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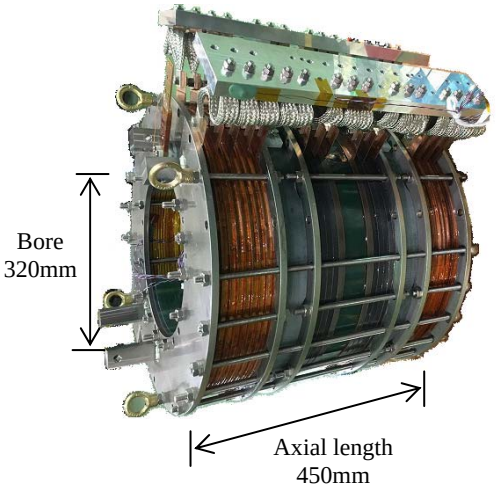
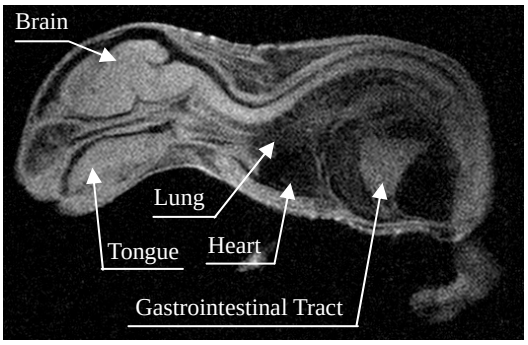
# Mitsubishi Electric, Kyoto Univ. and Tohoku Univ. Succeed in World's first 3 Tesla MRI with High-Temperature Coils

*Eliminating the need for helium and enabling earlier diagnoses through cleaner imaging*

**TOKYO, May 24, 2016** – Mitsubishi Electric Corporation (TOKYO: 6503), Kyoto University and Tohoku University announced today the world's first successful 3 tesla Magnetic Resonance Imaging (MRI) using a small model MRI with high-temperature superconducting coils that do not require cooling with increasingly scarce liquid helium. Mitsubishi Electric expects that the high-quality images made possible at this magnetic field strength will contribute to earlier detection of illnesses.




MRI model

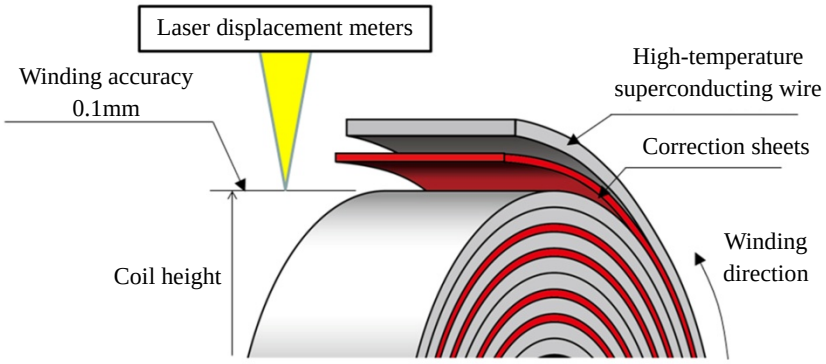



Mouse fetus image
(about 25mm long)

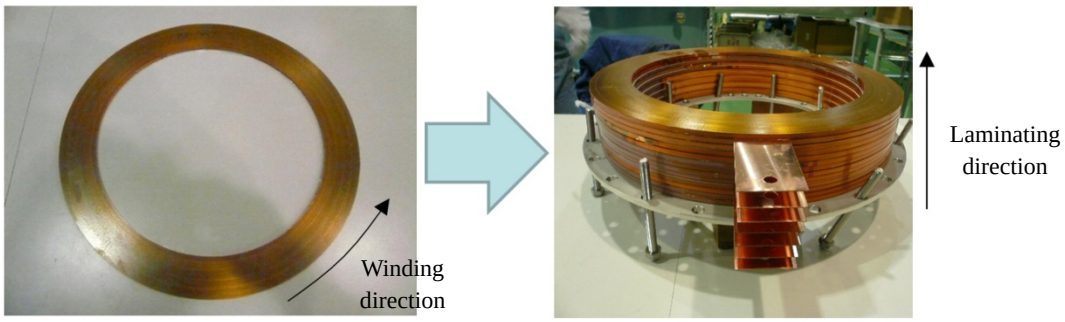
Mitsubishi Electric, Kyoto University and Tohoku University plan to increase the size of the system to one half of a full-size MRI scanner by 2020 and to commercialize a full-size version from 2021.

Mitsubishi Electric achieved a strong, stable 3 tesla magnetic field by increasing the precision of the coil winding. Existing commercially available MRIs use low-temperature superconducting wires with a round or square cross section of 2- to 3-millimeters. The high-temperature superconducting wires are about 0.2 millimeter thick and 4- to 5-millimeters wide and are usually wound several hundred times, creating a pancake coil. Small discrepancies in the thickness and width of the wire give the coil an uneven height that can disrupt the magnetic field and distort imaging. Mitsubishi Electric solved this problem by using laser displacement meters to measure the coil height and then adjusting it with correction sheets. This realized a winding accuracy of 0.1 millimeter for pancake coils with an outer diameter of about 400 millimeters, achieving the magnetic field homogeneity required for commercial imaging.

The small model has an imaging space 25 millimeters in diameter with field homogeneity of less than two-millionths, the same level required for a 230-mm dia. x 650-mm cylinder in a commercial-size MRI. Using this new approach, Mitsubishi Electric succeeded in imaging a 25-millimeter mouse fetus at 3 tesla.



Winding technology of high-temperature superconducting coils



Pancake coil　　Laminated coils

**Background**

Superconducting coils are differentiated into low-temperature and high-temperature systems. In low-temperature MRI systems, the superconducting coils and analytical instruments are cooled to minus 269 degrees Celsius by applying liquid helium. However, liquid helium is a limited and depleting resource, due to the low number of gas fields and rising demand from developing countries. The use of high-temperature superconducting coils is therefore expected to increase. High-temperature superconducting wires can direct more current than low-temperature ones with the same cross sections and are able to generate magnetic fields with smaller coils, which allows for the size of electrical instruments to be reduced.

**Development Framework**

| Name | Charge |
|---|---|
| Mitsubishi Electric | Design and manufacture of high-temperature superconducting coils, as well as small model MRI imaging |
| Kyoto University | Imaging system for the small model MRI (Professor Yasuyuki Shirai)<br>Research and analysis on how to reduce magnetic field turbulence through magnetization (Associate Professor Taketsune Nakamura) |
| Tohoku University | Measuring and estimating how to reduce magnetic field turbulence through magnetization (Professor Makoto Tsuda and Associate Professor Daisuke Miyagi) |

This new technology was developed under a Ministry of Economy, Trade and Industry (METI) and Japan Agency for Medical Research and Development (AMED) project called “Fundamental Technology Development for High Temperature Superconducting Coils”, which aims to realize the application of high-temperature superconducting coils in electrical instruments.

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**About Mitsubishi Electric Corporation**

With over 90 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Embracing the spirit of its corporate statement, Changes for the Better, and its environmental statement, Eco Changes, Mitsubishi Electric endeavors to be a global, leading green company, enriching society with technology. The company recorded consolidated group sales of 4,394.3 billion yen (US$ 38.8 billion*) in the fiscal year ended March 31, 2016. For more information visit:
www.MitsubishiElectric.com

*At an exchange rate of 113 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2016