Automation & Testing Suite

for embedded software | AUTOSAR-compatible

ATS 05.03.003.002

Basic Usage Manual

SCHLEISSHEIMER SOFT- UND HARDWAREENTWICKLUNG GMBH

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2024

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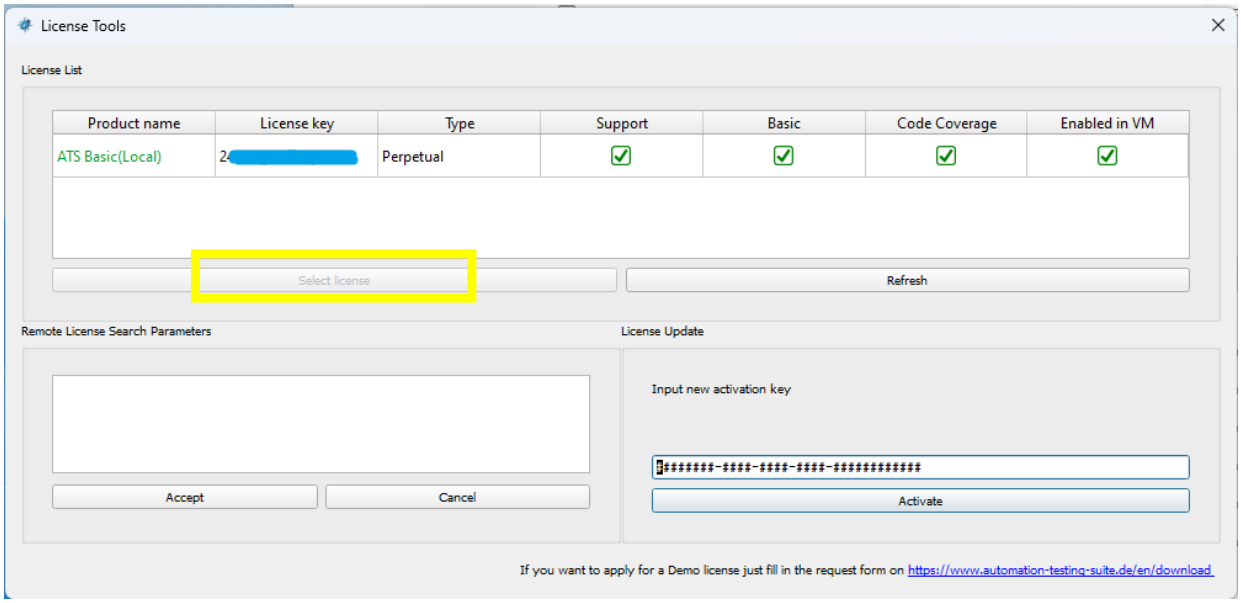
Chapter 1. Getting started

In this chapter, you will be introduced with activating the license, creating new project and opening the existing one (also from a different device), as well as saving it.

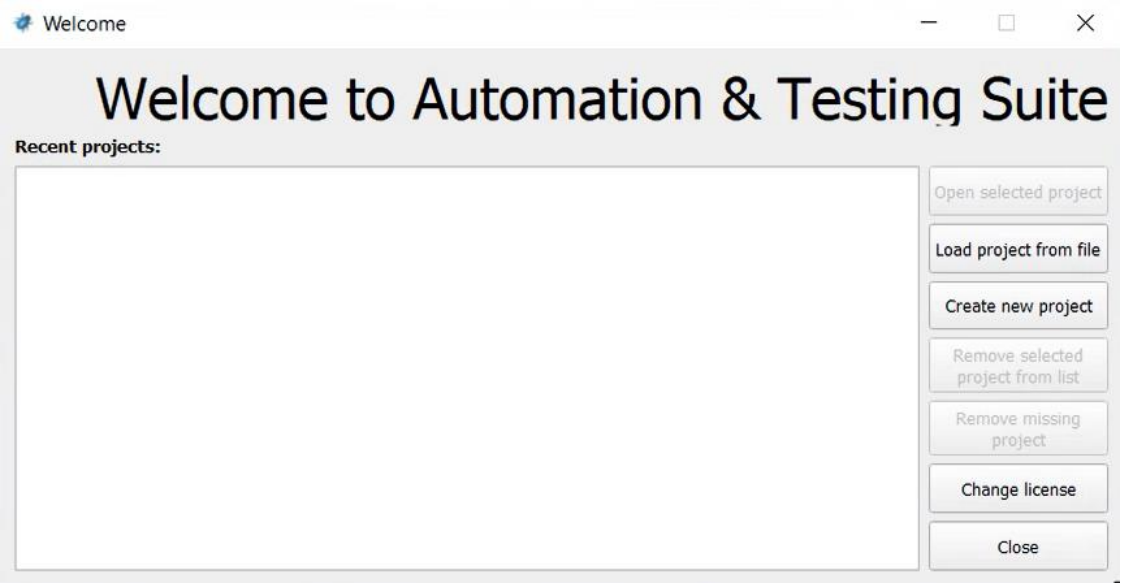
First, run the application. On your screen, the License Tool window will appear (Figure 1). You can import license by inputting the activation key (section on the right side) or by using remote license parameters (on the left). After successfully activating the license, application needs to be restarted.

Figure 1. License Tools



After restarting the application, you will need to select the particular license, which you want to use. To do that, click it and then just click the button „*Select license*". Now, on your screen there will be showed a logging view. After you log in, you can go further to Welcome Window (Figure 2).

Figure 2. Welcome Window



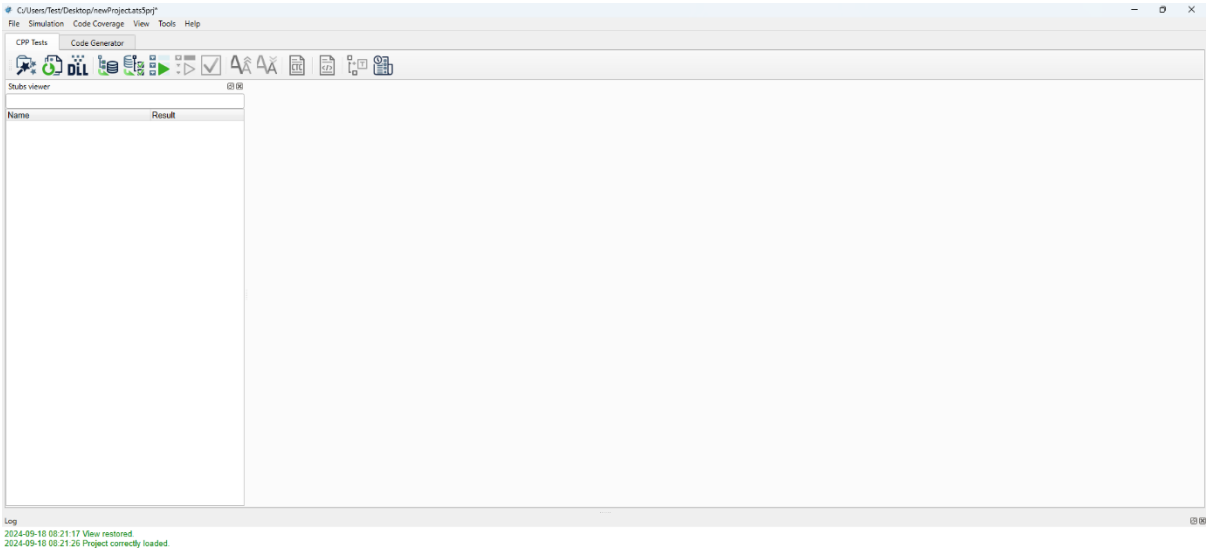
With this window, you are able to:

- open selected project,
- load project from file – it allows to open a project by manual selecting a particular *.ats5prj* file,
- create new project,
- remove selected project from list,
- remove missing project – it removes a project from ATS recent projects list, that is not existing anymore on your computer (for example a project that has been deleted),
- change license – it shows the License Tools
- close application.

1.1. Project creation

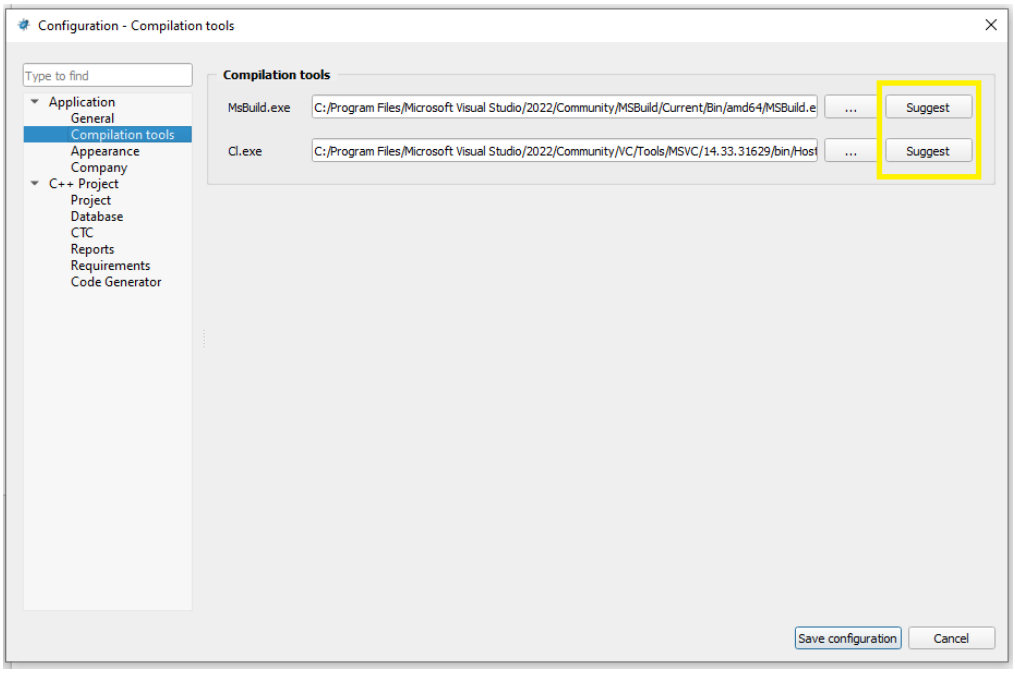
In the first step, select a place for your new project and type in the name. It will be saved as *.ats5prj* file. After creating a project, this is how main view of the application looks like (Figure 3).

Figure 3. Main View of ATS5.



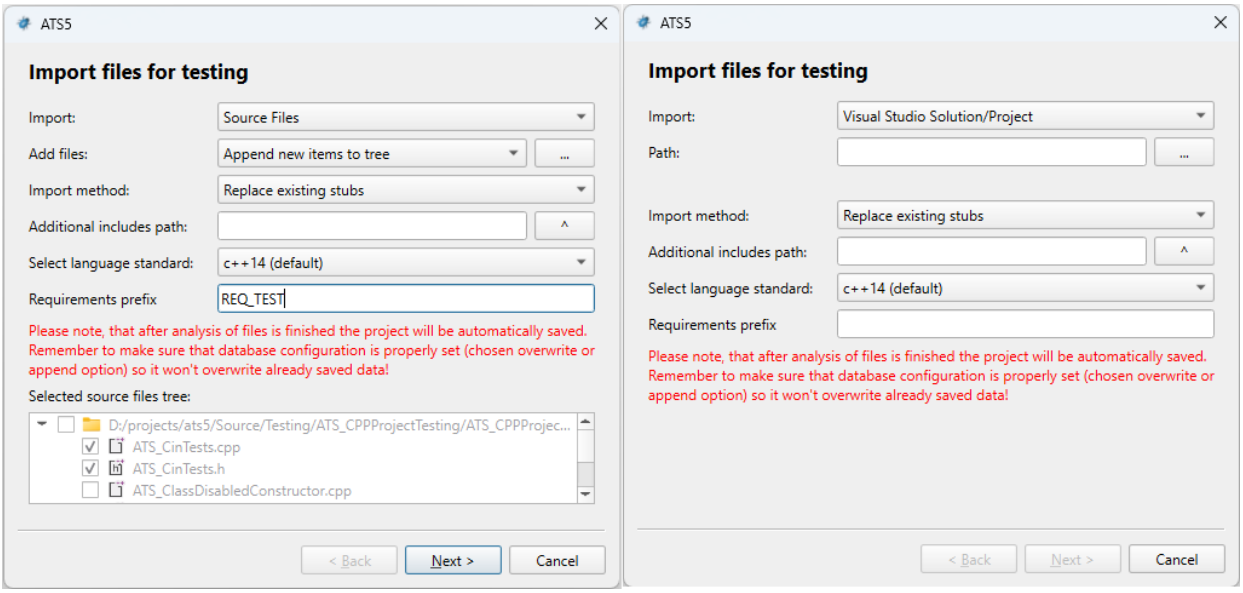
Before you start having the files analyzed by ATS, please make sure, that you have set a path to MSBuild and Cl.exe. To check this, go to *Tools* – *Configuration* – *Compilation tools*, as showed on Figure 4. If the fields are empty, use *Suggest* button to set them automatically. In case it does not happen automatically, you will have to set it manually (choose a particular path to those components or install them, if you have not done it yet).

Figure 4. Compilation Tools.



Now, you can start analysing source files and creating tests. To choose files for analysis, click the first left button on the Toolbar (or use CTRL + W keyboard shortcut):

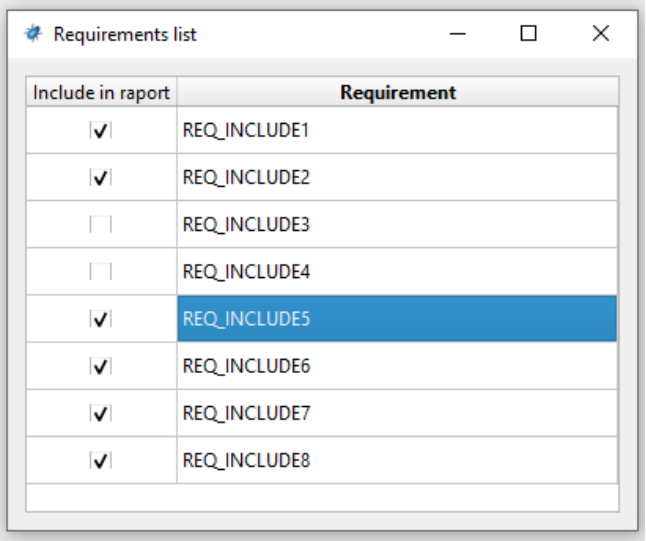
Figure 5. Importing files to CPP Tests.



It will display a dialog window with such features, as showed on Figure 5. In here, you can select:

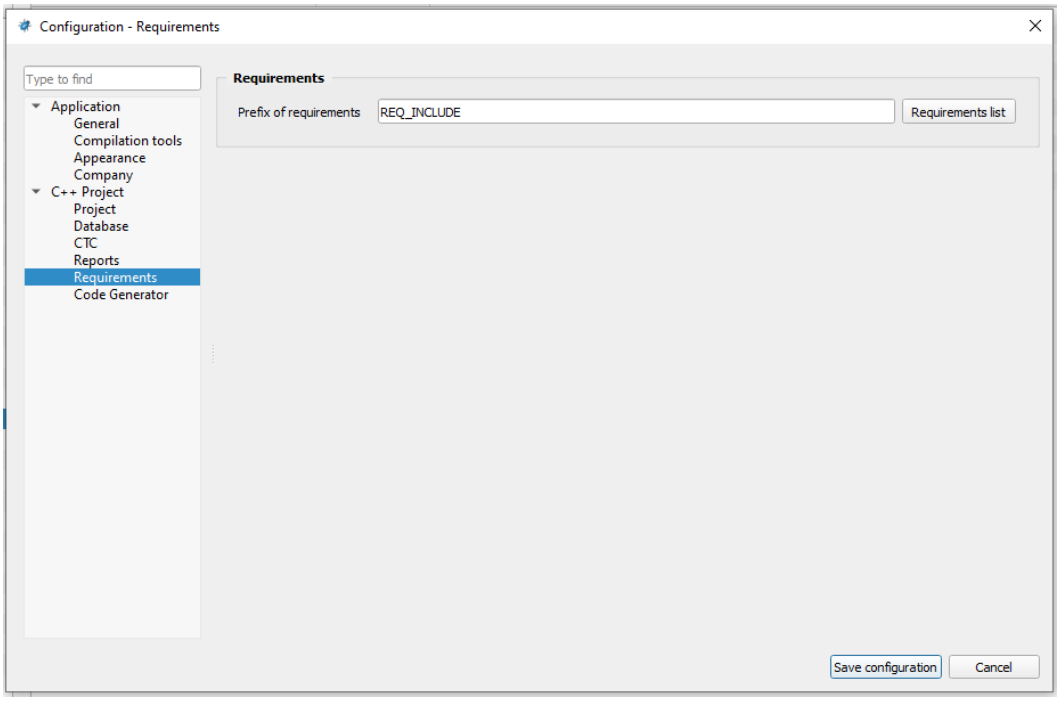
- a way of importing files (by *Visual Studio Solution/Project*, by *Project Root Folder* or by *Source files*),
- importing method (*Replace existing stubs* or *Append to existing stubs*),
- language standard,
- and also specify requirements prefix. Those requirements are recognized from comments in loaded files and added to the list of requirements (Fig. 6).

Figure 6. Requirements list.



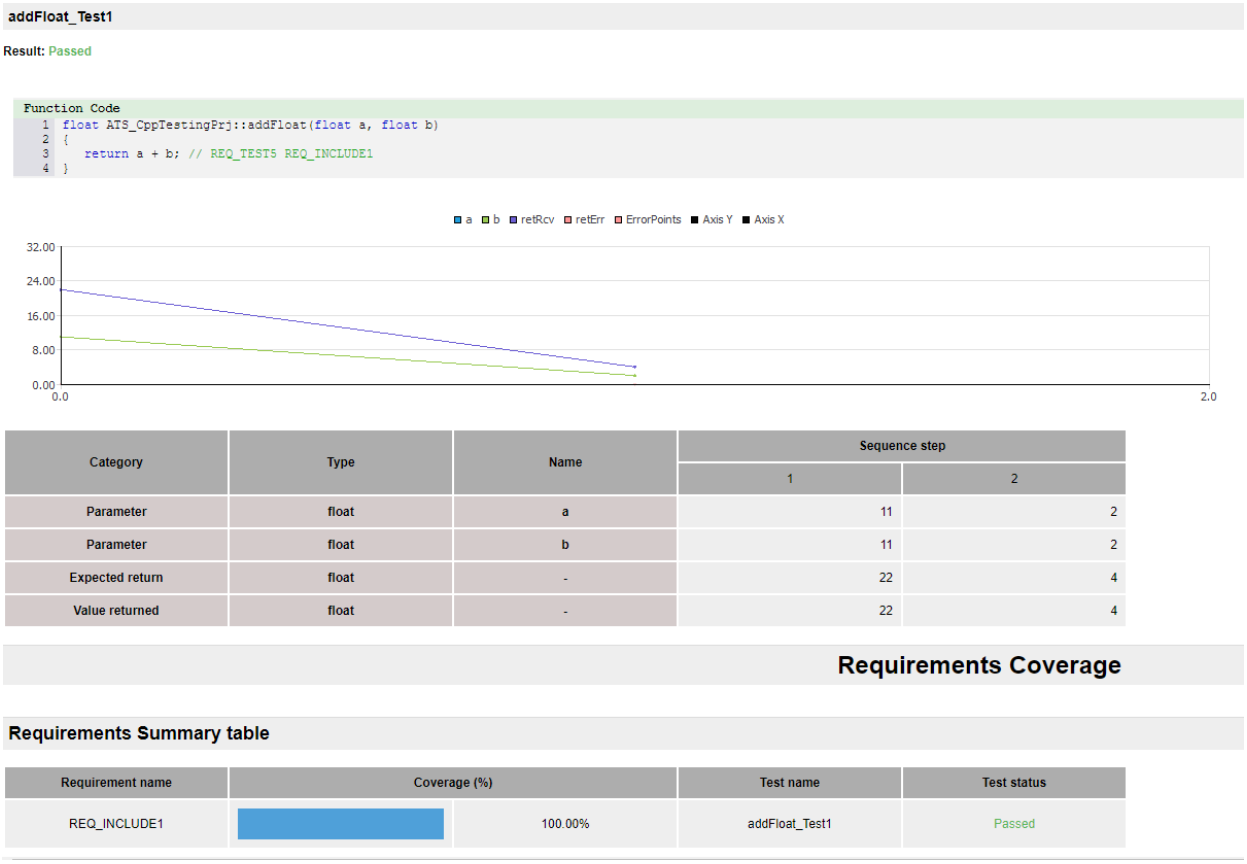
Requirements can be also configured in *Tools - Configuration – Requirements* (Fig. 7), where the prefix can be change or user can select/deselect many requirements to add them (or not) to the analysis.

Figure 7. Requirements in Configuration.



If there are requirements in the files and the prefix had been set, they will be presented in Test Report in form of the table (Fig. 8).

Figure 8. Requirements Summary table.



Requirements can also be added (with button “+”) or removed (with button “-“) for a specific test (Fig. 9).

Figure 9. Tools for adding/removing requirements.

Removing causes that the given requirement will not be displayed in Test Report and will be omitted in analysis. Adding is available when user want to add existing requirement, which was removed or omitted.

Going back to the dialog of importing files to analyse, in here you can also set the path for selected files (if the import way is Visual Studio Solution/Project

or Project Root Folder) or select a method for adding files (if the import way is Source Files). The options for that last case are *Append new items to tree*, *Override all items in the tree*.

Warning: since now, you are only able to parse files that are using basic variable types. Any other types will cause and display errors.

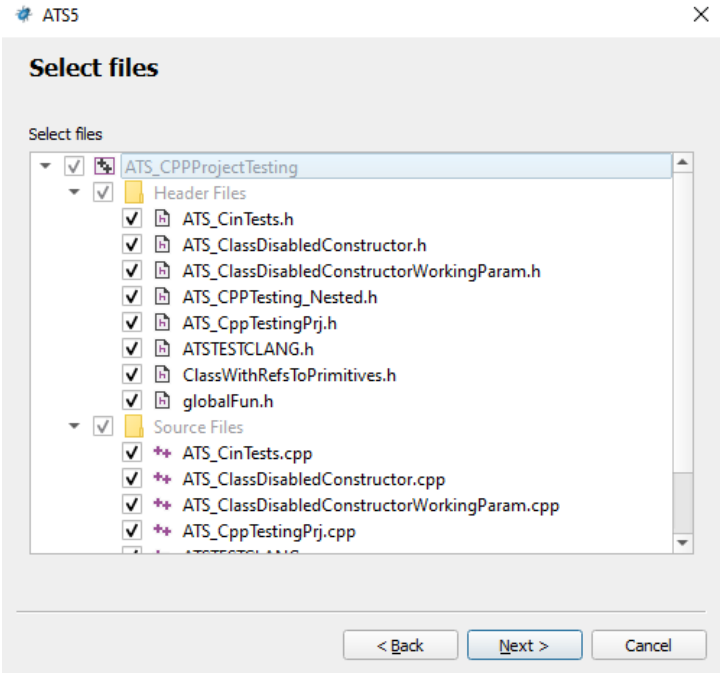
To describe and clarify the ways of importing files, please get familiar with this information:

- Visual Studio Solution/Project – it allows to choose *.sln* or *.vcxproj* files, so you can display files that are included in it.
- Project Root Folder – it allows to choose root folder from which files and subfolders will be displayed for further analysis.
- Source Files – it allows to add source files which a user wants to have displayed in tree section (right side of Figure 5). Adding source files is available multiple times when *„Add files"* option is selected.

Besides that, application allows to set additional includes path – it can be done in two ways. The first method is to simply click the button on the right side of the field and type in the paths, which you need. The second method is to click the „…" button and select the output folders manually. By setting additional includes path, you can specify paths to folders with files that are needed to be included in analysis, and that are placed outside the project.

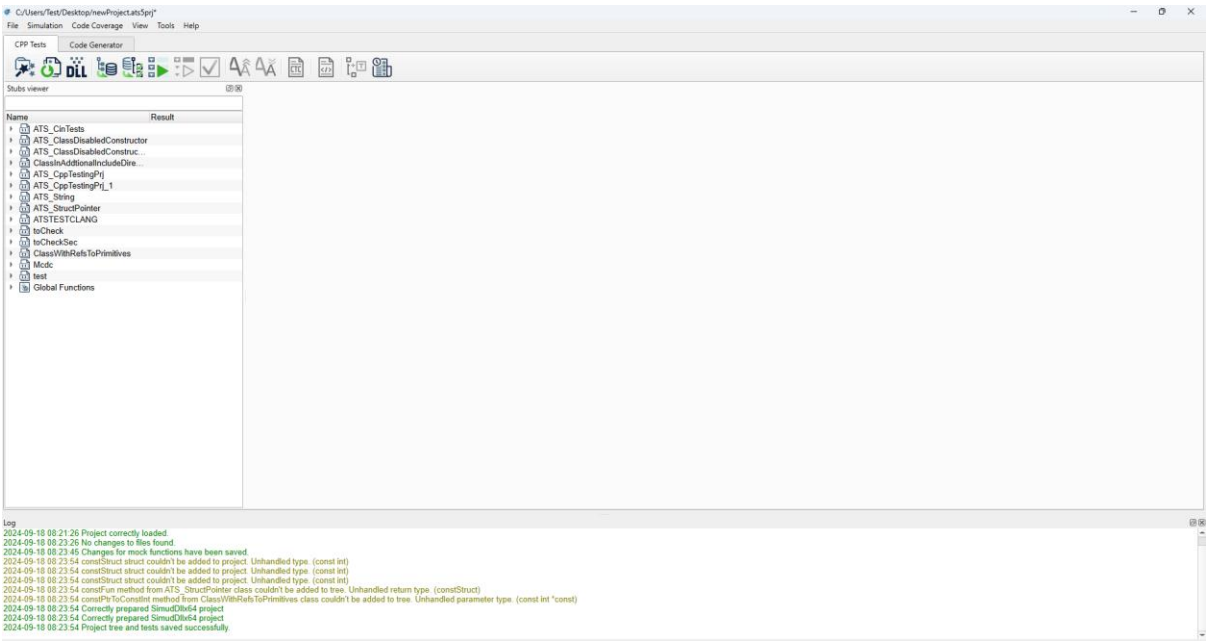
By going „*Next*", the application would show a selection section (Figure 10). In here please choose files, using checkboxes, that you would like to have in your project.

Figure 10. Selection section in CPP Tests.



The last step is to confirm all selected files. Click „*Finish*" to finalize the process of importing files and to display them in a main view (Figure 11).

Figure 11. Main View of ATS5 with imported project.

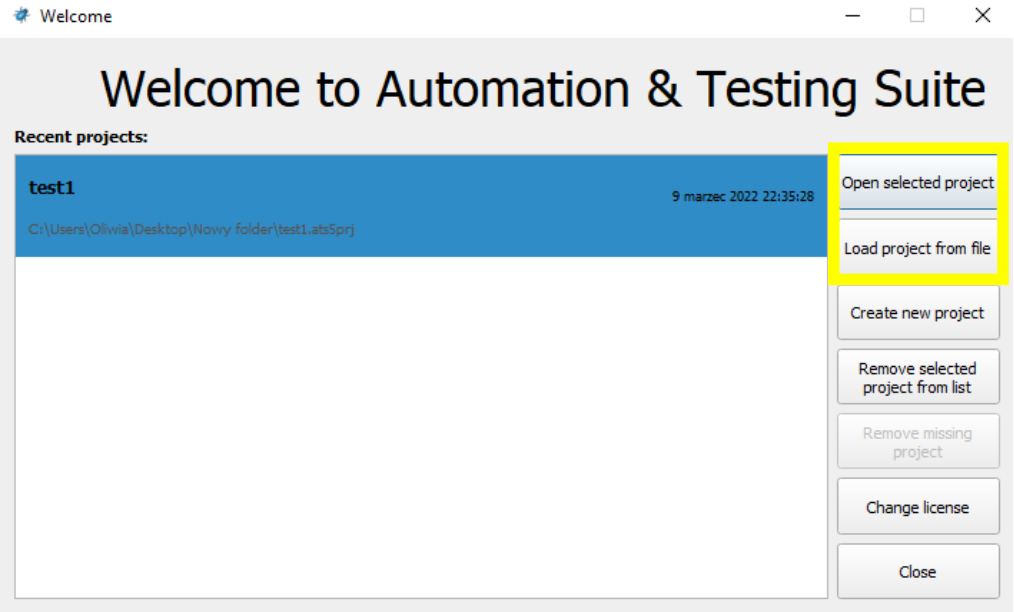


1.2. Opening existing project

If you already have created a project and now you would like to open it, you can do that by:

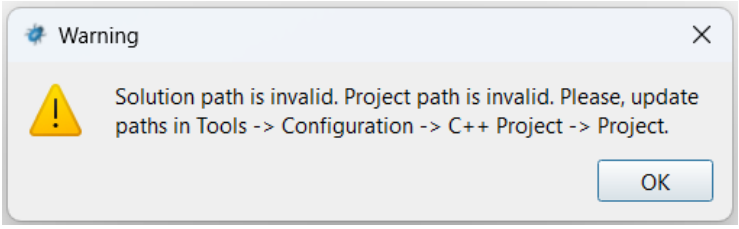
- opening selected project from Recent projects list (Figure 12), or
- loading a project from a file.

Figure 12. Recent projects list in Welcome Window



In case of opening existing ATS project from different device, you will need to adjust some paths to be able to use such project. Right after opening it, on the screen appears warning box with information which paths needs to be configured (Figure 13).

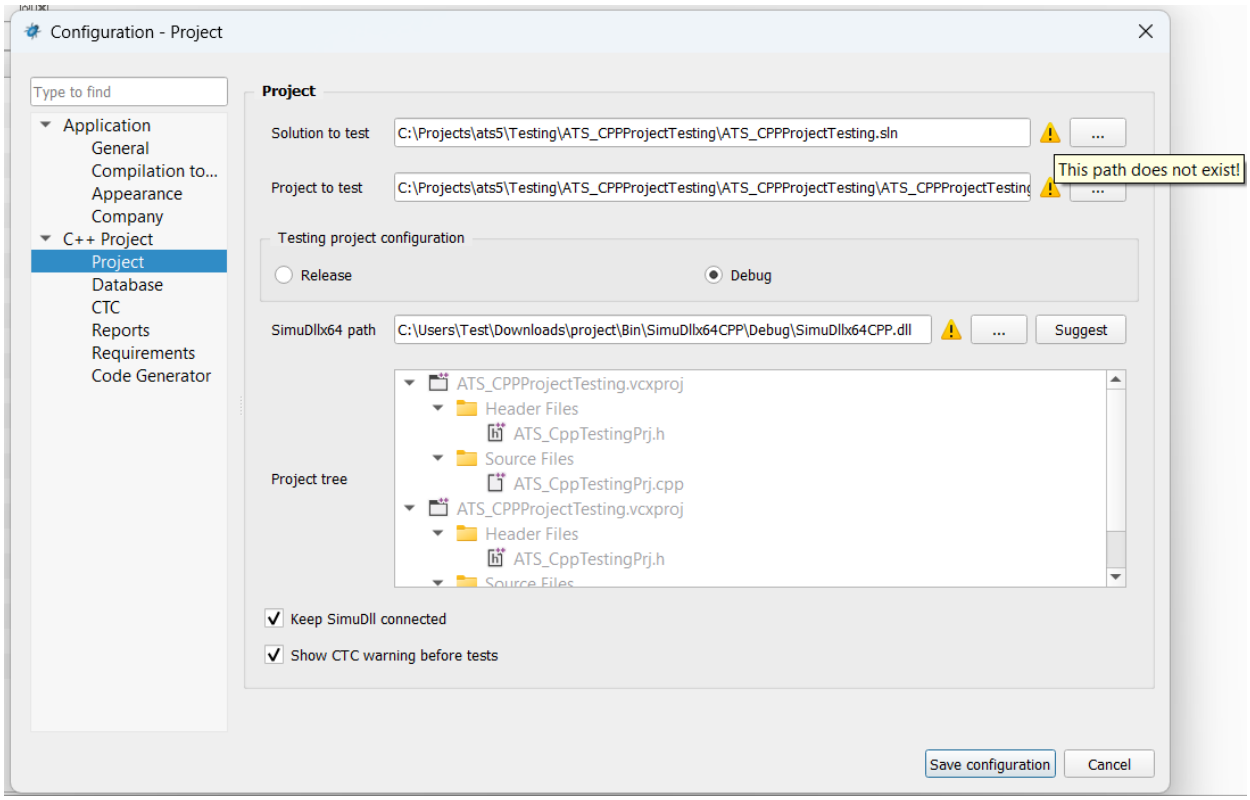
Figure 13. Warning Box - Configure project paths



Following the instructions, if you go to *Tools – Configuration – C++ Project – Project* section, you will notice some yellow triangles saying „*This path*

does not exist!”. Those errors occurs because loaded project has different paths set (local paths from different device), so you have to adjust them to be set as yours local paths. For SimuDll path this issue is easy to handle – you can click *Suggest* button and it will automatically search and set correct path for SimuDll project of this ATS project (Figure 14). However, to set project and solution path you will have to search for correct files manually – press „…” buttons to open browsing dialog and select correct paths.

Figure 14. Configuration - Configure project paths

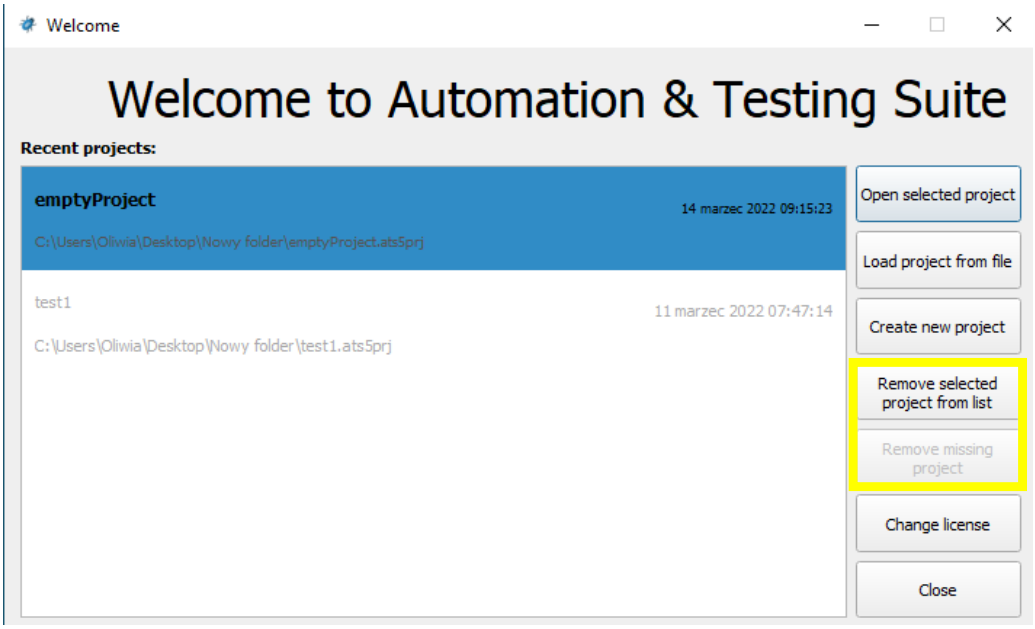


When those paths are fixed, you can save configuration. When you rebuild SimuDll some errors may occur, but those errors must be resolved manually in SimuDll project.

1.3. Removing project

If you have deleted a project, or moved it to other folder, you could see this project as disabled element on the list (Figure 15). To remove that element, simply select this project and then click the button „*Remove missing project*”.

Figure 15. Remove missing project in Welcome Window.

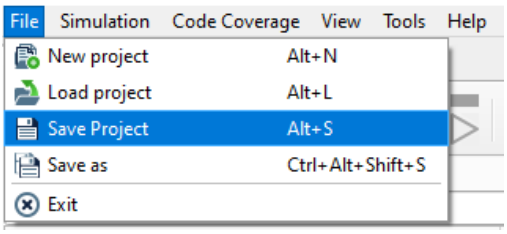


In case you would like to remove a particular project from Recent projects list, you can do this by selecting it and clicking „*Remove selected project from list*".

1.4. Saving project

To save a project you can go to *File* and select „*Save project*" (if your intent is to overwrite the existing project file) or „*Save as*" to save but simultaneously create new project file. There are also dedicated keyboard shortcuts for both actions.

Figure 16. File – Save options.

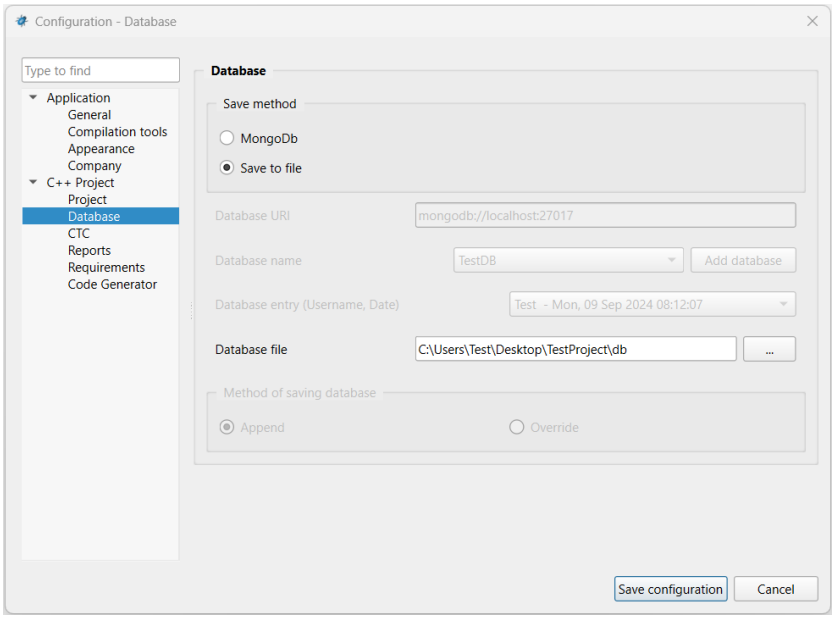


Another way to save project is by using this button from Toolbar:

A user can specify a saving method in *Tools – Configuration – Database*. The options are: saving tests as JSON files or saving them in MongoDB database

(Figure 17). In this second case, it is required to have MongoDB software to save tree in database.

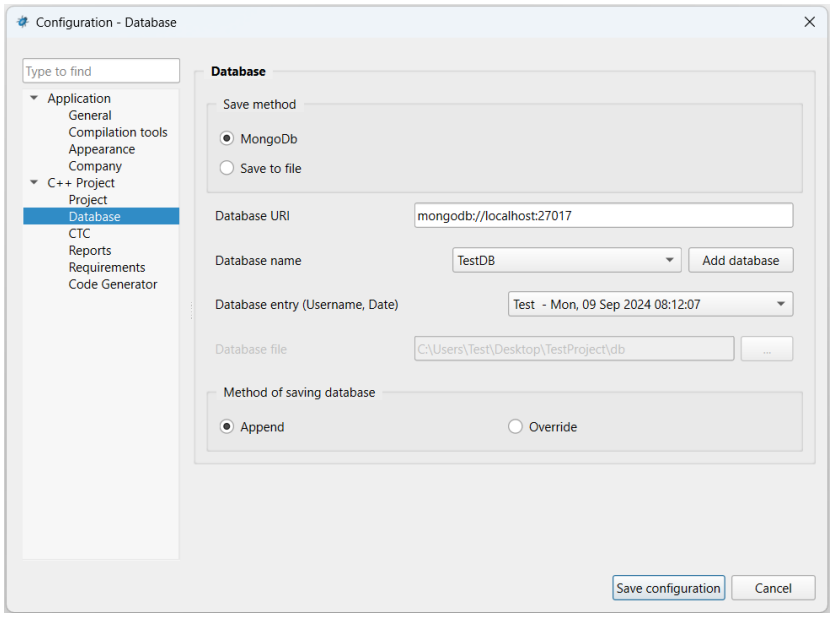
Figure 17. Configuration - Database.



Firstly, user has to select the database (or create new one using "*Add database*" button), and then specific database entry with a method of saving:

- *append* method causes adding new data to selected document,
- *override* method will overwrites selected document with latest changes.

Figure 18. Configuration - Saving data to MongoDb.



Chapter 2. Testing files

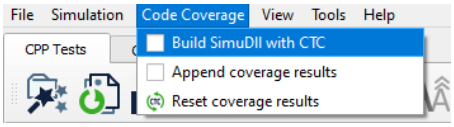
In this chapter, you will get to know how to build DLL, prepare your files for analysis, create tests and how to run them.

2.1. Building SimuDLL

Now, when you have opened a project or created a new one, there is only one more step to do before testing your files. This step is to build the DLL. It can be done by clicking the third button on the left:

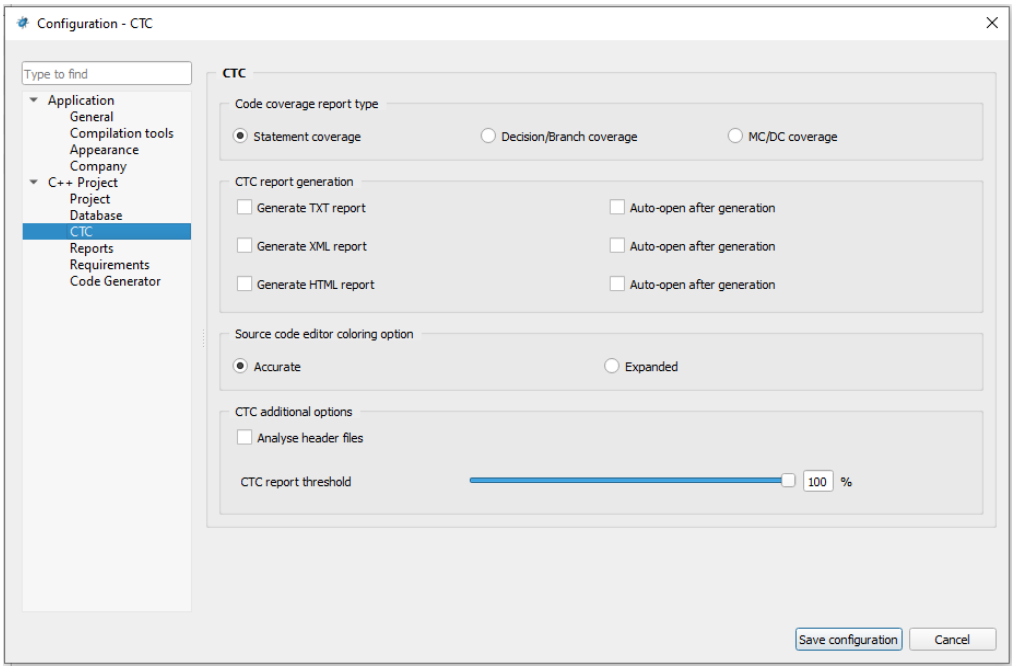
However, before building it, you should decide whether you would like to have it built with CTC enabled or not. If yes, go to the Code Coverage tab and tick the checkbox „*Build SimuDLL with CTC*" (Figure 19).

Figure 19. Code Coverage tab.



If you decided to build DLL with CTC enabled, you can set CTC options in *Tools - Configuration – CTC* menu (Figure 20).

Figure 20. CTC Tools.



Last important step to take, is to make sure that all constuctors and destructors are defined correctly.

Constructor and destructor methods are methods, which are used to create and destroy objects of the class with tests. By default, these methods are defined without any parameters, in the way showed on Figure 21.

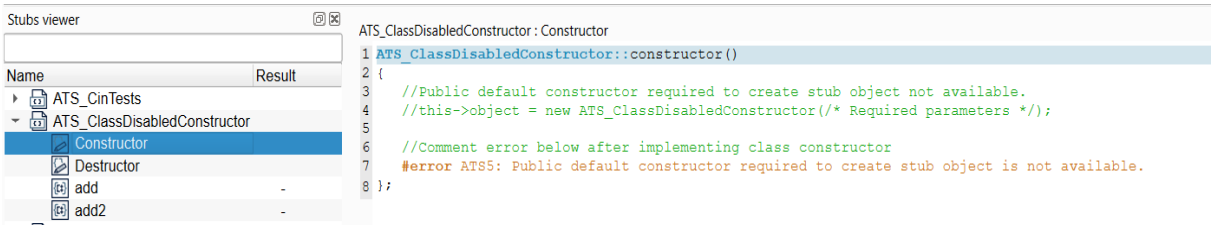
Figure 21. Defining constructors with non-params.

ATS_CppTestingPrj : Construct

```
1 ATS_CppTestingPrj::construct()
2 {
3     this->object = new ATS_CppTestingPrj();
4 };
```

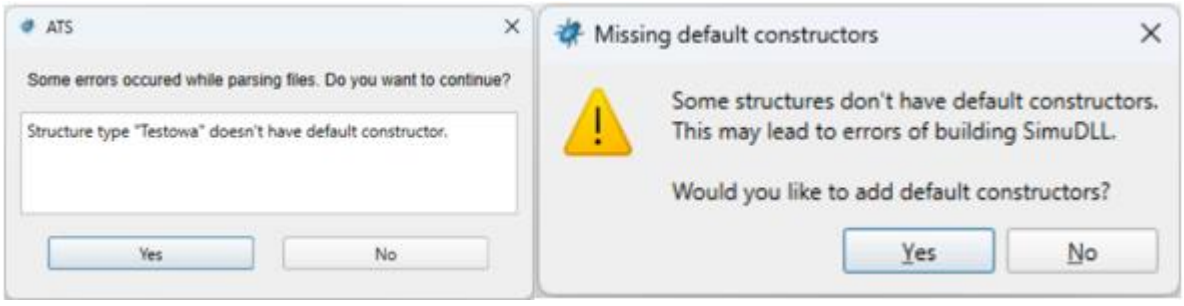
However, in some cases there is a necessity to define them with parameters. In such situations, if the application recognizes it, application will display an information, as shown on Figure 22.

Figure 22. Information while recognizing constructor with parameters.



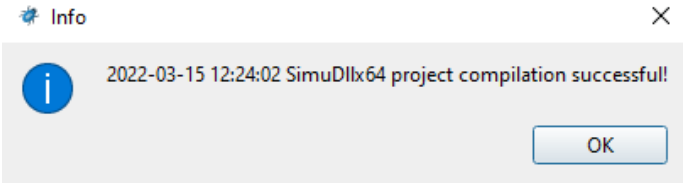
Also if parsed testing project contains structure without defined default constructor, ATS will recognize it and ask if user would like to create such default constructors (see Fig. 23).

Figure 23. Create default constructurs for structures.



After all is set up, successful building the DLL will display a dialog with confirmation (Figure 24). On the other hand, if something fails you will get errors displayed in a log window at the bottom of application with details – what went wrong.

Figure 24. Successfully built DLL notification.



After choosing files to analyze and compile the DLL now you are ready to test them.

2.2. Adding new test

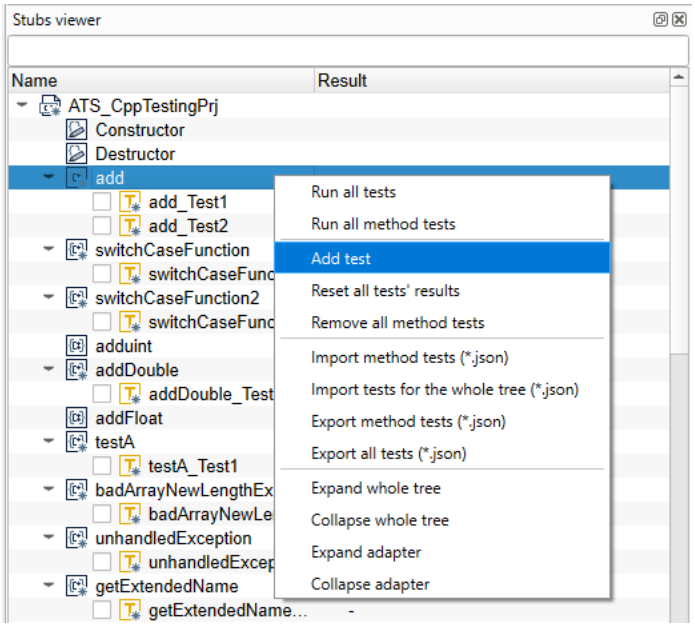
Adding test to adapters (tree items named as class methods or global functions) is possible in three ways.

First one is to simply double-click on adapter (this option is available only when adapter does not contain any tests yet). Second one is to use the second button from the right side of a Toolbar „Add a new test to the method”:

To create a test with above button, you have to select a target method first – it will be added directly for this method.

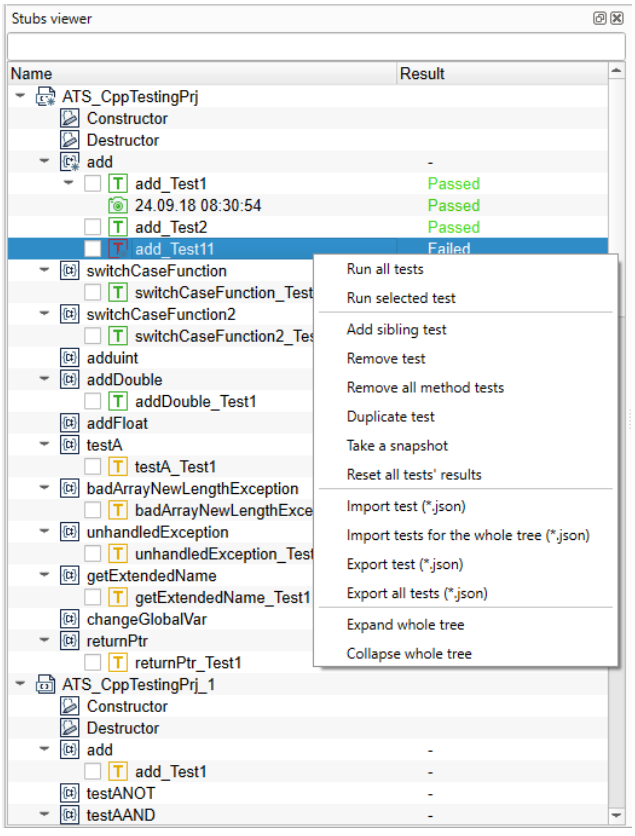
Third option is to use context menu on adapter by pressing right mouse button on it (Figure 25). Please note, launching a context menu in Stubs viewer is only possible when right-clicked on “Name” column area – invoking context menu won’t work if it was done on “Result” column.

Figure 25. Adding tests via context menu.



Application allows you to rename test by double-clicking on it. Also, there is a possibility to remove single/multiple tests or remove all tests from method/class, duplicate it, add sibling test, take a snapshot of it, run it and reset its results (Figure 26).

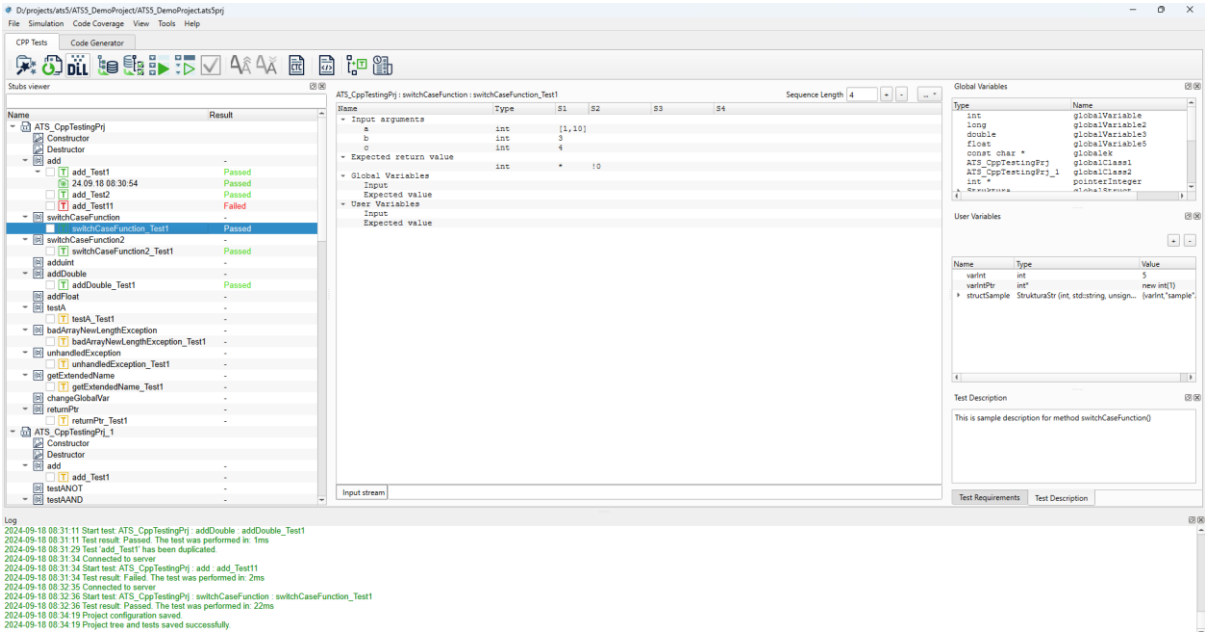
Figure 26. Additional options for test in Stubs Viewer



2.3. Modifying a test

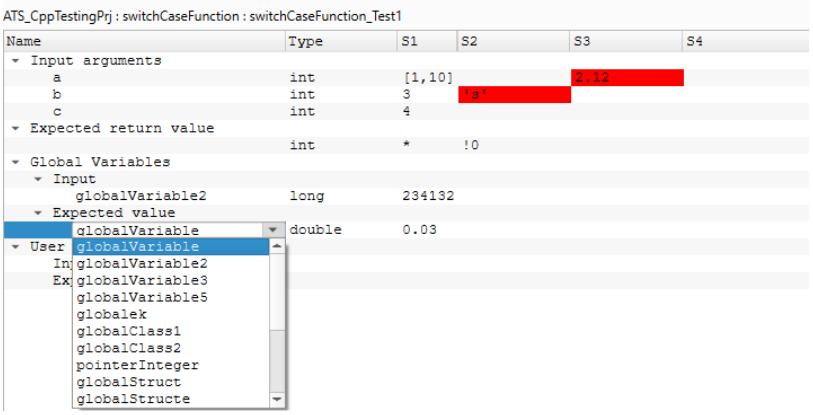
Clicking on test (tree item) shows a new window, that allows user to specify values for input arguments of methods/functions as well as expected return values (Figure 27).

Figure 27. Main View of ATS5 with added tests.



Application allows user to input only parameters that are used in a specific method/function. For example, for *switchCaseFunction* method, which returns integer and its parameters could be also only integer numbers, there will be error (marked as red background), if user tries to input other data types (Figure 28).

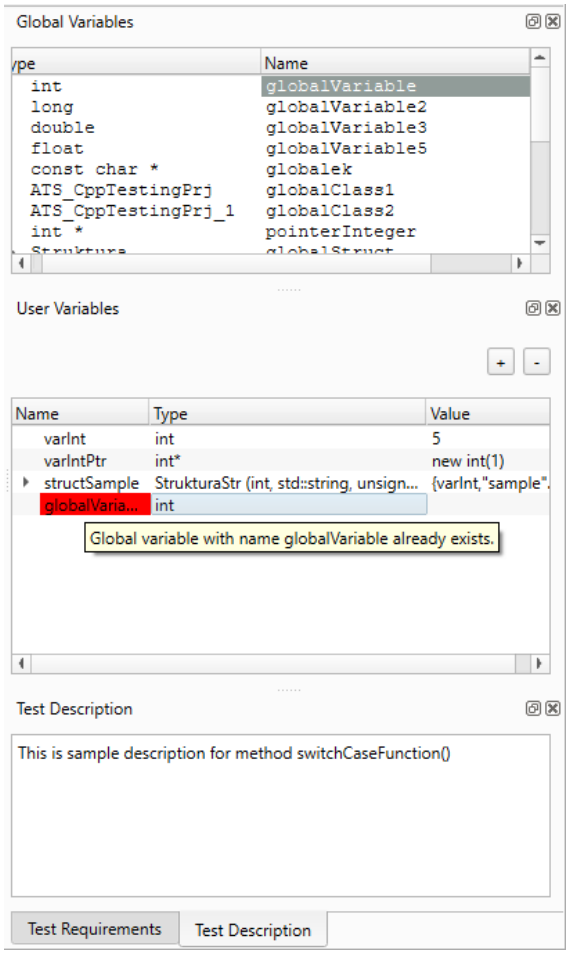
Figure 28. Setting wrong data type for a test parameter



Global variables can be added by selecting them from the expanding list (Figure above). You can select many different global variables in single test but once used global variable in input argument or expected value cannot be duplicated.

To use a user variable, firstly you need to create it in the view of class definition or while having selected any method/test of the class which you would like to create user variable for. By default, user variables creation section is located on the right side of ATS application just under Test Description (Figure 29). It is a docking widget so you can always undock this and place anywhere else to let it be more comfortable to use.

Figure 29. Add user variable section

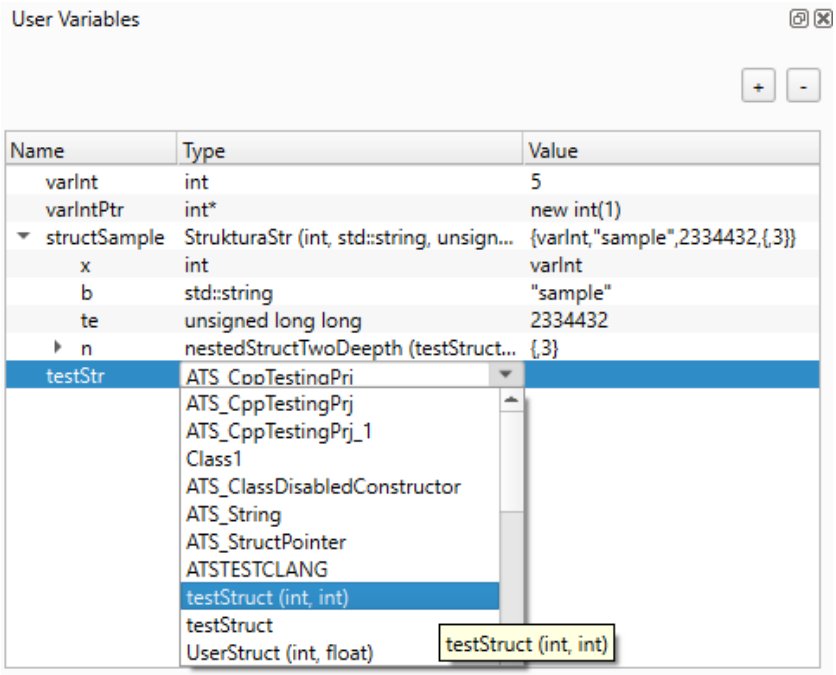


Press plus „+” button to create new user variable and specify name, type and value for it, then push Enter to confirm your inputs. Removing already

created user variable is done after you select it from the list and then click minus „-“ button. In case you create user variable with same name as already existing global variable, application will recognize it as error and mark such variable on red background.

When defining structure types for user variables, it is possible to select which constructor should be used – it can be selected via combobox list. All default constructors without parameters are named same as structure name (without arguments in parenthesis) and all custom constructors with different arguments are listed as well:

Figure 30. User variable structures constructor selection.

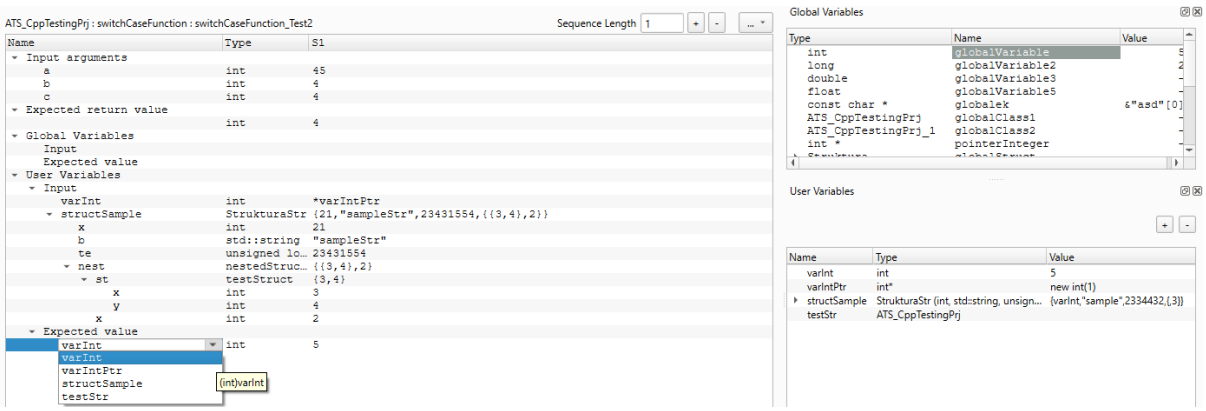


If some parametrized constructor was selected, user is able to define values for structure fields – those values will be then automatically placed in the main node of structure inside {} brackets.

Defining class objects variables is also done via selection in above combobox element – user has to simply choose which class type should be used for specific variable. For both structure and class objects variables it is allowed to use pointers by changing selected type using “*” character at the end of the

expression. SimuDll needs to be rebuilt to allow usage of such created user variables and to allow you to select them from combobox placed in the test definition section (Figure 31).

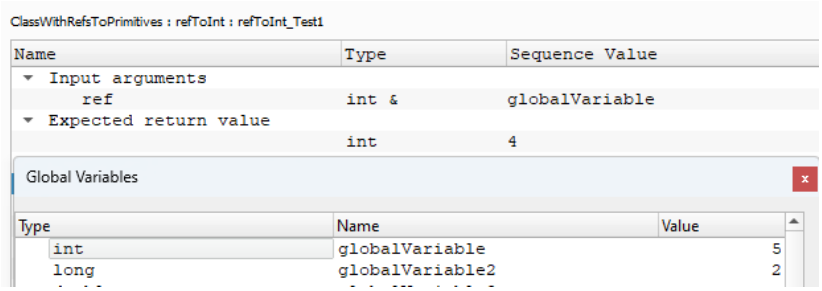
Figure 31. User variables usage in test



Similarly to global variables, you can use multiple user variables in single test, but they cannot be duplicated.

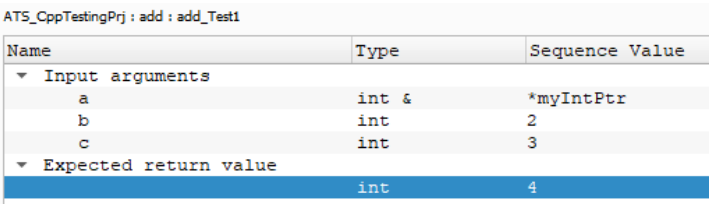
In tests, where a parameter can be a reference (e.g. int &), application allows you to use only user (local) variables or global variables (Figure 32).

Figure 32. Reference to global variable in test's parameter



If you declare user variable as a pointer, for example in this way: *(type)* int* *(name)* ptr *(value)* nullptr, it can be then used in test's parameters like this:

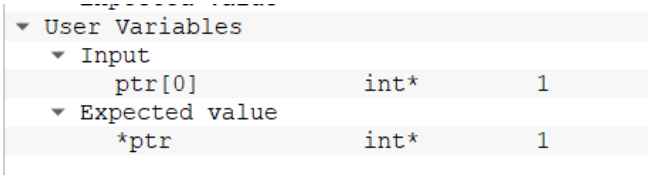
Figure 33. User variable as a pointer used in test's parameter



There is also a possibility to use pointers in arguments that are not using references. For example, you can define user variable as a pointer to integer and then use it as a parameter in argument of int type – simply use **userVar* or *userVar[0]*.

On the other hand, if you want to set value or set expected value of user variable which is pointer type, you can only do that by typing „*" before variable's name or array index after name like ptrVar[0] (Figure 34).

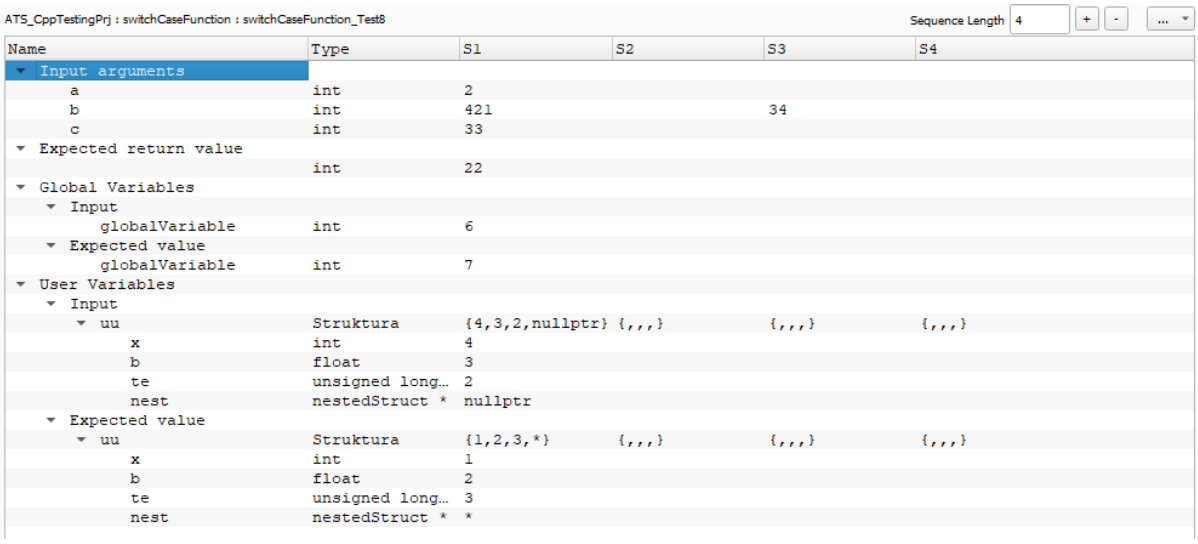
Figure 34. Setting or getting pointer user variable



2.3.1. Sequences

A particular test can be run in sequences. To add new sequence, click the „+" button on the right side of the fields with test params (Figure 35). Also, you can modify the amount of sequences by putting its length number in the textfield.

Figure 35. Test sequences



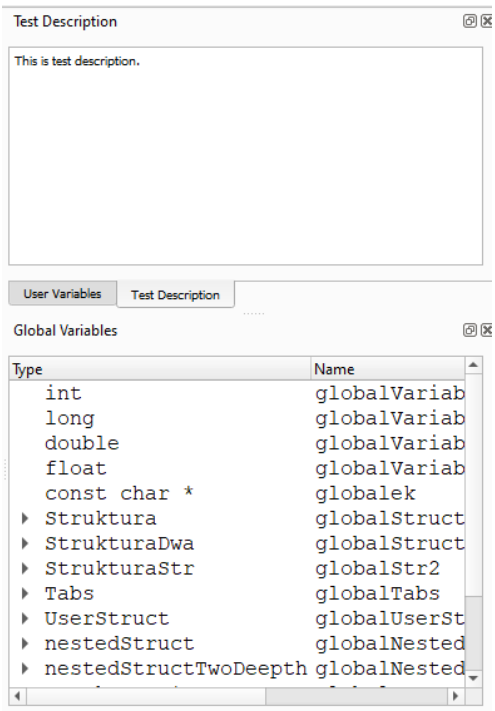
Each column „S1", „S2" and so on, is a separated sequence. So for first sequence of this test for input arguments were provided values: 2, 421, 33 and for

expected return value 22. Due to empty cells in second sequence, all values from previous sequence (S1) will be extended also to second sequence. It means that values for second sequence are exactly the same as for S1. You can notice that value for b parameter has changed in third sequence to 34. So all other empty cells will automatically expand values from previous sequence besides value for b parameter. About expected return value, in above case it will always be equal to 22 in each sequence.

To sum it up, if you do not define parameters in the following sequences, they will be automatically set as values of earlier defined parameters. Sequences work the same also for global and user variables.

In test, you can also add description, which will be displayed in generated reports (Figure 36).

Figure 36. Test description



By default, this section is placed on the right side of ATS application under Global Variables section, but it is a dockable widget so you can always dock it anywhere else.

2.3.2. Range values

ATS5 allows users to create tests with range values in parameters. Range is specified as [min, max, step]. To use a range, you have to put your values between square brackets „[" and „]", with comas as separator for min and max value and a step (which is optional, by default it will be set to 1). Ranges are presented on Figure 34. Important information about ranges is that they differ for return values. In such case, you can only specify [min, max] params (without step). It means that return values specified in a range (e.g. [1,50]), will take every value from that range as positively passed in a test (see expected return value in sequence S2 of below example).

Figure 37. Ranges in tests' parameters

ATS_CppTestingPrj : switchCaseFunction : switchCaseFunction_Test9

Name	Type	S1	S2
▼ Input arguments			
a	int	66	3
b	int	[1,5,1]	3
c	int	2	4
▼ Expected return value			
	int	<100	[1,50]

Another example – range specified as [5,10,2] will run test with given values 5, 7, 9 – so there will be created 3 sequences additionally for purpose of this range. If user will provide two ranges in separated parameters within single sequence, application will combine them, using Cartesian product operation. It is also possible to have range with a negative step. This requires putting a bigger value as a minimum parameter than maximum parameter (e.g. [15, 2, -3] or [-5, -1, 1]). As shown on Figure 34, after execution of this test, its result will passed (the received return value is 2 for S1 and 4 for S2, so it passes both conditions).

2.3.3. Special operators

Moreover, application allows you to use special operators for specifying return value. Those operators are:

- „<” - values less than;
- „>” - values bigger than;
- „<=” - values less and equal to;
- „>=” - values bigger and equal to;
- „**!**” - negation (it means that user can expect every value except the ones given in return range if exclamation mark was added);
- „*****” - all values are correct.

Figure 38. Special operators in ranges

ATS_CppTestingPrj : switchCaseFunction : switchCaseFunction_Test10 — Sequence Length

Name	Type	S1	S2	S3	S4
▾ Input arguments					
a	int	3	3		
b	int	4	-2		[-3,10,3]
c	int	33	[1,10,2]		
▾ Expected return value					
	int	!3	>0	*	<=82

Usage of these special operators is presented on Figure 38. It is not allowed to use those operators for input arguments, but for all expected return values (also for global and user variables) it is completely correct.

2.3.4. Structures usage in tests

It is possible to use structures within tests and to define user variables of such type. In ATS5 this test will be displayed and handled a little bit different than regular test with primitive types (Figure 39).

Figure 39. Empty struct fields

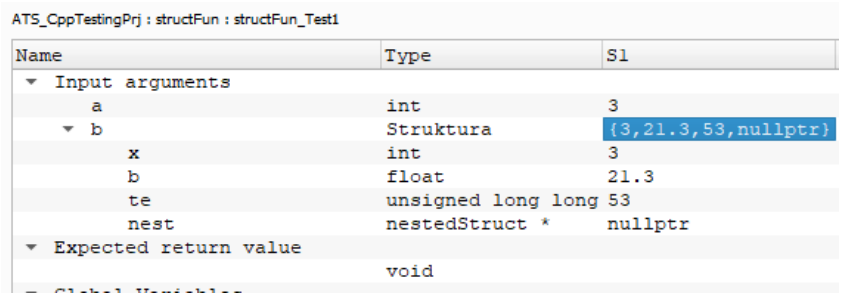
ATS_CppTestingPrj : structFun : structFun_Test1

Name	Type	S1
▾ Input arguments		
a	int	
▾ b	Struktura	{,,,}
x	int	
b	float	
te	unsigned long…	
nest	nestedStruct *	
▾ Expected return value		
	void	

As you can see, the general row of such structure shows what type is this, and after filling out the values in the below cells, this general row will be updated

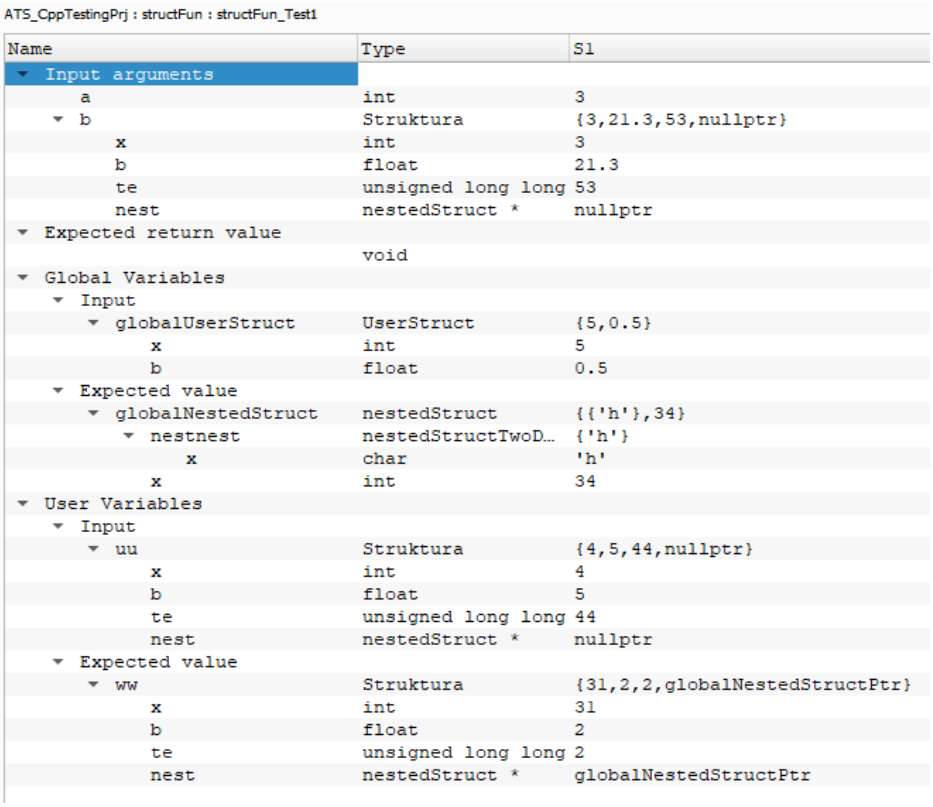
in real-time inside curly brackets {} with each value separated by a comma (Figure 40).

Figure 40. Struct usage in test



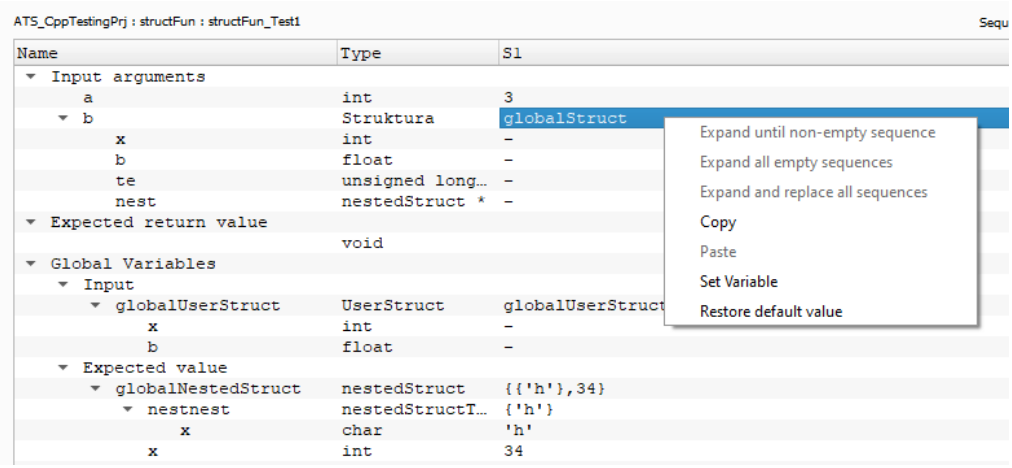
There are some rules to follow while defining values of struct fields in a test. Firstly, it is forbidden to use ranges as input arguments of struct – it is only possible to use range as expected return value. When a test contains global variable of struct type, it is forbidden to define its field with usage of user variable as its value. But on the other hand, if user variable is used in a test and it is a struct type, it is possible to use global variable as its value (Figure 41).

Figure 41. Struct examples in test



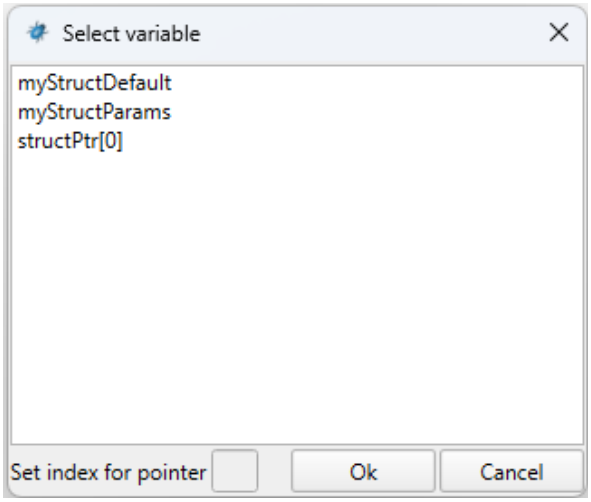
Additionally, user can set a value for current structure using option from context menu „Set variable” (Figure 42).

Figure 42. Set struct variable



Set variable option will open a new dialog with list of all global and user variables of the same type as currently selected struct (Figure 43).

Figure 43. Set Variable for struct

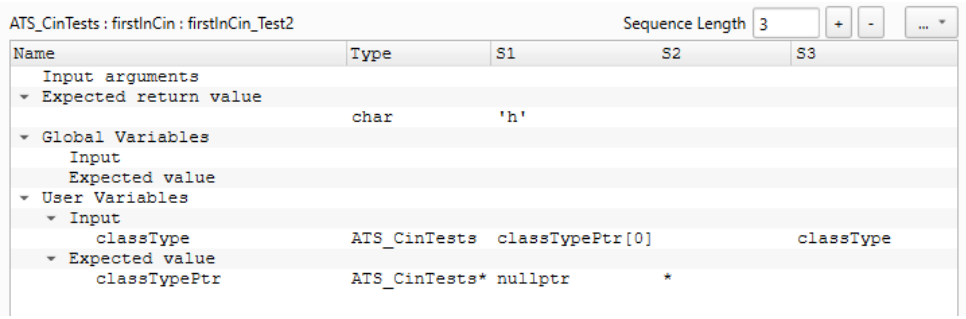


In case of pointers, it is possible to set an index. When variable is selected and confirmed, the fields with values cannot be modified (Figure 42) – they contain „-“ symbol. The only option to change it, is to restore the value by selecting option from context menu „Restore default value”.

2.3.5. Class objects usage in tests

As it was mentioned before, it is possible to use class objects in tests – as well as global or user variables (see Figure below) or input arguments/expected return values in tests as well as class pointers.

Figure 44. Class objects usage in tests



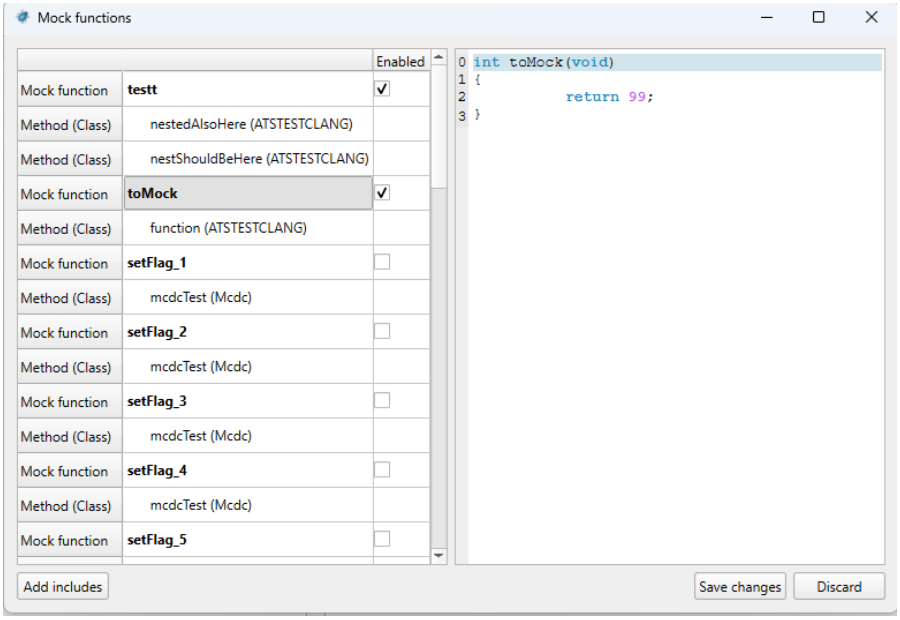
To set argument as class object, it is required to use “Set variable” option from right-click context menu opened on specific cell in sequence column.

2.3.6. Functions mocking

Mocking functionality is placed under a mock widget button placed in the toolbar:

In this window there are listed all mock functions recognized from testing project – in the parenthesis are defined classes which those mock functions are involved in, and on the left side of the parenthesis is written the name of function or method that mocked function is changed in:

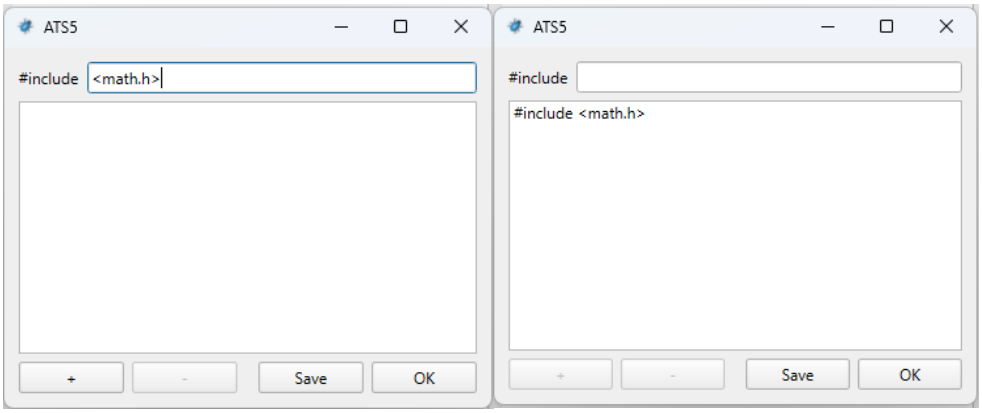
Figure 45. Mock functions widget.



To use such mock function, user needs to accept the checkbox in column "Enabled". If function is not a void type, specify the appropriate return type in code editor placed on right side after clicking on specific mock function. After user has defined all mock functions, it is required to click "*Save changes*" to apply this code edits. To run tests with mock functions usage, SimuDLL has to be rebuilt first.

If mock functions use some components from additional sources or libraries, it is allowed to add includes which will exist in a file where mocked functions are defined, by clicking on "*Add include*" button – then new window will be displayed (Figure 46).

Figure 46. Additional includes for mock functions.



To add new include, type in the component and confirm with “+” button – it will be then append to the list. Click “*Save*” to confirm the action and “*OK*” to quit.

Below is an example of behavior for mocked function and created test – originally it is supposed to return “1” value:

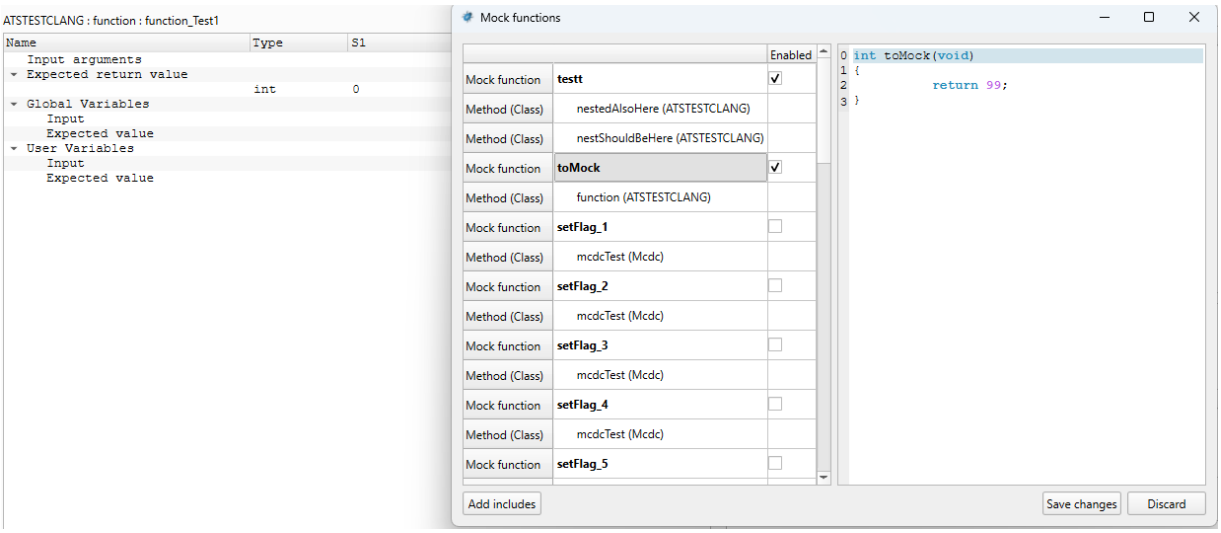
Figure 47. Original method definition before mocking.

ATSTESTCLANG : toMock : ATSTESTCLANG.h

```
51    int toMock()
52    {
53        return 1;
54    }
```

but according to enabled toMock() function, the output will be different (see Figure 49).

Figure 48. Example of mocked method.



The test output is “99” value instead of “1”:

Figure 49. Mock function result from test report.

Category	Type	Name	Sequence step
			1
Expected return	int	-	0
Value returned	int	-	99

2.4. Running tests

After filling in all params that you need for your tests, now you can run them. To start one selected test – click the button in Toolbar:

If your mouse's focus will be set to *class* or *adapter*, clicking *Run Selected Test* will cause running all tests from the selected class/adapter. Running selected test is also possible using context menu, after right-clicking tree item in the Stubs Viewer. If you would like to run all created tests, simply use button or again – use a context menu.

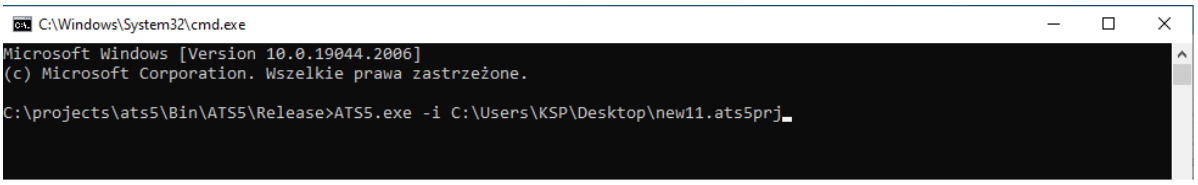
To select many tests from different classes and to make them execute, user can select particular checkboxes and then use the button to run them:

There is also a possibility to execute all created tests with automatic mode from command line. To have it done, open a command line from the folder with *ATS5.exe* file. Then, type in the following instructions (Fig. 50):

ATS5.exe -i *PATH*

PATH is a path to your created *.ats5prj* file which includes tests, that user want to execute. After running above command, ATS5 automatically generates HTML reports for done tests.

Figure 50. Automatic mode for running tests

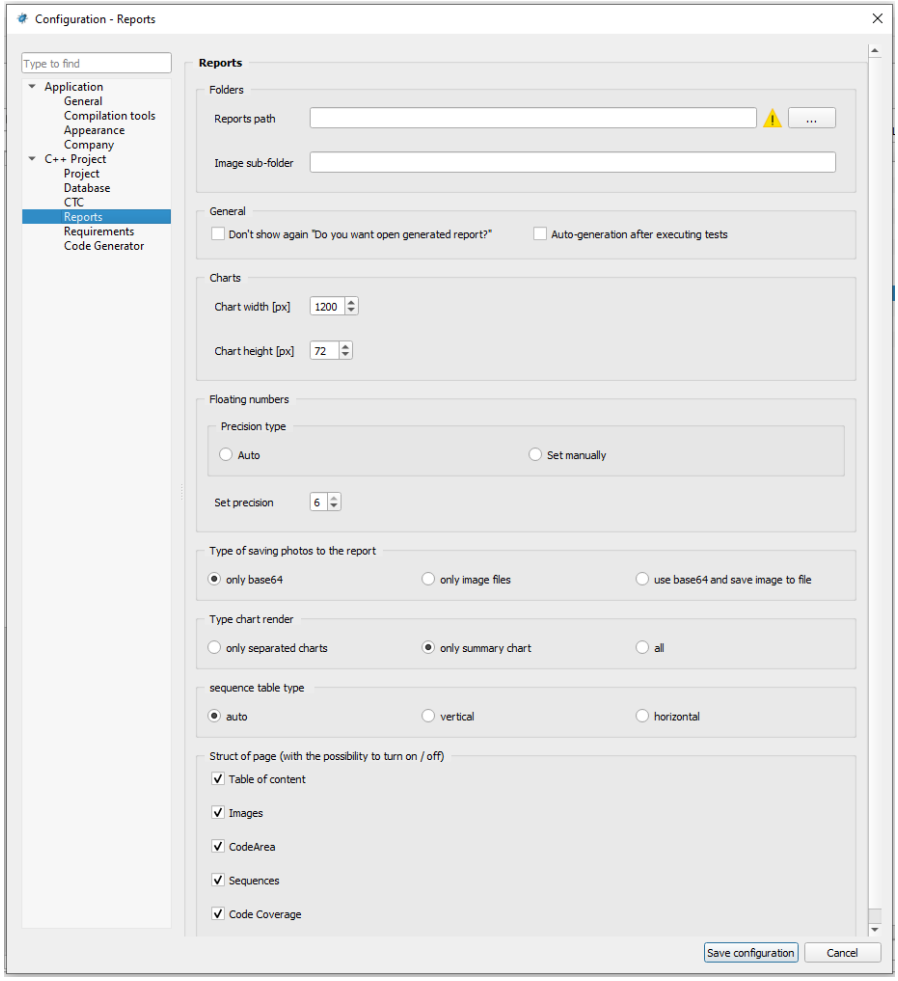


After running tests with methods described above, an informational dialog will appear. It includes such information as: numbers of tests done correctly and incorrectly, name of executed test, status of the test result (Passed/Failed), time in which the test was performed. In case that some test is not executable (for

example due to incorrect data types in params), this dialog will also include that information. Also, status of executed test is shown in column „*Result*" in the Stubs Viewer tree.

A view with the results of executed tests could be different – it depends on configurations that were set in Tools. Settings concerning generating reports can be checked in *Tools – Configuration – Reports* (Figure 51).

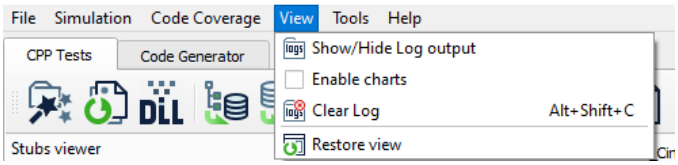
Figure 51. Reports Tools



In here, you can choose paths for reports, as well as for other images, and establish where they should be stored. By using checkboxes you can decide whether to auto-generate a report after every test execution or not. There is plenty of settings to choose, that will allow you to individualize ATS5.

If you would like to always show charts after test execution, you will find that option in a tab, called View. There is a checkbox „*Enable charts*”.

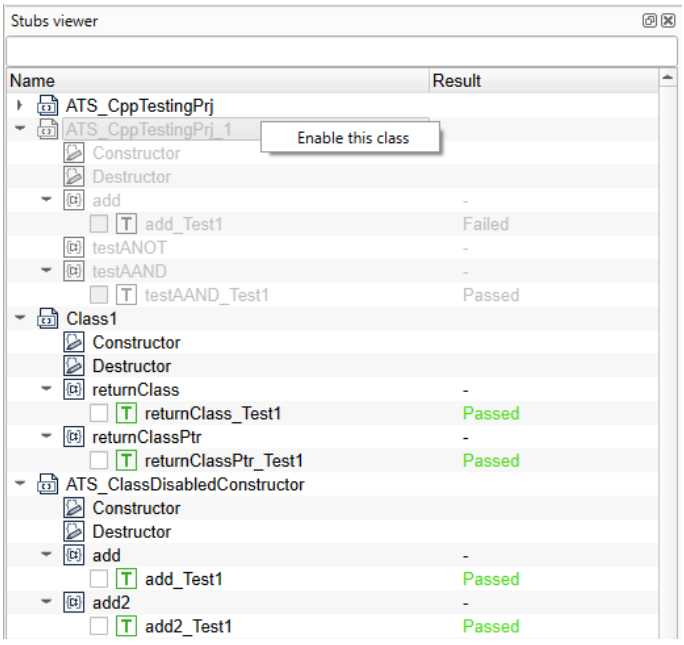
Figure 52. View tab



After setting this on, every executed test will automatically show charts with results.

It is possible to disable specific classes or global functions from tests execution – to do that, right-click on selected stub node (class or global function) in Stubs viewer and select option “*Disable class*” or “*Disable global function*” – it will make this element greyed out in the tree and all tests created for this stub will not be executed, neither they will be added to test report. If there are already some executed tests with results, all data will remain visible in the tree after this class was disabled.

Figure 53. Disabled class in stubs viewer.

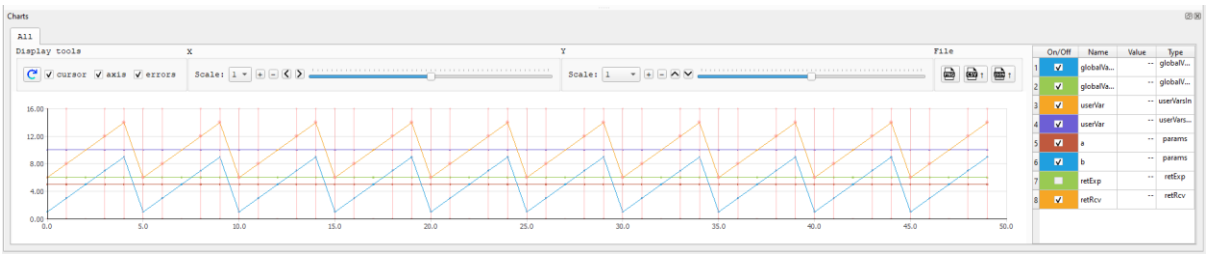


To restore elements again, just right-click on this stub in the tree and press “*Enable this class/global function*”.

2.4.1. Charts

Charts are presenting test's results – they can be very simple or pretty complicated, depending on given parameters value and number of sequences. Charts consist of input arguments, expected return values for variables and actual received return values.

Figure 54. Charts section



In the middle part of the *Charts* widget, you can find generated chart, tools for manipulating the chart and buttons for exporting the results. On the right side of it, there is a table with parameters' values. These values will be changing in real-time when your mouse will be hovering points on the chart.

The display tools consist of a button for resetting the view and three checkboxes to turn on/off displaying cursor, errors and axis on the chart.

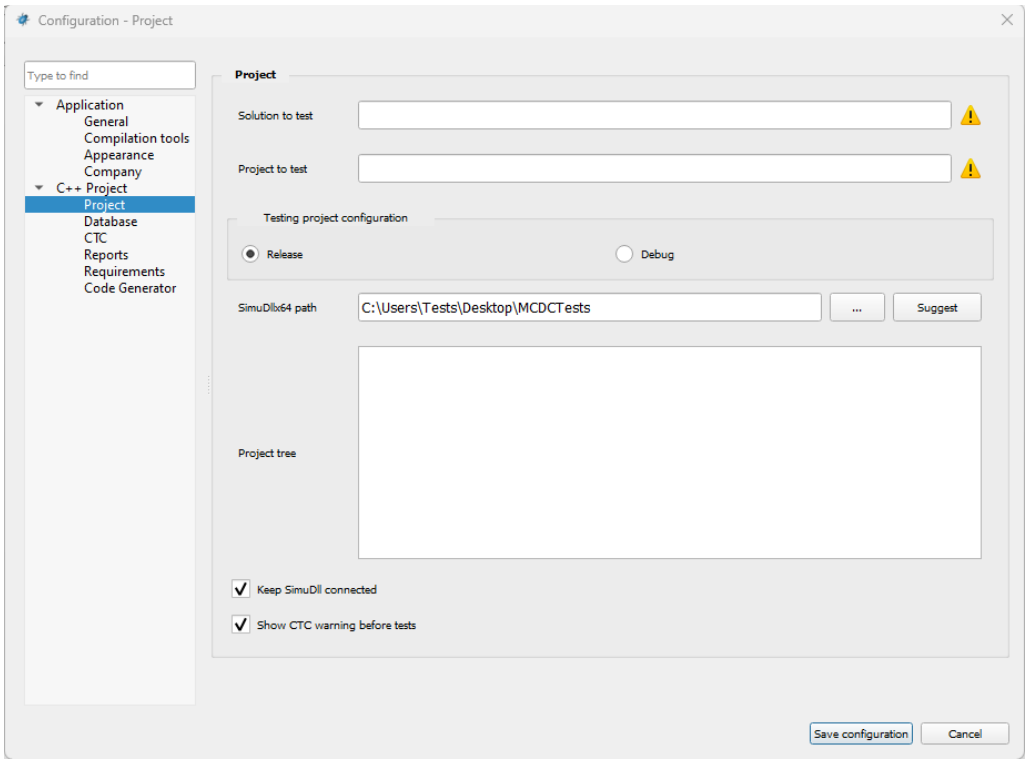
The following two sections concerning axis X and axis Y include tools for changing the scale of displayed chart – you can zoom it in or zoom it out. Also, there is a slider for moving the graph to right or left (for X axis) and to up and down (for Y axis). Moving the chart is also possible without the toolbar - in such case user has to click and hold on the chart and then move the mouse in any direction. In addition, zooming in and out the chart is allowed by using mouse wheel (axis X) and using mouse wheel while holding SHIFT (axis Y).

Furthermore, in the section called File, there are three buttons for exporting. The first one is used to generate PNG file with the displayed chart, the second one is used to export the results to CSV file, and the same happens, when user clicks the last button, with the only difference that the file with results will be in a format of JSON.

2.4.2. MC/DC coverage

As it was mentioned before, settings concerning CTC options can be defined in *Tools – CTC*, but there are also some other important decisions to make, when you would like to generate test report with MC/DC (Modified Condition/Decision Coverage) coverage included. Those decisions can be made in *Tools – Project* section (see Figure 55).

Figure 55. Project configuration with CTC options



The checkboxes in the bottom of the dialog allow you to decide whether you would like to show CTC warning dialogs when executing tests and whether you would like to keep connection with SimuDLL. The last one needs to be turned off if user wants to generate CTC report, so if you would have this checkbox set on and execute test, you will get a warning dialog about it.

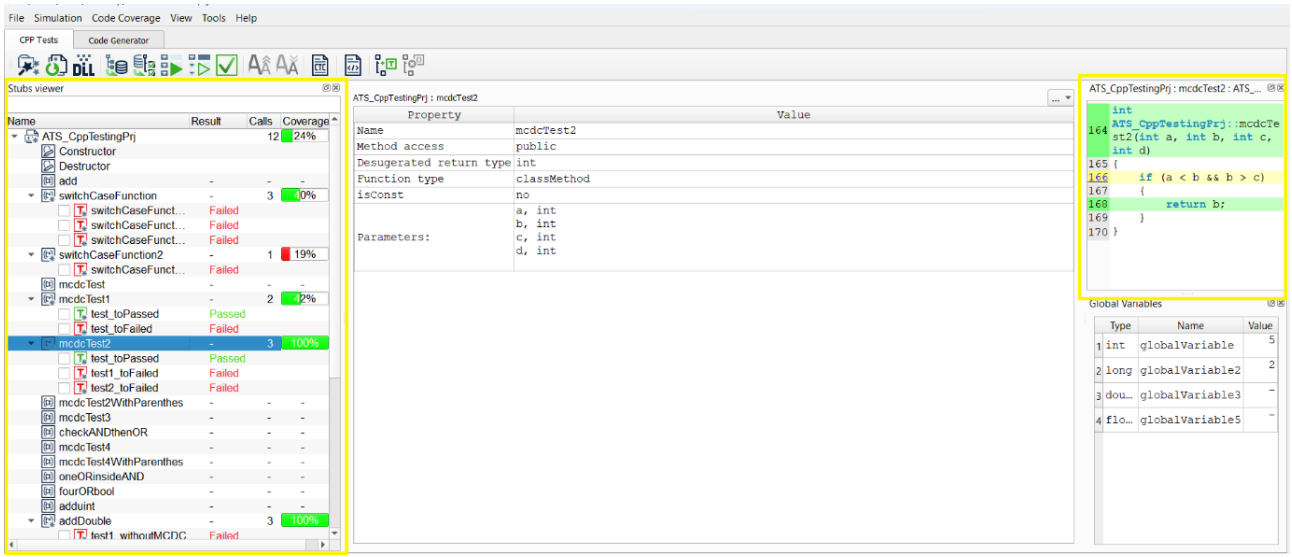
To enable generating MC/DC report, go to *Tools – CTC* and select „MC/DC coverage” in *Code coverage report type*. Furthermore, select which

type of report you would like to generate – TXT, XML or HTML report. Now, if you save your configuration, you are ready to execute tests with MC/DC feature.

In the general overview (Figure 56), when CTC option is set on, there are added some new features, such as:

- In the *Stubs' viewer* (on the left side of the screen below in the yellow frame) there is added a new column „Coverage" which displays the percentage of code coverage. If it shows 100% it means that all lines of the code have been tested.
- Coloring the lines (Fig. 57) – in the method's definition on the right side (yellow frame), the colors of the lines have different meanings. Explanation of them will be given under this below figure.

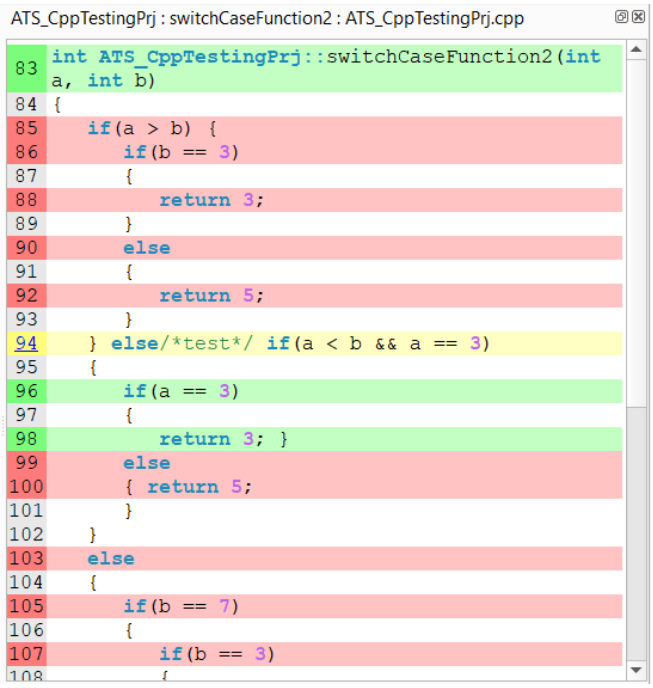
Figure 56. Main ATS5 window with CTC feature



Line which is marked:

- green – means that this line was used and executed during the test,
- yellow – means that there was MC/DC recognized in this line,
- red – means that this line of code has not been executed and used during the test (the conditions were false, so the program did not go inside the lines).

Figure 57. Lines' colors in method definition



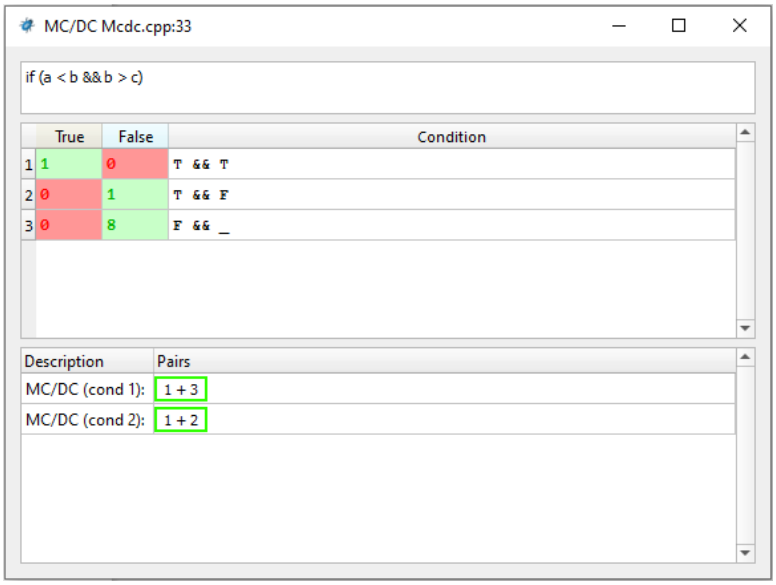
To open MC/DC details dialog, click the yellow line's number (it is underscored) in method's definition. It has 3 main sections (Figure 58) – on the top of the MC/DC dialog there is located analyzed condition from already executed test. Then, there is a table with all the conditions listed and their actual amount of execution – so value '5' in the first row of *True* column means that this condition was obtained 5 times and of course was successful (the result of True && True is always True). In the second row you can see that this condition was obtained and executed only once, and its result is False.

Underscore ("_") in the „Condition" column means any boolean value (True/False) as this value will not affect the result anyway.

The last section of this dialog is the description. It shows if the current condition (leaf-level Boolean expression) is independent from other conditions' results. The independence of a condition concerns that only one condition changes at a time. The symbol plus ("+") or minus ("-") placed between conditions' numbers in the description, indicates which pair of conditions were

achieved (plus) and which were not (minus). If there is at least one pair with plus, it means MC/DC was fulfilled.

Figure 58. Example of MC/DC dialog – plus symbols.

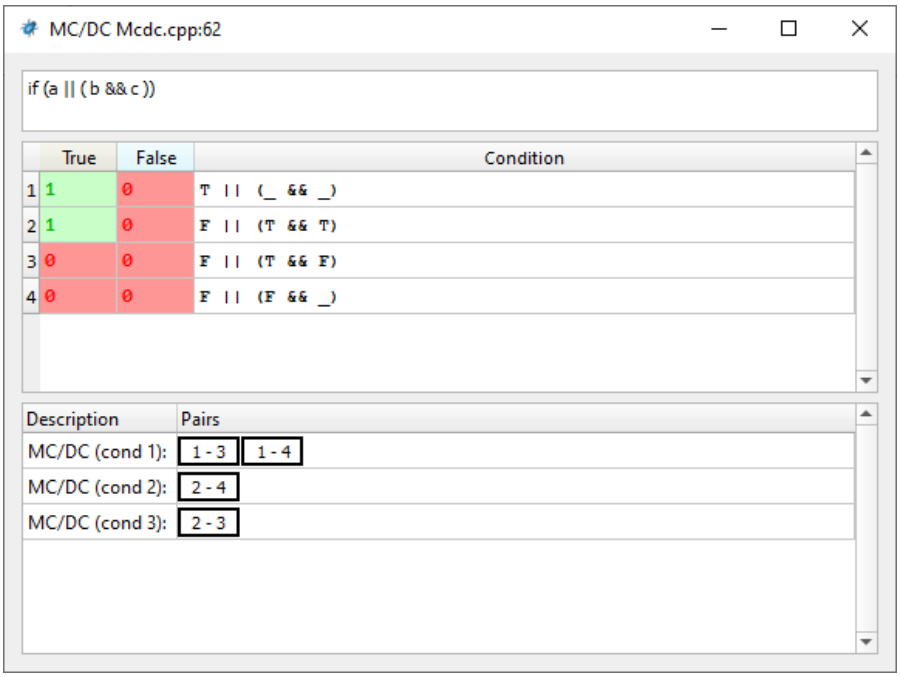


Interpretation for above example can be: to check the condition's independence, there needs to be executed a pair of condition 1 (True AND True) and 3 (False AND _), and also a pair of 1 and 2 – and they all have already been achieved. In other words:

- The first condition (T && T) and the third condition (F && _) demonstrate that 'a < b' can independently affect the outcome decision.
- The first condition (T && T) and the second condition (T && F) demonstrate that 'b > c' can independently affect the outcome decision.

Let's have a look at opposite situation with minuses (Figure 59).

Figure 59. Example of MC/DC dialog – minus symbols..



Example description interpretation for above is – to check independence of the condition there is a need to execute:

- *The first* condition (T || (_ && _)) and *the third* condition (F || (T && F)) **or** *the first* condition and *the fourth* condition (F || (F && _)). They all demonstrate that ‘a’ (from analyzed expression) can independently affect the outcome decision.
- The second condition (F || (T && T)) and the fourth condition (F || (F && _)). They all demonstrate that ‘b’ (from analyzed expression) can independently affect the outcome decision.
- The second condition (F || (T && T)) and the third condition (F || (T && F)). They all demonstrate that ‘c’ (from analyzed expression) can independently affect the outcome decision.

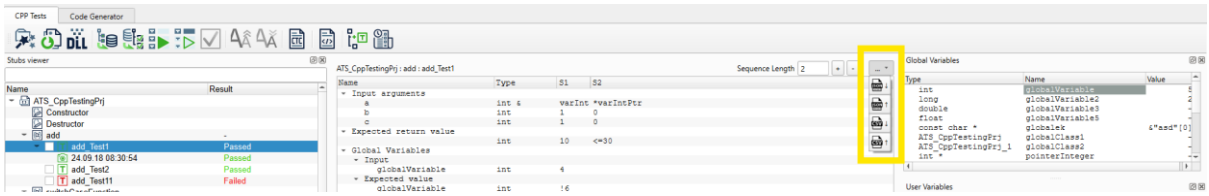
2.5. Importing/exporting tests

Application allows you to import ready tests (in a format of .JSON files) to the project. It can be done by right-clicking a class or method in Stubs viewer and selecting the option „*Import method tests*”/ „*Import tests for the whole tree*”. Other way to import tests is to select a button „...”, that is placed next to Sequence Length in tests parameters field or in class/method definition.

Figure 60. Importing/exporting buttons in class definition.

Exporting tests is equally simple – you can find this option in context menu of tree items or – after selected a specific test – export it via button, placed next to Sequence Length. As you can see, application allows you to export tests as CSV and also as JSON files.

Figure 61. Importing/exporting buttons in tests' parameters section.

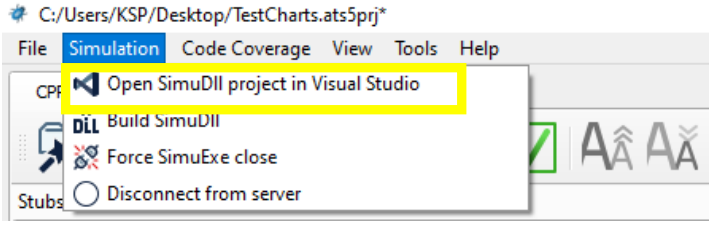


The difference between importing/exporting files in format of JSON or CSV, is that while using .JSON files, the test is imported as a new test, and exported test is also exported as a whole element. Importing by CSV file will cause loading only tests' values, and exporting as CSV file will save only tests' values.

2.6. Modifying SimuDLL project

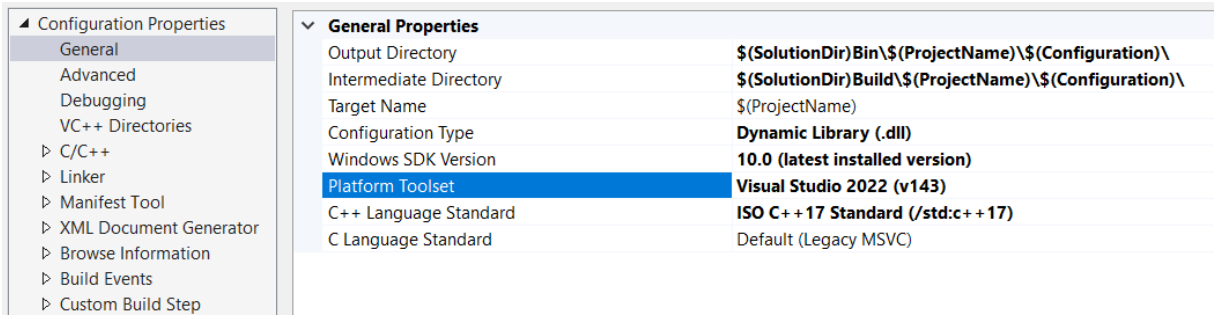
In case there will appear any error during SimuDLL project compilation, user can open SimuDLL project via ATS application by clicking *Simulation* menu, then „*Open SimuDLL project in Visual Studio*”. After that, *.vcxproj* file containing SimuDLL will be opened.

Figure 62. Simulation – Open SimuDLL in VS.



Proper SimuDLL project configuration looks like this:

Figure 63. SimuDLL Configuration.



Most important is to specify „*Platform Toolset*” to „***Visual Studio 2022 (v143)***”. Otherwise, there may appear errors during compilation. One of the common errors that appear (if „Platform Toolset” is not specified) is that our application cannot find included system headers in files that we are trying to analyse.

Chapter 3. Additional features of CPP Tests

Besides main features that were described before, ATS5 has some other functionalities. On the Figure 64 there are buttons marked in red, yellow, green and blue.

Figure 64. Toolbar additional features

Button in blue frame concerns refreshing project files. It will work, if the application finds any changes in files, that user is currently using in a project (in .h or .cpp files). After clicking the button, if there had been any changes made to the files, the application will update them, remaining all the created tests by user.

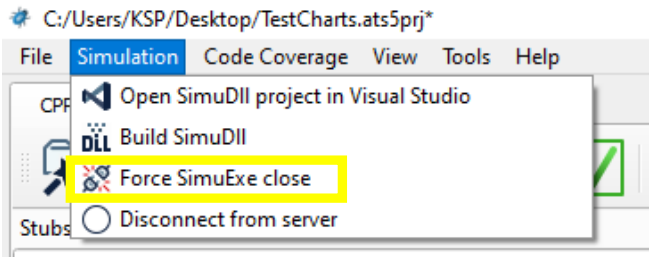
Buttons in red area are related to increasing/decreasing font size for constructor and destructor methods' definitions.

Buttons in yellow frame concern generating CTC and ATS reports.

Button in green frame concern adding new test for selected method/global function.

In case of a problem with executing tests, you can force SimuDLL to close. To do that, go to *Simulation – Force SimuExe close* (Figure 65).

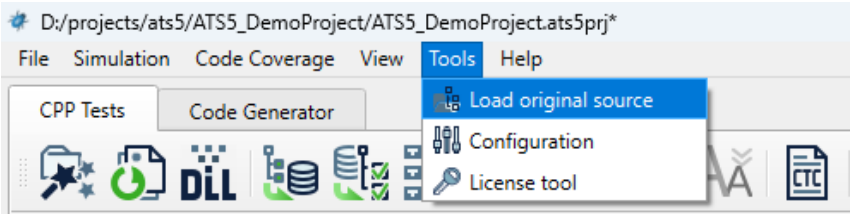
Figure 65. Force SimuExe close



Additionally, in *Tools* tab, you can find an option called „*Load original source*". It is used for restoring imported file to its original version – without any

added tests, variables or snapshots. Snapshots are used to make shots of a test, which cannot be modified but they can be used to restore its values.

Figure 66. Tools tab

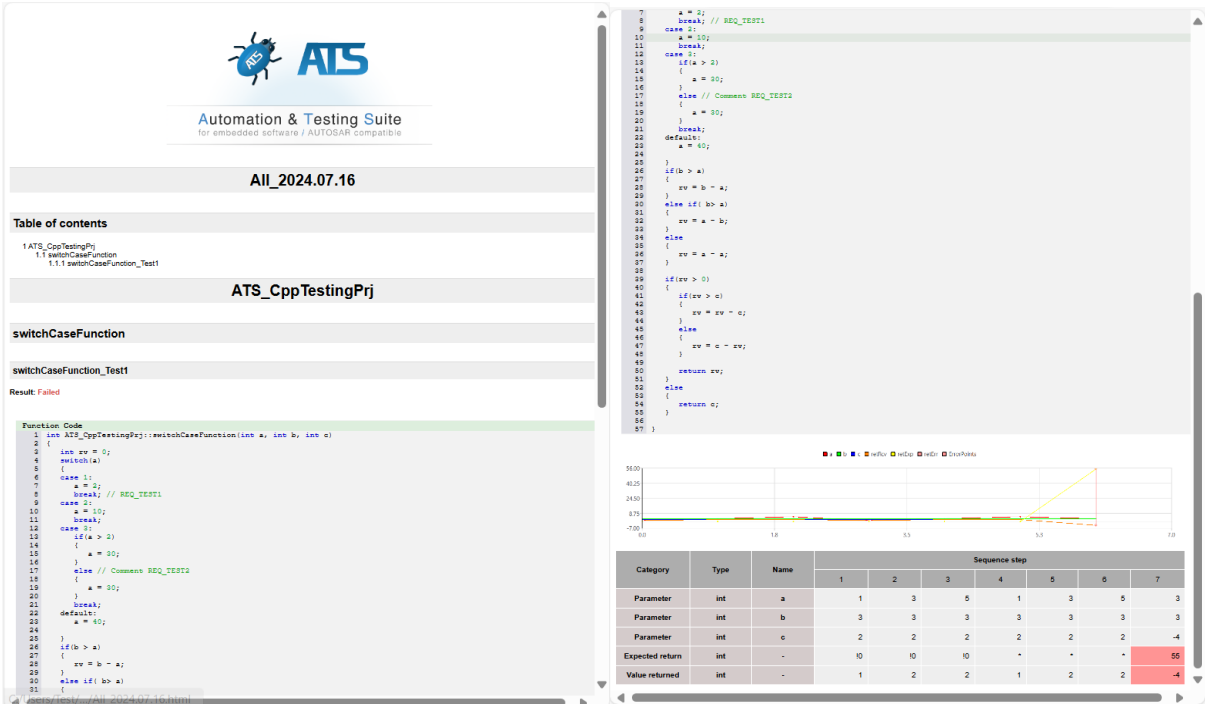


3.1. ATS Reports

Those reports are generated as HTML file. They include Table of contents in the top of the page, then the titles of classes that contain done tests, names of the methods with their test results and their definition titled as Function Code.

Optionally there could be included comments section. In the middle and the bottom of the page there is a chart with a legend of params, and below that the report includes a table with the values.

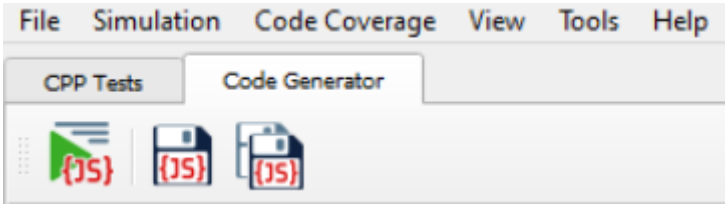
Figure 67. Report example.



Chapter 4. Code Generator

Code Generator is a functionality that allows you to load JavaScript files, modify them, create new one, and then use them to generate dynamic code between customizable tags in .hpp, .cpp and .h files.

Figure 68. Code Generator basic button

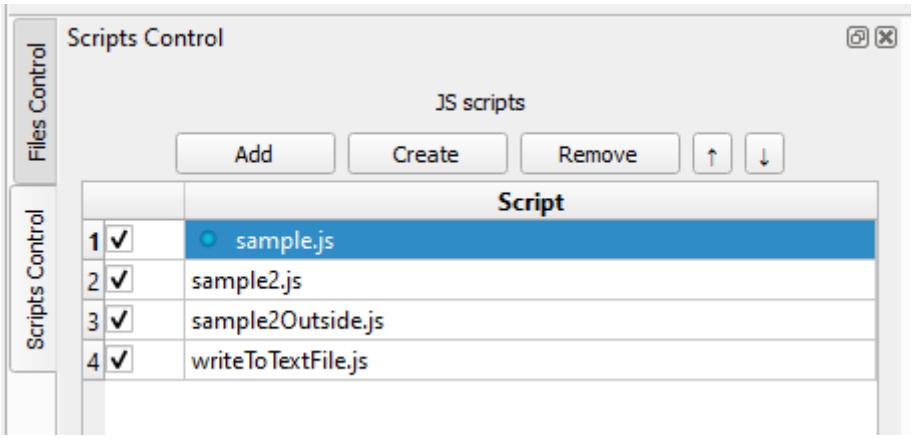


In Code Generator tab, there are 3 basic buttons. The first on the left is used to run all JS scripts, loaded to a project. The second in the middle is used to save single, selected script. And the last one saves all created or modified scripts.

4.1. Scripts Control

In this tab you are able to load existing JS scripts and open them in application (Figure 69). To load scripts from your computer, click *Add* button. To create new JavaScript script, select *Create*.

Figure 69. Buttons for Scripts Control



If you would like to remove loaded .js file from the Script list, select checkbox near desired item and then click *Remove* button – please note, it will remove all elements which have set checkboxes to true. All scripts on a list will

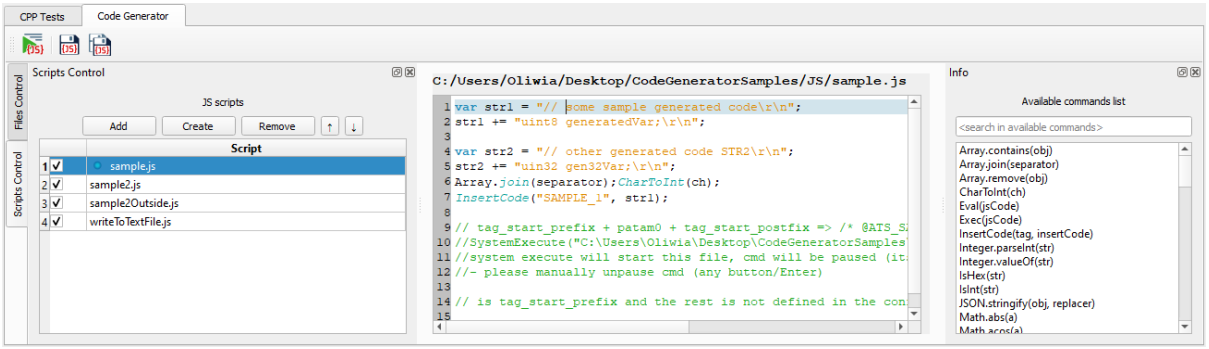
be executed in ascending order (from 1 to n). Down and up arrows buttons allow you to place particular .js file lower or higher on a list, which will cause changes in scripts execution order.

Besides removing actions, checkboxes are used also to enable or disable which files from the list should be executed while running the scripts – if you do not want some script to be executed but you want to save it on a list, simply uncheck the box. In this case, it will not be executed.

The blue circle (Figure 70) placed near the name of a file means that this file has been changed and stays unsaved. It will disappear after saving the script.

Going further, in the middle of the screen (Figure 70) there is a modifiable field with JS code. You can add commands from *Available commands list*, which is placed on the right side – just click the line and area, where you would like to have the command inserted and double-click the needed item from the list.

Figure 70. Scripts Control view in Code Generator



To sum up, by modifying JS files there is a possibility to interact with all the selected files and generate code from custom templates (by tags).

4.2. Files Control

Files Control basic buttons are used for importing files to the project, adding new, single files or removing the selected one (Figure 70). Files to import can be selected from Visual Studio projects or added separately by user.

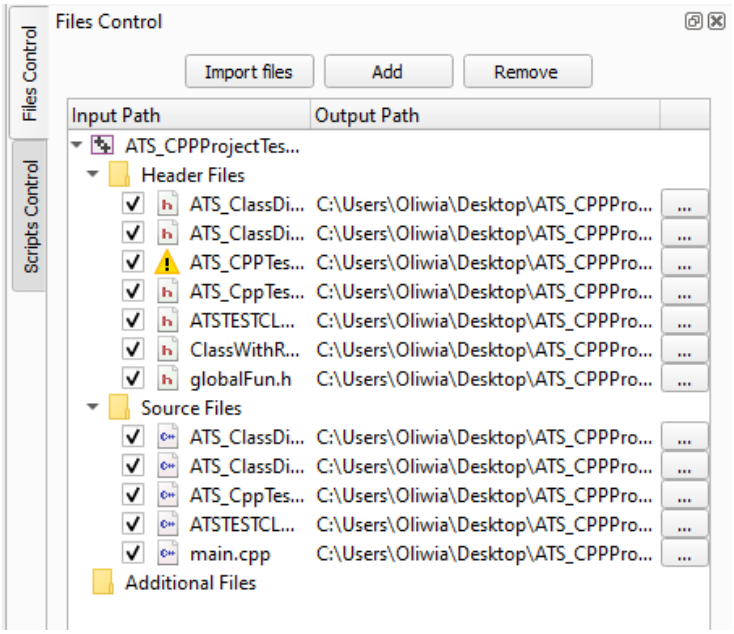
By using *add* button, you can add .h, .cpp or .hpp files to the project.

Remove button allows to delete checked files.

In the tree with imported files, you can find output path and a button „…" that allows you to manually specify an output path for JS methods (InsertCode, ReplaceCode). When these methods will make any changes to the files, those changes will be saved just in this output path. It is set by default to the path of the imported file.

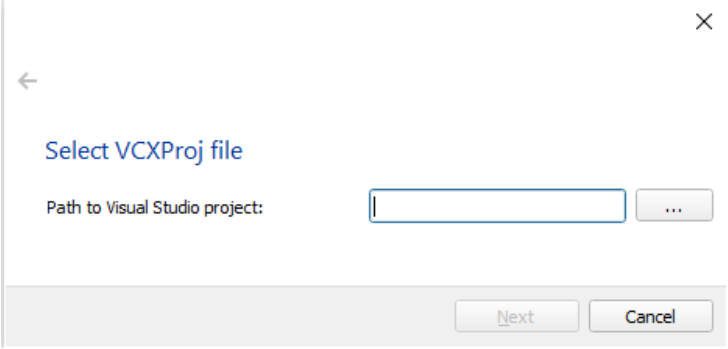
Yellow triangle with an exclamation mark inside informs about warning – a file cannot be found.

Figure 71. Basic button in Files Control



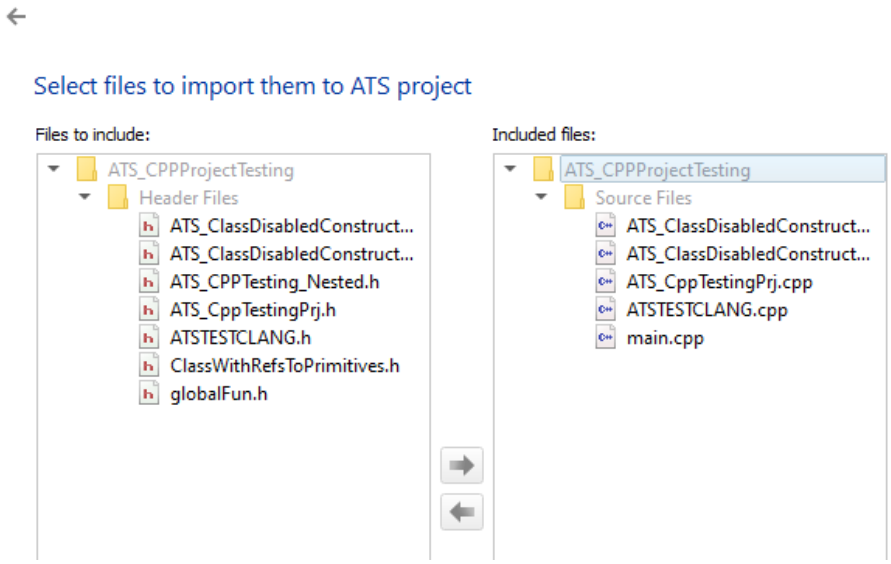
Clicking *Import files* button opens new window with selecting VCXProj file.

Figure 72. Selecting file to import in Files Control



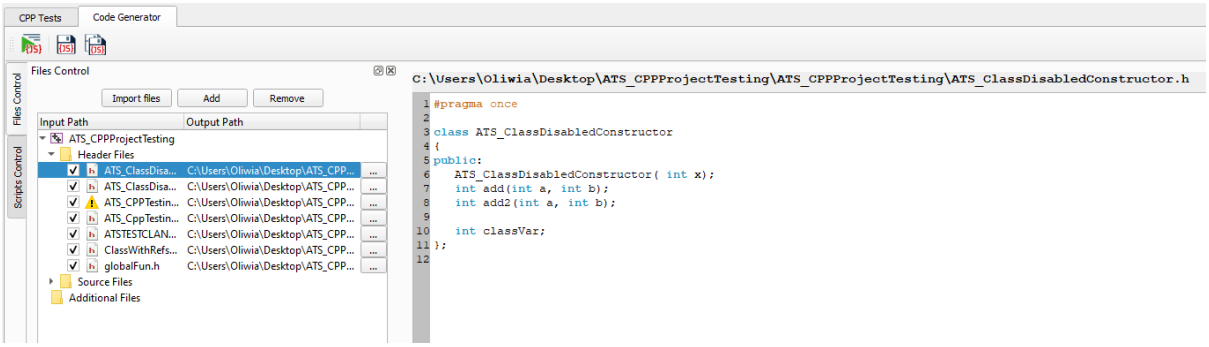
By going „*Next*”, there is a window that allows you to choose files, that you would like to include in a project (Figure 73) – you can select single elements or whole folders. To include them, select the item and click the right arrow. It will move the content of the selected item to the right side „*included files*”.

Figure 73. Selecting particular files to include in Files Control



At the end of the importing process there should be displayed a window with information that the importing was successful. Such imported files will be displayed in a tree and selecting one of its items displays the code of the file in the field on the left (Figure 74).

Figure 74. Files Control view in Code Generator



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