55. Sim Dynamic Simulations

55.1. Introduction

HSC Sim has tools for dynamic calculations for both minerals processing and species type of units. There are also tools to collect data, set up different calculation scenarios, set deviation for different parameters and to create events based on discrete conditions.

55.2. Dynamic Calculation Settings

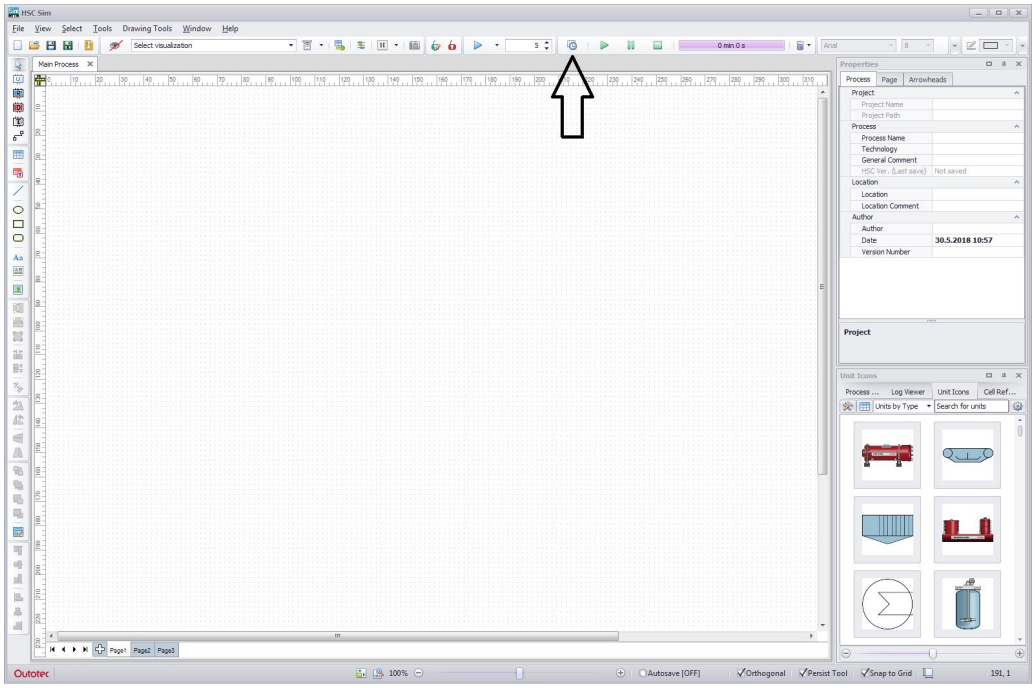

Fig. 1. Dynamic Calculations

Dynamic calculations can be used with the toolbar in **Fig. 1**. The most important tool in the toolbar is the Dynamic Dialog, which lets users set up different calculation scenarios for the flowsheet and more accurately control the step lengths etc. in the system.

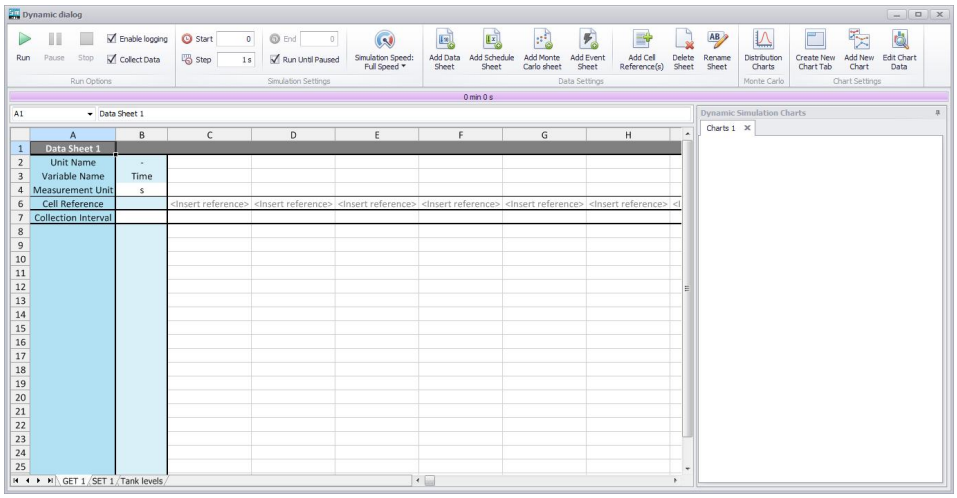

Fig. 2. Dynamic Dialog and the dynamic calculation settings.

With the Dynamic Dialog (**Fig. 2.**), users can collect data, set parameters, create events and visualize the calculation results with charts.

Dynamic Dialog contains the following sheets:

- Get Sheets: Used to collect data from any cell reference in the flowsheet.
- Set Sheets: Used to set values in the Flowsheet.
- Rand Sheets: Used to set values in the Flowsheet with some variation.
- Event Sheets: Used to create events based on what kind of conditions are met in the flowsheet.
- Tank Levels: Used to empty all tanks or set tank levels to specific state. All the units don't support this feature yet, with the exception of emptying tanks.

Get, Set and Rand sheet work in similar way as the sheets work in the Scenario Editor. Event sheet works in similar way as Control sheets, but with different options.

55.3. Dynamic Calculation Units

All the static units (distributions, reactions, minerals processing DLLs) can be used with the dynamic calculations. Often they don't have any mass or energy tanks, but in those cases they work exactly the same way as using the static calculations.

Some minerals processing DLL units support also dynamic calculations, and they contain parameters and tanks that work when the user calculates with the dynamic calculation toolbars. For minerals processing, using the dynamic calculations is very similar to using the static calculations, except that it requires often setting more parameters for the unit.

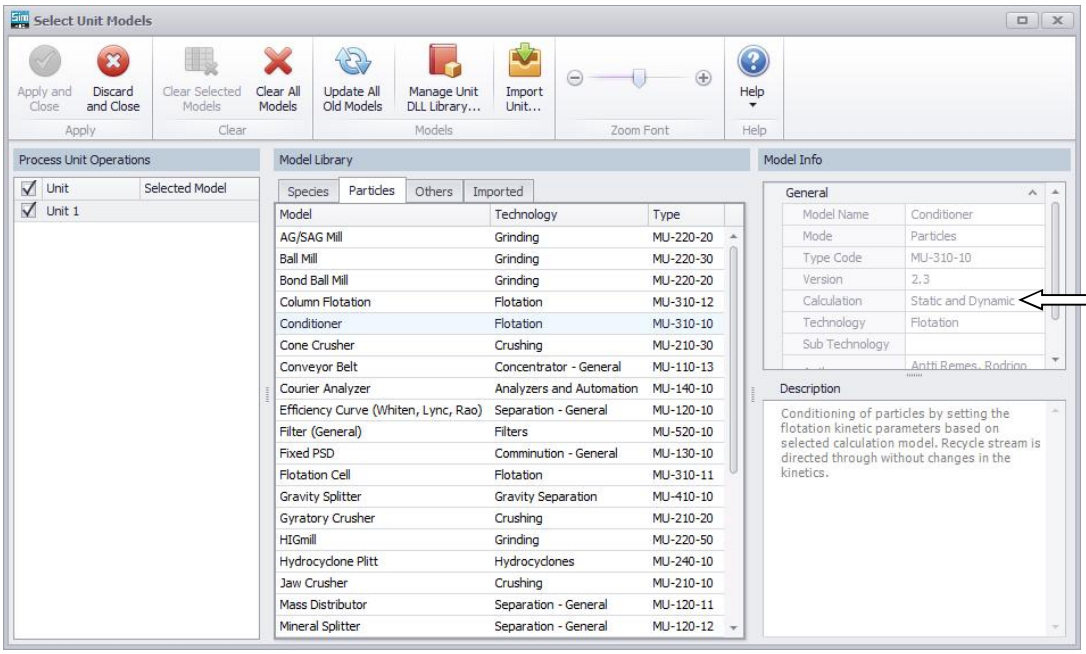

Fig. 3. Listed models in unit mode and type selector.

When selecting models for the units in the flowsheet, user can see on the right panel which kind of calculation modes are supported. If dynamic is listed separately, it means that the model usually has separate parameters and more advanced calculations when using the dynamic calculation mode.

55.4. Dynamic Calculation unit for Species

There is a new unit in HSC Sim for the dynamic calculations for pyro, hydro or other process applications which use species in the calculations.

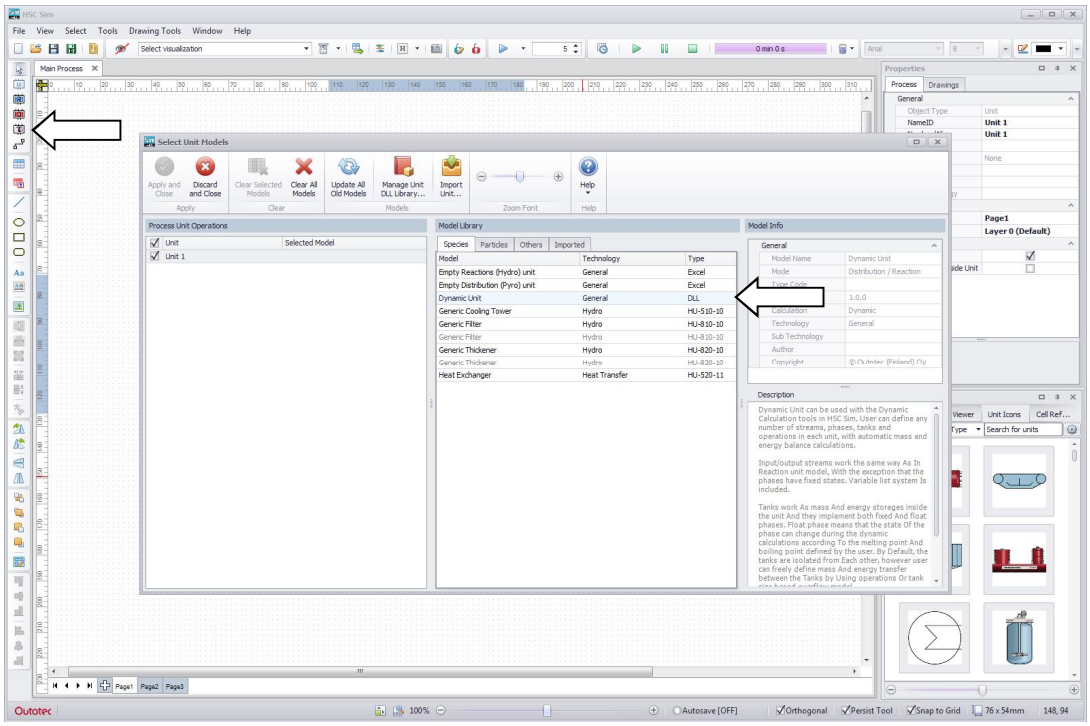

Fig. 4. New dynamic unit for species calculations.

The new unit can be found from the left drawing toolbar or from the unit mode and type selector as indicated by the arrows in **Fig. 4.**

In the unit, user can define any number of streams, phases, tanks and operations with automatic mass and energy balance calculations.

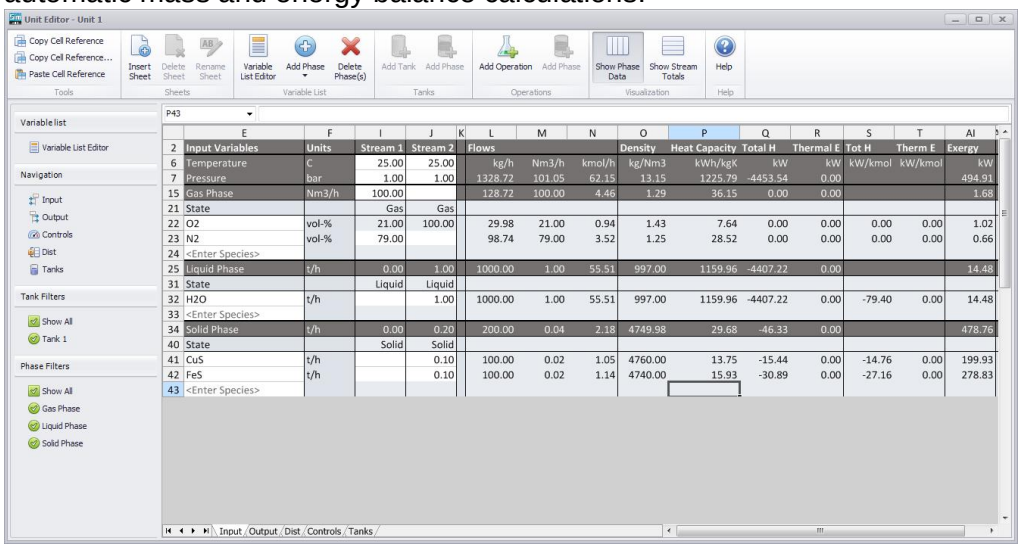

Fig. 5. Dynamic Unit input sheet with some inserted species.

Input/output streams work the same way as in Reaction unit model, with the exception that the phases have fixed states (**Fig. 5.**).
Variable list system is also included and it can be used to define and edit phases, add new variables and also to define whether the phase amounts are entered by the percentages (as in distribution units) or by absolute mass (as in reaction units).

NOTE! that on the contrary of the other units, the physical state of the whole phase is defined in a row below the phase name. Thus, in this unit, user doesn't have to define the suffix of the species, since the correct species entry is used according to the phase state.

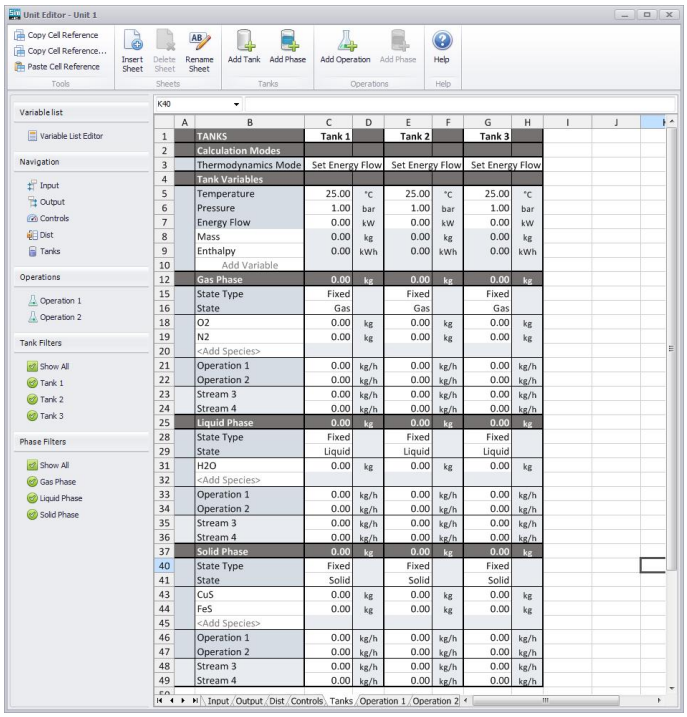

Fig. 6. Dynamic Unit tanks sheet.

Tanks work as mass and energy storages inside the unit and they implement both fixed and float phases. Float phase means that the state of the phase can change during the dynamic calculations according to the melting point and boiling point defined by the user. By default, the tanks are isolated from each other, however user can freely define mass and energy transfer between the tanks by using operations or tank size based overflow model.

User can also add variables to the tanks or create custom formulas by using the “Add Variable” dropdown below the Tank Variables.

As can be seen from the **Fig. 6.**, the phases and are automatically imported to the tank from the input sheet. However, if a phase is added inside the tank, it does not automatically go to the output sheet.

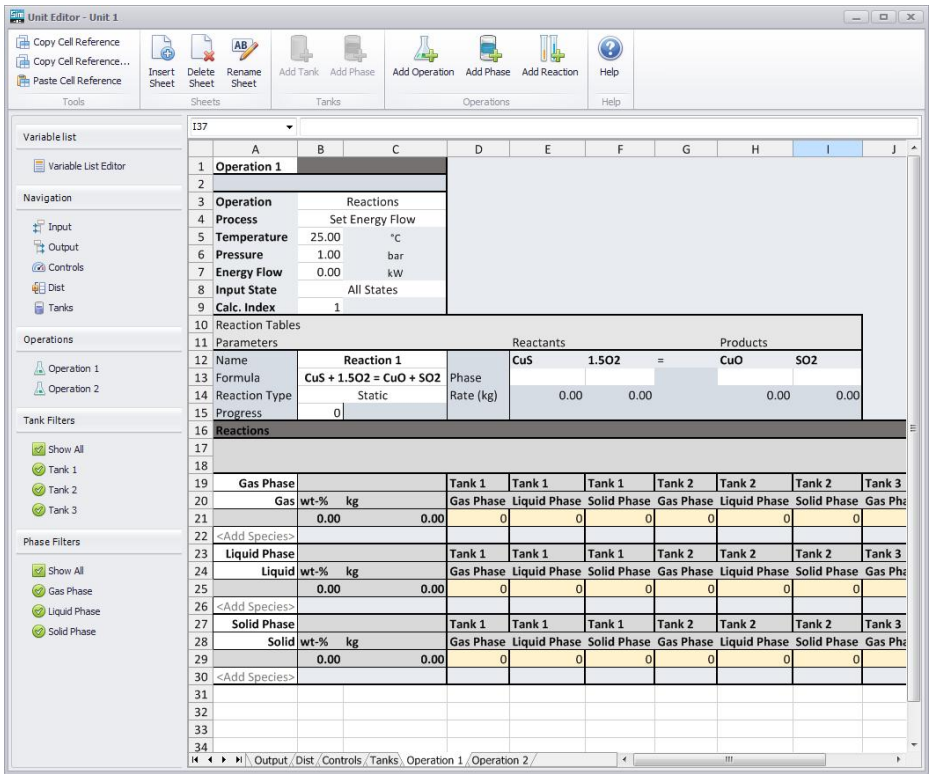

Fig. 7. Dynamic Unit operations sheet.

This unit contains multiple unit operation models which can be used together. It includes both Static Reaction and Distribution models, Equilibrium model, tank mass and energy transfer models and dynamic reactions model. An example of reactions operation sheet can be seen in **Fig. 7.**.

The main principle with the operations is that species are sent from tank sheet according to the user given value. During the calculation, species arrive to the operation sheet, the operation is calculated, and then user defines how the species are distributed back to the tanks.

In the example of the **Fig. 7.**, on the top part of the Operations sheet, user can define operation type and some default thermodynamic values. Calculation index can also be inserted, which defines the calculation order of the operations inside the unit.

On the Reaction Tables user can define the reaction equations and progress of the reactions. More reactions can be inserted with a button located in the upper bar. On the right side the phases for each of the species is selected, and on the lower part user can define where the species leave from the operation.

An example of dynamic unit flowsheet can be found from the HSC Installation Folder (…HSC9\Flowsheet_Dynamic\Gravitational Flow)