EM-Twin Exposure Tutorial

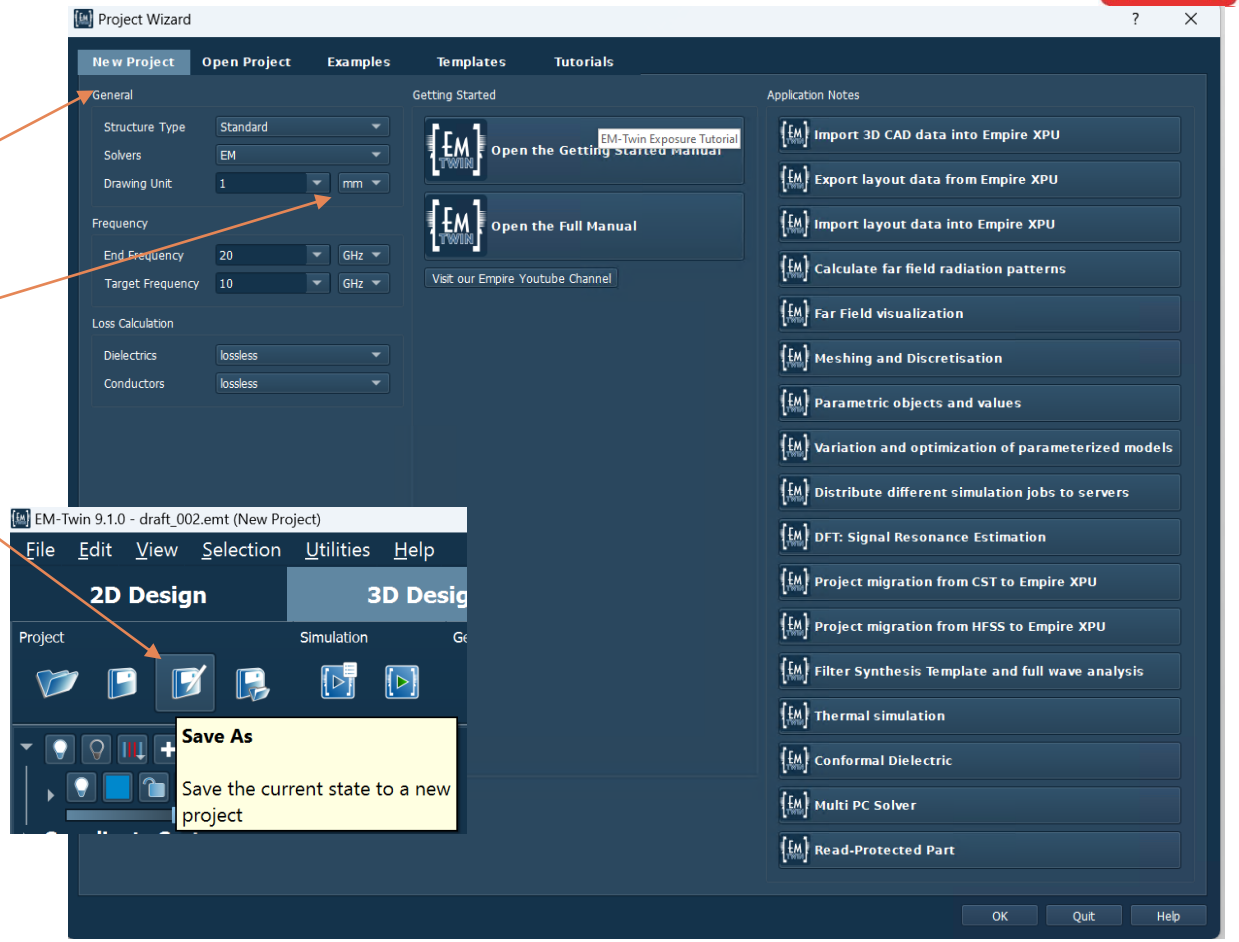
Ka-band horn antenna: APD evaluation

Overview

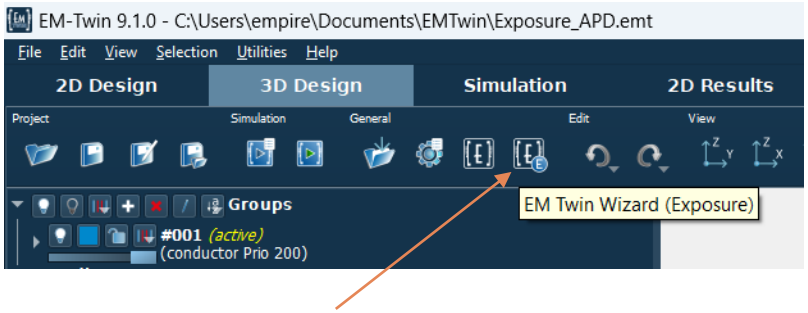
- New project creation
- Using the Exposure Wizard
- Antenna digital twin creation
- Phantom definition
- Field source placement
- Simulation set-up
- Parameter Sweep
- Near field and APD evaluation

Start

- Start EM-Twin
- Select “New Project”
- Change Drawing Unit to mm
- Press OK
- Press Save as &
  create a storage folder and
  enter file name,
  e.g., “Exposure_APD”
- Press Save



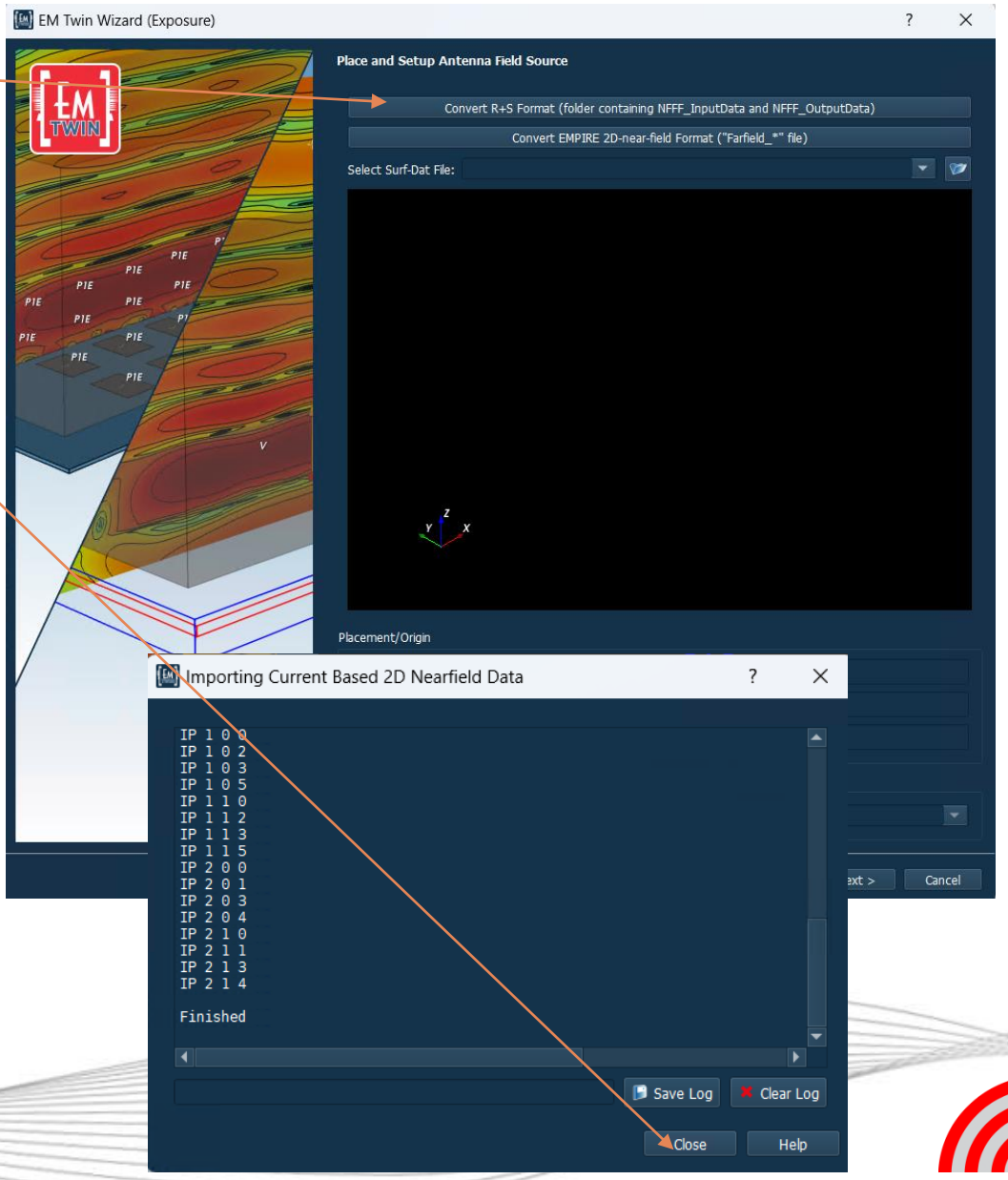
Wizard step 1: CAD Import



- Under 3D Design > General, click on the icon “EM Twin Wizard (exposure)”

Wizard step 2: Create source

- Select option Convert R+S Format
- Locate folder with the R&S measurement data and left-click on folder name (R_S_data_HSA_30GHz)
  The frequency must be selected if an antenna has been measured at several frequency points and if the corresponding nearfield currents have been created
- Click Close once the import is finished
  This way, the source file for the antenna digital twin "R_S_data_HSA_30GHz_30000MHz.surf.dat" is created in the project folder.
  The 3D radiation pattern of the source will be shown in the Wizard if it is available (not in this example)



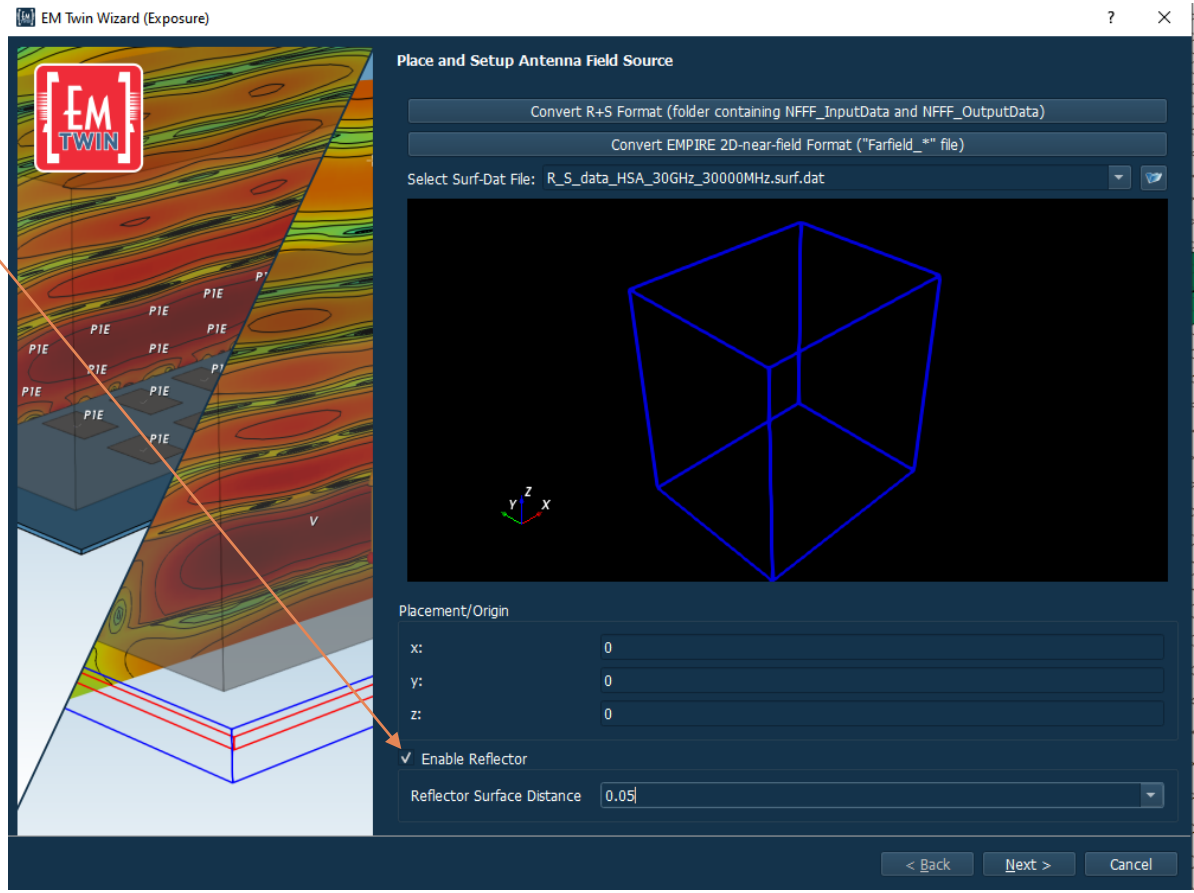
Wizard step 3: Field source configuration

- Click ‘Enable Reflector’
- Set Reflector Surface Distance to 0.05

The field source is usually transparent to electromagnetic fields while the real antenna contains usually several metal parts.
Defining a reflector inside the field source builds a more realistic digital antenna twin source setup.
Electromagnetic waves are often reflected from the phantom so that a volume with standing waves exists between the phantom and the antenna.*

Optionally the Reflector Surface Distance can be set to "automatic" to create a varianble with which the distance can be swept with a distance about lambda/2 in small steps to ensure that the worst case exposure is evaluated.

- Press Next



* *IEEE Journal publication:* Absorbed Power Density Assessment Using Simulation-Augmented Over-The-Air Measurement
https://ieeexplore.ieee.org/document/10440586

Wizard step 4: Flat phantom setup

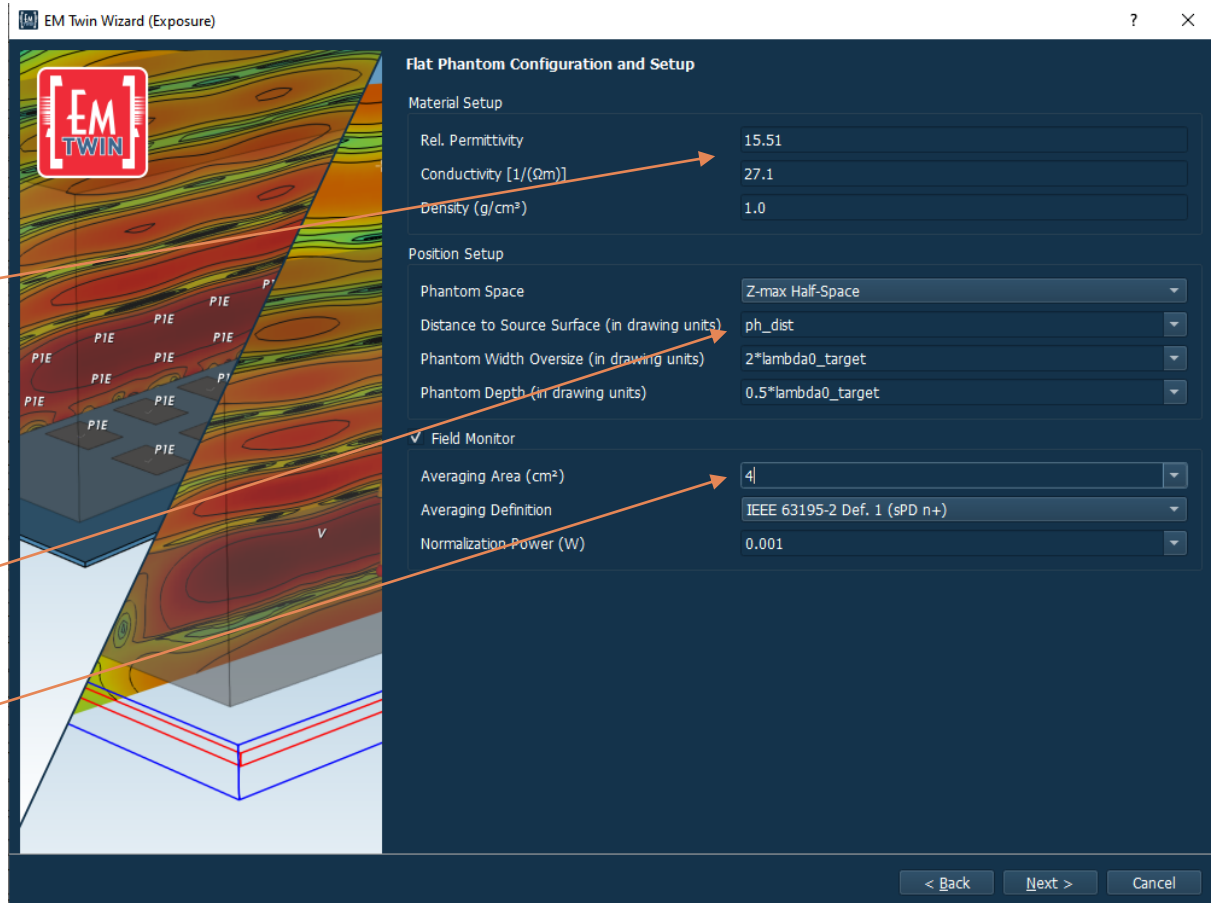
This step defines the flat phantom for the exposure investigation. Permittivity and Conductivity must be defined for the antenna frequency. (30 GHz in our case)

- Define permittivity as 15.51
- Define Conductivity as 27.1

- Define a variable to investigate a few phantom distances in one simulation setup (open pull down menu and select ph_dist)

- Set Averaging Area to 4 cm^2

- Click Next



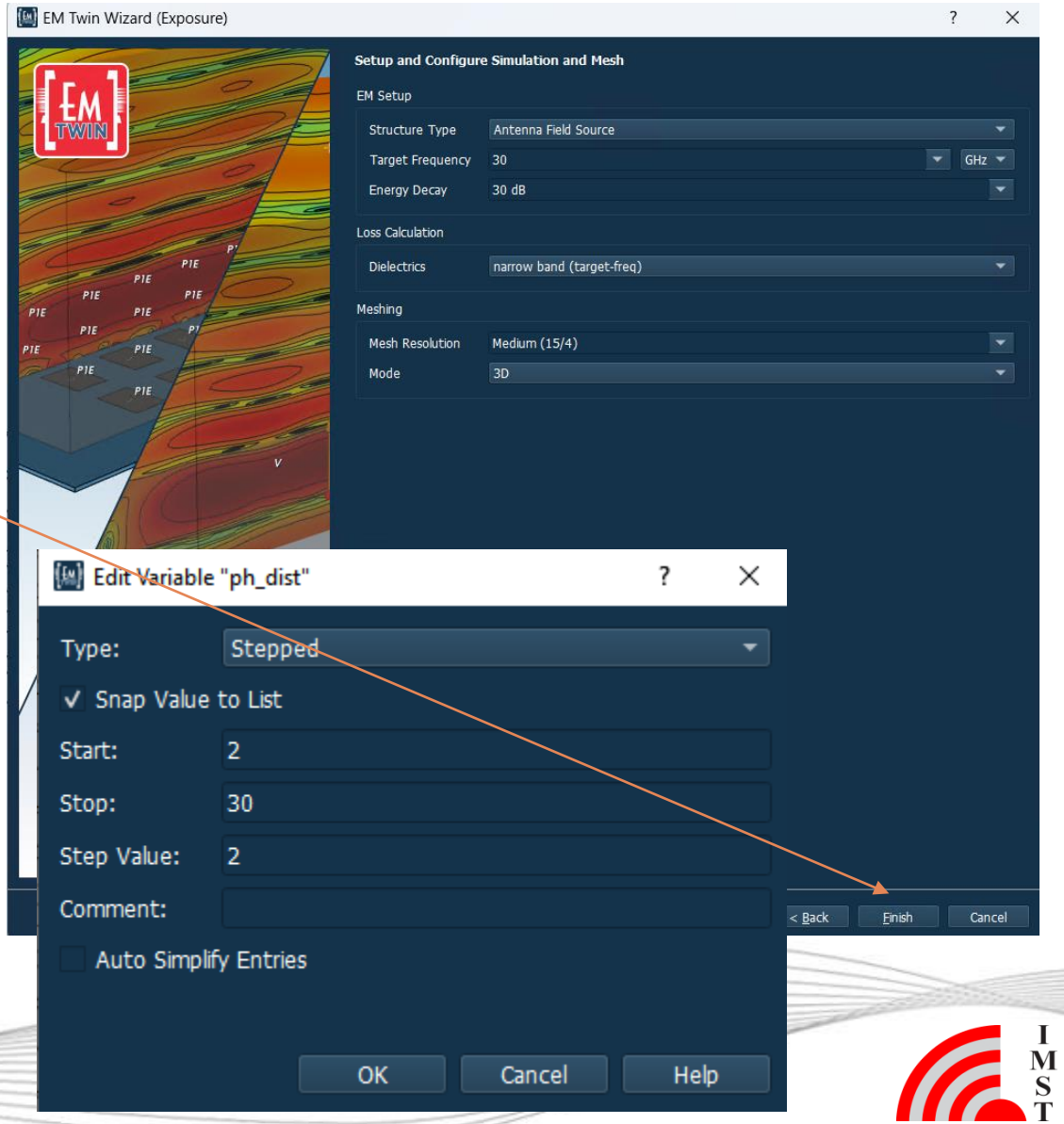
Wizard step 5: Simulation set-up

Simulation and mesh settings can be adjusted in this step.
The default settings do not need to be changed for this tutorial

- Click Finish
  The variable which defines the distance between the antenna and the phantom is defined in the next step.
  We want to look at several distances.

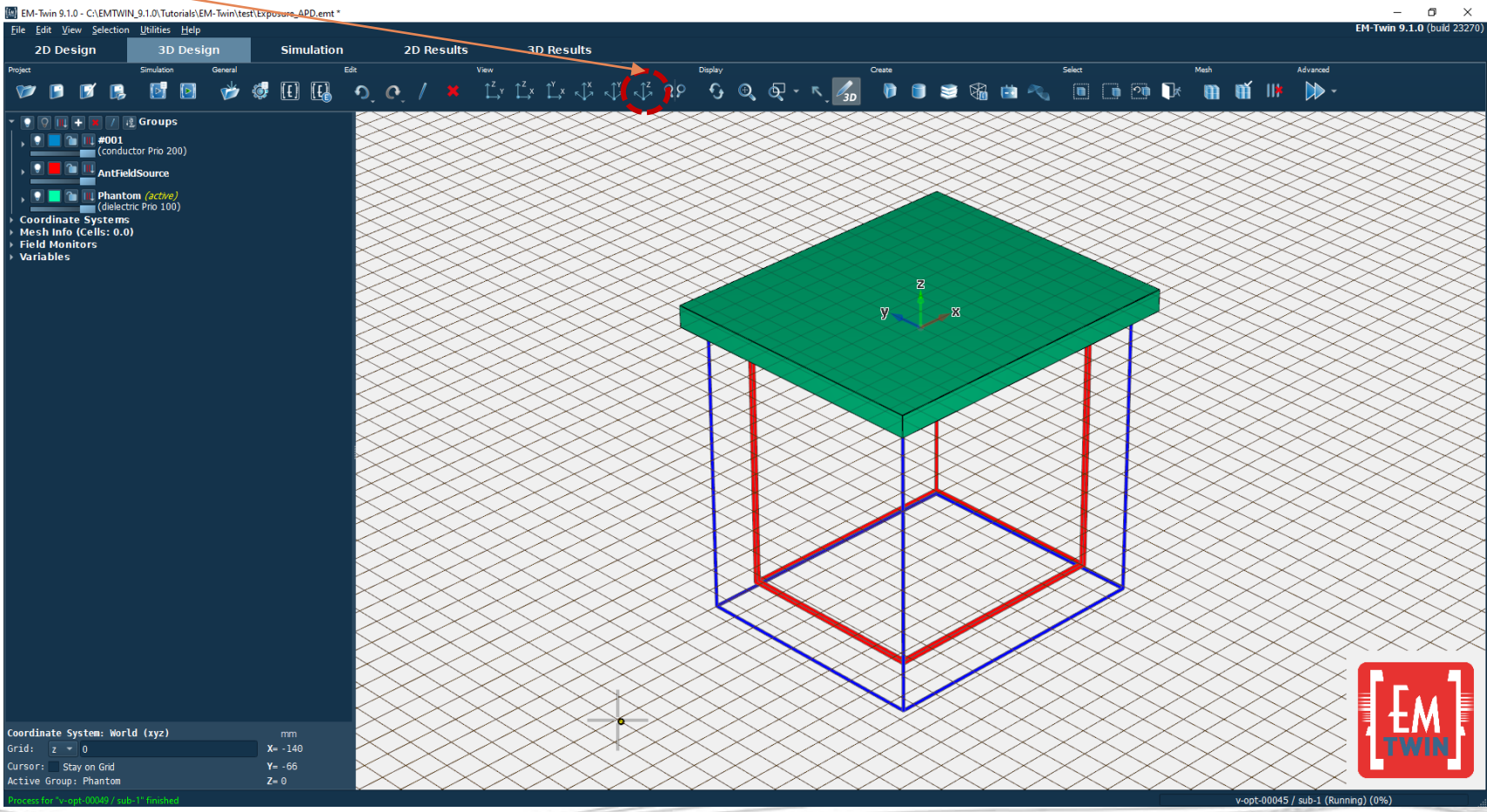
- Switch Type from *Constant* to *Stepped*
  Enter the following values:
  Start: 2
  Stop: 30
  Step Value: 2

- Press OK



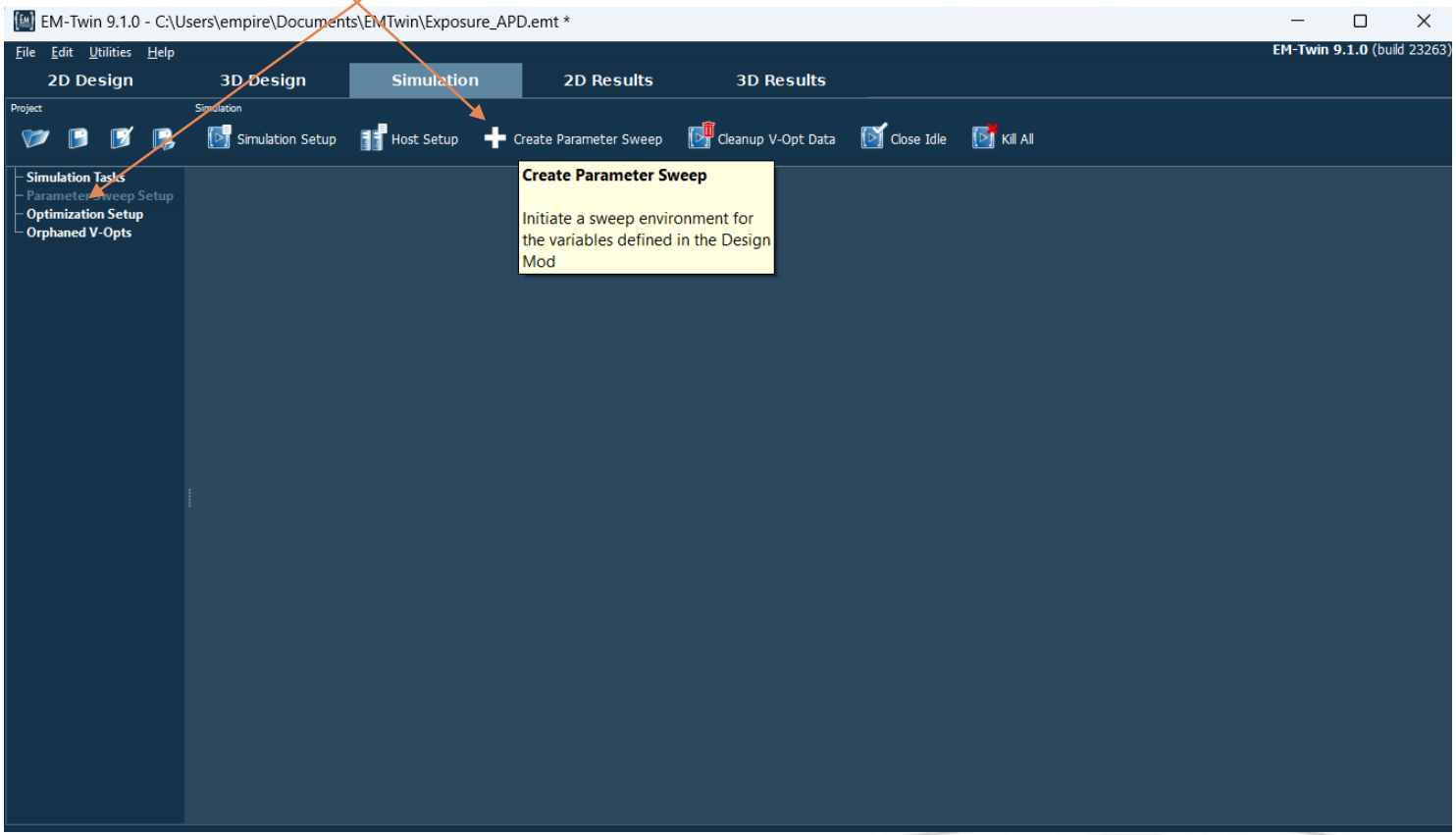
Step 6: Model check

- Switch to 3D Design mode
- Select Iso-z view and check model



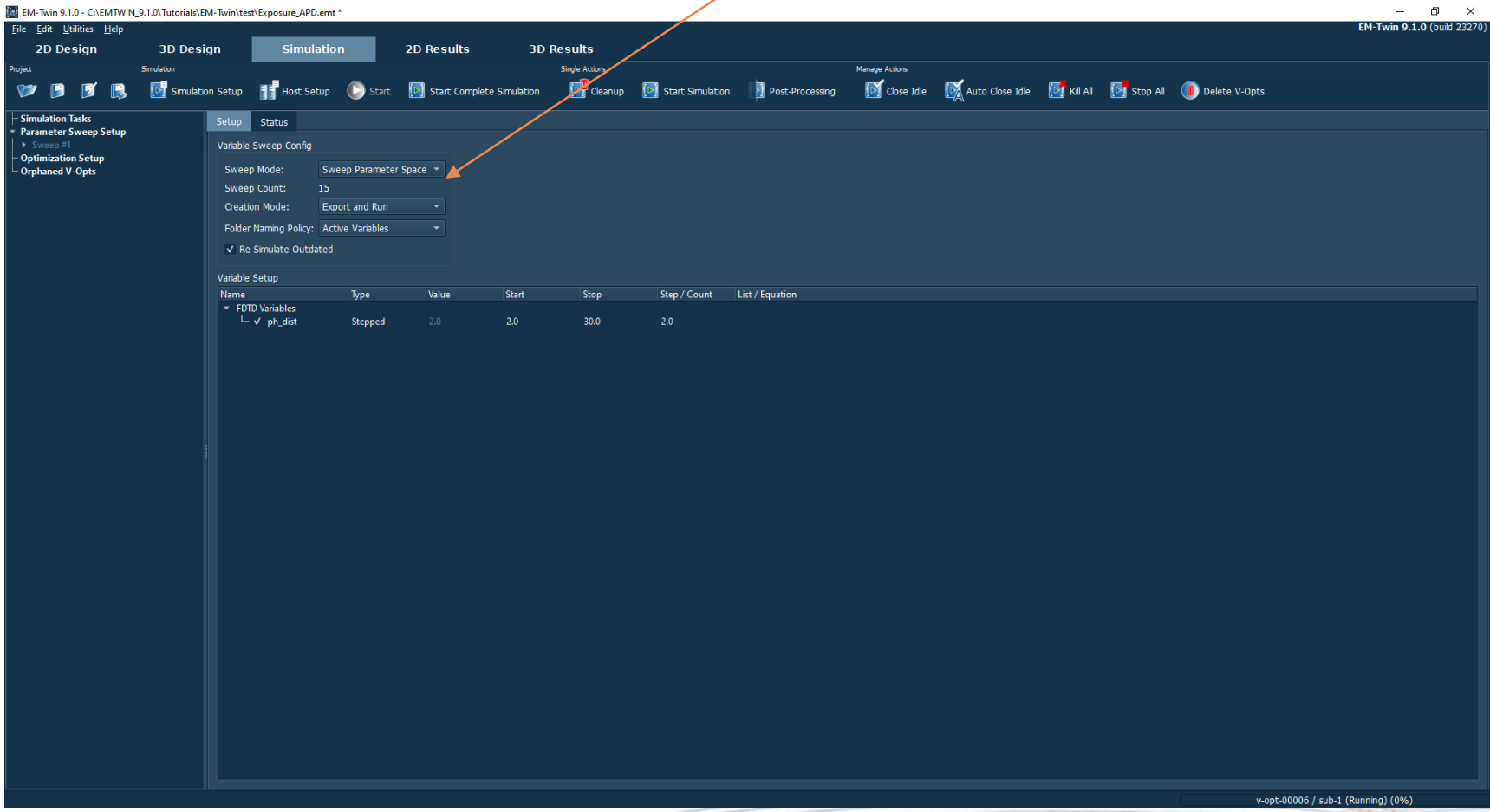
Step 7: Parameter Sweep

- Switch to Simulation Tab
- Select “Parameter Sweep Setup” on the left
- Click on Create Parameter Sweep
- Confirm sweep



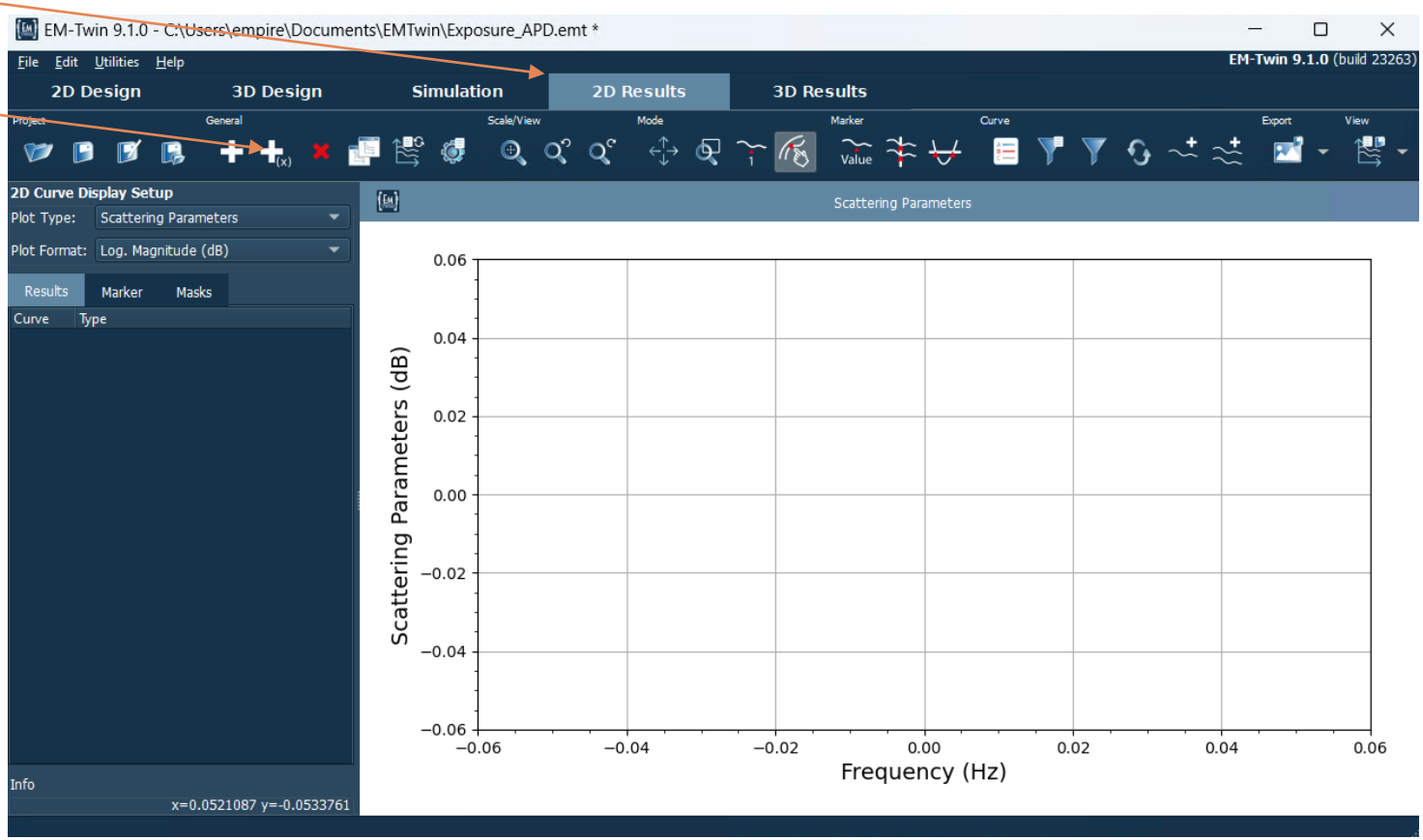
Step 8: Setup parameter sweep

- Change Sweep mode from ‘Sweep independent’ to ‘Sweep Parameter Space’
- Click “Start” and wait to finish (15 simulations)



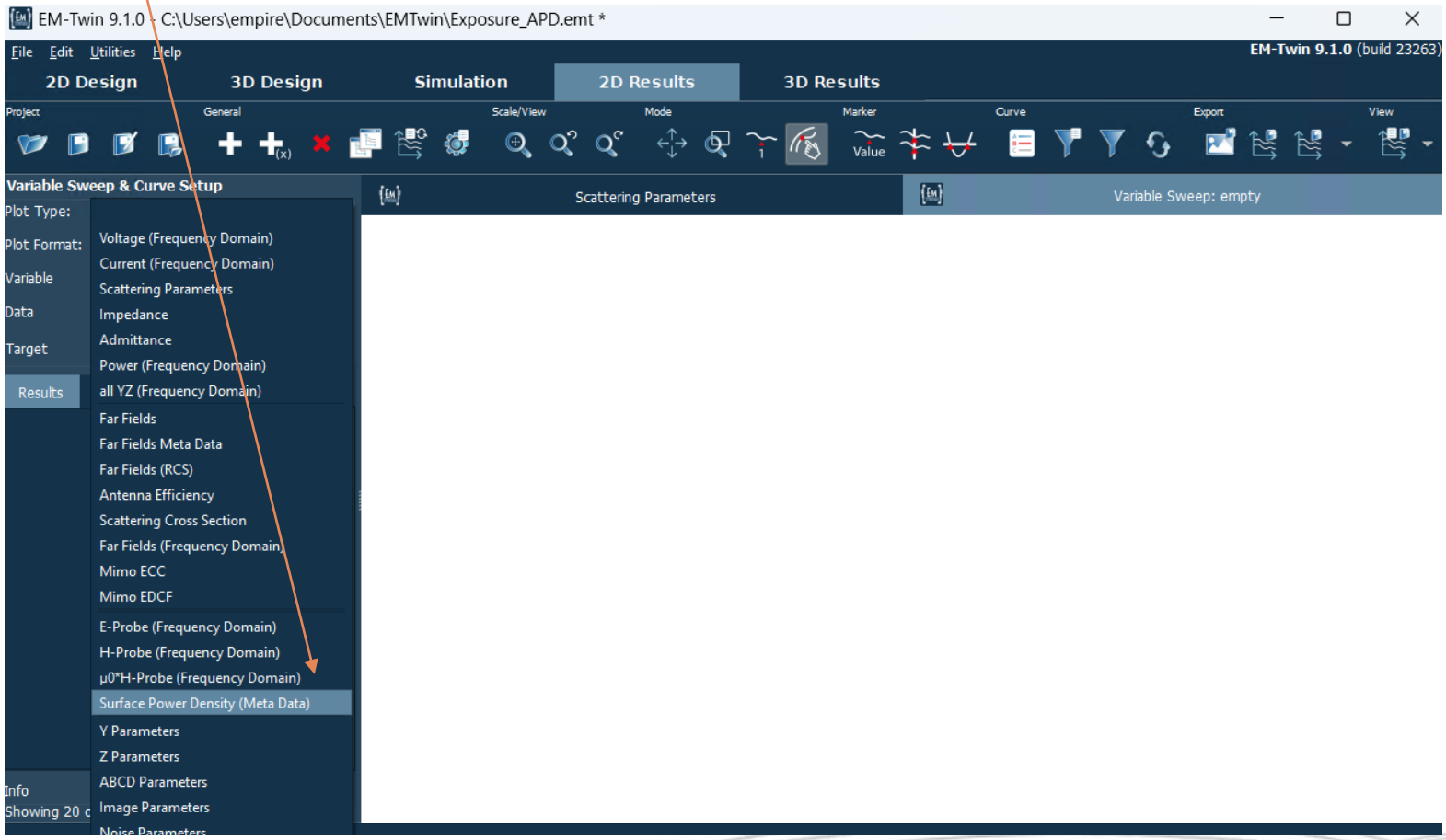
Step 9: 2D Results

- Switch to 2D Results
- Press *Add Sweep Results*



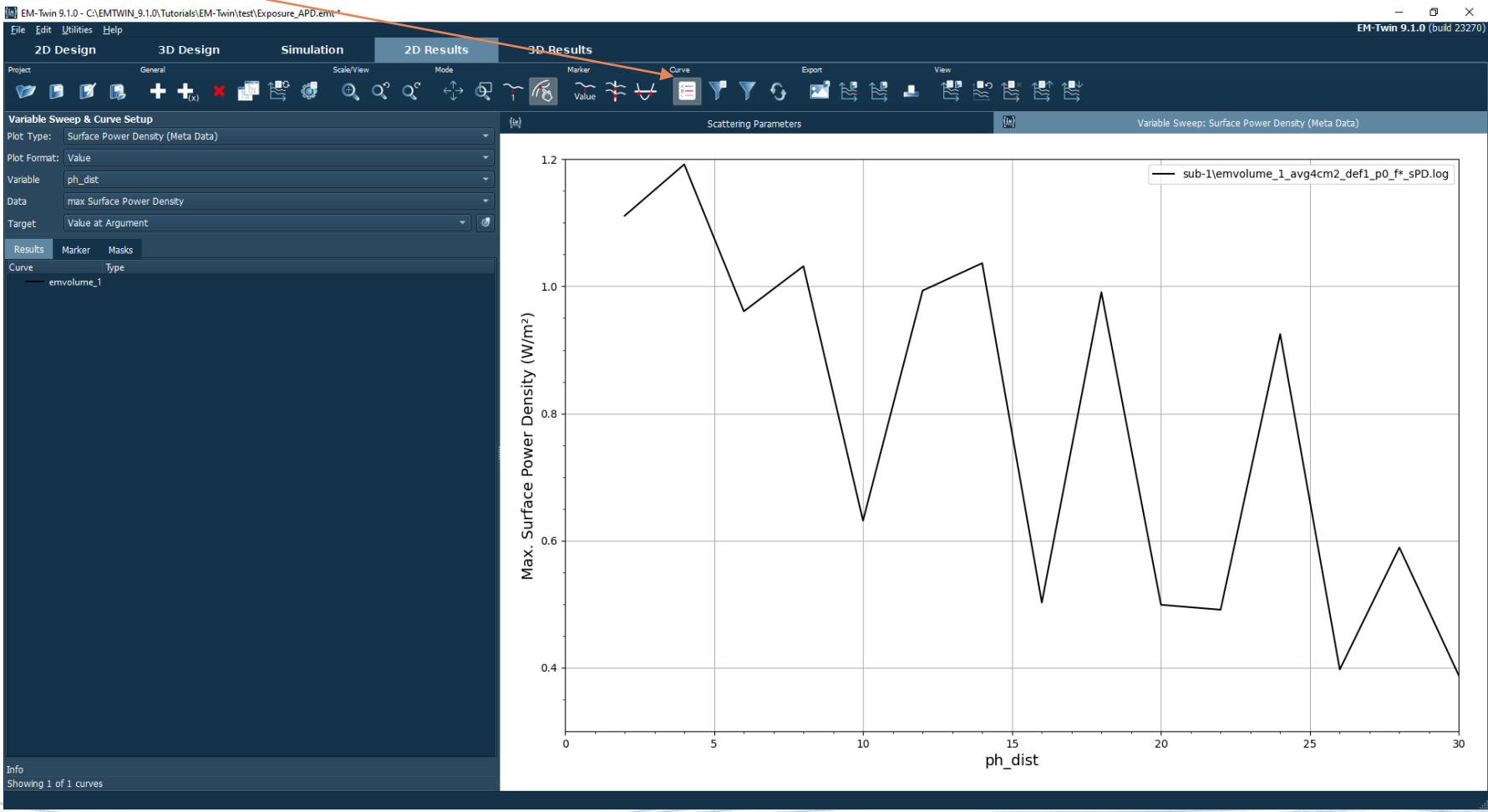
Step 10: 2D Results

- Change Plot Type to Surface Power Density (Meta Data)



Step 11: 2D Results

- Enable legend



Step 12: 3D Results APD distribution

1. Switch to 3D Results & Turn off group phantom (left click on light bulp)
2. Open Variables and adjust variable values
   to show dedicated APD distribution