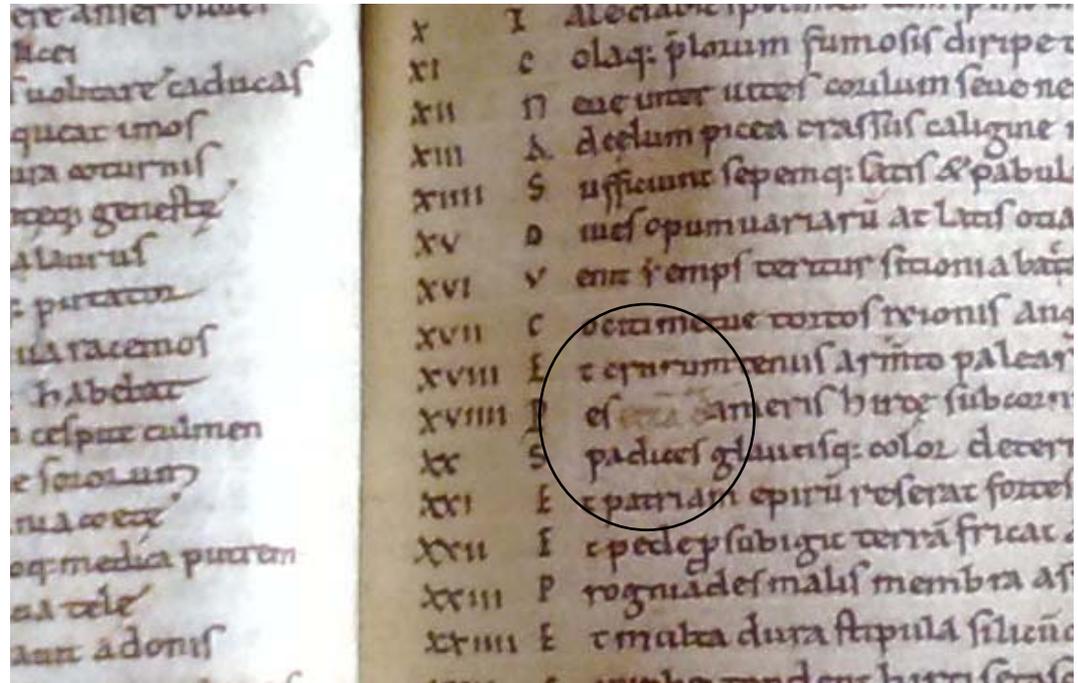
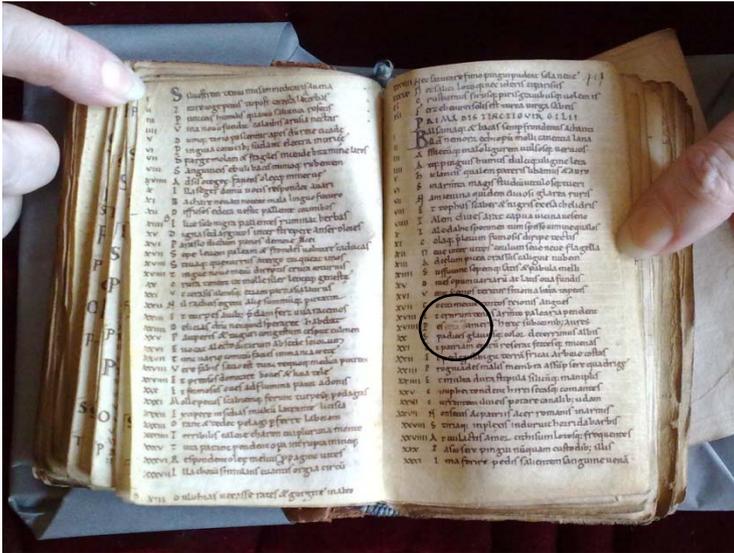


Hard Drive Directions 2010 - 2012

Dave Anderson
Seagate Technology



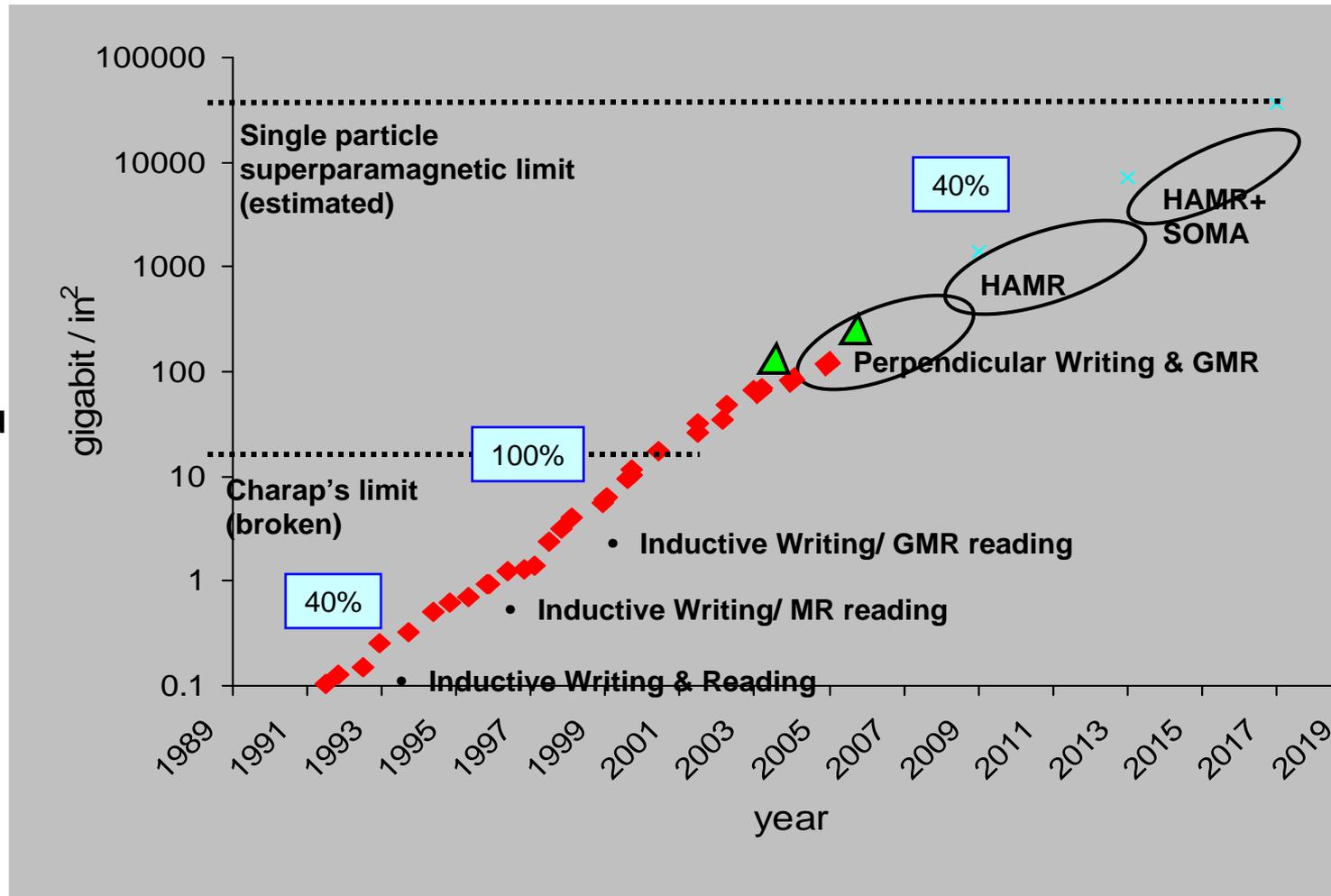
Preservation vs Technology



Areal Density Growth

- Areal Density CAGR 40%
- Transfer Rate CAGR 20%

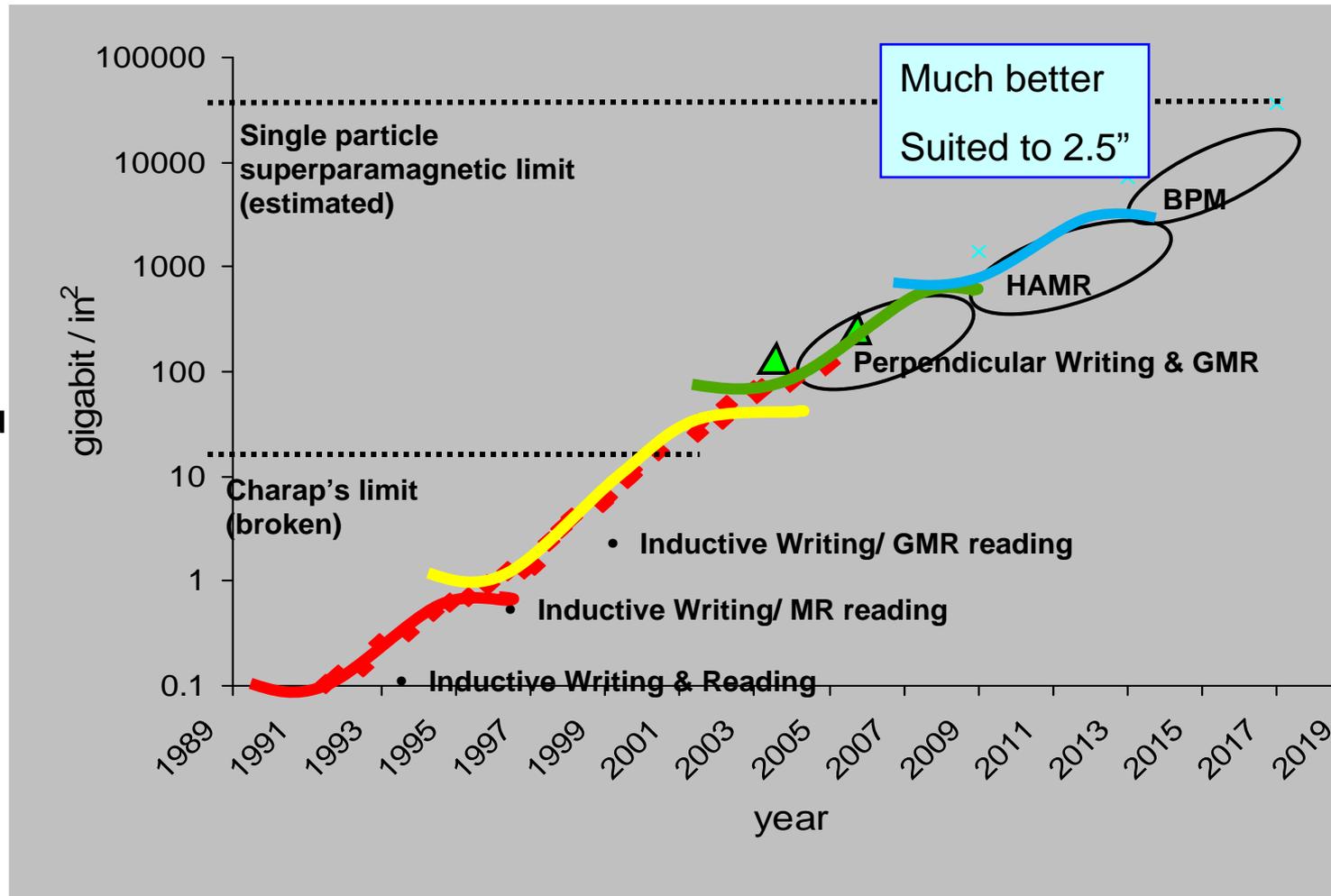
- Late 1990s – super paramagnetic limit demonstrated through modeling
- Perpendicular expected to extend to 0.5-1 Tb/in²
- Additional innovations required at that point
 - heat-assisted recording
 - bit patterned media recording



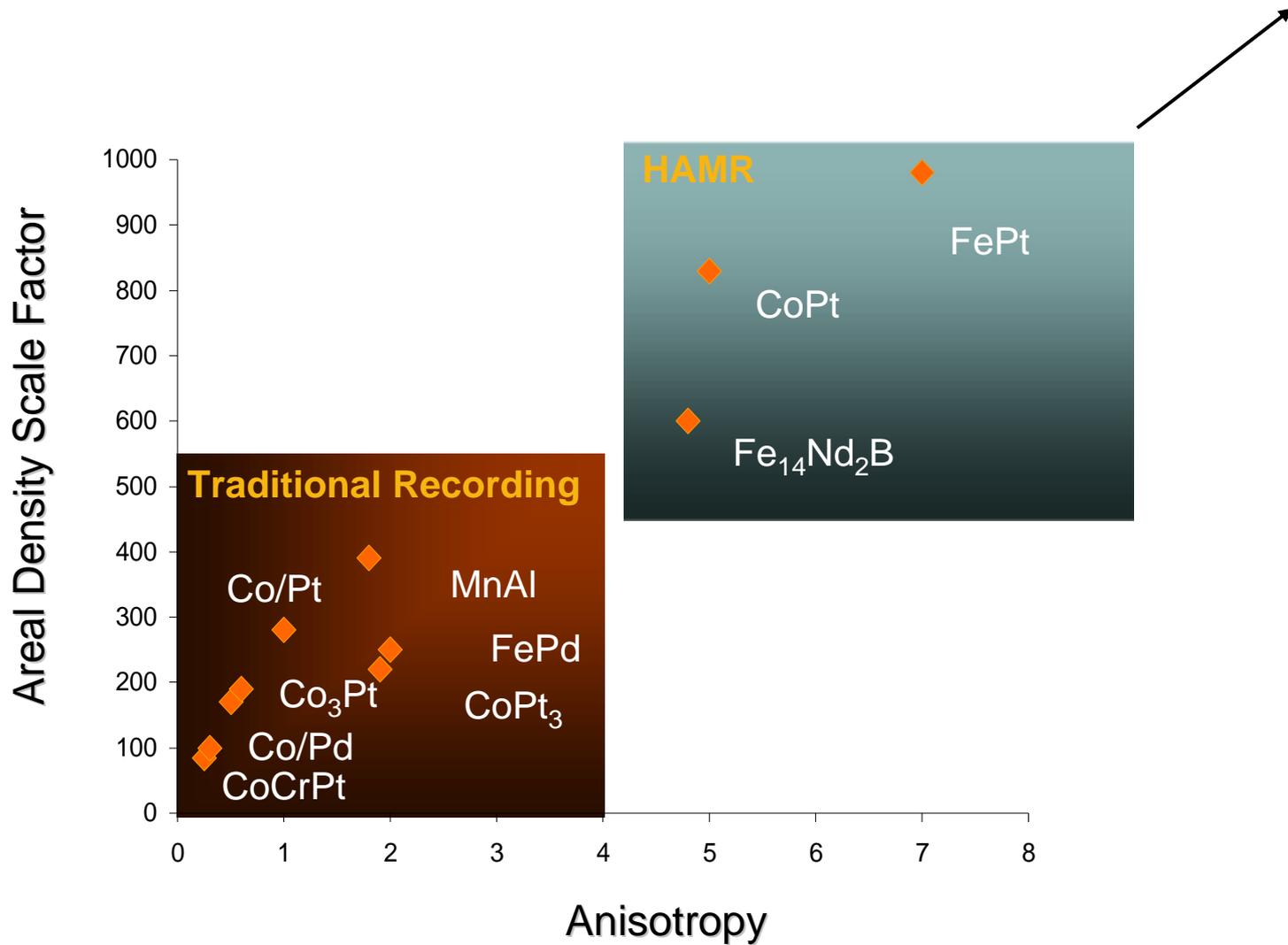
Areal Density Growth

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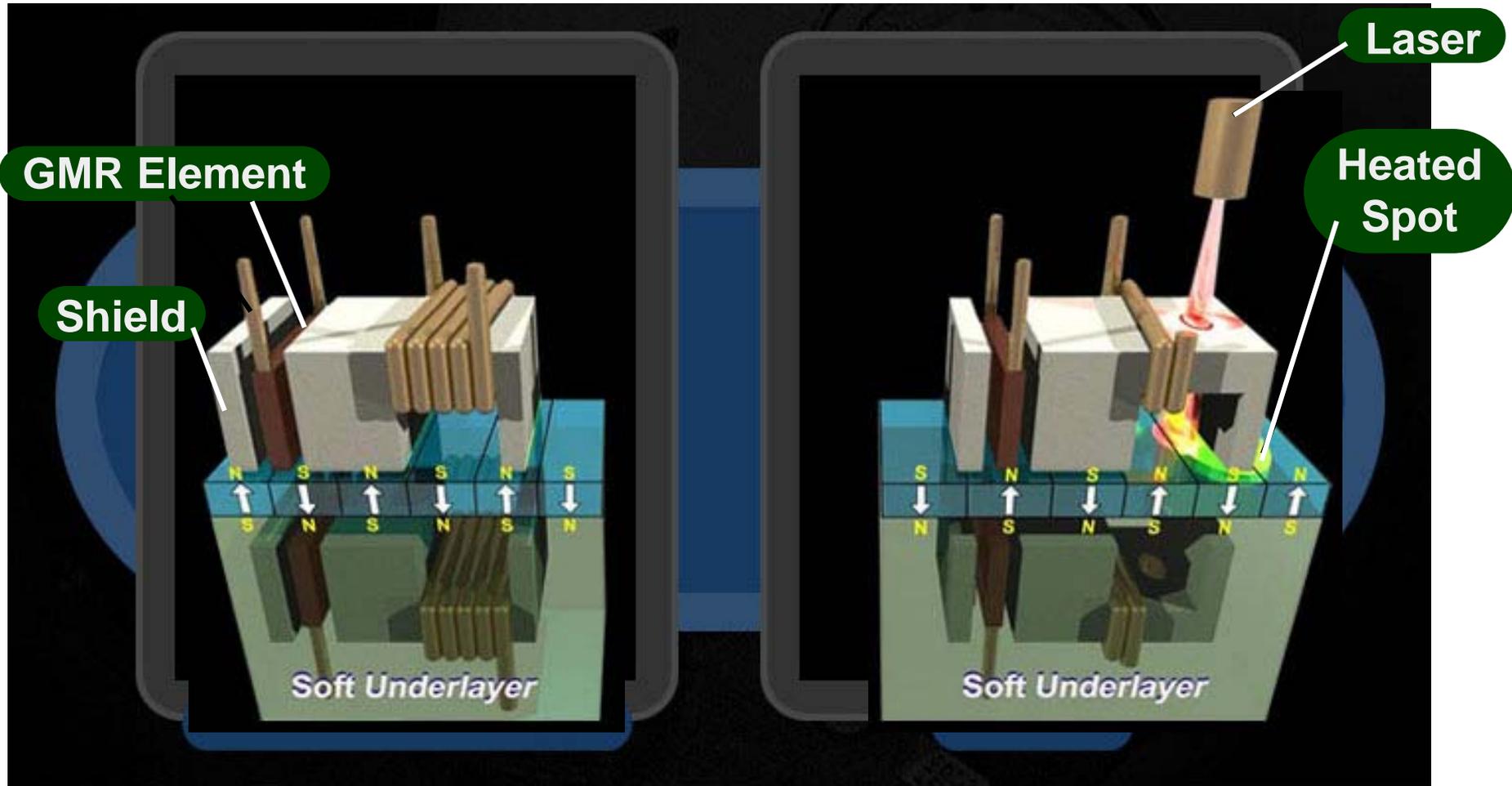
- Late 1990s – super paramagnetic limit demonstrated through modeling
- Perpendicular expected to extend to ~1 Tb/in²
- Additional innovations required at that point
 - heat-assisted recording
 - bit patterned media recording



Materials for Higher AD



Heat Assisted Magnetic Recording (HAMR)



Perpendicular Recording

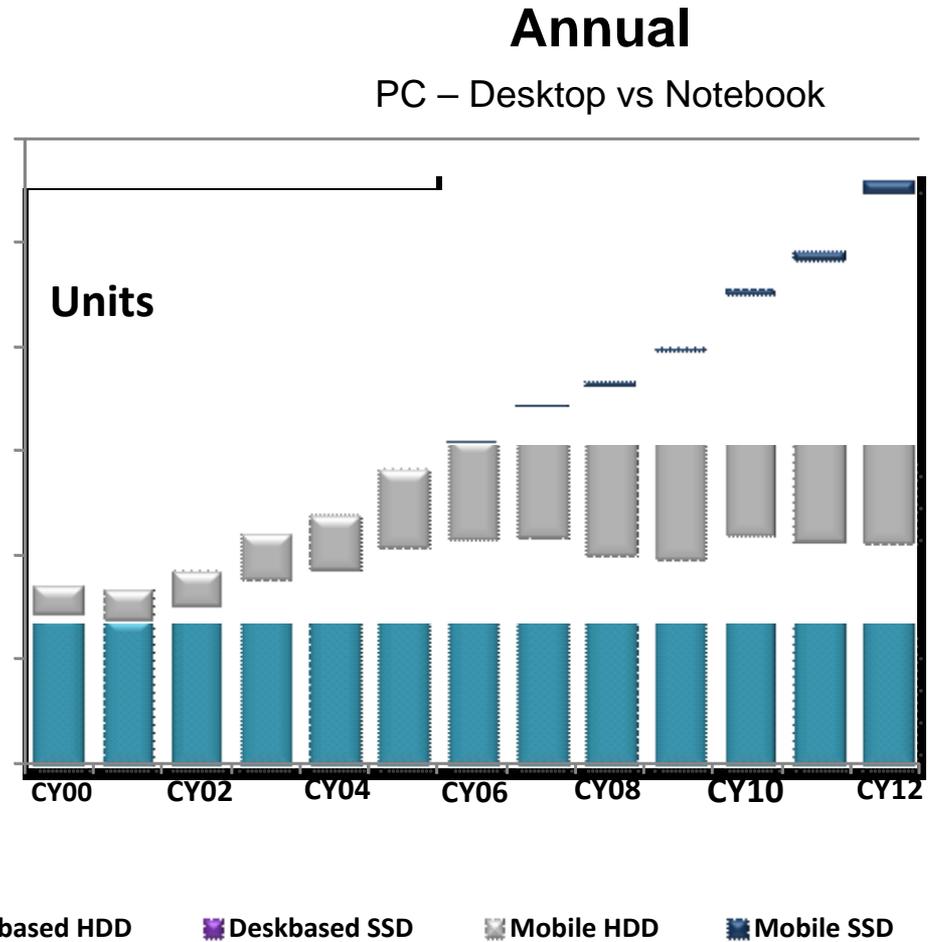
HAMR



Overall PC Market

Total Available Market

Products, not technology
Volume is king
Notebook now higher
volume than Desktop
SSD still VERY small

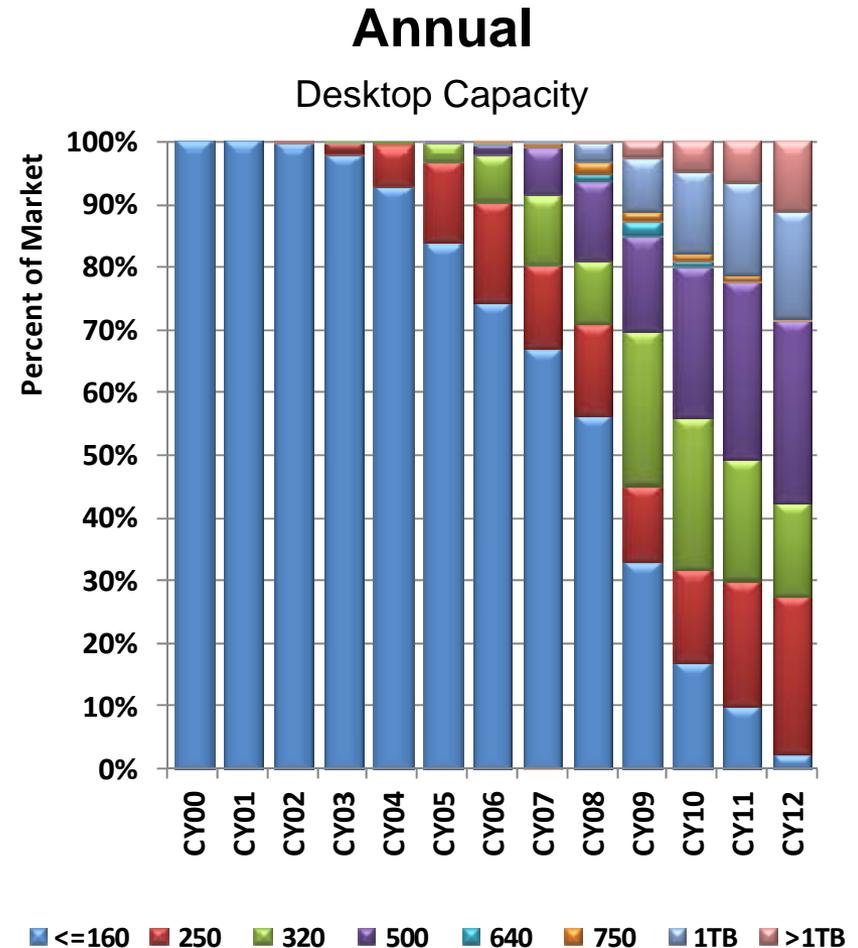


Source: Seagate Market & Competitive Intelligence

Desktop PC

HDD Total Available Market

3.5" minimum drive capacity exceeds desktop requirement

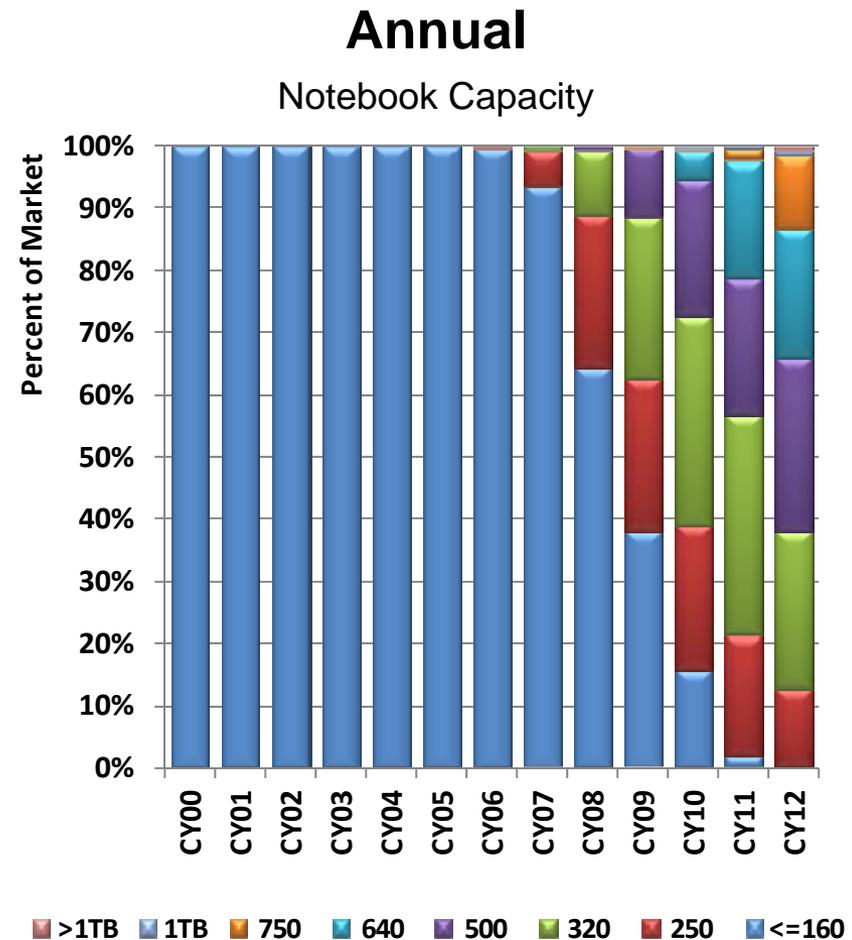


Source: Seagate Market & Competitive Intelligence

Notebook PC

HDD Total Available Market

NB capacities closing in on
DT capacities
2.5" being used in desktop



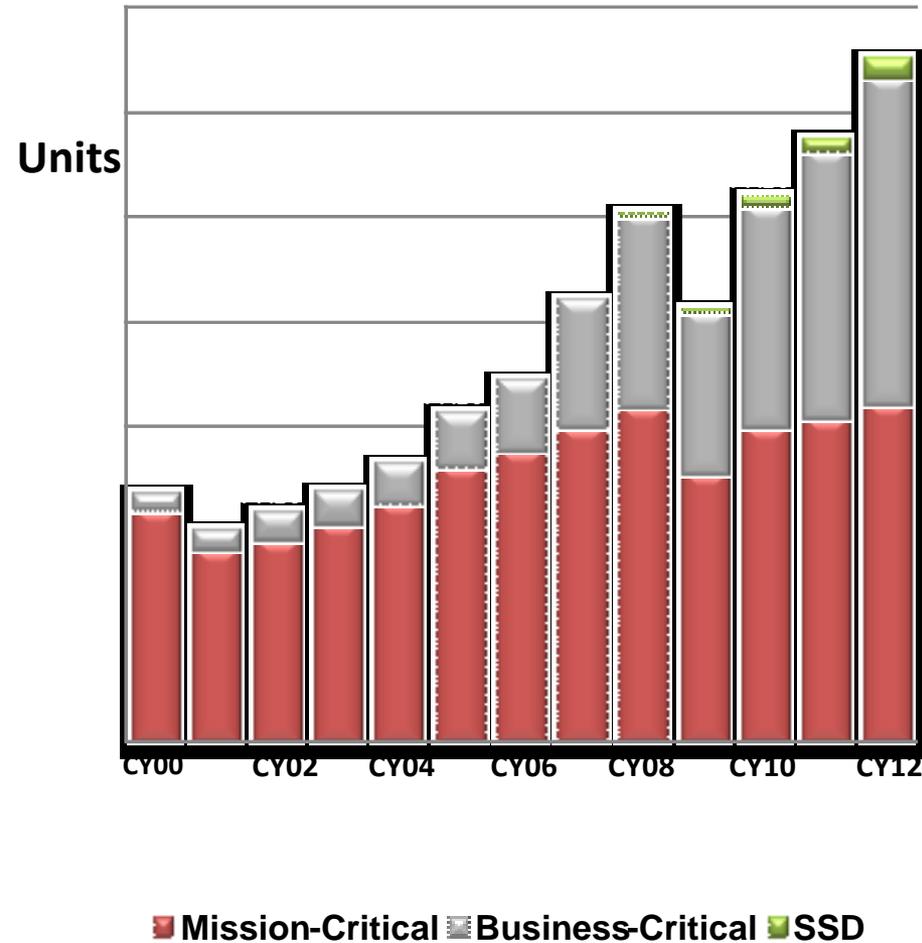
Source: Seagate Market & Competitive Intelligence

Overall EC Market

Total Available Market

Annual
Total EC Market

Business Critical (high capacity) growing!



Source: Seagate Market & Competitive Intelligence

Mission Critical Enterprise

Total Available Market

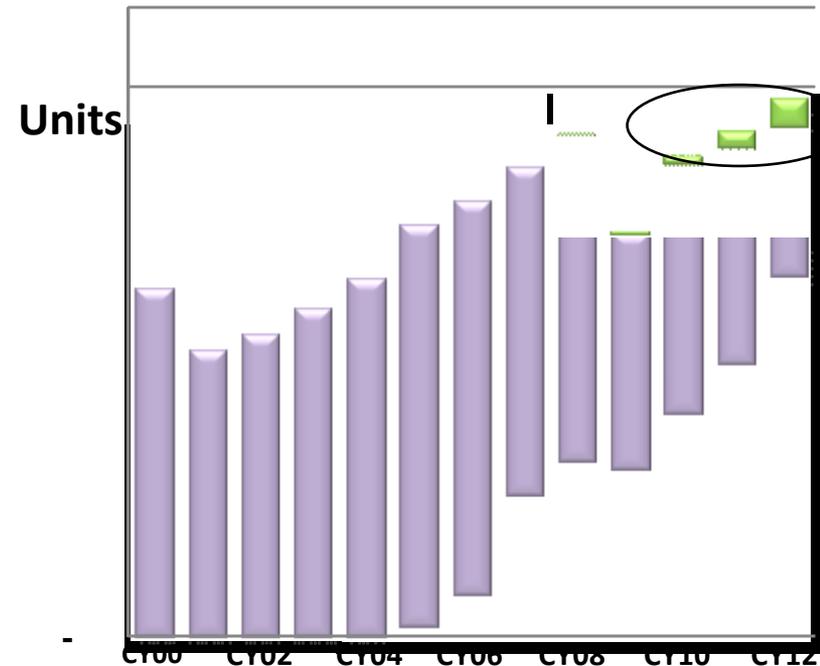
Just as with NB, 2.5" will dominate in 2-3 years

SSD still very small – much smaller than had been forecasted

SSD needs better NAND pricing to make more of an inroad

Annual

Mission Critical Form Factor



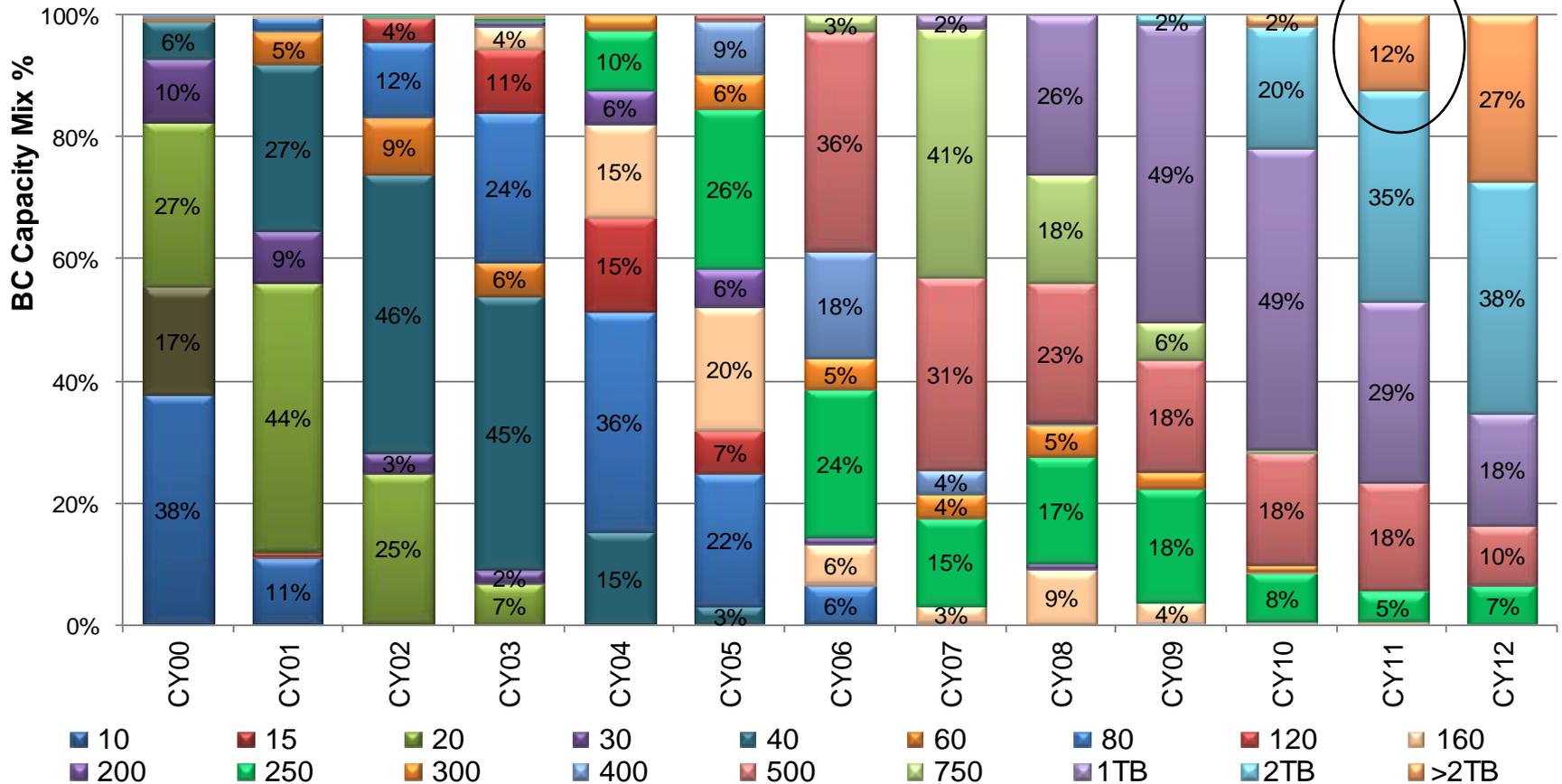
Source: Seagate Market & Competitive Intelligence

Business Critical Enterprise

Total Available Market

Annual – Business Critical Capacity Mix

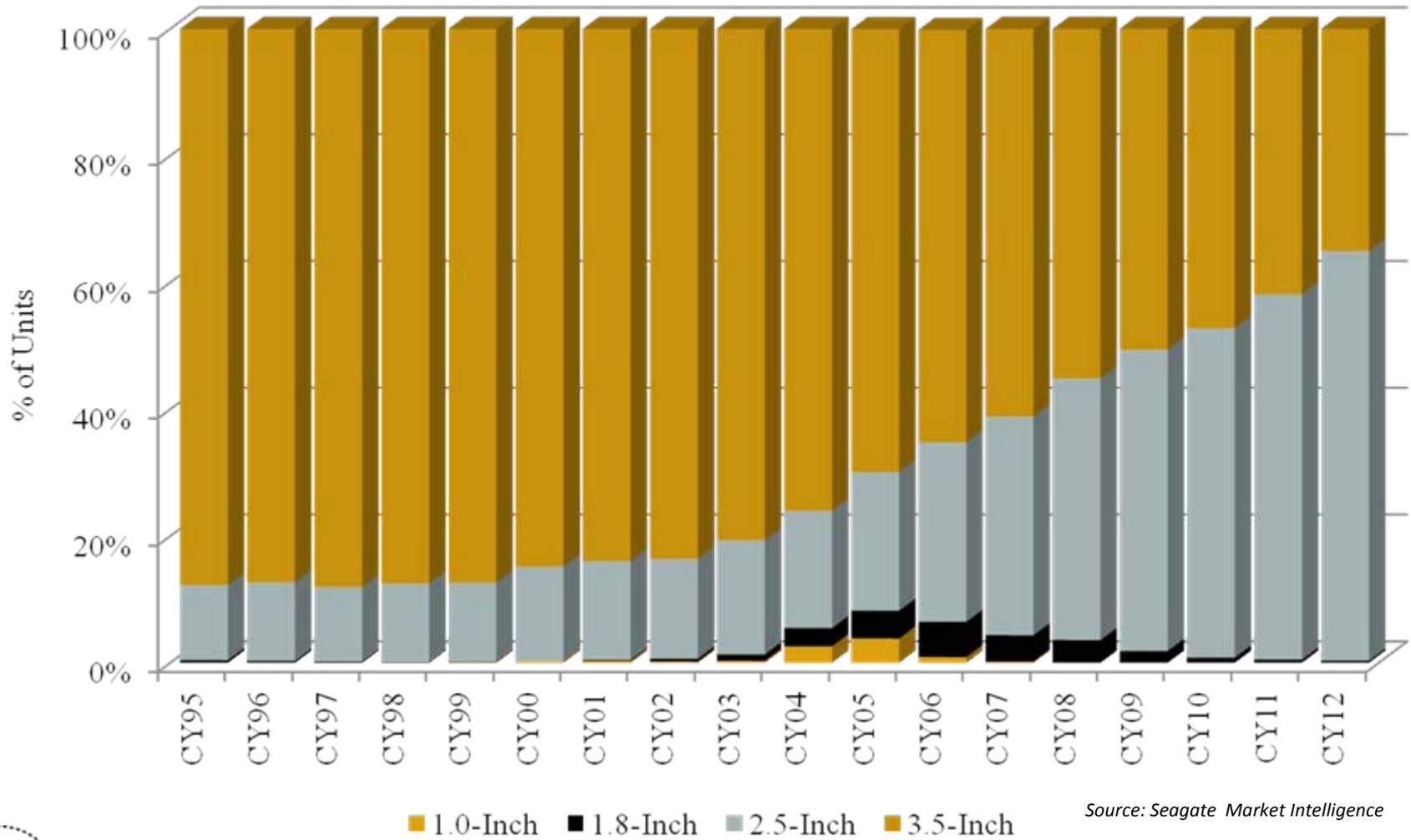
Are you REALLY Ready for 3 TB?



Source: Seagate Market & Competitive Intelligence

Total HDD Industry Unit Mix

By Form Factor



Source: Seagate Market Intelligence



Solid State Disks

Only a very small % of data center storage

Acceptance much slower than forecasted

- Reliability concerns
- In some cases performance less than expected
- Users find difficulty in identifying right data to move

NAND pricing actually increased recently

There will not be (in the foreseeable future) enough wafers processed to eliminate magnetic storage



Other Topics

Interfaces: Where will the client go?

- SATA pretty much limited to 6 Gb/s
- USB-3 will be considered as client drive interface
- What about optical?
- SAS will become a choice for low end server
- Get ready for 3 TB HDDs and 4K sectors!

Form Factor transition?

- New capacity technologies more amenable to 2.5"
- What to look for: 2.5 high capacity drive = $\frac{1}{2}$ of 3.5" drive
 - Today $\frac{1}{2}$ TB vs 2 TB



