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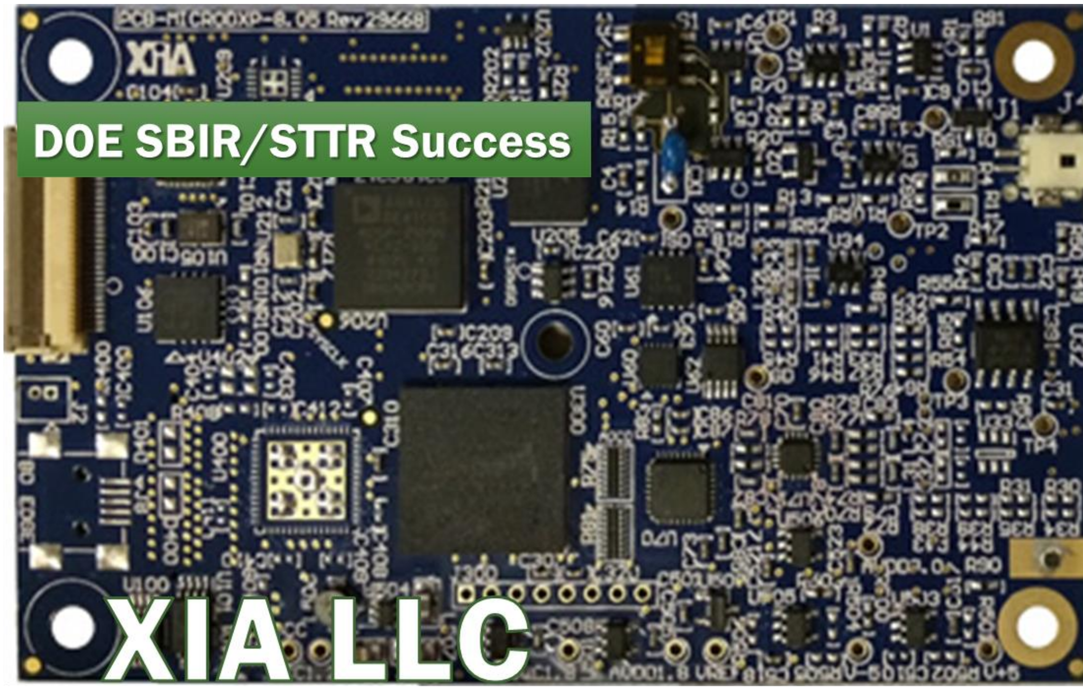

DOE SBIR/STTR Success

XIA LLC

XIA's compact digital pulse processing for x-ray applications is a complete, low power digital spectroscopy system on a credit card-sized PC board.

XIA deserves to be credited as one of the experimental physics startups that in the 90's revolutionized the acquisition and processing of x-ray, gamma-ray, and other radiation signals, promoting an unprecedented development in spectroscopy capabilities in Universities, National Laboratories, and Industry. Signal processing is key to extracting meaningful information from any type of detector and digitizing the signal allows scientists to use computer processing, thereby performing analyses that would be tedious or impossible to carry out manually. An example is the typical needle-in-the-haystack problem often encountered in High Energy Physics and Nuclear Physics experiments, where the event to be studied may happen only once every billion counts, making manual analysis impractical.

FACTS

PHASE III SUCCESS
XIA has sold in excess of $20M in instruments for synchrotrons and has multi-million dollar revenues per year from sales of its product lines.

IMPACT
XIA's invention and development of radiation digitizers has been a major innovation in the field of spectroscopy. Synchrotron fluorescence experiments would not run without XIA's instruments.

DOE PROGRAMS
Nuclear Physics (NP), Basic Energy Sciences (BES), National Nuclear Security Administration (NNSA).

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XIA's digitizer boards are the core of any x-ray spectrometer attached to modern electron microscopes or x-ray fluorescence instruments, and provide essential new capabilities for a wide range of applications from handheld and benchtop systems to standalone modules for ultra-high rate counting at synchrotron light facilities. Similarly, XIA's gamma-ray detector electronics provides state-of-the-art spectroscopy solutions in Nuclear Physics experiments, from demanding pulse shape processing to very high resolution spectrometry with applications in health physics, nuclear waste management, and nuclear materials and weapons security. The third class of instruments produced by XIA allows users to measure materials' ultra-low alpha particle emissivity, which is vital both to the multi-billion dollar semiconductor fabrication and packaging industry, and to physicists seeking to discover dark matter or measure the neutrino's mass.

Remarkably, the technology supporting all the above applications was developed with significant support from SBIR funds, which were critical to the foundation and growth of XIA. In fact, because the market for spectrometer electronics is mostly confined to academia and National Laboratories, SBIR grants and Broad Agency Announcement (BAA) funds were a major source of XIA income for many years. These funds were leveraged to support the company's most advanced R&D activities, while income from product sales was used to support product development. As a result of this business approach, today XIA is a healthy small business with 16 employees and a consistent stream of sales from spectrometers for electron microscopes, x-ray fluorescence instruments, synchrotron x-ray facilities and medium-large sized Nuclear Physics experiments. Product sales account for 75% of XIA income and more than $ 20 M in instruments for synchrotrons have been sold so far. A typical product generates revenues of $ 500,000 or more per year.

XIA's line of instruments was developed with R&D supported by 16 Phase II grants from the Department of Energy (DOE) since 1992. According to Dr. Warburton, VP of Advanced R&D and founder of XIA, these funds would not have been available from other sources and therefore, the SBIR grants were essential to the development of a technology that has had tremendous impact in the scientific community. As of 2017, sales of instruments developed through the DOE SBIR grants have generated a return of nearly 4 times the DOE SBIR investment. Moreover, in the case of XIA, as well as for other small businesses that develop scientific instruments, the value to the nation of the SBIR investment goes far beyond the sales achieved. Sales of scientific instruments are necessarily limited because customers are primarily confined to Universities and National Laboratories. A more complete perspective on XIA's accomplishments through the SBIR program should acknowledge that for example, x-ray fluorescent experiments at synchrotrons, as they are carried out today, could not be run without XIA's instruments, dramatically curtailing the productivity of research facilities that cost several hundred million dollars each to build and a comparable amount to operate annually.

Making detectors is particularly difficult because there is no national mechanism that funds detector development for synchrotron radiations. At the same time, stakes for these instruments are high because synchrotron users demand unprecedented performance, which can make product development very risky. A synchrotron light facility has a wide range of capabilities appealing to various scientific communities. Thus, there is a general consensus about the structure of such a facility, all the way down to the various beam lines, all of which serve a large spectrum of scientific needs. However, uses and opinions diverge when it comes to detectors because different research projects need very different types of detectors, with the result that there is no general consensus on what a detector and its associated spectroscopy electronics should look like. These challenges make it difficult for an SBIR awardee to reach Phase III in this field.

A nice example of the level of reliability that an instrument requires to transition from a nicely working prototype in Phase II to a commercially ready product in Phase III was encountered in the development of the most popular among XIA's products, a compact Digital Pulse Processing (DXP) card for embedded x-ray applications, their "microDXP". The microDXP is an electronics board the size of a credit card that performs complete digital spectroscopy and can easily be incorporated in a wide range of handheld spectroscopy systems providing, low power consumption, thermal stability, and superior energy resolution at lower costs. The technology for the microDXP was acquired by XIA through various SBIR awards in the late 90's and early 2000's and the small packaging was developed in response to specific customers' requirements. An early customer application required the boards to be continuously switched on and off, but a failure to turn back on was seen at a rate of about once per 10,000 cycles. This is a shortcoming that XIA had to address and that would never have surfaced during routine laboratory testing. A failure every 10,000 switches might seem not even worth addressing simply because typical uses do not require turning off and on the instrument so many times in its entire lifetime. However, if a successful product places thousands of units in the field and each is switched on and off only a hundred times a day, then typically 10 units will fail daily (and each unit three times a year), which is unacceptable to both customer and supplier. This is not an atypical example of what it takes for a small business to bring a product to the market.

Written By Claudia Cantoni, Commercialization Program Manager, DOE SBIR/STTR, February 2018.