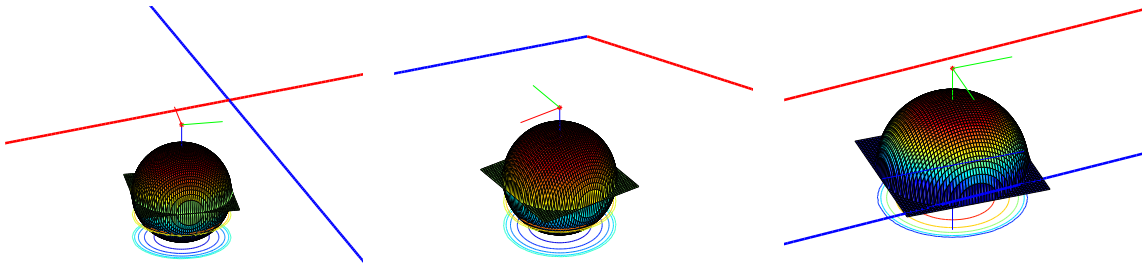
# Minimal solution for computing pairs of lines in non-central cameras: Supplementary Material

ID394

In this supplementary material we extend the simulations and the figures presented in the paper to compare the proposal with the linear extraction method used by Teller et al. The experiments are arranged following three different configuration of lines (see Fig. 1).

- Configuration A corresponds with a pair of orthogonal lines intersecting the middle point .
- Configuration B corresponds with a pair of orthogonal lines intersecting the corner end.
- Configuration C corresponds with a pair of parallel lines.

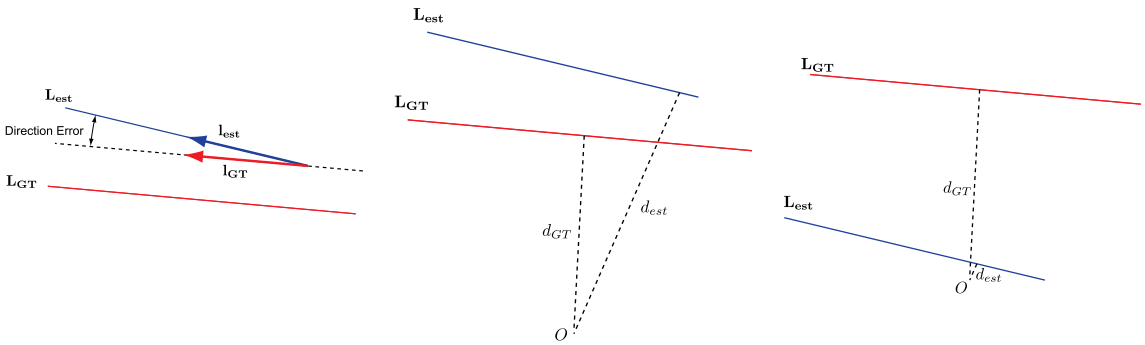


(a) (b) (c)

Figure 1: Lines configuration example. (a) Configuration A. (b) Configuration B. (c) Configuration C.

The set up of the experiments corresponds to the one described in the main paper. In each figure we show the angular error in direction (Fig. 2 (a) ) with respect to the ground truth and the error in the distance from the line to the reference system (Fig. 2 (b)). For each configuration we consider variations in :

- The length of the lines, 20 m vs. 1 m.
- The number of defining points: minimal set vs. all points.




(a) (b) (c)

Figure 2: (a) Direction Error in degrees. (b) Distance Error: $|d_{est} - d_{GT}|$. (c) Lack of effective base line effect in non-central line extraction.

Gaussian noise of a given $\sigma$ is added to the projected points. The value of $\sigma$ variates from 0.1 to 2. Each boxplot shows a comparison between the linear Teller's approach and our proposal depending on $\sigma$.

In general, we can see an improvement in the accuracy of the extracted lines with respect to the linear approach. As expected this improvement is greater in long lines than in short ones. We can also see that depending on the configuration (see Fig. 3 and Fig. 4) of the lines the results can vary. When having enough effective baseline (Fig. 3 (a) (c), Fig. 4 (c), Fig. 5 (a) (c)) there is an evident improvement in both direction error and distance error and these errors increase with the Gaussian error.

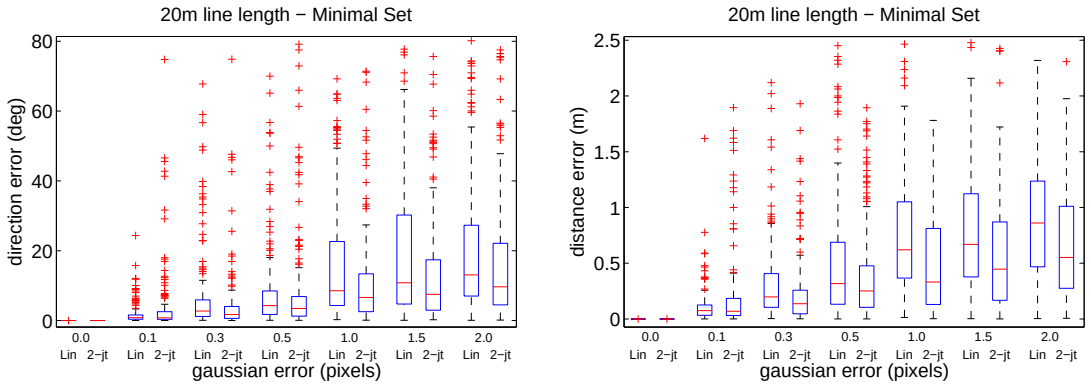
If there is not enough effective baseline between rays the proposal can not improve the results in depth estimation. To illustrate this conclusion, notice the following artefact on the graphics. When not having enough effective baseline the solution given by the linear algorithm and the proposal tends to belong through the origin having a low depth (see Fig. 2 (c)). In this case the estimated distance error is just the depth of the ground truth line with respect to the reference system. Due to the worst case corresponds to lines passing through the reference system the distance error does not increase in spite of augmenting the Gaussian error (see distance error (right figure) in Fig 3 (b) (d), Fig 4 (a) (b) (d) and Fig. 5 (b) (d)).

However, notice that in spite of this lack of effective baseline the proposal improve the results in line orientation even in short lines (see direction error (left figure) in Fig 3 (b) (d), Fig 4 (b) (d) and Fig. 5 (b) (d)).

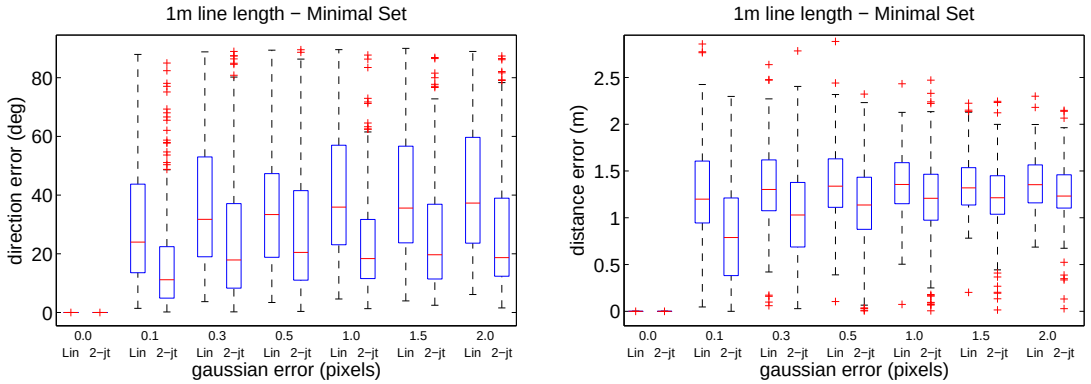
These experiments can be replicated using the attached Matlab code in this supplementary material (ECCVId1598SimCode.zip). The main file is mainID1598.m. The corresponding figure can be selected using the following flags:

- configFlag: A,B or C to select the configuration.
- lengthLinesFlag: 0 for long lines (20 m) and 1 for short lines (1 m)
- minimalSetFlag: 1 for minimal set and 0 for using all points.

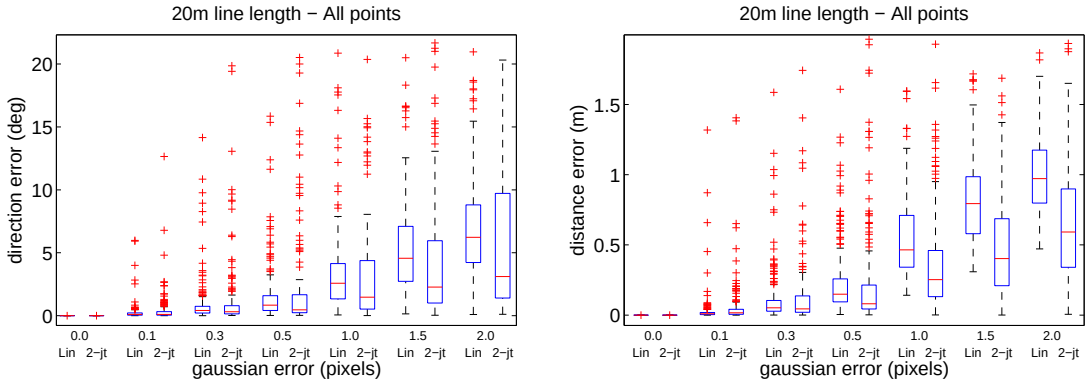
Version 7.4 of Matlab or superior is needed because of the using of function bsxfun.



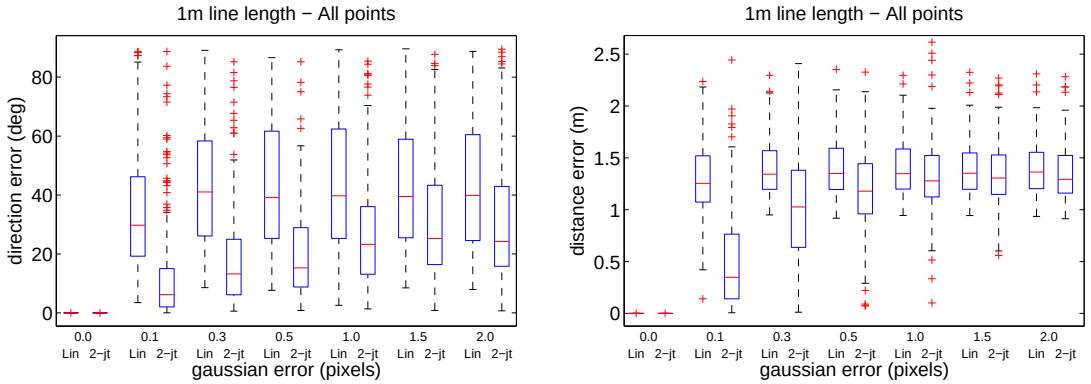

(a) 20 m length lines using the minimal set.




(b) 1 m length lines using the minimal set.

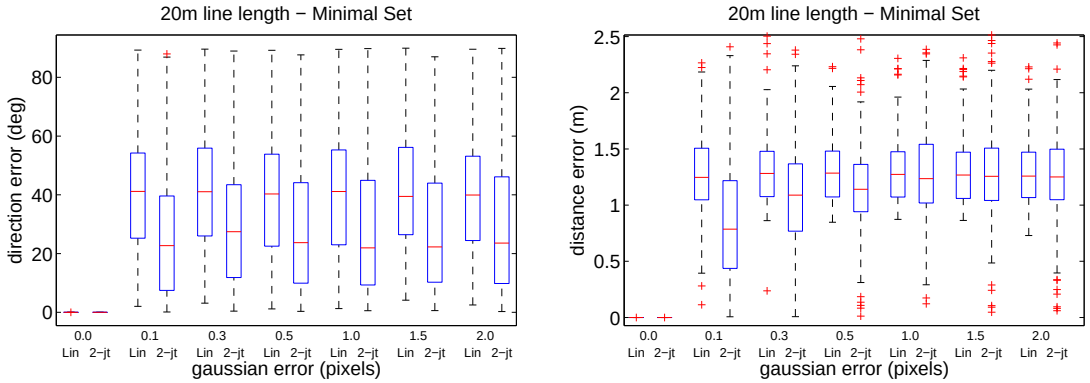



(c) 20 m length lines using all points.

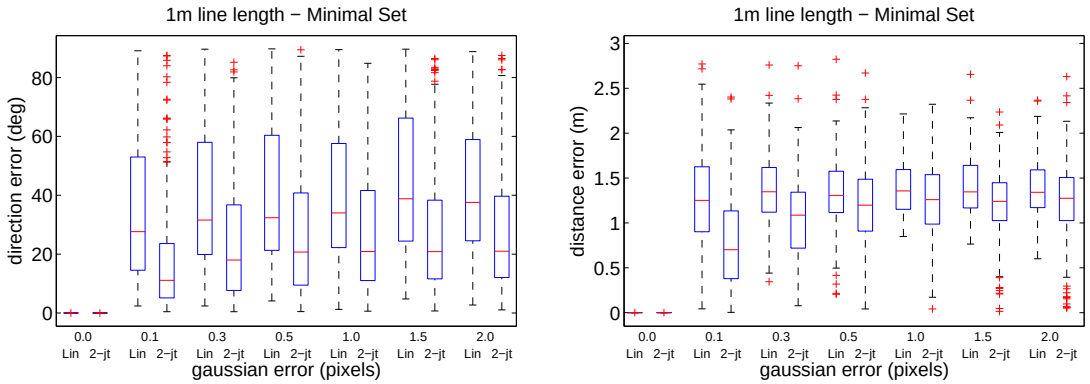



(d) 1 m length lines using all points.

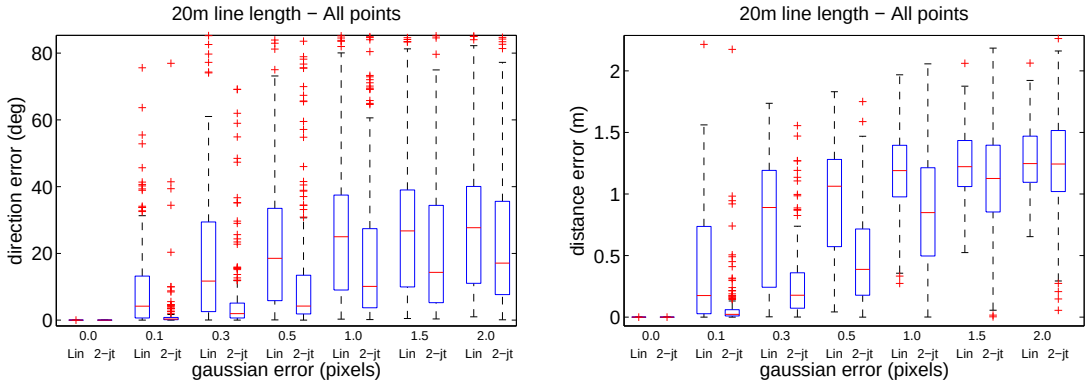
Figure 3: Configuration A.



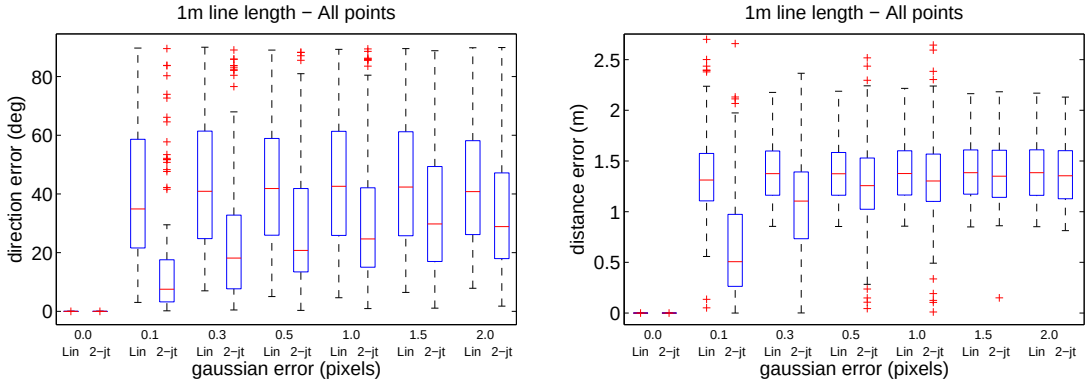

(a) 20 m length lines using the minimal set.




(b) 1 m length lines using the minimal set.

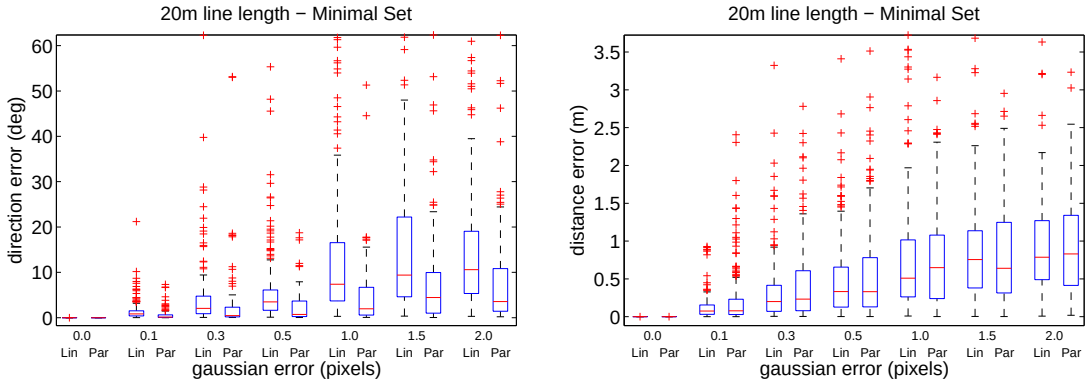



(c) 20 m length lines using all points.

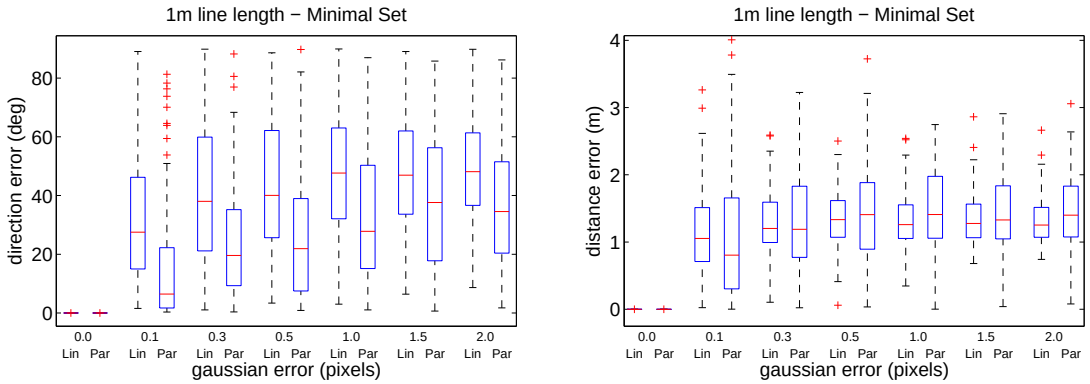



(d) 1 m length lines using all points.

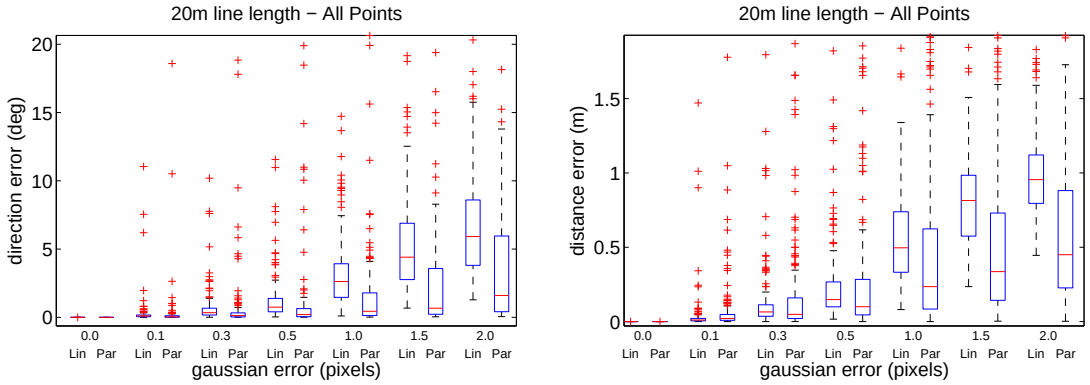
Figure 4: Configuration B.



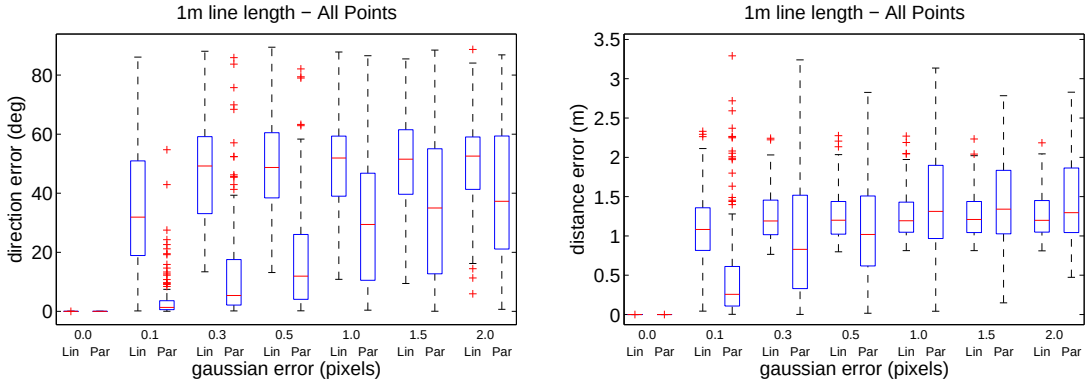

(a) 20 m length lines using the minimal set.




(b) 1 m length lines using the minimal set.




(c) 20 m length lines using all points.




(d) 1 m length lines using all points.

Figure 5: Configuration C.