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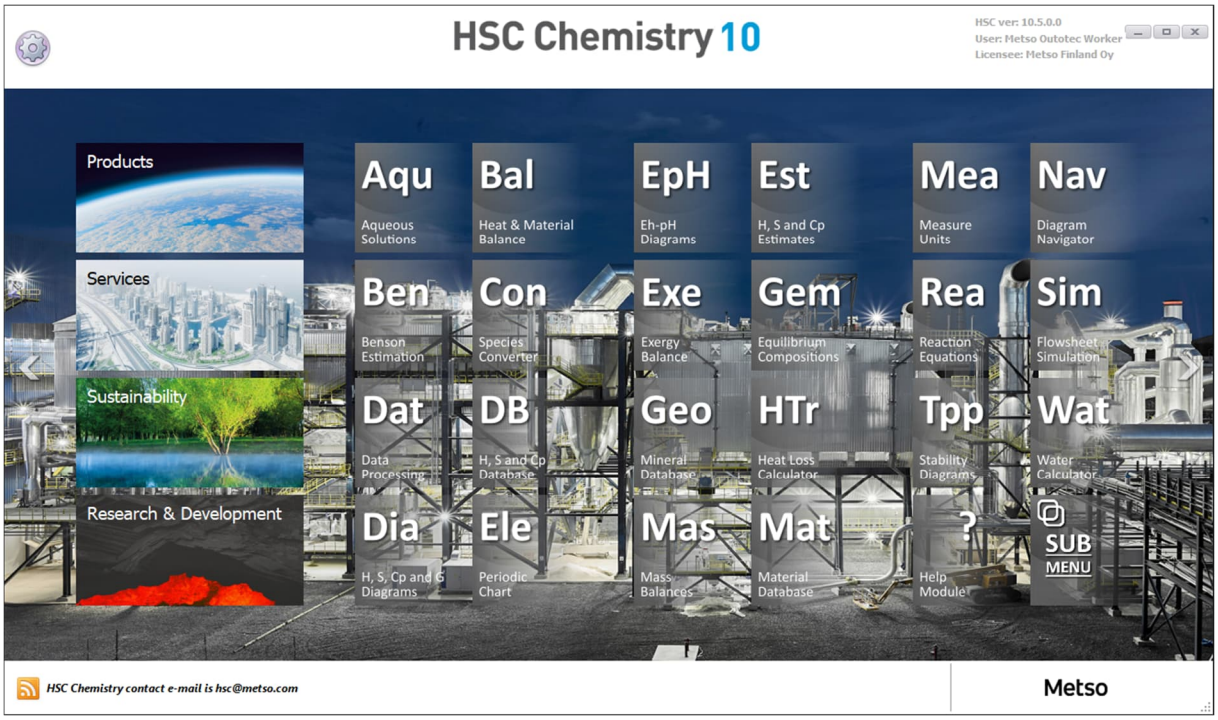
April 9, 2024

HSC 10 New Features



HSC 10 Releases

2024
HSC 10.5 April 2024

2023
HSC 10.4 October 2023
HSC 10.3 May 2023

2022
HSC 10.2 December 2022
HSC 10.1 April 2022

2021
HSC 10.0.8 December 2021
HSC 10.0.7 October 2021
HSC 10.0.6 June 2021
HSC 10.0.5 April 2021
HSC 10.0.4 January 2021

2020
HSC 10.0.3 November 2020
HSC 10.0.2 June 2020
HSC 10.0.1 March 2020 (including bug fixes only)
HSC 10.0.0 January 2020

New features 2024

New version of HSC 10 (ver. 10.5) has been released in April 2024!

HSC Sim General:

- Production planning tool is added in the dynamic scenario editor. In this tool, user can schedule which ore type can be processed in stream setup. The scheduling can be based on time or on inventory.
- Machine learning models such as neural networks created in third-party software can now be integrated into Sim models with ONNX support.
- Project folder is created automatically when new project is saved the first time.
- New key bindings are added for creating cell references, expanding sequences by autofill, and for easier flowsheet and formula navigation.

HSC Sim Models:

- Dynamic Unit is improved. Normal volume is now defined at 0 °C (273.15K) and 1 bar.

HSC Sim LCA:

- General performance and UX are improved.
- Support for openLCA 2.0 official version is added.
- Support for openLCA 2 Alpha versions is discontinued.

Microsoft Excel Add-ins:

- Support for 32-bit Excel is discontinued.
- New Microsoft Excel formula for setting measurement units is added:
    - SetUnits(temperatureUnit, pressureUnit, energyUnit)

HSC General:

- Support for 32-bit application interfaces is discontinued.
- End User License Agreement (EULA) 1/2024 is updated.
- Numerous small usability improvements and bugfixes are implemented.

New features 2023

New version of HSC 10 (ver. 10.4) has been released in October 2023!

HSC Sim General:

- Flowsheet - partial simulation of process areas is added.
- Dynamic reports – calculate the statistics and study the assets utilization KPI of dynamic simulations.
- 32-bit support will be discontinued in HSC 10.5
- The last HSC version supporting 32-bit application interfaces and Microsoft Excel add-ins.
- Automatic install of HSC add-ins for Microsoft Excel
- Partial simulation of process areas

HSC Sim Models:

- New High-Rate Thickener model is added.
- Reaction sheets using particles in several mineral processing units: Perfect Mixer, Conditioner, Bond Ball Mill, Pump Sump, Thickener (General), High-Rate Thickener and Water Tank. Convert particle's mineral into equivalent species and create reactions using particles. Reaction rates can be adjusted per particle's size.

HSC General:

- This is the last version supporting 32-bit application interfaces and 32-bit Microsoft Excel add-in.
- End User License Agreement (EULA) 1/2023 is updated.
- Installer is improved (For example, HSC add-in for Microsoft Excel is installed automatically).
- HSC Excel add-in example files (AddInSample.xlsx and AddInSample_EQ.xlsx) updated.
- Numerous small usability improvements and bugfixes.
- Plenty of small usability improvements and bugfixes

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New version of HSC 10 (ver. 10.3) has been released in May 2023!

HSC Sim General:

- Speed improvements for dynamic simulation (Up to 2-3x faster simulation speed)
- Improved UI for Sim main window
    - Function and tools logically grouped in menus and toolbars
    - Renaming of tools and panels
    - New flowsheet tool called *Visibility*
    - Improved flowsheet visualization
    - Fixed *Auto Route* tool
    - Updated default options in static calculation
    - Redesigned *Names (Rename Alias)* tool
- Stream Setup and mineral processing units contain full variable list. Add mass fraction, species concentration and pH for mineral flowsheet

HSC Sim Models:

- New screen, cyclone, crusher and HPGR models added
- Flocculant addition in generic thickener, improved cooling tower and filter

HSC General:

- Plenty of small usability improvements and bugfixes

New features 2022

New version of HSC 10 (ver. 10.2) has been released in December 2022!

HSC Sim general:

- [Beta] New time series database to collect dynamic calculation data.
- [Beta] Dynamic mass balance report that utilizes the new time series database
- [Beta] Possibility to add dynamic calculation charts on the flowsheet
- Variable tree structure and new variables for minerals unit editor
- Improved speed with snapshot saving / loading
- Small improvements to the flotation cell model
- Stream Setup: Possibility to track which element is analyzed

HSC General:

- HSC Aqua: Possibility to estimate binary Pitzer coefficients for ions with two different AI routines: Elastic net model or Simoes equations
- HSC license agreement was updated as HSC Chemistry 10 EULA 1/2022. Delay of delivery time was added to the first paragraph of section **15. General**.

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New version of HSC 10 (ver. 10.1) has been released in April 2022!

HSC Sim general:

- Increased speed with various items (closing sim, saving flowsheet, etc.)
- Increased speed with process model fit and process optimizer with dynamic simulations
- Multiple fixes and smaller adjustments to the Name / Alias system in HSC Sim
- Usability improvements to ordering of variables/streams in stream tables and flow tables
- Scroll bars and search filters for units, streams, controls and cell references in the UI
- Manual for process model fit added
- + Multiple bug fixes and smaller improvements

Minerals

- Added ore blending to Bond Ball Mill
- Added support for global sieve series in Mass Balance
- Visualization added for different ores in the flowsheet
- New stream setup: Improved and simplified modal calculation dialog
- Possibility to describe particles flotation behavior with maximum recovery (Rmax, %) and flotation kinetic rate (k, min-1) in Conditioner unit and Kinetic Model Fit tool

- Hydro variable list additions: Sulfide sulfur, metal sulfates, sulfates, acid as "AcidName" flow and new measurement units for Total Dissolved Solids
- Hydro water phase equilibrium calculations utilizing Aqua routines are faster

HSC – OpenLCA

- HSC Sim – OpenLCA: System supports dynamic calculations
- HSC Sim – OpenLCA: Possibility to store environmental footprint calculation parameters for comparison

HSC General:

- HSC Aqua: Possibility to estimate binary Pitzer coefficients for ions with AI routine
- Updated Geo database (Added new mineral chemistries and new minerals, adjusted stoichiometric values)

New features 2021

New version of HSC 10 (ver. 10.0.8) has been released in December 2021!

HSC Sim general:

- Scenario Editor (3D chart, running multiple scenarios improved)
- Templates for Unit tables for DLL units
- New Open LCA editor beta version
- Species converter minor improvements and manual update
- Mass balancing using size fractions
- New stream setup improvements (binary particle creation, using multiple sieve sets, UI improvements)
- Importing customs sheets into Reports
- New dynamic calculation controls (Dahlin, Feed forward, PID velocity form)
- New material cut-off model to separate materials according to particle property
- New blasting model for static blasting simulations
- General usability improvements, bug fixes and smaller improvements

HSC General:

- Updated Geo database

New version of HSC 10 (ver. 10.0.7) has been released in October 2021!

HSC Sim general:

- Process Model Fit tool (Beta) published for all users
- First version of Unit Tables. User can present DLL unit variables in flowsheet in similar way as with the Stream Tables.
- First version of Partial Simulation. User can run only parts of the flowsheet when simulating. This option can be found in the Simulation Menu.
- New faster Mass Balance engine published for all users
- First version of new Species Converter DLL unit. UI update + now conversion species lists can be done mineral by mineral and gangue can be also defined.
- Improvements to Event Sheets (multiple true/false variables, bug fixes, moving of event columns etc.)
- Improvements to SET sheet stopwatch functionality
- Small speed improvements to Sim loading, course license checking, unit selector dialog loading, calculation, copy-paste and drawing
- Possibility to paste images and tables directly to flowsheet from clipboard
- Option to add user defined custom calculation sheets from units in the Reports tool
- Manuals added for new Species Converter

- + many bug fixes and smaller improvements

New version of HSC 10 (ver. 10.0.6) has been released in June 2021!

HSC Sim general:

- New stream setup test version (beta). This includes many changes to the stream setup such as bigger UI changes, online modal calculations, support for ore properties / ore blending, improved water flow controls etc.
- Auto routing of streams is available in flowsheet drawing

- Dynamic unit variable lists are automatically merged
- New variables for dynamic unit
- Adaptive step size with automatic scaling for external controls
- Visualization and reporting for stream properties
- Possibility to get unit custom sheets to Reports

HSC Geo:

- Database update

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New version of HSC 10 (ver. 10.0.5) has been released in April 2021!

HSC Sim general:

- First implementation of stream property dialog with pressure drop variable
- Better integration of dynamic unit tank and input/output sheet variables
- Changed criteria for the recycle stream convergence (now it is less strict and it can be filtered)
- Attachments can be added for models in Model Base.
- Possibility to group runtime variables in DLL units
- Species list merge between hydro and dynamic unit. Species are now transferred automatically.
- Refactored OreMet Optimizer: Modified OPEX calculation method and added new parameters & tables
- New Magnetic Separation model based on Dobby and Finch model. Calculation is based on material magnetic susceptibility
- Logos and names (except unit icon logos) are changed according to the new brand
- PSD chart option added to the unit editor of minpro models
- PSD and other mineral processing charts added to the visualization mode as default panel, replacing the stream visualization setting panel
- Fixed an issue regarding slowness of the model when changing temperature in dynamic unit and inserting the flow into minpro unit.
- Custom species handling rework. This should fix the issue of custom species with bad data accidentally coming into the user database.
- Species converter is now more strict on the overall mass balance when used from the dynamic unit.
- Plenty of small usability improvements and bugfixes.

HSC Geo:

- Bugfixes and charts improvements
- Algorithm refactoring
- New import of 3DCT files
- Small usability improvements and bugfixes

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New version of HSC 10 (ver. 10.0.4) has been released in January 2021!

HSC Sim general:

- Option for automatic water vapor balance calculations in dynamic unit (Test version)
- Static model fitting with Model Optimization tool
- "% solids by volume" for minerals processing units. (Visualization, Reports, Stream Viewer)
- Fix for Species Converter operation in Dynamic Unit. Improved error minimization and now O will properly float if exact O measurement is OFF.
- Improved internal streams convergence check. Internal streams are now properly taken into account in mass and energy balance checking.
- Possibility to calculate individual runs in Scenario Editor (by right clicking on the row)
- Phase specific element flowrate for visualization in static hydro units

- Plenty of small usability improvements and bugfixes

HSC general:

- Update for Geo Database
- Small usability improvements and bugfixes

New features 2020

New version of HSC 10 (ver. 10.0.3) has been released in November 2020!

HSC Sim general:

- Flowsheet opening, saving and simulation speed improved roughly 30%. Depending on the flowsheet, the increase can be up to 60%.
- Possibility to define initial guesses for circulation streams to speed up convergence
- New improved internal control method for the Newton-Raphson control

- Generic thickener unit extension (Enthalpy calculations, possibility to use as a CCD unit with adjustable washing efficiency)
- New Hydro variable list variables: Recovery, Thermal Energy, Heat Content
- Reaction enthalpy to hydro unit editor
- Reverse reaction calculations
- Equilibrium constant calculations for reactions
- Adjusted CP for DLL units
- Improved comminution models and model manuals
- Plenty of small usability improvements and bugfixes

HSC Sim new tools:

- Unit availability (visible in visualization and report)
- Residence time distribution tool
- Possibility to create test cases for continuous testing by using scenario editor

Geo general:

- Database extended
- Small usability improvements and bugfixes

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New version of HSC 10 (ver. 10.0.2) has been released in June 2020!

This release contains new features and bug fixes such as:

SIM

- HSC Sim model opening and saving speed improved 30%
- Easy way to combine different hydro models (automatic variable list merger)
- New Hydro variable list variables: Phase Transfer, Recovery percentage, Thermal Energy, Heat Content, Adjusted Density
- Improved comminution models
- Improvements in reports tool (filters and possibility to show alias and ID)
- Three new tutorial videos about dynamic simulations in YouTube: https://www.youtube.com/watch?v=hC8utKwd9w0&list=PLc4W37RXMQWfeO4zBrwQZYNzXt2qU4UWa&index=13
- Mass Balance tool calculation improvements (More stable)

NAV

- Better UI
- Faster and more accurate calculations
- New phase type: Solid solutions

GEO

- Database extended
- Importing mineralogical data in Inca/Aztec format added to Geo

OTHER MODULES

- Many small features and bugfixes

New version of HSC 10 (ver. 10.0.0) has been released in January 2020!

The new release provides improvements and a number of new features. The new HSC 10 runs simultaneously with your previous HSC versions. A valid HSC 9 subscription entitles you to a free update to HSC 10.

Top new features

- New subscription based licensing replaces old perpetual licensing
- HSC 9 calculation module files are upward compatible with the new HSC 10
- Sim Model Base expands personal expertise to organization expertise
- Sim Model Optimization with Monte-Carlo, PSO, Simplex, MFit (SQP)
- Sim Model Convergence Monitor for static models
- Sim Dynamic Report is a new tool for collecting simulation data
- Sim file loading and calculation speed improvements
- Sim Unit Operation Protection
- Sim model combination improvements
- Sim OpenLCA dialog improved and updated
- Sim new generic unit operations
- Gem Equilibrium Module: Own Pitzer parameters, electrode potential calculations
- Aqua Module with own Pitzer database
- New Sampler Module with save/open features
- Diagram Navigator Module: new triangulation algorithm and several small improvements
- Data Processing Module with new algorithms and faster graphics
- Material Database Module with links to location maps
- HSC Main Database Module with new and updated data for chemical species
- HSC Main Menu with Sub Menu
- Many minor improvements and bug fixes

Model Base

- SharePoint database for HSC Sim process models. See **Figure 1**.
- Expands personal expertise to organization expertise.
- Routine that automatically creates SharePoint database.
- Default SharePoint folders: MinPro, Hydro, Pyro, Water, Energy, Plants, Users.
- Model Base stores process models, Process information, KPIs, and supplementary files.
- Search routine uses process info metadata (technology, products, etc.).
- End user must have a valid Microsoft license for the SharePoint site.

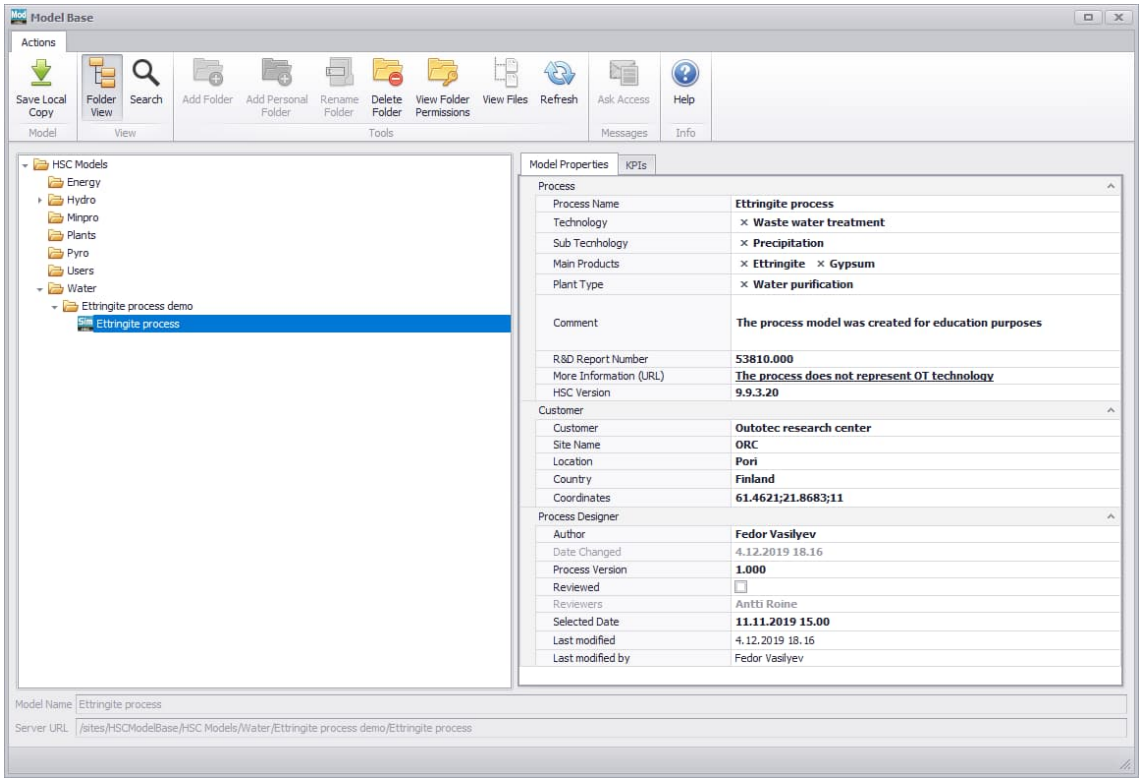
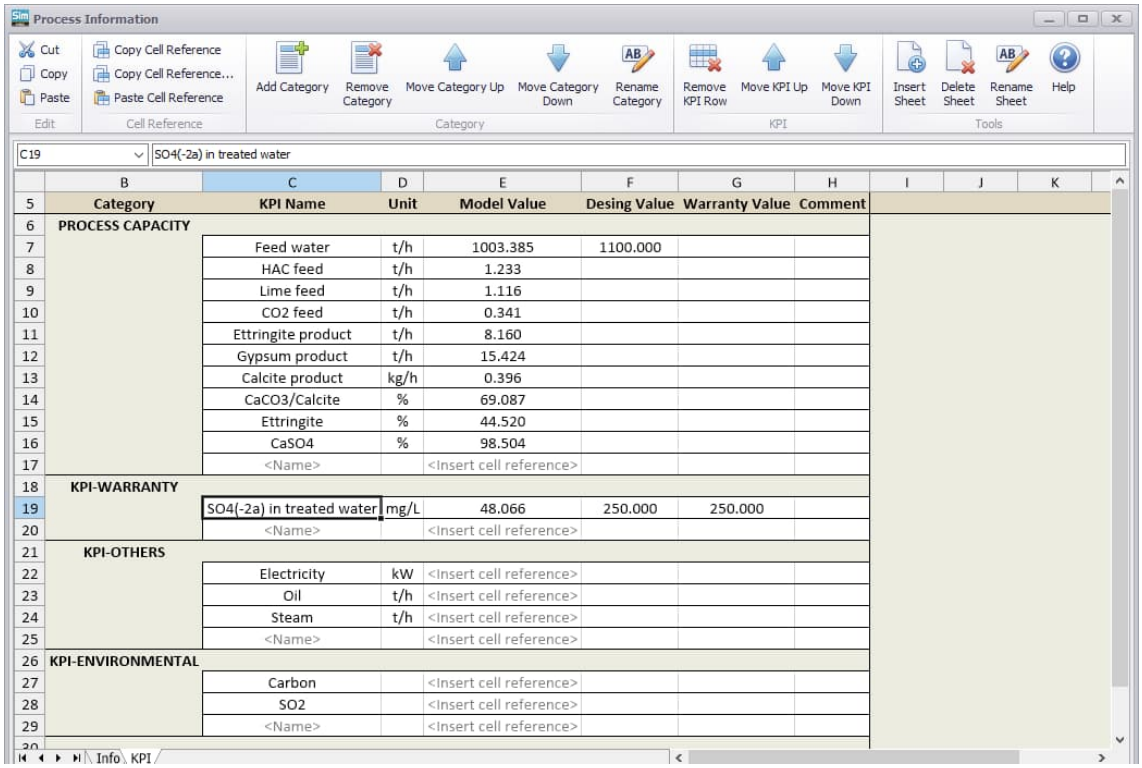


Figure 1. SharePoint database for process models is created automatically. Users can upload their models and supplementary files to the Model Base. The Model Base can be opened from the HSC main menu or accessed from HSC Sim. Model properties and key performance indicators can be viewed and edited in the Model Base.

New KPI Dialog in Sim

- Summary of the process key performance indicators with links to the model. See **Figure 2**.
- Headings may be used with the Model Base keyword search routines.



Category	KPI Name	Unit	Model Value	Desing Value	Warranty Value	Comment
PROCESS CAPACITY						
	Feed water	t/h	1003.385	1100.000		
	HAC feed	t/h	1.233			
	Lime feed	t/h	1.116			
	CO2 feed	t/h	0.341			
	Ettringite product	t/h	8.160			
	Gypsum product	t/h	15.424			
	Calcite product	kg/h	0.396			
	CaCO3/Calcite	%	69.087			
	Ettringite	%	44.520			
	CaSO4	%	98.504			
	<Name>		<Insert cell reference>			
KPI-WARRANTY						
	SO4(-2a) in treated water	mg/L	48.066	250.000	250.000	
	<Name>		<Insert cell reference>			
KPI-OTHERS						
	Electricity	kW	<Insert cell reference>			
	Oil	t/h	<Insert cell reference>			
	Steam	t/h	<Insert cell reference>			
	<Name>		<Insert cell reference>			
KPI-ENVIRONMENTAL						
	Carbon		<Insert cell reference>			
	SO2		<Insert cell reference>			
	<Name>		<Insert cell reference>			

Figure 2. Process information dialog contains a KPI sheet where the process key performance indicators can be summarized. The numerical data can be collected from the model using cell references which allows automatic updating of the values each time the model is changed.

Sim Model Optimization

- New tool for model optimization. See **Figure 3**.
- Direct optimization of any cell reference in Sim model.
- Four available algorithms: Monte-Carlo, PSO, Simplex, MFit (SQP).

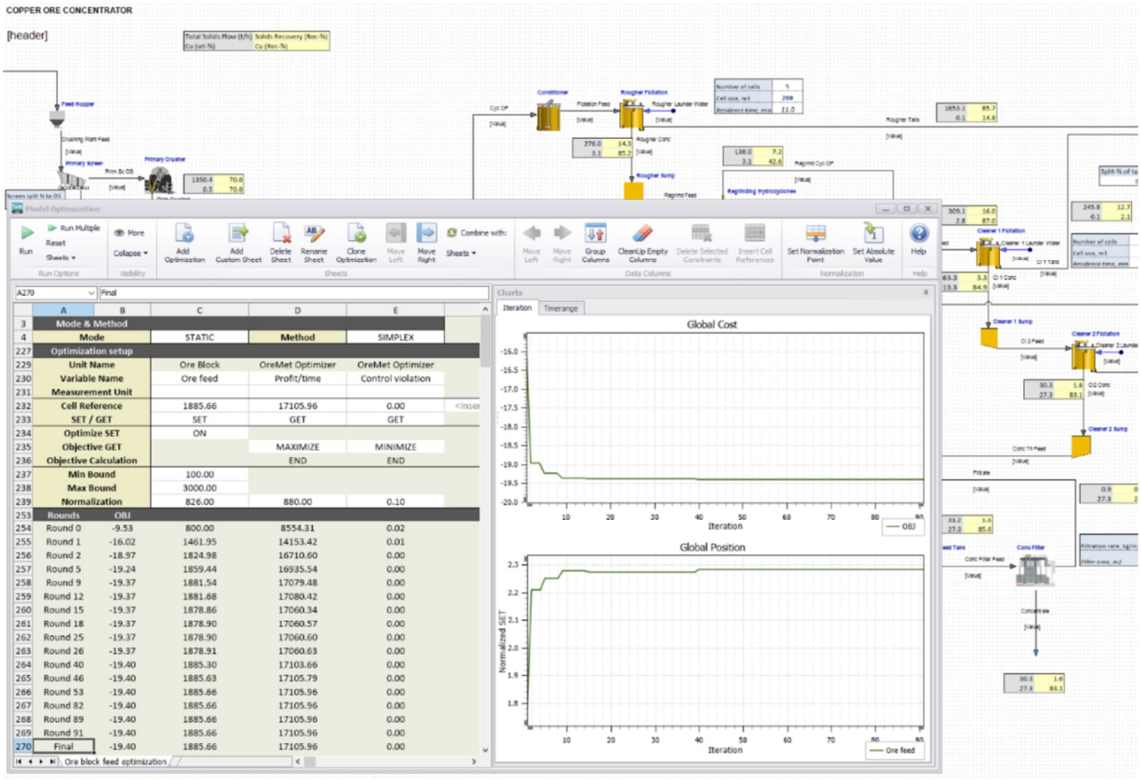


Figure 3. The new Model Optimization tool allows optimizing of process performance.

Sim Model Convergence Monitor

- New tool to finalize steady state calculations when convergence criteria are met. See **Figure 4**.
- Works for static models.
- Variables: Mass, heat, or both.
- An option is available to check the controls before completing the calculations.

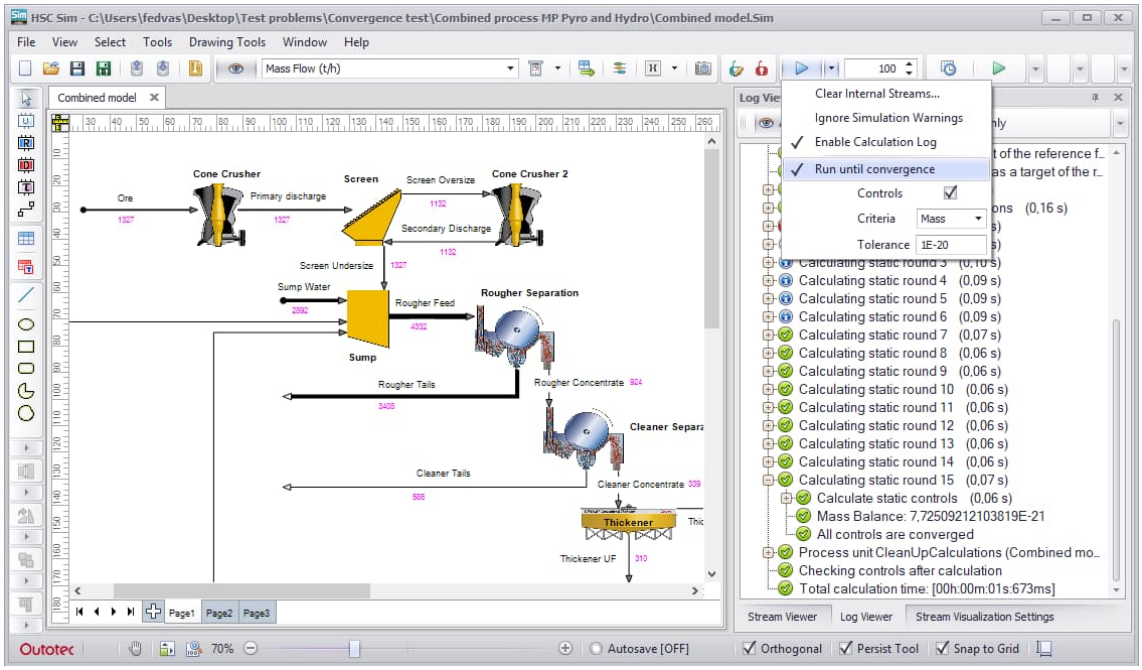


Figure 4. The convergence monitor can be used to complete a steady state calculation once the convergence criteria are met. The convergence monitor can check the global mass or heat balance, or both at the same time. The numerical value of the convergence criterion is shown in the Log Viewer. The convergence monitor can also check that all the controls are set at their setpoints before completing the calculations.

Improvements in dynamic calculations in Sim module

- Dynamic Report is a new tool to collect simulation data. See **Figure 5**.
- New variables for dynamic units.
- New features and bug fixes for Pyro and Hydro.
- Stream pipe delays.

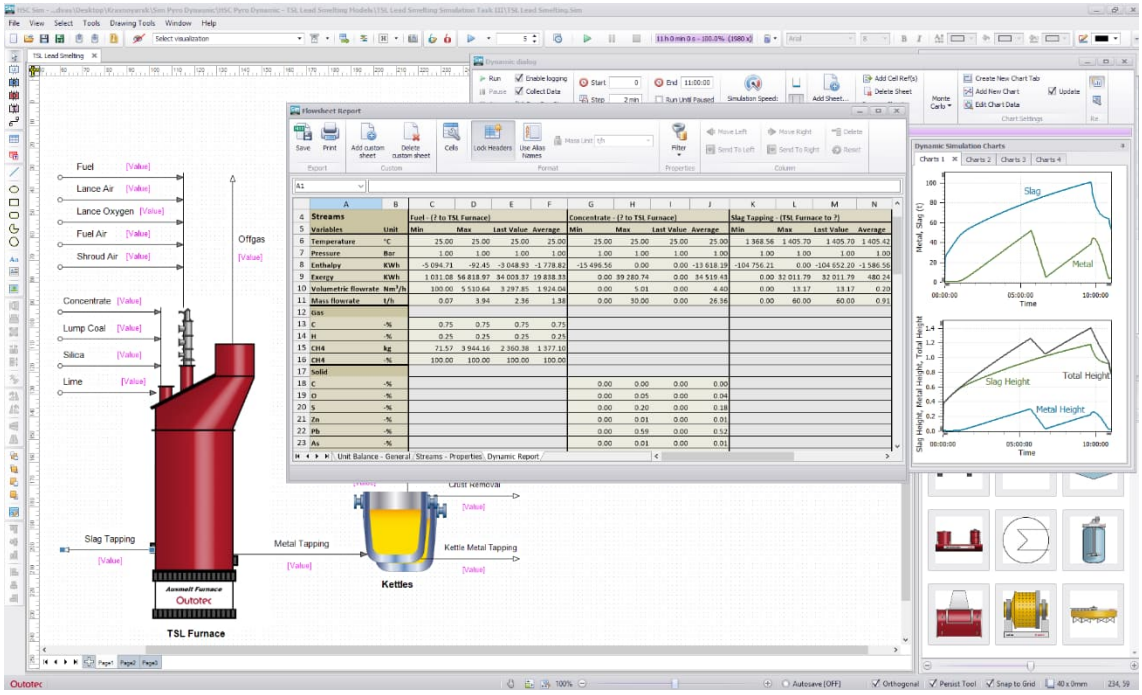


Figure 5. Dynamic Report collects the values of the user-defined variables from streams, tanks, and cell references during simulations and presents the minimum, maximum, average, and final values of the variables.

Sim Calculation Speed

- Model loading speed improved.
- Model calculation speed improvements.
- Multithreading (parallel computing) for dynamic models.
- Automatic calculation order of static process flowsheets improved.

Sim Unit Operation Protection

- Makes it possible to protect unit calculation and shows only Input and Output sheets. See **Figure 6**.
- Converts a unit operation to a black box.
- Password and HSC serial number based protection.

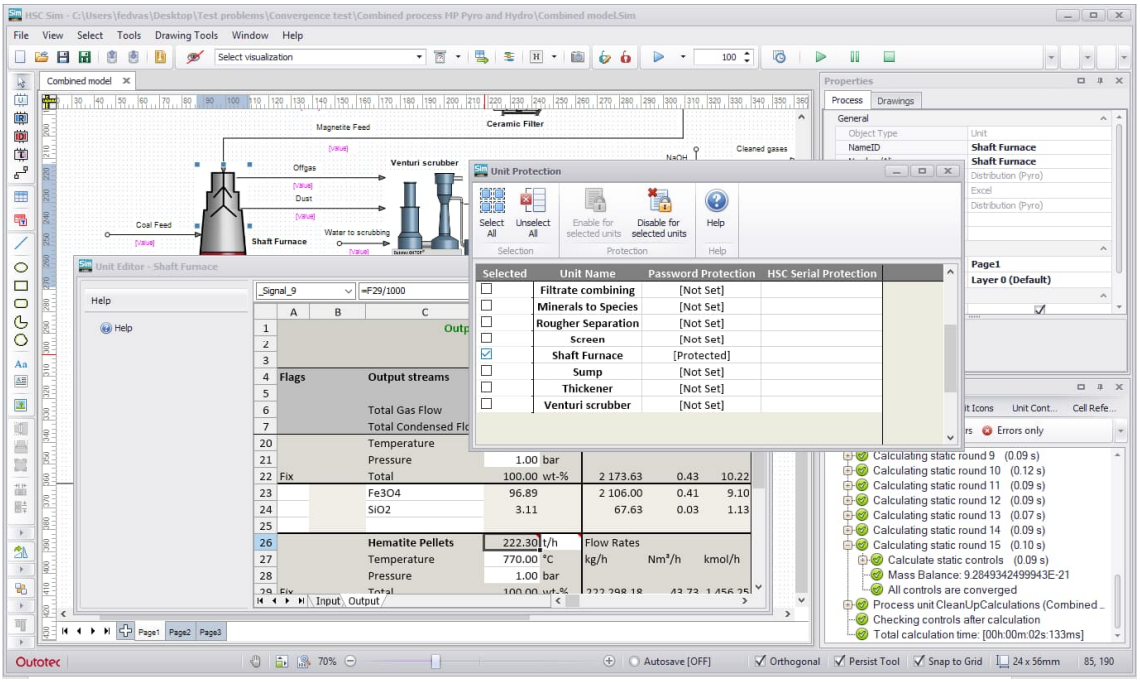


Figure 6. The Unit Protection tool makes it possible to protect a unit calculation. It converts a unit operation to a black box so that the user can see only Input and Output sheets. Password and HSC serial number based protection.

Sim Model Combination Improvements

- Process models may be imported into an existing model one by one.

Sim Environmental Features

- OpenLCA dialog improved and updated.

Sim New Features

- New generic units: Stockpile, Ore Bin.
- Updated generic units: Multicomponent option (Ball, Rod and AG/SAG mills), cyclone, flotation, mill.
- New default Hydro variables.
- New Diagnostics tool, which collects a warning log of possible problems for the end user.

Gem Equilibrium Module

- Own Pitzer parameters can now be used for aqueous solutions calculations in Gem.
- Electrode potential (E) calculations and plotting E for aqueous systems.

Aqua Module

- New database of user's own Pitzer parameters.
- Makes it possible to use own Pitzer data in Aqua calculations. See **Figure 7**.

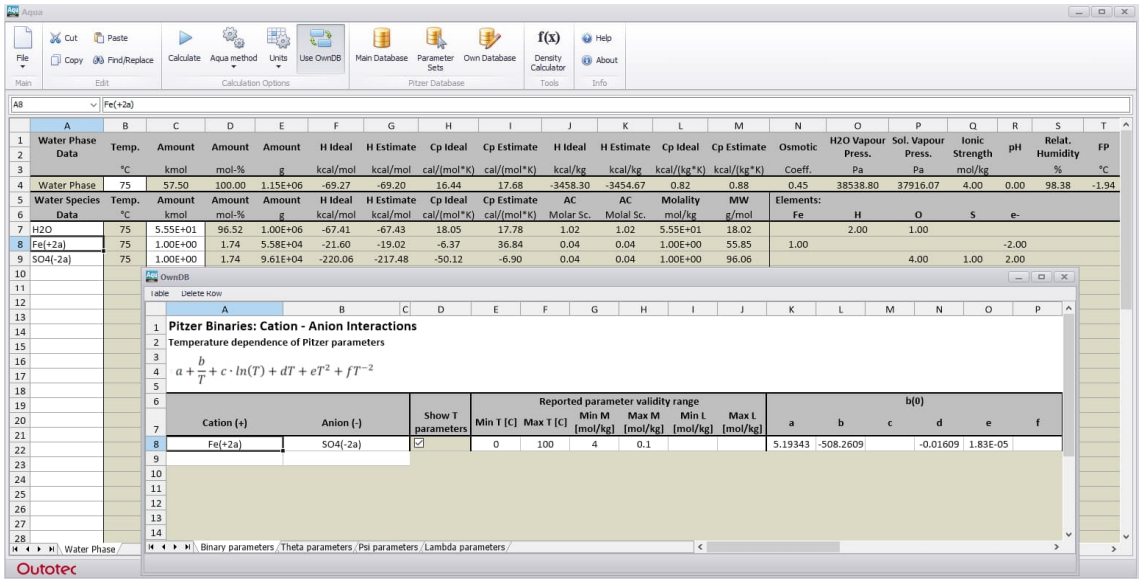


Figure 7. It is now possible to add your own Pitzer parameters in the Aqua module. These Own Pitzer parameters can also be used in the Gem and Sim modules.

Sampler Module

- New Sampler module replaces the old HSC 7 Sampler. See **Figure 8**.
- Better user interface and charts.
- Calculation results with comments can now be saved.

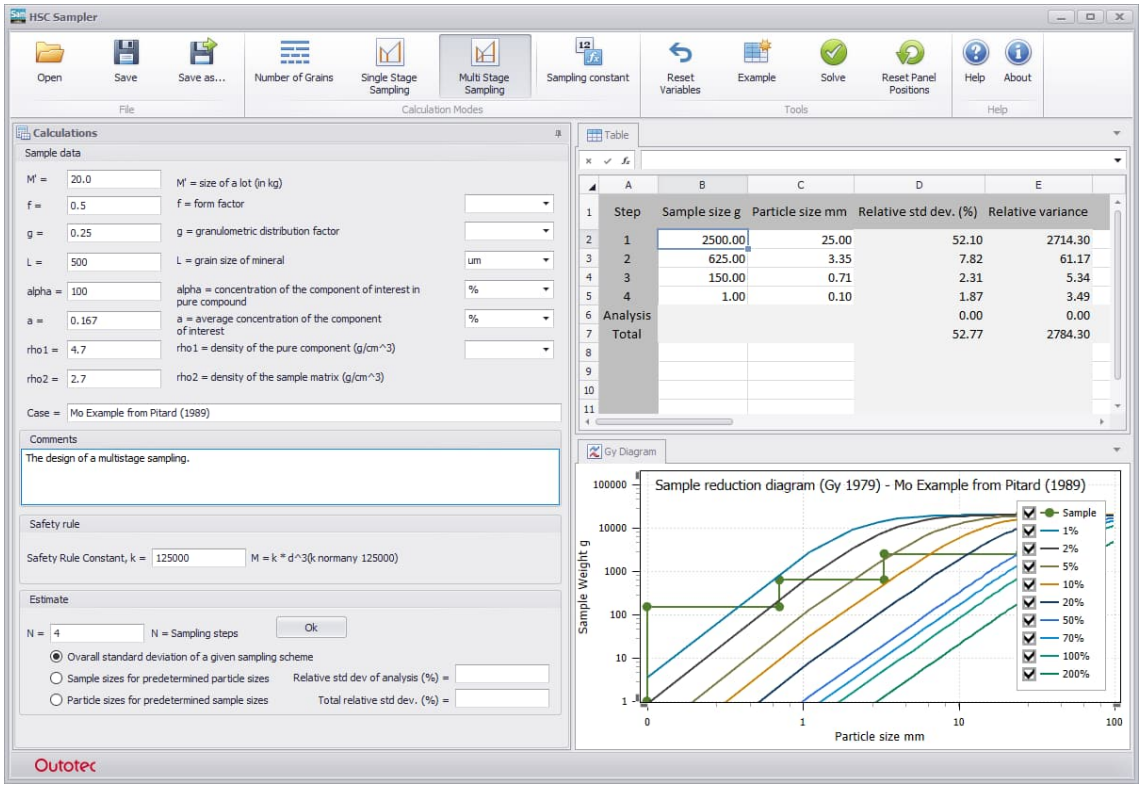


Figure 8. The new Sampler module replaces the old HSC 7 Sampler. The new Sampler features a better user interface and charts and allows the user to save the calculation results with comments.

Improved Diagram Navigator Module

- New triangulation algorithm for diagram digitalization. See **Figure 9**.
- New crystallization path calculation is available for ternary phase diagrams in the HSC Navigator module and as an Add-in function.
- New visualization features.
- Improved user interface.

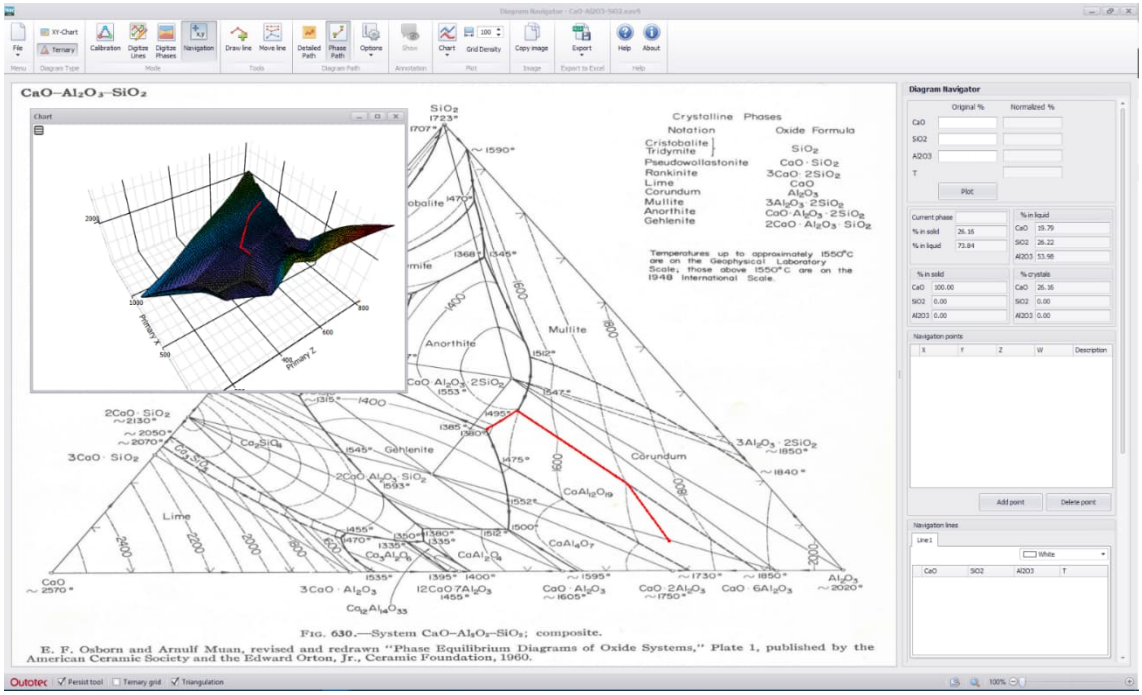


Figure 9. The new triangulation algorithm for the digitalization of the diagram surface allows the capturing of every tiny detail and use of the diagram for accurate calculation of crystallization paths. The digitized diagram surface and the crystallization path are visualized in a 3D chart. The crystallization path calculation is also available as an Excel Add-in function and can be used in other HSC modules.

HSC Data Processing Module

- New algorithms: principal component analysis (PCA) (see **Figure 10**) and k-means clustering (See **Figure 11**).
- Faster graphics.

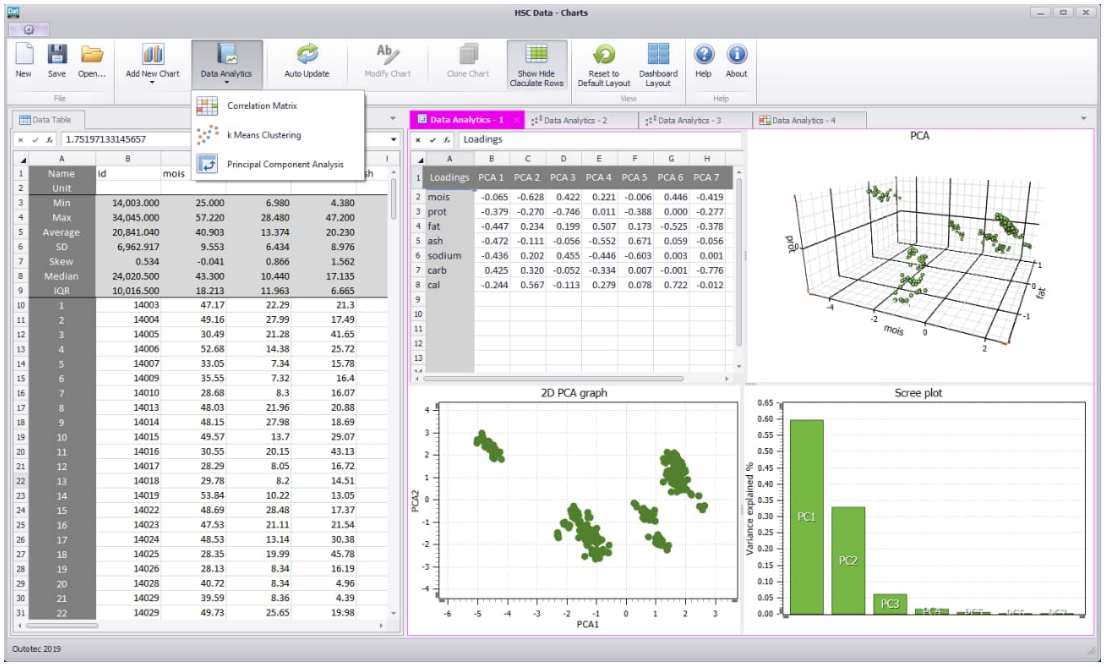


Figure 10. Principal component analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components.

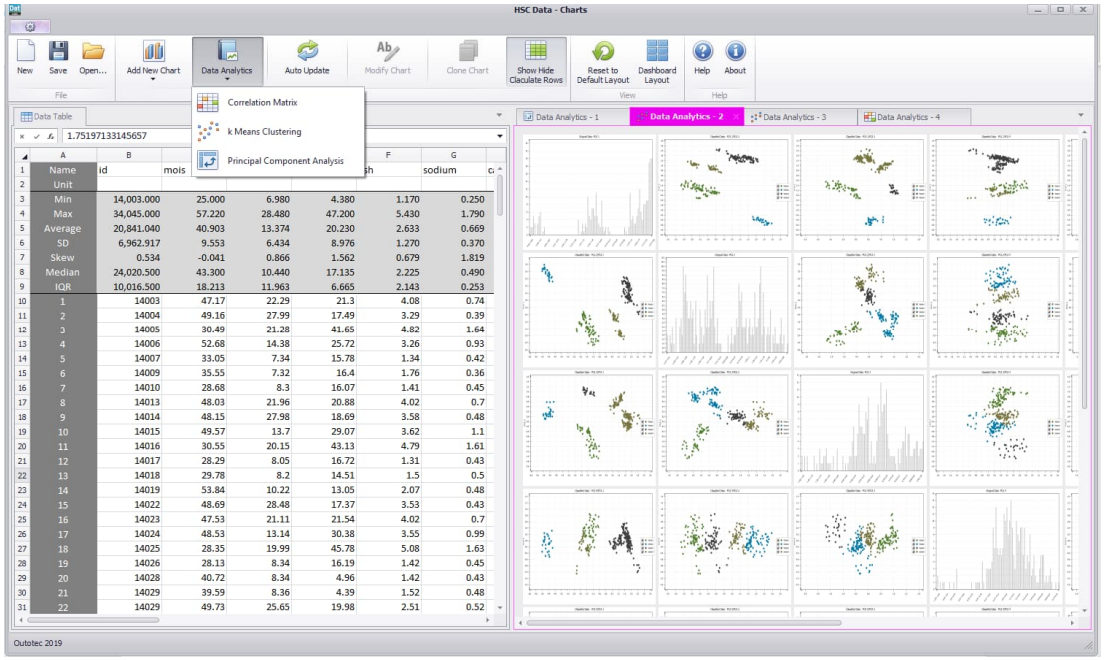


Figure 11. k-means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. The k-means clustering method implemented in HSC Data processing module clusters your data and visualizes the clusters in a multidimensional space.

Material Database Module

- New links to geographical location and maps.

HSC Main Database Module

- New and updated data for chemical species.

HSC Main Menu with Sub Menu

- The new Sub Menu lets the user easily hide rarely used module tiles. See **Figure 12**.

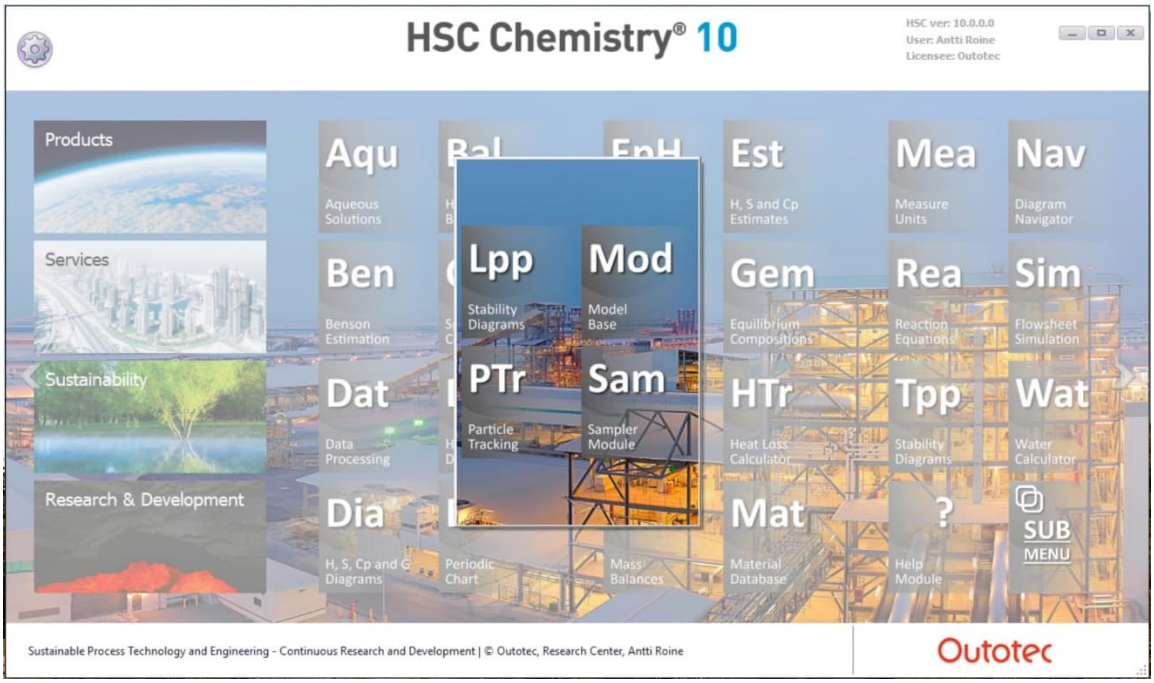


Figure 12. Rarely used module tiles can be easily moved into Sub Menu.

Others

- New Ptrack module (BETA version) for particle based balancing with mineral liberation data.
- Lots of small improvements and bug fixes.

HSC 10 Installation

- Default installation path C:\Program Files (x86)\HSC10.
- HSC 7, HSC 9, and HSC 10 can work simultaneously on the same computer.

New EULA Licensing Model with Subscription

- HSC 9 calculation module files are upward compatible with the new HSC 10.
- With the new subscription licensing model end users will get new software versions as they are released.
- The new licensing model does not support perpetual licenses without subscription. HSC 10 stops working after subscription period ends.
- Subscriptions are available for a period of one year or three years.