QUICKWAVE 2020

SOFTWARE FOR ELECTROMAGNETIC/MULTIPHYSICS DESIGN AND SIMULATIONS

3D MODULE   V2D BOR MODULE
MULTIPHYSICS/MICROWAVE HEATING MODULE
OPTIMISATION MODULE   HIGH-Q MODULE
GPU/MULTIGPU MODULES
CAD DESIGN MODULES

QWED has continued efforts on extending availability, speed, and functionality of the *QuickWave* software for electromagnetic design as well as the scope of its applications.

New *QW-Modeller* for *QuickWave* allows preparing a complete V2D (BOR) axisymmetrical projects for electromagnetic simulation with *QuickWave* software.

Patch Antenna Array Module has been introduced as a response to increasing popularity of 5G communication systems, to provide the user with convenient tool for designing patch antenna arrays.

Our longstanding experience in EM modelling show that the simulation speed is an important issue. *MultiGPU* version of *QW-Simulator* allows now for very fast simulations of V2D (BOR) axisymmetrical problems with very high accuracy of the simulation results by taking advantage of extremely high performance of multiple graphic cards.

The effective and practically useful solution for simulation convergence monitoring has been introduced in QuickWave 2017. It utilises monitoring of the electromagnetic (EM) energy in the calculation model and automatically stops the simulation when it decays to a certain level. Such approach to running the simulation allows for reducing the number of performed FDTD iterations and as a result the computing time, without reducing a computational accuracy. This solution is now also available for complete S-matrix postprocessing (Smn).

To support young engineers in their researches, new *QuickWave* STUDENT Release package including design and simulations of V2D (BOR) axisymmetrical problems, has been released. *QuickWave* STUDENT Release is addressed to all who want to become familiar with and understand basic electromagnetic phenomena.
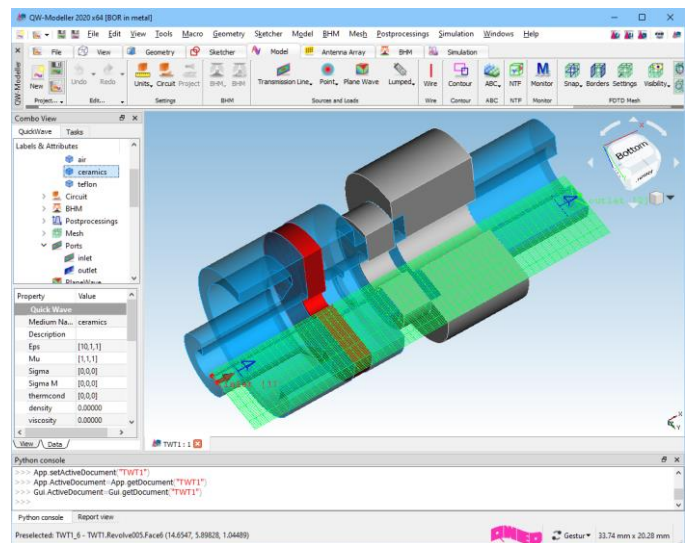
NEW QW-MODELLER

QW-Modeller for QuickWave is a plug-in (workbench) for the open source *FreeCAD* (http://www.freecadweb.org), general purpose feature-based parametric 3D CAD modeller with a modular software architecture, which makes it easy to provide additional functionalities without modifying the core system. The CAD capabilities of *FreeCAD* are based on the OpenCasCade® kernel, a professional-level CAD kernel, featuring advanced 3D geometry manipulation and objects.
QW-Modeller for QuickWave is free and can be used without time limitations or any restrictions for creating geometry, assigning the materials, adding ports, boundary conditions, setting mesh, excitation parameters, postprocessings, etc.

The *QW-Modeller* is based on the latest 0.18.4 version of FreeCAD migrated from Python 2 and Qt4 to Python 3 and Qt5, which introduces a lot of improvements in user interface and in geometry workbenches (Part, PartDesign and Sketcher).

V2D BOR Structures
In the newest 2020 version, *QW-Modeller* allows for preparation and configuration of simulation scenarios considering *V2D (BOR)* structures.
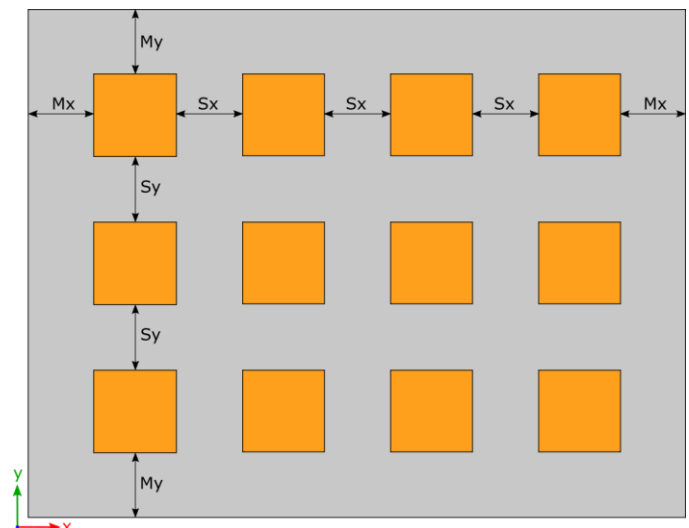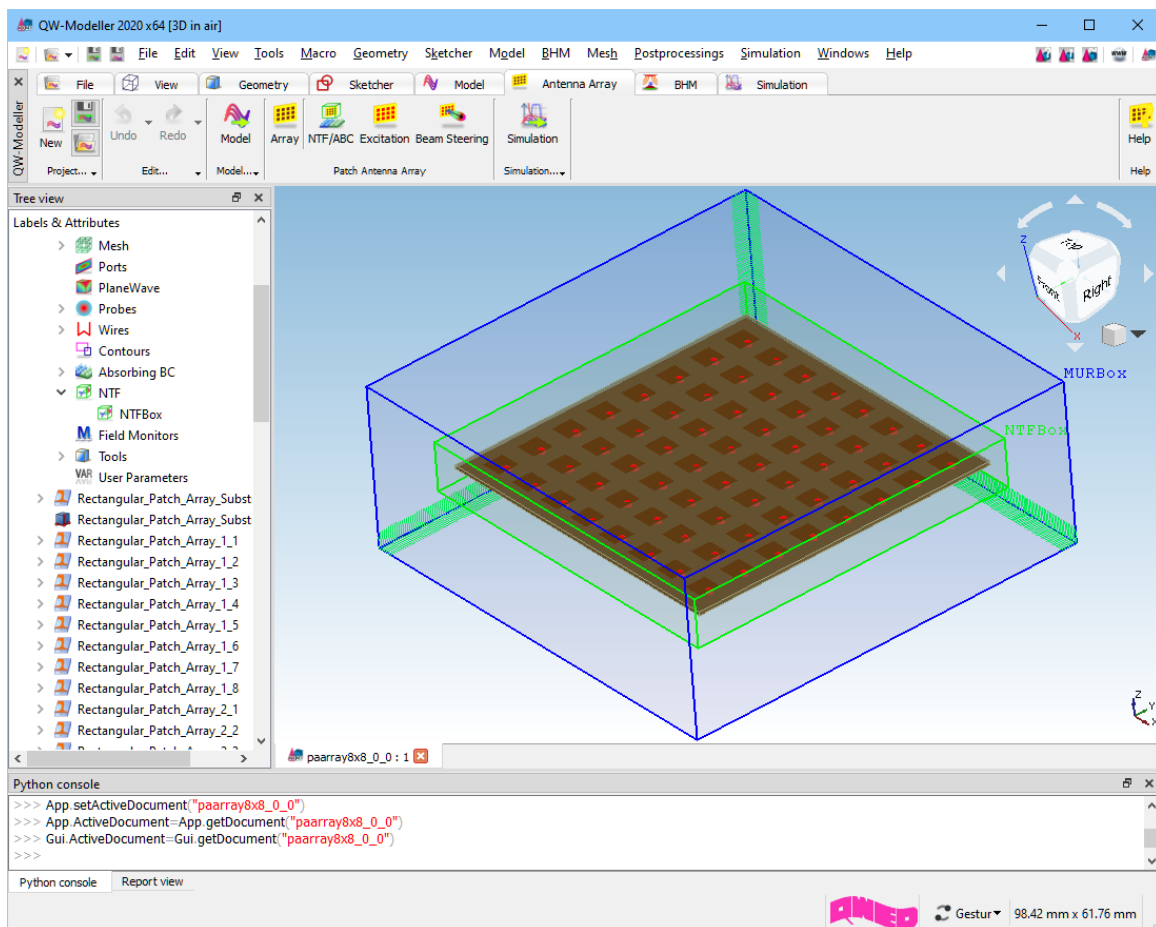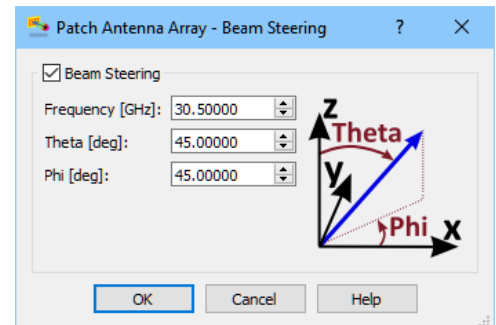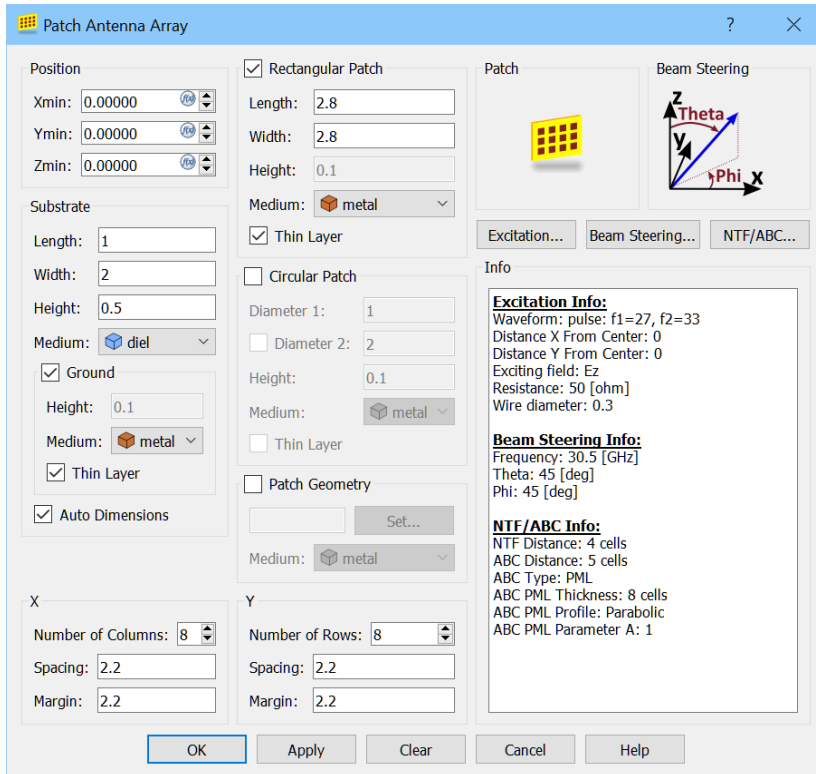

Path Antenna Array Module
Patch antenna arrays can be prepared in *QW-Modeller* as a finite sized $N_x \times N_y$ element matrices, arranged on a substrate of user-defined size. Each separate patch antenna is excited by a point port, placed in the middle of substrate height, joint with the wire connecting the patch and ground beneath the substrate. The direction of main radiation beam can be automatically steered by defining θ and φ angles, for which *QW-Modeller* calculates two-dimensional progression of the excitation signal delay (corresponding to phase shift) within all patch antennas.
There are three types of individual patch shape available:
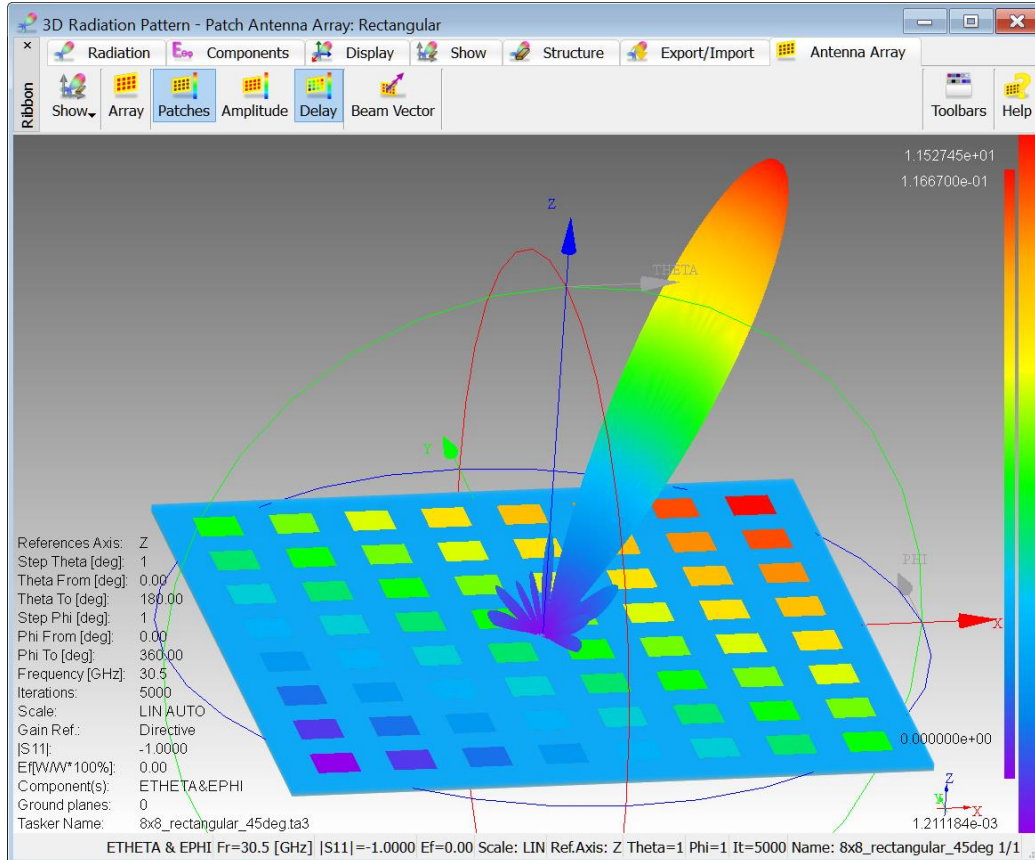
- *Rectangular*
- *Circular*
- *Geometry*

Patch antenna array with N_x=4 and N_y=3.

Rectangular patch antenna 8x8 array with beam steering

PATCH ANTENNA ARRAY MODULE

The Patch Antenna Array module allows for convenient analysis of planar antenna arrays with predefined direction of main beam direction. The Patch Antenna Array module consists of design part in *QW-Modeller* and results part in *QuickWave Simulator*. For patch antenna array scenarios prepared with dedicated functionalities of *QW-Modeller*, *QuickWave Simulator* provides visualisation of distribution of excitation parameters (amplitude and delay) across the matrix, together with 3D radiation pattern.

3D RADIATION PATTERN – PATCH ANTENNA ARRAY

The *3D Radiation Pattern* window allows for calculating and watching 3D radiation pattern results in a spherical coordinates. In the new *QuickWave 2020*, the *3D Radiation Pattern* window is equipped with additional display options dedicated to patch antenna arrays.

The distribution of excitation amplitude and excitation delay (corresponding to phase shift) across the array (for each excitation point) can be observed. In this new visualisation regime, the second colour bar, for visualisation of the colour palette and value range (from minimum to maximum) of the amplitude and delay, appears on right side of the display.
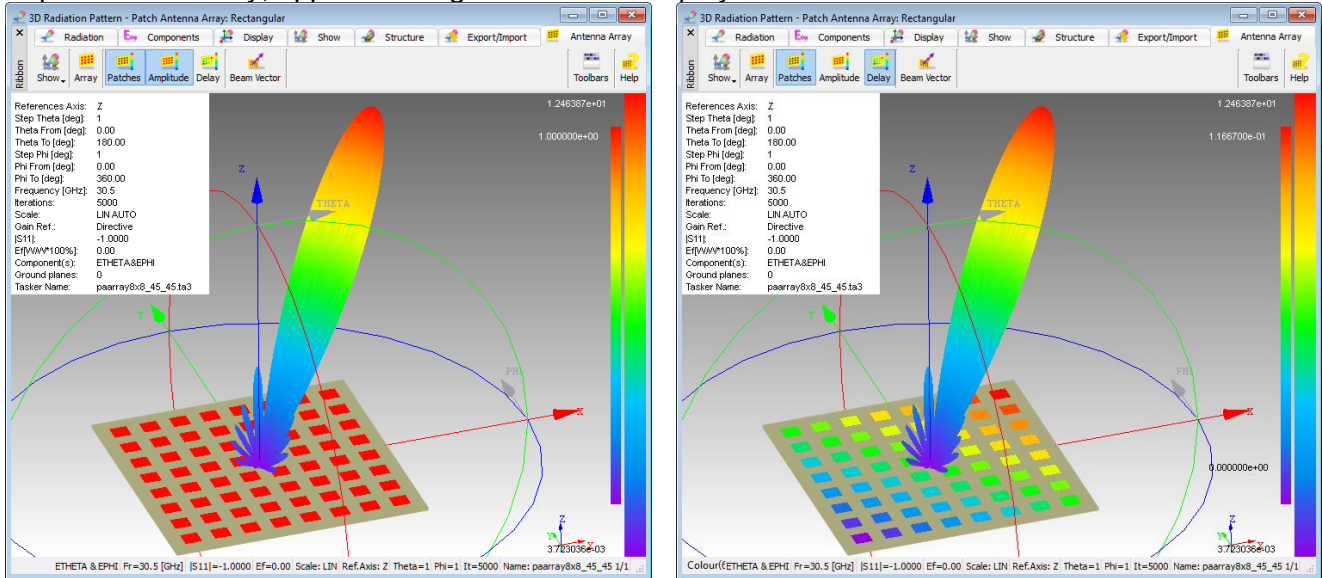

Additionally, a vector, indicating direction of main radiation beam, as specified by the beam steering parameters of the Patch Antenna Array module in QW-Modeller, can be also viewed.
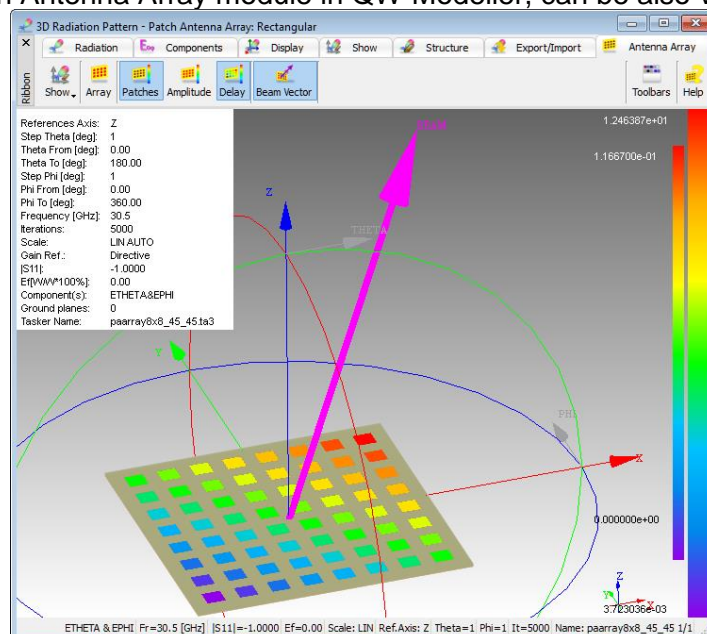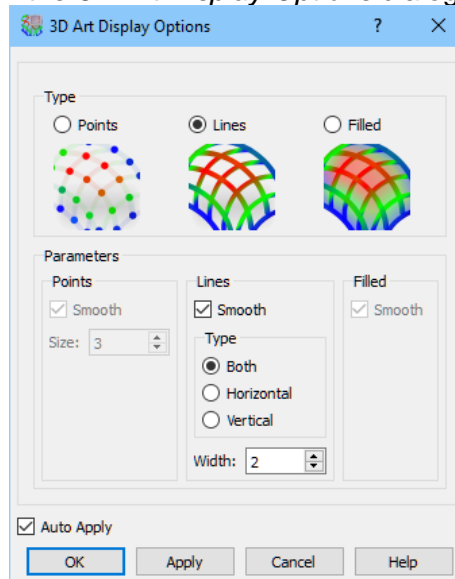
3D RADIATION PATTERN – NEW RADIATION PATTERN DISPLAY TYPES

Three types of display, Points, Lines (Horizontal, Vertical or Both), and Filled, in discrete and smooth versions, are available for 3D radiation pattern results.
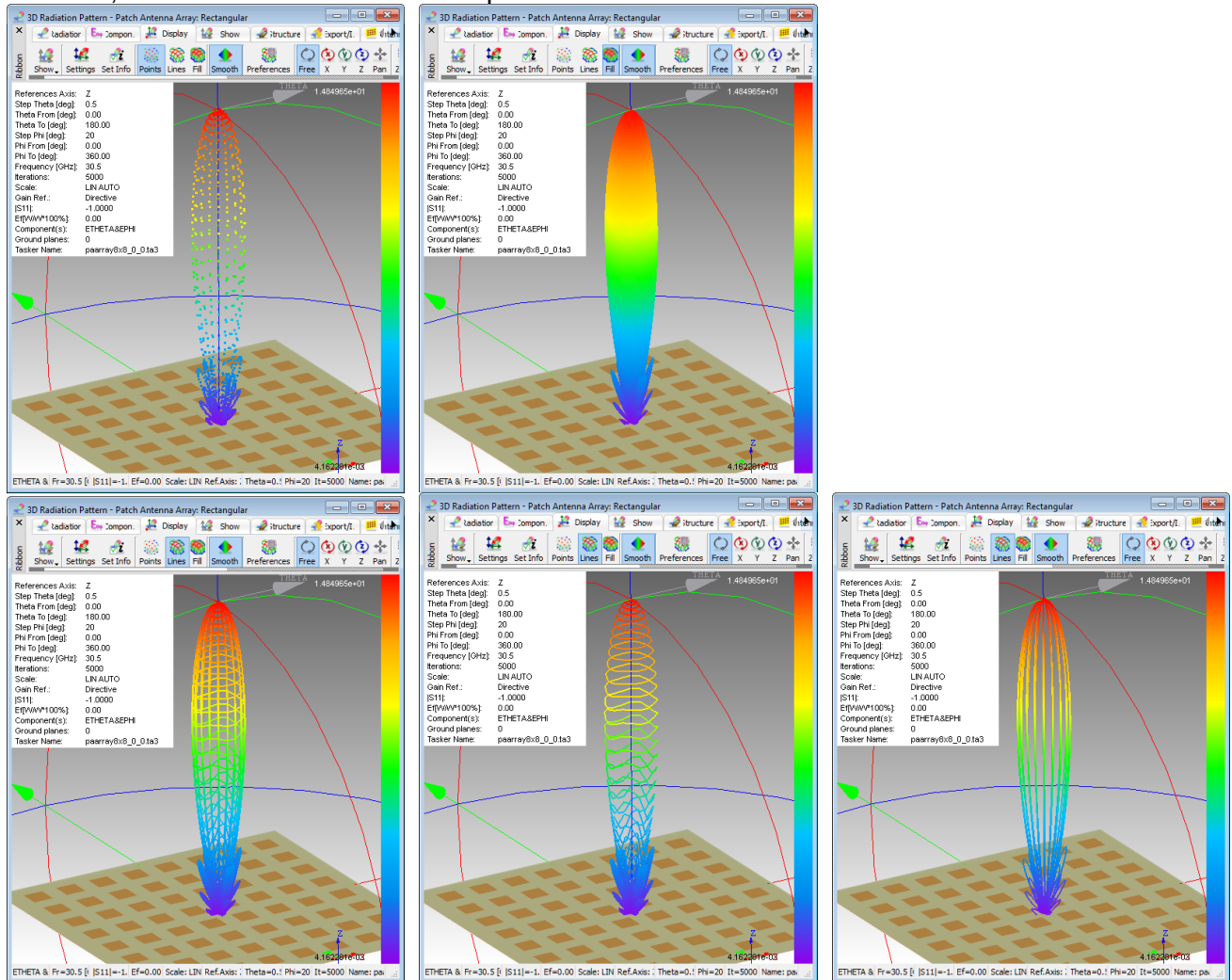

The display type can be chosen in the *3D Art Display Options* dialogue:

**3D RADIATION PATTERN – ADDITIONAL INFORMATION**

Configuration parameters of the calculated 3D radiation pattern can be viewed in the *3D Radiation Pattern* window using information table. The information table displaying parameters (i.e. position, background colour, text font) can be set in *Info Parameters* dialogue.
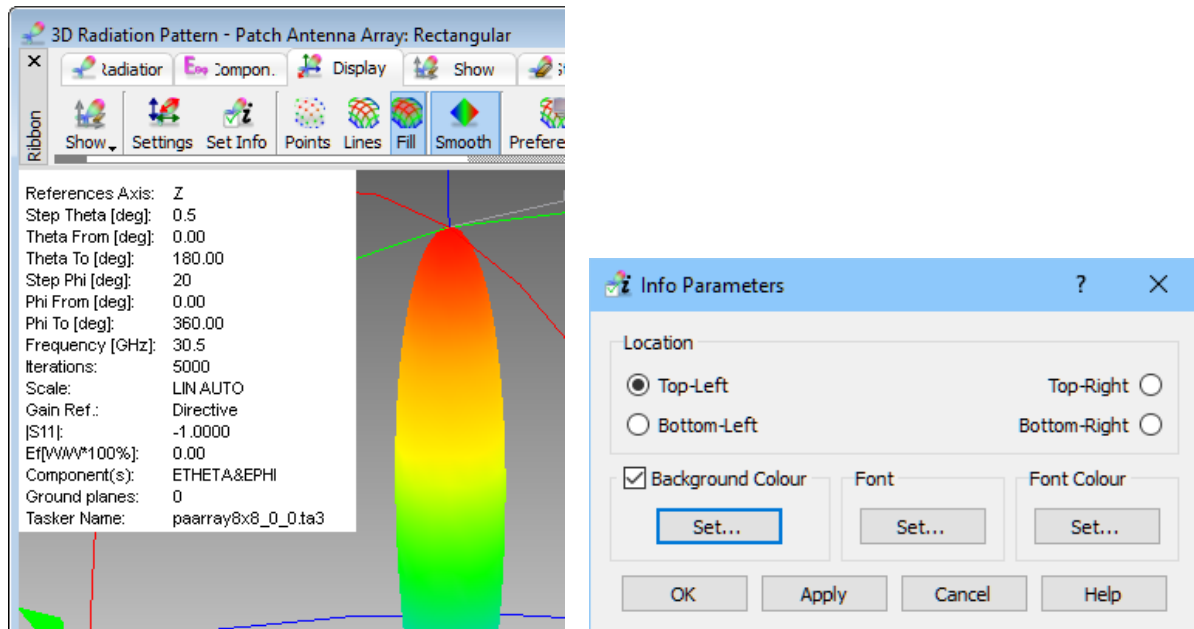

ENERGY STOP CRITERION FOR SMN POSTPROCESSING

The effective and practically useful solution for simulation convergence monitoring has been introduced in version 2017 of *QuickWave*. It is enabled for pulse excitation with a finite duration time and utilises monitoring of the electromagnetic (EM) energy in the calculation model and automatically stops the simulation when it decays to a certain level. This allows reducing the number of performed FDTD iterations and as a result the computing time, without reducing computational accuracy.

The Energy Stop Criterion feature solution is now available in *QuickWave* for complete S-matrix postprocessing (Smn).
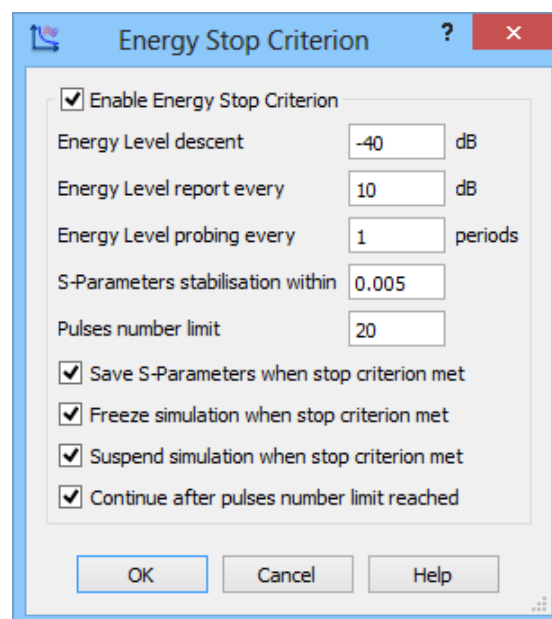
2D FIELDS – MULTI PLANES

New visualisation option for E fields in Vector 3D display is available. It allows observing E field in multiple planes for V2D (BOR) structures.
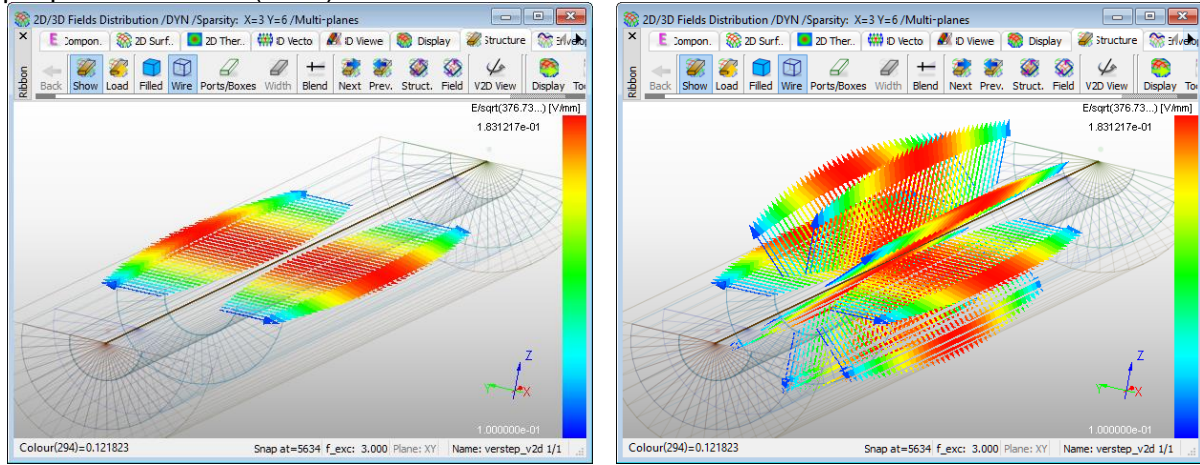
MULTIGPU VERSION OF QW-SIMULATOR FOR V2D (BOR) STRUCTURES

QW-Simulator MultiGPU performs spatial decomposition and divides analysed circuit into subregions, which are simulated on separate GPU cards. Using multiple GPU cards of a massively parallel architecture extends the available memory and significantly reduces the simulation time.

Now *QW-Simulator MultiGPU* is available for V2D (BOR) axisymmetrical structures.
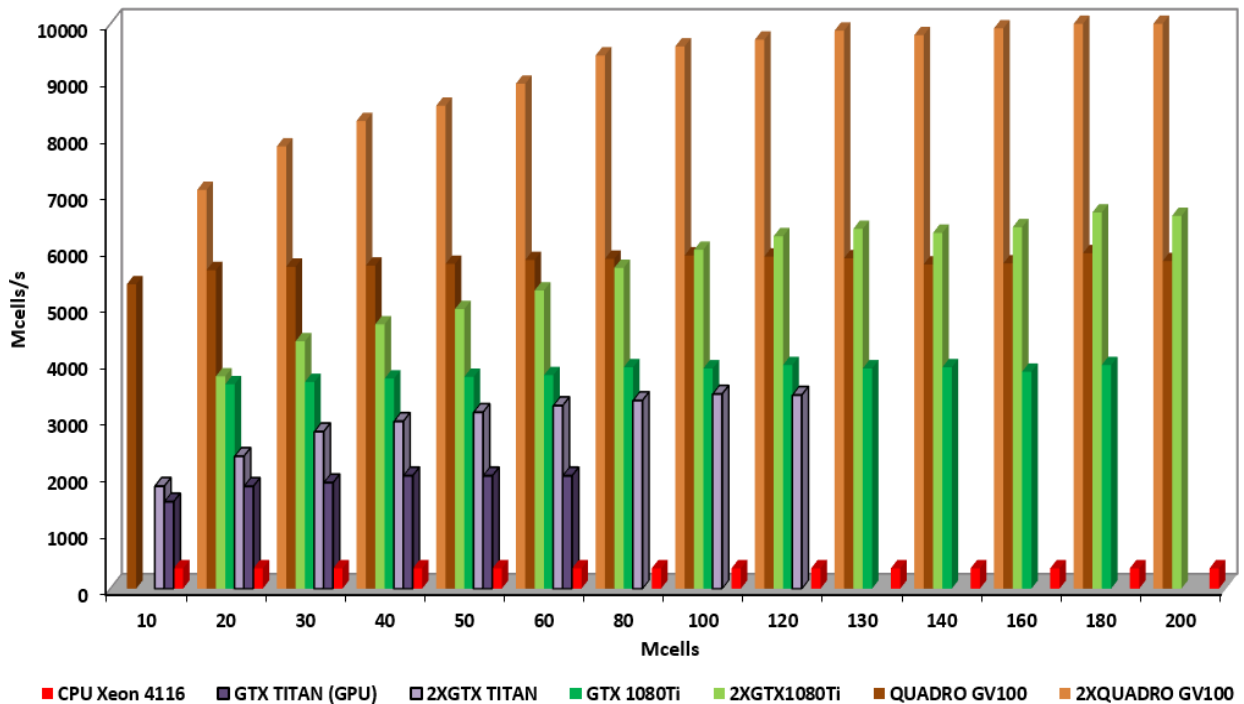
SpeedUp of the GPU and MultiGPU computation of a two-reflector Cassegrain antenna model (V2D BOR example) compared to QW-Simulator OMP version on Xeon 4116.

OTHER

1. *Go to Cell* option for setting the FDTD cell number to be displayed in the *Test Mesh* window for watching and testing the effective FDTD mesh grid.
2. AMIGO commands in UDO script language for using automatic meshing regime.
3. High Q Module (QProny): Q-factor extracted from attenuation coefficient, QProny log saved automatically in the *.htm file.
4. Radiative heat transfer condition in Heat Flow Module: it is possible to consider heat radiation between a pair of two rectangular walls – parallel or perpendicular – with arbitrary temperature distributions on each of the walls' surfaces.
5. Export (save) and import (load) of instantaneous and envelope values of the displayed components (in a plane) is available in the CSV text format in *2D Fields* window.
6. Template generation for TEM lines is accelerated with parallelised approach.

SHORT-TERM LICENCES

Short-term licences involve time periods from 1 month to 6 months and are available for *QuickWave Professional* package, *QuickWave Standard* package, and all *QuickWave* optional modules.
The new licences are protected with a software licencing procedure.

qwStore gives the possibility of getting quotation and purchasing short-term licence of your choice for *QuickWave* software.
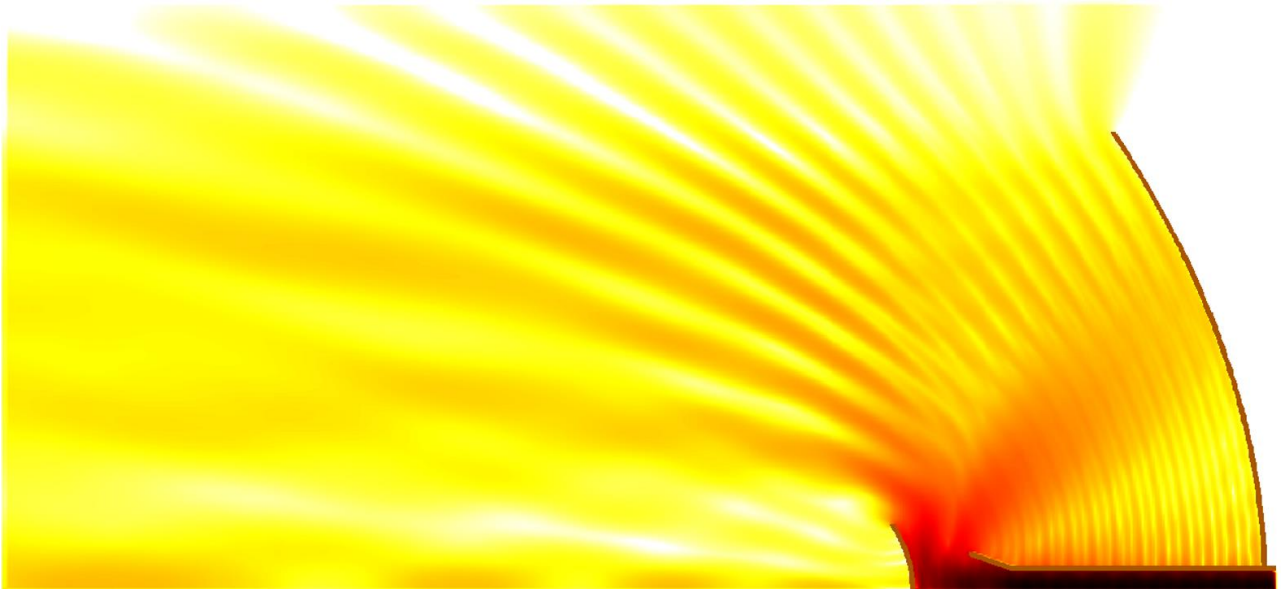
Design is as simple as it can be.

Simulation is as fast as you want it to be.

Results are as accurate as they should be.

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