

Title: Current and Future Directions in Hybridization for Pixelated Particle Detectors

Author: Alan Huffman

Title: Research Engineer

Company: RTI International

Address: 3040 Cornwallis Rd., RTP, NC 27709

Abstract:

For the last several years, the use of pixelated devices for high energy physics detector systems and other applications has become very important. A number of systems and experiments are set to come on line in the coming months that utilize large arrays of these devices and new applications in imaging and detection are arising on a regular basis. To date, these devices have been hybridized using flip chip technologies, with solder alloy or indium bumps mating sensor and readout IC devices. Other supporting technologies have been developed and refined over the years to support this application area.

Looking forward to the next generation of pixel devices and technologies, 3D integration has become a technology of interest. The goal of 3D integration is to interconnect devices together in the vertical direction, allowing the combination of heterogeneous devices in a smaller space with higher functionality. The combination of analog, digital, and sensor devices is being pursued (and realized) for a number of uses, but the application of this technology to high energy physics (HEP) and imaging systems is just now being explored.

This paper outlines current hybridization technologies and explores the capabilities and processes of 3D integration for HEP applications. Advantages and disadvantages of 3D integration and how this technology dictates device design will be discussed.