

Ecma/GA/2004/51

The Challenge of Breaking the 1 Terabyte Small Form Factor, Removable Media Barrier

Yoshio Aoki
President and CEO

OPTWARE

The Technology Advantage

DO WE NEED MORE CAPACITY ?

- In 2002, around 500 million optical drives and 13 billion disks were sold.
- In 2002, approx. 5 Exa-bytes (1EB = 10^{18} bytes) of unique information per year were produced, equivalent to 800 megabytes for every man, woman, and child on earth.
- Digital storage requirements growing at roughly 100% per annum; Development towards an all digital era.

Presented by THOMSON at the Photonics Europe 2004 conference in Strasbourg, 2004 April

YES !

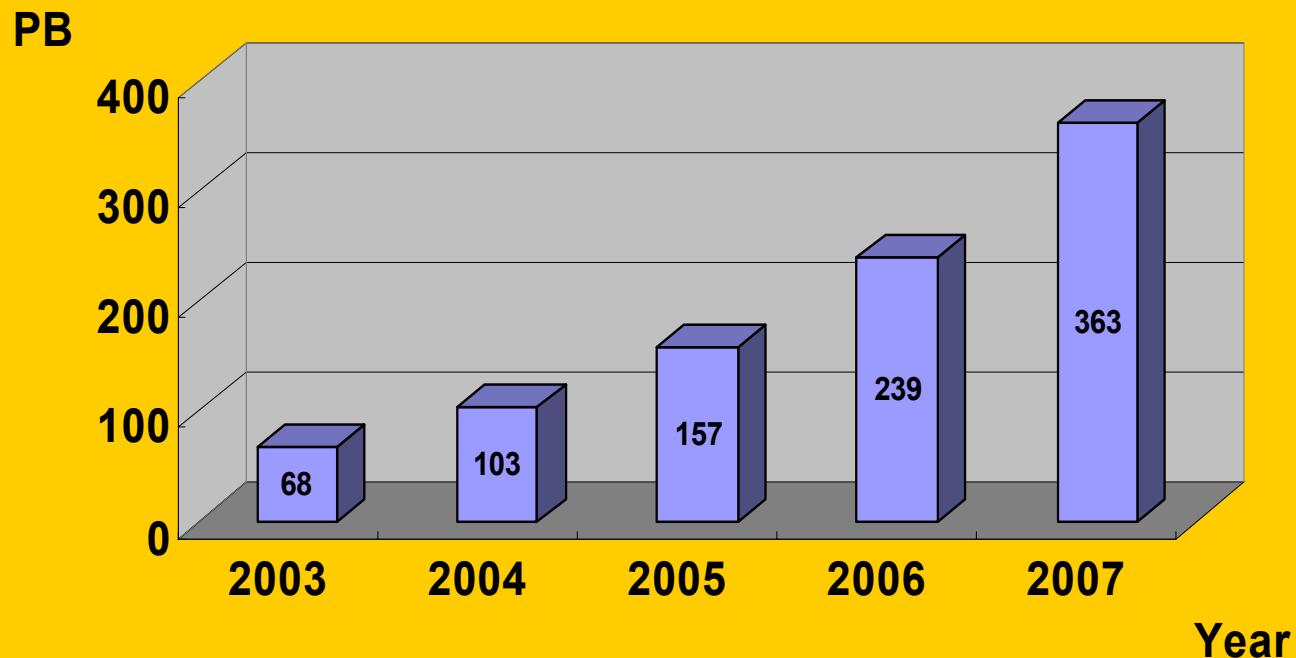
Mass Data Storage

- Healthcare (including Medical Imaging)
- Gas & Oil Exploration
- Pharmaceutical

MANY MASS STORAGE APPLICATIONS
INVOLVE DATA ARCHIVING and PREFER WORM

- **GE Healthcare**
- **Philips Medical**
- **3M Health Information Systems**
- **Siemens Medical**
- **McKesson Corp.**
- **Capgemini**

Digitized Data in Healthcare Industry www.healthcare-information.com (Sep. 2003)



Source: www.healthcare-information.com
McGraw Hill Company (Sep. 2003)

Medical Images

- *CAT scan: 40MB*
- *Digital X-ray: 60MB*
- *Multislice CAT scan: 500MB*
- *Cardiac video: 3GB*
- *University of Pittsburgh Medical Center*
 - One million diagnosis per year which require imaging

Agfa originally set a goal to sell 600TB of storage capacity to its clients in 2003 as part of its health-care business. It reached that target in June.

George Cervenka, technical marketing manager, Agfa USA

- **Schlumberger**
- **Shell Oil**
- **Texaco**
- **Belco Oil & Gas**
- **Gulf Oil**
- **British Petroleum**

Pharmaceuticals

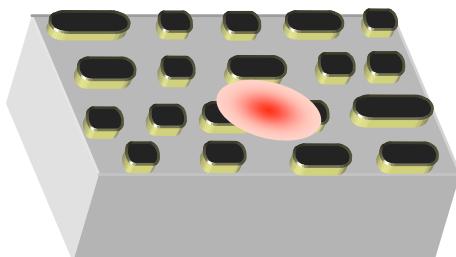
- Pfizer (US)
- Glaxo Smith Kline (UK)
- Sanofi-Synthélabo (France)
- Roche (Switzerland)
- Bayer (Germany)
- Bristol-Meyer (US) : 300TB~500TB/year

Other Markets

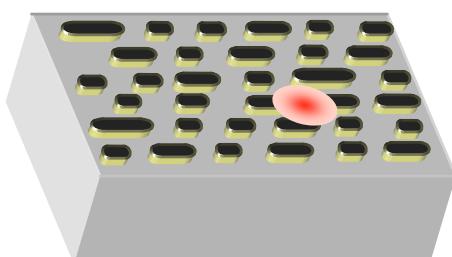
- ***Bioinformatics/Proteomics***
- ***Homeland Security***
- ***Arial Imaging (Geospatial)***
- ***Simulation & Modeling***
- ***Animation***
- ***Video Gaming***
- ***Broadcasting***

Optical Disc Technology

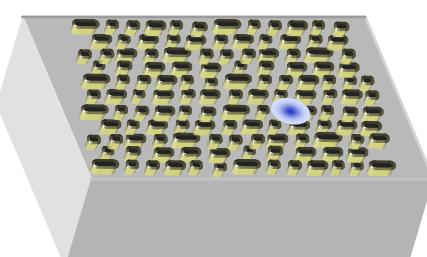
0,7 GB



9 GB

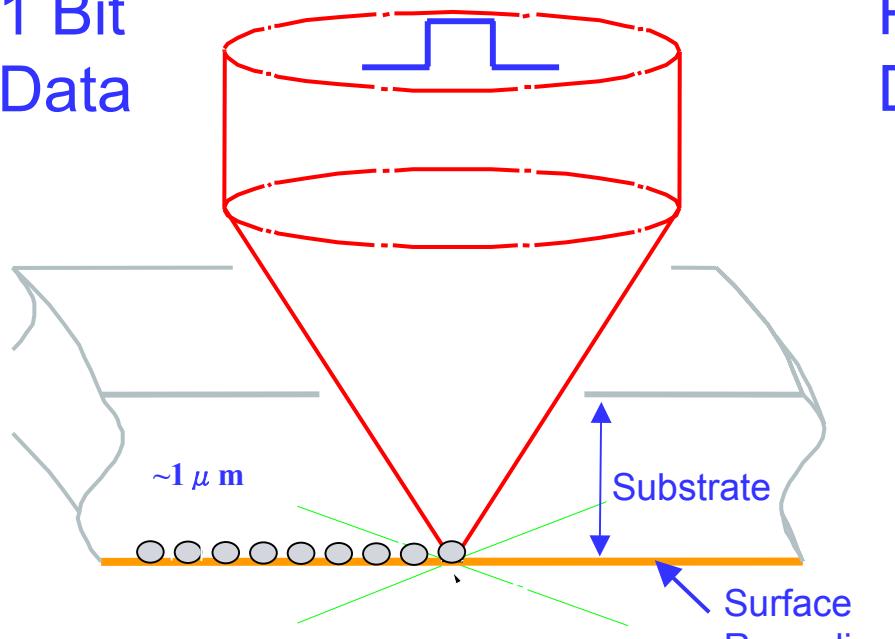


30~50 GB



What is next ?

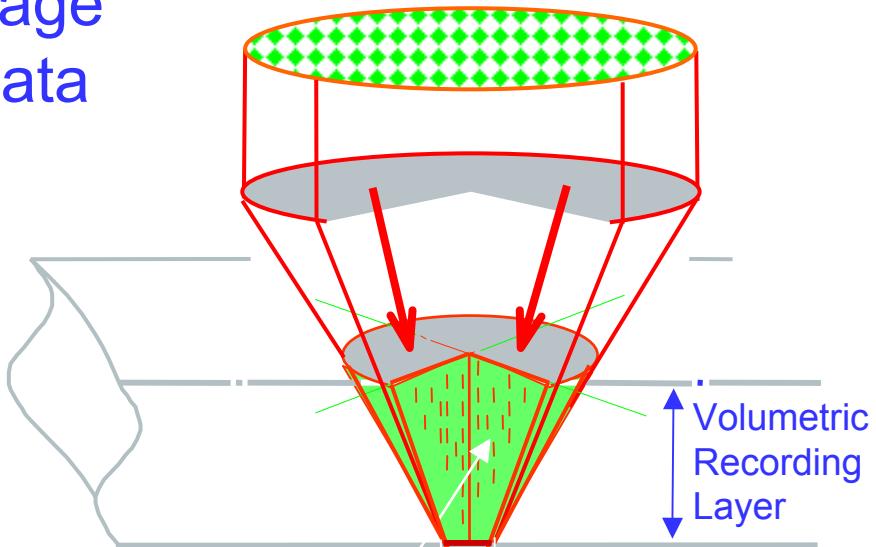
1 Bit
Data



Data are recorded on to the surface as bit by bit in CD/DVD System

Conventional Optical Disc

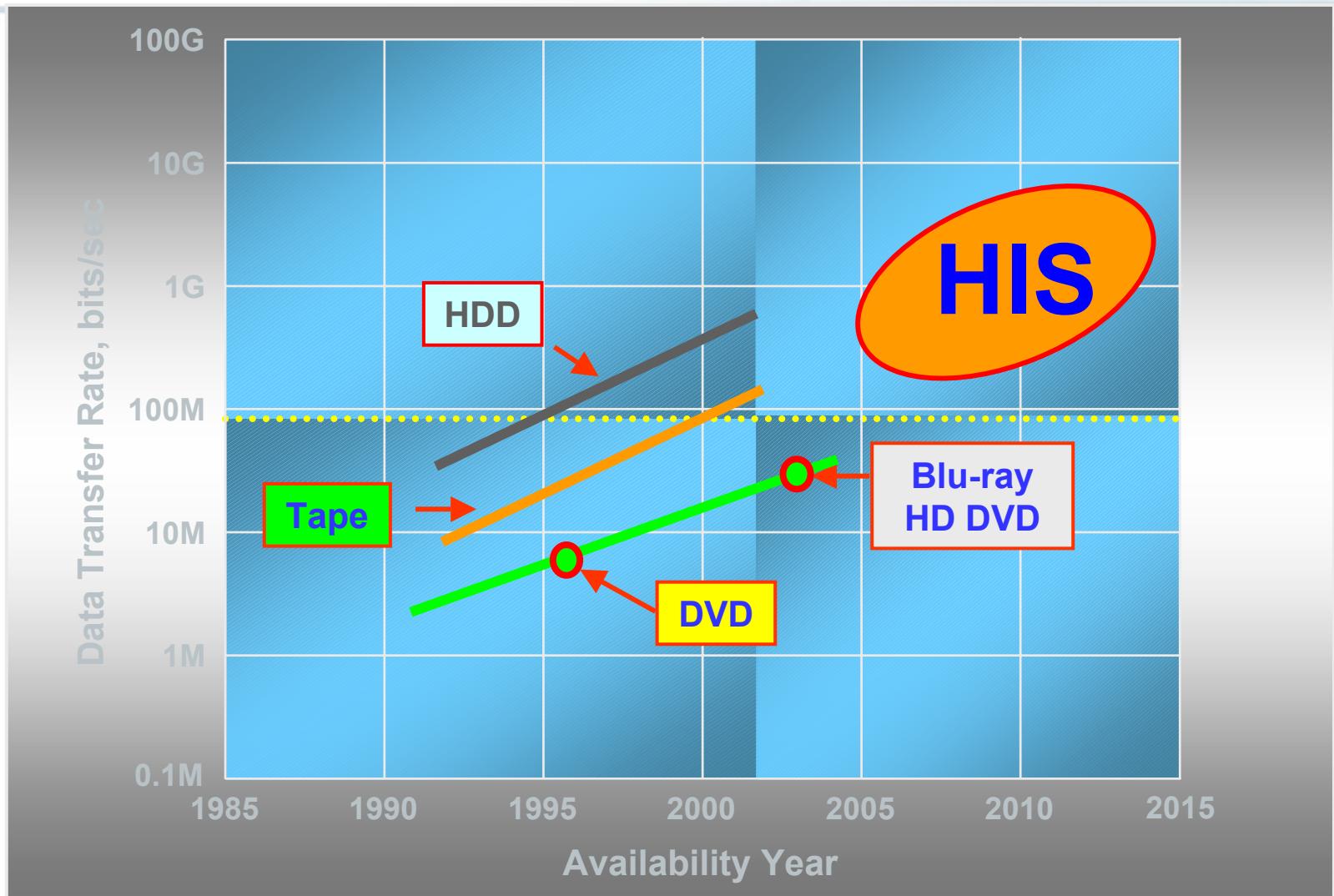
Page
Data



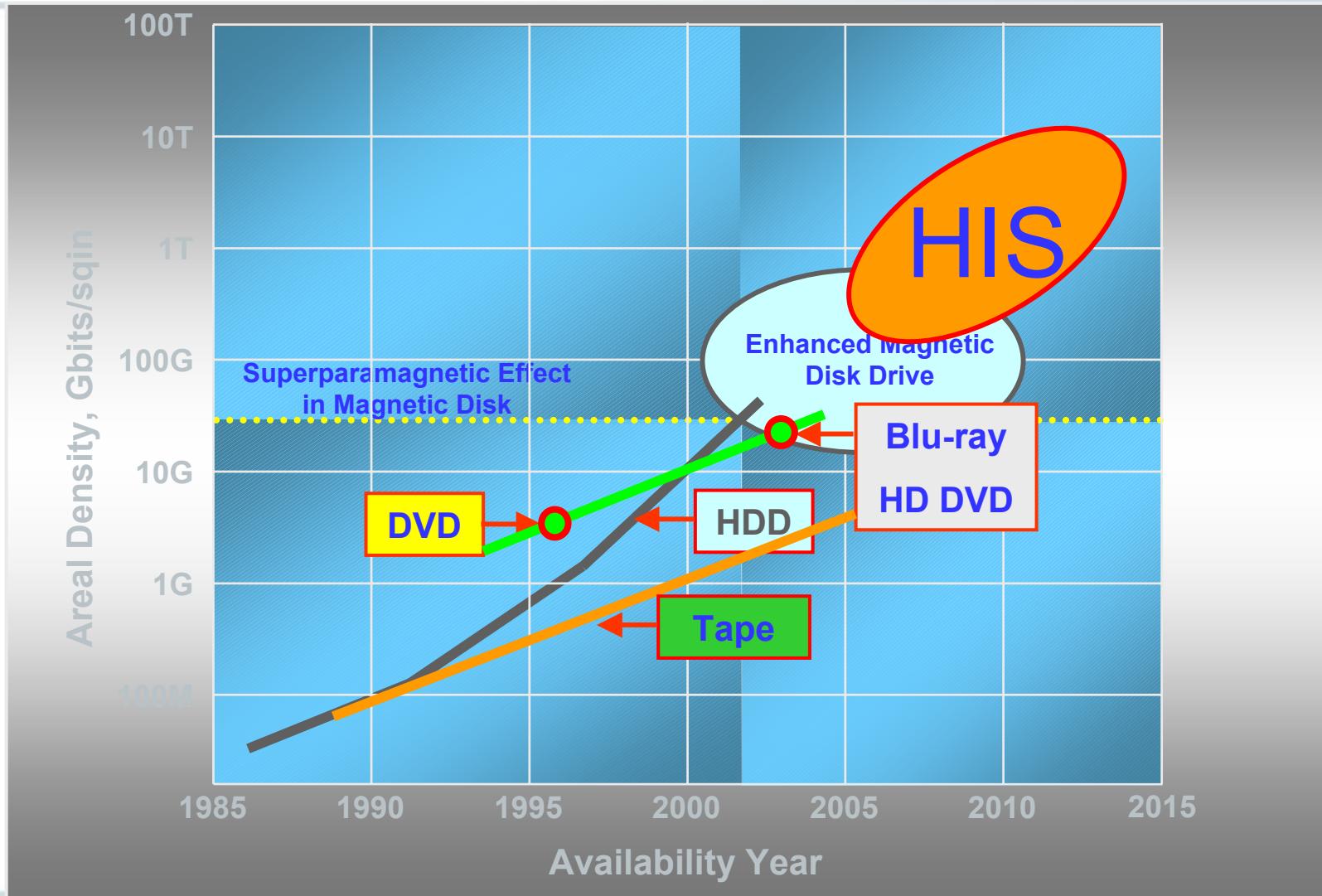
Page data are recorded into the volumetric recording layer in Holographic recording

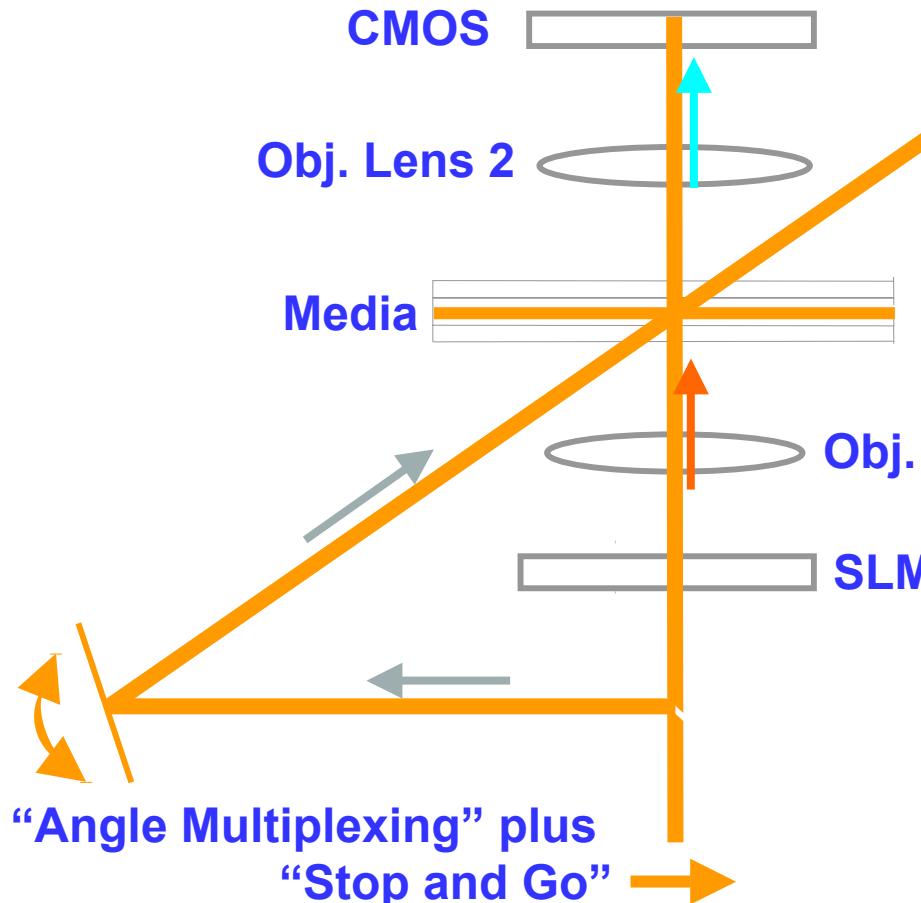
HVD™

Data Transfer Rate

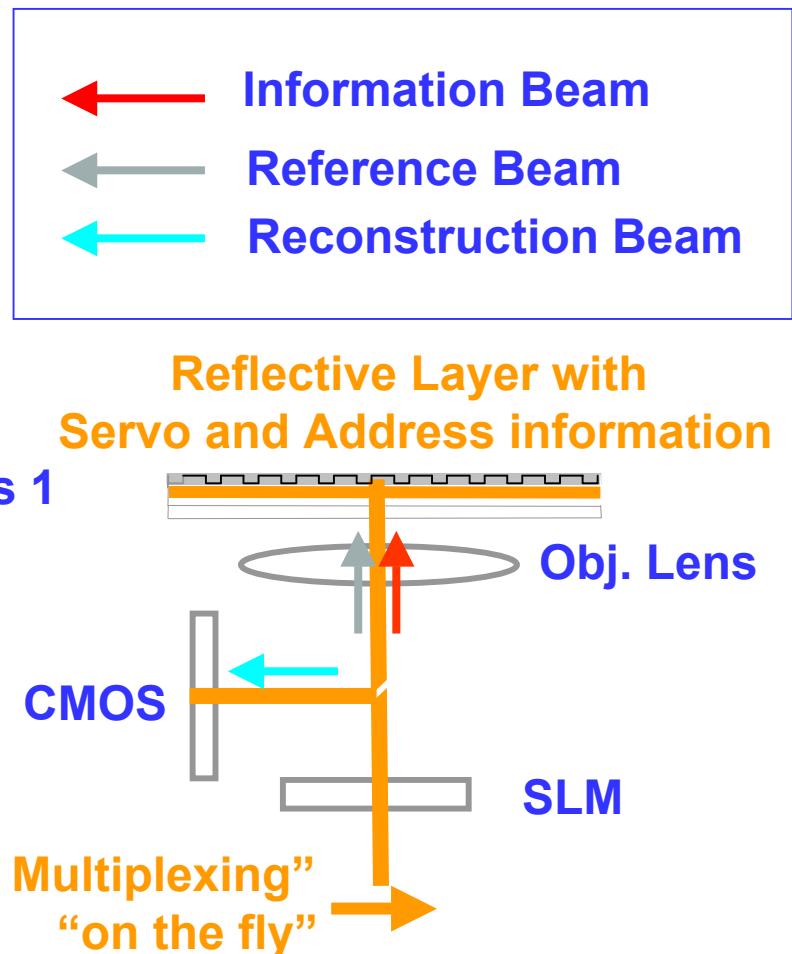


Areal Density



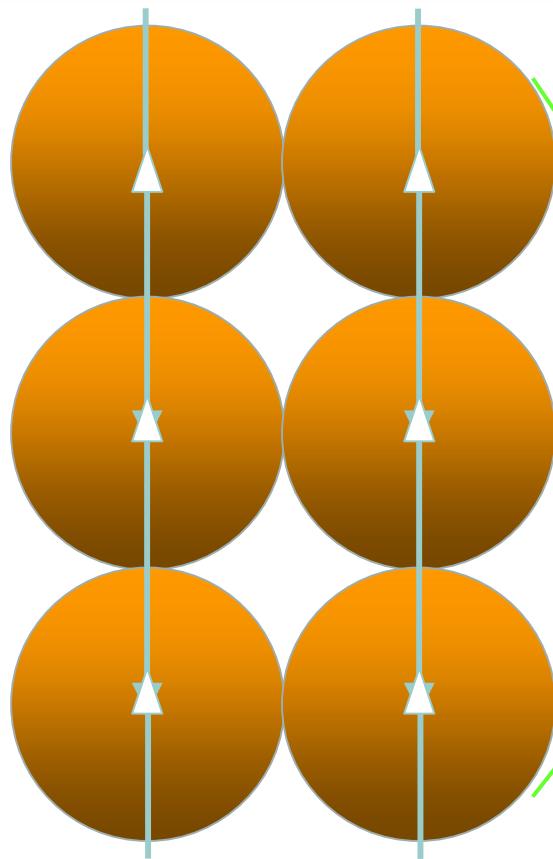


Conventional Holography



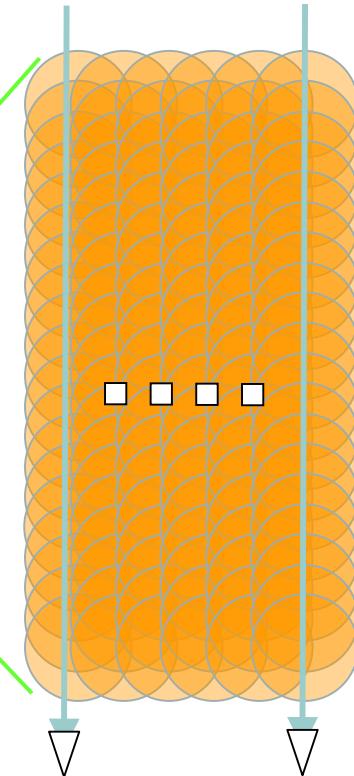
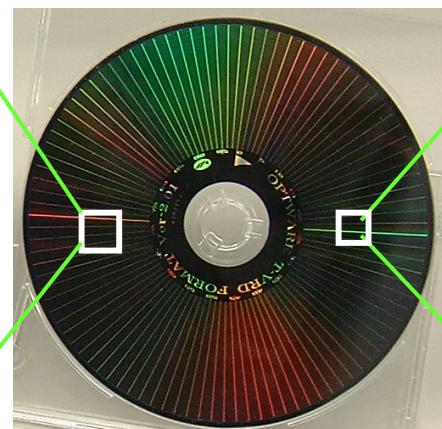
Collinear Holography

	Collinear™	Conventional
• Two beam configuration	Co-axially aligned (simple)	Off-axially aligned (complex)
• Disc type	Reflective	Transmission
• Optical servo	Focus & Tracking	None
• Read/Write	Continuous	Stop and Go
• Optics	Compact	Bulky
• Disc Tilt margin	Reasonably large	Almost none (Disc must be flat)



◀ “Stop and Go”

Conventional Holography

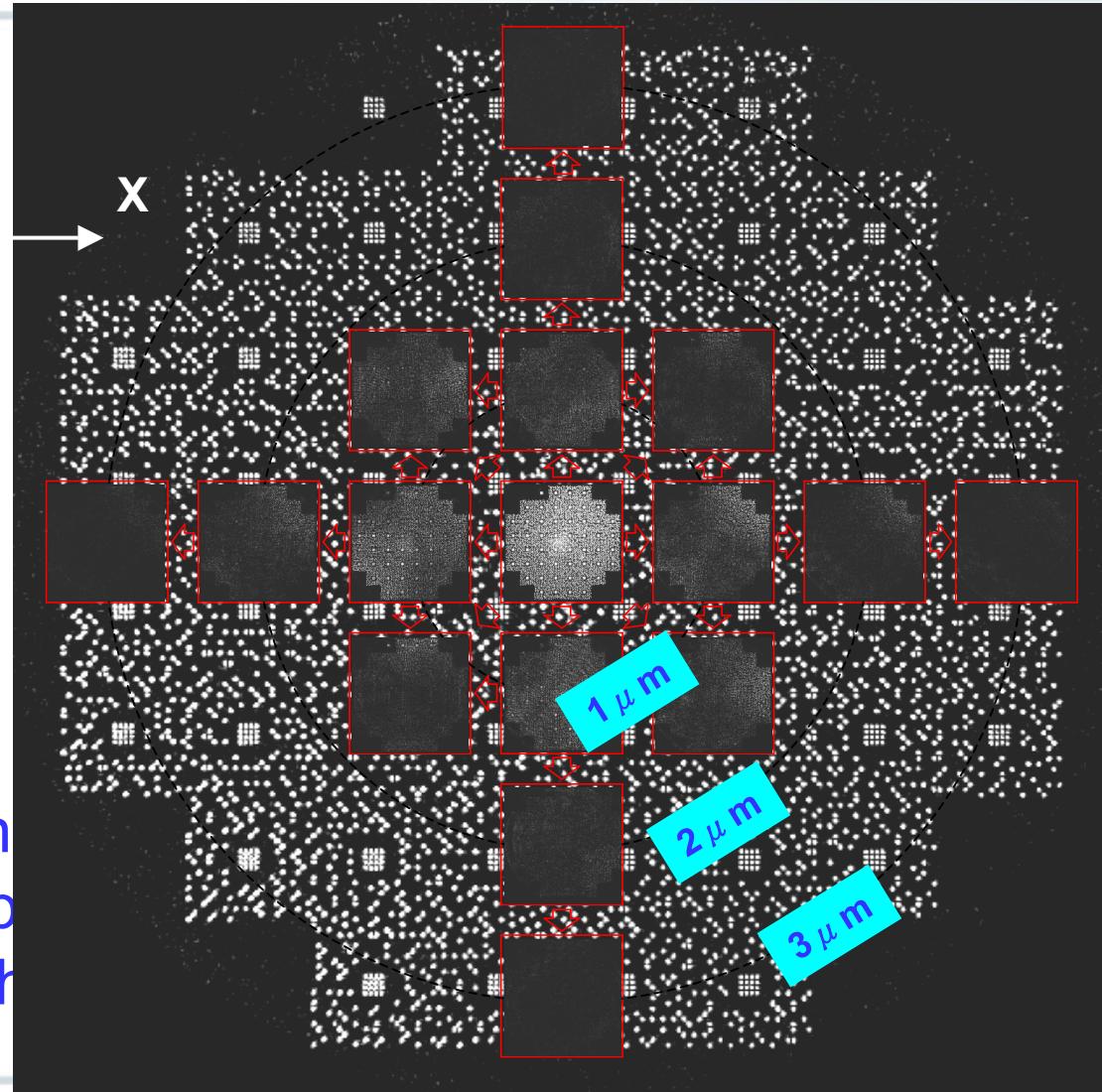


“On the Fly”

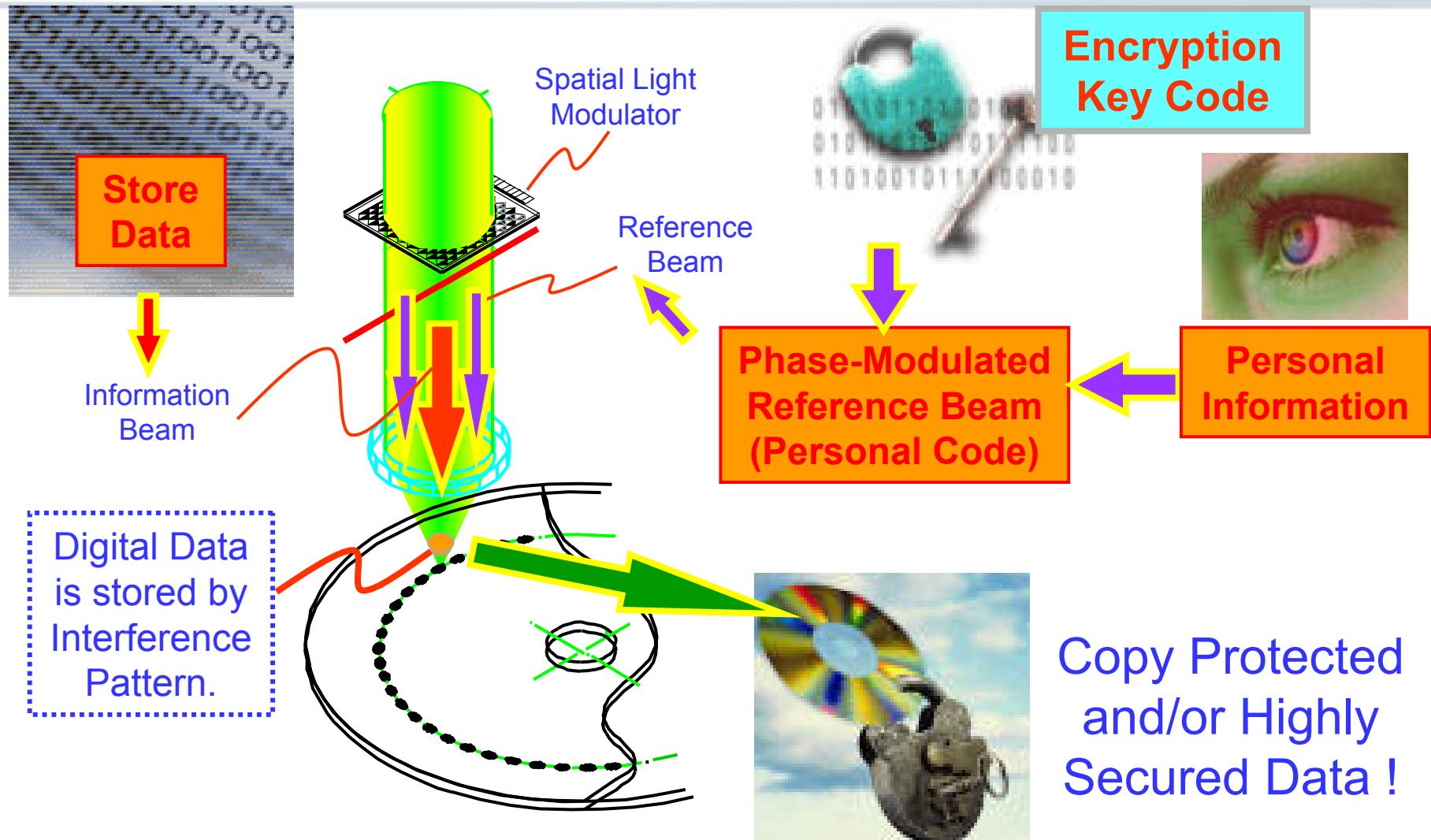
Collinear Holography

Shift Characteristics

Shift multiplexing
read/write can be
done at 3μ pitch



Holographic Data Security



WHY STANDARDIZE HOLOGRAPHIC INFORMATION STORAGE

- *Currently numerous enterprises - small, medium and very large - are developing and commercializing Holographic Information Storage (HIS) products, with first products are planned for market introduction next year (2005) and are currently undergoing testing.*
- *Because many of the applications for these products require the portability of stored information between information processing systems and across multiple platforms, the information stored by holographic means, on dynamic and/or static mediums, must be both removable and interchangeable.*
- *The important task of finalizing certain design features for Holographic Information Storage products, which assure portability and interchangeability, and simultaneously evolving industry-wide consensus for those design features, is best accomplished through the structured process of formal standardization involving critical and focused peer review and finalization.*

WHO ARE SOME OF THE CURRENT PLAYERS (1)

Fuji Photo Film

Imation

Toshiba

Konica-Minolta

Matsushita/Panasonic

Memory-Tech

Micron

Mitsubishi Chemical

Nippon Paint

OPTWARE

PulseTec

Sony

Toagosei

Mitsui Chemical

TDK

THOMSON

NHK Multi-Media

Nippon Television Network

Tokyo Broadcasting System

Fuji Television Network

TV Asahi Corporation

TV Tokyo Corporation

Warner Bros.

Disney

Universal

Pioneer

Sanyo

JVC

NEC

InPhase Technologies

Maxell

Aprilis

HOLOGRAPHIC INFORMATION STORAGE

WHO ARE SOME OF THE CURRENT PLAYERS (2)

Deutsche Thomson-Brandt GmbH

CEA-LETI

Moulage Plastique de l'Ouest

Optimal Optik

Toptica Photonics AG

RWTH Aachen

Darmstadt University of Technology

Budapest University of Technology and Economics

Technical University Berlin

Jenoptik LOS GmbH

Université d' Angers

Universita Politecnica delle Marche

University of Technology and Economy Budapest