

CereFlow™ 4-Dimensional Dynamic MRA (4-D dMRA)

What is CereFlow™ 4-D dMRA?

Based on Arterial Spin Labeling (ASL), CereFlow™ 4-D dynamic MRA (4-D dMRA) offers 4-D dynamic cerebral angiographic imaging and 3-D Time-to-Peak (TTP) map.

CereFlow™ 4-D dMRA makes use of dynamic cine balanced Steady State Free Precession (bSSFP) sequences to acquire non-contrast angiographic imaging that enhances the cerebrovascular dynamics comparable to the gold standard DSA.

By providing the dynamic display of vascular morphology, location, quantity, vessel size, feeding artery origin, depth and quantity of drainage vein, CereFlow™ 4-D dMRA is highly recommended for assisting clinical diagnosis and evaluation of ischemic stroke, cerebral artery stenosis and occlusion, arteriovenous malformation (AVM), moyamoya disease, brain tumor, congenital cerebrovascular disease etc.

CereFlow™ 4-D dMRA has the following features:

1. Simple and fast scan, no contrast agent required

CereFlow™ 4-D dMRA does not require injection of contrast agent. The scan can be completed in 6 minutes, at the speed of acquiring 10 slices of high-resolution MRA images per second.

2. Higher Signal-to-Noise Ratio (SNR) and sensitivity

Compared to the conventional sequence of continuous Gradient-Echo Look-Locker (LL-GRE), the bSSFP-based 4-D dMRA has a 30% increase in SNR and a 40% increase in Contrast-to-Noise Ratio (CNR), due to the fact that bSSFP has the advantage of endogenous flow compensation and is highly sensitive to blood flow imaging.

3. Higher spatial resolution and temporal resolution

By using Pulsed Arterial Spin Labeling (PASL) combined with dynamic cine-bSSFP and LL-GRE sequence, CereFlow™ 4-D dMRA achieves a time resolution of 50-100 ms, ten times that of Contrast-Enhanced dynamic MR Angiography (CE-dMRA), and a spatial resolution of 1.0-1.5 mm³, two times that of CE-dMRA, which is close to DSA and CTA imaging with a spatial resolution of less than 1.0 mm³.

4. High practicality

CereFlow™ 4-D dMRA covers a slab of 220 x 200 x 60 mm, including all major cerebral arteries. The overall scan time is about 6 minutes, fitting well with clinical operation.

5. Multi-dimensional image display

CereFlow™ 4-D dMRA provides 2-D, 3-D, 4-D visualization and video mode to assist medical professionals in the analysis of cerebrovascular diseases. The 3-D display may demonstrate temporal change of 2-D image stacks, or the hierarchical change of the non-temporal 2-D grayscale images, or the average non-temporal 3-D grayscale images. The 4-D display introduces even more versatility.

6. Ideal replacement of the gold standard DSA

The 4-D dMRA does not require contrast agent and scan within 6 minutes, providing a non-contrast quality cerebrovascular dynamic imaging comparable to the gold standard DSA. It eliminates the risk from the procedure under anesthesia, reduces clinical workload, lowers expenses, and improves the chance for patients to receive imaging exams.

7. Poly-modal color display

CereFlow™ 4-D dMRA not only provides a 4-D dynamic view of blood flow through major cerebral arteries, but also a color-coded time delay map that helps to visualize arterial peak time (Time-to-Peak, TTP) co-registered with 3-D vascular imaging.

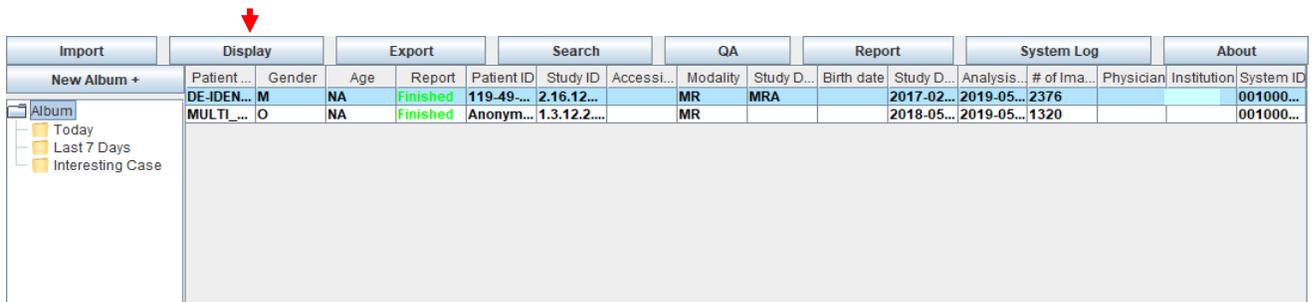
How to use CereFlow™ 4-D dMRA?

CereFlow™ interface is needed for 4-D dMRA processing and display. For smooth and better visual effects, the minimum requirement of the workstation video RAM is 4 GB.

The processing of raw image data of 4-D dMRA will automatically begin after being uploaded to CereFlow™. When the Report status of the case shows the processing as “Finished”, select the case, and click on “Display”. ([Figure 1](#), red arrow) A display viewer will pop out ([Figure 2](#)) exhibiting the processed images of 4-D dMRA. The default view is the superoinferior view centered on cerebral artery circle. ([Figure 2](#)) The viewer will play 4-D dMRA in a video mode repeatedly at half (50%) of the real speed.

The left upper corner of the pop-out viewer lists the mouse-controlled functions, including:

- Hot Key Menu: Right Button
- Brightness and Contrast: Wheel + Hold
- Rotate: Left Button + Hold
- Zoom In: Wheel Up
- Zoom Out: Wheel Down



Import	Display	Export	Search	QA	Report	System Log	About									
New Album +	Patient...	Gender	Age	Report	Patient ID	Study ID	Accessi...	Modality	Study D...	Birth date	Study D...	Analysis...	# of Ima...	Physician	Institution	System ID
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Last 7 Days																
Interesting Case																

Figure 1



Figure 2

Right click mouse to display the Hot Key Menu (Figure 3), which includes:

- TTP Map (T): Switch to TTP map
- Colored Display (C): Switch to colored display
- GreyScale Display (G): Switch to greyscale display
- Reset (R): Restore to the default view
- Pause/Continue Play (Space)
- Next Frame (Upwards Arrow)
- Previous Frame (Downwards Arrow)
- Increase Play Speed (Leftwards Arrow)
- Decrease Play Speed (Rightwards Arrow)
- Exit: Exit Hot Key Menu

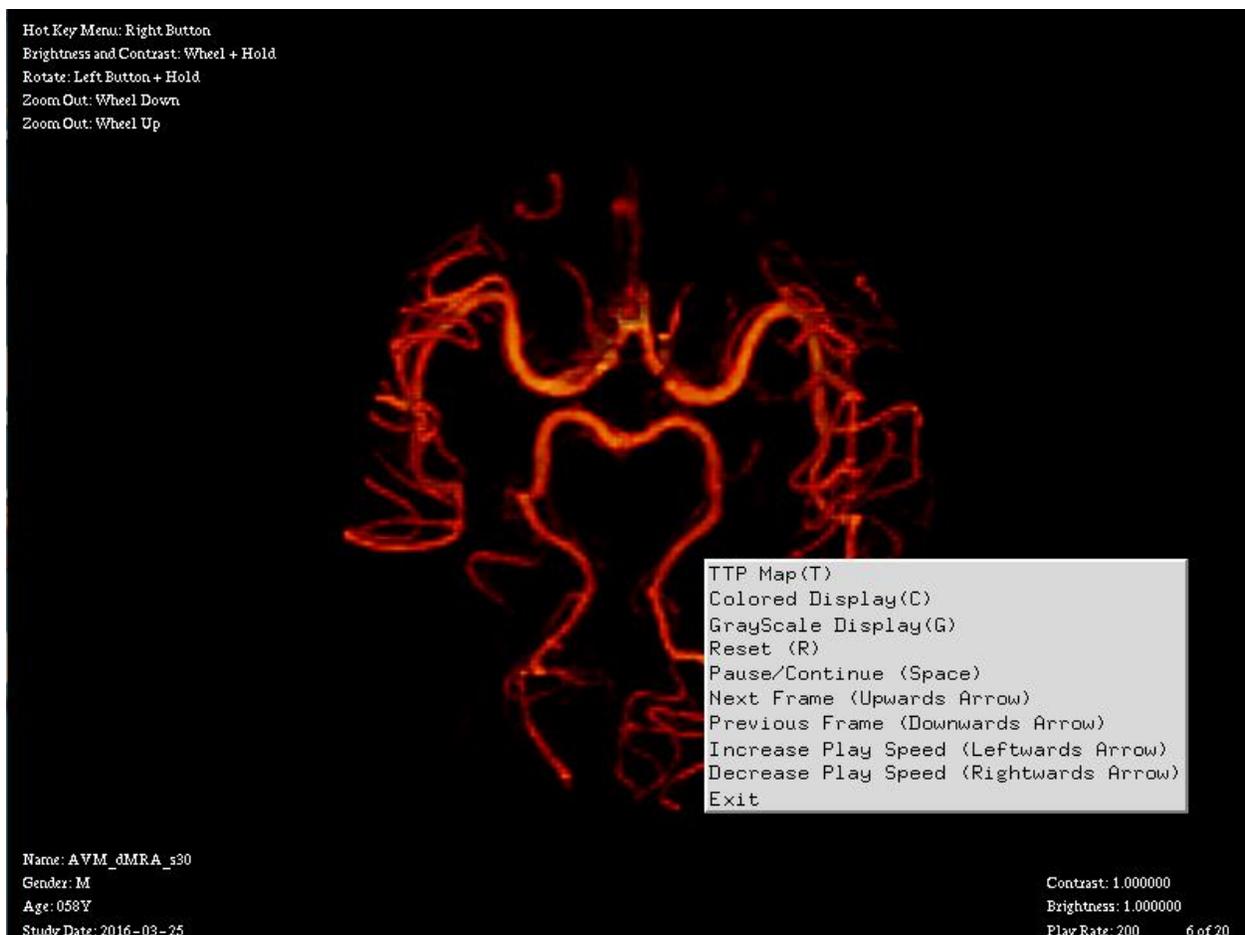


Figure 3