The Partner For Success

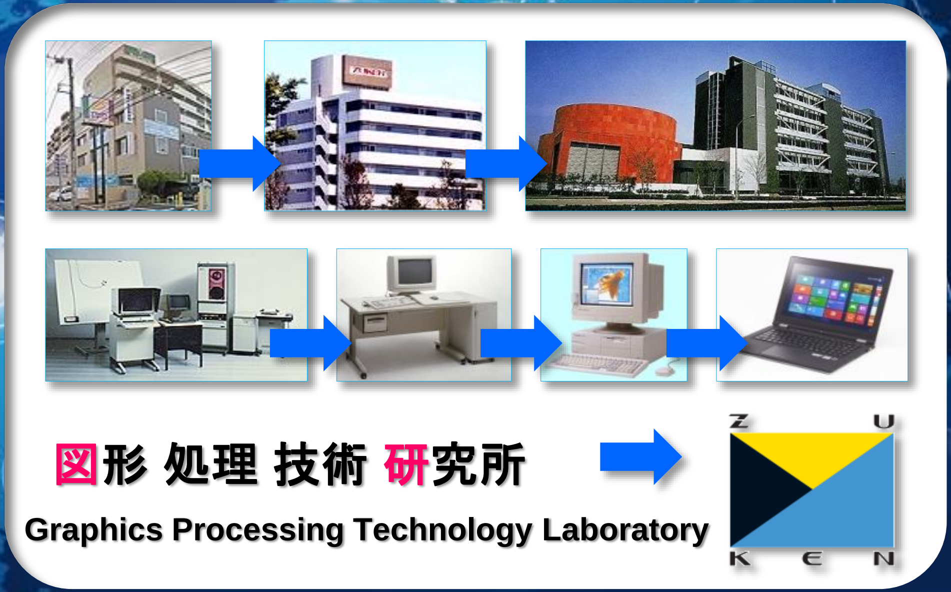
EDA Support and Roadmap for 3D Printing of Electronics

Humair Mandavia – Chief Strategy Officer

Agenda

- Zuken Corporate and Solution Overview
- CR-8000 : System-level Design Platform
- Challenges and Roadmap for 3D Printing of Electronics

Zuken Corporate Overview



図形 処理 技術 研究所

Graphics Processing Technology Laboratory

Zuken is a Global Operation

Zuken GmbH
European Headquarters
Munich, Germany

Zuken Inc.
Worldwide Headquarters
Yokohama, Japan

Zuken USA Inc.
North American Headquarters
Westford, Massachusetts

More Than 30 Offices Worldwide

Zuken Technology Scope

Leading-edge EDA/CAE System integrated with Enterprise PLM

Engineering Design Automation for Electrical Design Process, CAD/CAM/CAE, Co-Design

System-level Electronics & Conceptual Design

System-level Circuit & PCB design & DFM

Inteconnection design with Wire-Harness or Flexible PCB

System-in-Package & Module Design & DFM

SOC/PKG/PCB Collaboration Design & DFM

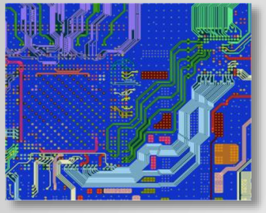
Electro-Mechanical Collaboartion Design

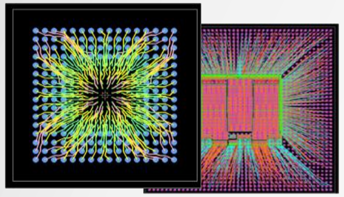
Product Data Management, Product Lifecycle management for Electric & Electronic Products

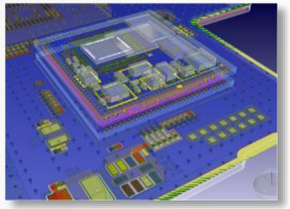
Library Management & Design Data Management

Integration as Electric and Electronic EDM with Enterprise PLM Environment

Targets of Zuken's Design & Manufacturing Solution


Single Board
Design


Single Chip
Multichip (Flat Layout)
Package Design

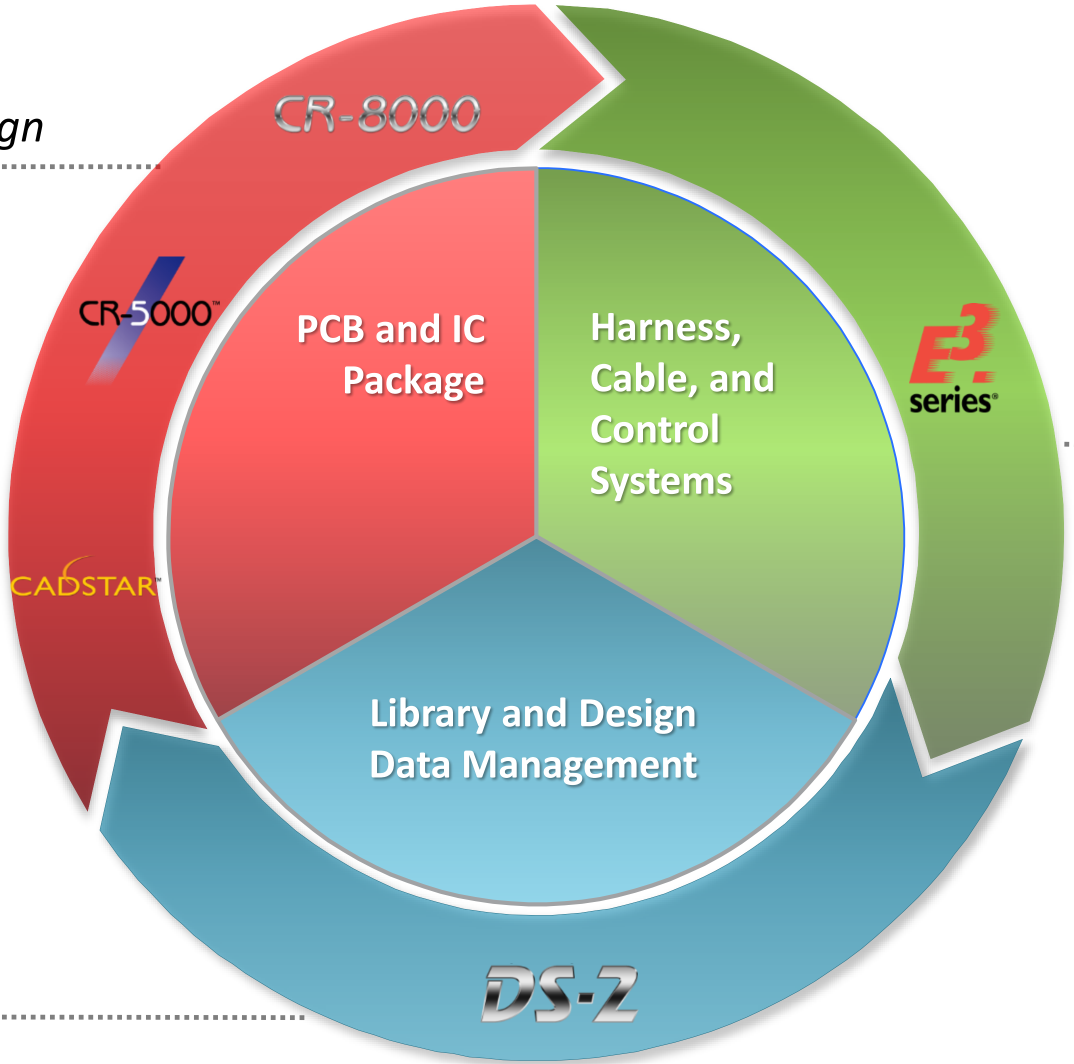

System in Package Design
3D/2.5D/TSV Chip Stack
& PoP/PiP Module


System in BOX
Multi-Boards with
Wire-Harness/Flexible-PCB


System of Systems
with Units &
Wire-harness/Network

Zuken Product Portfolio

A Reliable Partner for Electrical and Electronic Design



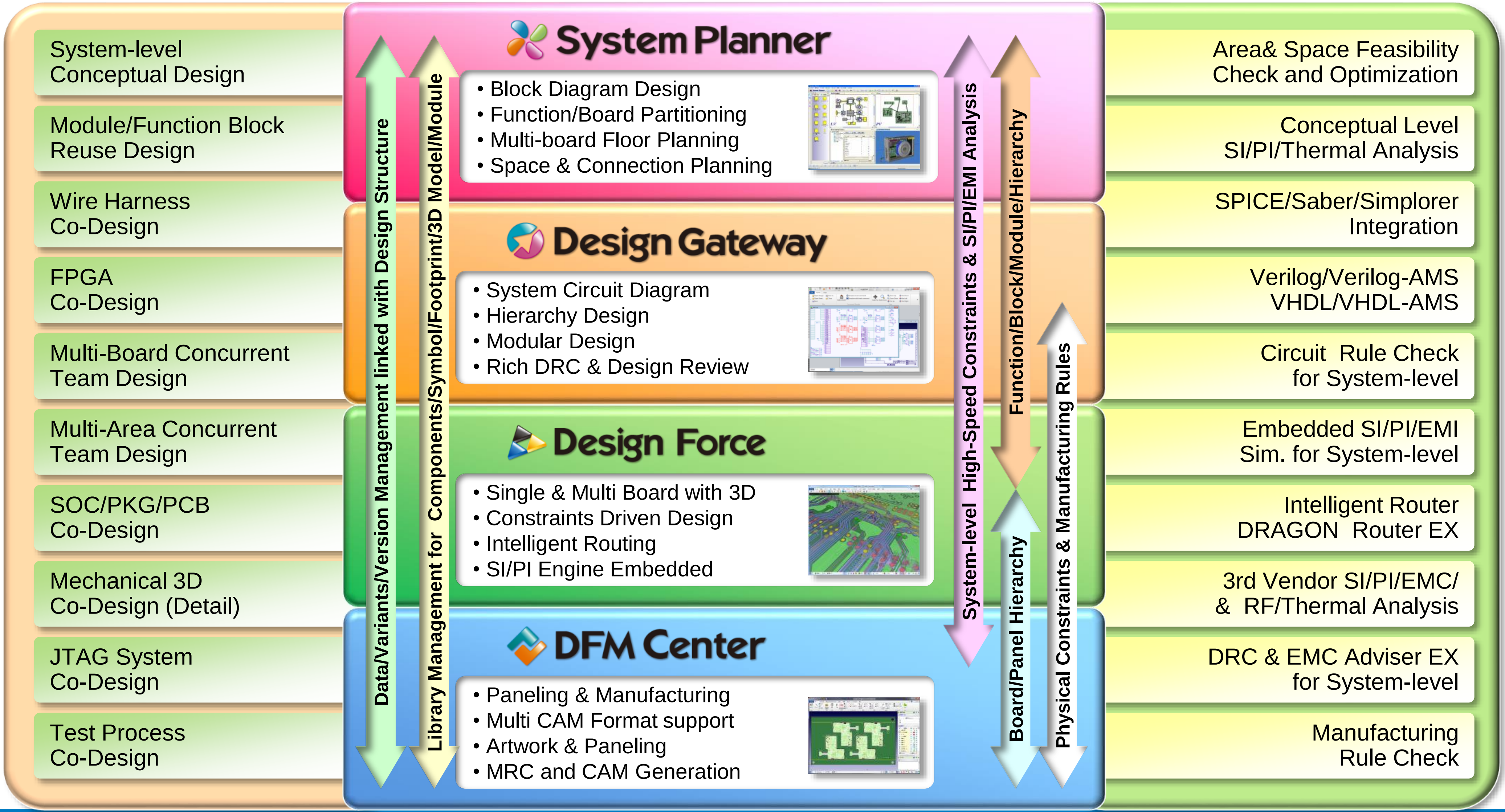
Product-centric design

Intelligent electrical design

Engineering data management

CR-8000: System-level Design Platform

CR-8000: System-level Design Platform



System-level
Conceptual Design

Module/Function Block
Reuse Design

Wire Harness
Co-Design

FPGA
Co-Design

Multi-Board Concurrent
Team Design

Multi-Area Concurrent
Team Design

SOC/PKG/PCB
Co-Design

Mechanical 3D
Co-Design (Detail)

JTAG System
Co-Design

Test Process
Co-Design

System Planner

- Block Diagram Design
- Function/Board Partitioning
- Multi-board Floor Planning
- Space & Connection Planning

Design Gateway

- System Circuit Diagram
- Hierarchy Design
- Modular Design
- Rich DRC & Design Review

Design Force

- Single & Multi Board with 3D
- Constraints Driven Design
- Intelligent Routing
- SI/PI Engine Embedded

DFM Center

- Paneling & Manufacturing
- Multi CAM Format support
- Artwork & Paneling
- MRC and CAM Generation

Area& Space Feasibility
Check and Optimization

Conceptual Level
SI/PI/Thermal Analysis

SPICE/Saber/Simplorer
Integration

Verilog/Verilog-AMS
VHDL/VHDL-AMS

Circuit Rule Check
for System-level

Embedded SI/PI/EMI
Sim. for System-level

Intelligent Router
DRAGON Router EX

3rd Vendor SI/PI/EMC/
& RF/Thermal Analysis

DRC & EMC Adviser EX
for System-level

Manufacturing
Rule Check

Key Focus Areas for CR-8000

Technology

Latest Technologies

SW/HW/App

Collaboration

Boundary-free Design Process

Co-Design

Globalization

Global Partners for Global Competition

Flexible Process

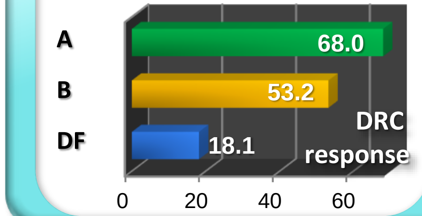
Supporting the Latest Technologies with CR-8000

Technology

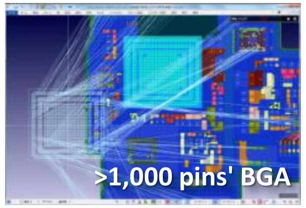
Latest Technologies

World’s highest performance with large Scale Design Data

High-Performance Verification



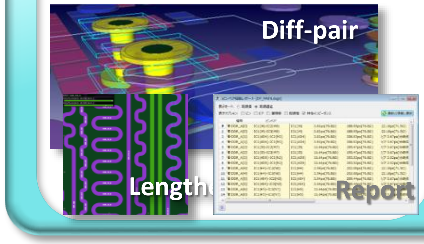
High-Performance Design



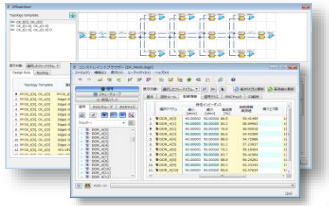
Ultra-Large Scale Design

Intuitive User Interface, Unified Interactive & Automatic Design

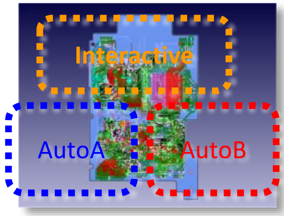
Differential VIA/Rules by area



Integrated Constraint Browser

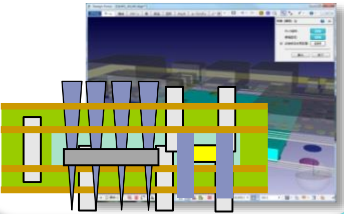


Interactive & Auto-Routing

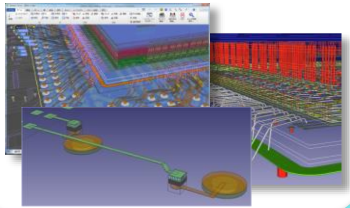


Supporting New PCB/SIP/3D-IC Technologies with Native 3D Graphics

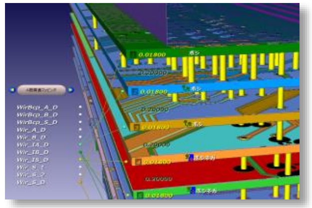
Embedded Components



PoP/PiP/3D-IC/TSV



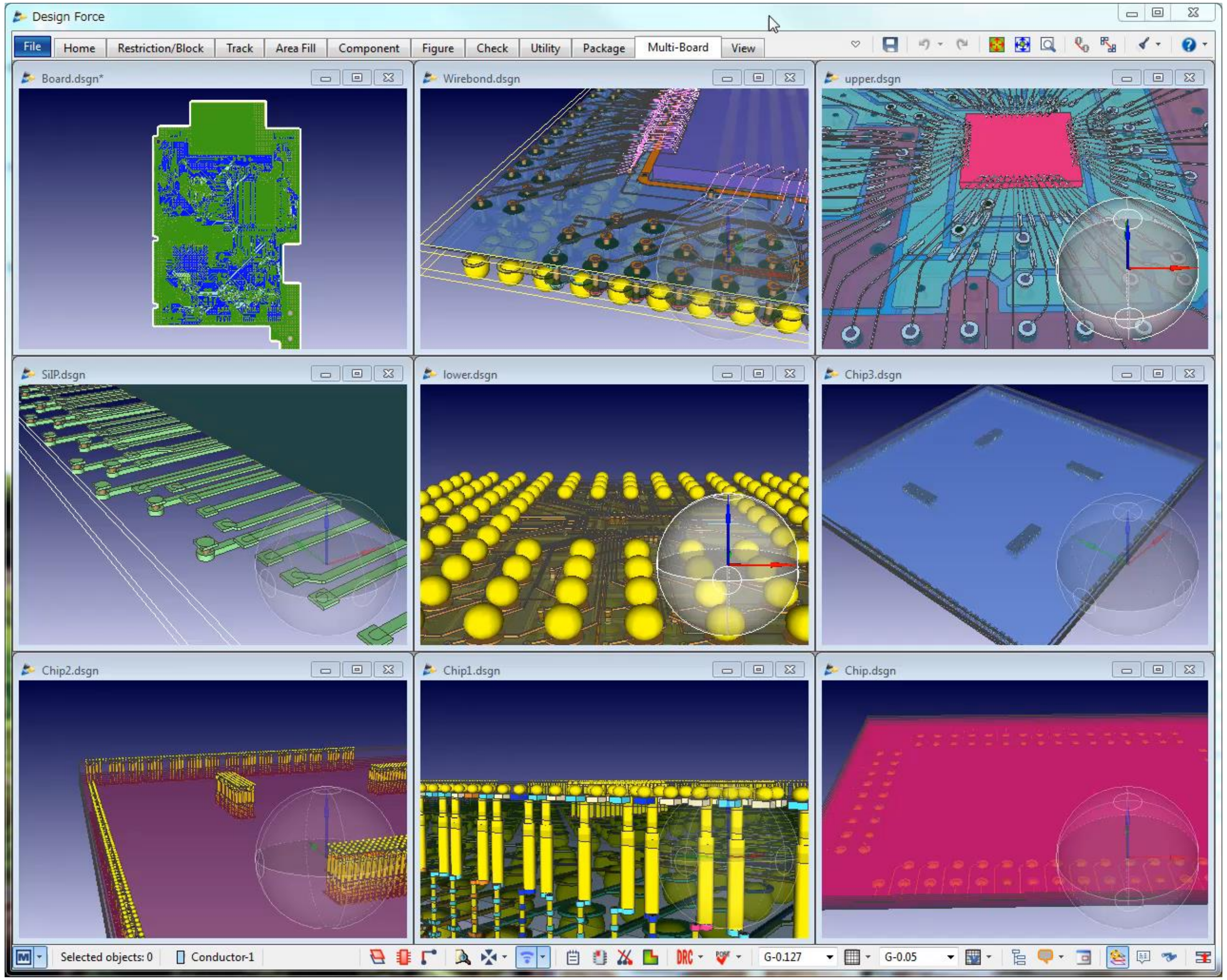
Dynamic Technology Editing



Supporting the Latest Technologies with CR-8000

Technology

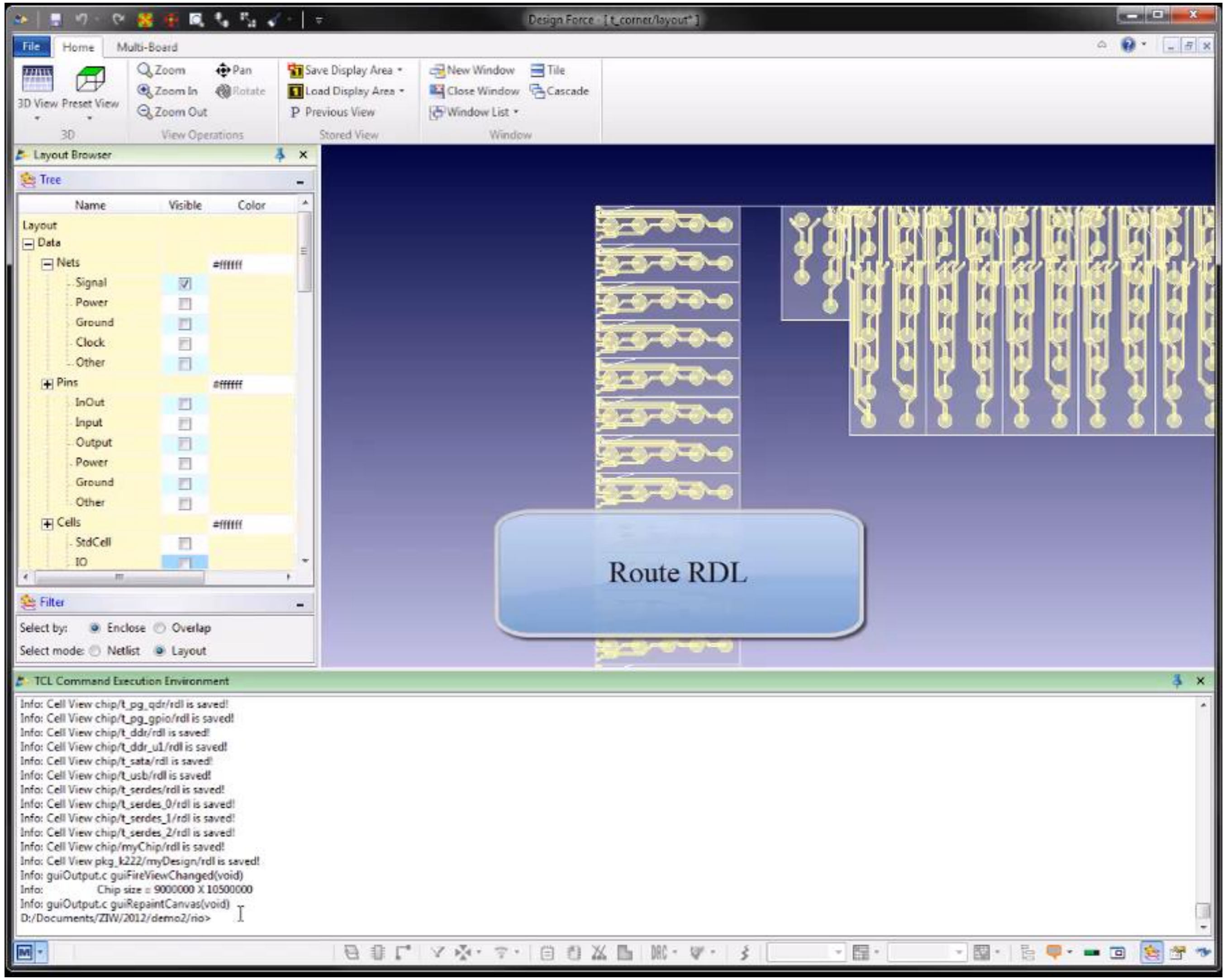
Latest Technologies



Supporting the Latest Technologies with CR-8000

Technology

Latest
Technologies



Select by: ● Enclose ○ Overlap

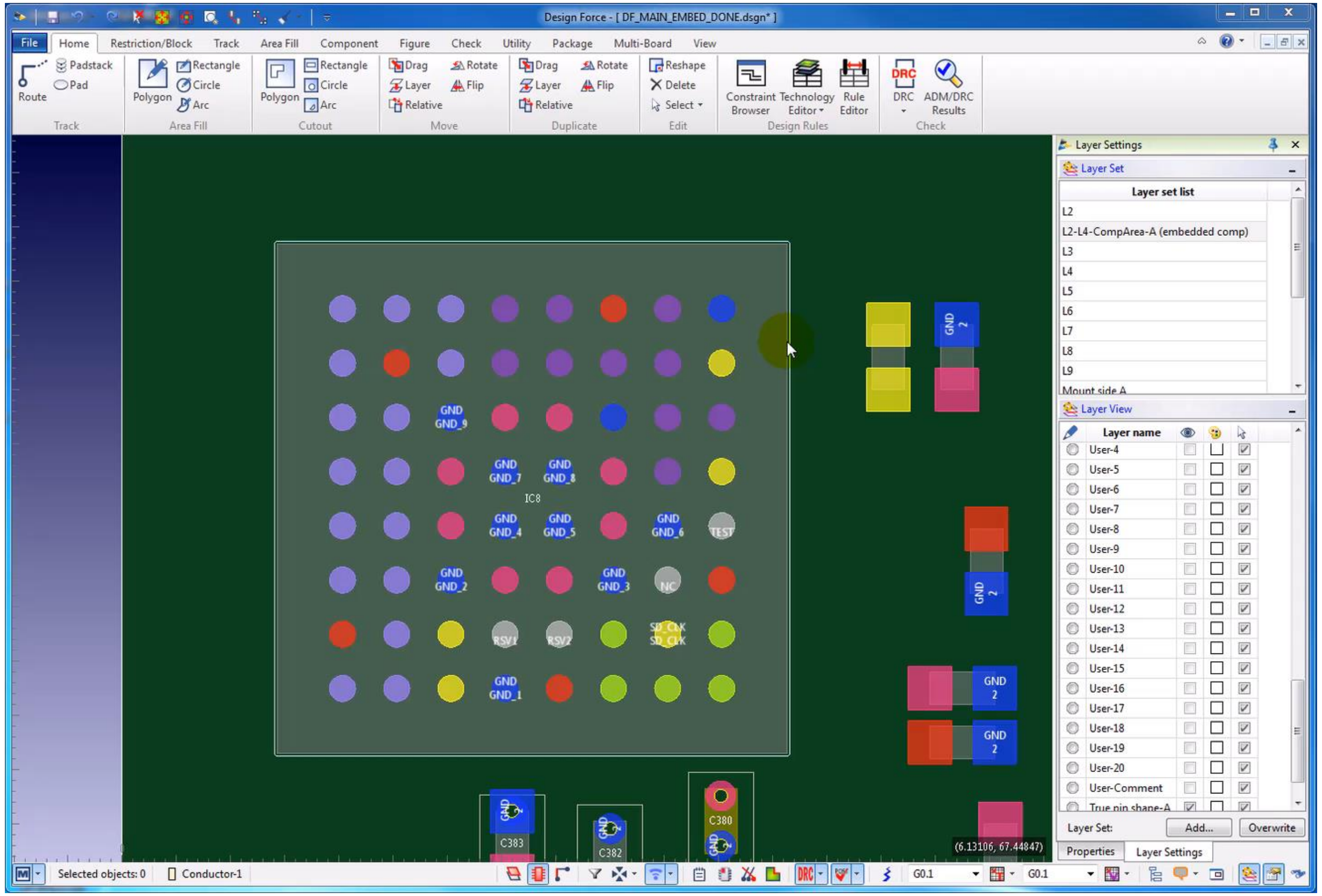
Select mode: ○ Netlist ● Layout

```
Info: Cell View chip/t_pg_qdr/rdl is saved!
Info: Cell View chip/t_pg_gpio/rdl is saved!
Info: Cell View chip/t_ddr/rdl is saved!
Info: Cell View chip/t_ddr_u1/rdl is saved!
Info: Cell View chip/t_sata/rdl is saved!
Info: Cell View chip/t_usb/rdl is saved!
Info: Cell View chip/t_serdes/rdl is saved!
Info: Cell View chip/t_serdes_0/rdl is saved!
Info: Cell View chip/t_serdes_1/rdl is saved!
Info: Cell View chip/t_serdes_2/rdl is saved!
Info: Cell View chip/myChip/rdl is saved!
Info: Cell View pkg_k222/myDesign/rdl is saved!
Info: guiOutput.c guiFireViewChanged(void)
Info:            Chip size = 9000000 X 10500000
Info: guiOutput.c guiRepaintCanvas(void)
D:/Documents/ZIW/2012/demo2/rio>
```

Supporting the Latest Technologies with CR-8000

Technology

Latest Technologies

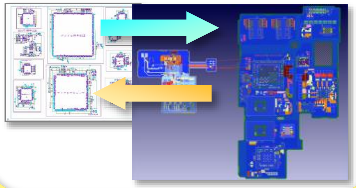


Enabling Collaboration with CR-8000

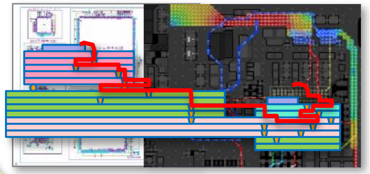
Boundary-free Design Process

Design & Review with System-level Design (PCBs & Interconnections)

System-level DRC & Verification



System-level SI/PI Analysis

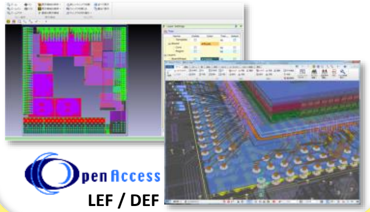


CR-8000 Technology Partners

KEYSIGHT TECHNOLOGIES
NATIONAL INSTRUMENTS
CST
SYNOPSYS® Accelerating Innovation
SiSoft
ANSYS

Collaboration with Other Design Process

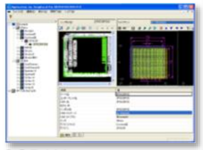
SoC/PKG/PCB Co-Design



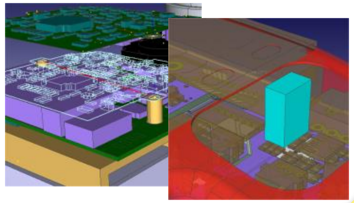
OpenAccess
LEF / DEF

FPGA Co-Design

GPM
Microsemi
ALTERA
LATTICE SEMICONDUCTOR
XILINX ALLIANCE PROGRAM



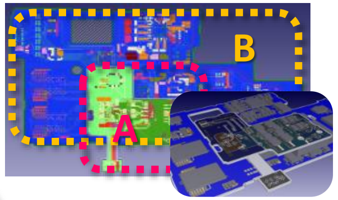
Electro-Mechanical Co-Design



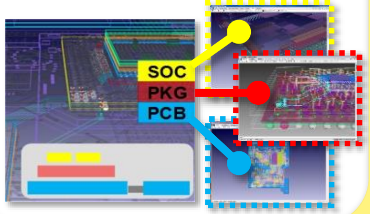
Concurrent Parallel Design & Team Design from Different Locations

Multi-Area Concurrent Design

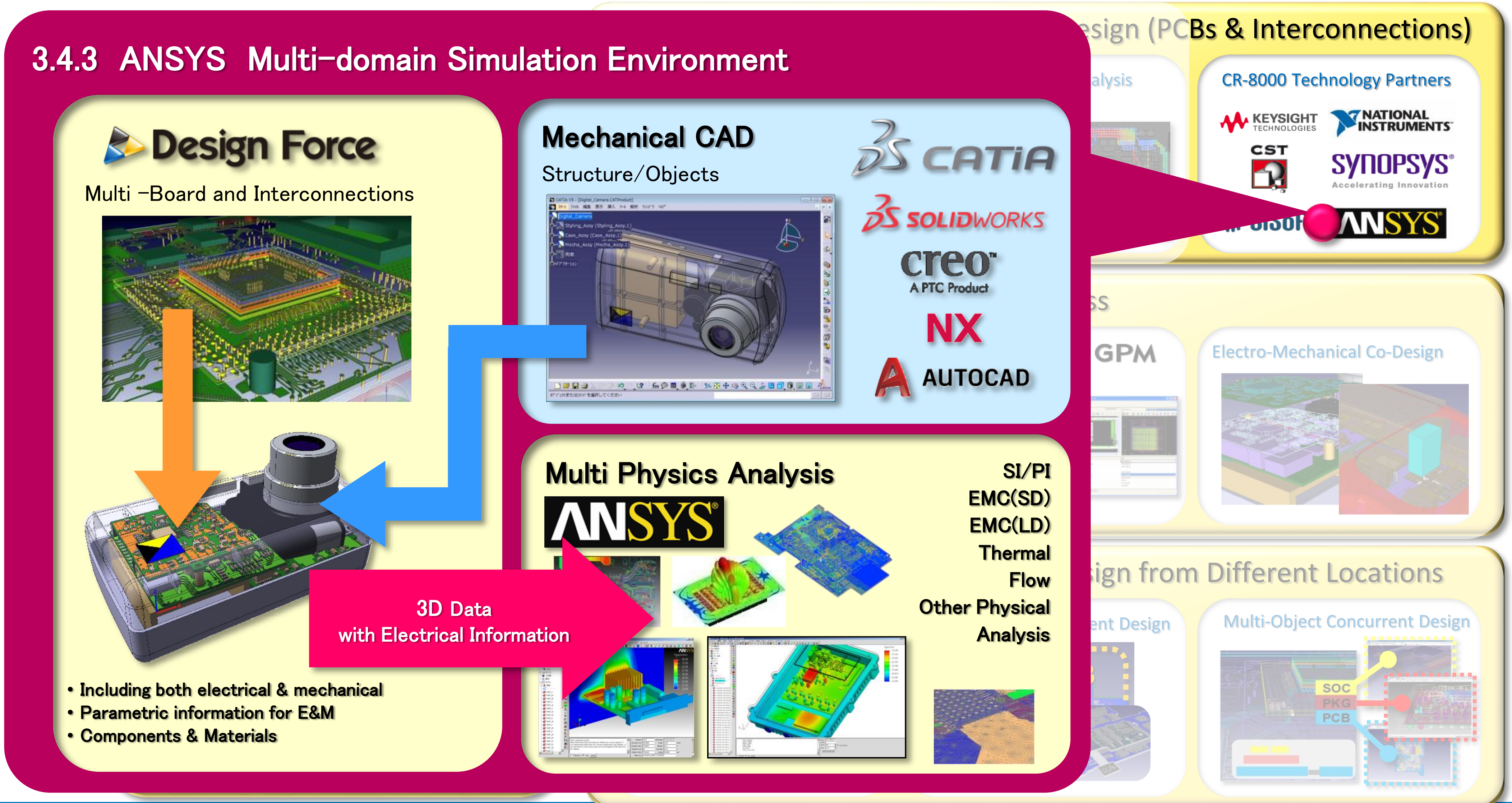
Multi-Board Concurrent Design



Multi-Object Concurrent Design



Enabling Collaboration with CR-8000



3.4.3 ANSYS Multi-domain Simulation Environment

Design Force

Multi –Board and Interconnections

- Including both electrical & mechanical
- Parametric information for E&M
- Components & Materials

Mechanical CAD

Structure/Objects

Multi Physics Analysis

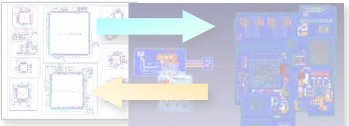
SI/PI
EMC(SD)
EMC(LD)
Thermal
Flow
Other Physical
Analysis

3D Data
with Electrical Information

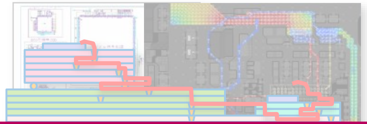
Enabling Collaboration with CR-8000

Design & Review with System-level Design (PCBs & Interconnections)

System-level DRC & Verification

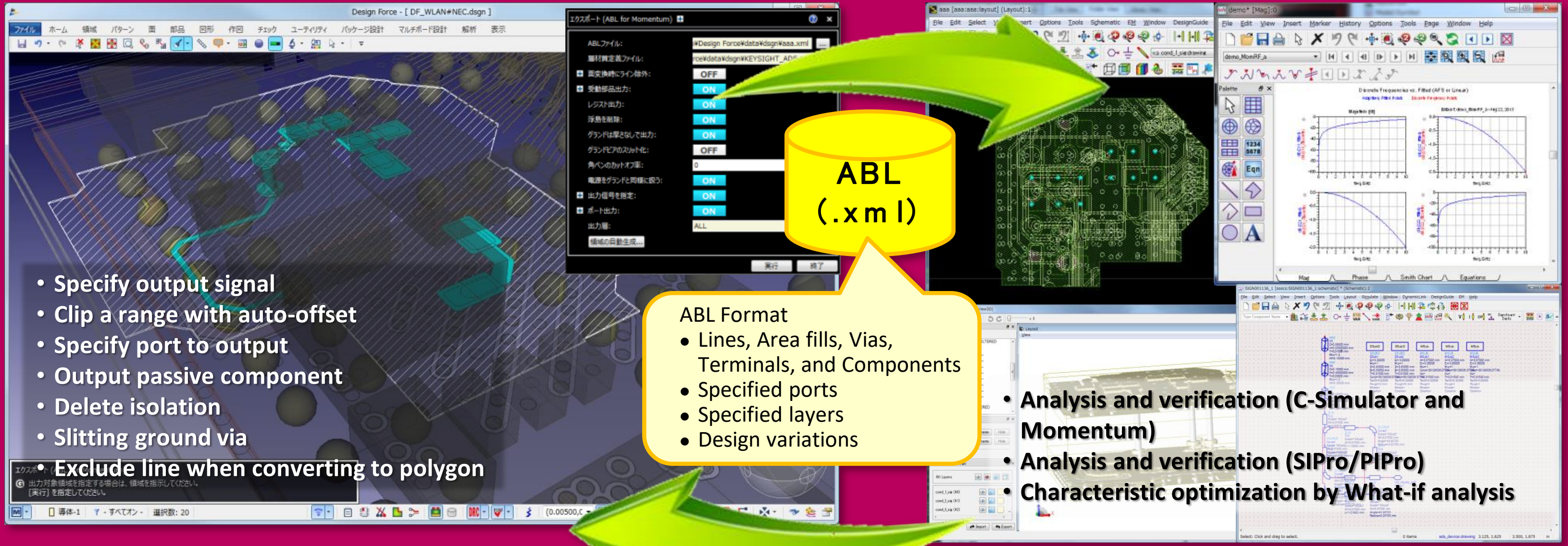


System-level SI/PI Analysis



CR-8000 Technology Partners

3.4.4 Interface and collaboration with RF design and analysis environments



- Specify output signal
- Clip a range with auto-offset
- Specify port to output
- Output passive component
- Delete isolation
- Slitting ground via
- Exclude line when converting to polygon

ABL (.xml)

ABL Format
- Lines, Area fills, Vias, Terminals, and Components
- Specified ports
- Specified layers
- Design variations

- Analysis and verification (C-Simulator and Momentum)
- Analysis and verification (SIPro/PIPro)
- Characteristic optimization by What-if analysis

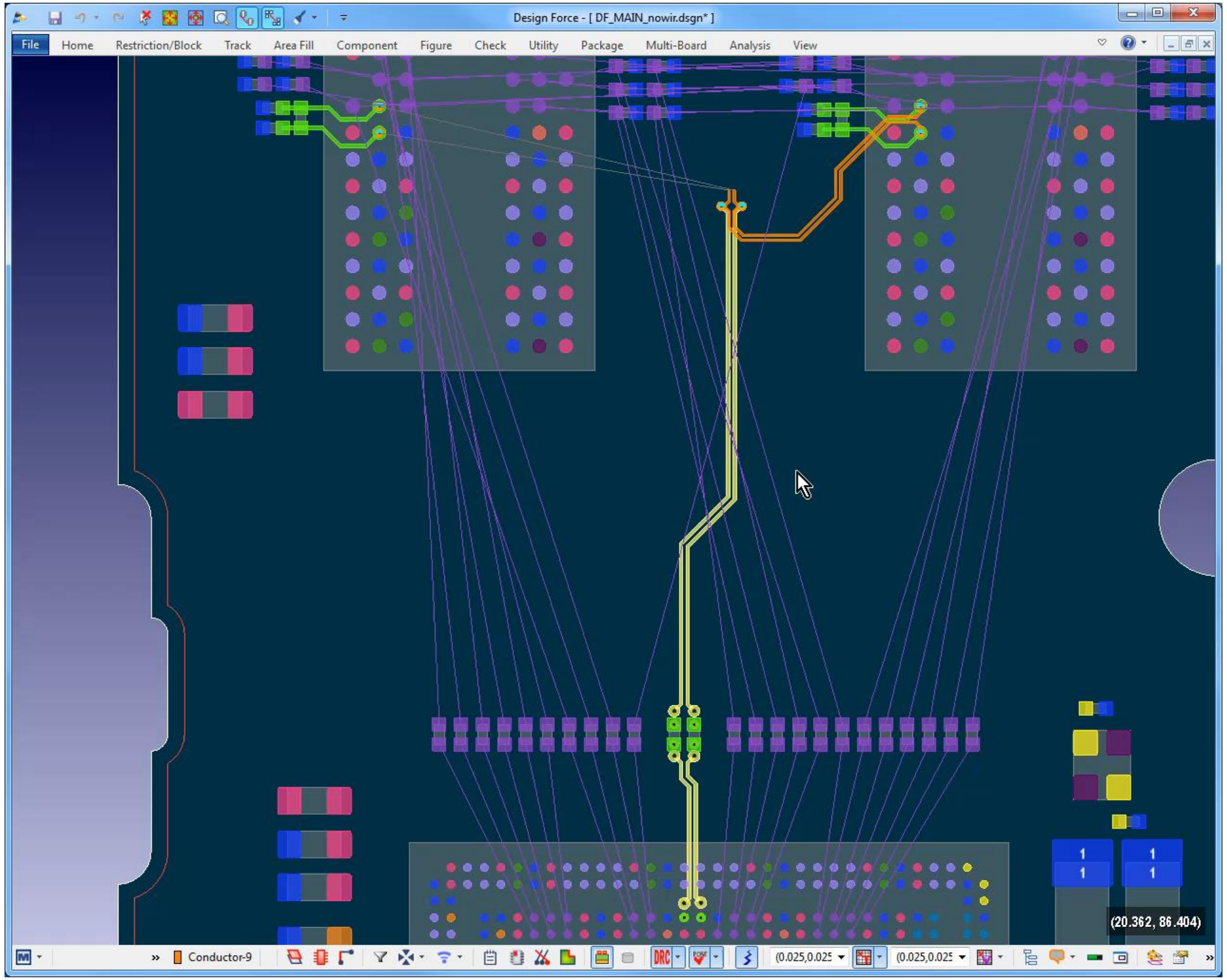
Design Force

KEYSIGHT TECHNOLOGIES

Enabling Collaboration with CR-8000

Collaboration

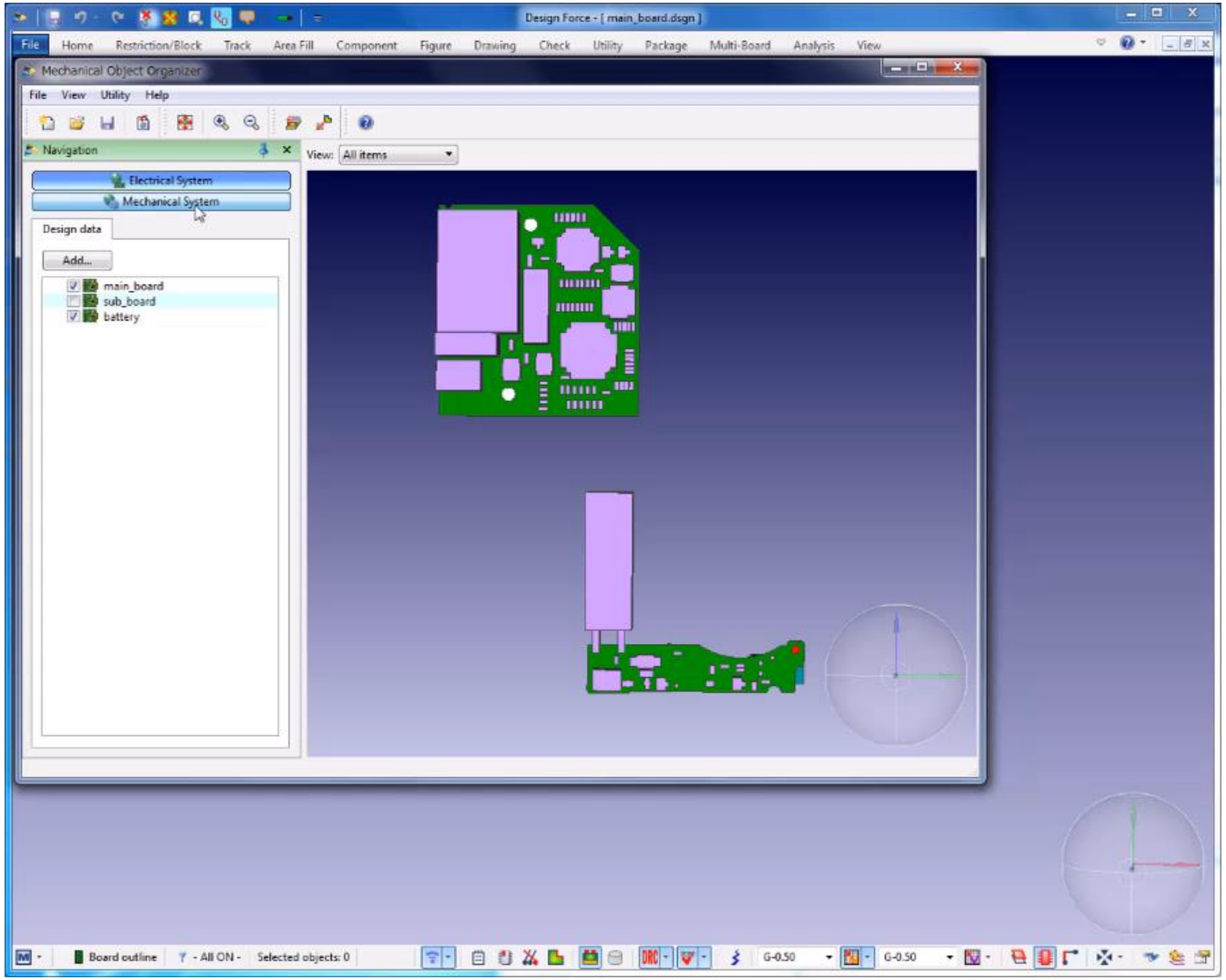
Boundary-free Design Process



Enabling Collaboration with CR-8000

Collaboration

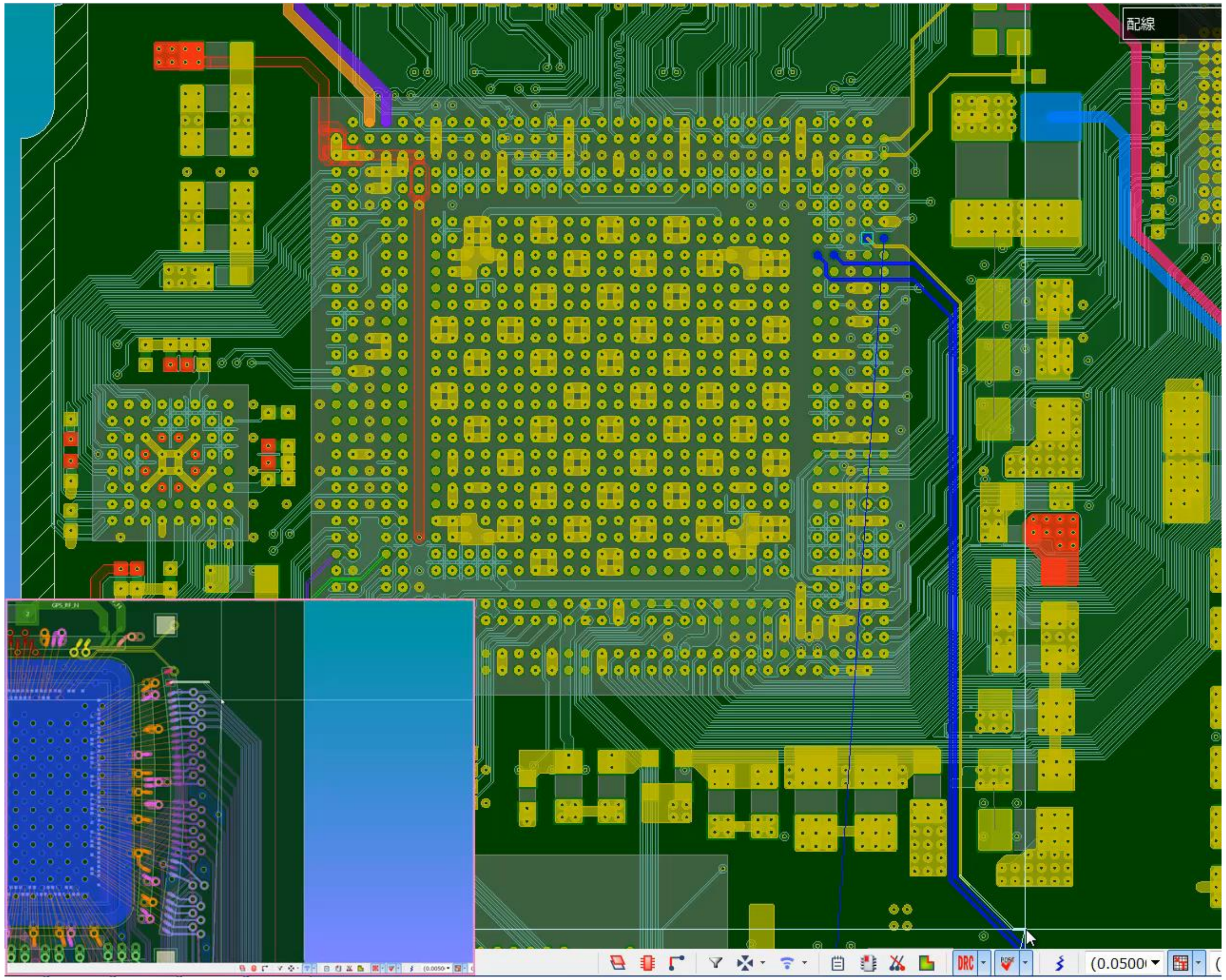
Boundary-free
Design Process



Enabling Collaboration with CR-8000

Collaboration

Boundary-free Design Process



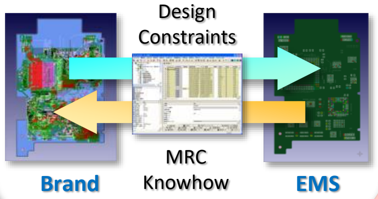
Promoting Globalized Engineering of Electronics

Globalization

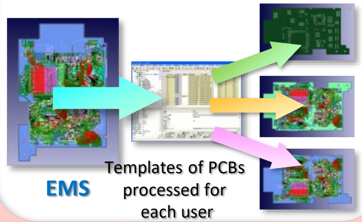
Global Partners for Global Competition

IP management with Design and Manufacture Data for BPO

Excluding IP from Design


Design Constraints
MRC Knowhow
Brand
EMS

Automatic IP Optimization

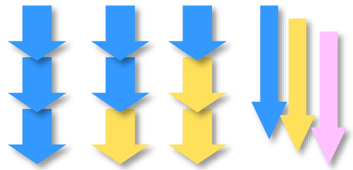

EMS
Templates of PCBs processed for each user

Improved output format

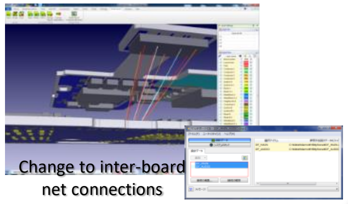
ODB++ Solutions Alliance
IPC-2581 CONSORTIUM
PDF Adobe
3DS SPATIAL
JEITA
Tech Soft 3D
JPCA

Flexible Design & Manufacture Process

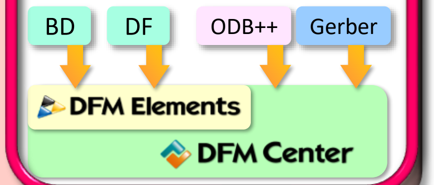
Vertical Design & Parallel Design



System-level Design Change

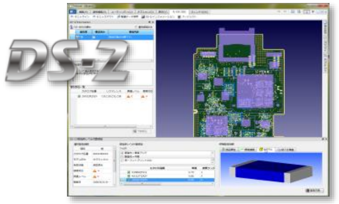

Change to inter-board net connections with Multi-board CB

Multi Format CAM In/Out

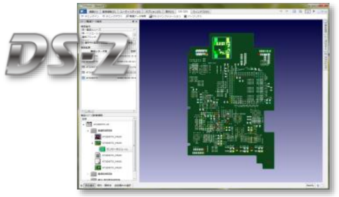

BD
DF
ODB++
Gerber
DFM Elements
DFM Center

Integration with DS-2, Open SDK for customer development

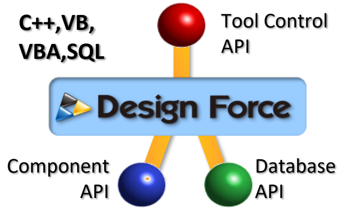
DS-2 Embedded with CR-8000



Modular Design Method



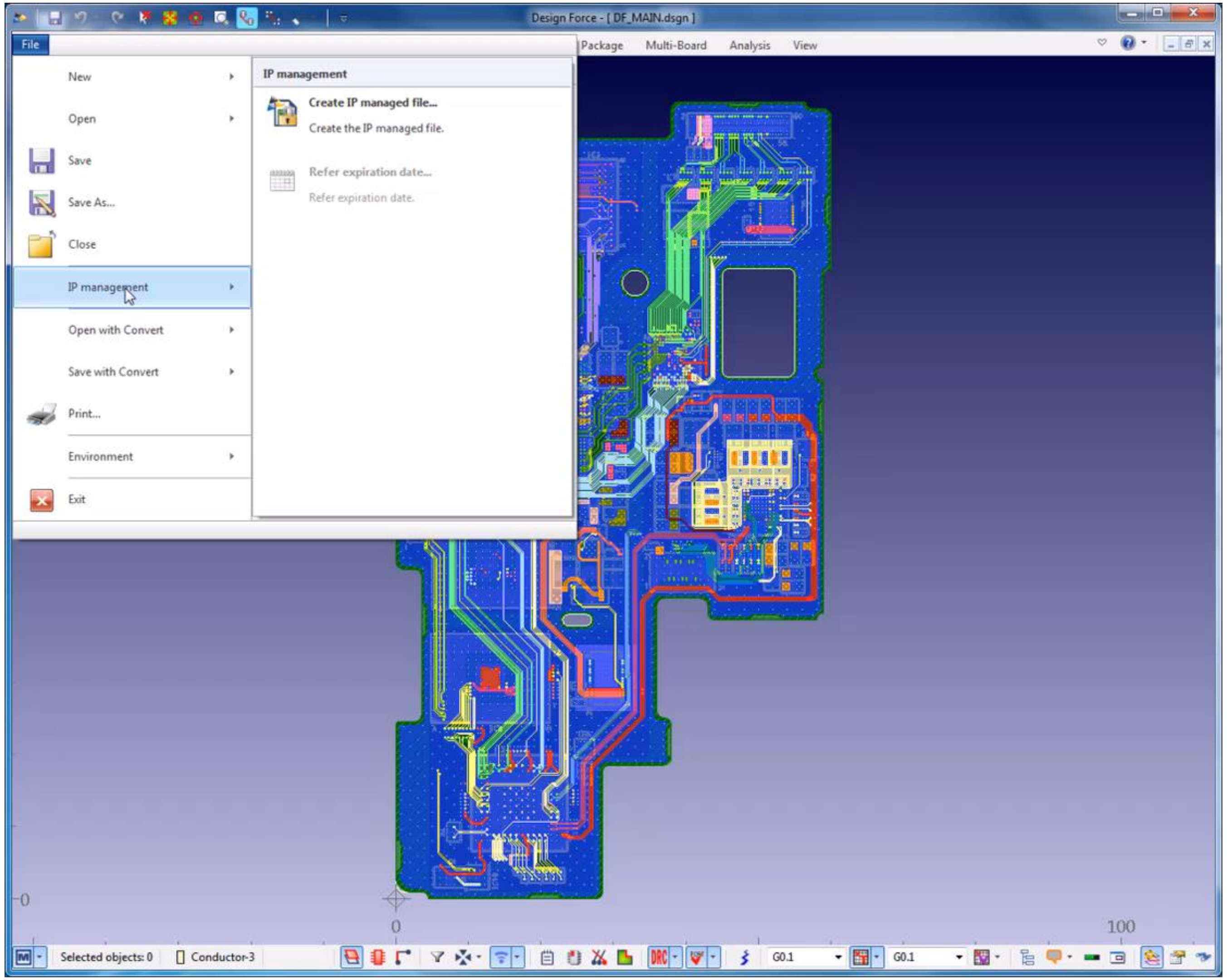
Open SDK


C++,VB, VBA,SQL
Tool Control API
Design Force
Component API
Database API

Promoting Globalized Engineering of Electronics

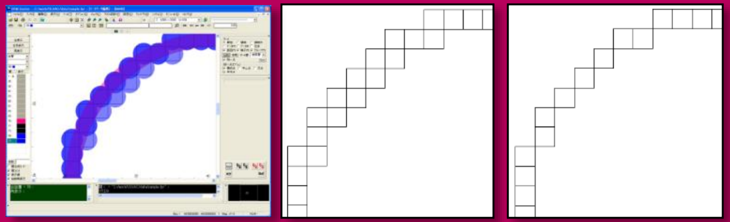
Globalization

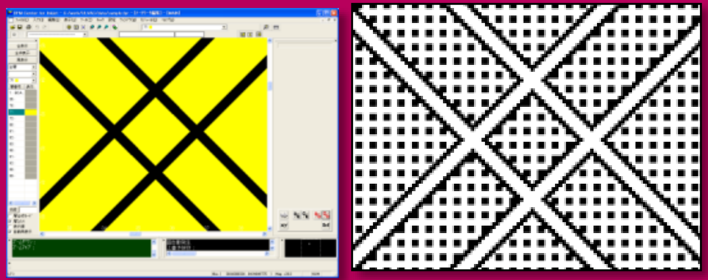
Global Partners for
Global Competition

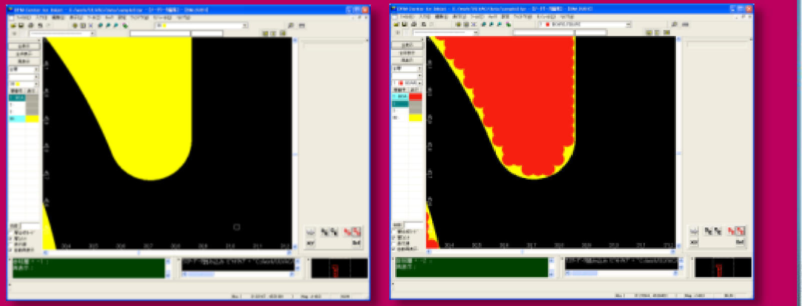


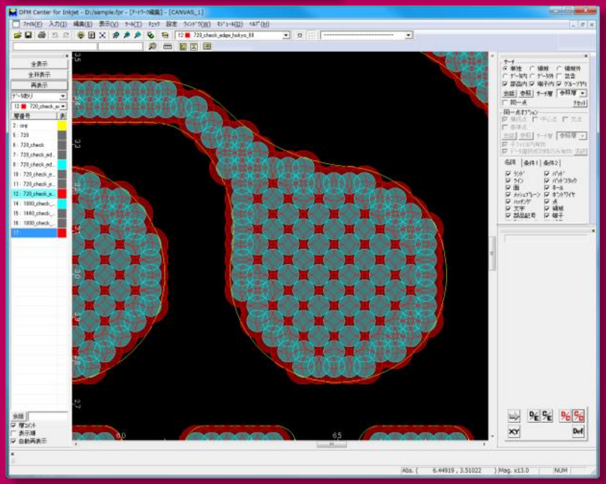
3.5.1 DFM for Inkjet

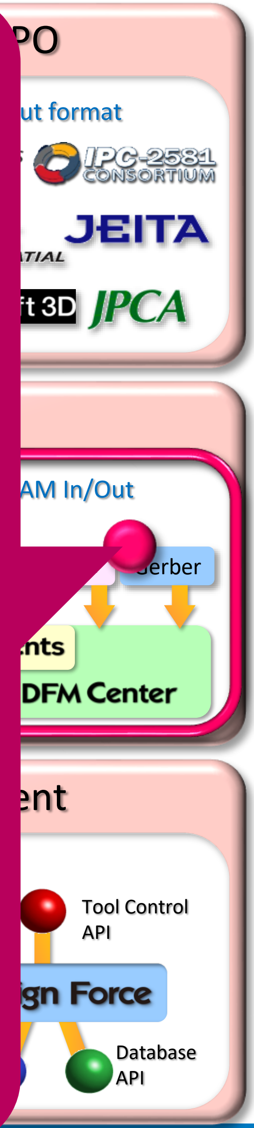
- Design for Manufacturing of Metal Ink Jet Printer
- Wide Application Coverage
  - FPD: Electrical paper/OLE display/Inorganic EL display
  - Solar: Organic thin film, dye-sensitized RFID: Antenna, circuit
  - OLED lighting
  - Floor/table censor network
  - Primary battery, rechargeable battery
  - Contactless charging system
  - Wire circuit, SiP etc...
- Vector/Raster Intelligent Conversion
- Optimization of dot size and dot pitch
- Optimizing number of dots/area
- Intelligent Optimization/Verification/Compensation
- Optimization for Thickness Control











Challenges and Roadmap for 3D Printing of Electronics

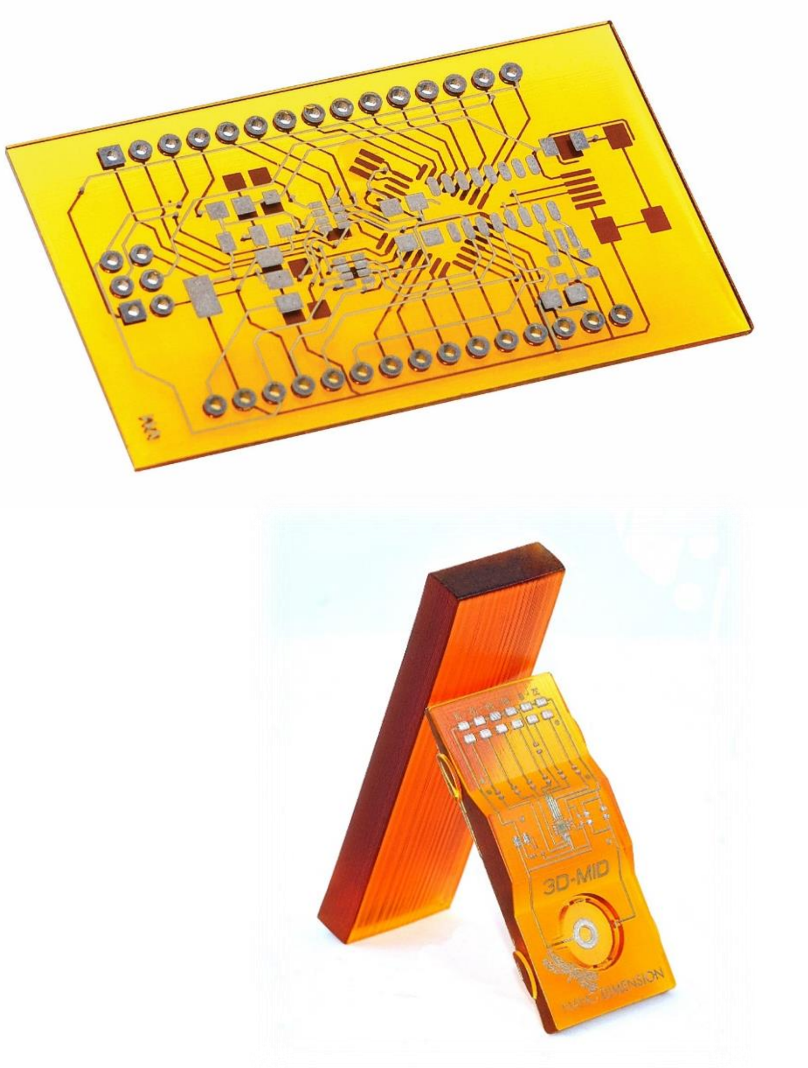
Challenges in 3D Printing for Electronics

- Limited options for conductive materials
  - Different behavior
  - Different design rules

- Optimizing traditional CAD data for 3D printing
  - DRCs for 3D printing
  - DFM/CAM for 3D printing

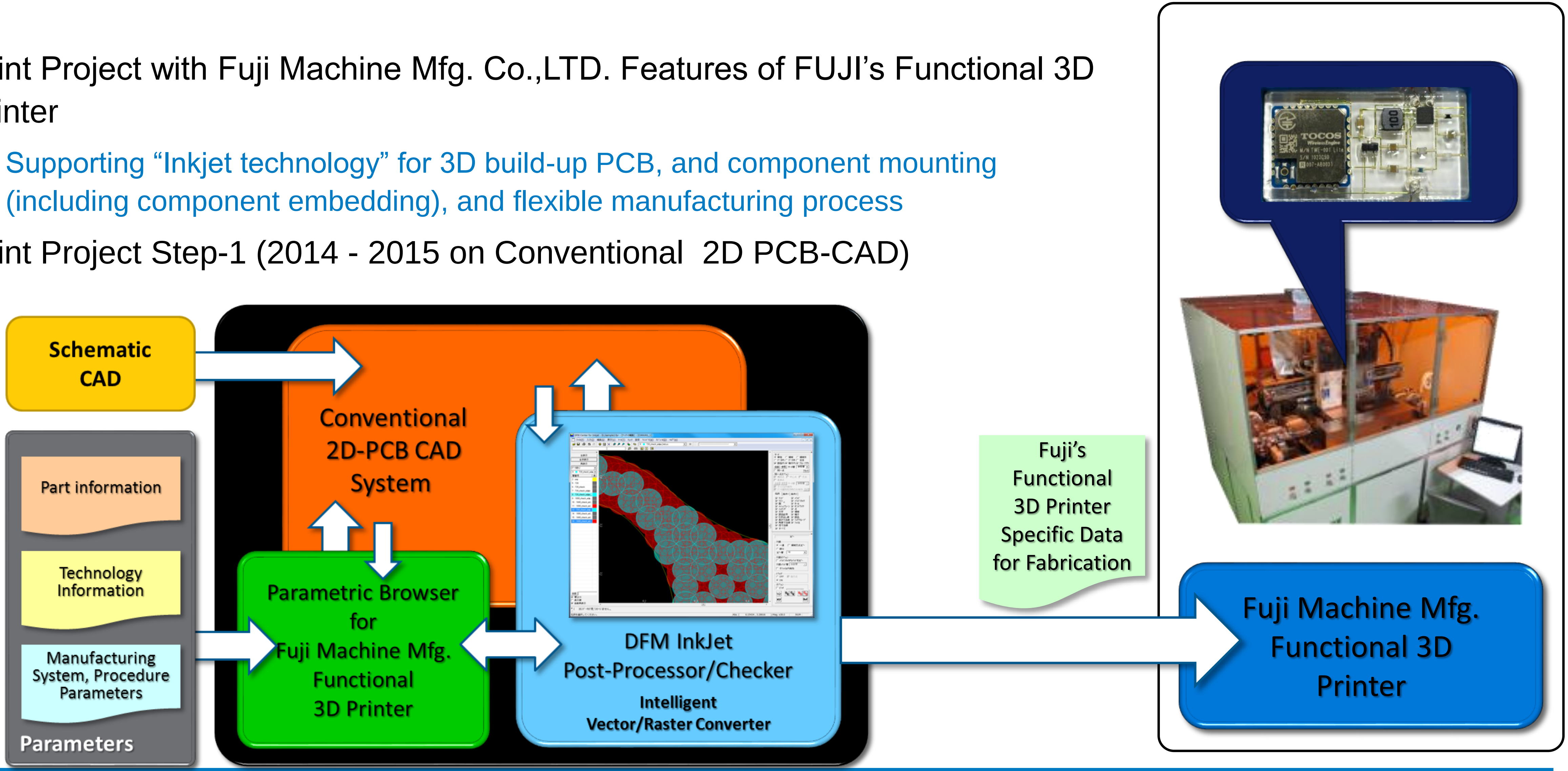
- Form factor vs board size
  - Desktop vs floor

- Assembly
  - Managing component placement



Current Support of 3D Printing – Fuji Machine Mfg.

- Joint Project with Fuji Machine Mfg. Co.,LTD. Features of FUJI's Functional 3D Printer
  - Supporting "Inkjet technology" for 3D build-up PCB, and component mounting (including component embedding), and flexible manufacturing process
- Joint Project Step-1 (2014 - 2015 on Conventional 2D PCB-CAD)



Schematic CAD

Conventional 2D-PCB CAD System

Part information

Technology Information

Manufacturing System, Procedure Parameters

Parameters

Parametric Browser for Fuji Machine Mfg. Functional 3D Printer

DFM InkJet Post-Processor/Checker

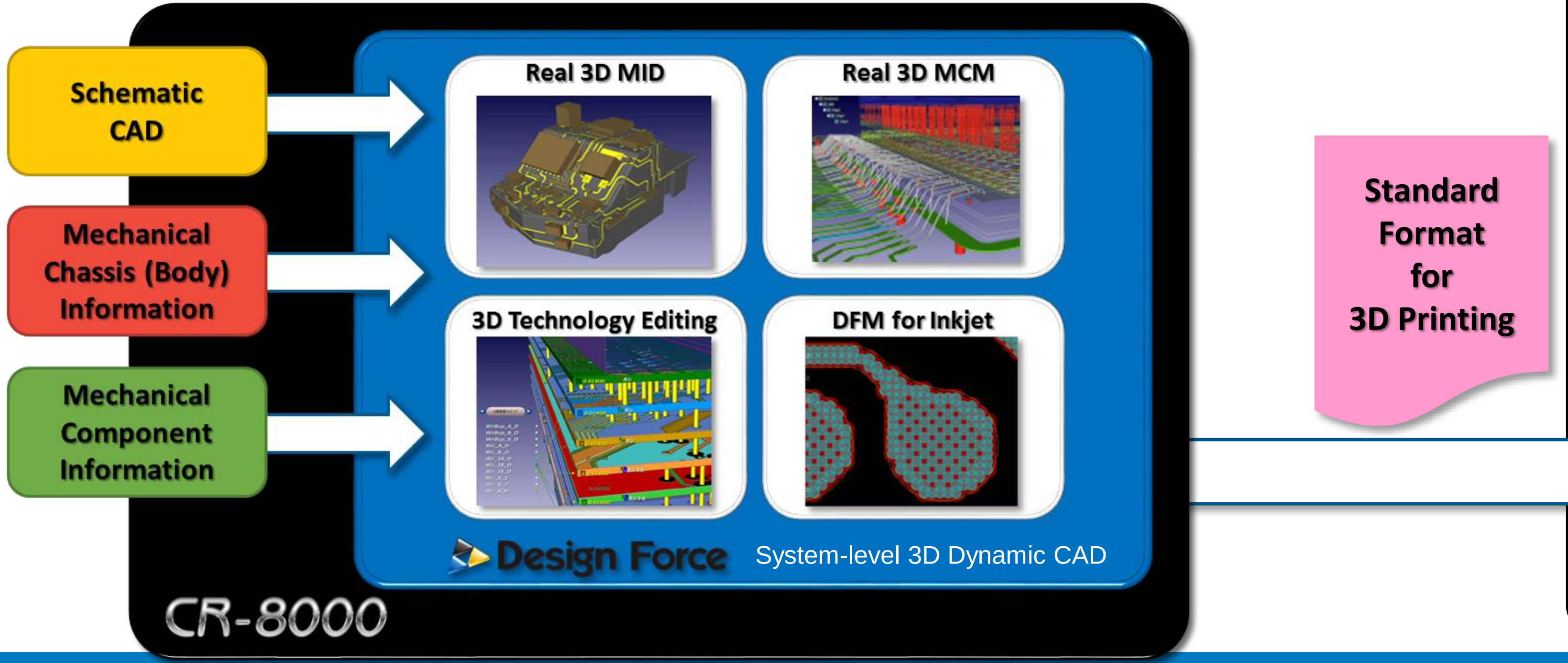
Intelligent Vector/Raster Converter

Fuji's Functional 3D Printer Specific Data for Fabrication

Fuji Machine Mfg. Functional 3D Printer

Roadmap for Support of 3D Printing – Fuji Machine Mfg.

- Joint Project with Fuji Machine Mfg. Co.,LTD. Step-2
- CR-8000 Design Force for Fuji's Functional 3D Printer
  - Design Force has dynamic 3D design and analysis features for system-level design
  - Support for dynamic editing of "Board Technology" with embedded component.
- Joint Project Step-2 (now in planning on CR-8000)



Schematic CAD

Mechanical Chassis (Body) Information

Mechanical Component Information

Real 3D MID

Real 3D MCM

3D Technology Editing

DFM for Inkjet

Design Force System-level 3D Dynamic CAD

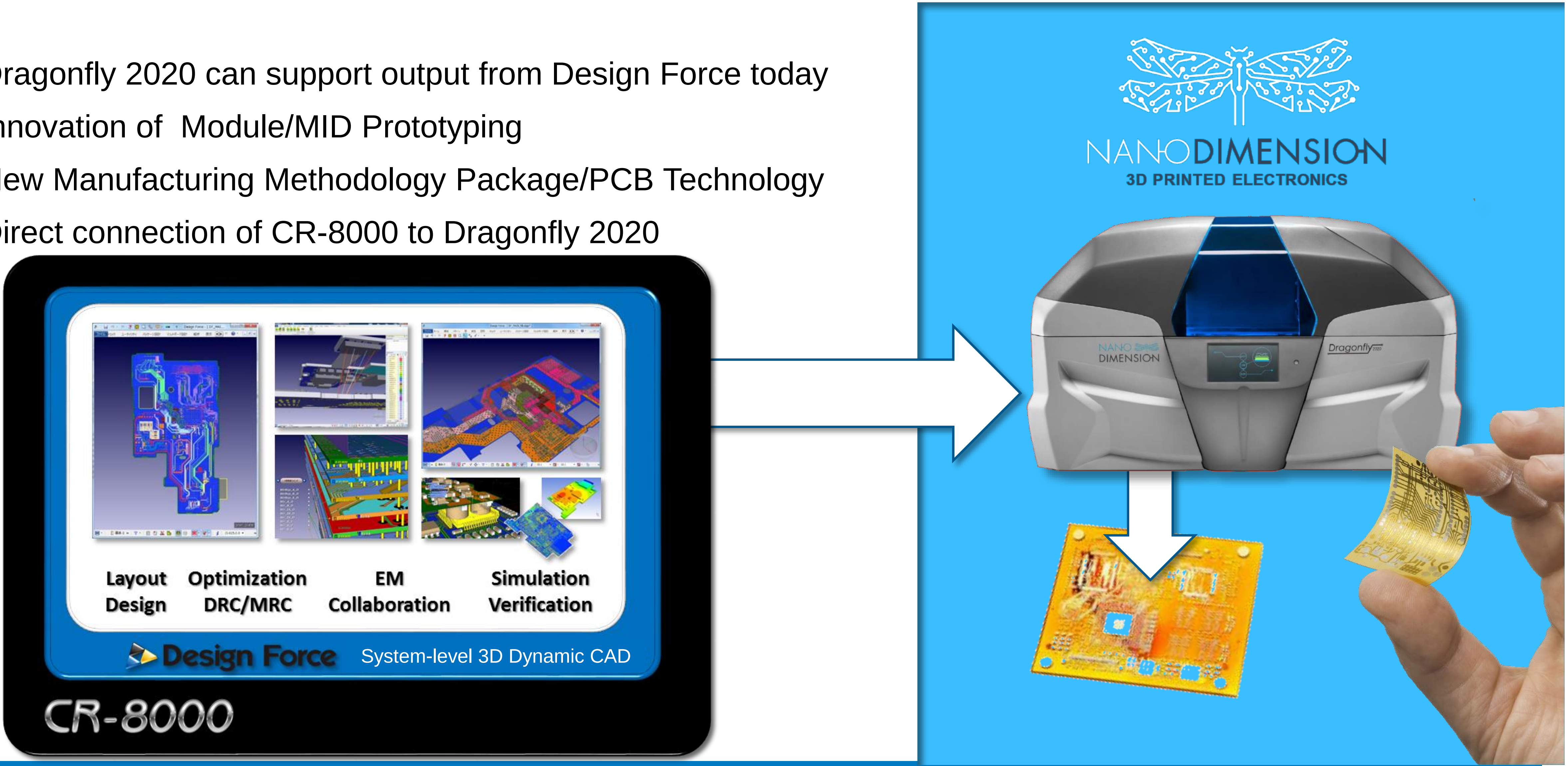
CR-8000

Standard Format for 3D Printing

Fuji Machine Mfg. Functional 3D Printer

Roadmap for Support of 3D Printing – Nano Dimension

- Dragonfly 2020 can support output from Design Force today
- Innovation of Module/MID Prototyping
- New Manufacturing Methodology Package/PCB Technology
- Direct connection of CR-8000 to Dragonfly 2020



Layout Design

Optimization DRC/MRC

EM Collaboration

Simulation Verification

Design Force System-level 3D Dynamic CAD

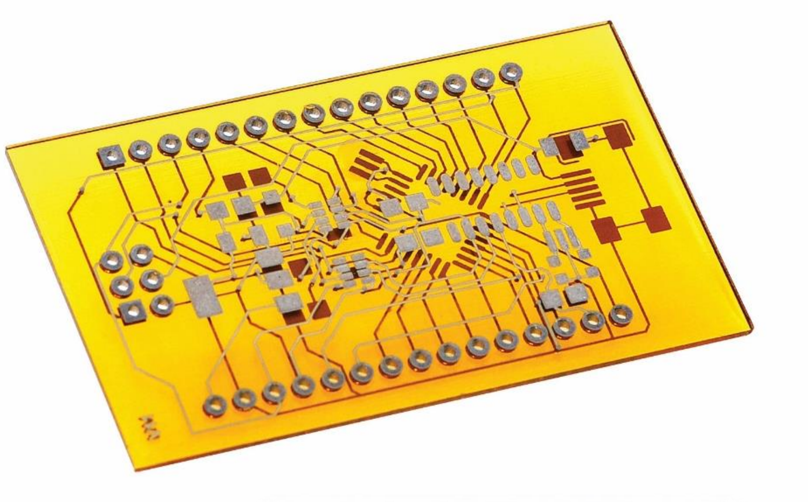
CR-8000

NANODIMENSION
3D PRINTED ELECTRONICS

Summary

Short term plan to deliver ZUKEN®

- ✓ Unique conductive materials
  - ✓ Support for rules by materials
  - ✓ Download design rule kits
- ✓ Optimizing traditional CAD data for 3D printing
  - ✓ DRCs for 3D printing
  - ✓ DFM/CAM for 3D printing
- ☐ Form factor vs board size
  - ☐ Desktop vs floor
- ☐ Assembly
  - ☐ Managing component placement



ZUKEN®

The Partner For Success