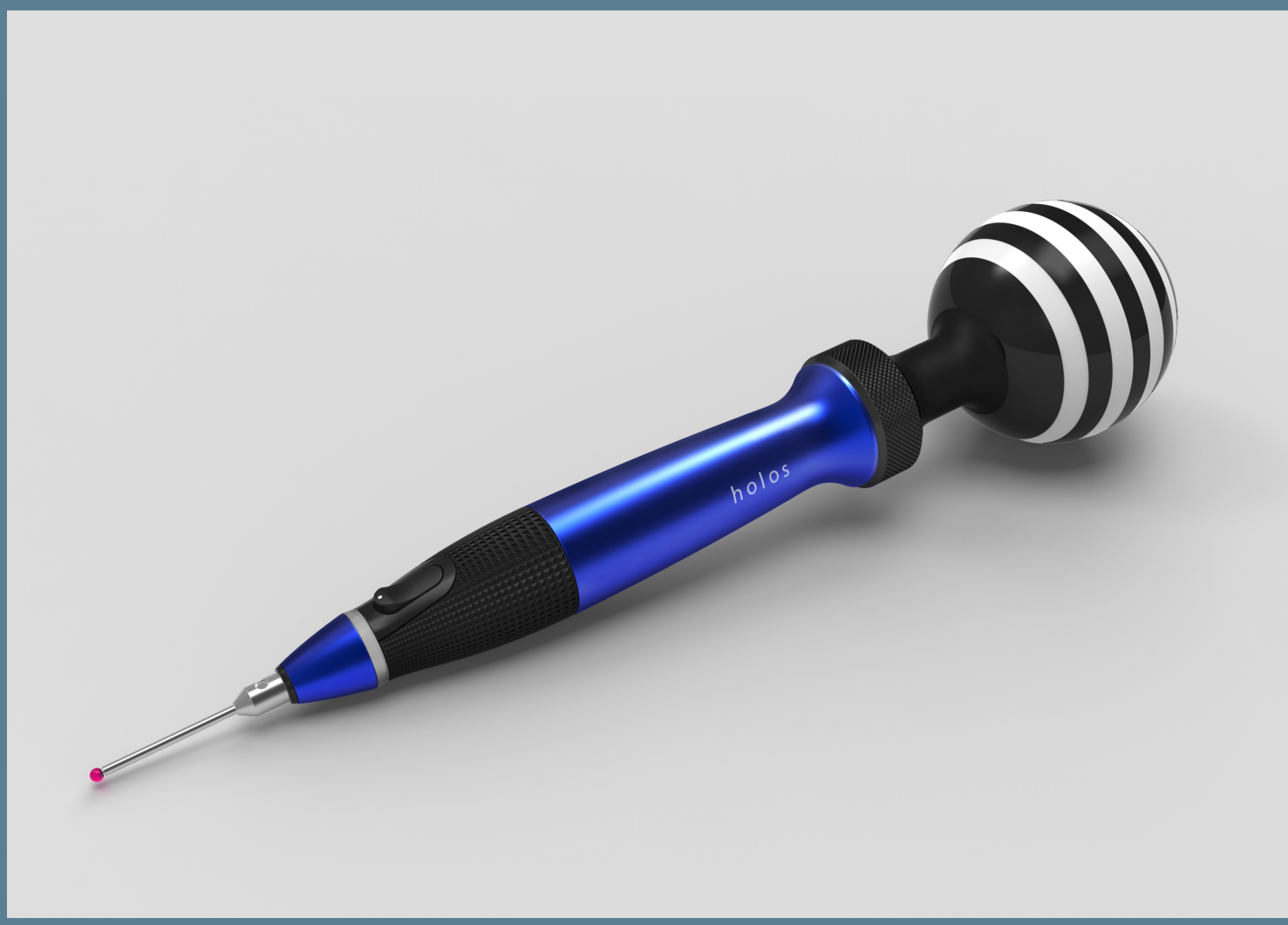
holos®

metrology



holos

metrology

HOLOS Touch Probe

The HOLOS touch probe is a microscale precision, handheld tool that allows accurate measurement of single point locations in space. The probe is tracked by a stereo camera system. The accuracy and range of this precision tool is variable according to the kind of camera and optics deployed in any particular HOLOS system. The probe system, hardware and software, are developed by, and are the intellectual property of Intelligent Earth (Isle of Man) Ltd.

The probe tip location, used to define the xyz coordinates of the measurement, is inferred from the location and orientation of the HOLOS sphere at the rear of the probe. The location and orientation of this sphere can be detected very accurately using proprietary software. The software analyzes the pattern of the rotationally symmetric banded sphere captured in the camera images to obtain very precise 3D measurements.

HOLOS technology (**H**igh-speed **O**bject **L**ocation and **O**rientation **S**ensing) was initially developed to allow a single camera to keep track of the tip of an interactive stylus enabling virtual writing and drawing on any kind of display screen or projected image, even if the tracking camera is placed at arbitrary distances and angles to the screen and the tip itself is occluded by the holding hand.

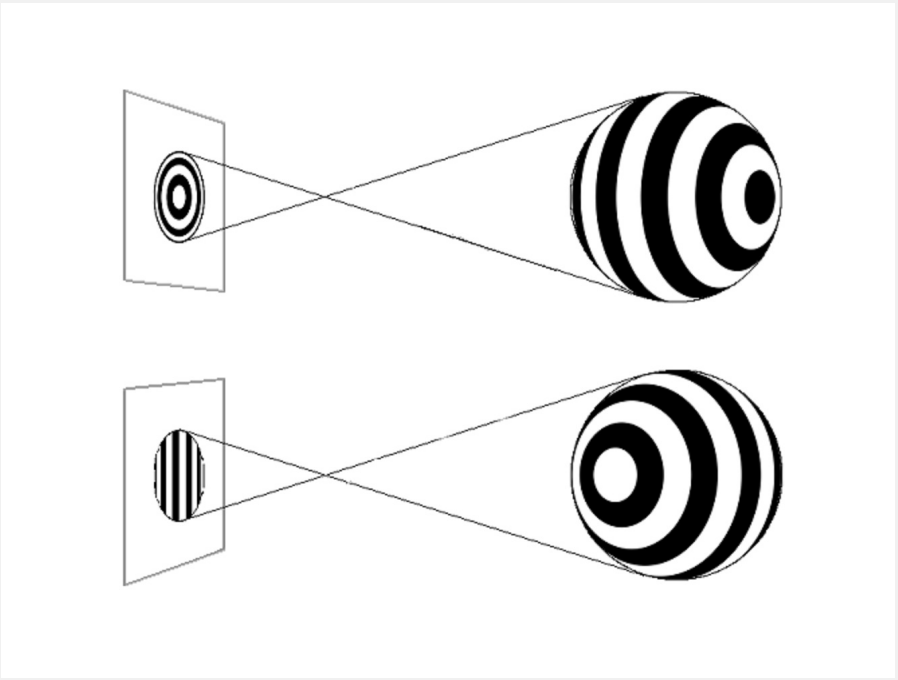
The HOLOS detection algorithm is now specifically optimized for precision tracking under hard constraints such as blurring and low resolution web cameras, limited allowable computing power, requirement of high detection rates as well as low latency. Achieving high quality at competitive pricing for consumer market applications has been a primary driving factor in this HOLOS optimisation process. Optimised for precision under hard constraints such as utilisation of webcams with cheap optics and low resolution, the HOLOS system is phenomenally accurate under more favourable conditions.

By allowing the algorithm to use more processing power, upgrading the optics, and incorporating a second camera, the HOLOS software can achieve a level of 3D measurement accuracy with great potential for Metrology applications. HOLOS systems can offer a similar range and accuracy at lower cost, or alternatively, better accuracy and greater range at the same cost as potential rival systems already established in the market.

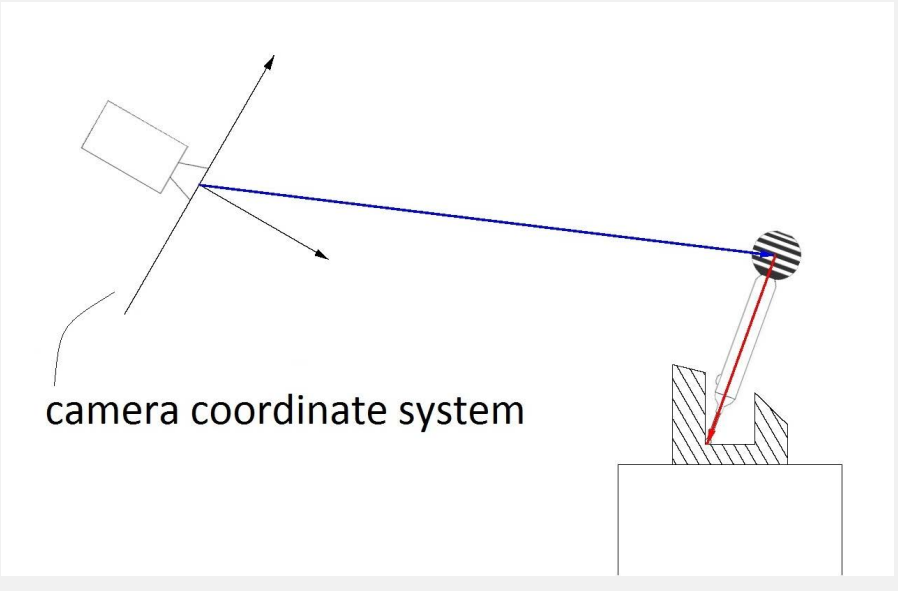
holos

metrology

HOLOS Technology



HOLOS tracking software is able to detect both the exact absolute 3D position and 3D orientation of a patterned sphere in space just from its appearance in a single 2D camera frame. Getting this full 3D information from only 2D is possible because each different position and orientation in 3D space generates a pattern on the camera's focal plane uniquely corresponding to only this position and orientation, which therefore can be inferred from the pattern. Different orientations in 3D space for example result in different curvatures of the bands in the pattern on the camera chip, as indicated in the figure above, allowing the software to pick up the exact orientation of the sphere from any viewing angle.



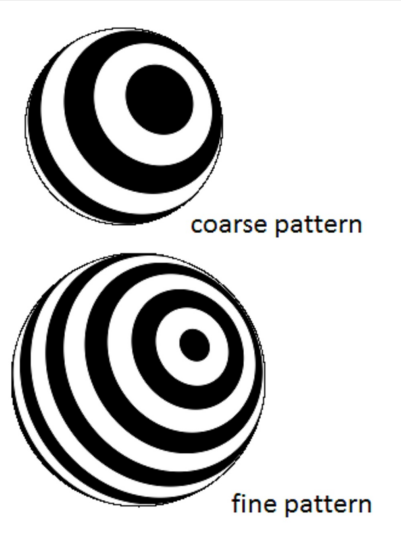
Once the software has identified both the position (blue vector in the image on the right) and the orientation (red vector) from the sphere pattern in the camera's image, the exact 3D tip position in camera coordinates can be calculated even if no direct line of sight exists to the tip. This for examples allows cavities and recesses to be measured which cannot be scanned from a distance with other methods such as LIDAR due to occlusion.

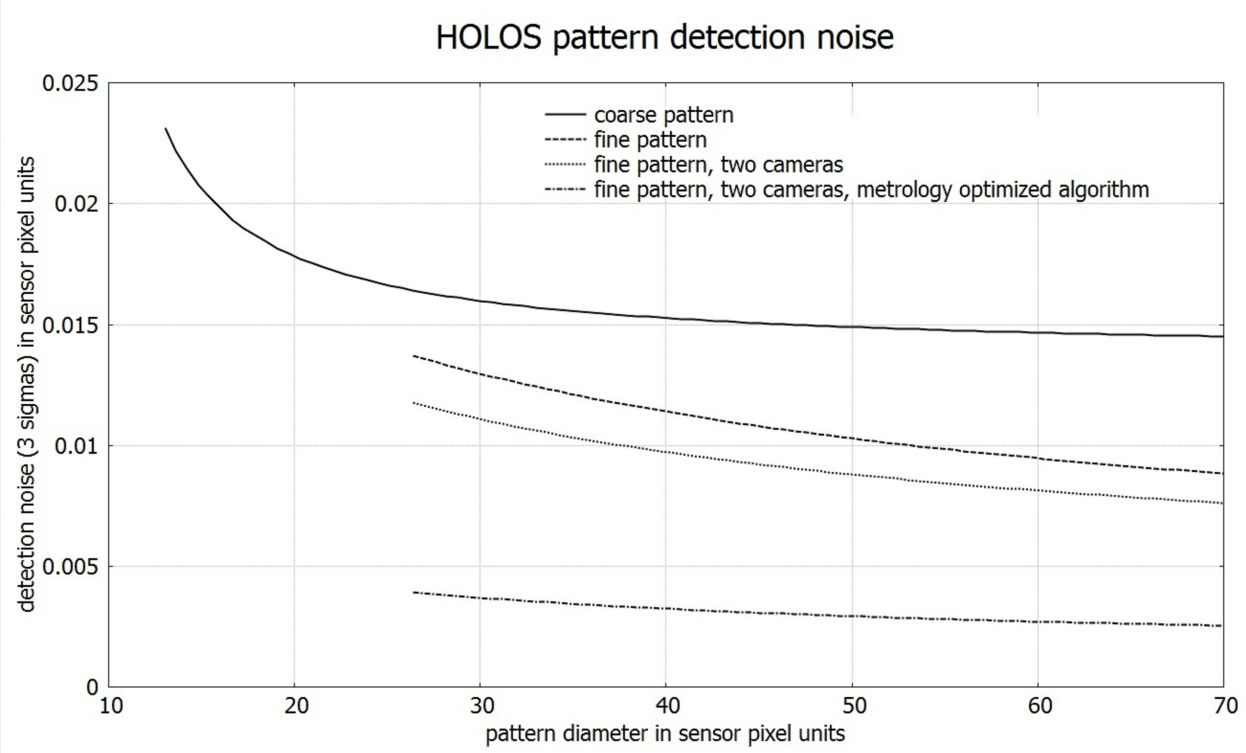
holos

metrology

HOLOS Technology

The core advantage of the HOLOS detection algorithm derives from the exceptionally high precision and robustness at which it can distinguish very slight subpixel changes of the pattern's position, diameter and band curvature in the camera image even if the pattern appears small, pixelated and moderately out of focus. With a fine band structure on the sphere as indicated in the image to the right, pattern movements on the sensor smaller than 1/100th of a pixel unit can be detected. The accuracy even improves to better than 1/300th of a pixel unit when our Metrology optimized HOLOS algorithm is used together with a stereo setup, where twice as much pixel information is available.





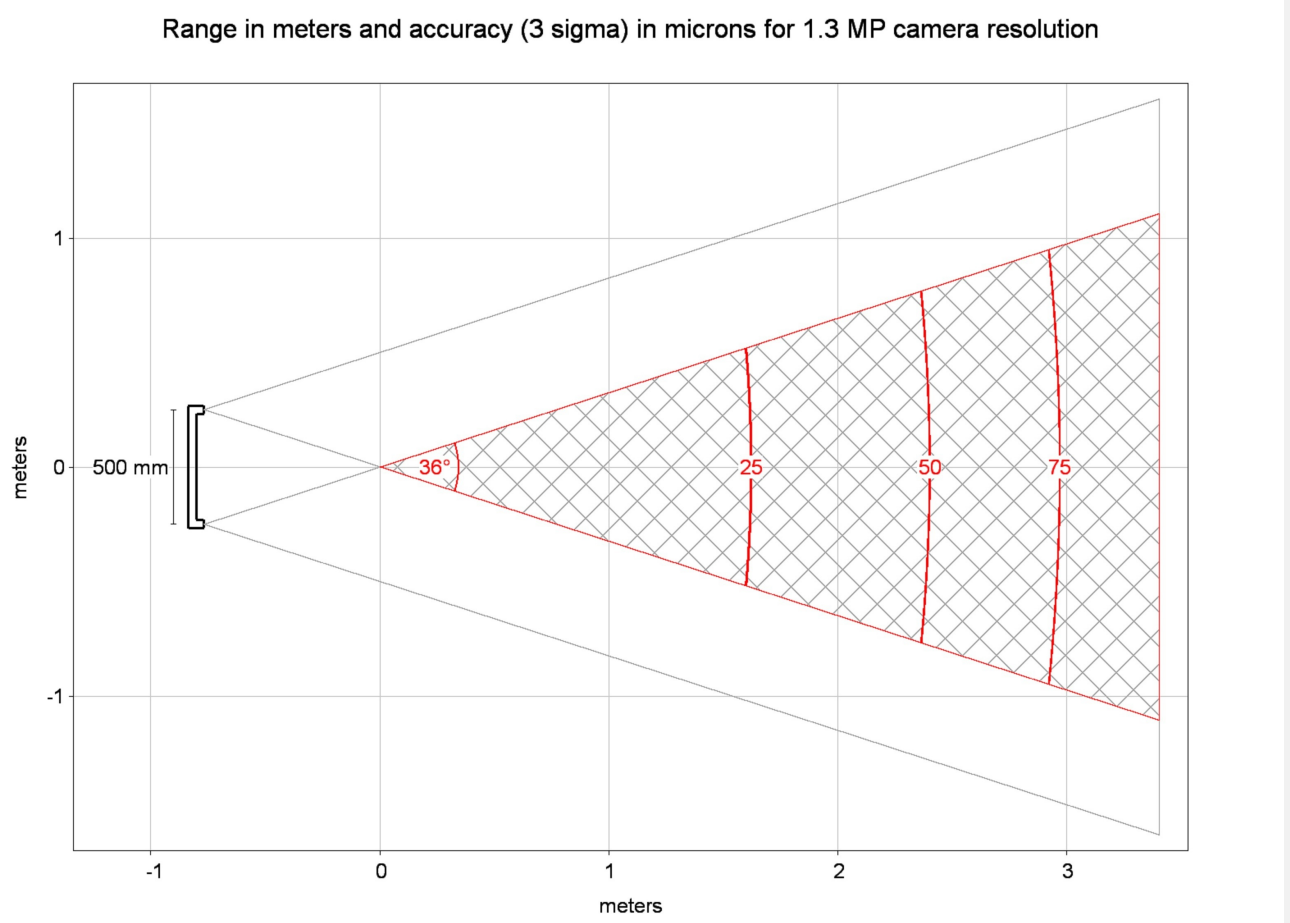
The detection accuracy for the pattern in the camera images together with the triangulation baseline directly determine the accuracy with which the 3D position of the probe tip can be detected. In the case of a single camera the baseline is the diameter of the sphere but in the stereo camera case it is the distance between the left and right camera which is on the order of 5 to 10 times larger, resulting in an improvement of the accuracy by a similar factor.

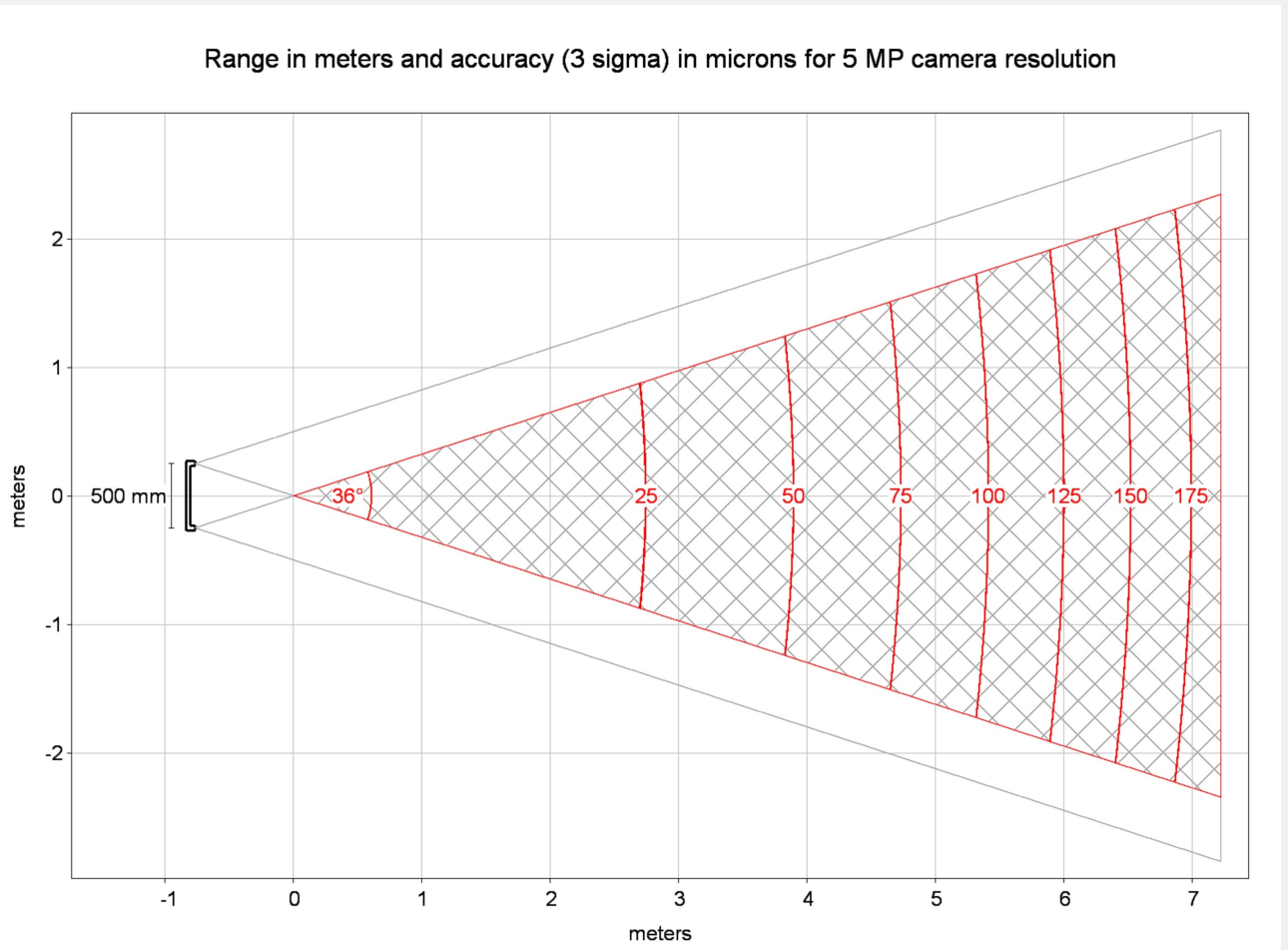
In the schematics on the following pages 3D tip position detection accuracy is predicted based on a baseline of 500 mm and the empirically measured pattern noise shown in the diagram above. Range and accuracy are shown for various camera resolutions, a sphere diameter of 55 mm and a 36° Angle of View.

holos

metrology

Accuracy and Range

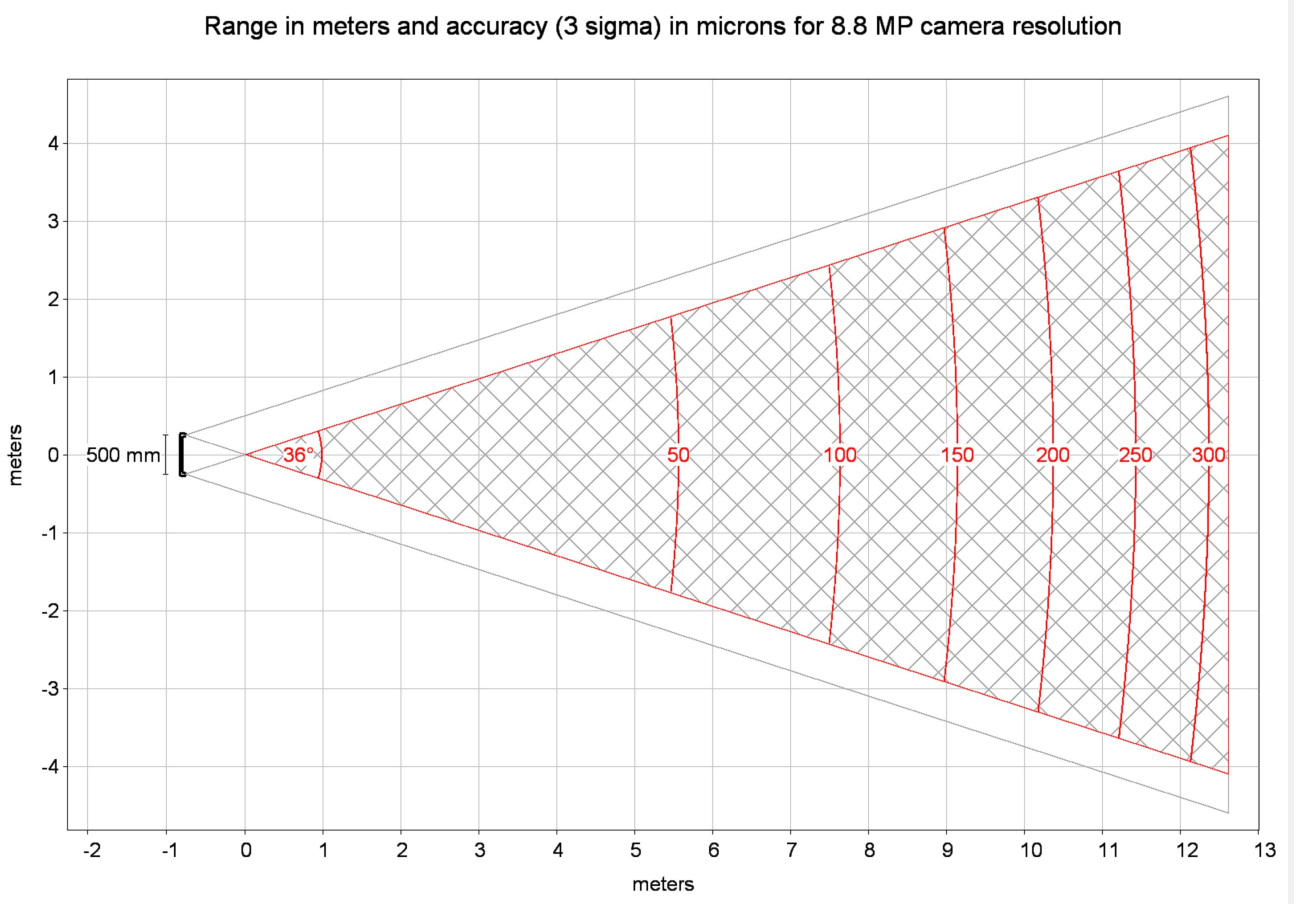


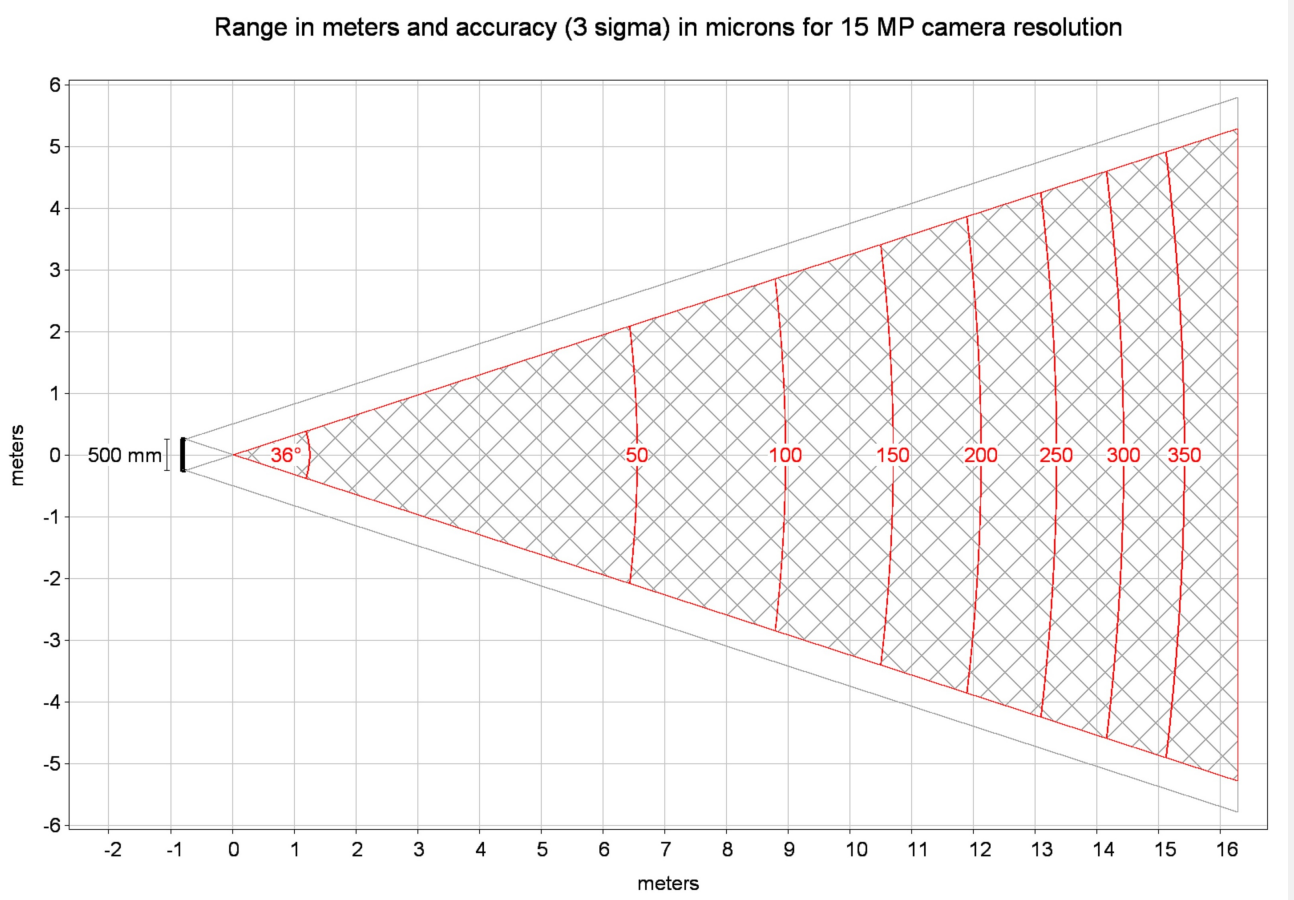


holos

metrology

Accuracy and Range





holos

metrology

HOLOS Technology Resellers

United States Reseller Information

SURVICE Metrology
4695 Millennium Drive
Belcamp, Maryland 21017
USA

metrology@survice.com
+1 410-297-2378

SURVICE