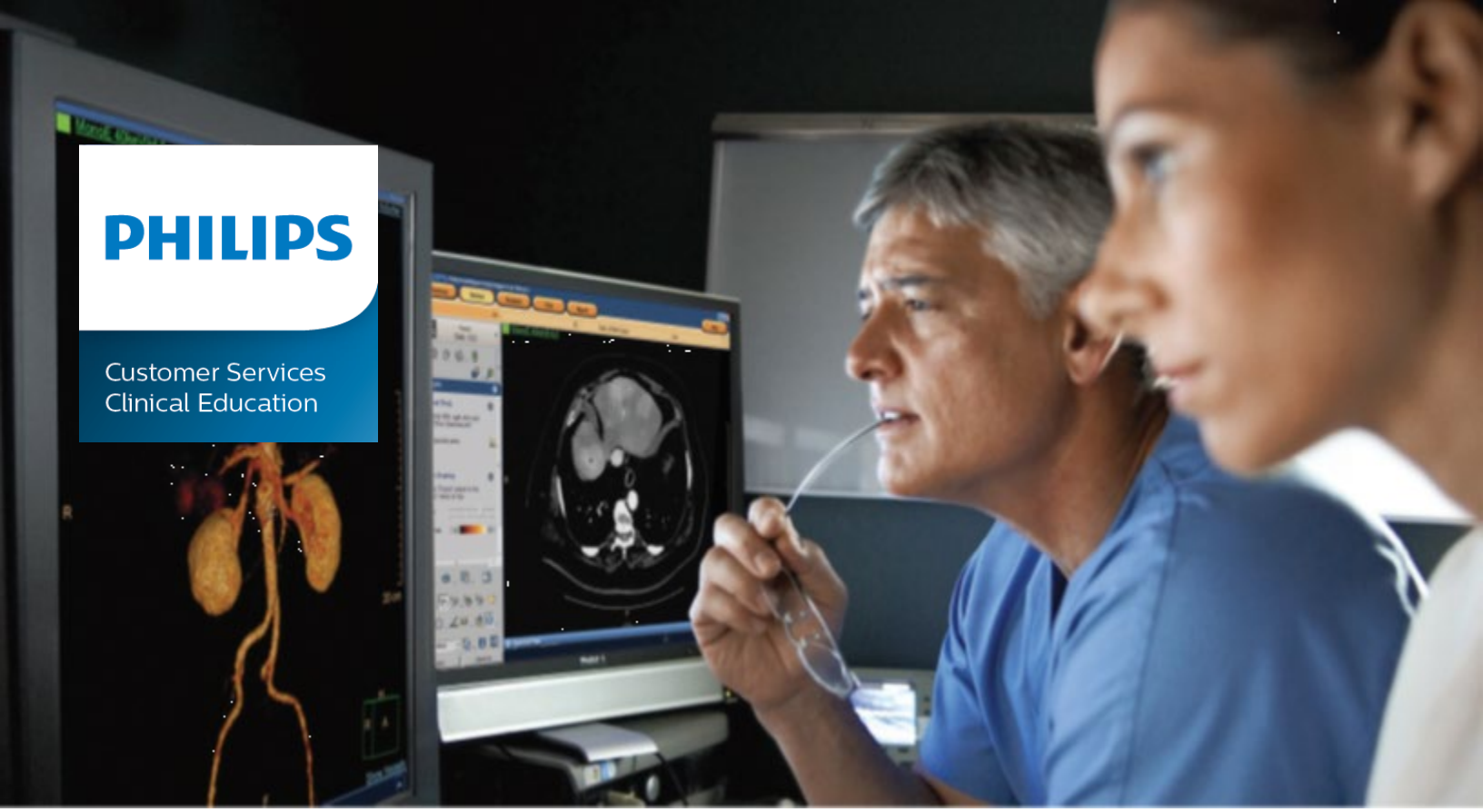


MR Neuro Perfusion

Purpose

This postprocessing package is meant to evaluate T2* perfusion studies and generate numerical and graphical results and maps. Paramagnetic contrast agents influence the local magnetic field and reduce the T2* of surrounding tissue.

If a valid Diffusion input series is available with the loaded study, Diffusion-Perfusion-Mismatch can be performed.

The Analysis Tool offers several specific calculation methods depending on the user's need and data types loaded.

Before you begin

A valid imaging series for the Neuro Perfusion package is a series which is sensitive to T2* changes over time - a series where a stack of slices is repeatedly acquired over time (dynamics). The MR Neuro Perfusion package requires at least 5 dynamics.

Background

Calculation Methods

Arterial Input Function

The AIF analysis workflow uses a deconvolution algorithm based on the knowledge of the Arterial Input Function to calculate the perfusion values. The AIF describes the input of contrast agent into the tissue of interest. When using this workflow, you define the AIF by selecting voxels (typically in an artery) that show the passage as induced by the passage of the contrast agent bolus. The curvature of the intensity curve of an arterial vessel is used to calculate the perfusion maps. The AIF method will calculate parameters such as relCBV, relCBF, MTT, T0, TTP, Delay map (Tmax). Main applications: stroke assessment and Diffusion-Perfusion Mismatch.

Model-Free

When using the non-AIF workflow, you can draw a ROI to focus on a specific area, e.g. a lesion. The Model-Free method will calculate parameters such as relCBV, relCBF, MTT, T0, TTP. Main applications: tumor assessment and stroke.

Gamma Variate

The Gamma Variate inherently corrects recirculation biases caused by a second pass of the contrast agent to the area of interest. The Gamma Variate method will calculate parameters such as relCBV, relCBF, MTT, T0, TTP. Main applications: tumor assessment and stroke.

Leakage Correction

Brain tumors may cause a disruption of the blood-brain-barrier, that typically leads to a leakage of contrast to the extracellular volume. In those high-permeability areas, caused by disruption of the blood-brain-barrier, relative Cerebral Blood Volume (rCBV) may be miscalculated and so overestimated. Leakage Correction allows to avoid estimation biases by correcting the rCBV value. The Leakage Correction method calculates parameters such as relCBV corrected and uncorrected, K1, K2, and R2 maps for goodness of fit. Main applications are: tumor assessment and grading.

Set-up

Launch the MR Neuro Perfusion application

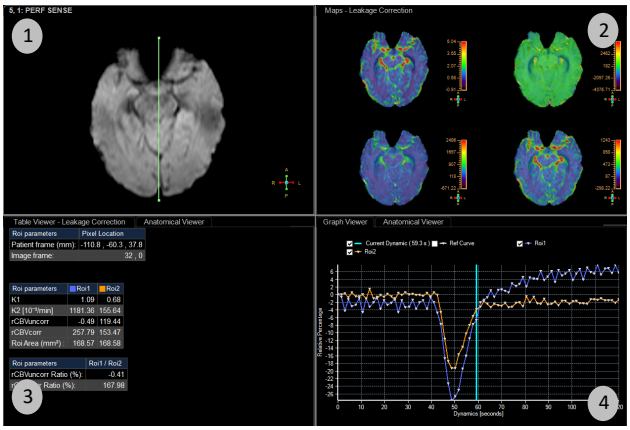
Scroll through the images

Through dynamics
In the image viewport, drag to the left or right.

Through slices
In the image viewport, drag up- or downwards.

Through maps
In the map viewport, drag to the left or right.

Layout



1. Reference Series

2. Parametric Real Time Maps

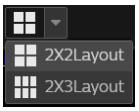
3. Table Viewer

4. Graph Viewer

Options

Click any menu item to enable/disable this option.

The menu offers functionalities such as Showing Skip Dynamics option, Follow Mouse, etc.



To select another screen layout, click the drop-down arrow and select 2x2 or 2x3 Layout

Select Series for Anatomical Viewer (optional)

Upon startup of the package, the Anatomical Viewer is empty. However, an additional imaging series in the Anatomical Viewer might help during navigation through the dataset and to draw ROIs.

Any type of imaging series can be loaded into the Anatomical Viewer. The orientation of the series in the Anatomical Viewer is always identical to the orientation of the source image and the map. This might require the calculation of real-time Multiple Planar Reformats.

Workflow

Select the Analysis method

Select from:

- Arterial Input Function
- Gamma Variate
- Model-Free
- Leakage Correction

Verify & adjust data quality (optional)

To adjust parameters for dynamics, temporal smoothing, or spatial smoothing, expand the selection for **Verify & adjust data quality**.

Skip Dynamics

If desired, you can skip the first dynamics in a study to ignore the initial dynamics in which the steady state has not yet been reached. To skip dynamics, enter the number of dynamics that you want to skip in the box in the Skip Dynamics step of the task guidance panel.

Apply Temporal Smoothing

For temporal smoothing of the resulting maps

Possible settings are: None (no smoothing), Weak, Medium, or Strong.

Apply Spatial Smoothing

For spatial smoothing of the resulting maps

Possible settings are: None (no smoothing), Weak, Medium, or Strong. Spatial smoothing smooths the maps and the original images. In such a way, spatial smoothing has an effect on the numerical results.

Define the mask (optional)

This optional workflow step serves to adjust the mask and to enable the display of the mask while adjusting. Setting a threshold mask will exclude background pixels from the functional map calculations. All pixels with values below the mask value will be displayed blue and will be excluded from the calculation. Only pixels with intensity above the mask value are used for the calculations.

- Right-click and drag in the source image to adjust the mask.

Select Maps

Select the maps in the task guidance panel for real-time calculation and display, and for the generation of new imaging series.

Select the checkbox of a map to display this map.

The display of the real-time calculated maps updates accordingly.

Measure ROIs

Draw one or more ROIs with or without contra-lateral behavior. Results will be shown accordingly

Select Underlay

You can select an MR series as underlay of the parametric maps allowing for better visualization. To optimize the display, you can also adjust the opacity of the overlaying parametric maps.

Generate Series

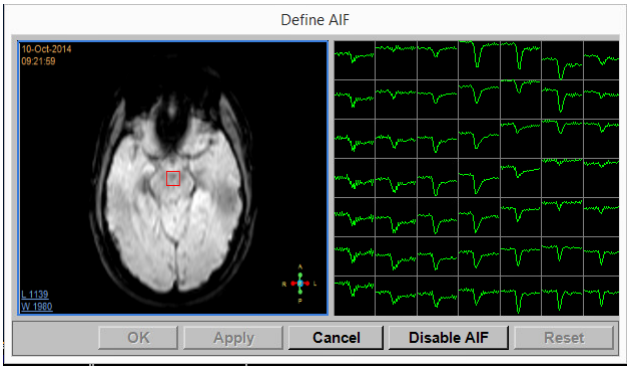
To export maps as a new image series, click **Generate Series.** Select from:

- Secondary Capture
- Secondary Capture RGB

AIF Workflow (Additional steps to perform)

1. Select **Manual AIF** from the **Analysis** drop-down menu.

- The **Define AIF** button is displayed in the Analysis step in the task guidance.
- The **Define AIF** window pops up with the mid slice displayed.



A red square shows up in the image viewport. This red square spans the size of 7 by 7 voxels. In the right viewport the dynamic curves of these 7x7 voxels are shown.

2. Navigate to the slice with the vessel relevant for Manual AIF definition.
3. Zoom, pan, and window the slices so that this vessel is clearly visible.
4. Drag the red box over this vessel.

   The display of the curves will automatically be updated.

5. Click on individual graphs to include them in the definition of the AIF.

   The selected graphs are yellow. For best results, the defined AIF curves should be early, high, and narrow.

6. Press **Apply** to confirm.

   Now the AIF is identified, and the resulting maps will be shown.