

Camelot

CAD Navigation System and Key Component of Synopsys Failure Analysis Product Line

Overview

Camelot™ software system is the next-generation CAD navigation standard for failure analysis, design debug and low-yield analysis. Camelot optimizes the equipment and personnel resources of design and semiconductor failure analysis (FA) labs by providing computer interfaces and navigation capabilities for more than 50 different types of analysis and test equipment.

Its application tools, features, options and networking capability provide a complete, integrated system for fast, efficient investigation and resolution of inspection, test and analysis jobs. In addition, Camelot enables closer collaboration between product and design groups with FA labs, thus dramatically improving time to yield and market.

Camelot has the ability to import CAD design data from all the key design tools and several user-proprietary formats and provides visual representations of circuits that can be manipulated, rotated, exploded, searched and linked with ease.

Camelot is part of the failure analysis product portfolio originally developed by Knights Technology. The Knights product line was acquired by Synopsys as part of its acquisition of Magma in 2012.

Benefits

- ▶ Reduces design and FA cycle time thereby improving time to market
- ▶ Increases productivity by providing a common software platform interface with all types of equipment
- ▶ Reads design data from all major design tools. Uses LVS data to map logical net, device name to physical location and vice versa
- ▶ Design data converted to proprietary Knights Database (KDB) for faster access and data security
- ▶ Provides a platform for overlaying images from various FA equipment on to the design layout
- ▶ Offers a growing number of add-on features critical to trace potential failures, circuit debug, multi-patterning and origin of killer defects
- ▶ Client/server solution for Linux, Windows XP Operating Systems users
- ▶ Seamless integration with existing Merlin™ databases and conversion tools are included
- ▶ A single tool converts layout, netlist and schematic data and establishes cross-mapping links between each data entity
- ▶ Speeds problem solving by cross-mapping between devices and nets so that exact locations can be viewed by all three domains (layout, netlist and schematic) simultaneously

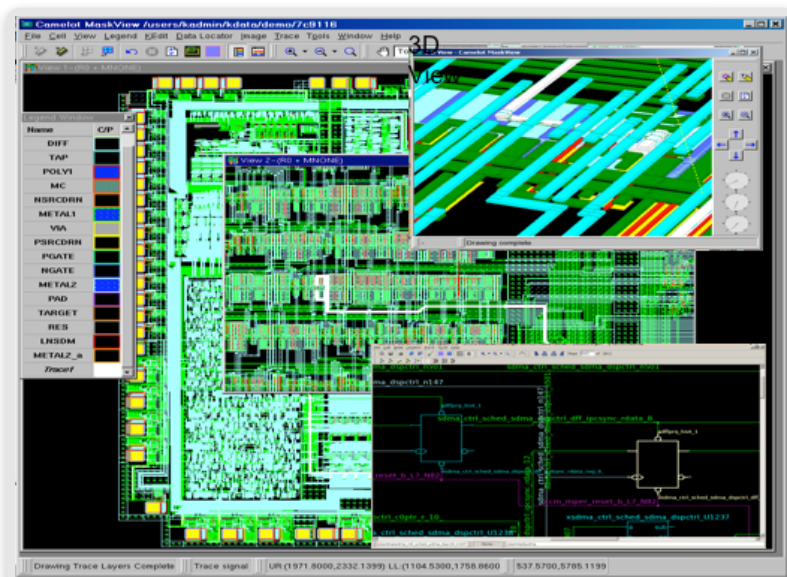
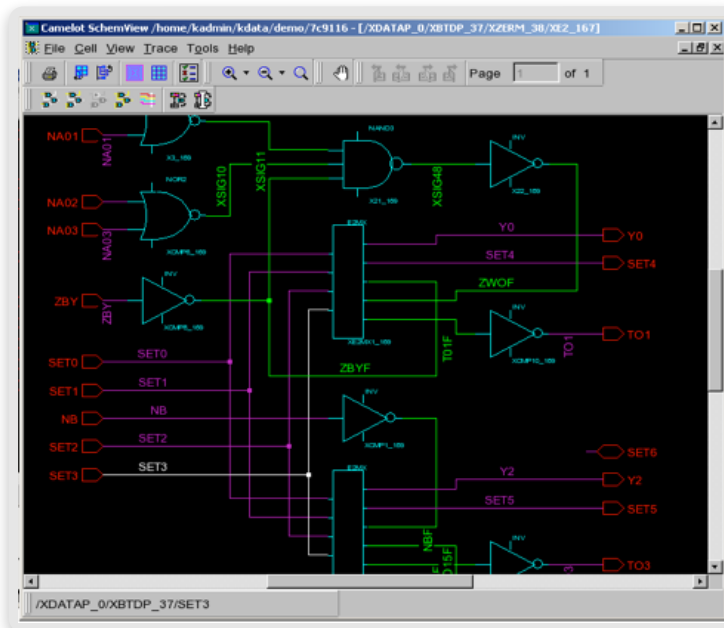


Figure 1: Camelot CAD-navigation system integrating layout, signal tracing and 3D view



- ▶ LVS Conversions: Cadence (DIVA), Mentor Graphics (CheckMate, Calibre), Synopsys (Hercules, ICV)
- ▶ Netlist Conversion: SPICE, EDIF, Verilog, Hercules
- ▶ Layout Conversion: GDSII, OASIS

Camelot users' highest priorities are data access and database capability. Camelot provides the optimal solution to the continually expanding needs of the FA lab and design debug team.

Ensuring data consistency is one of the key capabilities of Synopsys' CAD navigation software. The unique design of the internal database structures guarantees that decades old databases are still readable. This is an indispensable feature for all failure analysis, QA and manufacturing organizations, especially in the automotive industry.

Providing Critical Analysis Functions

In addition to its CAD navigation and database capabilities, Camelot's analysis features have become indispensable to the FA lab. Different viewing options are critical in tracking potential failures and determining the source and origin of killer defects. Camelot includes special schematic capabilities and layout add-on features that are invaluable to FA engineers as they debug chips manufactured using new processes. The list below details some of the most popular software options.

Defect Wafer Map (figure 3) integrates defect inspection data with the device CAD design using the defect coordinates to navigate an equipment stage and pinpoint the defect for closer inspection and characterization. Camelot sorts defects by size, location or class, as well as layout location and allows the user to define custom wafer maps. Additionally, users can classify defects, attach images and write updated information to the defect files.

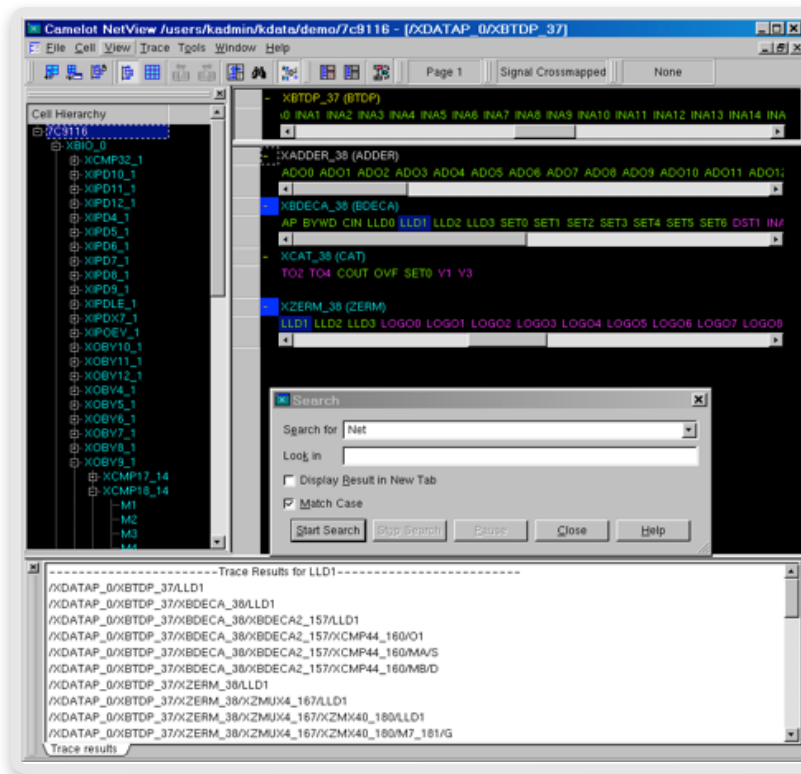


Figure 2: Camelot SchemView and NetView provide an easy way to navigate inside circuit schematics

Supporting All CAD Design Data

Synopsys is committed to remaining the leading provider of software solutions that link all CAD design data. Camelot is a comprehensive package that reads all EDA tools and design data from verification systems and several

user-proprietary formats. The Camelot database is designed to interface with all key LVS packages. In the past, many companies used Dracula in design verification. Today, there are more EDA developers and more verification package choices; Synopsys is the only company that supports all of them.

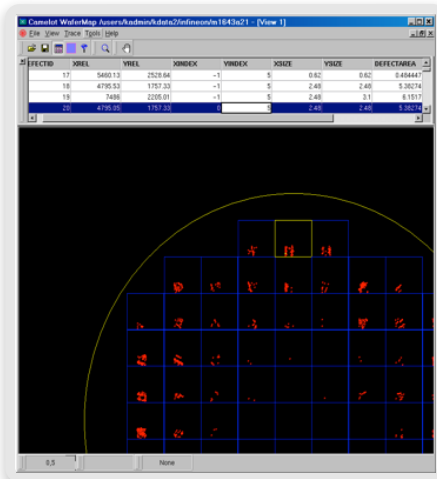


Figure 3: Defect Wafer Map pinpoints defects for closer inspection and characterization

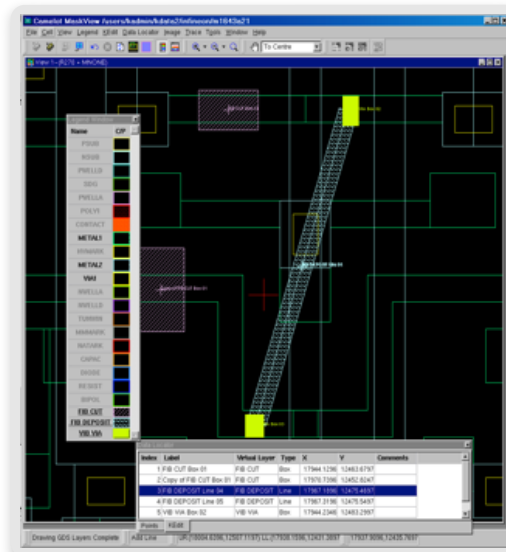


Figure 4: K-Edit allows collaboration between design, fab and FA lab

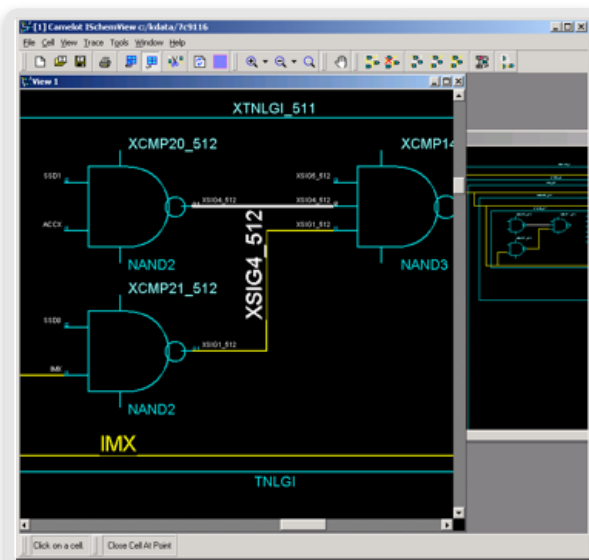


Figure 5: I-Schem creates a schematic from a netlist

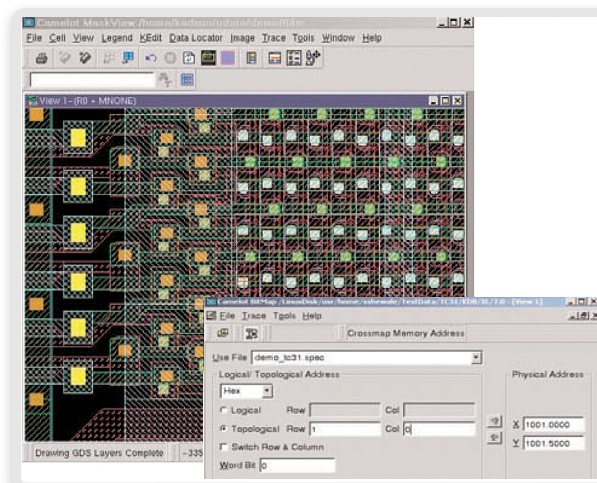


Figure 6: K-Bitmap identifies the physical location of bit addresses in memory devices

SchemView (figure 2) provides tracking of potential failures through visualization of the chip logic. Cross-mapped to the device layout and netlist, SchemView helps determine the source and origin of chip failures. The entire design is displayed in cell hierarchy format, allowing push-down to a transistor level. K-Bitmap identifies physical location of bit addresses in memory devices.

I-Schem (Interactive Schematic) (figure 5) creates a schematic from a netlist in a net-oriented format allowing forward and backward tracking to locate a fault. Features like Add Driver or Add Input Cone allow for quick analysis and verification of diagnostic results in scan chains.

K-Bitmap (figure 6) allows equipment CAD navigation when analyzing memory chips by identifying the physical location of failing memory cells. It eliminates tedious screen counting by converting the logical addresses or row and column coordinates, to the physical location.

3D Small-Area Analysis Option (figure 7) provides a three-dimensional cross-section capability to FA engineers, enabling faster localization of circuit failures to accelerate IC manufacturing yield improvement.

Hot-Spot Analyzer Option (figure 8) allows user to draw regions on the layout that correspond to hot-spot regions (emission spots) to detect the crucial nets. Counts of the number of nets in each hot-spot region and number of hot spots for each net are displayed.

User Defined Online Search (UDOS) (figure 9) allows users to search a small area of a die for unique polygon features, repeated features or lack of features. Applications include, but are not limited to, FIB-able regions, repeaters, pattern fidelity and lithographic applications.

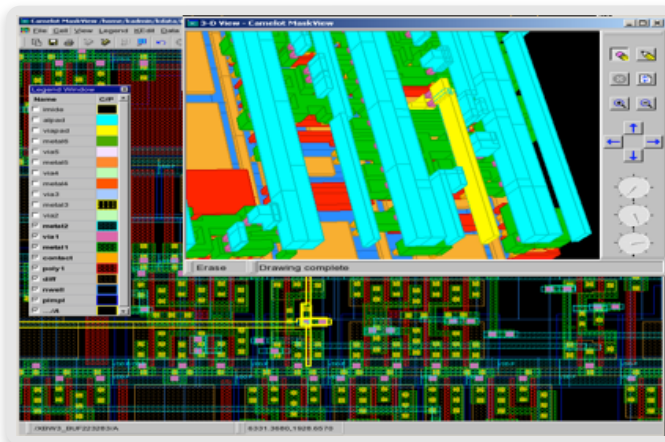


Figure 7: 3D Small-Area Analysis enables faster localization of circuit failures

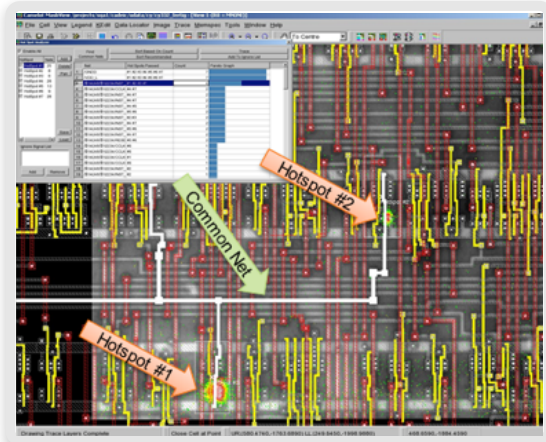


Figure 8: Hot-Spot Analyzer displays number of nets in a hot spot

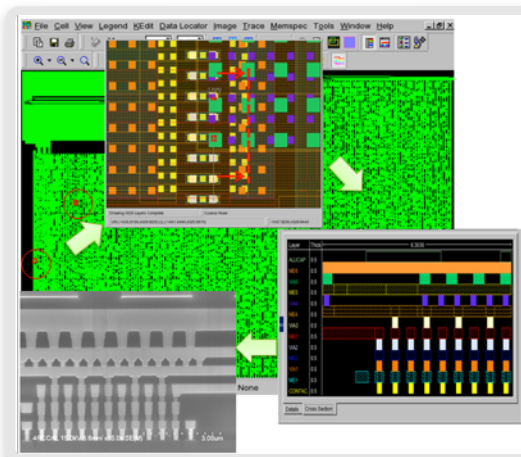


Figure 9: On-Line Search Analyzer finds easy-to-access traces

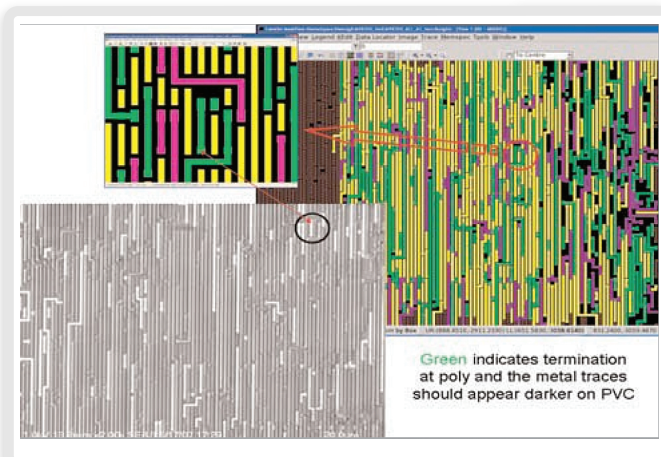


Figure 10: Passive Voltage Contrast (PVC) Checker identifies suspect vias or metal traces

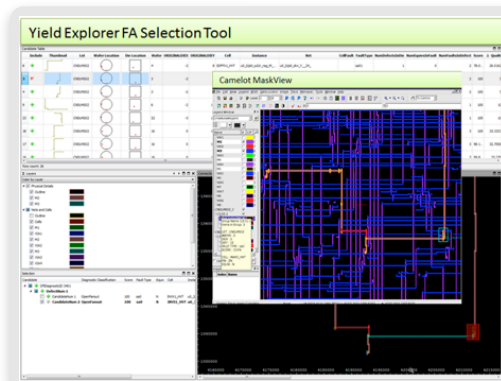


Figure 11: Camelot's open architecture integrates with Synopsys Yield Explorer

Passive Voltage Contrast Checker (PVC) Option (figure 10) quickly and accurately validates the integrity of a circuit's conductivity and provides detailed information for identifying suspect faults at via or metal traces.

Image mapper automates image alignment process in Camelot Maskview and hence saves a lot of time and effort spent in manual alignment.

Camelot Server Solution

Synopsys' Camelot server solution (figure 12) brings all the advantages of enterprise-wide computing to chip FA and design modification. Camelot is a client/server, open architecture system that connects users over local and wide area

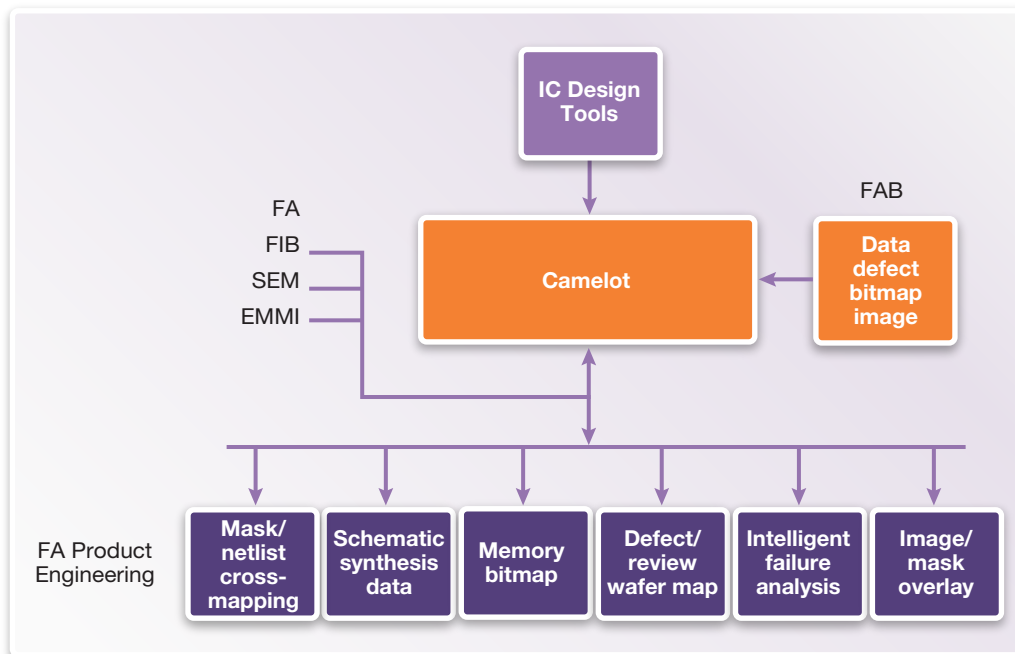


Figure 12: Camelot server solution

networks for seamless integration and database sharing. Instrument integration throughout the fab and other locations throughout the enterprise enables viewing, modifying, characterizing and testing the same wafer location with different instruments, or the same location on wafers at different facilities using the same chip design.

Complete, Up-to-Date Library of FA Tool Drivers

Camelot provides navigation for over 50 types of equipment. With a continued commitment to supporting drivers for all types of test and analysis equipment, Synopsys will continue to develop driver interfaces for new tools as they are introduced to the market, as well as next-generations of existing tools.

Tools Currently Supported by Camelot

- ▶ Analytical Probe Stations
- ▶ Atomic Force Microscopes
- ▶ E-Beam Probers
- ▶ IR Imaging
- ▶ Mechanical Stage Controllers
- ▶ Emission Microscopes
- ▶ Microanalysis Systems
- ▶ FIB Workstation
- ▶ Laser Probe
- ▶ LSM
- ▶ EDA LVS
- ▶ Microchemical Lasers
- ▶ OBIC Instruments
- ▶ Optical Review
- ▶ SEM Tools