

The Premier Advanced Recording Technology Forum

**THIC Inc.**

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## **Holographic technology and product development update**

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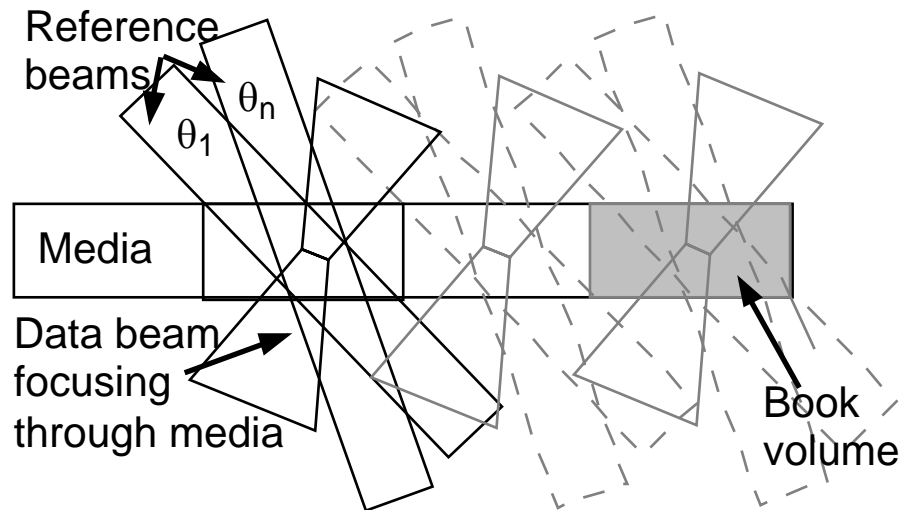
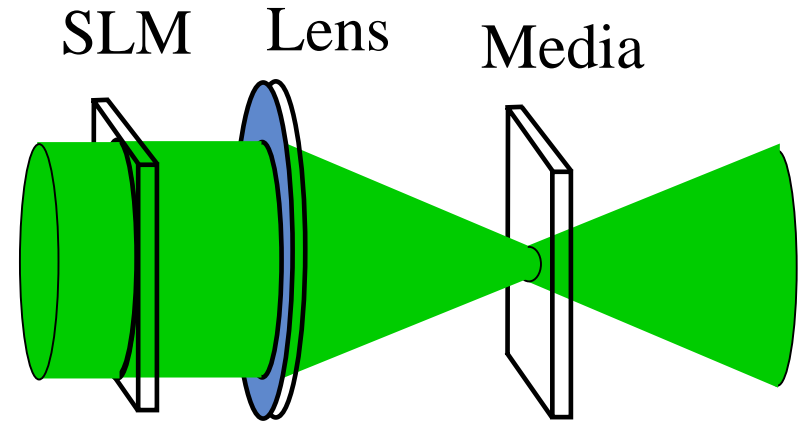
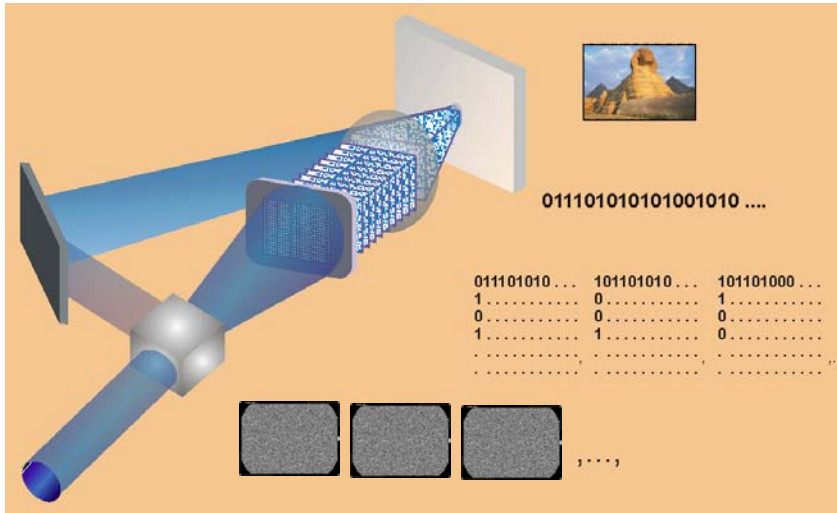
**Presented at the THIC Meeting at the National Center for  
Atmospheric Research, 1850 Table Mesa Drive, Boulder CO  
80305-5602**

**June 29-30, 2004**

## Agenda

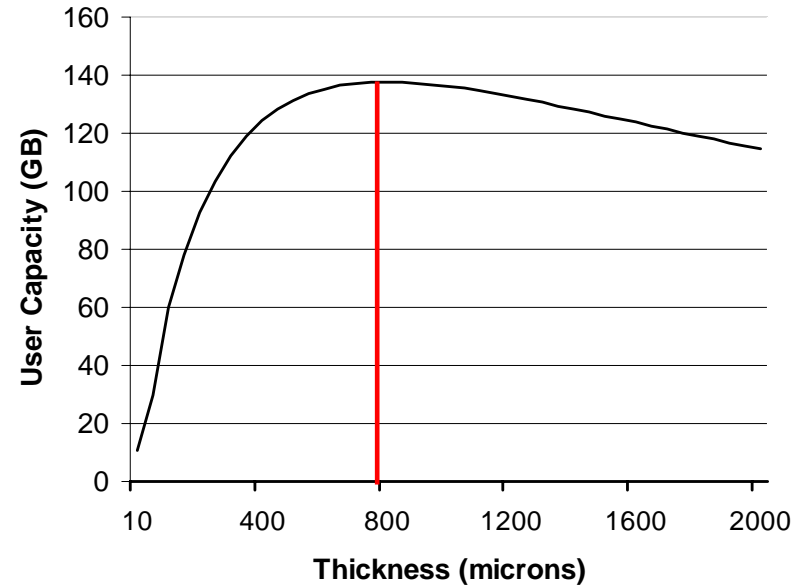
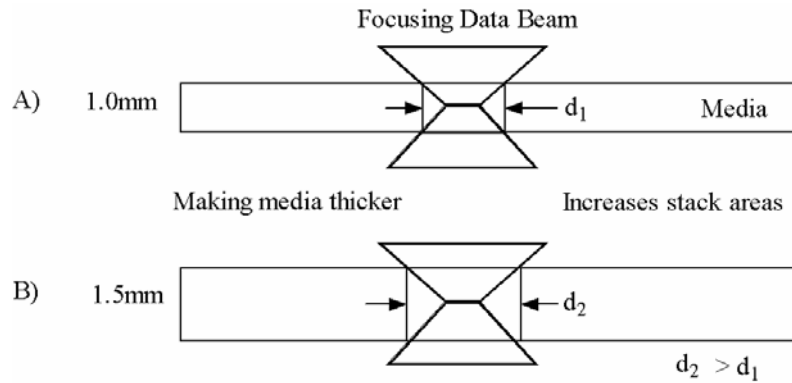
- Technology update
  - Polytopic filter
  - Phase Conjugation architecture
  - Technology roadmap
- Product development update
  - Drive development program status
  - Product road map
  - Product specifications and form factors
  - Partners and potential users

## **Technology update**

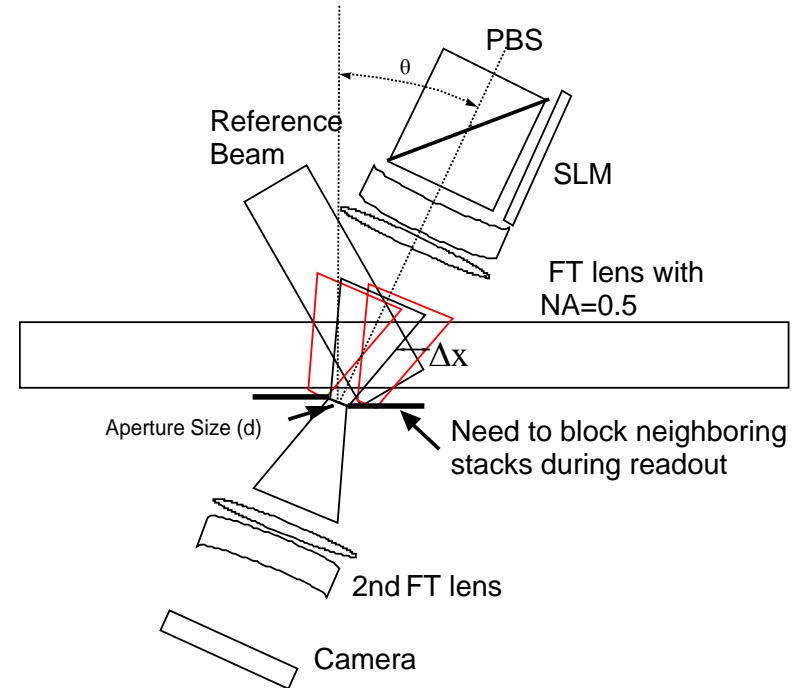
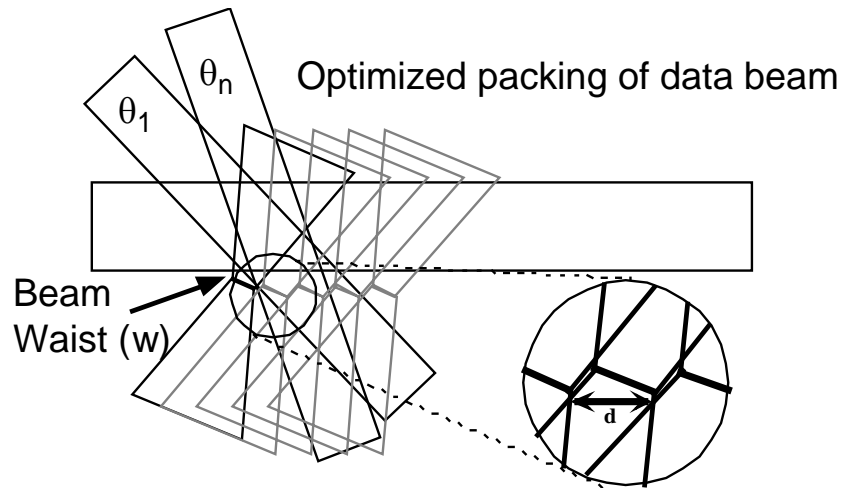




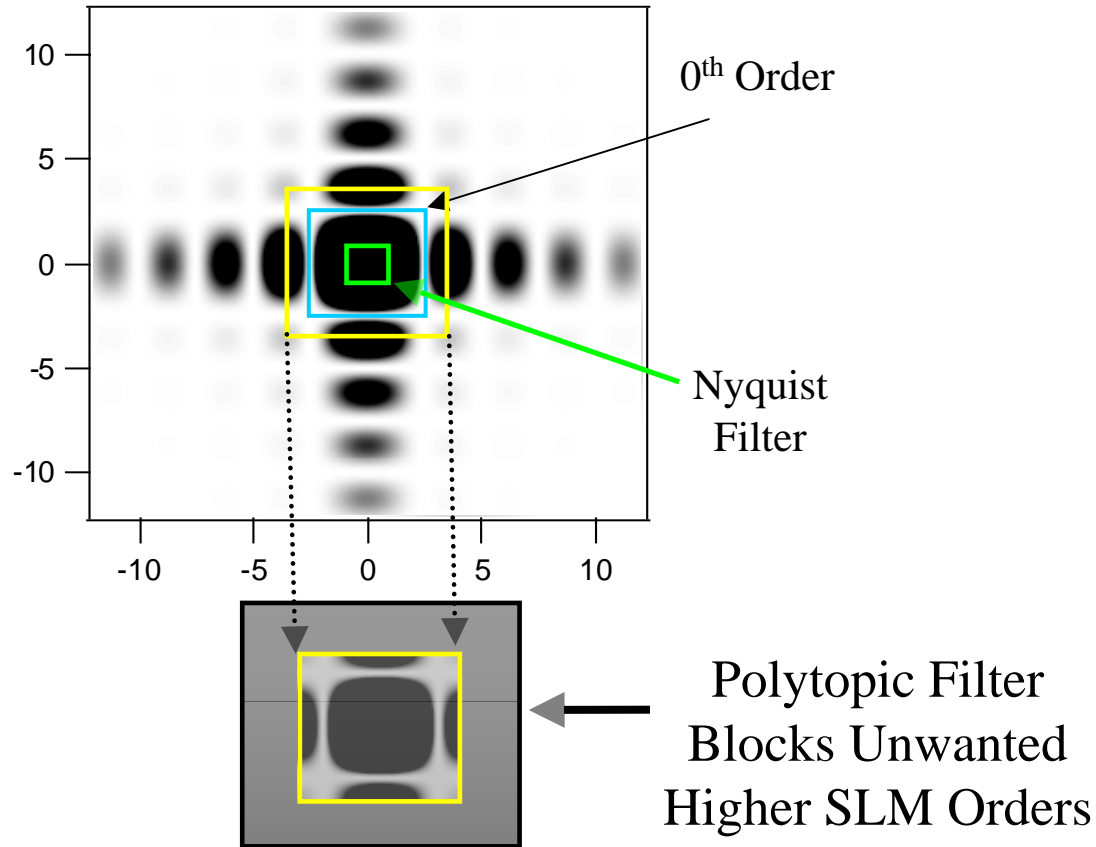
### Geometrical storage limit



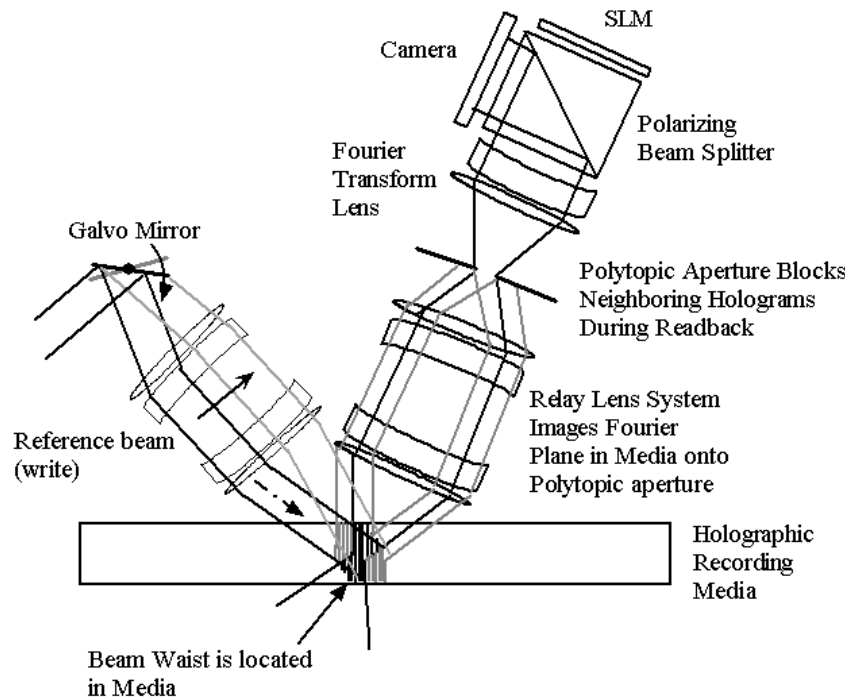
“Three-dimensional holographic disks” (H.-Y. S. Li and D. Psaltis) in Appl. Opt. vol 33, pp 3764-3774 (1994)



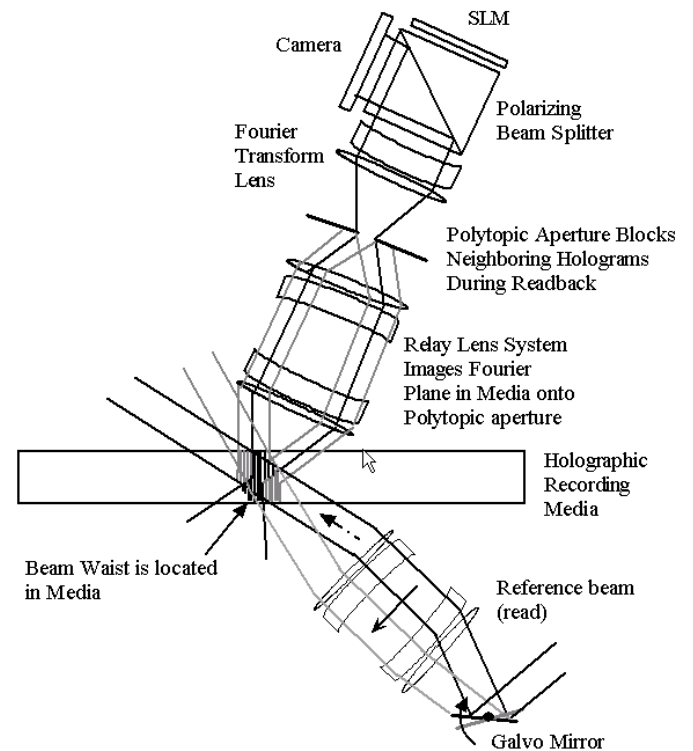
**At the Fourier/Focus  
plane of SLM**



**Write**

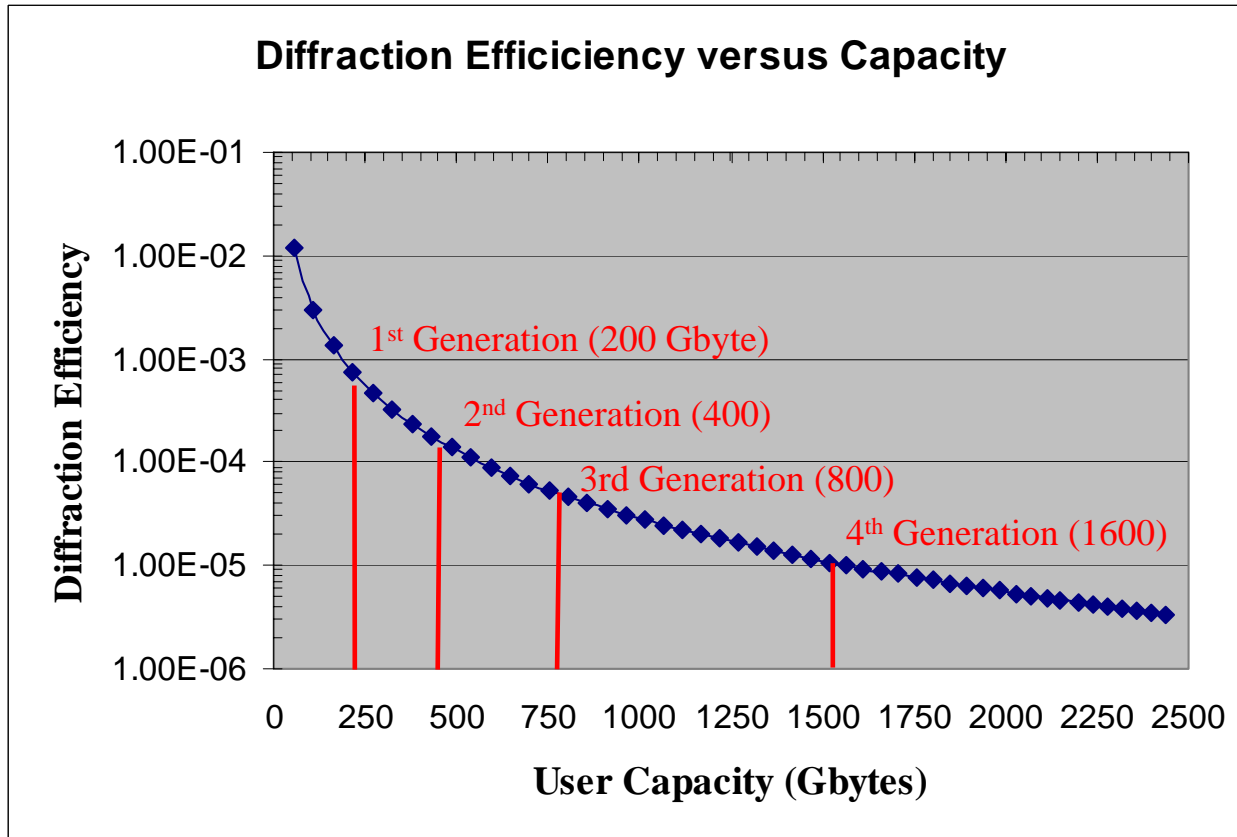


**Read**





# Balancing Capacity and Diffraction Efficiency: Polytopic



Areas of improvements  
To go from  
200GB to 1.6 TB

1. M#
2. Detector Sensitivity
3. Increase Laser Power

\*Assumes Current Media M#  
of 6 per 200um @ 1.5mm thick, FT plane in media

	<b>Current</b>	<b>P1</b>	<b>P2</b>	<b>P3</b>	<b>P4</b>
<b>Specs</b>	80GB (80Gb/in <sup>2</sup> )	200 GB 20 MB/s	400 GB 40 MB/s	800 GB 80 MB/s	1600 Gb/in <sup>2</sup> 120 MB/s
<b># of pages per book</b>	100	96	162	325	662
<b>Reference Beam Sweep (degrees)</b>	16	7	12	24.5	25
<b>Hologram pitch (<math>\theta</math>, r) (mm)</b>	1.0x0.9	0.82, 0.48	0.82, 0.48	0.82, 0.48	0.82, 0.48
<b>Nyquist filter / Beam Waist area</b>	1.2x	1.2x	1.2x	1.2x	1.2x
<b>NA of object beam</b>	<b>0.45</b>	<b>0.6</b>	<b>0.6</b>	<b>0.6</b>	<b>0.6</b>
<b>Bragg Null</b>	3-4 <sup>th</sup>	2nd	2nd	2nd	1st
<b>SLM/Camera Pixels</b>	1280x1024	1280x1024	1280x1280	1280x1280	1280x1280
<b>Wavelength (nm)</b>	532	407	407	407	407

### Angle and Polytopic Multiplexing

## **Product development update**

## Drive development program status

- Currently we are about half way to developing a prototype holographic storage drive.
- The prototype will use a blue laser, polytopic and Phase Conjugation hardware architecture.
- All hardware/firmware development is currently on schedule.
- We plan to have the prototype fully functional by the end of October 2004.
- We see no “show-stoppers” for completing the prototype on time and no new inventions are required.
- Goal: to ship Customer Qualification Units (CQU’s) by the end of 2005.

Recordable family →



Re-writable family →

Path from 200 GB to 1.6 TB



## ***DRIVE***

- 200 GB Capacity
- 20 MB/s Transfer Rate
- 250 ms avg. seek time
- 407 nm Laser
- 1.3 megabits/page
- BER  $<10^{-15}$
- 100K power on hours MTBF

## ***CARTRIDGE MEDIA***

- 130 mm disc
- 3 year shelf life (prior to recording)
- >50 year archive life
- No special handling required
- 5.25" X 6" X .25"

RW-drive backward read compatible with R-media  
R-drive backward read compatible for 4 generations

- ***TeraCart***

- **AM-1450 (Asaca Corp)**

With a storage density of 63.9TB per Square Foot of floor space, the AM1450 will be the highest density random access storage system available in the world.

- **290 TB of Random Access media in a single cabinet**
- **1450 cartridges per cabinet**
- **200GB Tapestry holographic media and multiple drives in the library cabinet**

## Tapestry HDS-200R Drives & Media



- End Users
  - InPhase Video Advisory Board (15 companies)



- Media Manufacturers
  - Maxell
  - Imation



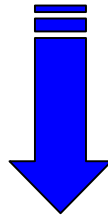
- Drive
  - OMA partner
  - Sony - Blue Lasers (ODS 2004)
  - Alps - Mechanics and Optics



- Media and Test Equipment Sales
  - 15 companies



- **Low cost, secure media**
- **Low cost, lens-less reader**
- **High density, rugged format**
- **High speed, no wear replication**
- **Fast turn-around master recording**



### **Consumer Market Opportunities**

- **Games**
- **Video Distribution**