



User Manual

Hyperpolarized ^{129}Xe MRI Analysis App

For Research Use Only



User's Manual
HP ¹²⁹Xe MRI Analysis App

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Center for Pulmonary Imaging Research.

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1 | Overview

Main Menu:

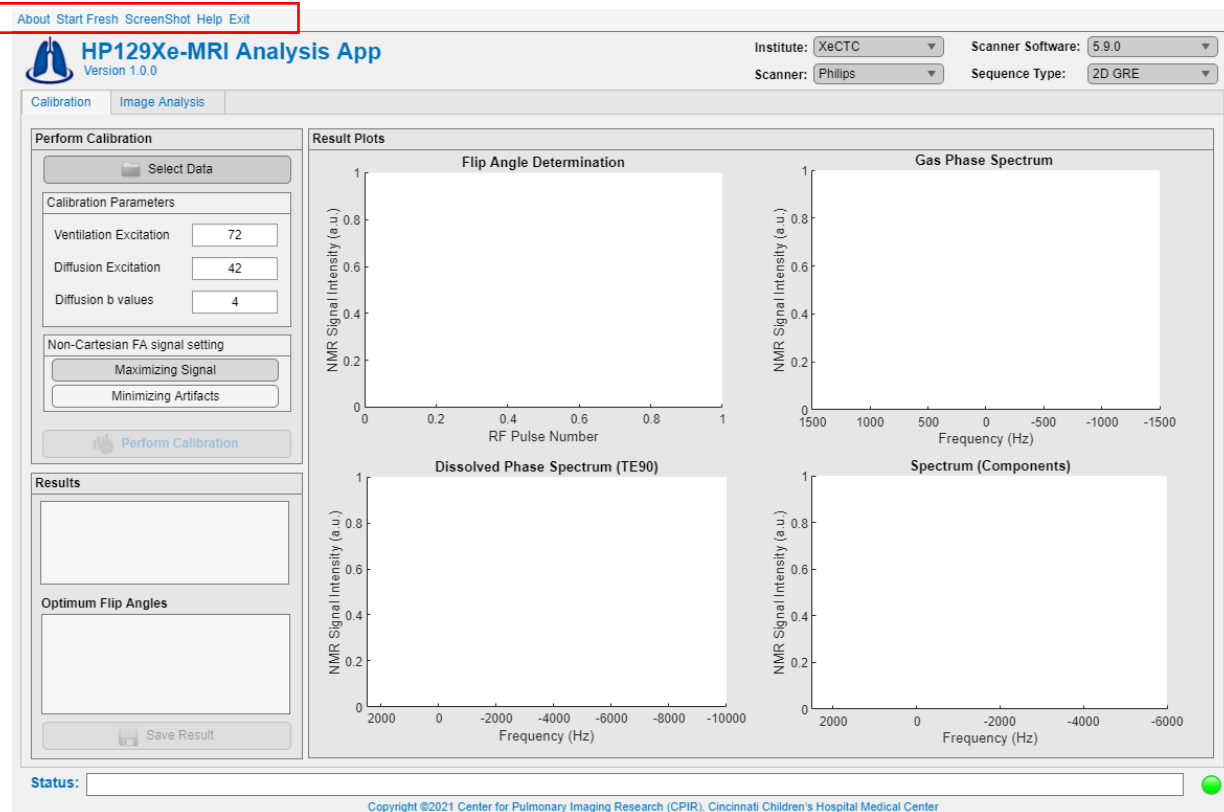
About: Provides an insightful overview of the application and its functionalities.

Start Fresh: Restores the app to its default settings and eliminates all variables. This feature proves beneficial when handling numerous subjects consecutively.

Screenshot: Captures the entire app window and saves it as a high-quality PNG file.

Help: Guides you to the comprehensive user manual, offering assistance and clarification.

Exit: Safely shuts down the application, concluding the user's session.



Institutes and Scanner Options:

These exceptional features allow for seamless customization of the application according to your specific requirements. They prove particularly valuable when working with multiple scanners, scanner software versions, and sequences.

About Start Fresh ScreenShot Help Exit

HP129Xe-MRI Analysis App
Version 1.0.0

Institute: XeCTC Scanner Software: 5.9.0
Scanner: Philips Sequence Type: 2D GRE

Calibration Image Analysis

Perform Calibration

Select Data

Calibration Parameters

Ventilation Excitation: 72
Diffusion Excitation: 42
Diffusion b values: 4

Non-Cartesian FA signal setting
Maximizing Signal
Minimizing Artifacts

Perform Calibration

Results

Optimum Flip Angles

Save Result

Result Plots

Flip Angle Determination

NMR Signal Intensity (a.u.) vs RF Pulse Number

Gas Phase Spectrum

NMR Signal Intensity (a.u.) vs Frequency (Hz)

Dissolved Phase Spectrum (TE90)

NMR Signal Intensity (a.u.) vs Frequency (Hz)

Spectrum (Components)

NMR Signal Intensity (a.u.) vs Frequency (Hz)

Status:

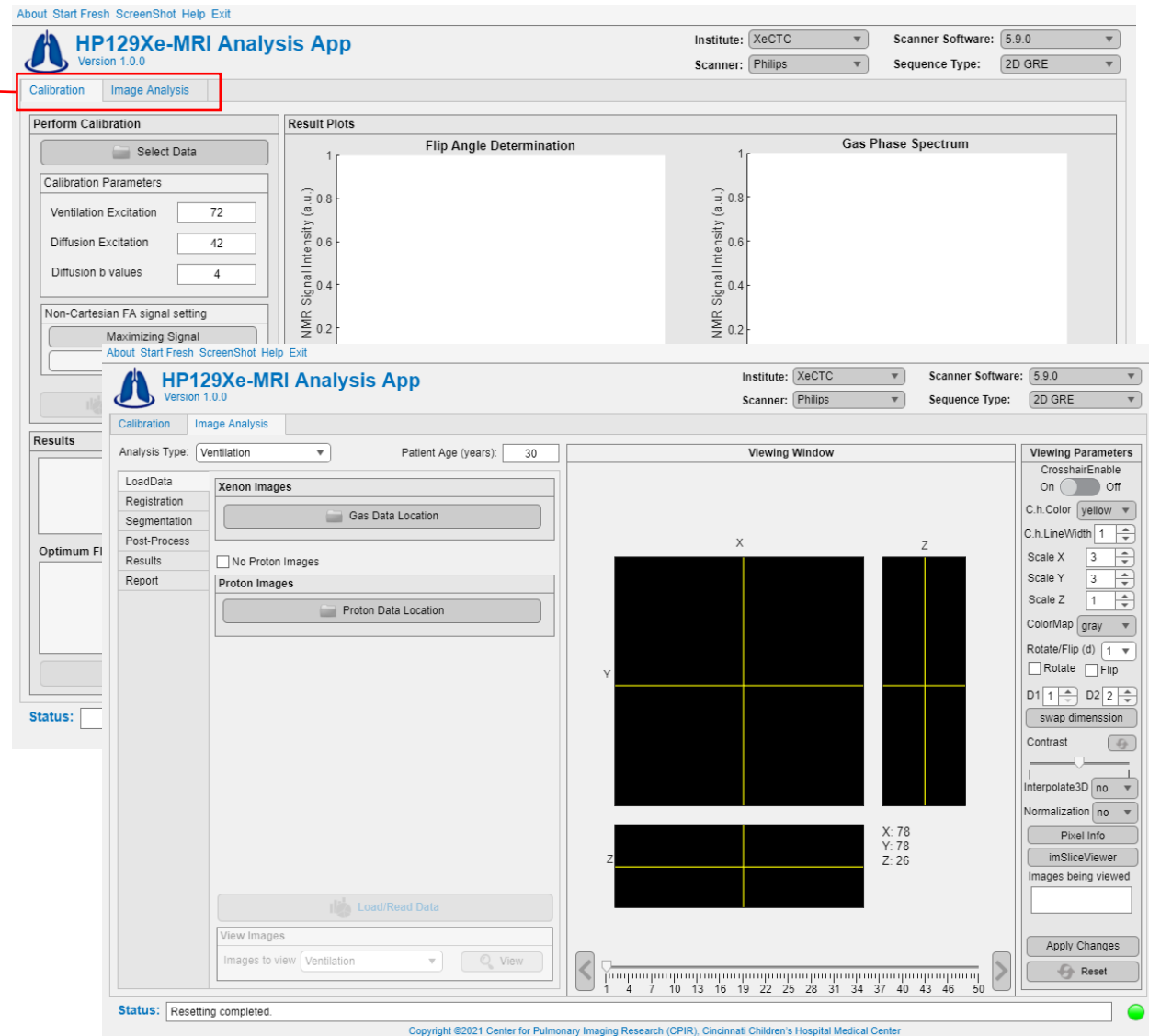
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Main Tabs:

Calibrations: Manages flip angles and frequency calibration, ensuring precise adjustments for optimal acquisitions.

Image Analysis: Facilitates image reconstruction and conducts comprehensive post-processing analysis, enabling in-depth examination and evaluation.

Note: These two tabs operate independently from each other, maintaining separate sets of parameters. There is no parameter sharing between them, ensuring complete autonomy and flexibility.

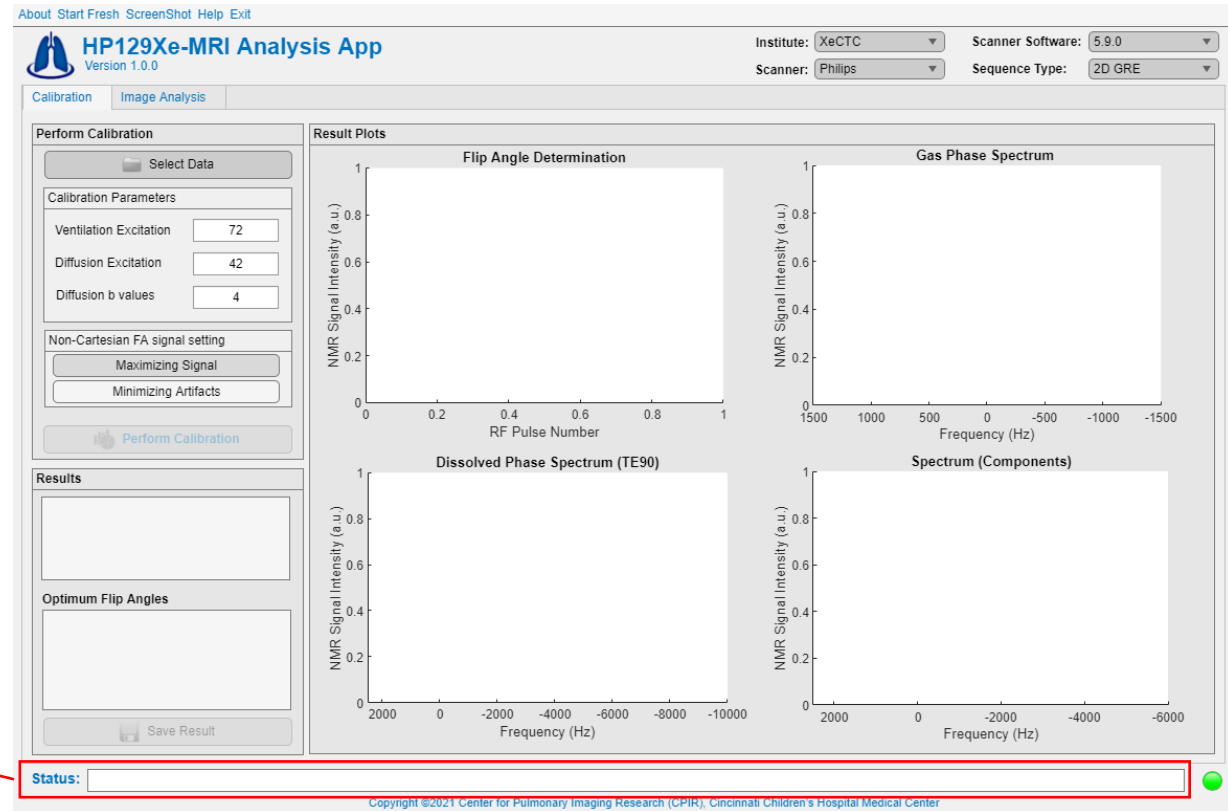


The screenshot displays the HP129Xe-MRI Analysis App interface, which is divided into two main sections: Calibration and Image Analysis. The top section, titled "HP129Xe-MRI Analysis App Version 1.0.0", includes a menu bar (About, Start Fresh, ScreenShot, Help, Exit) and a header area with dropdown menus for Institute (XeCTC), Scanner (Philips), Scanner Software (5.9.0), and Sequence Type (2D GRE). The main content area is split into two tabs: Calibration and Image Analysis. The Calibration tab is active, showing a "Perform Calibration" section with a "Select Data" button and "Calibration Parameters" (Ventilation Excitation: 72, Diffusion Excitation: 42, Diffusion b values: 4). It also includes a "Non-Cartesian FA signal setting" section with a "Maximizing Signal" button. The "Result Plots" section contains two graphs: "Flip Angle Determination" and "Gas Phase Spectrum", both showing NMR Signal Intensity (a.u.) on the y-axis. The Image Analysis tab is also visible, showing a "Viewing Window" with X, Y, and Z axes, a "Viewing Parameters" panel on the right, and a "Status" bar at the bottom indicating "Resetting completed."



Status Window:

The status window presents a text box that provides real-time updates on tasks and displays error messages when necessary. It serves as a valuable tool for tracking progress and promptly addressing any issues that may arise.

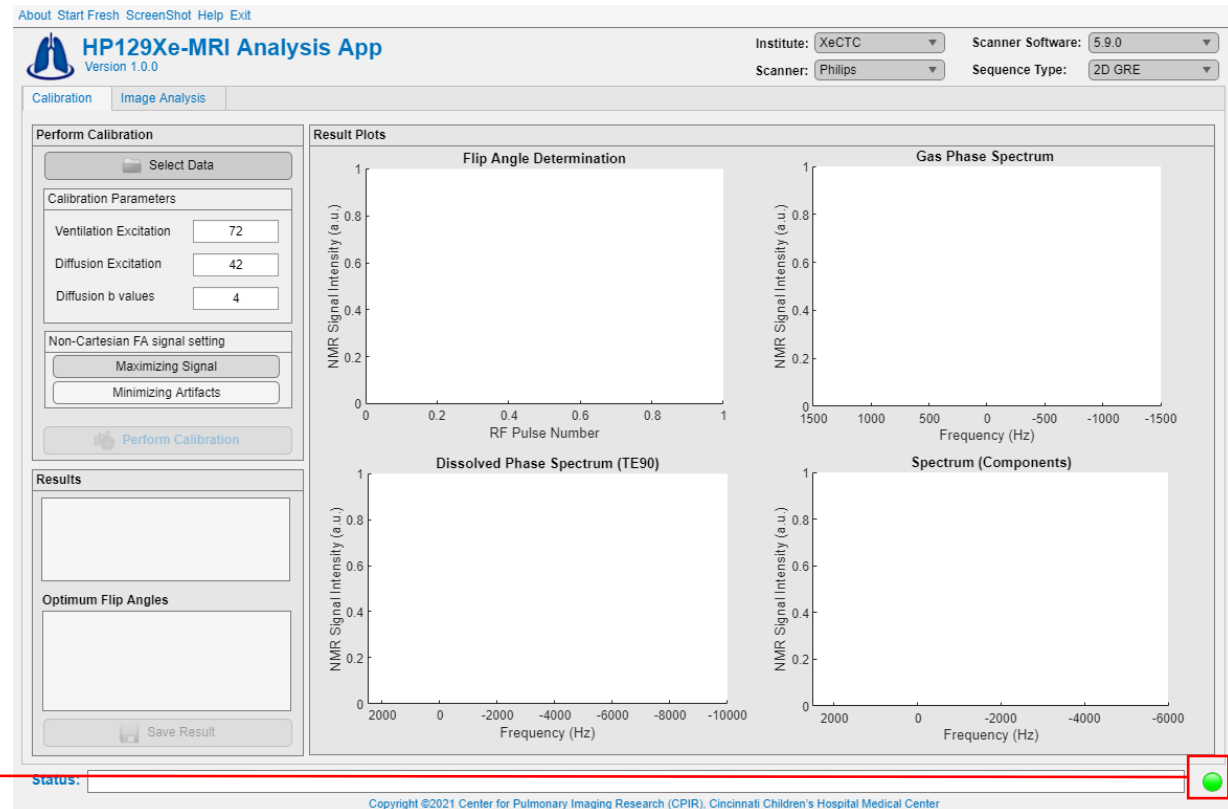




Lamp:

Green: Signals that the app is ready for execution, indicating availability for use.

Red: Indicates that the app is currently unable to process tasks. It's important to note that if a bug occurs and the process halts midway, the lamp will not turn green until another task is initiated.





2 | Flip Angle and Frequency Calibration

2.1 | Input

Perform Calibration Analysis:

1- Select Data: Choose the flip angle calibration data from the available options (refer to Table 2.1 for supported data types).

2 – Perform Calibration: Read in the selected data and conduct essential fittings and calculations to obtain accurate results. The determined optimal flip angles and frequency parameters are subsequently entered prior to image acquisition.

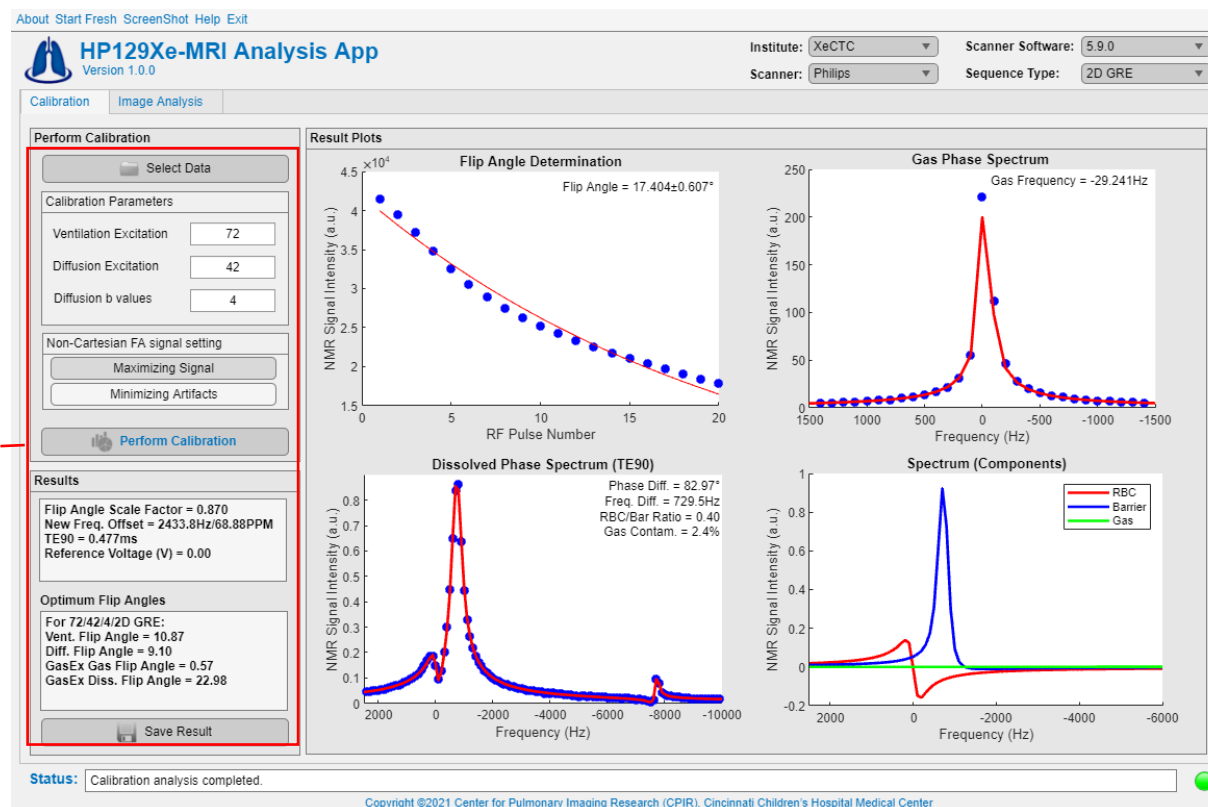


Table 2.1: Supported data type for Calibration analysis

Scanner	Philips	Siemens	GE
Data Type	.data*/.list	.dat*	

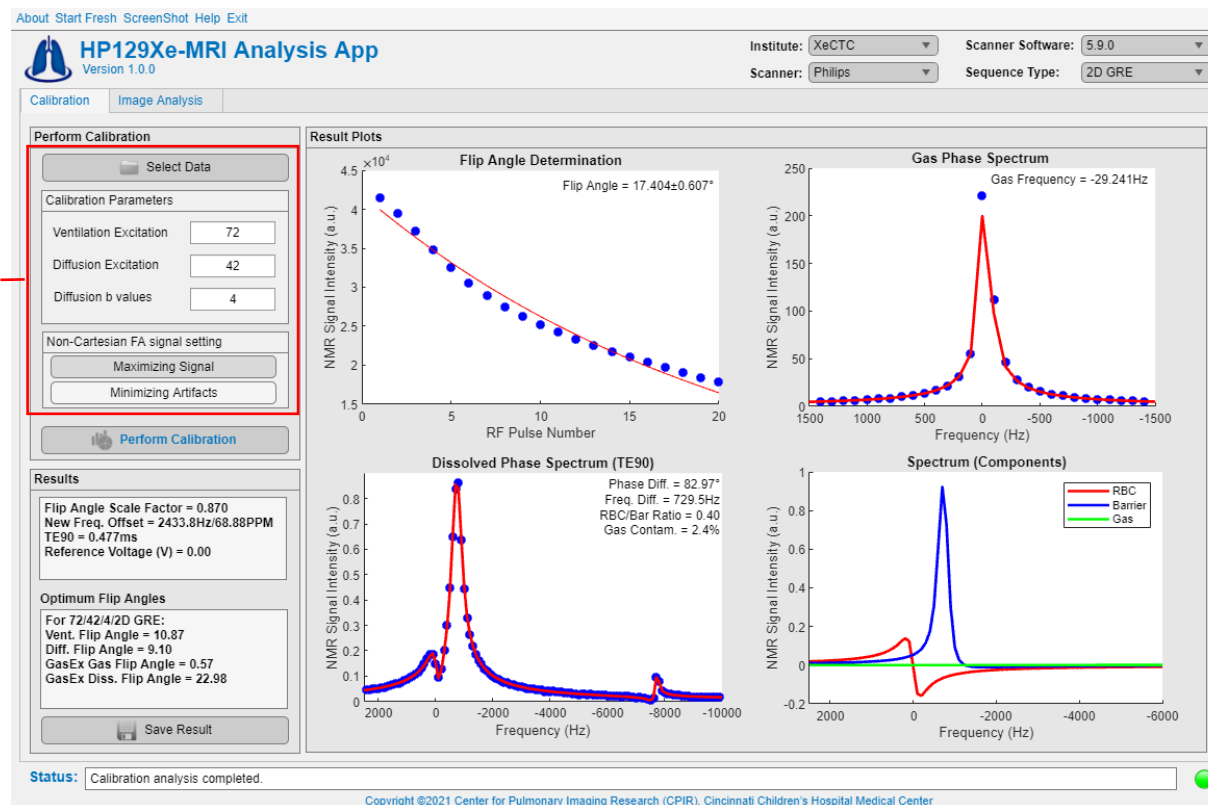
* The data that needs to be selected!



2.2 | Adjusting Parameters

Perform Calibration Analysis:

The calibration analysis allows for flexibility in adjusting parameters both before and after the analysis. These input parameters possess a dynamic property, meaning that any changes made to their values will automatically update the calculations. This enables effortless refinement and adaptation of the analysis based on parameter modifications.

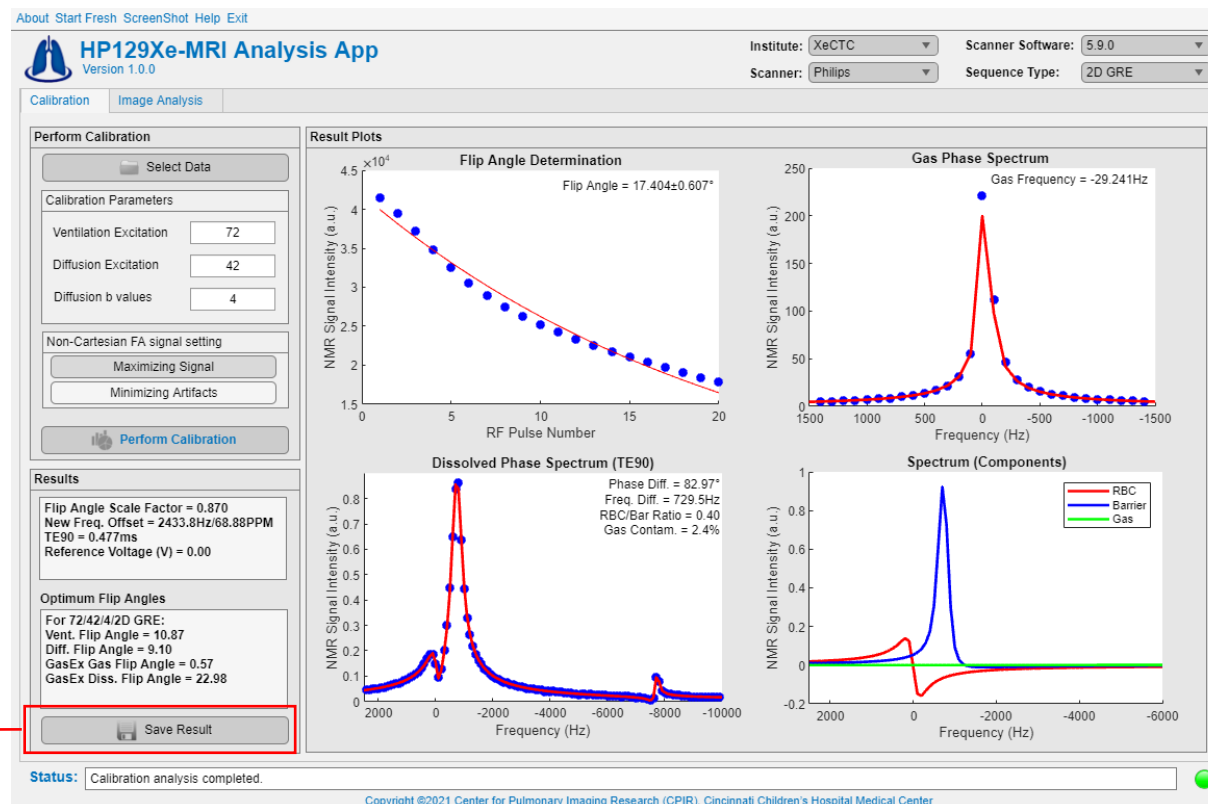




2.3 | Save Results

Save Results:

Saves a screenshot of the entire app window as a PNG and PDF files in the data path.



3 | Image Analysis

3.1 | Inputs

Load Data:

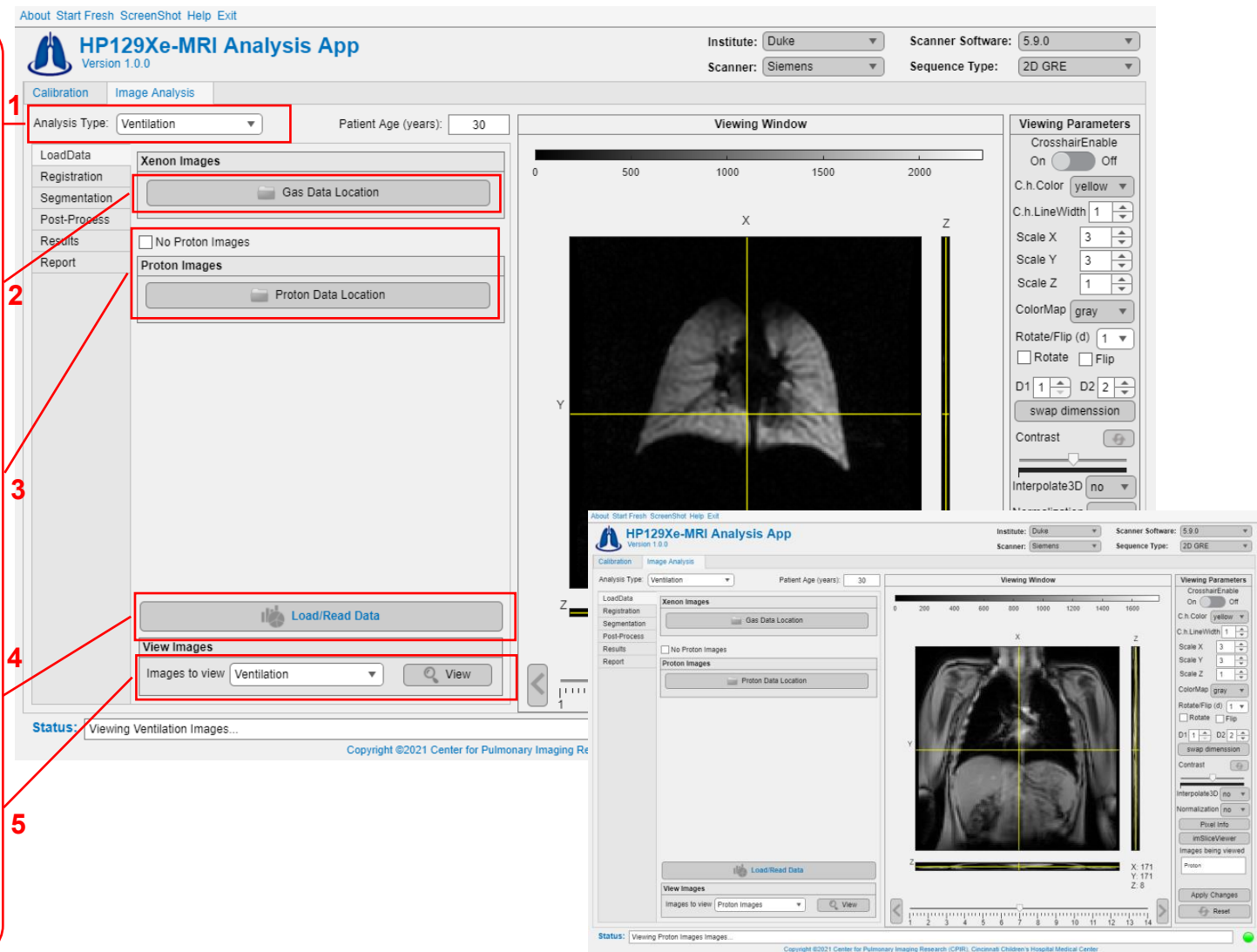
1- Choose Analysis Type:
Select the desired type of analysis from the available options.

2- Gas Data Selection:
Choose the data file/s for analysis. If raw data is selected, reconstruction functions will be invoked to process the data.

3- Proton Data Selection:
If proton data is available, select the corresponding data. Otherwise, check the "No Proton Images" box.

4- Load Data: Load the selected data for further processing and analysis.

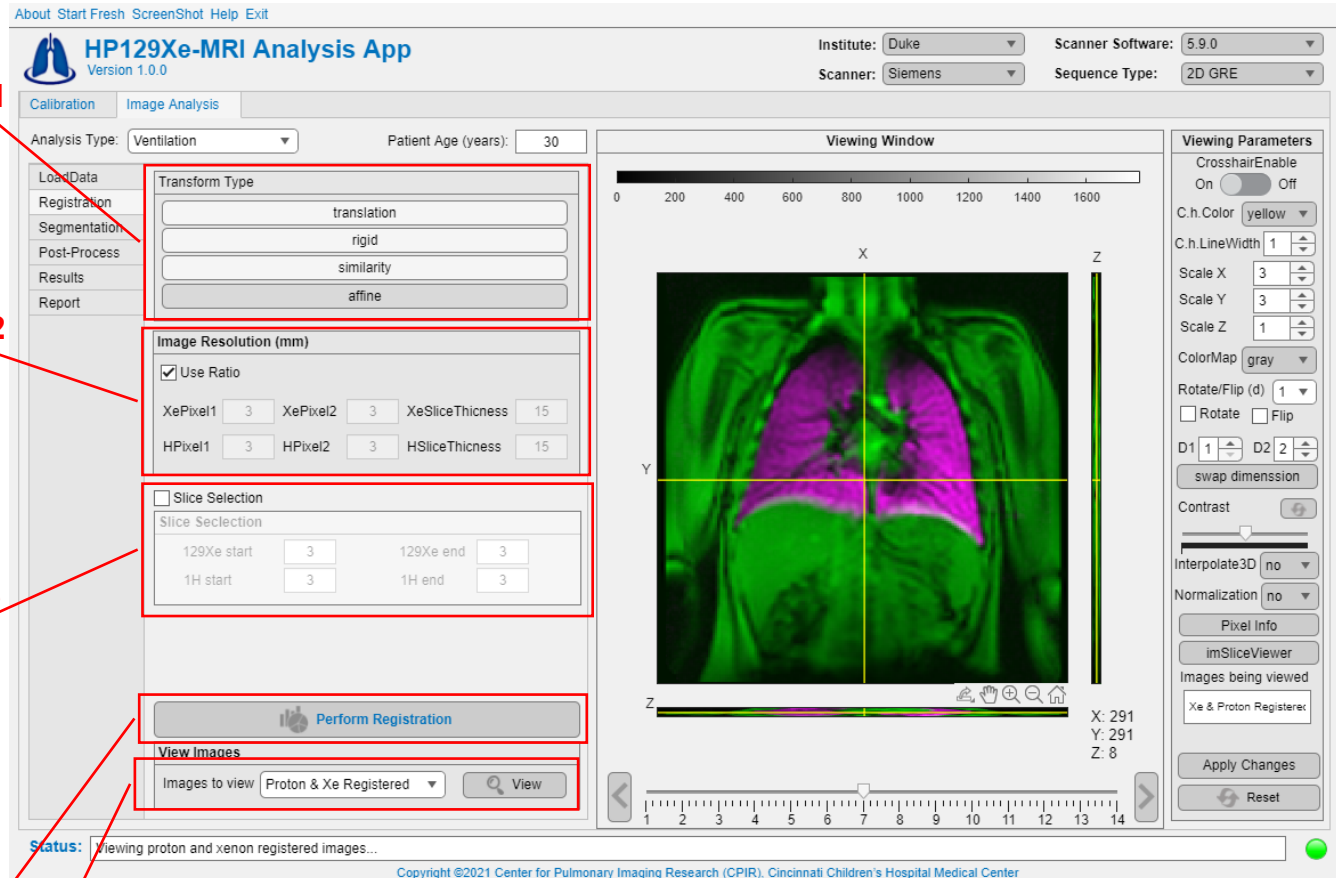
5- Image Selection:
Select the specific type of images to view.



3.2 | Registration

Perform Registration:

1. Registration Type Selection: Choose the desired registration type, with "affine" being the recommended option for optimal results.
2. Image Resolution: If the two images have different voxel sizes, it is advisable to specify the image resolution for accurate registration. The ratio of the image sizes can also be used as a reference.
3. Slice Selection: In case the slices of the images do not align, you can specify the starting and ending slices of the matched region. Linear interpolation will be employed to adjust the number of slices accordingly.
4. Registration Process: Initiate the registration process for multimodal 3D medical images.
5. Image Selection: Select image type to view.

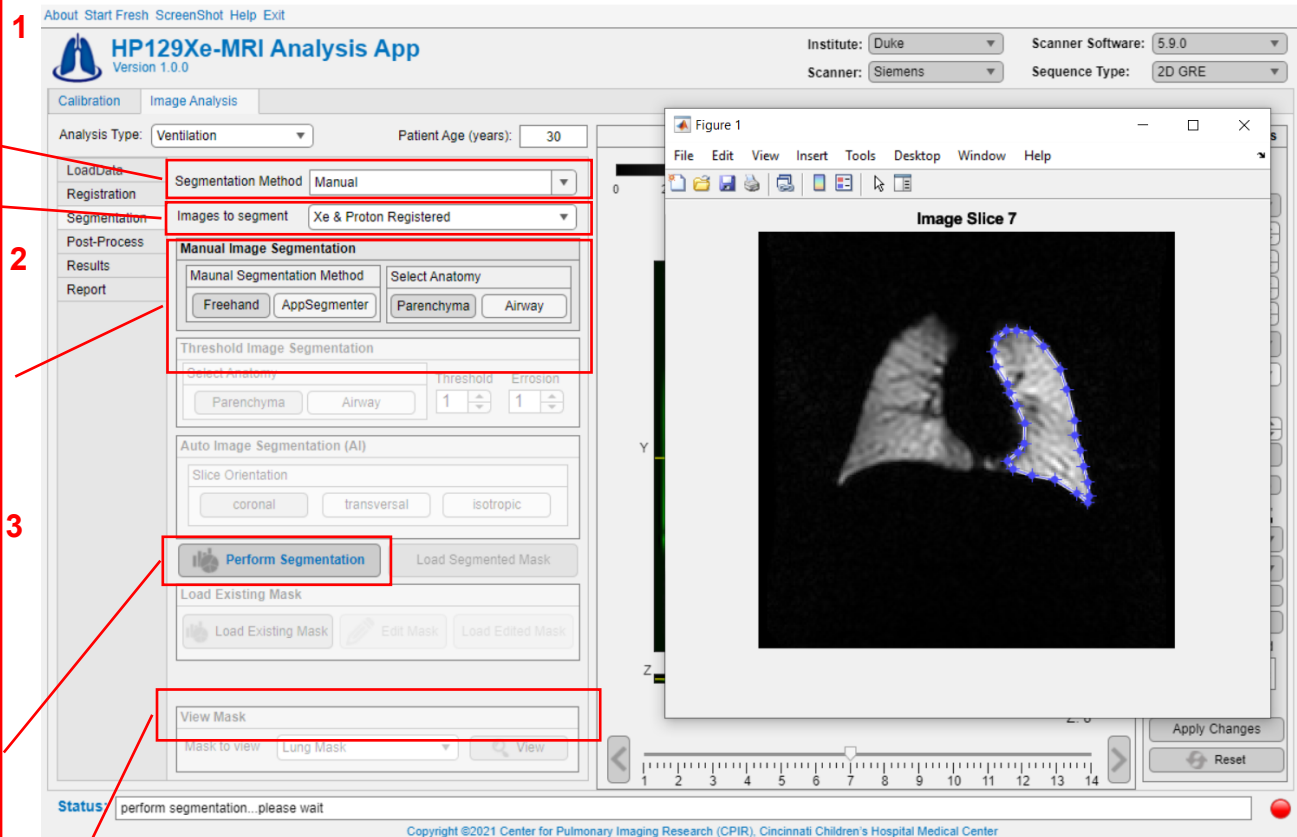




3.3 | Segmentation

Manual Registration:

1. Registration Type Selection: Choose the desired registration type, with "affine" being the recommended option for optimal results.
2. Image Resolution: If the two images have different voxel sizes, it is advisable to specify the image resolution for accurate registration. The ratio of the image sizes can also be used as a reference.
3. Slice Selection: In case the slices of the images do not align, you can specify the starting and ending slices of the matched region. Linear interpolation will be employed to adjust the number of slices accordingly.
4. Registration Process: Initiate the registration process for multimodal 3D medical images.
5. Image Selection: Select image type to view.







3.4 | post-Processing

3.4 | Results

3.6 | Patient Report



3.6 | Viewing Window

4 | Code Structure

4.1 | Code Hierarchy

4.2 | Implement Your Own Functions

4 | Debugging

5 | Report Issues



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