

## A IMPORTING PHANTOMS TO CST

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This appendix outlines the procedure for importing 3-D numerical breast phantoms with thermal and dispersive dielectric properties into CST. These instructions assume that the phantom to be imported is available as a 3-D Matlab matrix of dielectric properties. This procedure works around a number of limitations imposed by CST (the limited number of unique materials and lack of automatic dispersive material definitions, in particular). The instructions are divided into steps to be performed in Matlab (first) and steps to be performed in CST (second). The file names correspond to the names used in CST's "Make Your Own Voxel File" presentation, available to CST license holders through the CST support website.

### A.1 Matlab Steps

1. Threshold the phantom to no more than 256 distinct materials. (By comparison, the original Class 4 phantom contains 3 million distinct materials).
2. Write "material file" (.txt) defining a name, material number, thermal properties, non-dispersive dielectric properties, and (optionally) color for each material.
3. Write "material property file" (.lat) consisting of a single row specifying material numbers for each voxel. For large models, this should be a binary, not a text file. This can be accomplished with a single Matlab command: `fwrite(fileID,materialNumberMatrix)` assuming `fileID` is a handle for an already open file, and `materialNumberMatrix` is a 3-D matrix containing the material number for each voxel.
4. Write "vox file" (.vox) specifying the name of the material file, the material number of the background, the name of the material property (.lat) file, and the dimensions of the phantom (nx, ny, nz, and dx, dy, dz, and an offset). This

file can also contain the definition of a local working coordinate system for the imported voxel model.

5. Write a Visual Basic macro to define dispersive properties for each material. This macro contains code very similar to the history entries generated in CST by the graphical “User Dispersion List” definition routine.

## A.2 CST Steps

1. Click Modeling → Import/Export → Import 3D Files → Voxel Data to select the .vox file created in Matlab. If the CST project contains (or will contain) any materials other than the voxel model (antennas, for example), the “Mesh Priority” MUST be set to -1 (or lower) in the Voxel Model import window. Otherwise the imported voxel model will take precedence over the existing materials. CST’s standard intersection checks do not apply to voxel models. Finally, drag the box in the preview pane on the right to select the whole voxel model before clicking OK to import the model.
2. Click Home → Macros → Import Macro to import the Visual Basic macro that defines the dispersive properties.
3. Click Home → Macros → <Macro Name> to run the Visual Basic macro. Note that this may take a while for large models.