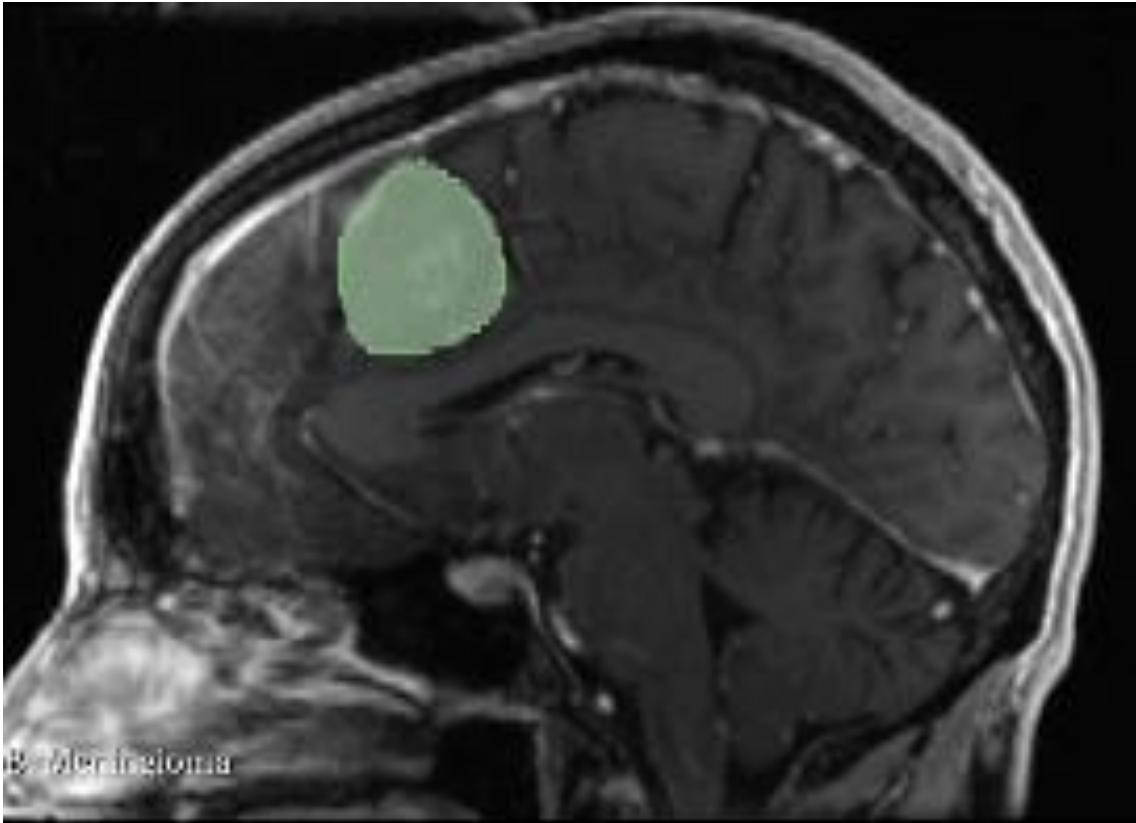


AI-based Segmentation in 3D Slicer

Sonia Pujol, Ph.D.
Brigham and Women's Hospital,
Harvard Medical School
Boston, MA

Slicer Ribeirão Preto Workshop
June 30, 2025

Manual vs AI-powered Segmentation



Medical images have traditionally been manually segmented, which is a time-consuming process that requires intensive effort by radiologists and is subject to inter-reader variability.

Manual vs AI-powered Segmentation



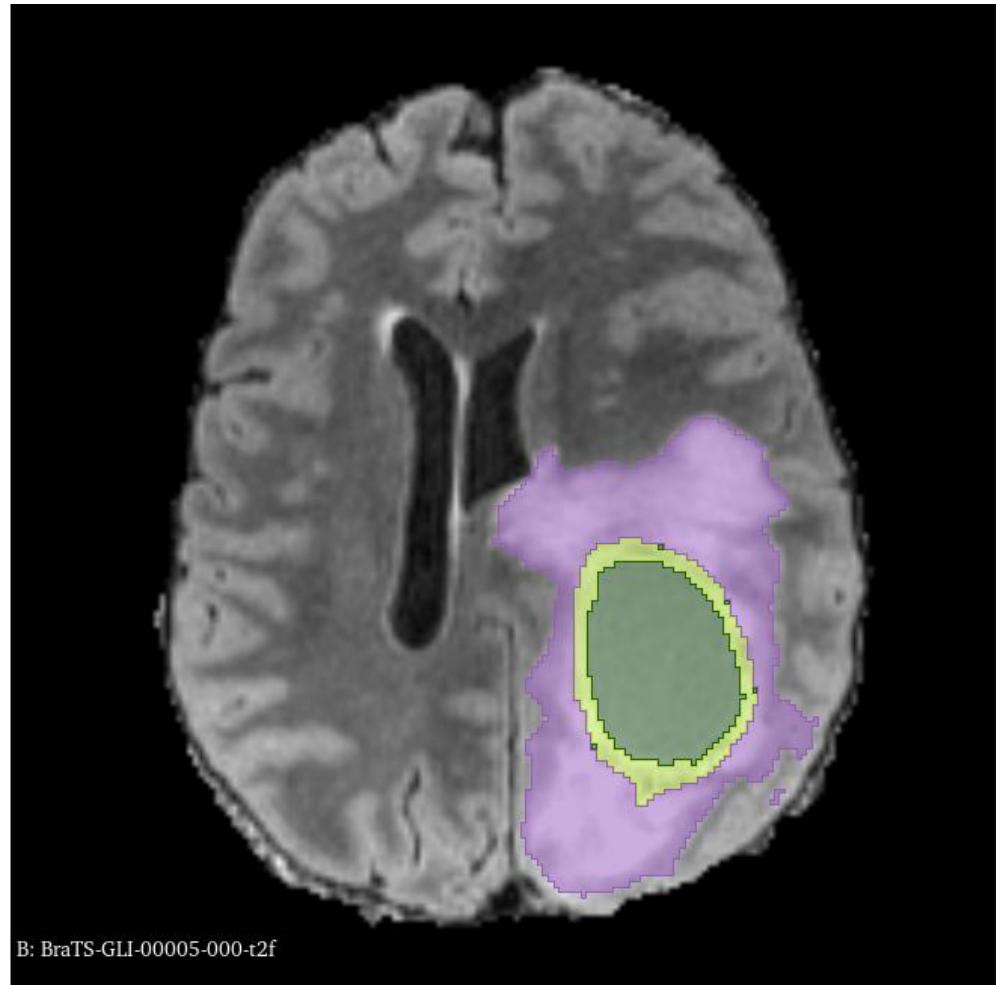
- In the past decade, image segmentation has been powered by the development of deep learning algorithms (e.g. nnUNet by the German Cancer Research Center (DKFZ)/Helmholtz Research)
- AI-powered segmentation tools can reduce the segmentation time and provide more reproducible results

AI Terminology

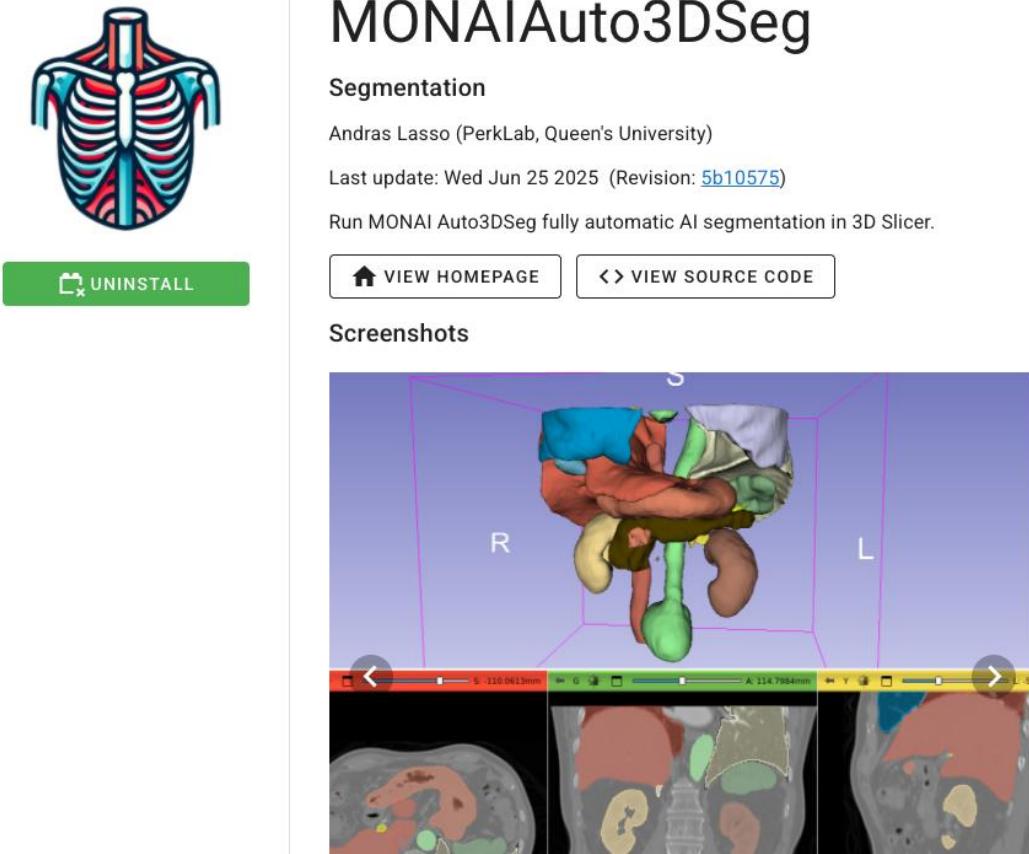
- A **Model** is an AI algorithm that was trained to perform a specific task (e.g. brain tumor segmentation model)
- The **Weights** of an AI model are small numbers that determine how much importance the model gives to different image features.
- During the **Training** phase, a Model learns patterns from data labelled by experts and adjusts its weights to improve its predictions
- During the **Validation/Test** phase, the model is evaluated on a separate set of data not used during the Training phase.
- During **Inference**, the model is applied to new datasets to perform the specific task it was trained for

3D Slicer AI Workshop

- This tutorial focuses on running inference tasks using various pre-trained AI models for automated segmentation of anatomical and pathological structures.



MONAIAuto3DSeg Slicer extension



- This tutorial uses the pre-trained models of the MONAIAuto3DSeg Slicer extension
- The tool is designed to work on laptops or on average desktop computer without a GPU

MONAIAuto3DSeg Slicer extension



MONAIAuto3DSeg

Segmentation

Andras Lasso (PerkLab, Queen's University)

Last update: Wed Jun 25 2025 (Revision: [5b10575](#))

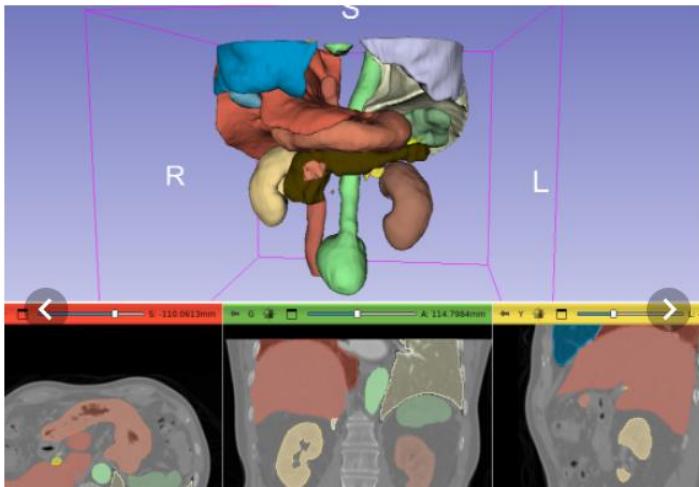
Run MONAI Auto3DSeg fully automatic AI segmentation in 3D Slicer.

UNINSTALL

[VIEW HOMEPAGE](#)

[VIEW SOURCE CODE](#)

Screenshots

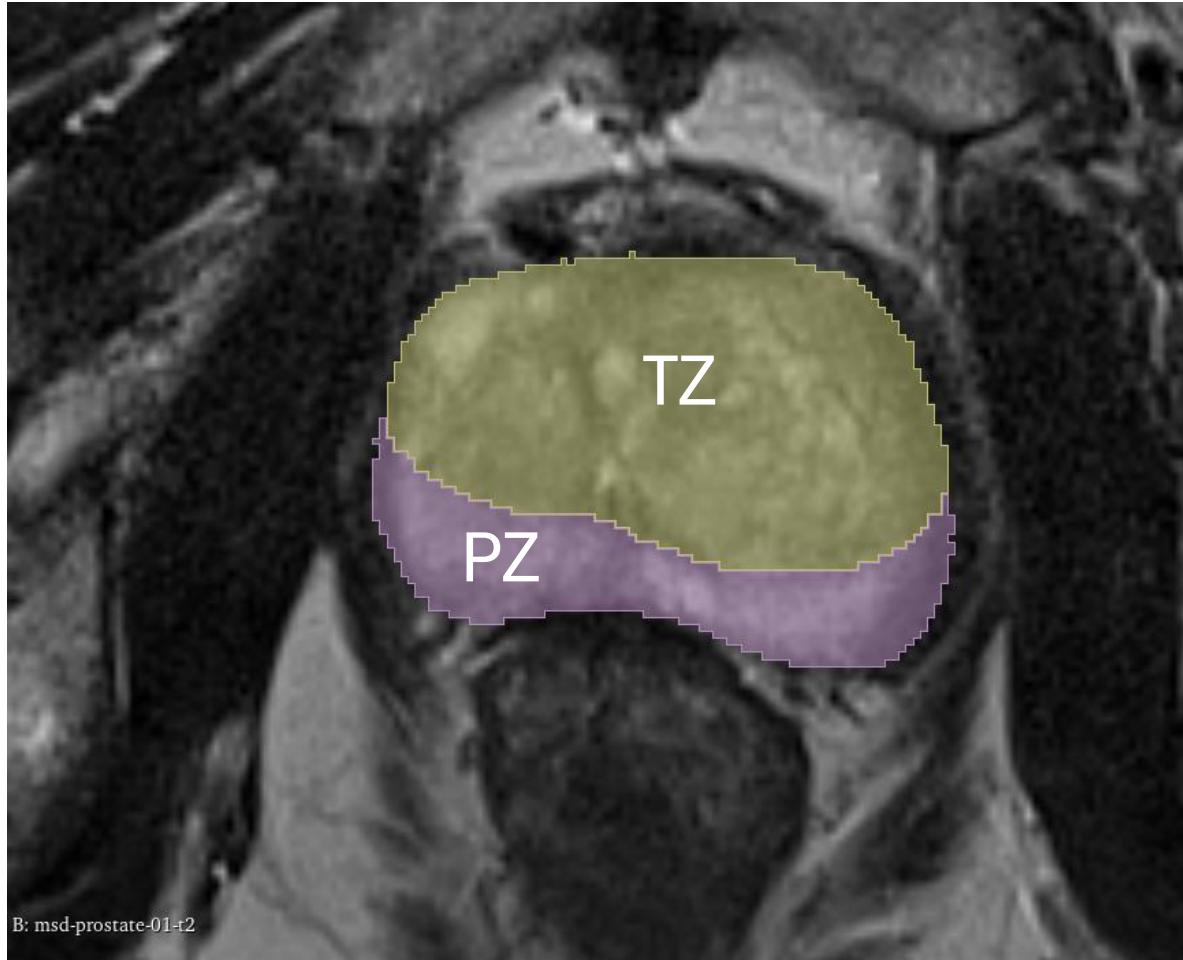


- Multiple modalities Support (CT, MRI)
- Multiple anatomies (head, thorax, abdomen, pelvis, etc.)
- Multiple pathologies (tumor, hemorrhage, edema)

Slicer AI Tutorial: Segmentation Tasks

- Segmentation Task #1: Prostate
- Segmentation Task #2: Brain Glioma
- Segmentation Task #3: Whole Body Segmentation

AI Segmentation Task #1: Prostate

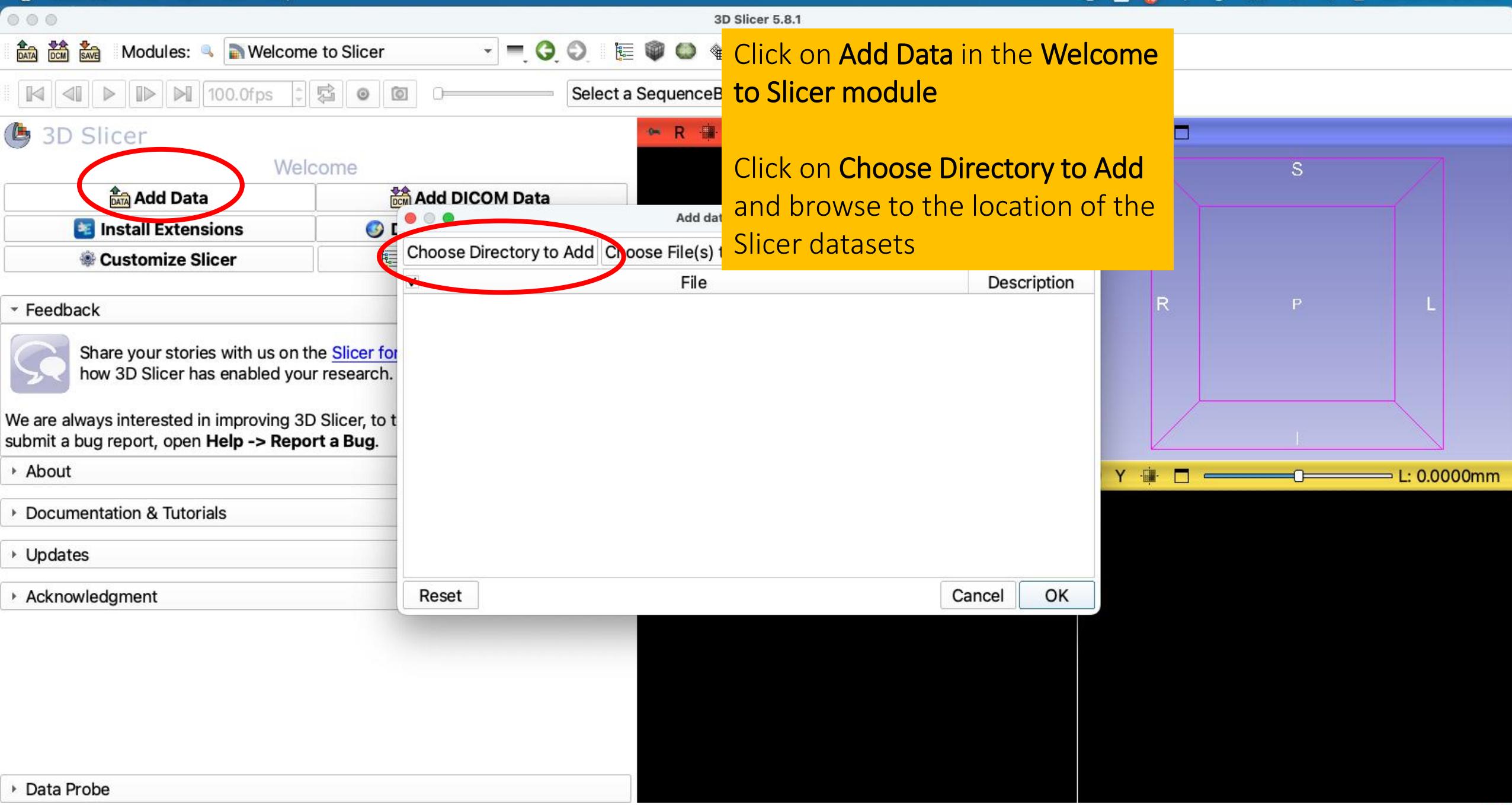


AI-based Segmentation of
Peripheral Zone (PZ) and
Transition Zone (TZ) of the
prostate on T2-weighted MRI
Images

Dataset:

msd_prostate_01-t2

msd_prostate_01-adc



DATA DCM SAVE Modules: Welcome to Slicer Select a SequenceBrowser S: 0.0000mm 1

3D Slicer Welcome

Add Data Install Extensions Customize Slicer

Feedback Share your stories with us on the [Slicer forum](#) how 3D Slicer has enabled your research.

We are always interested in improving 3D Slicer, to submit a bug report, open **Help -> Report a Bug**.

About Documentation & Tutorials Updates Acknowledgment Data Probe

Select the dataset3_ProstateMRI and click on Open

Choose

Name	Size	Kind	Date Added
PCT00-RESSONANCIA	--	Folder	Yesterday at 2:49 PM
PCT00-TOMOGRAFIA	--	Folder	Yesterday at 2:49 PM
SlicerData	--	Folder	Jun 26, 2025 at 12:19 PM
dataset1_ThoraxAbdomenCT	--	Folder	Jun 26, 2025 at 12:31PM
dataset2_BrainMRI_Meningioma	--	Folder	Jun 26, 2025 at 12:36 PM
dataset3_ProstateMRI	--	Folder	Jun 26, 2025 at 12:22 PM
dataset4_BrainMRI_Glioma	--	Folder	Jun 26, 2025 at 12:20 PM
SlicerSegmentationResults	--	Folder	Today at 8:52 AM

New Folder Cancel Open

Slicer loads the prostate MRI dataset

The image shows the 3D Slicer application interface. On the left, the 'Welcome' panel includes buttons for 'Add Data', 'Add DICOM Data', 'Install Extensions', 'Download Sample Data', 'Customize Slicer', and a 'Feedback' section with a message about the Slicer forum. Below these are links for 'About', 'Documentation & Tutorials', 'Updates', 'Acknowledgment', and 'Data Probe'. The main workspace displays a prostate MRI dataset with three orthogonal slices: a coronal slice at the top, a sagittal slice in the middle, and a transverse slice at the bottom. A 3D rendering of the prostate is shown on the right, outlined in magenta with labels for Superior (S), Inferior (I), Right (R), Left (L), Posterior (P), and Anterior (A). The top status bar shows '3D Slicer 5.8.1'. The bottom status bar shows coordinates: S: -6.8494mm, A: -6.6303mm, and L: -5.1050mm.



3D Slicer

- [Add Data](#)
- [Install Extensions](#)
- [Customize Slicer](#)

Feedback



We are always interested in your feedback! If you have found a bug or would like to submit a bug report, open [Help & Support](#).

About

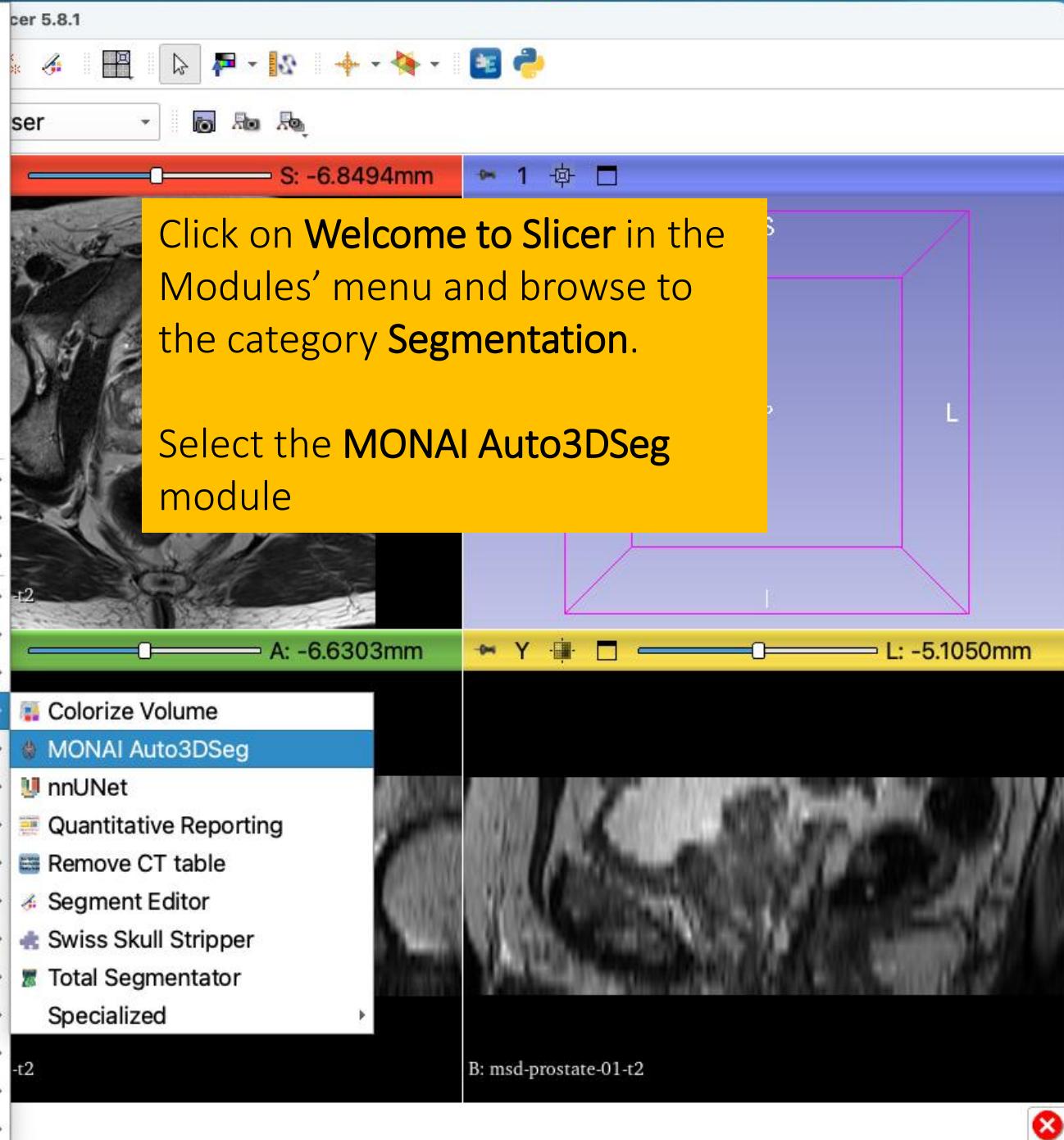
Documentation & Tutorials

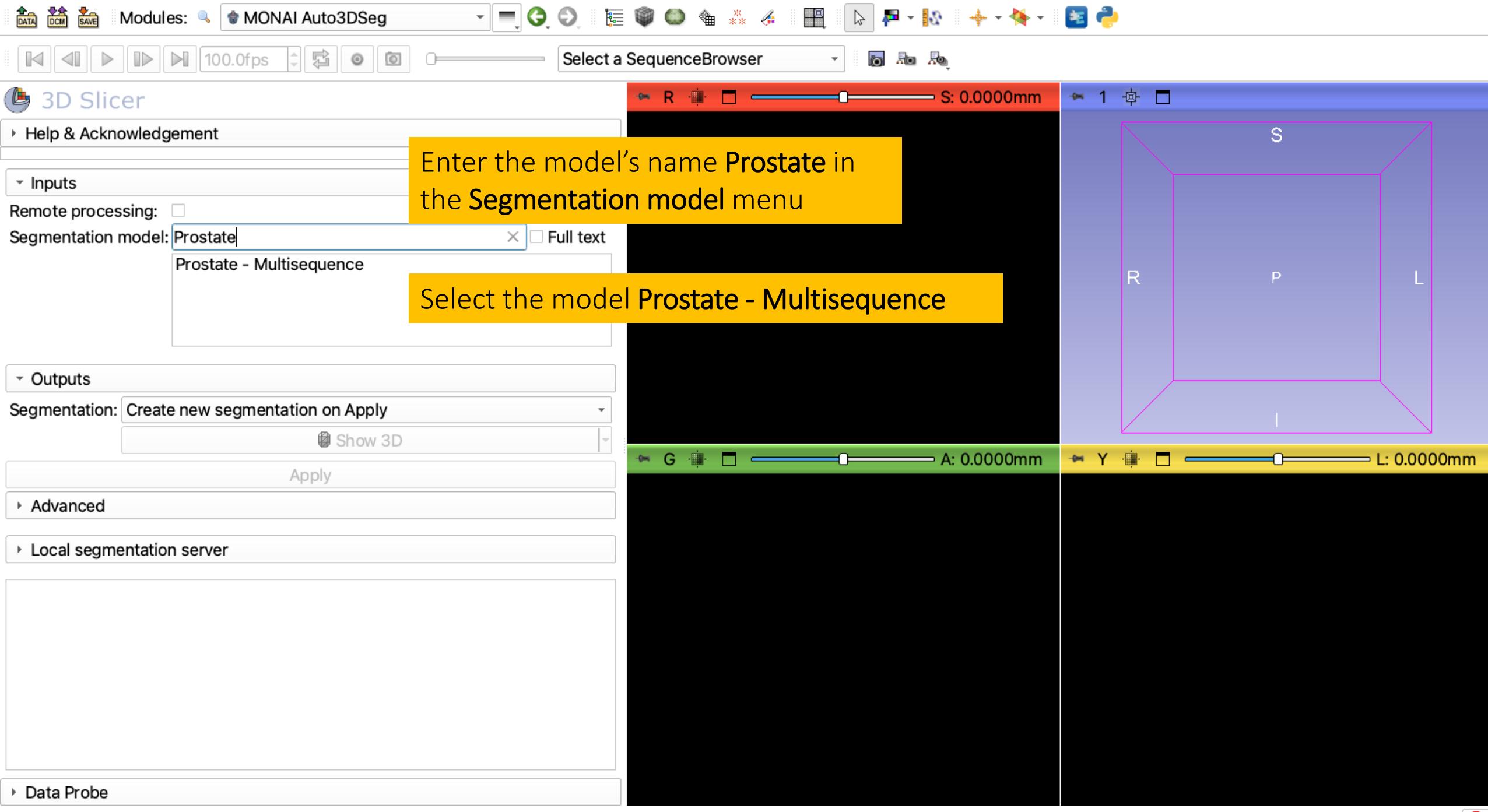
Updates

Acknowledgment

Data Probe

- [Data](#)
 - [Add DICOM Data](#)
 - [Markups](#)
 - [Models](#)
 - [Scene Views](#)
 - [Segment Editor](#)
 - [Segmentations](#)
 - [Transforms](#)
 - [View Controllers](#)
 - [Volume Rendering](#)
 - [Volumes](#)
- [Welcome to Slicer](#)
- [Utilities](#)
- [Radiotherapy](#)
- [DSCI](#)
- [Wizards](#)
- [Informatics](#)
- [Registration](#)
- [Segmentation](#)
 - [Quantification](#)
 - [Diffusion](#)
 - [Filtering](#)
 - [Surface Models](#)
 - [Converters](#)
 - [Endoscopy](#)
 - [Developer Tools](#)
 - [Legacy](#)
 - [Intensity Transform](#)
 - [Plastimatch](#)
 - [MultiVolume Support](#)







Select a SequenceBrowser

3D Slicer

Help & Acknowledgement

Inputs

Remote processing:

Segmentation model: Prostate

Prostate - Multisequence

Input T2 volume: msd-prostate-01-adc

Input ADC volume: msd-prostate-01-adc

Outputs

Segmentation: Create new segmentation on Apply

Show 3D

Apply

Advanced

Local segmentation server

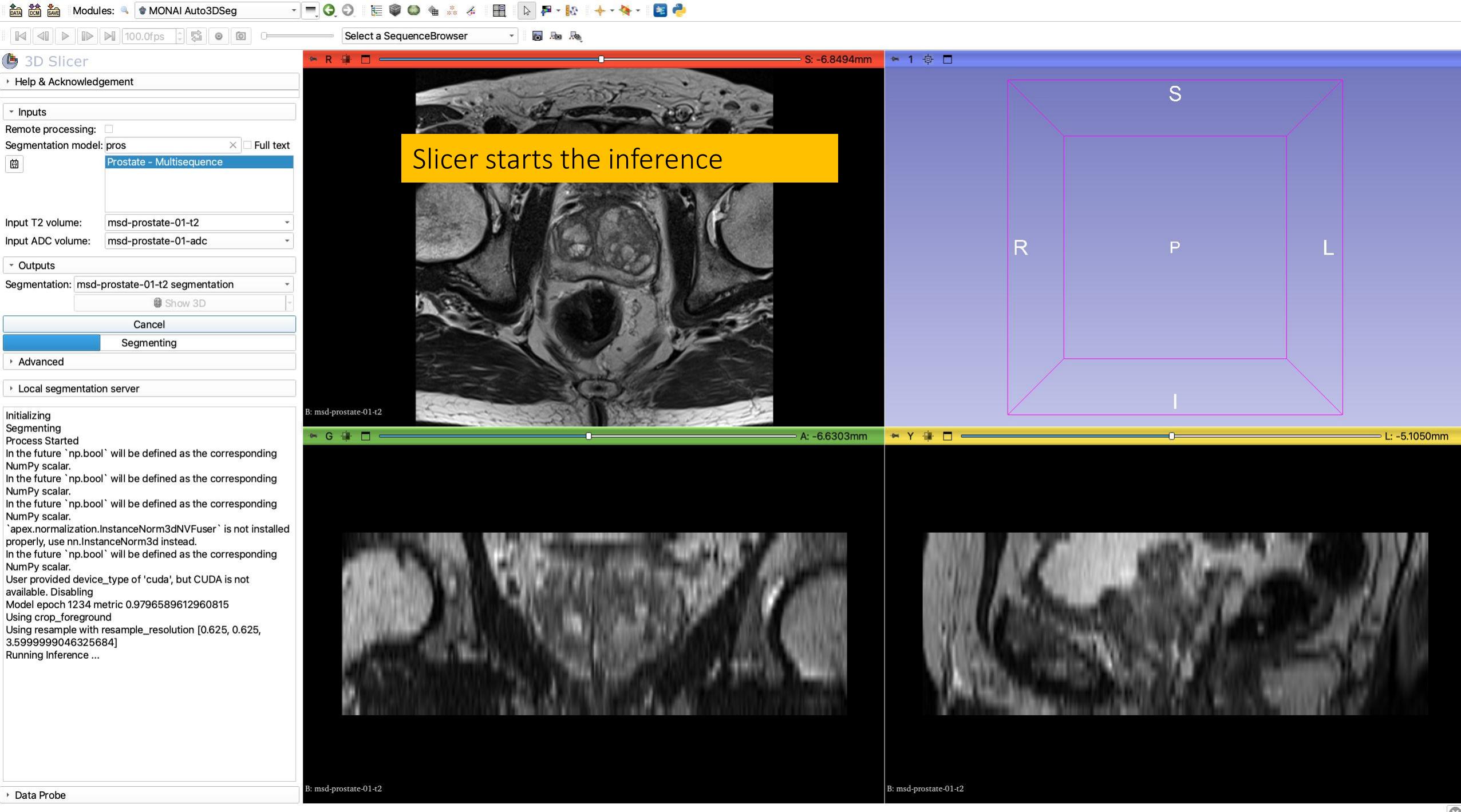
Data Probe

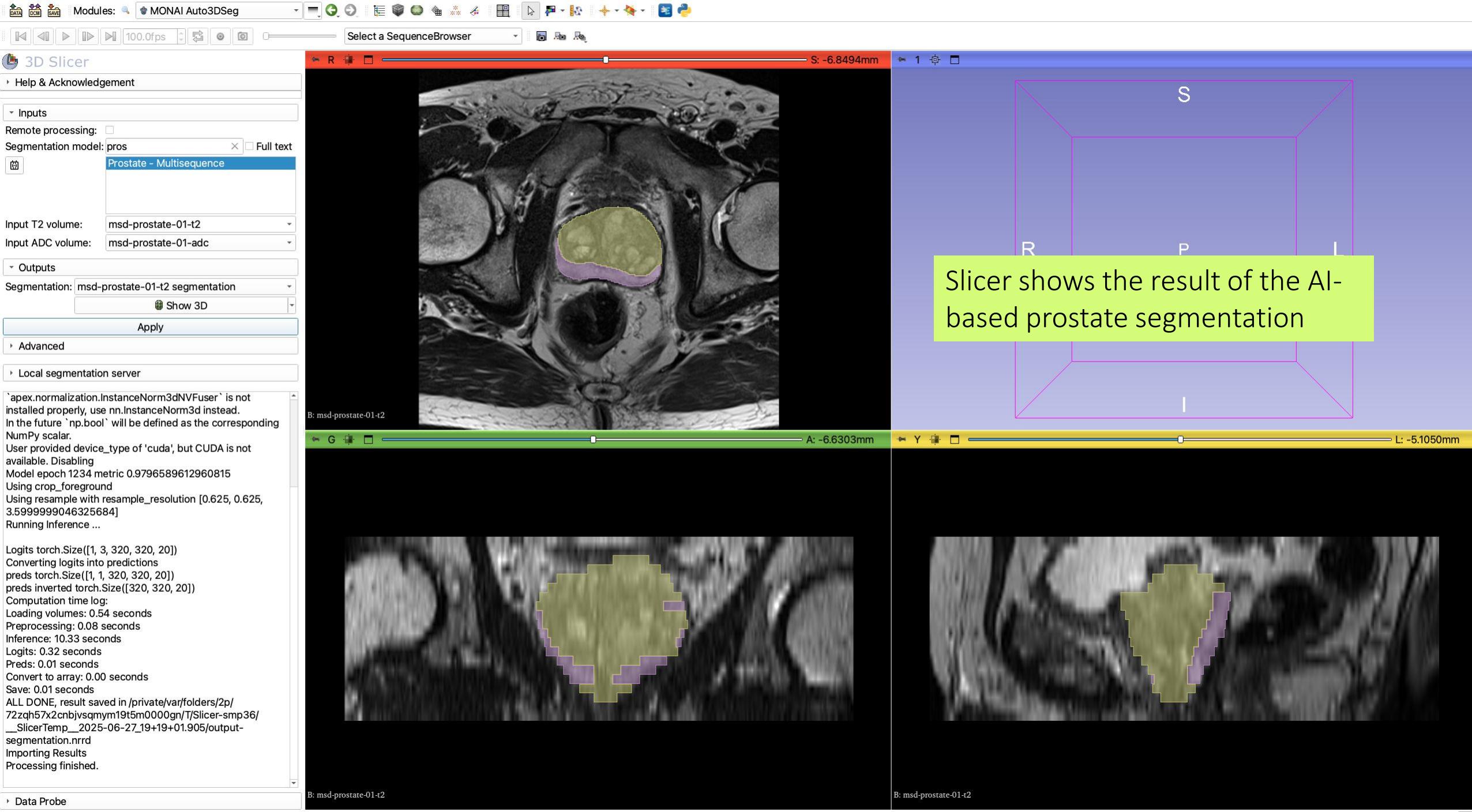
Enter the Input T2 volume **msd-prostate-01-adc** and the Input ADC volume **msd-prostate-01-adc**

Click on Create new segmentation on Apply

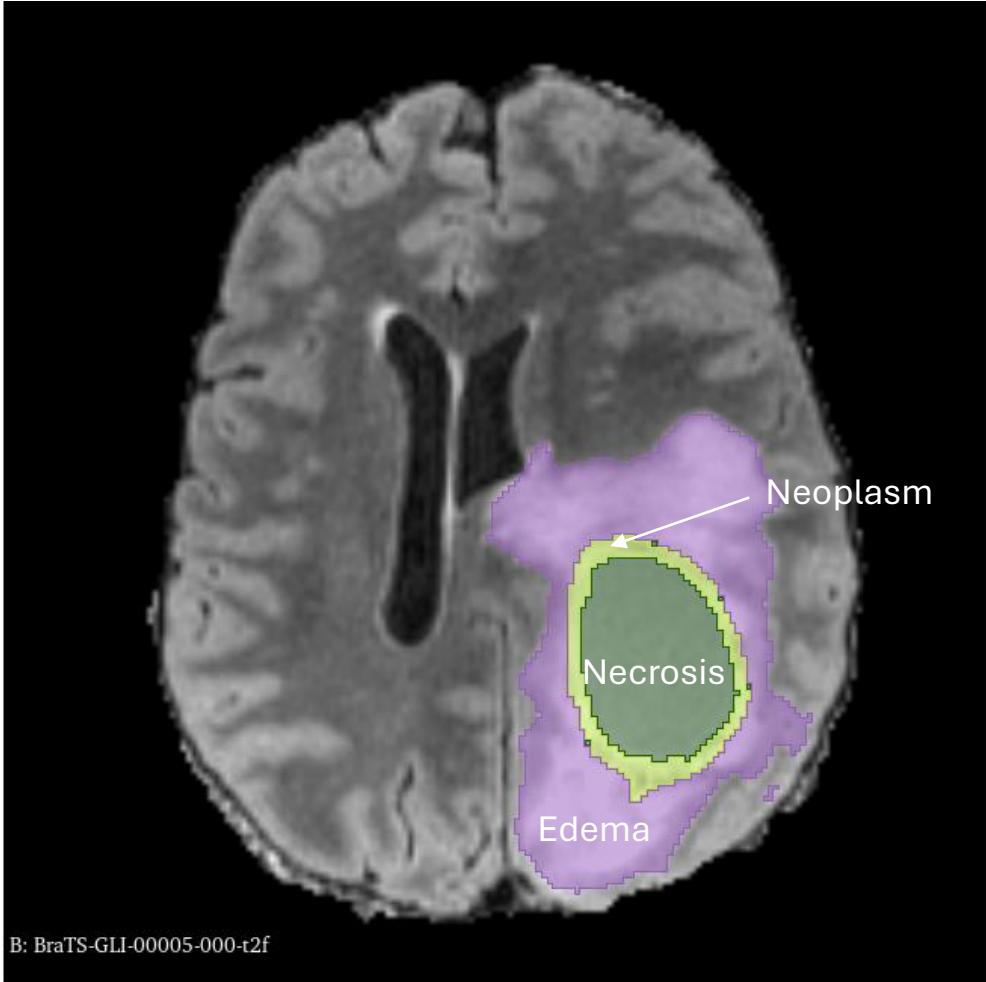
B: msd-prostate-01-t2







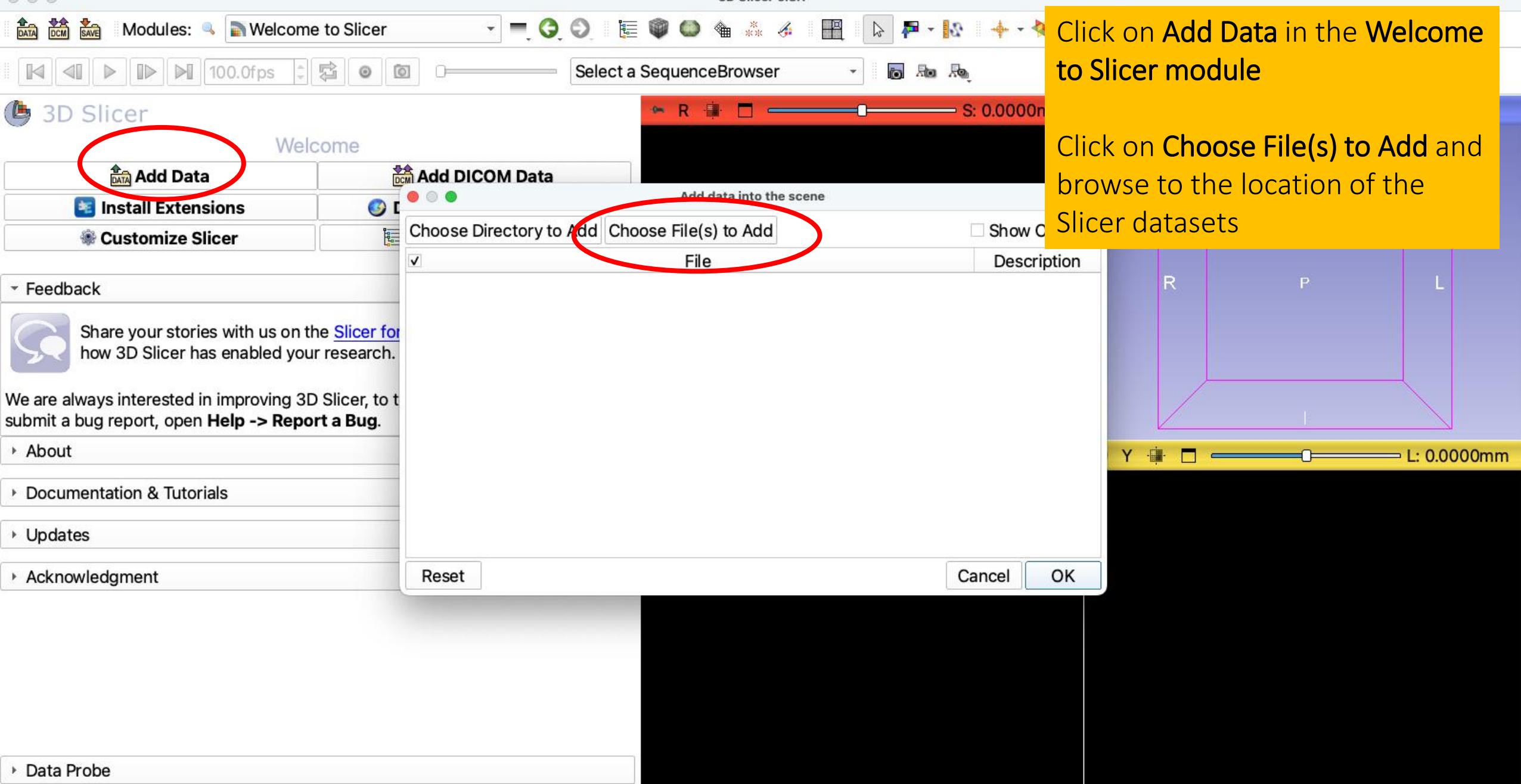
AI Segmentation Task #2: Brain Glioma



AI-based Segmentation of Neoplasm, Necrosis and Edema in Brain MRI images

Datasets:

- 1) BraTS-GLI_00005-000-t1n (T1-weighted)
- 2) BraTS-GLI_00005-000-t1c (T1-weighted post-Gd)
- 3) BraTS-GLI_00005-000-t2w (T2-weighted)
- 4) BraTS-GLI_00005-000-t2f (T2-FLAIR)



In the subdirectory dataset4_BrainMRI_Glioma, select the four dataset

BraTS-GLI-00006-t1c.nii.gz
BraTS-GLI-00006-t1n.nii.gz
BraTS-GLI-00006-t2f.nii.gz
BraTS-GLI-00006-t2w.nii.gz

Click on Open

Choose Directory to Add

Name	Size	Kind	Date Added
> dataset1_ThoraxAbdomenCT	--	Folder	Jun 26, 2025 at 12:31PM
> dataset2_BrainMRI_Meningioma	--	Folder	Jun 26, 2025 at 12:36PM
Meningioma.nrrd	5.1 MB	Document	Jun 26, 2025 at 12:44PM
> dataset3_ProstateMRI	--	Folder	Jun 26, 2025 at 12:22PM
> dataset4_BrainMRI_Glioma	--	Folder	Jun 26, 2025 at 12:20PM
BraTS-GLI-00006-00...segmentation.seg.nrrd	31 KB	Document	Jun 26, 2025 at 12:21PM
BraTS-GLI-00006-000-t1c.nii	17.9 MB	NIfTI-1	Jun 26, 2025 at 12:21PM
BraTS-GLI-00006-000-t1c.nii.gz	2.6 MB	gzip co...archive	Jun 26, 2025 at 12:21PM
BraTS-GLI-00006-000-t1n.nii.gz	2.3 MB	gzip co...archive	Jun 26, 2025 at 12:21PM
BraTS-GLI-00006-000-t2f.nii.gz	2.5 MB	gzip co...archive	Jun 26, 2025 at 12:21PM
BraTS-GLI-00006-000-t2w.nii.gz	2.4 MB	gzip co...archive	Jun 26, 2025 at 12:21PM

New Folder Cancel Open

R P L

L: 0.000mm

Add Data

Install Extensions

Customize Slicer

Feedback

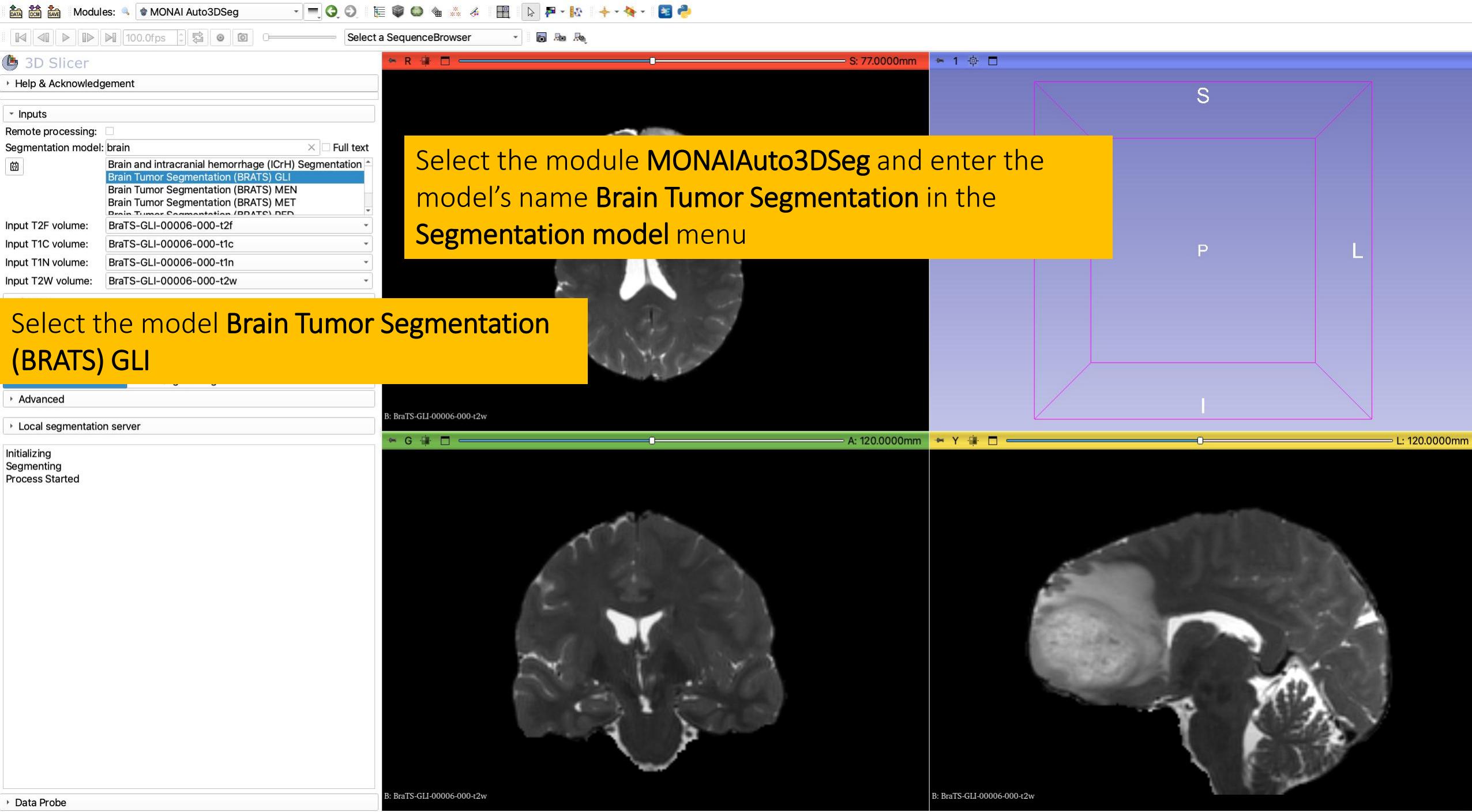
Share your stories with us on the [Slicer forum](#). Your feedback has enabled your research.

We are always interested in improving 3D Slicer, to report a bug or feature request, open [Help -> Report a Bug](#).

About Documentation & Tutorials Updates Acknowledgment Data Probe

Show Zoomed Slice

L F B





3D Slicer

Help & Acknowledgement

Inputs

Remote processing:

Segmentation model: brain

Brain and intracranial hemorrhage (ICrH) Segmentation

Brain Tumor Segmentation (BRATS) GLI

Brain Tumor Segmentation (BRATS) MEN

Brain Tumor Segmentation (BRATS) MET

Brain Tumor Segmentation (BRATS) P&P

Input T2F volume:

BraTS-GLI-00006-000-t2f

Input T1C volume:

BraTS-GLI-00006-000-t1c

Input T1N volume:

BraTS-GLI-00006-000-t1n

Input T2W volume:

BraTS-GLI-00006-000-t2w

Outputs

Segmentation: Create new segmentation on Apply

Show 3D

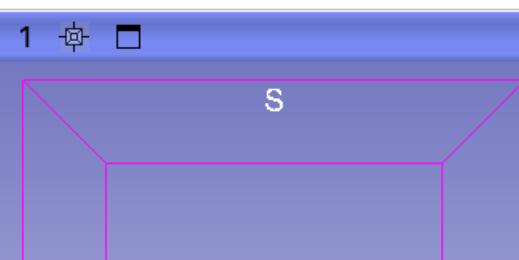
Apply

Advanced

Local segmentation server

Data Probe

Select a SequenceBrowser



Enter the input volumes as follows:

Input T2F volume: BraTS-GLI_00005-000-t12f

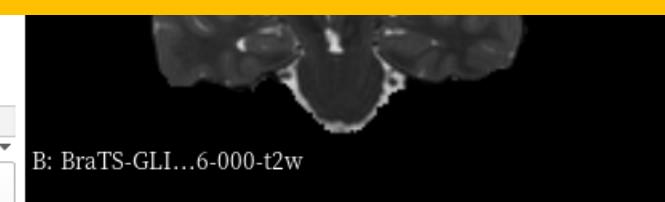
Input T1C volume: BraTS-GLI_00005-000-t1c

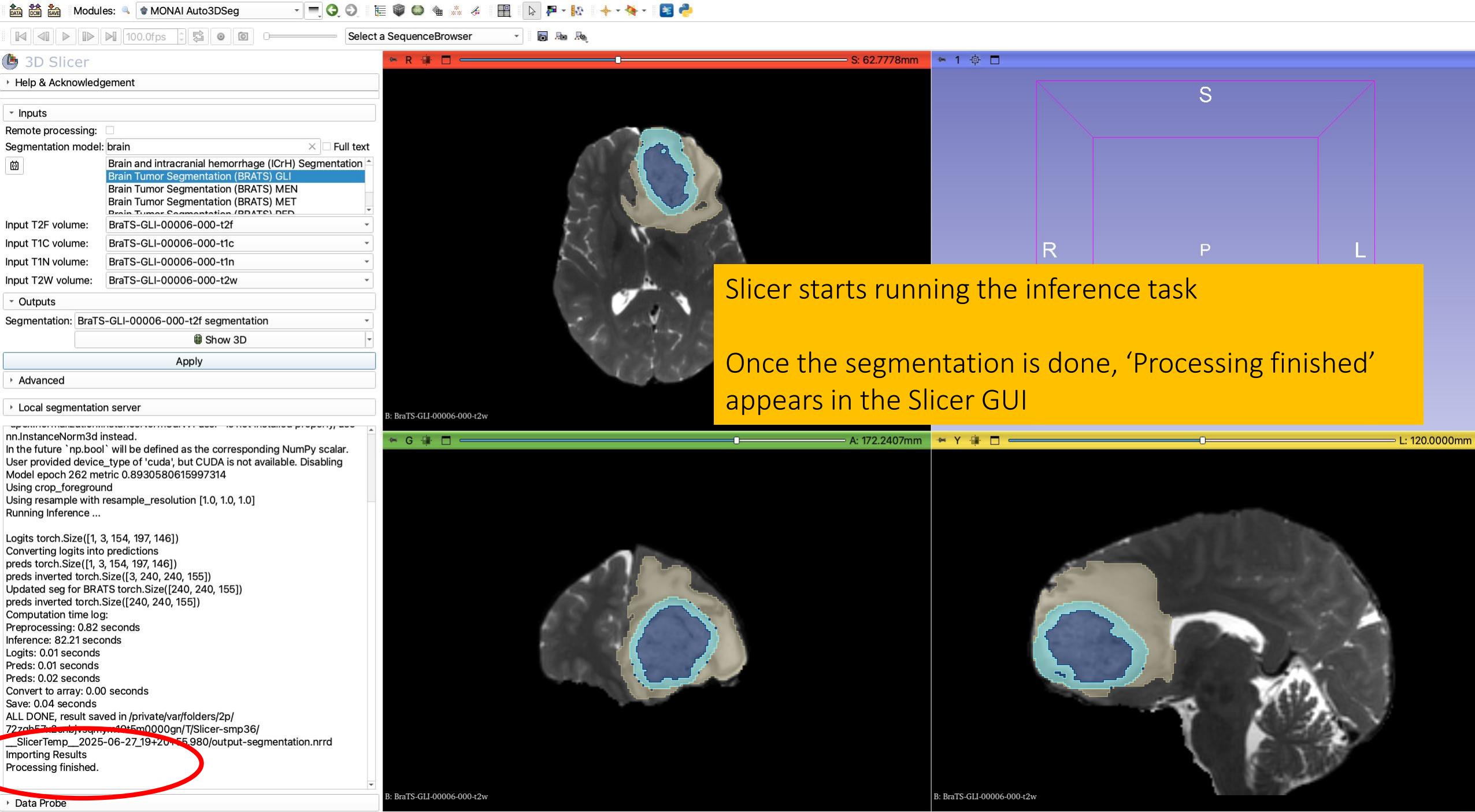
Input T1N volume: BraTS-GLI_00005-000-t1n

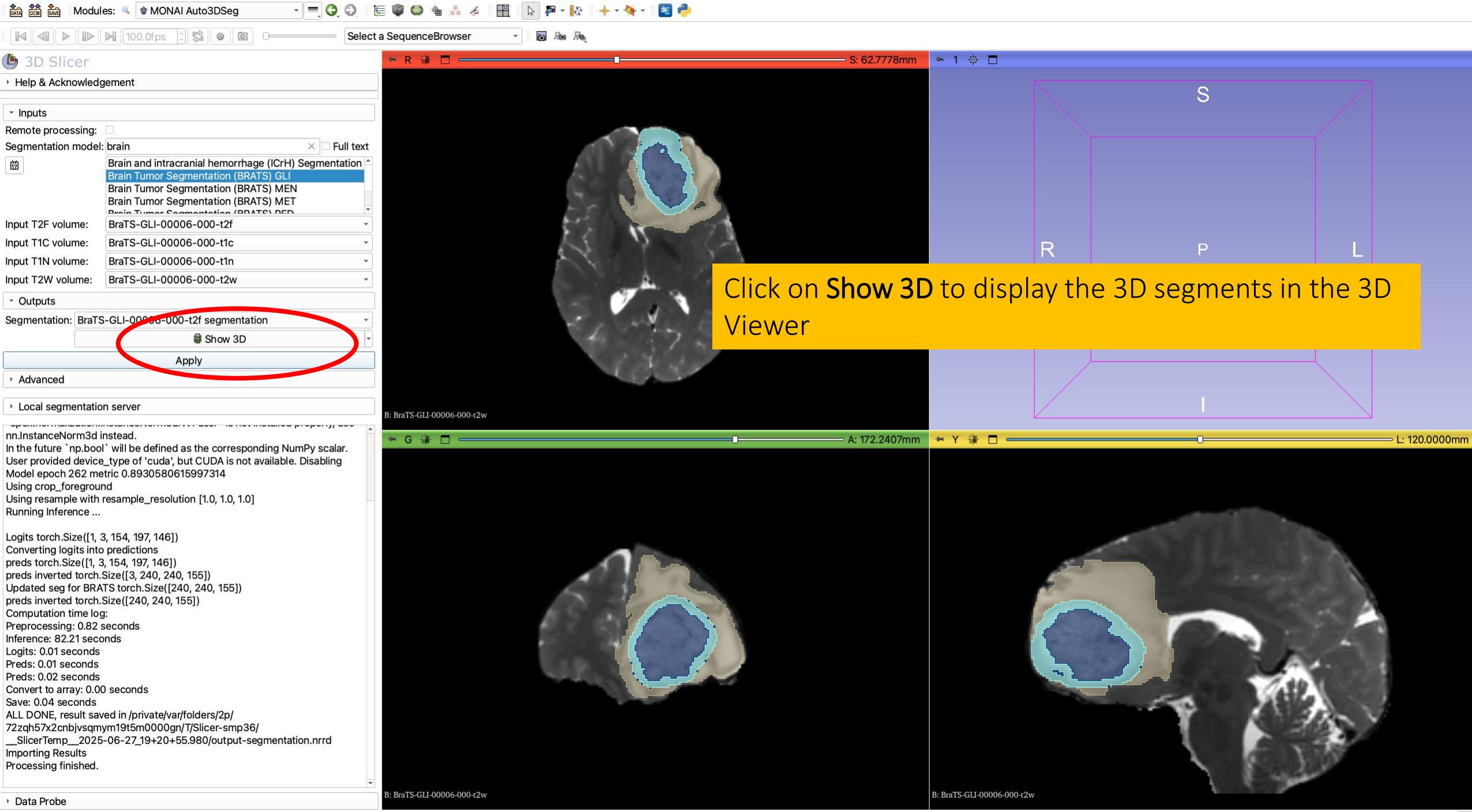
Input T2W volume: BraTS-GLI_00005-000-t2w

Click on **Create new Segmentation on Apply**

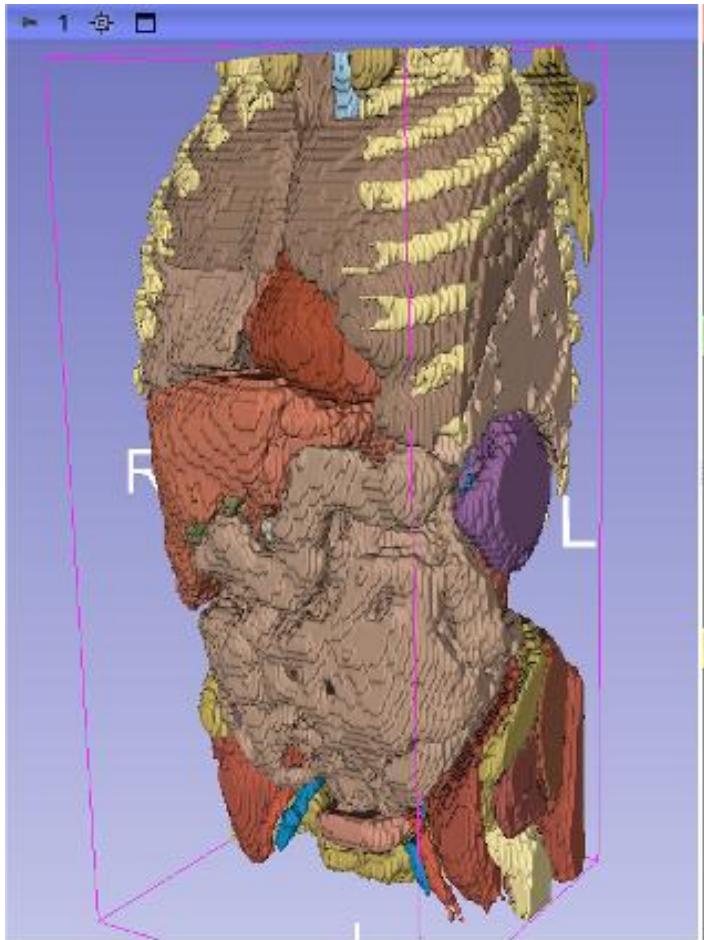
Click on **Apply** to start the segmentation



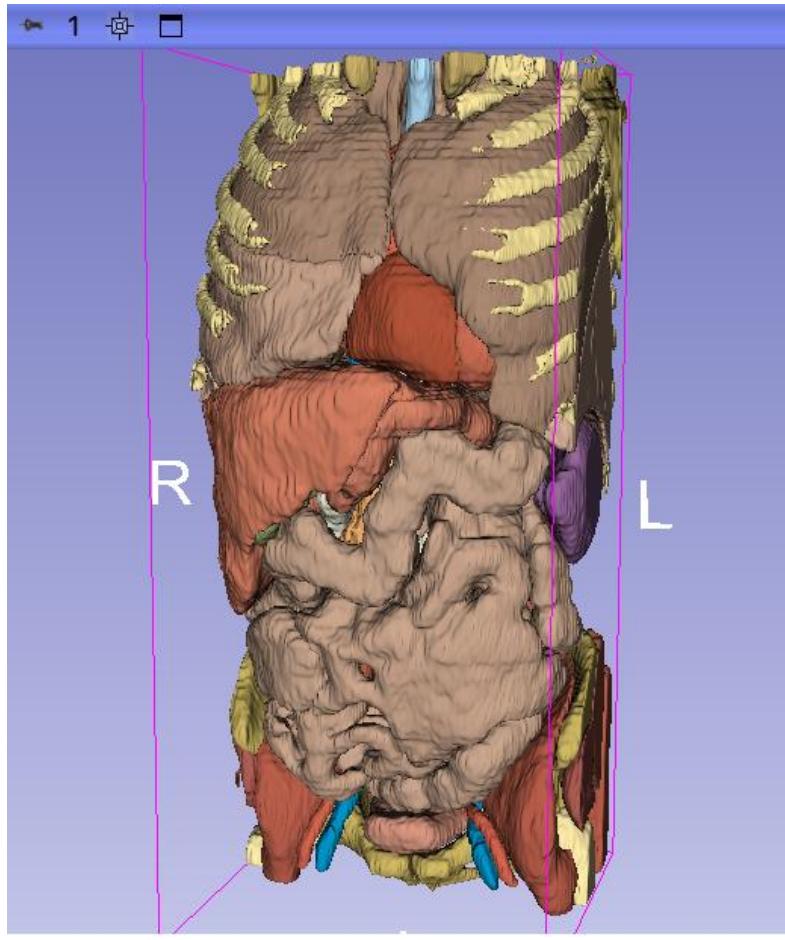




AI Segmentation Task #3: Whole Body
Segmentation



WholeBody Segmentation – TS1
– Quick (less than 1 min)



WholeBody Segmentation – TS1
(7 min on M3 Max Chip with 128 GB RAM)

AI-based Segmentation of
the whole body

Dataset:

CT_ThoraxAbdomen



3D Slicer

Help & Acknowledgement

Import DICOM files Show DICOM database

Loaded data

Node

In the Add DICOM Data module, select the Patient **patient1** and double click on the image **CT_Thorax_Abdomen** to load it in Slicer

DICOM networking

DICOM database settings

DICOM plugins

Select a SequenceBrowser

DICOM database

Patients Search

ID	Name	Study	Series	Modality	Date
Search...	Search...	Search...	Search...	All	Any

PCT00 patient1

Patient Information

Name: patient1 ID: patient1_ID Servers: None
Sex: Birth Date:

Study Study ID 6936864 - Wed Jun 1 2005 - CT Thorax Abdomen

Series

Series: 6 CT
512x512x291
CT_Thorax_Ab...

Advanced



3D Slicer

Help & Acknowledgement

Inputs

Remote processing:

Segmentation model: Whole body segmentation Full text



- Whole body segmentation TS1
- Whole body segmentation TS1 - quick
- Whole body segmentation TS2
- Whole body segmentation TS2 - quick

Input volume: 6: CT_Thorax_Abdomen

Outputs

Segmentation: 6: CT_Thorax_Abdomen segmentation

Show 3D

Apply

Advanced

Local segmentation server

Port: 8891

Log to Console:

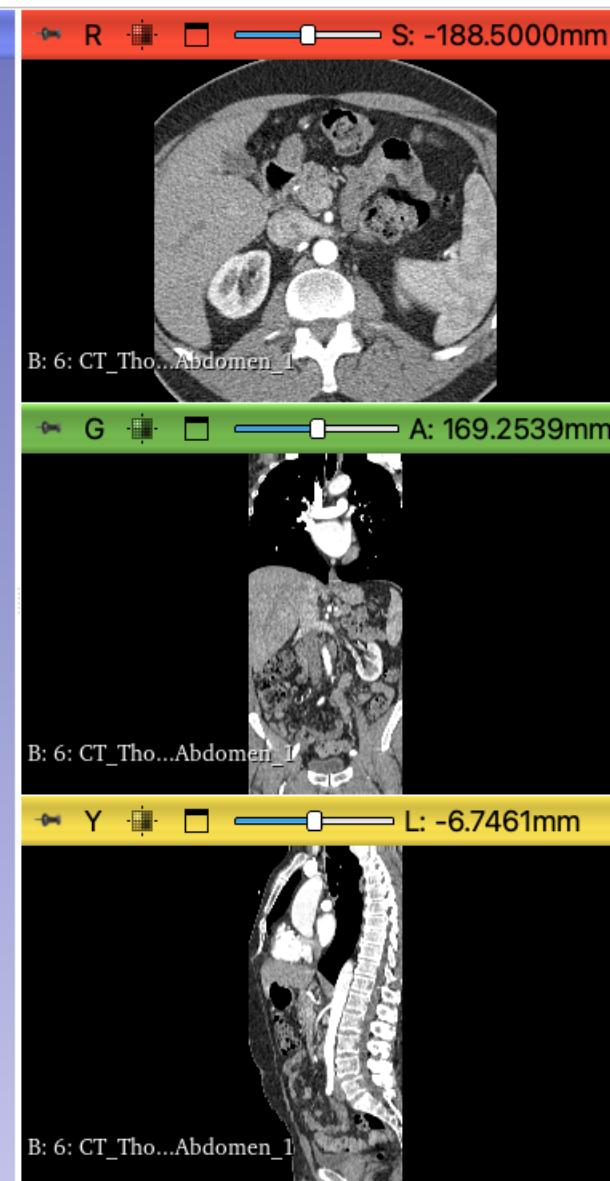
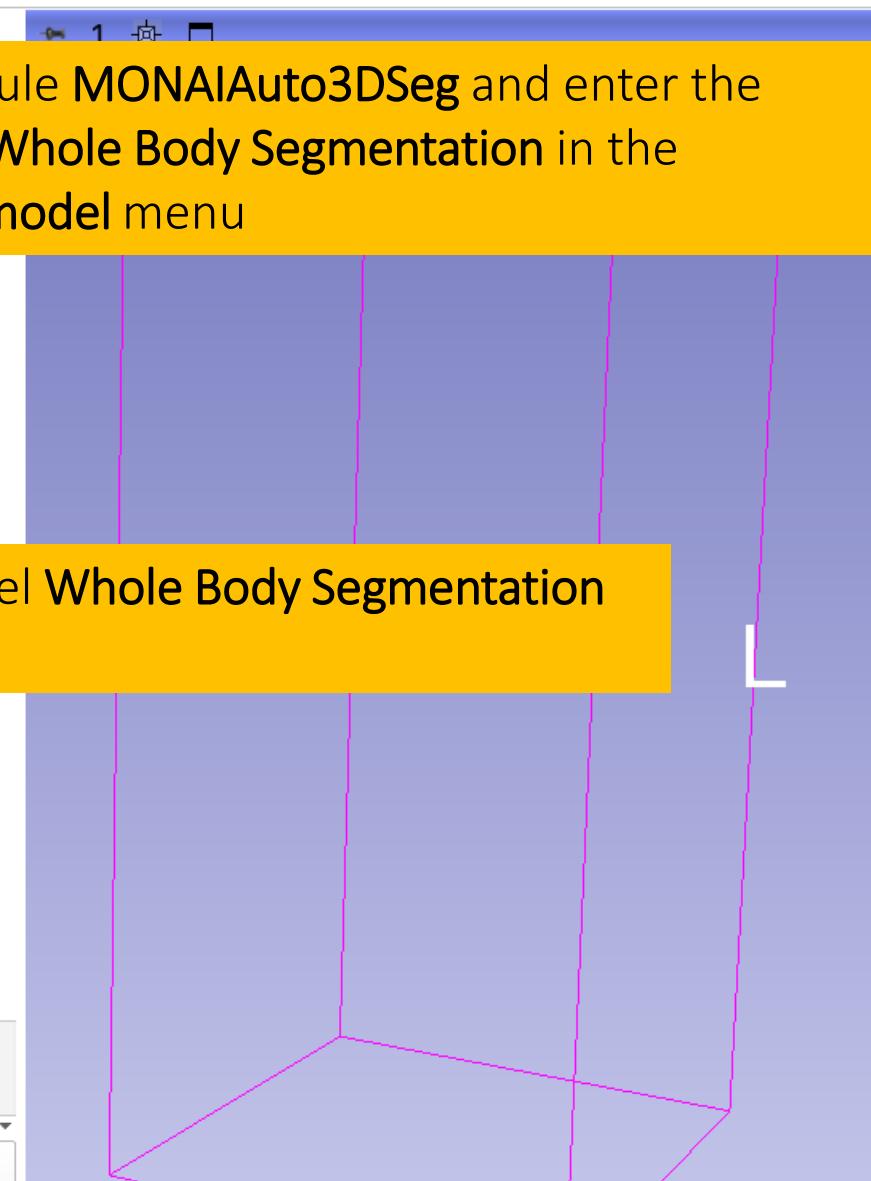
Log to GUI:

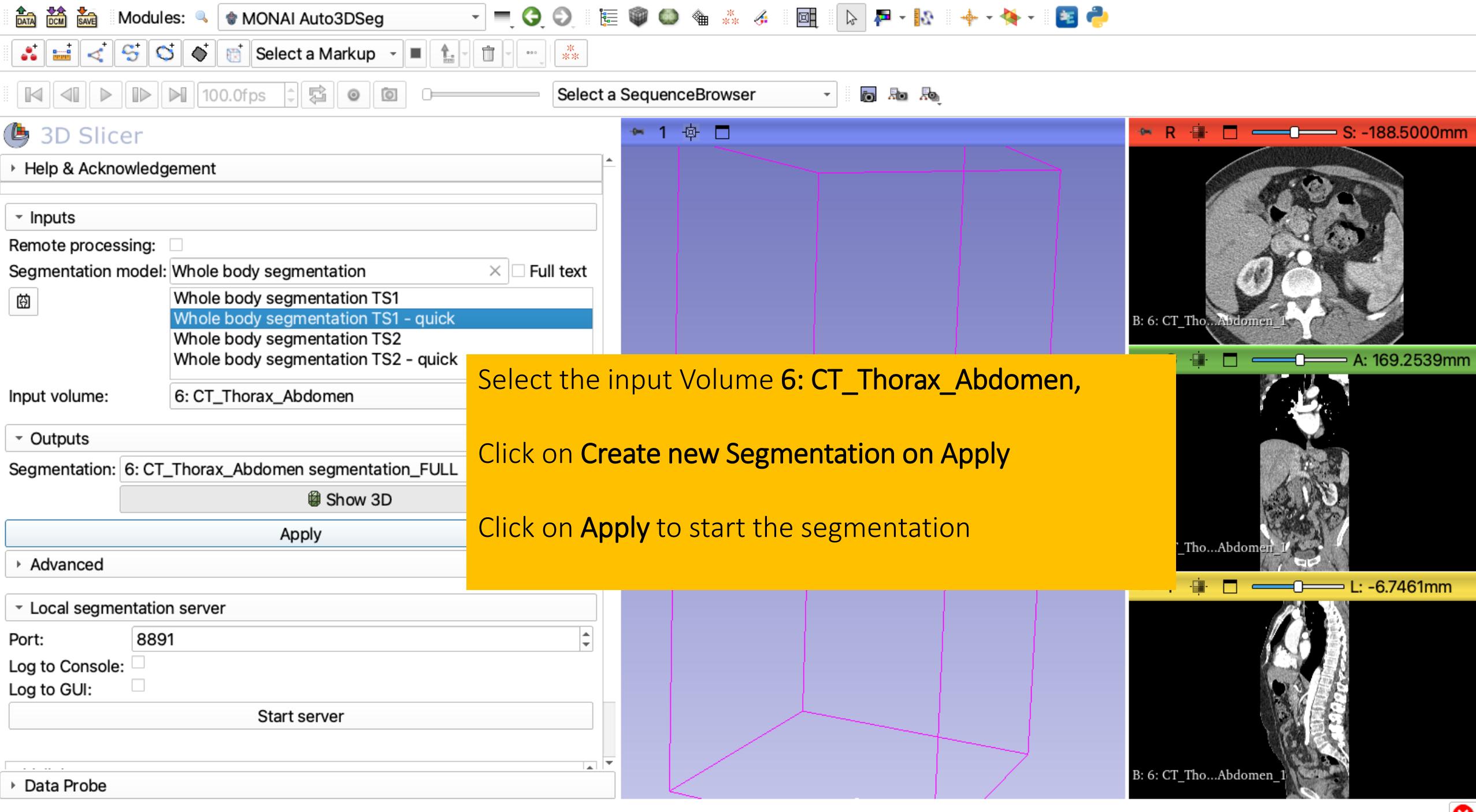
Start server

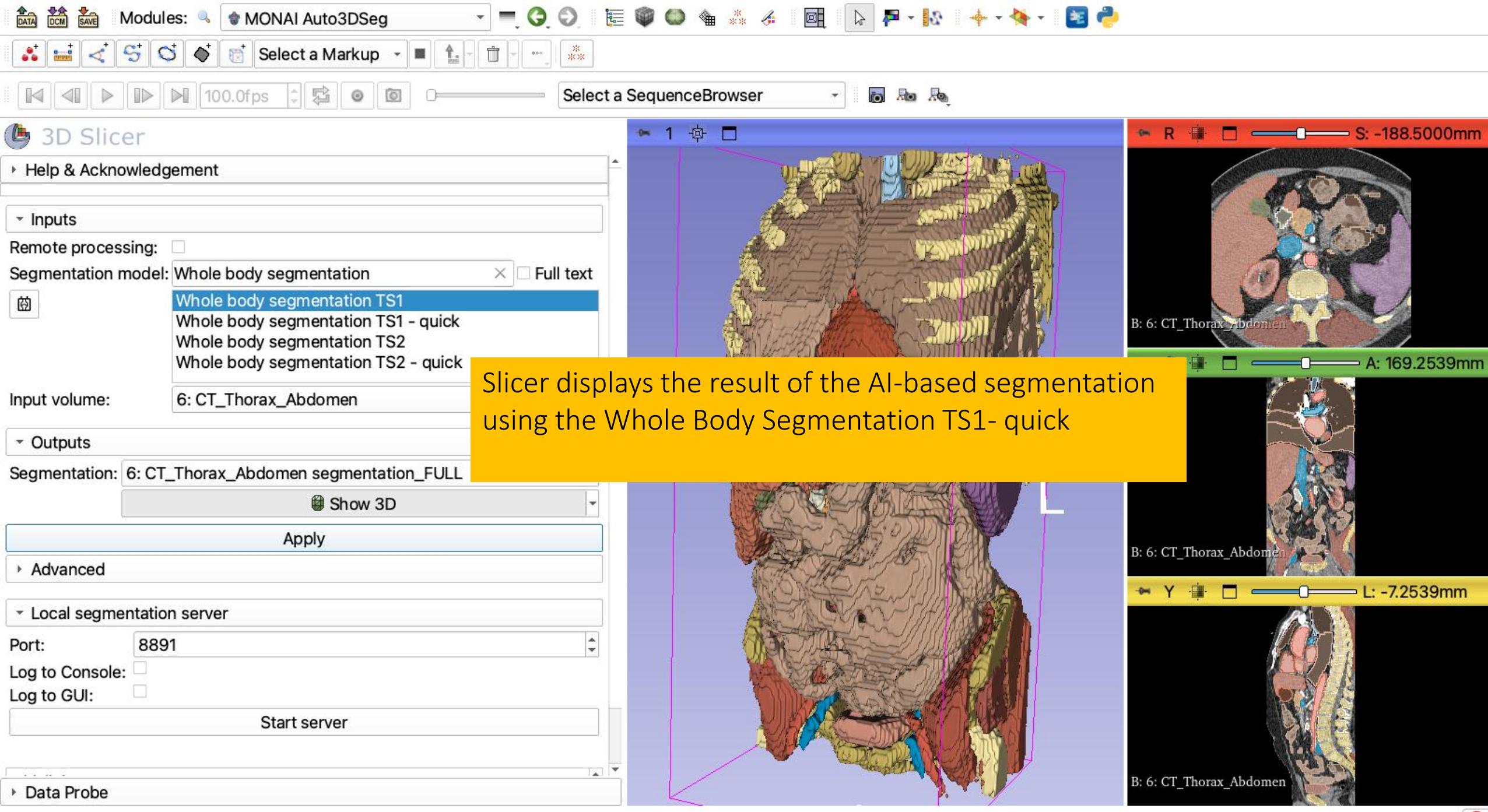
Data Probe

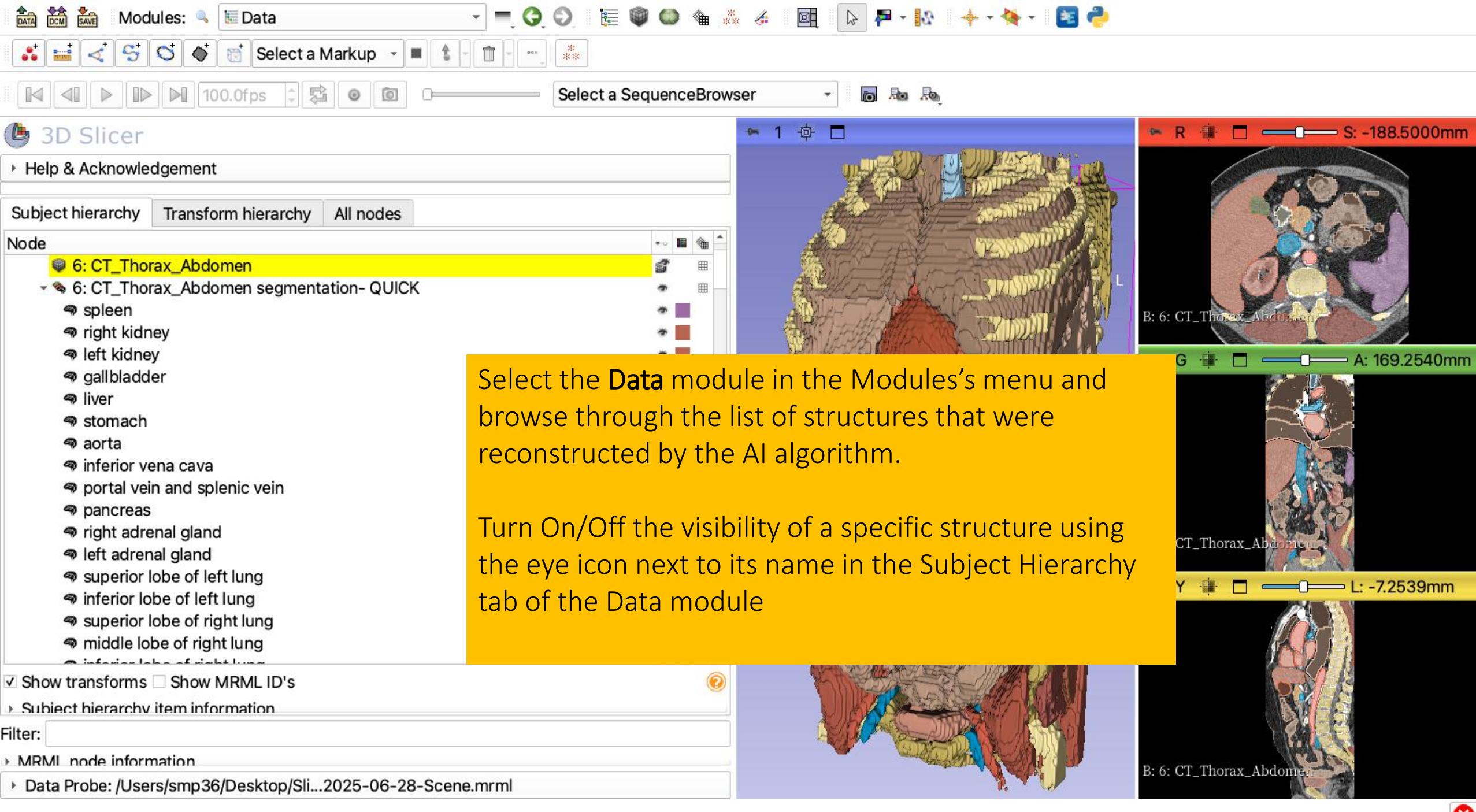
Select the module MONAIAuto3DSeg and enter the model's name Whole Body Segmentation in the Segmentation model menu

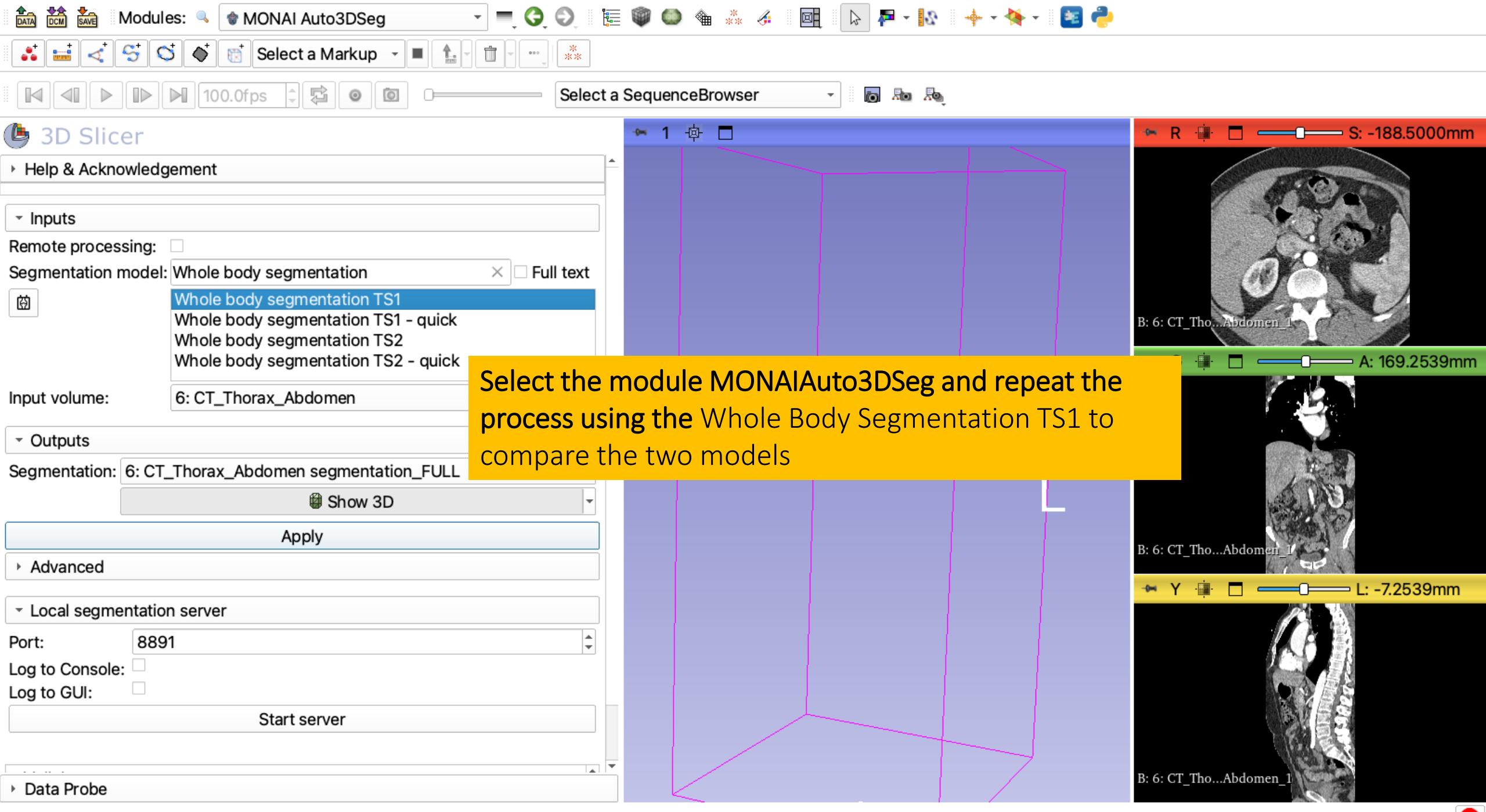
Select the model Whole Body Segmentation TS1 - quick













3D Slicer

Help & Acknowledgement

Inputs

Remote processing:

Segmentation model: Whole body segmentation Full text

Whole body segmentation TS1

Whole body segmentation TS1 - quick

Whole body segmentation TS2

Whole body segmentation TS2 - quick

Input volume: 6: CT_Thorax_Abdomen

Outputs

Segmentation: 6: CT_Thorax_Abdomen segmentation_FULL

Show 3D

Apply

Advanced

Local segmentation server

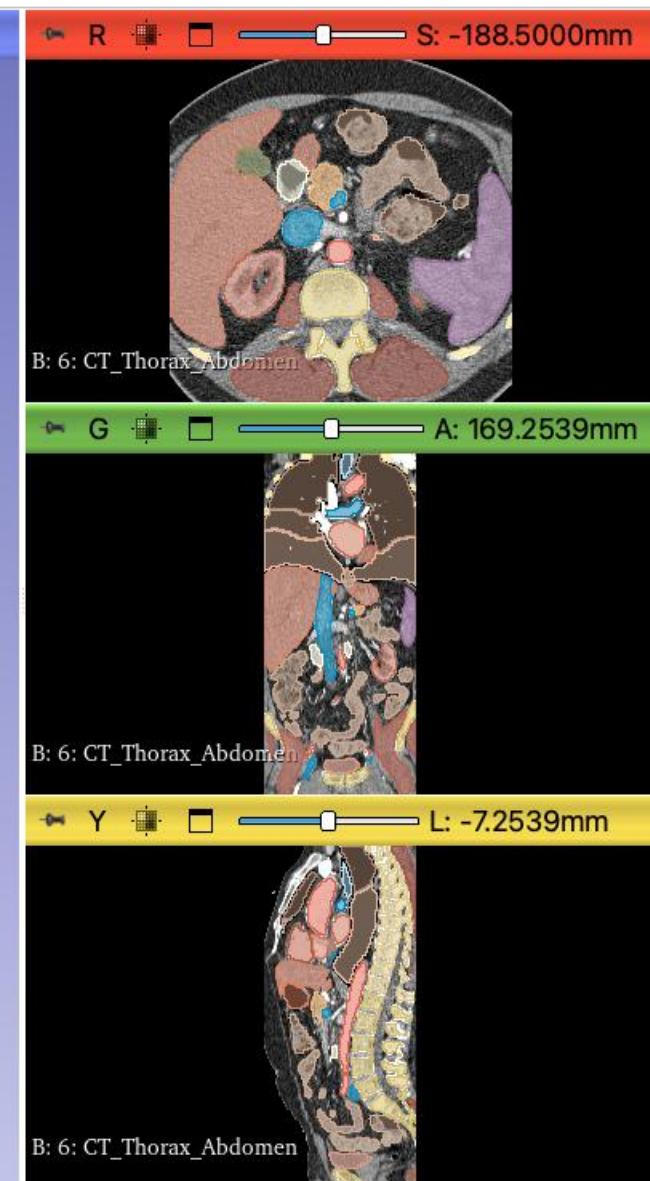
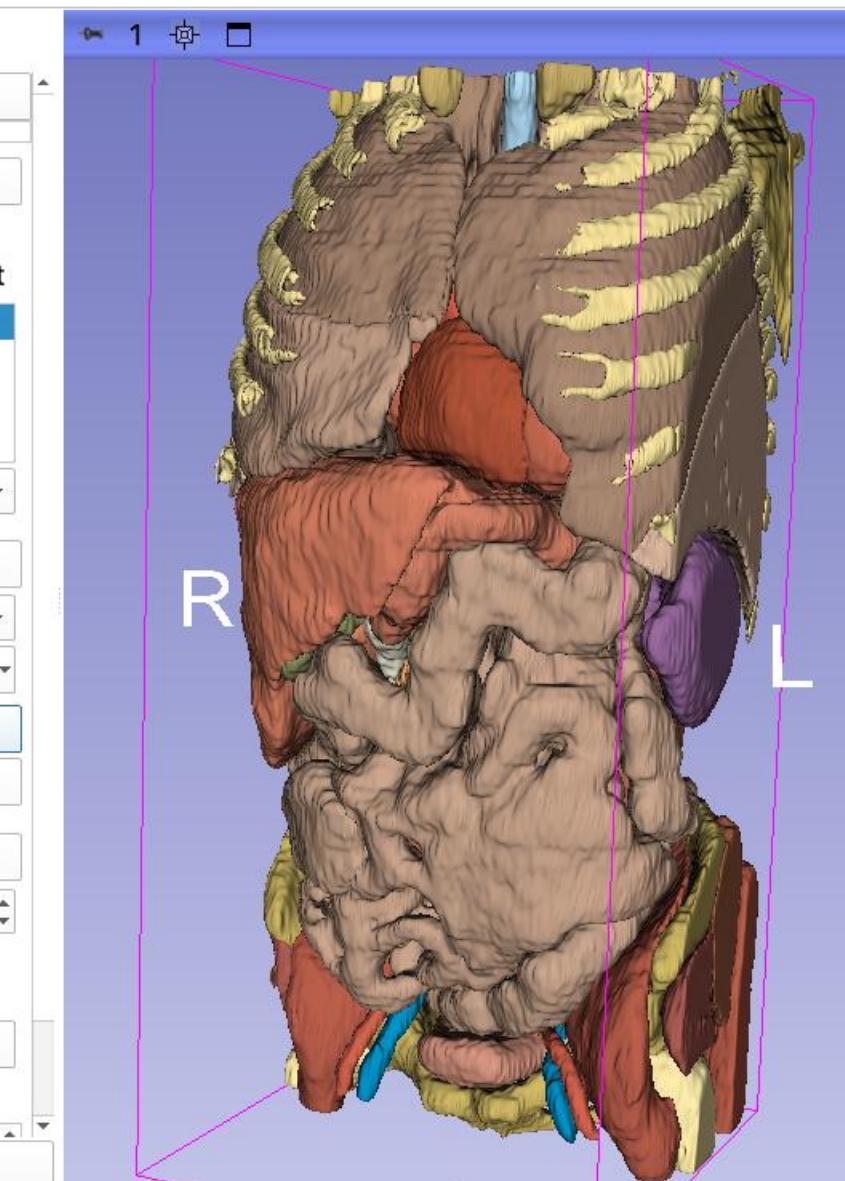
Port: 8891

Log to Console:

Log to GUI:

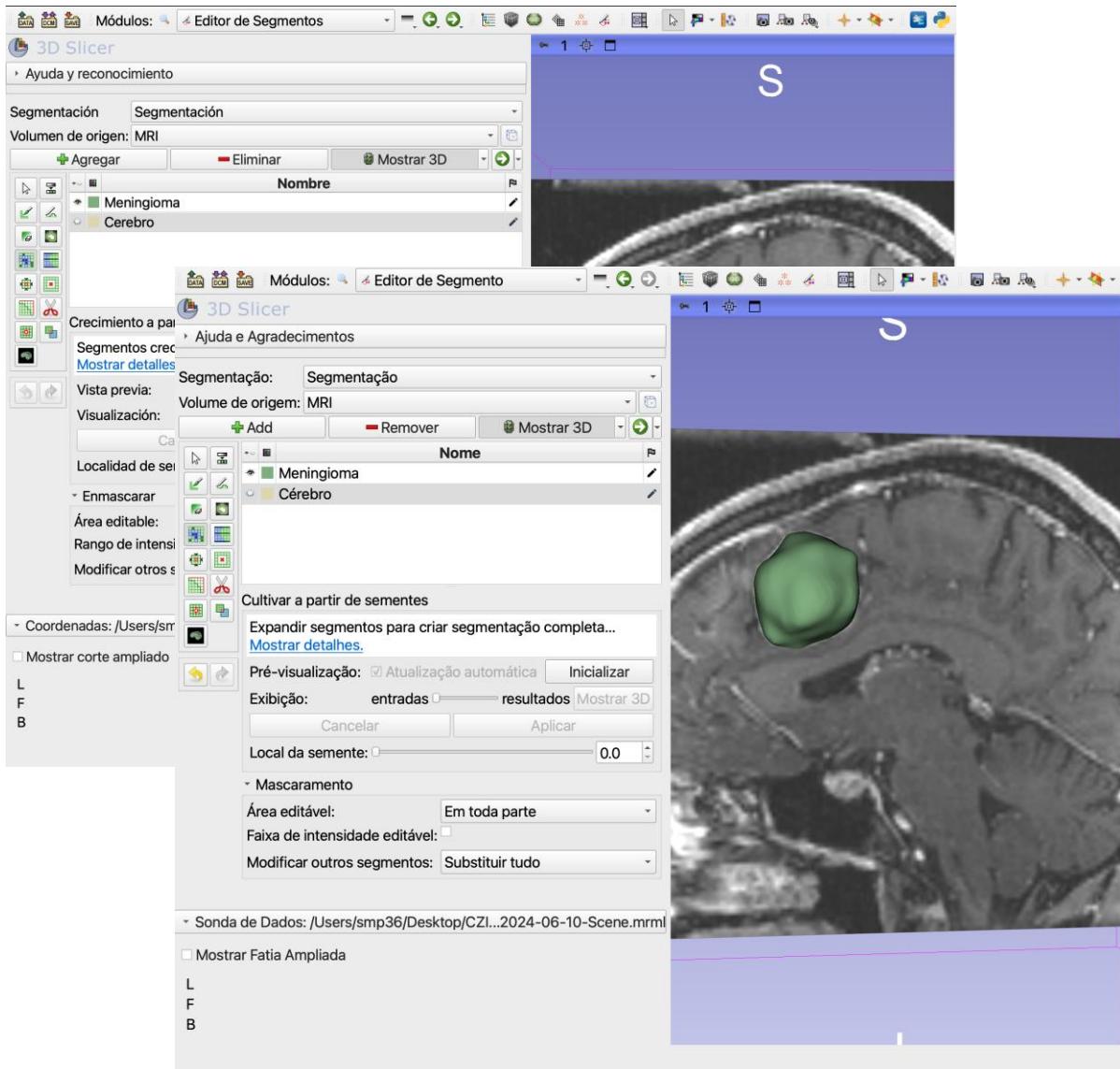
Start server

Data Probe



Conclusion

- The 3D SlicerMONAIAuto3DSeg extension provides fast AI-based segmentation of anatomical and pathological structures
- The module can run on standard laptop and desktop computers with no GPU



Acknowledgments

The 3D Slicer internationalization project and the 3D Slicer for Latin America project have been made possible by two CZI Essential Open Source Software for Science (EOSS cycle 4 & 5) grants.

Chan
Zuckerberg
Initiative 