

## Exercise 22 : Virtual Endoscopy Endoscopic Movie Generation

The Virtual Endoscopy module provides an interactive interface for endoscopic visualization. Often the desired result of such an endoscopic exploration is a detailed endoscopic movie sequence along a specified 'fly-through' path. This exercise will demonstrate how to achieve this by defining a path using key frames then generating all endoscopic renderings along this path.

1. Load the **CT\_Lungs.avw** data set from the **\$(\BIR\images\TutorialData** directory.
2. Open the **Virtual Endoscopy** module (**Display > Virtual Endoscopy**).
3. Before beginning to record the movie, move closer to the trachea. Position the cursor near the center of the trachea and click three times to cause incremental movement towards the target.



4. Press the **Add Key Frame** PowerBar button or choose **Generate > Sequence > Add Key Frame** to specify the first key frame (this is where the movie will begin).

5. Move closer to the trachea by clicking three more times within the tracheal lumen (figure 1). After the movement towards the trachea has stopped, press the **Add Key Frame** button to add another key frame.



6. Choose **Generate > Sequence > Auto Add Key Frame**, this option causes any new viewpoint to automatically be added as a key frame.
7. Continue to click within the tracheal lumen and navigate down to the bifurcation of the airway (approximately 9 clicks) (figure 2).

8. When you reach the bifurcation of the airway, click in the left bronchus to reorient the viewpoint down that specific branch. Click several more times to traverse down the left bronchus.



9. When you have moved down the left bronchus (figure 3), choose **Generate > Sequence > Auto Add Key Frame** to turn off the Auto Add Key Frame option.

10. To save the sequence, choose **Generate > Sequence > Save Sequence**.

11. To generate a movie of the sequence, choose **Generate > Sequence > Generate Sequence**. The full sequence (defined by the key frames) will now be generated by the module; all endoscopic renderings will be generated along the defined path.



12. The fly-through movie will be available in the Analyze workspace and can be viewed with the Movie module (**Display > Movie**).



Figure 1

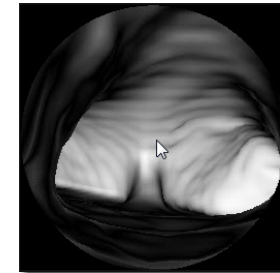


Figure 2

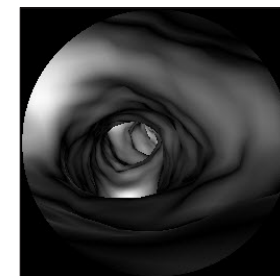


Figure 3

*note* | Rendering the endoscopic movie may take a few minutes depending upon your system and the size of the movie.

**Additional Task**

**1. Advanced Maneuvers**

1. After viewing your movie try recreating the movie adding these steps into the main exercise after **Step 7**.
2. When you reach the bifurcation of the airway, click in the right bronchus. Click two more times to move further into the bronchus (figure 1).
3. Press the **Back** PowerBar button three times, and then proceed down the left bronchus.
4. At the end of the left bronchus press the **Invert Positions** PowerBar button, then move back up through the left bronchus towards the trachea.
5. When you reach the trachea choose **Generate > Sequence > Auto Add Key Frame** to turn off the Auto Add Key Frame option.
6. Choose **Generate > Sequence > Generate Sequence** to generate the movie (figure 2).
7. Close the Virtual Endoscopy module before proceeding to the next Additional Task.

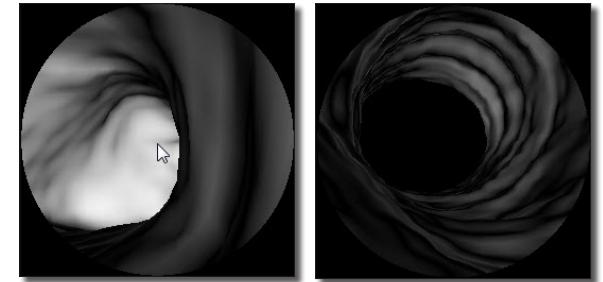


Figure 1

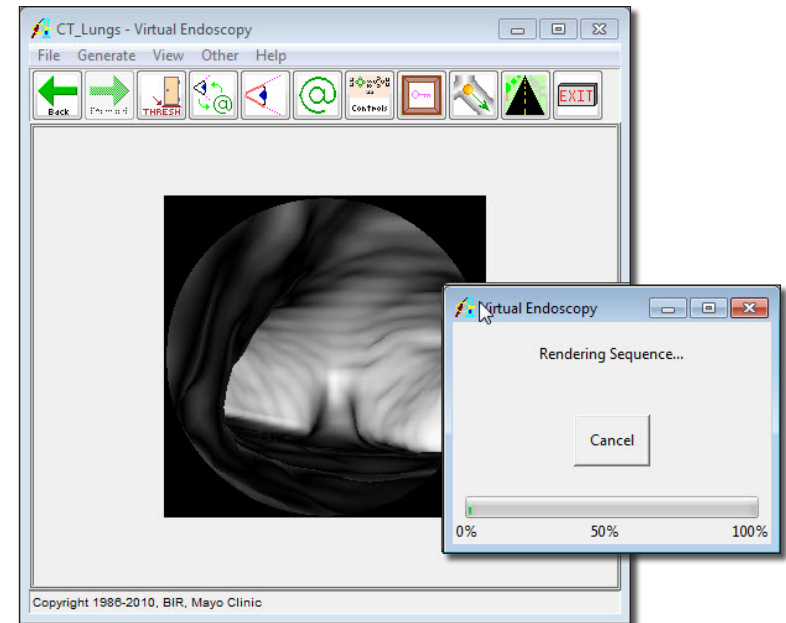


Figure 2

2. Generating a Centerline

The Virtual Endoscopy module provides that ability to generate the centerline of an endoscopic structure using the current Eye and Look At points. Key frames are automatically generated between the two points and displayed in the Sequence Edit window once the centerline has been created, allowing an endoscopic sequence to be generated along the centerline, thus reducing the time taken to create fly-through movies. This task will show you how to create a centerline and generate the resulting endoscopic movie.

1. Load the **CT\_Lungs.avw** data set from the `$.\BIR\images\TutorialData` directory.
2. Open the **Virtual Endoscopy** module (**Display > Virtual Endoscopy**).
3. Position the cursor over the center of the trachea and click to navigate into the trachea. Clicking 12 times should position you midway into the trachea (figure 1).
4. Press the **Eye** and **Look At** PowerBar buttons to enable the **Eye** and **Look At** views. Then press the **Show Object** PowerBar button to open the **Show Object** window.
5. In the Show Object window, click on and drag the green arrow (the Look At point) to the end of the airway (figure 2).
6. Use the **Look At** panels to correct the Look At position, make sure that the Look At position is on the airway (figure 3).

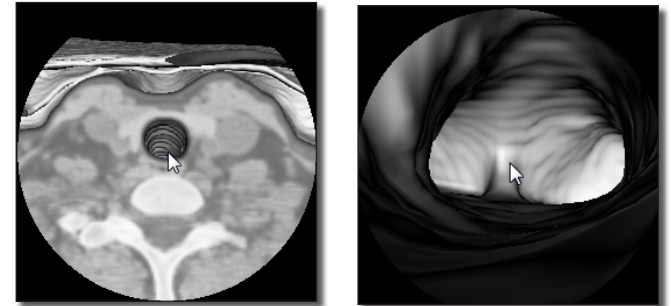


Figure 1

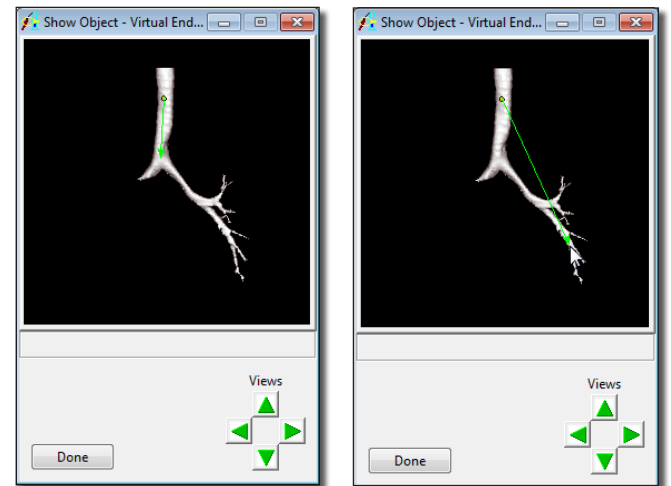


Figure 2

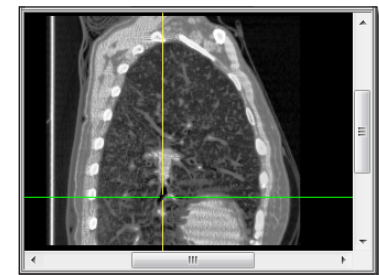


Figure 3

## 2. Generating a Centerline

7. Next select **Generate > Generate Centerline**. The module will calculate the centerline between the current Eye and Look At points. Once calculated, the Sequence Edit tool will open displaying the automatically generated key frames, the centerline will be displayed in the Show Object window (figure 4).

*note* If you do not have the Look At point centered exactly in the airway, you will receive an error when generating the centerline. If this happens, reposition your Look At point and try again.

8. To generate the endoscopic movie, select **Generate > Sequence > Generate Sequence**. The endoscopic movie based on the centerline will be generated and saved to the Analyze workspace.
9. Close all windows associated with the Virtual Endoscopy module before proceeding to the next Additional Task.

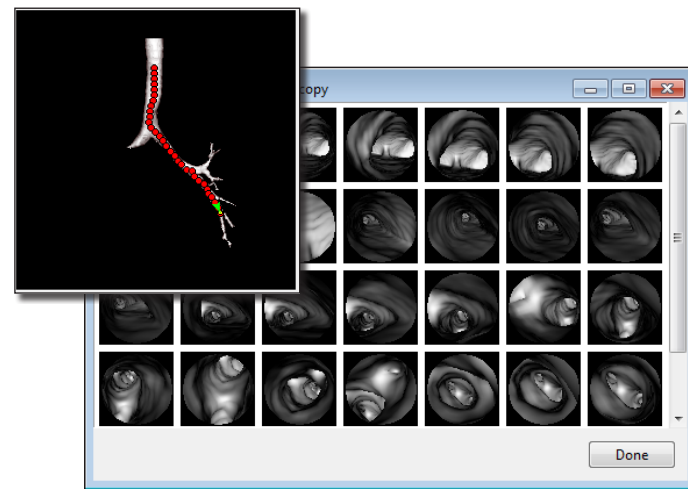


Figure 4

Additional Task

3. Adding Color to Endoscopic Movies

Movies generated in the Virtual Endoscopy module can be given a quick update by apply a color map using the Multiplanar Sections module.

1. Select the endoscopic fly-through movie from the Analyze workspace and open the **Multiplanar Sections** module **Display > Multiplanar Sections**.
2. Open the **Intensities** window **View > Intensities**.
3. In the **Intensities** window set **Type** to **Colormap**. Here you can generate your own custom color map or load an existing color map (figure 1). Load the **hot\_body.lkup** from the **C:\BIR\images\TutorialData\Colormaps** directory.
4. Once loaded, set **Range** to **Data Type** and then increase the **Max** value to **255**.
5. To review the movie, select the Display Sections button from the PowerBar (figure 2).
6. To save the color intensified movie, select **File > Output Intensified**. The color map will be applied to a copy of the movie and saved to the Analyze workspace.
7. Close all windows associated with the Virtual Endoscopy module before proceeding to the next exercise.

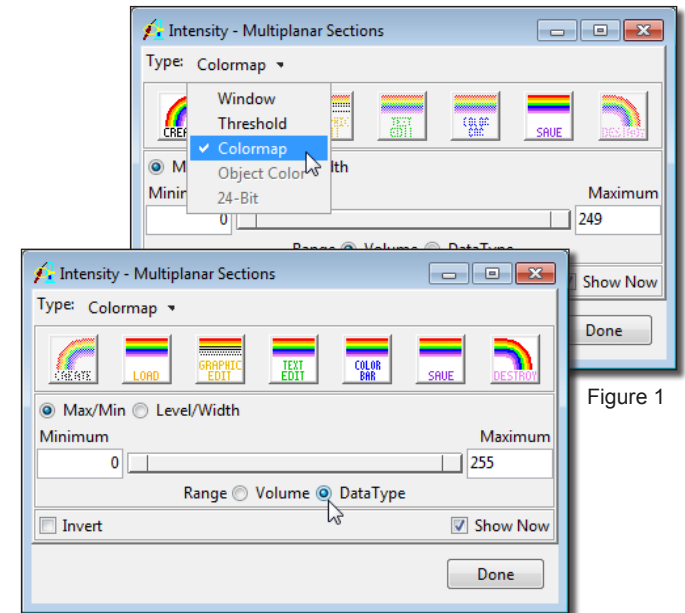


Figure 1

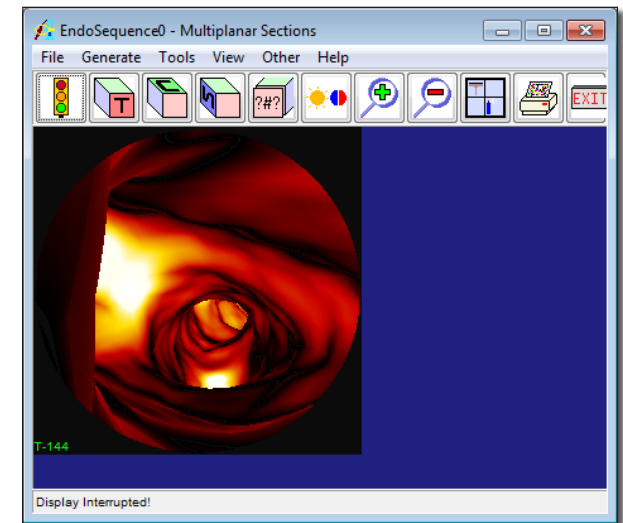


Figure 2