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VariPose

**Repositions human meshes including
internal structures**

$$\nabla \times E = -\frac{\partial B}{\partial t}$$

$$\nabla \times H = J + \frac{\partial D}{\partial t}$$



- * Visible Human male mesh is in “sleeping” position
- * This position is useful for some applications
- * However, for many situations the positions of the feet, arms and hands do not allow for accurate modeling
- * The US Air Force sponsored an SBIR project for Remcom to develop a method for “posing” the mesh



$$B = \mu H$$

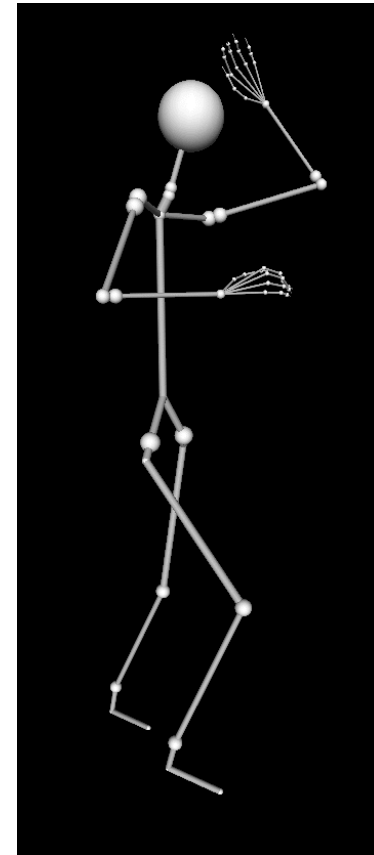
$$\nabla \cdot B = 0$$

$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



- * Interactive GUI to define body position
- * Computationally intensive internal repositioning done without user interaction
- * Continuity of internal structures, especially nerves and blood vessels
- * Conserve mass of individual tissues



$$B = \mu H$$

$$\nabla \cdot B = 0$$

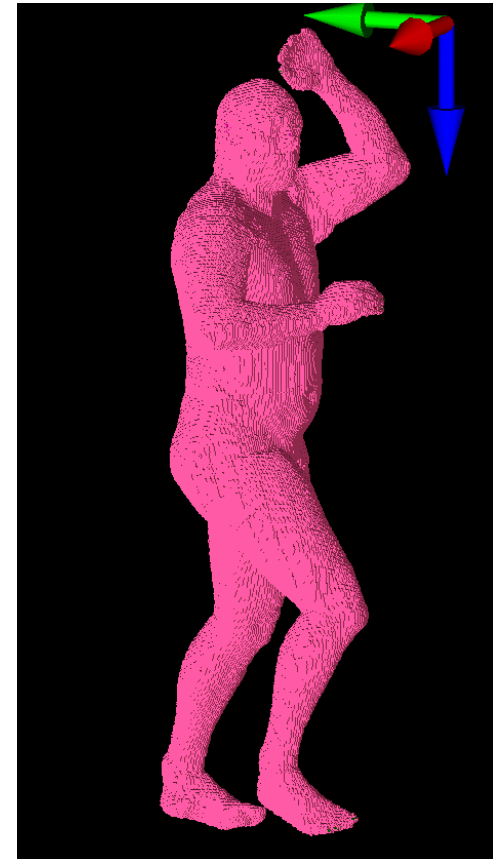
$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



VariPose Capabilities

- * Reposition visible human male mesh using 10, 5, 3, 2, or 1 mm meshes
- * Reposition visible human male mesh using 10, 5, 3, 2, or 1 mm meshes
- * Internal anatomical structures are included in the repositioned mesh
- * Output XFDTD format or generic voxel format
- * Stick Man GUI allows interactive generation of mesh position data
- * GUI display of resulting mesh



$$B = \mu H$$

$$\nabla \cdot B = 0$$

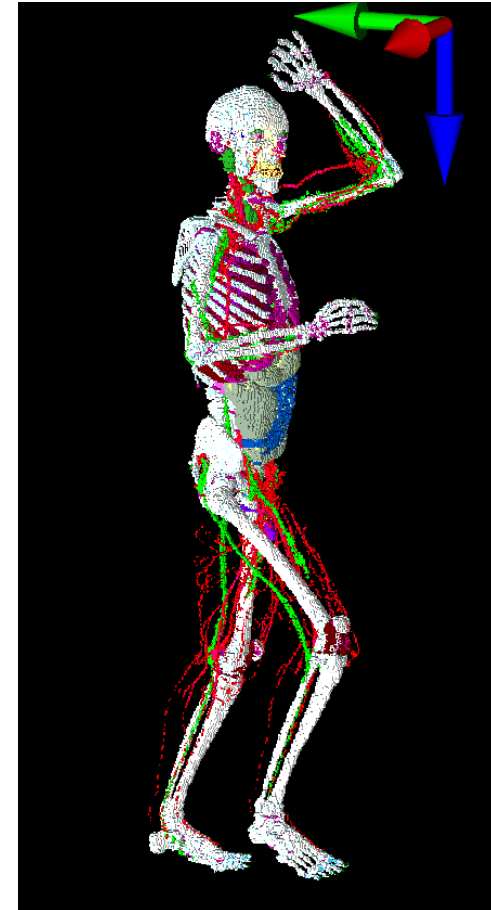
$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



Computer Requirements

- * Windows 2000/XP and Linux
- * High quality video card with 128 Mbytes for 1 mm mesh
- * 1.5GBytes of RAM for 1mm mesh
- * Stick man skeleton is interactive in real time
- * Mesh generation may take hours-days depending on mesh resolution and number/type of joints being repositioned



$$B = \mu H$$

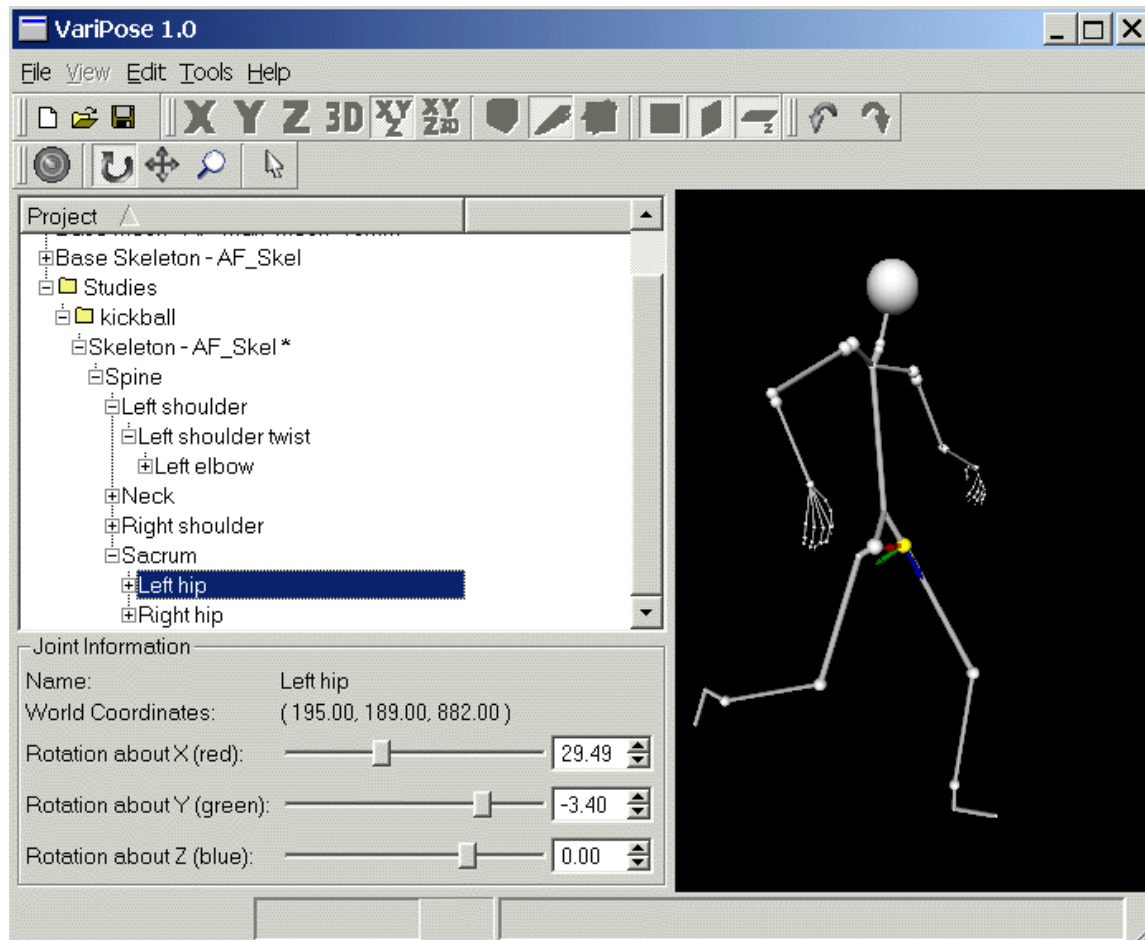
$$\nabla \cdot B = 0$$

$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



Stick Man GUI



$$B = \mu H$$

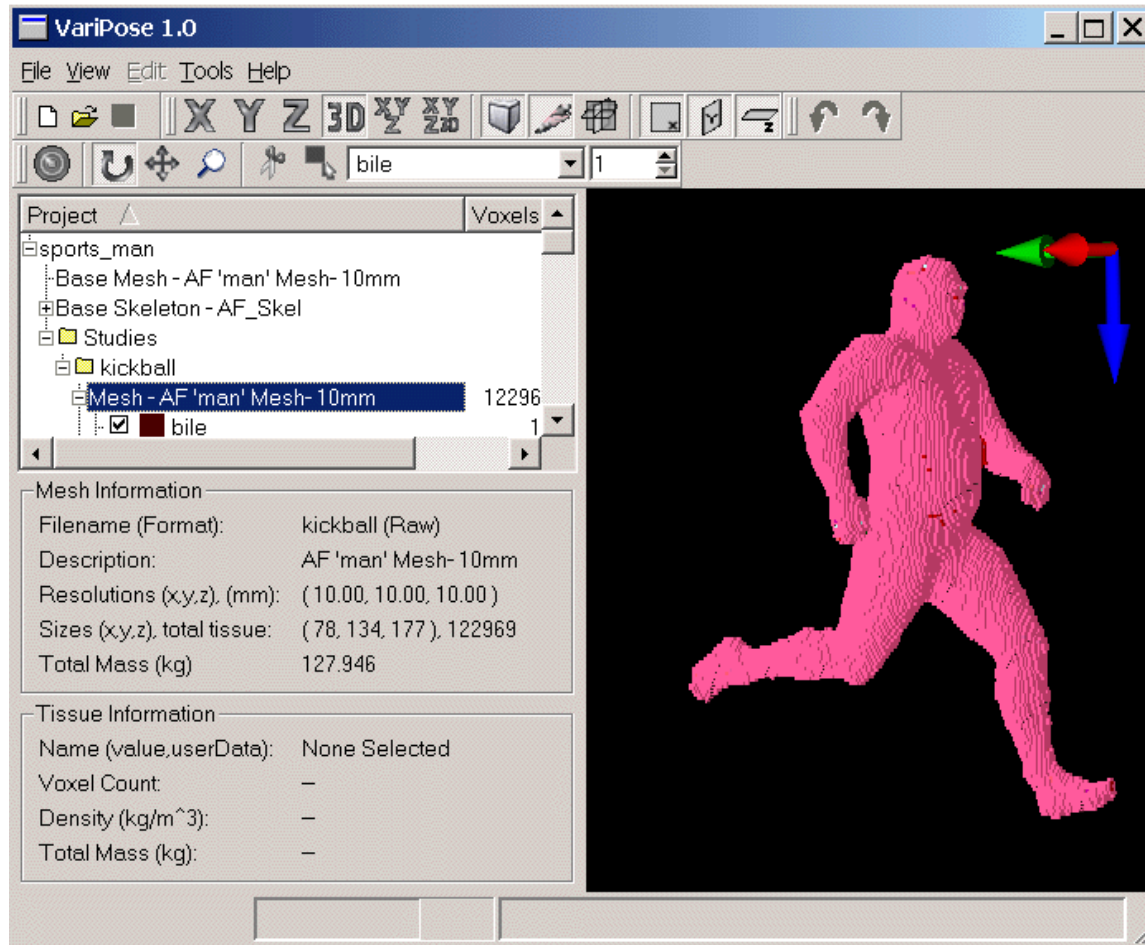
$$\nabla \cdot B = 0$$

$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



3D Mesh View



$$B = \mu H$$

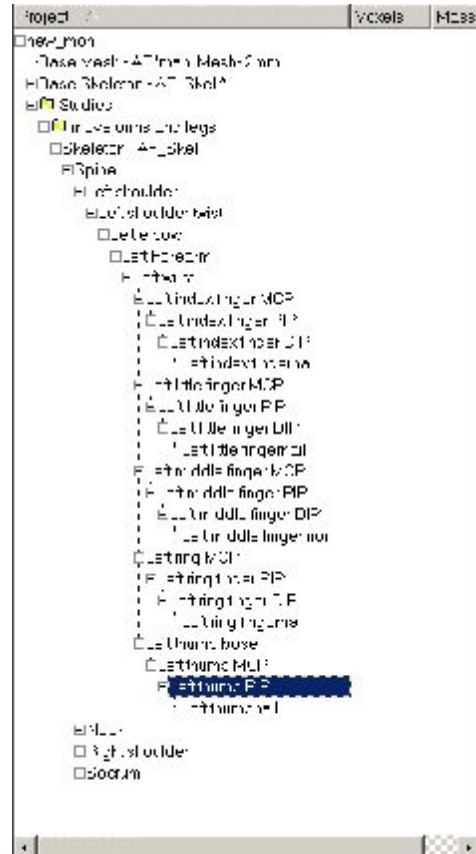
$$\nabla \cdot B = 0$$

$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



Expanded Skeleton Tree



$$B = \mu H$$

$$\nabla \cdot B = 0$$

$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



Tissue Summary

VariPose 1.0

File View Edit Tools Help

Project: new_man

Project	Voxels	Mass (kg)
Base Mesh - AF 'man' Mesh- 2mm	12820209	105.36
<input checked="" type="checkbox"/> bile	2356	0.019036
<input checked="" type="checkbox"/> bladder	12875	0.1060
<input checked="" type="checkbox"/> blood	81085	0.68630
<input checked="" type="checkbox"/> blood vessel	69998	0.58238
<input checked="" type="checkbox"/> body fluid	46355	0.37454
<input checked="" type="checkbox"/> bone marrow	346449	2.8824
<input checked="" type="checkbox"/> cancellous bone	204040	3.1340
<input checked="" type="checkbox"/> cartilage	63630	0.55841
<input checked="" type="checkbox"/> cerebellum	14434	0.1198
<input checked="" type="checkbox"/> cerebro spinal fluid	22836	0.18400
<input checked="" type="checkbox"/> cortical bone	311144	4.9534

Mesh Information

Filename (Format): af_man_2mm (Raw)
Description: AF 'man' Mesh- 2mm
Resolutions (x,y,z), (mm): (2.00, 2.00, 2.00)
Sizes (x,y,z), total tissue: (293, 170, 939), 12820209
Total Mass (kg): 105.362

Tissue Information

Name (value,userData): None Selected
Voxel Count: -
Density (kg/m^3): -
Total Mass (kg): -

$$B = \mu H$$

$$\nabla \cdot B = 0$$

$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



Before/After Tissue Summary

VariPose - Mesh Comparison

Tissue Name	AF 'man' Mesh- 5mm Voxels	AF 'man' Mesh- 5mm Mass (kg)	flatfeet Voxels	flatfeet Mass (kg)
bile	158	0.0199	158	0.0199
bladder	841	0.1083	842	0.1084
blood	5094	0.6737	5094	0.6737
blood vessel	4344	0.5647	4376	0.5689
body fluid	2993	0.3779	2993	0.3779
bone marrow	22172	2.8824	21926	2.8504
cancellous bone	13428	3.2227	13053	3.1327
cartilage	4060	0.5567	3999	0.5484
cerebellum	1051	0.1364	1051	0.1364
cerebro spinal fluid	1656	0.2085	1656	0.2085

Display Data: Voxel Count Volume Mass

Display Format: Actual Value Percent change from base

Close

$$B = \mu H$$

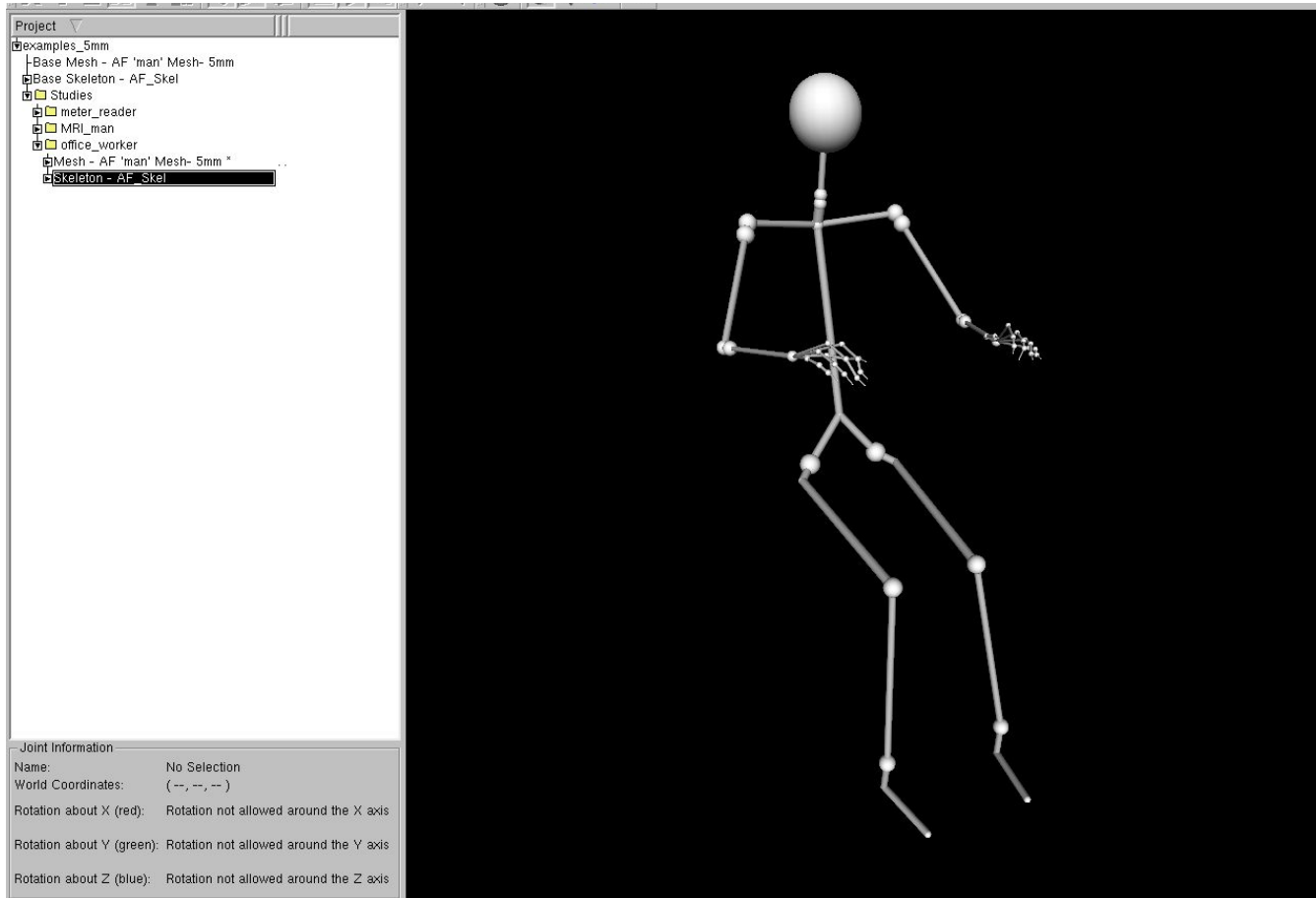
$$\nabla \cdot B = 0$$

$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



Step 1 Enter Mesh Position



$$B = \mu H$$

$$\nabla \cdot B = 0$$

$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



Step 2 Check Position and Tissue Weight/Voxels

Project: VariPose 1.0

File View Edit Tools Help

Project: examples_5mm

- Base Mesh - AF 'man' Mesh- 5...
- Base Skeleton - AF_Skel
- Studies
 - meter_reader
 - MRI_man
 - office_worker
- Mesh - AF 'man' Mesh- 5mm

	Voxels	Mass (kg)
bile	158	0.0199475
bladder	873	0.112399
blood	5116	0.676591
blood vessel	4555	0.59215
body fluid	2911	0.367514
bone marrow	21627	2.81151
cancellous bone	13150	3.156
cartilage	3985	0.546443
cerebellum	1051	0.136367
cerebro spinal fluid	1657	0.208616
cortical bone	19312	4.80386
eye cornea	1	0.0001345
eye lens	8	0.00153
eye sclera	33	0.00423225
eye vitreoushumor	88	0.0110979
fat	281687	32.2532
gall bladder	86	0.0110725
glands	1186	0.155662
grey matter	4147	0.538073
heart	2416	0.311
inner lung	22458	0.729885
kidneys	2696	0.35385
large intestine	3676	0.479029
ligaments	21318	3.25099
liver	14284	1.63906
lymph	505	0.06565

Mesh Information

Filename (Format): office_worker (Raw)
Description: AF 'man' Mesh- 5mm
Resolutions (x,y,z), (mm): (5.00, 5.00, 5.00)
Sizes (x,y,z), total tissue: (130, 161, 318), 895851
Total Mass (kg): 115.341

Tissue Information

Name (value,userData): None Selected
Voxel Count: --
Density (kg/m³): --
Total Mass (kg): --

$$B = \mu H$$

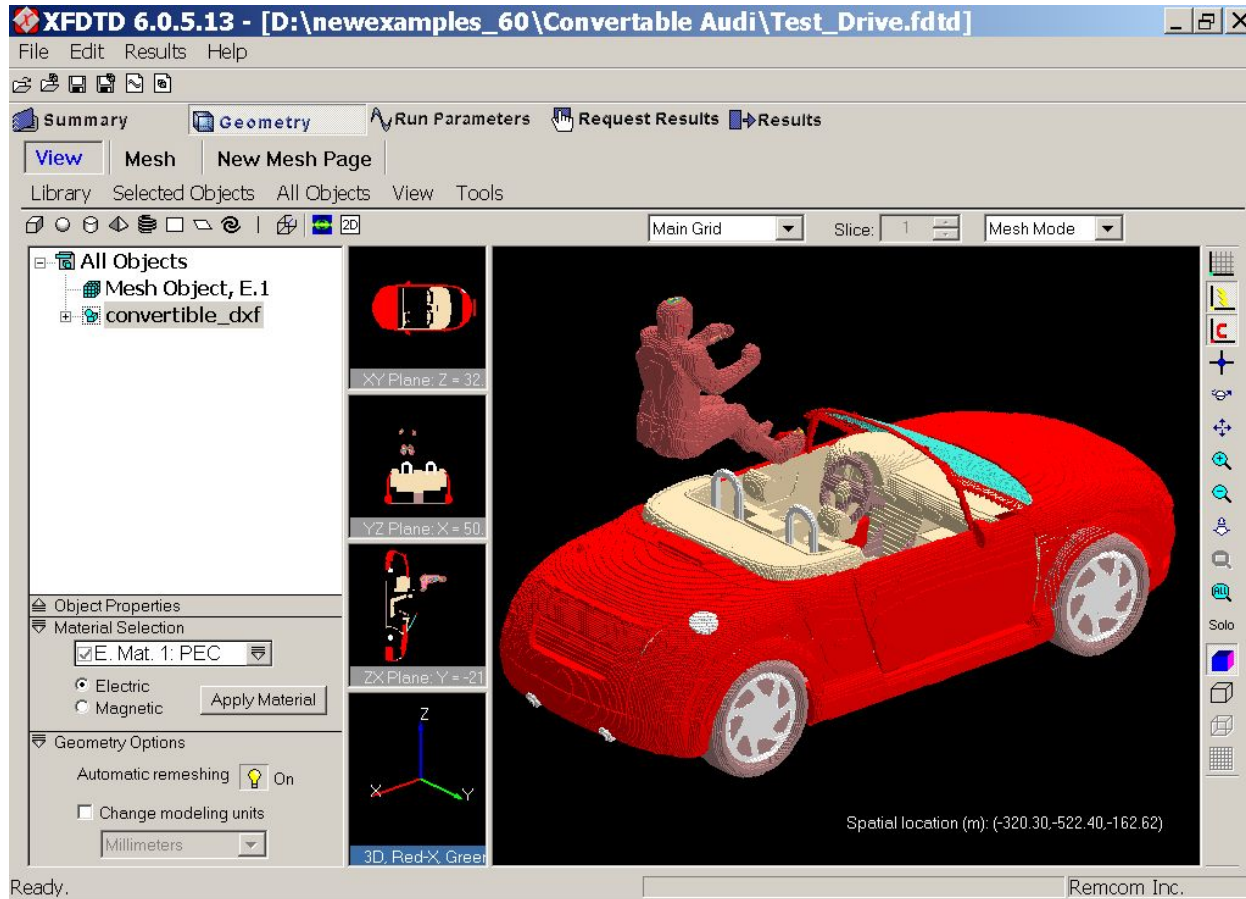
$$\nabla \cdot B = 0$$

$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



Step 3 Load Mesh into XFDTD



$$B = \mu H$$

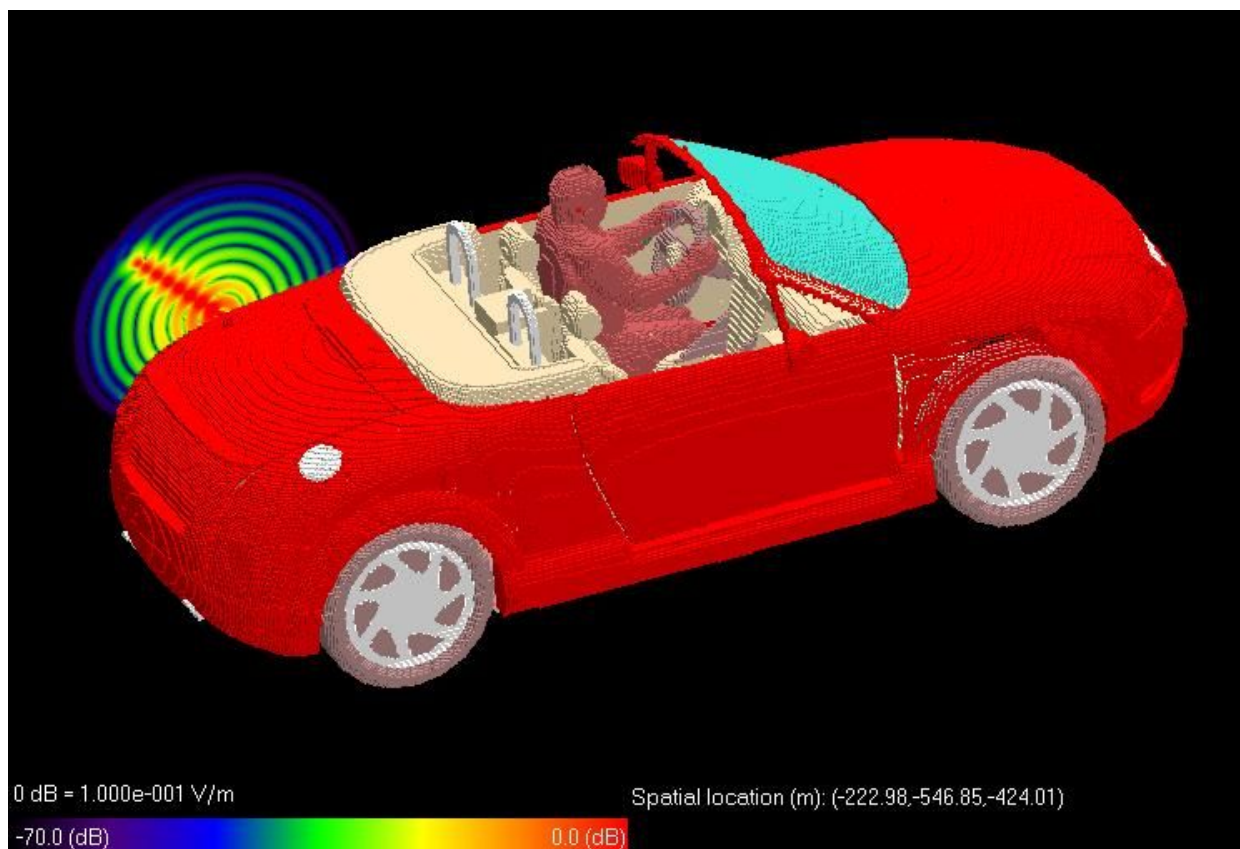
$$\nabla \cdot B = 0$$

$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



Step 4 Add Excitation and Obtain Results



$$B = \mu H$$

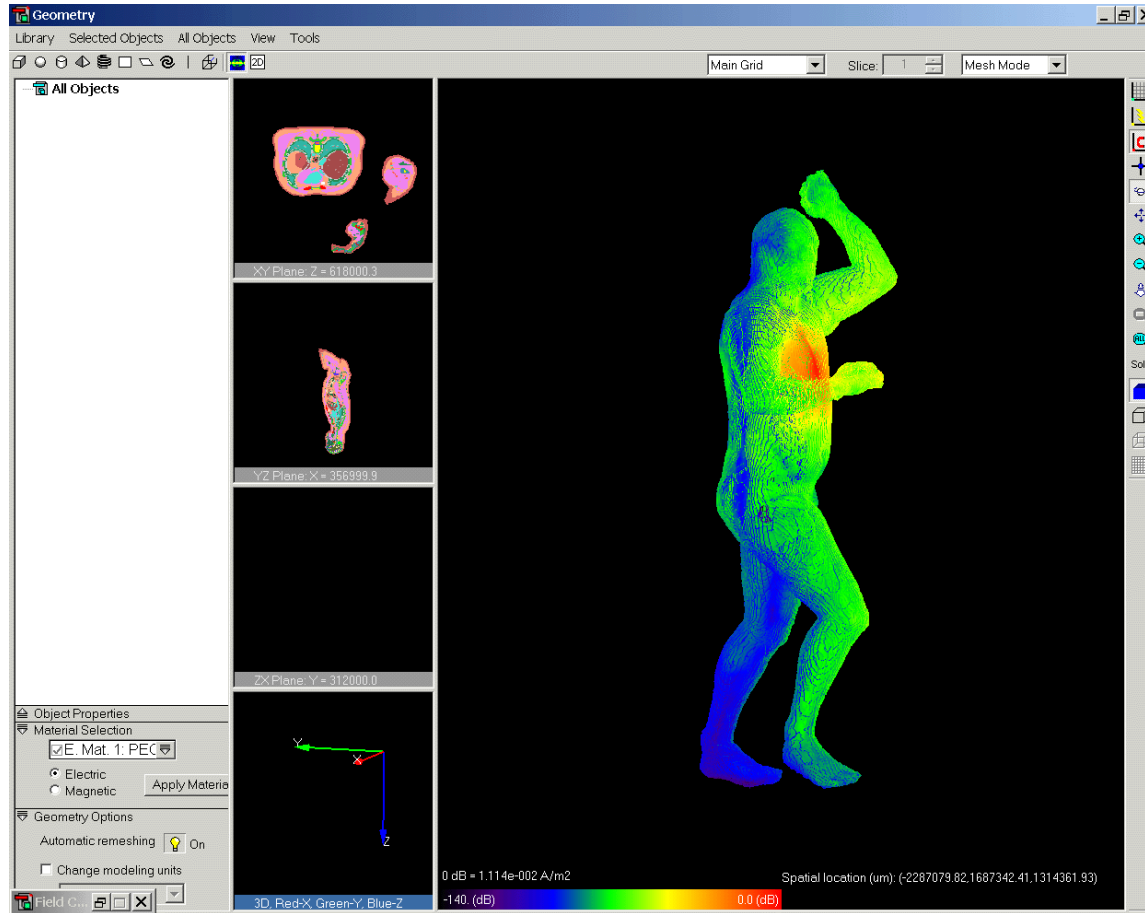
$$\nabla \cdot B = 0$$

$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



All XFDTD Functions including SAR are Available



$$B = \mu H$$

$$\nabla \cdot B = 0$$

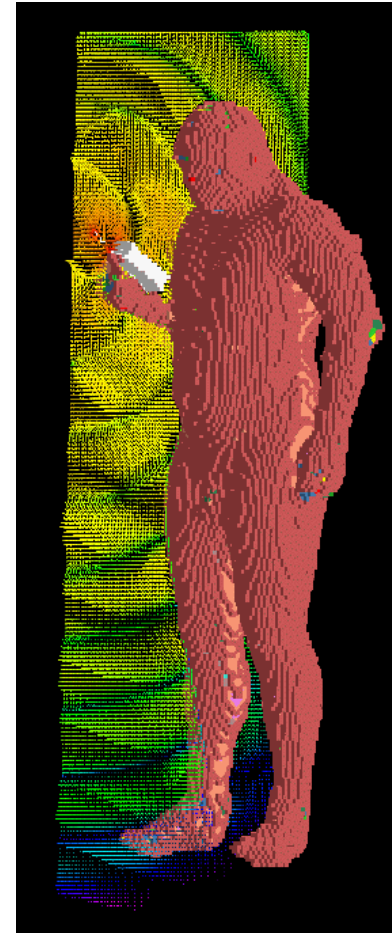
$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$



VariPose Summary

- * Provide for realistic positioning of heterogeneous human meshes
- * Interactive positioning GUI
- * Background Mesh Positioning engine
- * Provides information on tissue mass/voxels in repositioned mesh
- * Internal anatomical structures are included



$$B = \mu H$$

$$\nabla \cdot B = 0$$

$$\nabla \cdot D = \rho$$

$$D = \epsilon E$$