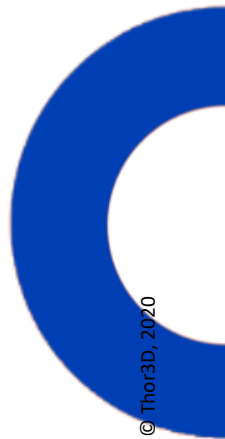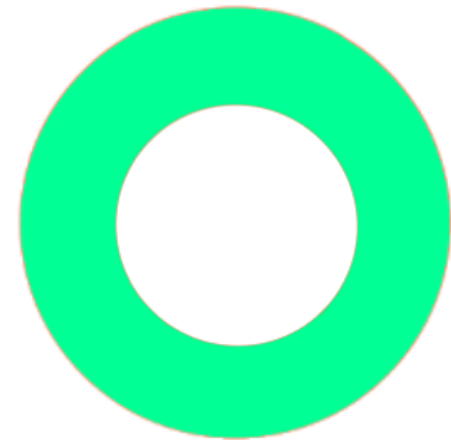**Calibry**

Everything about markers and how they help 3D scanning

What is a marker?

A marker is a small sticker or magnet with an image of a black or white dot printed on it. A **3**D scanner uses these "high-contrast" objects to determine its location. Markers are usually applied on (or near) the object being scanned, to increase accuracy and repeatability of **3**D data.

While many **3**D scanners use markers (or targets, as they are also commonly known) for "post-processing" alignment, Calibry scanner uses them for real-time tracking, allowing for fast and accurate scanning. This means that the embedded software recognizes and then analyzes each marker in real time in every frame at up to **30** frames per second. It records the exact location of each marker as they relate to each other and using that information aligns each frame to the following one.

Why do I need them?

Markers are needed for accurate and easy **3**D scanning. They actually solve two separate issues: difficulty during scanning and difficulty attaining high accuracy on large objects.

Difficulty during scanning

Without markers, the scanner will lose its alignment during scanning and the software will not know how Frame1 is supposed to be aligned to Frame2, Frame2 to Frame3 and so on... The software will try to align all frames using the objects' unique geometry. It has sophisticated algorithms which will understand that a human nose in Frame1, should be aligned to the same human nose in Frame2 and not to some other body part.

However, this guesswork doesn't always produce great results and in many cases, especially on objects with large flat surfaces and no unique geometry, even the most sophisticated algorithm will fail. Attaching markers to the object and giving the software a "constant feature" to track ensures the highest accuracy. It also ensures repeatability and that a geometrical error will not accumulate over a long distance.

### Difficulty attaining high accuracy on large objects

Imagine scanning a long pipe. It is **10** meters long and **1** meter in diameter. If you don't use markers, over some distance, the scan of the pipe will appear to bend slightly. That is because optical scanners accumulate an error over distance. Markers solve this issue and provide you with the most accurate results.

Where do I get these markers?

Calibry scanner works with markers that are **22**mm in diameter on the outside and **11**mm in diameter of the inner, white circle.

The most cost-effective solution is to simply print these markers on the office printer. Just purchase some adhesive blank labels from the nearest stationary store and print one marker per label.
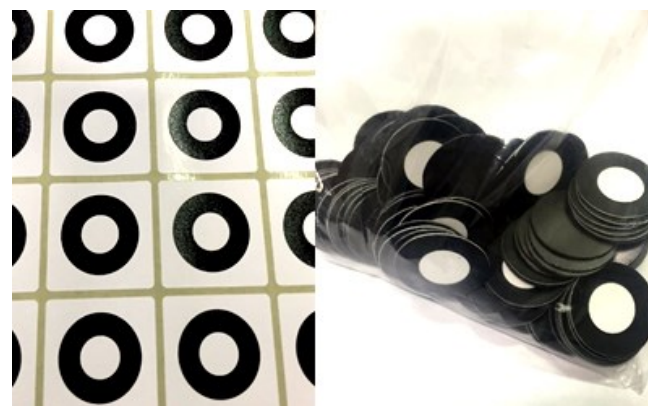
Another option, if you frequently scan metal objects, is to purchase magnetic markers. This approach is more expensive, but the markers are reusable and it makes the process of taking them off the object, once the scanning is done, much easier (the stickers take longer to take off).

11 mm

22 mm

What else should I know about markers?

Here are a few tips for scanning with Calibry scanner and markers.

- At any given time during scanning, the scanner needs to see minimum 3 markers in every frame. When it doesn't, scanning will automatically stop.

- Although 3 markers per frame is the minimum, the optimal number is 5. That is because in certain circumstances, even if the marker is visible to the camera, the software doesn't recognize it as such. This could be due to glare, for example. Thus, when applying markers on an object, try to affix them so that there are 5 markers in every 28*36cm space.

- When affixing markers, apply them on flat areas of the object and not on sharp edges of the object. Also, remember, that the scanner might sometimes not see a marker when looking at it from an awkward angle. This means that when scanning around a large corner (like from the bumper of the car to the back door), try affixing more markers in the field of view.

- Whether scanning with or without markers, the center of the frame of any optical device will produce better results than the edges of the frame. If you want a great scan of the entire object, make sure to scan each portion of that object with the center of the frame.

- The scanner shows, in real time, how many markers it is seeing. If you are not sure about whether you've affixed enough markers on the object, turn on the scanner in preview mode and walk around the object. You will see how many markers the scanner sees at all times and if it's less than 3, you'll know where more markers are needed.