

“Icarus” is a four frame, 1024 x 512 hybrid CMOS camera on a 25 μm pixel pitch. A hybrid camera denotes a custom Readout Integrated Circuit (ROIC) bonded to a matching array of common cathode silicon photodiodes. The Si photodiodes are sensitive to 1-10 keV X-rays in addition to energetic, keV range electrons and visible light.

Upon receiving an external asynchronous trigger, Icarus generates four, user programmable shutter pulses, distributes these four shutter pulses to the pixel array with high repeatability, and captures four frames of pixel data down to two ns integration time. In addition, Icarus has independently timed hemispheres so the user can capture up to eight frames of data on adjacent, 1024 x 256 hemispheres. Icarus is the third camera in the UXI imager family and leverages significant learning from previous imagers (cite past papers as Pratik deems fit). However, a physical implementation issue in the pixel unit cell resulted in only two or the four frames being available to the user in this iteration of the ROIC. A mask spin has been initiated to correct this issue, and all characterization efforts should remain unchanged upon receiving the corrected 4-frame ROIC.

Past imagers have suffered from hemisphere timing errors and gain offsets, vertical timing errors and frame-to-frame coupling concerns. Icarus seeks to mitigate these issues while still overcoming the physical challenges of the design requirements. Shutter pulses are now distributed through 43 optimized logic gates in a binary tree fashion, down from ~500 un-optimized logic gates in the same binary tree architecture on past ROICs. These pulses must still propagate across more than 22 mm of distance which presents a physical implementation challenge.

The UXI architecture includes user-selectable patterns to dictate unique integration time and independent inter-frame times for each shutter and allows independent timing between adjacent hemispheres.