High Performance ATHENA and ATLAS Simulation on PC under NT

The recent advances in PC hardware capability in terms of memory and CPU floating point performance has allowed the possibility of running realistic sized ***ATHENA*** and ***ATLAS*** problems on PCs. The Fall 1999 release of PC-TCAD will include all the important features of the latest UNIX release. A product chart showing the modules available on PC is in Figure 1.

The Fall 99 PC-TCAD release is ported to Windows NT4.0. It features PC specific interactive tools based on the popular UNIX products but with the look and feel of true NT products. There is also a dedicated PC Interactive tools manual. A view of the products in action is shown in Figure 2.

One of the most common concerns about ***ATHENA*** and ***ATLAS*** running on PC is the performance.

Six examples from our standard UNIX example set were chosen. These represented a cross section of typical applications:

- MOS shallow junction formation using fully coupled diffusion with {311} implant damage
- SOI Id/Vds using impact ionization, energy balance and lattice heating
- AlGaAs HEMT IV characterization
- BJT switching simulation using ***MixedMode***
- LDMOS power device breakdown including full process simulation
- Power Diode simulation using a large simulation mesh

Each of these files were executed on several different PC hardware configurations. The results are shown in Table 1. Naturally the results show that, as with UNIX, the speed of simulation is strongly determined by the hardware configuration.

Between the Desktop machine and the Notebook the typical speed up was 1.2x which corresponds to the ratio of the processor clock speed. Between the Dual Processor machine and the Desktop the typical speed up was 1.1x which also corresponds to the ratio of the processor clock speed.

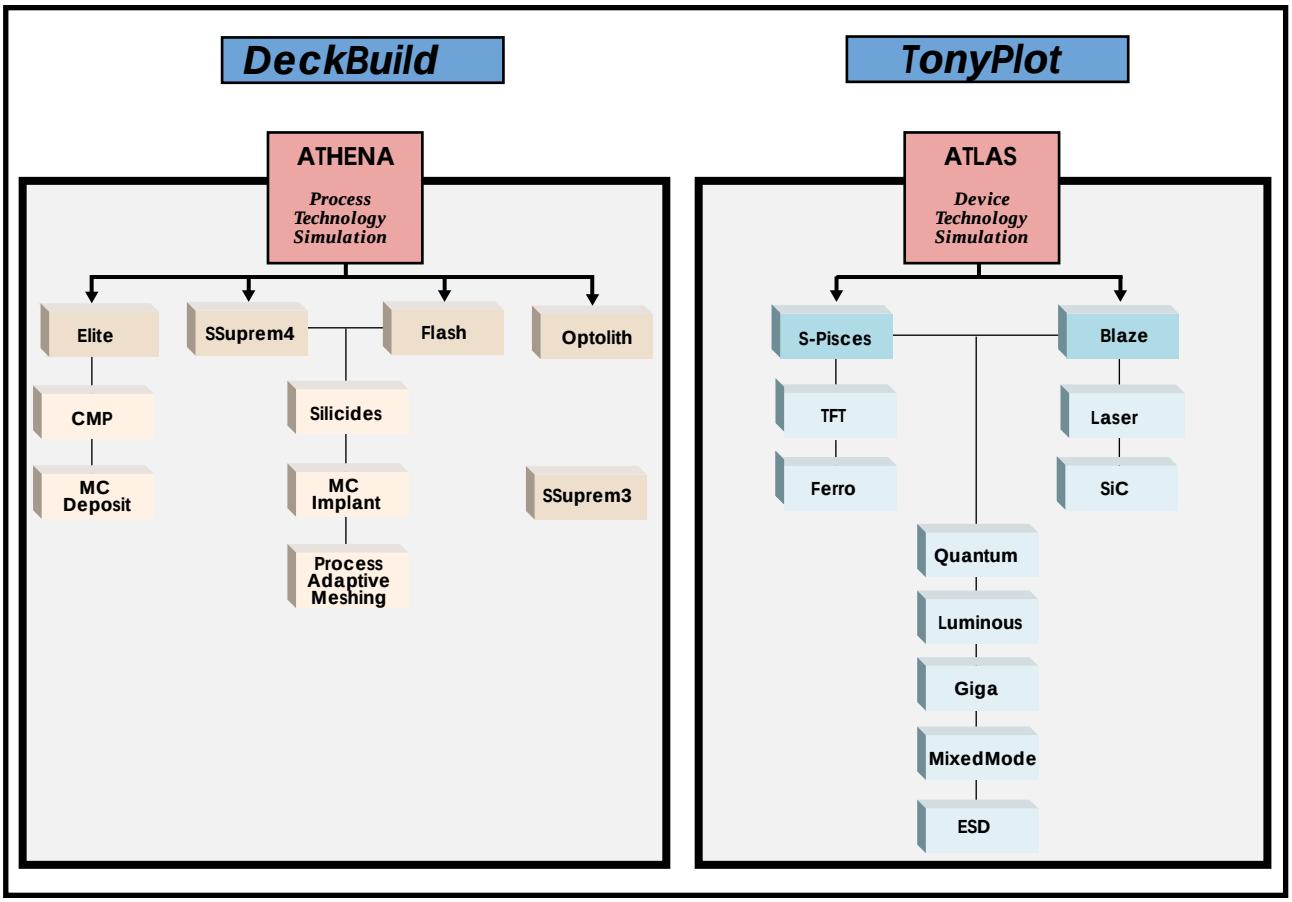

Figure 1. Products available in the Fall 99 release of PC-TCAD.

	PC	Pentium II Notebook	Pentium II Desktop	Dual Pentium III
	CPU SPEED (MHz)	333	400	2 x 450
	MEMORY (Mb)	64	256	1000
EXAMPLE	**Mesh Size**	**Timing (s)**	**Timing (s)**	**Timing (s)**
SOI with Energy Balance and Lattice Heat	1271	1154	919	783
AlGaAs HEMT I_D/V_{DS}	1204	424	329	290
Bipolar Switching in MixedMode	1922	1619	1276	1119
Fully Coupled Diffusion for MOS Junctions	1106	1403	1141	1071
LDMOS Breakdown	2874	3486	2787	2464
Large Power Diode	7659	6611	1248	1167

Table 1. Speed comparison for typical TCAD application examples on various types of PC. All CPU times are in seconds.

The Fall99 release of PC-TCAD tools does not include any specific speedup for dual processor machines. However since the typical task of running simulations involves running a simulator and simultaneously analyzing results in Tonyplot, it would be expected that dual processor machines would offer improved performance for 'interactive' use of the tools as opposed to these purely batch mode timing tests.

However of particular note are the timings for the Power Diode example. This example uses a very large mesh which required 168Mb of virtual memory to run in the UNIX version. The 5x speed up for this example between the desktop and the notebook machines is mostly due to the increased memory in the desktop machine. However between the dual processor machine and the desktop the speedup was similar to the other examples at 1.1x since the 256Mb in the desktop was sufficient. This quantifies the importance of memory to the PC performance on large examples.

Summary

In summary the Fall 99 release of PC-TCAD has been proven to run large, practical process and device simulations in a reasonable time. The CPU time scales linearly with processor clock speed if there is sufficient memory available. With only 64Mb of memory the largest examples will struggle, so a recommended memory of 256Mb will offer the best performance.

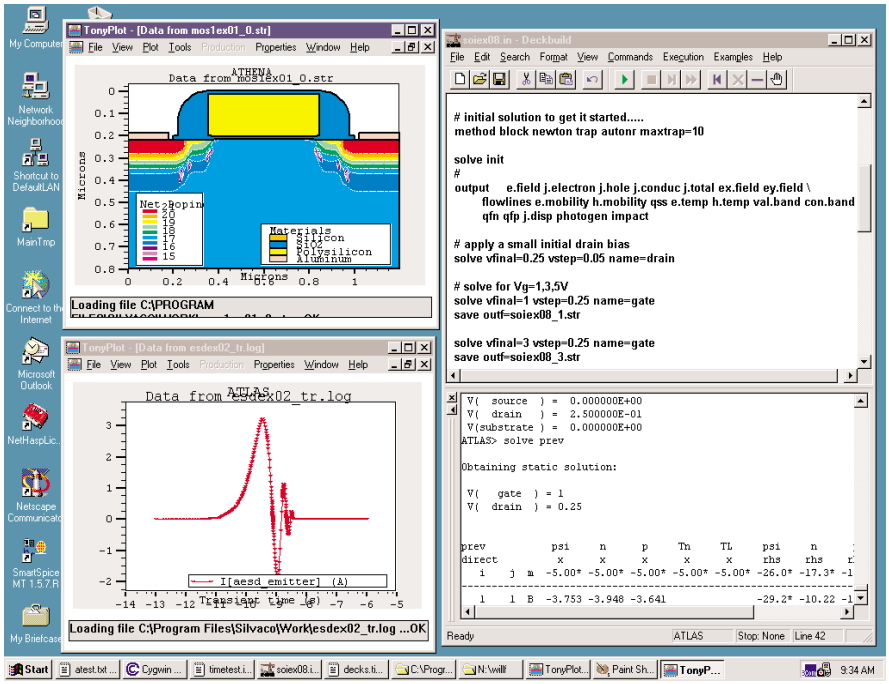

Figure 2. Screenshot of the PC-TCAD Interactive tools DeckBuild and TonyPlot.