High Track pitch capability for HAMR recording: 1M TPI

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ABSTRACT

With the recent 1.0[1], 1.5 and 2 Tb/inch^2 [2,5], 3000 KFCI Linear Density [9] basic technology demonstration, and drive level demonstration [3,4] Heat-Assisted Magnetic Recording (HAMR) [5] has proven to be a viable and promising technology for future magnetic data-storage products. The commercialization of HAMR presents some significant technical challenges that need to be resolved before the widespread adoption of the technology can begin. The recent demonstrations illustrate high track density performance for this new technology compared to conventional Perpendicular Magnetic Recording (PMR). In this paper we seek to probe some of the practical constraints to high track density recording.

Previous work has explored the impact on curvature of the written track. In this study we build upon previous material [5,6] to isolate adjacent track edge erasure (ATI), side reading and other factors that can contribute to the track pitch capability control. Figure 1a shows that the loss in BER on track due to the side reading effect- where previously written background signal is picked up by the ontrack reader. Figure 2b shows the losses due to adjacent track interference –both compared with PMR heads. Under aggressive Squeeze conditions ATI losses dominate, but at less constrained conditions the losses due to pick up of the adjacent track signal can match – and exceed ATI loss.

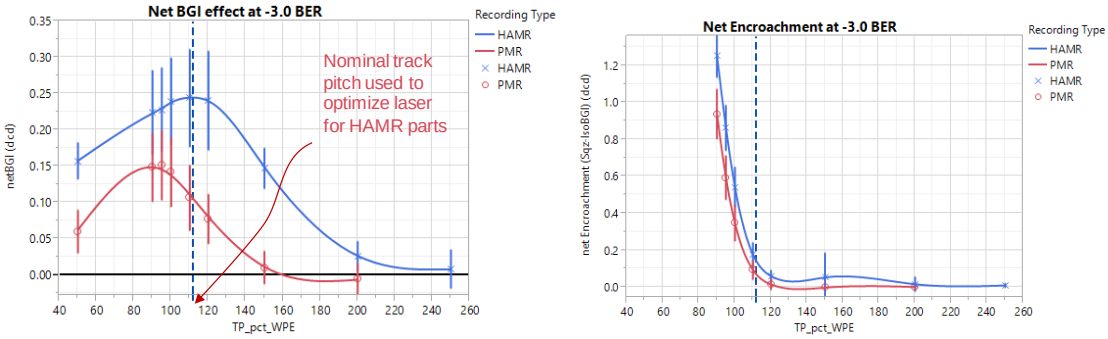

Figure 1:a) Spinstand measurement of the loss in Bit Error Rate(BER) between Isolated tracks and tracks with background interference (in decades), as a function of relative Track pitch used for PMR (Red Circle) vs HAMR heads (Blue X). Nominal track pitch used to compare the two head types indicated with the dashed line b) Encroachment from adjacent tracks (in decades) – comparing the same HAMR and PMR heads.

Different recording strategies such as Interlaced Magnetic Recording [7] raises complications due to background and top tracks, Multiple Sensor Recording for HAMR [8] offers the potential to isolate some the background signal. We compare and contrast the loss mechanisms across a range of head and media designs in order to bound the constraints for high KTPI recording and share some examples of high track density demonstrations to illustrate solutions. One such example is included in Figure 2 below, a written track demonstration at 1,000,000 (1M) tracks per inch recording using a HAMR head and media on spinstand. The

test conditions are using shingled magnetic recording, with 6 re-writes- capturing some ATI effects, and reflecting practical operational conditions.

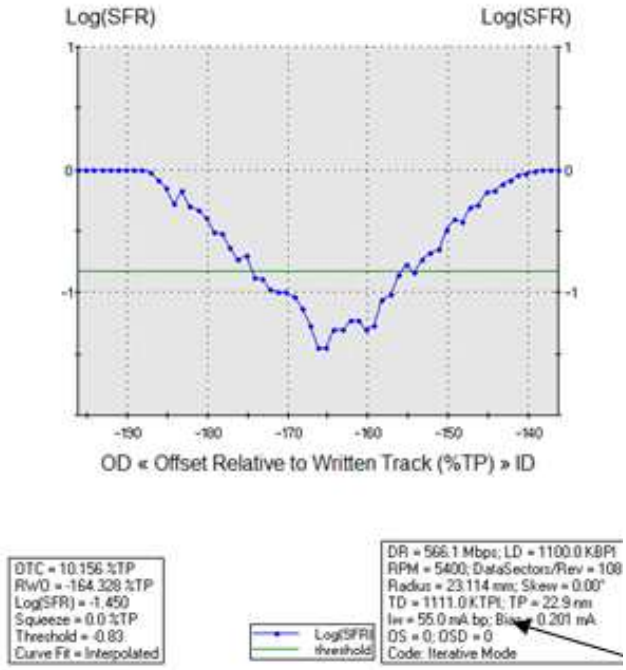

Figure 2: Areal density demonstration at 1M KTPI using standard demonstration conditions [10], with a HAMR Head using Shingled recording. 6 Adjacent writes, OTC margin of 10%, 5400 RPM. Test track density of 1111 KTPI indicated with arrow, before back off of track pitch for margin.

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