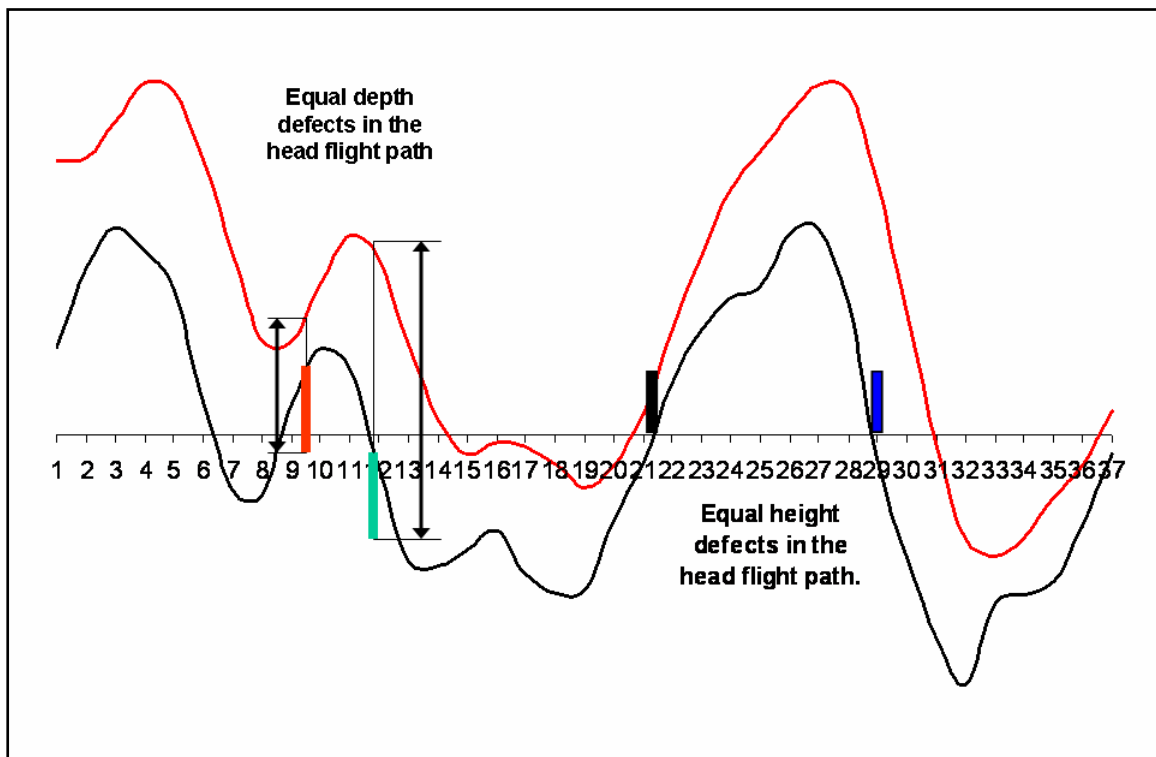


Gains and Measurements

The THoT tool is designed to be very versatile. This means that we need to be able to detect and measure many different size defects on a variety of surfaces.

For example, on a finished Perpendicular Magnetic Recording (PMR) disk with an average surface roughness of an Angstrom and a head fly height in the drive of eight nano-meters, we need to make sure that there are no defects higher than half the head design fly height, four nano-meters (40A).

This will insure that Fly Height Modulation (FHM), variation due to waviness conditions, will have enough safety margin to prevent head-to-disk interference (HDI). In the diagram below, the red line indicates the flight path of the head above the disk surface represented by the black line.



The impact on the defects (red and green for pits, black and blue for asperities) of FHM can be clearly seen.

If the defect is a particle on a first stage polish for either glass or nickel, the background finish may be relatively large and the actual defect can be correspondingly sized. In this case, the measurement requirement may be reduced. And, if we are examining rough substrates at the grind stage, this requirement may be reduced further.

Gain can be thought of very much like a microscope when looking at defects. Large defects only require low magnification where small defects require high magnification. Using low magnification (low gain) on a small defect would not allow you to see the defect. Using high magnification (high gain) on a large defect would mean that you could see the top of the defect or focus on the bottom but you could not see the entire defect, you would “clip” the image, there would be a lack of focal depth to see the entire height of the defect.

With an amplifier, if you have a low gain, it is very difficult to see very small details. If you have a high gain, you cannot see all of the large defect details. Since we always measure from the base up, large details will be “clipped” and you will not see the top.

The THoT tool has three gain ranges that are normally used, Gain = 1, Gain = 4 and Gain = 16. In normal operation these gain ranges have a maximum reading level of 1,024A, 256A and 64A respectively. They can be expanded 5X by switching laser ranges from 5mm/s/v to 25mm/s/v. This provides a maximum scale of 5,120A.

Ranges can be increased even higher using standard calibrated attenuators but the practicality of such requirements has not been demonstrated.

It must be remembered that this is for defects only. Morphology tests for waviness and runout have much higher ranges, some more than 500,000A (50um).

Typically, the gain = 16 setting is used to examine finished disks for defects in either the Optical Glide (OG), Optical Certification (OC) or Nano-Scan modes. This means that any defect greater than 64A high or deep will be “clipped” off at 64A.

The gain = 4 setting can also be used to examine finished disks but will only have one-quarter of the resolution with four times the highest range. Defects up to 256A will be measured but higher defects will be “clipped” off at 256A.

The gain = 1 setting is typically used only in the fast scan for OG and OC. Nano-Scan defects are normally well below this level of 1024A. This mode is used to find process handling damage and contamination.

The user needs to consider the application and select a gain that is proper for the tests being performed.