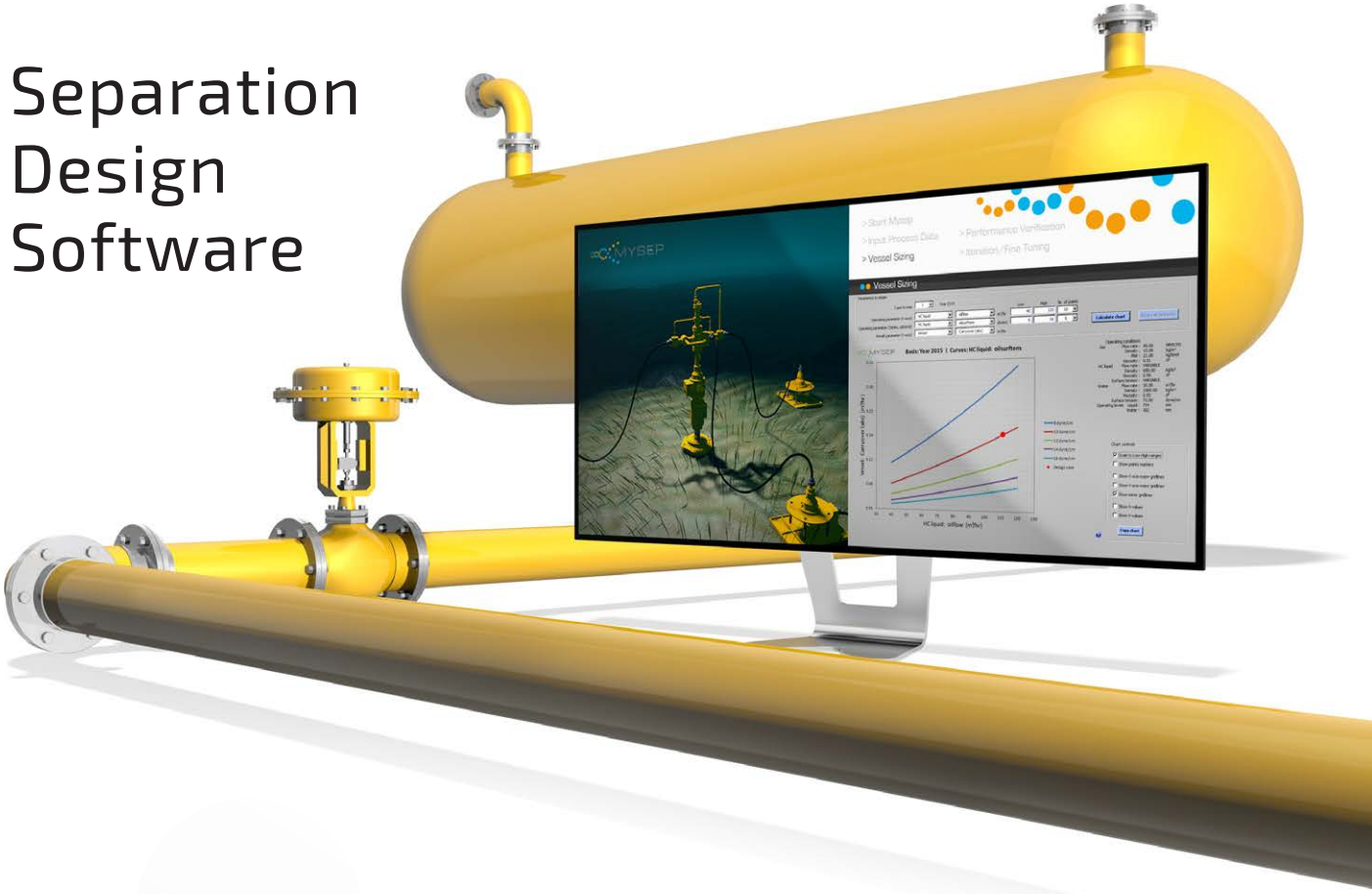
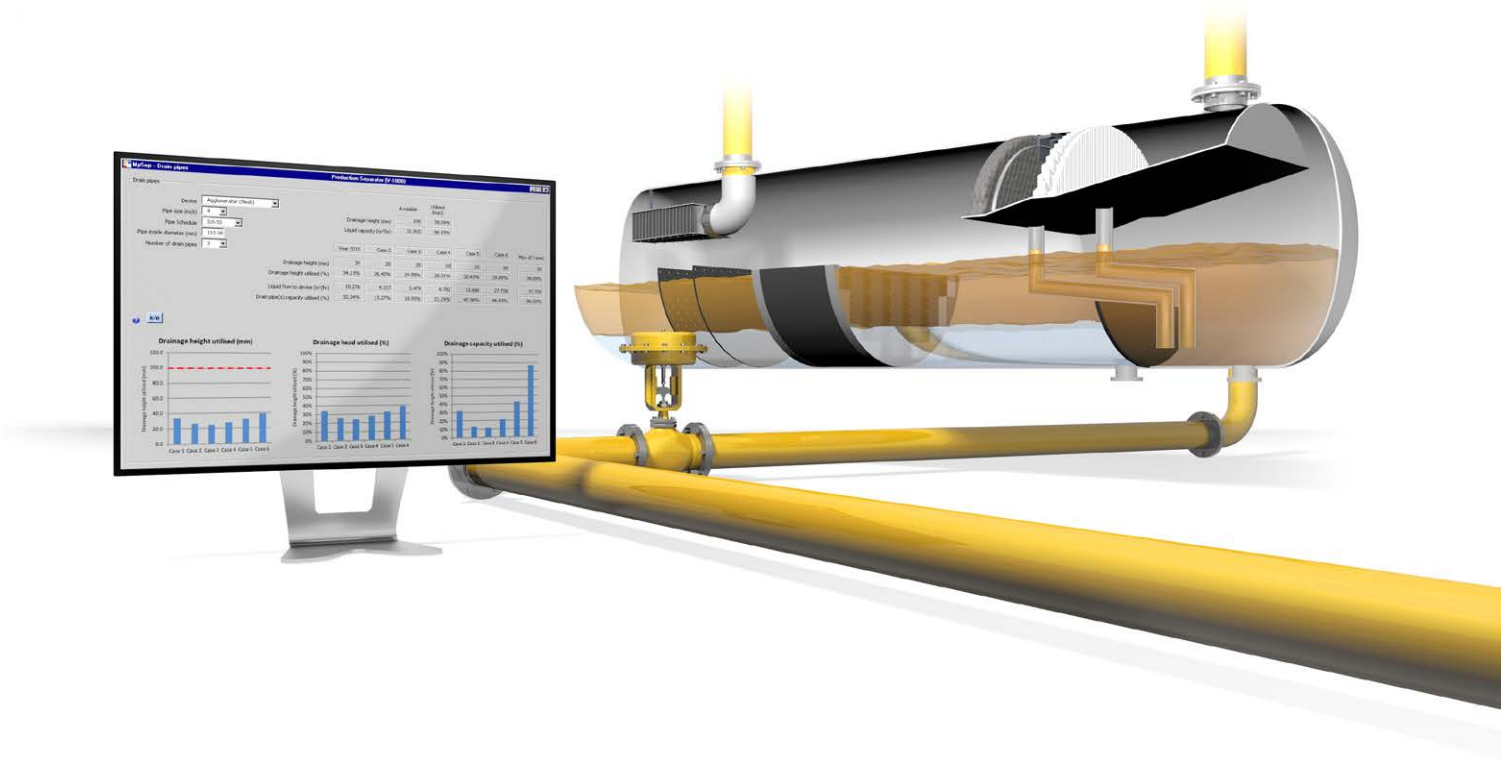
MYSEP

Separation Design Software





Description

MySep is computer software for the design, evaluation and simulation of separators and scrubbers. MySep enables the user to effectively determine vessel sizes, select internals and assess the associated overall performance of each vessel. Furthermore, MySep can also be used to evaluate an existing design and determine its theoretical performance based on actual operating data.

MySep can be used independently, and in conjunction with process modelling tools used to simulate entire flow schemes, such as Aspen Hysys, Petro-SIM, UniSim Design, VMGSim and ScimSci PRO/II. With the output from these process simulations, each vessel can be designed or simulated in detail and the separator performance results can be returned directly to the process simulator.

What is the power of MySep?

MySep answers questions and increases efficiency for both the design engineer and his company. To name a few:

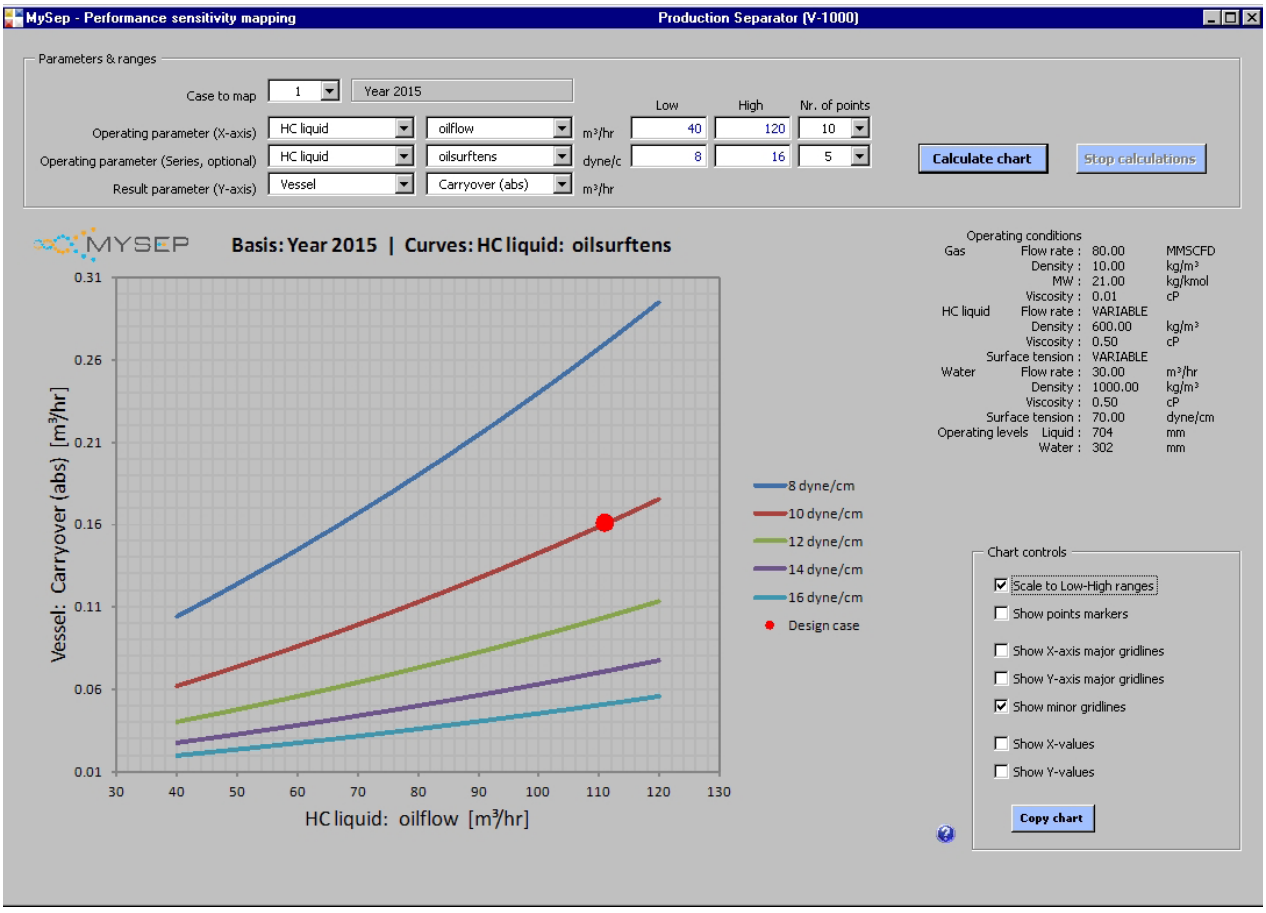
- Predict and assess the performance of new and existing separators. Be in the know.
- Reduce engineering hours and costs
- Avoid re-engineering
- Mitigate risk

Areas of application of MySep:

How can I use MySep?

MySep is set up such that the user is effectively guided through the design steps in the most efficient manner. At the same time, all aspects of the design are accessible at any time.

The effects of user input on key aspects of the design (e.g. droplet sizes, performance, residence times, etc) are calculated immediately and shown to the user in real-time. This allows fast optimisation of the design. MySep has built-in correlations for prediction of mist fractions, droplet size distribution and separation efficiencies at the various separation stages within the vessel. Nonetheless, the user has the possibility to override these predictions. By entering overriding values and reviewing the effect on overall performance, the user obtains insight in the sensitivity of the design.



MySep is available in two license types:

1) Standalone license version, for use on a single computer.

2) Network license version, for concurrent use on multiple computers on a network.

MySep adds value to your project, from Conceptual Design to daily Operations. It is all about you being in control of the design, its performance and consequently your peace of mind.

Features

MySep software has a wealth of features, that provide engineers with tools and insights to design and evaluate separation vessels in a comprehensive and efficient manner.

Phase separation

- Gas - liquid separation
- Liquid - liquid separation
- Liquid - sand separation

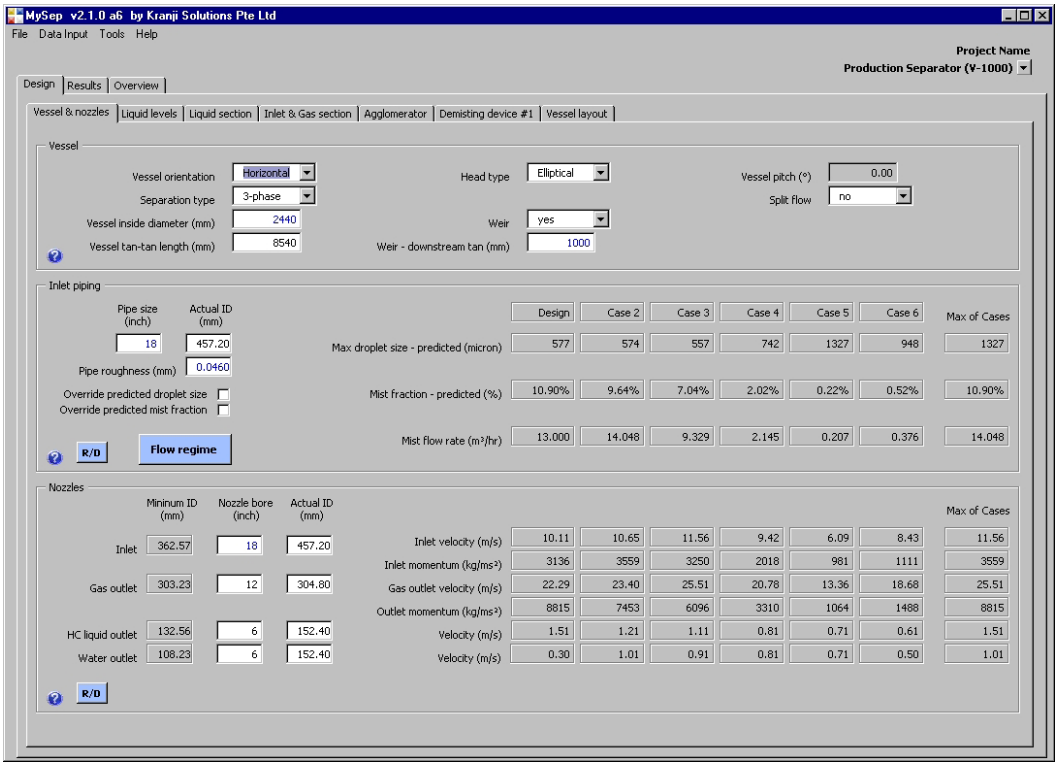
Automatic vessel sizing

- Full automatic sizing of the vessel based on selected equipment and other optional criteria
- Side-by-side comparison of multiple vessel configurations
- Automatic vessel weight calculation for each vessel configuration

Simulator communications

Bi-directional communication with process simulators:

- Aspen Hysys
- Petro-SIM
- SimSci PRO/II
- UniSim Design
- VMGSim
- Pull process data directly from process simulator into MySep
- Send vessel carryover and pressure drop to simulator
- MySep-RunTime geometry file generation



Vessel Motion

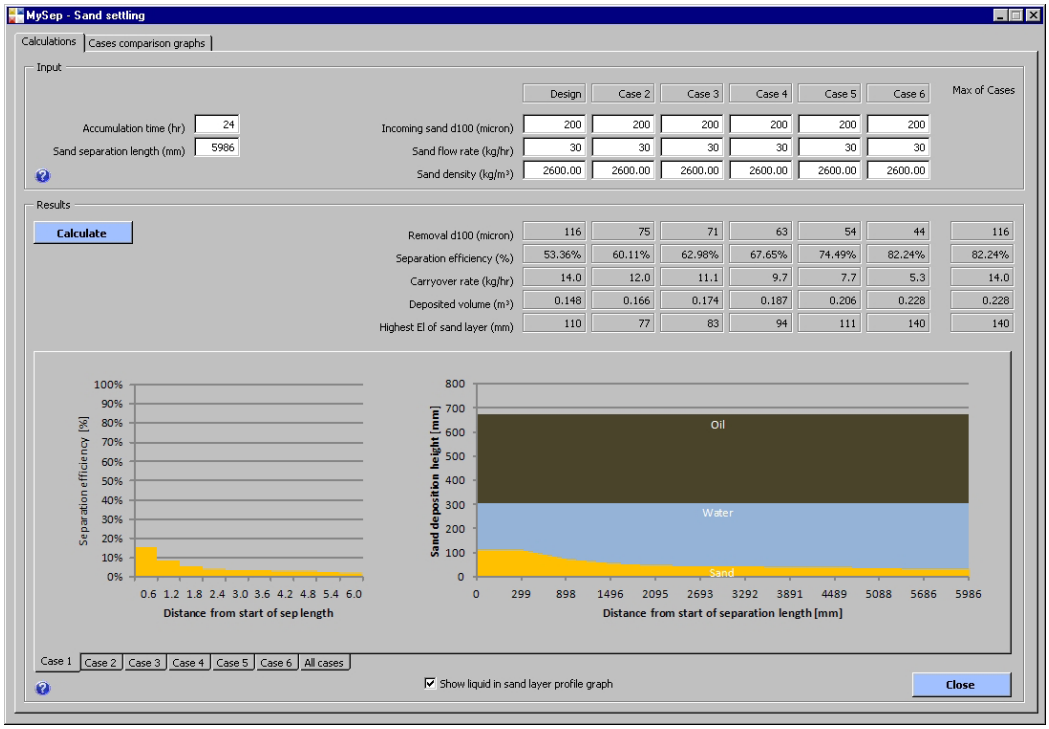
- The Motion module enables time transient simulation and analysis of liquid level height behaviour in the vessel as a result of motion of the facility (e.g. and FPSO)
- Time transient calculation of liquid level heights
- Automatic checking of internals against the dynamic liquid levels
- Warnings are shotn if the moving liquid levels cause operational issues for the separation internals
- "Video" mode that shows the dynamic level behaviour in the vessel (pitch and roll views)
- Level monitor graphs vs time
- Data export to Excel spreadsheet

Vessel weight

- Calculation of shell and heads thickness
- Vessel weight calculation
- Nozzles and internals weight calculation
- Selectable vessel codes: ASME VIII Div 1, ASME VIII Div 2, PD 5500
- Selectable material of construction

Input

- Input up to 6 design and operating cases
- Selectable input units (SI/metric and English/Imperial and combinations) and automatic conversion upon unit selection change
- Pull data directly from Hysys, Petro-SIM, PRO/II, UniSim Design and VMGSim
- Import case data from Excel spreadsheet



Inlet piping

- Droplet size distribution prediction
- Liquid entrainment fraction and flow rate prediction
- Selection of Key liquid phase mode for gas-liquid separation calculations
- Flow regime map and data

Inlet section

- Nozzle size, velocity and momentum calculation
- Inlet device selection: no inlet device, half pipe, vane type, inlet cyclones
- Basic hydraulic calculations, checks for gas blow-by/excessive carryover, and performance predictions for inlet cyclones

Liquid levels

- Direct input of liquid levels setpoints
- Auto-calculation of level setpoints from height, volume and time requirements input

Gravity separation section (gas-liquid, liquid-liquid and liquid-sand)

- Liquid from gas separation calculation (droplet size distribution based)
- Oil droplet from water separation calculation
- Water droplet from oil separation calculation
- Plate pack coalescer selection, dimensioning and performance
- Phase inversion point predictions
- Oil in water and water in oil outlet concentrations approximation
- Perforated distribution baffles design, pressure drop and level differences
- Degassing bubble size calculation
- Sand separation calculations: carryover and deposition height profiles

Demisting section

- Demisting device selection & performance predictions: Mesh pad, vane pack and cyclones
- Detailed geometrical parameters of equipment (e.g. mesh void fraction, wire diameter, cyclone swirl angle, diameter, etc, etc) used in performance calculations.
- Calculation of mesh pad flooding point, cyclone gas momentum and axial shear stress
- Detailed design / sizing of demisting equipment
- Drain pipes design and verification

Design layout

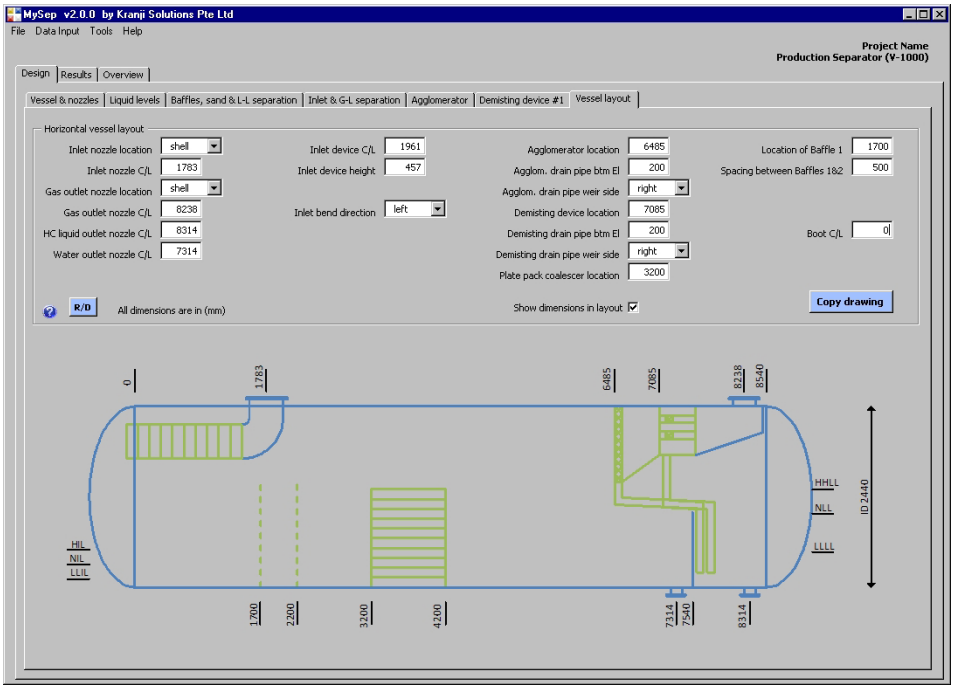
- To-scale layout drawing of vessel, nozzles and internals
- Selection of different vessel configurations, including: Liquid boot, split flow (central inlet + 2 outlets, central outlet + 2 inlets)
- Setting / adjustment of nozzle and internals dimensions and layout

Pressure drop

- Prediction of pressure drop across nozzles, internals and vessel
- Prediction and consideration of drainage head in equipment drain pipes

Other

- Prediction of liquid in gas carryover and droplet size distribution at each separation stage in the vessel
- Option to override predicted droplet sizes and liquid loads (mist) at each separation step
- Categorised design notifications tagged with “CRITICAL” or “INFO” if physical of equipment design limits are exceeded by user
- Detection and warning for onset of re-entrainment in gravity section of horizontal separators
- Export droplet size distribution data to Excel spreadsheet

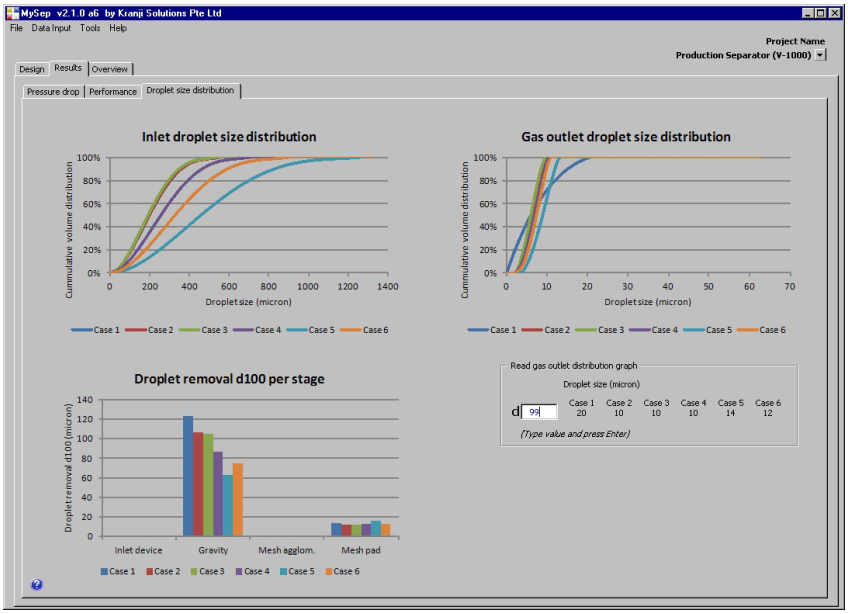


Operating envelope

- MySep Gallery - Vessel Operating envelope mapping
- Generation of graphical charts of a vessel's operating envelope
- Iso-carryover curves
- Operating limits
- Custom point
- Multiple indicators
- Chart controls

Sensitivity analysis

- Plotting of selectable parameters in a chart
- Wide range of selectable operating parameters
- Custom calculation ranges and number of points
- Chart controls



Report generation

- Full report generation
- Option to include own company logo
- Select with MySep calculation sections are to be included in the report

Datasheet generation

- Automatic generation or revision of vessel process datasheets
- Possibility to use your company's Excel-based datasheet template

External data processing

- Define your operating cases in an excel spreadsheet and have MySep run these cases and return all the key operating and performance parameters back to the spreadsheet

Benefits for Process and Simulation Engineers

Research-based modelling for accurate design and simulation

MySep calculations are based on an incremental evaluation of the performance of each of the components that make up a separator unit, following the fluids streams from inlet through the gravity gas-liquid, liquid-liquid and demisting sections of the device. This approach, coupled with the program's proprietary models and correlations, bring the confidence of unrivalled rigour and accuracy to designing a new separator or to evaluating the performance of an existing unit.

Predict separator performance

Separators are commonly designed using company in-house methods that do not provide the capability of determining separation performance. MySep allows existing equipment to be evaluated to determine if these will perform satisfactorily as operating conditions change, addressing prediction of liquid carry-over with gas, liquid dispersed phase carry-over with continuous phase as well as complete component pressure drop analysis.

Optimise the unit design

MySep's "Auto-size" feature allows the user to rapidly size a vessel for the governing process condition encompassing up to 6 process variations. The user can select the configuration of internals required and MySep will size the vessel to accommodate these, considering all key physical constraints such as control liquid levels and demister drainage. If required, a preliminary design can be manually adjusted to meet special requirements and the separation performance can be analysed in detail.

Optimise with different internal configurations

The Auto-size functionality also allows users to assess the impact of different configurations of internal devices on vessel sizing, for example, the effectof: vane-pack, mesh-pad and cyclonic demisters selections on overall vessel size and weight can be compared in a matter of seconds.

Optimise process system design

MySep offers links to leading process simulators like Aspen HYSYS, UniSim Design, Petro-SIM, PRO/II and VMG-Sim to access process and property data. This allows users to design or rate individual separator units with ease. Predicted carry-over data and pressure drop data can be transferred back to the simulator to allow the overall process simulation to take account of MySep results. This allows a system of primary and secondary separators to be optimised or a system comprising phase separators and other unit operations to be optimised taking account of key interactions.

Simulate the performance of separators in operation

Existing separators can be specified and their performance verified. Whilst this can be done in MySep itself, a new run-time module (MySep-RT) allows the user of leading simulation programs to directly integrate fully rigorous phase separator modelling within simulations. This can facilitate very efficient optimisation of overall process designs or operations using steady state simulations using case-studies to explore a virtually limitless rage of process conditions. Users can also explore the influence of process control strategies on separator operation and downstream operations using MySep-RT in dynamic simulations.

Verification of vendor internals performance prediction

Intrinsic to MySep vessel performance prediction are results for all separation internals in the vessel. These predictions are based on the actual geometry of the internals (typical geometrical values are provided by default in MySep). This means that the design engineer no longer needs to await or rely on vendor's input for performance data. The design engineer can predict the performance to fast track project progress by other disciplines such as; mechanical, piping, instrumentation and control. In addition, MySep provides the process engineer with an independent verification of vendor designs and performance expectations.

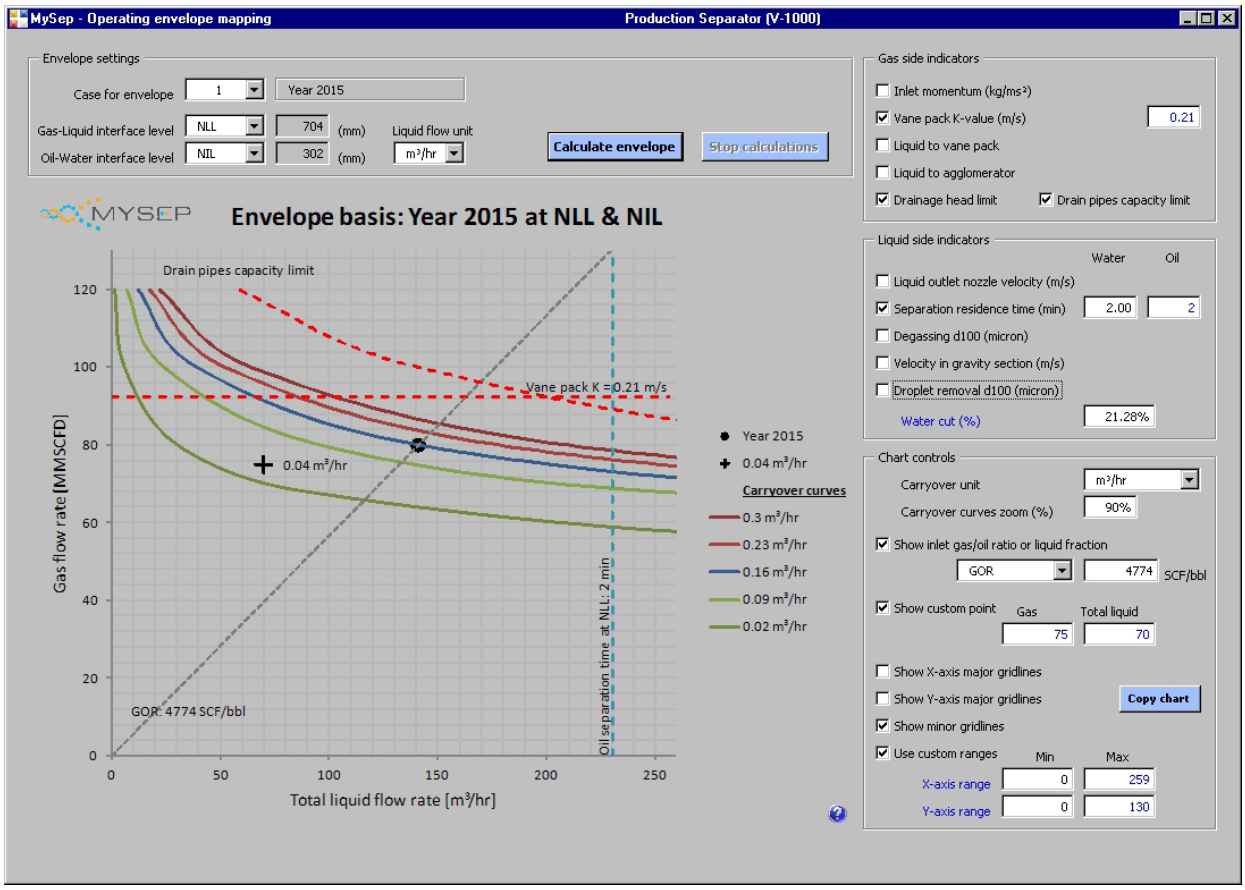
Production of separator design deliverables

For new separator designs or for revamp projects where new internals are identified for existing vessels, engineers can benefit from immediate availability of key deliverables. MySep provides: a to-scale separator diagram showing all key internal locations and dimensions; a data sheet that is fully customisable to the user's own Excel standard datasheet implementation; a fully-comprehensive

MySep report. The report documents all detailed process analysis of separation performance, including input specifications, carry-over details, pressure drop predictions and droplet size distribution results. This provide a valuable communication tool for vendor, contractor and process operators.

Explore sensitivity of performance to key process variables

Investigate the effect of operating parameters (e.g. liquid surface tension or liquid level) on vessel performance and other parameters. A wide range of selectable parameters are available for plotting, to obtain more in-depth insight in the dependencies and sensitivities of the design.



Evaluate feasible operating envelope

The Operating Envelope tool within MySep allows a plot of a vessel's performance to be generated. This gas versus liquid flow rate chart shows constant-carryover curves and superimposed operating limits for the vessel. Insights into off-design operating characteristics as well as vessel capacity limits are immediately apparent and these can form a basis for facility production planning and profitability analysis.

Weight estimates

MySep provides immediate calculation of vessel weight based on ASME or PD5500 design codes. This is of major importance for offshore equipment where any item has a magnified impact on structural requirements and overall project cost or feasibility. This is true to a lesser extent for on shore processing but increasingly, as modular construction practices are adopted, a similar impact of weight can be observed. A full breakdown is provided including the vessel, the internals, nozzles and flanges, vessel empty and full of liquid.

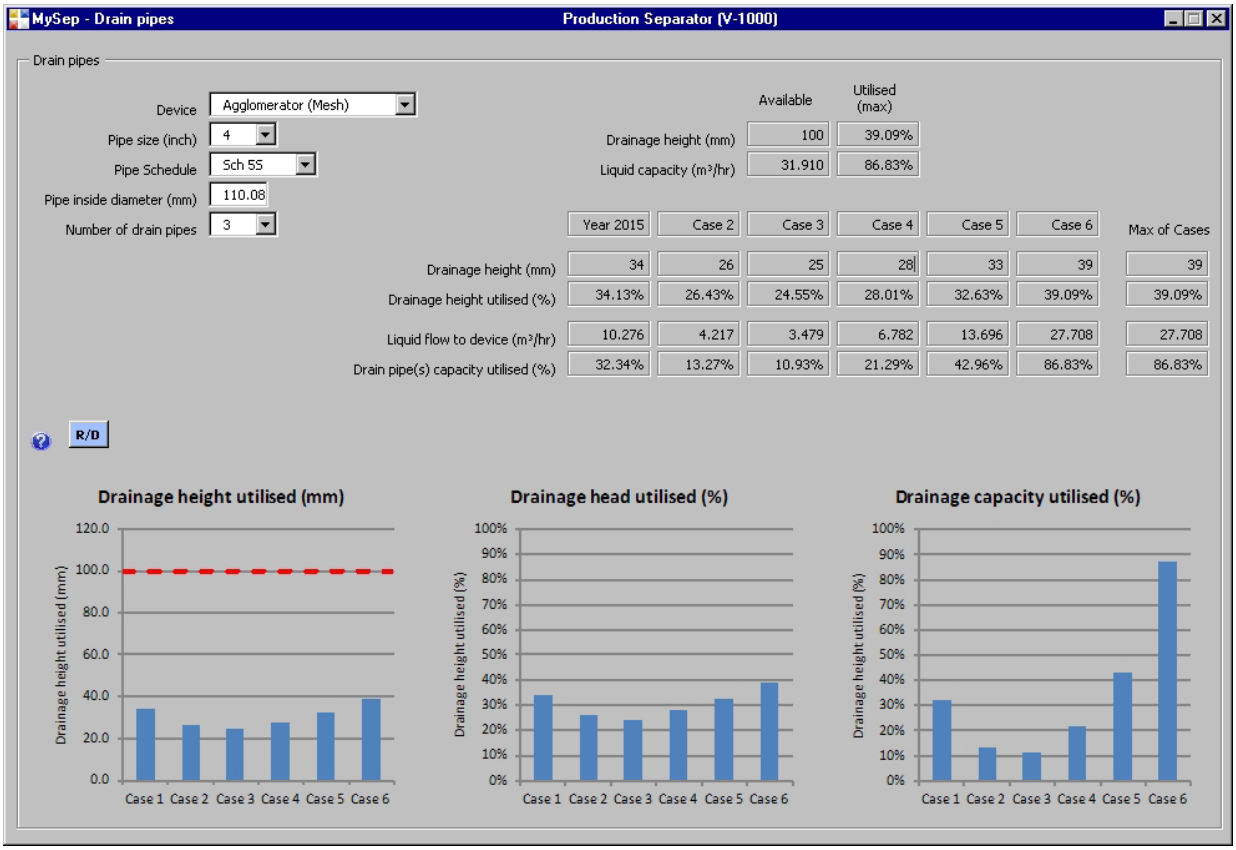
Analyse vessels subjected to sea motion

The motion module within the program allows an evaluation of the effect of prescribed vessel motion on liquid levels within a vessel. This can allow rapid development of suitable designs for FPSOs and other floating applications, including assessment of arrangement of wave inhibition baffles and dimensions and location of main separation internal devices.

Benefits for the Company

Reduced engineering time and project timescales

The consequence of the benefits for the design engineer, outlined below, is that reliable vessel designs can be obtained more rapidly using MySep. This has an impact in improving the competitiveness of estimates and bids for engineering projects and reduced risk of costly project over-runs.



Improved overall process optimisation

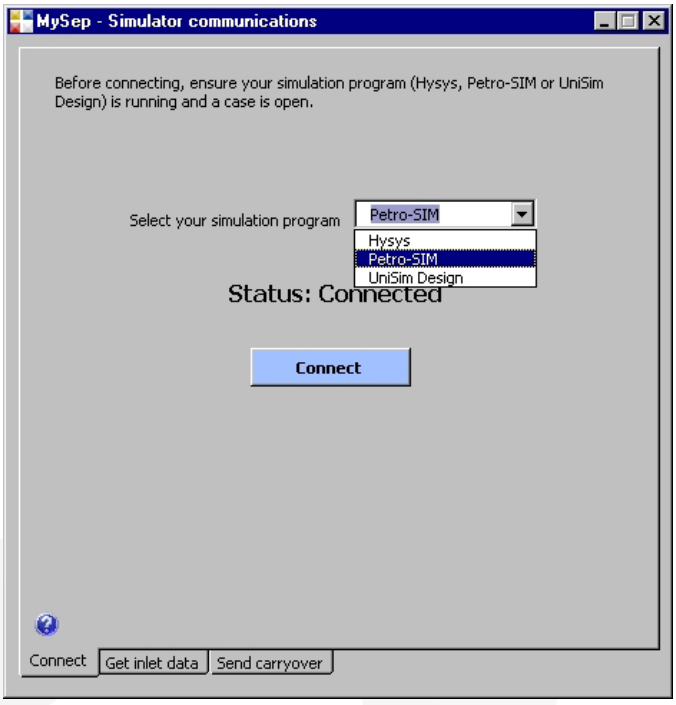
MySep communication with the leading process simulators Aspen HYSYS, Petro-SIM, UniSim Design, VMGSim or SimSci PRO/II provides fast and error free performance evaluation of actual simulator operation. This allows the overall process design or operation to be optimised by incorporating accurate carry-over predictions within the simulation so that consequent impact on downstream equipment can be taken into account.

Minimisation of re-engineering

In execution of projects it is not uncommon that re-engineering of separation equipment turns out to be necessary. For example, during the Detailed Design phase of the project, it becomes evident that vessel and internals size estimates determined during the FEED phase prove unsuitable. This costly exercise may be avoided through use of reliable MySep designs during the FEED stage. As overall process designs evolve and conditions change in the process models, MySep allows rapid assessment of performance of the current design and, if needed, re-design can quickly be performed to meet new constraints.

Risk mitigation

Un-planned shut down due to failure of key equipment can be associated with very large losses in operational revenue. For example, excessive carry-over of entrained liquid can result in rapid or progressive damage to compressors resulting in extended shut-down and expensive repair replacement costs. These risks can either be a result of inappropriate design or arising from variations in operating conditions. In the former case use of MySep for initial design or for evaluation of a vendor design can ensure liquid carry over is within satisfactory limits. In the latter case MySep can allow engineers to verify if operational changes such as reduced throughput can minimise the risk of lost production.



Capital cost savings (CAPEX reductions)

The optimisation capabilities outlined on the above provide an excellent opportunity for equipment cost saving. Vessel design based on rigorous performance prediction can often be made smaller than vessels designed on the basis of traditional in-house standards and rules-of-thumb. A reduction in vessel size not only reduces the cost for the vessel, but it can also have a significant knock-on effect on the overall project cost. For example, in offshore applications, smaller vessel sizes result in lower overall topsides weight, which in turn result in very significant cost savings on the platform structure and overall project cost. Very similar scale overall capital cost savings are also obtained where modular construction is employed for engineering of on-shore processes.

Assessment of production increase scenarios (OPEX v revenue)

More than ever increased production capacity is being sought across the process industries from oil and gas production through mid-stream and downstream processing to bulk chemicals and speciality chemicals. MySep can be used directly or in conjunction with a process simulator, to assess the viability of proposed measures to increase production. Changes in throughput, stream composition and operating conditions all affect the performance of phase separation equipment and the impact carry-over of liquid with vapour or aqueous liquids with hydrocarbon liquids. This in turn will impact the performance of other equipment in the process and ultimately the profitability of process operations. For example, excessive carry-over of a costly solvent with vapour leaving a separator will necessitate increased make-up and the cost of this will affect the process profitability. MySep performance predictions can help operators to explore the cost/benefit of operating changes aimed at increased production.

Improved budgeting accuracy

By using MySep in an early stage in the project (e.g. Conceptual and FEED phase), representative vessel sizes can be swiftly obtained. Having reliable vessel sizes in an early stage in the project means a more reliable and accurate project budget cost estimate which improves the accuracy of project viability assessments. Good estimates also minimise the risk of project capital cost over runs.

Reduced dependency on equipment vendors

During project execution, operating companies and EPC contractors typically rely on vendors for vessel sizing and/or vessel performance estimates. MySep allows these companies to determine such matters in-house. This results in less time spent on vendor communication, more detailed vessel and internal specifications can be provided to vendors during procurement mitigating operational risks described above. In addition, vessel performance predictions of vendors quoting equipment can be independently verified further mitigating risk of unsatisfactory operation and costly retro-fit.

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