

Background information

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How Cinematic Volume Rendering Technique brings a new view to clinical imaging

- **Innovative visualization technology opens up a host of possibilities for communication with patients and referring physicians, as well as for publications and training**
- **Syngo.via VB20 software upgrade available simplifies workflows across training systems and disciplines**

At this year's Annual Meeting of the Radiological Society of North America (RSNA) in Chicago, USA, the separately managed healthcare business of Siemens AG is presenting itself for the first time under its new brand name, Siemens Healthineers. The new name underlines the company's pioneering spirit and its engineering expertise in the healthcare industry. With a new strategic direction, Siemens Healthineers aims to enable healthcare providers around the world to meet their current challenges and to excel in their respective environments. Through products and solutions designed to increase efficiency and to reduce costs, Siemens Healthineers is setting new trends in healthcare together with its customers – working under the motto "Engineering Success. Pioneering Healthcare. Together."

An overabundance of data from various imaging procedures, rising patient numbers, and increasing pressure on costs are just some of the challenges faced by healthcare providers. Every effort is being made to keep workflows as simple and efficient as possible to avoid losing sight of what really matters: the patient. Rapid delivery of three-dimensional results is now possible thanks to a new version of the Syngo.via diagnostic software. Syngo.via VB20 is easy to use and provides customized fast access to individual user preferences. The software assistant manages diagnostic findings to make all relevant data immediately available. A few clicks are all it takes to display the given case on the monitor, presenting photorealistic images of unprecedented clarity of the human body with the Cinematic

Volume Rendering Technique (Cinematic VRT)¹ available on Syngo.via VB20. This type of images is already known as “Cinematic Rendering”.

To the layperson, the output of magnetic resonance imaging (MRI) or computed tomography (CT) scans is often nothing more than a meaningless jumble of forms in different shades of gray. It takes a trained eye to identify exactly what the images show. What if the inside of a human body could be visualized in photographic detail – complete with shadows and depth, as vividly as in real life? Such a notion is no longer the preserve of science fiction. Cinematic VRT, developed by Siemens Healthineers, uses raw data from CT and MRI scans to create hyper-realistic anatomical images. The key to the innovative technique is the physics of light. Cinematic VRT takes 3D imaging to a whole new level.

Simulated light

As its name suggests, the technique owes its origins to the cinema industry. In the film adaptation of the Lord of the Rings trilogy, the character Gollum appears entirely lifelike despite having been digitally added to the scenes in which he appears. Intrigued by this effect, Klaus Engel, a visualization specialist at Siemens Healthineers, realized that “although the character is digitally modeled and post-edited into the film, his lifelike appearance is achieved via a technique known as image-based lighting, whereby a spherical panorama is captured using a reflective sphere. The sphere records the current light environment for subsequent application to image datasets,” Engel explains. “To understand how these images are rendered, we must turn to the physics of light.”

Rays of light are made up of particles called photons. Photons interact with their environment: When light encounters matter, it is reflected, bouncing off in various directions. In some places it is absorbed, resulting in shadows. Cinematic VRT leverages this behavior. In this case, the matter in question consists of CT and MRI images. A physical rendering algorithm simulates the complex interactions between photons and the scanned images of the patient’s body. “The main difference compared with the animation industry is that, besides calculating how light is reflected off the surface of the body, we also take into account how light penetrates tissue and is scattered in different directions,” explains Engel. In other words, Cinematic VRT generates photorealistic images by calculating realistic lighting effects. In this way, even complex effects such as ambient occlusion can be

modeled. For instance, the depth of a fracture is fed into the calculations. The deeper the fracture, the less light is able to penetrate, resulting in a range of shadows.

The result is an almost perfect depiction of fractures, ivory-colored bones, and clearly defined organs and blood vessels – easily discernible from each other thanks to the inclusion of shadows and depth. The process requires vast amounts of computing power, as hundreds or even thousands of light paths per pixel must be calculated depending on the image resolution. The images can be rotated on the screen as desired or zoomed into for greater detail. The Syngo.via VB20 platform brings Cinematic VRT to the monitor, allowing photorealistic clinical images to be generated from any CT or MRI scan – available to the operator with just one click. In this process, it is important that there is no additional radiation exposure to the patient because rendering occurs in the post-processing stage.

Clinical application

What advantages do the fascinating images created with Cinematic VRT bring to clinical practice? “Our images provide an entirely novel view of tissue structures. For instance, a physician can access a highly detailed image of a fracture before the procedure,” says Engel, explaining that the images can be used to give patients clear and accessible information about the precise location of a fracture or tumor. Experts agree that Cinematic VRT shows enormous promise: “Surgeons naturally prefer to have a 3D view of CT and MRI scans. This is particularly true for surgeons specializing in musculoskeletal disorders, who can achieve insights into the topography of more complex fractures from 3D images. It will also be very useful for planning vascular, neurological, and craniofacial surgery procedures and interventions. In this respect, I think that Cinematic VRT could possibly herald a new era,” says Professor Franz Fellner, MD, who is director of Radiology at Linz General Hospital in Austria and President of the Upper Austria Medical Association and already uses Cinematic VRT as a teaching tool.

To become familiar with the inside of the human body, medical students dissect cadavers. Now, with Cinematic VRT, students as well as medical personnel and research assistants can gain a clearer understanding of the bronchial tree in the lungs, for instance. The major benefit of this technology is the ability to remove soft tissue, muscles, and blood vessels from images, for example, leaving only the bone structure visible. Alternatively, it can focus on individual organs or tissue structures. This enables completely different views of the

human body. Whether for communicating with patients or for teaching purposes, Cinematic VRT takes clinical imaging – in numerous ways – to a new level.

¹ Cinematic VRT is recommended for communication, education, and publication purposes and not intended for diagnostic reading.

The products/features (here mentioned) are not commercially available in all countries. Due to regulatory reasons their future availability cannot be guaranteed. Further details are available from the local Siemens organizations.

The statements by Siemens' customers described herein are based on results that were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption) there can be no guarantee that other customers will achieve the same results.

This background information, press pictures and further information on RSNA are available at www.siemens.com/press/rsna2016.

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