Test 4 – Range Analysis Results

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Notes

- each data set consists of 100 epochs over ~100 seconds (with exceptions where observations are missing, maintain 100 epochs
- there are some gaps in data due to missing observations
- no outliers have been removed
- RMSEs and mean errors are from surveyed coordinates
- Overall appears to be some correlation with test 3 results but it is not strong and still very random and dynamic

Numerical Results

Table 1: RMSE values for distance observation for each anchor at each test location

Tag point # - closest anchor	Anchor RMSEs [m]			
	12A4	**469D**	**4A86**	**591C**
14 – middle	0.190	0.056	0.066	0.920
4 – 591C	0.093	0.079	0.087	0.215
42 – 591C (very)	0.039	0.044	0.036	0.270
17 – 12A4	0.101	0.060	0.436	0.083
29 – 4A86	0.080	0.080	0.061	0.162
38 – 4A86 (very)	0.175	0.056	0.261	0.032
26 – 469D	0.041	0.140	0.120	0.154

Table 2: Mean distance errors for distance observation for each anchor at each test location

Tag point # - closest anchor	Anchor Mean Errors [m]			
	12A4	**469D**	**4A86**	**591C**
14 – middle	-0.189	-0.054	-0.063	0.915
4 – 591C	0.088	-0.077	-0.084	0.213
42 – 591C (very)	-0.034	0.038	-0.027	0.269
17 – 12A4	-0.098	-0.043	0.435	0.081
29 – 4A86	0.078	-0.073	-0.056	0.151
38 – 4A86 (very)	-0.105	-0.041	0.142	0.016
26 – 469D	-0.032	-0.138	-0.117	0.153

Graphical Results

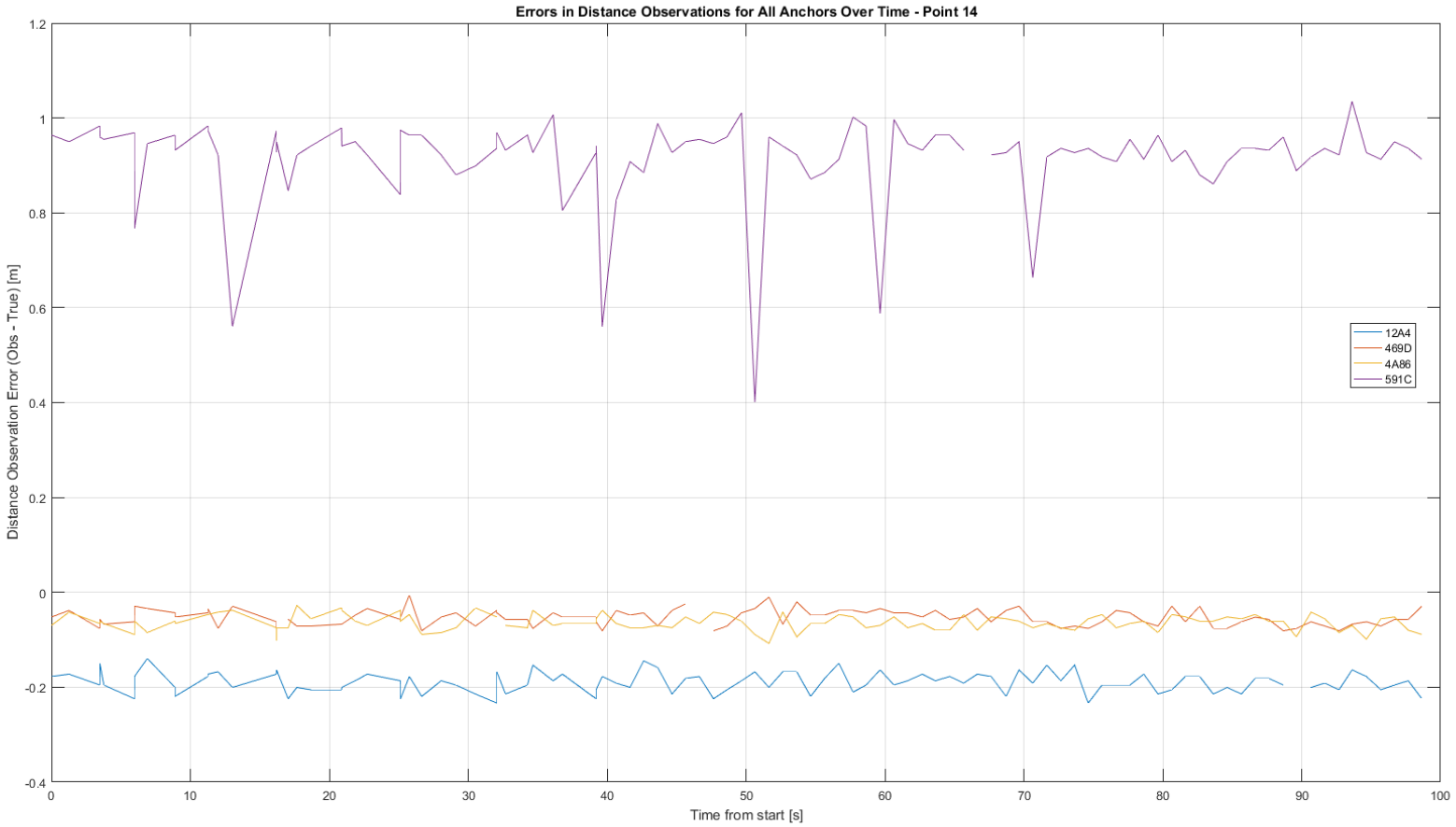

Figure 1: range errors compared to known position for 100 epochs at point 14 (relative center of network)

- 591C bias up to 1m, why God why
- -20cm bias apparent on 12A4
- Others standard
- Consistent with test 3, although much higher 591C bias

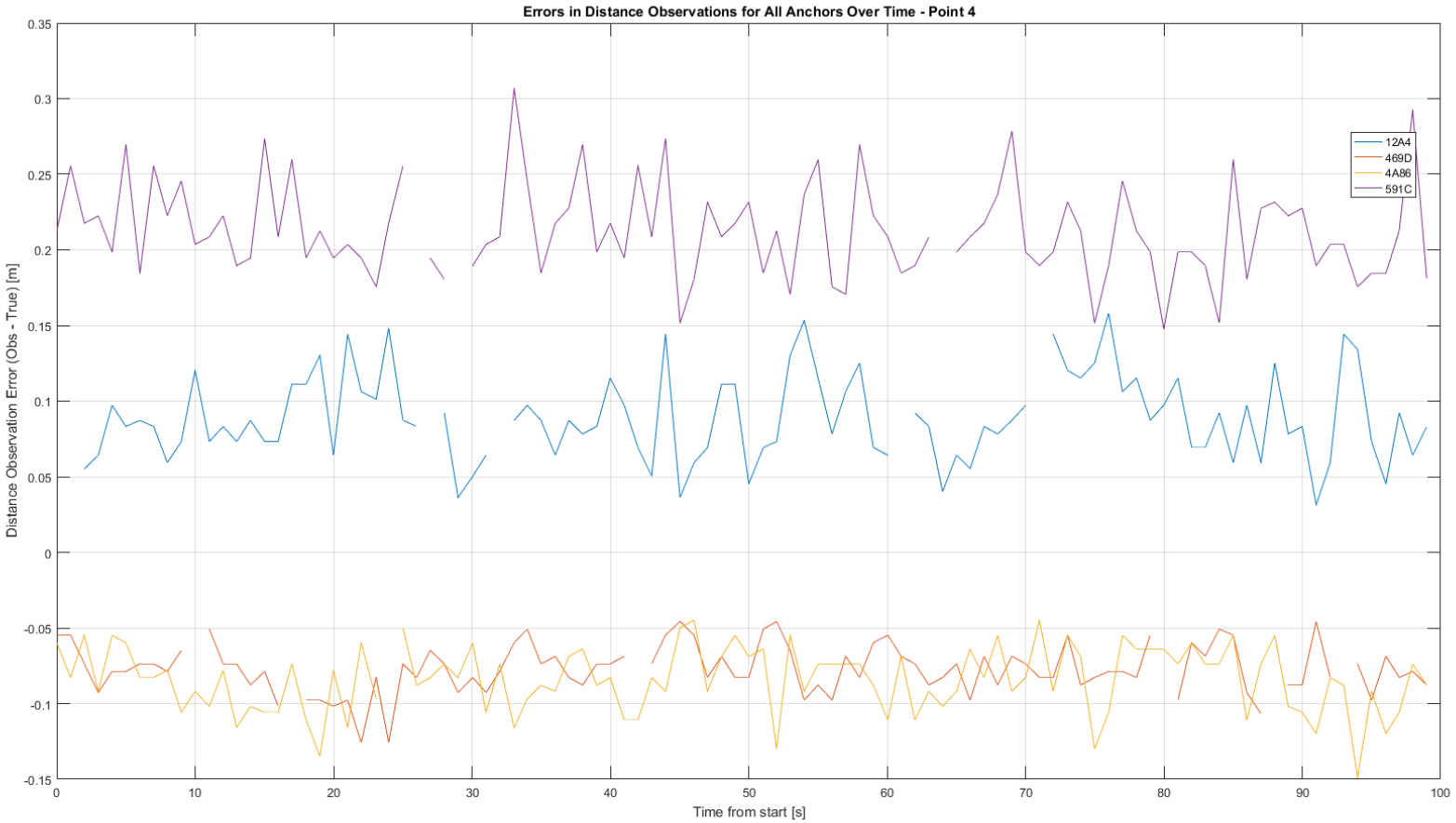

Figure 2: range errors compared to known position for 100 epochs at point 4 (closest to 591C)

- 591C bias back to normal ~20cm
- 12A4 bias switch to 10cm (+30cm)
- No change others
- Reduction in 591C bias consistent with test 3, 12A4 bias added is not consistent

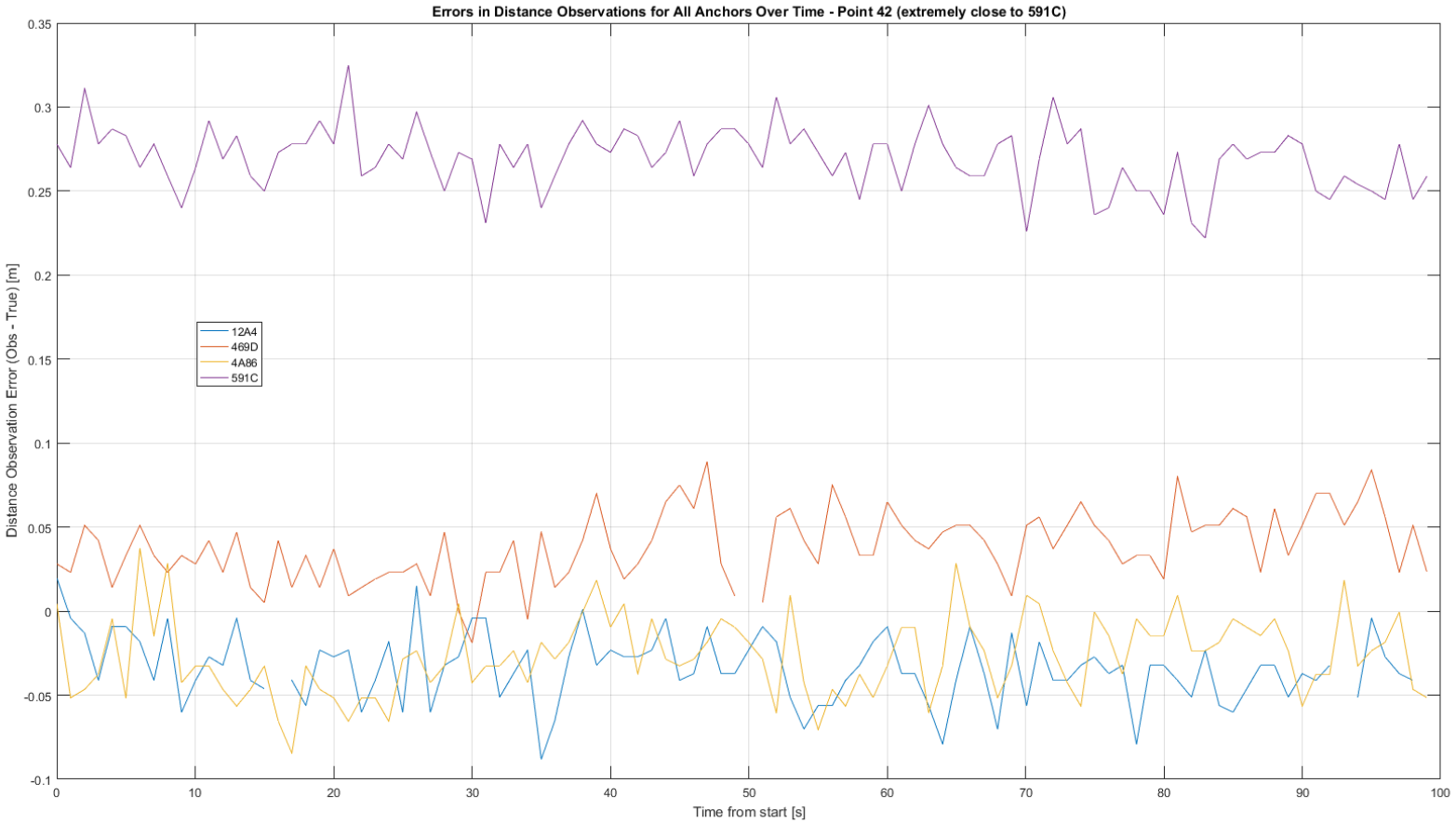

Figure 3: range errors compared to known position for 100 epochs at point 41 (extremely close to 591C)

- No change 591C bias
- 12A4 bias potentially zero
- 469D from -5cm to +5cm maybe
- No change 4A86
- This point very similar to test 3 on point 4

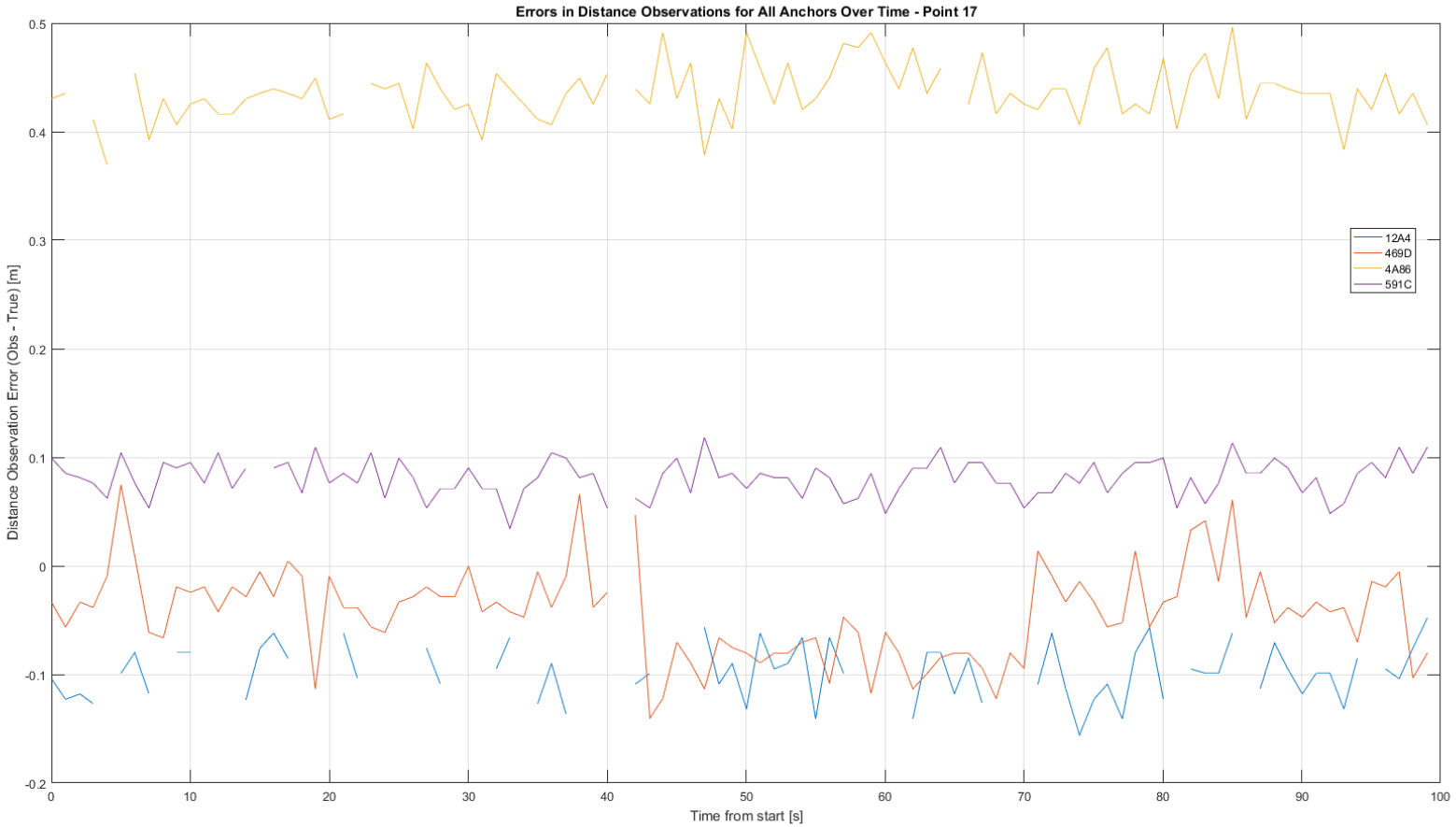

Figure 4: range errors compared to known position for 100 epochs at point 17 (closest to 12A4)

- 591C down to 10cm
- 4A86 up to 40cm bias
- 12A4 at -10cm, very spotty
- Added noise to 469D
- 4A86 bias not seen in test 3, spottiness in 12A4 not seen in test 3, reduction in 591C not seen in test 3

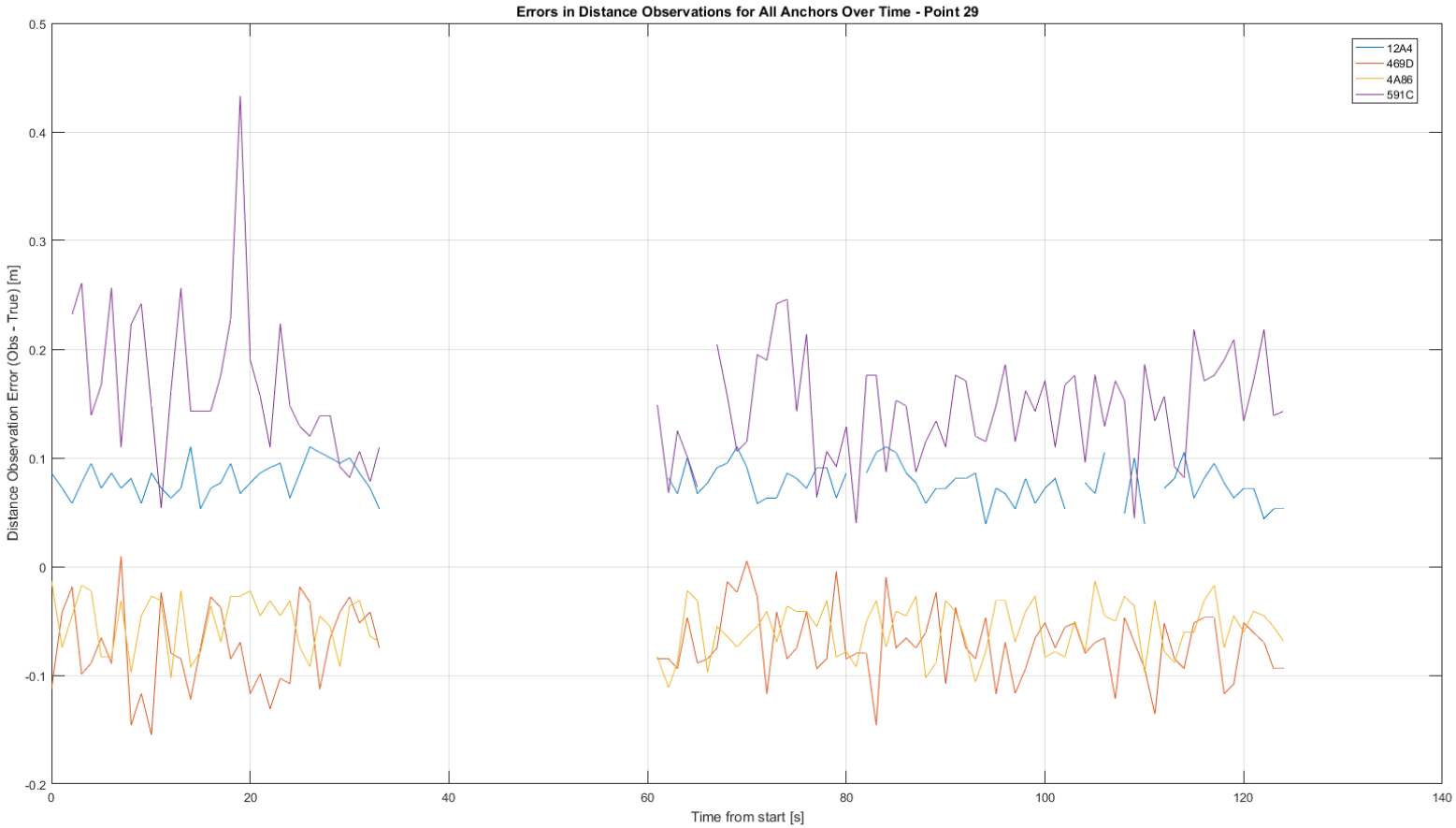

Figure 5: range errors compared to known position for 100 epochs at point 29 (closest to 4A86)

- ~20 second gap in all observations, seem to pick up in same place
- Large spike in 591C, also 15cm bias
- 10cm 12A4 bias
- Others returned to behaviours of beginning
- Increase in 12A4 seen similarly in test 3, further reduction of 591C bias also consistent

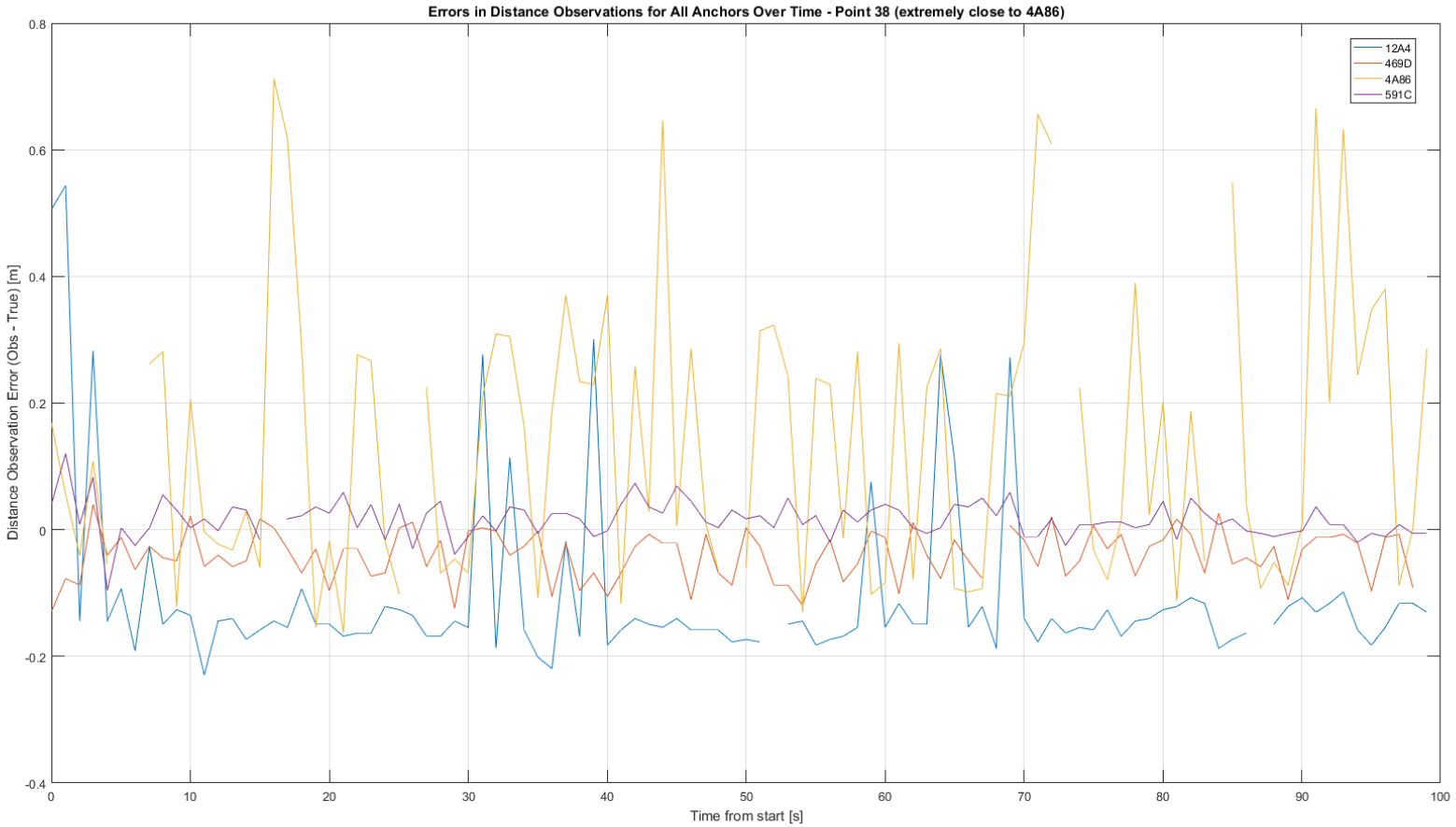

Figure 6: range errors compared to known position for 100 epochs at point 38 (extremely close to 4A86)

- Very large noise in 4A86 (extremely close one), also large noise in 12A4
- Others appear close to zero and low noise
- Apparently little to no bias in any measurement
- Only good 469D ranges are same as test 3

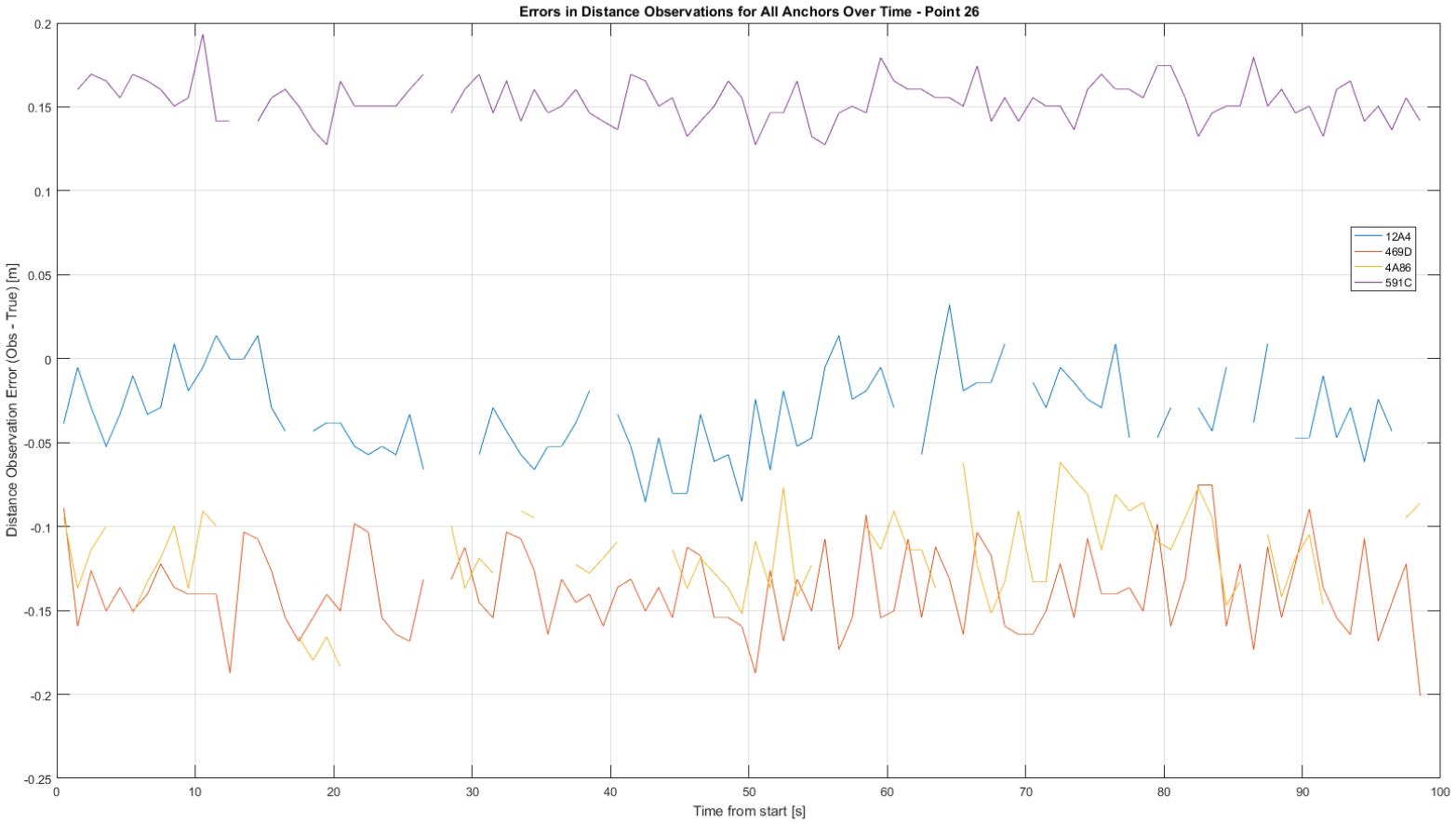

Figure 7: range errors compared to known position for 100 epochs at point 26 (closest to 469D)

- 591C bias returned to 15cm
- No bias on 12A4
- Others are similar to initial behavior but further from zero
- Large bias in 4A86 was seen in test 3, but not here
- 12A4, 591C very similar to test 3
- 469D slightly larger error here