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DEAN'S AWARD FOR INNOVATION

Larry E. Antonuk, Ph.D.

Professor of Radiation Oncology
Professor of Biomedical Engineering

Since 1987, Larry E. Antonuk's research group, consisting of imaging physicists, engineers and students, has been in the forefront of flat-panel X-ray imager development. Today, Dr. Antonuk is a recognized pioneer in this field.

Dr. Antonuk developed a new digital X-ray imaging technology, which has rapidly begun to replace film and X-ray image intensifiers in all kinds of X-ray imaging applications, from mammography to diagnostic and interventional radiology to radiation therapy megavoltage imaging.

Dr. Antonuk and his group, along with collaborator Dr. Robert Street at the Xerox Palo Alto Research Center, developed the new digital imaging technology based on the basic solid-state electronics amorphous silicon technology, which also is used for modern liquid crystal display flat panel televisions. Each X-ray imager, called an active matrix flat panel imager, is created as a single integrated circuit of amorphous silicon on glass, consisting of millions of transistors and other devices in a flat panel imager as large as 41x41 cm. By modifying the electronic and materials design, researchers can optimize these imagers for use in mammography, diagnostic radiography, angiography, cardiac imaging, general fluoroscopy, cone-beam computed tomography and megavoltage imaging for radiation therapy.

Dr. Antonuk's development of the flat panel imaging technology was initially driven by the very limited capabilities of X-ray imaging for localization and verification checks necessary during radiation therapy treatment. The development of electronic flat panel imagers has revolutionized the use of imaging in radiotherapy, leading to improved treatment techniques that integrate treatment with the use of both megavoltage and diagnostic type imaging. One of the most active research areas in radiotherapy is called Image-Guided Radiation Therapy, and this field is based entirely on the integrated use of AMFPI imaging devices.

Because his research group is involved in the design, development, and characterization of X-ray imaging technologies based on active matrix addressing for applications including radiotherapy, radiography, fluoroscopy, mammography and cone-beam CT, their development activities encompass several forms of transistor technologies as well as scintillating and photoconductive X-ray converters. The characterization efforts include empirical observer-independent performance variable determination (of modulation transfer, noise power and detective quantum efficiency), theoretical studies of these performance variables (including Monte Carlo and Cascaded Systems modeling) and patient imaging trials.

His other research interests include the empirical and theoretical characterization of imaging systems and clinical trials of prototype imagers.

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As one colleague remarks, "Dr. Antonuk is one of the most successful individual investigators at the University of Michigan." Since his arrival at Michigan in 1987 as a post-doctoral fellow in Radiation Oncology Physics, he has obtained 17 grants and contracts, including nine National Institutes of Health-funded R01 grants, bringing more than $22 million in research funding to his work.

He joined the U-M Medical School in 1988 as an instructor and was promoted to professor of Radiation Oncology in 2001 and Biomedical Engineering in 2002.

Dr. Antonuk is a fellow of the American Association of Physicists in Medicine and holds seven patents in the United States, Canada and Japan.

Dr. Antonuk says, "For physical and mental relaxation, I make time for biking, distance running, weight training, hiking and soccer officiating. I also enjoy vacation trips to wilderness and urban areas where I get a chance to practice my photography skills.

"I'd like to gratefully acknowledge our founding chair, Allen Lichter, our current chair Ted Lawrence, as well as my division director, Dick Fraass, for creating and maintaining the dynamic environment in our department that has allowed the continued success experienced by myself and other faculty members. I'd like to thank Elaine Brock, Jim Randolph and Mitch Goodkin at the Division of Research Development and Administration (DRDA) for their long-standing advice and support. Finally, I would like to thank my wonderful wife, Ann, and my children, Alan, Danielle and Mark, for their patience and encouragement."