LIGO

S3 Performance of the LIGO Interferometers as Measured by SenseMonitor

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(with thanks to Gaby Gonzalez, Mike Landry, Brian O'Reilly)

LIGO-G040102-00-Z

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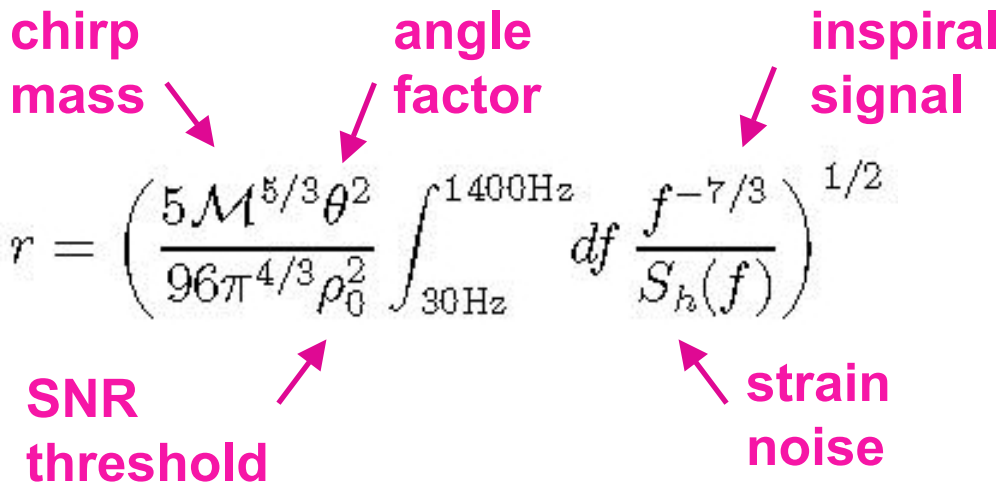
Outline

- SenseMonitor Review
- S3 Results

SenseMonitor

- SNR-based figure-of-merit monitor for the LIGO IFOs
- Real-time range estimates:



- SenseMonitor uses $M_1 = M_2 = 1.4\ M_o$, $\rho_0 = 8$.

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Calibration

- Now a *well-oiled machine*…
- Strain related to AS_Q via

$$x_h(f) = \frac{1 + \alpha(t)\beta(t)G(f)}{\alpha(t)C(f)} x_{AS\_Q}(f)$$

time-dependent gains

reference sensing and open-loop gain functions

- *C, G* fixed and measured during "calibration run"
- α from tracking calibration line
- β from IFO channels (**`DARM_GAIN, ICMTRX_01`**).

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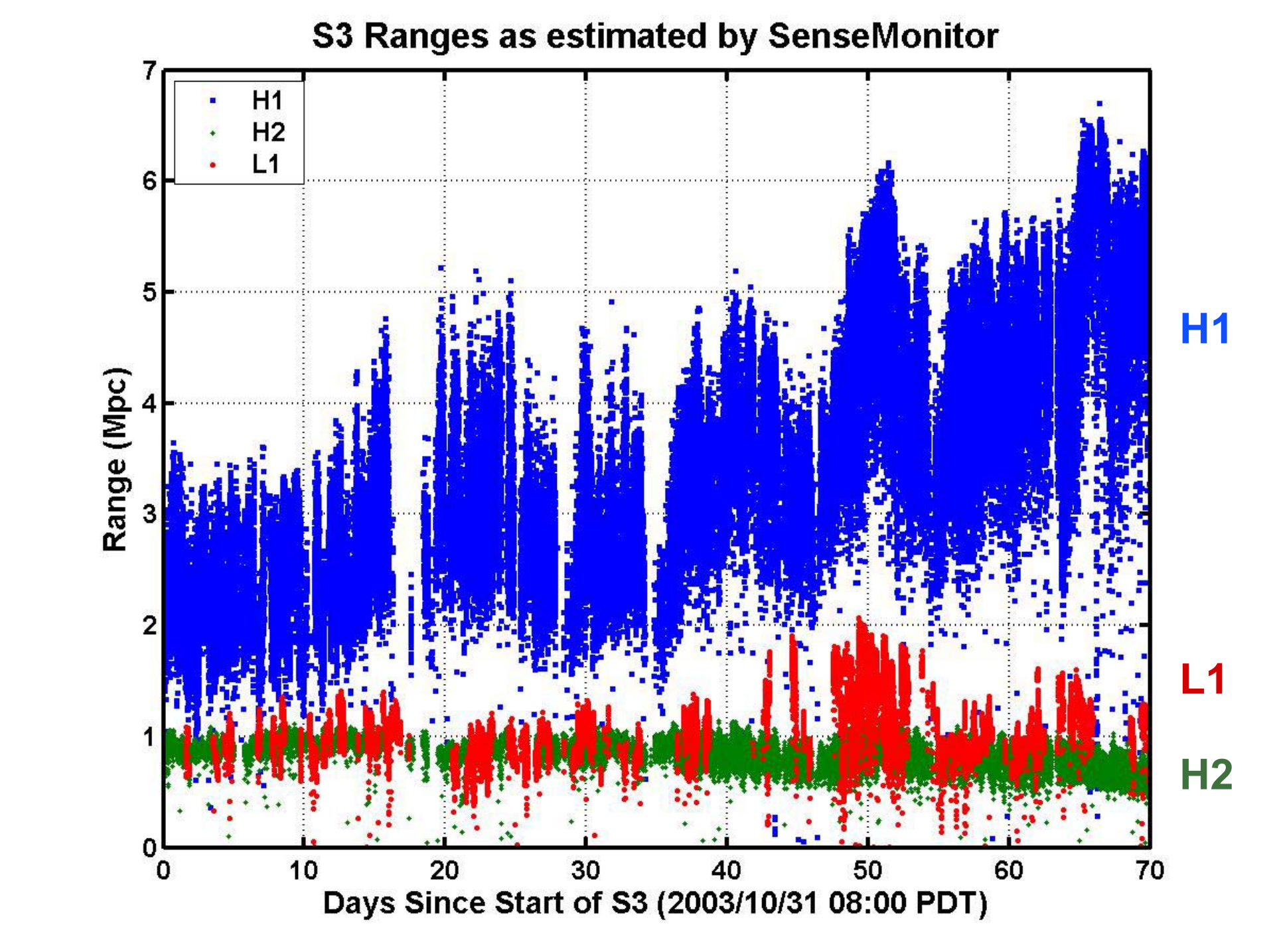
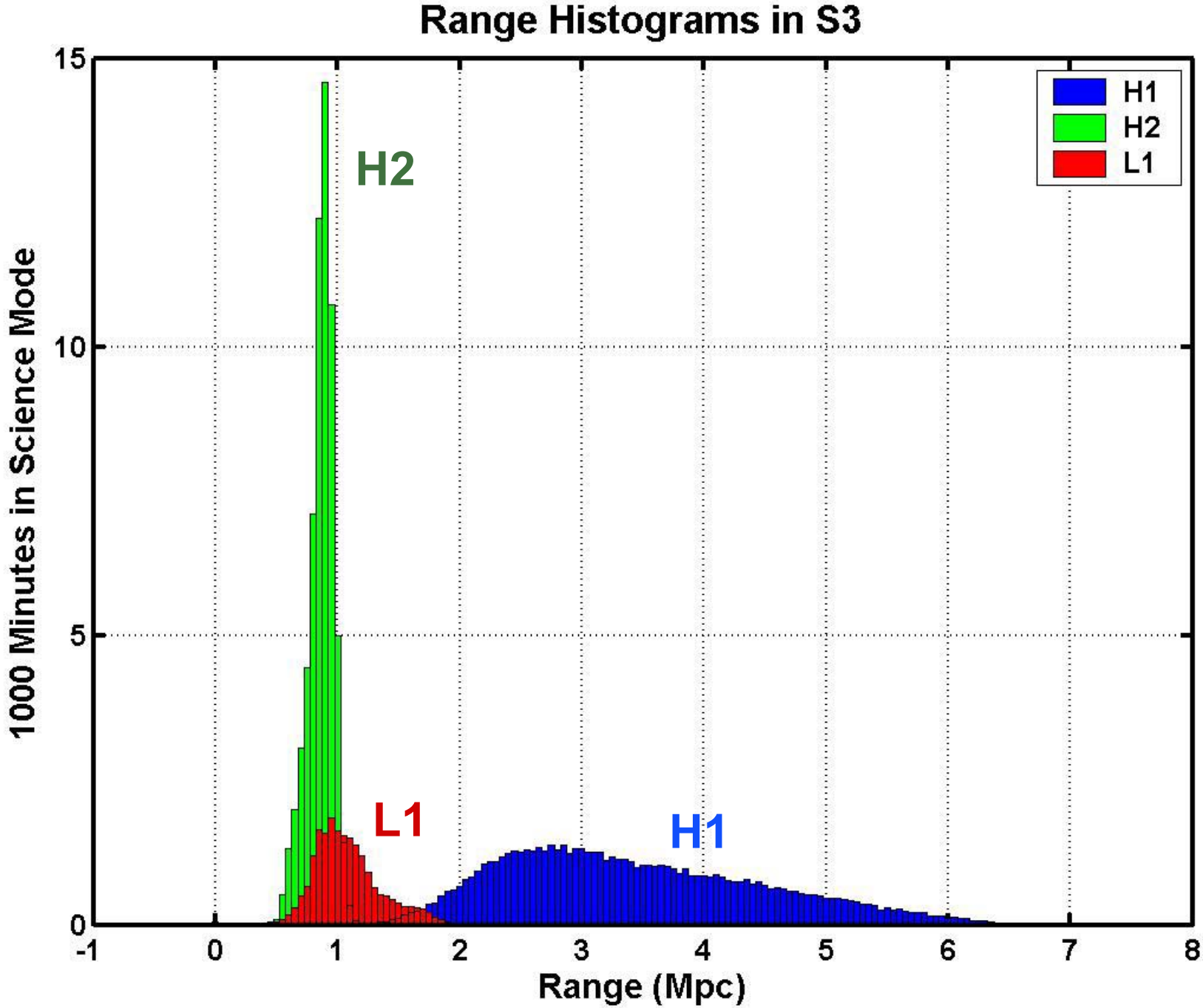
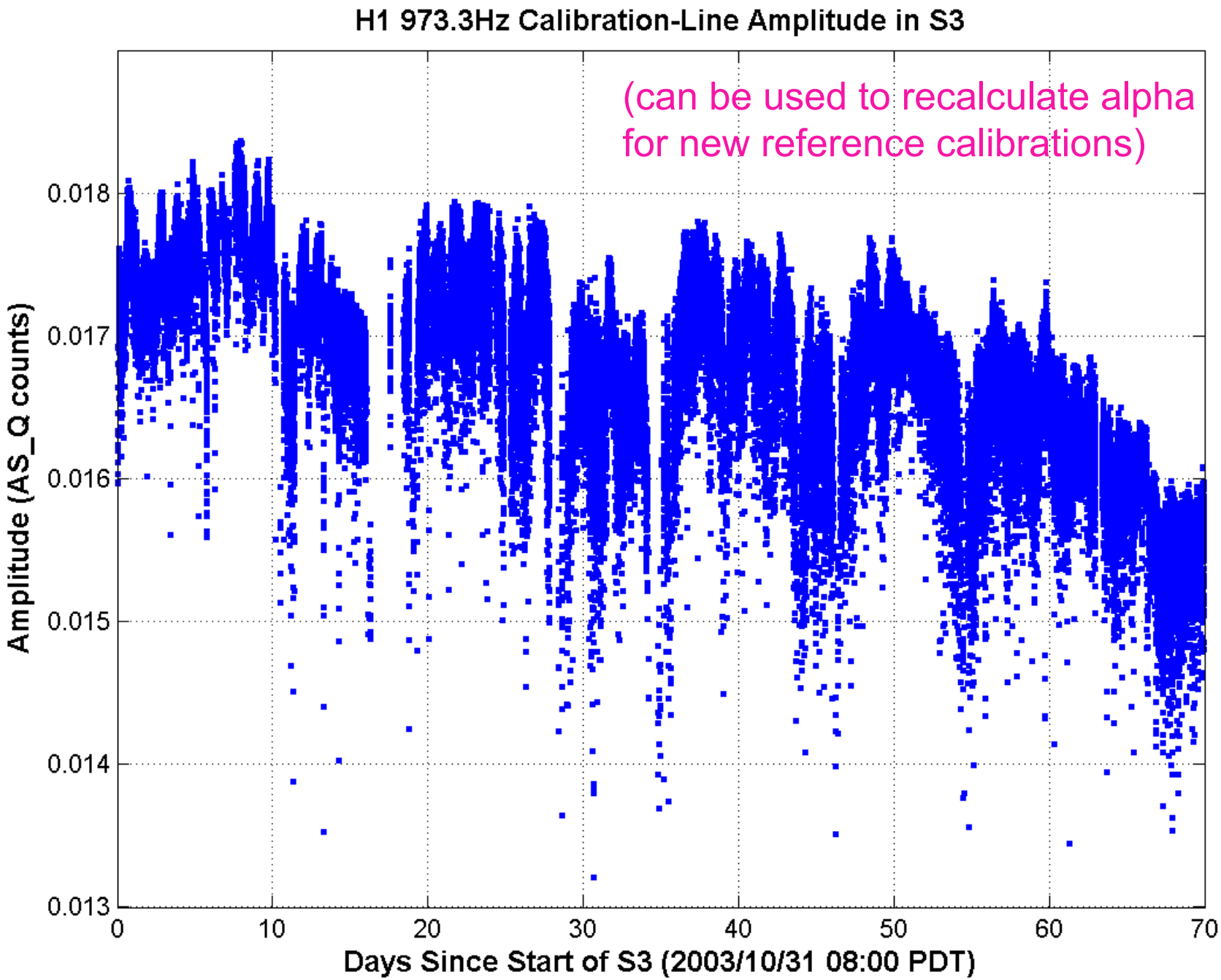
S3 Executive Summary

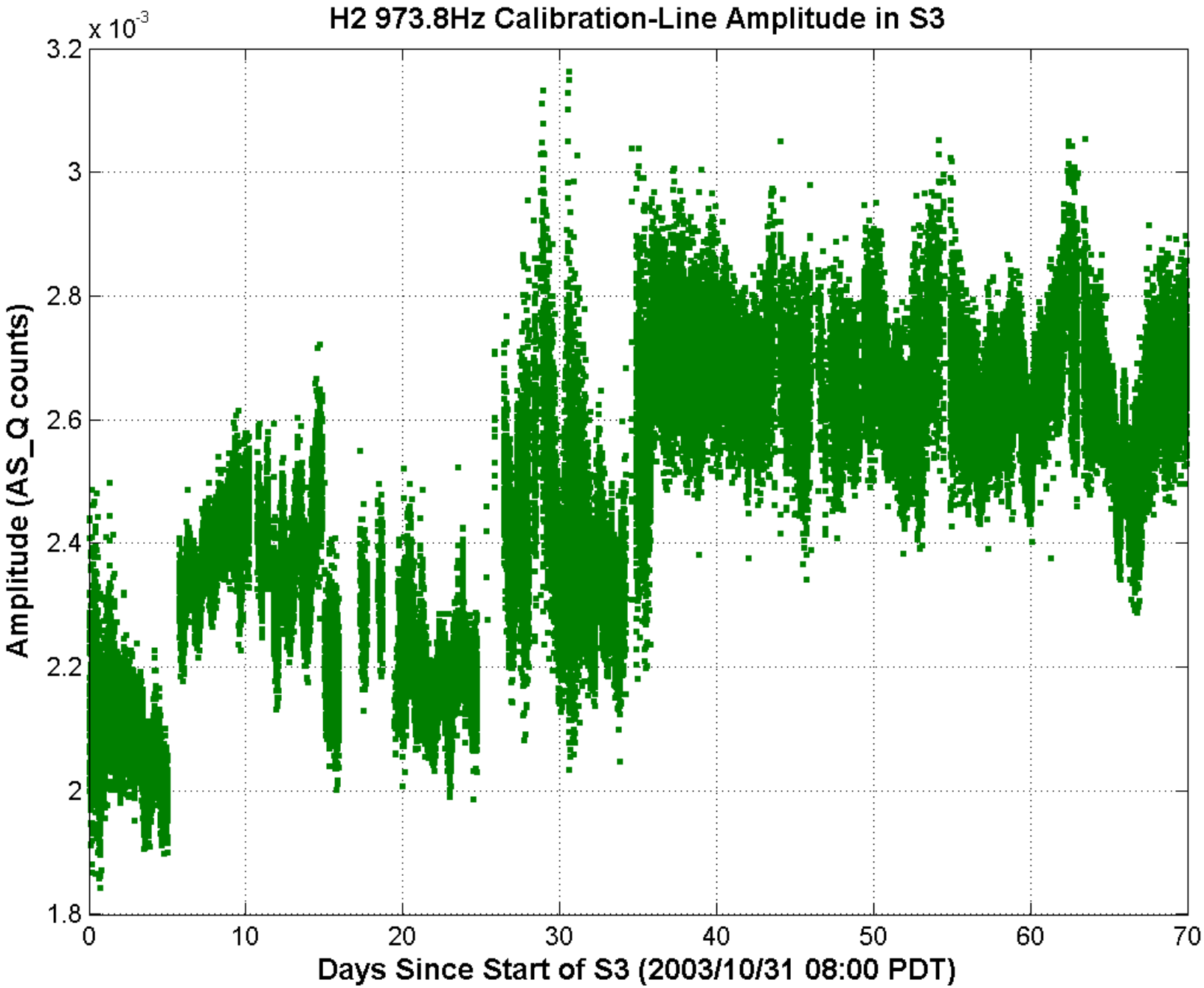
IFO	4-volume scanned (Mpc^3yr)	mean range (Mpc)	quartile ranges				
			0%	25%	50%	75%	100%
H1*	27.93	3.77	0.08	2.58	3.28	4.23	6.70
H2	0.32	0.88	0.04	0.81	0.88	0.93	1.19
L1	0.25	1.15	0.00	0.89	1.04	1.22	2.06

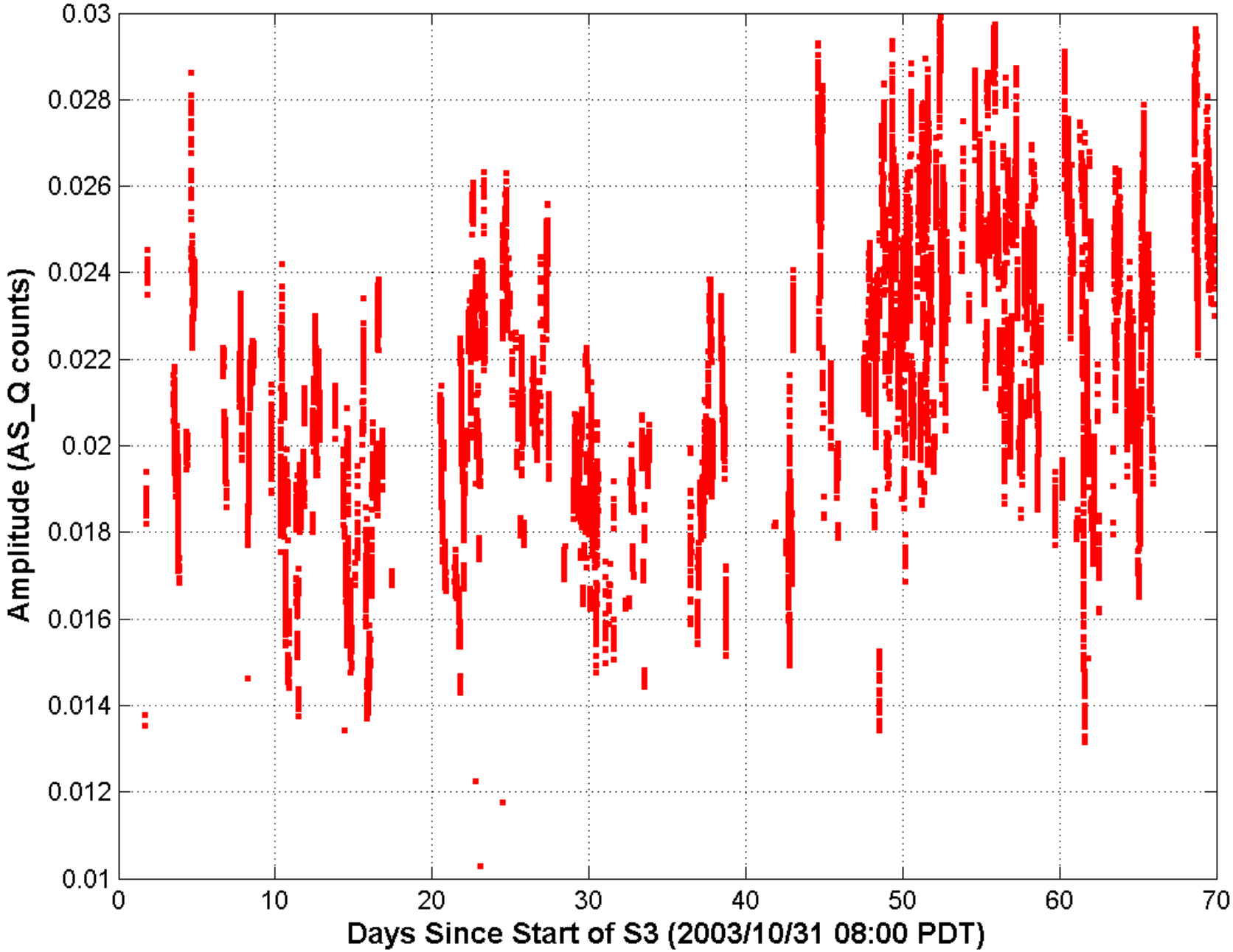
* includes post-run 12% DC correction for H1

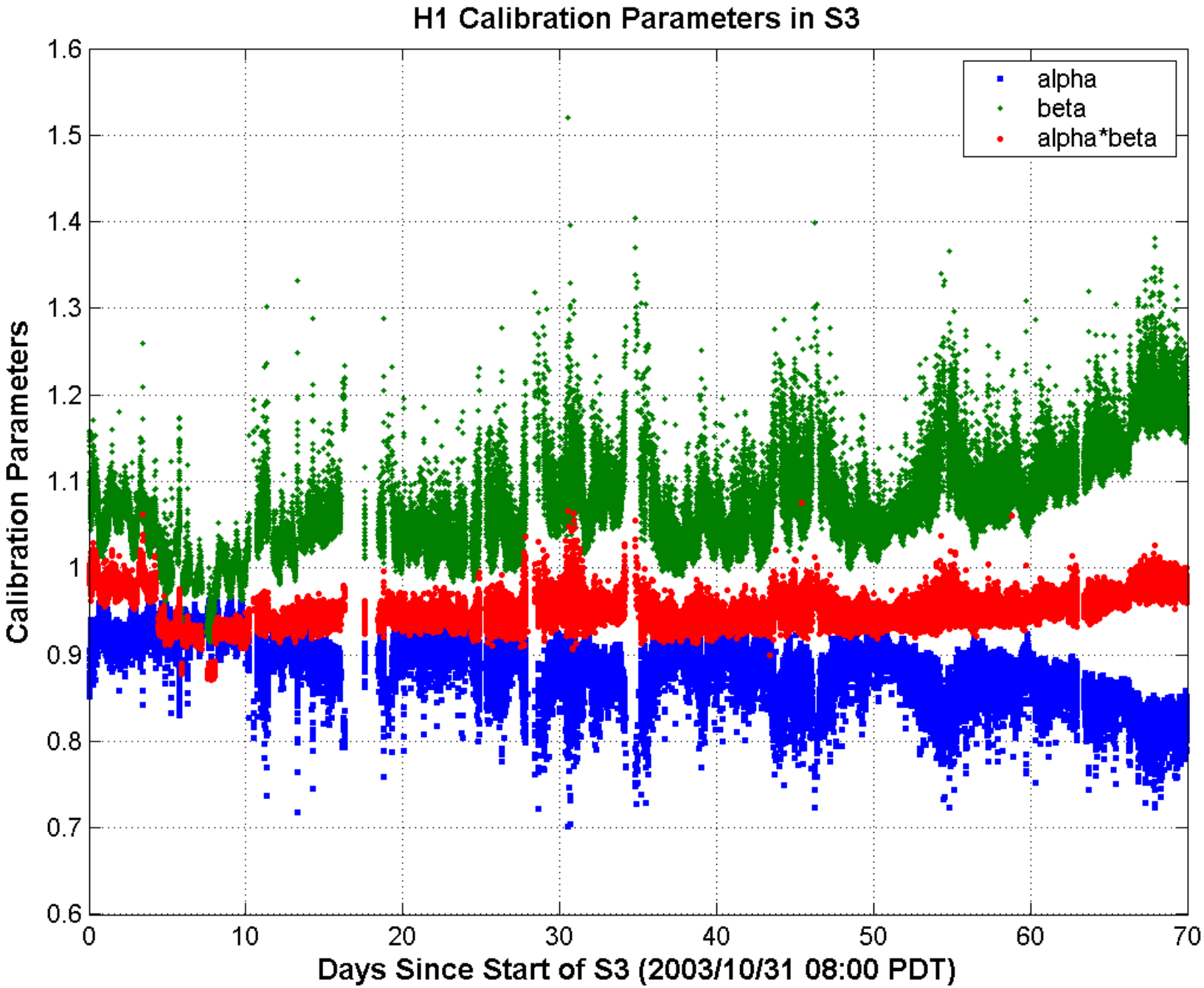

S3 Ranges as estimated by SenseMonitor
H1
H2
L1
Range (Mpc)
Days Since Start of S3 (2003/10/31 08:00 PDT)
0
1
2
3
4
5
6
7
0
10
20
30
40
50
60
70
H1
L1
H2

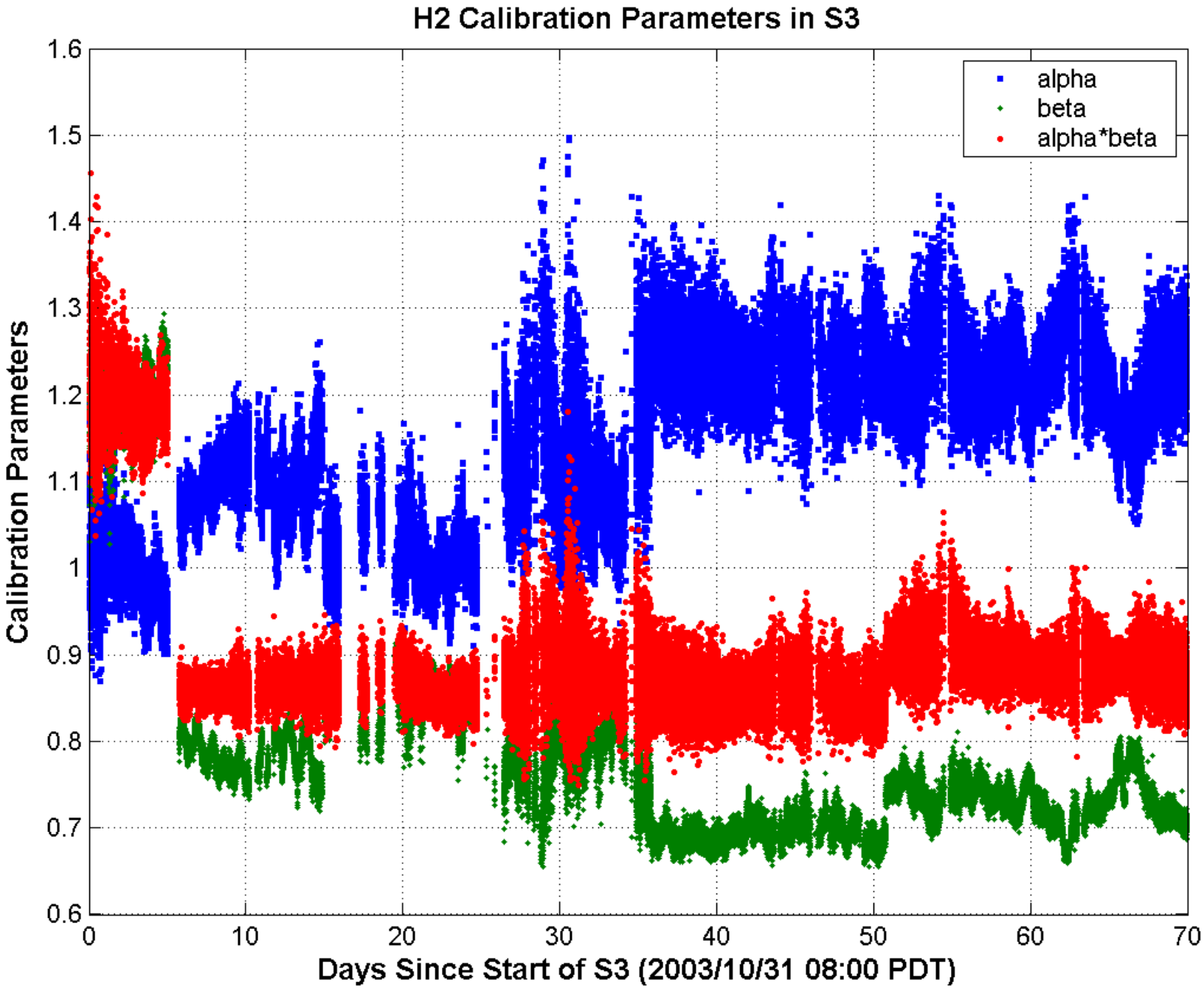

Range Histograms in S3
H1
H2
L1
H2
L1
H1
1000 Minutes in Science Mode
Range (Mpc)
0
5
10
15
-1
0
1
2
3
4
5
6
7
8

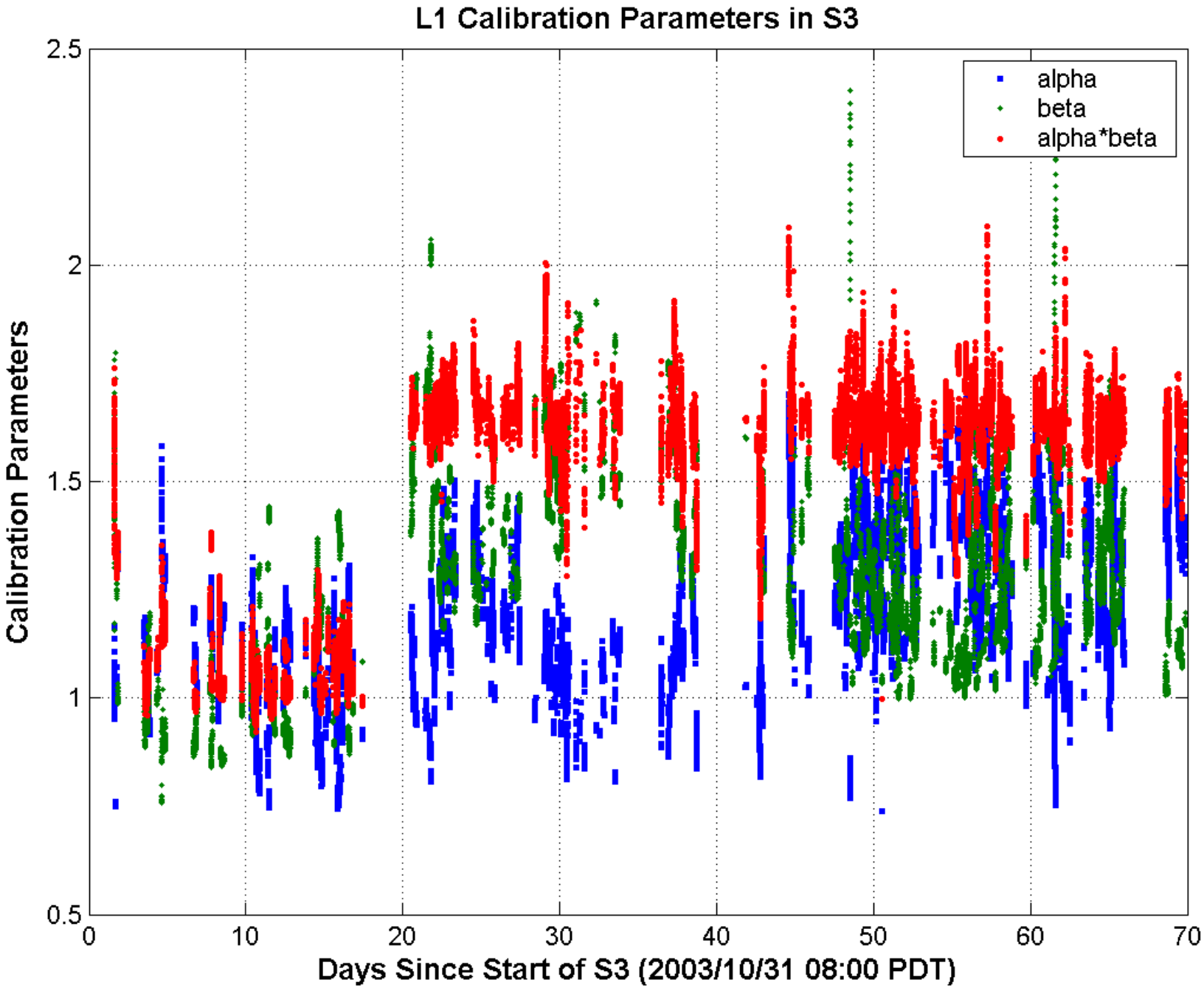

H1 973.3Hz Calibration-Line Amplitude in S3
(can be used to recalculate alpha
for new reference calibrations)
Amplitude (AS_Q counts)
0.018
0.017
0.016
0.015
0.014
0.013
0
10
20
30
40
50
60
70
Days Since Start of S3 (2003/10/31 08:00 PDT)

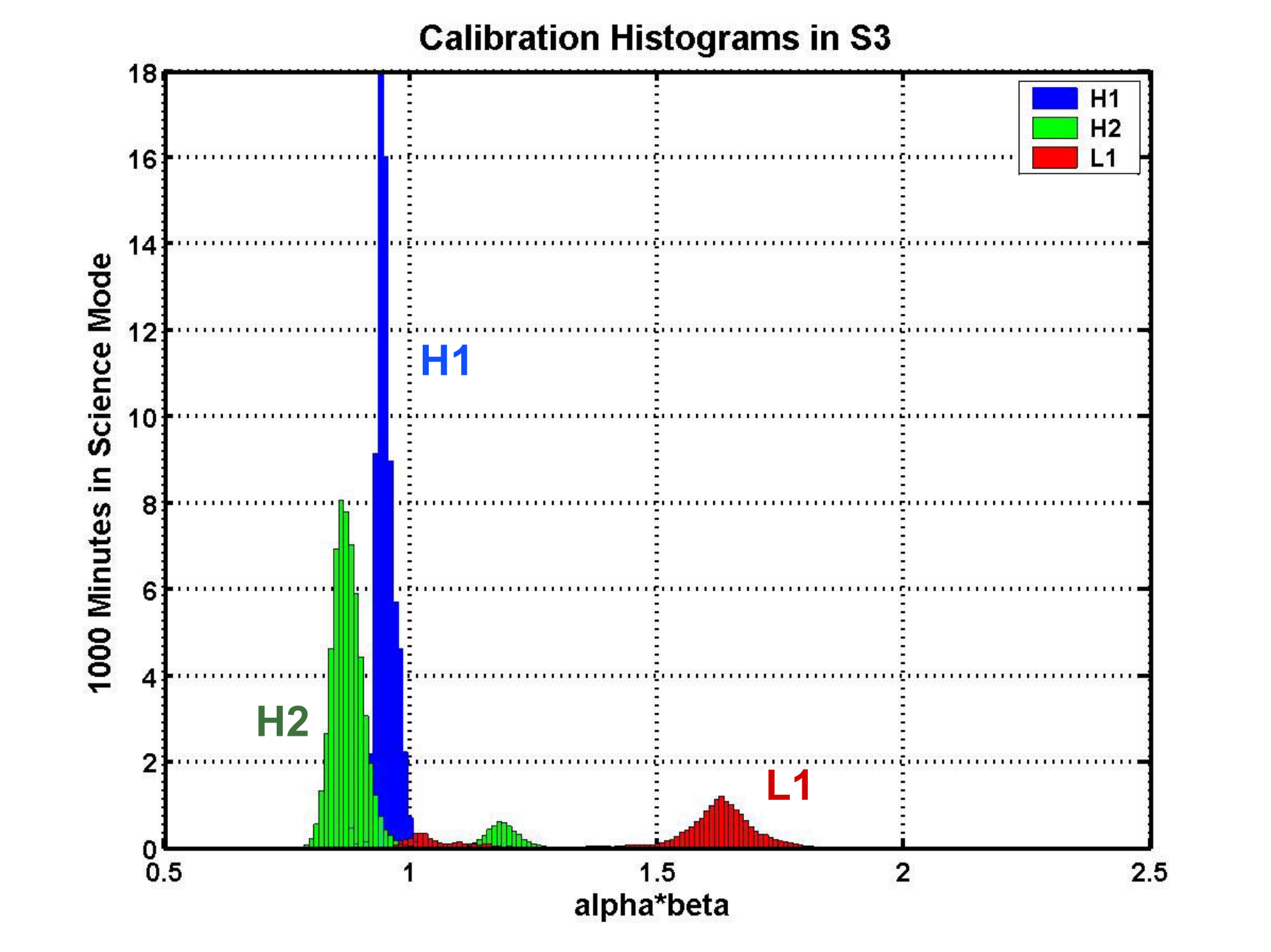

H2 973.8Hz Calibration-Line Amplitude in S3
x 10^-3
3.2
3
2.8
2.6
2.4
2.2
2
1.8
Amplitude (AS_Q counts)
0
10
20
30
40
50
60
70
Days Since Start of S3 (2003/10/31 08:00 PDT)


L1 927.7Hz Calibration-Line Amplitude in S3
Amplitude (AS_Q counts)
0.03
0.028
0.026
0.024
0.022
0.02
0.018
0.016
0.014
0.012
0.01
0
10
20
30
40
50
60
70
Days Since Start of S3 (2003/10/31 08:00 PDT)


H1 Calibration Parameters in S3
alpha
beta
alpha*beta
Calibration Parameters
Days Since Start of S3 (2003/10/31 08:00 PDT)
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0
10
20
30
40
50
60
70


H2 Calibration Parameters in S3
alpha
beta
alpha*beta
Calibration Parameters
Days Since Start of S3 (2003/10/31 08:00 PDT)
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0
10
20
30
40
50
60
70


L1 Calibration Parameters in S3
alpha
beta
alpha*beta
Calibration Parameters
2.5
2
1.5
1
0.5
0
10
20
30
40
50
60
70
Days Since Start of S3 (2003/10/31 08:00 PDT)


Calibration Histograms in S3
H1
H2
L1
1000 Minutes in Science Mode
alpha*beta
0
2
4
6
8
10
12
14
16
18
0.5
1
1.5
2
2.5