Study USA Offsets

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Points 0..28 are from Paul Ray via Kent's fax. Points 29...35 are from Berrie. The points dyawold are just taking the peak values for yaw, while the dyaw points are attempting to interpolate and throw out points where the peak can't be determined.

$i := 0 .. 35$

$bad := 10$

$i =$	$pitch0_i :=$	$yaw0_i :=$	$dpitch_i :=$	$dyawold_i :=$	$dyaw_i :=$	$day_i :=$
0	26.8	-13.6	.61	-.02	bad	190
1	27.2	-17.5	.71	-.01	-.12	195
2	31.5	-17.3	.74	-.26	-.1	195
3	27.4	-12.5	.79	-.24	-.1	207
4	19.8	-25.7	.70	-.21	-.18	225
5	76.7	-56.3	-.65	.49	.37	238
6	69.8	-56.2	bad	.74	bad	238
7	83.5	-41.0	-.36	-.01	.37	239
8	71.4	-40.9	-.30	.51	.37	241
9	29.7	-50.6	.14	.77	.8	244
10	20.4	-50.6	.34	.76	bad	244
11	29.5	-42.6	.02	.75	bad	246
12	42.6	-52.2	-.18	.53	bad	247
13	46.8	-52.2	-.21	.02	bad	248
14	52.5	-37.6	-.06	.76	bad	249
15	28.8	-47.0	.05	1.01	.75	252
	23.1	-46.8	.18	.50	.6	252
	53.9	-51.8	-.27	.55	.80	255
	75.0	-7.2	.22	.50	.50	256
	12.7	-49.0	.22	1.01	1.1	256
	41.8	-55.8	-.11	.44	.25	256
	63.3	-33.7	-.16	.51	.7	256
	60.2	-56.1	-.59	.48	.23	257
	50.3	-55.9	-.25	.54	.7	257
	77.2	-32.9	-.16	-.05	.08	258
	76.2	-33.1	-.22	.50	.50	258
	83.7	-32.7	-.18	-.07	.06	257
	64.3	-50.6	-.30	.25	.3	259
	78.6	-56.9	-.67	.53	.4	260
	78.	-32.9	-.16	-.06	-.06	258
	78.5	-56.4	-.64	.54	.54	263
	58.	-56.6	-.37	.54	.54	258
	60.85	-5.8	.2	.5	.5	258
	25.2	-49.4	.2	.5	.5	258
	38.5	-50.3	-.02	.5	.5	260
	25.	-50.	.2	1.0	1.0	260

Epoch 1 (0-4), epoch 2 (5-10), epoch 3 (11-26), epoch 4 (27-28), Berrie (29-35)

$istart := 0 \qquad istop := 35$

$j := istart .. istop \qquad k := 0 .. istop - istart$

$p0_k := pitch0_{istart+k}$

$y0_k := yaw0_{istart+k}$

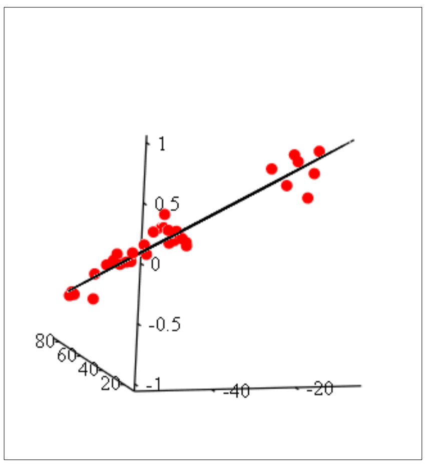
$dp_k := dpitch_{istart+k} \qquad \Delta y_k := off(p0_k, y0_k, -.15, -.015, 0)$

$dy_k := dyaw_{istart+k} \qquad \Delta p_k := off(p0_k, y0_k, 1.2, .017, .0105)$

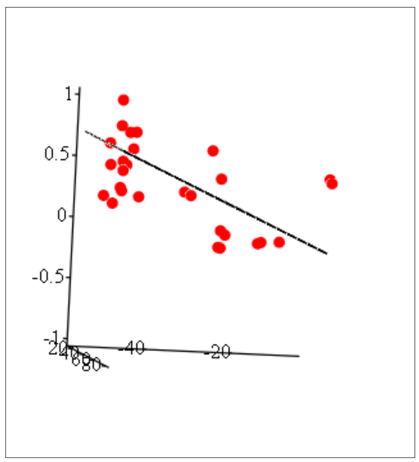
This function returns an offset as a function of the pitch (p), yaw (y), perpendicular distance to the plane (alpha), rot(phi about y)*rot(theta about p)*normal vec of plane initially pointing along the remaining axis.

$$off(p, y, \alpha, \theta, \phi) := \left| \begin{array}{l} u \leftarrow \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \\ u \leftarrow \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos(\theta) & -\sin(\theta) \\ 0 & \sin(\theta) & \cos(\theta) \end{pmatrix} \cdot u \\ u \leftarrow \begin{pmatrix} \cos(\phi) & 0 & \sin(\phi) \\ 0 & 1 & 0 \\ -\sin(\phi) & 0 & \cos(\phi) \end{pmatrix} \cdot u \\ off \leftarrow \dfrac{(\alpha - u_0 \cdot p - u_1 \cdot y)}{u_2} \\ off \end{array} \right.$$

These 3d plots are rotatable on the screen, which shows that the plane fits the points. The plots have been left in the position showing the plane edge on. Notice that the data from all Epochs has been included and are fit by the same planes. Presumably our discussions about different offsets in different Epochs was just due to exploring different parts of (pitch, yaw) space of this function.



$(p0, y0, dp), (p0, y0, \Delta p)$

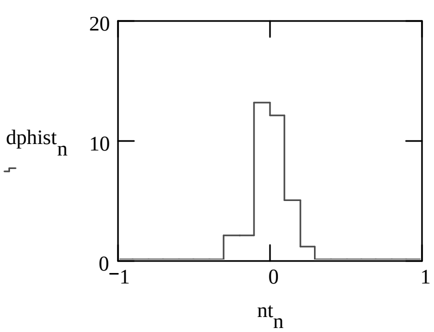


$(p0, y0, dy), (p0, y0, \Delta y)$

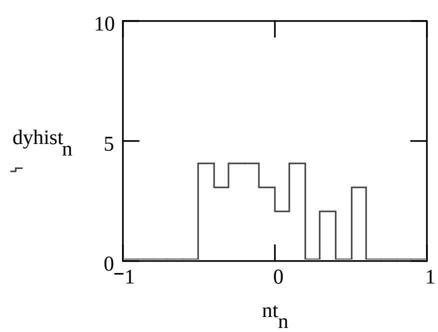
Histogram the difference between the measured offsets and the offsets predicted by the plane function "off()".

$n := 0 .. 20 \qquad nt_0 := -1.0 \qquad nt_{n+1} := nt_n + .1$

$dphist := hist(nt, dp - \Delta p)$



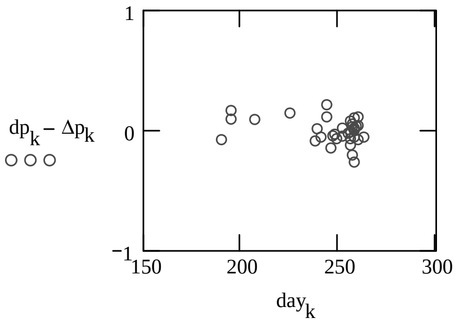
$dyhist := hist(nt, dy - \Delta y)$

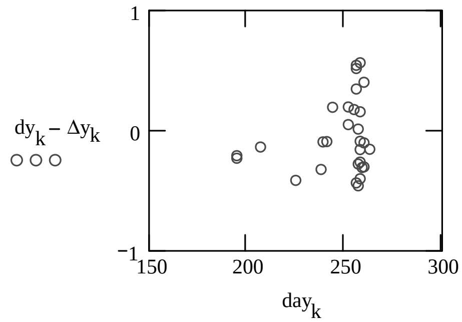


Presumably the greater scatter in the residuals for the yaw data is due to the poor measurement of the yaw offsets. When continuous scans in yaw are available, this should get better.

The use of these functions seems to predict an offset (in a one-to-one manner) for each (pitch,yaw) requested. The search for what actually is causing this (ARGOS software, misalignment of USA wrt ARGOS, USA software, wrong deg/step constants for the encoders) may not be so easily determined.

Plot the residual offsets as a function of time





For the epochs looked at, the offsets do not seem to be a function of time (ie: the residual offsets, after using the time independent plane functions, show no trend in time). This has to be looked at more carefully with more raster scans and a proper error analysis.