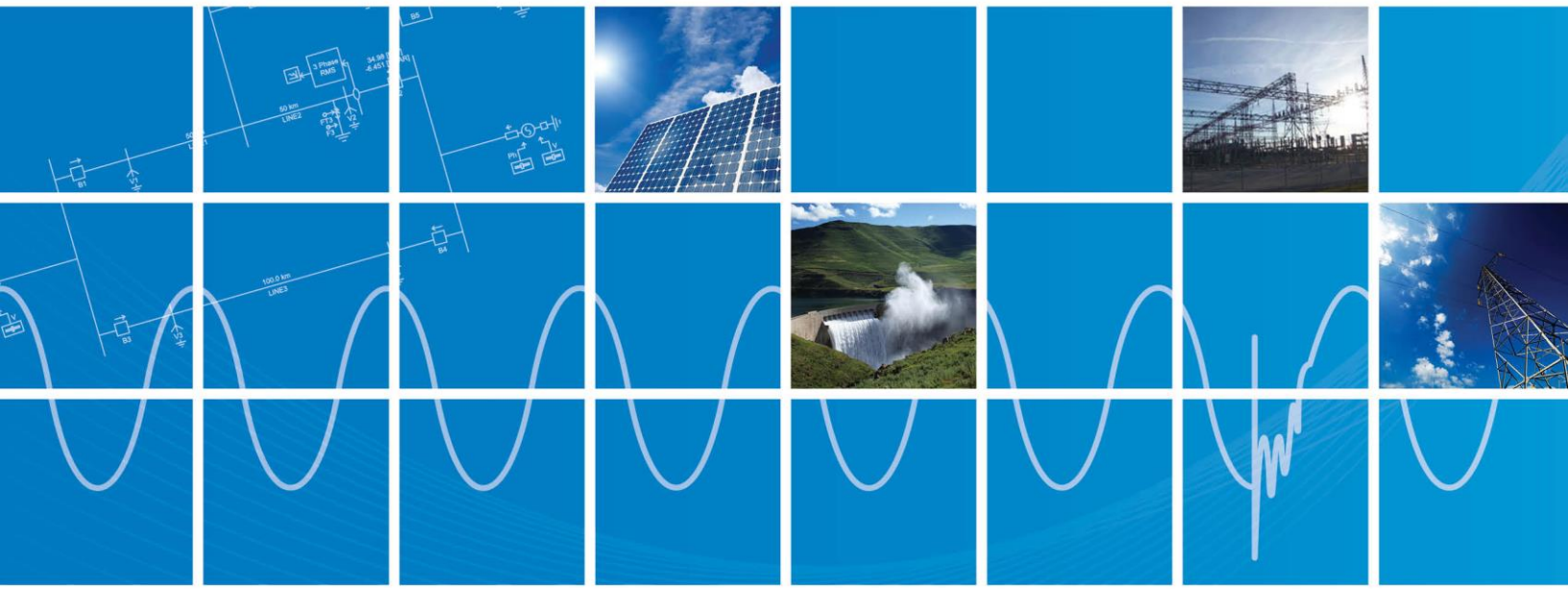
What's New in PSCAD v4.5.0

(As of June 12, 2012)

Written for PSCAD™ X4 version 4.5.0



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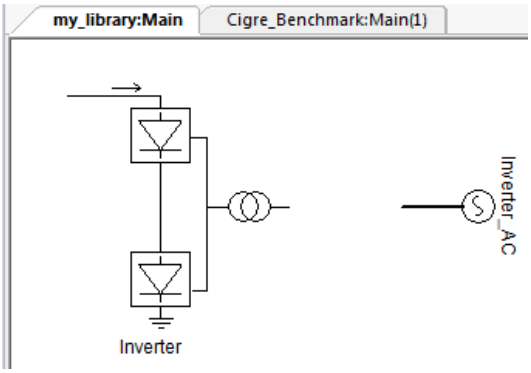
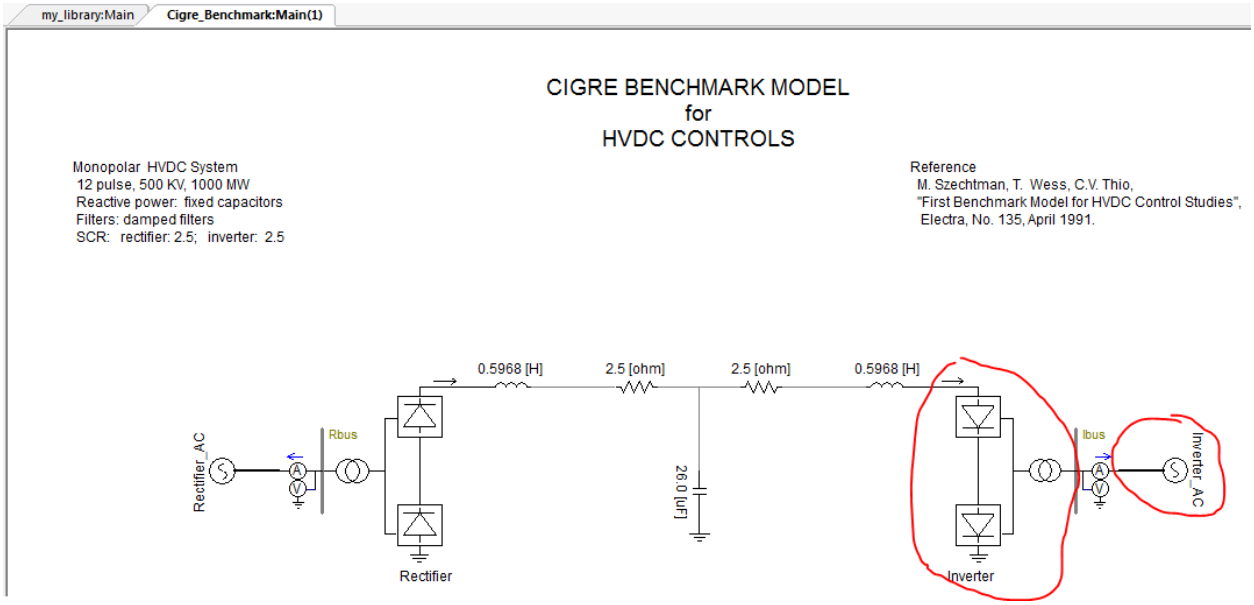
PSCAD

New Features & Enhancements:

1. **Inter-Project Module Instances**: Module components no longer require their definitions to reside in the local project: Entire module hierarchies and their corresponding definitions can be stored in a library project and instantiated to multiple projects.

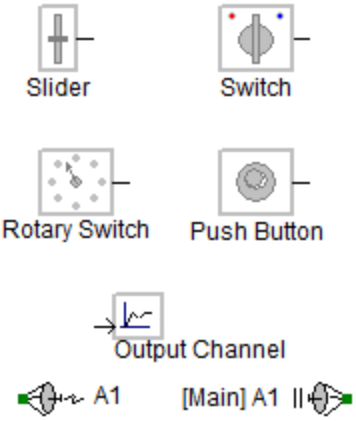




When a case project containing page module instances sourced from another project is compiled, the definition information is extracted from the external project and utilized in the same manner as if the module definitions were stored locally. Both a Fortran (*.f) and Data (*.dta) file for each external module is generated and placed in the local temporary folder.

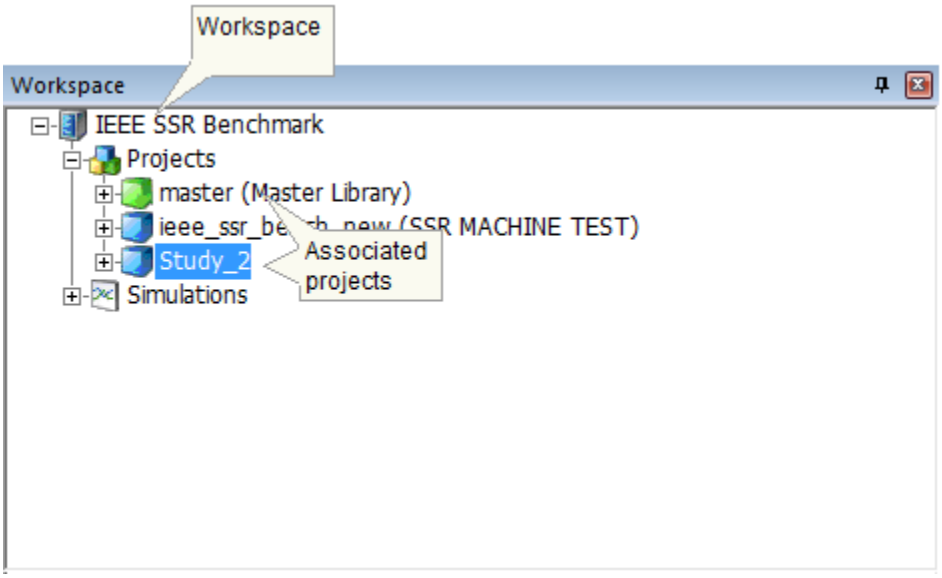
Restrictions:

Runtime objects and radio links are not fully supported when using inter-project module instances with multiple, simultaneous project runs. That is, if two or more projects containing an instance of a module linked to the same definition are run at the same time, you may experience source contentions.



These Components Should Not Appear in Inter-Project Module Instances

2. **Multiple Workspaces**: PSCAD now supports multiple workspaces: In past versions, the workspace and the application itself were inextricably linked together as one compete unit. Now, the application and the workspace have been divided into separate entities. What this means from the user's perspective is that entire workspaces may be loaded, saved and unloaded without having to close the application. A single workspace may house multiple projects, including both libraries and cases, as well as possessing its own unique setting options.



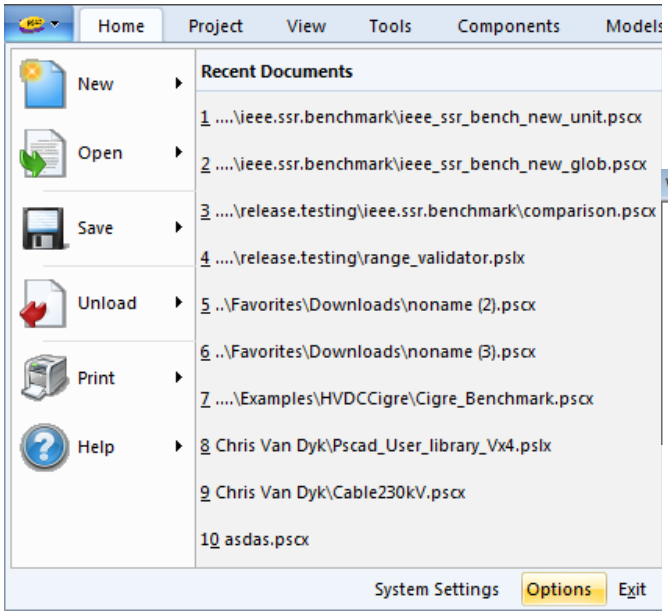
If the user has multiple study projects on the go, the projects related to each study can be encapsulated into unique workspaces, which may then be swapped in and out of the application. Note that only a single workspace may be loaded at one time.

When first starting out in v4.5.0, a workspace called *Untitled* will appear, with the master library project included, as a default. PSCAD will remember which workspace was last loaded when the application is closed, so if you initially choose not to use the multiple workspace concepts, you may continue to work within the *Untitled* default.

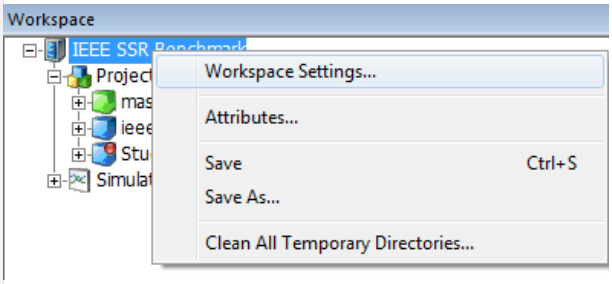
Workspace files are stored under the extension **.pswx*.

3. **Application/Workspace Options**: Due to the separation of the workspace and the application (as explained above), the settings dialog formerly known as the *Workspace Settings* has been separated into two dialogs: *Application Options* and *Workspace Options*.

   These dialogs can be accessed as shown below:



Accessing Application Options



Accessing Workspace Options

4. **Workspace-Level Control**: Pending.

5. **64-bit PSCAD** is now here! A separate software product, the PSCAD 64-bit application directly addresses the 'Out of memory' issue that some power users have experienced when attempting to run very large simulations: If a simulation exceeds the allocated process memory of 2 GB (imposed by the Windows 32-bit operating system) then the simulation will crash, resulting in lost time.

   It is important to note that although a 64-bit application will open up an enormous memory space (8 TB or 8,000 GB) the speed of execution is not affected. That being said, any machine that may be constrained by memory limits may see a big speed improvement with the added room: Speed improvements are tied to the memory loading, rather than the memory capacity.

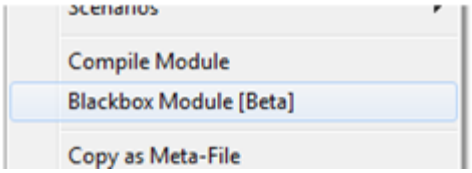
6. **Black Boxing**: A new feature has recently been added to the PSCAD beta product, referred to as black boxing. With a simple click, this feature will convert any page module* into an equivalent, non-module component, complete with generated source files and/or compiled binary files.

   Black boxing allows users to design their systems graphically, and then quickly black box the system, thereby protecting their intellectual property when distributing their models to clients.

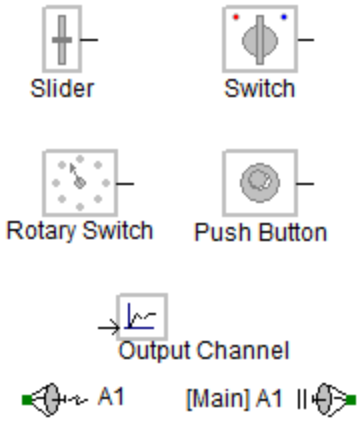
   The black boxing algorithm performs the following functions automatically:

   - *FORTRAN Source Generation*: PSCAD already generates FORTRAN source, however this code is written specifically to interact with EMTDC as part of the greater simulation project, and is not formatted to be used as external source. The black box function will generate FORTRAN source code specifically formatted to be used as external source for any EMTDC simulation.
   - *Automatic Object/Library file Creation*: The option to compile the generated source file into an object file is provided.
   - *Automatic Component Creation*: A new, non-module component definition and instance is created, based on the contents of the module hierarchy. This includes ports, parameters, graphics and script segments.

   The feature is invoked simply by right-clicking on a module component and selecting *Blackbox Module*.



   <u>*Restrictions:*</u>
   Runtime objects and radio links are not supported by the black boxing feature, and so therefore the module schematic cannot contain any of these components.



None of These Components are Supported When Black Boxing

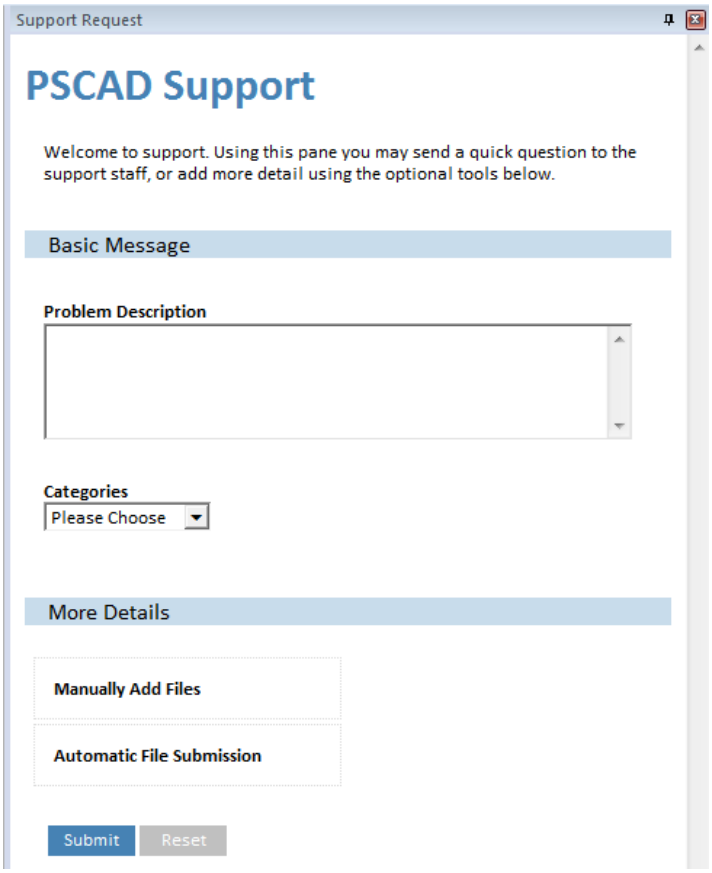
If the module you want to black box contains some or all of these components, then they must either be removed and/or substituted by supported components.

Child Module Components
The module component you are black boxing cannot contain any module components on its schematic. However, you can work around this by black boxing the child modules first, and then black box the parent.

Transmission Line Components
The module component you are black boxing cannot contain any transmission lines or cables.

**Electrical Components*
Presently, the black boxing feature does not support electrical components on the schematic (purely controls only).

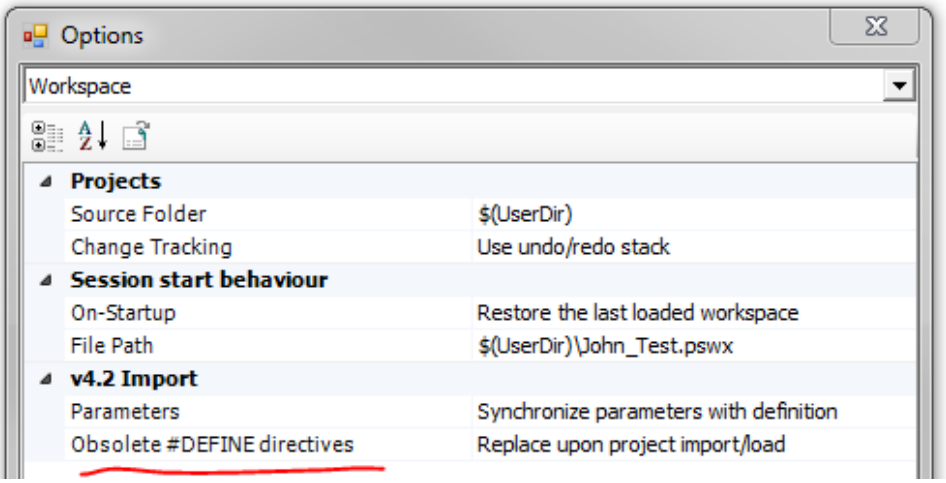
7. **Enhanced User Petition Request**: The former Support Petition Request dialog has been improved with additional features. New enhancements include the ability to manually attach files, as well as automatic collection and attachment of key files necessary for debugging of customer installation and licensing problems.



8. **Output Window**: In order to alleviate the burden of displaying runtime messages coming back from EMTDC in the message table, a new *Output* window was created. This is essentially a log file, to which all EMTDC runtime and non-standard messages have been redirected.

   This is a much better forum for these types of messages, as it is far easier to read, and the messages are presented in the log file as they were meant to appear. Also, the message table, which is designed to house navigable messages, is less cluttered and more manageable than before (#3530).

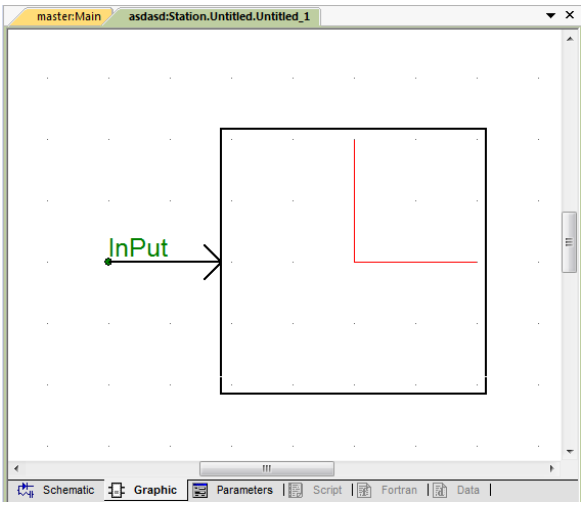
9. **#DEFINE script directive**: The obsolete #DEFINE script directive can now be removed automatically from your custom component definitions. Simply import (v4.2 and previous) or load your library and case projects into PSCAD, after you have adjusted a new *Application Setting*:



   This enhancement is disabled by default (#3490).

10. **Case Sensitive Passing Parameters**: In preparation for future developments, passing parameters are now case sensitive. A passing parameter is defined as any signal that is passed into a child page module from its parent. This can include either parameter or port signals.

    As a result of this change, you may experience compile errors when loading older projects loaded into v4.5. This easily fixed, as these errors are usually the result of a case-mismatch between a port/parameter and its corresponding import/export tag.

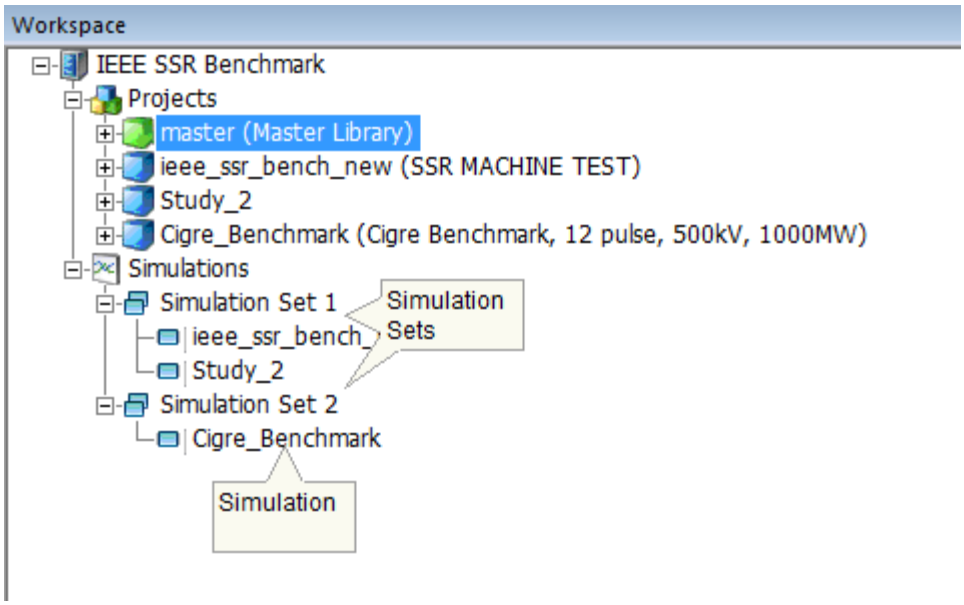


Signal Created in Graphic Section called '**InPut'**

Corresponding Import Tag on Schematic Called '**Input'**

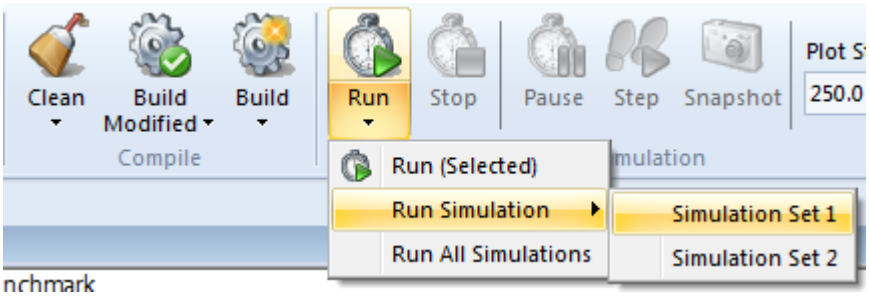
Note that this functionality may be controlled via the the *Workspace Option* called *Import/Export Tag Matching* under the *Build* category.

11. **Simulation Sets/Multiple EMTDC**: It is now possible to simultaneously launch and run multiple EMTDC simulations. Both sequential and parallel simulation runs is possible via the defining of what are referred to as 'simulation sets' in the workspace.

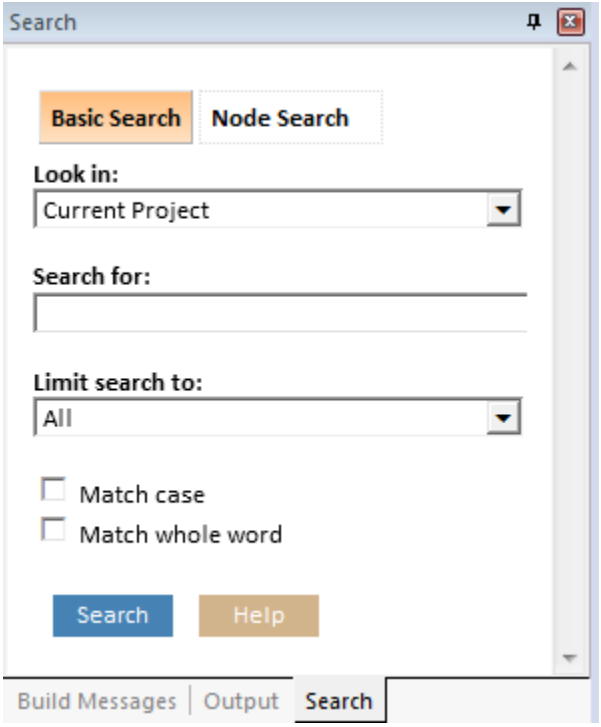


Only projects loaded under the Projects branch in the workspace may be added as a *Simulation* in a *Simulation Set*. All *Simulations* in a particular set will be launched simultaneously, utilizing the all processor resources available. Each set is run sequentially: In the image above for example, *Simulation Set 1* will launch and run the *ieee_ssr_bench_new* and *Study_2* projects simultaneously. Once finished, *Simulation Set 2* will launch and run the *Cigre_Benchmark* project.

Control for multi-EMTDC can be found in both the Simulations right-click pop-up menus, as well as on the *Run* button in the ribbon.

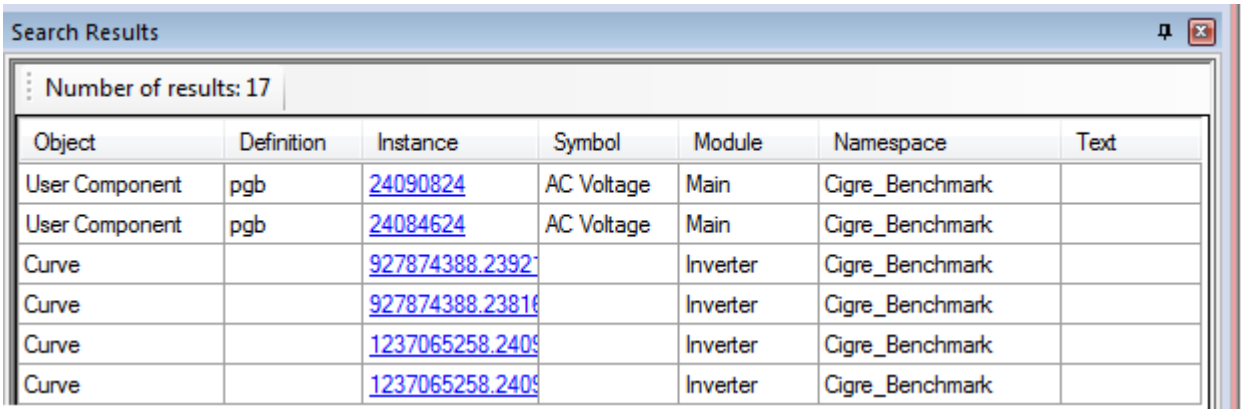


12. **Search Interface Redesign**: The search interface introduced with PSCAD v4.4 has been redesigned based on user feedback. The user-interface itself has been reformed to use less real estate, and simplified for ease of use.



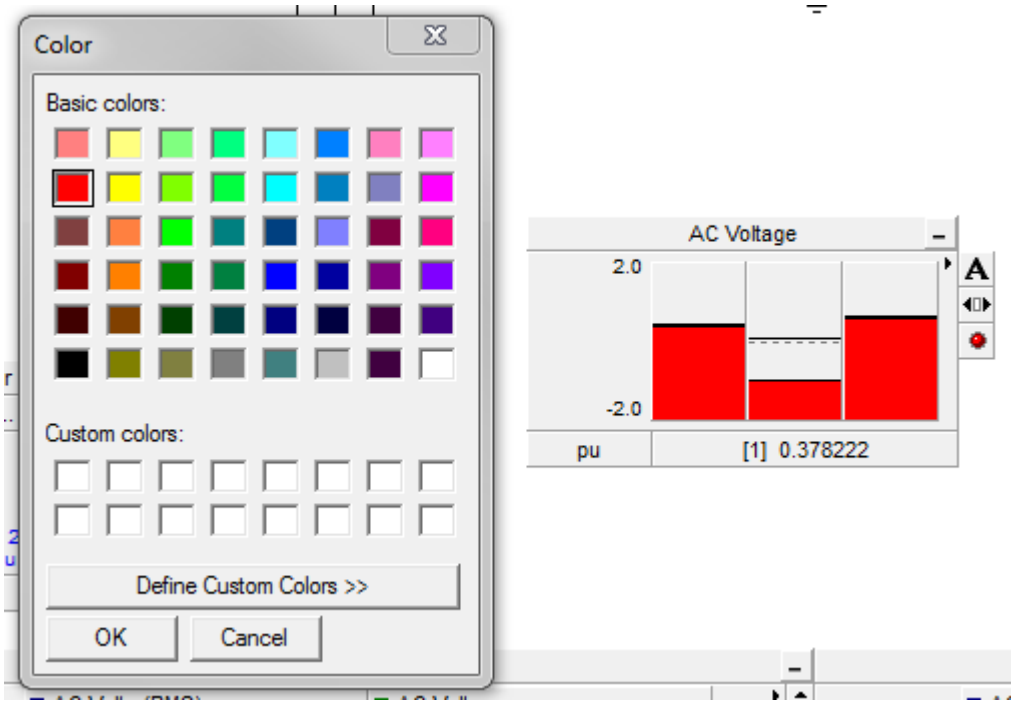
New functionalities include enhanced scoping (users may search based on project or specific module), as well as 'Match case' and 'Match whole word' options. Also, the 'Node Search' functionality has been added to the same interface.

The search results have also been redirected to an enhanced result table format, including limited aliasing to decipher the XML element, parameter and attribute names that are returned. This results in a much more understandable results list:

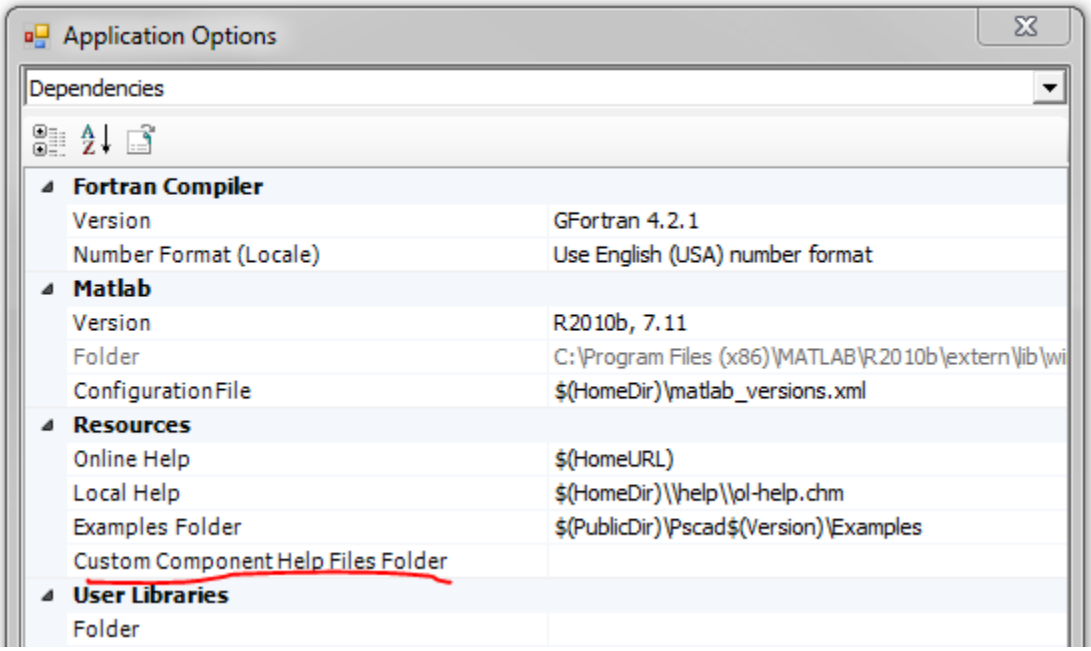


Object	Definition	Instance	Symbol	Module	Namespace	Text
User Component	pgb	24090824	AC Voltage	Main	Cigre_Benchmark	
User Component	pgb	24084624	AC Voltage	Main	Cigre_Benchmark	
Curve		927874388.2392		Inverter	Cigre_Benchmark	
Curve		927874388.2381		Inverter	Cigre_Benchmark	
Curve		1237065258.240		Inverter	Cigre_Benchmark	
Curve		1237065258.240		Inverter	Cigre_Benchmark	

13. **Polymeter Gauge Colour**: A new button has been added to the right-side popup menu of the polymeter to enable gauge colour customization. The colour can be unique to each, individual polymeter device in the project (#1074).



14. **Global Path for Custom Help Files**: PSCAD now provides the ability to specify a folder location for all user-defined component help files. The folder path can be specified in the *Application Options* dialog under the *Dependencies* category. This path is left blank be default, and if no folder is specified, it is assumed that specific help files are located in the same folder as the project where the corresponding definition resides (#3814).



15. **#VERBATIM Script Directive**: This directive is used to pass a line of script directly into the Fortran file from a component, unmodified and unprocessed. This is helpful in situations where users would like to insert custom directives, etc. into the PSCAD generated Fortran code.

    The #VERBATIM directive should appear as follows: #VERBATIM {<Text>}

    <Text> can be any line of text, such as a comment, compiler directive or source code. <Text> will appear in the Fortran file generated by PSCAD exactly as is (ie. verbatim).

```
! Caution should be exercised as ANY line of code will be
! written to the Fortran file, be it Fortran compatible or not!
!
! PSCAD Script:
!
#VERBATIM {! This is a comment line.}
#VERBATIM {  X = 1.0 ! This is a line of Fortran code.}
#VERBATIM {@#$%^&*!& This is a line of rubbish.}
!
! Appears in Fortran File As:
!
! This is a comment line.
  X = 1.0 ! This is a line of Fortran code.
@#$%^&*!& This is a line of rubbish.
```

Bug Fixes:

1. The copy, cut, paste and delete ribbon buttons now function while in the definition script editor (#3626).
2. Pasted text in the definition script text editor no longer is pasted twice when copied or cut using the Ctrl + x or c hotkeys (#3067).
3. The scenario manager now checks new scenario names using a case insensitive approach (i.e. if a scenario BASE exists, you cannot create a new scenario as BaSe) (#3647).
4. New scenario names are now trimmed of preceding whitespace, in order to avoid resulting problems (#3649).
5. Changes to graphic object fill colour will now be reflected immediately upon closing of the edit properties dialog (#3565).
6. Control interfaces now respond properly to mouse wheel action when corresponding workspace option is enabled (#3667, #3694).
7. Node dimension mismatch is now detected if connecting a multi-meter component between a x-phase and a y-phase circuit (#3633).
8. Overlaid sticky notes now retain their layout order when copied/pasted (#3639).
9. All three places to modify the project plot step now synchronize properly (#3675).
10. Ribbon bar no longer enters 'flakey' state during inter-project navigation while minimized (#3664).
11. The support request dialog is now launched in a non-modal state (i.e. you can work in PSCAD while this dialog is open) (#3577).
12. Ribbon button page size option list now indicates present the state when selected (#3638).
13. The base scenario can no longer be deleted (#3646).
14. Improper error message removed when viewing component, electrical and/or signal tables (#3609).
15. Graphic editor rectangle object behaviour is now consistent with other graphic objects (#3215).
16. Multiple, smaller selected components can now be moved via mouse drag while inside the bounds of a larger component (#3645).
17. Build messages 'unresolved output record' are now navigable (#3686).
18. Browse button for linking *.lib and *.obj files in library projects is now enabled (#2817).
19. PSCAD no longer throws a managed code exception when browsing to an off-canvas component (#3712).
20. Save as… has been removed from the scenario popup menu within the scenario manager dialog, due to functionality issues (#3721).
21. The 'none' option that appears in the component resource link no longer appears unless there is no definition to link to (#3619).
22. Transmission segment editor canvas now possesses its own canvas settings dialog (#3672).
23. Redundant view compile log menu item has been removed from project popup (#3610).
24. Undo/redo now functions properly following copy/paste of multiple selected components (#3743).
25. PSCAD no longer disables graphical state animation on load of an older project (#3685).

26. Signals created by constant tag components are now labelled as constant. This means that these control signals can now be ported through *Constant* type module parameters (#3454).
27. The contention between multiple group select (via Ctrl + left click) and copy drag (Ctrl + left mouse drag) has been alleviated. When the Ctrl key is depressed, the mouse pointer must now move at least 5 screen pixels before a copy event occurs (#3783).
28. Multiple group select can now be accomplished by combining both single component select and/or box select, so long as the Ctrl key remains depressed (#967).
29. Navigation from the message table (via a message hyperlink) will now work properly even if the project that generated the message is not in focus. Clicking the message link will now force the source project to open, so that the message source can be seen (#3616).
30. PSCAD now allows a project 'Save As…' when the project file name contains a period '.' character (#3700).
31. It is no longer possible to inadvertently add multiple values for a single control in the scenario manager, by attempting to add two scenarios of the same name (#3526).
32. Navigation from the component, control signal and electrical signal table is now functioning properly (#3591).
33. The name 'pscad' is no longer a valid project filename or namespace and has been restricted (#3779).
34. Node type-based line thickness is now functioning properly (#3323).
35. Minimized graph frames are no longer repositioned on project compile/run. The minimized and maximized canvas positions are stored separately (#3153).
36. It is no longer possible to rotate groups of components from inside to outside the canvas bounds (#3502).
37. An option to directly create a digital stacked polygraph with signal has been added to the output channel right-click menu, under the Graphs/Meters/Controls menu item (#3796).
38. Bus related warning messages that formally provided no hyperlink, are now navigable (#3757).
39. Changes to message table column layout are now saved (#3607) and will be remembered when PSCAD is restarted.
40. Component definitions are now re-linked properly when older, xml-based projects are loaded (#3804/#3552).
41. A new application option was added (called 'Tab Appearance') to control the project tab colour scheme, thereby enhancing view clarity when many cases are loaded in the workspace. Options are 'multi-coloured' and 'monochrome' (#3461).
42. The parameter editor test dialog now functions properly by considering conditional statements to enable/disable parameters and categories (#3572).
43. Fixed a parameter value population issue with component definition relinking when importing an older project file (#3805/#3806).
44. The 'save changes before building' workspace option is now functioning properly (#3666).
45. Unnecessary buttons in the global substitutions dialog have been removed (#3057).
46. Detailed output viewer drop list is no longer missing from the viewer menu (#3714).

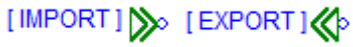
47. The workspace secondary window display has been given more flexibility: Options have been provided to toggle display of transmission lines/cables, as well as to toggle the display of namespace. Both options can be found in the application options dialog (#3533).
48. Parameter symbol names no longer get renamed when a parameter or category is copied to another definition with a parameter of the same name. This includes the transferring global substitutions (#3568).
49. The allowable plot step precision has been increased from 6 to 12 (ex. plot step = 19.531257845 is valid) (#3824).
50. Selection of multiple components via ctrl + left click now functions properly: Selecting canvas no longer deselects group and new objects can be easily added provided ctrl key remains depressed (#2842).
51. Proper options are now given if the snapshot file is missing at the start of the simulation. (i.e. start from time = 0.0 or abort) (#3677).
52. Component wizard help balloons have been re-worded to make more sense (#3589).
53. The EMTDC run process will now abort if any line constants program build errors are issued (#3508).
54. Node search no longer results in a crash if searching for a node whose associated wire or bus has been removed (#3869).
55. PSCAD no longer displays both search and query results windows on new installations (#3656).
56. Visual indication is now provided on running projects as a green 'play' symbol on the corresponding project icon (#3455).
57. PSCAD no longer crashes if an illegal EMTDC output file name is specified (#3884).
58. Sticky notes now retain their layering priority (i.e. foreground/background state) when the project is saved (#3755).
59. Fixed problem involving missing parameter values in imported case projects (#3766).
60. Missing additional Fortran source file names are now properly displayed in error message (#3518).
61. PSCAD will now adjust the destination canvas size setting accordingly when pasting a circuit that is larger than the current canvas size (#3724).
62. EMTDC no longer crashes if using the GFortran compiler and the project description contains an apostrophe (#3885).
63. PSCAD will now always use the exact snapshot file that the 'Input File' field is pointing to, regardless of compiler setting (snapshot files are compiler independent) (#3608).
64. The status bar will now display only information related to the project currently in view (#3470).
65. Scenario manager error messaging has been refined to be less cryptic (#3894, #3895).
66. Table-type parameters no longer require data to be enetered twice in order for it to stick (#3556).
67. File association extensions may now be entered as either '.<extension>' or simply '<extension>' (#3836).
68. PSCAD no longer improperly issues unresolved output record warnings when no observers are associated with an output signal (#3882).
69. Oversize canvas size can now be selected directly in the component wizard (#3680)

70. Orphaned wire graphics are now cleaned from canvas (via a refresh) on escape from wire mode (#3811).
71. Multiple run/optimal run output viewer now has an additional category for viewing initial seed used in random number generation (#3365).
72. The *Browse...* button dialog in the project settings link tab now includes *.o file extensions as part of its default file list (#3910).
73. Curve legend and control interface display text is now parsed properly when displayed in graphs and control panels. This means that names based of a substitution (ex. $(freq)) will display the subsitituted name (#3581/#3904).
74. Messages no longer appear interlaced (jumbled) in the message table when running multiple projects simultaneously (#3468).
75. Conditional statement 'evaluate' error no longer stops access to editing component definition (#3640).
76. Table parameters now display default cell values when initially created (#3559).
77. Node search returns results if only a node number is entered (or if only a subsystem number is entered) (#3946).
78. Creating a new case in a folder restricted access rights no longer crashes PSCAD (#3964).
79. Performing project related commands while in print preview no longer causes erroneous behavour (#3985).

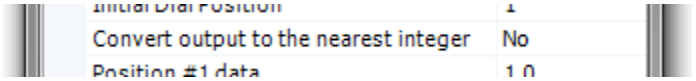
Master Library

New Models & Enhancements:

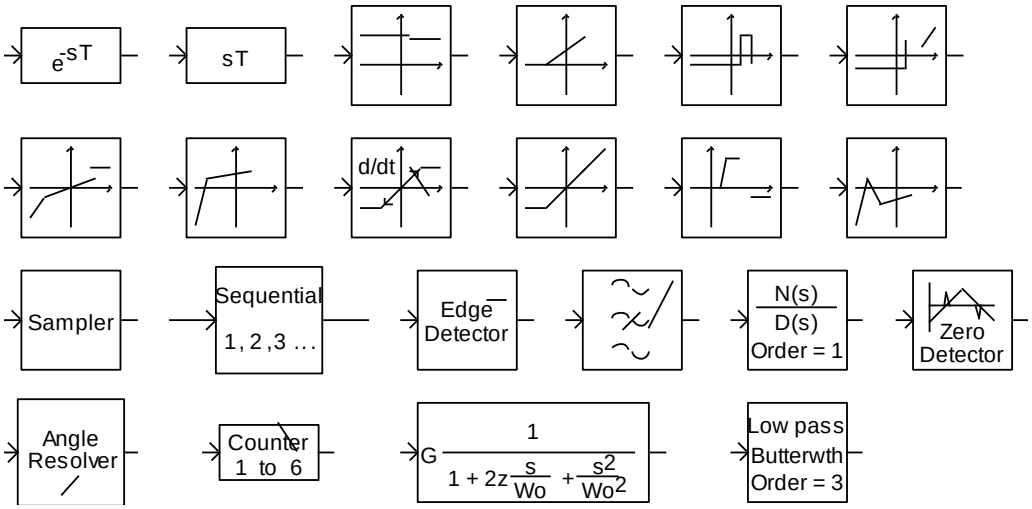
1. **Import/Export Tags**: Import/export components are now capable of displaying a label greater than 8 characters (#2295).



2. **Output Signal Type Conversion**: The switch, dial, range comparator, single-input comparator and two-input comparator components all now possess the ability to convert their output to the nearest integer (Fortran NINT). This alleviates the need for additional type conversion components when using these devices (#17/#1723).

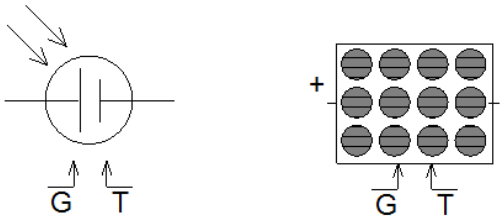


3. **Multi-Dimension CSMF Components**: The following CSMF components now support multi-dimension input/output. Note that in cases where interpolation is enabled, the output will be an array where the odd elements represent the signal itself and the even elements represent the interpolated time for each signal.

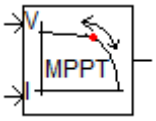


The dimension is entered within a parameter called Dimension.

4. **Aerial Cable Support**: Both the coaxial and pipe-type cable models, as well as the ground plane component, have each been modified to provide support for the new *Aerial Cables* feature.
5. **Photovoltaic (PV) Source**: The photovoltaic source component is assumed to consist of several strings of PV modules, connected in parallel; where each string could consist of a number of PV modules connected in series. All PV modules in the array are assumed identical.



6. **Maximum Power Point Tracker**: This component is used to track the maximum power point (MPP) voltage of the Photovoltaic (PV) source.



7. **Exciter/Stabilizer Standard Upgrade**: The exciter and stabilizer models in the master library have been upgraded to support the IEEE 421.5 2005 standard. Previously, the highest standard supported was IEEE 421.5 1992.

Bug Fixes:

1. Fixed undefined neutral problem (node G2) in 3-phase, 4-winding transformer, when configured in 3-phase view with 2nd winding connected in star. Also fixed an error in passing leakage values as arguments of the CFG routine (#3713).

EMTDC

New Features & Enhancements:

1. **New Storage Arrays**: A new set of storage arrays (STXFRx) have been added to EMTDC, specifically for the support of feedback loop paths existing in control systems collapsed using the *Blackbox Module* feature. This array set mimics the functionality of the internal STOx arrays, and may be used as part of externally linked source code. These arrays may be used in all custom written code for support of feedback loops.

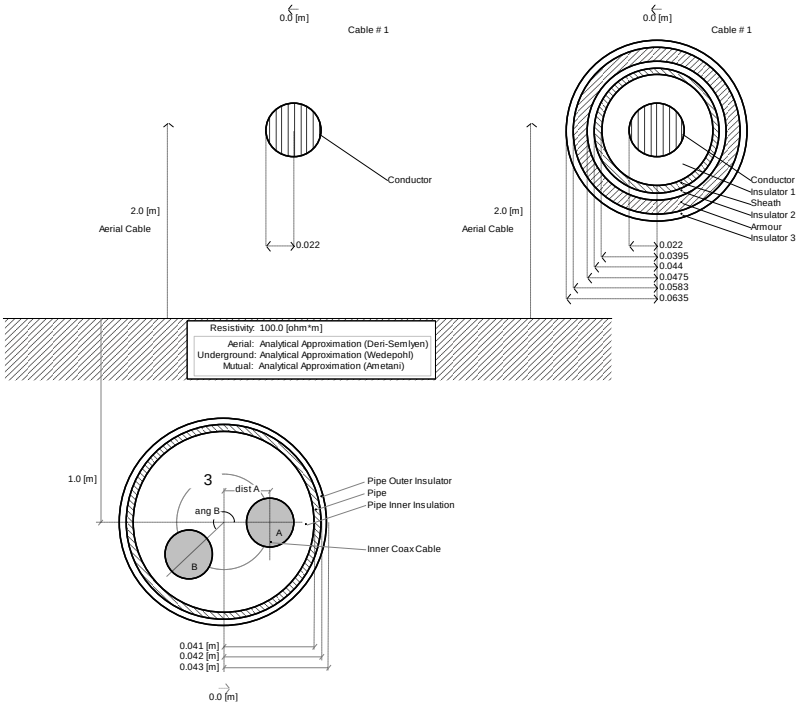
Bug Fixes:

1. The PQ meter animation update frequency has been modified to account for simulation run duration. For shorter runs, the display is updated at every 20% run increment. Longer runs are updated every 2 seconds real time (#3798).
2. EMTDC runs are no longer slowed due to an incompatibility problem between Intel process hyper-threading and the Intel Fortran Composer XE compiler (v12) (#3642).
3. PSCAD will no longer display a fixed percentual progress at 99% when simulating multiple runs from a snapshot file (#3690).

Line Constants Program (LCP)

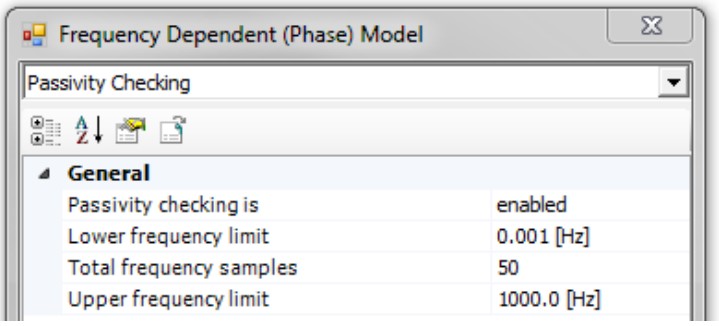
New Features & Enhancements:

1. **Aerial Cables**: It is now possible to combine both underground and aerial cables in the same right-of-way! The new feature affects mainly the ground plane component, where you must specify the formulae used for aerial, underground and mutual (underground/aerial) earth return representation. You must also specify in the coax or pipe cable components, whether or not they are aerial or underground.



Note that it possible to define the above-ground cables as bare, which is equivalent to an overhead line conductor. In other words, you can now effectively simulate overhead lines and underground cables within the same system. In the future, support will be added to allow actual tower components to be used to define the aerial cables (#2969).

2. **Passivity Checking**: The LCP now checks for passivity violations and if found, warns the user. New input parameters have been added to the frequency-dependent (phase) model for control of this feature (#3162).



Bug Fixes:

1. Fixed an inconsistent dimensioning problem between the potential coefficient and series impedance matrices, when modeling a bare underground cable (#3707).
2. The LCP will now produce an output file (*.out) when using the manual data entry component (#3303).
3. The LCP now outputs load flow formatted results when using the *Universal Tower* component. This is made possible by providing the ability to assign circuit numbers to conductor groups (#3324).
4. Fixed a bug involving the generation of a pi-section component from a cable. Additional off-diagonal, zero-capacitors was causing ideal loop issues (#3703).

Licensing/Utilities

Bug Fixes:

1. UpdateClient will now display error messages properly during product update and abort accordingly when the user has a temporary profile (#3723).
2. The FortranMedic will now warn if the ComSpec system environment variable is missing or incorrect (#3702).
3. The LicenseUpdate utility now logs a sufficient amount of information following a BadImage-FormatException (#3688).
4. FortranMedic now detects if Windows path is missing from the PATH environment (#3734).
5. License manager will no longer log 'uninitialized interface' message if no hardware lock is found (#3809).
6. Medic no longer generates incorrect required path due to IDE in system path (#3831).
7. Licensing will no longer log 'uninitialized interface' message if no lock found (#3809).
8. All open PSCAD instances now use a common licencing log file (#3793).
9. The support request dialog now displays a 3-digit product version (#3837).