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Quality control method for magnetic resonance imaging and spectrometry systems

磁共振成像/波谱仪质量控制方法

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part

1.Structure and drafting rules for standardization documents" Drafting. Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents. This document was proposed by the Chinese Academy of Sciences. This document is under the jurisdiction of the National Technical Committee for Standardization of Photoelectric Measurement (SAC/TC487). This document was drafted by: China Institute of Metrology, Peking University Third Hospital, Shanghai United Imaging Medical Technology Co., Ltd., China Academy of Sciences Aerospace Information Innovation Institute, Guangdong Zhongliang Testing Co., Ltd., Peking University, Beijing University of Aeronautics and Astronautics, Beijing Wandong Medical Science Technology Co., Ltd., Chongqing University, China University of Metrology, Midea Group (Shanghai) Co., Ltd., Beijing Institute of Graphic Communication, Guangdong Provincial Architectural Design Research Institute Co., Ltd., Guangzhou Institute of Metrology and Testing Technology, and Shandong First Medical University. The main drafters of this document are. Liu Zilong, Han Hongbin, Li Yuxiao, Li Jin, Lian Yusheng, Xu

Zheng, He Qingyuan, Liu Wenli, Cai Zhe, Lu Yonghong, Wan Yunjie, Li Zhuoran, Wang Pu, Zhang Shuqin, Xing Xiaocong, Wang Zhibo, Wang Xuezheng, Fu Yu, Yuan Lan, Wang Huan, Wang Liwen, Wang Hong, Qiu Jianfeng. Magnetic Resonance Imaging/Spectroscopy Quality Control Methods

1 Scope

China's national quality control method for magnetic resonance imaging and spectrometry systems. An MRI scanner degrades in ways that are invisible in the images it produces until they are severe: the main field drifts and loses homogeneity, the gradient calibration shifts so that distances in the image are wrong, the radiofrequency coils lose sensitivity unevenly, and the signal to noise ratio falls. None of that announces itself - the images still look like images - and a radiologist reading them has no way to know. So the machine is tested periodically against a phantom of known geometry and composition, and the measurements are tracked over time: geometric accuracy, slice thickness and position, spatial resolution, image uniformity, signal to noise, and ghosting. The value is in the trend rather than the absolute figure, which is why the method has to be repeatable enough that a change means something.

This document establishes the principles of quality control (hereinafter referred to as "QC") methods for imagers and spectrometers based on the magnetic resonance principle and describes The measurement conditions, measurement equipment, control process, data processing and other contents of magnetic resonance imaging/spectroscopy quality control methods are discussed. This document applies to the quality control, design, production, and batch verification of magnetic resonance imaging/spectroscopy in the fields of medicine and life sciences. It is used as a reference for quality control in inspection and other links.

2 Normative references

This document has no normative references.

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 Using the characteristics of atomic nucleus spin motion, in an external magnetic field, after being excited by radio frequency pulses, a signal is generated, which is detected by a detector and then processed. A measuring instrument that displays images after mathematical conversion.

3.2 Nuclear Magnetic Resonance Spectrometer An instrument for measuring material spectra using nuclear magnetic resonance (NMR) technology. Note

1.In a strong magnetic field, the energy level of the atomic nucleus splits. When absorbing

external electromagnetic radiation, the nuclear energy level transition will occur. Capturing this signal can obtain the corresponding The spectrum of the child. Note

2.This document relates to imaging nuclear magnetic resonance spectrometers associated with nuclear magnetic resonance imagers, which use their high-precision relaxation time measurements to achieve Calibration of magnetic resonance imaging equipment.

3.3 protondensity The amount of protons of a certain element per unit volume.

Note. When other parameters remain unchanged, the magnetic resonance signal intensity is proportional to the proton density.

3.4 The synthetic magnetization vector generated by the spin of the atomic nucleus in the magnetic field is stimulated by the radio frequency signal to form Larmor precession. The time it takes for the component of the synthetic magnetization vector about its spin axis (Z axis) to change to its initial state (before applying the RF signal) after the signal is removed.

Note. The component of the synthetic magnetization vector on its spin axis (Z axis) is restored to 1- e to determine the longitudinal relaxation time value.

3.5 The synthetic magnetization vector generated by the spin of the atomic nucleus in the magnetic field is stimulated by the radio frequency signal to form Larmor precession.