

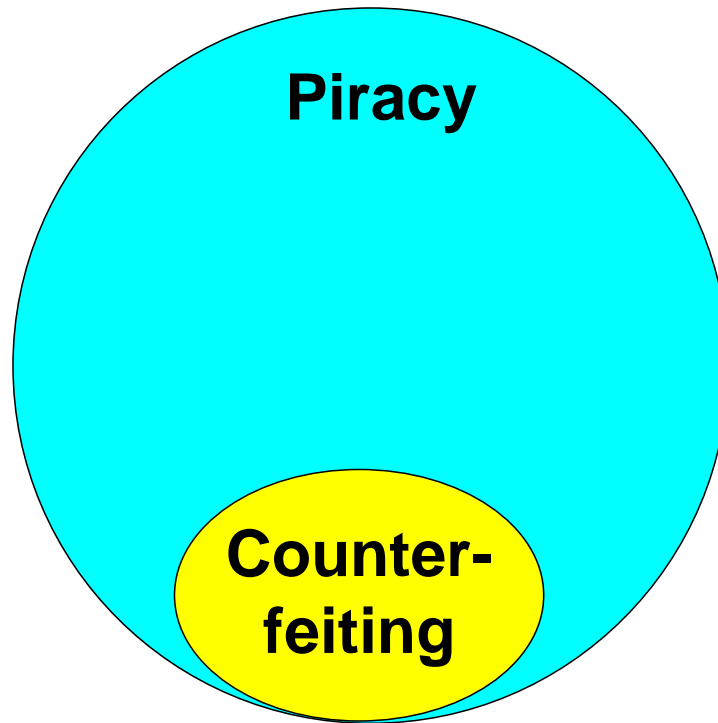
Optical DNA V2.0

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Microsoft Research

Effort in Progress

- David Evans, University of Virginia
- Performance modeling – MSR
 - Vanessa Testoni, Max Costa – UNICAMP
- AudioDev – aging
 - Vencil Wells
- Microsoft Anti-Piracy
 - Dave Lewis
- Technicolor, 3DCD – manufacturing
 - Holger Hoffman + ...
- XBOX



- Piracy
 - Buyer knows product is not genuine
- Counterfeiting
 - Seller tricks buyer into believing product is genuine

Why Optical Media?

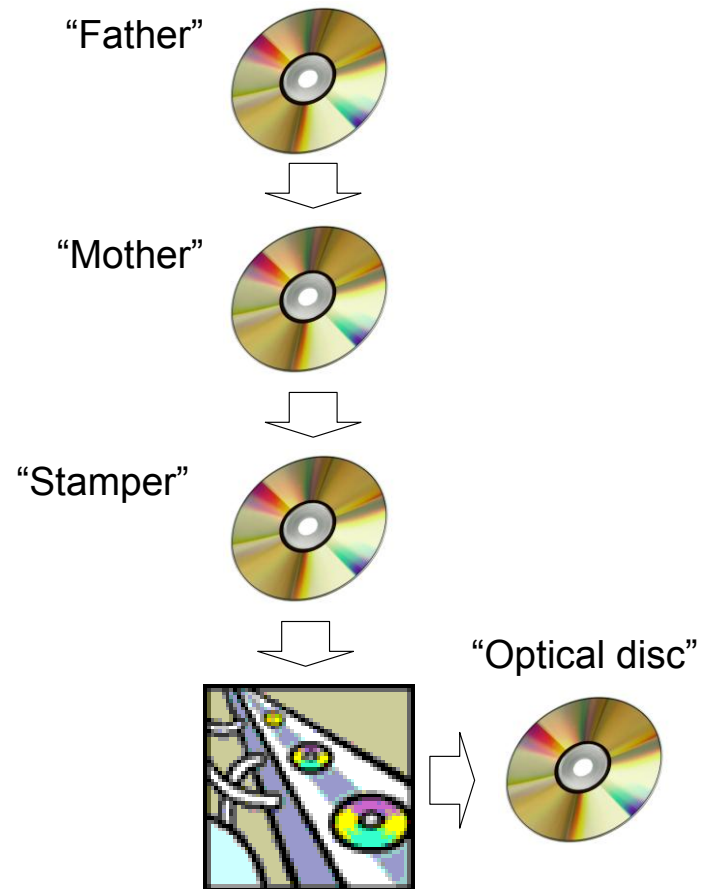
- Quite a bit of value to protect
 - US (\$21B + \$40B + \$132B) / year
- Blu-ray 50GB = US\$1-2
- 9.5GB = US 50¢
 - US\$ $5.31 \cdot 10^{-11}$ /byte
 - Download the same data, 3Mbps
 - US 11.5¢/kWh¹, 50-300W laptop-desktop
 - US 4-24¢ (energy) + US 7¢ (cable service)

Certificate of Authenticity

- Bauder and Simmons, Sandia Labs
- Physical object
 1. Expensive to create a near-exact replica
 2. Inexpensive to manufacture
 3. Inexpensive to sign and verify
 4. Robust to wear and tear
 5. Physical one-way function
 6. Great ROC
 7. Fingerprint interdependence
 8. Visual inspection of the verification path

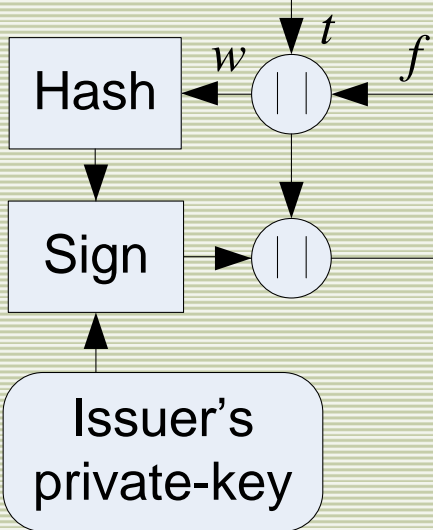
Source of Randomness

- Manufacturing errors inevitable
- Physical uniqueness simply outstanding
- Low errors \Rightarrow poor density
- Latest standard will always be a source of errors
- TechniColor
 - DVD = \$0.40
 - Hologram = \$0.25



O-DNA Issue

Tag ID: 1234567890
Expiration: Nov. 12, 2008
Options: not included
Regions: US only

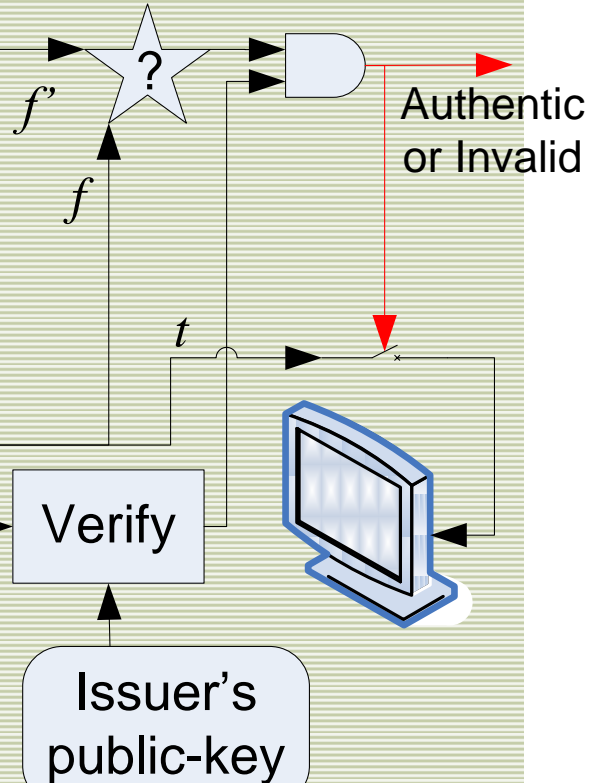


Fingerprint Scanner

Microsoft
Research

Fingerprint Scanner

O-DNA Verification



Postscribed ID™ Technical Factsheet



www.network-connected-disc.com

2009-03-18

What is Postscribed ID™?

Postscribed ID™ is a technology from Sony that enables the additional inscription of a unique ID onto a disc's signal surface after the stamping process at the disc plant. By using a high-powered laser diode and extremely accurate location control technology, Sony DADC can enable disc publishers to uniquely identify each disc.

The Errors

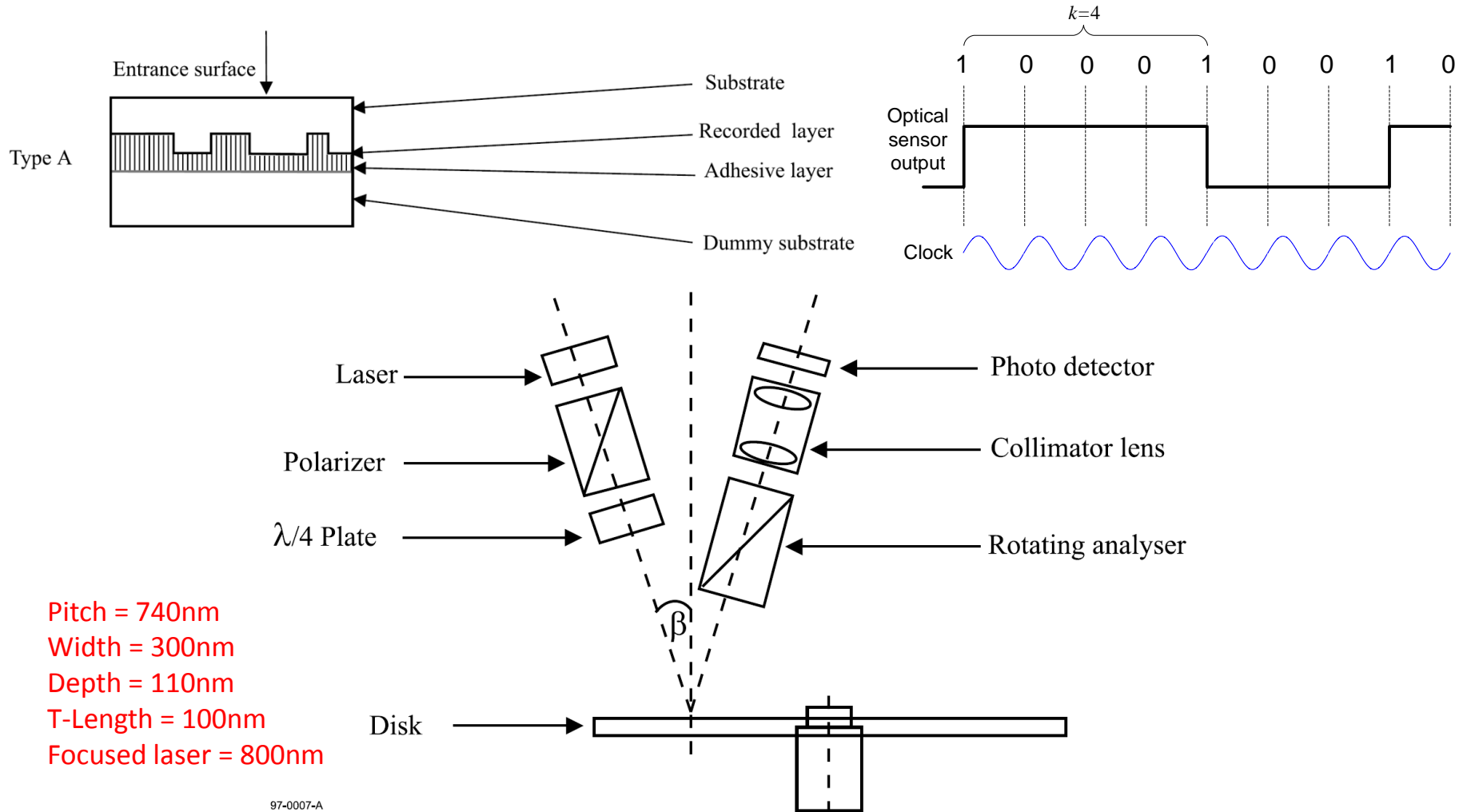
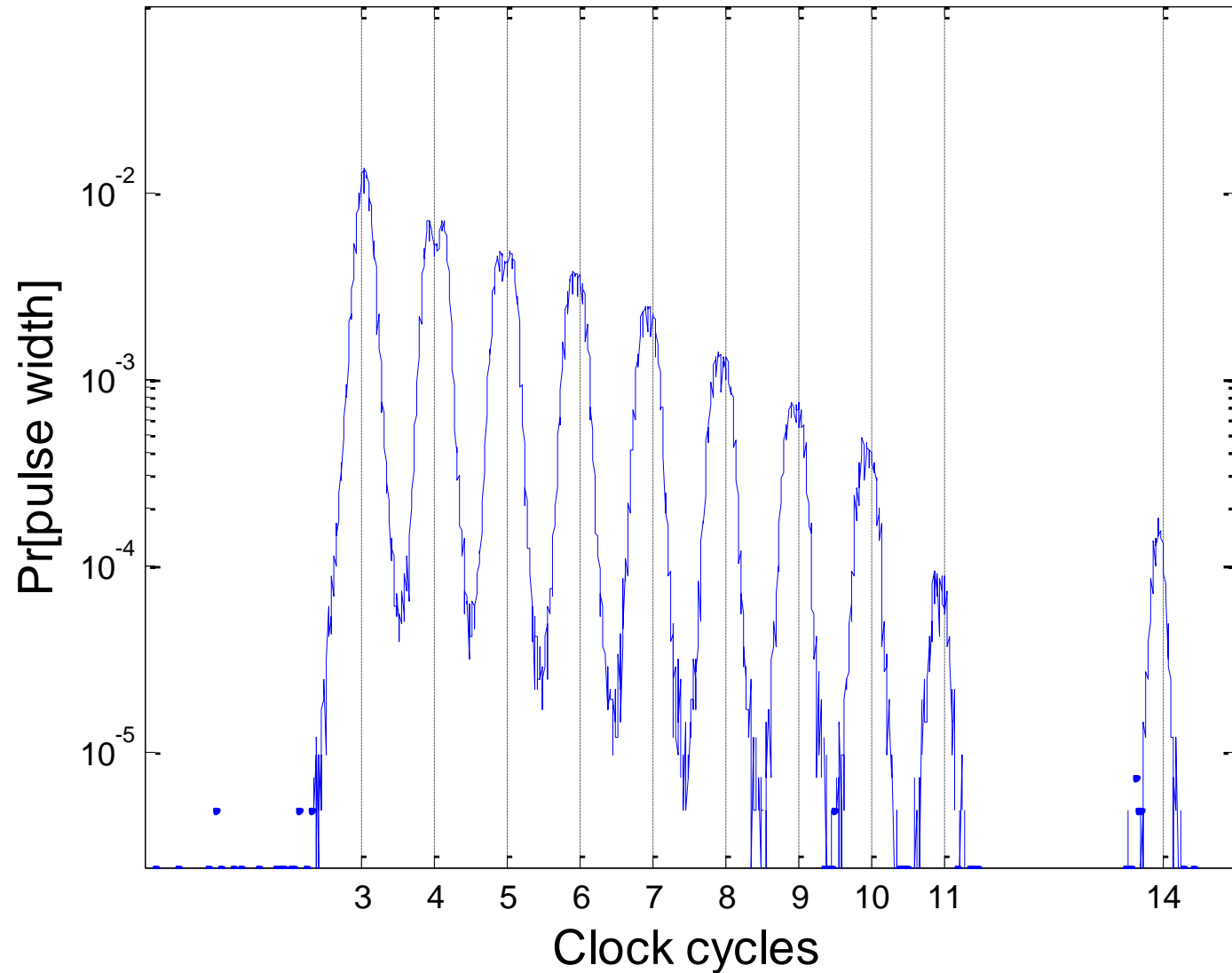
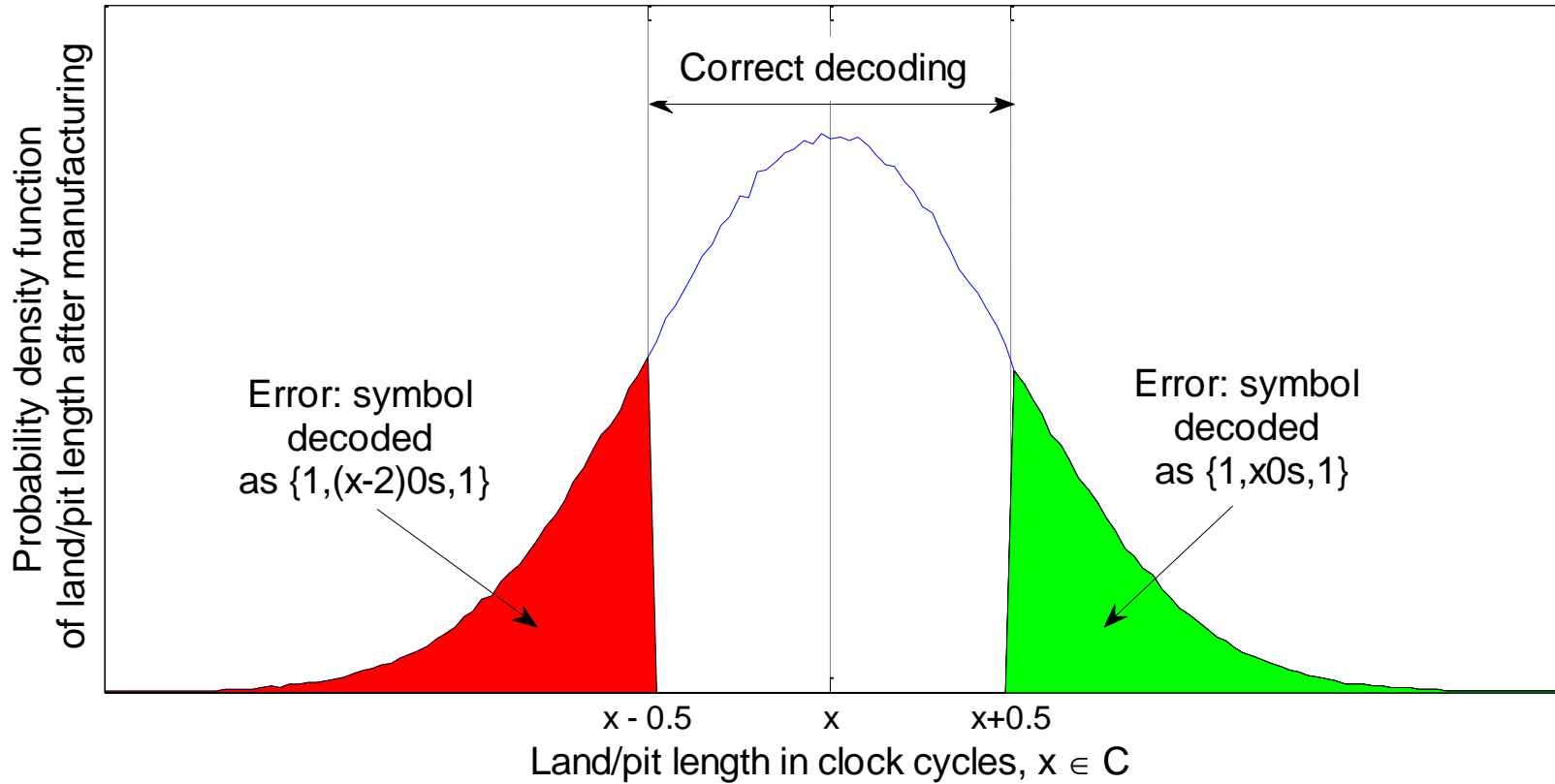


Figure B.2 - Example of a device for the measurement of birefringence

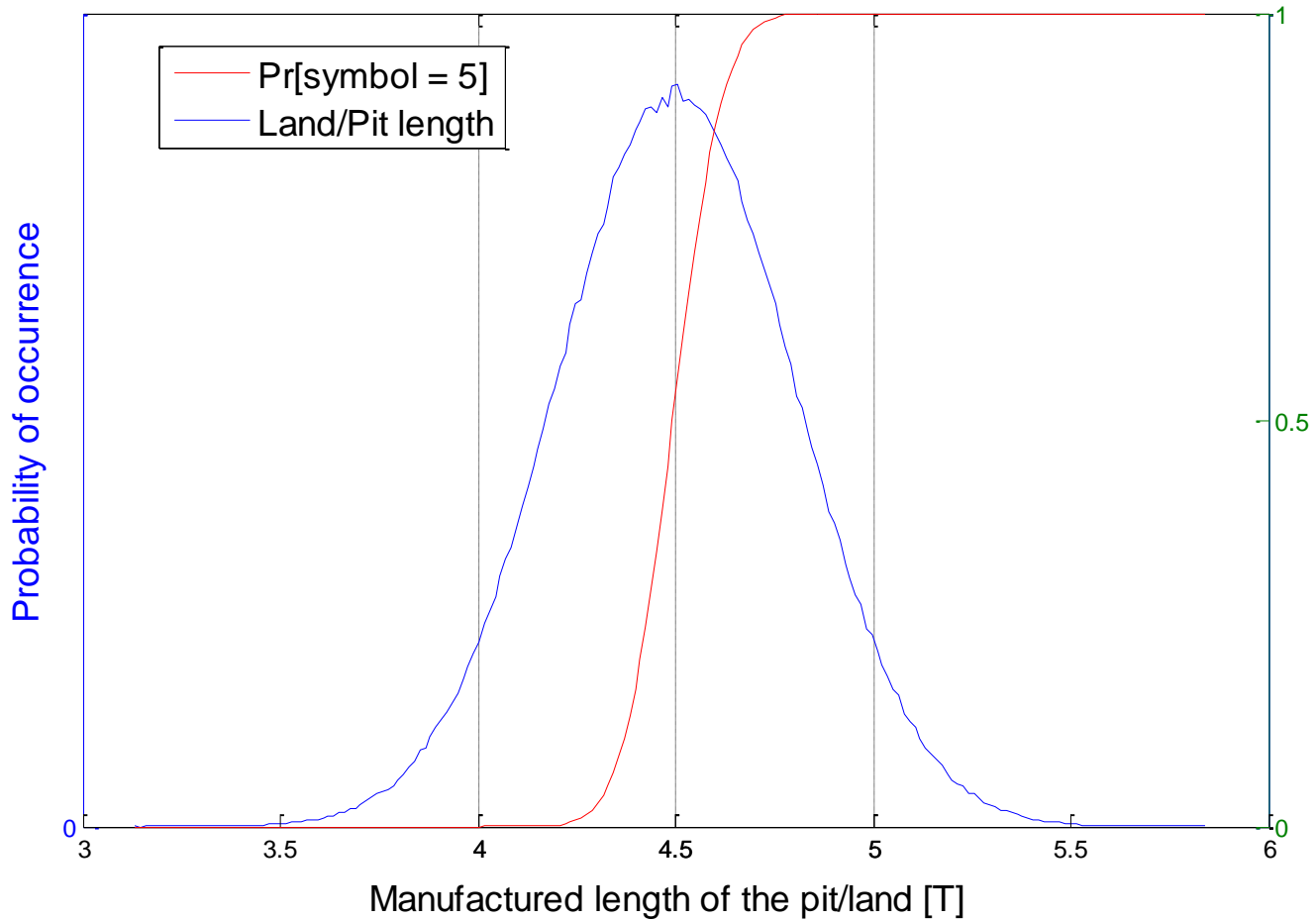
Pit/Gap Length



Expected Decoding



The Trick



The Trick

- Print K $x + 0.5$ half-cycle lands/pits
- Read this area L times
- Record how many times you've read an x
- Readout in $\{0, \dots, L\}^K$
- Two types of artifacts, e.g.,
 - Deterministic: $\left\{0, \dots, \frac{L}{3}\right\} \cup \left\{\frac{2L}{3}, \dots, L\right\}$
 - Probabilistic: $\left\{\frac{L}{3} + 1, \dots, \frac{2L}{3} - 1\right\}$
- Fingerprint = binary vector cardinality- K

Summary

- Anti-counterfeiting for optical media
- Cost
 - DVD, BluRay – negative if you get rid of holograms
 - DVD-R – zero
- Changed player – only software
- False positives/negatives negligible
- Simple
- Work in progress

Acknowledgments

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- **3DCD**, Technicolor, USA
- Dr. Paul Liao, **Panasonic USA Research**
- **Panasonic, Japan**
- Jared Feldner, **LeCroy**
- Hiroo Umeno and June Dorris, **XBOX**
- Gary Starkweather, David Heckerman, Yacov Yacobi, Jim Kajiya, Turner Whitted, Mike Sinclair, Gideon Yuval, Josh Benaloh, YuQun Chen, all **MSR**