



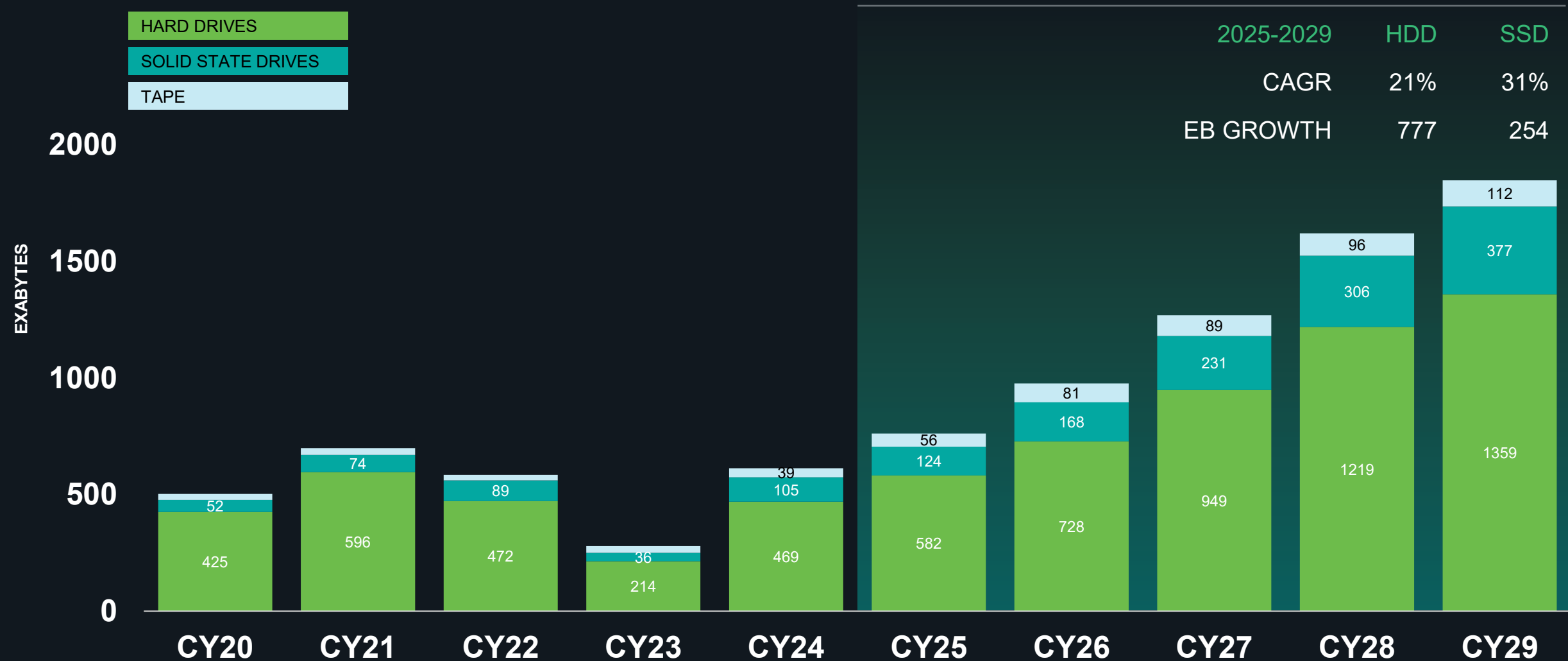
HAMR and SMR

Scaling Storage in the AI Era

June 2026

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Cloud Storage growth in the AI era



Source: IDC 2025 StorageSphere Forecast Q2 25 SSD

AI Changes the Slope of Storage Demand

Storage demand is driven by scale, persistence, and reuse

Larger Models

Early LLMs had ~1B parameters, while GPT-4 class has ~1T parameters.

During training, models need to be checkpointed. The checkpoint, itself is significantly larger than the model because it retains optimizer states.

Larger Training Datasets

Training datasets are growing at an even faster rate than model size.

Models in the early 2020's typically scaled only model size, leaving the training set size at 300B tokens. After DeepMind's Chinchilla, training sets have outpaced models significantly.

Shift to Inference

Early 2020's workloads were training-oriented. In 2025, training and inference were roughly equal.

Between 2025 and 2030 McKinsey projects global datacenter demand (in GW) CAGR of 35% for inference vs 22% for training and 11% for non-ai.

KV Cache storage scales directly with model size and number of users.



Capacity delivery is urgently needed for continuing to scale AI

Growth is accelerating across models, training data, and inference outputs

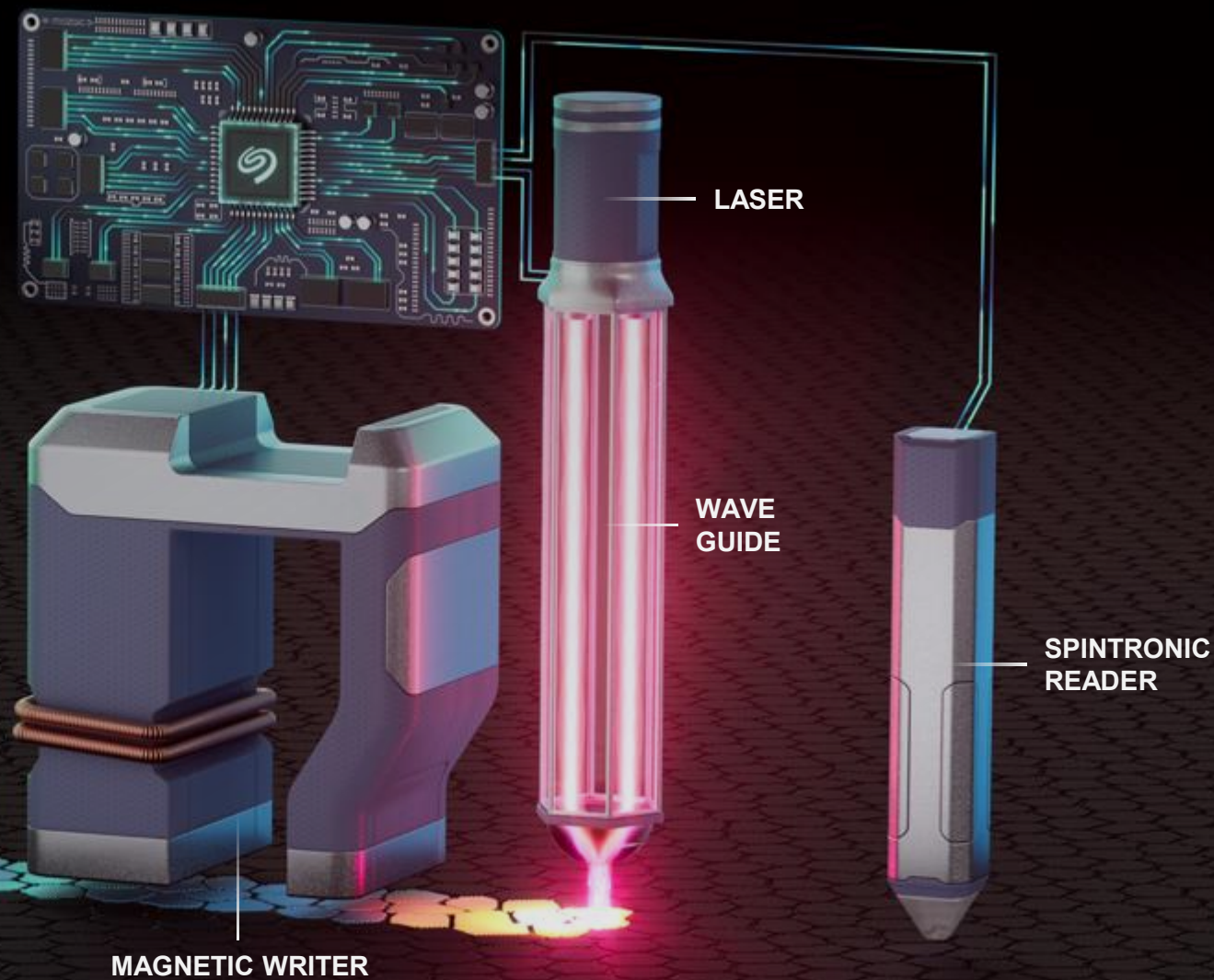


FROM PMR TO HAMR

The Next Chapter in Hard Drive Capacity Expansion

Principle building blocks of Mozaic (HAMR) technology

GRANULAR FePt MEDIA



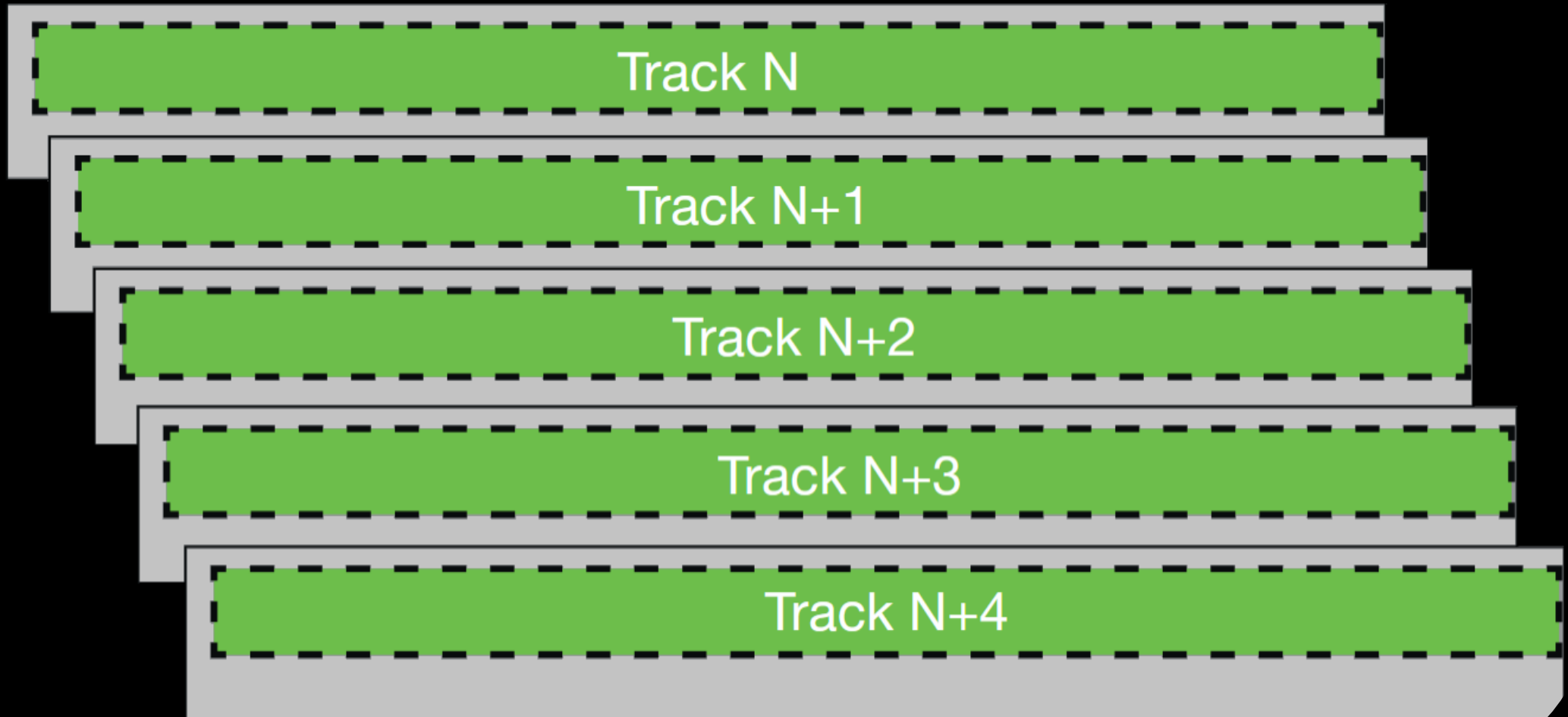
SMR ADC increases through format geometry

256MiB erase granularity and sequential write requirement result in further ADC gains.

- **Guaranteed valid track parity**
- **One-time adjacent track write**
 - Deterministic ATI
 - Single-sided squeeze

Reader

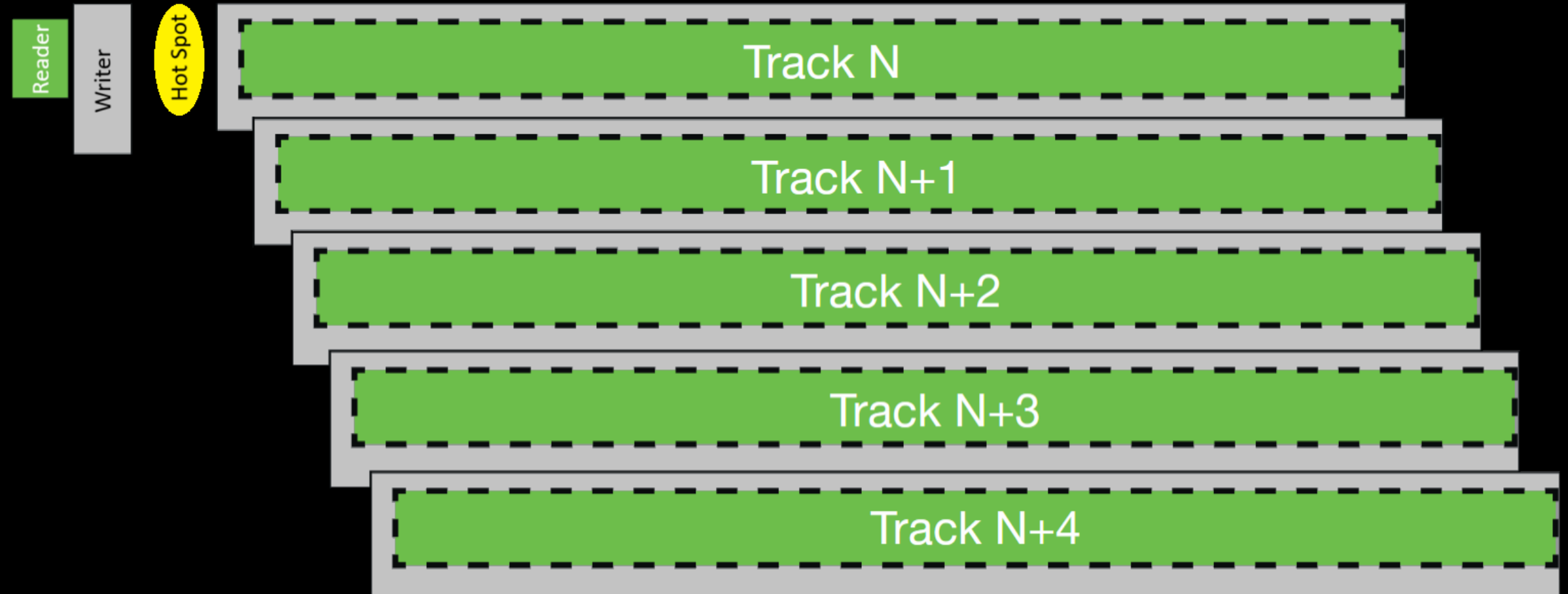
Writer



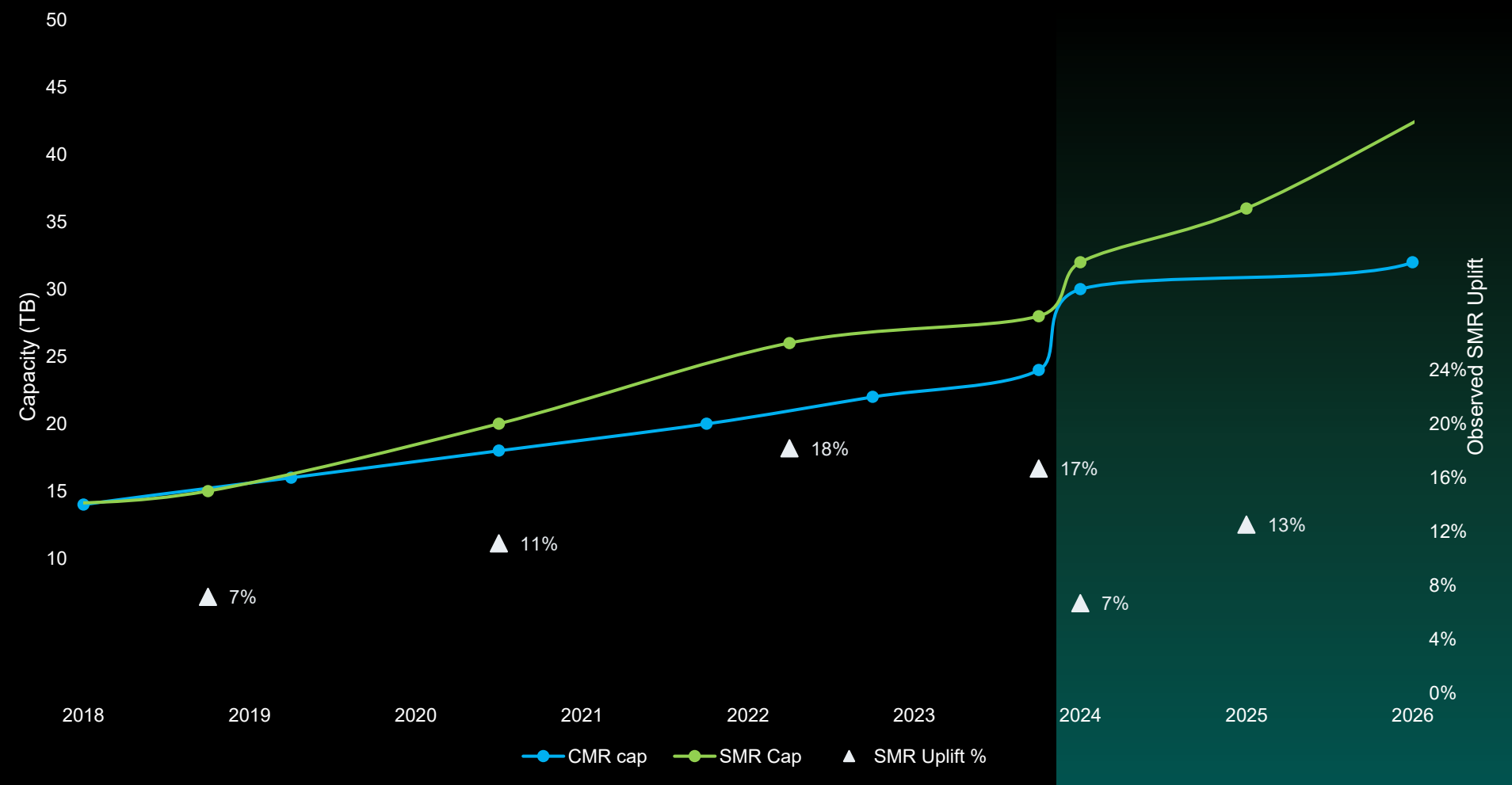
SMR interaction with HAMR

Physics of interference have changed.

- **ATI predominantly through thermal effects**
- **STE significantly reduced due to high coercivity**
- **Write width determined by the thermal spot size**



Leading capacities enabled by HAMR + SMR



System Considerations for SMR

1

Sequential Writing

Host Managed rules disallow random writing and writing unaligned to the media sector

2

Expanded Command Set

Host Managed SMR drives must support ZAC/ZBC for zone management commands

3

Rewrite Constraints

To rewrite a zone, the system must first issue a Reset Write Pointer zone management command





Thank you