Rheumatoid arthritis (RA) is an autoimmune disease that affects nearly 20 million people worldwide, striking young people as well as old, causing pain, stiffness, and swelling of the joints. Early diagnosis and treatment can slow or prevent joint damage and increase the likelihood of leading an active and full life.

Leading an international team of engineers, scientists, and physicians from Germany and the U.S., Andreas Hielscher, associate professor of biomedical engineering and radiology, has developed a 3D optical tomographic (OT) imaging system that displays disease activity in joints. Results from recent clinical trials indicate that his system can identify affected joints earlier than any other method.

In another project, members of his Biophotonics and Optical Radiology Laboratory are completing a dynamic optical imaging system for the diagnosis of breast cancer. Breast cancer afflicts one in nine women during their lifetime and is the second leading cause of cancer deaths in women. Hielscher’s patented imaging technology has been licensed by a New York company and clinical pilot studies using the new imager are underway.

Hielscher also employs OT imaging to localize green fluorescent proteins (GFPs), developed by Columbia’s 2009 Nobel laureate Martin Chalfie. GFPs and their derivatives make it possible to see and monitor cell and tissue behaviors during development, including observation of cancerous tumors in vivo. Hielscher and his colleagues use GFP to study the growth of cancers in the stomach, liver, and brain. Most recently, he is applying this technology to monitor drug effects in difficult-to-treat early childhood cancers, such as neuroblastoma and Wilms tumors.

He received his PhD degree in electrical and computer engineering from Rice University, was a postdoctoral fellow at Los Alamos National Laboratory, and was on the faculty at State University of New York Downstate Medical Center prior to coming to SEAS in 2001.