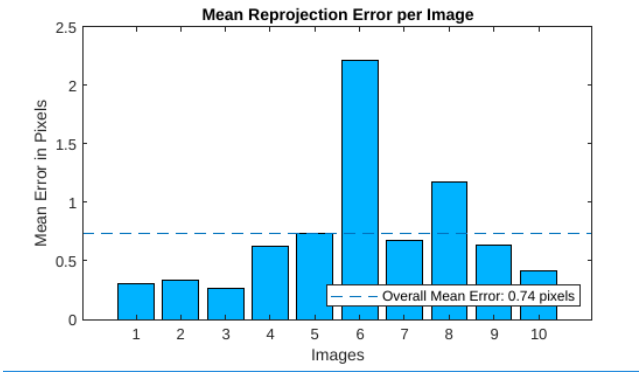
Practicum:4 Husky: Multi camera calibration :
output : checker board positions with respect to camera co-ordinate origin

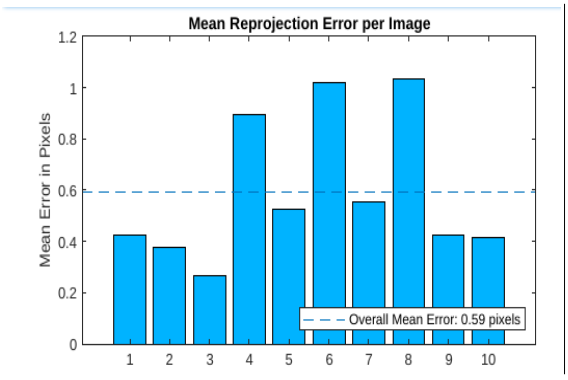
1. Intrinsic parameters for camera 1:

```
cameraParams_cam1 =
  cameraParameters with properties:

   Camera Intrinsics
                     Intrinsics: [0×0 cameraIntrinsics]

   Camera Extrinsics
                PatternExtrinsics: [10×1 rigidtform3d]

   Accuracy of Estimation
           MeanReprojectionError: 0.7382
              ReprojectionErrors: [77×2×10 double]
               ReprojectedPoints: [77×2×10 double]

   Calibration Settings
                       NumPatterns: 10
                 DetectedKeypoints: [77×10 logical]
                       WorldPoints: [77×2 double]
                        WorldUnits: 'mm'
                      EstimateSkew: 0
    NumRadialDistortionCoefficients: 2
       EstimateTangentialDistortion: 0

imagesUsed_cam1 = 10×1 logical array
     1
     1
     1
     1
     1
     1
     1
     1
     1
     1

estimationErrors_cam1 =
  cameraCalibrationErrors with properties:

    IntrinsicsErrors: [1×1 intrinsicsEstimationErrors]
    ExtrinsicsErrors: [1×1 extrinsicsEstimationErrors]
```

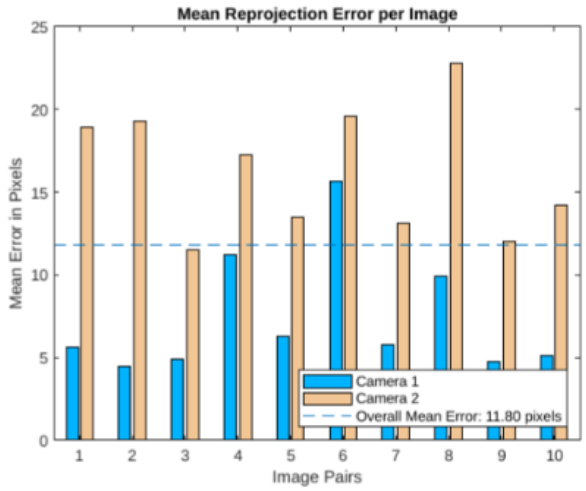
2. Intrinsic parameters for camera 2:

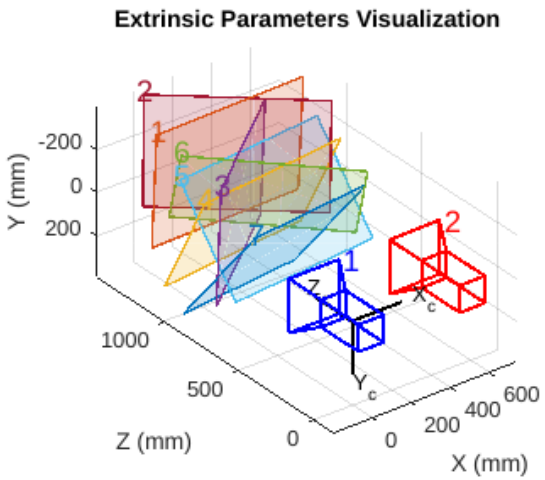
```
cameraParams_cam2 =
  cameraParameters with properties:

   Camera Intrinsics
                     Intrinsics: [0×0 cameraIntrinsics]

   Camera Extrinsics
                PatternExtrinsics: [10×1 rigidtform3d]

   Accuracy of Estimation
           MeanReprojectionError: 0.5931
              ReprojectionErrors: [77×2×10 double]
               ReprojectedPoints: [77×2×10 double]

   Calibration Settings
                       NumPatterns: 10
                 DetectedKeypoints: [77×10 logical]
                       WorldPoints: [77×2 double]
                        WorldUnits: 'mm'
                      EstimateSkew: 0
    NumRadialDistortionCoefficients: 2
       EstimateTangentialDistortion: 0

imagesUsed_cam2 = 10×1 logical array
     1
     1
     1
     1
     1
     1
     1
     1
     1
     1

estimationErrors_cam2 =
  cameraCalibrationErrors with properties:

    IntrinsicsErrors: [1×1 intrinsicsEstimationErrors]
    ExtrinsicsErrors: [1×1 extrinsicsEstimationErrors]
```





- Mean re-projection error per camera for stereo-camera pair:





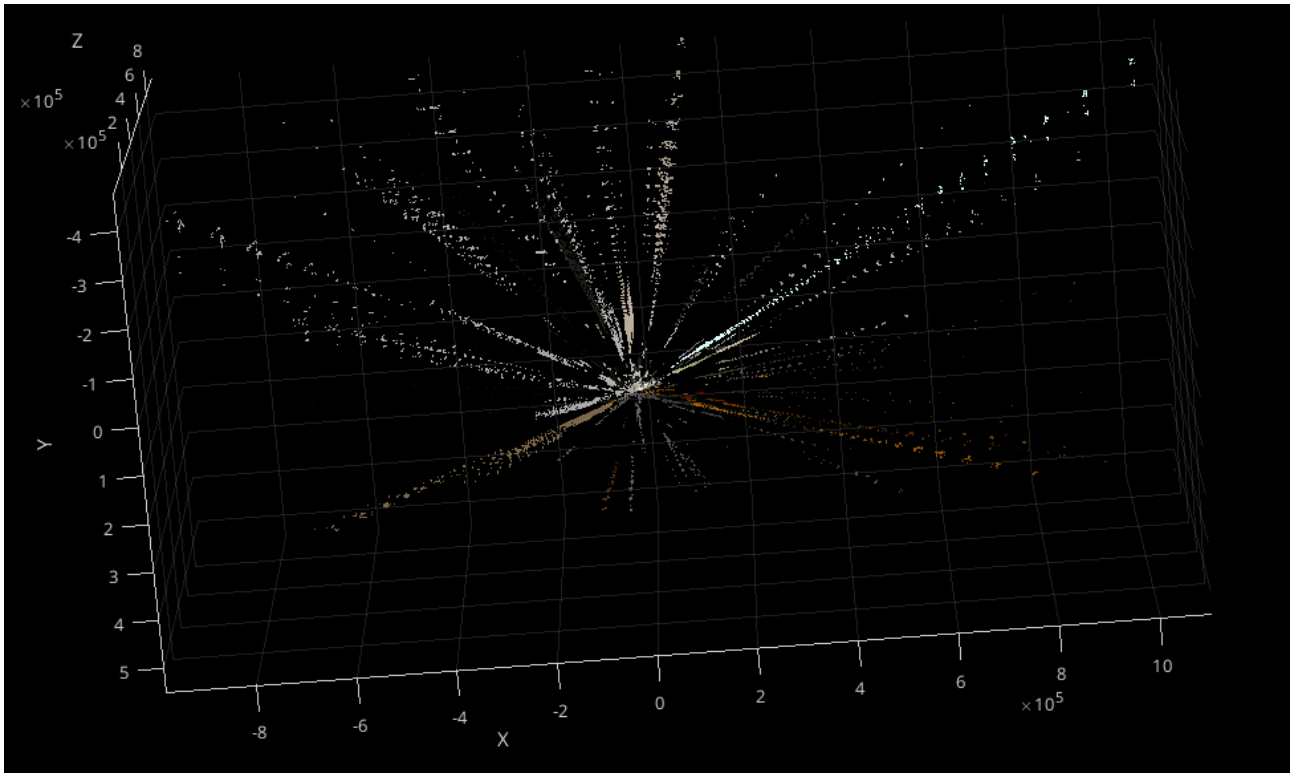
- Rectification of stereo images

1. Before Rectification

2. After Rectification

- Disparity map

- Reconstructing the 3-d scene



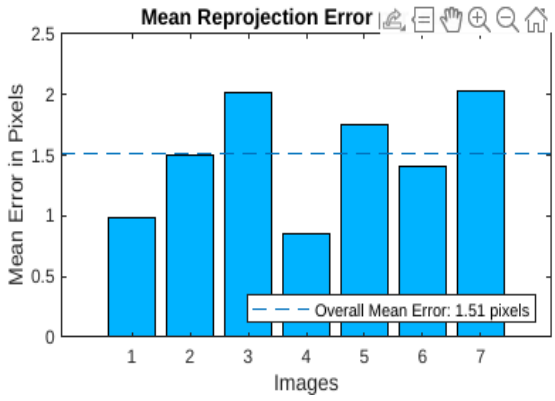
output : checker board positions with respect to camera co-ordinate origin

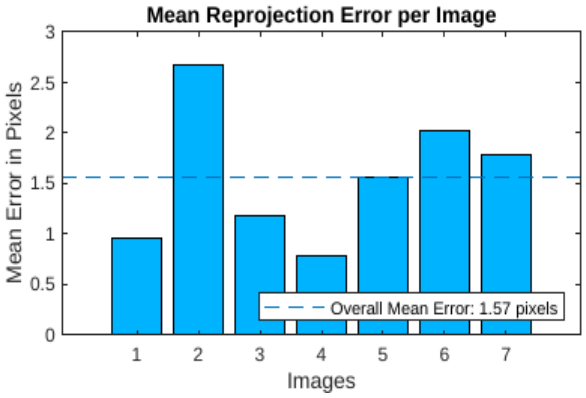
1. Intrinsic parameters for camera 3:

```
cameraParams_cam3 =
  cameraParameters with properties:

    Camera Intrinsics
                       Intrinsics: [0×0 cameraIntrinsics]

    Camera Extrinsics
                 PatternExtrinsics: [7×1 rigidtform3d]

    Accuracy of Estimation
             MeanReprojectionError: 1.5260
                ReprojectionErrors: [48×2×7 double]
                 ReprojectedPoints: [48×2×7 double]

    Calibration Settings
                         NumPatterns: 7
                   DetectedKeypoints: [48×7 logical]
                         WorldPoints: [48×2 double]
                          WorldUnits: 'mm'
                       EstimateSkew: 0
     NumRadialDistortionCoefficients: 2
        EstimateTangentialDistortion: 0
```

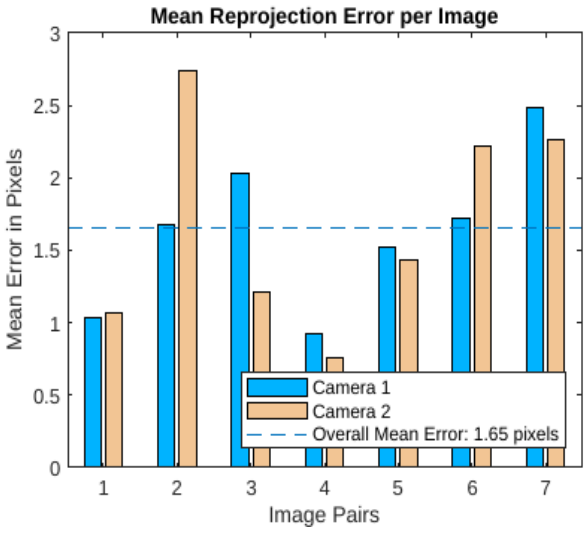
2. Intrinsic parameters for camera 4:

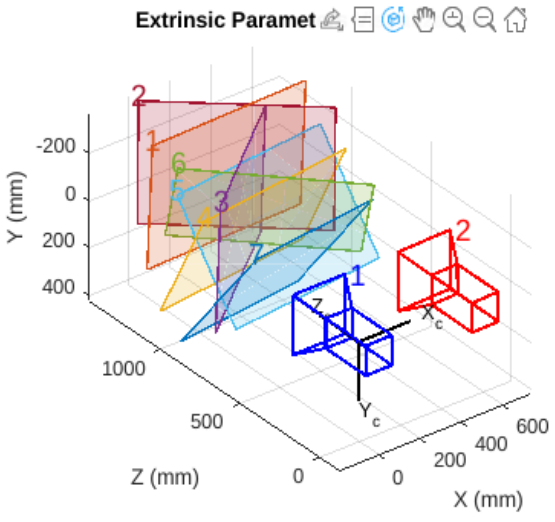
```
cameraParams_cam4 =
  cameraParameters with properties:

    Camera Intrinsics
                       Intrinsics: [0×0 cameraIntrinsics]

    Camera Extrinsics
                 PatternExtrinsics: [7×1 rigidtform3d]

    Accuracy of Estimation
             MeanReprojectionError: 1.5665
                ReprojectionErrors: [48×2×7 double]
                 ReprojectedPoints: [48×2×7 double]

    Calibration Settings
                         NumPatterns: 7
                   DetectedKeypoints: [48×7 logical]
                         WorldPoints: [48×2 double]
                          WorldUnits: 'mm'
                       EstimateSkew: 0
     NumRadialDistortionCoefficients: 2
        EstimateTangentialDistortion: 0
```





- Mean re-projection error per camera for stereo-camera pair:



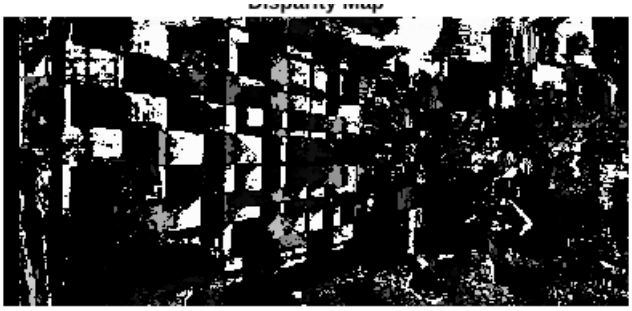


- Rectification of stereo images

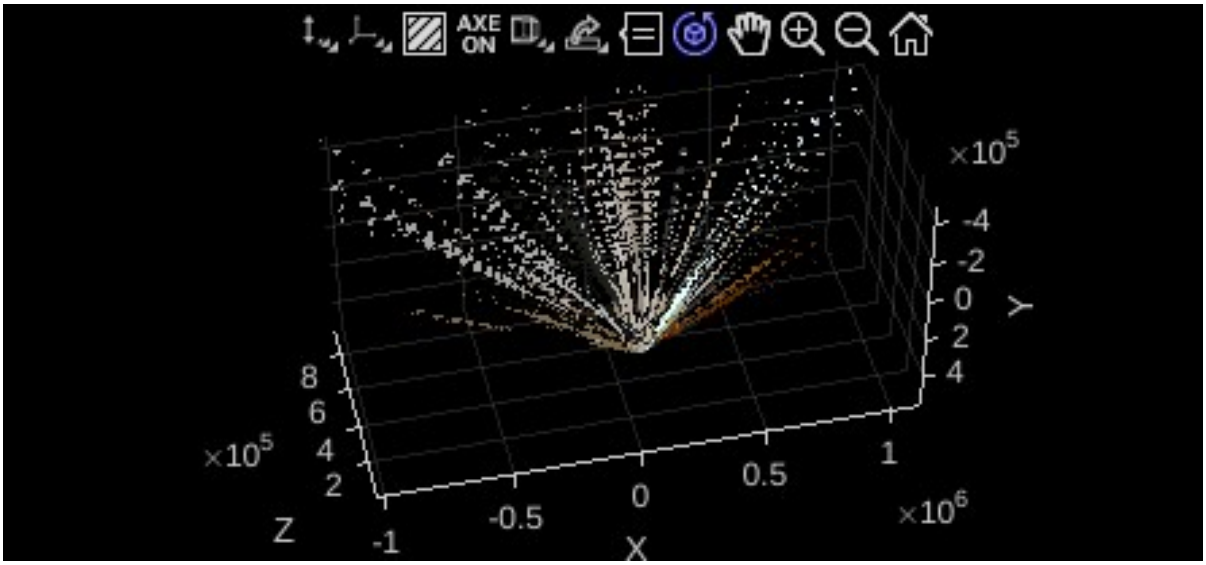
1. Before Rectification

2. After Rectification

- Disparity map



- Reconstructing the 3-d scene



Extrinsic parameter visualization for all four cameras together: