

## History of X-ray

### Philips – A leader in X-ray applications for nearly a century

The X-ray is the oldest form of medical imaging. This form of imaging has greatly improved thanks to continuous innovation. X-rays have become more broadly applicable for diagnosis and treatment and are of increasing value to the medical world.

- 1895** Röntgen invents an X-ray technology that can see through parts of the human body.
- 1919** Philips starts producing X-ray tubes after the company was asked by Dutch hospitals during World War One to repair X-ray tubes.
- 1925** Early X-ray tubes are inadequate because they radiate X-rays in all directions. Philips develops a narrow tube with a layer of lead so that the radiation can only pass through a glass window, thereby protecting the patient from undesirable radiation and high voltages.
- 1927** The technique of angiography - X-ray examination of the blood vessels - is invented by the Portuguese doctor Egas Moniz from the University of Lisbon. Using X-rays, he visualizes the vasculature of the brain, using a catheter to inject contrast medium.
- 1929** Werner Forssmann receives recognition for being the first doctor to insert a catheter into a human heart. Forssmann performed this operation in 1929 while he worked in Eberswalde. He used himself as an experimental subject for the operation. He placed a catheter into a vein in his own arm, and from there, slid it into the right atrium of his own heart. He then dashed off to the radiology department for an X-ray as proof. Although he was dismissed for performing this experiment, this success won him the Nobel Prize in Physiology or Medicine in 1954.
- 1946** Philips improves X-ray tubes by introducing a rotating anode. The anode is the part of the tube from which the X-ray radiation is emitted. A rotating anode achieves better heat distribution, allowing tubes to handle higher power levels (kW). This improved tube remained the standard type used in the medical world for years.
- 1951** Philips improves clarity and sharpness of X-ray images 400x by developing the first image intensifier. Prior to this development, doctors could only examine X-ray images in the dark and it took an average of 15 minutes before the image could be viewed properly. This delayed medical examinations, which made it unpleasant for both patients and doctors.
- 1955** Prior to 1955, X-ray systems were unable to change direction. Philips therefore developed the first C-arm - an X-ray system in the form of a half moon. Doctors

- could now move the X-ray equipment in various directions. Since the C-arm is flexible, diagnoses can be made more rapidly and treatments can be performed more rapidly, which is more comfortable for patients.
- 1957** Philips links an image intensifier to a monitor and television screen. Since the image was now viewable on a monitor, radiologists had more freedom of movement with the X-ray equipment. In addition, several different people could examine the image simultaneously.
- 1959** Cardiologist F. Mason Sones from the Cleveland Clinic in the United States performs the first study of the coronary artery using a catheter, X-ray imaging and contrast medium. He makes his breakthrough using a Philips system. In cooperation with Dr. F. Mason Sones, Philips further develops its X-ray system into an excellent imaging solution for the heart.
- 1964** Using X-ray imaging and catheters, vascular radiologist Charles Dotter invents interventional radiology. His treatment of patients with blocked arteries develops into today's well-known angioplasty.
- 1972** G. Hounsfield and J. Ambrose introduce the Computerized Tomography (CT) scanner, which generates multiple X-ray cross-sections of the body. This enables examination of every organ and tissue. In the following years, the CT scanner would provide increasingly faster and sharper images. From the very beginning, Philips plays an important and leading role in the development of CT scanners, notably with the Tomoscan from 1977 onwards.
- 1977** The first angioplasty procedure on a conscious patient is performed in Zurich by Dr. Andreas Grüntzig.
- 1980** The first angioplasty in the Netherlands takes place in St. Antonius Hospital Utrecht/Nieuwegein
- 1982** Philips develops a system that allows images of blood vessels or organs to be produced in real time by injecting the patient with contrast medium: a substance used to make fluids in the body visible in images. Blood vessels now become more visible.
- 1985** Philips introduces a system to produce digital images. These images are faster and sharper and can be exchanged more easily among doctors.
- 1988** Remote control of rotating X-ray systems and tables make radiography increasingly flexible. Philips responds with a new line of X-ray imaging equipment.
- 1990** Philips sets a new trend in cardiac and vascular diagnostics with the introduction of a multifaceted concept that flexibly combines C-arm, L-arm and X-ray tubes.
- 1998** Experiments are made with 3D images after it is discovered that a series of projections, combined with a C-arm that moves 180 degrees around the patient, can generate 3D images. It marks the start of research into the possibilities for three-dimensional imaging.

- 2005** Structures in the body may be visualized in 3D, but these images do not show soft tissue: MRI or CT is still needed for that. Philips responds by developing the XperCT, an X-ray system that uses 3D technology to make CT-like images.
- 2007** Philips introduces a navigation system for the heart that displays a 3D image of the patient's heart on a computer screen. Catheters can now be guided more easily to precise locations in the heart and followed in three-dimensional space in real time. Highly complex procedures, such as transcatheter treatment for cardiac arrhythmias, become easier and more successful.
- 2009** Philips markets a very large and clear 56-inch LCD screen on which information from eight different sources can be displayed and zoomed with advanced sharpness. By replacing the many different monitors previously needed during X-ray cardiology examinations, cardiologists can now work more quickly and efficiently.
- 2010** Philips introduces DoseWare, a solution that gives medical specialists real-time feedback on the radiation emitted during procedures that involve X-ray imaging.
- 2011** Philips introduces HeartNavigator, a 3D planning and navigation solution that can be used in transcatheter heart valve replacement procedures. Philips is the first supplier to receive FDA approval for this type of solution in this application.
- 2012** X-rays remain harmful and the medical community and industry continue to seek ways to reduce their harmful effects. Philips introduces a new X-ray technology that produces razor-sharp images while enabling doctors to limit the patient's and their own radiation exposure.