

CHARACTERIZATION OF PROPERTIES AND PERFORMANCE OF THE 96-CAPILLARY ARRAY FORMAT OF THE ABI PRISM® 3700 GENETIC ANALYZER AND COMPARISON WITH GEL-BASED SYSTEMS

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The two primary instrument formats used to develop DNA profiles for entry into the CODIS national database rely on detection of fluorescent signals following separation by electrophoresis through polymers enclosed either in a capillary or a slab gel. The newest platform which supports high throughput data generation and analysis is the ABI Prism® 3700 Genetic Analyzer. This instrument employs an array of ninety-six separate capillaries to simultaneously separate the amplified fluorescently labeled product of individuals DNA samples.

While the instrument was originally developed for high throughput sequencing applications, we have performed extensive testing with regard to use of this format for a variety of forensic applications, primarily database development and the potential for high throughput caseload work. In particular, we have demonstrated that the instrument provides exquisite sensitivity, linear response to input fluorescent material, and very limited cross-dye interference (i.e., pull-up) when operated within a broad well-defined range of signal. To achieve this range of signal, quantitation of the amount of DNA to be amplified is highly recommended and will be discussed.

DNA profiling results obtained with the instrument are fully reproducible. Precision within and between runs through the capillary array is excellent and compares favorably with slab gel formats such as the ABI Prism® 377 DNA Sequencer or the Hitachi FMBIO® II Fluorescent Scanner. Separation and detection of amplified fragments differing by a single base is easily achieved.

Detection of amplified materials from non-probative evidence samples is comparable on the ABI Prism® 3700 Genetic Analyzer and other formats. In mixtures of two DNA samples, as little as a two percent contribution of the minority sample can be detected. Following amplification with the Profiler Plus™ or COfiler™ multiplex kit components, patterns of amplified fragments generated from non-probative mixed samples resemble those observed by detection of fragments separated using the ABI Prism® 377 DNA Sequencer.

These results suggest that validation of the ABI Prism® 3700 Genetic Analyzer for both database and casework applications is possible.