

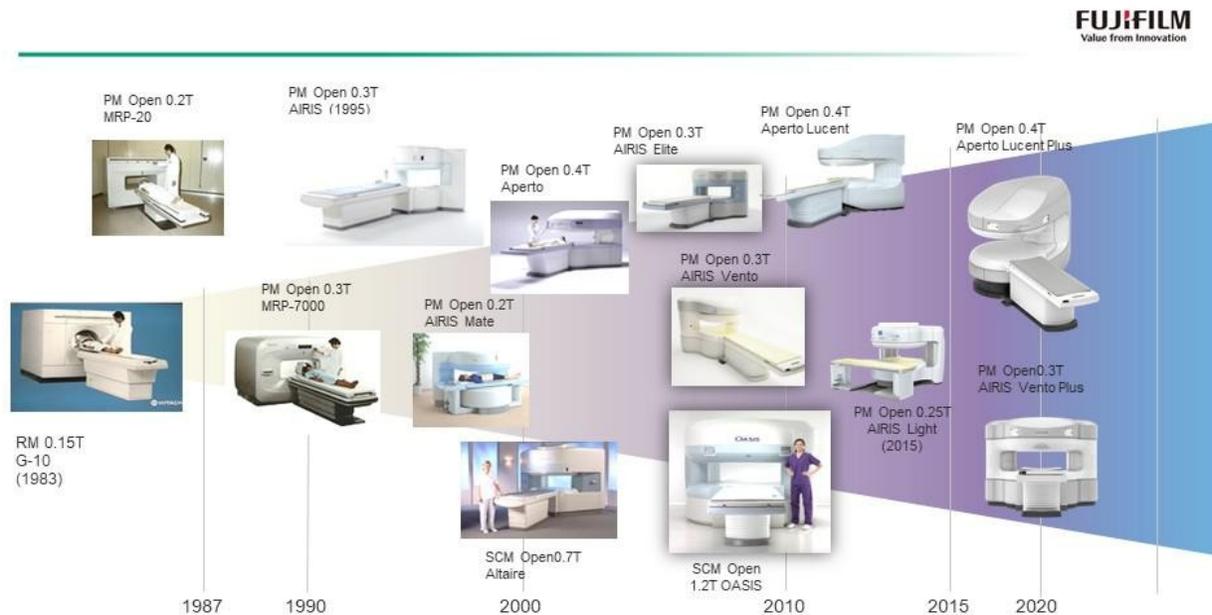


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Modern technologies in open permanent MR systems

FUJIFILM Healthcare Europe is a market leader in open magnetic resonance imaging. Since the first system shown in 1983, the company has consistently developed a line of open, patient-friendly, and environmentally friendly systems. More than 9,000 such open MR systems with magnetic field strength from 0.2T to 0.4T have been installed worldwide. The company is constantly developing the product, introducing new technologies and software solutions (Fig. 1)



Actual market trends in diagnostic imaging



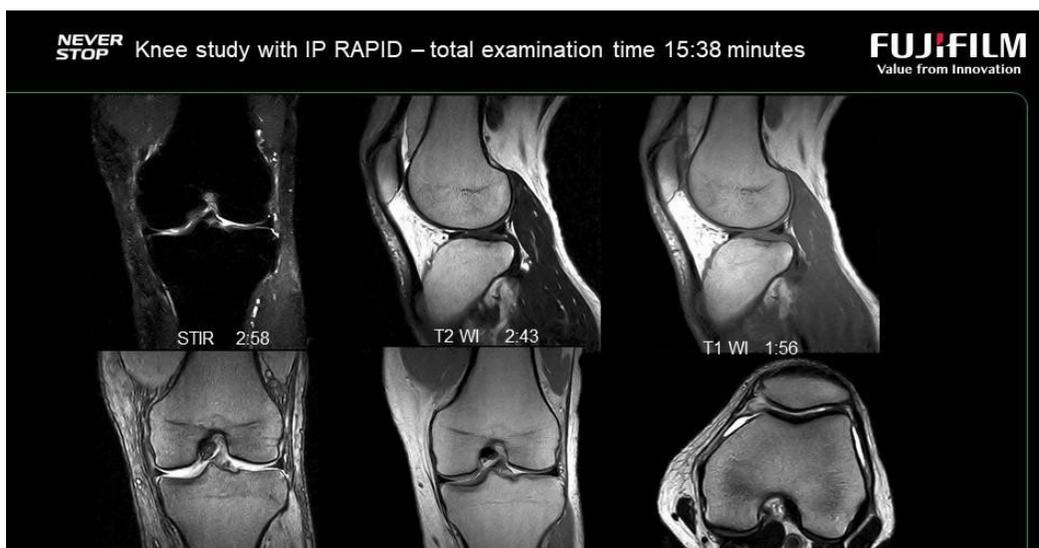
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Market developments and continued pressure to increase the availability of MRI scans have led many companies to turn to solutions that offer cost-effective MR models. Open MR systems with a permanent magnet perfectly fit into these trends and market requirements.

Open permanent magnet systems are constantly improving – both the computer and hardware parts and software follow trends in the development of magnetic resonance imaging clinical applications. Options and solutions once available only in high-field systems, are now also used in open permanent MR.

SynergyDrive™ and new generation of *PLUS* open systems

This year, FUJIFILM Healthcare Europe unveiled a new versions of the 0.3T and 0.4T *PLUS* systems, equipped with a [SynergyDrive™](#) package including AI and machine learning automation solutions, and faster signal acquisition and reconstruction methods. [SynergyDrive™](#) allows the examination time to be reduced by 30-40% compared to systems without [SynergyDrive™](#)¹. The time saved can be spent on additional sequences, additional patients, or increasing the spatial resolution of the study while maintaining standard time. (Fig.2)





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The innovation implemented by FUJIFILM Healthcare Europe in the *Aperto Lucent PLUS* and *AIRIS Vento PLUS* systems is the application of the unique **IP RAPID™** technology in open systems – called subsampling or Compressed Sensing.

It significantly shortens the examination time by reducing the amount of data collected during acquisition and applying iterative reconstruction, reducing noise, and improving image quality. This technology can be used without restrictions on the anatomy being studied or the sequence and technique used. The *LucentPLUS* and *Vento PLUS* allow a significant acceleration in examination time comparable to the standard examination times of high-field MR systems². It also allows clinical applications to be expanded with new solutions in open field, such as subtraction cerebral angiography, T2* weighted studies with enhanced sensitivity to bleeding, isotropic T1 and T2 weighted studies, and abdominal examinations. Thanks to the improved signal/noise ratio, it is possible to perform diffusion not only in the brain (with a factor of $b=1000$) but also other organs, such as the abdominal, pelvis or prostate. (Fig.3)

NEVER STOP 3D isotropic brain study with IP RAPID **FUJIFILM**
Value from Innovation

3D T2 FSE acquisition in Sagittal plane with MPR reconstructions in Coronal and Axial planes

3D T1 RSSG acquisition in Coronal plane with MPR reconstructions in Axial and Sagittal planes

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Automation of examination is carried out through two elements of **SynergyDrive™** - **AutoPose** and **AutoExam** option. The first facilitates the work of the technician by automatically positioning the head examination planes, which not only speeds up the scanning itself, but also ensures that the follow-up study will be performed the same way as the first one. This significantly affects the ability to compare changes, assess their dynamics and supports possible decision on the method of treatment. **AutoExam** is a fully automated head study where the technician only needs to press the START button once, and the entire study, including 3D TOF angiography and its automatic reconstruction of MIP **AutoClip** and diffusion with ADC map calculations, is carried out automatically, without the need for user intervention. Images after reconstruction are automatically sent to PACS and/or to the workstation with **AutoTransfer**.

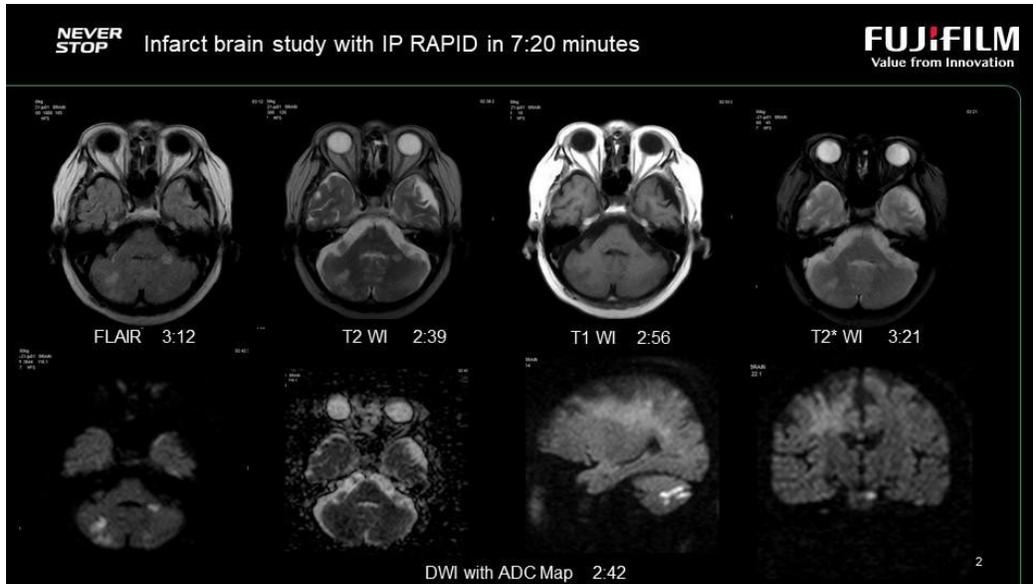
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RADAR™ technology is used for reducing artifacts caused by patient movement, blood flow or breathing. It applies without restrictions on the anatomy being studied, the slice plane or the receiving coil used. In the latest *PLUS systems*, the **RADAR™** can be applied also to Gradient Echo sequence, thus enabling the entire examination to be carried out using this technology. The use of **RADAR™** allows for examination without sedation for claustrophobic patients and children.

Lucent PLUS and *Vento PLUS* offer in neurological studies, in addition to standard sequences, SE, GE, FSE or FLAIR diffusion-weighted sequences with automatic ACD Map calculation, which significantly improves the quality of MR study in cases of stroke or tumors. (Fig.4)



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3D T1 and T2 weighted sequences enable three-dimensional studies with isotropic voxel, useful for assessing brain tissue and for tumors after contrast agent administration to accurately assess the size and location of the pathology. These sequences allow the operator to obtain volumetric isotropic data with the possibility of MPR reconstructions in any plane. The very high resolution and quality of the 3D sequences make it possible to assess the structures of the inner ear. Various ways for suppression of fat signal – both the standard STIR sequence and the separation of water and fat by **FatSep™** (Dixon) method, as well as spectral saturation **CHES** allow accurate diagnosis of the orbit and soft tissues of the head and neck.

In orthopedic studies, the suppression of the fat signal is of particular importance, and here also STIR, **FatSep™** (Dixon) and spectral saturation **CHES** serve the diagnosis of joint and soft tissue structures. Gradient Echo 3D sequences with additional fat suppression allow an accurate picture of the cartilage; diffusion can also bring additional information needed to analyze the changes. The open architecture of the system allows performing kinematic examinations of the joints and spine, and in the diagnosis of the shoulder joint allows ABER position with external rotation. The patient's wide table moved



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sideways, if necessary, gives the opportunity to study the elbow joint and wrist in a comfortable position along the body.

It is not insignificant that in an ageing society there are more and more patients with endoprosthesis and metal implants - their examination is safe in low-field MR. The presence of metal implants is not a contraindication for MR study in low-field permanent MR. **PrimeFSE** and **primeFIR** reduce the impact of metal artifacts and allow assessing the area around the implant.

Both *Lucent PLUS* and *Vento PLUS* offer the wide range of vascular studies – with and without contrast agent injection. In head examinations, 2D and 3D TOF and PC sequences are used; for renal vessel, portal vein and carotids another non-contrast method **VASC ASL™** can be used. Angiography after contrast media injection is possible in CE-Angio 3D option with **FLUTE™** contrast tracking option and 4D **TRAQ** option.

Unique solutions and technologies available in open permanent systems

Open MR systems, thanks to its open architecture, are helpful in pain therapy because punctures, biopsies or administration of the drug can be done using fluoroscopy options and special open receiving coils directly during the magnetic resonance imaging, without the use of radiation and X-rays.

Open permanent MR systems are patient-friendly – their architecture allows the study of claustrophobic patients, and quiet gradients reduce the discomfort of the study, which is especially important for children and the elderly.

Low-field systems are also environmentally friendly – they do not use water to cool the gradients, no helium to maintain the magnetic field, and the electricity consumption is many times less than high-tesla systems.

References



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1. Based on FujiFilm's internal measurements. Results may vary, depending on the scan conditions. Data on file.
2. Compared to FujiFilm's conventional high-field MR system without IP-RAPID technology. Results may vary, depending on the scan conditions. Data on file.

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