The Need for Large-Scale Biometric Testing

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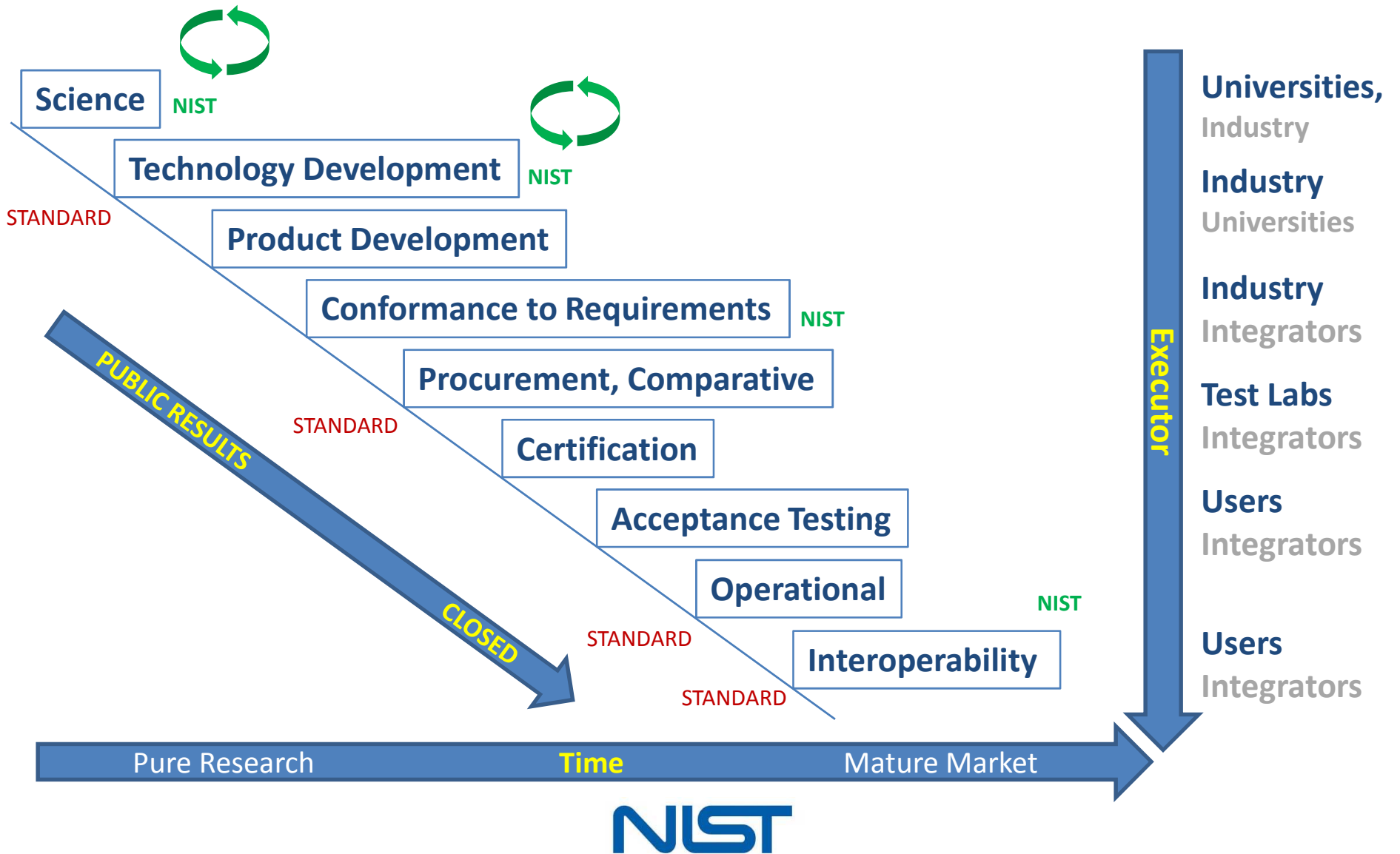
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The purposes of biometric testing

» Scientific discovery
  » Basic research, sensors, algorithms,
» Research and development
  » Is the method better than before?
  » Internal commercial, or gov-industry cooperation
» Capability testing
  » Is the technology viable?
    • Benchmarking
    • Core capability
  » Establishing criteria
» Testing to know what's possible
  » Could requirements be met
  » Is the technology viable?
» Comparative testing
  » Which technology?
  » Which implementation?

» Conformance
  » To requirements
  » To standards
» Interoperability testing
  » Can we upgrade, replace, while keeping our data?
  » Jurisdictional interoperability
» Certification
  » Can we leverage others' tests?
» Regression
  » Has the update helped?

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Stages of Testing

Science

Technology Development

STANDARD

Product Development

Conformance to Requirements   NIST

Procurement, Comparative

STANDARD

Certification

Acceptance Testing

Operational   NIST

STANDARD

Interoperability

STANDARD

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PUBLIC RESULTS

CLOSED

Pure Research   **Time**   Mature Market

Executor

Universities,
Industry

Industry
Universities

Industry
Integrators

Test Labs
Integrators

Users
Integrators

Users
Integrators

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Why test at all?

» It's about money
  » Biometric errors cause additional cost
    • Failure to enroll → additional time, procedures, modalities, processes, time
    • In 1:N false non-match → benefits fraud, immigration fraud
    • In 1:N false match → identity resolution processes
  » Can the application requirements be met?
 » Can the technical requirements be met?
  » Risk mitigation
    • Characterizing performance allows procedures to mitigate risk e.g. a finding that FTE > 0.03 prompts environmental redesign to regulate humidity, or ambient light.
  » Conformance, Interoperability
    • Entire system needs to be upgraded / junked if it doesn't interoperate with others

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Trading Time for Accuracy
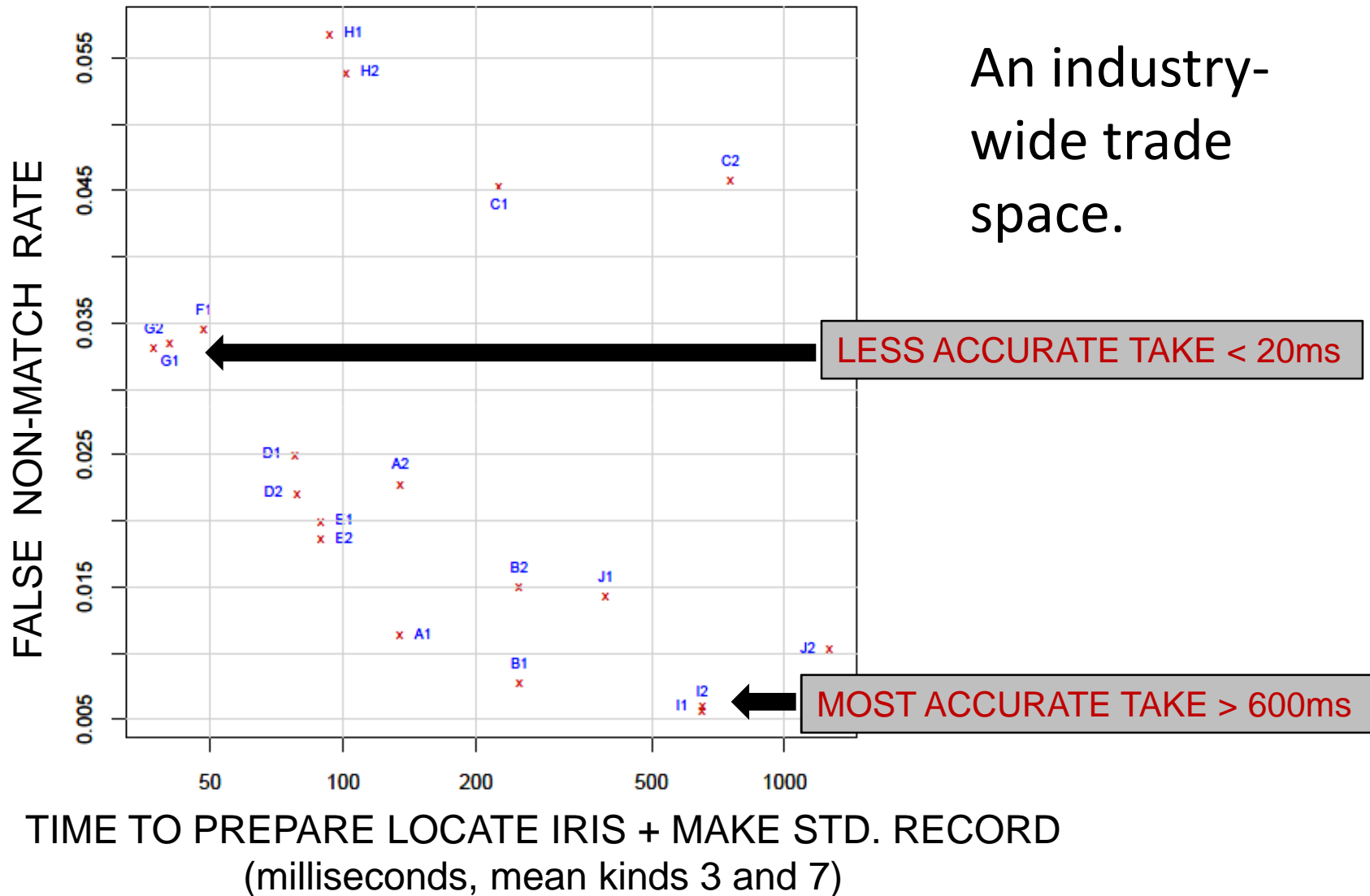
An industry-wide trade space.

Large scale testing, eh? What's large?

» Statistical definition of large
  » Depends on purpose
    • e.g. show, with 99% confidence, that a match-on-card comparison algorithm has FAR < 10-4
    • e.g. existence proof that a gummy finger can be enrolled in a biometric system
    • e.g. given a choice of instructional modes for use of a biometric sensor, determine via live test, which is best
    • e.g. testing whether a e-Passport conformance testing suite correctly rejects defective records or JPEG 2000 streams
  » Technology dependent
    • e.g. comparing AFIS systems vs. comparing 1:1 ePassport gates
» Practically…
  » Systematic effects are larger than random effects and these can be identified efficiently
    • Irises with radius greater than 150 pixels always fail to enroll
  » Cost constraints limit population size, test duration
    • Corners are cut (e.g. full-cross comparison of N samples)
  » Test crews get tired

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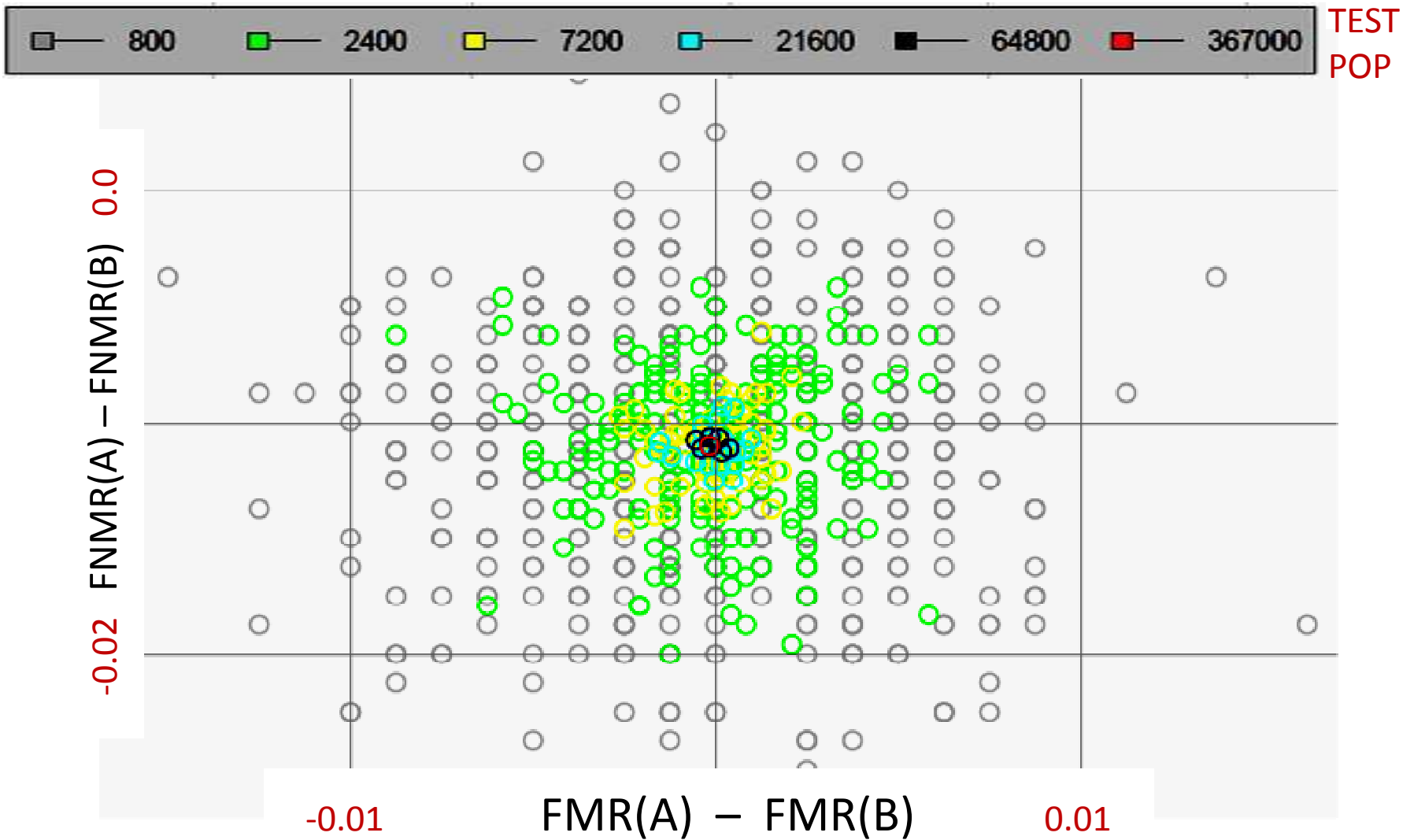
IBPC 2010

» International Biometric Performance Conference

  » Novel test methods, metrics

  » Specification, requirements, certification

  » Accuracy, security, operational

  » Emphasis on **how** systems are tested, vs. latest results

» Co-chairs

  » Patrick Grother, Elham Tabassi, NIST

  » Christoph Busch, Fraunhofer

  » Tony Mansfield, NPL

» Logistics

  » March 2-4, 2010

  » Gaithersburg, Maryland

  » Call for papers: http://biometrics.nist.gov/ibpc2010

In 119 pages IREX covers

- **http://iris.nist.gov/irex**
- Compare algorithmic accuracy
  - ROCs
  - Fixed threshold – effect on FMR and FNMR
- Speed-accuracy trade-space
- False Match Rate Calibration
  - How to set the threshold
- Effect of dataset
  - On FNMR, on FMR
- Algorithm interoperability
  - Enroll on A – Identify on B
  - Segmentation performance
- Image quality assessments
- Biometric zoo

- Compare lossy compression algs
  - JPEG vs. JPEG 2000
- Limits of lossless compression
- Bounds on iris size
- How closely to crop an iris
- Comparison of specialized formats
  - Masked vs. Polar
  - Which is fit for purpose
- Effect of pupil dilation
  - And change in dilation
- Effect of eyelid occlusion
- Effect of iris-pupil displacement

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Thanks
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Minutia interoperability: http://fingerprint.nist.gov/minex
Iris interoperability: http://iris.nist.gov/irex
Biometric Performance Conference: http://biometrics.nist.gov/ibpc2010

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