# LUCIA BalScan System

## Introduction

The new **LUCIA *BalScan*** is a ballistic identification system, which can be used for routine bullet and cartridge case scanning and comparison work. It can also be used for building up central databases and for networking ballistic laboratories.

It has been under intensive development at Laboratory Imaging for last five years. The development has been continuously consulted with ballistic specialists. The result is a fully integrated device and software.

Much attention has been paid to virtualization of bullets and cartridge cases. As computer data storage capacity is increasing continually, it is easier to store more information about the examined object. Our goal is that the bullet or cartridge case is fully scanned under different light conditions to one data file. This file can be later opened in the software and the work with it should maximally emulate viewing a real object.

## Device

- Movement and scanning in 5 axes: rotation, focus, illuminator position and XY translation
- Exact laser autofocus
- LED circular segmented ring light
- Additional LED side light
- High quality monochrome or color 2 MPix low noise camera
- High quality telecentric lens
- Set of bullet and cartridge holders
- A large variety of scanned calibers including non-circular objects such as cylinder locks
- Possibility to scan highly deformed fragments
- The device is controlled from the PC using menus, toolbars, and a virtual joystick



*LEFT: The current fully functional prototype of LUCIA BalScan developed at Laboratory Imaging. The device enables a comfortable operation of bullets and cartridge cases.*

*LEFT BOTTOM: The idea of the look of the device which was developed in cooperation with the Projectina company.*

*RIGHT BOTTOM: Holders for cartridge, bullets and a special holder for the cylinder lock.*

## Live Examination

• It is possible to examine bullets and cartridge cases in live image mode, their position can be changed and the light can be operated from the software by keyboard or mouse.
• All the light settings and positions are fully reproducible and can be stored in the computer for later use.
• The device can also work as a comparison microscope, a digitized bullet or cartridge case can be placed in the reference and compared with the live image.
• Interesting details can be annotated with arrows and texts and stored or printed.

## Bullet Scanning

• Bullet is placed in a bullet holder and then stepwise rotated and scanned, the scanning takes  typically about 3 minutes.
• The result is a bullet surface image (example on the image above) or a virtual bullet enabling the simulation of bullet rotation. It is possible to create the surface image from virtual bullet later.
• An independent 3D laser autofocus assures that the image will be always focused for highly deformed bullets as well.
• Typical size of a scanned bullet surface file is 7 MB (9 mm LUGER, with a monochrome camera, one light).

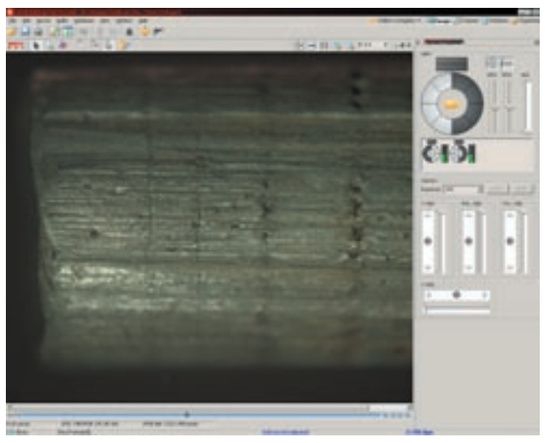
## Cartridge Case Scanning

• Cartridge is placed in a cartridge holder and scanned, scanning lasts typically 2 minutes.
• The 3D focus assures that the image will be in focus in all parts including the firing pin impression area.
• The 3D model and anaglyph on the firing pin can be displayed.
• Cartridge case can be scanned using an unlimited number of lights.
• Nearly any flat surface up to 50 x 50 mm can be scanned.
• A typical cartridge case file has 2 MB size (9 mm LUGER, with a monochrome camera, one light).

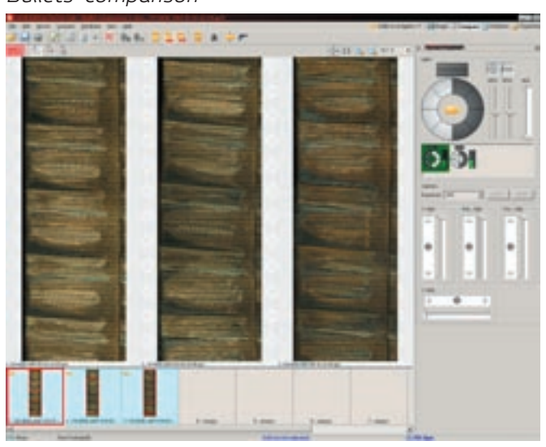
## Comparisons

• Live image can be synchronized and compared with stored images.
• Up to nine stored images can be compared side by side.
• The comparison division line can be moved and rotated.
• Comparison results can be annotated, stored, printed and exported.
• Cartridge case and bullet images can be freely rotated on the screen.
• Position, zoom, rotation and lights can be synchronized between images.
• Magnifier glass provides high resolution detailed view of an area of interest.

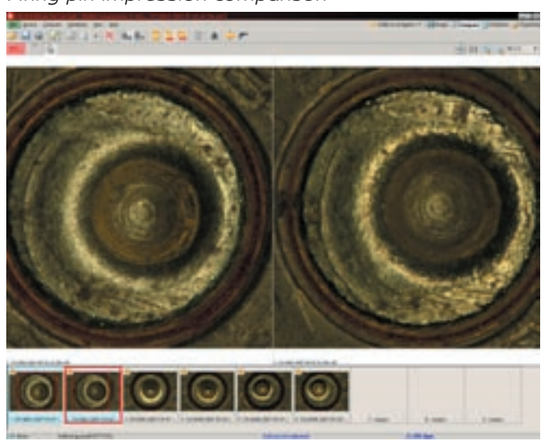
*Examination of a bullet*



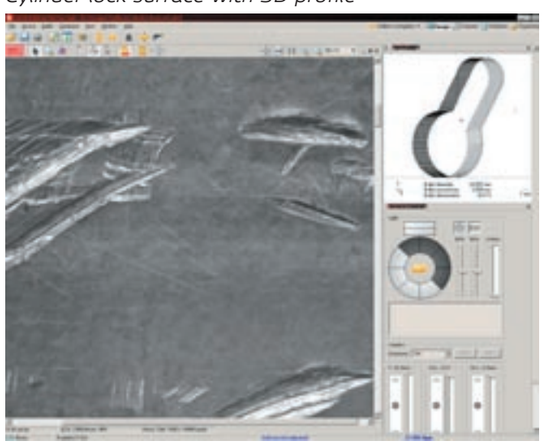
*Bullets' comparison*



*Firing pin impression comparison*



*Cylinder lock surface with 3D profile*

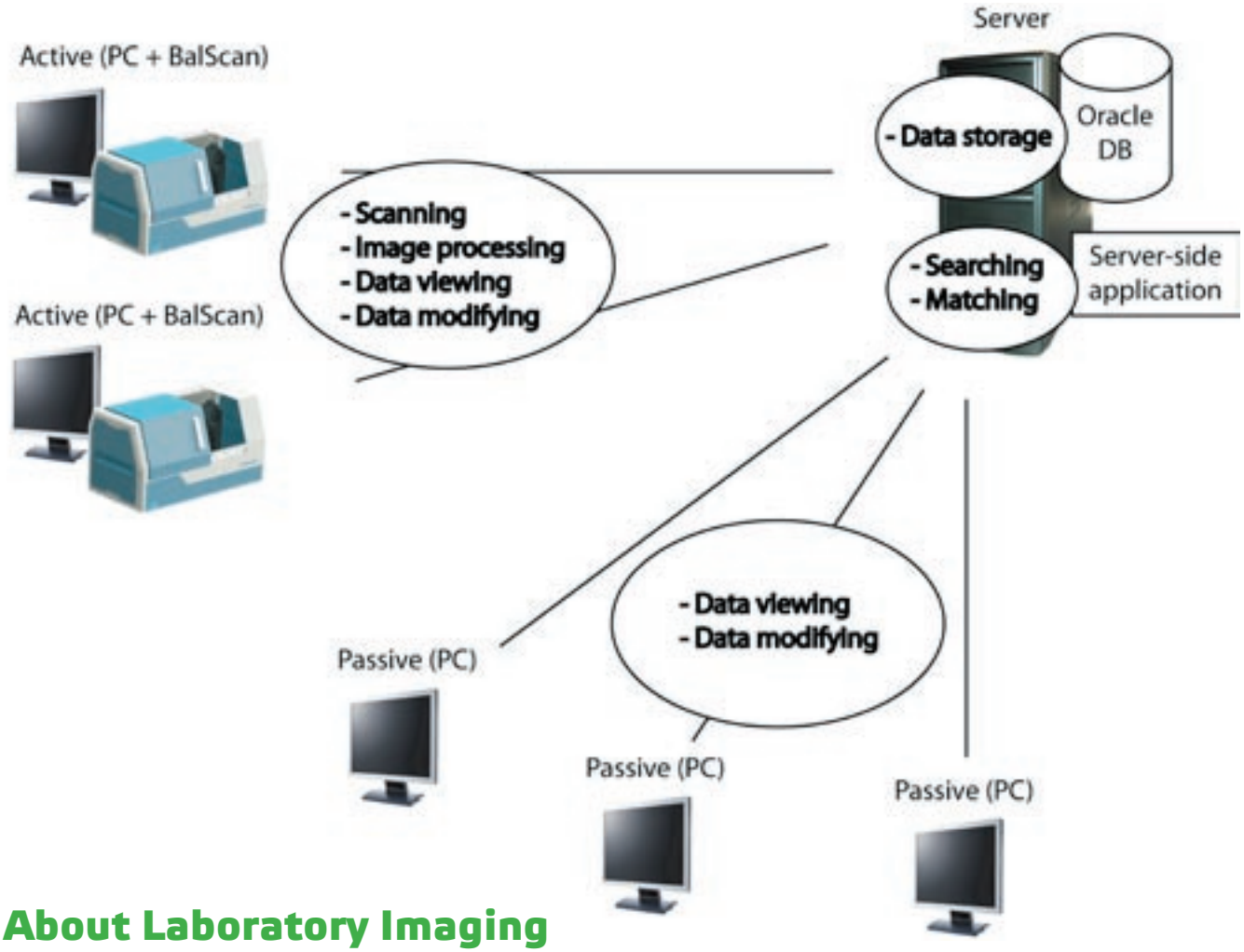


## Databases

- Support for Oracle database running on the central server.
- Several BalScan workstations can be connected to the central server. The workstations can be active or passive.
- An active workstation is equipped with the BalScan scanner and can create new cases, edit the cases, search in the database and make comparisons.
- A passive workstation can only edit the cases, search in the database and make comparisons.
- Database can also run locally on the scanning station without the network connection to the server.
- Database is secured with user rights, user names and passwords.

## Searching and Filtering

- Bullet and cartridge case images can be filtered according to the evidence number, date, description etc…
- Further filtration is realized according to the image metadata such as: calibre, diameter, angle and other dimensions, which can be determined by the software.
- An advanced expert-assisted searching is enabled by marking the positions of important markers. The search results are displayed in a table including the hit probabilities.
- Non-assisted advanced textural search is done automatically. Images are sorted by the hit probability.
- Manual comparison of searched images is easily available by a few mouse clicks.




## About Laboratory Imaging

*Laboratory Imaging (LIM) is a company with a broad expertise in image analysis and microscopy. Since 1990 we are developing systems for image analysis called LUCIA. From the beginning a tight cooperation with forensic laboratories has been held. Today, we are developing the general image analysis software for forensic laboratories as well as special dedicated systems and customized solutions for individual customers.*

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