



# 2014 Rapid DNA Maturity Assessment Results

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**NIST**  
National Institute of  
Standards and Technology  
U.S. Department of Commerce

# Disclaimer

**We will mention commercial STR kit and instrument names, but we are in no way attempting to endorse any specific products.**

**NIST Disclaimer**: Certain commercial equipment, instruments and materials are identified in order to specify experimental procedures as completely as possible. In no case does such identification imply a recommendation or it imply that any of the materials, instruments or equipment identified are necessarily the best available for the purpose.

Information presented does not necessarily represent the official position of the National Institute of Standards and Technology or the U.S. Department of Justice.

# Purpose of Maturity Assessment

- To assess the status **in the fall 2014** of rapid DNA typing technology for the CODIS 13 core loci
  - In support of lab use and future external (non-lab-based) Rapid DNA implementation
- Integrated (swab in – allele detection) instruments capable of genotyping the core CODIS 13 STR markers were eligible for the study

# Rapid DNA Instruments

## ANDE (NetBio)



- One biochipset
  - Stored at RT
  - Shelf life  $\approx$  6 months
- RFID swabs tagged for sample tracking

PowerPlex 16 loci  
 $\approx$ 86 min runtime  
(5 samples)

**ANDE PP16**

## RapidHIT 200 (IntegenX)



- Kit = 4 components
  - Stored between RT-4°C
  - Shelf life  $\approx$  6 months @ 4°C
- Cotton Swabs

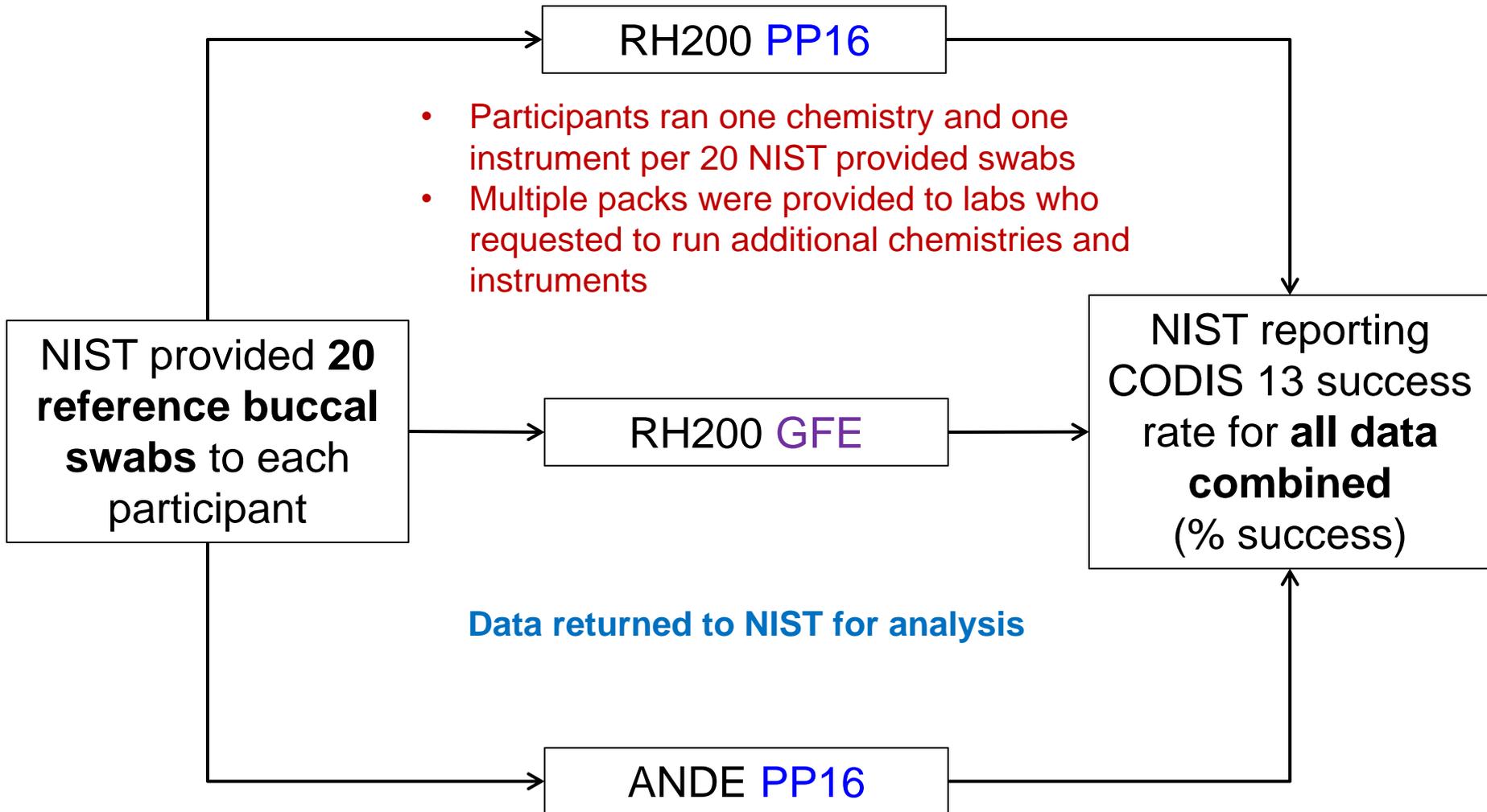
PowerPlex 16 loci  
 $\approx$ 90 min runtime  
(5 samples)

**RH200 PP16**

GlobalFiler Express loci  
 $\approx$ 120 min runtime  
(1-7 samples)

**RH200 GFE**

# R-DNA Maturity Assessment



# Timeline of Maturity Assessment

**January 2014:** Buccal samples collected at NIST and stored at RT



**October 2014:** Samples shipped to participating laboratories



**October-December 2014:** Data generated and electronically returned to NIST



**November-December 2014:** Data analyzed at NIST

# Maturity Assessment

Participating Laboratories (7)    Instrument Platforms (2)    Independent Instruments (11)    Chemistry    Total Samples Tested (280)

Federal

NetBio ANDE



5

PowerPlex 16

100

State

IntegenX RapidHIT 200



6

PowerPlex 16

60

Private

GlobalFiler  
Express

120

# NIST Analysis Parameters

- **Rapid DNA Analysis:** Without human intervention
- **Modified Rapid DNA Analysis:** Expert interpretation and analysis of electropherogram

<https://www.fbi.gov/about-us/lab/biometric-analysis/codis/rapid-dna-addendum-to-qas-final-effective-12-1-2014>

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- Additional analysis (PHR, Stutter, etc.) of the data performed with GeneMapper IDX v 1.3
  - Custom bins and panels designed for analysis of all data in GeneMapper
- In-house Excel programs used to analyze peak height ratios, stutter, and precision

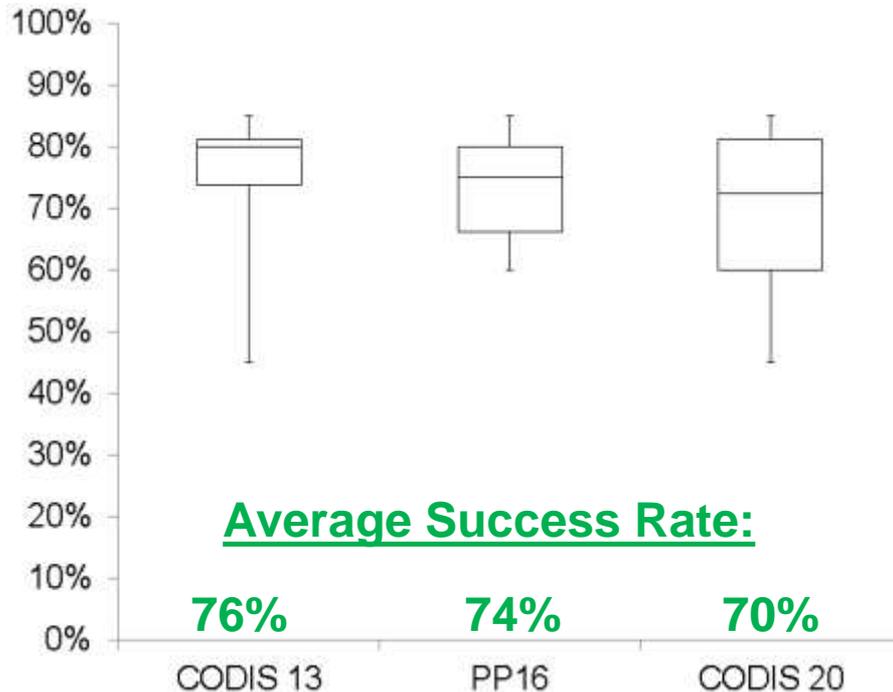
<http://www.cstl.nist.gov/strbase/software.htm>

# Overall Success

Success was measured by **complete and concordant genotypes** produced by the integrated rapid DNA devices as compared to lab generated correct genotypes

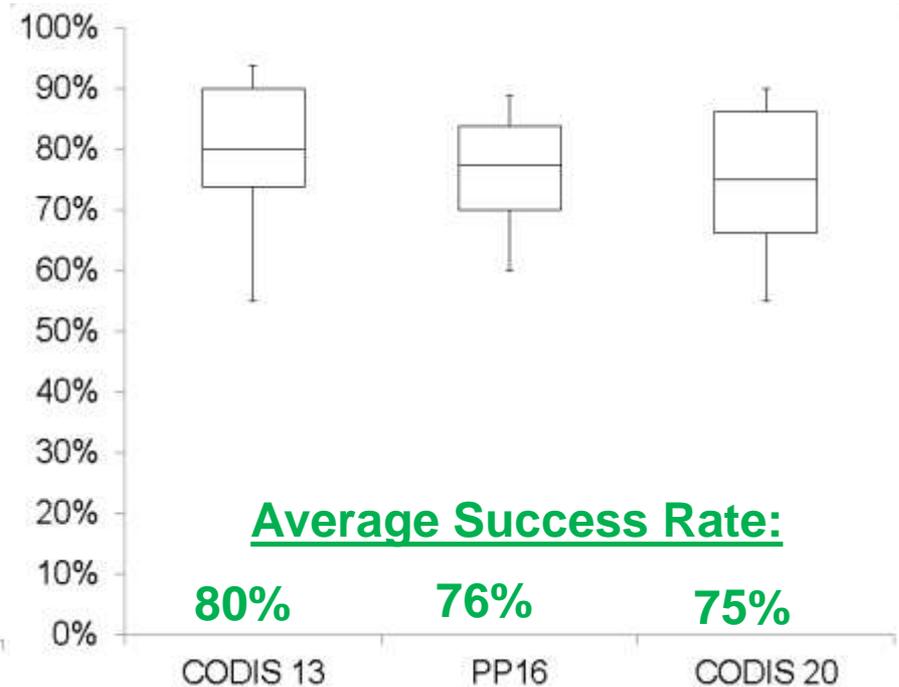
## Rapid DNA Analysis

Analysis without human intervention



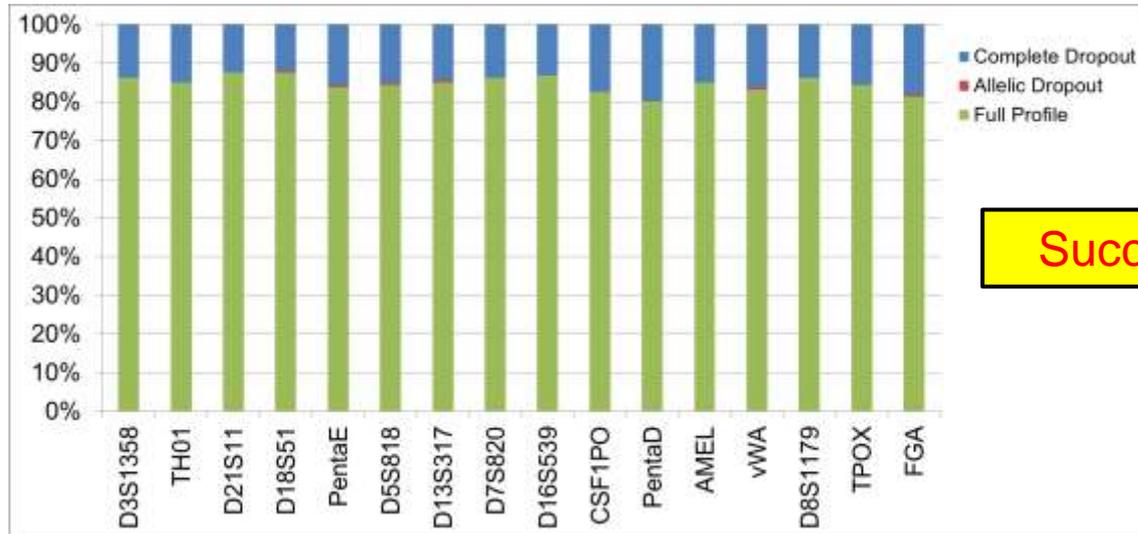
## Modified Rapid DNA Analysis

Analysis involved manual interpretation



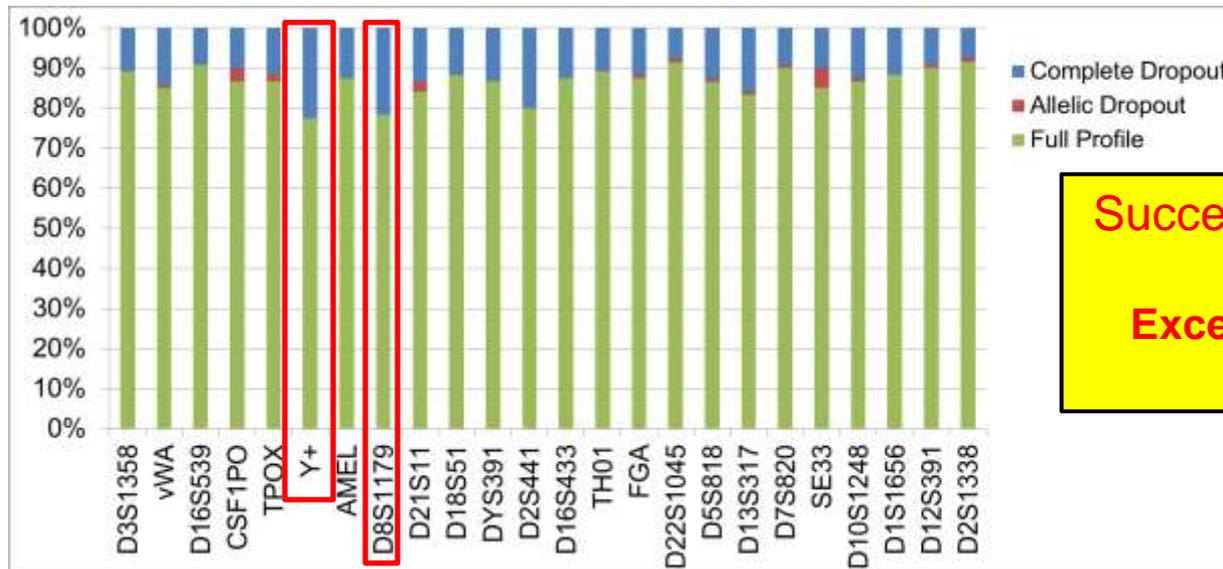
# Locus Success (Rapid Analysis)

## PowerPlex 16



Success above 80%

## GlobalFiler Express



Success above 80%  
Except for Y+ and D8S1179

# Peak Height Ratios

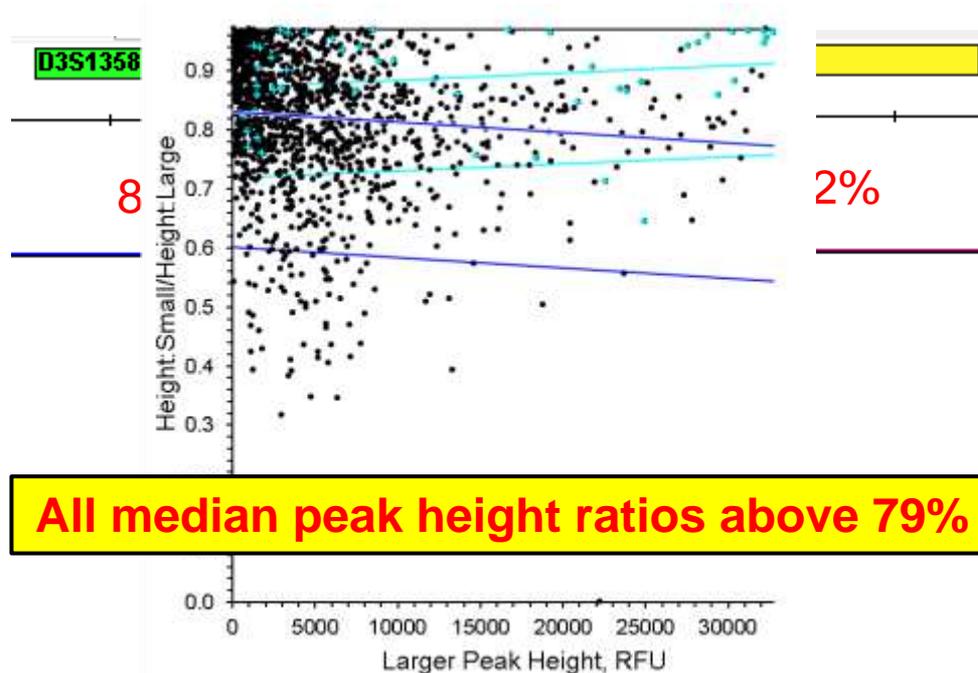
## PowerPlex 16

Locus	Median
Penta_E	0.81
AMEL	0.83
Penta_D	0.84
D18S51	0.86
D3S1358	0.87
D8S1179	0.87
TPOX	0.87
D5S818	0.88
vWA	0.88
D21S11	0.88
D16S539	0.88
D13S317	0.89
CSF1PO	0.89
FGA	0.89
D7S820	0.89
TH01	0.93

Full Profiles: n=118

Peak height ratios were calculated for all **complete profiles** for the PowerPlex 16 and GlobalFiler Express chemistries.

The PowerPlex 16 data is a **combination of the data generated** from both ANDE and the RapidHIT 200.



## GlobalFiler Express

Locus	Median
SE33	0.79
D2S1338	0.82
D5S818	0.85
D18S51	0.85
D12S391	0.86
D21S11	0.87
CSF1PO	0.87
vWA	0.88
D7S820	0.88
TPOX	0.89
D16S539	0.89
D1S1656	0.89
D22S1045	0.89
D8S1179	0.90
D13S317	0.90
AMEL	0.90
D3S1358	0.90
D19S433	0.90
D10S1248	0.91
TH01	0.91
FGA	0.92
D2S441	0.92

Full Profiles: n=67

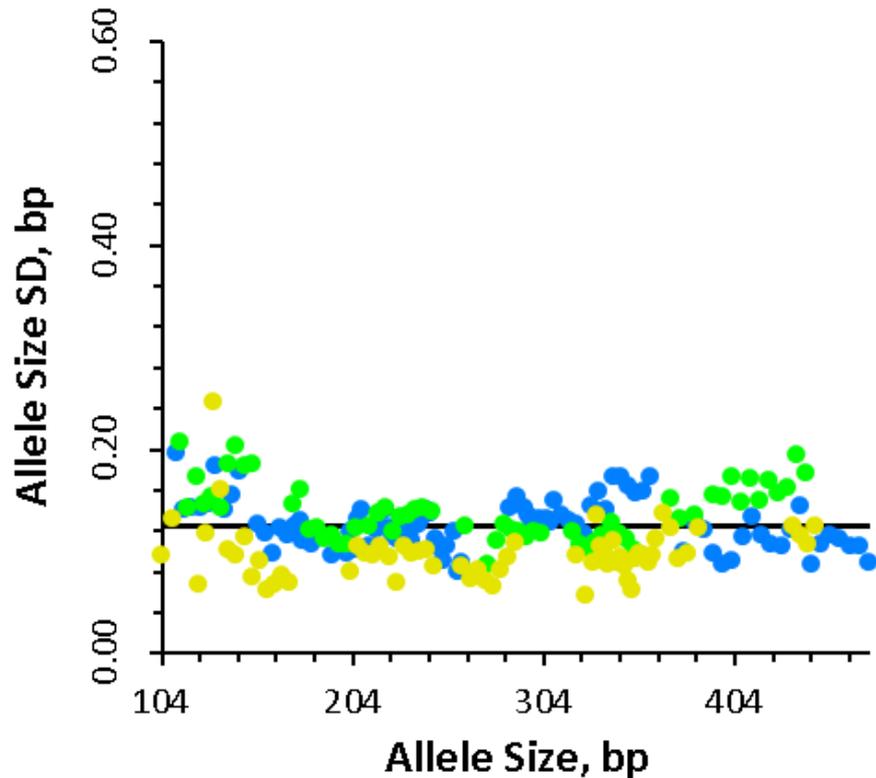


# Ladders

- Both instruments run a ladder with each run
  - Incorporated into the chip/kit
- Each instrument contains an “onboard” ladder(s)
  - For use if the ladder on the chip fails
- Ladders and internal size standard allow for accurate allele calling
  - Poor precision ( $>0.5$  bp) can result in miscalled data

# Ladder Precision

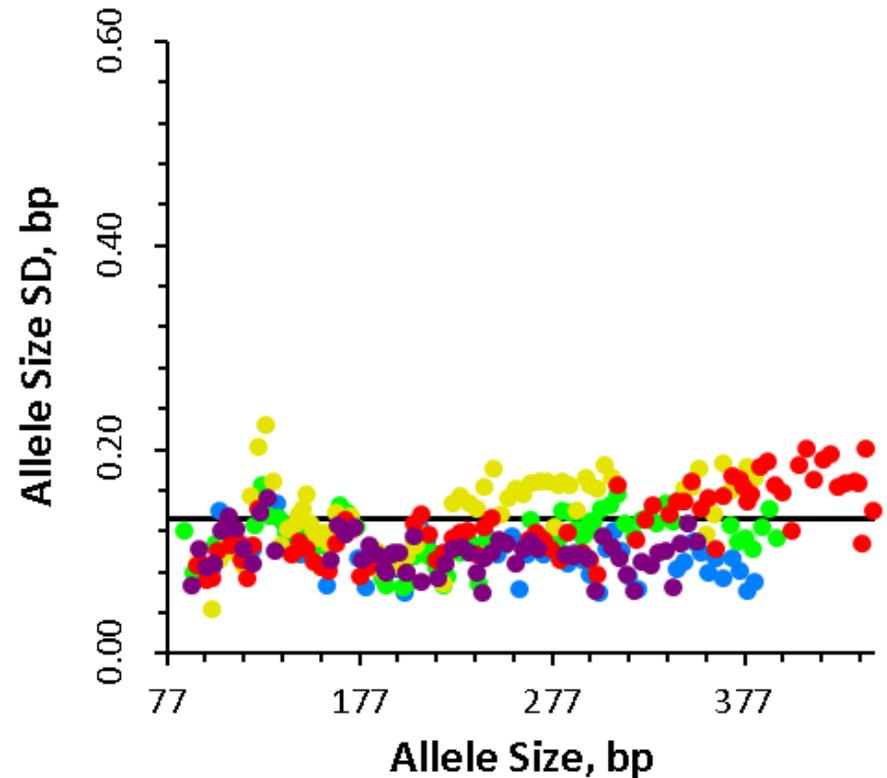
## PowerPlex 16



**Allelic Precision of 0.125 bp**

Ladders: : n=46

## GlobalFiler Express



**Allelic Precision of 0.133 bp**

Ladders: : n=74

# Maturity Assessment Summary

- 11 instruments within 7 laboratories tested
  - Total of 280 samples examined
- Data generated October-December 2014 and returned to NIST
- Changes since 2014 Maturity Assessment Data was generated (between both companies)
  - Known changes to manufacturing, software, and hardware

# Summary of Results

- 2014 R-DNA Maturity Assessment exhibited a 76% success rate for the CODIS 13 Core Loci using Rapid DNA Analysis
  - Success ranged from 45% to 85% across laboratories, chemistries, and instruments
- Precision is below 0.25 bp on for both PP16 and GFE data generated
- Continuing to run R-DNA platforms with newer chemistries and upgrades

# Final Results

Rapid DNA Instrument Platforms	Number of Participating Labs	Total Instruments	Samples Attempted	Core CODIS Success (Rapid DNA Analysis)	Core CODIS Success (Modified Rapid DNA Analysis)
2	7	11	280	76.1%	80.0%

Overall success for the R-DNA maturity assessment is reported:

[http://www.nist.gov/mml/bmd/genetics/dna\\_biometrics.cfm](http://www.nist.gov/mml/bmd/genetics/dna_biometrics.cfm)

 <b>NIST</b> <small>National Institute of Standards and Technology Technology Center for Forensic Science, U.S. Department of Commerce</small> Email: <a href="mailto:Erica.Romsos@nist.gov">Erica.Romsos@nist.gov</a>	<h2>Rapid DNA Maturity Assessment</h2> <p><u>Erica L. Romsos</u><sup>1</sup>, Sanae Lembirick<sup>2</sup>, and Peter M. Vallone<sup>1</sup></p> <p><sup>1</sup> U.S. National Institute of Standards and Technology, 100 Bureau Drive, Gaithersburg, MD 20899-8314, USA <sup>2</sup> Montgomery College, Rockville, MD 20850, USA</p>	  P-148
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Poster presented at the 26th Congress of the International Society for Forensic Genetics (Krakow, Poland), September 2-5, 2015

[http://www.cstl.nist.gov/strbase/pub\\_pres/RomsosISFG2015RapidDNA.pdf](http://www.cstl.nist.gov/strbase/pub_pres/RomsosISFG2015RapidDNA.pdf)

# Thank you for your attention!

Thanks to David Duewer and Sanae Lembirik for assistance with data analysis

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## Funding

**DHS** – Rapid DNA  
Prototype and Kinship  
Performance Evaluation

**FBI** - the Evaluation of  
Forensic DNA Typing as  
a Biometric Tool

