Version 4.6 R3

1. Added support of proxy servers with authentication when using Hydrosystem with an Internet license.
2. Improved diagnostics of errors when obtaining an Internet license for the program.
3. Added the ability to import data from files of "START-Prof" version 4.87.
4. Fixed a bug at the displaying some pipeline models imported from other programs on a very small scale.
5. Fixed a bug when copying a file with a license to the settings folder with non-standard environment variables in the system.
6. Fixed some other minor errors and inaccuracies.

Version 4.6 R2

1. A bug has been fixed that could cause problems at the program launching when another PASS software, which has the same protection system (Nozzle-FEM, for instance) is running on the same computer.
2. A bug has been fixed due to which the interface of the isometric drawing export module in AutoCAD was not in English.

Version 4.6

3. The ability to calculate single-phase flow in pipelines with fluids composition in different inflows, considering their mixing along the flow (when using the STARS thermodynamic library), is implemented. Added functions for displaying fluid composition in branches.
4. Scenario manager is added (1st stage):
    a. The ability is added to manually set the values of control parameters and perform a one-time calculation of the pipeline with the specified values.
    b. When setting the values of control parameters variables and formulas may now be used thus allowing to simultaneously assign/change the value of a particular parameter for many elements at once.
    c. Formular editor for formulas is implemented.
5. Generation of isometric drawings of the pipeline and the main calculation results to AutoCAD (versions 2020 or newer) is added.
6. Import of pipeline geometry from DXF files (AutoCAD, MicroStation, etc.) with the ability to intelligently recognize elements is implemented.
7. Licensing system has been updated:
    a. Remote internet licenses are added along with traditional local and network dongles.
    b. The list of supported hardware protection dongles (Sentinel HL, Guardant) has been updated. Modern dongles formats are supported.
    c. The automatic software update system has been improved to include automatic update of a hardware dongle.
8. Improvements have been made to the module for pipeline profile plot:
    a. When generating a profile, it is now possible along with the automatic generation of a graph for the return pipeline, to build it based on the results of the calculation of the current pipeline (if the return pipeline is modeled in it), indicating its starting and ending points. Please note that this function only works if the number of nodes in the graph for the supply and return pipelines is the same.
    b. Fixed a rare bug when the profile plot might not be displayed due to insufficient memory for circuits containing a large number of closed loops.

    c. Fixed a bug due to which the profile plot could not be displayed along the desired path if this path was not previously shown on the piping diagram during the process of graph export.
9. Added the ability to specify the coefficient of compressibility of the fluid (at manual fluid properties input) for a more accurate calculation of the shock wave velocity during the waterhammer analysis.
10. Import from the START-Prof piping models with nodes in which more than three pipes are connected, is now supported.
11. Import data from START-Prof files version 4.86 R4+ is now supported.
12. Improved program diagnostic system when performing calculations:
    a. Messages about the recalculation of flowrates in branches are displayed;
    b. Message output indicating that the element has a zero insulation thickness, is displayed;
    c. The diagnostics of negative pressure along the flow has been improved.
13. Output of Kv value of valves in the report with detailed calculation results is added.
14. Added diagnostics for incorrectly specified pump characteristics (when several identical points are specified in the characteristic), which could lead to incorrect approximation of the pump curve and problems with calculation convergence.
15. Fixed a rare error that caused program crash when editing experimental viscosity values for black oils specified using the STARS library.
16. Corrections and improvements have been made to the waterhammer calculation module:
    a. Fixed a bug due to which the waterhammer calculation report inaccurately displayed the value of the maximum pressure during a waterhammer when using excess pressure units.
    b. Fixed a rare bug that could cause problems with waterhammer calculations in pipelines that have branches containing only a pump and a reducer.
    c. A rare error has been fixed that could cause problems with calculating waterhammer immediately after performing the operation of merging sections in complex pipelines.
    d. A rare error has been fixed that could cause problems with calculating waterhammer after removing the initial node of the first pipeline branch from the piping model.
17. Changes have been made to the AVEVA-Hydrosystem data import modules - a number of errors noted by users have been fixed and the interface language can now be changed.
18. A bug has been fixed that could cause the display of calculation results on a pipeline scheme to work incorrectly if the unit of measurement of the selected parameter was switched just before turning on the calculation results display.
19. Fixed a bug due to which, when installing the program in a configuration that does not include heat analysis, freezes could occur when clicking on the “Insert” menu.
20. Fixed other minor errors and inaccuracies.

Version 4.5 R3

1. Added support of data import from "START-Prof" files version 4.86.

Version 4.5 R2

1. The calculation of gas-liquid slug flow induced force values, exported to the START-Prof software, has been improved.

Version 4.5

1. Slug flow parameters (size, frequency, speed of slugs, etc.) for gas-liquid flow can now be calculated and reported using TUFFP Unified model.
2. Forces in elbows and flow-turns caused by gas-liquid slug flow are now calculated and can be exported to the START-Prof software for accounting them in piping stress analysis.
3. Several improvements have been made to the calculation of gas-liquid flow using the TUFFP methods:
    a. two-phase flow pattern map output for this model has been improved;
    b. Severe slugging pattern is now more accurately displayed on the flow pattern map;
    c. the latest (2021) version of the TUFFP Unified model libraries is now used for gas-liquid flow calculation.
4. The insulation materials database (with materials according to ASTM standards) has been added to the program to allow a user both entering materials properties manually and select insulation and cover materials from database.
5. Selecting methods for two-phase flow calculation becomes easier – now along with loading the XML file with calculation settings, one can select a "typical" two-phase flow calculation profile from the list.
6. Improvements have been made to the calculation of ‘settling slurry’ flow:
    a. solid phase correction for the centrifugal pumps performance curves has been added;
    b. the algorithm for determining the flow pattern of liquid-solid mixtures at very low flow rates has been improved;
    c. a bug has been fixed that may cause the mass fraction of solid particles to be displayed incorrectly in the calculation results.
7. A few improvements have been made to two-phase gas-liquid flow analysis with mass transfer between the phases:
    a. the diagnostics of chocked flow on components with known loss coefficient has been improved;
    b. the diagnostics and calculation of the rare case when the phase transits from gas directly into liquid (not into two-phase region) has been improved.
8. The calculation of Mach number for an isothermal gas-liquid flow without mass transfer between the phases (a.k.a. ‘frozen’ flow) has been improved.
9. Added the thermal calculation of underwater pipelines.
10. Clarifications have been made to the thermal analysis of pipelines:
    a. the calculation of the "internal" heat transfer coefficient (from the fluid to the pipe wall) has been improved. This allowed to increase the accuracy of the calculation of long uninsulated pipelines;
    b. heat losses output for piping components has been clarified;
    c. the calculation of a rare case of laminar gas flow has been improved;
    d. improvements have been made to the heat analysis for fittings, bends and other elements of the pipeline, which in some cases allowed to increase the accuracy of temperature drop calculation for uninsulated pipelines.
11. Piping model export to PCF files has been added (these files can be used then for import into other 3D modeling systems and/or for generation of isometric drawings).
12. Working with "disconnected" piping systems (consisting of two or more fragments physically not connected to each other) is now enabled. Disconnected pipelines may be also imported from PCF or START-Prof files.
13. Added a new “Connect nodes” function that connects any two pipeline nodes with a branch, containing a pipe section (the length and direction of the section are

calculated automatically). This function is very useful for connecting disconnected fragments in a pipeline.

14. Several improvements have been made to the PCF files import:
    a. import of some types of tees has been clarified;
    b. import of caps has been optimized;
    c. import of equipment has been added;
    d. the ability to import names of elements from PCF has been added;
    e. some other clarifications and improvements have been made.
15. Piping element selection on piping diagram now has a new feature: by right-clicking on a component/node/etc. one can select not only the element itself, but also the branch/fragment of the pipeline it belongs to.
16. New versions of import modules from AVEVA PDMS, E3D and MARINE has been added.
17. A new version of the List&Label 26 report generator has been added.
18. Some improvements of the calculation speed using the thermodynamic library GERG-2008 have been made.
19. A bug has been fixed that prevents analysis of pipelines with pumps if the flow rates are specified not in branches, but as inflows/outflows at nodes.
20. Single-phase flow hydraulic resistance calculation for reducers has been improved.
21. The "undefined" fluid phase output into the program list windows has been fixed.
22. Fixed an inaccuracy in the calculation of forces caused by waterhammer for elements with a change in flow direction and "active" elements of the pipeline (opening/closing valves, etc.).
23. Fixed a bug that may cause the parameters of the environment and the thermal insulation to be reset when adding a branch following from the node where the tee has been already added.
24. A rare bug has been fixed causing the flow pattern map to be displayed incorrectly if height units are changed after running the analysis.
25. Zero length piping sections that can cause problems with the convergence of two-phase flow calculations are now reported of.
26. An error of exporting pipelines containing empty branches to START-Prof.ini file has been fixed.
27. Fixed some other minor bugs and inaccuracies.

Version 4.4

1. A new improved model of centrifugal pumps at waterhammer calculation has been added.
2. Processing of column separation and distributed cavitation effect during waterhammer is extended.
3. Group operations feature for branches parameters (diameters, temperatures, etc.) and components properties (location, soil, thermal insulation, etc.) has been added.
4. Hydrosystem integration with Simulis Thermodynamics has been improved:
    a. Added Simulis Thermodynamics calculator launch from Hydrosystem and fluid composition input right in Simulis calculator;
    b. Added the ability of more fine tuning of Simulis Thermodynamics thermodynamic model;
    c. Added the ability to automatically recalculate the parameters of pseudo-components when switching from ‘STARS’ to Simulis Thermodynamics thermodynamic library;
    d. Fixed minor bugs and inaccuracies of Simulis Thermodynamics calling from Hydrosystem.

5. In beta-testing mode, the phase transitions calculation in the "reverse" 2phase flow analysis (with pressure and temperature specified at the outlet node of unbranched pipeline) of a gas-liquid flow with mass transfer between phases has been added (including those with choked and near choked flow);
6. Several accuracy improvements were made in “direct” 2phase gas-liquid flashing/condensing flow analysis.
7. Program handling the lopped pipelines containing user-made errors and inaccuracies in elements sizes has been improved:
    a. Fixed a number of inaccuracies in determining the pipe projections when using the "Loop closing pipe" option;
    b. The algorithm of mismatches diagnostics in piping components elevation differences has been changed – now the program shows a branch with mismatch instead of a circuit;
    c. A new function has been added for automatic search and correction of mismatches in vertical projections of piping components in pipelines containing lopped circuits.
8. Valves import from PCF files has been improved.
9. Improvements have been made to the calculation of density for fluids containing oil fractions with high boiling point using ‘STARS’ library.
10. The severe slugging two-phase flow prediction has been improved.
11. Two-phase flow pattern diagram output has been improved.
12. Improvements have been made to the parameters selection service:
    a. Added a dynamic view of the parameters selection progress (indicating the number of the current iteration and the current values of control parameters) which allows to evaluate the progress and convergence of the calculation more accurately;
    b. Added the ability to interrupt the calculation with parameters selection.
13. Fixed error at ‘frozen’ two-phase flow calculation in pipelines with closed branches.
14. The diagnostic system of waterhammer analysis has been improved.
15. A bug which, in some cases, may cause the reset of calculated values of control/target parameters in the control/target parameters window has been fixed.
16. A rare error that in some cases may cause the incorrect oil fraction boiling points recalculation at units change, has been fixed.
17. Heat and hydraulic calculation algorithm for the rare case of laminar gas flow has been improved.
18. Some minor errors and inaccuracies in the program have been fixed.

Version 4.3 R6

1. An error that in some rare cases may cause the incorrect calculation of forces (that are exported into START-Prof software) in some of the bends in pipeline during waterhammer analysis, has been fixed.

Version 4.3 R5

1. The import of eccentric reducers from START-Prof software has been improved.

Version 4.3 R4

1. The calculation of properties and phase equilibria of petroleum specified as a mixture of pseudo-components using STARS library has been improved.
2. The waterhammer calculation of pipelines containing storage tanks has been improved.

Version 4.3 R3

1. A diagnostic message has been added if it's not possible to save the file to a write-protected directory.
2. The storage tanks dynamic pressure losses output into calculation results for two-phase flow calculation has been fixed.
3. A rare error has been fixed, due to which in the "reverse" calculation (the case when there is one branch in the pipeline, the pressure is specified at the end point of pipeline and the "undefined" fluid phase state is selected) dynamic losses for reducers was not presented in calculation results and pressure losses for component with known pressure drop could be incorrectly taken into account at the calculation.
4. A multiple components selection problem, due to which the right-clicking on the selected elements could reset the selection, has been fixed.
5. A bug, due to which after performing the calculation the calculated values of Kv for valves and the Spaix pump selection button were not immediately updated in the parameters window, has been fixed.
6. The inaccuracy of displaying the initial parameters of pumps and storage tanks in the input data list window has been fixed.
7. For more convenience the headers of the active tabs in the program interface are now shown in a lighter color.

Version 4.3 R2

1. Error at the data import has been fixed.
2. An installation of the program bug, due to which problems could arise with the launch of a program that was installed not in the full configuration, has been fixed.

Version 4.3

1. A calculation of pipelines consisting of pipes with different wall roughness has been added.
2. A new piping component 'reservoir' has been added to simplify modeling storage tanks and other equipment with liquid column.
3. Added the ability to set and calculate gauge pressures along with absolute pressure.
4. The option of customizing the list of pipe diameters from which the diameters are selected during the diameters calculation has been added.
5. Added the ability to more accurately enter properties and calculate the parameters of solid particles when calculating 'slurry' flow – now you can model the size distribution of particles.
6. Added the ability to import data from the AVEVA E3D software through open format files - the corresponding plug-in is now supplied with the program.
7. Clarifications and improvements have been made to the module for importing data from the AVEVA PDMS software.
8. Added the ability to copy temperature dependent properties table of the fluid from Excel and other software.
9. The algorithm for initializing the default waterhammer boundary conditions has been changed — now the boundary conditions in the start and end nodes of the pipeline by default are the conditions of constant pressure (regardless of what is specified in the node when calculating the stationary flow - pressure or flowrate).
10. Added the ability to automatically recalculate elevations on the elements according to their graphic orientation (the so-called "recalc by graphics") at each

calculation of the pipeline. This feature is optional - you can enable/disable it in the program settings.

11. The algorithm for group selection of elements “from node to node” on the graphical diagram of the pipeline has been changed - now the first of the selected nodes is considered the binding node by default. You can change the binding node as before by pressing and holding the Ctrl key (after selecting the desired fragment of the pipeline) and clicking on the corresponding node in the diagram.
12. Added the ability to cancel and return operations using the keyboard shortcuts Ctrl + Z and Ctrl + Y in the project tree window and the graphics window (previously these keyboard shortcuts worked only for operations in the parameters window).
13. Various improvements have been made to the graphics subsystem of the program:
    a. Added the ability to show the sizes of pipes on the pipeline diagram
    b. Added the ability to display the name of the pipeline elements on the pipeline diagram
    c. Added the ability to fit the pipeline model into the window by double-clicking on the mouse wheel
    d. Added the ability to rotate the pipeline model around an some point through Shift + click and hold the mouse wheel
    e. After operations of zoom and pan now program automatically returns to the mode of selecting elements in the diagram
14. The output of the results into the list window after the calculation has been optimized, which allowed increasing the speed of their output.
15. The diagnostics of components with a constant pressure drop in the branches in which the fluid flowrate is initially unknown has been improved.
16. A bug due to which, in some cases, the maximum pressure in the entire pipeline during the waterhammer could be calculated not accurately has been fixed.
17. A bug due to which the environment and insulation parameters could be lost when inserting nodes has been fixed.
18. Some minor errors and inaccuracies in the program have been fixed.

Version 4.2

1. A new feature of calculating “slurry” flow (mixtures of liquid and solid phases) has been added.
2. The calculation of the unbalanced forces arising in a pipeline during waterhammer with their export to various pipeline stress analysis software, such as START-Prof and CAESAR II has been added.
3. The adding of reducers has been simplified – now, for reducers, user only need to specify their type (smooth or sudden) and the type of transition is automatically determined by the program.
4. Added the goal-seek analysis tuning – now user can specify the maximum number of iterations and the allowable error of calculation.
5. Charts output to Excel (the results of waterhammer calculation, pipeline profile etc.) has been improved – now the charts are displayed regardless of which separator of the integer and fractional parts is specified in Excel settings and Windows regional settings.
6. Fixed a bug due to which in some cases incorrect ground temperature for underground pipelines could be displayed in the input data report.
7. Fixed a bug due to which in some cases U-shaped expansion loops could not be displayed correctly on the pipeline layout window.
8. The calculation of the waterhammer wave velocity has been improved.

9. Fixed a bug due to which the view-points could change their position when inserting a node.
10. Improved the data import from PCF files.
11. Some other minor bugs and typos have been fixed.

Version 4.1

1. A new feature of setting and calculating the three-phase liquid-liquid-gas flow (for homogeneous liquid phase case only) has been added.
2. Multi-parameter optimization feature has been added to parameters selection service (in beta-testing mode).
3. Autosave of the current project backup file has been added.
4. Data import from pcf-files has been improved.
5. The export of the pipeline model data to the START-software neutral format files has been improved.
6. The accuracy of the tees resistances calculation in the thermal analysis of the 'frozen' two-phase flow has been increased.

Version 4.0 R3

1. A bug in fluid components search and input has been fixed.
2. The calculation of the fluids containing petroleum fractions with a boiling point below 0C using the "STARS" library has been improved.
3. The error in calculation of two-phase flow in pipelines containing closed ending branches has been fixed.
4. An error leading to improper use of the pressure drop on the equipment at two-phase flow calculation has been fixed.
5. The use of computer RAM in two-phase flow calculation using the "STARS" library has been optimized.
6. Added support of the "START" files 4.82 R2 and later versions.

Version 4.0

1. 1. Significant changes have been made to the two-phase flow calculation module:
    a. The calculation of two-phase gas-liquid flows with boiling and condensation in branched pipelines (without recycles) is added.
    b. The possibility of predicting the occurrence of a severe slugging flow in pipelines with gas-liquid flow is added.
    c. The phase change calculation algorithm has been improved - phase transitions places are now calculated more accurately.
    d. The calculation of Mach numbers for water-steam mixtures using the WaterSteamPro library has become more precise.
    e. Some corrections have been made in the calculation of pipelines containing branches with negative flowrates.
    f. The inaccuracy in calculating the temperature and enthalpy after the orifice in a two-phase flow has been corrected.
    g. The inaccuracy of hydraulic resistance calculation for two-phase flow on vertical pipes is fixed.
    h. The error of the two-phase calculation settings files interpretation, due to which frictional losses on bends, elbows and reducers could be considered differently than on straight pipes, has been fixed.
2. Waterhammer calculation has been improved:
    a. The speed of waterhammer calculation has been dramatically increased;
    b. The account of a liquid vaporization (cavitation) at waterhammer calculation is added;

    c. The possibility of waterhammer calculation in pipelines with several consecutive local resistances is added;
    d. The diagnostics of the viewpoints location is added. This diagnostics allows to show when the viewpoint is too close to the reflecting node or the element with a changing state, as a result of which it is necessary to increase the calculation accuracy (to reduce the data output step) in order to accurately calculate the magnitude of the pressure and velocity peaks;
    e. The calculation of waterhammer caused by the opening/closing of the butterfly valve has become more accurate;
    f. Corrections has been made in the waterhammer calculation for pipelines with manually entered inflows/outflows in nodes;
    g. A bug, due to which the length of the reducers was incorrectly taken into account during the waterhammer calculation, has been fixed.
3. The refinements and improvements to other calculation functions of the program have been made:
    a. The account of internal heat transfer (from the fluid to the pipe wall) at the thermal calculation of pipelines was corrected, which made it possible to improve the accuracy of calculations of uninsulated pipelines with strong cooling/warming during flow.
    b. The normalization algorithm of the fluid compounds compositions (in cases when the sum of the entered components fractions is not equal to 100%) has been improved.
    c. A bug, due to which, in some cases, static pressure differences in the closed branches of the pipeline were inaccurately considered, has been fixed.
    d. A rare bug of the incorrect Mach numbers and velocities calculation and output before the pipe enter and after pipe exit has been fixed.
4. Significant improvements have been made to the user interface of the program:
    a. The group operations of the pipeline elements selection, group copying/cutting/deleting and pasting with binding to any node of the pipeline is added.
    b. The possibility of the adjustment of flow distribution calculation convergence criteria is added in the user interface, which makes it possible to adjust these criteria for complex pipelines with convergence problems, and also, if necessary, speed up the calculation due to an allowable reduction in its accuracy.
    c. The modeling of pipelines with looped circuits is optimized.
5. Design of the output forms of the program has been improved – their structure is adapted to the documents output in editable formats (.docx and .rtf).
6. A rare error, due to which in some cases there were problems with the printing of the input data on pipelines, has been fixed.
7. Some other minor bugs and typos have been fixed.

Version 3.88

1. Parameter selection feature has been introduced that allows maintaining specified flow parameters at any pipeline location:
2. Waterhammer module has been upgraded:
    a. It is now possible to consider cavitation during waterhammer analysis (in beta-mode)
    b. Dampers (waterhammer arrestors) now may be simulated
    c. Customizable reports are added with waterhammer calculation results and charts

    d. A list has been added to view elements with changed state, boundary conditions in nodes and dampers characteristics
    e. Hydraulic friction at waterhammer is now calculated more precisely.
3. Topological pipeline analysis has been added that allows viewing both unconnected and computationally independent pipeline parts.
4. Algorithm of heat and hydraulic analysis of long gas/steam pipelines with big pressure loss has been optimized to achieve better convergence.
5. Joule-Tomson effect for gas is now considered more precisely that has refined heat and hydraulic analysis of long steam pipelines and also improved its convergence.
6. A number of improvements of hydrate calculation via PVTSim have been made:
    a. Equation of state used in phase equilibria calculations via PVTSim can now be selected by user,
    b. Database of components and reference constants has been upgraded to that of the latest PVTSim version;
7. Program warning and error messages during analysis have been optimized, including:
    a. Messages of aggregate state changing and wrong aggregate state during heat and hydraulic analysis of pipelines with single-phase fluids;
    b. Messages at calculating pipelines with pumps having invalid pump head curve definition;
8. A bug in heat analysis of gas pipelines containing control valves has been fixed.
9. Analysis of two-phase flows in pipelines with big hydrostatic pressure differences and low pressure has been refined.
10. Liquid flow with negligibly small velocities is now calculated more precisely.
11. “Recalc on Graphics” command now more accurately calculates projections of closing loop pipes.
12. Input data report has been modified:
    a. Thermal insulation is now displayed more correctly;
    b. Fluid data display is now optimized.
13. A number of heat and hydraulic pipeline analysis bugs have been fixed, including that of pipelines:
    a. having closed branches,
    b. having branches with upstream flows.
14. A bug on removing pump NPSHR curve points has been fixed.
15. “Insert node” command has been optimized to refine the location of new node for very long pipes.
16. A rare bug on calculating phase equilibria of fluid containing one oil fraction has been fixed.
17. A bug has been fixed that deals with considering roughness at hydraulic analysis of two-phase flow by TUFFP Unified model.
18. Some other minor bugs and typos have been fixed.

Version 3.87

1. Two-phase flow calculation using “Unified model” by TUFFP (Tulsa University Fluid Flow Project) has been significantly improved:
    a. automatic selection of closure relations for “Unified model” has been implemented – it’s based on newest data of TUFFP experimental database which allows to improve the convergence of calculation results to the experimental data;

    b. new option of closure relations manual selection for “Unified model” has been implemented (for more precise adjustment of two-phase flow calculation methods);
    c. latest version of TUFFP ”Unified model” has been plugged to Hydrosystem (including newest experimental database).
2. Integration with Hydrate Open Structure of PVTSim thermodynamic package (by Calsep) has been developed – it allows to call PVTSim for hydrates calculation in pipeline straight from Hydrosystem.
3. Hydrosystem interface with “START” software has been improved:
    a. the checking of pipeline structure at ctp-files import has been added – it allowed to prevent the import of incorrect pipelines containing the connections of 4 or more pipes in one single node;
    b. the bug of incorrect displaying of the pipelines with zero-length pipes (imported from START) has been fixed.
4. The range of the viscosities at which automatic pump head curve correction is turned on (for liquids with high viscosities) has been revised.
5. Slight improvements in calculation diagnostics for pipelines with control valves has been made:
    a. incorrect message at negative pressure drop on control valve has been excluded;
    b. nodes inflow/outflow displaying in calculation results window has been fixed.
6. Gas pipelines heat calculation algorithm has been significantly optimized for extended pipelines with very high pressure drop values.
7. The algorithm of calculation for pipelines with “dangling” circuits (connected with the rest of the pipeline with only one branch) has been improved.
8. Flow pattern map drawing for two-phase flow has been improved.
9. Some minor bugs have been fixed.