

DS1102A Dual Laser Fault Injection System

Easy to use dual spot laser fault injection

Introduction

Riscure, a Keysight company, worked with Opto engineering to develop a product that allows flexible positioning of the two laser spots with the smallest possible spot size for each of the lasers. The outcome is a product that allows easy positioning of two spots in view.



Context

Market

Countermeasures for fault injection are becoming more advanced. To bypass some of these countermeasures, a security evaluator needs to be able to generate multiple laser pulses at different locations. In the past years, we offered a Multi-Area DLS upgrade, but its drawback is that it's difficult to position the glass fiber to deliver the second laser spot to the surface. In addition, the spot size of the second pulse is limited to the fiber core (9 micrometer single-mode fiber / 50 micrometer multi-mode fiber) and the optical power of the pulse is reduced.

State-of-the-art technology

With the Keysight DS1102A Dual Laser Fault Injection System, you can:

- Direct two laser beams through one objective.
- Position the lasers independently across the die surface by making use of the adjustable mirrors of the Dual Laser Fault Injection System.
- Reduce the spot diameter of each laser to the objective limit of approximately one micrometer.



Figure 1. Keysight DS1102A Dual Laser Fault Injection System

Challenges Solved

1. **Generate two laser spots with independent location and timing:**

High security chips are usually equipped with countermeasures against fault injections. Most advanced countermeasures are divided over multiple locations on a chip. To test if these countermeasures are adequate against advanced attacks, a security evaluator needs to be able to generate multiple pulses, with location and time independent of one another.

2. **Reproduce a successful dual laser fault injection:**

A successful dual laser fault may be discovered during a die surface scan. Such faults need to be reproducible to prove that the fault can be repeated and to be able to perform regression tests. To produce this dual laser fault, we need to return accurately to the same locations on the die.

3. **Work with different laser sources:**

The dual laser system accepts multiple laser sources, beam splitters, and objectives. It is possible to work with two different laser sources or two of the same kind, giving the broadest range of test scenarios possible. The mirror technology in the Dual Laser Fault Injection System makes sure both laser spots have the same quality.

4. **Speed up the evaluation process:**

Fault injection is a time-consuming process because of the many attempts needed to find the correct spot for the laser. In addition to using the Dual Laser Fault Injection System for multi-laser attacks, it can also be used in a setup with two lasers both scanning half the surface of a chip, firing simultaneously, to shorten the time to find the correct spot for the fault injection.

5. **Multi-pulse attacks with Diode Pumped Solid State Fault Injection Laser:**

The Diode Pumped Solid State Fault Injection Laser has a very high energy pulse, but its charging time makes it less suitable for multi-pulse attacks. By setting up two Diode Pumped Solid State Fault Injection lasers on the Dual Laser Fault Injection System, a multi-pulse attack can be performed by firing one laser right after the other.

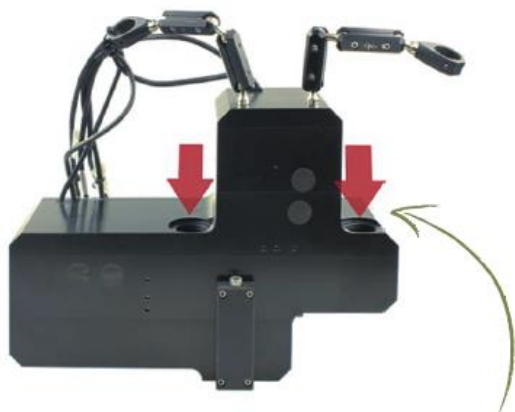


Figure 2. Two laser ports allow connection to the Diode Pumped Solid State Fault Injection Laser, Multimode, and Single Mode Diode Fault Injection Laser.

Unique Features

1. **Motorized positioning** of both laser spots so that automated scanning of the die surface by both laser spots can be easily controlled from Inspector software.
2. **High position** accuracy and resolution that enables returning exactly to the same position as where the laser fault injection was successful before.
3. Uses the **wide field of view** of the Fault Injection Laser System to create a relatively large distance on die between two laser spots.
4. **Use multiple type of laser sources:**
 - a. Diode Pumped Solid State Fault Injection Laser (short pulse and very high power).
 - b. Multimode Diode (high pulse repetition and high power).
 - c. Single Mode Diode (very high pulse repetition and smallest spot size).
5. **Upgrade Fault Injection Laser System** with Dual Laser Fault Injection System module at any point in time.

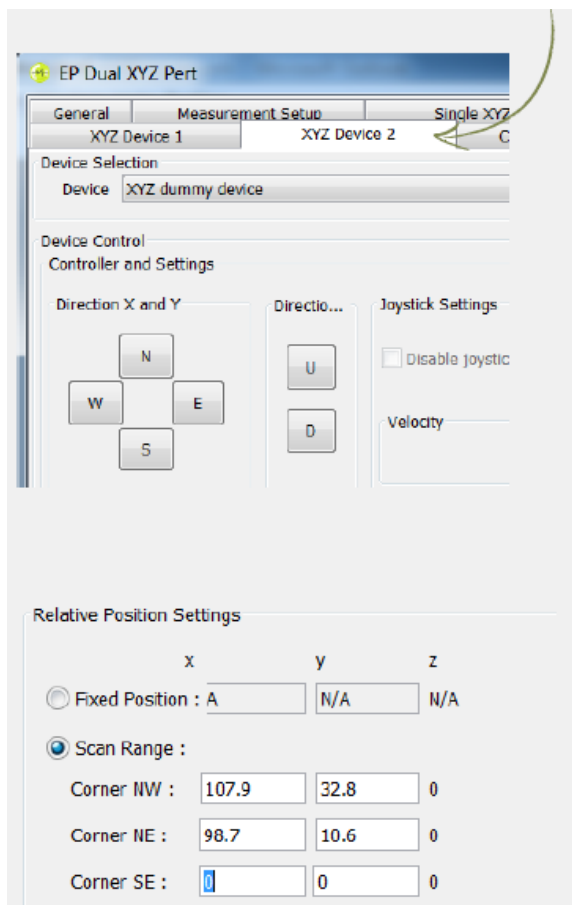


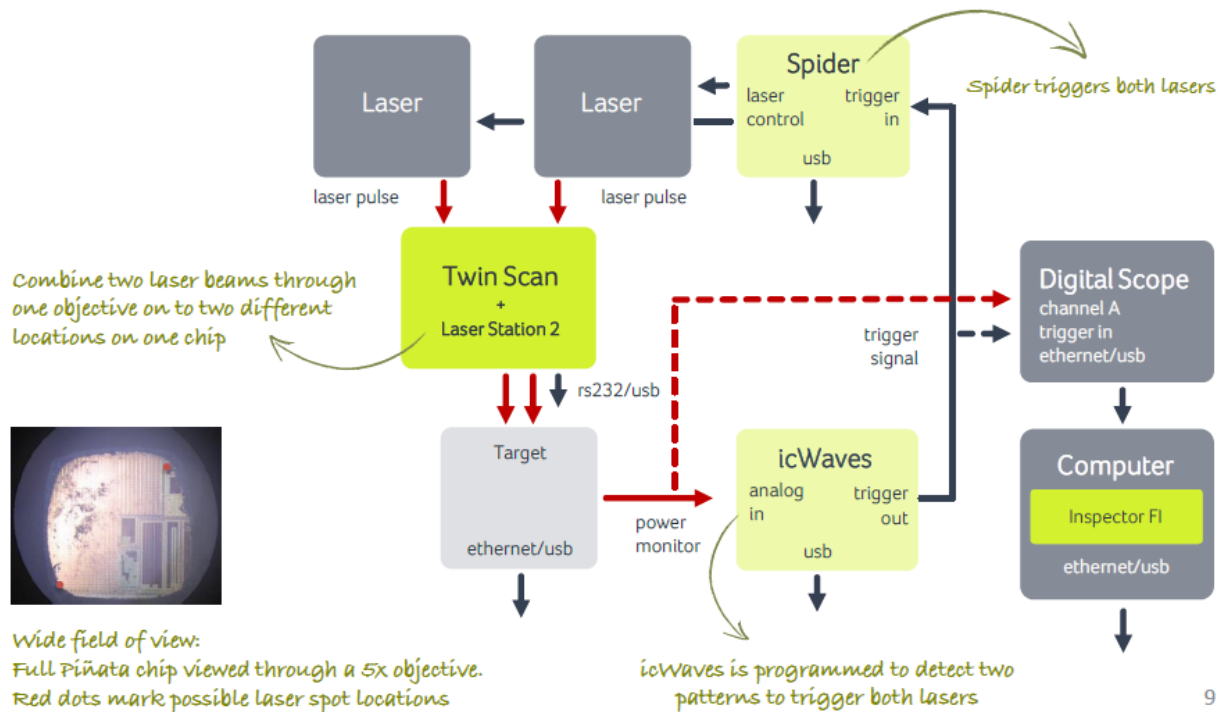
Figure 3. Control both laser sources from Inspector software

Upgrade to Fault Injection Laser System



Figure 4. DS1102A Dual Laser Fault Injection System

Use Case: Dual Laser Spots



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Figure 5. Use case — dual laser spots

Technical Blueprint

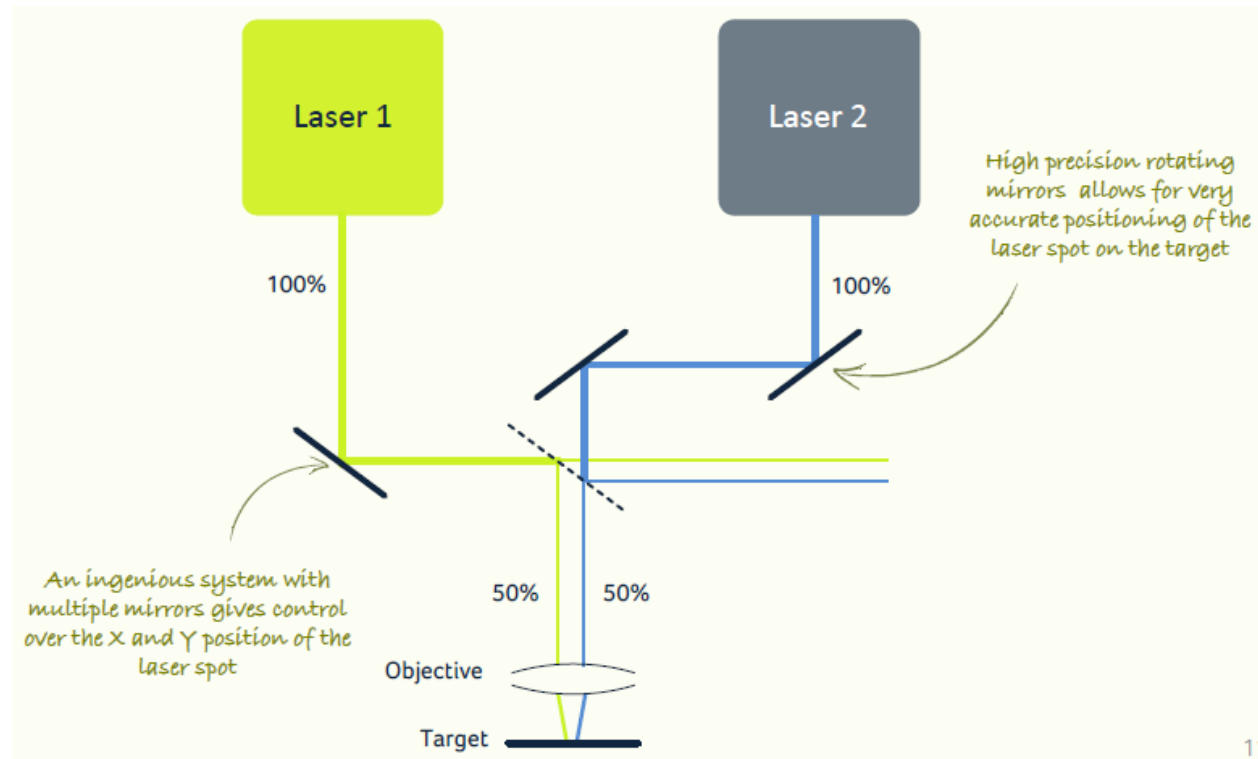


Figure 6. Technical blueprint

Technical Specifications

Specification	Value
The optical power transmission by the Dual Laser Fault Injection System module for each laser	47% with +/-12% tolerance and additional tolerance of +/-10% for polarized light
X-axis spot position resolution for 10x objective	0.16 μm
Y-axis spot position resolution for 10x objective	0.32 μm
X-axis spot position accuracy for 10x objective	3.21 μm
Y-axis spot position accuracy for 10x objective	6.43 μm
Maximum X-axis spot travel length for 10x objective	1.93 μm
Maximum Y-axis spot travel length for 10x objective	2.44 μm
Controller DC adapter	Min. voltage 24 V DC; Min. current 2,25 A
Controller COM port settings	Baud rate 9600; Data bits 8; Stop bits 2; Parity none
Environment	Noncondensing, temperature 20 – 30 °C, (68 – 86 °F)

Package

Quantity	Description	Photo
1	Dual Laser Fault Injection System positioning module	
1	Dual Laser Fault Injection System controller	
1	Dual Laser Fault Injection System controller DC PSU adapter	
-	Country specific power cable (included with PSU)	
4	Dual Laser Fault Injection System controller axis cable, SUB D15 connector	
2	Tilting connector for laser alignment	
1	Dual Laser Fault Injection System controller USB-COM port cable (2 meter long)	
3	Allen wrenches (M5 x 1, M2 x 1, M1.5 x 1)	
2	Mechanical extension tube	
2	Thread-dovetail adapter	
1	Laser spot-size reducer	
1	User Manual	

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