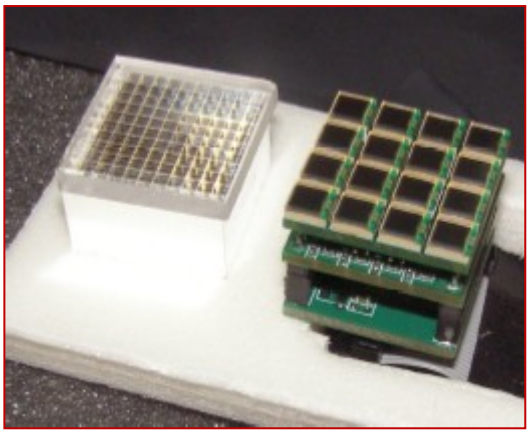
FIRST IMAGING DEVICE BASED ON ARRAY OF INDIVIDUAL SILICON PHOTOMULTIPLIERS

James Proffitt from the Jefferson Lab's Radiation Detector and Medical Imaging Group has designed and built the first imaging photodetector based on 3 mm x 3 mm silicon photomultiplier units from the leading photodetector manufacturer, Hamamatsu, from Japan.

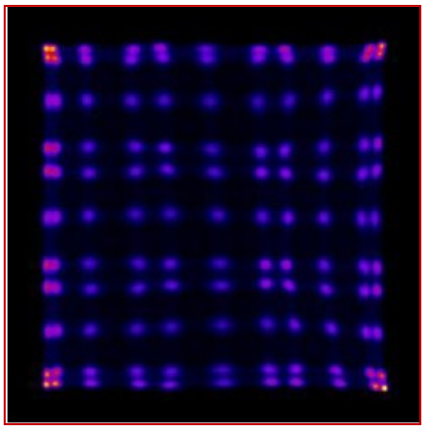
Sixteen 3 mm sensors arranged in a 4x4 array resulted in a small prototype of a very compact imaging photomultiplier, and during the very intense studies performed in only three weeks, it was confirmed that the technology can be used in many novel and unique medical imaging devices.
Indeed, several patent disclosures were submitted from the Group in the last six months relying at least partially on this new cutting-edge technology. Mobile, portable and wearable medical imagers for breast, heart, prostate, brain and assisting in cancer surgery were envisaged and disclosed.



The prototype of imaging silicon photomultiplier (SiPM) is shown with the 1.675mm pitch LYSO scintillation array and optical window, forming together a gamma/PET imaging module.

Many research institutions and companies, including all big medical imaging companies, are working on implementation of this hot new photodetector technology.

The new photomultiplier was already tested in magnetic fields up to 3 Tesla and no magnetic field effects were observed on its operation. This offers a unique opportunity of constructing very powerful dual-modality imagers combining nuclear medicine (molecular imaging) and MRI (structural imaging). The Radiation Detector and Medical Imaging Group collaborated on this aspect of the project with Dr Ray Raylman from West Virginia University.



High resolution imaging capability of the SiPM is demonstrated in this image, in which the individual scintillation pixels are well separated when irradiated with an uncollimated beam of 511 keV gamma rays.

The next step in this development is to construct the first prototype of an endorectal PET probe for early detection of prostate cancer. Due to its compactness and operational safety, the new technology makes such probes feasible, as opposed to previously proposed technical solutions for the prostate probes. Two medical institutions, located at Johns Hopkins University and the University of Michigan, have expressed interest in clinical implementation of the new Jefferson Lab probes. Two proposals for funding of prostate imagers with these probes were recently submitted to the Department of Defense.

Stan Majewski, the leader of the group, hopes that these developments will also help the group to enter into contractual agreements with medical imaging companies (known as Cooperative Research and Development Agreements, or CRADAs), which could bring key upfront funding for the continuation of the imaging technology development and for prototype imager construction, in addition to potential future royalties.

This new technology, as is the case of all photodetectors, has many other uses, including basic science research at Jefferson Lab (Hall D), space sciences, industrial applications and homeland security.

The first paper describing the initial series of measurements using this new photomultiplier with medical imaging in mind was already prepared and will be sent for publication as soon as intellectual property (IP) protection issues are resolved.

This pilot development was made possible primarily due to funds from the Commonwealth of Virginia provided to the group via Jefferson Science Associates, LLC (JSA), with additional funds provided by the Department of Energy's Office of Biological and Environmental Research (OBER) and a small Southeastern Universities Research Association (SURA) grant.

For more information on this and other technologies available from Jefferson Lab, contact Jim Boyce at boyce@jlab.org