

Import the file names from the list provided by Duane E.

```
filenamesRaw = (* Import[
    "/Users/mcgill/Documents/My\ Projects/Pelagic-Benthic\ Coupling/Laser\
    Measure/Jun2021\ Test/Image\ File\
    Names\ Jun2021.txt", "Table"]][All, 2]; *)
Import["/Volumes/ProjectLibrary/900622.PelagicBenthic/Laser\
    Measure/Laser_calibration_images/2021_06_21/Image\
    File\ Names\ Jun2021.txt", "Table"]][All, 2];

First@filenamesRaw
USB/v4345_21Jun21/21Jun21_29.png', ...
```

Throw away extraneous characters at the beginning and end of the file paths.

```
filenames = StringDrop[#, -5] & /@ (StringDrop[#, 4] & /@ filenamesRaw);

First@filenames
v4345_21Jun21/21Jun21_29.png
```

Import the translation vectors from a file that's part of the MATLAB output that Duane E. provided.

```
transDatRaw = (* Import[
    "/Users/mcgill/Documents/My\ Projects/Pelagic-Benthic\ Coupling/Laser\
    Measure/Jun2021\ Test/Translation\ Vectors\ Jun2021.txt", "Table"]; *)
Import["/Volumes/ProjectLibrary/900622.PelagicBenthic/Laser\
    Measure/Laser_calibration_images/2021_06_21/Translation\
    Vectors\ Jun2021.txt", "Table"];

First@transDatRaw
{[, -97.9634, +/-, 0.1891, 66.5872, +/-, 0.2065, 1034.59, +/-, 1.1512, ]}
```

Strip away all the extraneous entries.

```
transDat = transDatRaw[[All, {2, 4, 5, 7, 8, 10}]];

First@transDat
{-97.9634, 0.1891, 66.5872, 0.2065, 1034.59, 1.1512}
```

Import the rotation vectors from a file that's part of the MATLAB output that Duane E. provided.

```
rotDatRaw = (* Import[
    "/Users/mcgill/Documents/My\ Projects/Pelagic-Benthic\ Coupling/Laser\
    Measure/Jun2021\ Test/Rotation\ Vectors\ Jun2021.txt", "Table"]; *)
Import["/Volumes/ProjectLibrary/900622.PelagicBenthic/Laser\
    Measure/Laser_calibration_images/2021_06_21/Rotation\
    Vectors\ Jun2021.txt", "Table"];

First@rotDatRaw
{[, 0.0601, +/-, 0.0016, 0.1226, +/-, 0.0016, -1.5834, +/-, 0.0001, ]}
```

Strip away all the extraneous entries.

```
rotDat = rotDatRaw[[All, {2, 4, 5, 7, 8, 10}]];
```

```
First@rotDat
```

```
{0.0601, 0.0016, 0.1226, 0.0016, -1.5834, 0.0001}
```

Convert the rotation data from radians to degrees.

```
rotDatDeg = rotDat / Degree;
```

```
First@rotDatDeg
```

```
{3.44348, 0.0916732, 7.02446, 0.0916732, -90.7221, 0.00572958}
```

Verify that all the data tables are the same length.

```
Length@filenames
```

```
58
```

```
Length@transDat
```

```
58
```

```
Length@rotDatDeg
```

```
58
```

Format the data so that the translation and rotation data are paired with the correct file name.

```
tableDat = Partition[
  Flatten[Riffle[Partition[Riffle[filenames, transDat[[All, {1, 3, 5}]]], 2],
    rotDatDeg[[All, {1, 3, 5}]]], 7];
```

```
First@tableDat
```

```
{v4345_21Jun21/21Jun21_29.png, -97.9634,
 66.5872, 1034.59, 3.44348, 7.02446, -90.7221}
```

Format the data into a nice table.

```
TextGrid[Prepend[tableDat, {"File Name", "X trn (mm)", "Y trn (mm)",
  "Z trn (mm)", "X rot (deg)", "Y rot (deg)", "Z rot (deg)"}], Frame → All]
```

File Name	X trn (mm)	Y trn (mm)	Z trn (mm)	X rot (deg)	Y rot (deg)	Z rot (deg)
v4345_21Jun21/21Jun21_29.png	-97.9634	66.5872	1034.59	3.44348	7.02446	-90.7221
v4345_21Jun21/21Jun21_28.png	291.538	28.6601	915.431	10.3419	-10.5997	-90.0804
v4345_21Jun21/21Jun21_27.png	-105.992	-59.2205	1144.48	-19.3144	9.05273	-89.6507
v4345_21Jun21/21Jun21_26.png	-364.296	-61.9412	1232.18	-11.8602	7.1677	-90.5388
v4345_21Jun21/21Jun21_25.png	-500.125	-45.3388	959.554	0.320856	-24.5341	-88.0006
v4345_21Jun21/21Jun21_24.png	-474.365	82.2774	956.769	8.2334	-22.5058	-92.0915
v4345_21Jun21/21Jun21_23.png	-120.104	46.3515	967.655	-32.2002	-10.6456	-70.3936
v4345_21Jun21/21Jun21_22.png	-414.394	206.557	927.703	0.905273	7.38543	-92.1144
v4345_21Jun21/21Jun21_21.png	-388.445	180.715	853.396	-13.9744	-12.0493	-80.9246

v4345_21Jun21/21Jun21_20.png	-100.407	230.728	946.399	6.65204	16.1975	-101.454
v4345_21Jun21/21jun21_30.png	83.3412	214.224	945.252	0.95111	12.1238	-100.594
v4345_21Jun21/21Jun21_19.png	222.322	213.629	889.742	-13.7796	0.532851	-92.9911
v4345_21Jun21/21J7n21_19.png	199.732	193.268	851.558	-23.8465	-12.6681	-83.48
v4345_21Jun21/21Jun21_18.png	250.705	122.948	912.535	12.3358	16.8278	-97.9242
v4345_21Jun21/21Jun21_17.png	119.246	110.549	829.891	7.32813	2.79603	-96.5491
v4345_21Jun21/21Jun21_16.png	4.5308	112.314	814.465	-1.63866	0.509932	-94.3203
v4345_21Jun21/21Jun21_15.png	-9.3035	80.3452	963.829	-8.82355	13.0176	-92.6186
v4345_21Jun21/21Jun21_14.png	-63.7444	130.257	983.167	-10.9263	12.7941	-93.9422
v4345_21Jun21/21Jun21_13.png	-136.627	58.5498	1012.14	-19.6811	2.28037	-84.1732
v4345_21Jun21/21Jun21_12.png	-220.589	72.3409	923.753	1.99962	-5.91292	-97.5231
v4345_21Jun21/21Jun21_11.png	-261.635	159.757	975.312	16.3637	3.9706	-106.232
v4345_21Jun21/21Jun21_10.png	-314.074	54.8641	921.423	-6.28535	-15.0516	-91.318
v4345_21Jun21/21Jun21_9.png	-416.587	143.902	1018.48	17.8763	1.05424	-102.731
v4345_21Jun21/21Jun21_8.png	-470.214	66.6171	1110.9	21.7953	4.23416	-100.686
v4345_21Jun21/21Jun21_7.png	-508.534	-64.9872	1051.81	-8.26205	-23.6689	-85.7088
v4345_21Jun21/21Jun21_6.png	-422.717	-4.9737	1021.35	20.3744	-10.1471	-98.3597
v4345_21Jun21/21Jun21_5.png	-236.255	-24.8871	1080.94	2.62415	-1.99962	-92.6817
v4345_21Jun21/21Jun21_4.png	-58.2129	-53.5285	1072.17	-16.3981	-5.82125	-81.2053
v4345_21Jun21/21Jun21_3.png	74.2232	-50.3546	1072.54	-14.2323	1.123	-83.2336
v4345_21Jun21/21Jun21_2.png	354.054	3.1271	1161.1	11.1498	33.094	-103.522
v4345_21Jun21/21Jun21_1.png	-412.744	143.607	1026.71	18.3404	1.63293	-102.989
21Jun21_1001.png	-97.1439	65.0094	1034.48	3.44348	7.00154	-90.682
21Jun21_1002.png	-72.4572	136.981	602.762	1.24905	-2.38923	-90.1091
21Jun21_1003.png	-56.4159	186.524	691.915	-2.99657	-0.962569	-91.805
21Jun21_1004.png	-78.2796	156.534	752.585	-2.30329	1.36364	-90.0518
21Jun21_1005.png	-44.5448	126.499	634.997	4.18259	0.0916732	-90.9914
21Jun21_1006.png	-62.4839	108.361	600.507	3.98779	-1.52407	-89.3528
21Jun21_1007.png	-64.1246	106.97	596.193	3.49504	-2.39496	-88.9918
21Jun21_1008.png	-74.9258	131.026	614.095	1.75898	-2.16005	-89.6335
21Jun21_1009.png	-56.6431	185.983	690.172	-2.78457	-1.10008	-91.7936
21Jun21_1010.png	-135.7	116.702	1087.73	10.7831	2.84187	-87.0609
21Jun21_1011.png	-122.116	112.006	1212.33	11.8087	5.64363	-87.7485
21Jun21_1012.png	-125.911	104.841	1233.85	12.6967	4.46334	-88.648
21Jun21_1013.png	-100.209	83.3705	1110.19	12.0894	7.34532	-89.8169
21Jun21_1014.png	-94.2055	110.998	1023.02	11.6425	7.72347	-90.3211
21Jun21_1015.png	-84.6154	123.882	923.652	10.2674	7.72347	-91.9941
21Jun21_1016.png	-99.6322	140.134	699.193	4.84722	5.16235	-91.7305
21Jun21_1017.png	-86.856	141.597	637.686	4.36594	4.75555	-91.6331
21Jun21_1018.png	-111.235	113.431	567.392	8.34227	4.35448	-90.2981
21Jun21_1019.png	-92.3064	150.814	635.785	3.3117	3.72423	-91.6503

21Jun21_1020.png	-124.846	150.779	783.399	0.979758	5.07068	-90.4643
21Jun21_1021.png	-105.401	114.256	888.439	3.83309	3.64401	-88.8314
21Jun21_1022.png	-105.401	114.256	888.439	3.83309	3.64401	-88.8314
21Jun21_1023.png	-85.9648	130.439	984.801	11.654	3.39191	-90.2122
21Jun21_1024.png	-67.5995	179.767	818.413	5.48894	2.32048	-93.6614
21Jun21_1025.png	-81.6659	181.488	707.429	5.94157	4.73263	-94.8646
21Jun21_1026.png	-100.397	114.783	575.512	11.9691	7.55731	-92.0056
21Jun21_1027.png	-82.7564	151.952	644.252	5.29413	5.49467	-92.8192

Format the data into a second table with only the last 27 images, which were used to measure the laser offset and direction vectors.

```
TextGrid[Prepend[Take[tableDat, -27], {"File Name", "X trn (mm)", "Y trn (mm)",
  "Z trn (mm)", "X rot (deg)", "Y rot (deg)", "Z rot (deg)"}], Frame → All]
```

File Name	X trn (mm)	Y trn (mm)	Z trn (mm)	X rot (deg)	Y rot (deg)	Z rot (deg)
21Jun21_1001.png	-97.1439	65.0094	1034.48	3.44348	7.00154	-90.682
21Jun21_1002.png	-72.4572	136.981	602.762	1.24905	-2.38923	-90.1091
21Jun21_1003.png	-56.4159	186.524	691.915	-2.99657	-0.962569	-91.805
21Jun21_1004.png	-78.2796	156.534	752.585	-2.30329	1.36364	-90.0518
21Jun21_1005.png	-44.5448	126.499	634.997	4.18259	0.0916732	-90.9914
21Jun21_1006.png	-62.4839	108.361	600.507	3.98779	-1.52407	-89.3528
21Jun21_1007.png	-64.1246	106.97	596.193	3.49504	-2.39496	-88.9918
21Jun21_1008.png	-74.9258	131.026	614.095	1.75898	-2.16005	-89.6335
21Jun21_1009.png	-56.6431	185.983	690.172	-2.78457	-1.10008	-91.7936
21Jun21_1010.png	-135.7	116.702	1087.73	10.7831	2.84187	-87.0609
21Jun21_1011.png	-122.116	112.006	1212.33	11.8087	5.64363	-87.7485
21Jun21_1012.png	-125.911	104.841	1233.85	12.6967	4.46334	-88.648
21Jun21_1013.png	-100.209	83.3705	1110.19	12.0894	7.34532	-89.8169
21Jun21_1014.png	-94.2055	110.998	1023.02	11.6425	7.72347	-90.3211
21Jun21_1015.png	-84.6154	123.882	923.652	10.2674	7.72347	-91.9941
21Jun21_1016.png	-99.6322	140.134	699.193	4.84722	5.16235	-91.7305
21Jun21_1017.png	-86.856	141.597	637.686	4.36594	4.75555	-91.6331
21Jun21_1018.png	-111.235	113.431	567.392	8.34227	4.35448	-90.2981
21Jun21_1019.png	-92.3064	150.814	635.785	3.3117	3.72423	-91.6503
21Jun21_1020.png	-124.846	150.779	783.399	0.979758	5.07068	-90.4643
21Jun21_1021.png	-105.401	114.256	888.439	3.83309	3.64401	-88.8314
21Jun21_1022.png	-105.401	114.256	888.439	3.83309	3.64401	-88.8314
21Jun21_1023.png	-85.9648	130.439	984.801	11.654	3.39191	-90.2122
21Jun21_1024.png	-67.5995	179.767	818.413	5.48894	2.32048	-93.6614
21Jun21_1025.png	-81.6659	181.488	707.429	5.94157	4.73263	-94.8646
21Jun21_1026.png	-100.397	114.783	575.512	11.9691	7.55731	-92.0056
21Jun21_1027.png	-82.7564	151.952	644.252	5.29413	5.49467	-92.8192

Export the data in csv format.

```
Export["LMCalJun2021.csv",
  Prepend[Take[tableDat, -27], {"File Name", "X trn (mm)", "Y trn (mm)",
    "Z trn (mm)", "X rot (deg)", "Y rot (deg)", "Z rot (deg)"}]]
LMCalJun2021.csv
```

Enter the image size in pixels and imaging cell size in cm for the ROV's Ikegami HDL-57 camera.

```

imageSize = {1920, 1080}
cellSizeCm = {0.9587, 0.5393}
{1920, 1080}
{0.9587, 0.5393}

```

Verify that the image cell pixels are 5 µm square.

```

pixelSize = cellSizeCm / imageSize
{0.000499323, 0.000499352}

```

Calculate the focal length and field of view based on the Zhang calibration. Because the pixels are nominally square, the h and v focal lengths should be the same but there is some noise in the calculation. Use the average of the two values from this line in the calibration file:

Focal length (pixels): [1589.4668 +/- 1.8917 1591.4754 +/- 1.9061]

```

focalLengthPixels = 1590
1590

```

```

focalLengthCm = focalLengthPixels 0.0005
0.795

```

$$\text{fieldOfView} = \frac{\text{ArcTan}\left[\frac{0.5 \text{ cellSizeCm}}{\text{focalLengthCm}}\right]}{\text{Degree}} 2$$

```

{62.1763, 37.4721}

```