Leica TruView Accuracy
White Paper

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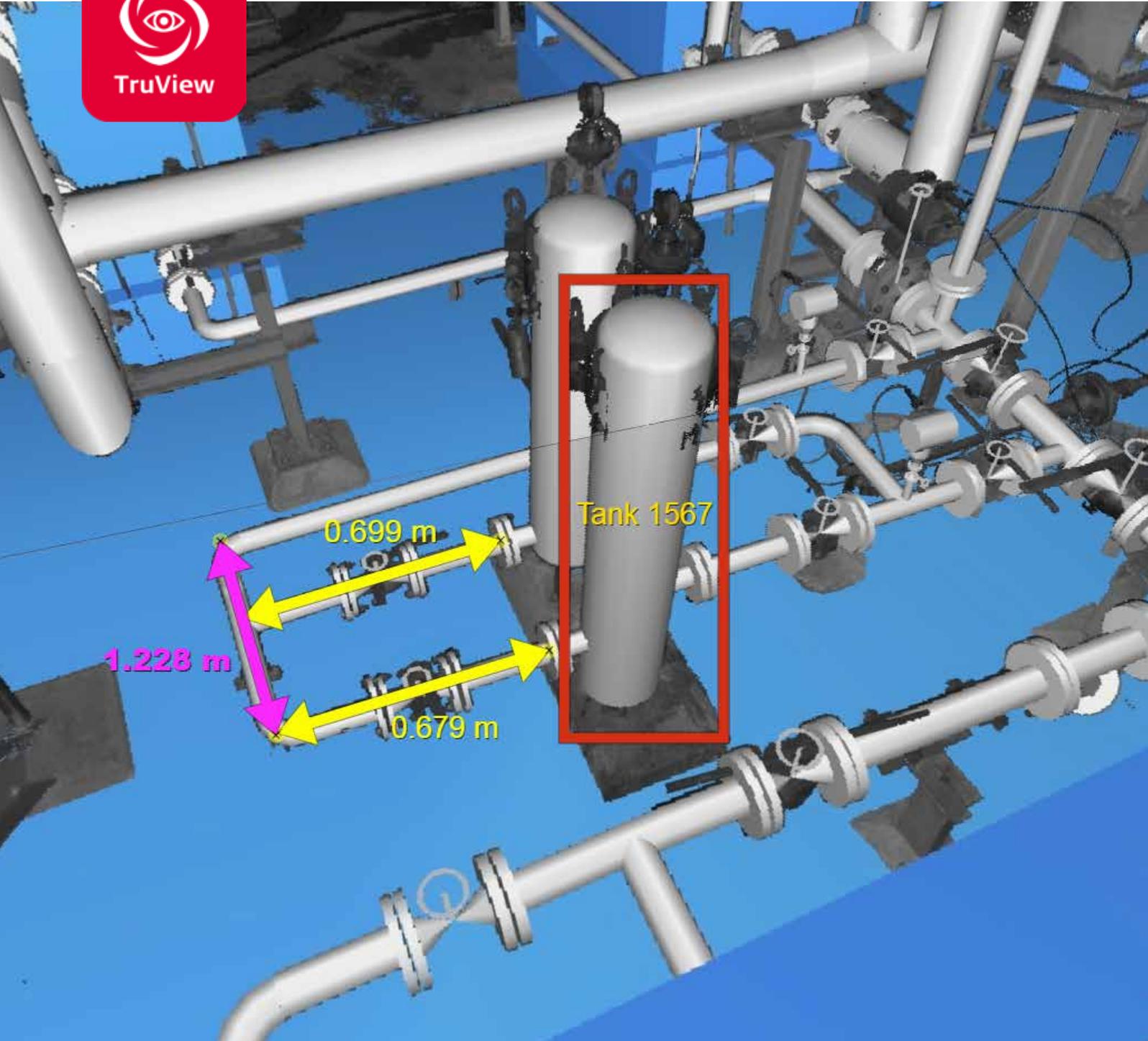
Leica
Geosystems

Leica TruView Accuracy

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Summary

The table of examples at the end of this document shows that Leica TruView data can be as accurate as 7mm at 50m from the scanner position. For a complete understanding of the accuracy of TruView data please review the entire document.

Data Representation

In the Leica Geosystems Cyclone family of products, scanned point coordinates are stored in a database as measured, together with related information like intensity and colour. Leica TruView uses a different storage mechanism (Patent Pending) consisting of digital images for visualisation and an encoded representation of scan points. Each TruView data set contains scan and image data relative to a single scanner location. TruView is image based and stores at most one scan point per image pixel, since the user would have no way of identifying different scan points if they occurred in the same pixel. As a result of this design, smaller TruView images hold less scan points than large ones and in general a TruView data set will contain fewer points than the original scan.

Sources of Error

Coordinate data as presented in TruView contains two sources of error. The first source of error is a characteristic of the data measurement device that collected the data in the first place ($E_{SCANNER}$) often specified at the one standard deviation level. The second source of error ($E_{ENCODING}$) stems from the fact that TruView encodes the measured data from the scanner to make it more compact for efficient web transfer, resulting in TruView points at slightly different locations than the measured scan points in Cyclone. A simple and conservative estimate for the total error in TruView scan data is the sum of $E_{SCANNER}$ and $E_{ENCODING}$.

Publisher allows the user to control the amount of encoding error using the parameter "Encoding Error @200m" (was "Precision @200m" in first release). The value entered for this parameter is the tolerable value of encoding error at 200m. At all shorter ranges the encoding error will be smaller, while at larger ranges the encoding error will be larger. The user must select the tradeoff between smaller encoding error and larger data sets as appropriate for their application.

It is important to note that the specified encoding error is a maximum for all points at 200m or less, it is not an average. So, no point within 200m of the scanner will move due to encoding by more than the user specified amount.

Consequences of Errors

When making measurements between two scan points the error in the measurement is larger than either point error. If the errors in the two points are similar in magnitude then the error in the measurement is approximately 1.4 times the individual point error. Given the point errors described above the measurement error would be 1.4 ($E_{SCANNER} + E_{ENCODING}$).

The error values described above can be used to relate to probabilities that the numbers presented are within the error bound of the true value. For normal distributions 68% of measured values would be within the one standard deviation error of the corresponding true values and 95% of the measured values would be within two standard deviations of the true values. While the encoding error is not normally distributed, using the summed errors presented above should result in similar statistical behaviour.

Distribution of TruView Encoding Errors

As described previously, the TruView encoding errors decrease at ranges smaller than 200m. The user can set the 200m value during the publishing process, but the variation of error with range is a characteristic of how the data is encoded. The graph shows the variation of encoding error in the initial release of TruView 1.0, as well as the improved variation for subsequent releases. The improved method reduces encoding errors at ranges less than 200m, and the encoding errors essentially increase linearly beyond 200m.

TruView Encoding Errors
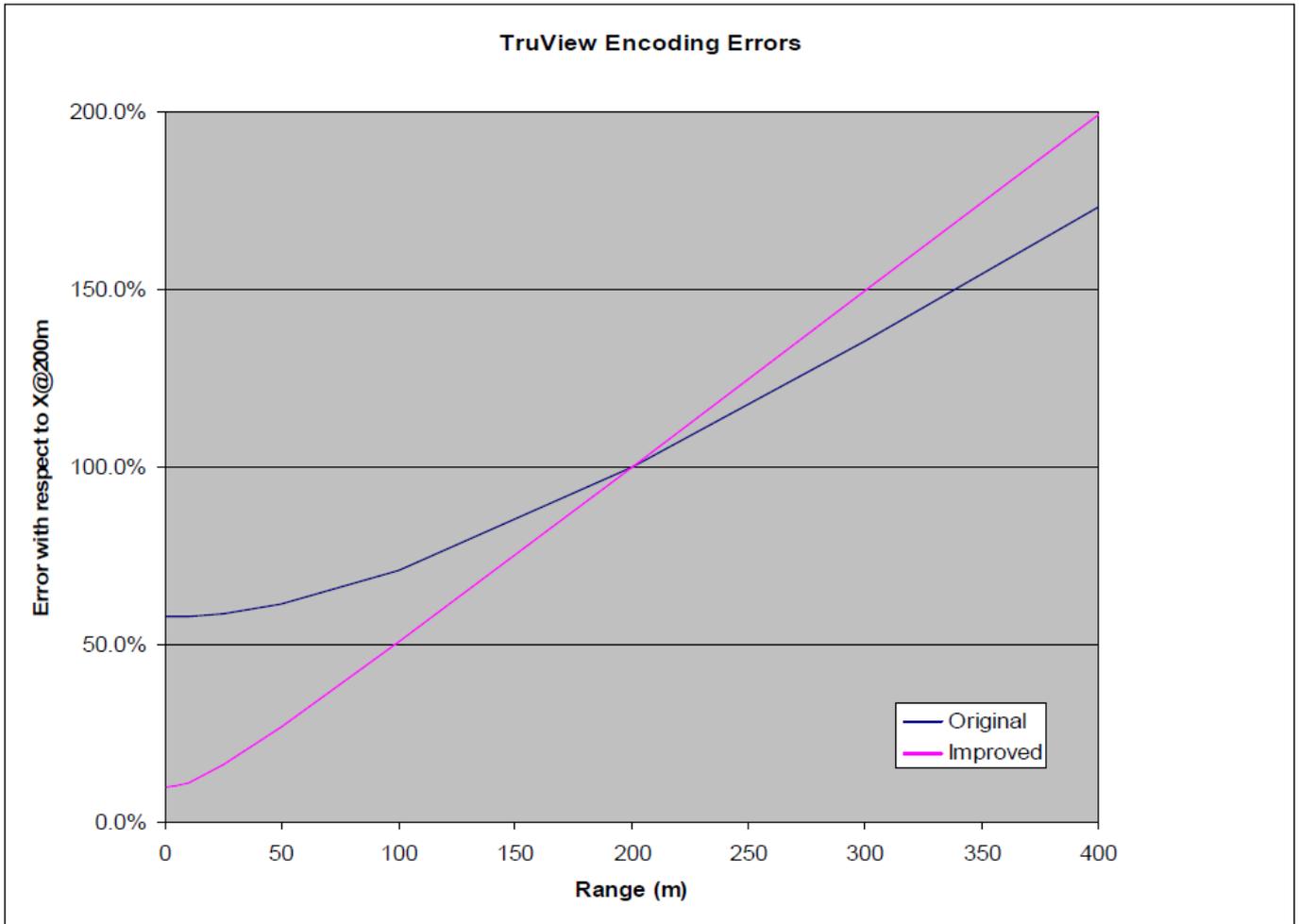
An Example

Given a scanner with an error specification of 6mm at 50m (idealised as having constant range error over the 200m shown below) together with a TruView "Encoding Error @200m" of 6mm, what are the accuracies of scan points within TruView?

Range (m)	$E_{SCANNER}$ (mm)	$E_{ENCODING}$ (mm)	E_{TOTAL} (mm)
200	17	6	**23**
100	9	3	**12**
50	6	2	**7**
10	4	1	**5**

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