CONCEPT-II

CONCEPT-II is a frequency domain method of moment (MoM) code, under development at the Institute of Electromagnetic Theory at the Technische Universität Hamburg-Harburg (www.tet.tuhh.de).

Overview of demo examples

The following demonstration examples for CONCEPT-II will be discussed in detail ($CONCEPT: home directory of the package):

1. Wire loop, directory $CONCEPT/demo/example1-wire-loop
2. Cylindrical monopole antenna radiating over a finite ground plate, directory $CONCEPT/demo/example2-monopole-on-plate
3. Box with aperture and internal radiator, directory $CONCEPT/demo/example3-box-with-aperture
4. Dielectric sphere in a plane wave field, directory $CONCEPT/demo/example4-dielectric-sphere

To find out how CONCEPT-II works it is recommended to start with example 1 (wire loop)

Important: file names should never contain blanks.

Shortcuts: **Help** → **Navigation**

Example 3: Box with aperture and internal dipole antenna

It is assumed that the user is already familiar with examples 1 and 2.

It is recommended to start from an empty directory and set up the simulation according to Fig 1.

$CONCEPT/demo/example3-box-with-aperture

The structure under investigation is shown in Fig 1: It is a PEC cube with internal dipole antenna. Note that the dipole antenna consists of a narrow strip of triangular patches. As the antenna is more or less surrounded by PEC walls this example forms a challenge for a numerical computation. Galerkin testing is activated, see last item of the project tree. The applied frequency is 300 MHz. The internal dipole is fed by 1 W. Hence this power must completely go through the aperture as no other loss mechanism is present.

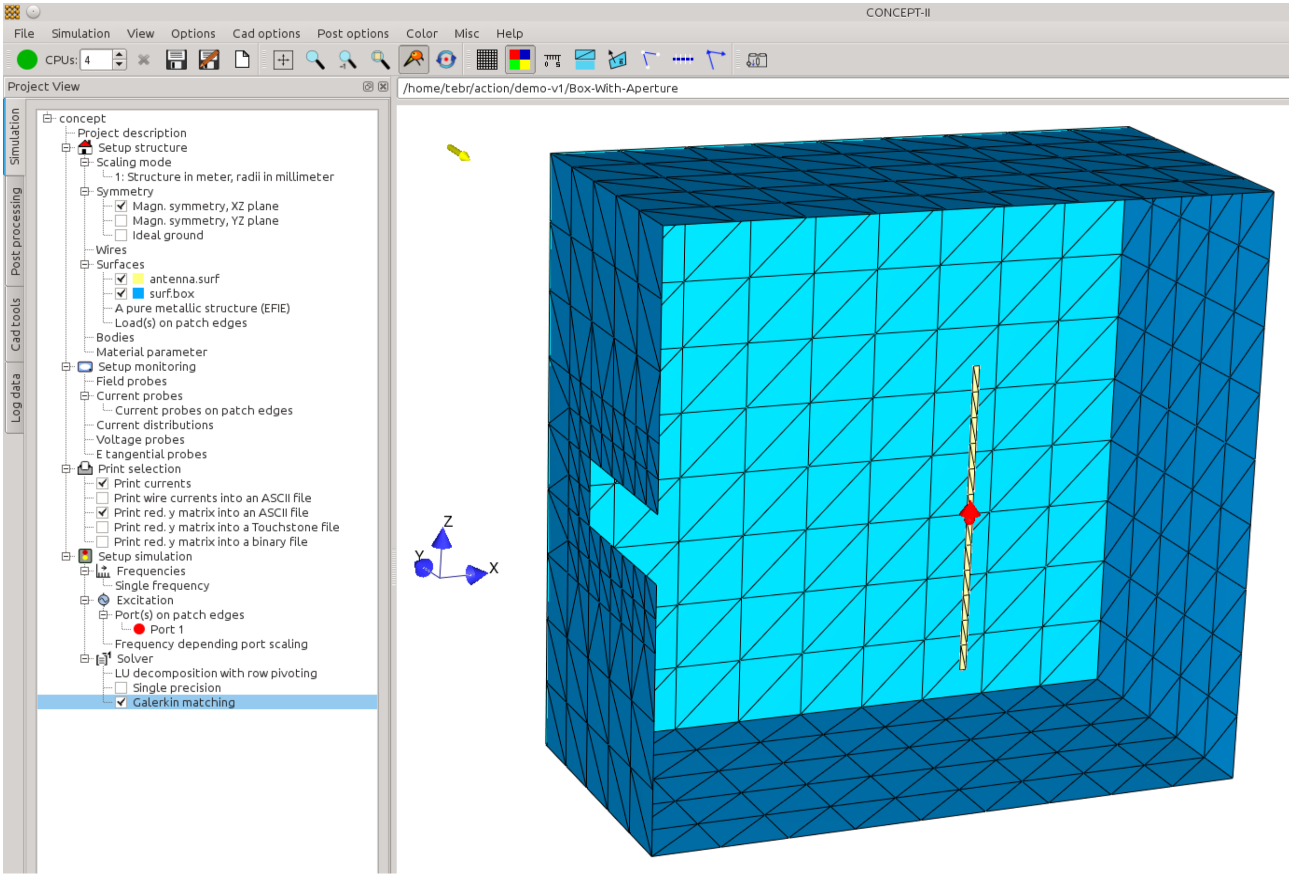
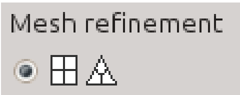


Fig 1: PEC cube with aperture and internal radiator (center-driven strip of patches)

As we have electrical and geometrical symmetry only half of the box needs to be discretized. The x-z plane is a plane of magnetic symmetry.

Creating the box with aperture (*surf.box*)

- Edge length of the cube is 1m
- **Cad tools** →  (tool bar)
  - P1(xyz): 0 0 0
  - P7(x,y,z): 1 0.5 1
  - 300 MHz, 8 patches per wavelength
  - Magnetic symmetry: **Symmetry with respect to the XZ plane**
  - Deactivate: 'Set all patches to triangles'
- Erase the patches at the location of the aperture. For the position of the aperture notice Fig 1.
  - Use the rubber tool for this purpose:  . Mark the patches, then update 
  - Refine the patches around the aperture using the following refinement pattern



Creating the dipole antenna strip (*antenna.surf*)

- The antenna is located in the center of the box

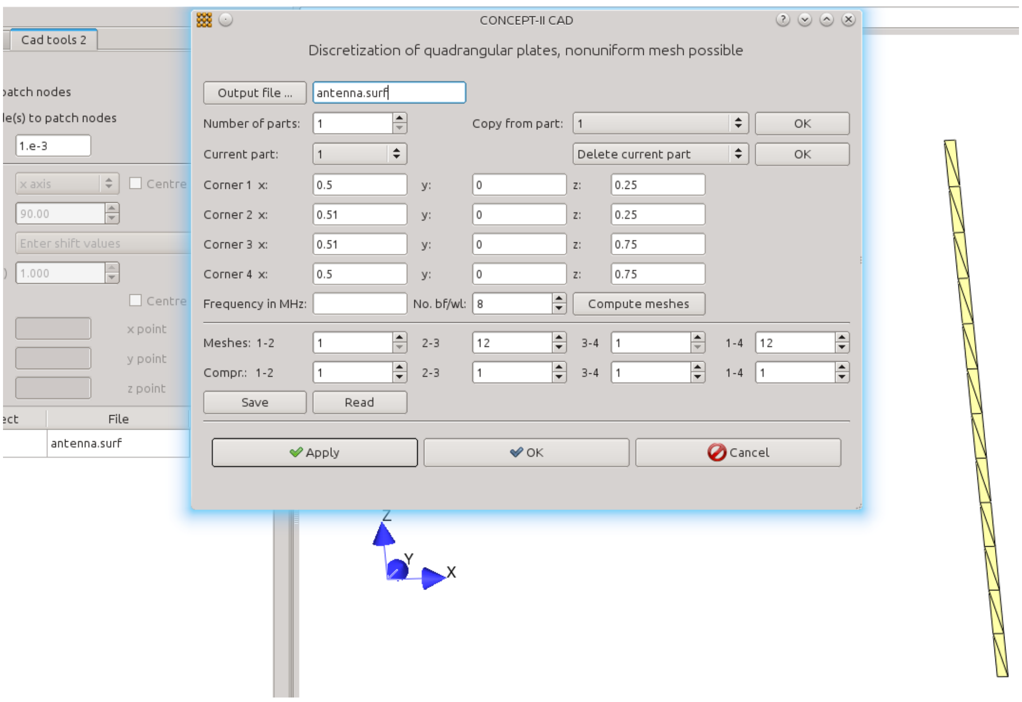


Fig 2: Creating the antenna strip

- Use the plate tool to create the strip antenna. **Cad tools,** → **Cad tools 2**, see Fig 2. The length of the strip is 0.5 m and the width is 1 cm

Convert all quadrangles of the box and the antenna strip into triangles by clicking on (tool bar)

Deactivation of the check mark left to a wire or surface patch file (project tree, **Cad tools 1**) makes the structure part become invisible, but it is still loaded.

Check the length and the width of the patch strip by using the ruler (tool bar, see Fig 3)

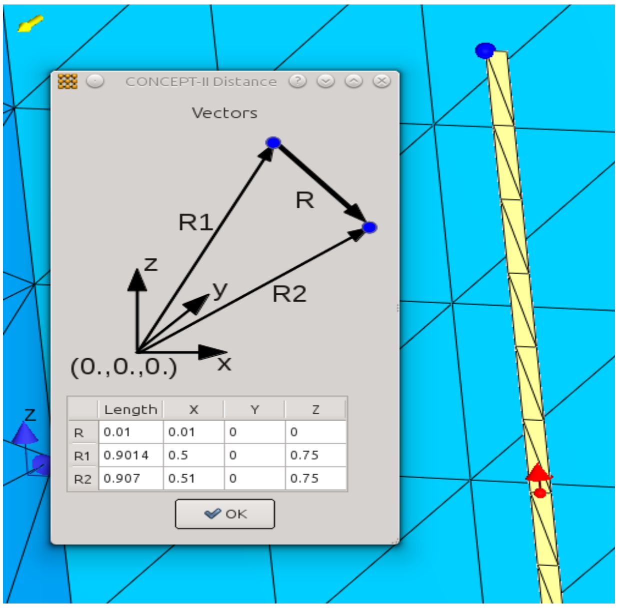


Fig 3: Selecting two nodes by right mouse click provides the distance between the nodes. The patches of the strip are lying in the x-z plane. The y coordinates of all strip nodes are 0.

Setting the edge generator, frequency, symmetry, and MoM testing method

Click on **Simulation** and load the files from the cad section. *Antenna.surf* and *surf.box* automatically appear under **Surfaces** entry (simulation project tree)

Section **Setup structure:**

Set check mark: 'Magn. symmetry, XZ plane'

Section **Setup simulation**

Excitation → **Ports (power input/voltage input)** → window opens → (Turn mouse wheel for zooming in) → right click on the center edge of the strip antenna → a generator symbol appears → eventually change direction by a second click. Choose 1 W as input power.

Frequencies → **Single frequency** → enter 300 MHz

For a high precision computation: activate the check mark 'Galerkin matching' as indicated in Fig 1.

Run the back end.

Displaying the 3D radiation diagram together with the structure

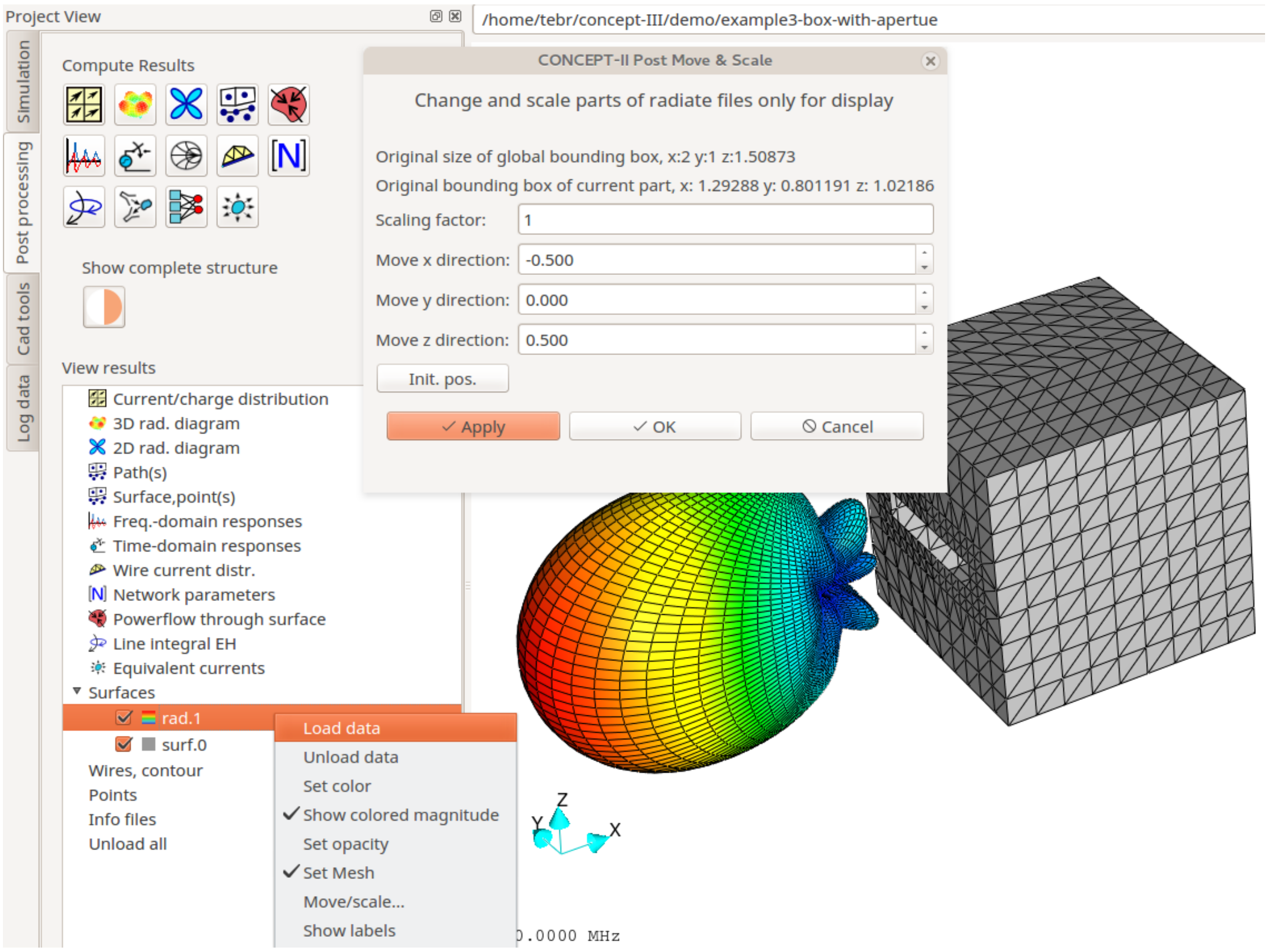


Fig 4: Application of the move-scale tool

- Go to **Post processing**

- Click on  (create a 3D radiation diagram, activate: ‘High precision integration for far field’)

- Click on . The structure under investigation is shown in the display area together with the radiation diagram. Both structures intersect each other

- Post processing tree: The file names *rad.1* and *surf.0* appear under **Surfaces**

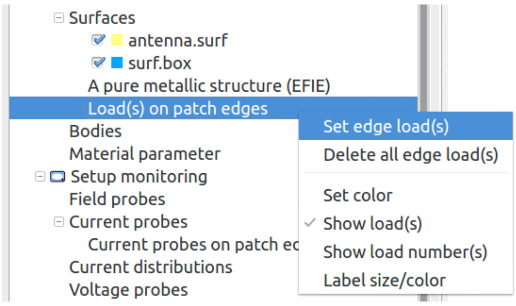
- Right click on **rad.1** →**Move/scale...** → a sub-window opens. Enter values as shown in Fig 4 and click **Apply.** Box and cavity are well separated now.

- **File** → **Save image as** (Choose format and picture name and save image of the display area onto the hard disk)

- Check the power budget (**Log data** → **3D rad. diagram**): 0.989 W are computed in the far field, 1 W was the input power (3D radiation diagram: a 80x80 grid has been assumed on the unit sphere)

Placing a load on a patch edge

Click the **Simulation** tab. Under Surfaces (entry of the simulation project tree), right click on **Load(s) on patch edges** → **Set edge load(s)**, see next figure.



A window according to Fig 5 opens

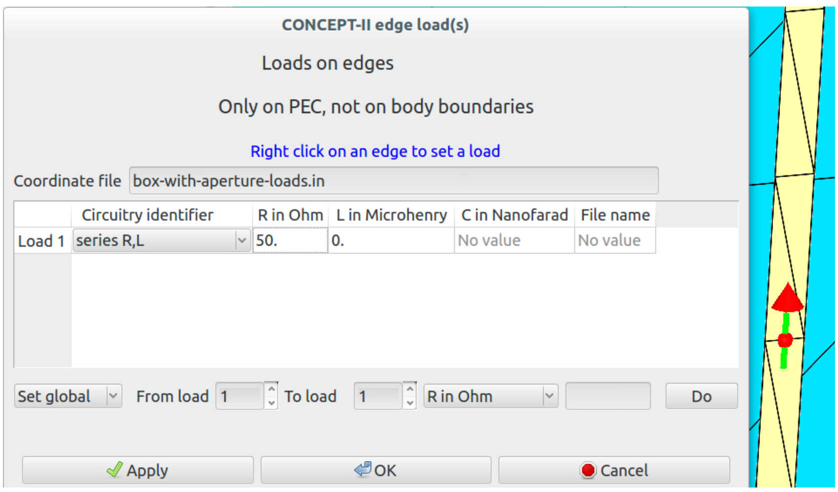


Fig 5: Window for setting edge loads

Right click on an edge → The load symbol appears over the edge → enter the values of the lumped load, here 50 Ω as inner resistance of the edge generator. Change symbol color and size by **Options → Modify elements...**