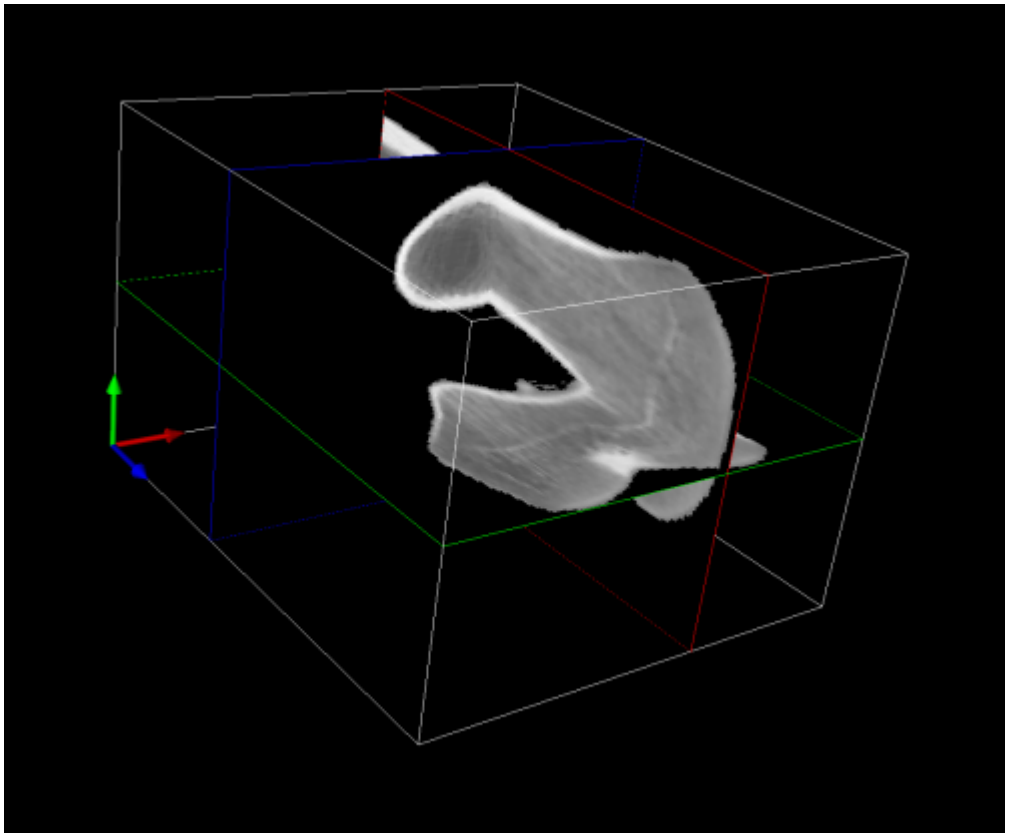
Image and Surface Files

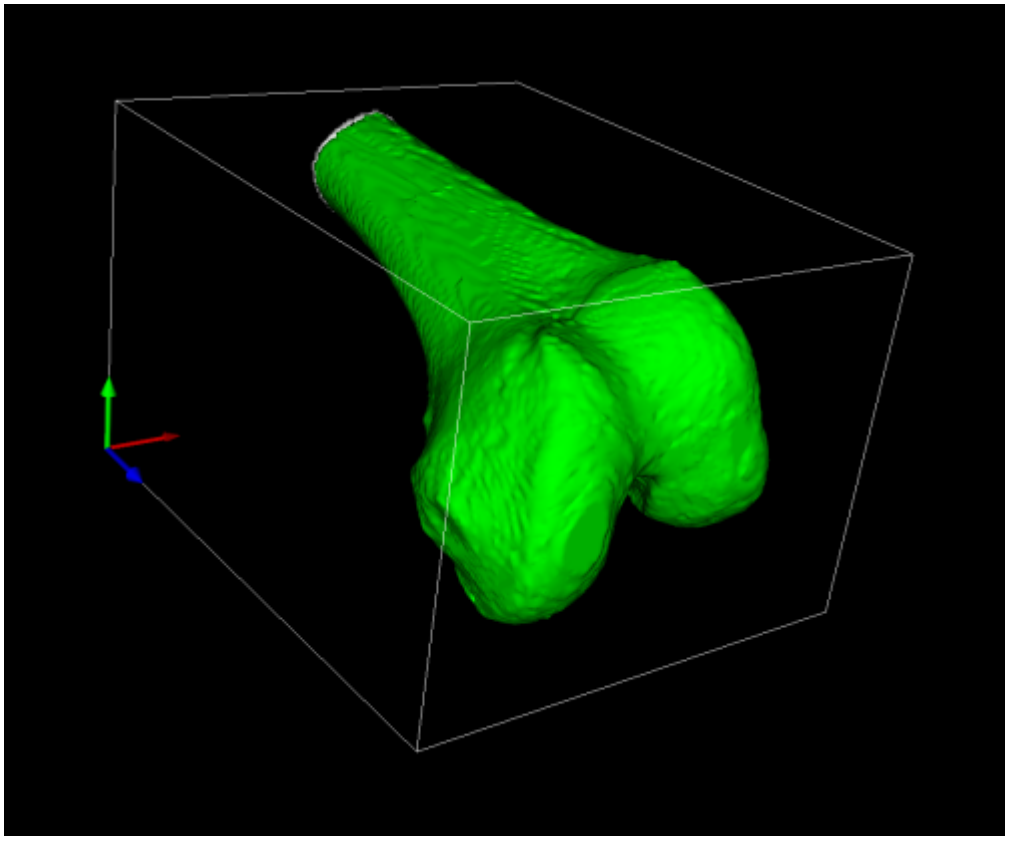
This page provides an overview of the image and surface files used in the DSX Suite.

Image File



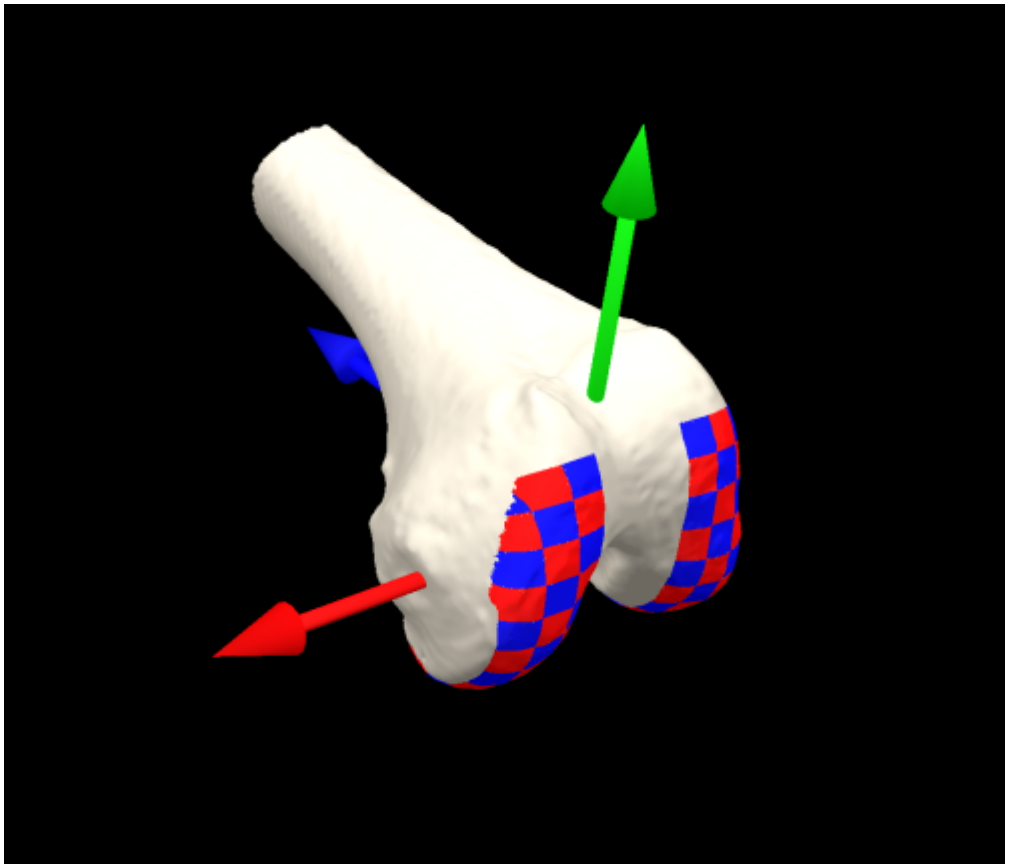
The Image File contains the segmented 3D image data (CT or MRI) of the object. This file is created in a program like Surface3D, Mimics, or ScanIP by labeling the voxels representing the object, then setting all other voxels to zero. The resulting image volume is usually then cropped to the bounding box of the object's voxels, though this step is optional. The Image File has an implicit reference frame, with the origin in the lower-left corner of the first image slice, X going to the right, Y up, and Z increasing through the stack of slices. This reference frame is sometimes called the “CT frame” in the DSX documentation. The units for 3D image data are usually millimeters, but this depends on the settings of the scanner software. The DSX applications can import Image Files in the TIFF, RAW, and DICOM formats, and export them in the TIFF and RAW formats.

Surface File



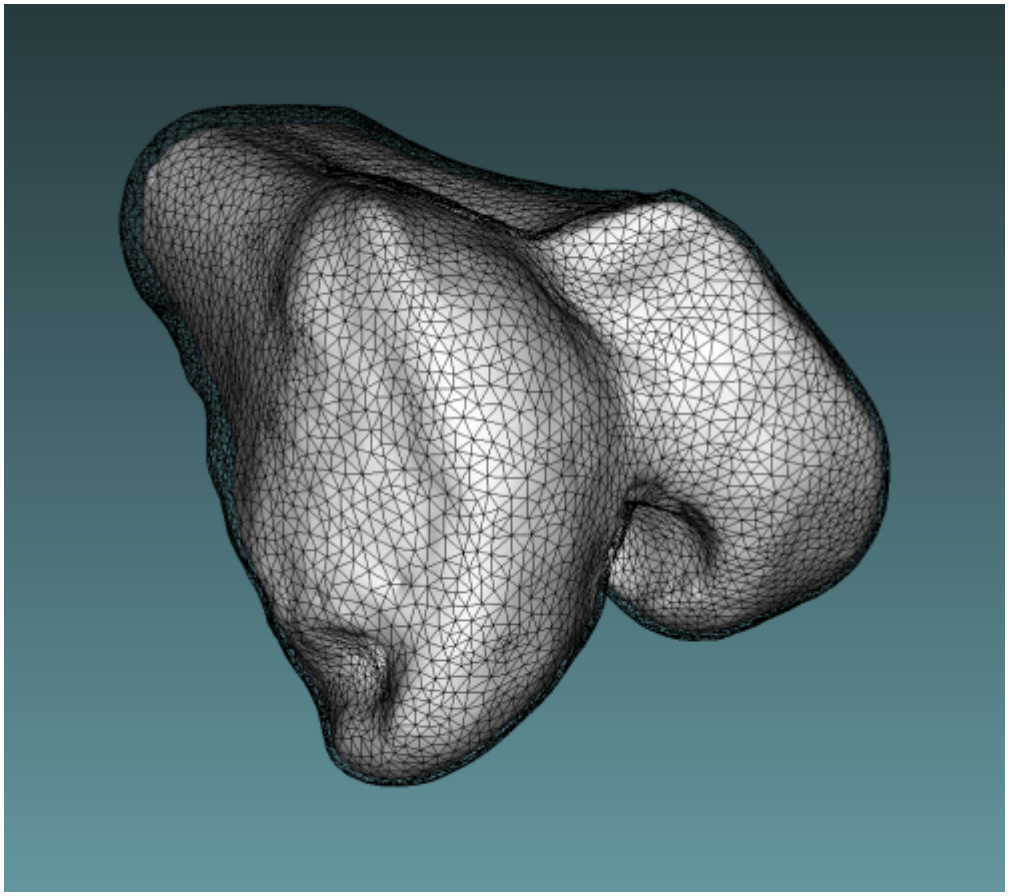
The Surface File contains a polygonal representation of the surface of the object. It is often created by applying a marching-cubes algorithm to the data in the Image File, then outputting the vertices and polygons in the OBJ or STL formats. The vertices must be in the same units as the image data (usually millimeters), and expressed in the same reference frame as the one defined by the Image File. This is because the Image File is used to generate DRRs for tracking the objects in X-ray images, and the tracked poses are then used to animate the surface models for kinematic analysis. So the surface model must be in the same frame and units as the image data that was used to create it. If you generate the Image File and Surface File using Surface3D, they will automatically be output in the same frame. If you use third-party software to generate one or both of these files, you should use the Image/Surface Match widget in Orient3D to make sure that the files are consistent with each other. The DSX applications can import and export Surface Files in the OBJ and OpenInventor formats.

ROI Surface File



The ROI Surface File is the same polygonal surface model as in the Surface File, but the vertices are expressed in meters in the object's local coordinate system (LCS). The LCS is the “anatomically meaningful” reference frame for the object, often defined by running a mathematical algorithm on the surface geometry (e.g., the Miranda algorithm for the distal femur and proximal tibia). This file can also contain regions of interest (ROIs) that are used for bone-to-bone distance calculations. Tracking results from Locate3D and X4D are output as the transform from the X-ray lab frame to the LCS of the object. Thus, the placement of the LCS within each object should be done carefully and with an eye towards the kinematic analyses that will be performed on the tracking results. Meters are used for the units because Visual3D expects distances and translations to be specified in meters. The DSX applications can import and export Surface Files in the OBJ and OpenInventor formats.

Inner Surface File



The Inner Surface File is an optional file that is used only by the Image Data Generator widget in Orient3D to make 3D image data (Image Files) from surface models. This widget is primarily used for generating simulated CT data from surface models created from MRI. If the object has an Inner Surface File when the Image Data Generator is used, voxels between the outer surface and the inner surface will be given the specified cortical density, and voxels inside the inner surface will be given the specified cancellous density. This creates more realistic simulated CT data then using only the Surface File and a constant cortical thickness. The Inner Surface File must be in the same units and reference frame as the Surface File. It should be a closed polygonal surface without holes, and it should not connect to or intersect with the outer surface. The DSX applications can import and export Surface Files in the OBJ and OpenInventor formats.