

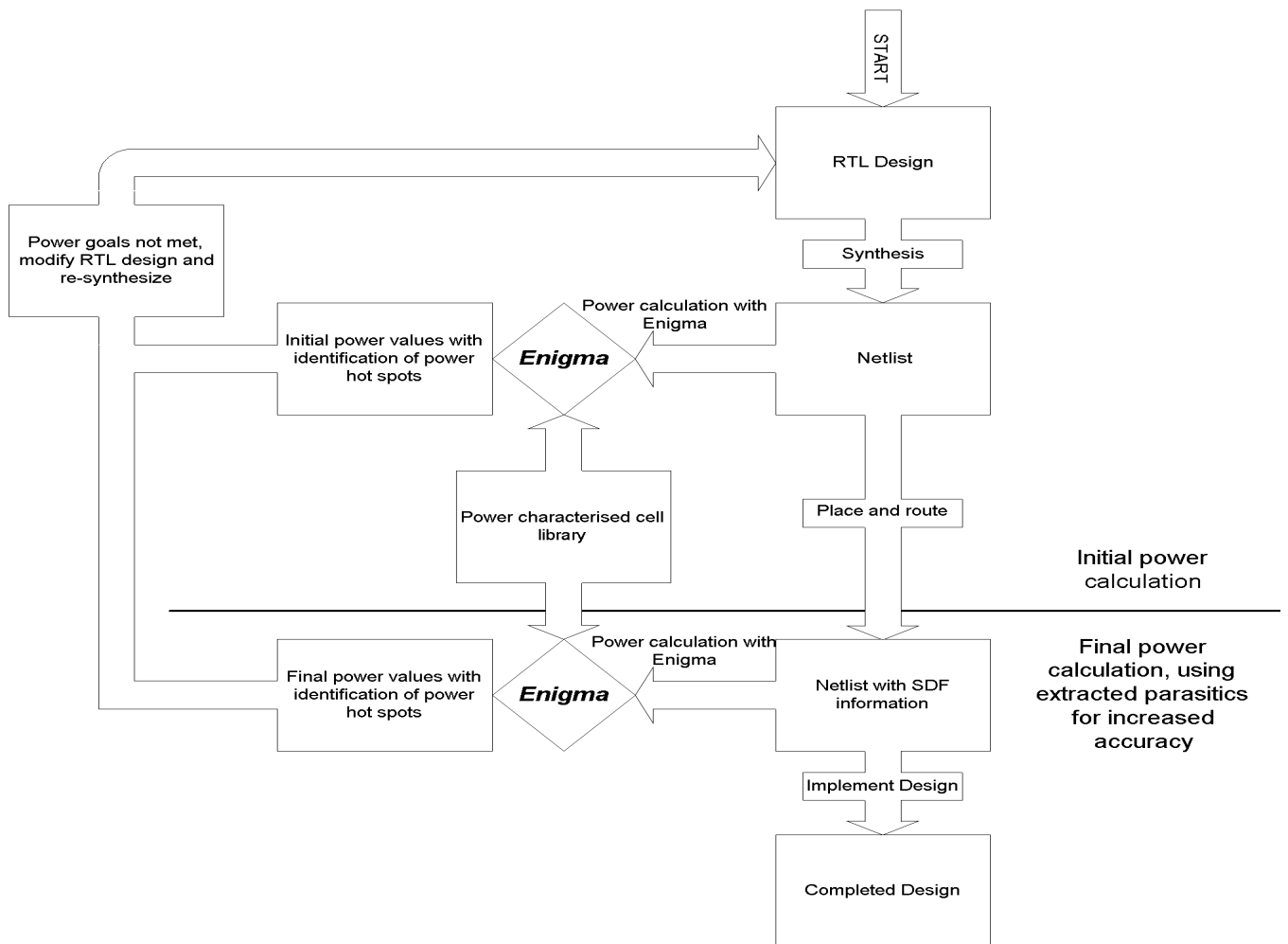
# ENiGMA Energy Investigation via Gate and Module Analysis

The ENiGMA Power Tool delivers accuracy and speed in digital circuit power analysis. Power is calculated from a Verilog/VHDL gate level netlist annotated with the power characteristics of the design's target cell library. Both Dynamic and Static (Leakage) current can be incorporated into the analysis. The tool can be used with or without wire loading information derived from initial global placement of the circuit's modular blocks. This permits accurate exploratory power analysis among various design options at an early stage of development. When a particular design has been advanced and placed and routed, more detailed and accurate analysis can be performed with the tool.

ENiGMA can operate in a number of simulation modes, functional cycle based, pure netlist or annotated with post place and route interconnect loading. In all cases, glitch activity, a significant contributor to circuit power is accurately determined, even in pre place and route calculations.

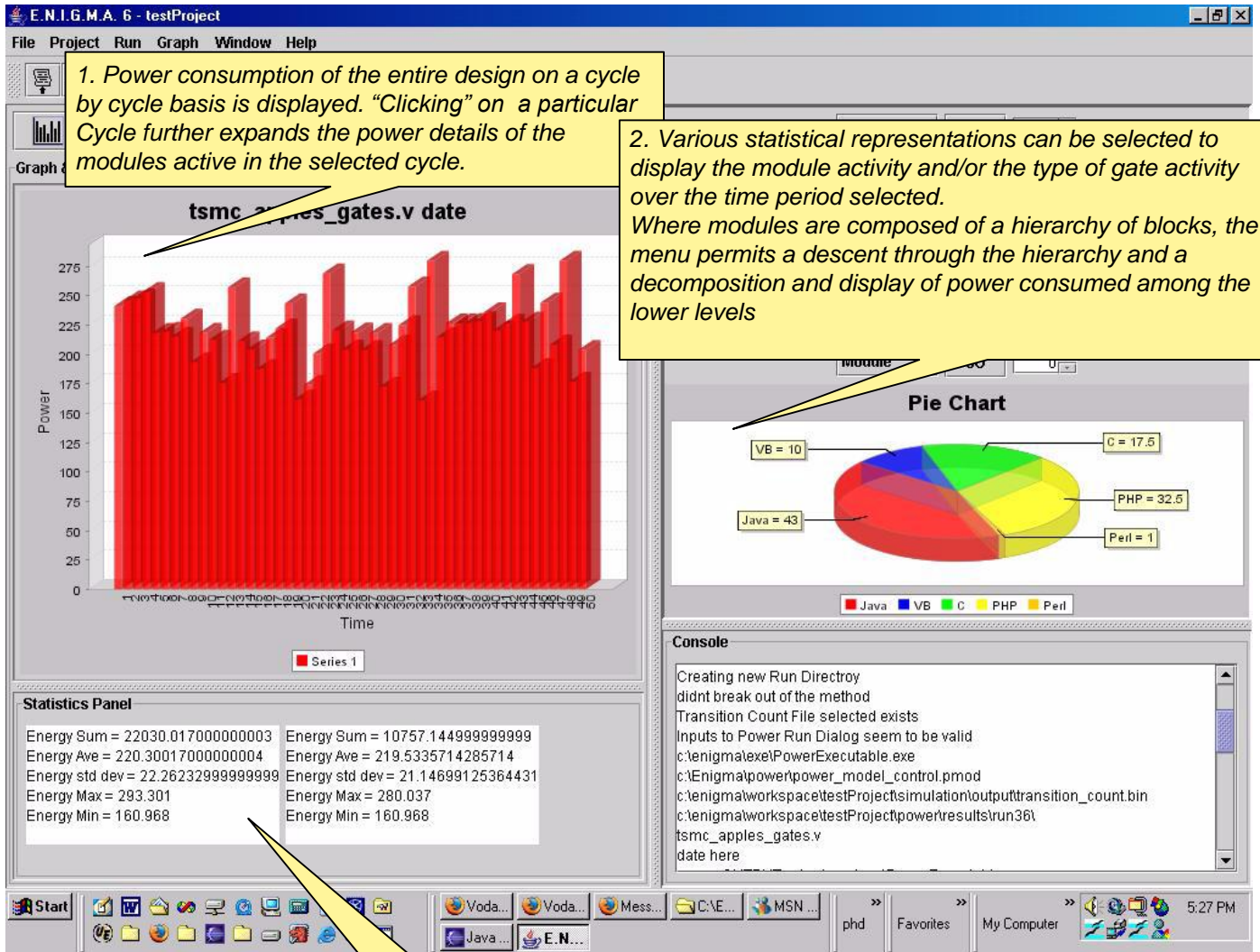
Accuracy in ENiGMA is guaranteed through the cell library specified gate energy models of the synthesised circuit. However, central to its power analysis is Neosera's innovative APPLES (**A**ssociative **P**arallel **P**rocessor for **L**ogic **E**vent-driven **S**imulation) technology. ENiGMA uses the APPLES processor in cycle based mode to accelerate the power calculations. ENiGMA is faster at simulating and analysing the power dissipation in circuits than software gate-level simulators. With ENiGMA, Dynamic, Static and Toggle power analysis within a 3% error margin is delivered faster than simple simulation.

ENiGMA is completely self-contained in that it does not require an outer environment such as a Verilog simulation system.



## The ENiGMA GUI

ENiGMA uses a normal menu selection technique to select and compile verilog/VHDL netlist files into optimised APPLES netlist files which have been characterised to the target cell-library .  
The output of the energy analysis is stored in various binary files which can be viewed with the ENiGMA viewer.



## A Performance Comparison between ENiGMA and a conventional Gate-Level Power Tool(PrimeTimePX)

ENiGMA has a highly optimised database containing all library and interconnect information regarding the simulated circuit. Once generated the d/base enables future power computations to be determined **without any re-compilation** of the circuit, unlike other power tools. The structure of the database also facilitates rapid power estimation. On average, the d/base is 2.33 times that of the verilog database.

Circuit	Verilog (Gate-netlist size in bytes)	ENiGMA(Database size in bytes)	Ratio(ENiGMA/Verilog)
<b>C2670</b>	51,203	58,625	1.14
<b>C3450</b>	61,422	78,417	1.27
<b>C5354</b>	91,248	108,542	1.19
<b>C6288</b>	113,497	113,079	0.99
<b>C7552</b>	128,928	162,786	1.26
<b>Multiplier(64-bit)</b>	612,982	1,537,785	2.51
<b>Multiplier(128-bit)</b>	2,534,705	6,185,182	2.44
<b>Multiplier(256-bit)</b>	10,595,560	24,854,602	2.34
<b>Averages</b>	1,773,693	4,137,375	2.33

ENiGMA has a very efficient power estimation algorithm which combined with its optimised data-base can compute power in a fraction of the time required by conventional software tools. The efficiency of ENiGMA relative to other equivalent tools becomes more pronounced as circuit sizes are increased, attaining a performance advantage **2 orders of magnitude faster**.

Circuit	PrimeTimePX(secs)	ENiGMA(secs)	%(ENiGMA/PrimetimePX)
<b>C2670</b>	4.57	1.05	22.98
<b>C3450</b>	5.52	1.56	28.33
<b>C5354</b>	7.47	2.478	33.17
<b>C6288</b>	3.42	0.33	9.75
<b>C7552</b>	10.6	4.5	42.41
<b>Multiplier(64-bit)</b>	27.11	1.337	4.93
<b>Multiplier(128-bit)</b>	138.89	5.972	4.3
<b>Multiplier(256-bit)</b>	877.12	17.304	1.97

Executing numerous circuits through ENiGMA with different libraries has established the envelope of accuracy relative to PrimeTime PX to be **within 10% (8%)**. Neosera will be releasing new power models that will have enhanced power modeling capabilities.

	TSMC 13	TSMC 18	TSMC 25
<b>Accuracy (ENiGMA/PrimeTimePX)</b>	1.03	0.86	0.89

## ENiGMA Value Proposition

ENiGMA is a highly efficient and accurate gate-level power tool. Some of the key distinctive and unique attributes of ENiGMA are:

- Cycle accurate power estimation on a cycle by cycle basis can be rapidly generated and accessed.
- As circuit size increases, relative to other gate-level power estimation tools, ENiGMA's processing speed attains 2 orders of magnitude.
- Power/Energy dissipation can be analysed through the module hierarchy.