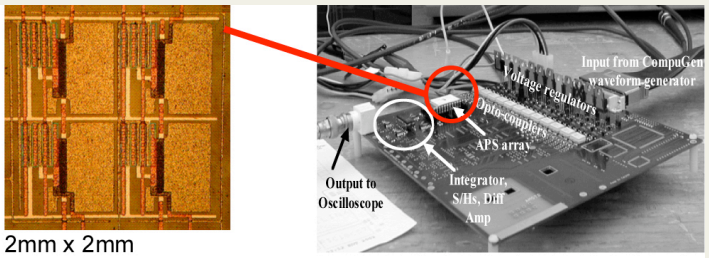
X-Ray Digital Imager (Medical)

A new X-ray digital flat panel imager is under development to make larger screen viewers with high picture resolution and low background noise.
A prototype using a multi-mode 'active pixel sensor' (APS) is undergoing testing and shown to have multi- mode capability to switch instantaneously between high-resolution snapshot and low-resolution movie modes. High-resolution snapshot modes are associated with chest radiography, while movie modes are associated with real-time low dose fluoroscopy.



2mm x 2mm

Figure 1: Amorphous silicon 'amplified pixel sensor' array (APS Array)

The Problem

In the health sector, radiologists do not want to give patients high X-ray doses due to safety reasons. X-rays are given to subjects in two ways:

- Static – one-time high dose;
- Real-time on-going monitoring x-ray – low continuous dose.

The problem with current large flat panel X-rays is twofold:

- Snapshot X-rays use doses that provide data with a large amplitude variance, thus resulting in a poor-quality low contrast image. Therefore, they require an imager with high dynamic range to accommodate both high- and low-intensity readings.

- Real-time ongoing monitoring X-rays (e.g. barium food meal, to view the intestines) use low doses which yield blurry pictures, making it harder for the radiologist to make an accurate diagnosis of the subject's condition. The X-ray images are also difficult to increase in size without losing picture quality.

As a result, medical practitioners require two instruments to do the job: X-ray film for snapshots, and image intensifier cameras for movie-mode fluoroscopy.

The Need

The health sector requires larger high-quality digital images for better diagnosis in the following[1]:

High X-ray dose

- Chest radiography
- Mammography

Low continuous real-time X-ray dose

- Low-noise fluoroscopy, e.g. imaging lower intestine via barium meal
- Tomosynthesis (lung/breast)
- Dental fluoroscopy

Dual-mode operation (an imager that is able to switch from real-time X-ray analysis to one-time large dose snapshot)

The Alternative

Another technology in the market uses passive pixel sensor (PPS) or TFT switch technology, which uses large area imagers to perform chest X-rays. However, this technology is estimated to have 6x more noise compared with the SFU technology, and the manufacturing costs are higher (refer to benefits).

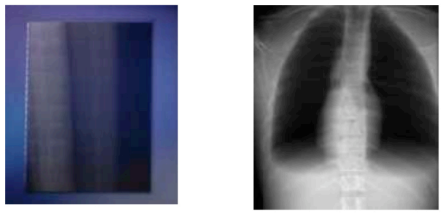


Figure 2: Large X-ray Imager (30x40cm) using PPS Array technology taking a snapshot of chest X-ray

The Benefits

The benefits of the X-ray digital flat panel imager have been shown initially in the highlighted sections in the table below:

Benefit	Features	Existing Technology	SFU Technology
Patient	Noise	3000-5000 noise electrons	500-700 noise electrons
	Dynamic Range	80 dB	100 dB
Manufacturer	Cost	HIGH cost due to 2000-3000 mulitplexers to be put 'off-panel' only	LOW cost due to 'on-panel' multiplexers, therefore <100 connections 'off-panel'
	External Interface	'Off-panel' multiplexer	'Off-panel' and 'on-panel' multiplexers possible

The standard features include: read-out-speed (real-time 30/60Hz programmable); resolution (100 micron pixels); saturation input at 1pF pixel capacitance (>40 million electrons programmable); fill factor (near 100%); lifetime (10,000 hours).

Request

Looking for partners to help us develop the technology further by:

- Performing a comparison analysis of in-house fabricated 5 x 5 cm APS and PPS array units
- Establishing communication to give strategic advice to develop a specific product for field testing
- Eventually acquiring the technology to build larger prototype X-ray imaging units
- Assessing the market need for X-ray users for this technology
- Reviewing licensing opportunities

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References

[1] Handbook of Medical Imaging, 1, Physics and Psychophysics, Eds. J. Beutel, H.L. Kundel, R.L. Van Metter, SPIE, 2000.