

## **Leveraging O-MASS Technology for a Multi-Terabyte Removable Media Solution**

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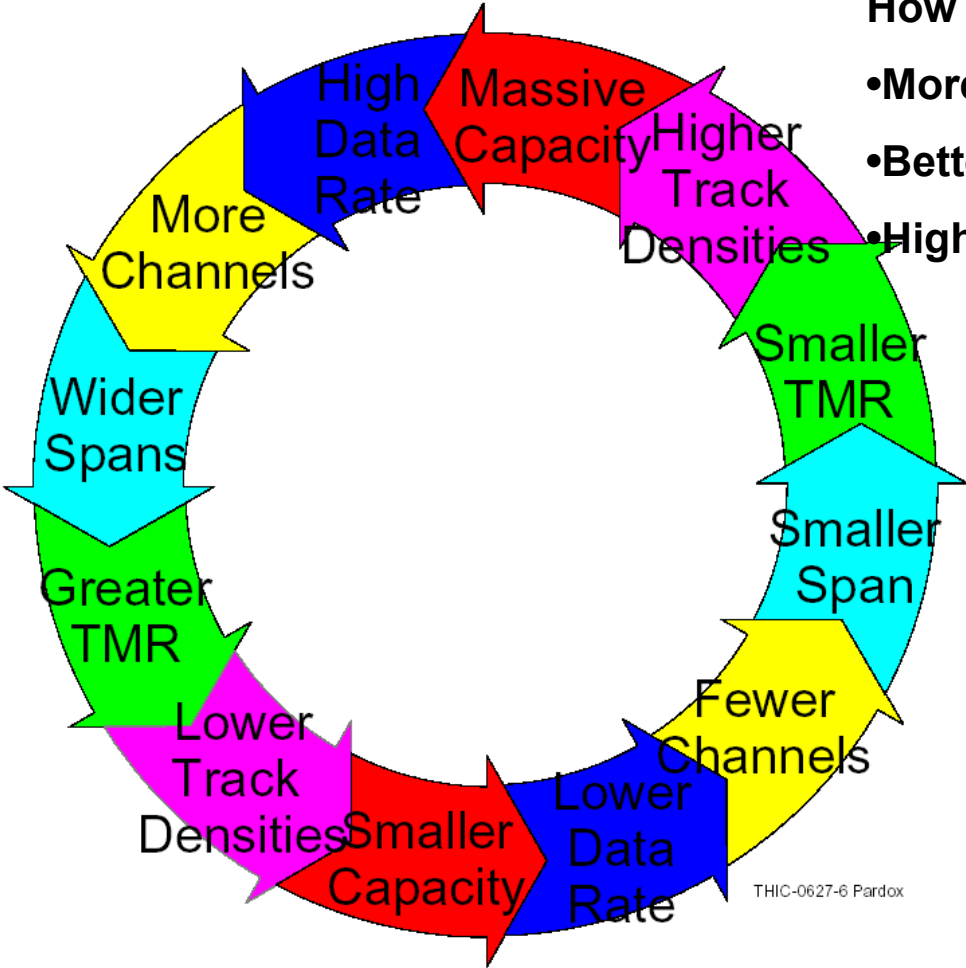
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# Data Rate/Capacity Paradox



How to break this paradox:

- More channels
- Better TMR
- Higher track densities

THIC-0627-6 Paradox

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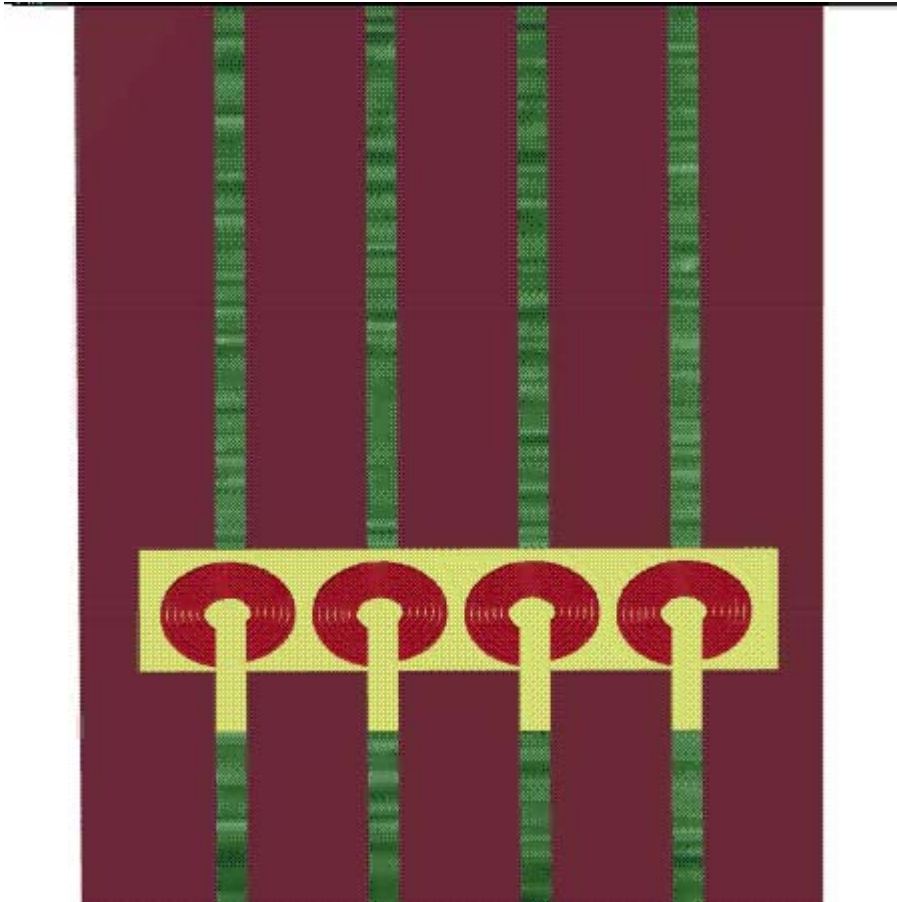


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This slide is from: THIC Jan 18th 2000



## Track Misregistration (TMR) Limitations

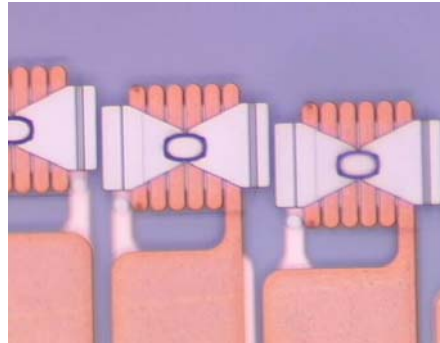


**In current systems the physical track width is 100-200 times the bit length**

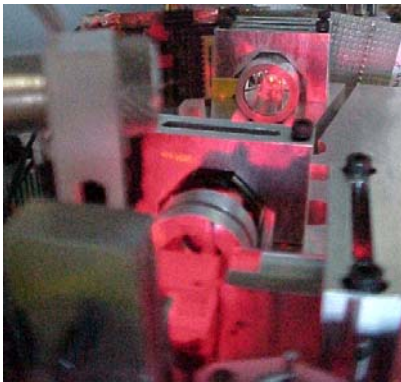
**This is due to thermal and hygroscopic expansion and mechanical instability**

**Current head technology does not allow a small pitch between the head elements**

# O-Mass is Based on Three Technologies



Inductive thin film planar write head



Magneto-Optical and Magneto Resistive Read Head



Tracking Servo

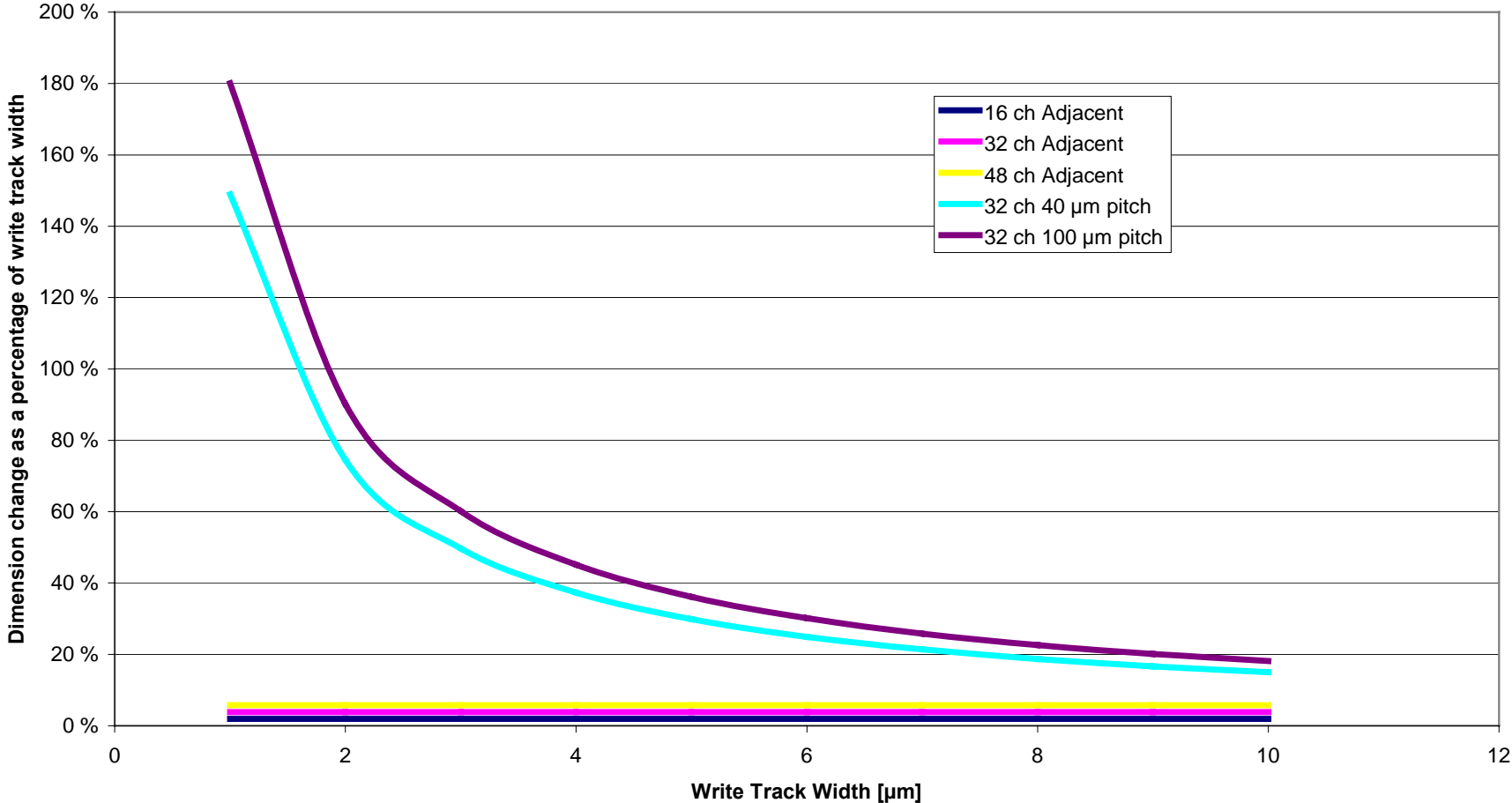
# The Solution is Adjacent Writing and Reading



Very low span enable independence of media stability

### Dimensional Stability as a Function of Track Width

Basic assumption: Media stability 0.0012  $\mu\text{m}/\mu\text{m}$



# High Density Increase the Spacing Loss Sensitivity



At high density the spacing loss become most important.

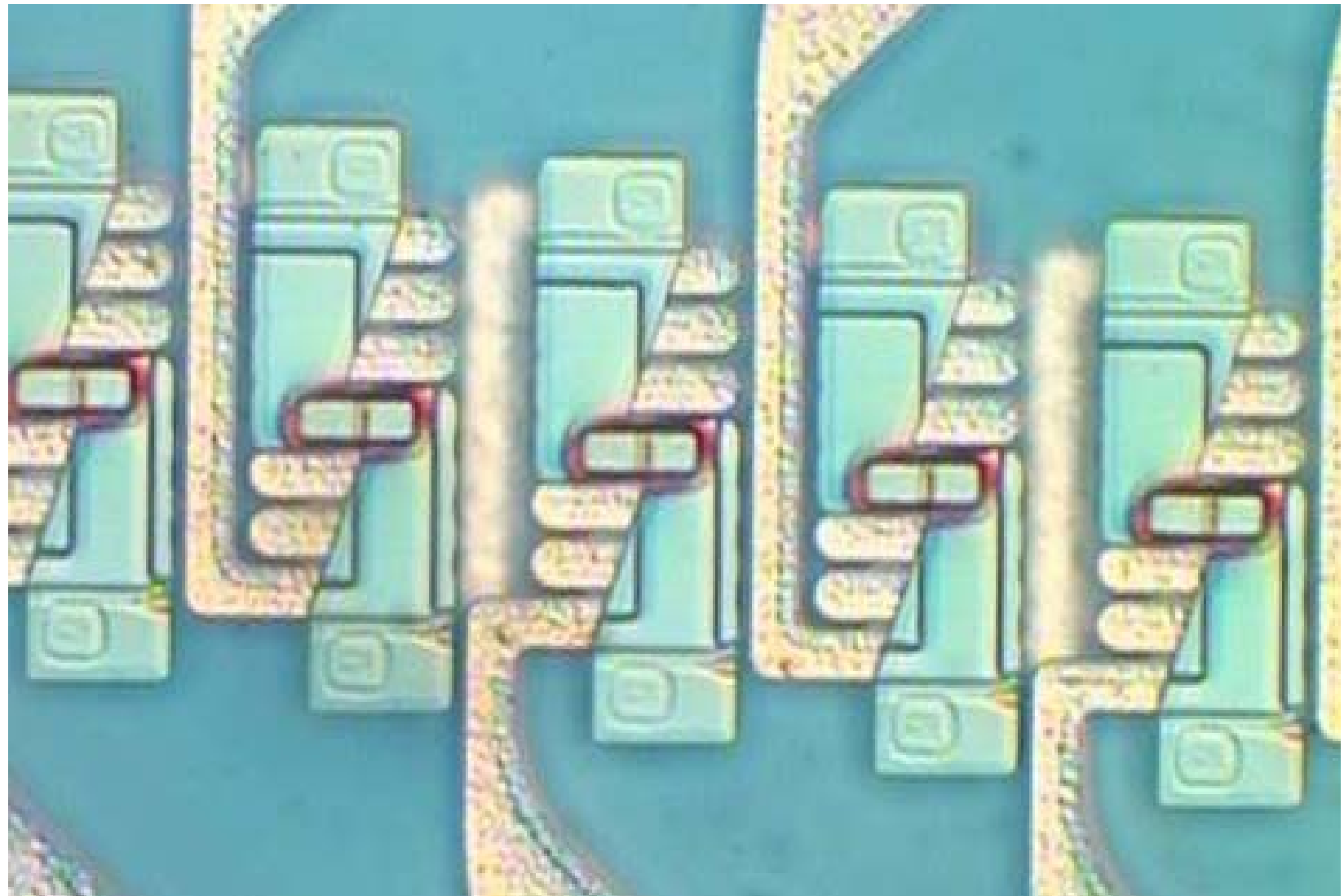
More aggressive roadmap for Increased track density enable less aggressive roadmap for linear density

O-Mass high track density roadmap allows more volume of magnetized media to be “seen” by the read sensor even at same areal density.



Assumption: KBPI=KFCI

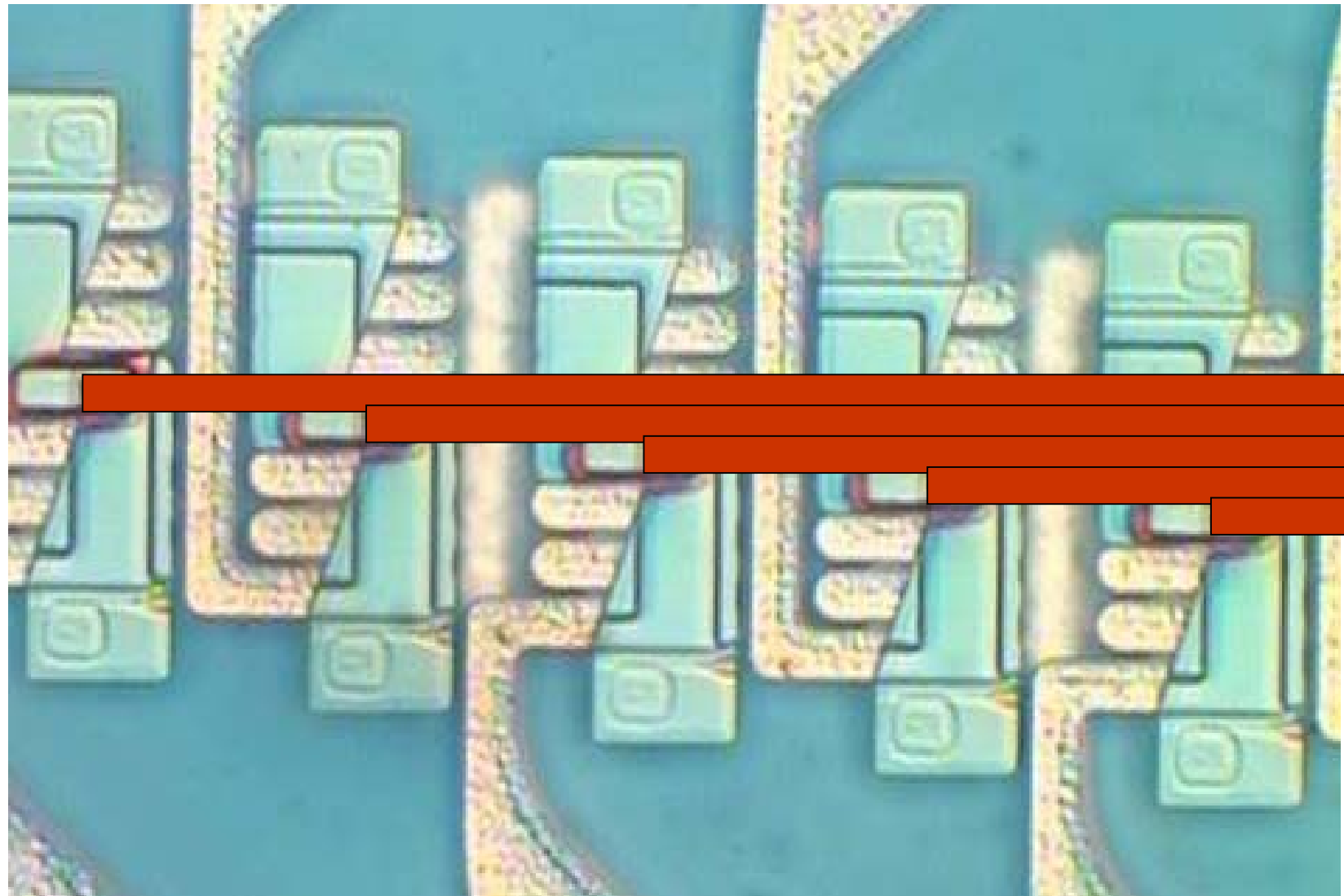
# Write Head Close Up



# Adjacent Reading Reduce the Servo Requirements



All tracks written simultaneously, shaves off nearly 2x PES in write TMR.

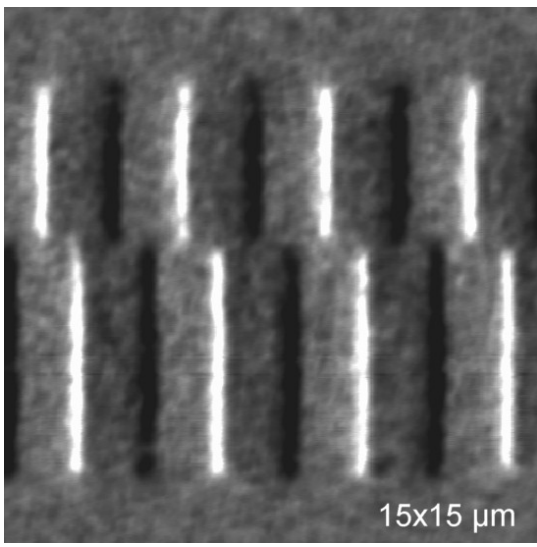
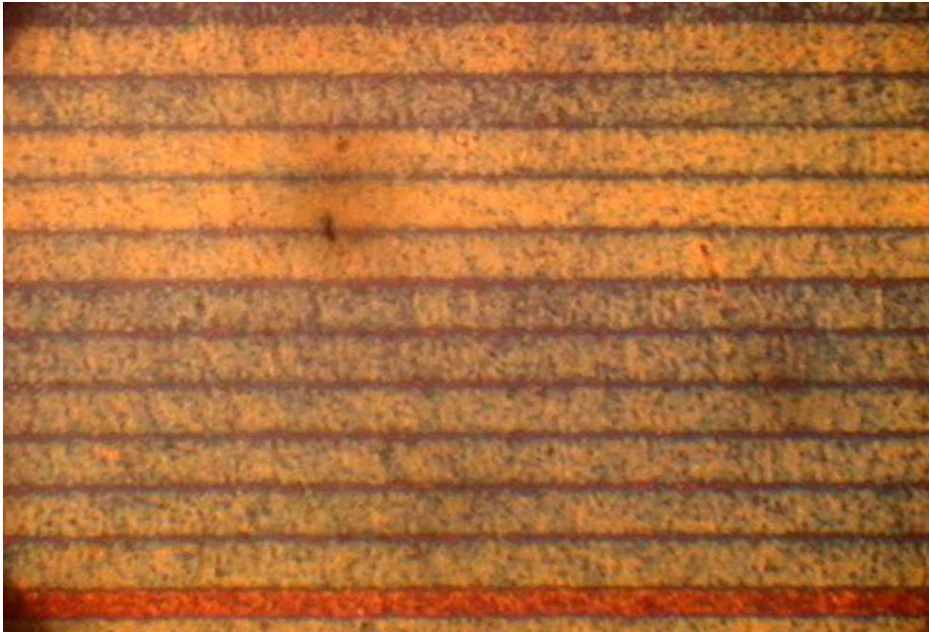




# Track Layout

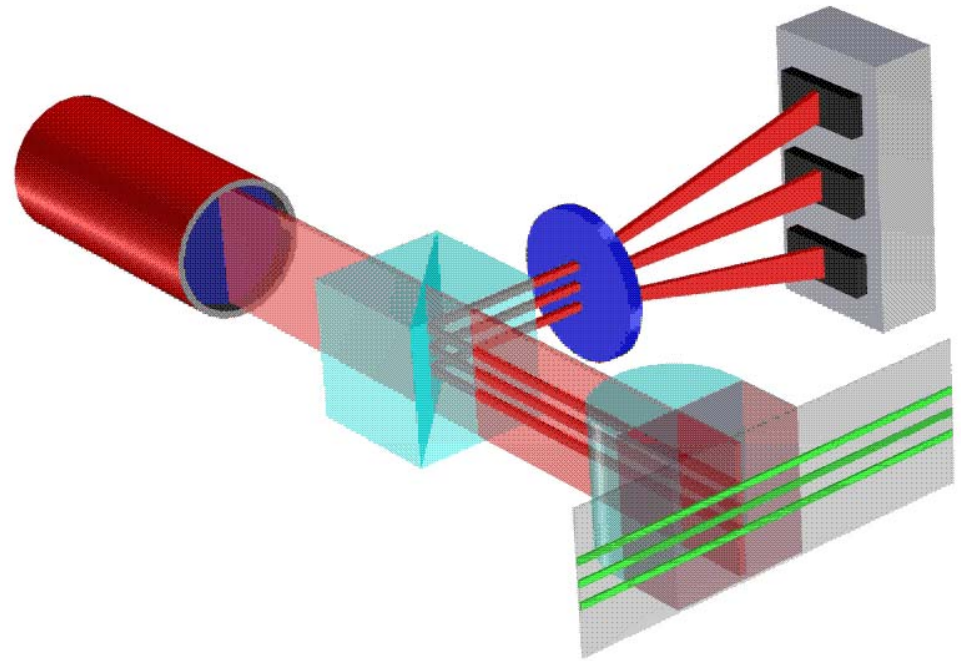


Writes tracks with partial overwrite (“shingling”)  
Write track width is 5.5  $\mu\text{m}$   
Effective track width is 4.2  $\mu\text{m}$   
Trackwidths down to  $\sim 1 \mu\text{m}$  demonstrated



# Read Heads

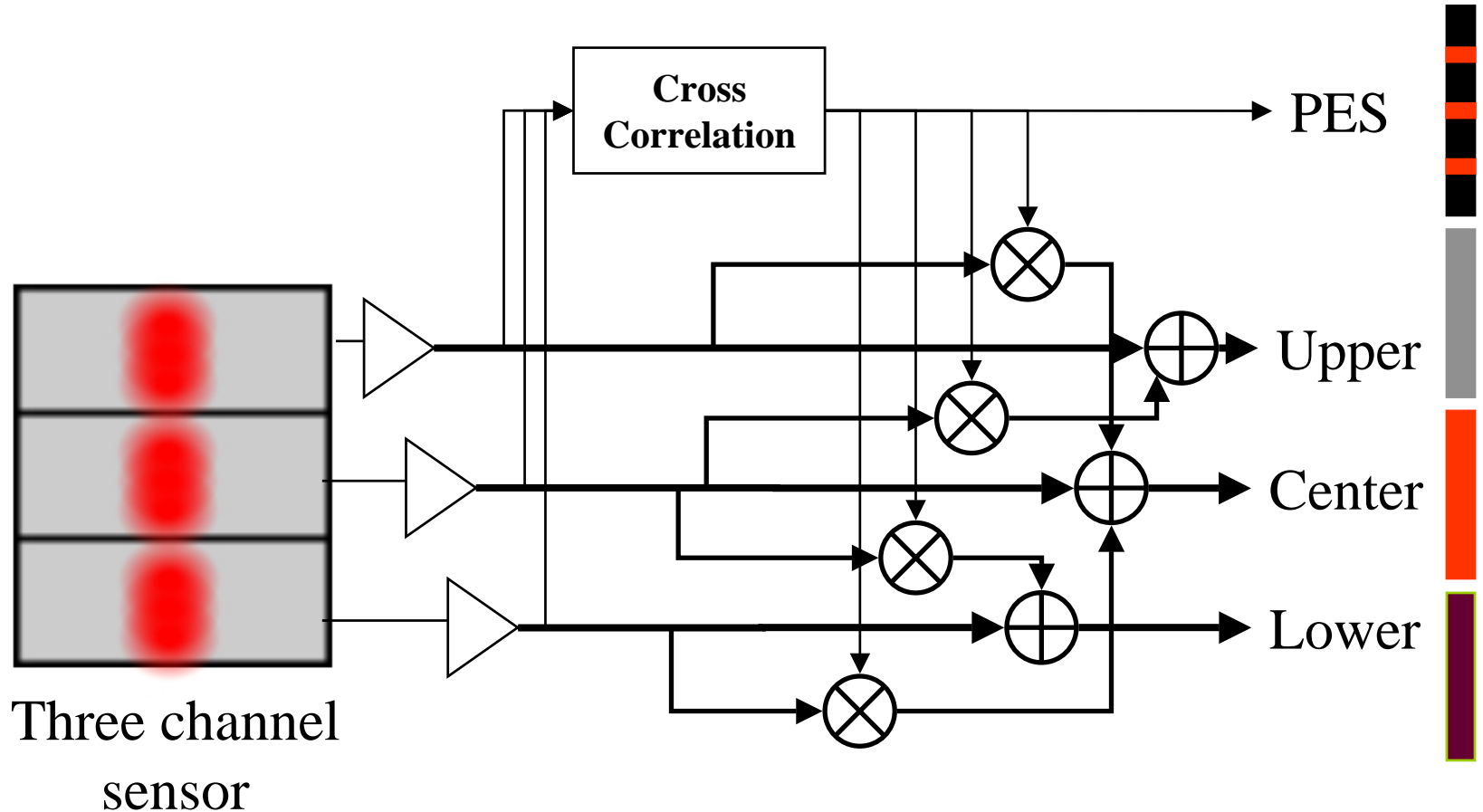
**Magneto-optical** read head with optical servo: Current development capable of 2  $\mu\text{m}$  read track width, 130 kbp.



- **Magneto-Resistive** read head with mechanical servo: Under development. Capable of 2  $\mu\text{m}$  read track width and 250-300 kbp.

# Reading Adjacent Tracks

Position Error Signal (PES) extracted from data tracks – no tolerances of servo track involved.  
Real time channel to channel crosstalk cancellation  
Read track width almost the same as write track width



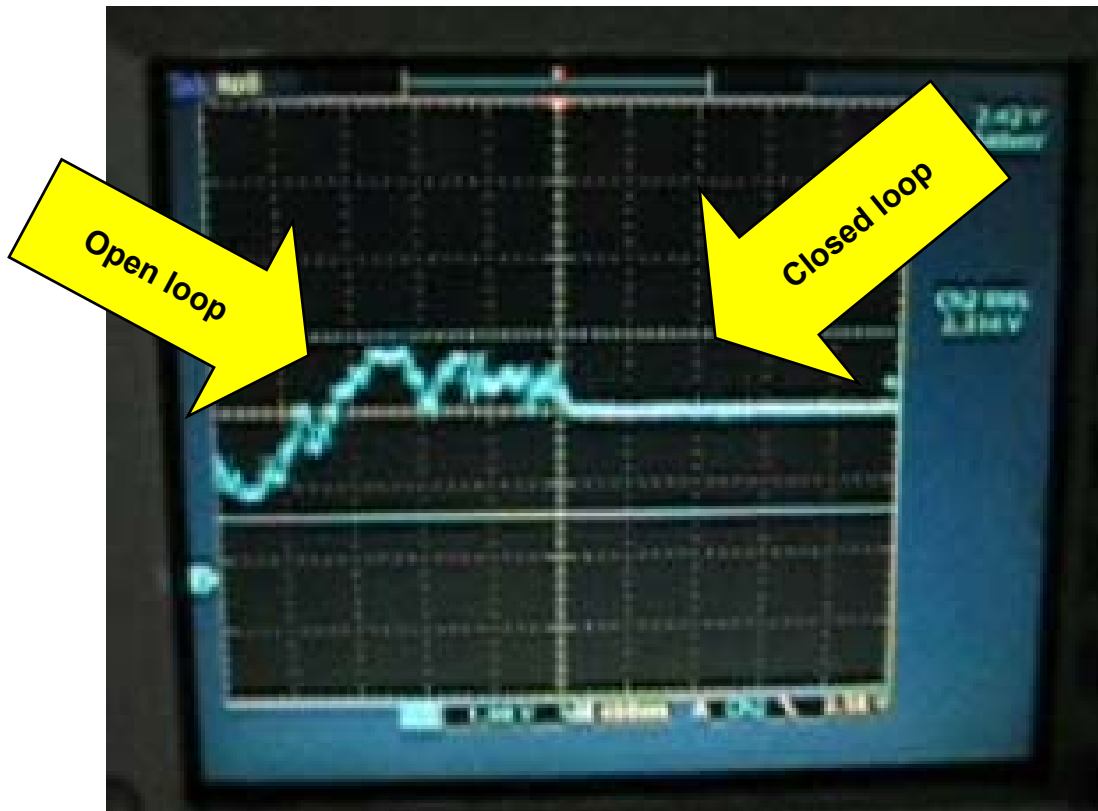
# Read Tracking Servo PES

## PES generated from data tracks only

- Eliminates tolerances to prewritten servo-tracks
- Tracking based on tracking repeatability rather than out-of-cartridge preformatted servo

## Track Following

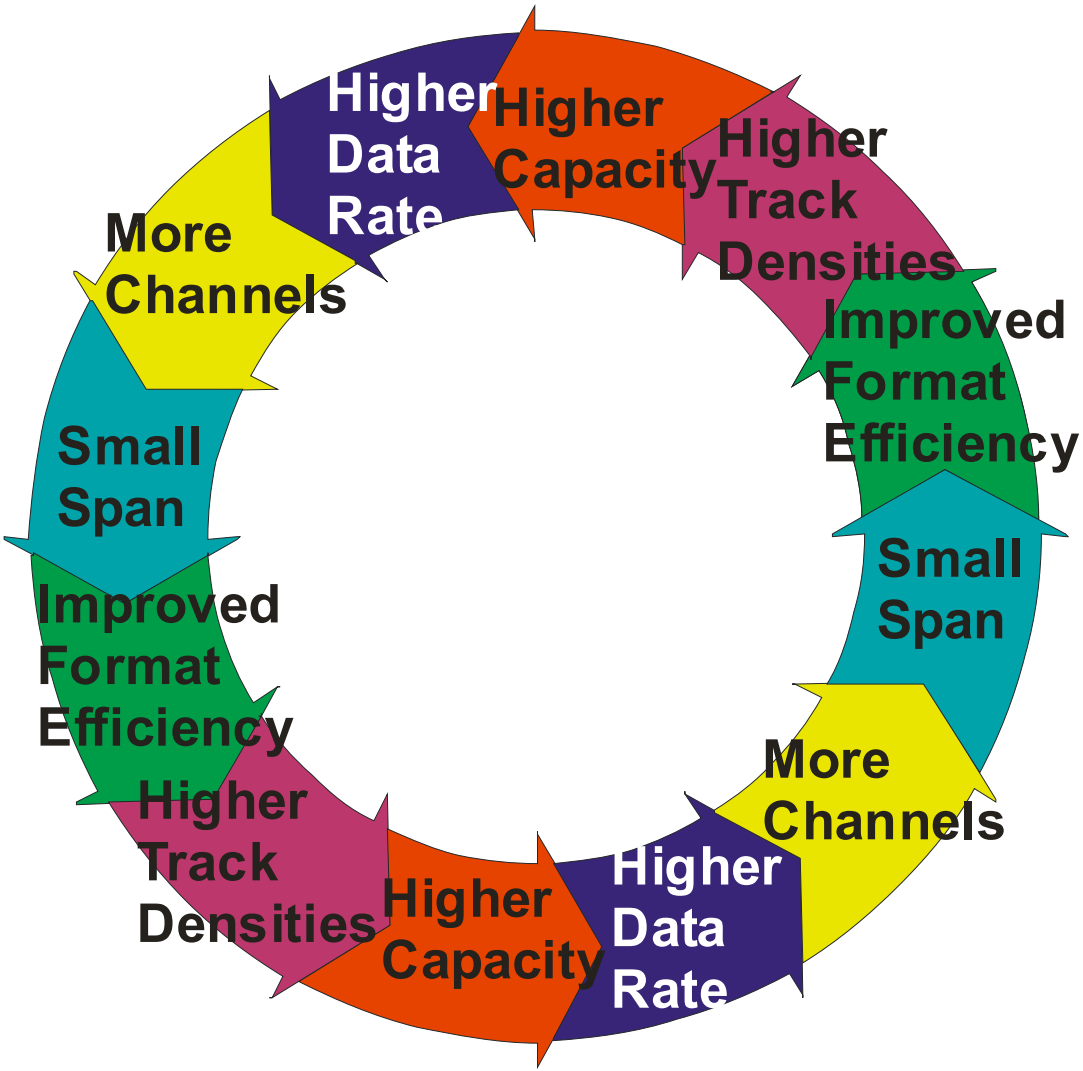
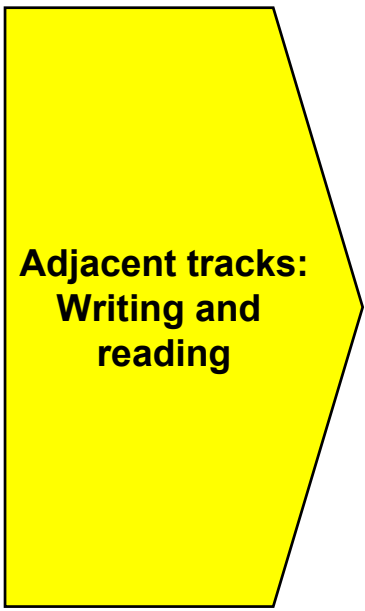
- Open loop ~2  $\mu\text{m}$  peak-peak
- Closed loop ~200 nm ( $3.5\sigma$ )



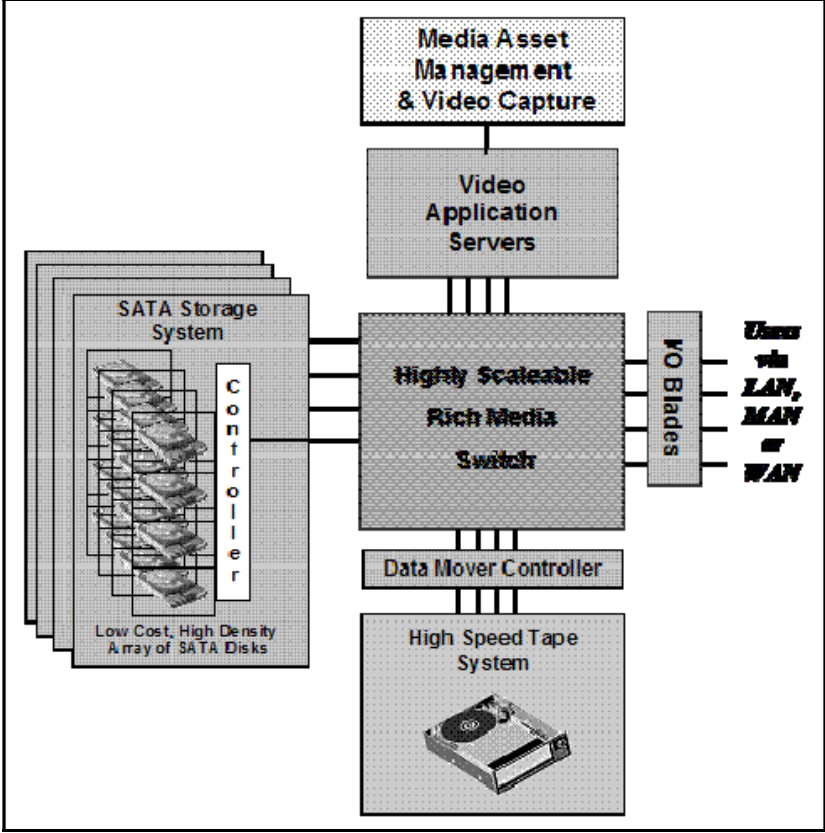
# Read Tracking Servo PES



# The Paradox Solved



# Use of O-Mass Technology



- The SIVSS project is a cross-European collaboration aiming to develop enabling technology for error-resilient representation, slicing, storage and handling of rich audio-visual signals.
- We are specifically focused on providing a communication and storage infrastructure with a throughput scalable from tens of GB/s (Gigabytes per second) to Tb/s (Terabits per second) at a new threshold of cost effectiveness.



O-Mass is developing critical components for tape drives that enable very high areal density.

Main focus is on increasing track density.

Write head prototypes writing 16-32 adjacent tracks. 1.0 – 10  $\mu\text{m}$  write track width.

Magneto-optical read head prototypes reading 32 adjacent tracks. 2-10  $\mu\text{m}$  read track width.

Magneto-Resistive read heads under development for reading adjacent tracks.

Tracking servo without prewritten servo tracks based on signal processing from data tracks only.