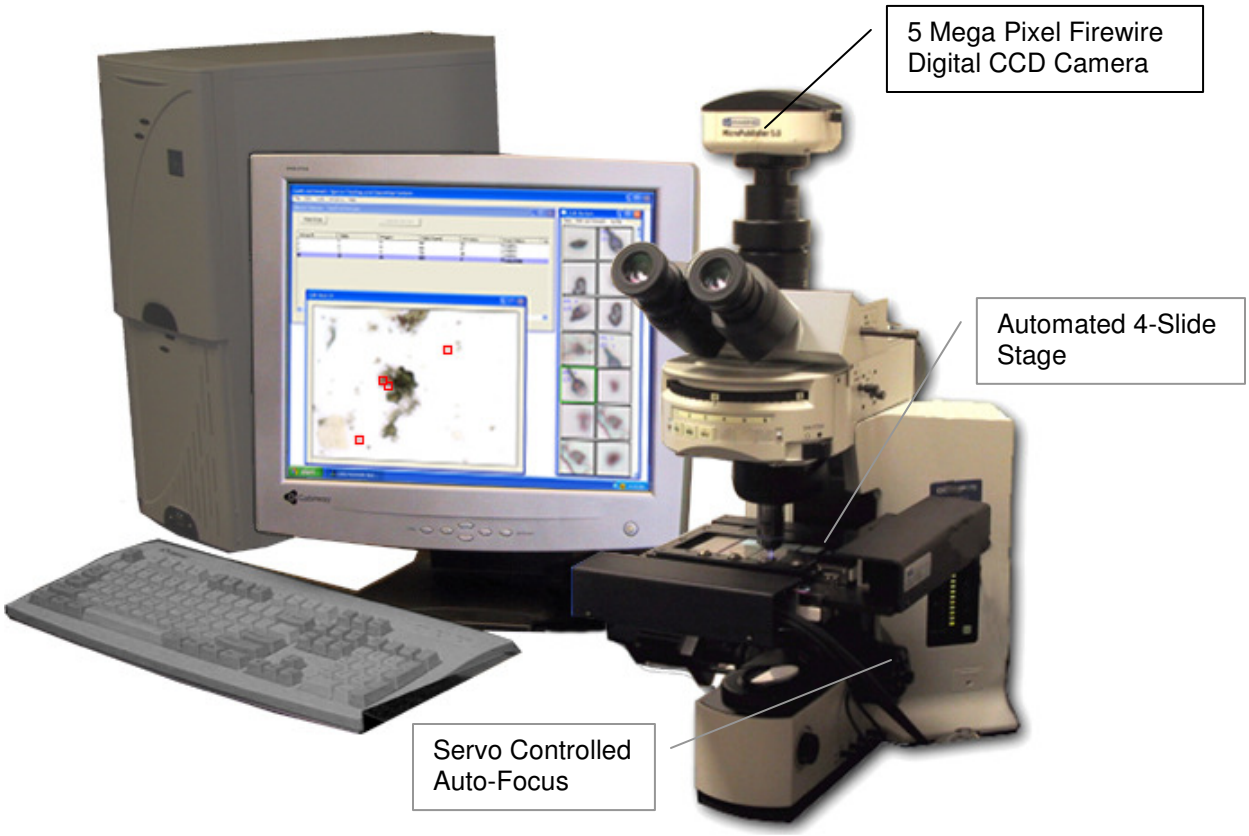
# Loats Associates, Inc. Sperm Finding and Documentation System




## Background

The analysis of a sexual assault case by a forensic laboratory is a multi-step procedure. One step in this process is an often lengthy manual microscopic examination of slides of vaginal smears or smears from other crime scene evidence to determine the presence or absence of spermatozoa. This step is important since identification of the presence and quantity of sperm available is a good indicator of the potential success of a DNA extraction and Short Tandem Repeat (STR) analysis.

However, manual screening of slides for sperm is labor intensive and can take considerable time, depending upon the nature of the slide. This often creates a workflow bottleneck, which impedes rapid turn around of sexual assault cases. There is consequently need for effective automated procedures to facilitate swift and less labor intensive analysis of slides. Such automated methods can improve laboratory productivity, decrease case turn around time, provide valuable information to more effectively determine which evidence items would be suitable for autosomal or Y STR analysis, and assist forensic scientists in making better use of limited crime scene samples and laboratory resources. In addition, automated processing and analysis can save valuable time and money that can be re-directed to address other important analyses.

## System Description

Image analysis experts at Loats Associates, Inc., working in cooperation with scientists at the Vermont Forensic Laboratory, have developed a system for the automated screening of evidentiary slide preps for the presence of spermatozoa. The system consists of:

- a Windows based computer with mouse, full size keyboard, and large flat panel monitor,
- a robotic microscope with motorized focus and stage that accepts multiple slides,
- a high resolution color digital camera to import images into the computer and,
- Software to control the system, interpret images and document results.

## Features

The system can process multiple slides in a single run and uses a 40X objective magnification to systematically search defined sample regions on each slide for the presence of spermatozoa. Individual database files are

created by the system for each slide scanned and are tracked according to a user specified Case and Item number. Access to the system for run initiation, results review and verification and report generation are all password protected to assure good evidentiary control.

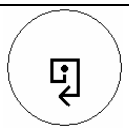
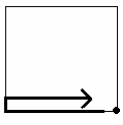
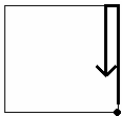
## Identifying Sperm

In recognizing sperm, the system has been designed to utilize visual cues revealed by "Christmas Tree Stain", the most common staining protocol used by the forensic community in the US for smear screening. Much like a human reader, the system's software uses characteristic features of color, size and shape to identify candidate spermatozoa on the slides.

The system dynamically displays the current image frame analyzed, marking the positions of any candidate


sperm identified with a red box, along with summary statistics for each slide: number of cells found and number of frames processed.

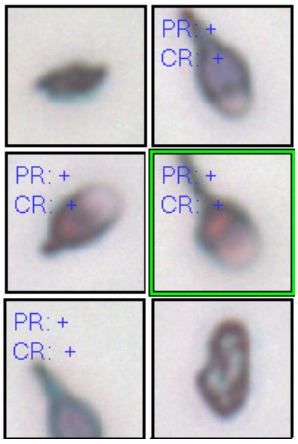
As each candidate sperm is identified, the system automatically records the coordinates of the cell location, and an image of the cell is displayed in an on-screen picture gallery, and this image is saved into a database for subsequent user review.

| | |
|---|---|
|  | Ring scan pattern |
|  | Rectangle by Width scan pattern |
|  | Rectangle by Height scan pattern |

Automated scanning continues until a user-specified number of candidate sperm cells have been located on each slide or the designated sample region on the slide is exhausted. At that time, the system proceeds with scanning of the next slide or stops scanning operations if all slides in the run have been processed.

## Reviewing

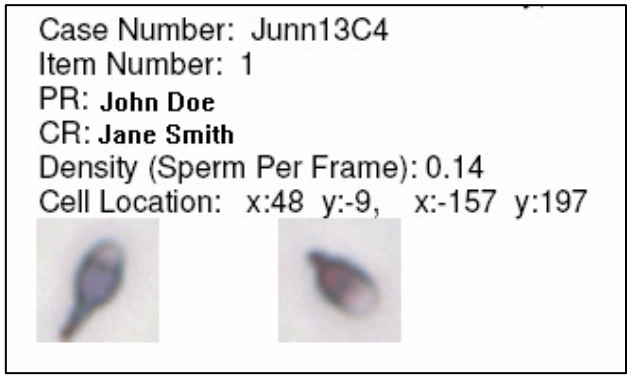
Upon completion of automatic slide scanning, the system user can review the candidate sperm found by the system in the on-screen picture gallery and verify those cells that are spermatozoa. If needed, the user can easily direct the system to return to the actual slide position of an identified cell so that a detailed visual examination of the cell can be made through the microscope eyepieces.




## Reporting

Review and verification results are automatically added to the database records for each slide and hardcopy summary reports of slide results can be easily generated. The generated reports provide summary data for one or more slides grouped according to Case Number or corresponding to a user specified selection of slides.

The reports indicate if a slide is positive or negative for sperm, provide a measure of the relative density of sperm found, and indicate the identity of the analysts/users who performed the final data review and verification tasks. Several sample images, selected by the system user from the sperm found on each slide may also be included, together with coordinates indicating the locations of the cells on the slide.




Developed in cooperation with scientists at the Vermont Forensic Laboratory, Eric Buel, PhD, Director, www.dps.state.vt.us/cjs/forensic.html, and supported in part by NIJ Grant 2004-DNBXK003

Loats Associates, Inc, 201 East Main St. Westminster, MD 21157. (410) 876 8055, loats@loats.com, www.loats.com