



**PHILIPS**

Multi Nuclei

Seamless integration  
of Multi Nuclei

# Seamless integration of Multi Nuclei

Multi-nuclei (MN) imaging and spectroscopy is a key area of leading-edge clinical investigation. However, it typically involves a different software version, cumbersome user interface, and a dedicated coil. And scan times tend to be quite long, which can disrupt day-to-day imaging throughput. To advance clinical insights in this promising area, Philips has made multi-nuclei imaging and spectroscopy become part of your daily clinical workflow. Designed for out-of-the-box implementation, our Multi Nuclei solution delivers the confidence to explore new imaging pathways and the speed to integrate multi-nuclei studies into your day-to-day workflow.

Adding Multi Nuclei to your MR 7700 or Elition X opens a window of research into other nuclei, in search of metabolic and functional information. It allows you to perform clinical imaging, spectroscopy and research studies of **six different nuclei** ( $^1\text{H}$ ,  $^{31}\text{P}$ ,  $^{13}\text{C}$ ,  $^{23}\text{Na}$ ,  $^{19}\text{F}$  and  $^{129}\text{Xe}$ ).

Besides regular proton ( $^1\text{H}$ ) imaging, you can:

- Begin to evaluate sodium ( $^{23}\text{Na}$ ) presence throughout the body with sub-millisecond TE acquisition facilitating imaging of short T2-signals
- Measure the dynamics of muscle metabolism using phosphorus ( $^{31}\text{P}$ ) spectroscopy by visualizing the changes in PCr / Pi-ratio over time
- Investigate metabolic processes by using carbon ( $^{13}\text{C}$ )
- Image fluorine ( $^{19}\text{F}$ )\* exogenous labeled contrast agents
- Create xenon ( $^{129}\text{Xe}$ ) images

Simply put, our Multi Nuclei solution can be used **across all anatomies**.

\* Caution: Investigational device for imaging with fluorine ( $^{19}\text{F}$ ). Limited by federal (or United States) law to investigational use. Clinical imaging with these nuclei requires usage of a cleared drug. No FDA-cleared drugs are currently available for these nuclei.

Seamless integrated workflow, **for 6 different nuclei**



We've made it easy for your operation, with a **seamless integrated workflow** for multi-nuclei image acquisition, spectroscopy, reconstruction, and viewing. Rather than a complex process, multi-nuclei studies have become a simple protocol that can be "dragged and dropped" into your ExamCard. How much simpler can it be?

The nucleus is just a scan parameter like any other sequence parameter. A single ExamCard can be used to run both proton and non-proton imaging and images can be checked on the console before the patient even leaves the room. Reconstruction and viewing of non-proton images or spectra, as well as the process for sending the data to PACS is fully integrated, so workflow does not differ from proton imaging. Easy export of multi-nuclei data is supported for enhanced DICOM, SPAR/SDAT, and XML-REC.

In addition to a seamless user interface, the dual tuned head coil enables brain exams, including **acquisition of proton and other nuclei, without switching coils**. This allows you to schedule your multi-nuclei studies as part of your clinical exam time slots. A **full brain study, including both proton (1H) and sodium (23Na) imaging can be completed in 30 minutes<sup>1</sup>**, all organized in one ExamCard using the same dual tuned head coil. A sodium (23Na) brain exam can be completed in less than 15 minutes<sup>2</sup>.

Transmit-receive flex coils are available for carbon (13C), phosphorus (31P), and sodium (23Na) scans. The ExamCard interface immediately recognizes these multi-nuclei coils. A sodium (23Na) knee exam can be as fast as 15 minutes<sup>3</sup>. Improved SNR and simplified spectra<sup>4</sup> can be achieved for phosphorus (31P) and carbon (13C) spectroscopy by combining body coil decoupling, with the transmit-receive surface coils.

<sup>1</sup> Measured from start of first scan to end of last reconstruction. Includes 1H (T2w TSE, T2w FLAIR, SSf DWI, and 3D T1w FFE pre&post) + 23Na (with a voxel size <= than 4mm isotropic).

<sup>2</sup> For 4 mm isotropic voxels.

<sup>3</sup> For 3 mm isotropic voxels, slice coverage > 95 mm.

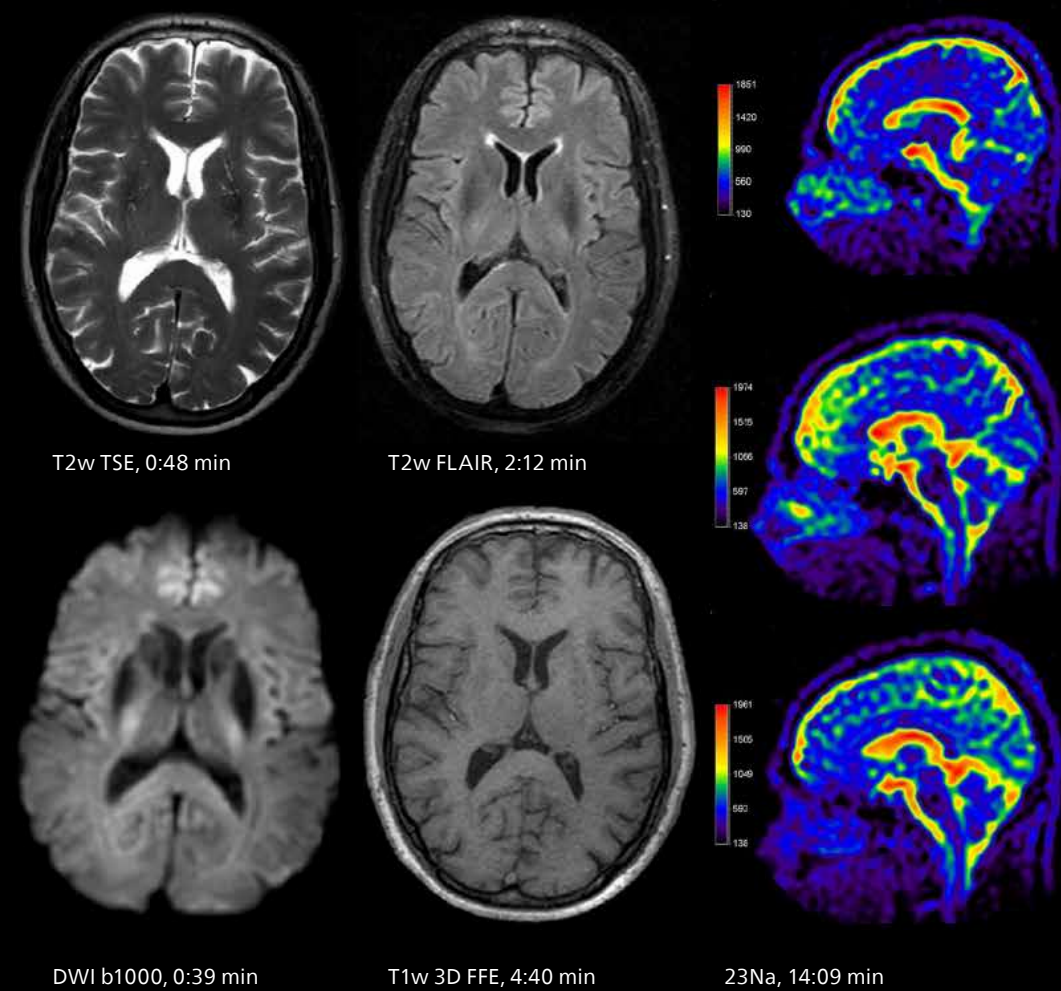
<sup>4</sup> Compared to non-decoupled spectroscopy results.

<sup>5</sup> For brain exams with a dual tuned head coil.

Acquisition of proton and other nuclei, **without switching coils<sup>5</sup>**

Our Multi Nuclei solution can be used **across all anatomies**





Include  $^{23}\text{Na}$  imaging into your daily clinical protocol

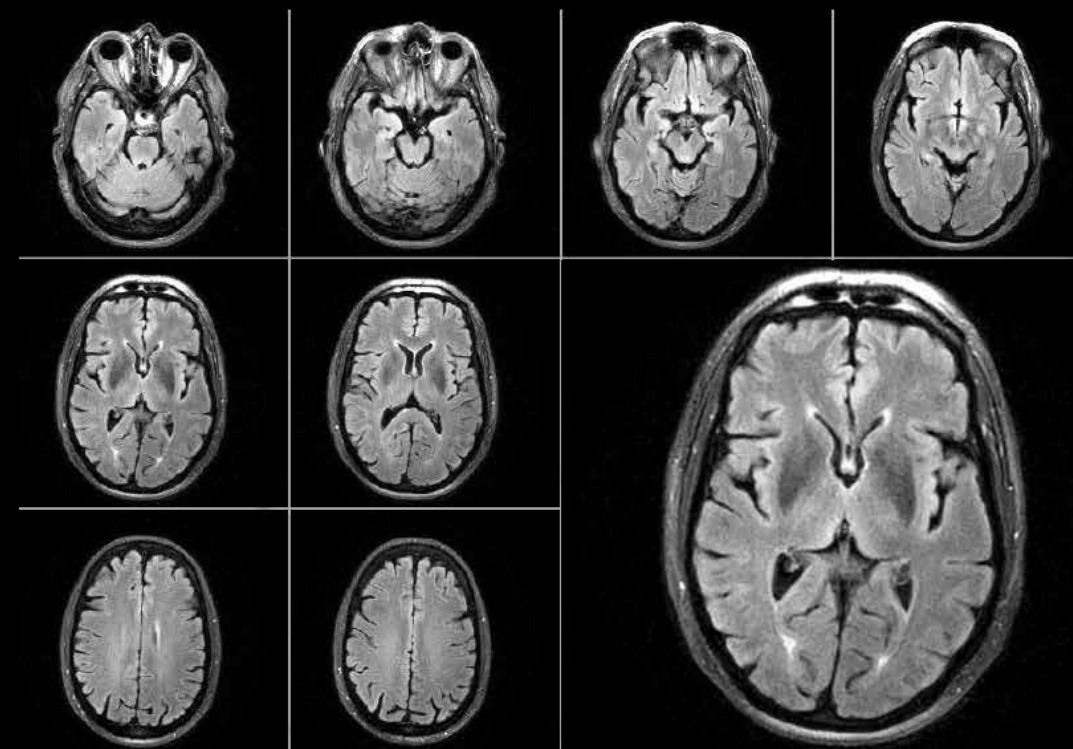
Brain MultiNuclei			00:27:32
	T2w TSE	tra	
	T2w FLAIR	tra	
	DWI	tra	
	3D T1w FFE	tra	
	23 Na	sag	

Routine Brain examination including  $^{23}\text{Na}$  imaging as well as pre and post contrast T1w scans in under 30-minutes using a dual-tuned  $^1\text{H}/^{23}\text{Na}$  head coil<sup>1</sup>

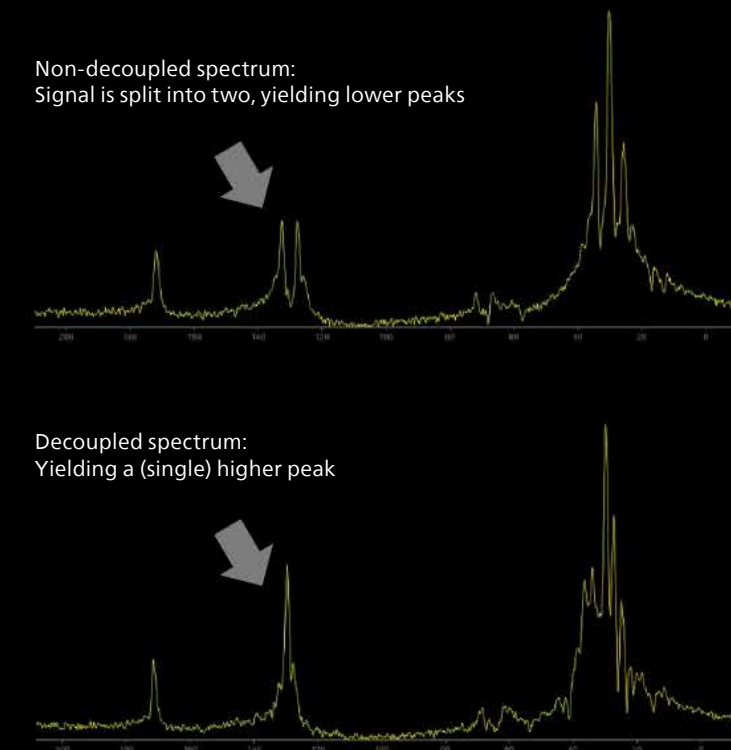
<sup>1</sup> For 3 mm isotropic voxels, slice coverage > 95 mm.

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Identifying metabolism with  $^{13}\text{C}$  spectroscopy



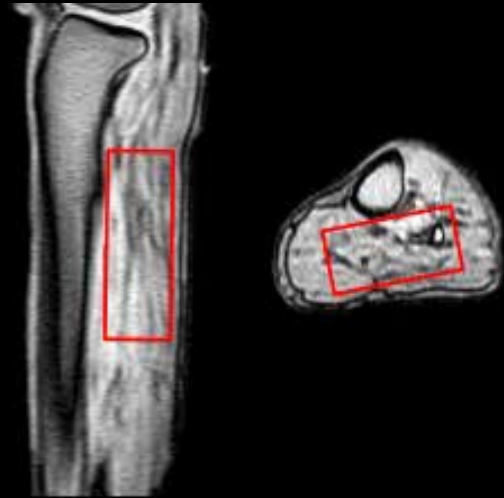
(Proton) FLAIR imaging using the dual-tuned  $^{13}\text{C}$  head coil



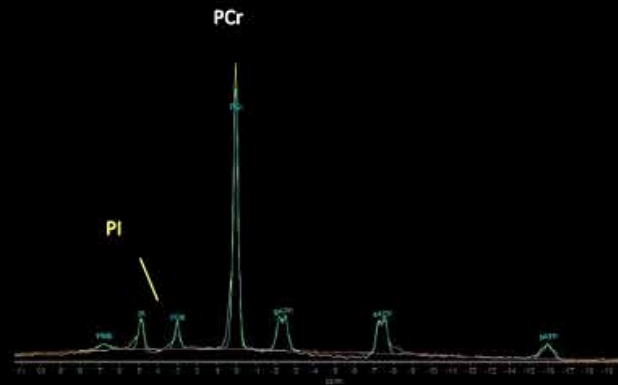
$^{13}\text{C}$  natural abundance spectroscopy of the full brain. Most  $^{13}\text{C}$  signal is coming from the fat. Decoupling was done to enhance the SNR of the peak detection.

Results from case studies are not predictive of results in other cases. Results in other cases may vary.





Planning of the spectroscopy voxel in the calf-muscle



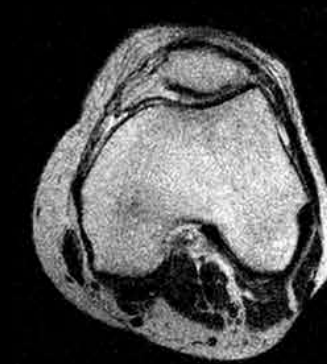
Single 31P spectrum of the calf-muscle showing the PCr and PI peaks

## Dynamic muscle metabolism using 31P spectroscopy

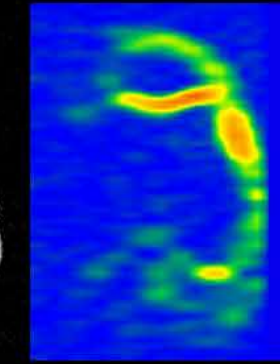


Dynamic 31P spectroscopy of the calf-muscle (5sec/acq, 50 dynamics) showing how the signals of PCr and PI change during a calf-muscle exercise

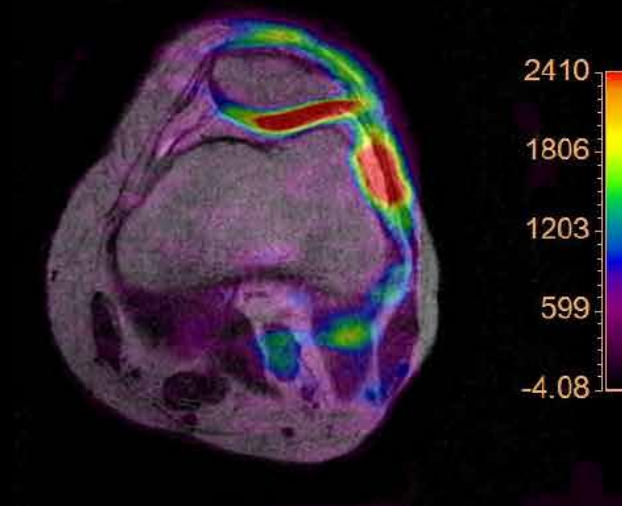
## Metabolite imaging, across all anatomies



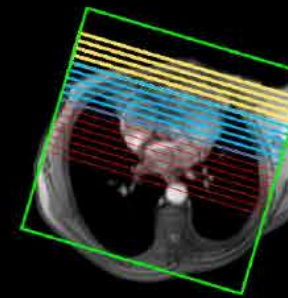
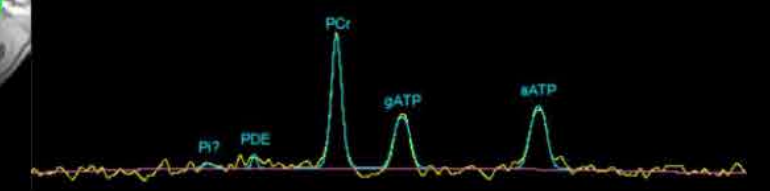
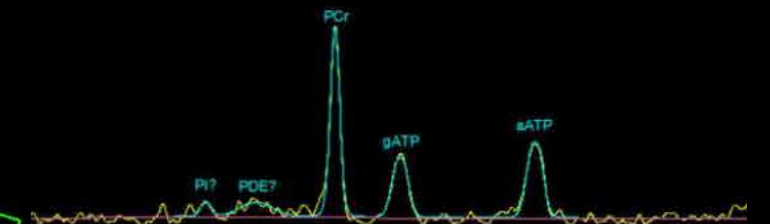
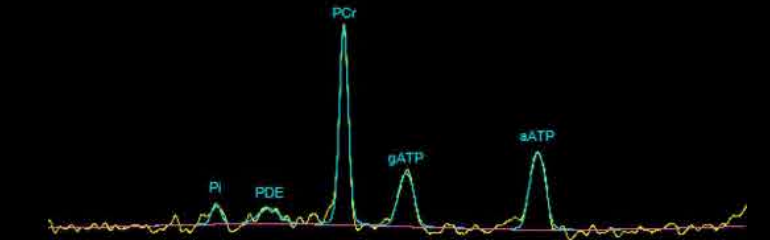
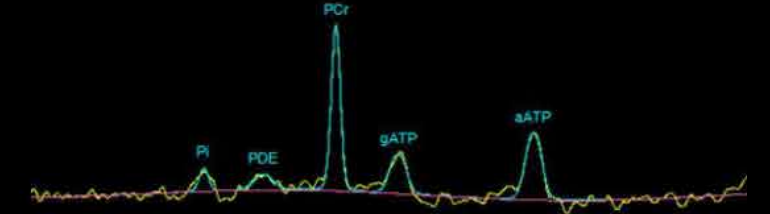
Anatomical imaging (1H body coil)



Functional 23Na imaging of the knee with a laterally placed flex coil Na-140



23Na imaging, overlaid on 1H anatomical imaging Sodium (23Na) knee exam can be performed as fast as 15 minutes. The sub-millisecond TE acquisition for sodium (23Na) imaging facilitates imaging of short T2-signals.



31P, cardiac triggered, 1D CSI of the heart Using flex coil P-140 with the patient in prone position



# Dual tuned head coil

The dual tuned head coil allows you to perform brain exams, including acquisition of proton and other nuclei (31P, 13C, 23 Na), without switching coils, in routine scan times. A full brain study, including both proton (1H) and sodium (23Na) imaging can be completed in 30 minutes<sup>1</sup>, all organized in one ExamCard, using the same dual tuned head coil. A Sodium (23Na) brain scan can be completed in less than 15 minutes<sup>2</sup>.

Multi-nuclei imaging or spectroscopy can be run and reconstructed directly from the standard user interface. The ExamCard interface immediately recognizes the dual tuned head coil. And the nucleus is just a scan parameter like any other sequence parameter. Reconstruction and viewing of multi-nuclei images or spectra, as well as the process for sending the data to PACS is fully integrated, so workflow does not differ from proton imaging.

Nucleus	1H, 31P, 13C, 23Na
Systems	3.0T dSync
Inner diameter	26,5 cm
Length of resonator	24 cm
Coil solution type	Transmit-receive, single channel
Applications	Brain
Coil connection	T/R interface



1 Measured from start of first scan to end of last reconstruction. Includes 1H (T2w TSE, T2w FLAIR, SSh DWI, and 3D T1w FFE pre&post) +23Na (with a voxel size <= than 4mm isotropic).  
2 For 4 mm isotropic voxels.



# Multi Nuclei flex coil

The transmit-receive Multi Nuclei flex coil, with a 14 cm diameter, allows you to perform multi-nuclei imaging, spectroscopy and research studies, across all anatomies. Benefit from improved signal-to-noise ratio (SNR) and simplified spectra, by combining body coil decoupling with this transmit-receive surface coil.

Multi-nuclei imaging or spectroscopy can be run and reconstructed directly from the standard user interface. The ExamCard interface immediately recognizes the Multi Nuclei flex coil. And the nucleus is just a scan parameter like any other sequence parameter. Reconstruction and viewing of multi-nuclei images or spectra, as well as the process for sending the data to PACS is fully integrated, so workflow does not differ from proton imaging.

Nucleus	31P, 13C, 23Na
Systems	3.0T dSync
Coverage	14 cm
Coil solution type	Transmit-receive, single channel
Applications	Multi purpose, all anatomies
Coil connection	T/R interface



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