

# CALIBRATING A TEXEL CAMERA

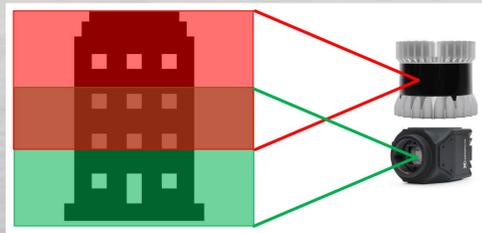
## Project

A Texel Camera is a camera that combines a lidar sensor and a standard digital camera to produce 3 dimensional images called swaths.

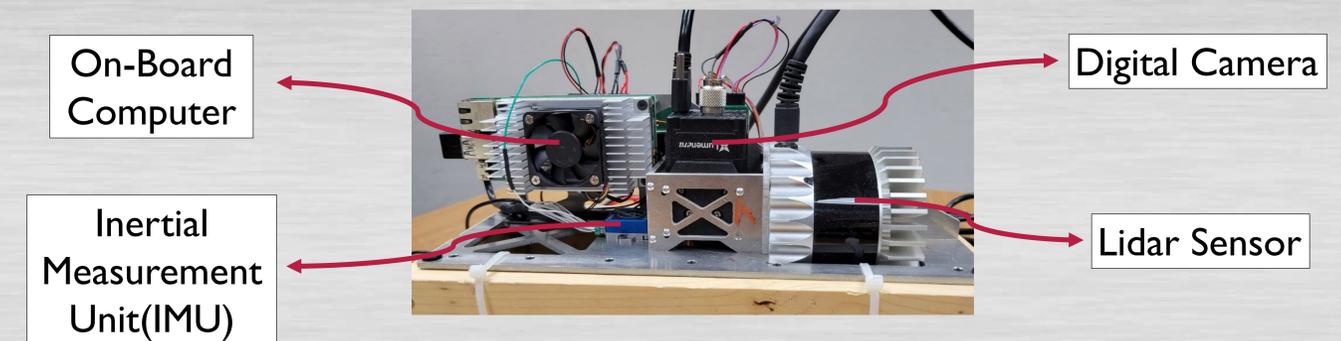
All cameras have built in error. Calibration is the process of calculating that error and correcting for it. Since these errors stem mostly from physical factors of the device recalibration should only be necessary if there is a hardware change.

Sources of Error:

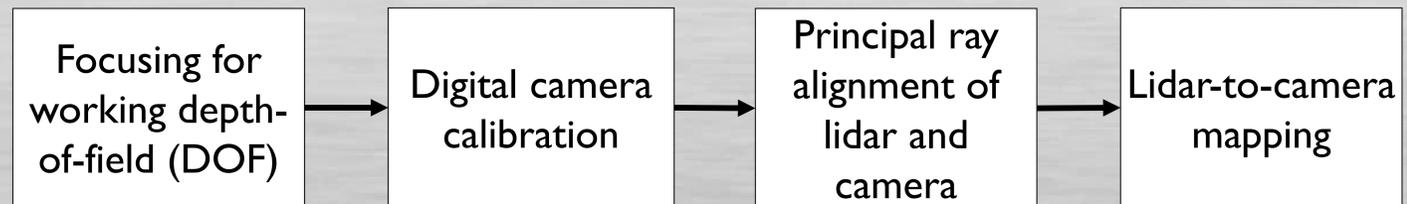
- Imperfections in manufacturing
- Parallax
- Reprojection error



## Texel Camera



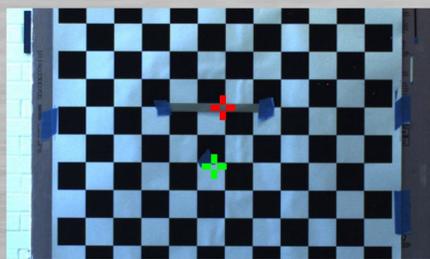
## Calibration Process



## Methods

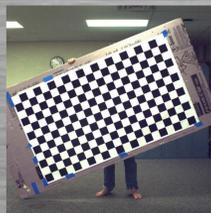
### Focus Digital Camera

- Select DOF based off use on a UAV and lidar limitations
- Use formula to calculate optimal distance for focus



### Calibrate Digital Camera

- Take Pictures of a checkerboard pattern at various distances and angles
- Use MATLAB to calculate intrinsic parameters

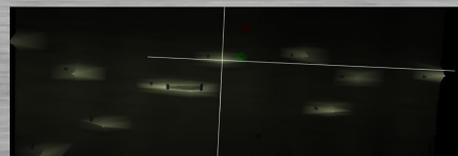


### Align Sensors

- Set up camera perpendicular to a checkerboard pattern a set distance away.
- Using a strip of reflective tape find the center column
- Pivot camera until the lidar center on the image overlaps the high intensity point from the lidar

### Map Camera to Lidar

- Using live feed from the lidar tap reflective markers on the wall so that only one point lights up in the lidar for each marker
- Collect data for entire field of view of the camera
- Use Matlab to find best fit polynomial for mapping

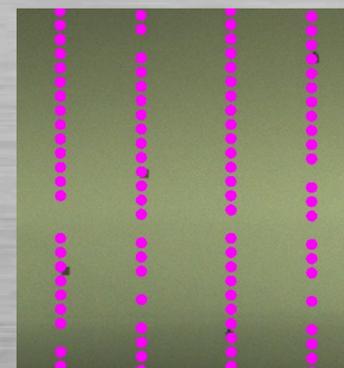


## Conclusion

### 3 Parameters



### 11 Parameters

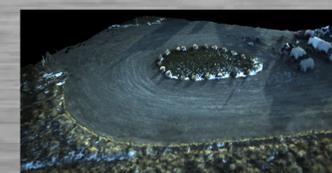


These images show where the lidar points (purple dots) fall on the camera image after the mapping has been calculated. Ideally the purple dots are exactly on top of the reflective tape (gray squares). Each image used a different number of parameters to calculate the mapping.

- Both mappings did well meaning:
1. The calibration and alignment did a good job compensating many parameters so we only need to use three parameters for the mapping
  2. The overall calibration was a success.

### Future Projects

#### Land Surveying



#### Object Registration

