



*NA-MIC*

*National Alliance for Medical Image Computing*

*<http://www.na-mic.org>*

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# **Qualitative and quantitative comparison of two RT dose distributions**

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NA-MIC Tutorial Contest: Summer 2012

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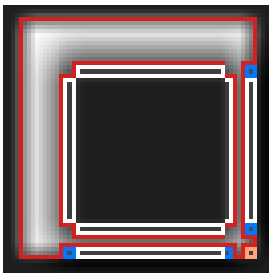


# Learning Objective

THIS TUTORIAL DEMONSTRATES HOW TO COMPARE TWO DOSE DISTRIBUTIONS

## Qualitatively

by analyzing isodose distributions



## Quantitatively

by direct voxel-by-voxel comparison

using acceptance criteria for:

- dose difference
- distance-to-agreement



# Pre-requisite

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This tutorial assumes that you have already completed

## **Data Loading and 3D Visualization** by Sonia Pujol

<http://www.slicer.org/slicerWiki/index.php/Documentation/4.1/Training>



# Material

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This tutorial requires the installation of the Slicer4.1 release and the tutorial dataset. They are available at the following locations:

**Slicer** download page

<http://download.slicer.org>

**Tutorial dataset:** [dose\\_comparison\\_data.zip](#)

<http://forge.abcd.harvard.edu/gf/project/plastimatch/frs>





# Platforms

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This tutorial is designed for...



10.7.4





# Overview

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1 Downloading the Plastimatch 3D Slicer Extension

2 Loading and visualizing sample dose volumes

3 Performing direct voxel-by-voxel dose comparison

4 Running isodose calculation and visualization

5 Performing dose difference and distance-to-agreement acceptance criteria ( $\gamma$ -analysis)



# Overview

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# Downloading the Plastimatch Extension

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The Plastimatch Extension is downloadable using  
Slicer's integrated Extension Manager  
(in the near future)

[http://www.plastimatch.org/3d\\_slicer\\_integration.html](http://www.plastimatch.org/3d_slicer_integration.html)

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The Plastimatch Extension can also be compiled manually  
(right now)

[http://www.plastimatch.org/getting\\_started.html](http://www.plastimatch.org/getting_started.html)



# Overview

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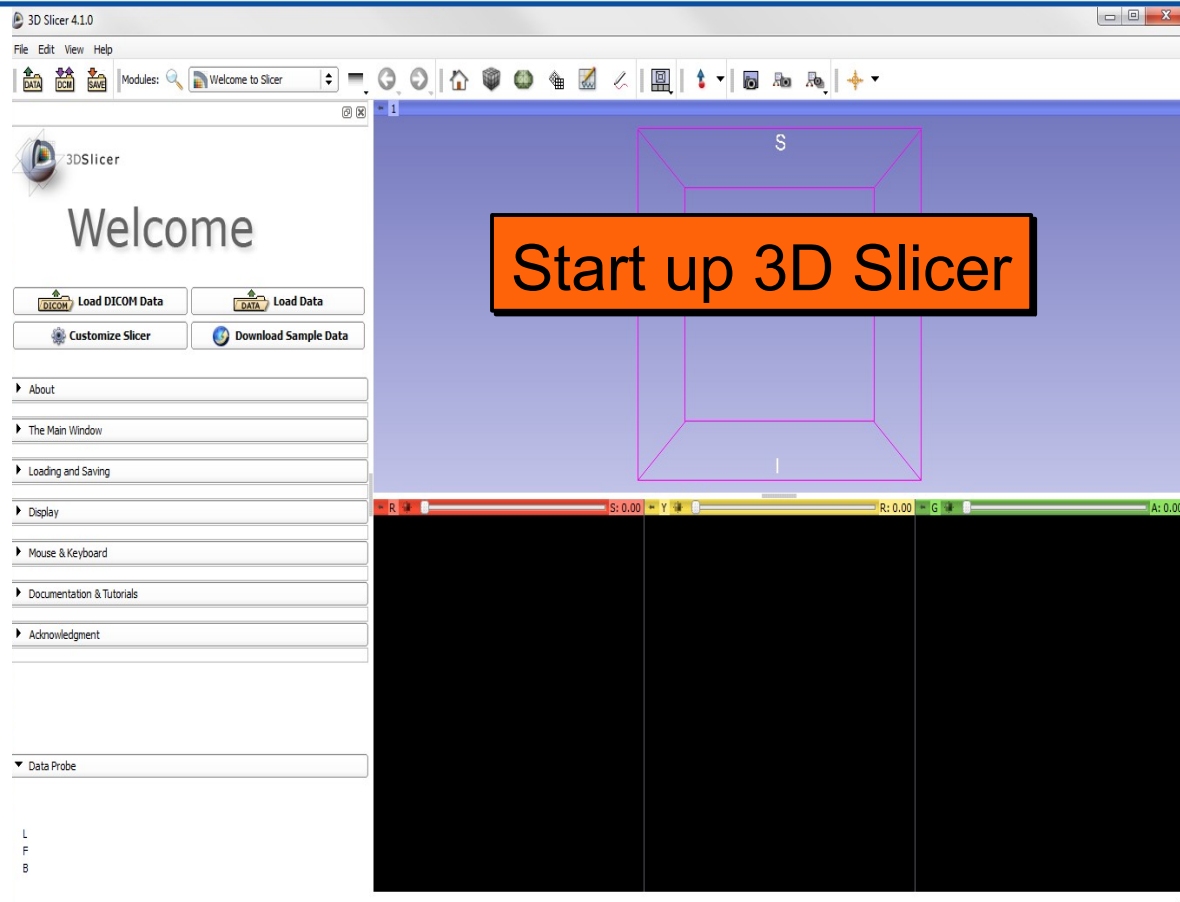
3 Performing direct voxel-by-voxel dose comparison

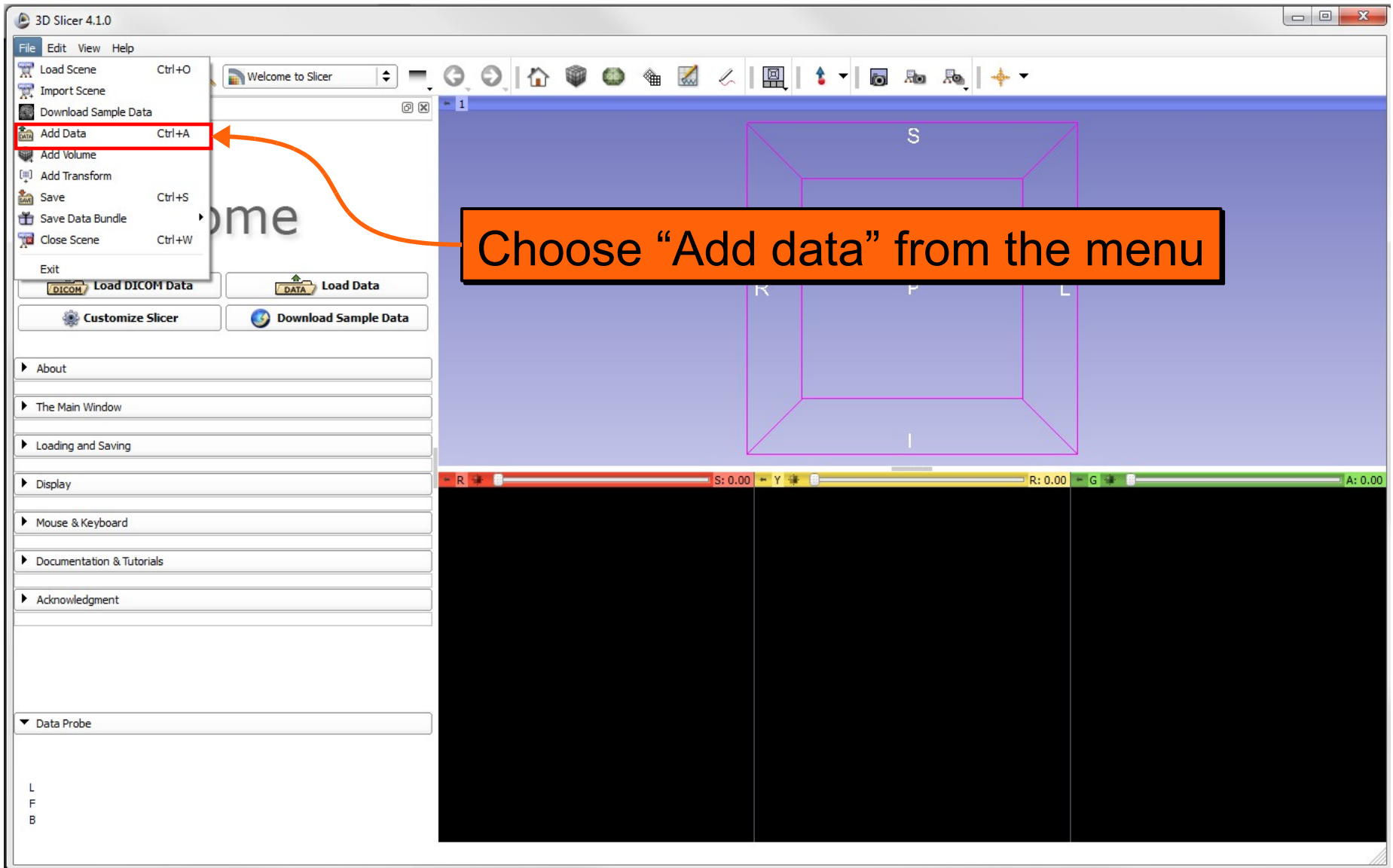
4 Running isodose calculation and visualization

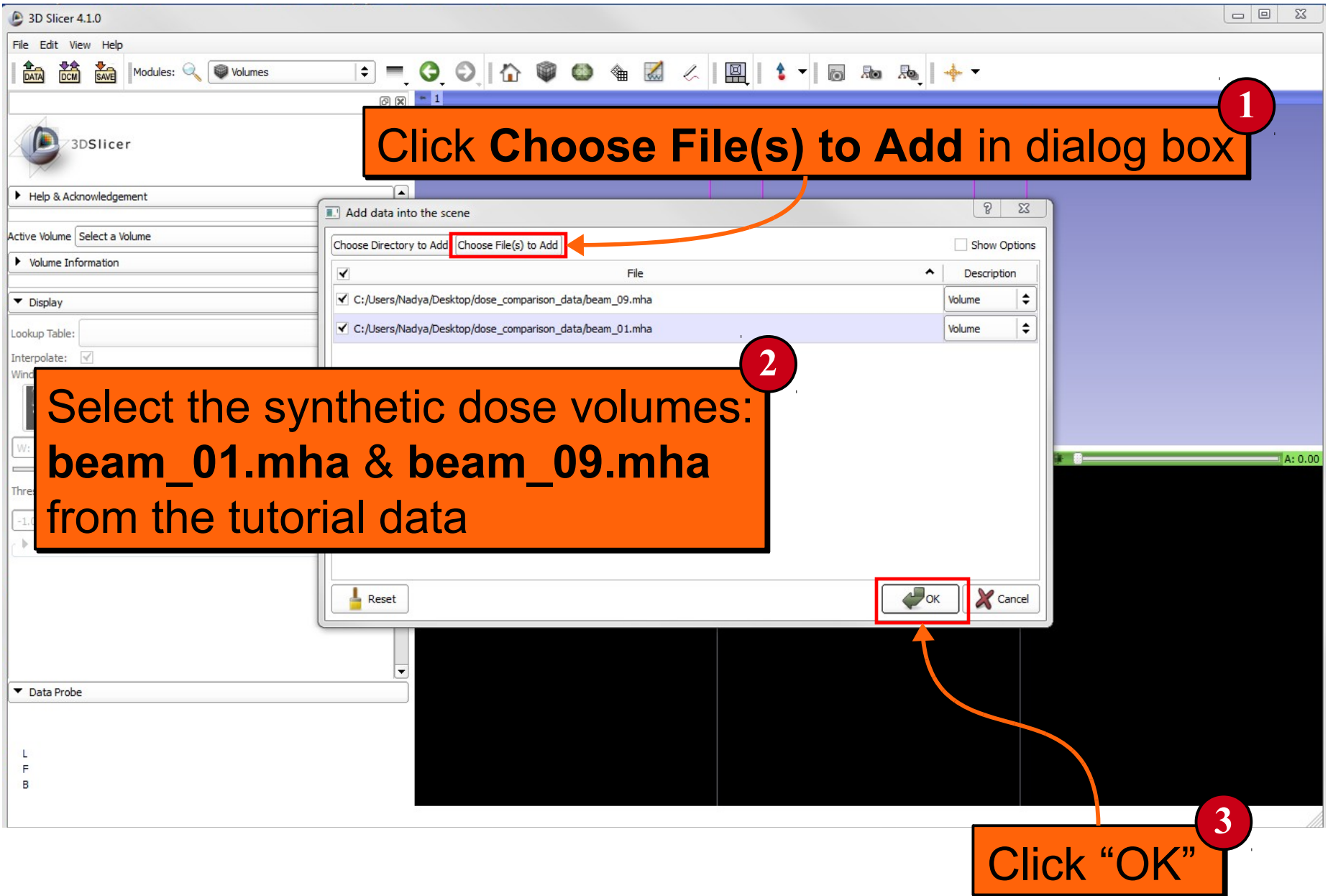
5 Performing dose difference and distance-to-agreement acceptance criteria ( $\gamma$ -analysis)



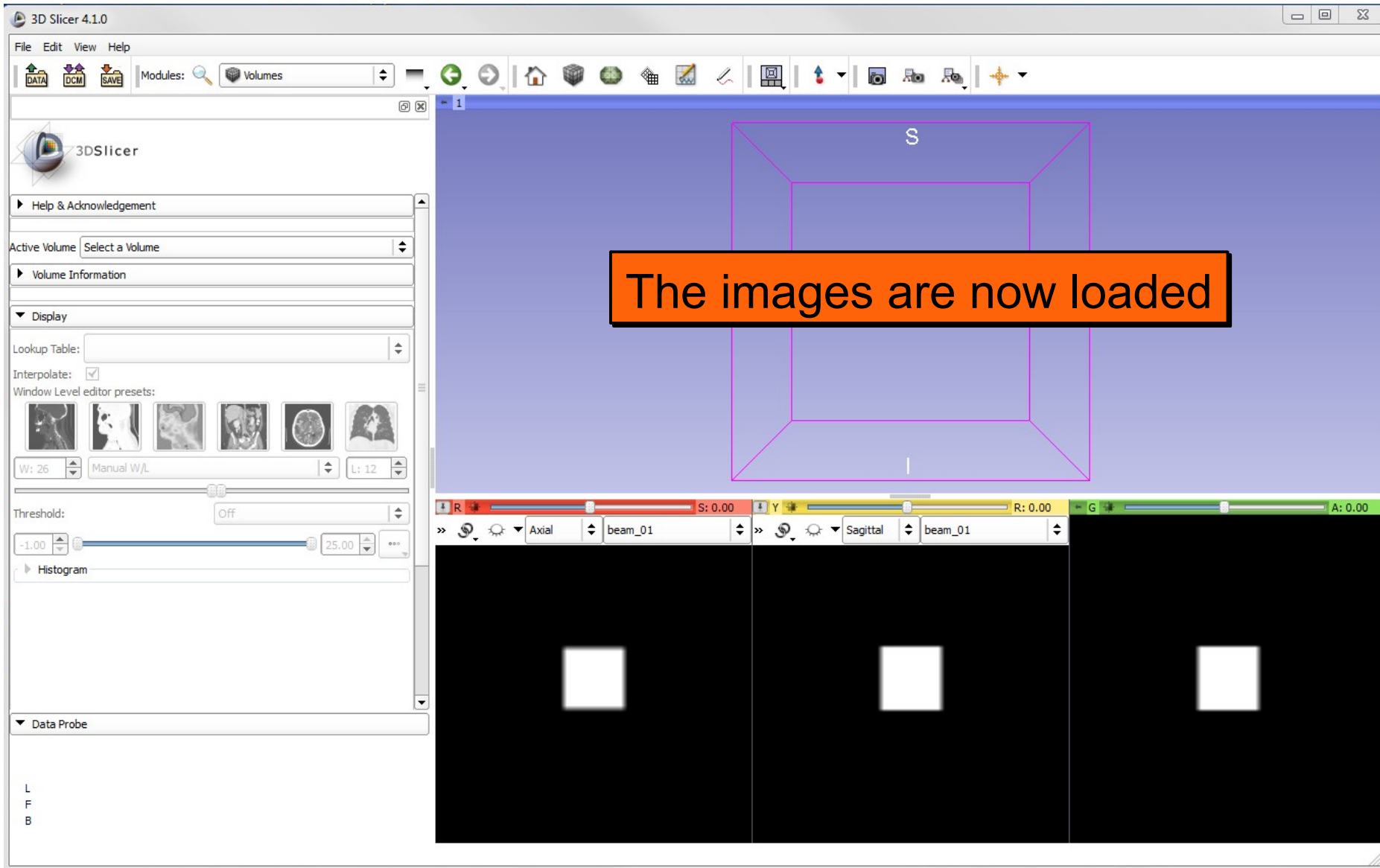
# Loading and visualizing the sample data











3D Slicer 4.1.0

File Edit View Help

Modules: **Volumes**

Active Volume: beam\_09

Volume Information

Display

Lookup Table: **Green**

Interpolate: ☒

Window Level editor presets:

W: 26 Auto W/L L: 12

Threshold: Off

Histogram

Data Probe

To better see the image alignment, we assign the images different colors using the 'Volumes' Module

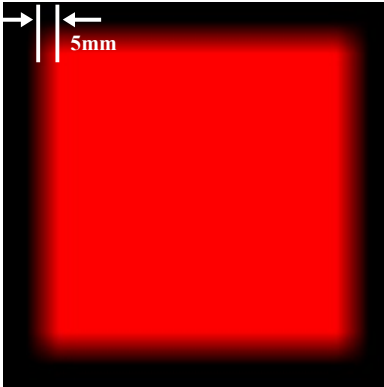
Here we assign **GREEN** to **beam\_09.mha** and **RED** to **beam\_01.mha**

Use the **foreground transparency slider** to blend the images.

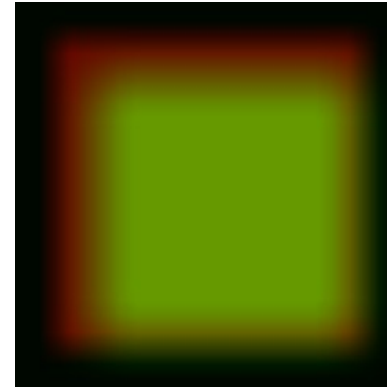
Set beam\_01 as the **foreground** image and beam\_09 as the **background** image



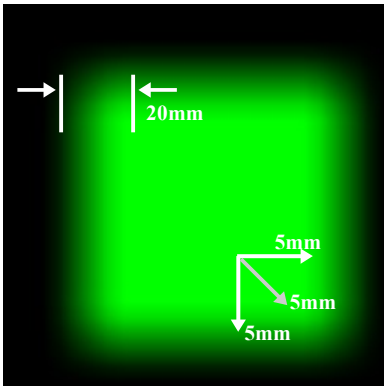
# Synthetic dose distributions



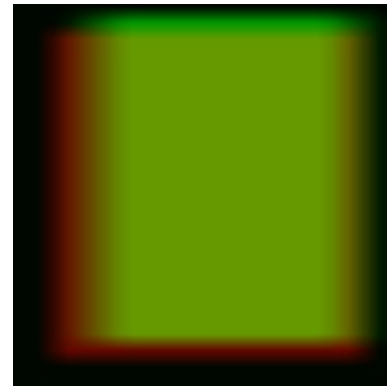
**dose\_01.mha**  
- axial view  
- 5mm penumbra



**superimposition**  
- axial view



**dose\_09.mha**  
- axial view  
- 20mm penumbra  
- 5mm shift along each axis



**superimposition**  
- coronal view



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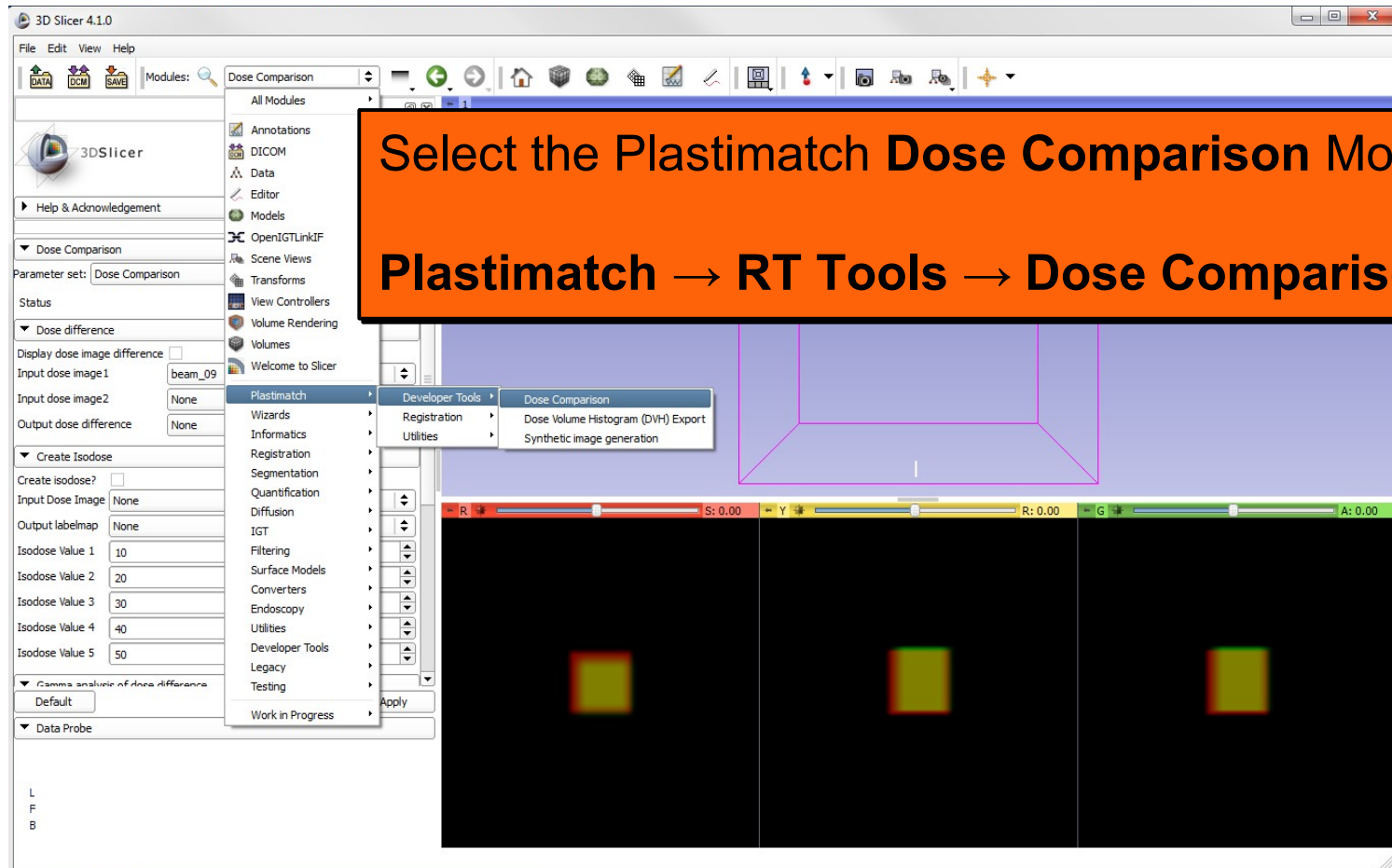
3 Performing direct voxel-by-voxel dose comparison

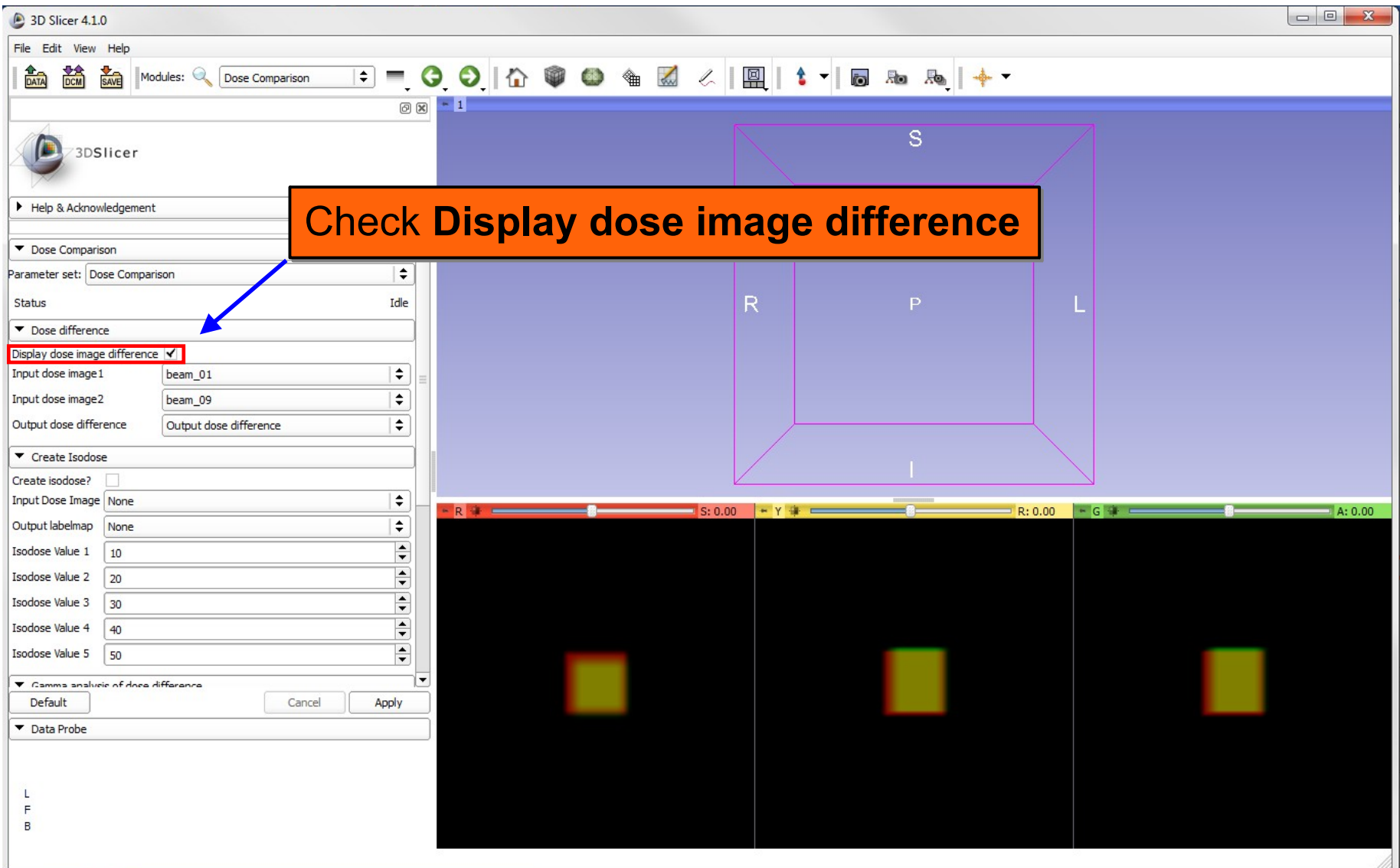
4 Running isodose calculation and visualization

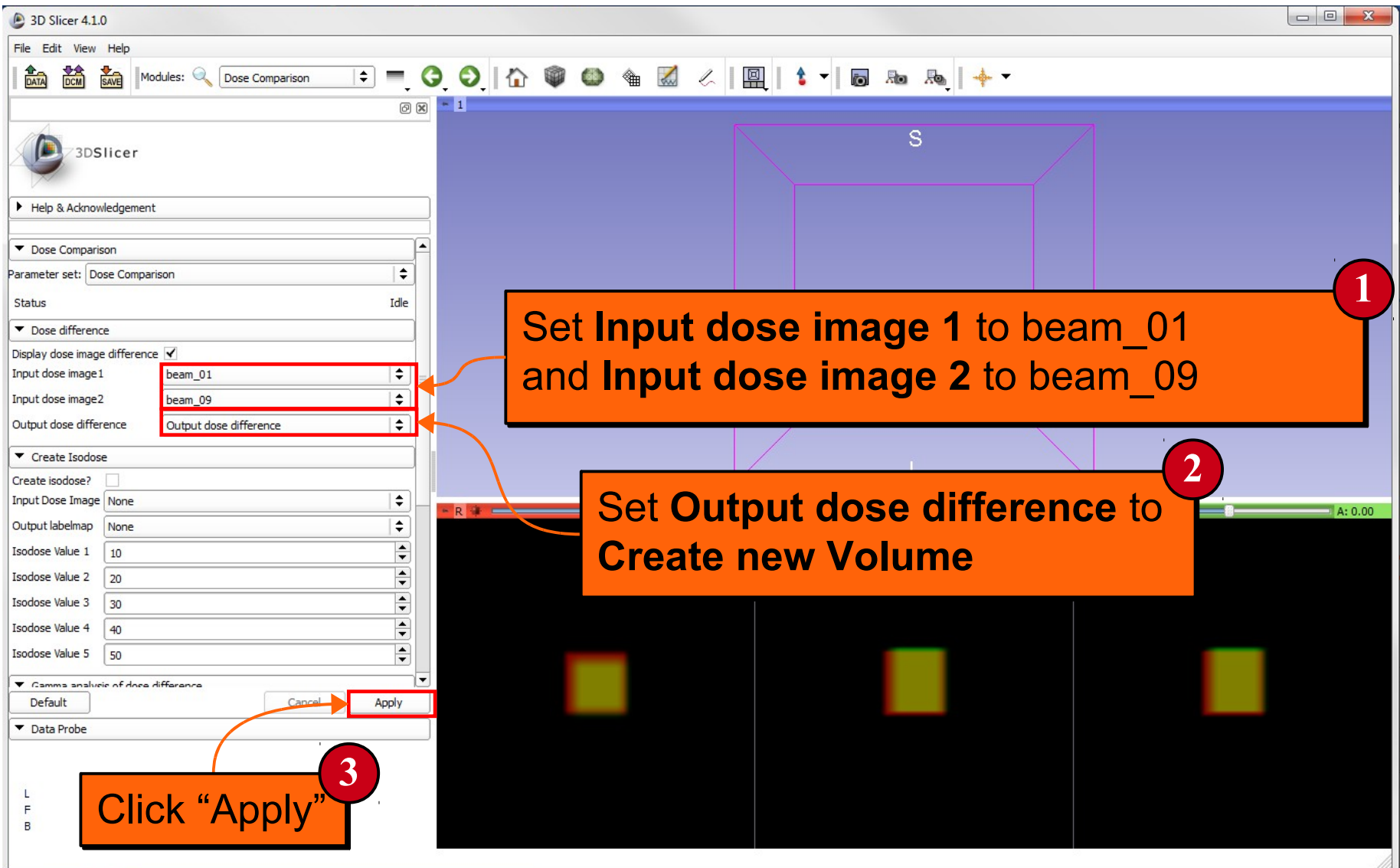
5 Performing dose difference and distance-to-agreement acceptance criteria ( $\gamma$ -analysis)



# Running direct voxel-by-voxel dose comparison







3D Slicer 4.1.0

File Edit View Help

Modules: Dose Comparison

3DSlicer

Help & Acknowledgement

Dose Comparison

Parameter set: Dose Comparison

Status Completed 100%

Dose difference

Display dose image difference ☒

Input dose image1 beam\_01

Input dose image2 beam\_09

Output dose difference Output dose difference

Create Isodose

Create isodose? ☐

Input Dose Image None

Output labelmap None

Isodose Value 1 10

Isodose Value 2 20

Isodose Value 3 30

Isodose Value 4 40

Isodose Value 5 50

Default Cancel Apply

Data Probe

Red RAS: (4.0, 43.8, -20.0) Axial Sp: 5.0

L None 0

F None 0

B Output dose difference (49, 41, 46) 22.75

When the calculation is complete, the dose difference image is automatically displayed

Hovering the mouse over a voxel in the output volume displays the difference between the two input doses at that location





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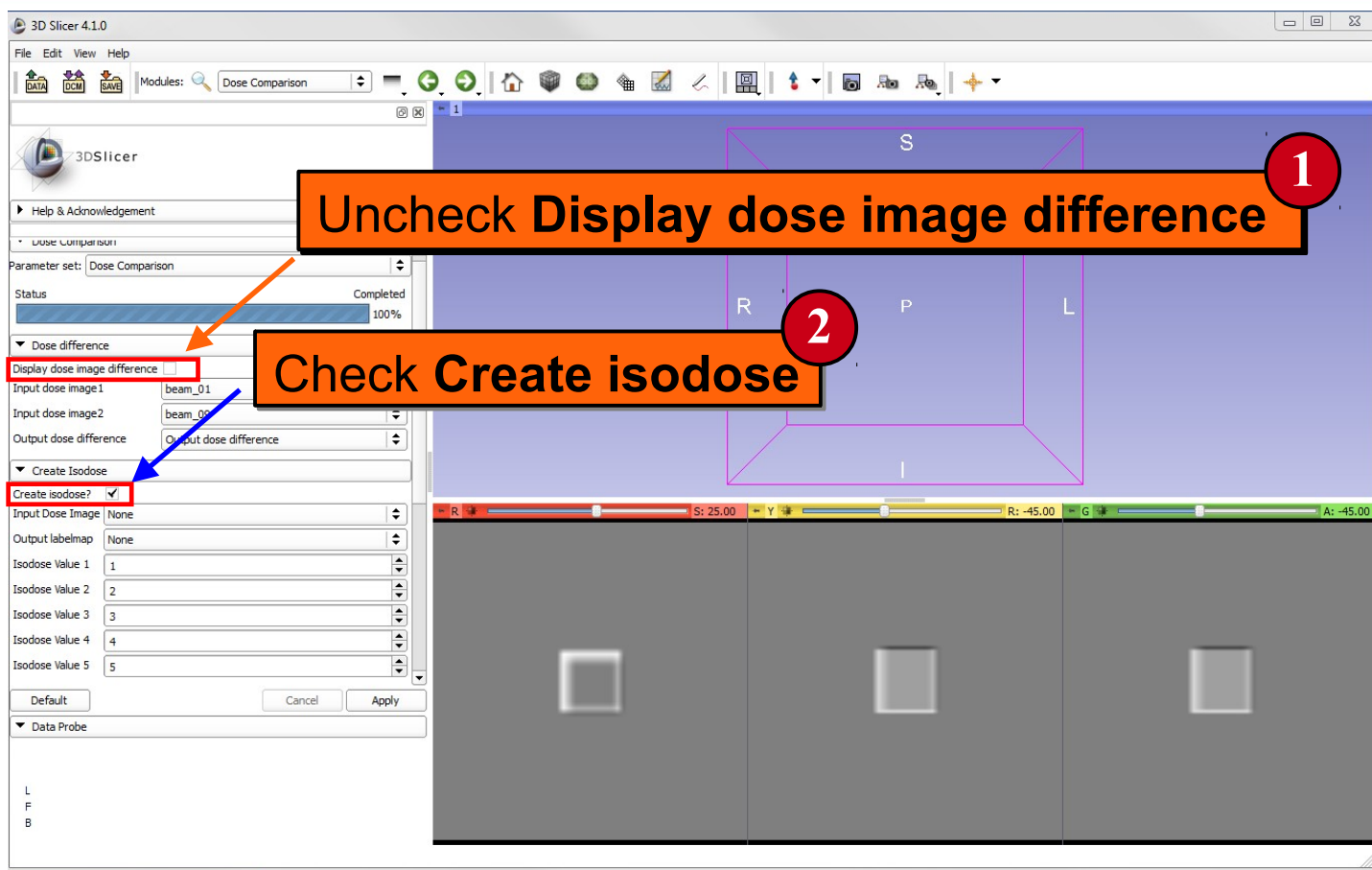
3 Performing direct voxel-by-voxel dose comparison

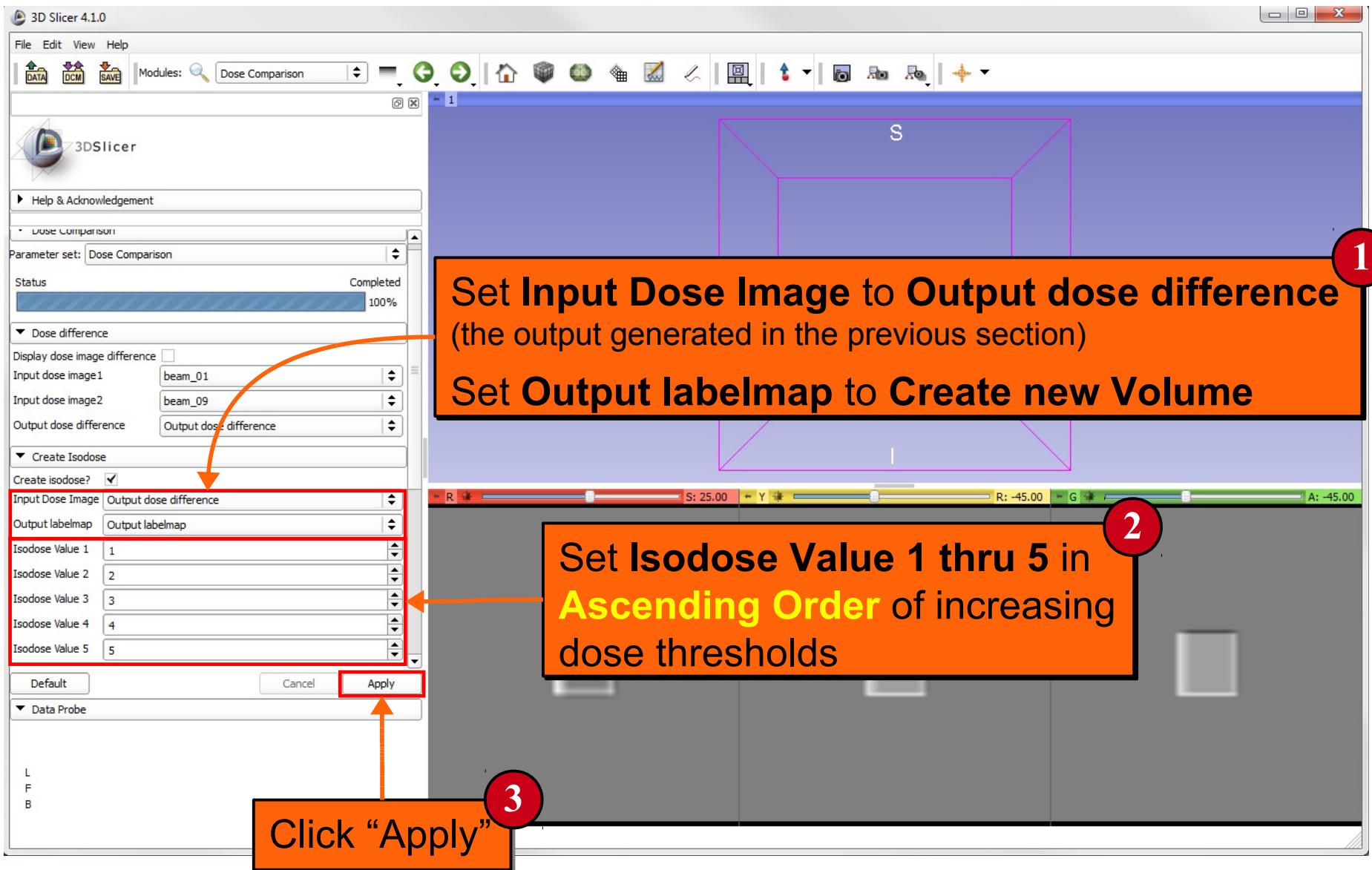
4 Running isodose calculation and visualization

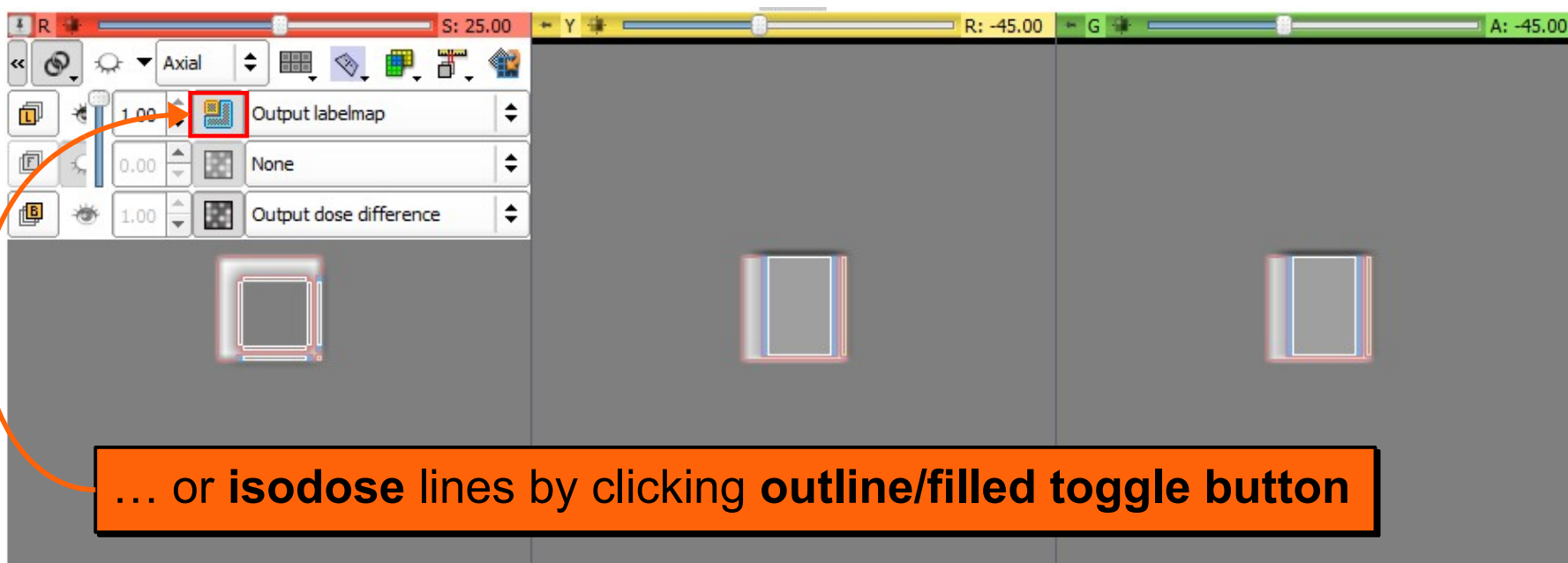
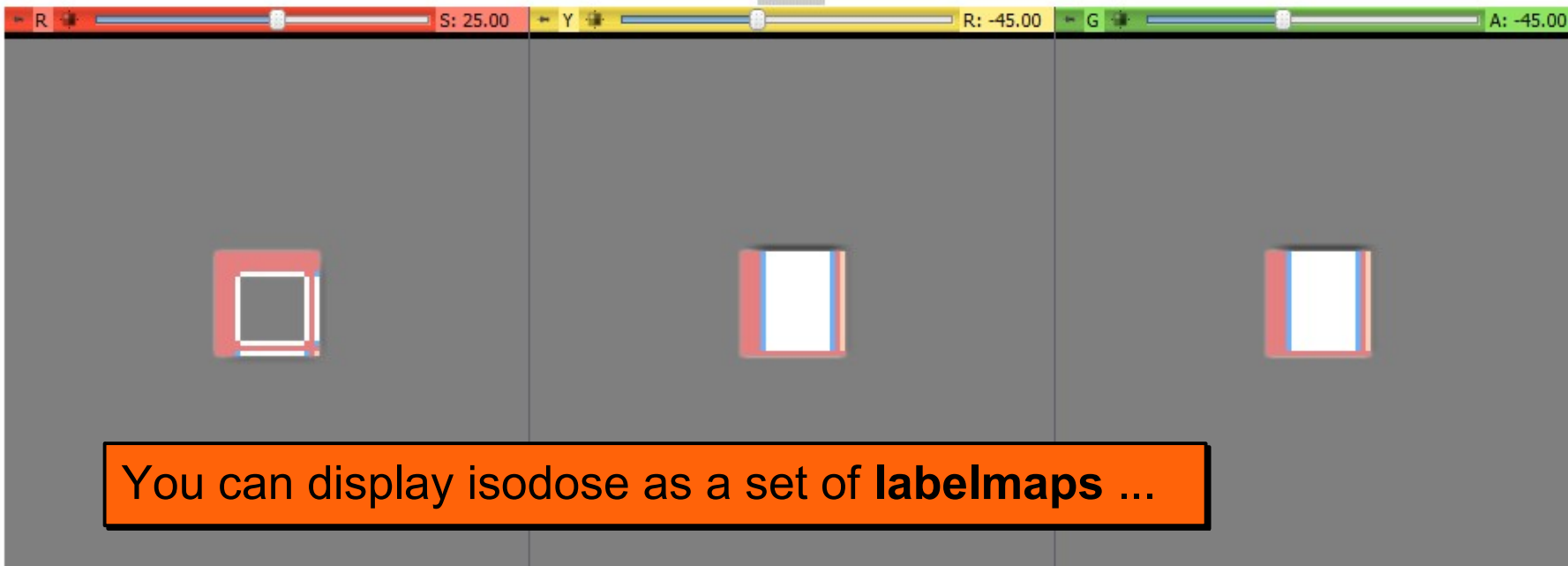
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# Running isodose calculation and visualization









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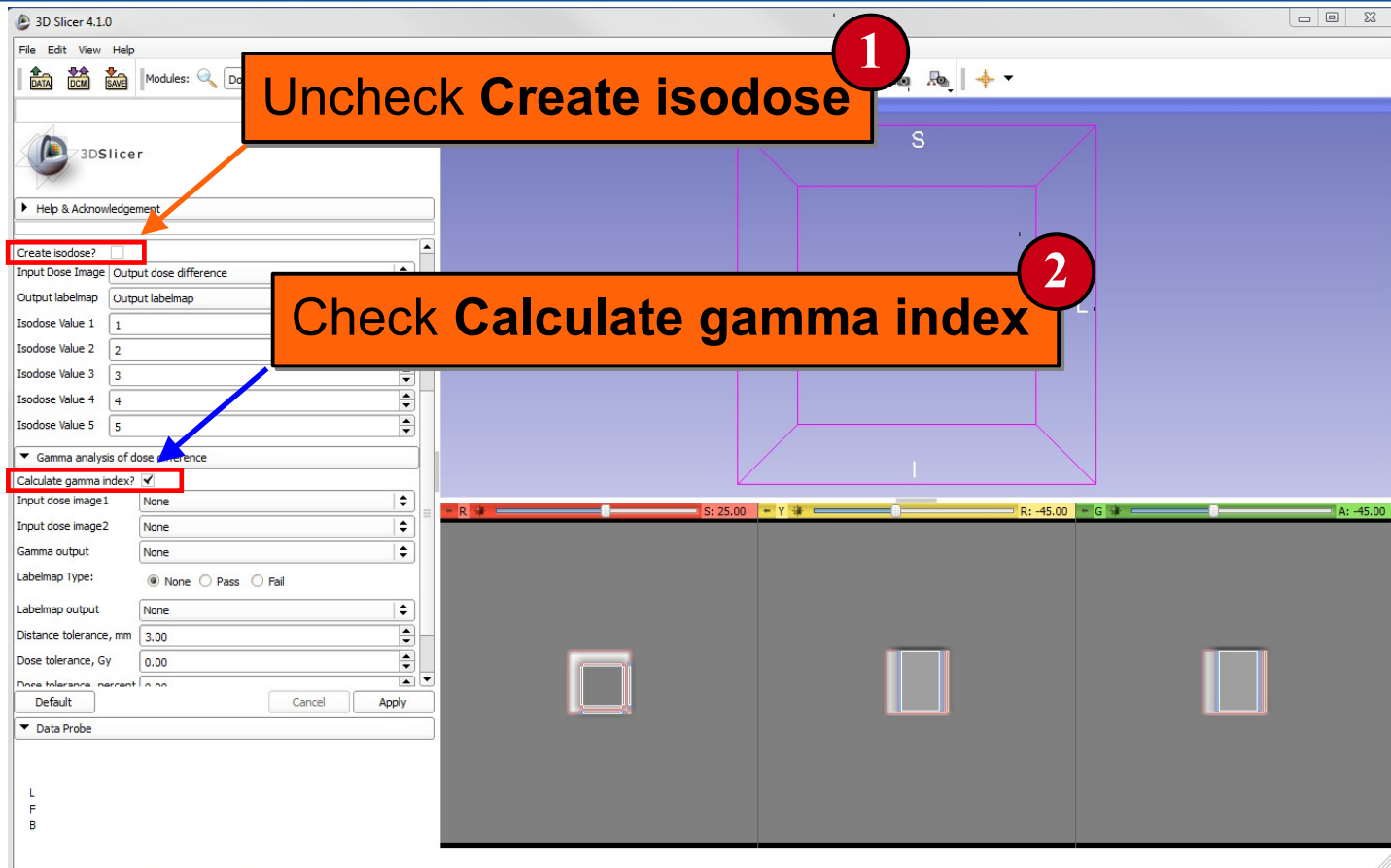
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# Dose difference and distance-to-agreement acceptance criteria



3D Slicer 4.1.0

File Edit View Help

Modules: Dose Comparison

3DSlicer

Help & Acknowledgement

Isodose Value 1: 1  
Isodose Value 2: 2  
Isodose Value 3: 3  
Isodose Value 4: 4  
Isodose Value 5: 5

Gamma analysis of dose difference

Calculate gamma index? ☒

Input dose image1: beam\_01  
Input dose image2: beam\_09  
Gamma output: Gamma output  
Labelmap Type: ☐ None ☐ Pass ☒ Fail  
Labelmap output: Labelmap output  
Distance tolerance, mm: 3.00  
Dose tolerance, Gy: 3.00  
Dose tolerance, percent: 0.00  
Max gamma to calculate: 2.00

Default Cancel Apply

Data Probe

L  
F  
B

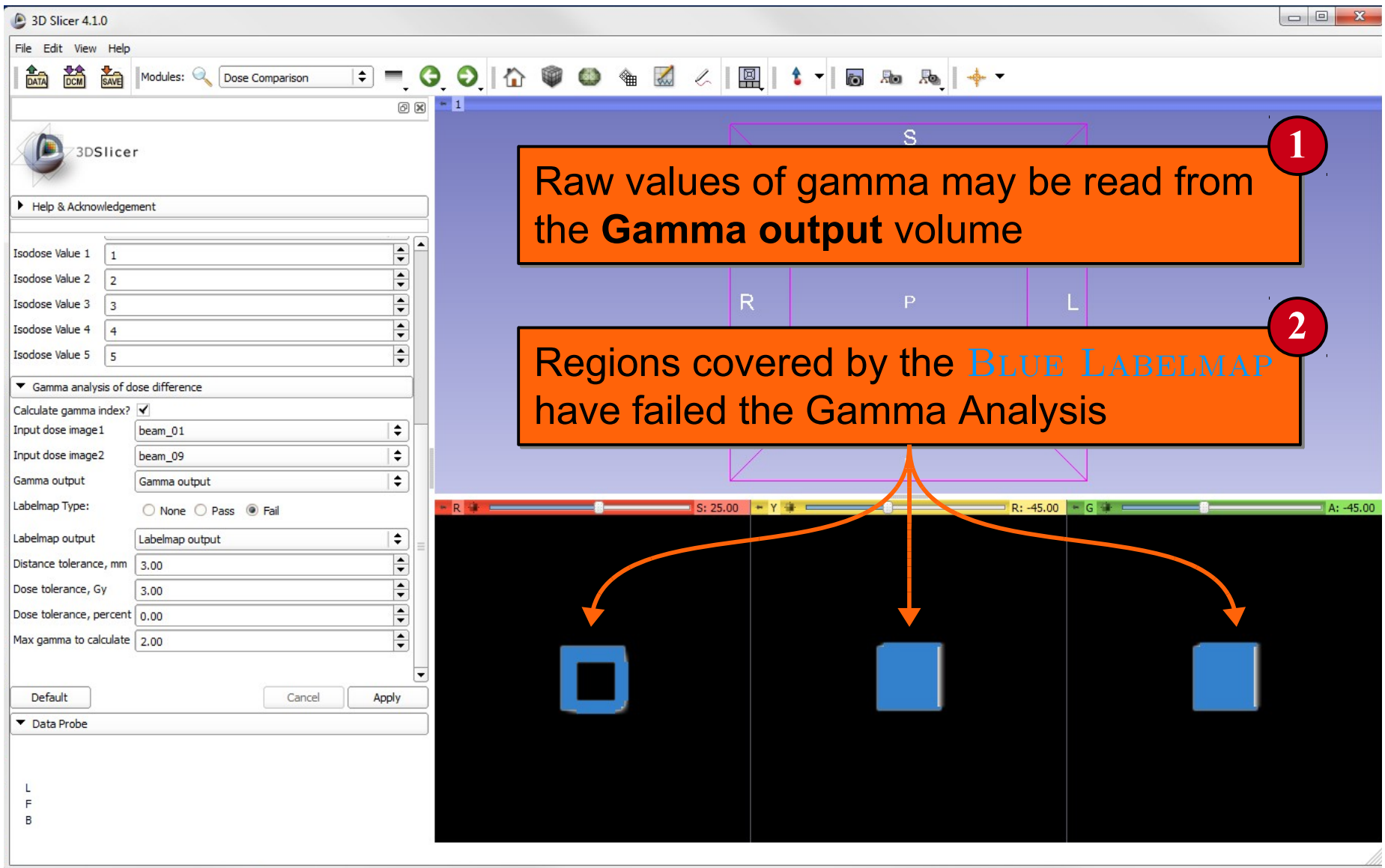
1 Set Input dose image 1 to beam\_01 and Input dose image 2 to beam\_09

2 Set Gamma output to "Create new Volume"

3 Set Labelmap Type to "Fail" and Set Labelmap output to "Create new Volume"

4 Set acceptance criteria:  
Distance tolerance, mm to 3  
Dose tolerance, Gy to 3  
Max gamma to calculate to 2

5 Click "Apply"







# Conclusion

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We have demonstrated how to use the Plastimatch Dose Comparison 3D Slicer Extension to perform various methods of dose comparison including: direct dose comparison, isodose visualization, and  $\gamma$ -analysis

THANK YOU!



# Acknowledgments

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