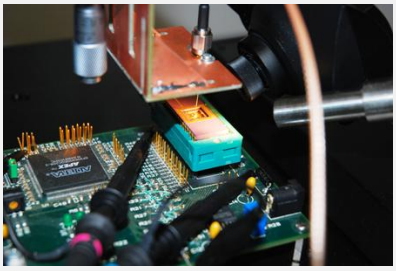
Characterizing Electronics Components to Prevent Security Threats Using LabVIEW



Electromagnetic Bench

"With its expansive instrument driver library, LabVIEW offers the ability to easily interface between several devices, includes seamless support of numerous buses, and allows for the rapid development of advanced man-machine interfaces."

- Anne-Lise RIBOTTA, ENSM.SE

The Challenge:

Developing a scalable architecture on five different test benches to rapidly characterize secured communication products.

The Solution:

Using LabVIEW to build a highly flexible and easy-to-use software architecture that interfaces with a broad range of test equipment and can evolve with future security needs.

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It is essential for the microelectronics industry to develop the most advanced tools and techniques to ensure the highest security level for its products. The introduction of secured chips for use in electronics products and components offers great potential for researchers in the industry; however, as new security technology is introduced, researchers must develop new methods for protection from hackers. Industry experts are challenged with anticipating potential threats and mastering the techniques attackers may use to develop optimal counter measures in advance.

The Micro-PackS Technological Consortium is the first national R&D structure in France focused on microtechnology assembly and safety concerns. It is located within the Provence Microelectronical Center, (ENSM-SE-CMP) in the Saint-Etienne Mines School in Gardanne, France. Within the consortium, the Laboratory of Safety Characterization implements test benches that characterize the security of systems such as chip boards and cellular phones using different methodologies.

The lab develops synergies around micropackaging, communication objects, and security and offers shared laboratory equipment for use among large, medium, and small electronics companies and university researchers. The onsite CEA-Léti/ENSM.SE-CMP team contributes actively to developing and maintaining this laboratory with the help of corporations such as STMicroelectronics and Gemalto.

An Automated and Complex Platform

The goal of the laboratory is to supply users with the means to carry out the following:

- Improve their knowledge of physical phenomena that allow attacks
- Assess the efficiency of their counter-measures throughout the innovation cycle
- Characterize and improve the security of their products prior to certification
- Anticipate future attacks, especially via specific information extraction techniques

The lab allows electronics manufacturers to quickly characterize their secured components, offers small- and medium-sized companies access to high-performance equipment, and gives researchers the opportunity to increase their security expertise.

The lab consists of five test benches, including laser, parameter test, electromagnetic, and consumption benches, and a bench dedicated to contactless systems [tags and near-field communication (NFC) objects]. The last bench consists of NI products dedicated to RF modulation including the NI PXI-5600 upconverter and PXI-5610 downconverter, as well as products for real-time signal processing, including an NI PCI-5640R field-programmable gate array (FPGA) card controlled by the LabVIEW FPGA Module.

The team built each bench on a calculator that drives characterization devices. Bench components include an oscilloscope, generators (laser, electrical, or electromagnetic pulses), and an X-Y table to locate the object and the reader suited to the system under test. The set is synchronized via an FPGA module dealing with time control. The bench components dialog through digital buses, such as RS232, GPIB, PXI, or Ethernet, depending on the equipment.

To give all lab users the ability to rapidly characterize their products with little training and high performance, we were challenged with automating and standardizing the test benches. This required the team to develop a solution that could be easily integrated across all test equipment.

The team set out to develop a scalable software architecture common to all buses. We wanted the flexibility to add software and hardware components to the lab while ensuring easy maintenance. In addition, the solution needed to have the ability to evolve with some or all of the system and complement it with new functionality or hardware.

To meet these demands, we chose LabVIEW graphical system design software for our solution. With its expansive instrument driver library, LabVIEW offers the ability to easily interface between several devices, includes seamless support of numerous buses, and allows for the rapid development of advanced man-machine interfaces. During development, the team referenced *The LabVIEW Style Book* by Peter A. Blume for assistance with development methodologies that are quick and simple to implement for complex applications.

Application Development

Application implementation took place in three stages: definition of specifications, software architecture, and application development.

In the first stage we gathered specifications for each test bench. We developed an accurate definition of the requirements for the application, which allowed us to create a comprehensive software and hardware specifications document.

During the second stage we defined the software architecture through the implementation of two state machines rated by a queue system. We dedicated one machine to managing devices and the man-machine interface and the other to secured component testing. The specificity of these state machines offers the ability to automatically reconfigure the software depending on the existing equipment and/or the expected test. This feature allows the LabVIEW application to be installed on any test benches for easier maintenance.

After validating the steps, the team began LabVIEW code development and implemented both state machines rated in the queue easily and rapidly.

The Result

The new software solution based on LabVIEW allows lab participants to characterize electronics components depending on their needs. Installed on all test benches, the solution offers continuous stability and uniformity across the entire security laboratory.

With a design structure that makes it scalable, this application will easily integrate with new equipment and new test benches. LabVIEW enables the security lab to guarantee a rapid and continuous evolution of the security level and successfully face a variety of future threats.

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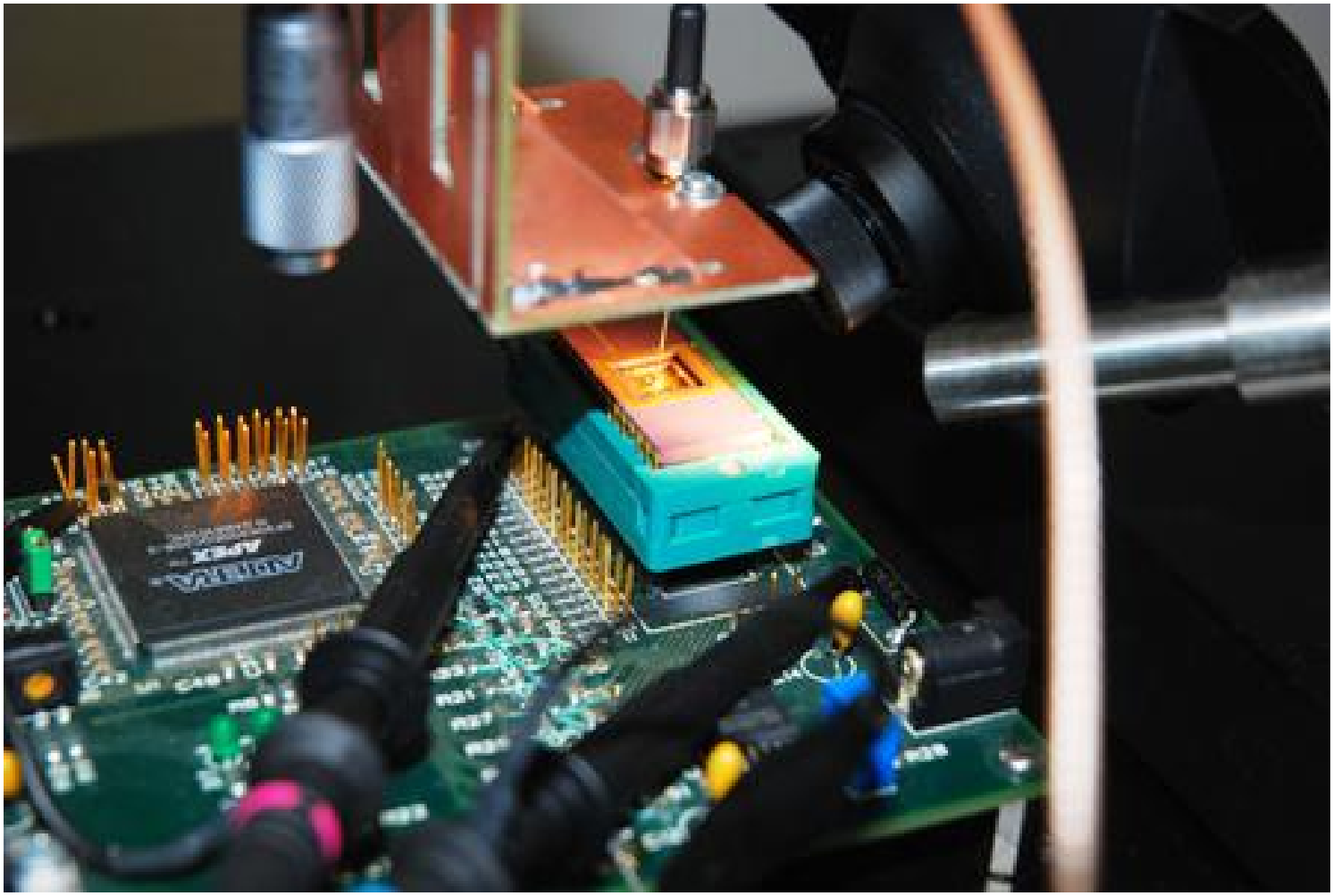

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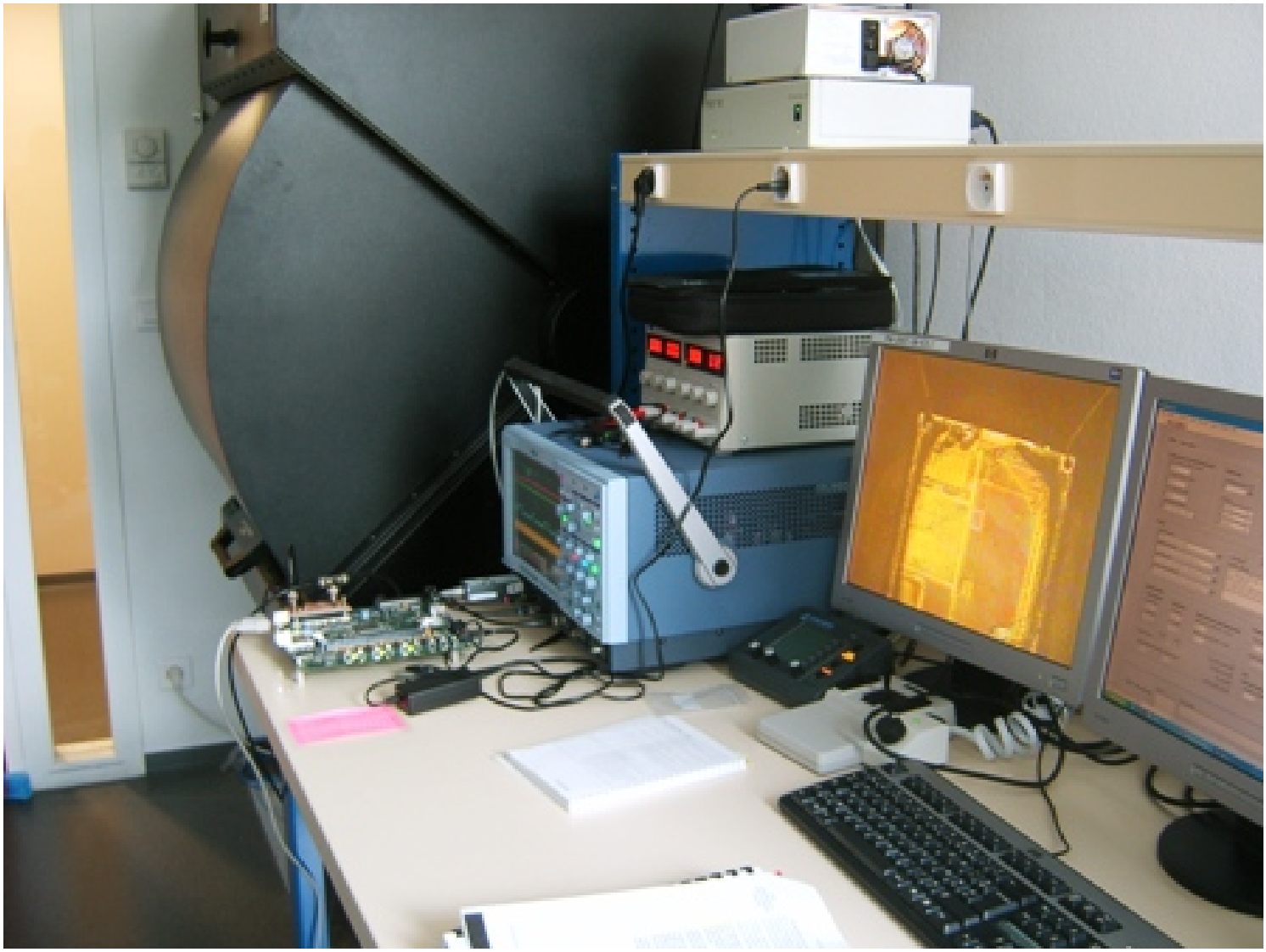
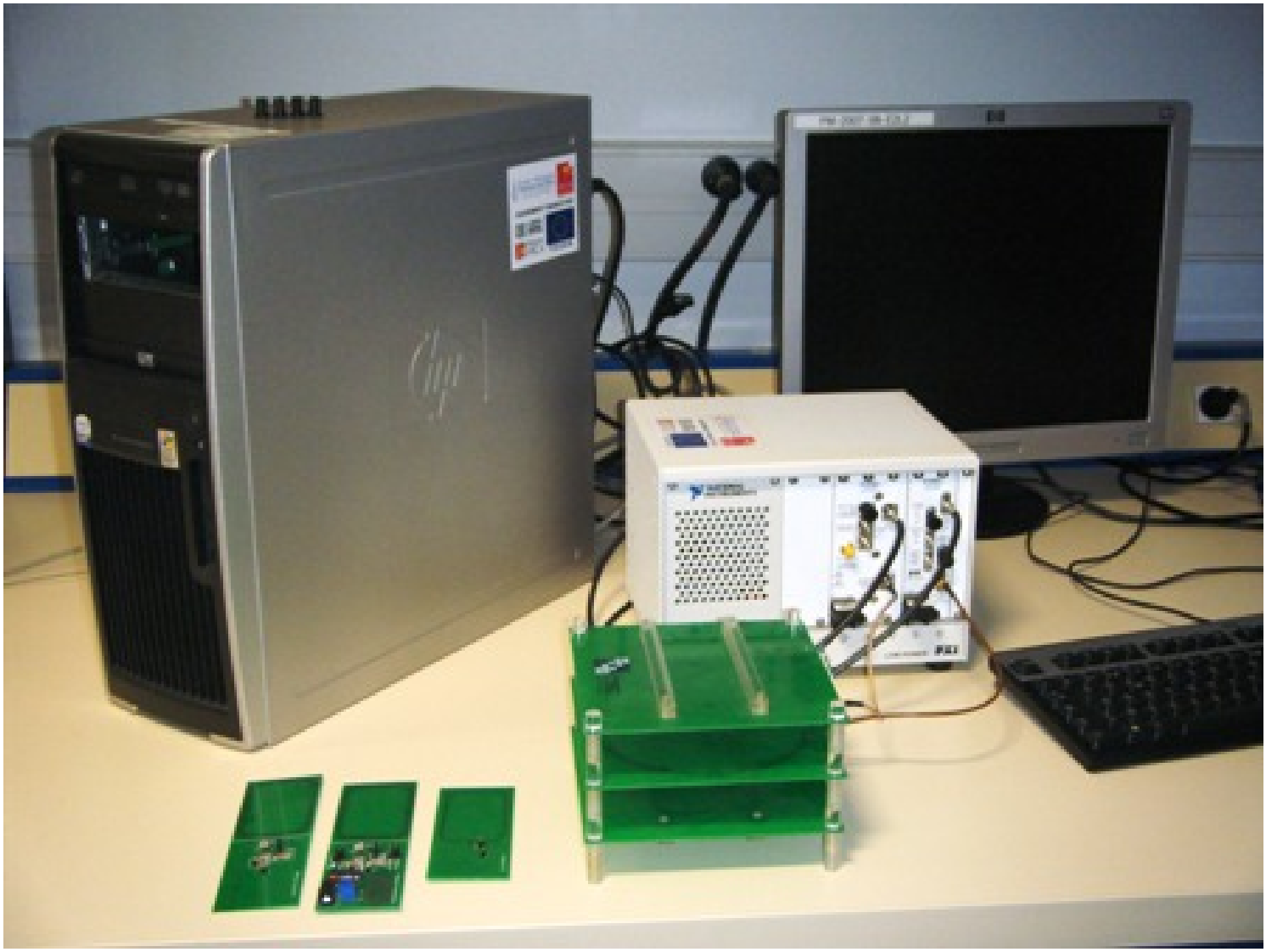
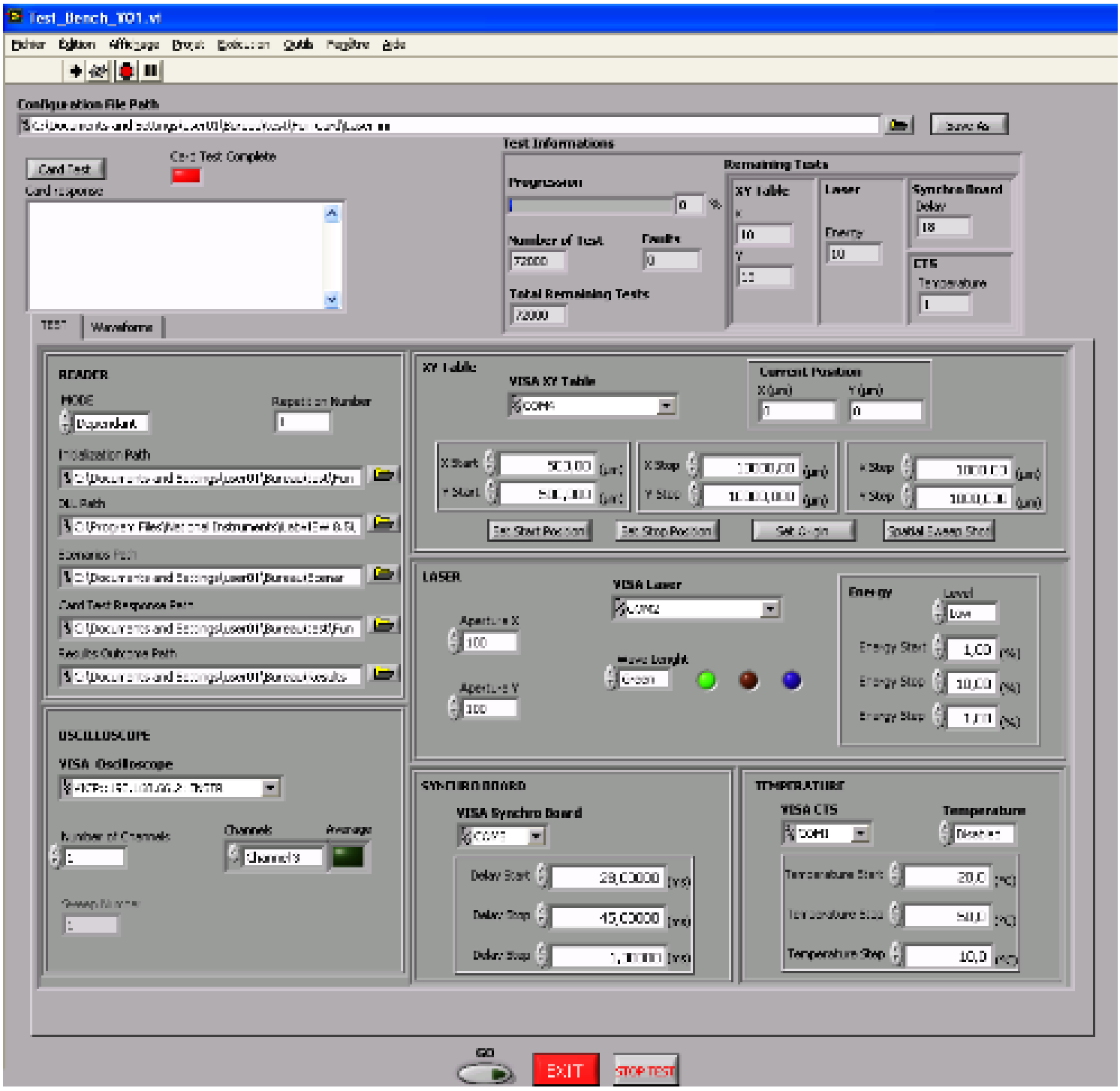


Laser Bench



Bench Dedicated to Contact-Free System Study



Bench Man-Machine Interface for a Laser Test
