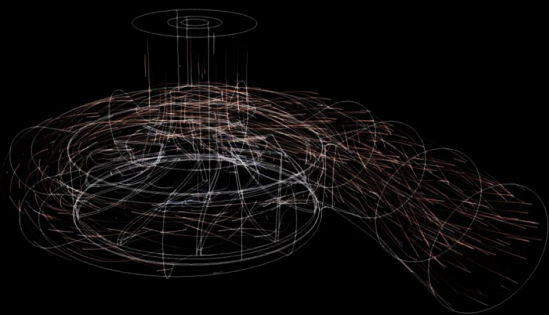
**PREDICT**  
In Seconds!

# SimAI – Workflow and Applications



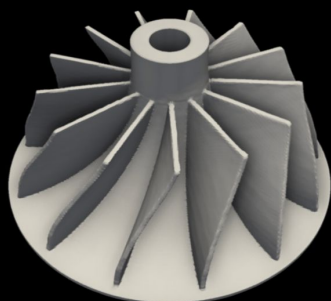
# GeomAI to Generate New Shapes

## SimAI



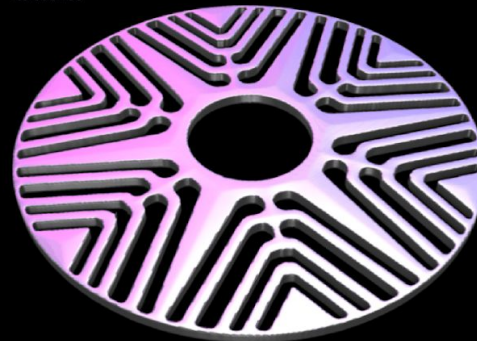
give me **a shape**, I will show you the **physics**

## GeomAI – *Concept Exploration*

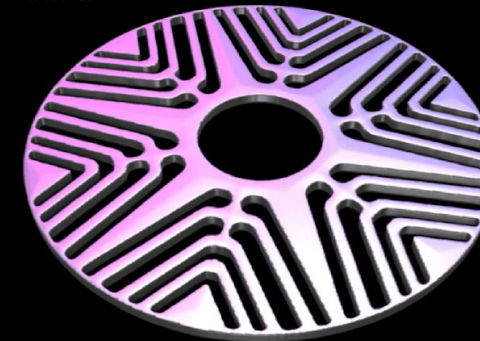


give me **shapes**, I will generate **new shapes**

MotorCAD  
Iteration 95



MotorCAD  
Iteration 95



## E-motor optimization

Enhance e-motor efficiency by optimizing the topology and placement of magnet pockets.

Front  
Iteration 0

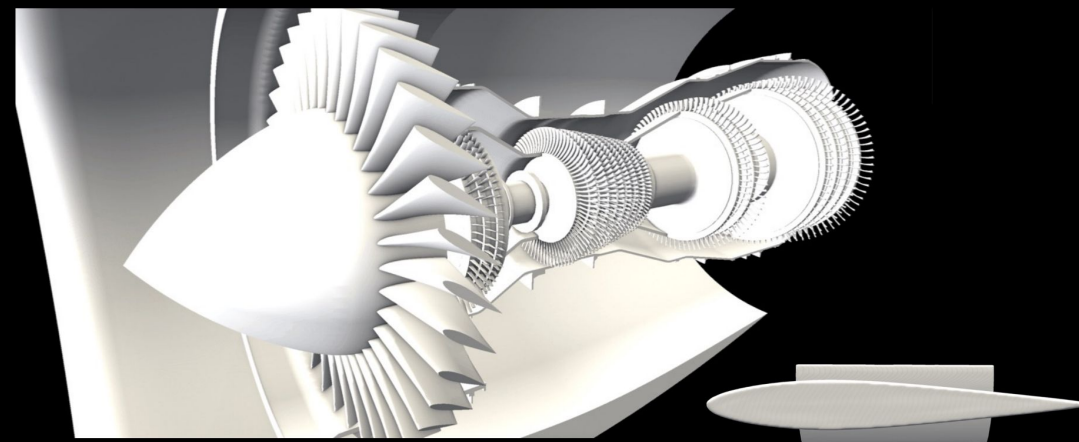


Iso  
Iteration 0



## Side mirror optimization

Identify the most stable shape with maximum driver visibility.



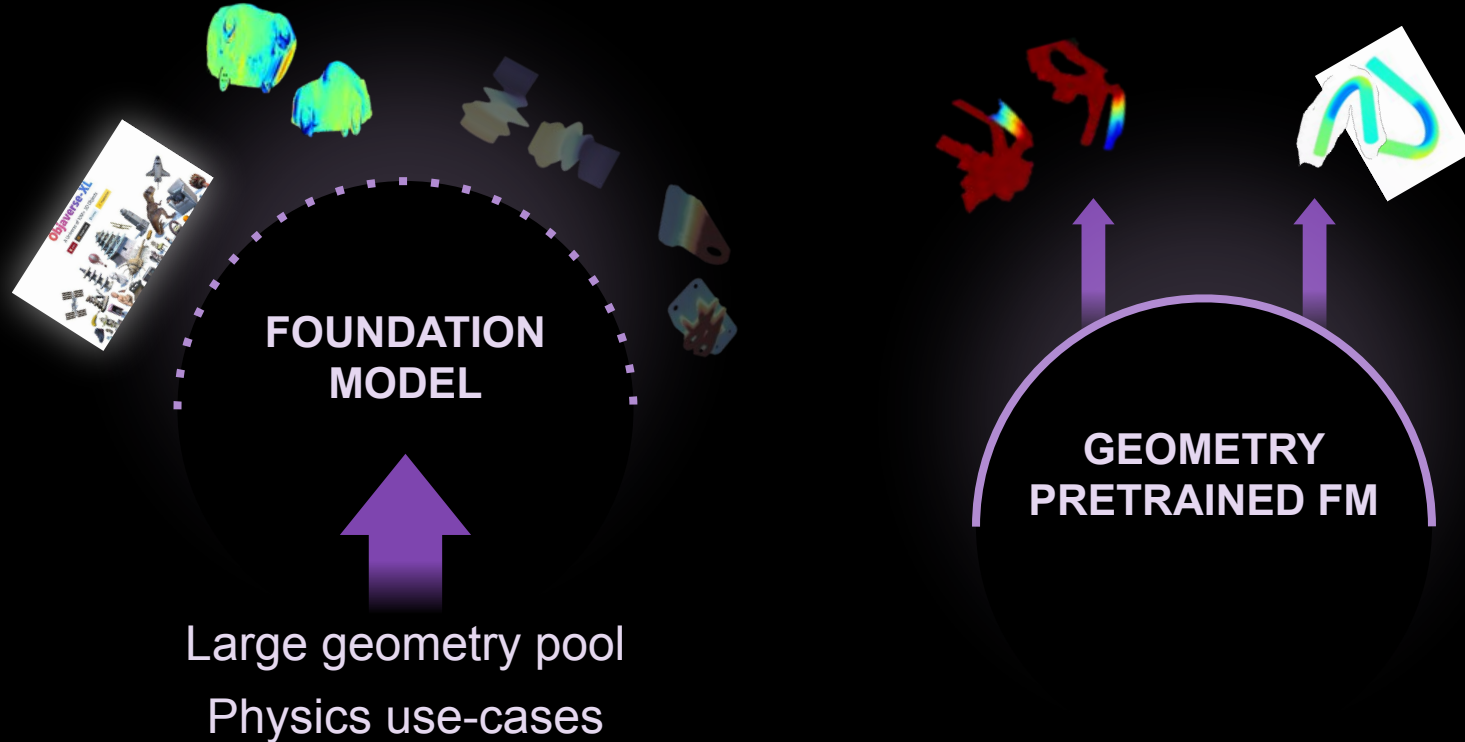
## Turbine optimization

Maximize potential through optimized flow physics and energy conversion.

# Foundation Models for Physics

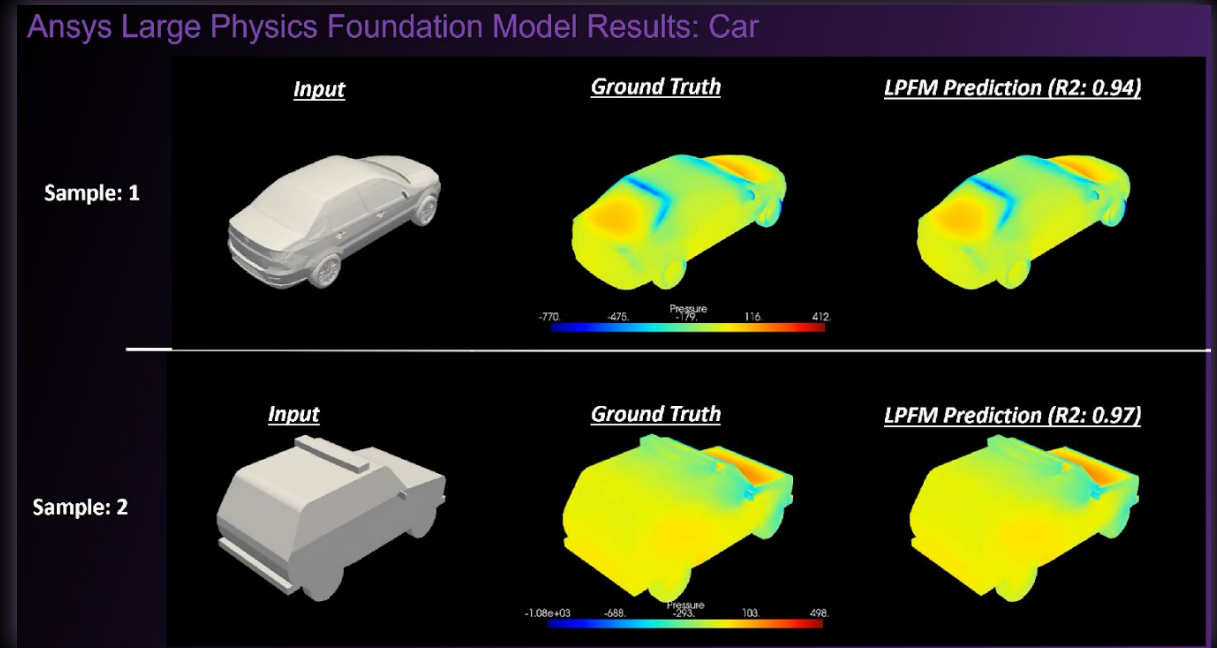
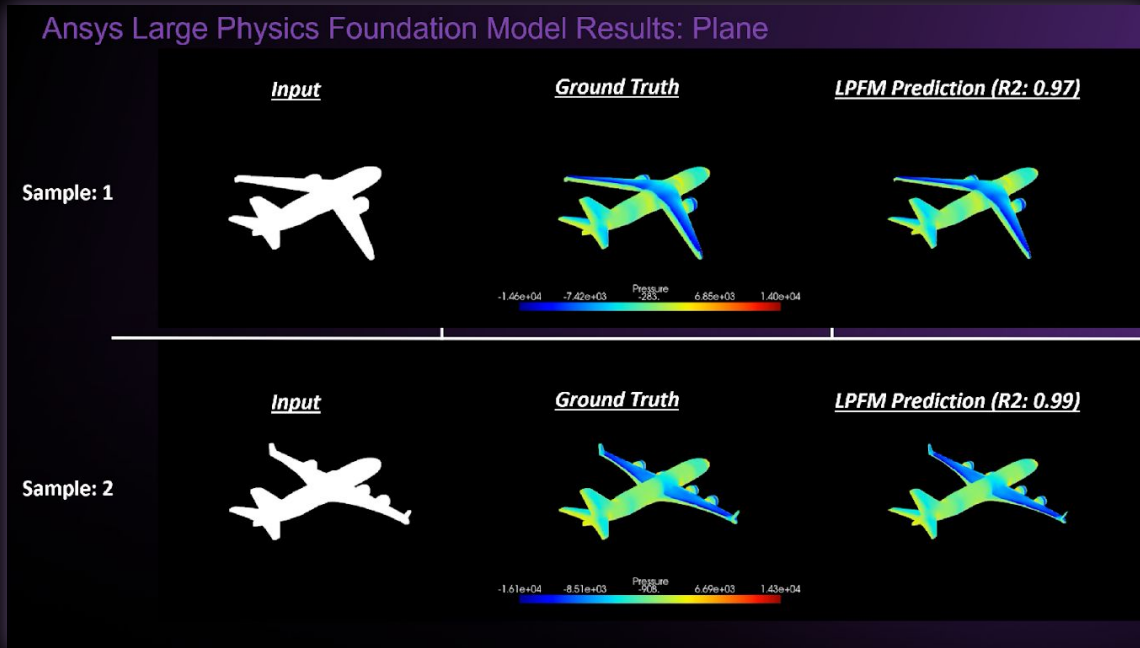
Pre-train on diverse geometries primarily and some common physics use cases

Adapt pre-trained models to different downstream physics use cases

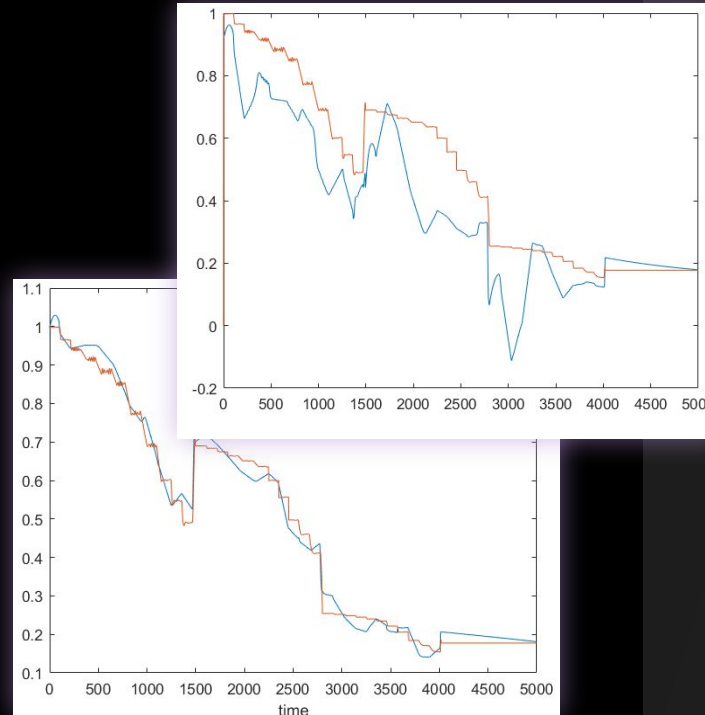
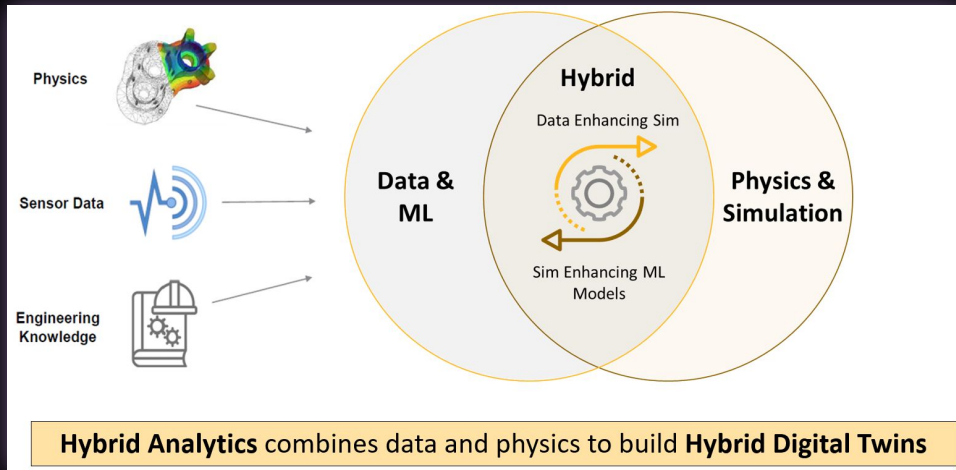


- Large geometry pre-training allows prediction on diverse geometries
- Resolution invariance due to curriculum learning from lower to higher resolution
- One-shot finetuning

# Large Physics Foundational Models



# TwinAI: Hybrid Digital Twins Combining Simulation and Data



**ACCURACY**

Both: ~98% ↑

Sim: ~90% ↑

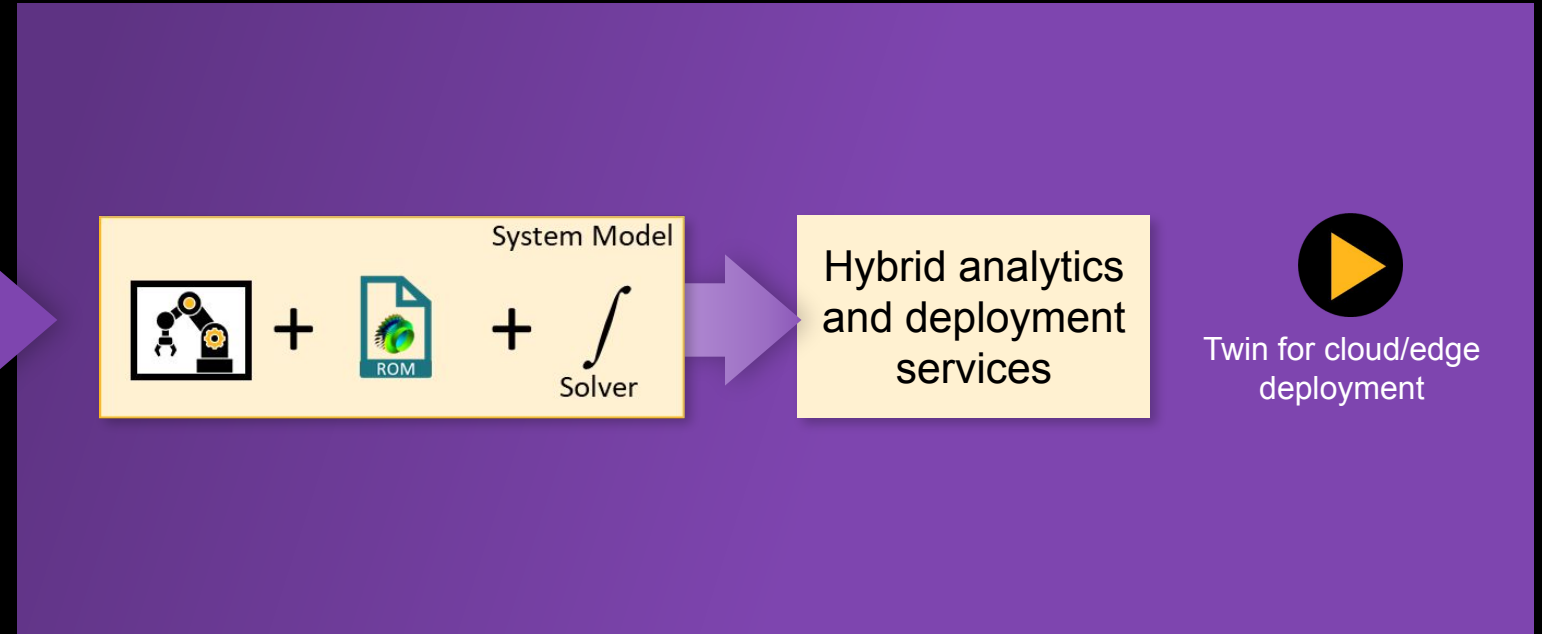
Data: ~80%

# Synopsys Solution for Digital Twins

## Validated Physics



## Ansys/Synopsys Twin Builder® & Ansys/Synopsys TwinAI™

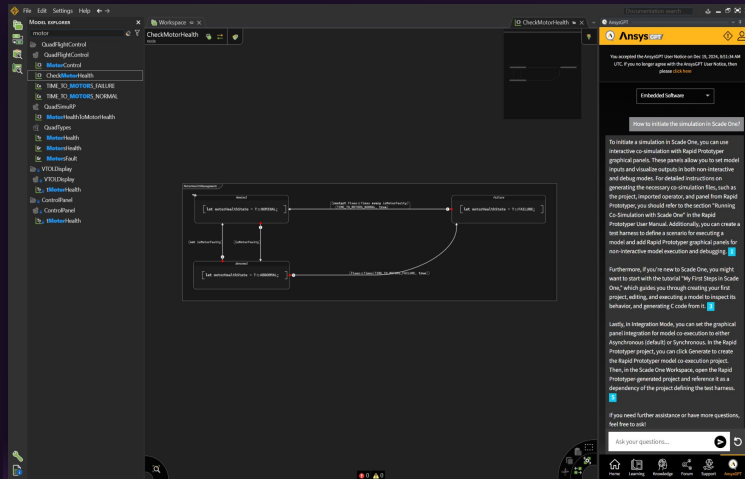


1. Best in class **Reduced Order Modeling** capabilities  Reuse
2. **Hybrid Analytics**  Accurate, evolving models
3. Unique **deployment** model and open architecture  Scalability

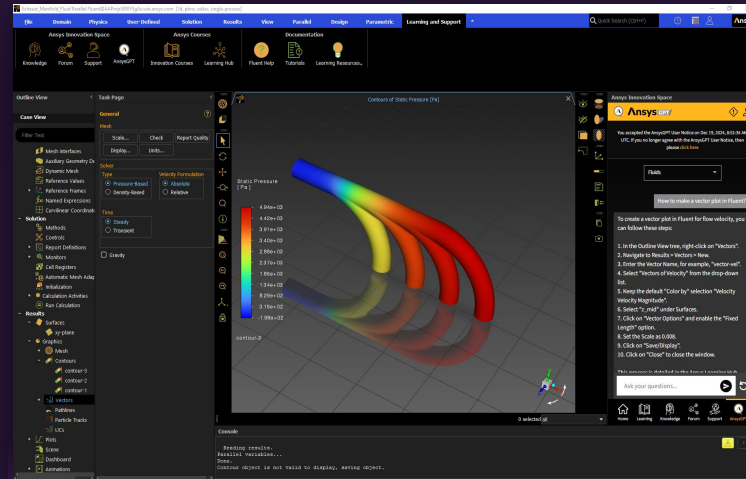
### OPEN ECOSYSTEMS AND KEY ANNOUNCED PARTNERS



# Engineering Copilot In-product Integration



SCADE ONE



FLUENT



MECHANICAL

# AGENDA

Machine Learning within tools

Reinforcement Learning in  
Optimization

Generative AI

Agentic AI

**Silicon to Systems**

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**AI/Machine Learning in  
Engineering Simulation**

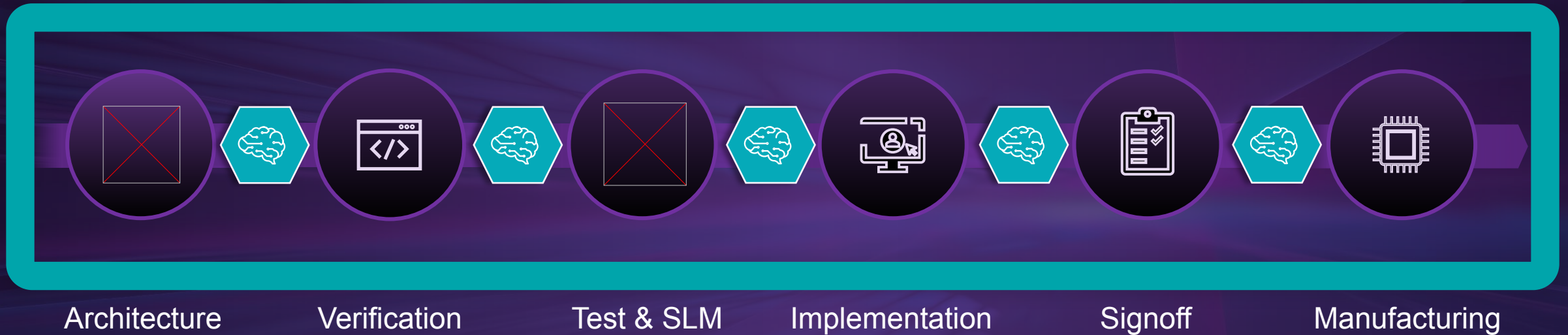
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**AI/Machine Learning in EDA**

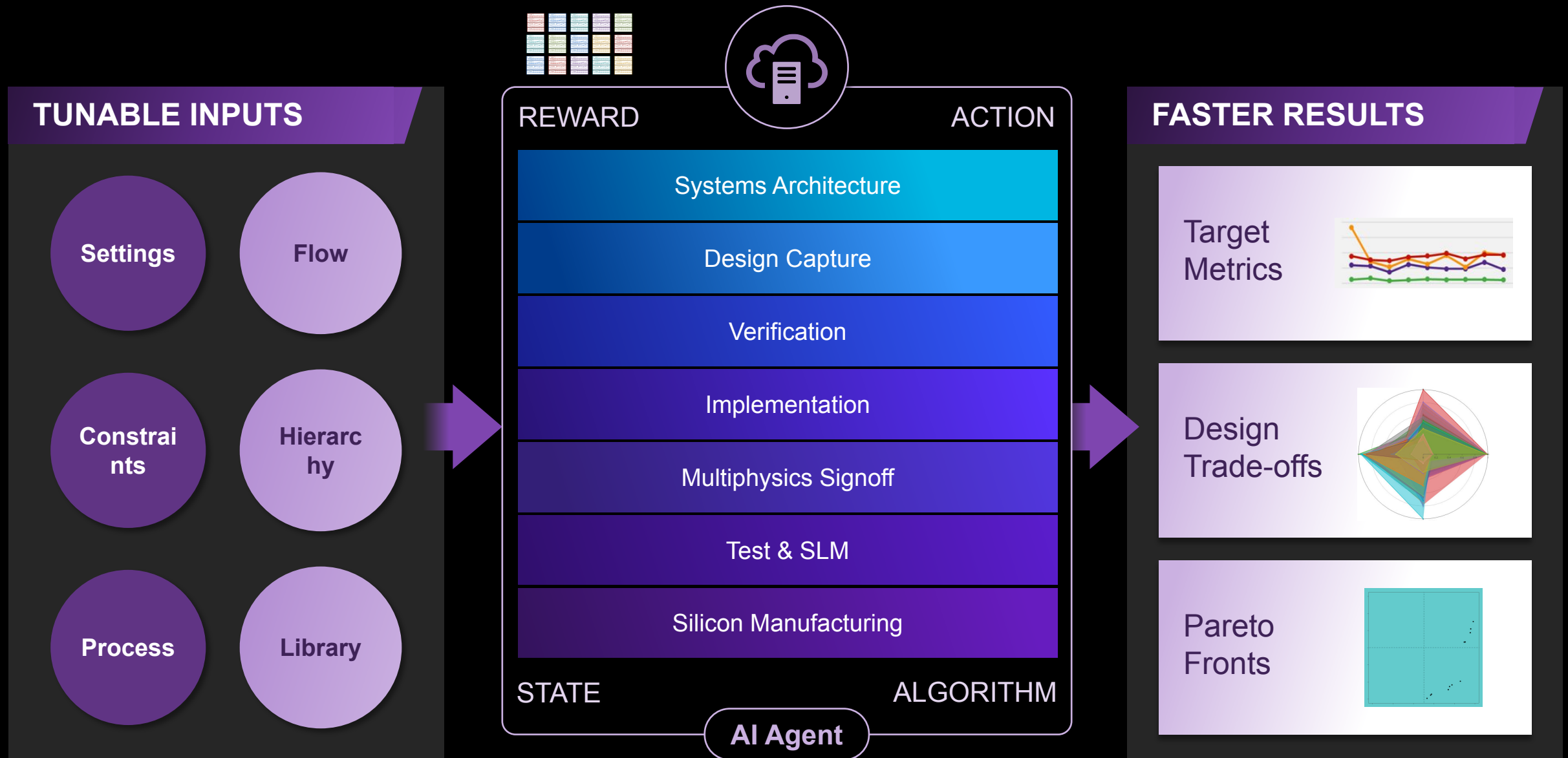
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# AI Can Accelerate Every Step of the EDA Workflow



# Applying AI to Navigate Chip Design Solution Space



# Value to Customers and Internal Users

**DSO.ai**

Up to **12%** Total Power Reduction, **25%** Less DRC, **200MHz** Higher Fmax

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**VSO.ai**

**3X** TAT, **45%** CPU Savings, **12%** Higher Coverage.

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**TSO.ai**

**15% to 35%** Pattern Count Reduction

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**ASO.ai**

**3X** Less Layout ECOs, **16%** Area Savings, **4X** Productivity

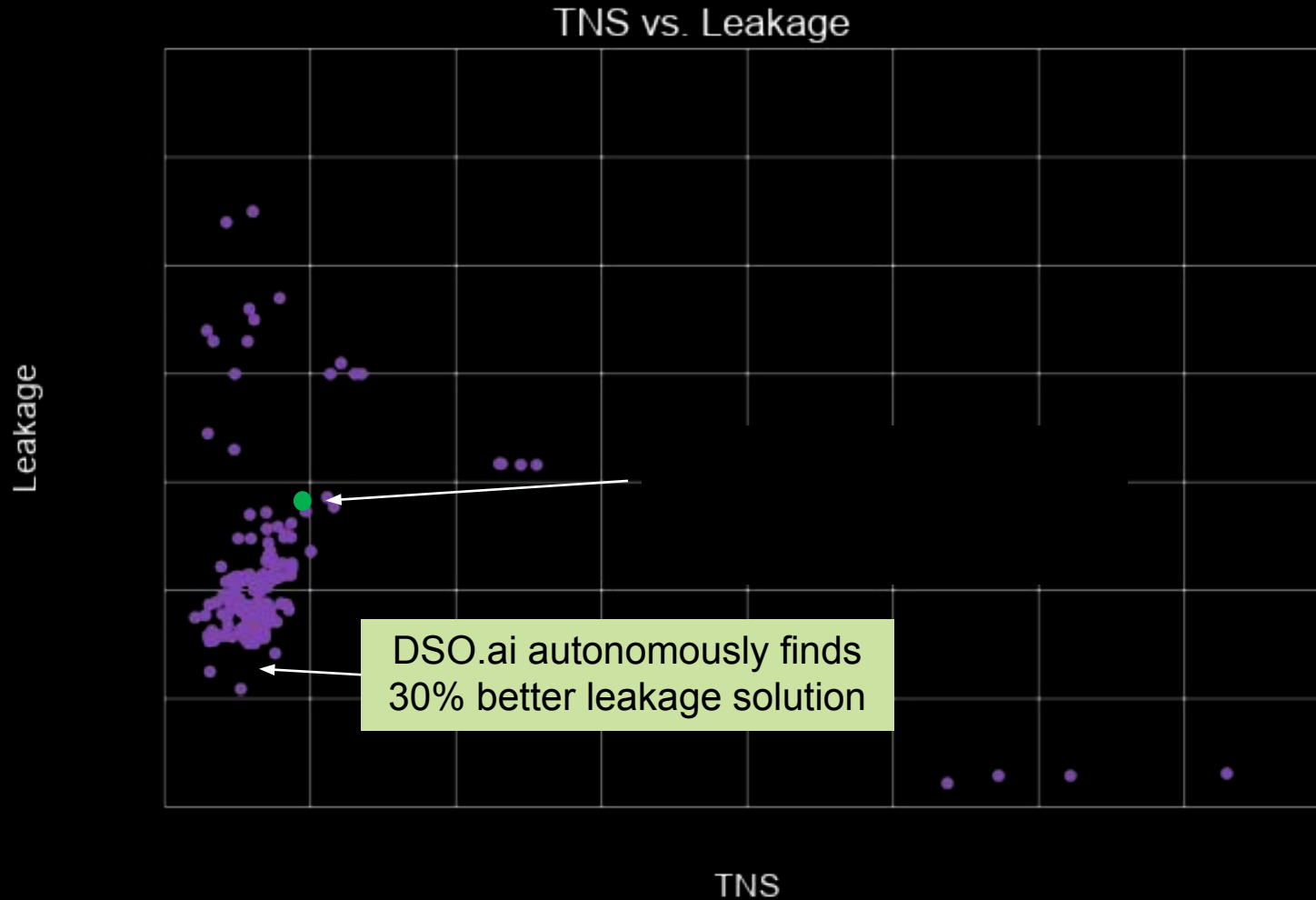
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**Assistants**

**>60** Person Time Savings in CSG, **40** Person Time Savings in IPG with Synopsys.ai Copilots

# DSO.ai: Design Space Optimization

Example: Exploring library cell parameters for better power



## Problem Statement:

Achieve lowest power while maintaining  
TNS <-100ns


## DSO Parameter Space

- Design, tool, flow parameters
- Library cell parameters


## Objectives (prioritized)

- Leakage
- TNS
- Plus secondary (DRC etc)


# DSO.ai: Delivering Highly Optimized PPA

  
28nm  
Image sensor


**12%**  
Area  
Shrink

  
4nm  
Mobile SoC

**25%**  
Lower  
Power

  
FinFET  
CPU


**20%**  
Faster  
TAT

  
7nm  
Automotive  
CPU

**3x**  
Productivity

  
5nm  
HPC

**4.5%**  
Fmax  
Boost

  
6nm  
Mobile

**6.5%**  
Smaller  
Area

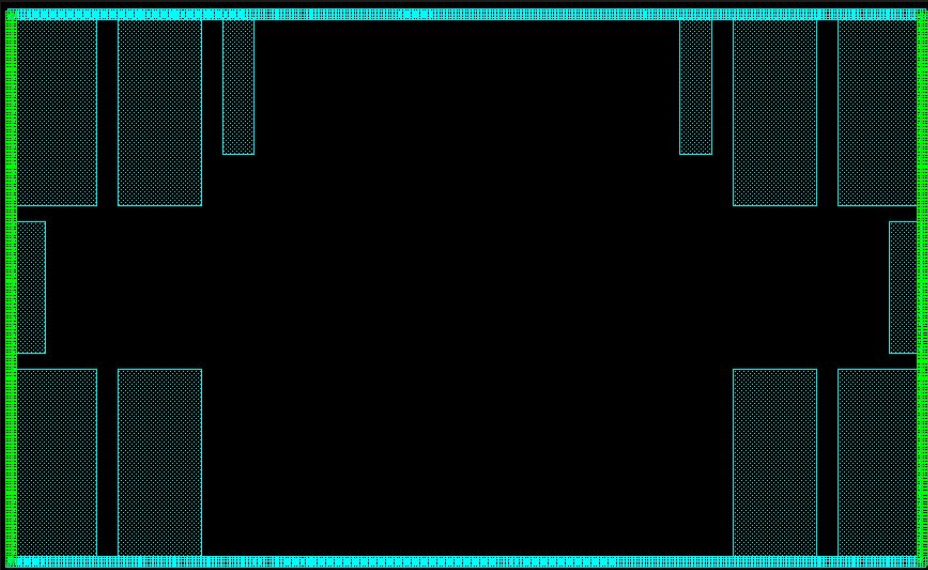
*\*Based on results from deployments at:*




# Digital Implementation: High Performance CPU Core

## AI-driven Optimization Results

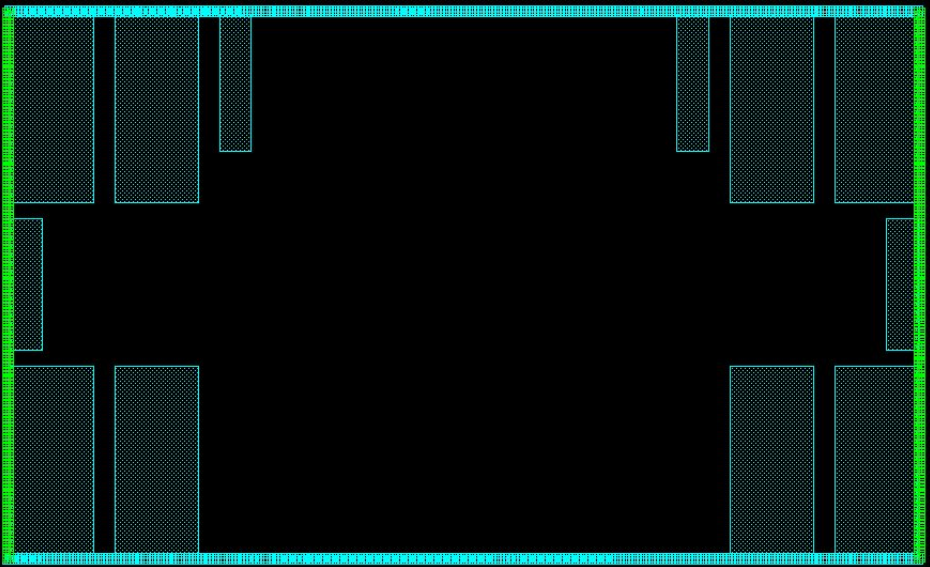
- RISC-V based “Big Core” targeted for data center applications
- Size: 426um x 255um (single core only)
- Technology process: 5nm




	Perf.	Power	Area
<b>Target</b> User Expectation	1.95Ghz	30mW	MET
<b>Baseline</b> OOTB RISC-V Reference Flow	1.75Ghz	29.8mW	MET
		<b>2 days, 90 runs, 0 human!</b>	
<b>DSO.ai</b> AI-Driven RISC-V Reference Flow	<b>1.95Ghz</b>	<b>27.9mW</b>	<b>MET</b>

# Node Migration using AI: High Performance CPU

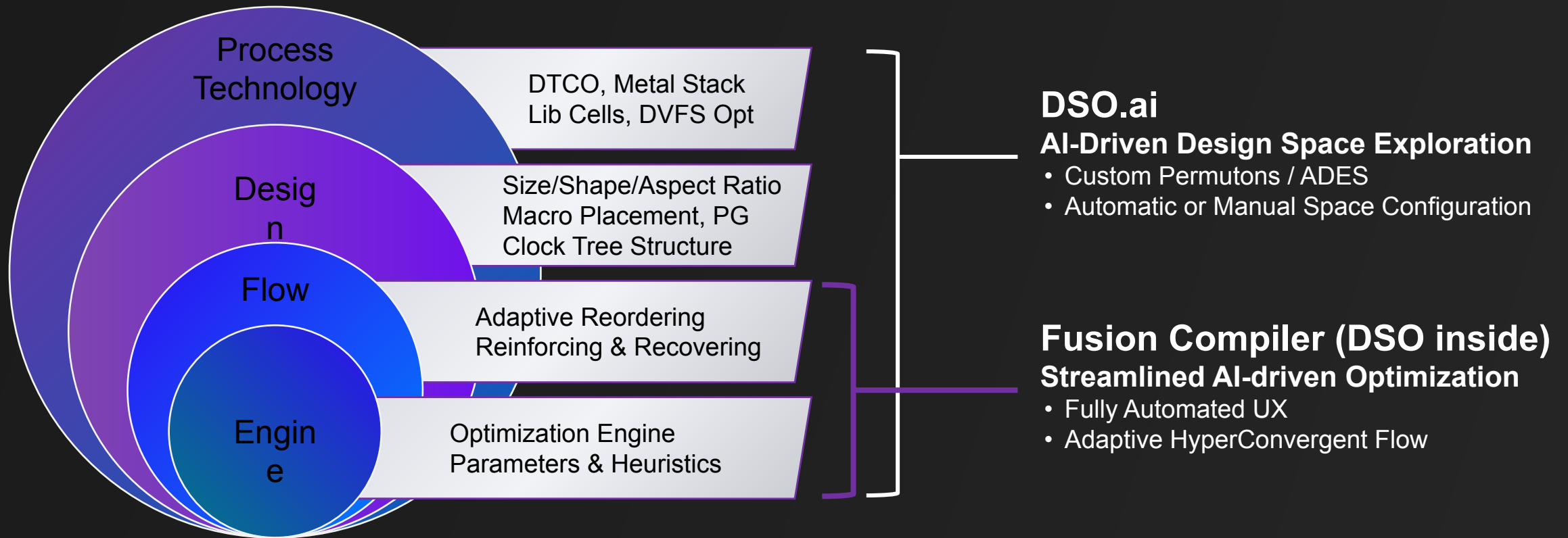
- RISC-V based “Big Core” targeted for data center applications
- Size: 404um x 242um (10% shrink)
- Technology: 5nm □ 4nm



	Perf.	Power	Area
<b>Target</b> User Expectation	2.1Ghz	30mW	-10%
<b>Baseline</b> OOTB RISC-V Reference Flow	1.85Ghz	28.4mW	-10%
 <b>1 days, 15 runs, 0 human!</b>			
<b>DSO.ai</b> AI-Driven RISC-V Reference Flow	<b>2.15Ghz</b>	<b>29.4mW</b>	<b>-10%</b>

# AI-Driven Digital Implementation Use Models

## Digital Design and Optimization Solution Space



# AI Applications in EDA

## MACHINE LEARNING

### Machine Learning Better, faster tools

ML within tools
ML-enhanced PT
ML-enhanced FC
ML-enhanced ICV
Ansys SimAI

## REINFORCEMENT LEARNING

### AI as an Optimizer Optimization of Results

DSO.AI	SYNOPSIS.AI	DATA ANALYTICS
	VSO.ai	Design.da
	TSO.ai	Fab.da
	ASO.ai	Silicon.da
	OptiSlang	

## GENERATIVE AI / LLMs

### AI as an Assistant Assistive & Creative Capabilities

ASSISTIVE	CREATIVE
Run Assistance	RTL Creation
Workflow Assistance	Testbench Creation
Knowledge Assistance	Assertion Creation
Ansys GPT	

## AGENTIC AI

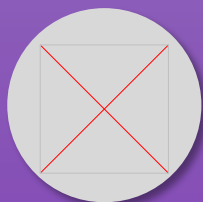
### AI as a Colleague Autonomous Tasks



Next Big Thing!

# Synopsys LLM-Based GenAI Vision & Strategy

## GenAI Apps for Chip Design



### Assistive

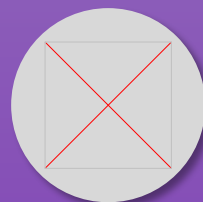
Assistive Features  
automating EDA workflow

Copilot

Knowledge Assistant

Run Assistant

Workflow Assistant



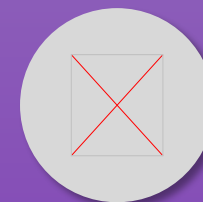
### Creative

Content Creation using  
Designer Assistant

RTL Assistant

Verification Assistant

Tech Collateral Assistant



### Autonomous

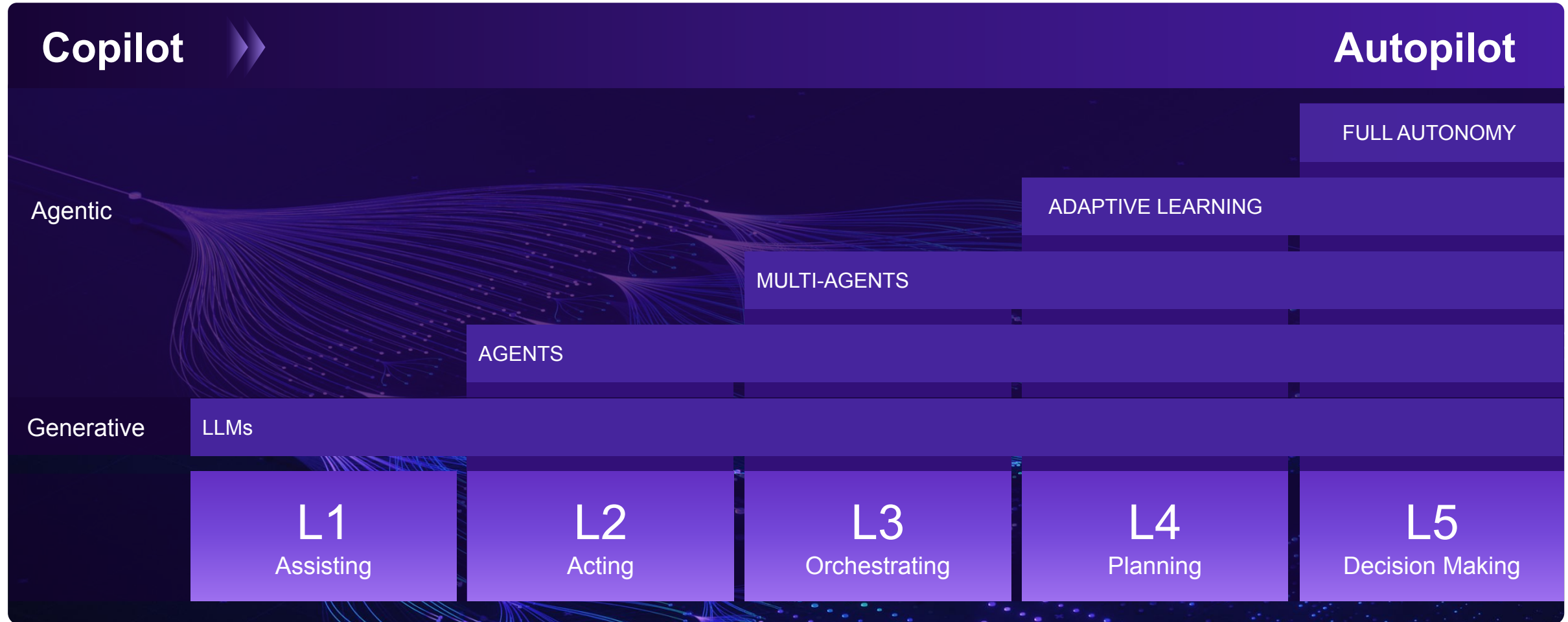
Automated workflows  
and content creation

RL agent workflow automation

Design creation

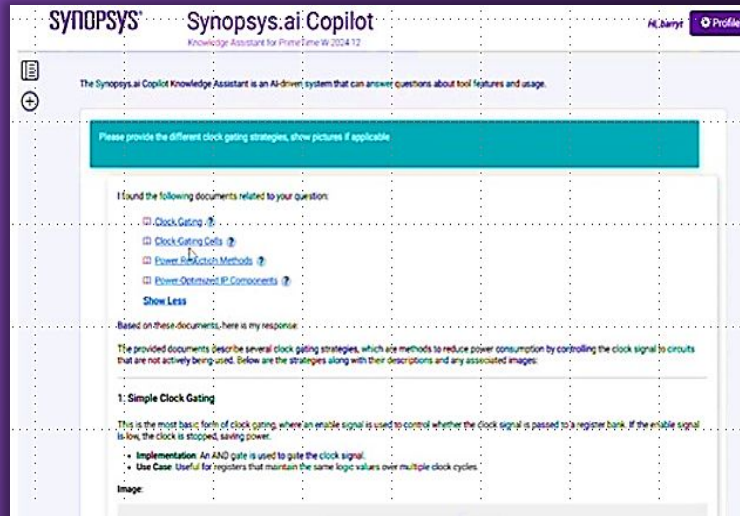
On-Prem / Cloud Enabled Optionality

# Agentic AI: Re-engineer EDA Workflows with AgentEngineer™



# Synopsys.ai Copilot Apps to Boost Everyday Productivity

## Knowledge Assistant

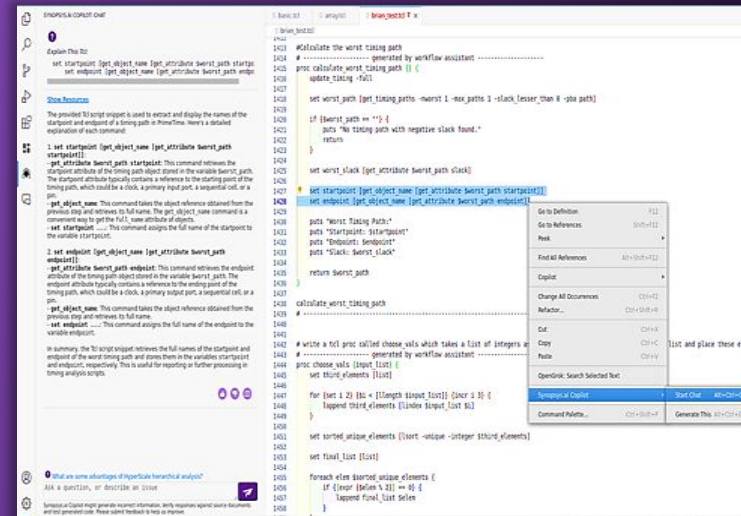


Answer tool / flow questions

Faster time-to-answers:  
tools, flows, Jiras

13 Tools: FC, PT, VCS, PS,...

## Workflow Assistant

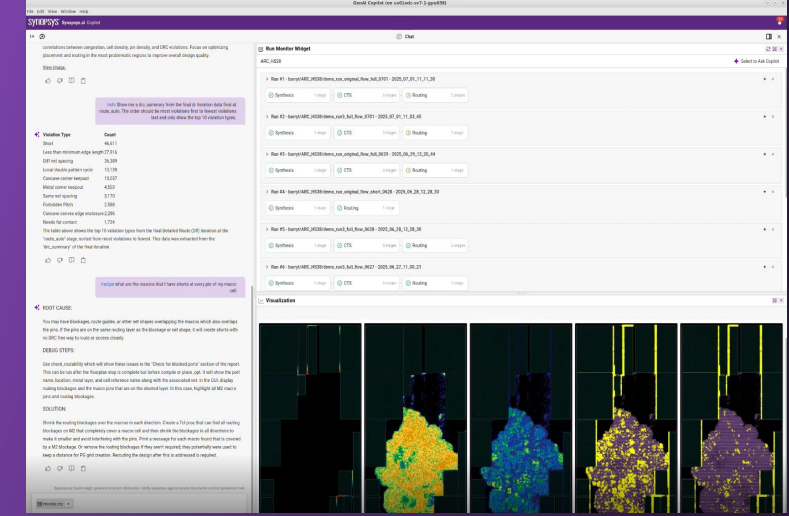


Generate & optimize tool scripts

Faster time-to-solution:  
script creation, optimization

FC, PT, CC, PW ...

## Run Assistant



Analyze, debug designs,  
suggest next steps

Faster time-to-solution:  
Design and run debug

FC, PT, Verdi ...

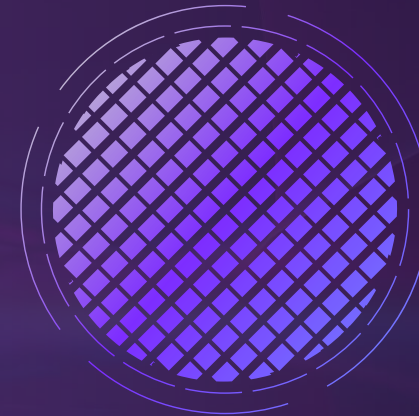
# THE ERA OF PERVASIVE INTELLIGENCE



Artificial  
Intelligence

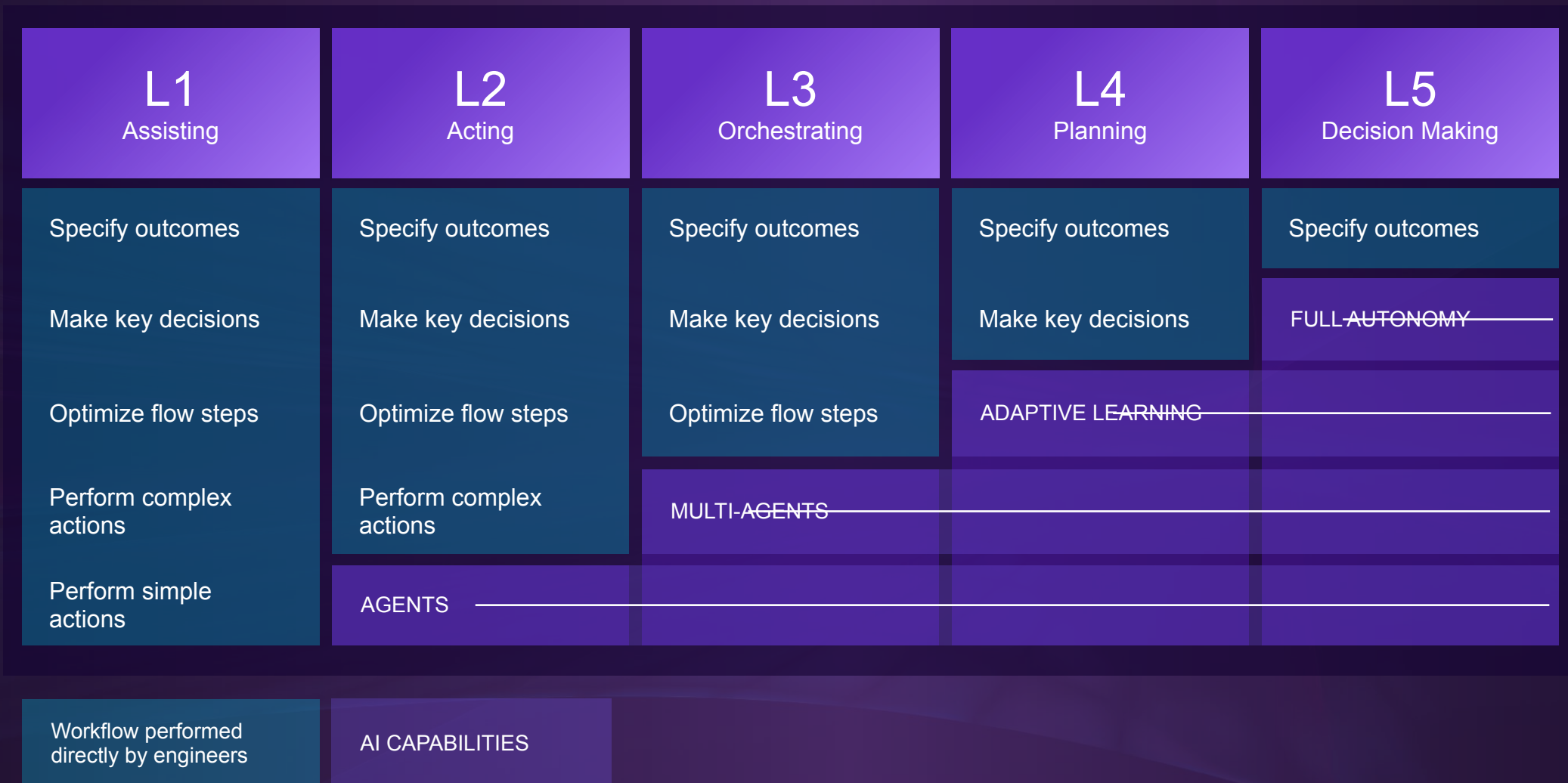


Software Defined  
Systems



Silicon  
Proliferation

# Transformation of Workflows



# SUMMARY

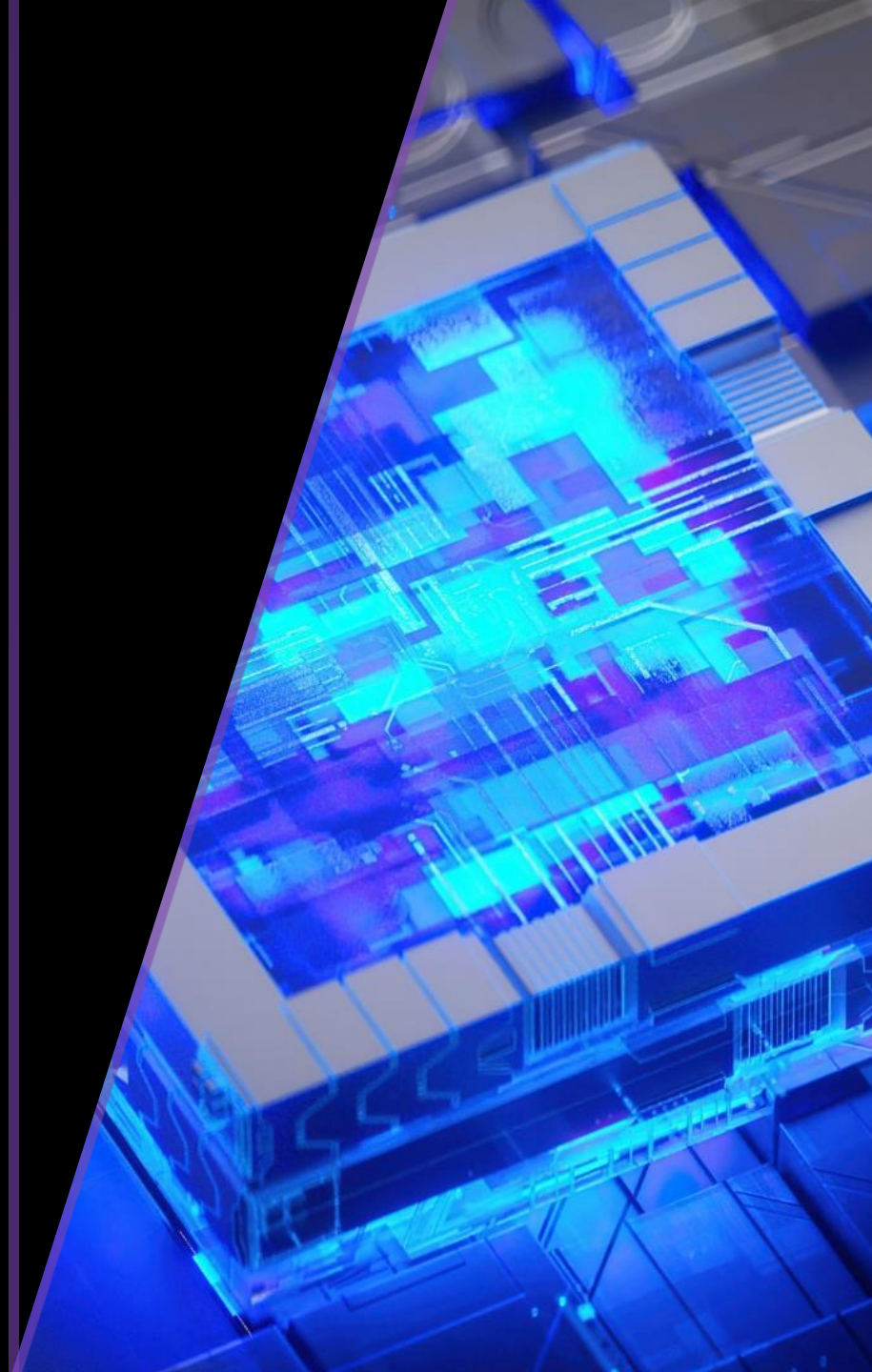
## Intelligent Systems

### AI/Machine Learning in Engineering Simulation

- Use solvers to train the AI/ML models to speed up simulation
- Design space exploration
- Generate new models
- Foundational models to speed up simulation
- Engineering co-pilots and agents to improve ease of use of simulation

### AI/Machine Learning in EDA

- Machine Learning within tools
- Reinforcement Learning in Optimization
- Generative AI
- Agentic AI



**SYNOPSYS<sup>®</sup>**

Thank you