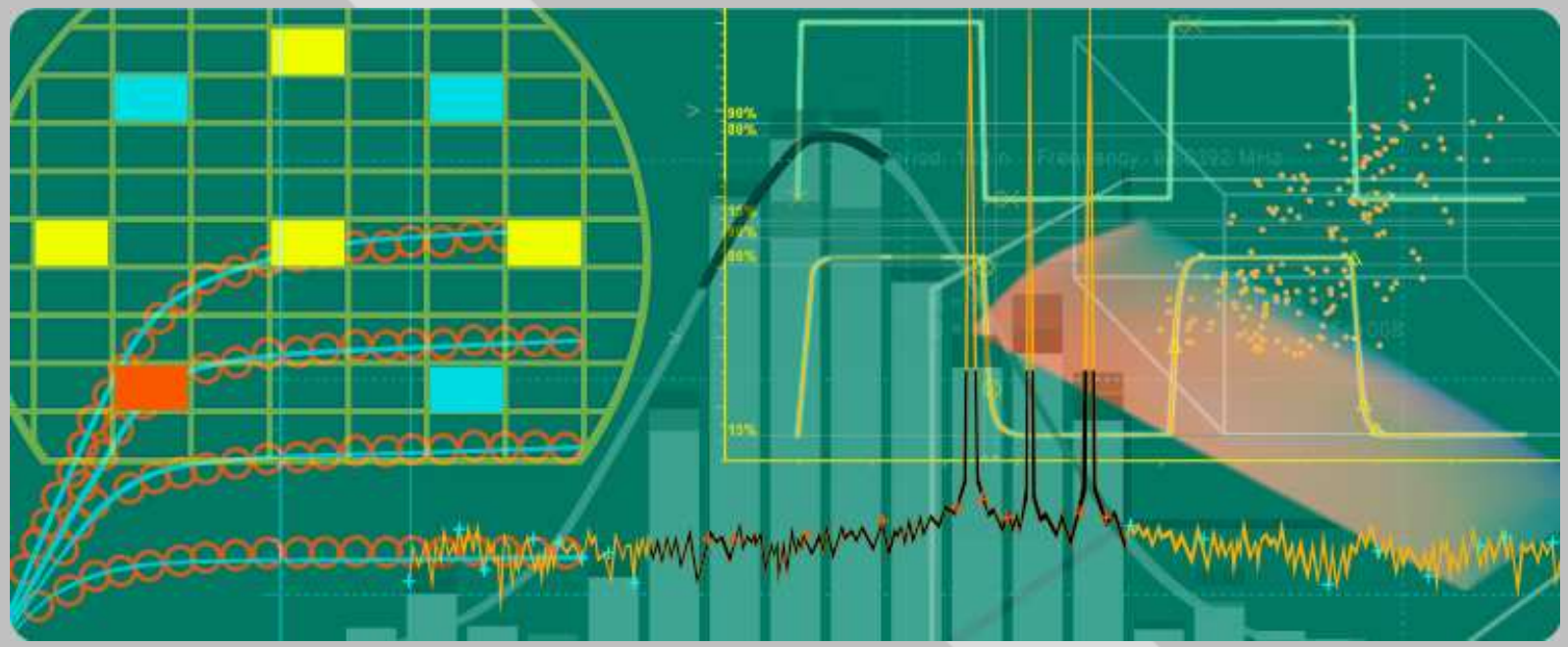
UTMOST IV SPICE Optimization Module

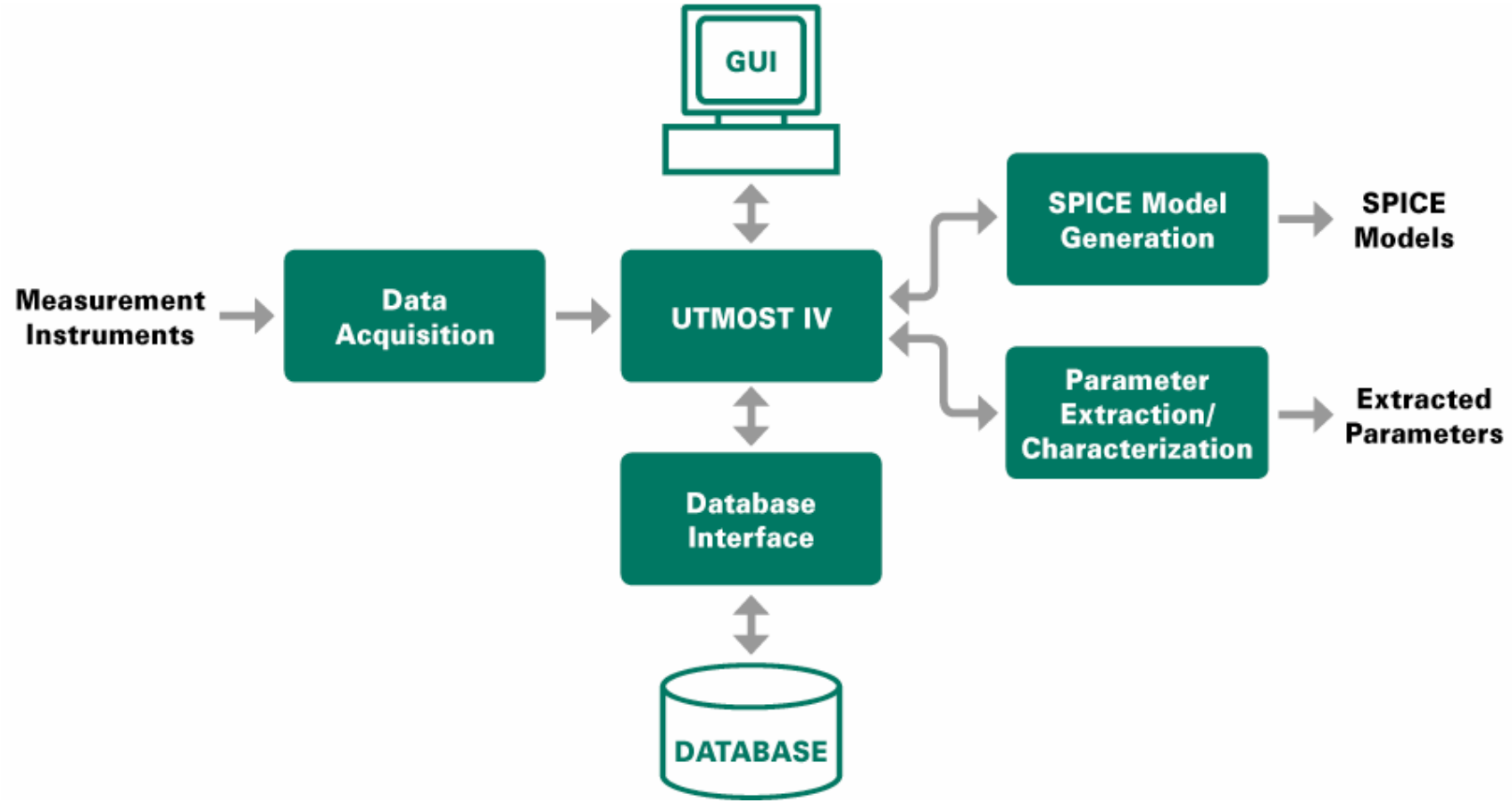


Dr. Ivan Pesic

January 2007

SIMUCAD DESIGN AUTOMATION

UTMOST IV Architecture



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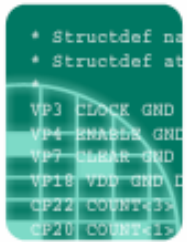
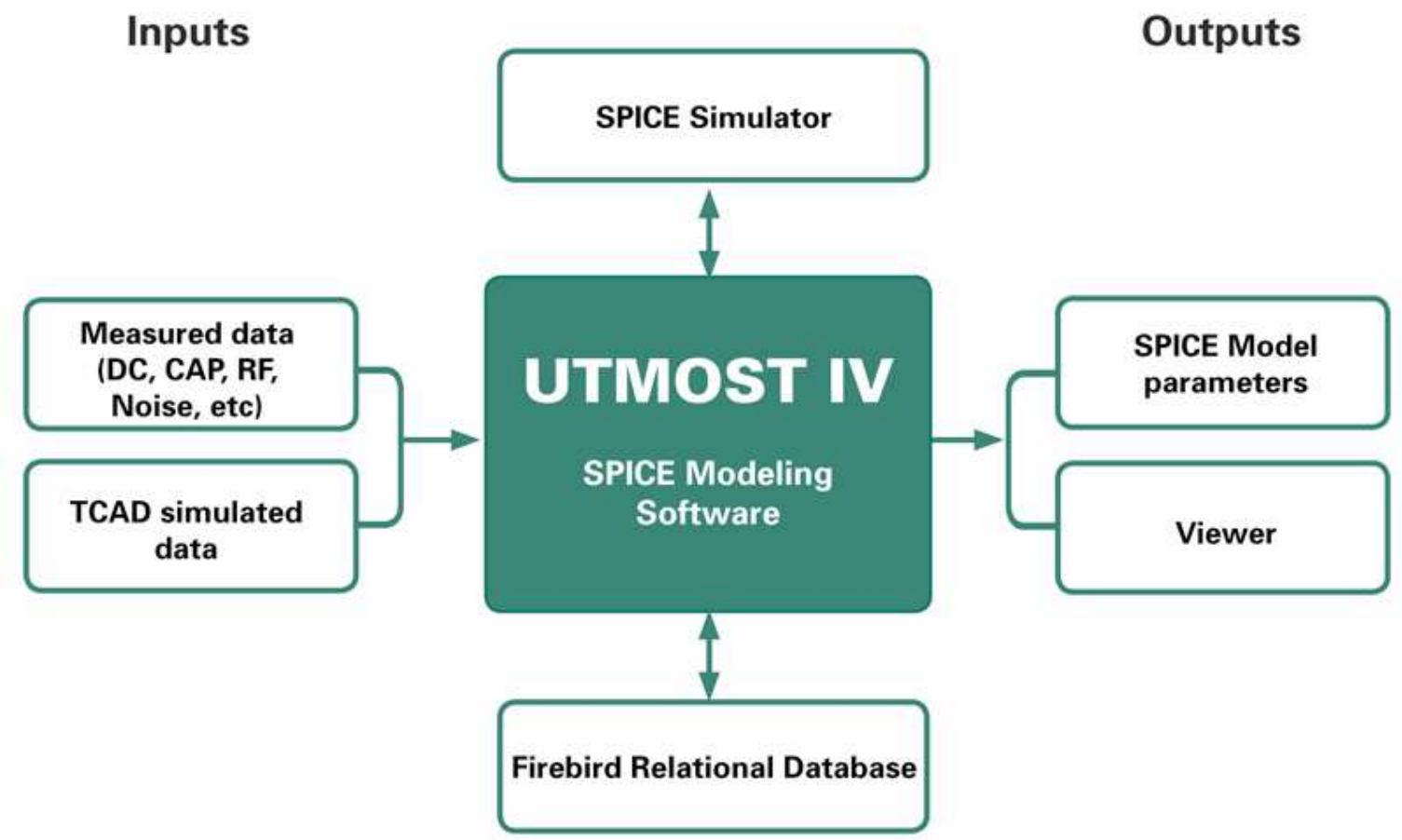


Optimization Module Overview

- Underlying 64-bit Relational Database
- Flexible Data Format
- Technology Independent
- Full Macro-model Support
- High-speed SmartSpice Interface
- Unlimited Multi-target Optimization
- Family of Advanced Optimizers

UTMOST IV Optimization Module Architecture



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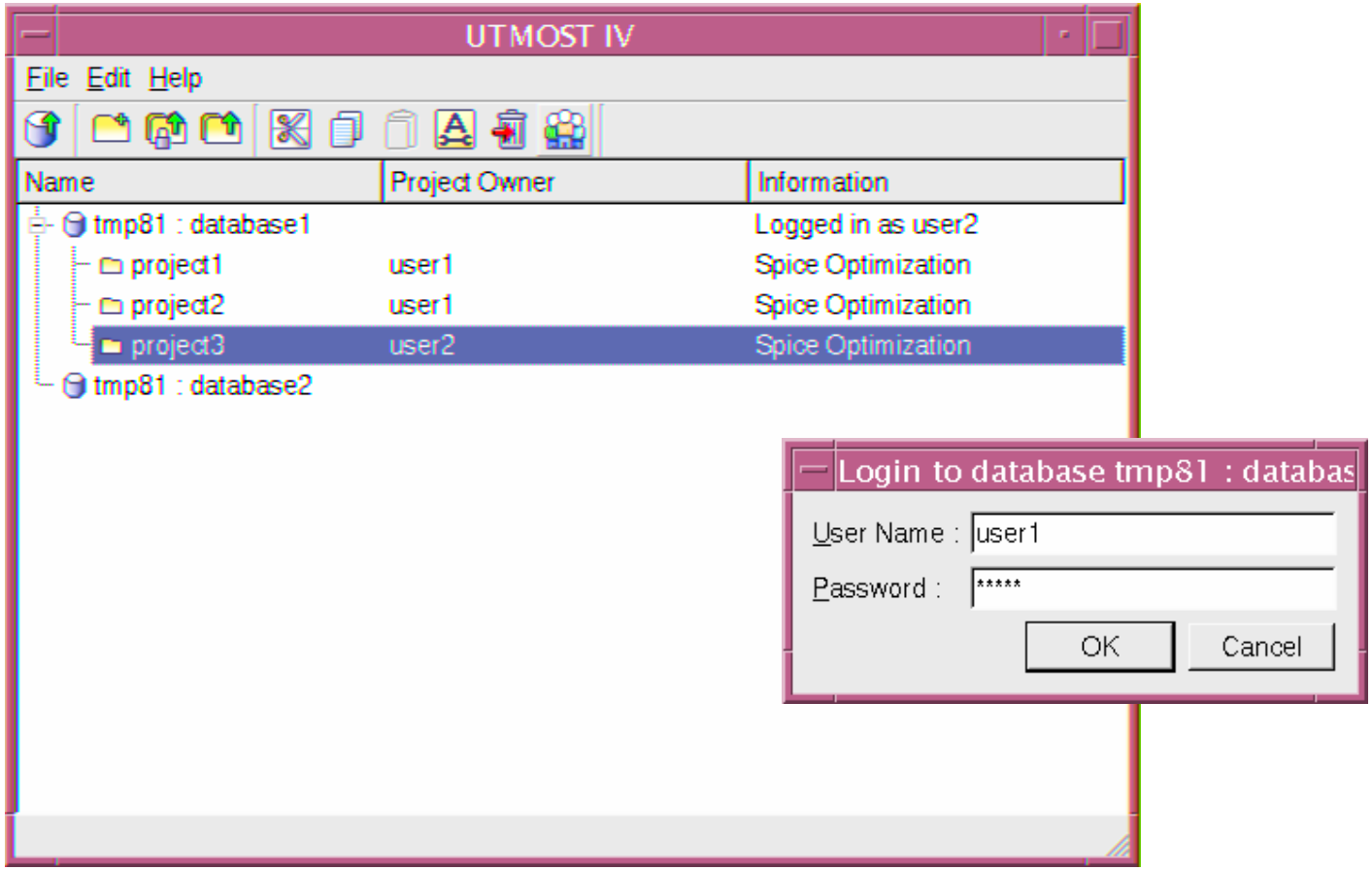
64-bit Relational Database

- Multi-user, multi-access Firebird 64bit relational database organises your work
- Data sharing, storage and retrieval



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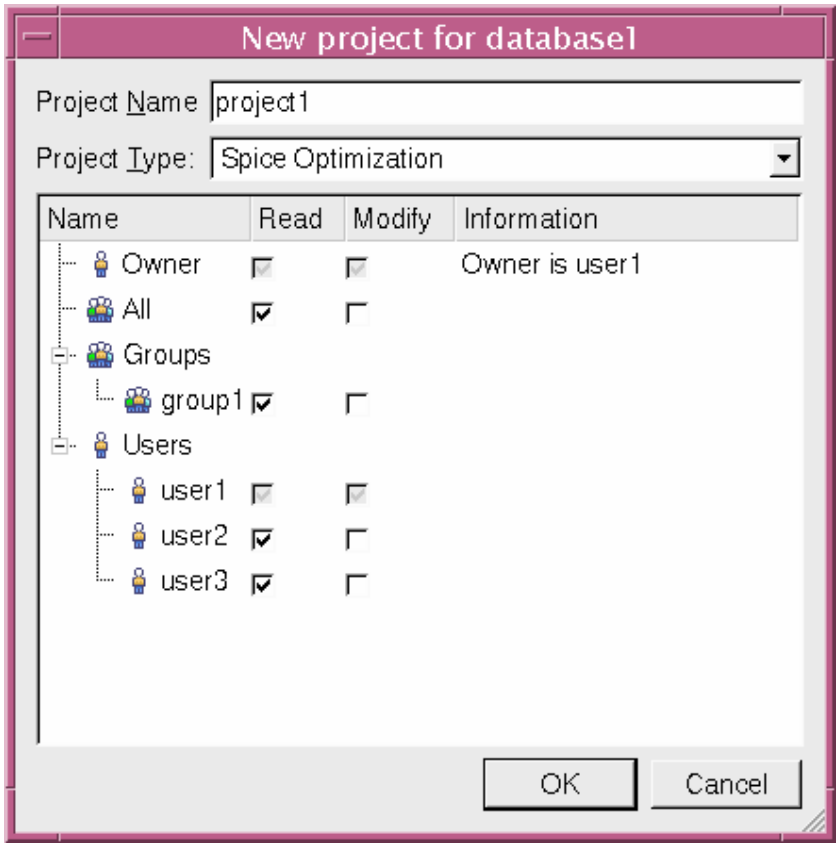
Database Permissions

- Full access control for data security



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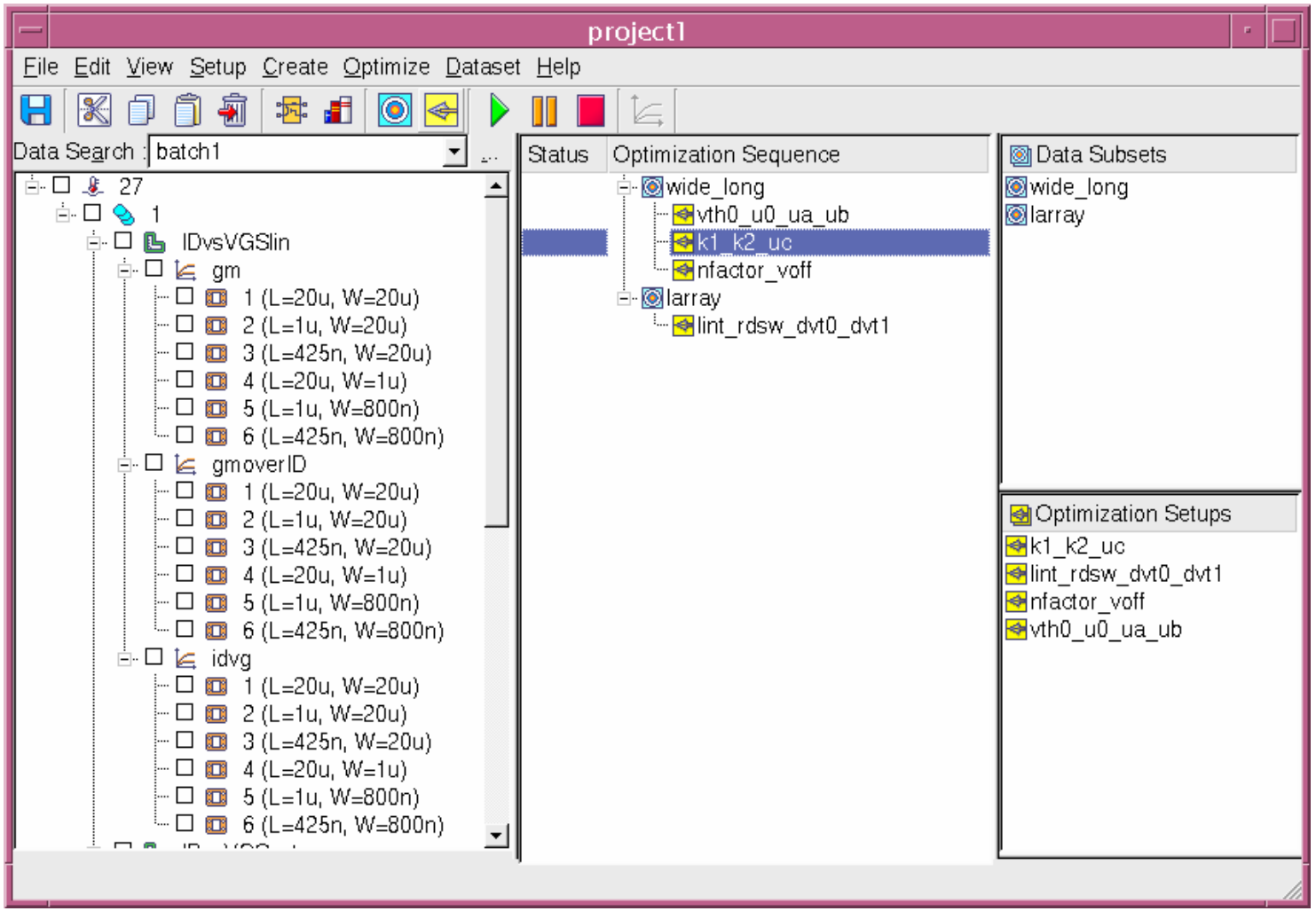
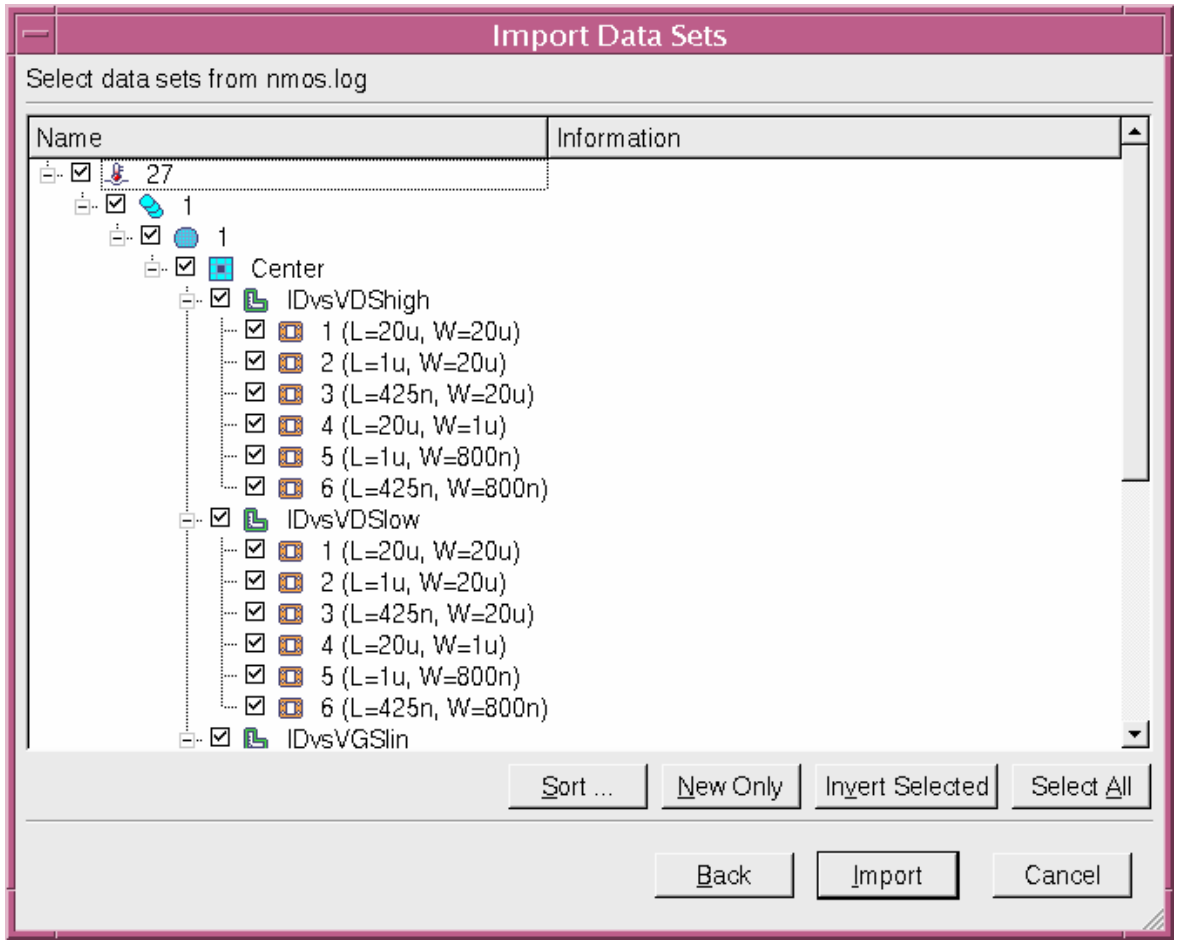
The Project Window



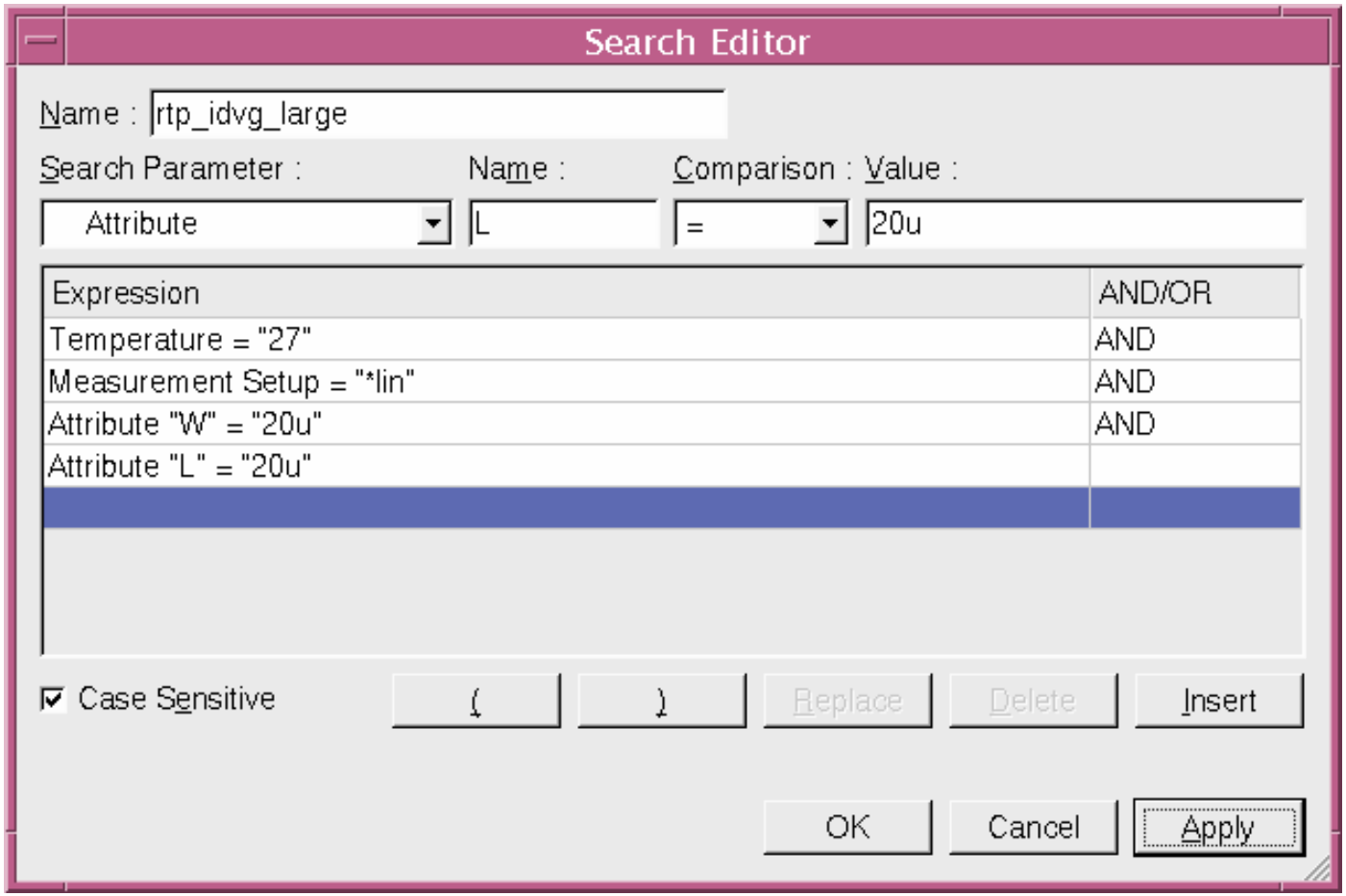
Data Import



- Dataset import for legacy UTMOST III logfiles
- Flexible dataset import using UTMOST IV datafiles
- No longer any requirement for data to have equally spaced points
- Sweeps can be linear or logarithmic, or simply a list of values

Search Editor

- Database search allows you to retrieve and share information



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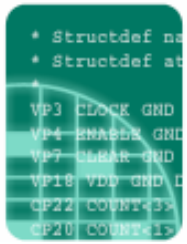
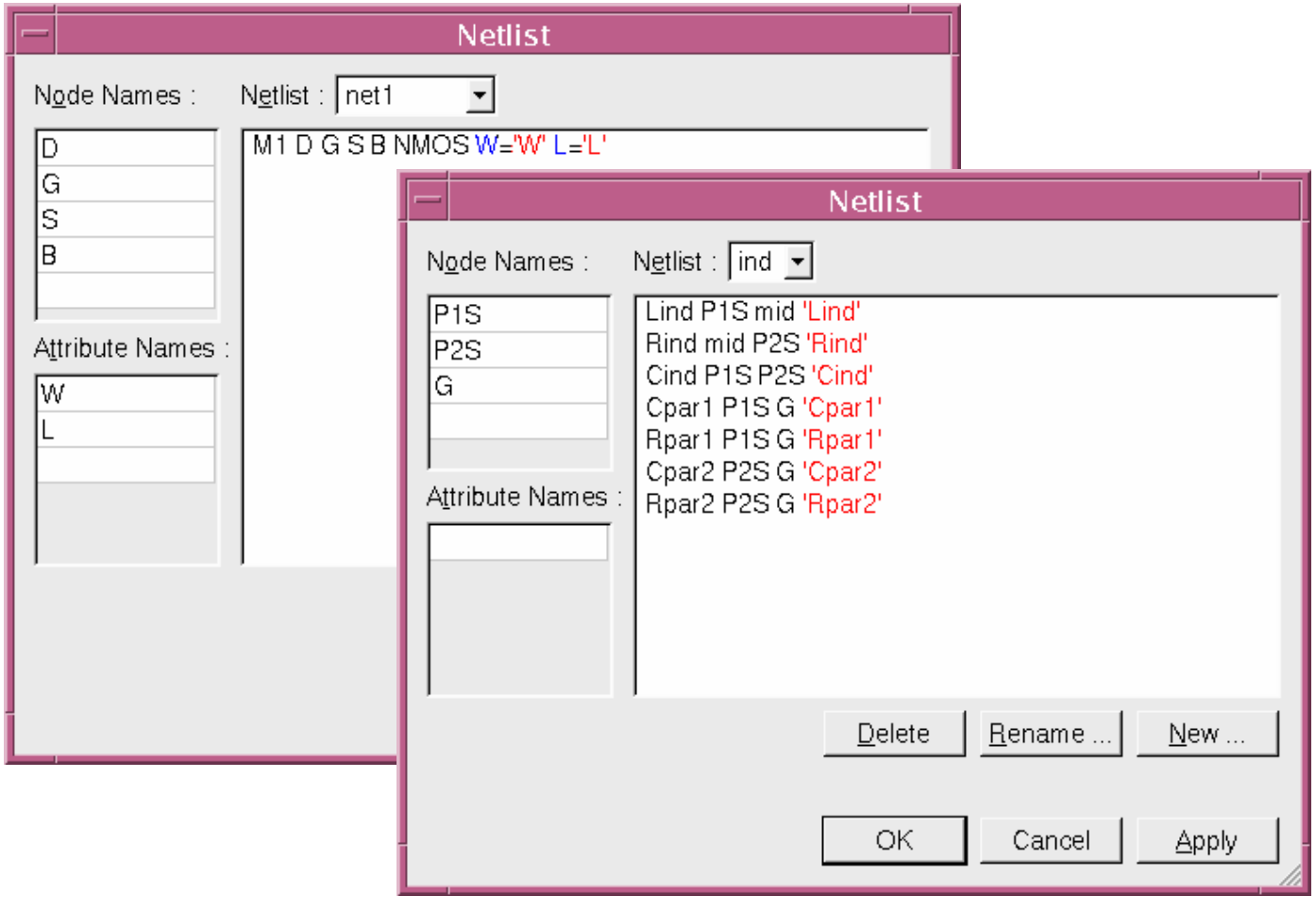


Technology Independent

- No more BIP, MOS, SOI, SPICE model modules to buy like in UTMOST III and competitors' software
- No limit to number of name of device nodes
- Supports all types of semiconductor devices
- All spice model types available through SmartSpice

Netlist Definition

- Netlist of any complexity can be defined for macro-model
- All macro-model parameters available for simultaneous optimization and rubberbanding



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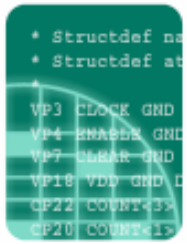
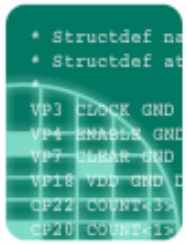


High Speed SmartSpice Interface

- Simulation is provided using the full power and flexibility of SmartSpice
- Very fast simulation times provided by high speed API interface
  - 80 dc simulations per second on AMD Atlon64 X2 4800
- No significant loss in speed when using macro-model instead of compact model
- Optimization time for typical LDMOS macro-model
  - UTMOST III approx. 1.5 - 2.0 hours
  - **UTMOST IV approx. 2-3 minutes**

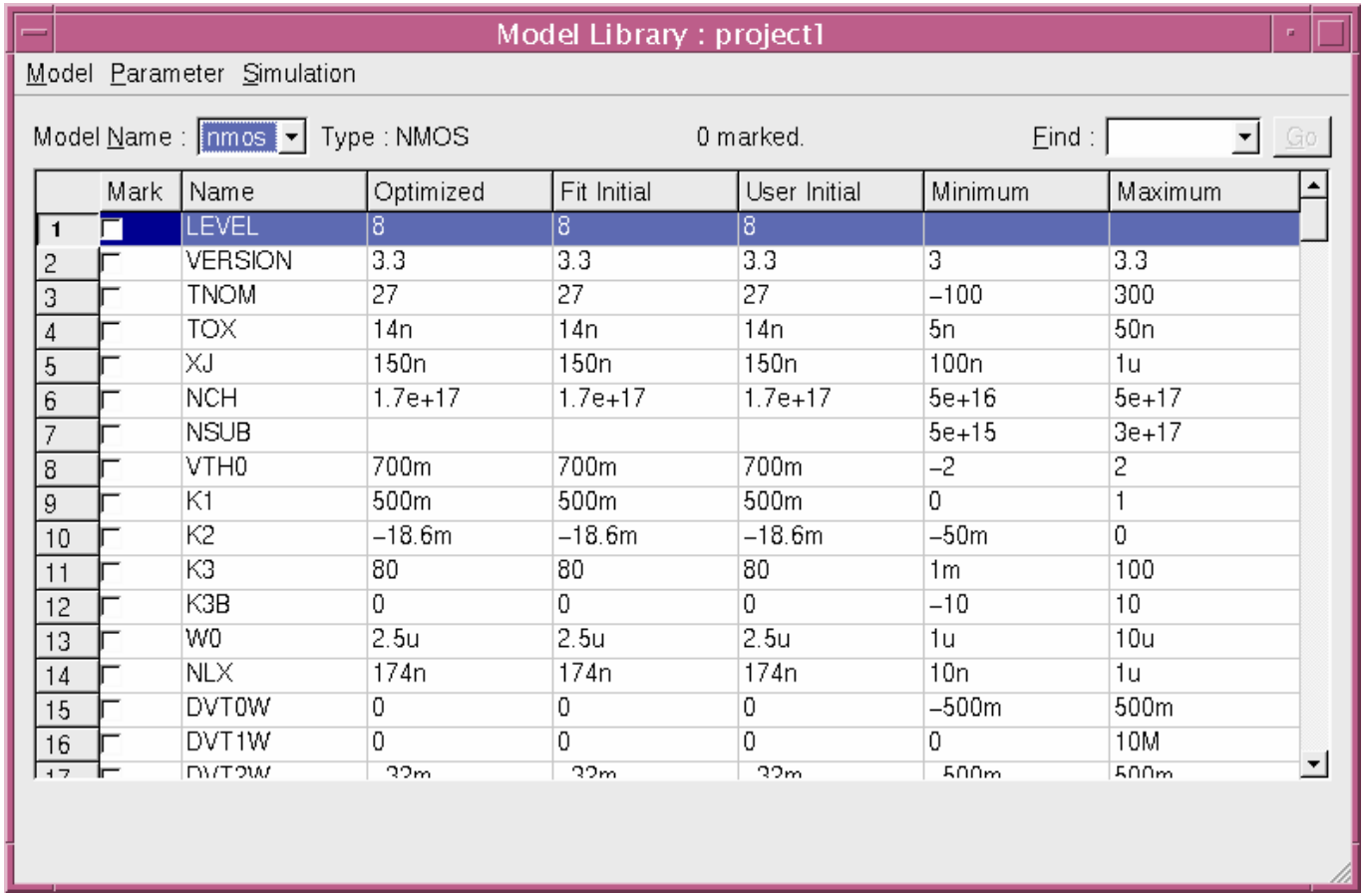


ModelLib Saves the Day

- UTMOST IV no longer contains the models
- Model information provided by ModelLib in SmartSpice
- No difference between SPICE simulator and model extractor is possible
- Any new SPICE models in SmartSpice are also instantly available to UTMOST IV
- Web-based and web-delivered model updates

Model Library

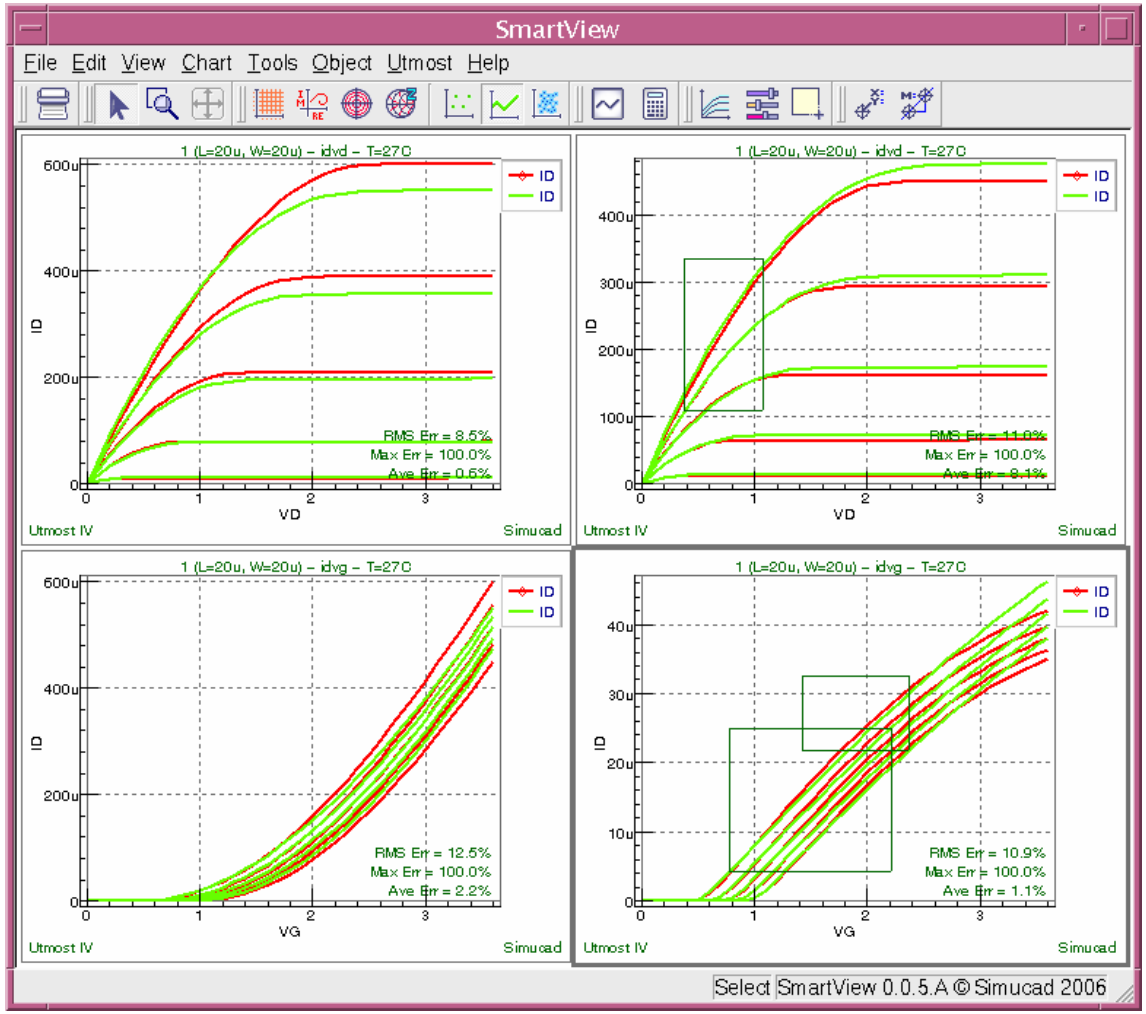
- No limit to number or type of models
- Versatile import and export



	Mark	Name	Optimized	Fit Initial	User Initial	Minimum	Maximum
1		LEVEL	8	8	8		
2		VERSION	3.3	3.3	3.3	3	3.3
3		TNOM	27	27	27	–100	300
4		TOX	14n	14n	14n	5n	50n
5		XJ	150n	150n	150n	100n	1u
6		NCH	1.7e+17	1.7e+17	1.7e+17	5e+16	5e+17
7		NSUB				5e+15	3e+17
8		VTH0	700m	700m	700m	–2	2
9		K1	500m	500m	500m	0	1
10		K2	–18.6m	–18.6m	–18.6m	–50m	0
11		K3	80	80	80	1m	100
12		K3B	0	0	0	–10	10
13		W0	2.5u	2.5u	2.5u	1u	10u
14		NLX	174n	174n	174n	10n	1u
15		DVT0W	0	0	0	–500m	500m
16		DVT1W	0	0	0	0	10M
17		DVT2W	–32m	–32m	–32m	–500m	500m

Multi-target Optimization

- Any combination of data can be used as the target for an optimization
- Multiple temperatures, mix dc and ac, multiple batch or wafers



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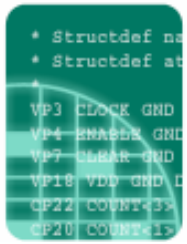
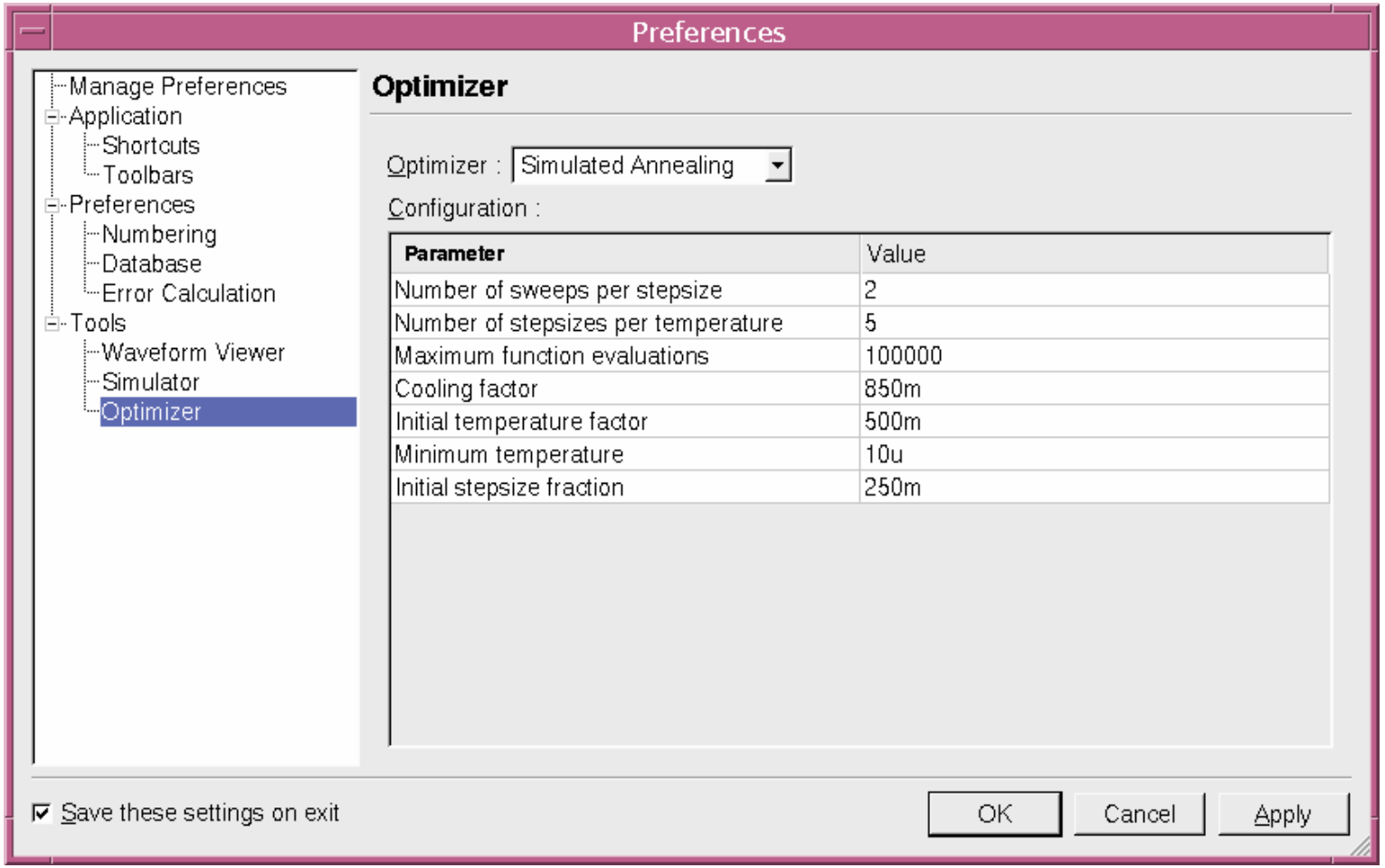


Family of Advanced Optimization Algorithms

- Local (traditional) optimizers are fast, but need good starting point
  - Levenberg Marquartz
  - Gauss-Siedel
  - Hooke-Jeeves
- Global (next generation) optimizers run more iterations, but require less conditioning
  - Genetic Algorithm
  - Simulated Annealing
  - Parallel Tempering
  - Differential Evolution

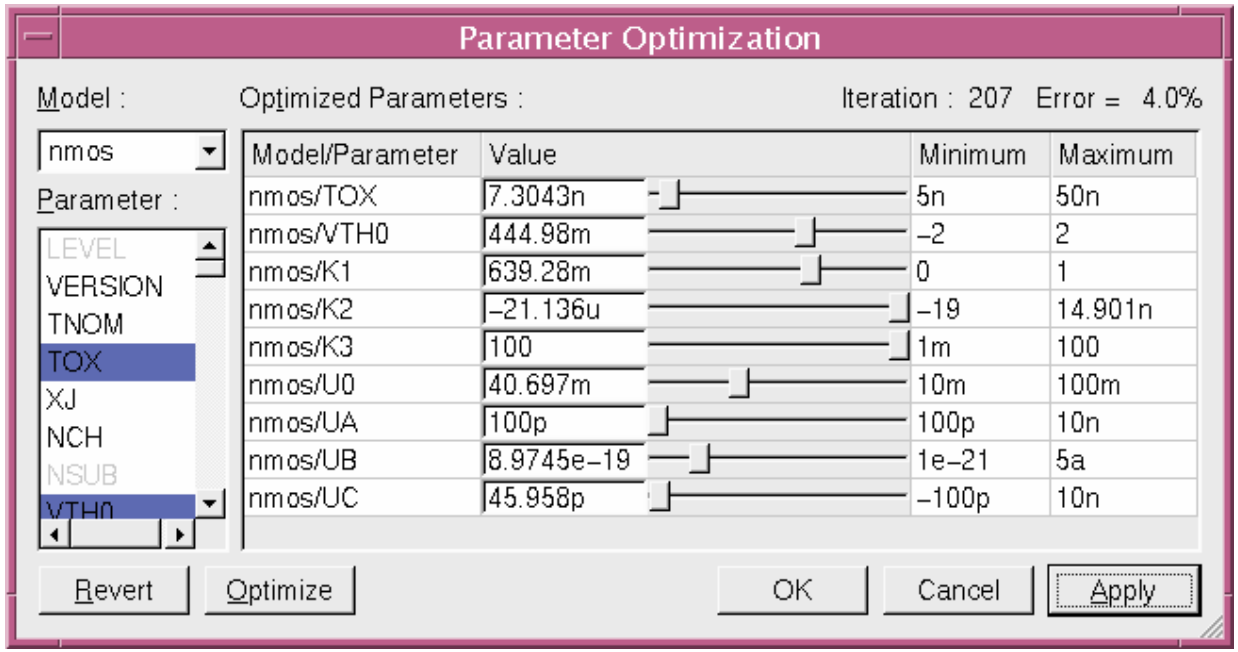
Optimizer Settings

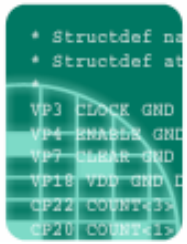
- Easy to select and configure optimizer



Rubberband Optimization

- No limit to number of parameters
- Parameters for multiple models may be optimized at the same time





Conclusion

- UTMOST IV Optimization Module provides an easy to use, database-driven environment for the generation of accurate, high quality SPICE models and macro-models for analog, mixed-signal and RF applications

- UTMOST IV provides model extraction solution for problems that were not possible to solve with UTMOST III and competitors' software
  - Deep sub-micron CMOS with the new generation of SPICE models (HiSIM, PSP, Dual Gate, BSIM, etc.)
  - Complex power MOS/Bipolar macro-models
  - Passive and active RF macro-model (varactor, inductor, etc.) s-parameter optimization