RePoseD: Efficient Relative Pose Estimation With Known Depth Information

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This supplementary material provides the following information: Sec. 1 provides more details about the proposed solvers, including a general approach that can be used to solve all variants of the depth-aware relative pose problem that require 3 point correspondences, the 3PT_{suv}(inverse) solver for affine-invariant inverse depths, and the variants of the affine-invariant 4PT focal length solvers. Sec. 2 provides more experimental results.

1. More Details About the Solvers

1.1. Solvers Using Three Point Correspondences

For calibrated camera pose estimation with monocular depth, all possible cases can be solved using three point correspondences and a varying number of monocular depth estimates. Similarly, for focal length problems, most cases can be solved using three point correspondences and a varying number of depth estimates. In general, all cases that involve three point correspondences can be solved using a similar approach.

Here we show the solution to the shared unknown focal length scale-invariant case, *i.e.*, the $3\text{PT}_{s00}f$ solver. In this case, the shifts in the monocular depths are omitted (considered to be zero) and we only consider the unknown scales. The minimal case is two 3D-3D point correspondence with one 3D-2D point correspondences. We have

$$\begin{aligned}
\|s\mathbf{K}^{-1}(\beta_1\mathbf{q}_1 - \beta_2\mathbf{q}_2)\| &= \|\mathbf{K}^{-1}(\alpha_1\mathbf{p}_1 - \alpha_2\mathbf{p}_2)\|,\\
\|s\mathbf{K}^{-1}(\beta_1\mathbf{q}_1 - \eta_3\mathbf{q}_3)\| &= \|\mathbf{K}^{-1}(\alpha_1\mathbf{p}_1 - \alpha_3\mathbf{p}_3)\|,\\
\|s\mathbf{K}^{-1}(\beta_2\mathbf{q}_2 - \eta_3\mathbf{q}_3)\| &= \|\mathbf{K}^{-1}(\alpha_2\mathbf{p}_2 - \alpha_3\mathbf{p}_3)\|.
\end{aligned}$$

where $\alpha_1, \alpha_2, \alpha_3, \beta_1, \beta_2$ are known depths estimated *e.g.*, using MDE network, and η_3 is the unknown depth.[1] There are three equations in three unknowns $\{s, f, \eta_3\}$, which can be solved similarly as for the 3PT_{suv} solver presented in Sec. 3.1 of the main paper. In general, all the problems using three point correspondences can be converted into solving three equations in three unknowns. They differ in the number of depth parameters for the 2D points, but the structure and the solution strategy in all cases similar.

[1] Note that in this case, for the last (third) correspondence, we assume that we know/use the depth only from one image, *i.e.*, we have 3D-2D correspondence with unknown depth η_3.

1.2. 3PT_{suv} Inverse Depth Solver

Some MDE networks return affine-invariant inverse depths. In this case, the true depths can be expressed as

$$\eta_i = \frac{s_1}{\alpha_i + u},\ \lambda_i = \frac{s_2}{\beta_i + v}, \tag{1}$$

where α_i, β_i are known values from the inverse monocular depth, and $\{s_1, s_2\}, \{u, v\}$ are the unknown scales and shifts in the inverse depth. In this case, we have

$$\frac{s_2}{\beta_i + v}\mathbf{K}_2^{-1}\mathbf{q}_i = \frac{s_1}{\alpha_i + u}\mathbf{R}\mathbf{K}_1^{-1}\mathbf{p}_i + \mathbf{T}, \tag{2}$$

Dividing (2) by s_1 gives

$$\frac{s}{\beta_i + v}\mathbf{K}_2^{-1}\mathbf{q}_i = \frac{1}{\alpha_i + u}\mathbf{R}\mathbf{K}_1^{-1}\mathbf{p}_i + \mathbf{t},. \tag{3}$$

In this case, similarly to the affine-invariant depth case, we have 9 DOF for calibrated cameras. However, in contrast to the affine-invariant depths, the constraints (3) for affine-invariant inverse depths are more complicated, since they contain unknown parameters in the denominators. We can use similar tricks to eliminate the rotation and translation from the original equations (3) as the ones used for the affine-invariant depth solvers presented in the main paper. In this case, we obtain

$$\begin{aligned}
\|\frac{s\tilde{\mathbf{q}}_1}{\beta_1 + v} - \frac{s\tilde{\mathbf{q}}_2}{\beta_2 + v}\| &= \|\frac{\tilde{\mathbf{p}}_1}{\alpha_1 + u} - \frac{\tilde{\mathbf{p}}_2}{\alpha_2 + u}\|,\\
\|\frac{s\tilde{\mathbf{q}}_1}{\beta_1 + v} - \frac{s\tilde{\mathbf{q}}_3}{\beta_3 + v}\| &= \|\frac{\tilde{\mathbf{p}}_1}{\alpha_1 + u} - \frac{\tilde{\mathbf{p}}_3}{\alpha_3 + u}\|,\\
\|\frac{s\tilde{\mathbf{q}}_2}{\beta_2 + v} - \frac{s\tilde{\mathbf{q}}_3}{\beta_3 + v}\| &= \|\frac{\tilde{\mathbf{p}}_2}{\alpha_2 + u} - \frac{\tilde{\mathbf{p}}_3}{\alpha_3 + u}\|.
\end{aligned} \tag{4}$$

However, these equations have unknowns in the denominators, and simply multiplying the equations with the denominators results in a very complex system of equations that is difficult to solve.

To solve the equations efficiently, we first multiply (4) with $\alpha_1 + u$, and let

$$b_1 = \frac{s(\alpha_1+u)}{\beta_1+v},\ b_2 = \frac{s(\alpha_1+u)}{\beta_2+v},\ b_3 = \frac{s(\alpha_1+u)}{\beta_3+v},$$
$$c_2 = \frac{\alpha_1+u}{\alpha_2+u},\ c_3 = \frac{\alpha_1+u}{\alpha_3+u}. \tag{5}$$

Substituting (5) into (4) we have three equations

$$\begin{aligned} \|b_1\tilde{\mathbf{q}}_1 - b_2\tilde{\mathbf{q}}_2\| &= \|\tilde{\mathbf{p}}_1 - c_2\tilde{\mathbf{p}}_2\|, \\ \|b_1\tilde{\mathbf{q}}_1 - b_3\tilde{\mathbf{q}}_3\| &= \|\tilde{\mathbf{p}}_1 - c_3\tilde{\mathbf{p}}_3\|, \\ \|b_2\tilde{\mathbf{q}}_2 - b_3\tilde{\mathbf{q}}_3\| &= \|c_2\tilde{\mathbf{p}}_2 - c_3\tilde{\mathbf{p}}_3\|, \end{aligned} \tag{6}$$

where b_1, b_2, b_3, c_2, c_3 are new unknowns. However, these unknown are not independent. To find the constraints on b_1, b_2, b_3, c_2, c_3, we use the elimination ideal technique [4]. In this case, we first create an ideal J generated by five polynomials (5). Then, the unknown parameters s, u, v are eliminated from the generators of J by computing the generators of the elimination ideal $J_1 = J \cap \mathbb{C}[\alpha_1, \alpha_2, ..., c_2, c_3]$. These generators can be computed using the following Macaulay2 [10] code

```
R = QQ[s,u,v,α1,α2,α3,β1,β2,β3,b1,b2,b3,c2,c3];
eq = {b1(β1+v)-s(α1+u), b2(β2+v)-s(α1+u),
      b3(β3+v)-s(α1+u), c2(α2+u)-(α1+u),
      c3(α3+u)-(α1+u)};
J = ideal(eq);
J1 = eliminate(J,{s,u,v});
g = mingens J1;
"constraints.txt" << toString g << close;
```

In this case, by eliminating $\{s, u, v\}$ from (5) we obtain the following two equations in $\{b_1, b_2, b_3, c_2, c_3\}$

$$\begin{aligned} &b_1b_2\beta_1 - b_1b_3\beta_1 - b_1b_2\beta_2 + b_2b_3\beta_2 + b_1b_3\beta_3 - b_2b_3\beta_3 = 0, \\ &c_2c_3\alpha_2 - c_2c_3\alpha_3 + c_2\alpha_1 - c_3\alpha_1 - c_2\alpha_2 + c_3\alpha_3 = 0. \end{aligned} \tag{7}$$

Combining (7) with (6) we have 5 equations in 5 unknowns, which can be solved using the Gröbner basis method [4]. Using the automatic generator of Gröbner basis solvers [16], we obtain a solver with an elimination template of size 54×66 and 12 solutions. Note that there are two trivial solutions $b_2 = b_3 = c_2 = c_3 = 0, \|b_1\tilde{\mathbf{q}}_1\| = \|\tilde{\mathbf{p}}_1\|$. Hence, there are up to 10 feasible solutions.

The 3PT_{suv}(inverse) solver is much more complex than the 3PT_{suv} solver for affine-invariant depths presented in the main paper. In the next section, we show that the 3PT_{suv}(inverse) solver does not give better results than the 3PT_{suv} solver inside RANSAC even when used with affine-invariant inverse depths.

1.3. Fast 4PT Solvers

In Sec 3.2 of the main paper, we have mentioned that the focal length problems with affine-invariant depth can be efficiently solved using all the six equations. Here we provide more details on the solutions.

$4\text{PT}_{suv}f$(Eigen). By using four 3D-3D point correspondences, we can rewrite the six equations for this problem as

$$\mathbf{M}\,[1, c, cv, cv^2, u, u^2, f^2, cf^2]^\top = 0, \tag{8}$$

where $\mathbf{M}$ is a 6×8 coefficient matrix.

Since these equations only contain f^2, we let $w = f^2$ and consider w as the hidden variable [14]. Then (8) can be written as

$$\mathbf{M}(w)\,[1, c, cv, cv^2, u, u^2]^\top = 0, \tag{9}$$

where $\mathbf{M}(w)$ is a 6×6 polynomial matrix in w. In this case

$$\mathbf{M}(w) = \mathbf{M}_0 + w\mathbf{M}_1, \tag{10}$$

where $\mathbf{M}_0$ and $\mathbf{M}_1$ are 6×6 coefficient matrices.

Thus, in this case, the solutions to $1/w$ are the eigenvalues of the following matrix

$$\mathbf{A} = -\mathbf{M}_0^{-\top}\mathbf{M}_1^\top. \tag{11}$$

Note that there are 4 zero columns in $\mathbf{M}_1$, which will result in zero eigenvalues. Based on [14], these zero columns can be removed together with the zero rows. Hence, we only need to find the eigenvalues of a 2×2 matrix resulting in 2 solutions to the problem. We denote this solver as $4\text{PT}_{suv}f$(Eigen).

$4\text{PT}_{suv}f_{1,2}$(Eigen). For different and unknown focal lengths case, we have the following six equations

$$\mathbf{m}_i\,[1, c, cf_2^2, cf_2^2v, cf_2^2v^2, f_1^2, f_1^2u, f_1^2u^2]^\top = 0, \tag{12}$$

where $i = 1, 2, ..., 6$. We consider v as a hidden variable, and (12) can be written as

$$\mathbf{M}(v)\,[1, c, cf_2^2, f_1^2, f_1^2u, f_1^2u^2]^\top = 0, \tag{13}$$

where $\mathbf{M}(v)$ is a 6×6 polynomial matrix in v. It can be solved similarly to the shared unknown focal length case, and there are only two possible solutions. We denote this solver as $4\text{PT}_{suv}f_{1,2}$(Eigen).

2. More Experiments

2.1. Results for 3PT_{suv}(Inverse)

This solver was derived to be used with affine-invariant inverse depths, *e.g.*, obtained via Depth Anything [24]. However, we observed that the 3PT_{suv}(inverse) solver does not improve the accuracy even for affine-invariant inverse depths when used inside RANSAC. In addition, $3PT_{suv}$(inverse) is much more time-consuming than the $3PT_{suv}$ solver as shown in Table 1. In this experiment, we use GC-RANSAC [2] without LO to show that $3PT_{suv}$(inverse) solver is not practical. As such, we did not evaluate the $3PT_{suv}$(inverse) solver in the main paper.

Depth	Method	Phototourism				
		$\epsilon_{\mathbf{R}}(^\circ)\downarrow$	$\epsilon_{\mathbf{t}}(^\circ)\downarrow$	mAA($\mathbf{R}$)↑	mAA($\mathbf{t}$)↑	$\tau(ms)\downarrow$
DA V2 [25]	$3PT_{suv}$	1.27	2.94	0.83	0.66	45.37
	$3PT_{suv}$(inverse)	1.28	3.02	0.83	0.65	194.77

Table 1. Comparison between $3PT_{suv}$ and $3PT_{suv}$(inverse) using Depth anything V2 [25] on the Phototourism dataset with GC-RANSAC [2].

2.2. Results for Fast 4PT Solvers

Table 2 shows that the relaxed eigenvalue solvers for the focal length problems are faster but give much worse results. Hence, we didn't use them in the real experiments.

Depth	Method	Phototourism						
		$\epsilon_{\mathbf{R}}(^\circ)\downarrow$	$\epsilon_{\mathbf{t}}(^\circ)\downarrow$	$\epsilon_f\downarrow$	mAA($\mathbf{R}$)↑	mAA($\mathbf{t}$)↑	mAA(f)↑	$\tau(ms)\downarrow$
DA V2 [25]	$4PT_{suv}f$	2.32	6.58	0.22	0.72	0.44	0.33	50.99
	$4PT_{suv}f$(Eigen)	5.17	17.25	0.30	0.52	0.22	0.21	8.18
	$4PT_{suv}f_{1,2}$	5.78	17.37	0.26	0.48	0.20	0.23	54.27
	$4PT_{suv}f_{1,2}$(Eigen)	7.65	23.42	0.32	0.39	0.15	0.18	7.92

Table 2. Comparison between the focal length solvers shown in the main paper and the fast eigenvalue solutions inside GC-RANSAC [2].

2.3. More Results

We provide more results for the three different cases including more datasets, RANSAC configurations, matches, depths estimated using MiDaS [3] and additional solvers. Tables 3-5 show results for the for the ETH3D dataset for the three evaluated cases. Tables 6-8 show the results on the ScanNet dataset for the three evaluated cases. Tables 9 and 10 show the results for on the Phototourism dataset for the case of calibrated cameras and cameras with two unknown and different focal lengths. We note that Mast3r [17] with its non-linear optimization strategy is not included for the calibrated case, since the authors recommend using the 5PT [20] solver with RANSAC to obtain the poses instead.

Tables 3-10 include multiple configurations of PoseLib [15] in which we use different error functions for scoring and LO. We evaluate the standard Sampson error denoted as S, the reprojection error denoted as R and its version with included shift denoted as R_s. We find that for focal length problems with good depth, optimizing the reprojection error often yields results that are comparable to or better than those obtained using the Sampson error. This may be because the Sampson error can become unstable in certain degenerate configurations [13], whereas the reprojection error remains robust.

We have also evaluated our proposed solvers $3PT_{100}f$ and $3PT_{100}f_{1,2}$ for the shared and different unknown focal cases respectively. These solvers assume zero shifts and known scales or same scales in both images and thus known scale ratio s. On Phototourism and ETH3D they perform worse than alternatives. However, when evaluated on ScanNet these solvers perform on par with solvers considering scale and shift. Additionally, solvers that do not model scale and shift can still produce reasonable results when using Mast3r's depth, as Mast3r inherently corrects depth scales based on multi-view information. This suggests that in some scenarios (such as indoor scenes) MDEs may provide depths for which scale and shift do not need to be considered.

For the case of different focal lengths on the ScanNet dataset (see Table 8) Mast3r [17] with its optimization strategy achieves the best results. However, we show that these results can be surpassed when Mast3r matches are used in conjunction with MoGe [23] for depth estimation. For this combination, the hybrid RANSAC strategy [26] with either of the evaluated solvers yields better accuracy in both pose and focal length than Mast3r. We note that the runtime evaluation is fair, since for Mast3r runtime we do not include the inference time of the network which produces the matches.

For the two uncalibrated cases we also include ablation results using the hybrid RANSAC proposed in [26] with shift optimization disabled during LO. We denote this strategy as H_{NS}. The results show that optimizing shift is not crucial for accuracy as the differences between the two approaches are minimal and in some cases disabling shift optimization yields increased accuracy. This suggests that the including shift in the hybrid RANSAC scheme is not the reason for its superior performance compared to standard PoseLib [15].

In Tables 3-8 we also include results using SIFT matches [19]. Compared to the learning based matches the resulting accuracy is worse, but the ordering of compared methods remains very similar.

Depth	Solver	Opt.	SP+LG [6, 18]			RoMA [9]			SIFT [19]		
			$\epsilon(°)\downarrow$	mAA↑	$\tau(ms)\downarrow$	$\epsilon(°)\downarrow$	mAA↑	$\tau(ms)\downarrow$	$\epsilon(°)\downarrow$	mAA↑	$\tau(ms)\downarrow$
-	5PT [20]	S	0.91	87.67	48.14	0.56	91.10	184.36	1.82	82.85	29.39
Real Depth	Rel3PT [1]	S	0.88	88.21	103.18	0.52	91.38	532.02	1.16	85.32	51.50
	P3P [7]	S	0.83	88.88	29.68	0.52	91.33	141.39	1.09	85.64	13.39
	$3PT_{suv}$(M) [26]	S	0.79	88.55	41.81	0.45	91.39	145.59	1.09	85.57	25.77
	$3PT_{suv}$ **(ours)**	S	0.80	88.60	29.59	0.47	91.37	127.81	1.00	85.72	16.07
	P3P [7]	R	0.33	92.56	**13.27**	0.26	93.41	52.53	0.74	86.89	**6.57**
	$3PT_{suv}$(M) [26]	R	**0.32**	**92.60**	25.64	**0.25**	**93.91**	57.20	0.70	87.25	19.64
	$3PT_{suv}$ **(ours)**	R	**0.32**	92.57	13.76	**0.25**	93.90	**42.86**	0.70	87.28	8.74
	P3P [7]	R_s	0.36	92.30	14.47	0.29	93.33	57.28	0.72	87.07	7.28
	$3PT_{suv}$(M) [26]	R_s	0.36	92.12	26.70	0.29	93.46	62.30	0.72	87.18	19.47
	$3PT_{suv}$ **(ours)**	R_s	0.36	92.10	15.27	0.29	93.46	45.96	**0.69**	87.38	9.29
	$3PT_{suv}$(M) [26]	H [26]	0.52	91.39	549.59	0.39	92.73	1505.19	0.74	87.52	716.51
	$3PT_{suv}$ **(ours)**	H [26]	0.52	91.42	543.48	0.39	92.72	1490.93	0.73	**87.72**	724.13
MiDas [3]	Rel3PT [1]	S	4.81	71.25	36.34	3.23	82.22	149.63	9.92	58.41	22.71
	P3P [7]	S	0.94	86.16	22.97	0.60	**90.80**	91.36	3.03	80.98	11.25
	$3PT_{suv}$(M) [26]	S	**0.88**	87.34	31.11	**0.58**	90.77	79.17	2.78	82.47	21.18
	$3PT_{suv}$ **(ours)**	S	**0.88**	**87.39**	20.40	0.59	90.76	67.13	2.91	**82.50**	12.49
	P3P [7]	R	12.40	28.75	14.86	9.06	37.21	65.21	14.63	29.91	**6.94**
	$3PT_{suv}$(M) [26]	R	12.16	28.56	23.87	9.17	37.19	53.98	16.24	29.42	18.23
	$3PT_{suv}$ **(ours)**	R	12.24	28.61	**13.25**	9.30	36.91	42.72	16.00	29.33	9.03
	P3P [7]	R_s	8.05	38.57	14.60	6.00	48.28	57.97	10.47	39.31	7.46
	$3PT_{suv}$(M) [26]	R_s	5.68	49.47	24.18	3.75	63.57	48.37	8.18	46.00	18.19
	$3PT_{suv}$ **(ours)**	R_s	5.69	49.64	13.79	3.75	63.54	**37.26**	7.42	46.18	9.38
	$3PT_{suv}$(M) [26]	H [26]	1.08	85.38	685.32	0.67	90.49	1605.43	**2.31**	80.52	768.46
	$3PT_{suv}$ **(ours)**	H [26]	1.07	85.45	683.39	0.67	90.50	1590.71	2.34	80.55	771.69
DA v2 [25]	Rel3PT [1]	S	5.57	68.46	35.74	3.90	80.56	145.85	10.99	55.38	22.66
	P3P [7]	S	**0.90**	86.25	23.26	0.72	90.61	93.99	3.07	81.10	11.56
	$3PT_{suv}$(M) [26]	S	**0.90**	**87.19**	32.50	0.56	90.99	88.60	2.69	82.99	22.08
	$3PT_{suv}$ **(ours)**	S	0.91	87.07	21.68	0.56	**91.01**	75.87	2.47	**83.08**	13.04
	P3P [7]	R	11.40	30.75	14.88	9.31	37.43	65.83	13.28	34.64	**6.97**
	$3PT_{suv}$(M) [26]	R	11.73	30.08	24.46	9.19	37.18	56.91	14.04	34.10	18.24
	$3PT_{suv}$ **(ours)**	R	11.71	29.93	**13.52**	9.20	37.25	45.22	13.02	34.43	8.85
	P3P [7]	R_s	6.87	43.36	14.71	5.12	52.28	59.11	7.78	48.49	7.46
	$3PT_{suv}$(M) [26]	R_s	4.24	56.53	24.89	2.69	68.58	53.70	5.34	57.61	18.14
	$3PT_{suv}$ **(ours)**	R_s	4.27	56.50	14.13	2.70	68.50	**42.35**	4.73	57.65	9.38
	$3PT_{suv}$(M) [26]	H [26]	0.97	85.52	605.63	**0.54**	90.62	1493.75	**2.12**	80.89	635.29
	$3PT_{suv}$ **(ours)**	H [26]	0.98	85.56	593.95	**0.54**	90.62	1477.73	2.19	80.79	632.61
MoGe [23]	Rel3PT [1]	S	4.74	72.08	42.19	2.74	82.04	170.29	9.77	56.78	25.50
	P3P [7]	S	0.91	87.67	25.72	0.54	91.16	111.74	**1.99**	83.96	12.09
	$3PT_{suv}$(M) [26]	S	0.89	87.71	33.45	0.53	91.04	98.20	3.10	84.08	22.36
	$3PT_{suv}$ **(ours)**	S	0.89	87.67	22.41	0.54	91.05	84.24	2.23	84.32	13.17
	P3P [7]	R	1.89	77.65	15.16	1.48	83.13	66.70	2.68	76.75	**6.75**
	$3PT_{suv}$(M) [26]	R	1.90	77.43	24.49	1.48	83.11	57.53	4.13	75.92	18.19
	$3PT_{suv}$ **(ours)**	R	1.92	77.31	**13.45**	1.47	83.13	45.41	3.37	76.15	8.80
	P3P [7]	R_s	1.68	79.07	15.51	1.28	84.99	64.68	2.74	77.19	7.69
	$3PT_{suv}$(M) [26]	R_s	1.76	78.13	24.93	1.32	84.91	55.70	3.20	77.04	18.31
	$3PT_{suv}$ **(ours)**	R_s	1.77	78.07	14.12	1.31	84.99	**43.77**	2.47	77.17	9.09
	$3PT_{suv}$(M) [26]	H [26]	0.86	**88.26**	566.16	0.50	91.17	1414.96	2.16	**84.85**	572.73
	$3PT_{suv}$ **(ours)**	H [26]	**0.85**	88.24	554.79	**0.49**	**91.23**	1401.61	2.23	84.73	575.19
UniDepth [21]	Rel3PT [1]	S	1.36	78.82	49.70	0.70	88.25	207.86	4.46	66.94	27.89
	P3P [7]	S	0.88	88.00	25.93	0.56	91.11	112.65	2.40	**84.29**	12.36
	$3PT_{suv}$(M) [26]	S	0.94	87.42	33.90	0.55	91.04	97.85	3.14	83.73	22.69
	$3PT_{suv}$ **(ours)**	S	0.95	87.49	22.58	0.55	91.01	83.72	**2.39**	83.91	13.31
	P3P [7]	R	2.02	76.60	15.48	1.59	82.49	68.16	2.88	76.38	**6.98**
	$3PT_{suv}$(M) [26]	R	2.05	76.28	24.68	1.57	82.38	58.47	4.89	75.36	18.25
	$3PT_{suv}$ **(ours)**	R	2.05	76.17	**13.63**	1.59	82.30	46.47	3.65	75.63	8.75
	P3P [7]	R_s	1.78	78.26	15.64	1.29	84.85	64.83	3.06	76.79	7.74
	$3PT_{suv}$(M) [26]	R_s	1.80	77.51	25.03	1.31	84.93	55.43	3.29	76.18	18.45
	$3PT_{suv}$ **(ours)**	R_s	1.81	77.40	14.18	1.30	84.98	**43.64**	2.74	76.43	9.13
	$3PT_{suv}$(M) [26]	H [26]	**0.86**	**88.03**	558.61	**0.53**	**91.33**	1402.46	2.41	84.10	618.95
	$3PT_{suv}$ **(ours)**	H [26]	**0.86**	**88.03**	550.74	**0.53**	**91.33**	1392.71	2.60	84.17	617.79

Depth	Solver	Opt.	Mast3r [17]		
			$\epsilon(°)\downarrow$	mAA↑	$\tau(ms)\downarrow$
-	5PT [20]	S	0.66	90.29	126.77
Mast3r [17]	Rel3PT [1]	S	**0.67**	90.30	104.46
	P3P [7]	S	**0.67**	90.24	56.52
	$3PT_{suv}$(M) [26]	S	**0.67**	90.20	42.49
	$3PT_{suv}$ **(ours)**	S	**0.67**	**90.35**	30.90
	P3P [7]	R	29.42	17.49	38.12
	$3PT_{suv}$(M) [26]	R	29.98	16.85	33.80
	$3PT_{suv}$ **(ours)**	R	30.00	17.05	22.95
	P3P [7]	R_s	23.13	18.65	36.68
	$3PT_{suv}$(M) [26]	R_s	23.74	15.23	31.22
	$3PT_{suv}$ **(ours)**	R_s	24.16	14.97	**21.01**
	$3PT_{suv}$(M) [26]	H [26]	0.92	87.96	2647.02
	$3PT_{suv}$ **(ours)**	H [26]	0.92	87.98	2635.27

Table 3. Results for the calibrated case on the ETH3D dataset [22]. Opt.: S, R, R_s - PoseLib [15] implementation using Sampson error (S), reprojection error (R) or reprojection error with shift considered (R_s), H - hybrid RANSAC from [26].

Depth	Solver	Opt.	SP+LG [6, 18]					RoMA [9]					SIFT [19]				
			$\epsilon(°)\downarrow$	$\epsilon_f\downarrow$	mAA$\uparrow$	mAA$_f\uparrow$	$\tau(ms)\downarrow$	$\epsilon(°)\downarrow$	$\epsilon_f\downarrow$	mAA$\uparrow$	mAA$_f\uparrow$	$\tau(ms)\downarrow$	$\epsilon(°)\downarrow$	$\epsilon_f\downarrow$	mAA$\uparrow$	mAA$_f\uparrow$	$\tau(ms)\downarrow$
-	6PT [16]	S	2.45	0.04	75.57	61.52	80.02	1.15	0.02	85.23	75.03	147.48	6.24	0.11	66.12	53.17	60.59
Real Depth	3p3d [8]	S	2.06	0.04	78.00	62.83	30.70	0.93	0.02	85.98	74.98	113.30	2.13	0.07	73.42	57.68	17.51
	4PT$_{suv}f$(M) [26]	S	1.83	0.03	78.86	63.71	112.34	0.99	0.02	86.37	75.21	167.49	2.09	0.07	76.08	59.23	80.85
	4PT$_{suv}f$(**ours**)	S	1.72	0.03	78.90	63.56	51.10	1.03	0.02	86.25	75.04	107.05	2.04	0.06	75.72	58.82	36.68
	3PT$_{s00}f$(**ours**)	S	1.75	0.03	79.17	63.63	25.11	0.99	0.02	86.68	74.99	79.96	1.73	0.06	76.69	59.92	13.00
	3PT$_{100}f$(**ours**)	S	1.77	0.04	77.56	62.33	18.72	0.99	0.02	86.42	74.77	72.35	1.96	0.07	73.30	56.84	8.11
	4PT$_{suv}f$(M) [26]	R	0.41	**0.01**	91.57	87.77	105.13	**0.29**	**0.00**	93.06	90.15	149.04	0.84	**0.01**	85.08	82.52	81.64
	4PT$_{suv}f$(**ours**)	R	0.41	**0.01**	91.58	87.92	44.28	**0.29**	**0.00**	93.14	90.04	88.67	0.83	**0.01**	85.52	82.73	34.27
	3PT$_{s00}f$(**ours**)	R	0.41	**0.01**	91.52	87.66	19.48	**0.29**	**0.00**	93.33	90.04	66.85	0.81	**0.01**	85.81	83.78	10.77
	3PT$_{100}f$(**ours**)	R	**0.40**	**0.01**	**91.61**	**88.60**	**13.49**	**0.29**	**0.00**	**93.59**	**90.48**	**61.25**	**0.79**	**0.01**	**86.84**	**84.31**	**6.18**
	4PT$_{suv}f$(M) [26]	R$_s$	0.50	**0.01**	90.26	84.96	106.97	0.34	0.01	92.30	88.51	154.70	0.98	**0.01**	83.59	80.29	80.49
	4PT$_{suv}f$(**ours**)	R$_s$	0.50	**0.01**	90.33	85.09	46.15	0.34	0.01	92.33	88.63	94.59	0.97	**0.01**	83.84	80.12	34.25
	3PT$_{s00}f$(**ours**)	R$_s$	0.49	**0.01**	90.52	85.04	20.05	0.32	**0.00**	92.81	88.95	67.22	0.91	**0.01**	84.69	82.07	11.23
	3PT$_{100}f$(**ours**)	R$_s$	0.48	**0.01**	90.67	85.66	14.00	0.33	**0.00**	93.00	89.00	61.62	0.89	**0.01**	85.97	82.24	6.61
	4PT$_{suv}f$(M) [26]	H [26]	1.07	0.02	82.01	75.63	1502.02	2.12	0.02	76.69	72.51	3218.22	12.97	0.30	38.95	30.42	2578.61
	3PT$_{s00}f$(**ours**)	H [26]	1.07	0.02	82.19	75.76	1411.05	2.28	0.02	76.42	72.43	3067.57	14.53	0.26	37.57	29.82	2286.38
	3PT$_{s00}f$(**ours**)	H$_{NS}$ [26]	1.04	0.02	81.80	75.69	1333.74	2.25	0.01	76.68	73.00	2721.78	14.61	0.28	37.89	29.74	2129.14
MiDas [3]	3p3d [8]	S	4.08	0.07	61.91	49.69	25.35	1.91	**0.02**	78.71	68.10	86.60	10.75	0.24	44.34	33.09	14.32
	4PT$_{suv}f$(M) [26]	S	**2.17**	**0.04**	**73.99**	59.89	103.86	**1.14**	**0.02**	**85.11**	**74.93**	142.78	8.04	0.11	62.00	48.25	77.55
	4PT$_{suv}f$(**ours**)	S	2.26	**0.04**	73.53	59.35	45.74	1.19	**0.02**	84.86	74.80	84.62	7.07	0.10	63.35	49.54	35.24
	3PT$_{s00}f$(**ours**)	S	2.26	**0.04**	73.11	**60.38**	21.36	1.25	**0.02**	84.66	74.47	65.79	7.18	0.12	**63.89**	50.42	11.90
	3PT$_{100}f$(**ours**)	S	9.25	0.16	52.77	41.40	12.76	5.32	0.05	70.75	60.27	48.01	26.46	0.30	31.99	24.88	5.63
	4PT$_{suv}f$(M) [26]	R	14.47	0.19	24.45	25.80	99.10	11.06	0.19	30.87	26.96	129.24	18.87	0.27	24.75	26.50	79.83
	4PT$_{suv}f$(**ours**)	R	14.56	0.20	24.04	25.42	41.15	11.16	0.19	30.65	27.07	71.31	18.48	0.26	24.58	27.52	33.25
	3PT$_{s00}f$(**ours**)	R	14.58	0.20	24.54	25.74	18.31	10.99	0.19	31.44	27.85	60.52	16.72	0.34	25.44	27.64	10.68
	3PT$_{100}f$(**ours**)	R	18.29	0.24	22.02	22.85	**9.15**	12.95	0.21	29.01	25.81	36.22	21.12	0.35	22.43	25.00	**4.11**
	4PT$_{suv}f$(M) [26]	R$_s$	8.46	0.14	36.05	34.35	101.66	6.29	0.11	46.33	38.06	138.43	13.43	0.18	33.90	32.31	77.38
	4PT$_{suv}f$(**ours**)	R$_s$	8.60	0.14	36.05	34.09	43.58	6.36	0.11	46.47	38.10	80.46	12.56	0.18	34.39	32.71	33.41
	3PT$_{s00}f$(**ours**)	R$_s$	8.56	0.14	35.48	34.10	19.15	6.47	0.12	45.22	38.08	62.22	13.36	0.19	33.83	32.57	10.89
	3PT$_{100}f$(**ours**)	R$_s$	13.22	0.19	31.71	29.83	9.48	9.26	0.15	41.05	33.72	**36.18**	18.30	0.27	27.57	26.81	4.39
	4PT$_{suv}f$(M) [26]	H [26]	2.58	0.05	68.70	56.01	1303.38	1.48	0.03	81.10	67.25	2301.37	7.55	0.10	62.20	49.75	1261.37
	3PT$_{s00}f$(**ours**)	H [26]	2.47	0.05	69.04	56.45	1316.09	1.48	0.03	81.44	67.03	2410.90	6.00	**0.09**	63.10	**51.24**	1350.34
	3PT$_{s00}f$(**ours**)	H$_{NS}$ [26]	2.57	0.05	68.54	56.38	1238.87	1.41	0.03	81.26	67.31	2213.96	**5.41**	**0.09**	63.72	51.01	1328.62
DA v2 [25]	3p3d [8]	S	4.54	0.08	61.60	48.76	27.01	2.07	**0.02**	78.86	68.29	91.39	10.31	0.19	46.33	36.95	15.09
	4PT$_{suv}f$(M) [26]	S	2.10	**0.04**	74.60	60.77	104.75	1.21	**0.02**	85.33	75.09	146.35	7.39	0.09	66.11	**53.64**	78.44
	4PT$_{suv}f$(**ours**)	S	**2.02**	**0.04**	**74.67**	60.41	46.62	**1.20**	**0.02**	**85.61**	**75.43**	88.03	5.80	0.09	**66.77**	52.75	36.03
	3PT$_{s00}f$(**ours**)	S	2.20	**0.04**	73.66	**60.93**	21.62	1.23	**0.02**	84.89	75.00	67.61	6.40	0.11	64.30	51.31	12.21
	3PT$_{100}f$(**ours**)	S	12.16	0.20	49.70	39.23	12.56	6.20	0.06	67.86	57.93	46.57	24.77	0.33	32.32	26.61	5.81
	4PT$_{suv}f$(M) [26]	R	13.22	0.18	26.18	28.41	100.09	10.98	0.18	32.52	30.93	134.01	15.48	0.25	28.99	27.56	79.64
	4PT$_{suv}f$(**ours**)	R	13.16	0.18	26.12	28.05	42.01	10.95	0.17	32.71	31.17	75.68	15.99	0.23	29.98	29.16	33.52
	3PT$_{s00}f$(**ours**)	R	13.44	0.19	26.23	28.12	18.64	11.16	0.17	32.68	31.01	63.33	14.21	0.26	30.04	29.73	10.84
	3PT$_{100}f$(**ours**)	R	17.08	0.26	24.19	25.57	**8.92**	11.90	0.21	31.29	28.65	**35.25**	20.84	0.32	25.83	25.66	**4.05**
	4PT$_{suv}f$(M) [26]	R$_s$	6.31	0.10	44.42	39.84	102.76	4.75	0.08	53.63	44.53	145.36	9.96	0.14	43.88	38.47	77.80
	4PT$_{suv}f$(**ours**)	R$_s$	6.32	0.10	43.88	39.12	44.51	4.72	0.08	53.87	45.24	87.17	9.09	0.13	43.94	39.14	34.58
	3PT$_{s00}f$(**ours**)	R$_s$	7.45	0.12	41.38	38.13	19.63	5.55	0.09	50.94	44.24	65.92	9.79	0.14	42.48	38.22	11.08
	3PT$_{100}f$(**ours**)	R$_s$	13.04	0.21	35.07	30.57	9.36	8.41	0.13	45.70	38.04	35.85	17.45	0.23	35.22	32.10	4.50
	4PT$_{suv}f$(M) [26]	H [26]	2.34	0.05	70.07	58.00	1190.89	1.28	0.03	81.56	68.72	2161.36	6.98	0.09	65.52	52.56	1143.14
	3PT$_{s00}f$(**ours**)	H [26]	2.33	0.05	70.16	58.31	1216.89	1.30	0.03	81.57	68.68	2245.95	**5.47**	0.09	65.81	52.53	1213.12
	3PT$_{s00}f$(**ours**)	H$_{NS}$ [26]	2.36	**0.04**	70.00	58.56	1132.10	1.31	0.03	81.36	68.50	2109.71	5.72	**0.08**	64.57	51.74	1171.09
MoGe [23]	3p3d [8]	S	3.18	0.06	68.24	54.64	27.70	1.56	**0.02**	80.98	70.19	98.44	7.02	0.14	54.64	42.53	15.70
	4PT$_{suv}f$(M) [26]	S	2.10	0.04	76.06	61.81	107.30	1.02	**0.02**	85.91	75.61	151.65	6.28	0.09	70.32	54.94	80.88
	4PT$_{suv}f$(**ours**)	S	2.15	0.04	75.59	60.88	57.91	1.10	**0.02**	85.85	75.80	92.92	6.24	0.09	67.78	53.36	42.11
	3PT$_{s00}f$(**ours**)	S	1.99	0.04	76.94	62.66	24.72	1.05	**0.02**	86.04	75.83	75.12	3.44	0.08	71.69	56.15	13.17
	3PT$_{100}f$(**ours**)	S	9.42	0.16	52.38	41.58	14.47	5.54	0.06	70.95	61.14	54.72	25.66	0.46	32.52	24.16	6.61
	4PT$_{suv}f$(M) [26]	R	2.59	0.04	69.92	62.11	102.45	1.91	0.03	76.56	65.93	138.82	7.72	0.08	64.95	57.21	80.37
	4PT$_{suv}f$(**ours**)	R	2.68	0.04	69.37	62.00	52.91	1.96	0.03	76.55	65.80	79.71	6.94	0.07	65.45	58.29	38.82
	3PT$_{s00}f$(**ours**)	R	2.56	0.04	70.86	63.26	21.40	1.95	0.04	76.77	66.04	72.94	3.87	0.07	68.64	60.78	11.90
	3PT$_{100}f$(**ours**)	R	5.74	0.06	61.30	54.62	**10.30**	3.15	0.04	71.39	61.14	**41.74**	9.63	0.13	55.50	51.13	**4.56**
	4PT$_{suv}f$(M) [26]	R$_s$	2.53	0.05	69.12	57.39	104.99	1.92	0.04	77.16	63.83	148.77	5.97	0.08	66.77	54.42	79.95
	4PT$_{suv}f$(**ours**)	R$_s$	2.63	0.05	68.87	57.18	55.04	1.87	0.04	77.10	63.82	89.96	5.43	0.08	66.22	54.96	39.57
	3PT$_{s00}f$(**ours**)	R$_s$	2.49	0.05	70.04	58.86	22.20	1.95	0.04	77.46	64.31	74.67	4.54	0.07	68.06	56.60	11.99
	3PT$_{100}f$(**ours**)	R$_s$	6.30	0.07	60.26	50.42	10.64	3.16	0.04	71.44	58.33	41.99	10.35	0.17	54.08	44.17	4.94
	4PT$_{suv}f$(M) [26]	H [26]	1.50	**0.03**	79.23	66.34	956.33	**0.89**	**0.02**	86.99	**76.66**	1923.31	5.99	0.06	73.86	60.64	905.27
	3PT$_{s00}f$(**ours**)	H [26]	**1.41**	**0.03**	80.24	67.42	967.52	0.91	**0.02**	**87.20**	76.50	2043.91	**2.68**	**0.05**	**76.45**	**63.05**	970.49
	3PT$_{s00}f$(**ours**)	H$_{NS}$ [26]	1.43	**0.03**	**80.32**	**67.46**	939.37	0.90	**0.02**	86.82	76.10	1947.06	3.04	**0.05**	75.51	62.86	949.56
UniDepth [21]	3p3d [8]	S	3.49	0.07	69.47	55.57	27.57	1.89	0.02	82.50	71.89	97.99	6.04	0.12	59.35	45.23	15.84
	4PT$_{suv}f$(M) [26]	S	2.21	0.04	75.61	61.37	106.73	1.12	0.02	85.63	75.66	151.31	6.59	0.08	69.78	54.68	82.44
	4PT$_{suv}f$(**ours**)	S	1.92	0.04	76.18	62.00	46.97	1.12	0.02	85.59	75.64	91.92	5.85	0.09	69.01	54.12	35.07
	3PT$_{s00}f$(**ours**)	S	2.04	0.04	76.89	62.42	23.47	1.04	0.02	85.78	75.69	75.62	4.93	0.08	70.49	55.91	12.87
	3PT$_{100}f$(**ours**)	S	3.98	0.07	63.26	51.81	15.52	2.20	0.02	79.68	69.89	59.07	14.63	0.28	40.83	32.62	6.91
	4PT$_{suv}f$(M) [26]	R	2.70	0.04	69.55	59.49	101.94	2.07	0.04	76.35	63.30	139.31	8.16	0.08	65.71	56.75	79.06
	4PT$_{suv}f$(**ours**)	R	2.69	0.04	69.50	59.62	42.12	2.11	0.04	76.21	63.44	79.50	6.81	0.08	66.14	57.13	33.34
	3PT$_{s00}f$(**ours**)	R	2.68	0.05	69.61	59.84	20.48	2.07	0.04	76.25	63.64	75.00	4.31	0.07	67.61	57.65	11.21
	3PT$_{100}f$(**ours**)	R	2.78	0.05	68.11	58.88	**11.64**	2.10	0.04	75.89	63.05	**48.44**	4.52	0.08	64.80	56.29	**5.08**
	4PT$_{suv}f$(M) [26]	R$_s$	2.67	0.05	69.03	58.06	104.79	1.89	0.03	77.33	64.83	149.96	5.77	0.08	66.92	54.13	78.80
	4PT$_{suv}f$(**ours**)	R$_s$	2.65	0.05	68.79	58.11	44.72	1.88	0.03	77.14	64.62	90.69	4.51	0.08	68.09	55.20	33.84
	3PT$_{s00}f$(**ours**)	R$_s$	2.51	0.05	69.22	59.00	21.45	1.94	0.03	77.02	64.61	77.26	4.44	0.08	67.90	55.58	11.89
	3PT$_{100}f$(**ours**)	R$_s$	2.74	0.05	67.70	57.35	12.22	1.90	0.03	76.91	64.55	49.48	4.47	0.09	65.45	54.25	5.68
	4PT$_{suv}f$(M) [26]	H [26]	**1.27**	**0.03**	81.68	**69.64**	1107.04	0.83	0.02	87.30	77.34	1997.88	5.60	**0.06**	75.43	62.37	1127.82
	3PT$_{s00}f$(**ours**)	H [26]	1.28	**0.03**	**81.99**	69.28	1149.25	0.82	0.02	**87.53**	**77.79**	2133.46	3.25	**0.06**	76.47	63.73	1203.16
	3PT$_{s00}f$(**ours**)	H$_{NS}$ [26]	1.33	**0.03**	81.89	**69.64**	1093.90	**0.81**	**0.01**	87.27	77.75	2029.72	**3.04**	**0.06**	**76.60**	**64.10**	1243.91

Depth	Solver	Opt.	Mast3r [17]				
			$\epsilon(°)\downarrow$	$\epsilon_f\downarrow$	mAA$\uparrow$	mAA$_f\uparrow$	$\tau(ms)\downarrow$
-	6PT [16]	S	1.23	0.03	82.99	69.00	85.89
Mast3r [17]	3p3d [8]	S	1.37	0.03	81.30	67.31	38.96
	4PT$_{suv}f$(M) [26]	S	1.58	0.03	79.68	66.05	95.89
	4PT$_{suv}f$(**ours**)	S	1.36	0.03	80.86	67.16	48.36
	3PT$_{s00}f$(**ours**)	S	1.34	0.03	82.09	68.26	34.54
	3PT$_{100}f$(**ours**)	S	1.64	0.03	79.97	66.16	25.08
	4PT$_{suv}f$(M) [26]	R	40.71	0.34	8.29	14.31	88.61
	4PT$_{suv}f$(**ours**)	R	41.52	0.33	8.25	14.73	41.03
	3PT$_{s00}f$(**ours**)	R	42.35	0.33	8.70	14.66	30.71
	3PT$_{100}f$(**ours**)	R	40.13	0.33	9.04	15.08	**19.67**
	4PT$_{suv}f$(M) [26]	R$_s$	37.48	0.46	6.84	11.96	96.18
	4PT$_{suv}f$(**ours**)	R$_s$	37.81	0.46	6.51	12.16	48.75
	3PT$_{s00}f$(**ours**)	R$_s$	36.34	0.39	7.36	13.39	35.78
	3PT$_{100}f$(**ours**)	R$_s$	34.88	0.40	7.85	13.53	23.95
	4PT$_{suv}f$(M) [26]	H [26]	2.43	0.05	72.28	58.32	3825.11
	3PT$_{s00}f$(**ours**)	H [26]	2.39	0.04	72.45	58.61	4079.21
	3PT$_{s00}f$(**ours**)	H$_{NS}$ [26]	2.36	0.04	72.48	58.92	3431.39
	-	M [17]	**1.32**	**0.01**	**85.64**	**82.95**	4800.37

Table 4. Results for the case of two cameras with shared unknown focal length on the ETH3D dataset [22]. Opt.: S, R, R$_s$ - PoseLib [15] implementation using Sampson error (S), reprojection error (R) or reprojection error with shift considered (R$_s$), H - hybrid RANSAC from [26], H$_{NS}$ - hybrid RANSAC [26] without optimizing for shift in LO, M - non-linear optimization used in [17].

Depth	Solver	Opt.	SP+LG [6, 18]					RoMA [9]					SIFT [19]				
			$\epsilon(°)\downarrow$	$\epsilon_f\downarrow$	mAA$\uparrow$	mAA$_f\uparrow$	$\tau(ms)\downarrow$	$\epsilon(°)\downarrow$	$\epsilon_f\downarrow$	mAA$\uparrow$	mAA$_f\uparrow$	$\tau(ms)\downarrow$	$\epsilon(°)\downarrow$	$\epsilon_f\downarrow$	mAA$\uparrow$	mAA$_f\uparrow$	$\tau(ms)\downarrow$
-	7PT [11]	S	4.55	0.11	54.17	36.19	18.41	2.46	0.05	71.94	56.85	61.02	15.24	0.20	43.24	27.99	12.17
Real Depth	4p4d [8]	S	3.80	0.10	57.55	37.99	17.95	2.18	0.05	72.70	56.65	65.62	4.36	0.14	57.78	35.64	10.62
	4PT$_{suv}f_{1,2}$(M) [26]	S	3.73	0.09	60.21	39.12	97.08	1.96	0.04	75.42	57.35	157.06	4.53	0.12	58.78	36.95	82.43
	4PT$_{suv}f_{1,2}$(**ours**)	S	3.55	0.10	60.40	38.75	29.35	2.05	0.04	75.24	57.09	89.33	4.43	0.13	58.68	36.46	21.67
	3PT$_{s00}f_{1,2}$(**ours**)	S	3.39	0.09	61.56	39.71	18.18	2.02	0.04	75.96	57.99	73.89	3.51	0.10	61.88	37.86	10.07
	3PT$_{100}f_{1,2}$(**ours**)	S	3.63	0.09	61.46	39.60	21.81	1.92	0.04	75.96	57.67	84.35	3.61	0.11	61.35	38.74	11.34
	4PT$_{suv}f_{1,2}$(M) [26]	R	0.67	**0.01**	88.65	86.27	88.59	0.43	**0.00**	91.34	89.35	122.85	1.29	**0.01**	80.17	80.05	80.64
	4PT$_{suv}f_{1,2}$(**ours**)	R	0.68	**0.01**	88.60	86.20	20.93	**0.42**	**0.00**	91.49	89.50	54.34	1.24	**0.01**	80.36	79.96	17.50
	3PT$_{s00}f_{1,2}$(**ours**)	R	**0.64**	**0.01**	**89.18**	**86.84**	**8.98**	**0.42**	**0.00**	**91.84**	**89.82**	**40.03**	1.22	**0.01**	80.40	80.84	**5.55**
	3PT$_{100}f_{1,2}$(**ours**)	R	0.66	**0.01**	88.79	86.33	13.42	**0.42**	**0.00**	91.59	89.60	53.83	**1.21**	**0.01**	**80.95**	**80.85**	7.24
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	0.93	**0.01**	86.06	83.08	90.19	0.58	0.01	89.92	87.29	128.38	1.59	0.02	76.88	78.23	80.17
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	0.93	**0.01**	86.03	83.04	22.50	0.58	0.01	89.95	87.39	58.50	1.58	0.02	76.78	78.40	18.12
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	0.88	**0.01**	86.69	83.73	10.03	0.54	0.01	90.56	87.84	41.63	1.49	0.02	77.61	79.54	6.02
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	0.92	**0.01**	86.32	83.40	13.66	0.54	0.01	90.36	87.66	55.06	1.48	0.02	78.06	79.47	7.51
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	2.11	0.02	77.88	72.52	1838.11	1.99	0.02	76.18	70.63	4016.40	18.31	0.31	35.45	25.22	3476.62
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	2.15	0.02	78.23	72.93	1741.36	1.96	0.02	76.23	70.70	3874.62	17.68	0.29	36.79	25.05	3363.73
	3PT$_{s00}f_{1,2}$(**ours**)	H$_{NS}$ [26]	2.24	0.02	77.73	73.02	1632.86	2.12	0.02	77.05	71.95	3361.76	18.52	0.27	36.11	25.38	3337.42
	4p4d [8]	H [26]	2.31	0.02	77.22	71.78	1788.15	2.01	0.02	76.23	70.55	3866.99	17.72	0.29	36.48	24.81	3351.30
MiDas [3]	4p4d [8]	S	7.13	0.15	46.45	30.84	14.83	2.64	0.05	67.34	52.94	51.51	18.99	0.29	28.58	19.47	9.91
	4PT$_{suv}f_{1,2}$(M) [26]	S	5.14	0.10	53.00	36.05	88.47	2.42	0.05	71.64	56.16	129.33	13.32	0.21	42.46	28.16	79.00
	4PT$_{suv}f_{1,2}$(**ours**)	S	4.87	0.11	52.76	35.88	24.01	2.44	**0.04**	71.73	**56.25**	62.74	14.75	0.22	40.53	28.24	19.07
	3PT$_{s00}f_{1,2}$(**ours**)	S	5.15	0.12	52.89	34.57	13.60	2.78	0.05	70.19	55.15	54.98	14.01	0.25	38.48	25.06	7.48
	3PT$_{100}f_{1,2}$(**ours**)	S	6.37	0.13	50.18	32.46	17.33	3.46	0.06	68.97	53.08	65.10	14.46	0.24	37.24	23.22	9.55
	4PT$_{suv}f_{1,2}$(M) [26]	R	18.78	0.21	23.23	23.43	83.69	14.14	0.20	31.98	26.12	105.79	22.96	0.23	27.27	27.77	76.95
	4PT$_{suv}f_{1,2}$(**ours**)	R	19.31	0.21	22.73	23.13	18.56	14.44	0.20	31.60	25.65	39.00	23.63	0.23	26.84	28.18	15.76
	3PT$_{s00}f_{1,2}$(**ours**)	R	19.65	0.21	23.90	23.74	**8.00**	14.60	0.20	31.51	25.90	**34.57**	21.05	0.27	28.27	27.75	**4.15**
	3PT$_{100}f_{1,2}$(**ours**)	R	19.76	0.21	24.10	23.94	12.33	14.80	0.21	31.87	26.17	46.89	22.02	0.25	27.81	26.80	6.50
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	15.40	0.19	28.40	27.58	84.90	11.02	0.15	38.04	31.91	112.86	19.90	0.20	28.93	29.04	76.15
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	17.81	0.19	27.49	26.78	20.11	11.41	0.15	37.79	32.02	45.86	19.17	0.19	29.17	29.37	16.54
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	15.05	0.18	28.36	27.62	9.05	11.32	0.16	37.55	31.36	36.96	18.04	0.21	30.77	30.12	4.72
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	16.50	0.18	27.40	26.57	12.41	11.91	0.17	36.42	30.24	48.33	18.91	0.21	28.30	28.67	6.98
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	3.87	**0.08**	61.51	44.99	2095.26	**2.24**	0.06	73.42	54.05	3348.48	9.87	0.15	53.94	39.48	2694.59
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	3.91	**0.08**	61.69	45.15	2098.90	**2.24**	0.06	**73.51**	54.31	3356.13	9.29	**0.13**	**54.23**	**42.16**	2525.58
	3PT$_{s00}f_{1,2}$(**ours**)	H$_{NS}$ [26]	**3.70**	**0.08**	**62.08**	**45.99**	1912.59	2.32	0.06	72.93	54.14	3079.09	**9.17**	0.14	**54.23**	40.28	2793.96
	4p4d [8]	H [26]	4.24	**0.08**	61.48	44.64	1958.88	2.25	0.06	73.30	53.99	3136.35	9.45	0.16	51.25	37.75	2619.87
DA v2 [25]	4p4d [8]	S	6.82	0.13	47.06	31.27	15.28	2.74	0.05	69.66	54.57	52.90	16.62	0.26	31.38	21.24	9.76
	4PT$_{suv}f_{1,2}$(M) [26]	S	4.41	0.10	55.03	36.66	89.93	2.23	**0.04**	73.11	**57.15**	132.70	10.78	0.17	46.89	31.72	79.22
	4PT$_{suv}f_{1,2}$(**ours**)	S	4.14	0.10	55.65	37.45	24.63	2.29	0.05	72.84	57.12	67.11	11.06	0.17	47.11	30.85	19.69
	3PT$_{s00}f_{1,2}$(**ours**)	S	4.76	0.11	53.09	35.21	14.07	2.45	**0.04**	71.54	56.14	55.95	13.00	0.21	41.55	27.17	7.62
	3PT$_{100}f_{1,2}$(**ours**)	S	6.41	0.14	49.68	33.50	17.75	4.10	0.06	67.76	52.32	67.40	14.52	0.25	37.03	22.58	9.76
	4PT$_{suv}f_{1,2}$(M) [26]	R	14.80	0.17	29.09	27.35	84.32	11.17	0.16	36.37	30.37	109.49	17.65	0.20	33.37	30.18	76.99
	4PT$_{suv}f_{1,2}$(**ours**)	R	14.79	0.17	29.14	27.35	18.93	11.36	0.16	36.19	30.59	42.60	18.42	0.20	33.12	30.10	15.76
	3PT$_{s00}f_{1,2}$(**ours**)	R	14.82	0.16	28.92	27.71	**8.24**	12.04	0.16	36.40	30.58	**37.01**	15.34	0.21	35.46	31.60	**4.35**
	3PT$_{100}f_{1,2}$(**ours**)	R	15.11	0.18	28.82	27.42	12.45	12.46	0.17	35.71	30.24	47.30	15.49	0.21	34.34	31.68	6.31
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	9.54	0.12	36.11	34.23	85.43	6.79	0.10	45.45	39.65	118.26	13.58	0.15	38.45	34.58	77.35
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	9.62	0.12	36.03	34.10	20.74	6.88	0.10	44.99	39.57	51.19	13.31	0.17	38.48	34.20	16.97
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	10.18	0.13	35.65	33.16	9.60	7.54	0.12	43.69	37.85	39.63	13.28	0.17	38.41	35.06	4.90
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	11.24	0.15	34.35	31.61	12.62	8.12	0.13	42.68	36.90	48.98	14.06	0.18	37.55	34.73	6.87
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	3.60	**0.08**	61.64	45.60	1896.45	**2.18**	0.06	73.14	54.95	3128.59	9.40	0.13	54.85	41.01	2514.02
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	**3.50**	**0.08**	**61.86**	**46.25**	1894.68	2.23	0.06	73.31	55.02	3097.87	**8.36**	**0.12**	**57.27**	**42.92**	2385.11
	3PT$_{s00}f_{1,2}$(**ours**)	H$_{NS}$ [26]	3.63	**0.08**	61.28	45.78	1736.37	2.23	0.06	**73.45**	55.26	2924.53	8.65	0.13	56.11	41.10	2500.77
	4p4d [8]	H [26]	3.73	**0.08**	61.30	44.67	1842.68	2.21	0.06	73.21	54.71	2913.63	9.37	0.15	53.53	39.48	2354.63
MoGe [23]	4p4d [8]	S	4.98	0.11	52.91	36.19	16.30	2.40	0.05	71.59	56.53	59.06	9.77	0.18	44.96	29.55	10.38
	4PT$_{suv}f_{1,2}$(M) [26]	S	4.07	0.09	57.28	38.04	90.86	2.22	0.04	73.47	57.08	138.85	10.07	0.17	50.40	33.44	81.56
	4PT$_{suv}f_{1,2}$(**ours**)	S	3.91	0.10	57.16	37.69	26.93	2.21	0.04	73.21	57.23	71.54	9.81	0.16	50.25	32.82	20.65
	3PT$_{s00}f_{1,2}$(**ours**)	S	4.12	0.10	57.27	38.71	15.50	2.26	0.04	73.80	57.69	65.36	7.06	0.14	53.46	36.03	8.33
	3PT$_{100}f_{1,2}$(**ours**)	S	6.30	0.11	53.05	35.28	19.86	3.18	0.05	70.99	55.15	78.18	11.20	0.18	43.40	28.07	10.69
	4PT$_{suv}f_{1,2}$(M) [26]	R	5.57	0.06	55.69	57.08	84.59	3.40	0.04	67.12	63.83	113.97	9.46	0.08	53.53	57.12	77.13
	4PT$_{suv}f_{1,2}$(**ours**)	R	5.41	0.06	54.89	56.85	20.70	3.42	0.04	67.06	63.69	45.55	10.39	0.08	52.46	55.44	16.83
	3PT$_{s00}f_{1,2}$(**ours**)	R	5.24	0.06	57.27	57.41	**9.02**	3.41	0.04	67.99	64.18	**43.41**	6.64	0.07	56.04	**58.55**	**4.35**
	3PT$_{100}f_{1,2}$(**ours**)	R	5.55	0.06	54.49	56.14	13.65	3.57	0.04	65.89	63.49	57.74	7.62	0.07	52.91	56.54	6.94
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	4.98	0.06	57.02	52.29	85.88	2.93	0.04	69.22	60.95	121.27	8.99	0.09	53.69	51.21	77.88
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	4.69	0.06	57.37	52.07	22.37	2.89	0.04	69.19	61.04	53.39	9.21	0.09	53.22	51.17	17.89
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	4.97	0.06	57.55	52.91	10.63	2.97	0.04	69.40	61.33	46.70	7.08	0.08	56.14	53.00	5.04
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	5.26	0.06	54.77	51.03	14.16	3.10	0.04	67.11	60.10	59.65	8.09	0.08	52.27	50.24	7.55
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	2.15	**0.03**	74.71	62.05	1531.76	1.30	**0.02**	83.81	73.09	2765.01	7.73	0.07	66.29	57.82	2218.02
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	2.06	**0.03**	75.05	62.82	1499.79	**1.27**	**0.02**	**84.10**	**73.59**	2823.21	**6.01**	**0.06**	**67.20**	58.33	2194.89
	3PT$_{s00}f_{1,2}$(**ours**)	H$_{NS}$ [26]	**2.05**	**0.03**	**75.18**	**63.09**	1492.10	1.29	**0.02**	84.09	73.46	2705.98	6.03	**0.06**	66.93	57.73	2268.05
	4p4d [8]	H [26]	2.32	**0.03**	73.61	61.97	1548.72	1.39	**0.02**	83.82	72.85	2712.66	6.66	0.07	62.60	53.43	2187.77
UniDepth [21]	4p4d [8]	S	5.26	0.11	52.71	35.74	16.46	2.51	0.05	71.03	56.20	58.78	10.94	0.19	42.18	28.27	10.44
	4PT$_{suv}f_{1,2}$(M) [26]	S	3.78	0.10	57.41	37.66	91.97	2.30	0.05	73.06	57.01	138.56	9.96	0.17	50.60	33.67	82.85
	4PT$_{suv}f_{1,2}$(**ours**)	S	4.22	0.10	57.07	37.57	25.63	2.34	0.04	73.14	57.16	70.39	10.13	0.17	50.57	32.50	19.53
	3PT$_{s00}f_{1,2}$(**ours**)	S	4.23	0.11	56.07	37.90	15.68	2.26	0.04	72.87	57.34	65.32	7.24	0.15	53.27	34.44	8.20
	3PT$_{100}f_{1,2}$(**ours**)	S	3.95	0.09	57.21	38.46	20.27	2.27	0.04	73.53	57.24	78.21	9.24	0.15	49.16	32.60	10.66
	4PT$_{suv}f_{1,2}$(M) [26]	R	5.50	0.06	54.93	53.88	86.41	3.47	0.05	66.81	61.28	114.91	10.28	0.10	53.65	52.82	77.53
	4PT$_{suv}f_{1,2}$(**ours**)	R	5.68	0.07	54.90	54.33	19.34	3.39	0.05	66.96	61.62	46.08	10.08	0.09	53.56	53.28	16.05
	3PT$_{s00}f_{1,2}$(**ours**)	R	5.62	0.07	55.44	54.45	**9.84**	3.47	0.05	66.65	61.61	**44.65**	7.00	**0.08**	55.22	54.32	**4.75**
	3PT$_{100}f_{1,2}$(**ours**)	R	5.10	0.06	56.00	54.90	14.05	3.31	0.05	67.15	61.79	60.78	6.80	**0.08**	55.52	55.48	7.16
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	5.10	0.06	56.33	51.74	87.25	3.01	0.04	68.89	61.84	122.40	8.22	0.09	56.68	52.10	77.89
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	4.94	0.06	56.38	52.09	21.43	3.03	0.04	68.78	61.81	54.77	8.10	0.09	56.61	52.15	17.02
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	5.16	0.07	56.55	52.50	11.27	3.03	0.04	68.97	61.99	48.73	6.78	0.09	57.60	52.94	5.57
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	4.86	0.06	56.83	52.51	15.01	2.95	0.04	69.26	61.80	64.21	6.76	**0.08**	57.21	53.24	8.01
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	2.24	**0.03**	**74.88**	63.63	1670.30	1.22	**0.02**	84.26	73.36	2836.79	7.98	0.09	65.71	57.32	2327.70
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	**2.04**	**0.03**	74.81	64.25	1651.51	**1.17**	**0.02**	**84.62**	**73.94**	2885.64	**6.43**	**0.08**	**67.18**	**57.84**	2496.09
	3PT$_{s00}f_{1,2}$(**ours**)	H$_{NS}$ [26]	2.09	**0.03**	**74.88**	**64.33**	1541.87	1.27	**0.02**	84.13	73.46	2696.57	6.69	**0.08**	66.21	57.43	2372.27
	4p4d [8]	H [26]	2.46	0.04	73.96	63.04	1597.52	1.26	**0.02**	84.10	72.81	2722.93	6.83	0.09	62.72	54.06	2471.83

Depth	Solver	Opt.	Mast3r [17]				
			$\epsilon(°)\downarrow$	$\epsilon_f\downarrow$	mAA$\uparrow$	mAA$_f\uparrow$	$\tau(ms)\downarrow$
-	7PT [11]	S	2.71	0.07	68.00	47.29	36.46
Mast3r [17]	4p4d [8]	S	3.35	0.08	63.11	43.94	29.51
	4PT$_{suv}f_{1,2}$(M) [26]	S	5.10	0.11	57.94	41.15	102.97
	4PT$_{suv}f_{1,2}$(**ours**)	S	4.97	0.12	57.92	41.43	39.07
	3PT$_{s00}f_{1,2}$(**ours**)	S	4.13	0.10	60.24	42.47	32.49
	3PT$_{100}f_{1,2}$(**ours**)	S	**2.85**	**0.07**	**66.70**	**46.54**	39.40
	4PT$_{suv}f_{1,2}$(M) [26]	R	49.82	0.36	2.65	10.16	87.74
	4PT$_{suv}f_{1,2}$(**ours**)	R	49.68	0.36	2.55	10.28	23.55
	3PT$_{s00}f_{1,2}$(**ours**)	R	50.05	0.34	2.59	10.76	**17.18**
	3PT$_{100}f_{1,2}$(**ours**)	R	49.34	0.35	2.55	10.73	26.95
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	50.42	0.42	3.11	7.67	94.04
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	50.58	0.42	2.91	7.49	30.17
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	46.77	0.39	3.66	8.96	21.25
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	46.21	0.37	3.71	8.45	31.11
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	5.29	0.13	52.43	32.37	5273.77
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	5.34	0.13	52.41	32.33	5338.04
	3PT$_{s00}f_{1,2}$(**ours**)	H$_{NS}$ [26]	5.19	0.13	52.46	32.44	4657.79
	4p4d [8]	H [26]	5.14	0.13	52.46	32.32	5107.02

Table 5. Results for the case of two cameras with different unknown focal lengths on the ETH3D dataset [22]. Opt.: S, R, R$_s$ - PoseLib [15] implementation using Sampson error (S), reprojection error (R) or reprojection error with shift considered (R$_s$), H - hybrid RANSAC from [26], H$_{NS}$ - hybrid RANSAC [26] without optimizing for shift in LO.

Depth	Solver	Opt.	SP+LG [6, 18]			RoMA [9]			SIFT [19]		
			$\epsilon(^{\circ})\downarrow$	mAA↑	$\tau(ms)\downarrow$	$\epsilon(^{\circ})\downarrow$	mAA↑	$\tau(ms)\downarrow$	$\epsilon(^{\circ})\downarrow$	mAA↑	$\tau(ms)\downarrow$
-	5PT [20]	S	6.98	37.95	50.27	3.64	56.18	209.19	31.35	17.37	20.61
Real Depth	Rel3PT [1]	S	6.90	38.28	74.72	3.61	56.63	381.28	14.18	26.67	26.17
	P3P [7]	S	6.60	39.58	24.48	3.60	56.67	107.58	15.44	25.73	11.66
	3PT$_{suv}$(M) [26]	S	6.70	39.09	34.27	3.62	56.58	92.19	15.13	24.38	17.43
	3PT$_{suv}$ **(ours)**	S	6.72	38.98	21.39	3.61	56.65	85.04	15.51	24.22	10.02
	P3P [7]	R	5.54	43.78	13.27	**3.42**	59.36	52.49	**7.85**	**35.64**	**7.43**
	3PT$_{suv}$(M) [26]	R	**5.51**	**43.89**	24.24	3.43	59.37	41.09	9.02	33.31	15.65
	3PT$_{suv}$ **(ours)**	R	5.52	43.85	**11.99**	3.43	**59.39**	**33.88**	8.99	33.41	7.45
	P3P [7]	R$_s$	6.07	40.90	14.42	3.51	58.95	55.93	9.70	32.53	8.90
	3PT$_{suv}$(M) [26]	R$_s$	7.33	36.49	26.67	3.58	56.63	42.97	13.95	28.21	15.45
	3PT$_{suv}$ **(ours)**	R$_s$	7.29	36.53	14.84	3.59	56.50	34.86	14.27	28.11	8.25
	3PT$_{suv}$(M) [26]	H [26]	5.82	41.90	1756.20	**3.42**	59.05	4206.15	18.95	23.87	882.97
	3PT$_{suv}$ **(ours)**	H [26]	5.80	41.97	1737.82	3.43	59.05	4064.46	19.02	23.76	869.16
MiDas [3]	Rel3PT [1]	S	8.34	34.07	43.34	3.93	53.43	207.44	44.37	11.17	25.64
	P3P [7]	S	6.85	38.39	24.73	3.70	55.91	103.26	20.36	19.50	11.25
	3PT$_{suv}$(M) [26]	S	**6.84**	**38.53**	32.39	**3.64**	**56.44**	78.69	21.13	19.49	17.11
	3PT$_{suv}$ **(ours)**	S	6.86	38.48	19.90	**3.64**	56.41	74.16	21.31	19.16	9.86
	P3P [7]	R	17.89	12.30	13.89	13.34	17.42	58.59	21.55	11.11	**7.32**
	3PT$_{suv}$(M) [26]	R	17.83	12.34	23.98	13.33	17.47	41.70	26.72	9.15	15.36
	3PT$_{suv}$ **(ours)**	R	17.81	12.36	**11.96**	13.31	17.55	34.56	26.44	9.37	7.55
	P3P [7]	R$_s$	14.19	17.94	14.67	10.20	24.59	56.72	19.74	14.51	8.48
	3PT$_{suv}$(M) [26]	R$_s$	13.24	19.86	26.03	8.78	29.77	40.27	21.04	14.55	15.12
	3PT$_{suv}$ **(ours)**	R$_s$	13.26	19.51	14.37	8.80	29.73	**32.78**	20.84	14.44	8.13
	3PT$_{suv}$(M) [26]	H [26]	7.03	37.56	998.68	3.84	54.97	1780.84	**16.93**	22.29	610.19
	3PT$_{suv}$ **(ours)**	H [26]	7.03	37.49	983.36	3.84	54.93	1755.98	17.02	**22.40**	604.40
DA v2 [25]	Rel3PT [1]	S	8.33	33.95	42.50	3.96	53.30	203.95	43.72	10.21	24.64
	P3P [7]	S	6.99	37.79	23.98	3.70	55.68	98.12	24.36	16.97	11.06
	3PT$_{suv}$(M) [26]	S	**6.89**	38.50	34.61	**3.63**	**56.43**	91.84	16.81	20.99	17.63
	3PT$_{suv}$ **(ours)**	S	6.91	**38.52**	21.90	**3.63**	**56.43**	86.06	16.73	21.09	10.09
	P3P [7]	R	23.12	5.87	13.26	19.47	7.45	56.69	26.22	5.66	**7.06**
	3PT$_{suv}$(M) [26]	R	23.35	5.70	25.05	19.35	7.40	45.12	30.83	4.85	15.79
	3PT$_{suv}$ **(ours)**	R	23.36	5.66	**12.27**	19.35	7.39	**37.25**	30.84	4.81	7.57
	P3P [7]	R$_s$	16.59	12.99	14.08	12.23	18.64	53.23	21.82	10.69	8.37
	3PT$_{suv}$(M) [26]	R$_s$	13.02	18.83	27.50	8.27	30.91	45.52	18.32	15.37	15.59
	3PT$_{suv}$ **(ours)**	R$_s$	13.02	18.69	15.28	8.22	31.06	37.90	17.90	15.79	8.33
	3PT$_{suv}$(M) [26]	H [26]	7.21	36.70	931.97	3.92	54.51	1764.65	**14.62**	**22.73**	577.86
	3PT$_{suv}$ **(ours)**	H [26]	7.20	36.68	916.70	3.93	54.52	1744.47	14.74	22.43	576.69
MoGe [23]	Rel3PT [1]	S	8.68	33.50	48.65	4.01	52.56	229.08	45.83	10.37	26.50
	P3P [7]	S	6.71	39.23	26.36	3.60	56.57	116.72	14.18	26.34	11.60
	3PT$_{suv}$(M) [26]	S	6.71	39.28	35.99	3.62	56.53	97.38	14.30	25.18	17.68
	3PT$_{suv}$ **(ours)**	S	6.72	39.19	22.58	3.63	56.49	93.10	14.62	24.94	9.99
	P3P [7]	R	6.37	39.41	14.25	4.32	53.40	58.35	**8.22**	**33.61**	7.51
	3PT$_{suv}$(M) [26]	R	6.31	39.60	25.45	4.32	53.45	45.60	9.92	30.26	15.39
	3PT$_{suv}$ **(ours)**	R	6.31	39.63	**12.53**	4.32	53.45	37.86	9.81	30.56	**7.31**
	P3P [7]	R$_s$	6.73	37.99	15.09	4.07	54.91	59.33	8.90	31.81	8.82
	3PT$_{suv}$(M) [26]	R$_s$	6.80	37.07	27.37	4.03	54.59	44.53	10.16	29.71	15.02
	3PT$_{suv}$ **(ours)**	R$_s$	6.82	37.16	14.54	4.03	54.62	**36.34**	10.19	29.76	7.93
	3PT$_{suv}$(M) [26]	H [26]	**5.95**	41.78	838.82	3.52	58.09	1586.27	11.20	28.01	542.18
	3PT$_{suv}$ **(ours)**	H [26]	**5.95**	**41.79**	825.19	**3.50**	**58.15**	1546.92	11.67	27.61	544.23
UniDepth [21]	Rel3PT [1]	S	7.07	37.74	74.11	3.65	55.95	363.97	21.13	20.51	29.39
	P3P [7]	S	6.73	39.23	26.49	3.60	56.80	118.75	14.59	25.76	11.65
	3PT$_{suv}$(M) [26]	S	6.76	39.09	36.22	3.64	56.48	98.97	13.64	24.99	17.83
	3PT$_{suv}$ **(ours)**	S	6.75	39.13	22.85	3.64	56.48	94.58	13.82	24.90	9.99
	P3P [7]	R	5.83	41.42	14.23	4.10	54.54	58.73	**7.80**	**34.55**	7.56
	3PT$_{suv}$(M) [26]	R	**5.82**	41.51	25.53	4.10	54.54	46.19	9.15	31.60	15.22
	3PT$_{suv}$ **(ours)**	R	**5.82**	41.50	**12.53**	4.10	54.55	37.79	8.93	31.93	**7.36**
	P3P [7]	R$_s$	6.38	39.05	14.96	3.94	56.00	59.76	8.92	32.06	8.98
	3PT$_{suv}$(M) [26]	R$_s$	6.57	38.10	27.21	4.00	55.77	45.63	10.02	30.18	15.18
	3PT$_{suv}$ **(ours)**	R$_s$	6.56	38.25	14.49	4.00	55.75	**36.46**	9.76	30.54	8.05
	3PT$_{suv}$(M) [26]	H [26]	5.93	**41.86**	828.68	**3.49**	**58.35**	1590.70	11.12	28.56	515.95
	3PT$_{suv}$ **(ours)**	H [26]	5.95	41.78	821.55	**3.49**	58.32	1557.50	11.16	28.61	520.79

Depth	Solver	Opt.	Mast3r [17]		
			$\epsilon(^{\circ})\downarrow$	mAA↑	$\tau(ms)\downarrow$
-	5PT [20]	S	3.21	62.88	163.73
Mast3r [17]	Rel3PT [1]	S	3.21	62.91	174.26
	P3P [7]	S	3.21	62.90	78.05
	3PT$_{suv}$(M) [26]	S	3.22	62.89	52.88
	3PT$_{suv}$ **(ours)**	S	3.21	62.91	39.21
	P3P [7]	R	6.49	38.15	43.99
	3PT$_{suv}$(M) [26]	R	6.70	37.36	35.16
	3PT$_{suv}$ **(ours)**	R	6.70	37.31	23.24
	P3P [7]	R$_s$	6.17	40.59	44.95
	3PT$_{suv}$(M) [26]	R$_s$	7.71	33.83	33.22
	3PT$_{suv}$ **(ours)**	R$_s$	7.80	33.55	**22.85**
	3PT$_{suv}$(M) [26]	H [26]	**3.17**	**62.99**	2459.38
	3PT$_{suv}$ **(ours)**	H [26]	**3.17**	62.97	2439.66

Table 6. Results for the calibrated case on the `ScanNet` dataset [5]. Opt.: S, R, R$_s$ - PoseLib [15] implementation using Sampson error (S), reprojection error (R) or reprojection error with shift considered (R$_s$), H - hybrid RANSAC from [26].

Depth	Solver	Opt.	SP+LG [6, 18]					RoMA [9]					SIFT [19]				
			$\epsilon(°)\downarrow$	$\epsilon_f\downarrow$	mAA$\uparrow$	mAA$_f\uparrow$	$\tau(ms)\downarrow$	$\epsilon(°)\downarrow$	$\epsilon_f\downarrow$	mAA$\uparrow$	mAA$_f\uparrow$	$\tau(ms)\downarrow$	$\epsilon(°)\downarrow$	$\epsilon_f\downarrow$	mAA$\uparrow$	mAA$_f\uparrow$	$\tau(ms)\downarrow$
-	6PT [16]	S	10.54	0.14	28.39	25.51	71.04	4.78	0.05	48.67	47.45	139.19	52.70	0.36	9.36	14.31	53.69
Real Depth	3p3d [8]	S	10.01	0.14	28.80	26.17	19.87	4.76	0.05	48.91	47.42	82.15	27.88	0.26	17.09	19.65	12.20
	4PT$_{suv}f$(M) [26]	S	9.12	0.13	30.12	27.82	93.60	4.77	0.05	49.16	48.20	114.10	35.81	0.33	13.15	17.21	77.02
	4PT$_{suv}f$(**ours**)	S	9.53	0.13	29.77	26.95	47.06	4.76	0.05	49.17	48.21	87.56	32.53	0.30	14.23	18.17	35.21
	3PT$_{s00}f$(**ours**)	S	9.25	0.13	30.29	27.20	25.93	4.77	0.05	49.39	48.12	72.31	21.04	0.18	20.62	24.50	17.29
	3PT$_{100}f$(**ours**)	S	9.76	0.13	29.35	26.52	14.38	4.78	0.05	48.76	47.37	52.18	29.93	0.26	14.34	19.20	7.22
	4PT$_{suv}f$(M) [26]	R	7.01	**0.07**	37.06	40.35	86.73	3.86	**0.03**	55.40	58.97	92.86	23.76	0.16	24.03	30.81	76.84
	4PT$_{suv}f$(**ours**)	R	7.06	**0.07**	37.02	40.29	42.48	3.86	**0.03**	55.51	59.15	61.14	19.64	0.12	24.79	32.14	33.53
	3PT$_{s00}f$(**ours**)	R	6.90	**0.07**	37.42	40.30	22.33	**3.81**	**0.03**	**56.01**	**59.54**	56.73	9.76	**0.08**	31.37	36.80	15.47
	3PT$_{100}f$(**ours**)	R	6.86	**0.07**	**37.71**	**40.42**	**10.29**	3.82	**0.03**	55.99	59.53	**37.32**	**8.61**	**0.08**	**33.22**	**37.71**	**4.84**
	4PT$_{suv}f$(M) [26]	R$_s$	10.88	0.15	28.79	25.87	89.48	4.20	0.05	50.79	48.54	104.83	25.31	0.23	20.85	24.57	76.49
	4PT$_{suv}f$(**ours**)	R$_s$	10.95	0.15	28.74	26.37	45.41	4.20	0.05	50.91	48.57	70.86	25.37	0.21	21.65	24.39	34.65
	3PT$_{s00}f$(**ours**)	R$_s$	8.50	0.10	32.67	30.58	23.78	4.06	0.04	53.16	52.51	59.27	12.13	0.11	28.31	31.93	15.85
	3PT$_{100}f$(**ours**)	R$_s$	8.05	0.10	33.28	31.32	11.36	4.04	0.04	53.24	53.19	40.06	10.30	0.10	29.76	34.24	5.47
	4PT$_{suv}f$(M) [26]	H [26]	**6.81**	0.09	37.17	33.24	2382.94	3.88	0.04	55.30	56.74	5177.04	40.86	0.28	14.33	20.25	1250.62
	3PT$_{s00}f$(**ours**)	H [26]	7.07	0.09	36.25	32.88	2039.93	3.83	0.04	54.98	56.07	4685.72	58.64	0.36	10.11	16.93	956.78
	3PT$_{s00}f$(**ours**)	H$_{NS}$ [26]	7.09	0.09	36.20	32.72	1708.54	3.94	0.04	54.39	55.64	3848.05	59.62	0.34	10.19	17.12	873.97
MiDas [3]	3p3d [8]	S	12.24	0.16	25.92	24.47	20.80	5.31	0.06	44.96	43.56	82.37	47.37	0.47	6.11	10.46	14.08
	4PT$_{suv}f$(M) [26]	S	9.93	0.14	28.80	26.18	91.75	4.84	**0.05**	48.45	47.24	110.59	45.44	0.50	7.30	12.29	76.46
	4PT$_{suv}f$(**ours**)	S	10.03	0.14	28.67	25.93	40.86	**4.76**	**0.05**	48.97	48.01	78.83	42.66	0.44	8.39	13.10	30.59
	3PT$_{s00}f$(**ours**)	S	9.68	0.12	29.61	27.88	20.31	4.79	**0.05**	**49.03**	**48.04**	61.08	35.87	0.30	10.61	15.47	12.26
	3PT$_{100}f$(**ours**)	S	16.01	0.19	23.55	22.77	12.27	5.50	0.06	42.99	41.73	43.73	62.79	0.45	3.67	8.51	6.52
	4PT$_{suv}f$(M) [26]	R	20.80	0.21	10.07	17.73	86.00	14.43	0.15	15.57	22.87	90.87	38.38	0.34	6.89	13.94	76.41
	4PT$_{suv}f$(**ours**)	R	20.80	0.21	9.95	17.20	36.65	14.65	0.15	15.21	22.94	56.73	33.59	0.32	7.27	14.81	29.05
	3PT$_{s00}f$(**ours**)	R	21.07	0.20	9.90	17.79	17.87	14.55	0.15	15.67	22.96	50.92	25.38	0.25	8.86	16.49	10.32
	3PT$_{100}f$(**ours**)	R	21.02	0.20	10.02	17.52	**8.82**	14.52	0.15	15.47	22.69	**30.86**	30.19	0.27	7.53	16.31	**4.51**
	4PT$_{suv}f$(M) [26]	R$_s$	17.44	0.20	13.83	17.93	87.83	11.47	0.13	21.50	26.04	99.87	31.50	0.35	10.05	14.93	75.12
	4PT$_{suv}f$(**ours**)	R$_s$	17.70	0.21	13.89	18.34	38.70	11.52	0.13	21.48	26.15	62.98	28.44	0.33	10.37	15.53	29.55
	3PT$_{s00}f$(**ours**)	R$_s$	17.49	0.18	14.20	19.24	18.60	11.64	0.12	21.45	26.42	53.08	**24.02**	0.24	11.90	18.05	10.57
	3PT$_{100}f$(**ours**)	R$_s$	17.95	0.21	13.87	18.09	9.28	11.55	0.13	20.92	25.29	31.60	33.23	0.30	8.66	15.27	4.88
	4PT$_{suv}f$(M) [26]	H [26]	9.07	**0.11**	**30.07**	28.92	1630.59	5.11	**0.05**	47.35	46.92	2387.02	36.67	0.28	12.25	18.91	1013.03
	3PT$_{s00}f$(**ours**)	H [26]	9.11	**0.11**	29.97	**29.19**	1679.00	5.10	**0.05**	47.30	46.86	2475.56	26.03	0.22	**14.56**	20.26	1214.10
	3PT$_{s00}f$(**ours**)	H$_{NS}$ [26]	**9.05**	**0.11**	29.91	28.41	1387.32	5.13	**0.05**	47.24	46.94	2378.65	27.08	**0.20**	14.05	**20.85**	1174.27
DA v2 [25]	3p3d [8]	S	13.72	0.17	25.53	23.51	22.29	5.12	0.06	45.59	44.35	86.67	51.13	0.49	5.71	9.48	14.02
	4PT$_{suv}f$(M) [26]	S	9.67	0.13	29.20	27.21	92.72	**4.71**	**0.05**	**49.39**	48.11	115.50	39.02	0.38	10.30	15.93	77.30
	4PT$_{suv}f$(**ours**)	S	9.46	0.13	**29.60**	27.74	41.87	**4.71**	**0.05**	49.32	**48.29**	85.64	34.58	0.36	11.58	15.23	30.89
	3PT$_{s00}f$(**ours**)	S	9.78	0.13	29.04	26.54	20.16	4.83	**0.05**	48.47	47.49	61.50	36.43	0.33	9.08	14.69	11.73
	3PT$_{100}f$(**ours**)	S	15.74	0.19	24.18	22.26	12.28	5.57	0.06	43.27	43.31	43.29	60.62	0.47	3.52	8.12	6.20
	4PT$_{suv}f$(M) [26]	R	24.47	0.30	5.78	12.25	87.57	19.52	0.25	8.53	14.69	97.54	37.11	0.39	4.31	11.68	76.57
	4PT$_{suv}f$(**ours**)	R	24.25	0.30	5.71	12.07	37.49	19.28	0.25	8.46	14.55	62.13	36.76	0.37	4.32	11.78	29.22
	3PT$_{s00}f$(**ours**)	R	25.01	0.30	5.50	12.49	17.04	19.69	0.25	8.53	14.43	49.23	29.40	0.32	5.34	13.09	10.03
	3PT$_{100}f$(**ours**)	R	24.97	0.29	5.48	12.54	**8.60**	19.59	0.25	8.53	14.62	**30.23**	33.71	0.35	4.97	11.89	**4.39**
	4PT$_{suv}f$(M) [26]	R$_s$	16.35	0.19	14.37	18.57	88.97	10.59	0.12	23.23	26.71	107.49	25.33	0.26	11.21	17.33	75.51
	4PT$_{suv}f$(**ours**)	R$_s$	16.31	0.19	14.40	18.84	40.08	10.59	0.12	23.25	26.61	70.44	24.24	0.25	11.31	18.01	29.81
	3PT$_{s00}f$(**ours**)	R$_s$	17.21	0.18	14.07	19.75	18.29	11.13	0.13	22.05	26.32	51.76	**24.07**	**0.21**	11.21	17.86	10.32
	3PT$_{100}f$(**ours**)	R$_s$	16.87	0.19	14.45	19.09	9.28	11.17	0.13	22.27	26.05	31.65	30.06	0.27	9.89	16.71	4.86
	4PT$_{suv}f$(M) [26]	H [26]	**9.15**	**0.11**	29.16	**28.36**	1530.35	5.27	**0.05**	46.09	46.31	2437.10	32.47	0.25	**12.56**	19.56	1013.89
	3PT$_{s00}f$(**ours**)	H [26]	9.49	**0.11**	28.52	27.81	1447.28	5.25	0.06	46.07	46.05	2436.98	30.57	0.25	12.33	**19.87**	1108.35
	3PT$_{s00}f$(**ours**)	H$_{NS}$ [26]	9.31	**0.11**	28.82	28.01	1254.83	5.30	**0.05**	46.08	46.27	2297.62	30.18	0.24	11.93	18.95	1053.87
MoGe [23]	3p3d [8]	S	11.98	0.15	26.23	24.58	24.05	5.03	0.06	46.15	44.79	90.61	41.21	0.43	8.62	12.01	14.96
	4PT$_{suv}f$(M) [26]	S	9.45	0.13	29.69	27.13	93.81	4.69	0.05	49.40	48.49	118.19	35.11	0.31	13.75	19.30	78.28
	4PT$_{suv}f$(**ours**)	S	9.48	0.13	29.59	26.44	42.41	4.75	0.05	49.24	48.21	88.21	29.46	0.32	13.48	17.85	31.08
	3PT$_{s00}f$(**ours**)	S	9.25	0.12	30.14	27.51	22.36	4.71	0.05	49.48	48.45	71.14	20.45	0.19	19.45	22.68	12.78
	3PT$_{100}f$(**ours**)	S	16.64	0.22	22.79	21.06	13.36	6.11	0.07	41.01	39.30	47.81	59.03	0.54	4.25	8.09	7.56
	4PT$_{suv}f$(M) [26]	R	7.70	**0.08**	33.60	37.02	88.43	4.67	**0.04**	50.32	53.92	98.15	18.70	0.14	23.23	29.59	76.94
	4PT$_{suv}f$(**ours**)	R	7.71	**0.08**	33.47	36.96	37.72	4.64	**0.04**	50.34	53.90	62.43	17.50	0.13	23.21	29.27	29.08
	3PT$_{s00}f$(**ours**)	R	7.75	**0.08**	33.59	**37.16**	18.83	4.63	**0.04**	50.35	54.04	57.80	**9.57**	**0.09**	**30.01**	**35.07**	10.76
	3PT$_{100}f$(**ours**)	R	8.05	**0.08**	32.86	36.68	**9.52**	4.81	**0.04**	49.31	52.83	**33.99**	13.47	0.11	25.23	31.06	**5.21**
	4PT$_{suv}f$(M) [26]	R$_s$	9.14	0.11	29.94	29.95	91.50	4.92	0.05	48.57	48.60	109.77	17.36	0.15	22.96	28.01	76.38
	4PT$_{suv}f$(**ours**)	R$_s$	9.02	0.11	30.09	30.03	40.37	4.92	0.05	48.51	48.31	71.22	15.36	0.16	23.29	27.20	29.81
	3PT$_{s00}f$(**ours**)	R$_s$	8.94	0.10	30.70	31.10	20.18	4.82	0.05	48.79	49.13	61.16	11.35	0.12	27.18	29.66	11.31
	3PT$_{100}f$(**ours**)	R$_s$	9.19	0.11	29.69	30.19	10.34	5.02	0.05	47.14	47.75	35.84	16.55	0.15	22.05	26.66	5.93
	4PT$_{suv}f$(M) [26]	H [26]	7.08	0.09	36.42	33.81	1397.78	**3.92**	**0.04**	54.47	55.43	2128.23	31.25	0.21	17.00	23.34	927.84
	3PT$_{s00}f$(**ours**)	H [26]	6.93	0.09	36.89	34.19	1396.01	3.93	**0.04**	54.49	55.66	2247.51	15.89	0.14	22.92	27.57	1107.28
	3PT$_{s00}f$(**ours**)	H$_{NS}$ [26]	**6.85**	0.09	**36.91**	34.39	1227.36	3.94	**0.04**	**54.63**	**56.09**	2196.60	13.98	0.13	24.08	27.99	1043.71
UniDepth [21]	3p3d [8]	S	10.48	0.14	28.27	25.34	24.92	4.83	0.05	48.27	46.77	96.78	31.00	0.32	13.49	15.44	15.91
	4PT$_{suv}f$(M) [26]	S	9.35	0.13	30.12	27.06	94.09	4.74	0.05	49.37	48.43	120.53	30.00	0.30	15.01	18.81	78.73
	4PT$_{suv}f$(**ours**)	S	9.51	0.13	29.69	27.00	42.53	4.61	0.05	49.69	48.44	88.36	27.01	0.30	14.56	18.18	30.90
	3PT$_{s00}f$(**ours**)	S	9.08	0.12	30.39	27.78	22.63	4.64	0.05	49.47	48.03	71.48	19.61	0.18	19.87	24.17	12.54
	3PT$_{100}f$(**ours**)	S	10.88	0.14	28.03	26.19	14.63	4.85	0.06	47.85	45.81	53.38	37.70	0.37	10.51	13.52	7.60
	4PT$_{suv}f$(M) [26]	R	7.02	**0.08**	35.82	**36.84**	88.78	4.39	0.05	51.37	51.16	100.03	17.93	0.15	23.88	29.25	76.21
	4PT$_{suv}f$(**ours**)	R	7.00	**0.08**	35.89	36.43	37.75	4.36	0.05	51.55	51.45	62.24	16.23	0.14	24.45	30.11	29.05
	3PT$_{s00}f$(**ours**)	R	7.00	**0.08**	36.05	36.49	18.99	4.36	0.05	51.63	51.20	58.03	**9.04**	**0.09**	**31.09**	**35.66**	10.77
	3PT$_{100}f$(**ours**)	R	7.00	**0.08**	36.00	36.81	**10.66**	4.36	0.05	51.61	51.37	**40.68**	9.08	**0.09**	30.51	35.05	**5.28**
	4PT$_{suv}f$(M) [26]	R$_s$	8.55	0.11	31.61	30.32	92.41	4.52	0.05	50.55	48.76	109.69	15.31	0.15	23.82	27.45	76.33
	4PT$_{suv}f$(**ours**)	R$_s$	8.55	0.11	31.61	30.31	40.77	4.52	0.05	50.61	48.38	70.86	14.28	0.15	24.86	28.61	29.91
	3PT$_{s00}f$(**ours**)	R$_s$	8.34	0.10	32.26	31.17	20.20	4.51	0.05	50.63	48.44	61.07	10.78	0.11	27.91	30.84	11.51
	3PT$_{100}f$(**ours**)	R$_s$	8.41	0.10	32.23	31.32	11.56	4.52	0.05	50.68	48.39	42.95	11.09	0.11	27.01	30.77	6.15
	4PT$_{suv}f$(M) [26]	H [26]	6.90	0.09	36.87	33.71	1384.13	**3.93**	**0.04**	54.76	56.47	2081.34	28.47	0.22	17.76	23.56	930.90
	3PT$_{s00}f$(**ours**)	H [26]	**6.72**	0.09	37.14	34.13	1436.90	**3.93**	**0.04**	54.89	**56.78**	2163.29	14.01	0.12	23.88	30.37	1116.45
	3PT$_{s00}f$(**ours**)	H$_{NS}$ [26]	6.80	0.09	**37.32**	34.10	1222.71	3.96	**0.04**	**54.94**	56.73	2178.86	14.19	0.12	23.75	29.53	1072.67

Depth	Solver	Opt.	Mast3r [17]				
			$\epsilon(°)\downarrow$	$\epsilon_f\downarrow$	mAA$\uparrow$	mAA$_f\uparrow$	$\tau(ms)\downarrow$
-	6PT [16]	S	3.38	0.03	61.09	63.59	97.82
Mast3r [17]	3p3d [8]	S	3.40	**0.03**	60.29	62.71	49.14
	4PT$_{suv}f$(M) [26]	S	3.41	**0.03**	60.53	63.25	97.91
	4PT$_{suv}f$(**ours**)	S	**3.38**	**0.03**	61.02	63.43	52.40
	3PT$_{s00}f$(**ours**)	S	**3.38**	**0.03**	**61.11**	**63.73**	41.71
	3PT$_{100}f$(**ours**)	S	3.43	**0.03**	59.79	61.75	33.09
	4PT$_{suv}f$(M) [26]	R	8.79	0.08	30.17	36.35	87.99
	4PT$_{suv}f$(**ours**)	R	8.74	0.08	30.43	36.71	42.88
	3PT$_{s00}f$(**ours**)	R	7.65	0.07	33.52	38.84	37.79
	3PT$_{100}f$(**ours**)	R	7.86	0.07	32.94	38.45	**26.16**
	4PT$_{suv}f$(M) [26]	R$_s$	13.60	0.13	23.51	26.42	96.92
	4PT$_{suv}f$(**ours**)	R$_s$	14.07	0.13	23.83	26.65	50.78
	3PT$_{s00}f$(**ours**)	R$_s$	9.97	0.10	28.45	31.35	43.01
	3PT$_{100}f$(**ours**)	R$_s$	9.97	0.10	28.53	30.60	30.23
	4PT$_{suv}f$(M) [26]	H [26]	3.42	**0.03**	59.78	61.92	3348.40
	3PT$_{s00}f$(**ours**)	H [26]	3.42	**0.03**	59.97	62.19	3592.91
	3PT$_{s00}f$(**ours**)	H$_{NS}$ [26]	**3.38**	**0.03**	60.11	62.00	3223.20
	-	M [17]	3.45	0.06	59.49	52.90	5080.77

Table 7. Results for the case of two cameras with shared unknown focal length on the ScanNet dataset [5]. Opt.: S, R, R$_s$ - PoseLib [15] implementation using Sampson error (S), reprojection error (R) or reprojection error with shift considered (R$_s$), H - hybrid RANSAC from [26], H$_{NS}$ - hybrid RANSAC [26] without optimizing for shift in LO.

Depth	Solver	Opt.	SP+LG [6, 18]					RoMA [9]					SIFT [19]				
			$\epsilon(^\circ)\downarrow$	$\epsilon_f\downarrow$	mAA↑	mAA$_f\uparrow$	$\tau(ms)\downarrow$	$\epsilon(^\circ)\downarrow$	$\epsilon_f\downarrow$	mAA↑	mAA$_f\uparrow$	$\tau(ms)\downarrow$	$\epsilon(^\circ)\downarrow$	$\epsilon_f\downarrow$	mAA↑	mAA$_f\uparrow$	$\tau(ms)\downarrow$
-	7PT [11]	S	17.38	0.19	17.90	18.87	16.87	6.75	0.08	37.74	35.25	60.31	68.26	0.69	2.75	5.97	9.17
Real Depth	4p4d [8]	S	16.37	0.19	18.01	19.69	14.09	6.61	0.08	38.11	35.43	55.64	50.55	0.37	6.41	11.34	7.92
	4PT$_{suv}f_{1,2}$(M) [26]	S	15.84	0.20	18.42	19.19	88.28	6.54	0.08	38.67	35.87	115.22	50.98	0.43	6.80	9.79	79.68
	4PT$_{suv}f_{1,2}$(**ours**)	S	15.97	0.21	17.80	18.37	25.67	6.49	0.08	38.67	35.96	74.31	52.16	0.42	6.98	9.16	17.15
	3PT$_{s00}f_{1,2}$(**ours**)	S	14.97	0.19	18.79	19.08	16.32	6.44	0.08	39.03	36.21	64.50	30.18	0.28	13.25	16.30	7.94
	3PT$_{100}f_{1,2}$(**ours**)	S	14.23	0.18	19.22	19.70	18.99	6.46	0.08	38.83	36.05	73.44	22.38	0.24	16.69	18.69	11.07
	4PT$_{suv}f_{1,2}$(M) [26]	R	11.89	**0.08**	25.82	34.78	80.53	5.12	**0.04**	45.93	55.91	85.85	41.48	0.22	15.79	25.85	77.84
	4PT$_{suv}f_{1,2}$(**ours**)	R	11.97	0.09	25.82	34.59	19.98	5.11	**0.04**	45.95	55.98	38.51	40.51	0.22	16.12	25.45	14.56
	3PT$_{s00}f_{1,2}$(**ours**)	R	11.76	**0.08**	26.07	**35.06**	**9.77**	5.02	**0.04**	46.45	56.41	**34.33**	17.43	**0.10**	**22.23**	33.05	**3.97**
	3PT$_{100}f_{1,2}$(**ours**)	R	11.71	**0.08**	26.16	34.74	13.36	5.04	**0.04**	46.43	**56.57**	48.19	**16.45**	**0.10**	21.95	**33.79**	7.62
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	17.00	0.16	19.78	23.15	82.22	5.83	0.06	41.17	43.85	96.03	39.88	0.28	13.57	20.51	78.16
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	16.93	0.16	19.85	22.90	22.86	5.88	0.06	40.95	43.59	48.61	38.88	0.25	13.89	20.99	15.72
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	13.07	0.12	23.11	27.49	11.30	5.51	0.05	43.24	47.74	38.84	19.56	0.13	20.00	28.28	4.61
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	12.86	0.12	23.12	27.43	14.36	5.57	0.05	42.97	47.58	52.55	18.60	0.13	19.55	28.13	8.26
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	**10.94**	0.10	**27.01**	30.33	3187.44	**4.64**	**0.04**	**48.82**	53.28	6680.16	55.59	0.46	8.22	13.99	2375.56
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	12.20	0.11	24.98	28.98	3006.32	4.96	**0.04**	47.13	51.78	6266.57	62.95	0.56	5.57	11.57	2141.07
	3PT$_{s00}f_{1,2}$(**ours**)	H$_{NS}$ [26]	11.58	0.11	25.39	30.12	2712.46	4.97	**0.04**	46.64	52.05	5845.02	63.97	0.57	5.11	11.49	2204.79
	4p4d [8]	H [26]	63.44	1.00	2.30	3.12	16442.64	64.67	1.00	2.23	2.93	19101.36	67.07	1.00	0.37	0.69	17765.79
MiDas [3]	4p4d [8]	S	18.98	0.20	17.13	18.58	14.44	6.90	0.09	37.07	34.38	57.05	56.12	0.46	2.94	7.36	8.87
	4PT$_{suv}f_{1,2}$(M) [26]	S	17.76	0.24	16.48	17.60	85.78	6.89	**0.08**	37.45	35.47	109.98	59.76	0.52	4.03	5.11	78.73
	4PT$_{suv}f_{1,2}$(**ours**)	S	17.54	0.25	16.39	17.54	24.68	6.84	0.09	37.37	34.52	67.68	59.17	0.53	3.96	5.19	16.95
	3PT$_{s00}f_{1,2}$(**ours**)	S	17.00	0.21	17.34	18.50	14.93	6.65	**0.08**	38.20	35.21	56.94	49.17	0.41	5.03	8.89	7.92
	3PT$_{100}f_{1,2}$(**ours**)	S	16.12	0.19	17.88	18.80	17.28	6.62	**0.08**	37.99	35.30	64.37	52.31	0.42	4.58	8.69	10.40
	4PT$_{suv}f_{1,2}$(M) [26]	R	26.43	0.19	9.97	16.85	79.24	16.20	0.13	15.42	24.33	83.72	55.83	0.37	6.54	12.87	76.52
	4PT$_{suv}f_{1,2}$(**ours**)	R	26.35	0.19	10.04	16.72	19.69	15.87	0.13	15.82	23.71	36.21	55.30	0.35	6.54	12.68	14.23
	3PT$_{s00}f_{1,2}$(**ours**)	R	25.74	0.19	10.05	16.74	**9.85**	15.83	0.13	15.79	23.94	**34.03**	**35.28**	0.26	8.62	15.64	**3.97**
	3PT$_{100}f_{1,2}$(**ours**)	R	25.67	0.19	10.09	17.19	12.96	15.98	0.13	15.82	23.77	44.85	37.26	**0.25**	8.41	**16.39**	6.72
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	25.95	0.24	10.03	13.87	81.39	15.45	0.15	15.51	21.74	92.21	50.19	0.38	6.85	11.03	77.18
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	25.64	0.24	9.66	14.31	21.88	15.23	0.15	15.79	21.87	43.73	52.18	0.39	6.63	10.71	15.17
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	24.92	0.22	10.01	15.05	10.99	14.78	0.14	15.95	23.01	37.36	37.82	0.31	8.39	13.68	4.50
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	24.75	0.21	9.89	15.46	13.48	14.47	0.14	16.09	22.71	48.16	37.62	0.28	8.80	14.53	7.33
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	13.80	**0.13**	19.91	**23.38**	2238.95	**6.45**	**0.08**	**38.55**	36.73	3600.11	56.15	0.45	6.87	12.64	2220.51
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	**13.66**	0.14	**20.03**	23.26	2206.62	6.50	**0.08**	38.31	36.74	3648.22	43.21	0.26	**8.94**	15.49	2245.79
	3PT$_{s00}f_{1,2}$(**ours**)	H$_{NS}$ [26]	13.76	0.14	**20.03**	23.27	2086.05	**6.45**	**0.08**	38.53	**36.79**	3739.98	41.71	0.28	8.70	14.96	2220.57
	4p4d [8]	H [26]	14.14	0.14	19.78	22.80	2451.92	6.79	**0.08**	37.45	36.37	3935.23	58.33	0.51	5.27	10.89	2280.19
DA v2 [25]	4p4d [8]	S	19.91	0.22	16.53	17.73	14.79	6.88	0.09	37.06	35.05	58.49	57.00	0.54	2.77	5.33	8.59
	4PT$_{suv}f_{1,2}$(M) [26]	S	16.70	0.21	17.90	18.49	87.23	6.65	**0.08**	**38.19**	**36.24**	116.51	54.32	0.48	5.29	7.69	79.72
	4PT$_{suv}f_{1,2}$(**ours**)	S	16.62	0.22	17.17	18.08	25.66	6.84	0.09	37.83	35.46	73.90	54.23	0.51	4.65	7.92	17.17
	3PT$_{s00}f_{1,2}$(**ours**)	S	16.69	0.21	18.21	18.73	15.39	**6.60**	**0.08**	**38.19**	35.50	58.31	50.78	0.40	4.59	7.07	7.78
	3PT$_{100}f_{1,2}$(**ours**)	S	16.85	0.20	17.42	18.87	16.93	6.80	**0.08**	37.76	35.77	63.67	55.21	0.45	4.72	7.33	10.34
	4PT$_{suv}f_{1,2}$(M) [26]	R	21.58	0.20	10.70	15.24	80.39	14.37	0.17	15.53	18.47	88.48	45.65	0.33	8.67	12.72	77.04
	4PT$_{suv}f_{1,2}$(**ours**)	R	21.91	0.20	10.79	14.88	20.48	14.32	0.17	15.52	18.45	40.65	45.70	0.32	8.66	13.08	14.41
	3PT$_{s00}f_{1,2}$(**ours**)	R	21.78	0.20	10.81	15.39	**9.92**	14.23	0.17	15.47	18.72	**34.91**	31.59	**0.24**	10.37	14.79	**4.08**
	3PT$_{100}f_{1,2}$(**ours**)	R	21.73	0.20	10.87	15.02	11.76	14.41	0.17	15.23	18.42	41.82	32.53	0.26	9.79	14.83	6.42
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	20.47	0.20	11.58	14.89	82.53	12.07	0.14	19.41	20.37	97.58	40.16	0.31	9.67	13.85	77.56
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	20.56	0.21	11.68	15.05	22.72	12.12	0.15	19.28	20.04	50.27	39.58	0.29	9.15	14.04	15.34
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	20.19	0.19	11.93	16.09	11.18	12.54	0.14	18.88	20.67	38.91	**29.56**	**0.24**	**11.00**	**15.72**	4.58
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	20.02	0.19	11.92	15.88	12.77	12.38	0.14	18.75	20.65	45.27	31.32	0.25	10.51	15.35	6.94
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	**14.26**	**0.14**	18.67	**20.82**	2075.73	6.89	0.09	36.13	32.05	3673.36	50.57	0.42	8.27	11.70	2259.69
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	14.34	0.15	**18.68**	20.63	2044.96	6.99	0.09	35.60	31.74	3665.44	45.24	0.33	8.40	12.71	2251.86
	3PT$_{s00}f_{1,2}$(**ours**)	H$_{NS}$ [26]	14.53	0.15	18.35	**20.82**	1906.46	7.05	0.09	35.49	31.88	3813.10	45.70	0.31	8.48	12.75	2254.04
	4p4d [8]	H [26]	17.54	0.17	16.41	18.59	3654.94	8.77	0.11	29.80	27.27	5970.94	56.77	0.58	5.21	9.41	4615.33
MoGe [23]	4p4d [8]	S	16.82	0.20	18.12	18.76	16.94	6.54	0.08	38.23	35.95	66.19	47.57	0.34	6.80	11.77	9.43
	4PT$_{suv}f_{1,2}$(M) [26]	S	15.30	0.21	18.04	18.39	87.92	6.48	0.08	38.62	36.23	121.68	48.81	0.45	7.42	10.23	80.87
	4PT$_{suv}f_{1,2}$(**ours**)	S	15.50	0.20	18.33	18.63	26.63	6.45	0.08	38.63	36.26	78.42	50.51	0.45	7.28	10.25	17.25
	3PT$_{s00}f_{1,2}$(**ours**)	S	15.05	0.21	18.58	18.67	17.27	6.44	0.08	38.99	35.98	69.50	28.82	0.30	12.03	15.01	8.39
	3PT$_{100}f_{1,2}$(**ours**)	S	15.65	0.19	17.80	19.15	19.76	6.47	0.08	38.71	35.76	77.13	41.69	0.35	7.45	11.70	11.40
	4PT$_{suv}f_{1,2}$(M) [26]	R	13.72	0.10	22.34	31.46	81.79	6.16	**0.05**	39.75	50.07	91.97	37.27	0.20	14.78	24.81	77.61
	4PT$_{suv}f_{1,2}$(**ours**)	R	13.84	0.10	22.16	31.33	20.89	6.15	**0.05**	39.68	49.92	43.28	37.02	0.22	15.02	24.59	14.42
	3PT$_{s00}f_{1,2}$(**ours**)	R	13.50	0.10	22.57	31.56	**10.81**	6.13	**0.05**	40.11	50.24	**40.11**	**17.76**	**0.11**	**19.11**	**30.83**	**4.26**
	3PT$_{100}f_{1,2}$(**ours**)	R	13.82	0.10	22.39	**31.81**	14.04	6.12	**0.05**	40.13	49.87	53.29	18.39	**0.11**	18.43	30.25	7.36
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	15.27	0.13	20.54	25.11	84.46	6.58	0.06	37.47	43.04	102.27	31.77	0.21	14.85	22.62	78.69
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	14.97	0.13	20.86	25.34	23.30	6.55	0.06	37.59	43.01	53.65	31.93	0.21	14.83	22.67	15.52
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	14.62	0.13	20.91	25.67	12.65	6.49	0.06	37.79	43.63	45.60	20.35	0.15	17.39	25.63	5.10
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	15.27	0.13	20.82	25.85	15.40	6.44	0.06	37.83	43.36	58.28	19.97	0.15	16.90	25.30	8.10
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	**10.49**	0.10	26.54	31.47	1763.41	4.82	**0.05**	47.52	51.02	3001.08	50.14	0.39	10.21	17.47	2121.61
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	10.51	**0.09**	**26.82**	31.59	1739.14	**4.74**	**0.05**	48.11	51.68	2967.25	25.60	0.17	15.58	22.31	2124.60
	3PT$_{s00}f_{1,2}$(**ours**)	H$_{NS}$ [26]	10.53	**0.09**	26.52	31.67	1674.71	4.75	**0.05**	**48.26**	**52.06**	3015.70	24.71	0.15	15.76	24.58	1949.16
	4p4d [8]	H [26]	10.97	0.10	26.36	31.41	1887.22	4.92	**0.05**	47.34	50.80	2947.58	47.69	0.33	8.62	15.23	2031.49
UniDepth [21]	4p4d [8]	S	16.66	0.19	17.86	19.06	17.09	6.52	0.08	38.43	36.12	65.59	47.08	0.34	6.45	11.99	9.42
	4PT$_{suv}f_{1,2}$(M) [26]	S	15.21	0.20	18.35	18.90	88.32	6.39	0.08	39.17	36.25	121.35	47.73	0.40	7.69	9.93	81.08
	4PT$_{suv}f_{1,2}$(**ours**)	S	15.48	0.21	18.30	18.54	26.45	6.53	0.08	38.52	36.27	78.39	49.25	0.42	6.95	9.65	17.31
	3PT$_{s00}f_{1,2}$(**ours**)	S	14.79	0.19	18.79	18.98	17.47	6.47	0.08	39.05	36.41	68.83	28.80	0.32	11.76	14.05	8.44
	3PT$_{100}f_{1,2}$(**ours**)	S	14.66	0.19	18.72	19.42	19.94	6.29	0.08	39.47	36.61	77.66	27.04	0.27	13.75	16.07	11.33
	4PT$_{suv}f_{1,2}$(M) [26]	R	13.12	0.10	23.32	31.32	80.63	6.13	0.05	40.14	50.29	91.51	34.65	0.19	15.52	25.50	77.69
	4PT$_{suv}f_{1,2}$(**ours**)	R	13.15	0.10	23.38	31.48	20.94	6.11	0.05	40.29	50.30	43.34	36.48	0.20	15.85	25.23	14.52
	3PT$_{s00}f_{1,2}$(**ours**)	R	12.78	**0.09**	23.57	31.94	**11.01**	6.09	0.05	40.40	50.47	**40.35**	16.38	**0.11**	**21.03**	30.98	**4.25**
	3PT$_{100}f_{1,2}$(**ours**)	R	12.47	**0.09**	23.66	32.02	14.00	6.08	0.05	40.45	50.49	53.93	**15.93**	**0.11**	20.85	**31.06**	7.29
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	14.13	0.13	21.19	24.75	85.47	6.28	0.06	38.89	43.01	102.34	28.63	0.21	16.22	22.70	78.49
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	14.16	0.13	20.99	24.92	23.13	6.31	0.06	38.81	43.08	53.91	27.93	0.20	16.12	22.31	15.81
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	13.89	0.13	21.29	25.19	12.66	6.28	0.06	38.83	43.37	46.52	16.96	0.14	19.42	25.87	5.09
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	13.84	0.13	21.45	24.99	15.44	6.23	0.06	39.13	43.56	59.57	17.36	0.15	19.39	25.55	8.14
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	10.76	0.10	27.20	31.21	1765.25	4.77	**0.04**	47.81	52.12	2906.99	49.16	0.34	10.66	17.82	2030.51
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	10.29	**0.09**	27.82	31.78	1710.72	**4.71**	**0.04**	**48.26**	52.41	2847.16	23.15	0.16	16.73	23.83	1903.55
	3PT$_{s00}f_{1,2}$(**ours**)	H$_{NS}$ [26]	**10.06**	**0.09**	**27.84**	**32.63**	1644.48	4.76	**0.04**	48.17	**52.78**	3074.51	24.82	0.16	16.65	23.70	1949.20
	4p4d [8]	H [26]	10.98	0.10	26.70	31.11	1856.57	4.80	0.05	47.55	51.37	2944.89	48.04	0.34	8.65	15.93	1942.77

Depth	Solver	Opt.	Mast3r [17]				
			$\epsilon(^\circ)\downarrow$	$\epsilon_f\downarrow$	mAA↑	mAA$_f\uparrow$	$\tau(ms)\downarrow$
-	7PT [11]	S	4.01	0.04	54.25	52.79	37.99
MoGe [23]	4p4d [8]	S	4.01	0.05	54.10	52.25	41.40
	4PT$_{suv}f_{1,2}$(M) [26]	S	4.05	0.04	54.33	52.82	119.79
	4PT$_{suv}f_{1,2}$(**ours**)	S	4.04	0.05	54.34	52.71	53.46
	3PT$_{s00}f_{1,2}$(**ours**)	S	4.01	0.04	54.51	52.55	45.87
	3PT$_{100}f_{1,2}$(**ours**)	S	4.00	0.04	54.75	52.67	59.35
	4PT$_{suv}f_{1,2}$(M) [26]	R	6.48	0.05	38.35	49.81	104.27
	4PT$_{suv}f_{1,2}$(**ours**)	R	6.49	0.05	38.24	49.82	36.16
	3PT$_{s00}f_{1,2}$(**ours**)	R	6.48	0.05	38.35	49.78	**30.58**
	3PT$_{100}f_{1,2}$(**ours**)	R	6.48	0.05	38.35	49.75	43.52
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	6.26	0.05	39.71	47.46	111.89
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	6.25	0.05	39.63	47.57	44.83
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	6.17	0.05	40.09	47.73	36.30
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	6.27	0.05	39.86	47.52	48.82
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	**3.60**	**0.03**	58.16	**62.02**	2472.09
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	**3.60**	**0.03**	**58.19**	61.95	2523.10
Mast3r [17]	4p4d [8]	S	4.07	0.05	53.41	50.67	33.18
	4PT$_{suv}f_{1,2}$(M) [26]	S	4.39	0.05	50.91	49.03	105.79
	4PT$_{suv}f_{1,2}$(**ours**)	S	4.47	0.05	50.50	48.49	42.35
	3PT$_{s00}f_{1,2}$(**ours**)	S	4.11	0.05	53.43	51.44	35.55
	3PT$_{100}f_{1,2}$(**ours**)	S	4.02	**0.04**	54.36	52.61	46.32
	4PT$_{suv}f_{1,2}$(M) [26]	R	17.23	0.10	17.76	30.11	89.75
	4PT$_{suv}f_{1,2}$(**ours**)	R	16.81	0.10	18.23	30.78	25.78
	3PT$_{s00}f_{1,2}$(**ours**)	R	13.80	0.08	21.80	33.07	**21.61**
	3PT$_{100}f_{1,2}$(**ours**)	R	13.58	0.08	21.88	33.20	35.34
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	22.22	0.18	14.75	20.84	97.55
	4PT$_{suv}f_{1,2}$(**ours**)	R$_s$	22.47	0.17	14.49	19.84	33.13
	3PT$_{s00}f_{1,2}$(**ours**)	R$_s$	16.72	0.13	18.21	24.13	27.01
	3PT$_{100}f_{1,2}$(**ours**)	R$_s$	16.11	0.12	18.48	25.07	41.22
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	4.21	0.05	52.41	50.25	4445.31
	3PT$_{s00}f_{1,2}$(**ours**)	H [26]	4.20	0.05	52.74	50.55	4517.18
	3PT$_{s00}f_{1,2}$(**ours**)	H$_{NS}$ [26]	4.15	0.05	52.77	50.55	4123.90
	4p4d [8]	H [26]	4.21	0.05	52.39	50.10	4520.03
	-	M [17]	**3.80**	0.05	**56.37**	**53.87**	5080.77

Table 8. Results for the case of two cameras with different unknown focal lengths on the `ScanNet` dataset [5]. Opt.: S, R, R$_s$ - PoseLib [15] implementation using Sampson error (S), reprojection error (R) or reprojection error with shift considered (R$_s$), H - hybrid RANSAC from [26], H$_{NS}$ - hybrid RANSAC [26] without optimizing for shift in LO, M - non-linear optimization used in [17].

Depth	Solver	Opt.	SP+LG [6, 18]			RoMA [9]		
			$\epsilon(^\circ)\downarrow$	mAA↑	$\tau(ms)\downarrow$	$\epsilon(^\circ)\downarrow$	mAA ↑	$\tau(ms)\downarrow$
-	5PT [20]	S	1.42	76.56	63.79	0.78	86.18	264.61
Real Depth	Rel3PT [1]	S	1.40	77.23	146.21	0.78	86.24	726.88
	P3P [7]	S	1.39	77.61	34.92	0.78	86.48	158.59
	3PT$_{suv}$(M) [26]	S	1.39	77.47	41.69	0.78	86.37	133.69
	3PT$_{suv}$ (ours)	S	1.39	77.47	29.45	0.78	86.38	118.89
	P3P [7]	R	0.46	90.65	14.73	0.29	94.32	59.42
	3PT$_{suv}$(M) [26]	R	0.46	90.68	24.98	0.29	94.32	50.49
	3PT$_{suv}$ (ours)	R	0.46	90.70	13.04	0.29	94.32	37.90
	P3P [7]	R$_s$	0.75	87.28	16.01	0.48	92.27	64.69
	3PT$_{suv}$(M) [26]	R$_s$	0.77	86.78	25.58	0.49	91.91	51.34
	3PT$_{suv}$ (ours)	R$_s$	0.77	86.78	14.63	0.49	91.92	39.78
	3PT$_{suv}$(M) [26]	H [26]	0.98	84.04	714.12	0.62	89.51	1701.35
	3PT$_{suv}$ (ours)	H [26]	0.98	84.03	705.92	0.62	89.52	1681.53
MiDas [3]	Rel3PT [1]	S	9.22	55.52	44.63	1.65	70.53	177.33
	P3P [7]	S	1.58	72.18	27.33	0.83	84.09	111.49
	3PT$_{suv}$(M) [26]	S	1.43	76.66	34.35	0.78	86.10	88.11
	3PT$_{suv}$ (ours)	S	1.44	76.48	22.98	0.78	85.82	73.67
	P3P [7]	R	24.24	4.97	15.65	22.29	6.37	70.82
	3PT$_{suv}$(M) [26]	R	24.22	4.98	24.05	22.44	6.38	49.42
	3PT$_{suv}$ (ours)	R	24.36	4.96	12.99	22.53	6.28	37.34
	P3P [7]	R$_s$	18.71	13.20	16.09	16.79	16.19	64.14
	3PT$_{suv}$(M) [26]	R$_s$	14.55	18.78	25.52	11.75	24.35	48.92
	3PT$_{suv}$ (ours)	R$_s$	14.71	18.65	15.31	11.83	24.23	37.41
	3PT$_{suv}$(M) [26]	H [26]	2.03	69.17	934.38	1.08	81.45	2078.11
	3PT$_{suv}$ (ours)	H [26]	2.03	69.17	922.74	1.08	81.44	2051.80
DA v2 [25]	Rel3PT [1]	S	5.35	53.60	44.38	1.52	66.28	177.96
	P3P [7]	S	1.44	75.57	29.79	0.78	86.09	127.26
	3PT$_{suv}$(M) [26]	S	1.41	76.93	35.16	0.78	86.23	95.37
	3PT$_{suv}$ (ours)	S	1.41	76.92	23.80	0.78	86.21	81.93
	P3P [7]	R	14.28	23.17	16.09	12.67	26.26	72.41
	3PT$_{suv}$(M) [26]	R	14.27	23.12	24.17	12.59	26.30	49.82
	3PT$_{suv}$ (ours)	R	14.26	23.13	12.99	12.60	26.29	38.09
	P3P [7]	R$_s$	10.79	31.81	16.71	8.85	36.99	69.50
	3PT$_{suv}$(M) [26]	R$_s$	10.15	33.06	25.21	7.38	40.20	49.51
	3PT$_{suv}$ (ours)	R$_s$	10.19	33.03	14.96	7.40	40.13	38.66
	3PT$_{suv}$(M) [26]	H [26]	1.91	72.85	878.70	1.14	83.37	1864.97
	3PT$_{suv}$ (ours)	H [26]	1.90	72.82	867.00	1.14	83.36	1845.20
MoGe [23]	Rel3PT [1]	S	8.12	53.40	55.85	1.69	67.22	221.06
	P3P [7]	S	1.40	77.37	32.95	0.78	86.42	148.76
	3PT$_{suv}$(M) [26]	S	1.40	77.24	38.42	0.78	86.38	116.49
	3PT$_{suv}$ (ours)	S	1.40	77.24	26.66	0.78	86.40	102.31
	P3P [7]	R	2.53	72.05	15.39	2.17	76.15	66.88
	3PT$_{suv}$(M) [26]	R	2.52	72.10	24.58	2.18	76.16	50.25
	3PT$_{suv}$ (ours)	R	2.53	72.08	12.90	2.18	76.14	38.02
	P3P [7]	R$_s$	2.34	72.52	16.53	1.82	78.46	69.56
	3PT$_{suv}$(M) [26]	R$_s$	2.65	68.71	25.40	1.89	76.93	51.40
	3PT$_{suv}$ (ours)	R$_s$	2.66	68.67	14.74	1.89	76.95	40.08
	3PT$_{suv}$(M) [26]	H [26]	1.27	80.28	788.18	0.87	86.85	1753.49
	3PT$_{suv}$ (ours)	H [26]	1.27	80.28	780.57	0.87	86.85	1737.27
UniDepth [21]	Rel3PT [1]	S	4.07	51.60	52.49	1.33	67.56	214.73
	P3P [7]	S	1.40	77.47	34.30	0.78	86.43	150.95
	3PT$_{suv}$(M) [26]	S	1.40	77.33	40.31	0.78	86.37	119.66
	3PT$_{suv}$ (ours)	S	1.40	77.33	28.19	0.78	86.38	105.03
	P3P [7]	R	1.73	79.31	15.44	1.61	81.24	67.38
	3PT$_{suv}$(M) [26]	R	1.73	79.30	25.03	1.61	81.19	51.46
	3PT$_{suv}$ (ours)	R	1.73	79.30	13.21	1.62	81.18	39.11
	P3P [7]	R$_s$	1.63	78.65	16.46	1.42	82.22	69.20
	3PT$_{suv}$(M) [26]	R$_s$	1.69	77.72	25.56	1.49	81.06	51.66
	3PT$_{suv}$ (ours)	R$_s$	1.69	77.71	14.72	1.49	81.07	40.20
	3PT$_{suv}$(M) [26]	H [26]	1.15	82.09	720.34	0.78	87.60	1695.57
	3PT$_{suv}$ (ours)	H [26]	1.15	82.08	713.58	0.78	87.60	1678.83

Depth	Solver	Opt.	Mast3r [17]		
			$\epsilon(^\circ)\downarrow$	mAA ↑	$\tau(ms)\downarrow$
-	5PT [20]	S	1.14	81.66	137.75
Mast3r [17]	Rel3PT [1]	S	1.13	80.83	149.86
	P3P [7]	S	1.13	81.50	66.06
	3PT$_{suv}$(M) [26]	S	1.12	81.40	45.03
	3PT$_{suv}$ (ours)	S	1.12	81.39	33.73
	P3P [7]	R	22.69	15.88	36.56
	3PT$_{suv}$(M) [26]	R	22.81	15.86	30.03
	3PT$_{suv}$ (ours)	R	22.83	15.83	19.87
	P3P [7]	R$_s$	21.28	18.01	36.74
	3PT$_{suv}$(M) [26]	R$_s$	28.49	14.10	27.77
	3PT$_{suv}$ (ours)	R$_s$	28.63	14.11	18.63
	3PT$_{suv}$(M) [26]	H [26]	2.10	72.14	2154.89
	3PT$_{suv}$ (ours)	H [26]	2.10	72.16	2136.39

Table 9. Results for the calibrated case on the `Phototourism` dataset [12]. Opt.: S, R, R$_s$ - PoseLib [15] implementation using Sampson error (S), reprojection error (R) or reprojection error with shift considered (R$_s$), H - hybrid RANSAC from [26].

Depth	Solver	Opt.	SP+LG [6, 18]					RoMA [9]				
			$\epsilon(^\circ)\downarrow$	$\epsilon_f\downarrow$	mAA↑	mAA$_f$ ↑	$\tau(ms)\downarrow$	$\epsilon(^\circ)\downarrow$	$\epsilon_f\downarrow$	mAA ↑	mAA$_f$ ↑	$\tau(ms)\downarrow$
-	7PT [11]	S	8.03	0.17	38.14	23.78	24.80	4.30	0.10	53.16	34.73	75.10
Real Depth	4p4d [8]	S	7.58	0.16	39.34	24.65	23.69	4.24	0.10	53.51	35.01	77.49
	4PT$_{suv}f_{1,2}$(M) [26]	S	7.33	0.17	39.56	24.08	118.98	4.22	0.10	54.07	34.83	190.34
	4PT$_{suv}f_{1,2}$(ours)	S	7.40	0.17	39.55	24.13	36.71	4.24	0.10	53.97	34.84	107.46
	3PT$_{s00}f_{1,2}$(ours)	S	6.74	0.15	41.25	24.60	25.27	4.08	0.10	55.22	35.05	100.87
	3PT$_{100}f_{1,2}$(ours)	S	6.47	0.14	42.12	25.15	29.80	4.00	0.10	55.70	35.28	120.13
	4PT$_{suv}f_{1,2}$(M) [26]	R	2.27	0.03	69.17	63.33	106.32	1.25	0.02	79.75	73.91	136.12
	4PT$_{suv}f_{1,2}$(ours)	R	2.28	0.03	69.14	63.31	24.35	1.26	0.02	79.68	73.84	54.16
	3PT$_{s00}f_{1,2}$(ours)	R	2.23	0.03	69.50	63.66	12.05	1.21	0.02	80.37	74.49	48.02
	3PT$_{100}f_{1,2}$(ours)	R	2.22	0.03	69.63	63.80	16.99	1.21	0.02	80.51	74.66	71.87
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	2.58	0.04	66.75	57.64	109.16	1.40	0.02	78.39	70.01	149.05
	4PT$_{suv}f_{1,2}$(ours)	R$_s$	2.59	0.04	66.73	57.63	27.16	1.40	0.02	78.42	70.07	67.11
	3PT$_{s00}f_{1,2}$(ours)	R$_s$	2.55	0.04	66.90	57.81	13.41	1.39	0.02	78.50	70.19	52.89
	3PT$_{100}f_{1,2}$(ours)	R$_s$	2.53	0.04	67.07	58.01	18.43	1.39	0.02	78.64	70.24	76.01
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	2.86	0.04	63.88	53.46	1922.12	1.60	0.03	75.10	64.07	3518.89
	3PT$_{s00}f_{1,2}$(ours)	H [26]	2.82	0.04	64.19	53.73	1901.23	1.58	0.03	75.41	64.37	3531.28
	3PT$_{s00}f_{1,2}$(ours)	H$_{NS}$ [26]	2.83	0.04	64.14	53.74	1830.03	1.58	0.03	75.49	64.47	3291.30
	4p4d [8]	H [26]	2.89	0.05	63.21	52.87	1921.03	1.63	0.03	74.63	63.62	3199.77
MiDas [3]	4p4d [8]	S	12.50	0.24	30.95	18.92	20.67	5.58	0.13	46.41	29.53	67.95
	4PT$_{suv}f_{1,2}$(M) [26]	S	8.75	0.19	36.60	22.37	112.19	4.96	0.12	51.13	33.29	164.23
	4PT$_{suv}f_{1,2}$(ours)	S	8.91	0.19	36.25	22.18	32.32	4.91	0.12	51.09	33.08	84.29
	3PT$_{s00}f_{1,2}$(ours)	S	8.60	0.19	36.62	21.94	18.17	4.70	0.11	51.39	32.56	71.37
	3PT$_{100}f_{1,2}$(ours)	S	10.43	0.21	33.43	19.60	21.76	5.40	0.13	48.28	29.98	87.11
	4PT$_{suv}f_{1,2}$(M) [26]	R	24.05	0.43	8.74	6.69	102.85	22.64	0.42	9.81	7.32	124.83
	4PT$_{suv}f_{1,2}$(ours)	R	24.19	0.43	8.73	6.68	23.01	22.84	0.42	9.78	7.30	44.95
	3PT$_{s00}f_{1,2}$(ours)	R	24.14	0.44	8.58	6.66	10.24	22.20	0.42	9.69	7.32	38.35
	3PT$_{100}f_{1,2}$(ours)	R	25.18	0.45	8.38	6.44	13.90	23.65	0.44	9.52	7.15	54.35
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	25.68	0.39	8.53	6.71	105.59	23.30	0.37	9.76	7.53	136.61
	4PT$_{suv}f_{1,2}$(ours)	R$_s$	25.85	0.39	8.41	6.68	25.59	23.33	0.37	9.73	7.59	56.36
	3PT$_{s00}f_{1,2}$(ours)	R$_s$	23.44	0.40	9.08	7.13	11.16	21.48	0.38	10.34	7.99	42.06
	3PT$_{100}f_{1,2}$(ours)	R$_s$	24.87	0.41	8.60	6.89	14.84	23.15	0.39	9.85	7.72	57.47
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	13.29	0.27	21.68	13.55	2599.72	9.10	0.21	32.05	19.20	4662.34
	3PT$_{s00}f_{1,2}$(ours)	H [26]	13.40	0.28	21.33	13.39	2574.24	9.11	0.21	32.04	19.30	4680.00
	3PT$_{s00}f_{1,2}$(ours)	H$_{NS}$ [26]	13.51	0.28	21.30	13.33	2473.64	9.24	0.21	31.53	19.00	4284.73
	4p4d [8]	H [26]	13.45	0.28	21.28	13.31	2477.52	9.16	0.21	31.94	19.18	4255.18
DA v2 [25]	4p4d [8]	S	10.40	0.20	34.72	22.08	22.02	4.61	0.11	51.24	33.30	73.93
	4PT$_{suv}f_{1,2}$(M) [26]	S	8.17	0.18	37.62	23.32	113.20	4.43	0.10	52.90	34.36	170.68
	4PT$_{suv}f_{1,2}$(ours)	S	8.19	0.18	37.62	23.27	33.14	4.42	0.10	52.83	34.35	90.36
	3PT$_{s00}f_{1,2}$(ours)	S	7.66	0.16	38.90	23.57	20.44	4.20	0.10	53.95	34.56	81.59
	3PT$_{100}f_{1,2}$(ours)	S	9.63	0.19	34.81	20.83	24.07	5.22	0.12	49.29	30.86	99.79
	4PT$_{suv}f_{1,2}$(M) [26]	R	20.29	0.31	15.82	11.26	103.77	15.56	0.27	19.53	13.92	130.30
	4PT$_{suv}f_{1,2}$(ours)	R	20.17	0.31	15.77	11.30	23.77	15.62	0.27	19.53	13.86	50.34
	3PT$_{s00}f_{1,2}$(ours)	R	20.10	0.31	15.81	11.40	12.14	15.41	0.27	19.61	13.99	50.56
	3PT$_{100}f_{1,2}$(ours)	R	20.25	0.31	15.67	11.29	16.02	15.83	0.28	19.17	13.70	68.33
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	21.69	0.30	15.50	10.96	106.75	15.42	0.25	19.67	14.54	143.06
	4PT$_{suv}f_{1,2}$(ours)	R$_s$	21.68	0.30	15.39	11.02	26.52	15.45	0.25	19.67	14.46	63.06
	3PT$_{s00}f_{1,2}$(ours)	R$_s$	19.78	0.29	16.08	11.53	13.51	14.90	0.24	20.07	14.94	55.30
	3PT$_{100}f_{1,2}$(ours)	R$_s$	20.13	0.29	15.43	11.21	17.28	15.62	0.25	19.14	14.41	72.22
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	9.55	0.21	32.88	20.88	2490.39	6.53	0.16	43.25	27.71	4026.79
	3PT$_{s00}f_{1,2}$(ours)	H [26]	9.48	0.21	32.49	20.65	2494.66	6.52	0.16	43.30	27.79	4113.61
	3PT$_{s00}f_{1,2}$(ours)	H$_{NS}$ [26]	9.50	0.21	32.41	20.61	2387.10	6.55	0.16	42.97	27.61	3760.43
	4p4d [8]	H [26]	9.89	0.22	32.14	20.41	2402.27	6.56	0.16	43.21	27.74	3676.08
MoGe [23]	4p4d [8]	S	7.71	0.16	39.12	24.44	22.82	4.22	0.10	53.61	34.99	77.14
	4PT$_{suv}f_{1,2}$(M) [26]	S	7.54	0.17	39.01	23.83	110.08	4.33	0.10	53.44	34.72	180.83
	4PT$_{suv}f_{1,2}$(ours)	S	7.65	0.17	38.89	23.85	44.03	4.34	0.10	53.42	34.71	100.14
	3PT$_{s00}f_{1,2}$(ours)	S	7.03	0.16	40.42	24.43	23.41	4.18	0.10	54.49	34.98	95.72
	3PT$_{100}f_{1,2}$(ours)	S	8.14	0.17	38.40	23.22	28.33	4.53	0.11	52.62	33.61	116.32
	4PT$_{suv}f_{1,2}$(M) [26]	R	6.60	0.08	47.16	39.06	98.69	4.87	0.07	54.21	43.35	128.82
	4PT$_{suv}f_{1,2}$(ours)	R	6.71	0.08	46.98	38.96	31.64	4.90	0.07	54.05	43.34	48.16
	3PT$_{s00}f_{1,2}$(ours)	R	5.73	0.07	48.59	40.41	10.22	4.40	0.06	55.38	44.33	46.38
	3PT$_{100}f_{1,2}$(ours)	R	7.32	0.09	43.79	36.79	16.37	5.38	0.07	51.71	41.53	70.36
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	6.36	0.10	46.43	34.85	100.79	4.81	0.07	53.48	40.42	140.72
	4PT$_{suv}f_{1,2}$(ours)	R$_s$	6.40	0.10	46.34	34.74	33.59	4.78	0.07	53.62	40.55	60.11
	3PT$_{s00}f_{1,2}$(ours)	R$_s$	5.97	0.09	47.32	36.09	11.16	4.51	0.07	54.49	41.56	50.55
	3PT$_{100}f_{1,2}$(ours)	R$_s$	7.46	0.10	42.45	32.62	17.18	5.29	0.08	51.27	38.68	73.28
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	3.88	0.07	57.21	42.80	1953.23	2.41	0.05	69.08	52.39	3663.43
	3PT$_{s00}f_{1,2}$(ours)	H [26]	3.83	0.07	57.62	43.25	2031.28	2.39	0.05	69.29	52.57	3803.60
	3PT$_{s00}f_{1,2}$(ours)	H$_{NS}$ [26]	3.81	0.07	57.63	43.22	1981.97	2.40	0.05	69.31	52.57	3490.21
	4p4d [8]	H [26]	4.19	0.07	55.76	41.76	1881.29	2.44	0.05	68.75	52.18	3330.63
UniDepth [21]	4p4d [8]	S	7.67	0.16	39.18	24.61	23.63	4.20	0.10	53.84	35.24	77.78
	4PT$_{suv}f_{1,2}$(M) [26]	S	7.53	0.17	39.25	23.98	118.02	4.30	0.10	53.60	34.85	182.14
	4PT$_{suv}f_{1,2}$(ours)	S	7.55	0.17	39.18	23.99	36.04	4.29	0.10	53.53	34.71	99.76
	3PT$_{s00}f_{1,2}$(ours)	S	7.01	0.15	40.51	24.48	24.61	4.18	0.10	54.39	34.91	96.84
	3PT$_{100}f_{1,2}$(ours)	S	8.61	0.17	35.74	22.02	28.02	4.91	0.11	49.44	31.67	117.07
	4PT$_{suv}f_{1,2}$(M) [26]	R	4.90	0.07	52.64	43.12	106.30	4.20	0.06	56.76	47.14	135.10
	4PT$_{suv}f_{1,2}$(ours)	R	4.89	0.07	52.59	43.12	24.46	4.20	0.06	56.72	47.10	53.40
	3PT$_{s00}f_{1,2}$(ours)	R	4.82	0.07	52.85	43.28	12.89	4.06	0.06	57.16	47.32	54.73
	3PT$_{100}f_{1,2}$(ours)	R	4.93	0.07	52.32	42.95	17.72	4.20	0.06	56.18	46.85	78.06
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	5.27	0.08	51.34	38.73	109.68	4.30	0.07	56.25	43.10	151.19
	4PT$_{suv}f_{1,2}$(ours)	R$_s$	5.25	0.08	51.39	38.82	27.63	4.30	0.07	56.27	43.07	69.30
	3PT$_{s00}f_{1,2}$(ours)	R$_s$	5.16	0.08	51.62	39.05	14.60	4.16	0.07	56.77	43.54	61.95
	3PT$_{100}f_{1,2}$(ours)	R$_s$	5.32	0.08	50.72	38.58	19.24	4.40	0.07	55.58	43.18	83.57
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	3.38	0.06	60.15	47.02	1945.50	2.30	0.04	69.95	53.90	3440.95
	3PT$_{s00}f_{1,2}$(ours)	H [26]	3.35	0.06	60.38	47.24	1957.65	2.29	0.04	70.18	54.09	3533.26
	3PT$_{s00}f_{1,2}$(ours)	H$_{NS}$ [26]	3.36	0.06	60.28	47.16	1884.36	2.28	0.04	70.22	54.11	3305.84
	4p4d [8]	H [26]	3.45	0.06	59.49	46.63	1940.62	2.31	0.04	69.67	53.64	3114.21

Depth	Solver	Opt.	Mast3r [17]				
			$\epsilon(^\circ)\downarrow$	$\epsilon_f\downarrow$	mAA ↑	mAA$_f$ ↑	$\tau(ms)\downarrow$
-	7PT [11]	S	4.39	0.09	54.01	35.02	39.53
Mast3r [17]	4p4d [8]	S	5.20	0.11	49.69	31.64	36.90
	4PT$_{suv}f_{1,2}$(M) [26]	S	7.02	0.14	43.95	27.62	108.64
	4PT$_{suv}f_{1,2}$(ours)	S	7.03	0.14	44.10	27.81	44.88
	3PT$_{s00}f_{1,2}$(ours)	S	5.40	0.12	49.25	30.88	37.40
	3PT$_{100}f_{1,2}$(ours)	S	4.62	0.10	53.12	33.99	47.05
	4PT$_{suv}f_{1,2}$(M) [26]	R	38.38	0.47	6.28	5.91	89.42
	4PT$_{suv}f_{1,2}$(ours)	R	38.64	0.47	6.17	5.88	25.45
	3PT$_{s00}f_{1,2}$(ours)	R	36.01	0.44	7.06	6.27	20.10
	3PT$_{100}f_{1,2}$(ours)	R	36.02	0.45	7.00	6.24	31.46
	4PT$_{suv}f_{1,2}$(M) [26]	R$_s$	50.46	0.60	3.35	3.04	96.19
	4PT$_{suv}f_{1,2}$(ours)	R$_s$	50.77	0.59	3.38	3.09	32.15
	3PT$_{s00}f_{1,2}$(ours)	R$_s$	46.79	0.53	4.77	4.10	24.23
	3PT$_{100}f_{1,2}$(ours)	R$_s$	46.23	0.51	4.91	4.32	35.48
	4PT$_{suv}f_{1,2}$(M) [26]	H [26]	10.11	0.24	35.16	20.56	4871.24
	3PT$_{s00}f_{1,2}$(ours)	H [26]	10.13	0.25	35.17	20.51	4980.42
	3PT$_{s00}f_{1,2}$(ours)	H$_{NS}$ [26]	32.04	0.76	1.33	2.48	6117.25
	4p4d [8]	H [26]	32.03	0.76	1.33	2.49	6492.27
	-	M [17]	2.71	0.04	66.54	56.43	4903.10

Table 10. Results for the case of two cameras with different unknown focal lengths on the `Phototourism` dataset [12]. Opt.: S, R, R$_s$ - PoseLib [15] implementation using Sampson error (S), reprojection error (R) or reprojection error with shift considered (R$_s$), H$_{NS}$ - hybrid RANSAC [26] without optimizing for shift in LO, H - hybrid RANSAC from [26], M - non-linear optimization used in [17].

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