HSC 9 New Features

HSC 9 Releases

2019
HSC 9.9.2 June 2019
HSC 9.9.0 March 2019

2018
HSC 9.8. December 2018
HSC 9.7. October 2018
HSC 9.6. May 2018
HSC 9.5. April 2018

2017
HSC 9.4. December 2017
HSC 9.3. September 2017
HSC 9.2. May 2017
HSC 9.1.1. March 2017

2016
HSC 9.0.7. December 2016
HSC 9.0.6.1 October 2016
HSC 9.0.5.5 September 2016
HSC 9.0.4.1 June 2016
HSC 9.0.3.4 June 2016 (HSC public course)
HSC 9.0.2.8 April 2016
HSC 9.0.1.1 January 2016
HSC 9.0.0.25 December 2015

New features 2019

New version of HSC 9 (ver. 9.9.2) has been released June 2019!

This release contains new features and bug fixes such as:

- New ’Size Redistribution’ and ’Water Tank’ models for mineral processing simulations
- Thermoeconomics tool improved
- Improvements to Minpro unit operations
- HSC Sim bug fixes
- Improvement to Gem Aqua calculations
- More Unit options to Gem input and output amounts
- Mass balance improvements and bug fixes

New version of HSC 9 (ver. 9.9.0) has been released March 2019!

This release contains new features and bug fixes such as:

- Speed and memory optimizations.
- Dyna-dialog UI improvements
- Stability fixes
- Copy paste bug fixes
- New ‘Negeswararao’ hydrocyclone model in minerals processing
- Lot of small bug fixes

New features 2018

New version of HSC 9 (ver. 9.8) has been released December 2018!

This release contains new features and bug fixes such as:

SIM
- Calculation speed optimization
- Model loading speed optimization
- Improved handling of own database species in models
- Unit Controls –panel for managing flowhseet's controls, see **Figure 1.**
- New Rod mill minerals processing unit model, see **Figure 2.**
- New Blasting minerals processing unit model, see **Figure 3.**
- Neethling froth recovery calculation method in flotation cell unit model
- Option to disable Log writing
- Option to Check for New HSC version
- Other small bug fixes

NAV
- Polygon digitizing, see **Figure 4.**
- Gradient path

DAT
- Refactored axis and series selection in Charts
- Correlation Matrix

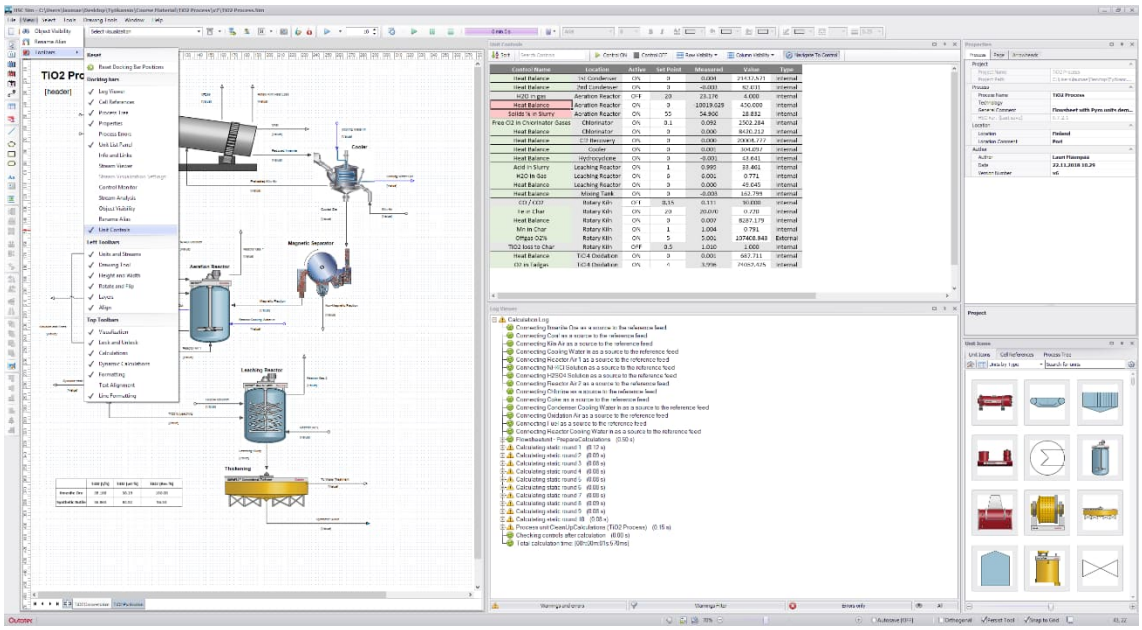


Figure 1. Unit Controls –panel for managing flowhseet's controls.

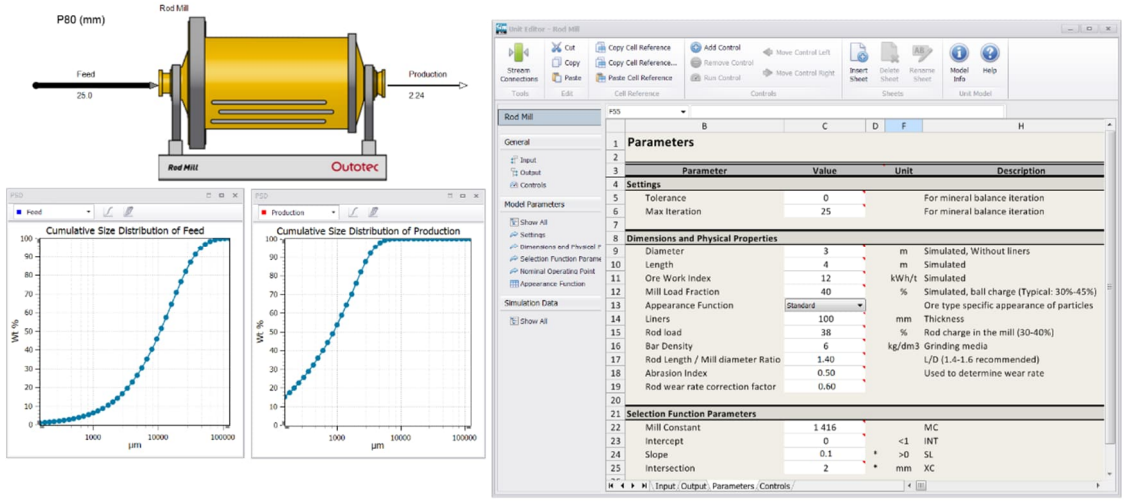


Figure 2. New Rod mill minerals processing unit model.

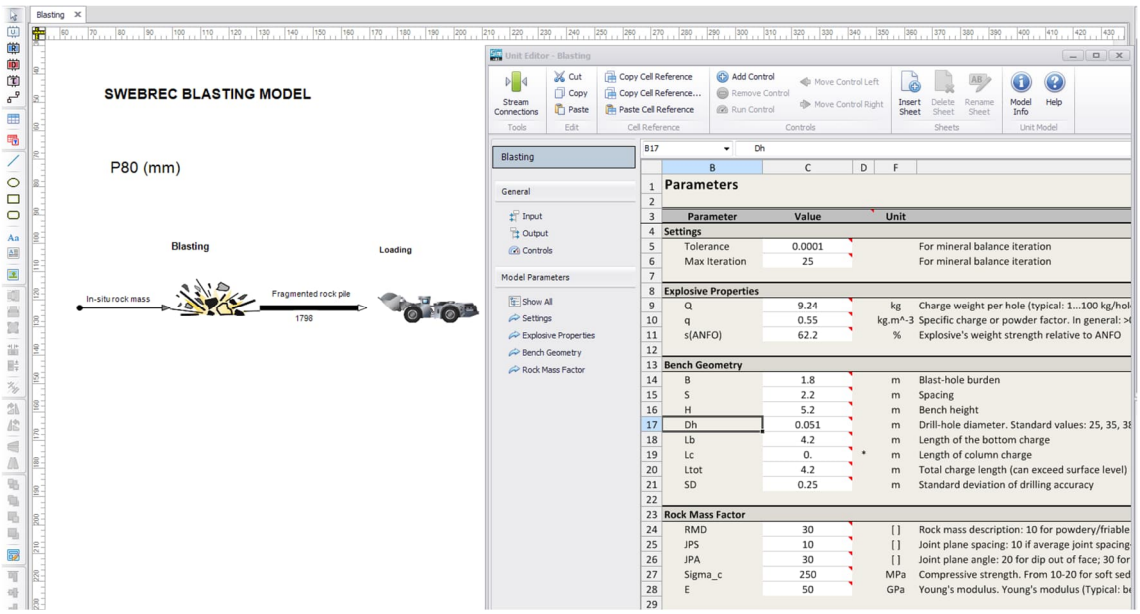


Figure 3. New Blasting minerals processing unit model.

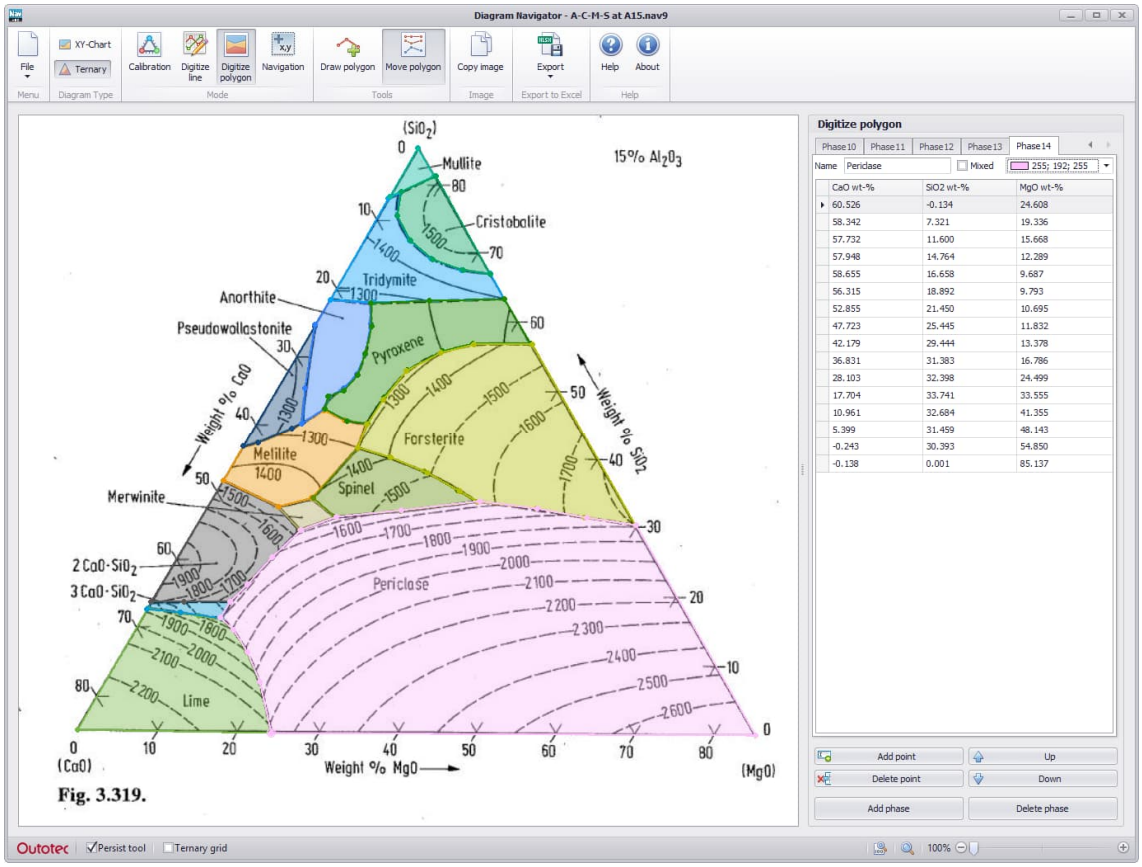


Figure 4. Polygon digitizing.

New version of HSC 9 (ver. 9.7) has been released October 2018!

This release contains new features and bug fixes such as:

SIM
- Copy – pasting of units with models included
- Neural Networks linking to process models, see **Figure 5**.
- Neural Networks training from simulated data
- OpenLCA interface
- Reactions (Hydro) Unit – Pressure and Aqua enthalpy corrections
- Reactions (Hydro) Unit – more variables (Adjusted Cp, pH, Element flowrate, Ideal gas volume, Relative humidity, Dew point temperature), see **Figure 6**.
- Reactions (Hydro) Unit – Copy chemical reactions from existing units
- Reactions (Hydro) Unit – Re-order and sort possibilities for several variable groups
- Log Viewer – Possibility to filter out warnings
- Minor improvements for Scenario Editor UI
- Minor improvements for Stream Table Editor
- Other small bug fixes

MAS
- Improved balancing algorithm is now capable to reconciliate streams also with partially missing assays.
- Databars for recoveries in pivot grid
- Other small bug fixes

MFIT
- Flotation stage reference streams and repetition groupings can be checked & manually set by user in a dedicated configuration dialog, see **Figure 7**.

DB
- Database updated (MainDB9.7.)

GEO
- Database updated

GEM

- Possibility to apply constraints to equilibrium calculations
- Other small bug fixes

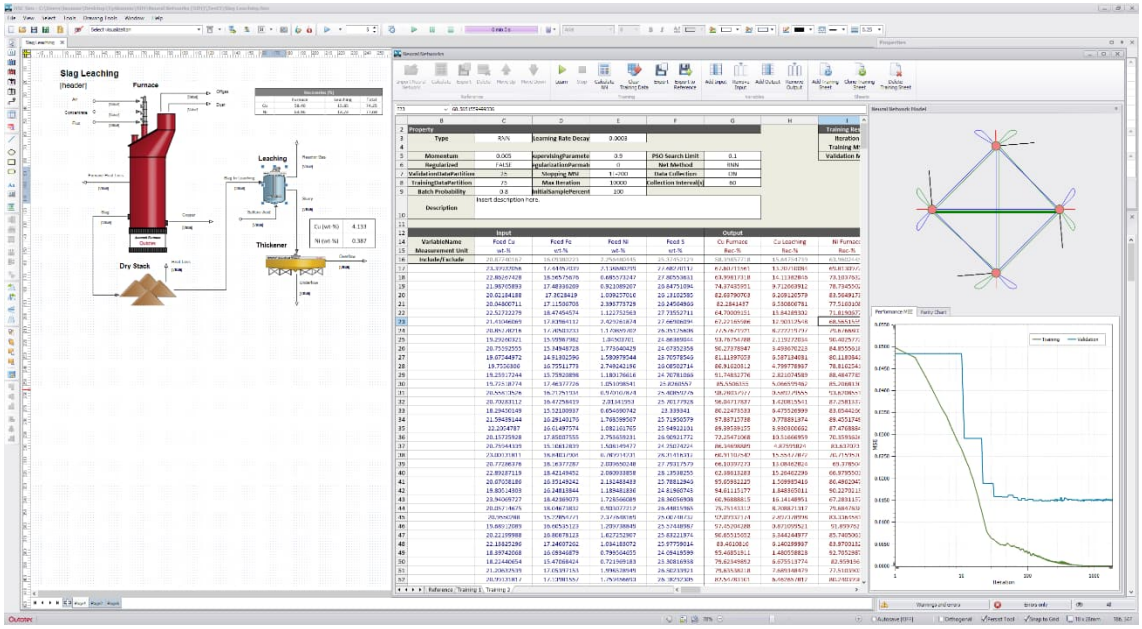


Figure 5. Sim – Neural Networks.

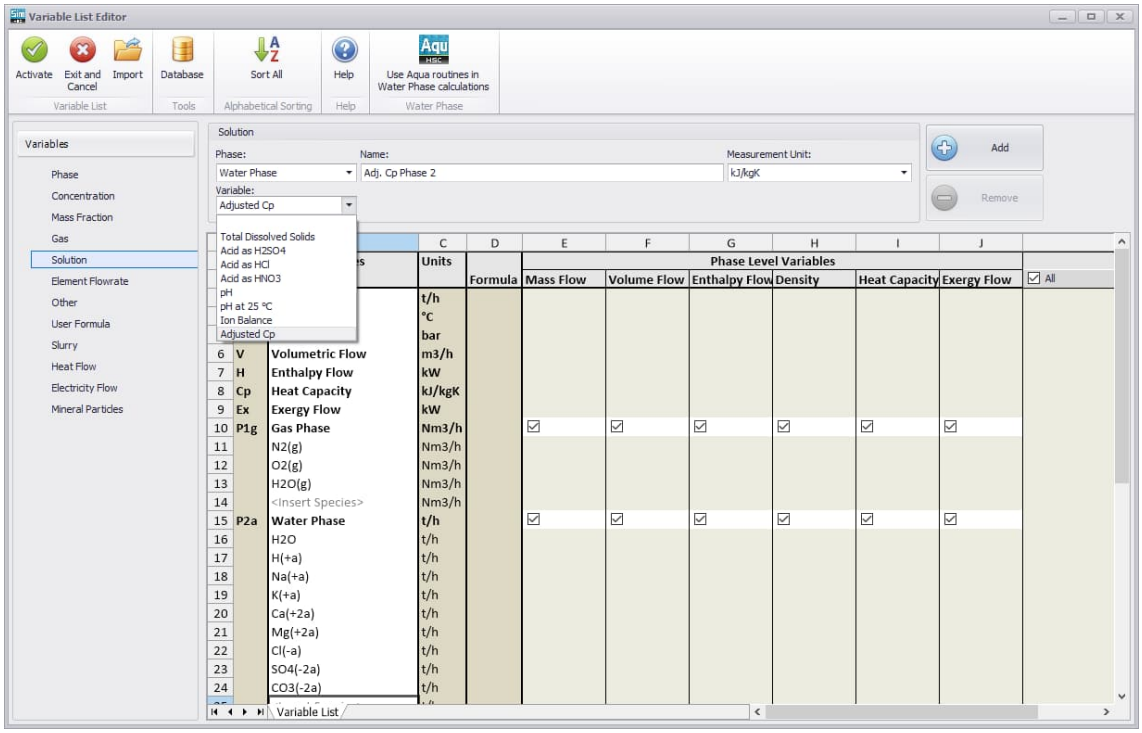


Figure 6. Sim Hydro – new variables.

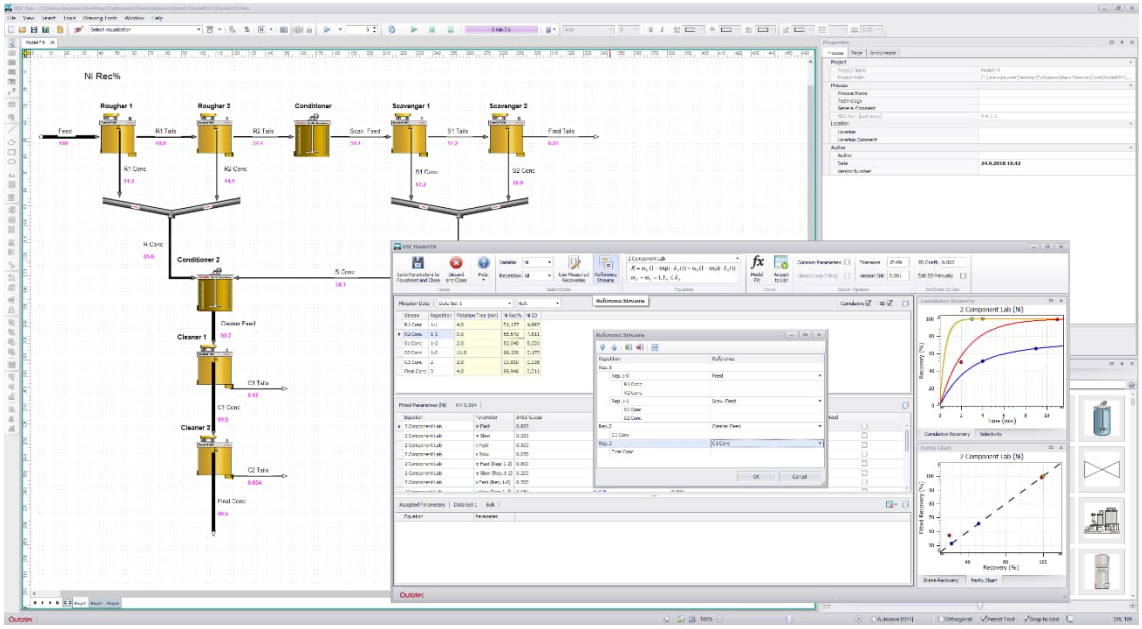


Figure 7. Model fit reference stream dialog.

New version of HSC 9 (ver. 9.6) has been released May 2018!

This release contains new features and bug fixes such as:

DAT – Updated module!
- Data plotting, see **Figure 8**.
- Neural networks
- Particle Swarm Optimization

SIM
- First implementation of Dynamic simulation, see **Figure 9**.
- Dynamic calculation settings dialog
- New multi-purpose dynamic calculation unit for species simulation
- Progressive dynamic calculation updates for minerals processing unit operation models
- PID control for dynamic calculations
- New Chalmers crusher models for minerals processing: jaw, cone and gyratory crusher, see **Figure 10**.
- New dynamic conveyor belt model for minerals processing
- Reactions (Hydro) Unit – more variables (Total Dissolved Solids, Acid concentrations, Ion Balance)
- Reactions (Hydro) Unit – more measurement units (mol/l, mmol/l, mg/l)
- Stream Table improvements (Header, Clone Table Set, More formatting options)
- Data bars in Tables, see **Figure 11**.
- Autosave
- Other small bug fixes

MAS
- Visualization of balance equation in flow sheet
- Other small bug fixes

GEM
- User Formulas for custom variable visualization, see **Figure 12**.

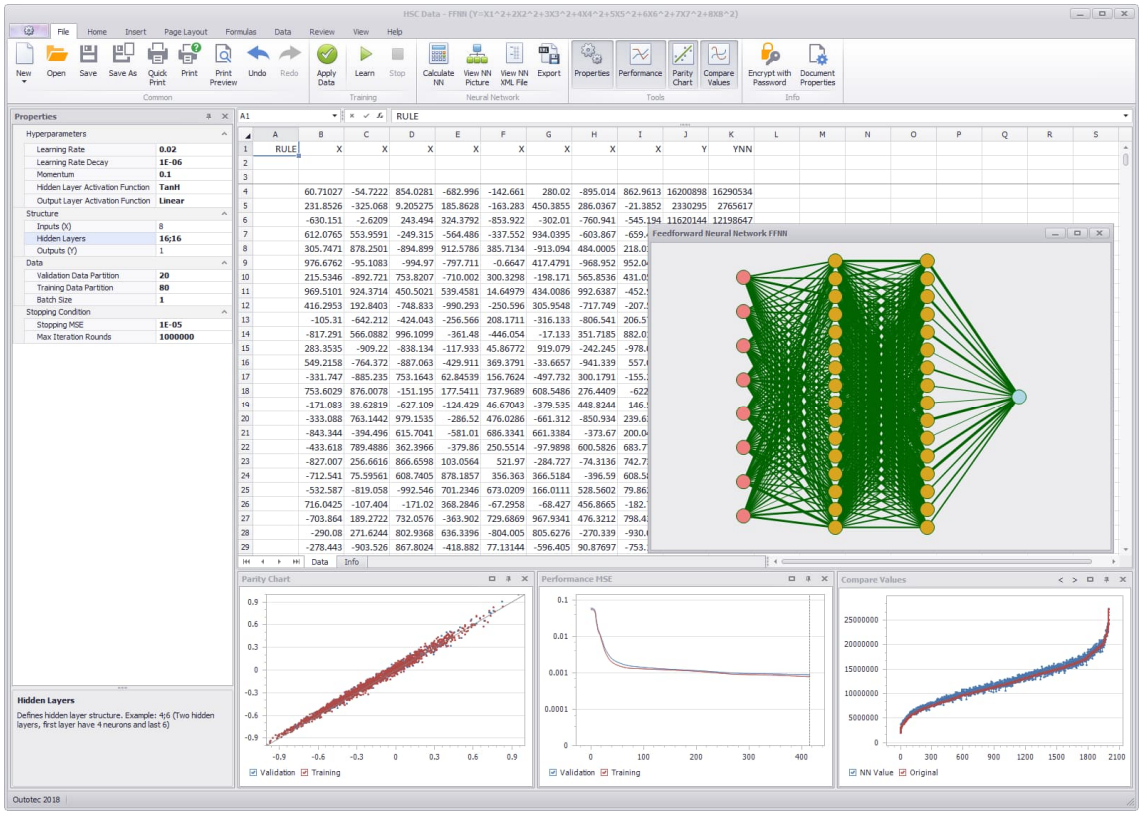


Figure 8. Dat module updated.

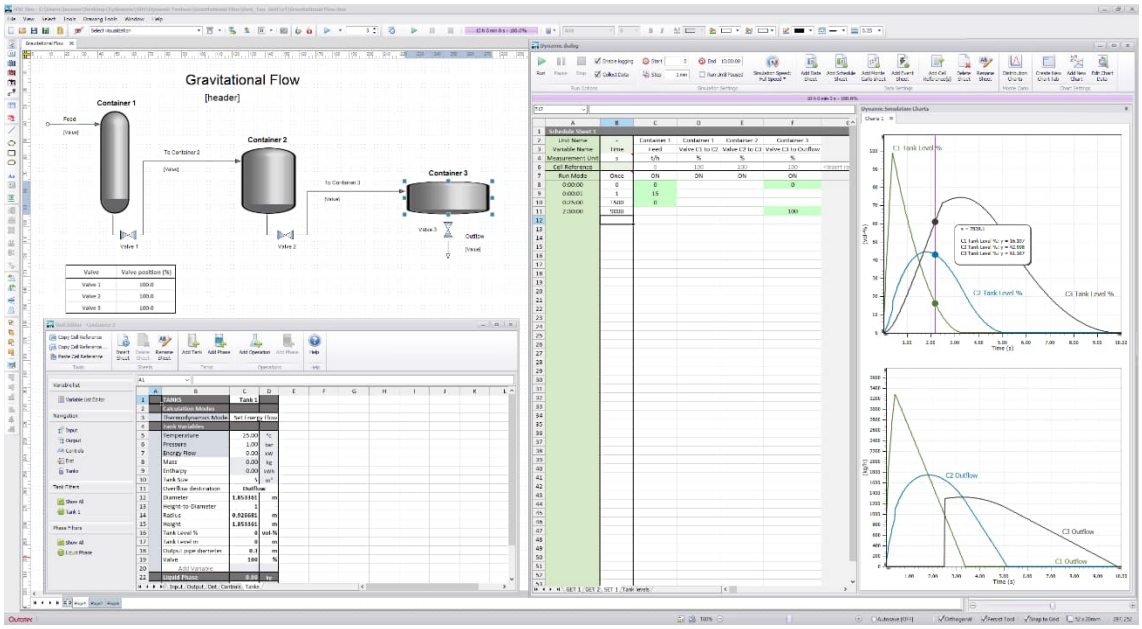


Figure 9. First implementation of Dynamic simulation.

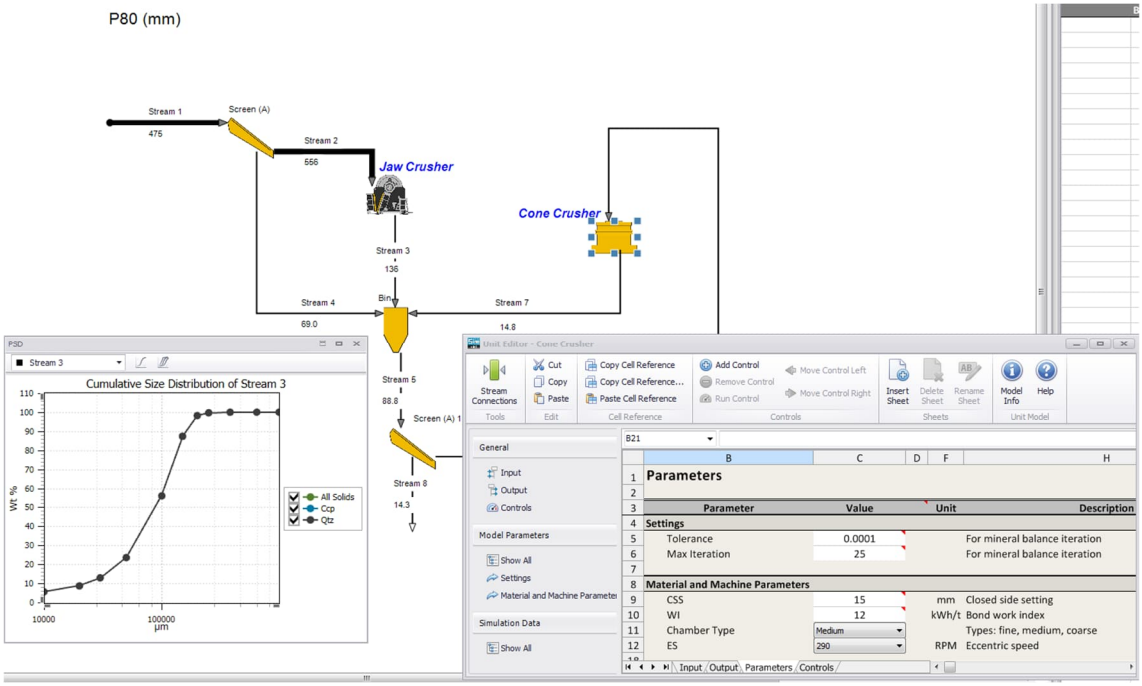


Figure 10. New Chalmers crusher models.

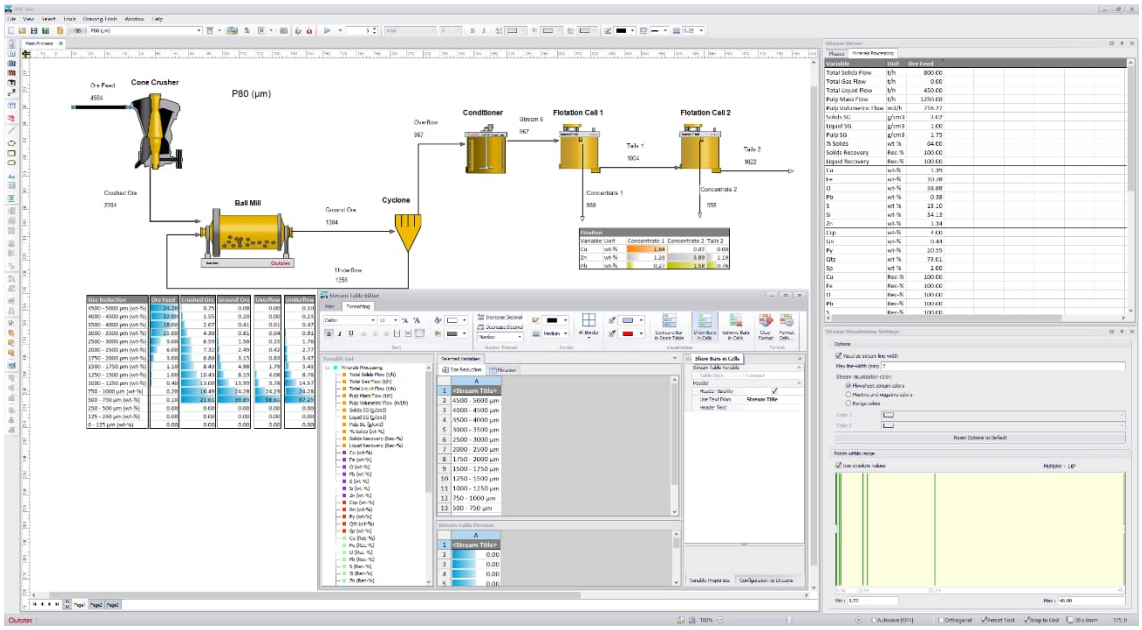
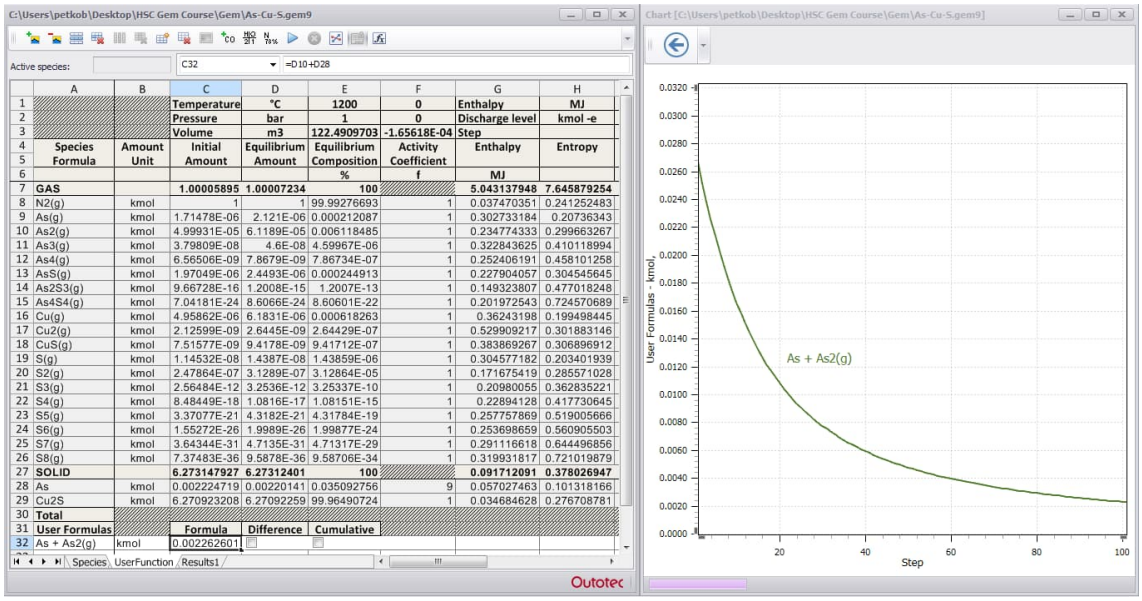


Figure 11. Data bars in Tables.



	A	B	C	D	E	F	G	H
1			Temperature	°C	1200	0	Enthalpy	MJ
2			Pressure	bar	1	0	Discharge level	kmol -e
3			Volume	m3	122.4909703	-1.65618E-04	Step	
4	Species Formula	Amount Unit	Initial Amount	Equilibrium Amount	Equilibrium Composition	Activity Coefficient	Enthalpy	Entropy
5					%	f	MJ	
6	GAS		1.00005895	1.00007234	100		5.043137948	7.645879254
7	N2(g)	kmol	1	1	99.99276693	1	0.037470351	0.241252483
8	As(g)	kmol	1.71478E-06	2.121E-06	0.000212087	1	0.302733184	0.20736343
9	As2(g)	kmol	4.99931E-05	6.1189E-05	0.006118485	1	0.234774333	0.299663267
10	As3(g)	kmol	3.79809E-08	4.6E-08	4.59967E-06	1	0.322843625	0.410118994
11	As4(g)	kmol	6.56506E-09	7.8679E-09	7.86734E-07	1	0.252406191	0.458101258
12	AsS(g)	kmol	1.97049E-06	2.4493E-06	0.000244913	1	0.227904057	0.304545645
13	As2S3(g)	kmol	9.66728E-16	1.2008E-15	1.2007E-13	1	0.149323807	0.477018248
14	As4S4(g)	kmol	7.04181E-24	8.6066E-24	8.60601E-22	1	0.201972543	0.724570689
15	Cu(g)	kmol	4.95862E-06	6.1831E-06	0.000618263	1	0.36243198	0.199498445
16	Cu2(g)	kmol	2.12599E-09	2.6445E-09	2.64429E-07	1	0.529909217	0.301883146
17	CuS(g)	kmol	7.51577E-09	9.4178E-09	9.41712E-07	1	0.383869267	0.306896912
18	S(g)	kmol	1.14532E-08	1.4387E-08	1.43859E-06	1	0.304577182	0.203401939
19	S2(g)	kmol	2.47864E-07	3.1289E-07	3.12864E-05	1	0.171675419	0.285571028
20	S3(g)	kmol	2.56484E-12	3.2536E-12	3.25337E-10	1	0.20980055	0.362835221
21	S4(g)	kmol	8.48449E-18	1.0816E-17	1.08151E-15	1	0.22894128	0.417730645
22	S5(g)	kmol	3.37077E-21	4.3182E-21	4.31784E-19	1	0.257757869	0.519005666
23	S6(g)	kmol	1.55272E-26	1.9989E-26	1.99877E-24	1	0.253698659	0.560905503
24	S7(g)	kmol	3.64344E-31	4.7135E-31	4.71317E-29	1	0.291116618	0.644496856
25	S8(g)	kmol	7.37483E-36	9.5878E-36	9.58706E-34	1	0.319931817	0.721019879
26	SOLID		6.273147927	6.27312401	100		0.091712091	0.378026947
27	As	kmol	0.002224719	0.00220141	0.035092756	9	0.057027463	0.101318166
28	Cu2S	kmol	6.270923208	6.27092259	99.96490724	1	0.034684628	0.276708781
29	Total							
30	User Formulas		Formula	Difference	Cumulative			
31	As + As2(g)	kmol	0.002262601					

Figure 12. Gem - User Formulas for custom variable visualization.

New version of HSC 9 (ver. 9.5) has been released April 2018!

This release contains new features and bug fixes such as:

SIM
- New SAG mill minerals processing unit model, see **Figure 13**.
- Charts in Thermoeconomics Calculator
- Visualization measurement unit “t/d”
- Visualization with “Flow Tables”, see **Figure 14**.
- Link to the tutorial videos
- Other small bug fixes

MAS
- Improved water balancing routine, possibility to fix “Solids %” values and adjust “Solids-%” accuracies with SD settings.
- Balancing navigator: numeric data informatics
- SD calculation from Sampling Rounds
- Other small bug fixes

NAV
- 3D visualization for digitized XY-diagrams, see **Figure 15**.
- Other small bug fixes

HSC CHART
- Trendlines, see **Figure 16**.

AQU
- UI improvements and new features Main Database, Parameter Sets and Density Calculator, see **Figure 17**.

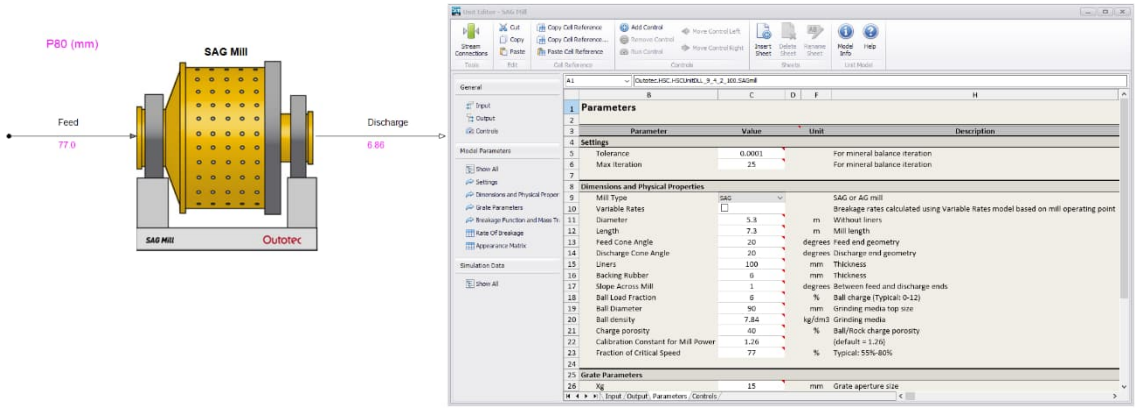


Figure 13. New SAG mill minerals processing unit model.

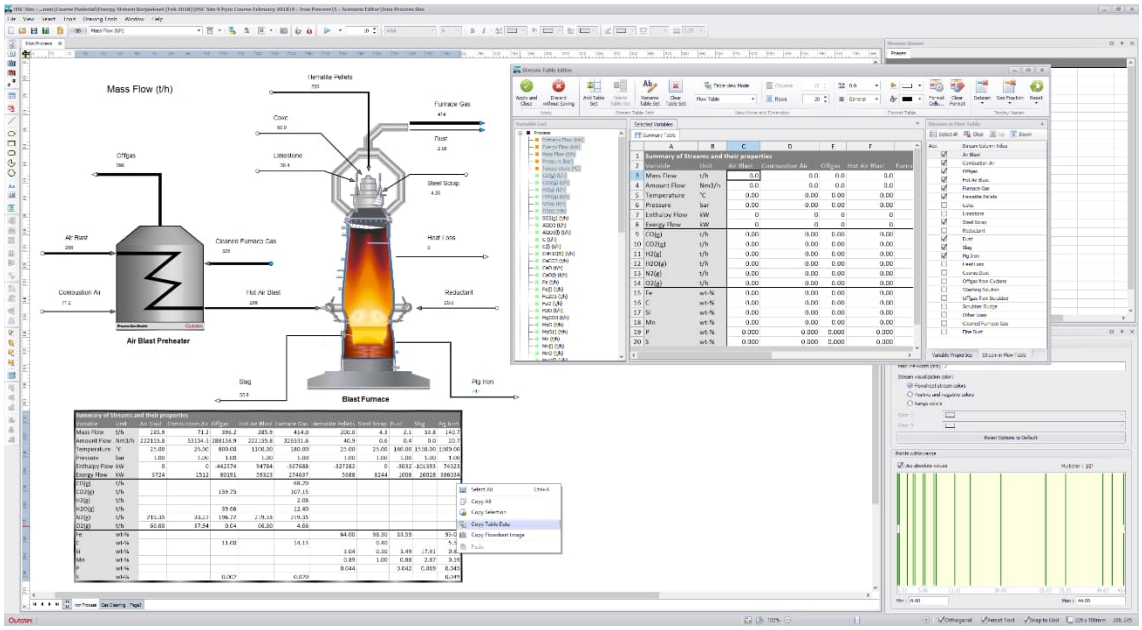


Figure 14. Sim Visualization with “Flow Tables”.

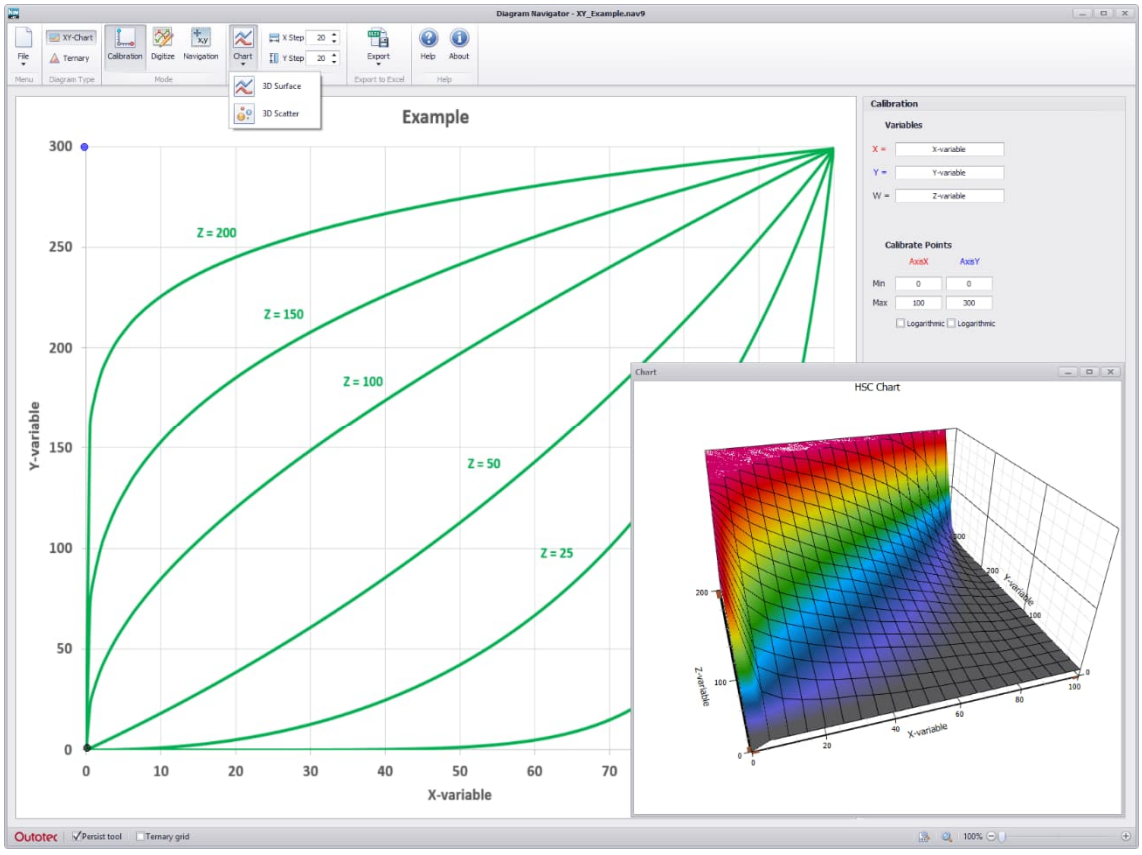


Figure 15. In Navigator 3D visualization for digitized XY-diagrams.

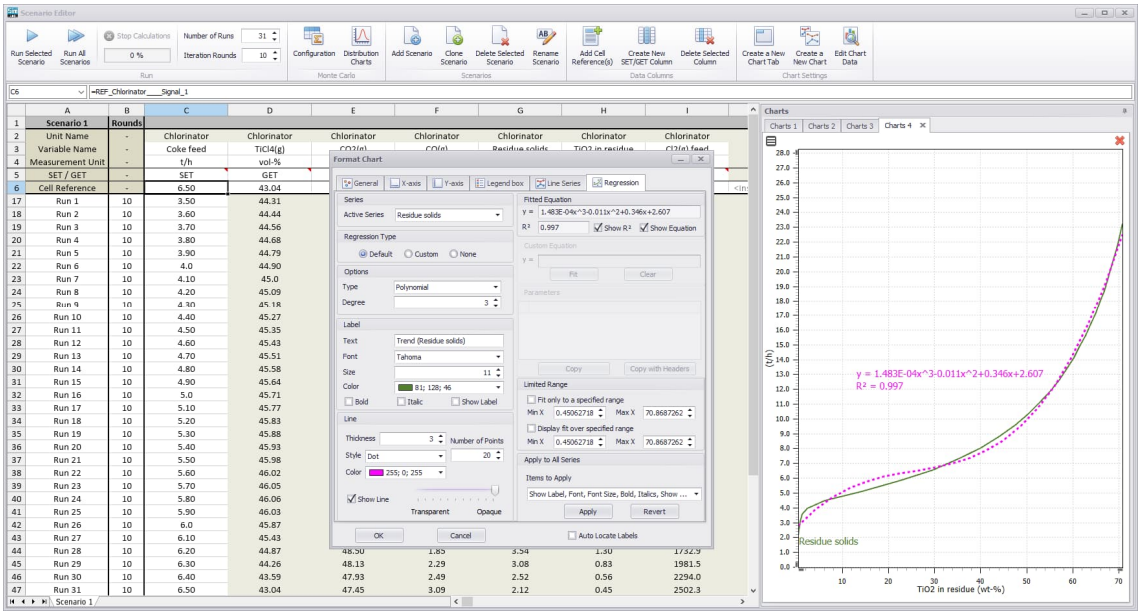


Figure 16. Trendlines can be added to all HSC Charts.

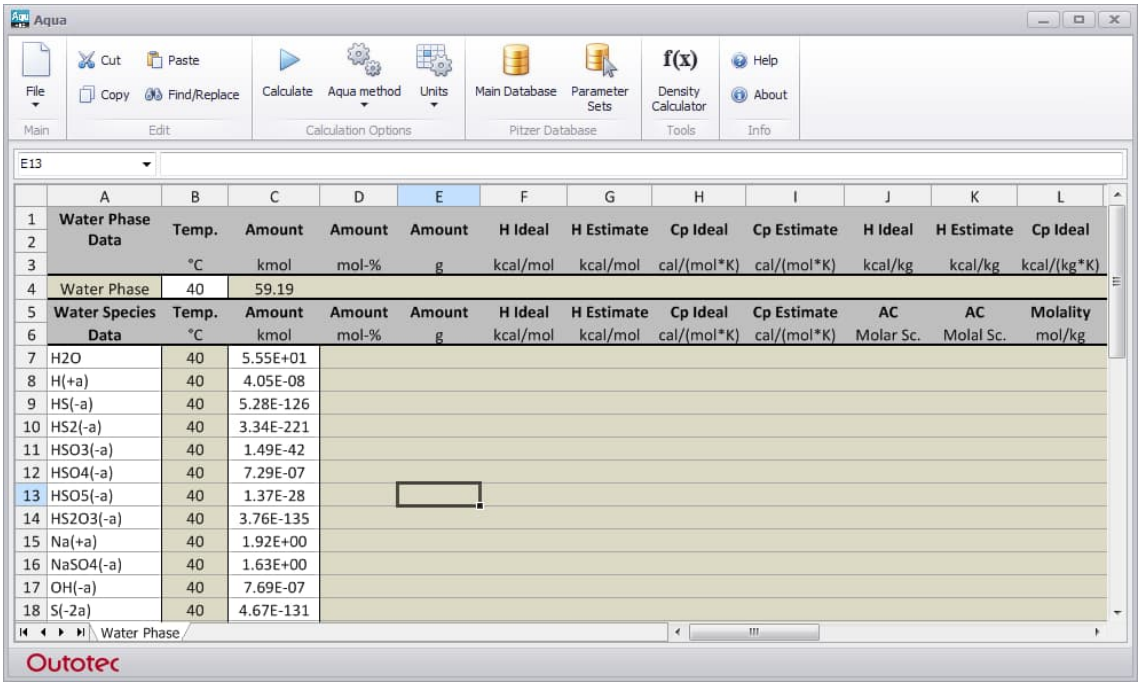


Figure 17. Aqua module user interface improvements and new features: Main Database, Parameter Sets and Density Calculator.

New features 2017

New version of HSC 9 (ver. 9.4) has been released!

This release contains new features and bug fixes such as:

MAT – Material Database, **Figure 18**.
- New module for creating feed Materials to be used in SIM.
- Materials can be created from species or other materials
- Materials have properties which can be utilized in DLL calculations

NAV – Diagram Navigator
- New module for digitizing diagrams (pictures), **Figure 19**.
- Supported for ternary and XY diagrams
- Excel Add-In function for digitized ternary diagrams

SIM Thermoeconomics Calculator
- New Sim tool for advanced exergy analysis, **Figure 20**.
- Thermoeconomics is a field that connects thermodynamics with economics through the second law of thermodynamics, resulting in a cumulative exergy cost analysis for the entire process.
- This tool provides cumulative exergy efficiencies in the flowsheet, and it is used for analyzing the effects of process parameters on resource consumption and the reasons for exergy destruction in the process.

SIM - other features
- Temperature dependency for exergy in energy streams
- Possibility to connect energy streams between units
- Particle Size –visualization measurement units
- Energy Flow –visualization measurement units
- Improved flowsheet drawing speed for flowsheets with multiple Reactions units
- Minerals Processing Example: Grinding and Flotation of Cu-ore
- Possibility to use Materials from Material DB in simulation
- In stream visualization and stream tables for mass balanced data the dataset and size fraction names can be hide
- Possibility to import DLL units from exiting Flowsheets
- New Colum Flotation unit DLL model for minerals processing, **Figure 21**.
- Other small bug fixes

MAS
- Sampling rounds can be saved separately in Measurement Data
- Automatic data importing from REX flotation test work database, **Figure 22**.
- New calculation method: LLS (Limited Least Squares)
- Flowsheet interactivity, clicking of flowsheet activates mass balance dialog selections and figures
- Simulation stream can be saved/read from Mass Balance
- Back calculation of oxides from the balanced minerals
- Back calculation of additional elements from the balanced minerals (based on mineral matrix)
- Improved water balance calculation algorithm
- Other small bug fixes

MODEL FIT

- Repetition fitting bug for Rectangular Distribution fixed

DB
- UI improvement for Cp Fit dialog

GIBBS
- Visualization options for phase amounts

HELP
- New UI and PDF files

Composition | Analyses

Material: Feed Material

A7

	A	B	C	D	E	F	G	H
1	**Composition**	**wt-%**	**Species**	**wt-%**	**Elements**	**wt-%**	**Reference**	
2	**Total**	**100.000**		**100.000**		**100.000**		
3	[Concentrate]	75.000	CuFeS2	16.838	Cu	13.335		
4	[Silica Flux]	20.000	Cu5FeS4	1.316	Fe	23.795		
5	C	3.000	Cu2S	8.355	S	26.038		
6	H2O	2.000	FeS	9.428	Zn	0.881		
7			FeS2	26.250	Ni	0.426		
8			ZnS	1.313	Si	11.127		
9			NiS	0.659	O	17.188		
10			SiO2	23.805	Mg	2.429		
11			MgO	4.029	Al	0.770		
12			Al2O3	1.455	Ca	0.786		
13			Fe2O3	0.454	C	3.000		
14			CaO	1.100	H	0.224		
15			C	3.000				
16			H2O	2.000				
17								
18								

Figure 18. Material Database – New module.

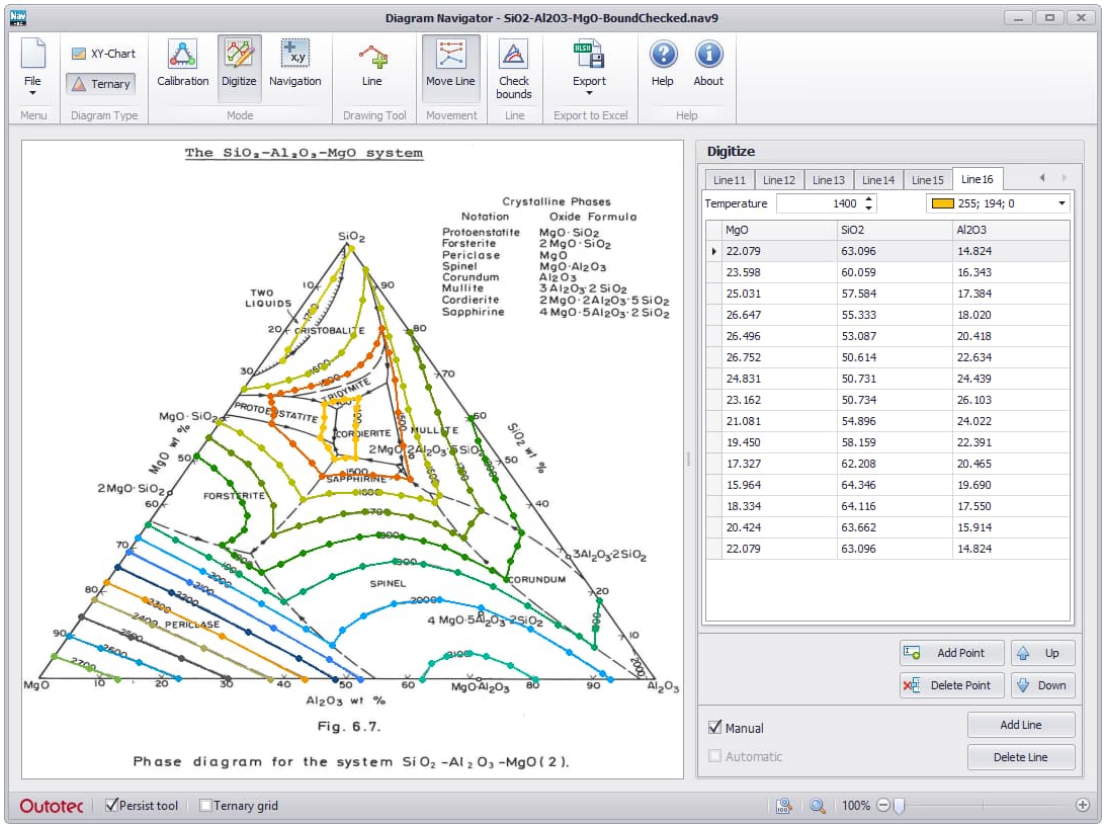


Figure 19. Diagram Navigator – New module.

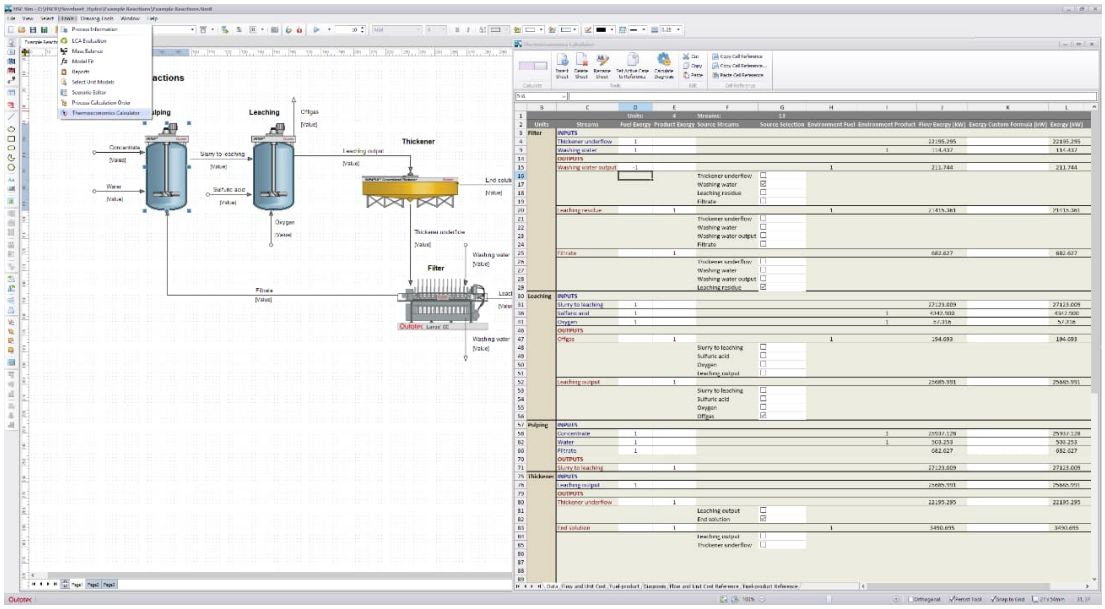


Figure 20. Thermoeconomics Calculator for advanced exergy analysis.

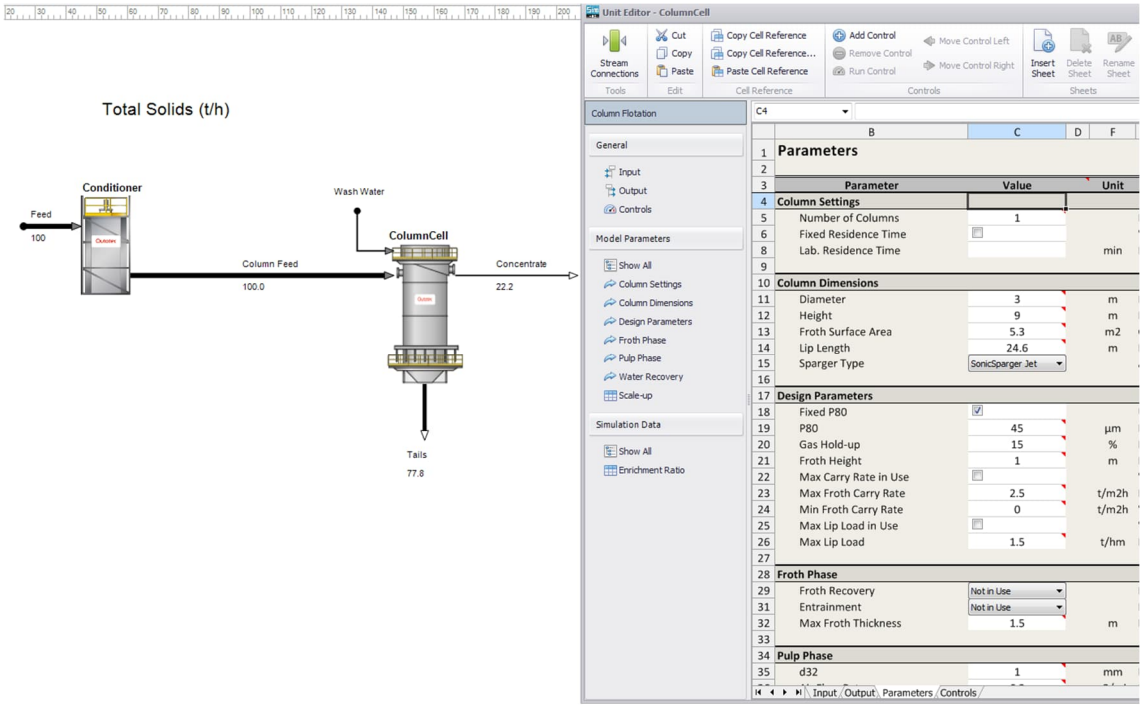


Figure 21. New Colum Flotation unit DLL model.

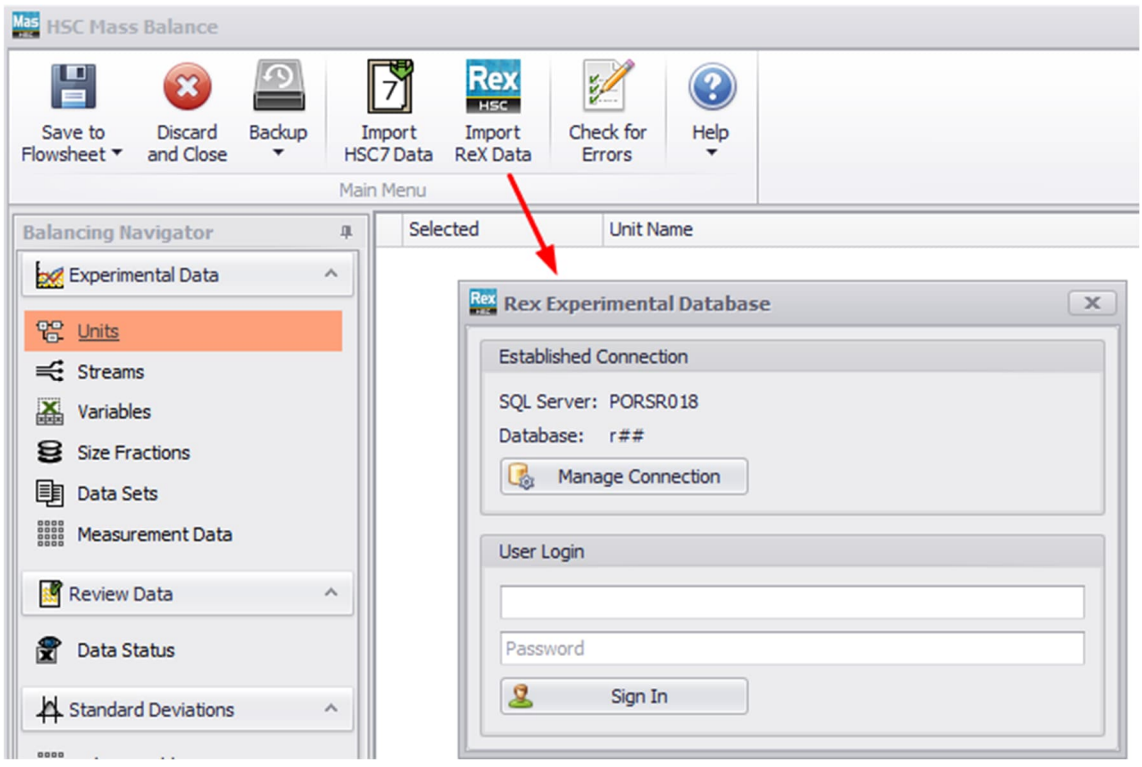


Figure 22. Automatic data importing from REX flotation test work database

New version of HSC 9 (ver. 9.3) has been released!

This release contains new features and bug fixes such as:

SIM
- New DLL units:
- Bond Ball Mill (Particles unit) **Figure 23**.
- Heat Exchanger (Species, Reactions unit) **Figure 24**.
- Cooling Tower (Species, Reactions unit) **Figure 25**.
- Improved calculation speed for flowsheets with multiple Reactions units
- Improved flowsheet drawing speed for flowsheets with multiple Reactions units
- Formatting –ribbon in Table Editor
- Other small bug fixes

MAS
- Improved missing measurement estimation
- Other small bug fixes

DB
- Charts to visualize H,S,Cp and ΔG **Figure 26**.
- Compare Species dialog
- Automatically calculated estimates
- Improved Keywords filter

GEM
- Solution model selection in the spreadsheet
- Options to enable/disable warnings

GEO
- UI Improvements

EST
- Property panel for the charts
- More graph types

HSC CHART
- Crosshair tool for scanning polyline graphs **Figure 27**.

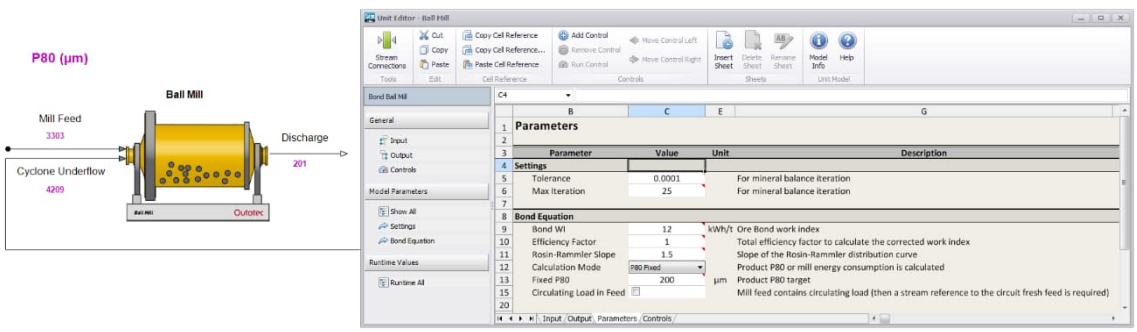


Figure 23. New DLL unit Bond Ball Mill (Particles unit).

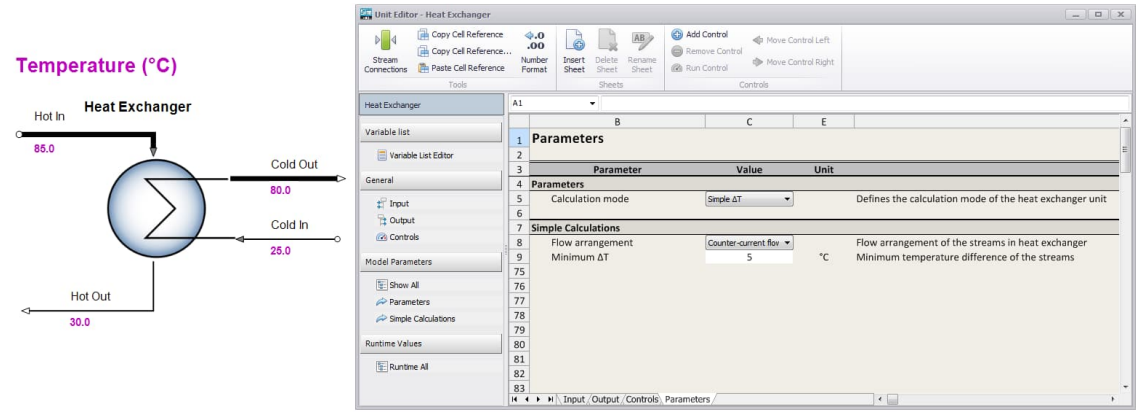


Figure 24. New DLL unit Heat Exchanger (Species, Reactions unit).

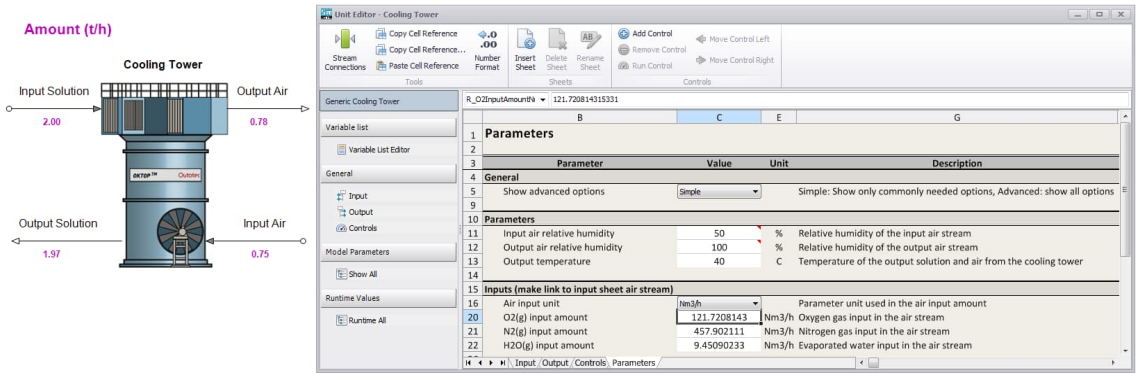


Figure 25. New DLL unit Cooling Tower (Species, Reactions unit).

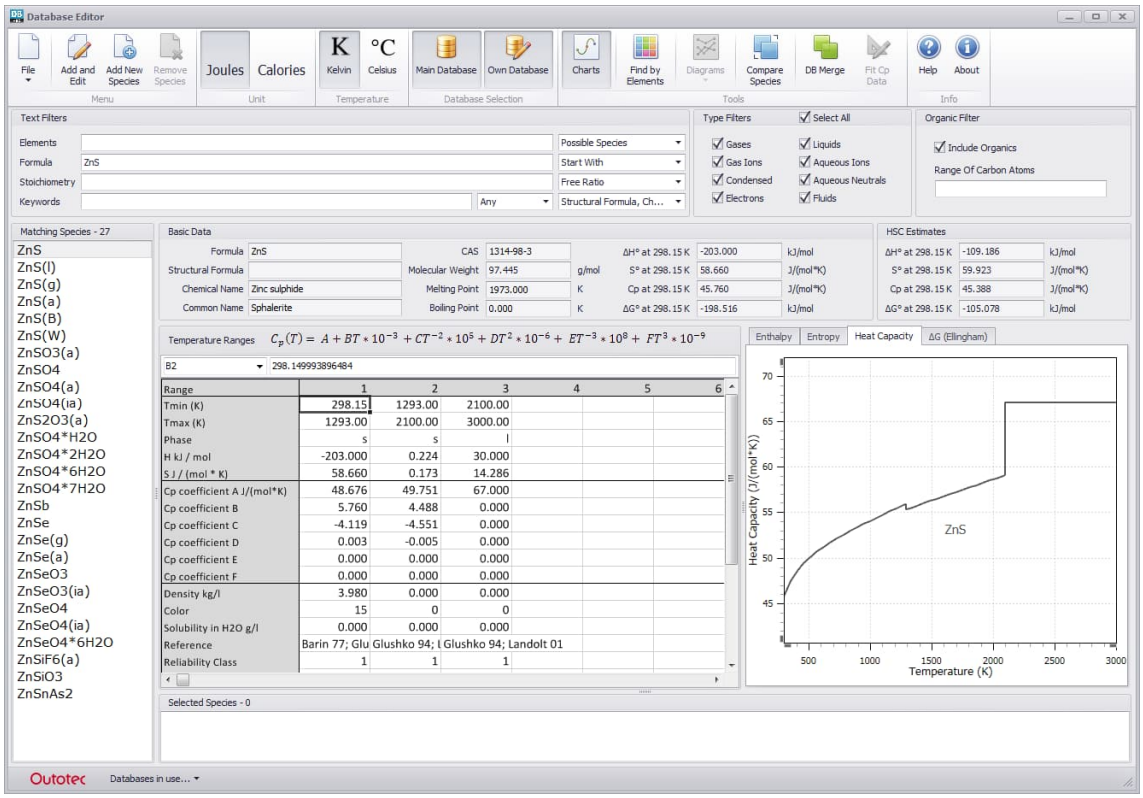


Figure 26. Charts to visualize H,S,Cp and ΔG.

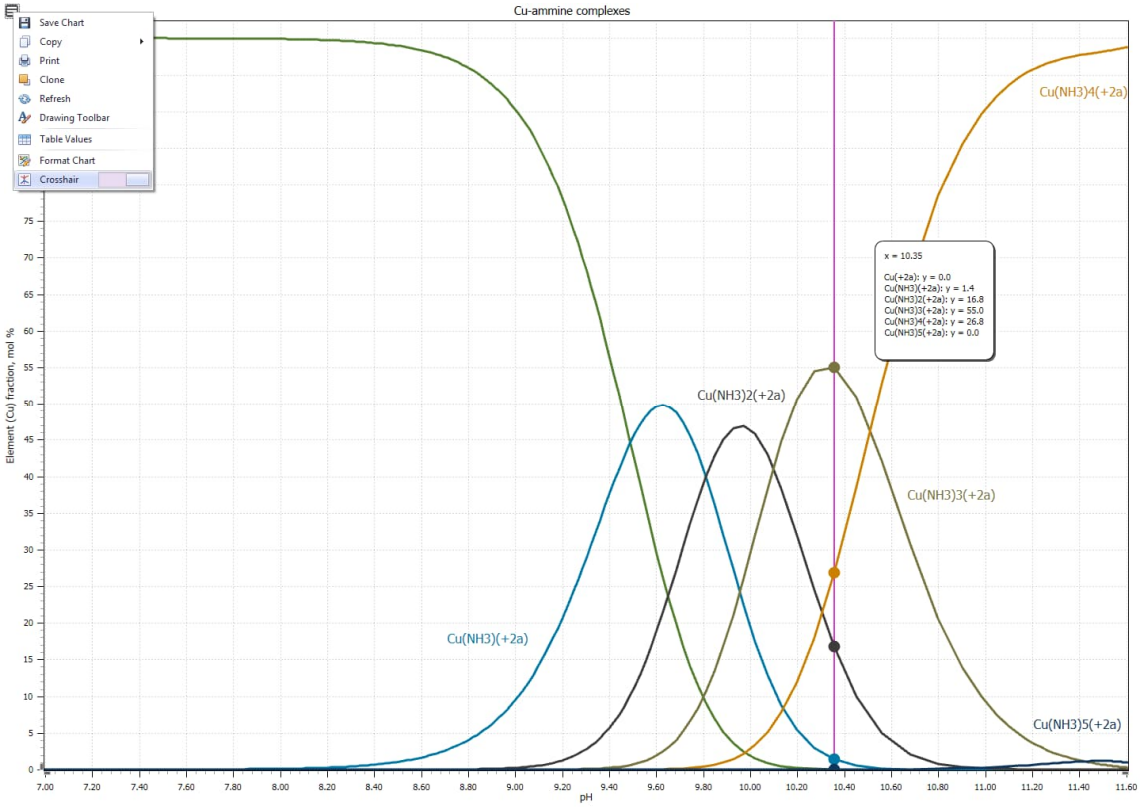


Figure 27. Crosshair tool for scanning polyline graphs.

New version of HSC 9 (ver. 9.2) has been released!

This release contains new features and bug fixes such as:

SIM
- Copy cell reference of multiple separate cells/ranges
- Renaming of external cell references (signals) **Figure 28**.
- Cell References list for browsing and editing external cell references (signals)
- Adding several cell references to the Scenario Editor
- New Mineral Processing DLL Units (Ball Mill and Cone Crusher)
- Stream Table Editor Update (kuva)
- MJ enery unit option in Distribution (Pyro) units
- First implementation of Newton-Rhapson control method for solving simultaneously multiple internal controls.
- Process Information visible in property panel
- Flowsheet settings updated
- Other small bug fixes

MAS
- Charts –view for visualizing calculation results **Figure 29**.
- Other small bug fixes

MFIT
- Closed-Loop fitting
- Selectivity -charts

DB
- New Main database
- Cp equation expanded with two coefficients **Figure 30**.
- Tritium (T) element added

EST
- More graph types

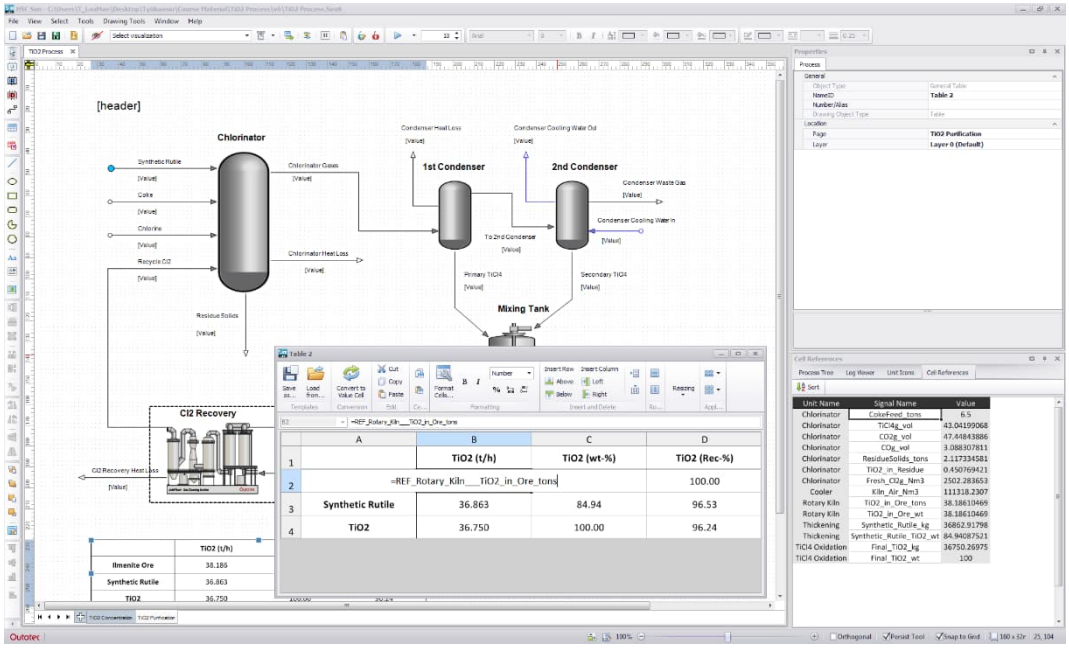


Figure 28. HSC Sim cell reference renaming.

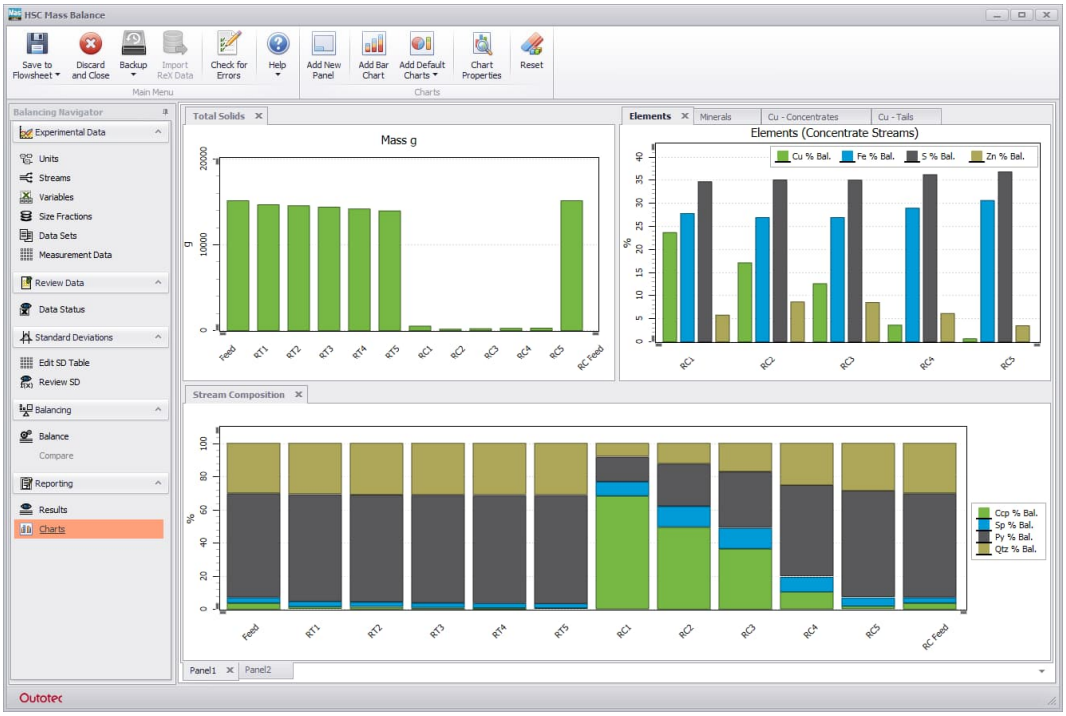


Figure 29. HSC Mass Balance charts view for visualizing calculation results.

Temperature Ranges $C_p(T) = A + BT * 10^{-3} + CT^{-2} * 10^5 + DT^2 * 10^{-6} + ET^{-3} * 10^8 + FT^3 * 10^{-9}$

Figure 30. Cp equation expanded with two coefficients**.**

HSC version 9.1.0 has been released 8th of March

We are happy to announce a new release of HSC 9.
This version (9.1.0) is a free update for all HSC 9 users with a valid subscription. The setup file can be downloaded from the Download site.

This release contains new features and bug fixes such as:

SIM
- Measurement units for visualizing concentrations (ppm and g/t), **Figure 31**.
- Energy units changed to power units (kWh --> kW)
- Particle DLL and Reaction Excel units can handle streams with both mineral particles and species, Figure 32.
- New DLL unit: OreMet Optimizer, **Figure 33**.
- Fixes in Sankey visualization
- Improved Print dialog, **Figure 34**.
- Other small bug fixes

MAS
- Stream by Equation dialog
- Calculation setting: Assay Sum = 100
- Other small bug fixes

EST
- New user interface, **Figure 35**.
- Links to HSC Database
- Graphs to compare estimates with database values

EpH
- Filter for organic species

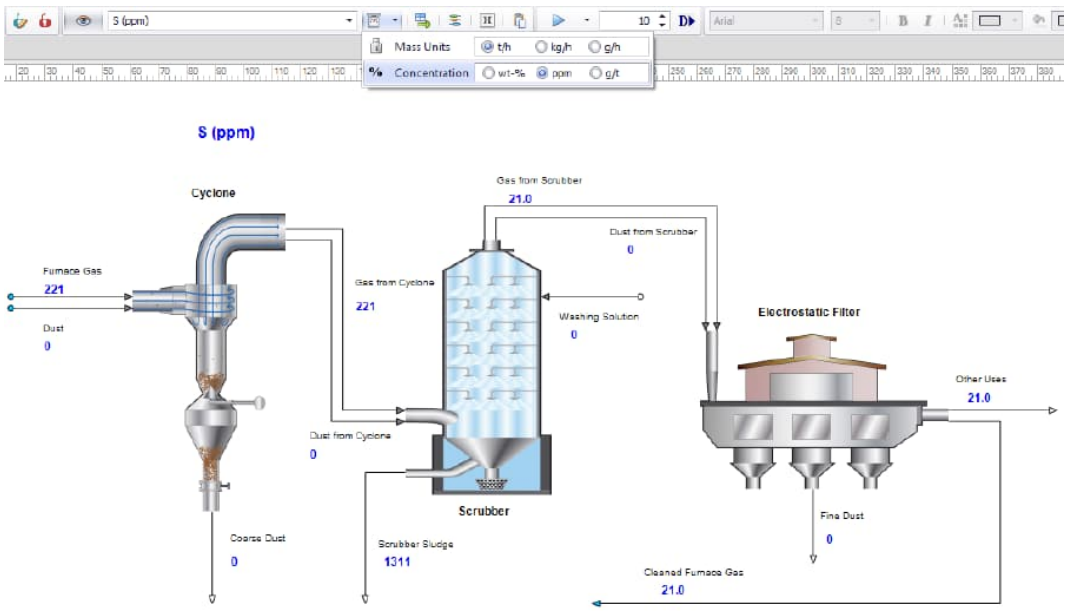


Figure 31. Measurement units for visualizing concentrations (ppm and g/t).

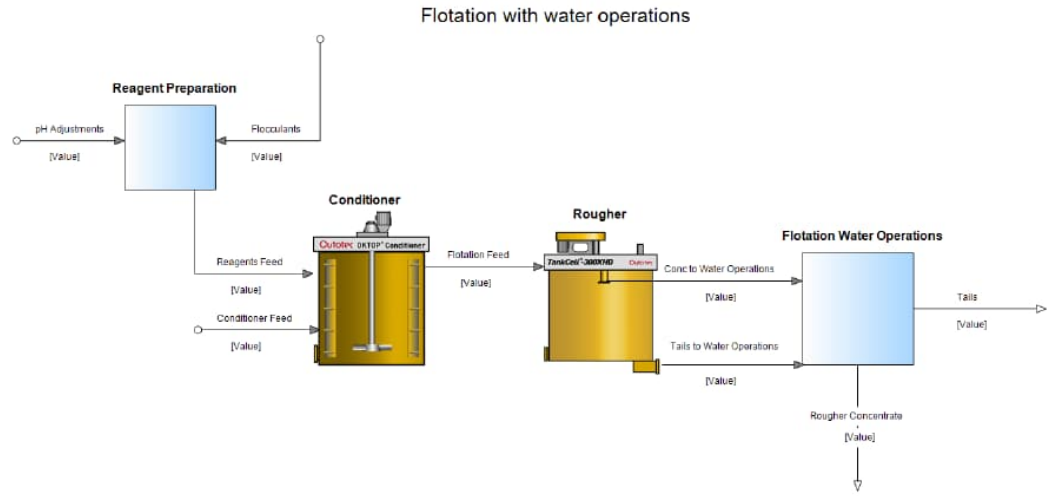


Figure 32. Particle DLL and Reaction Excel units can handle streams with both mineral particles and species.

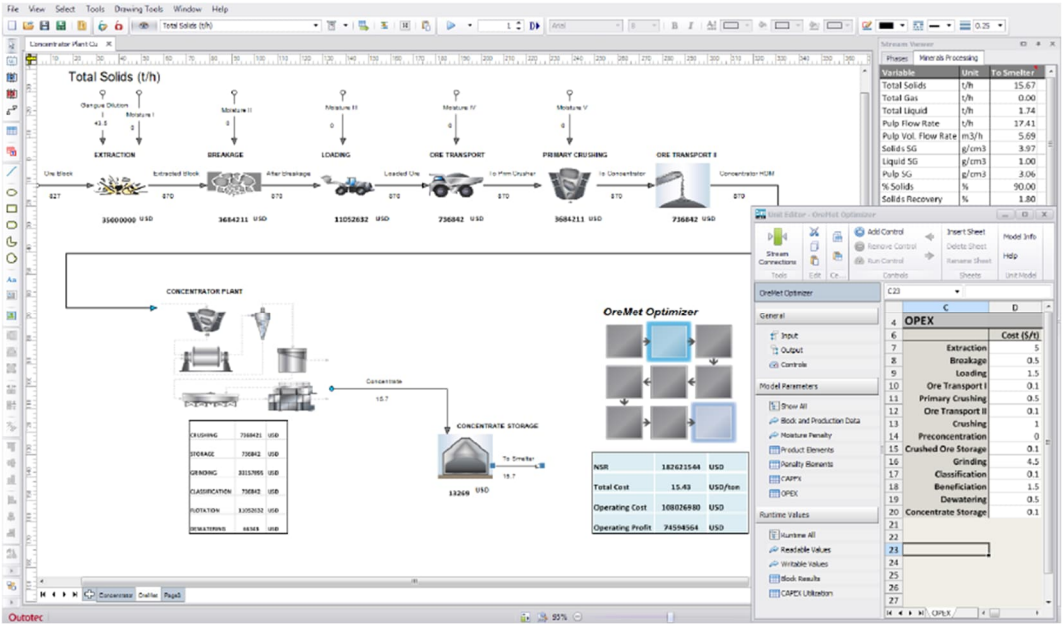


Figure 33. Oremet Optimizer.

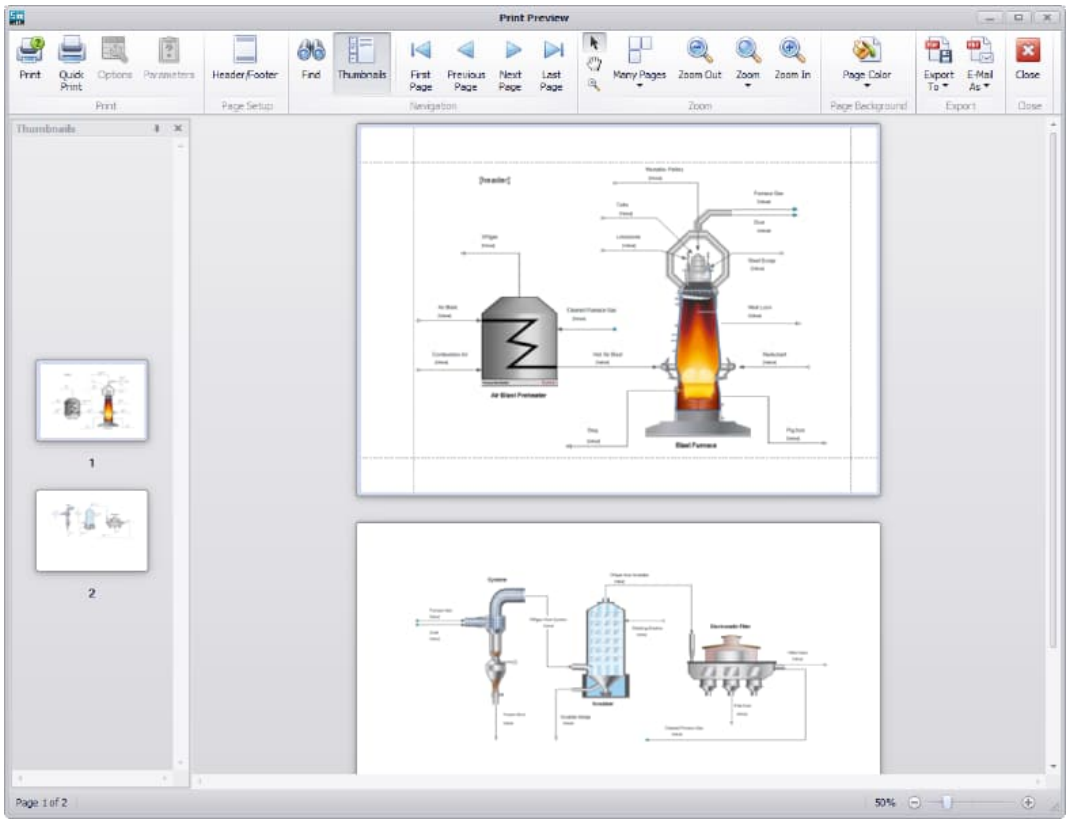


Figure 34. Improved Print dialog.

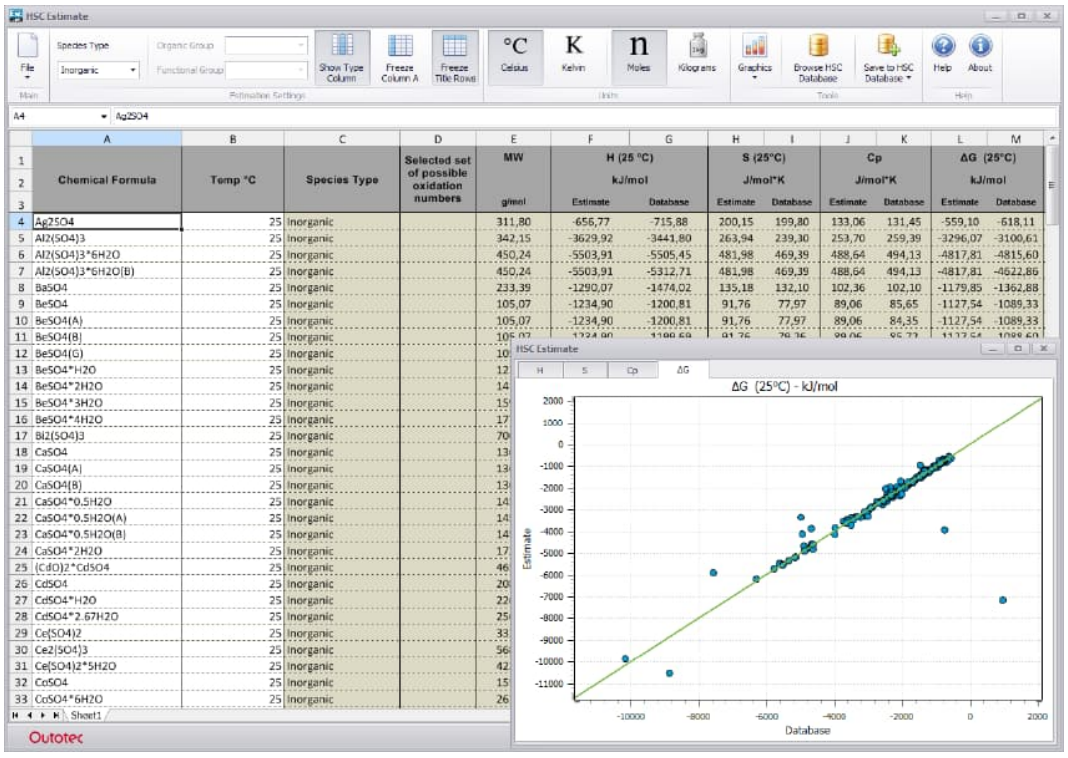


Figure 35. New Est module user interphase.

New features 2016

New version of HSC 9 (ver. 9.0.7.) has been released in December 2016

This release features new features and bug fixes such as:

SIM

- Copy-Paste of Cell Reference ranges
- Formula Navigator dialog, **Figure 36**.
- New DLL unit for grinding (HIGmill), **Figure 37**.
- Mass Balance improvements (Fixed value status, g/t and ppm measurement units)
- Model Fit allows parameter fitting individually for each Data Set and each Fraction
- Database browser for Pyro excel units
- Templates and documentation for creating custom DLL units
- Frequency plots for Monte Carlo simulation, **Figure 38**.
- Improved Rename Alias -tool
- Other small bug fixes

GEM

- Bug fixes related to the chart

CON

- Database Browser

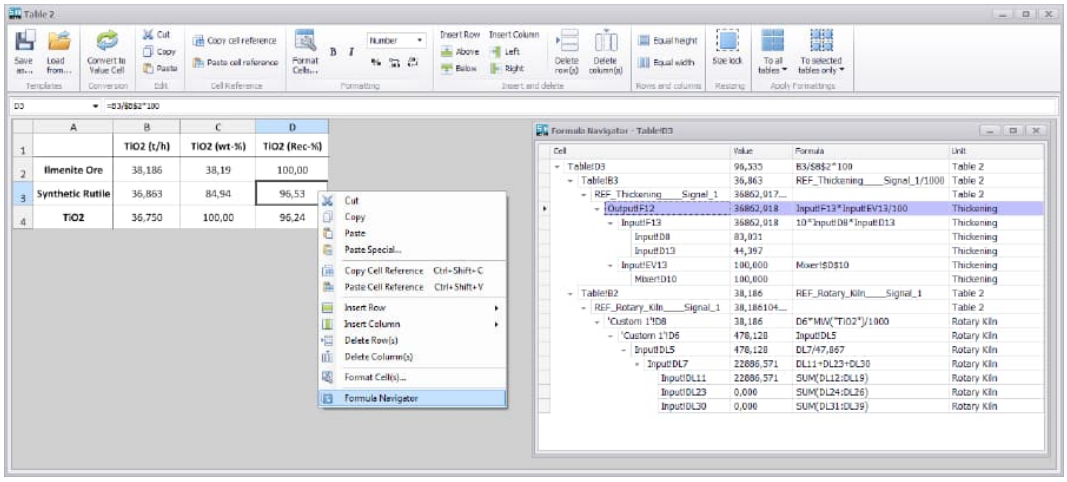


Figure 36. Formula Navigator.

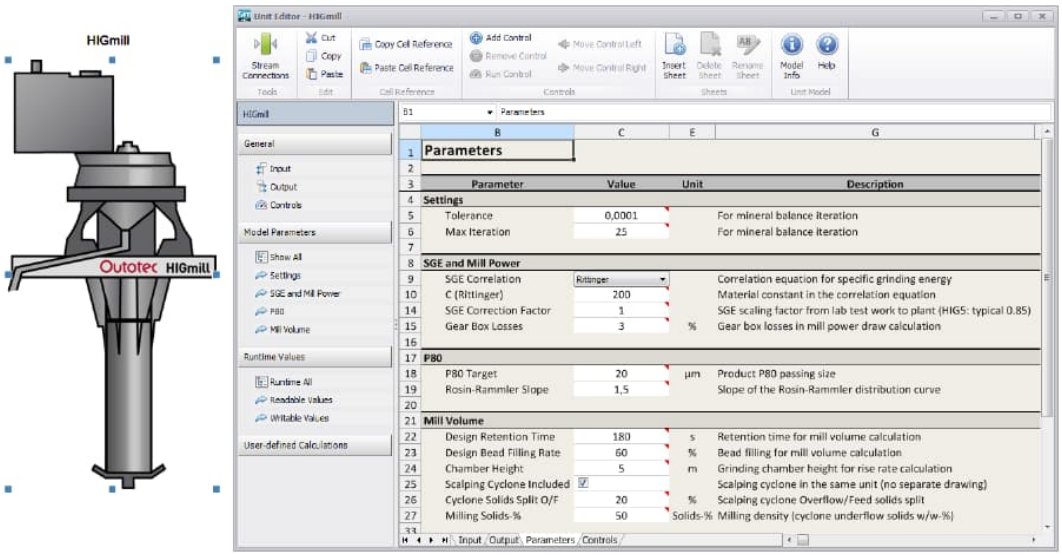


Figure 37. HIGmill DLL Unit.

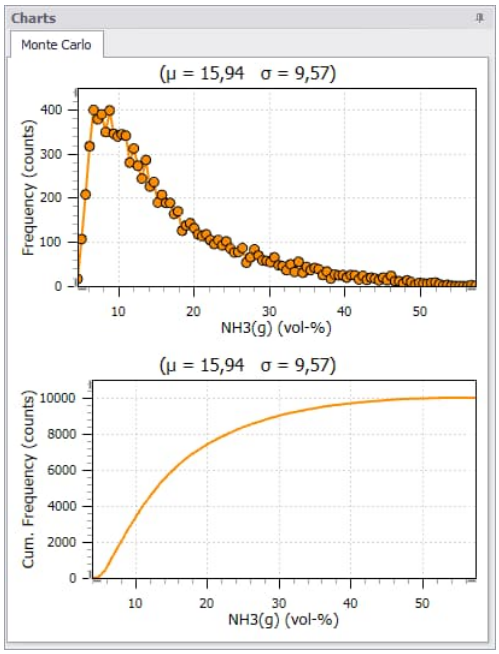


Figure 38. Frequency plots for Monte Carlo simulation.

New version of HSC 9 (ver. 9.0.6.1) has been released in October 2016

This release features new features and bug fixes such as:
- Possibility to use different stream table design for different streams, **Figure 39**.
- View series values for all the charts, **Figure 40**.
- Clearer visualization list for Hydro(Reactions) models
- Simulation time shown in the Log Viewer, **Figure 41**.
- Bug fixes to Mass Balance tool

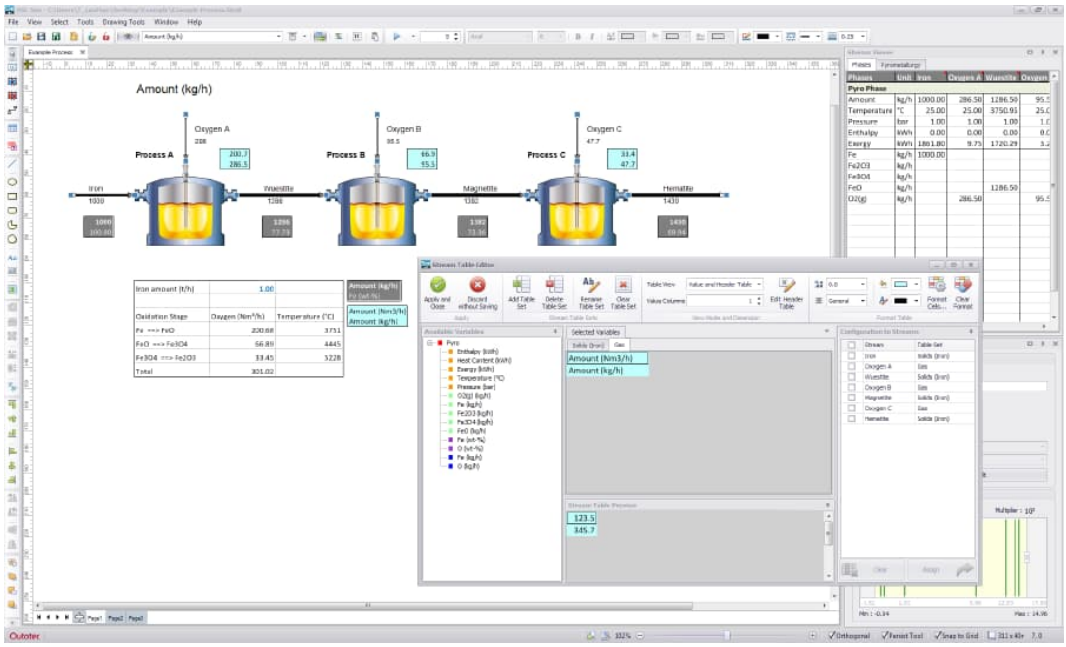


Figure 39. Possibility to use different stream table design for different streams.

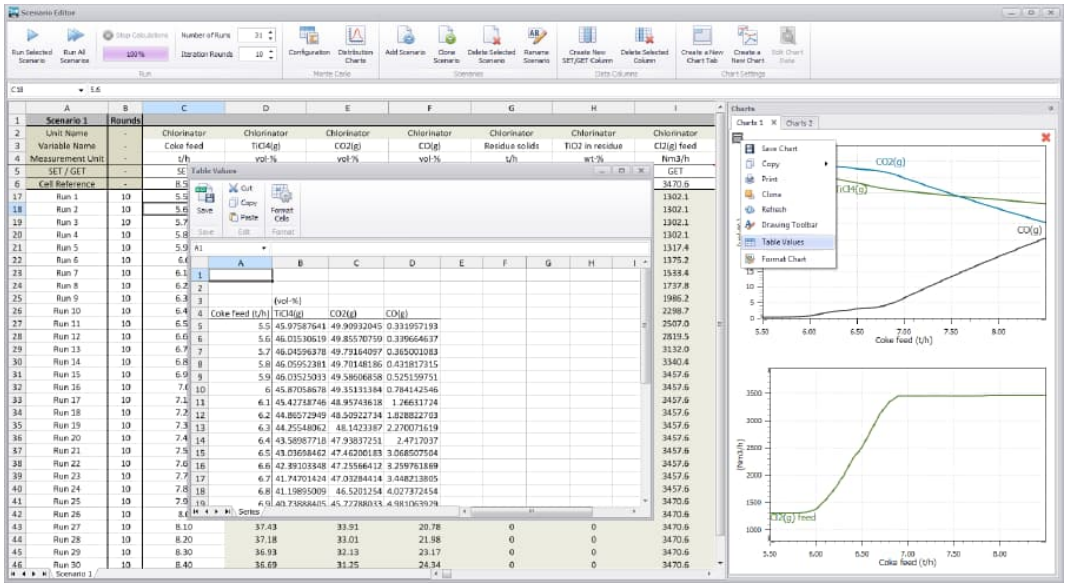


Figure 40. View series values for all the charts.

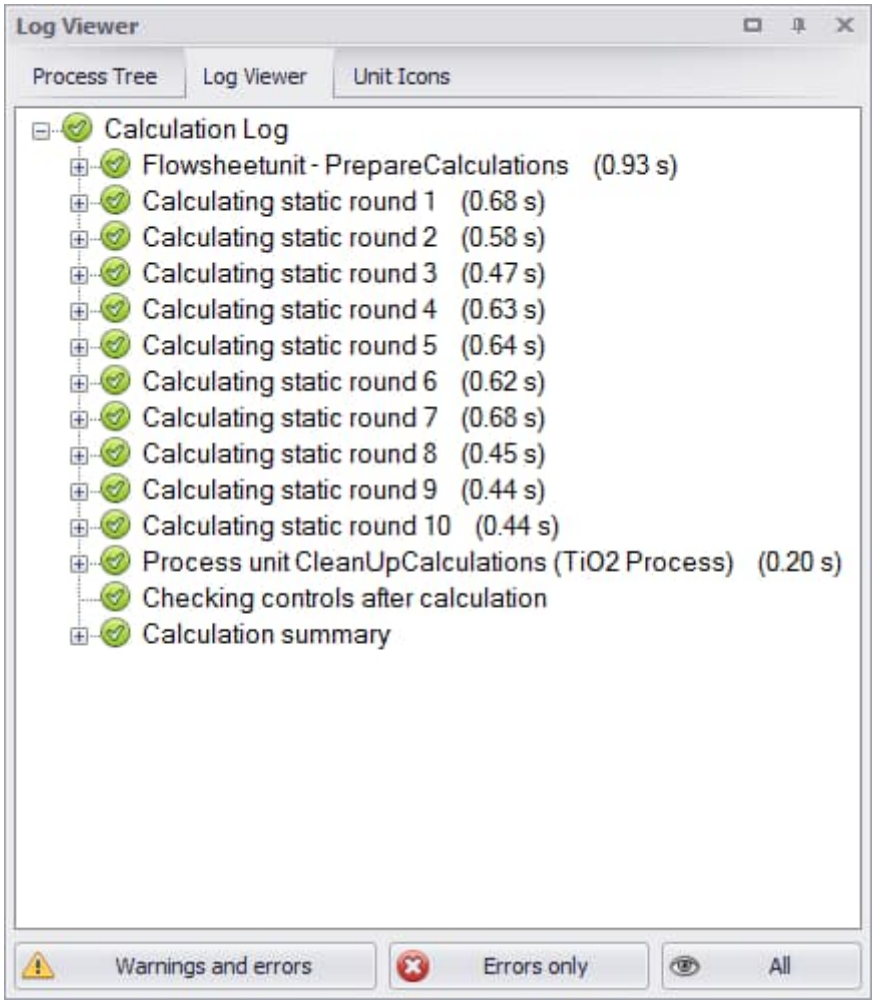


Figure 41. Simulation time shown in the Log Viewer.

New version of HSC 9 (ver. 9.0.5.5) has been released in September 2016

This release features new features and bug fixes such as:

- Stream Analysis charts for particle models, **Figure 42**.
- Monte Carlo simulation options in the Scenario Editor, **Figure 43**.
- Flowsheet speed optimization for large models
- Improvements of Aqua solution routine in Equilibrium Calculations module
- Several minor bug fixes

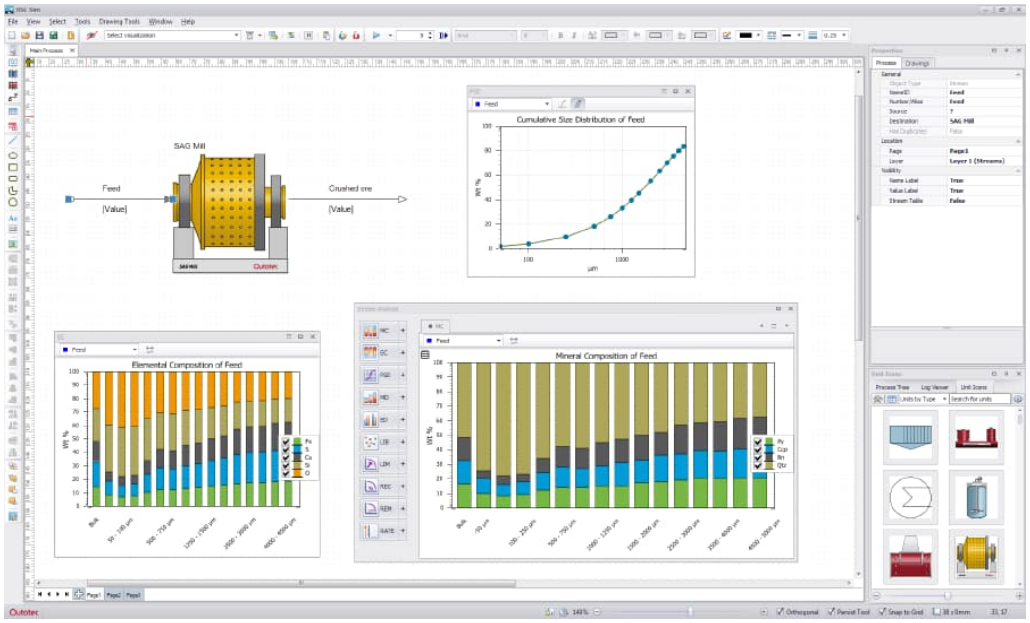


Figure 42. Stream Analysis charts for particle models.

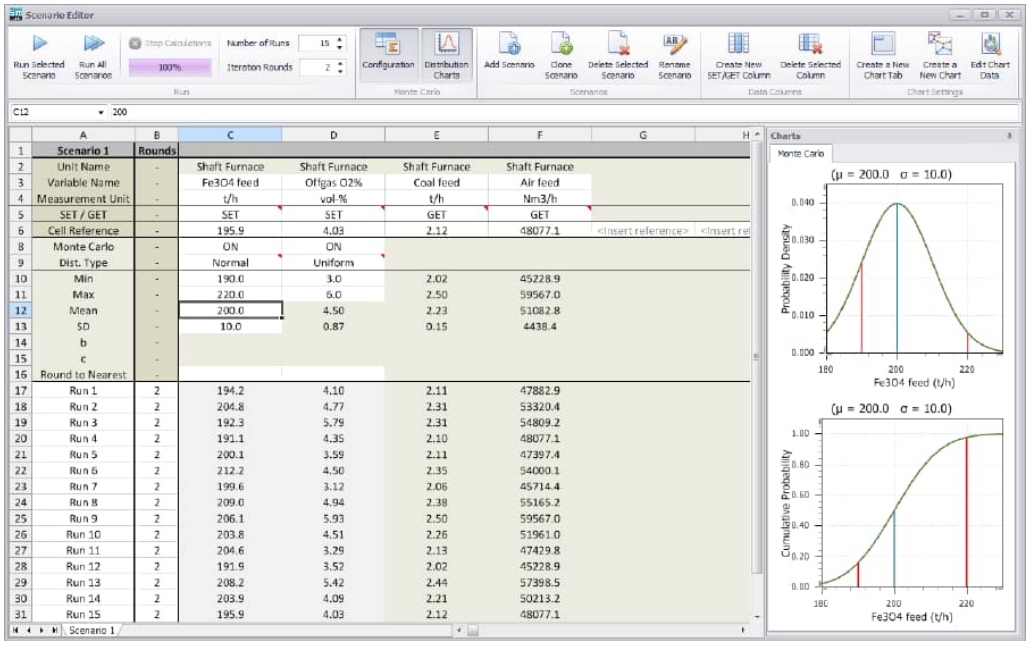
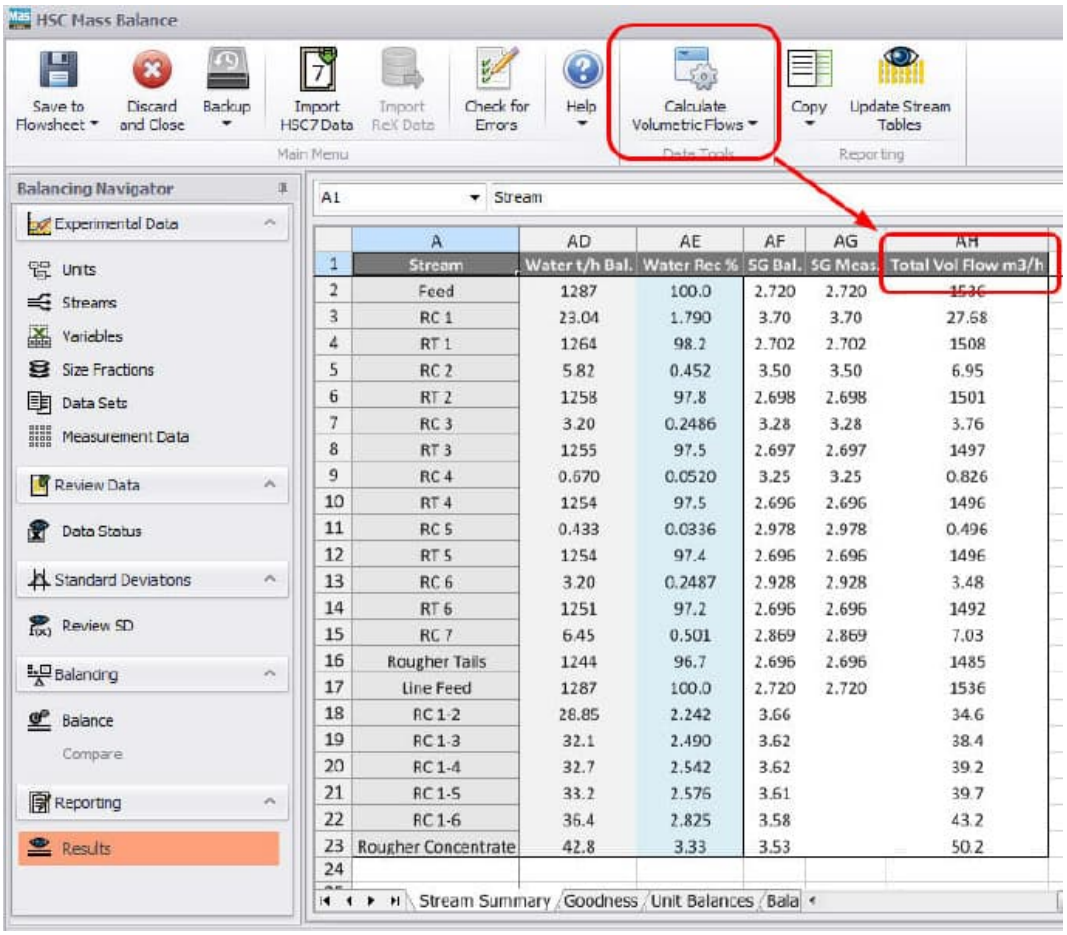


Figure 43. Monte Carlo simulation options in the Scenario Editor.

New version of HSC 9 (ver. 9.0.4.1) has been released in June 2016

- Mass Balance: volumetric flow rates can be calculated for all streams, based on balanced minerals and solids-% values, just by one click on the 'Results' view, **Figure 44**.

- New in HSC 9.0.4, Sim Model Fit: now the grade-recovery plots of the minerals and/or elements are shown, in addition to the cumulative recovery plot, **Figure 45**.



	A	AD	AE	AF	AG	AH
1	Stream	Water t/h Bal.	Water Rec %	SG Bal.	SG Meas	Total Vol Flow m3/h
2	Feed	1287	100.0	2.720	2.720	1536
3	RC 1	23.04	1.790	3.70	3.70	27.68
4	RT 1	1264	98.2	2.702	2.702	1508
5	RC 2	5.82	0.452	3.50	3.50	6.95
6	RT 2	1258	97.8	2.698	2.698	1501
7	RC 3	3.20	0.2486	3.28	3.28	3.76
8	RT 3	1255	97.5	2.697	2.697	1497
9	RC 4	0.670	0.0520	3.25	3.25	0.826
10	RT 4	1254	97.5	2.696	2.696	1496
11	RC 5	0.433	0.0336	2.978	2.978	0.496
12	RT 5	1254	97.4	2.696	2.696	1496
13	RC 6	3.20	0.2487	2.928	2.928	3.48
14	RT 6	1251	97.2	2.696	2.696	1492
15	RC 7	6.45	0.501	2.869	2.869	7.03
16	Rougher Tails	1244	96.7	2.696	2.696	1485
17	Line Feed	1287	100.0	2.720	2.720	1536
18	RC 1-2	28.85	2.242	3.66		34.6
19	RC 1-3	32.1	2.490	3.62		38.4
20	RC 1-4	32.7	2.542	3.62		39.2
21	RC 1-5	33.2	2.576	3.61		39.7
22	RC 1-6	36.4	2.825	3.58		43.2
23	Rougher Concentrate	42.8	3.33	3.53		50.2
24						

Figure 44. Mass Balance: volumetric flow rates can be calculated for all streams, based on balanced minerals and solids-% values, just by one click on the 'Results' view.

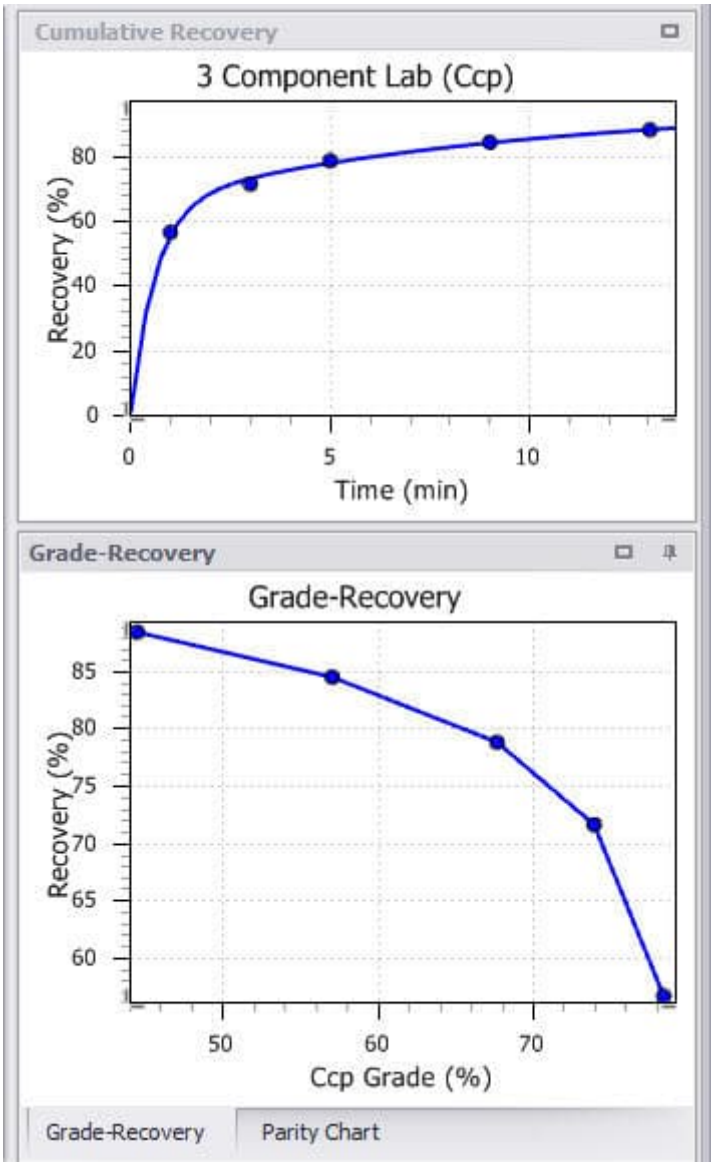


Figure 45. Sim Model Fit: now the grade-recovery plots of the minerals and/or elements are shown, in addition to the cumulative recovery plot.

New versions of HSC 9 (ver. 9.0.3.4 – 9.0.0.25) has been released in December 2015 - June 2016

- **HSC License Types**: New Server License and Virtual Device License

SIM

- Reaction units with Gibbs wizard

GEM

- Improved calculation engine
- Logarithmic steps for species amounts, temperature, and pressure
- Improved chart routine, user interface and titration calculations
- Reactor calculation