



Exoplanet Characterisation Observatory (EChO)

Assessment Phase Payload Study

Contribution to calibration plan using real stars

ECHO-TN-0001-IAP

Issue 1

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DOCUMENT CHANGE DETAILS

Issue	Date	Page	Description Of Change	Comment

Scope of the exercise: Attracting the attention of the consortium to the potential use of G stars as calibration sources.

Executive summary:

Kepler has shown that 70% of G dwarf stars are stable to the level of 10^{-5} over a period of 30 days. Bright G-dwarf stars are very abundant in the solar neighborhood (537 brighter than $K=5.5$) and are uniformly distributed. We propose a calibration strategy, using short (1h) and long (10h) calibration using G stars.

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1. G stars as standard candles

We have identified a potential calibration strategy to double check the stability of the instrument on the time scale of the transit (hours), time to constraint day side to night side variation (days) and global climate change (years).

Ciardi et al. 2011 (AJ 141, 108) have shown that 70 % of G dwarfs are stable to better than 10^{-5} over periods of 30 days. Subsequent studies with Kepler will be able to refine the stability level over years.

In the solar neighbourhood, we have over 500 G stars brighter than $K=5.5$ (Fig 1) uniformly distributed over the ECHO sky (Fig 2). The brightest of these stars will have typical 10 times more flux than most of our targets. The faintest G stars from this sample are comparable to our brightest targets. Observing G stars is a very efficient way to use a very stable source, allowing High S/N observations to be able to determine accurately the slow variation with time of the instrument response and detector performances.

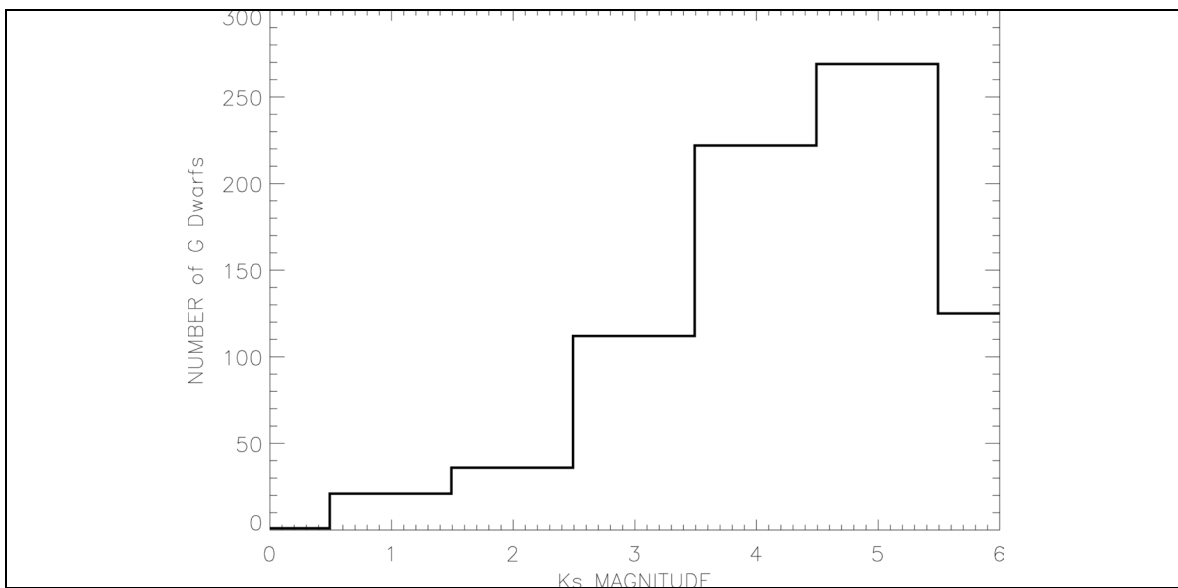


Figure 1: Ks magnitude histogram for close and bright G stars that could be used as calibration sources for ECHO.

Our calibration strategy will evolve with the mission, as we will learn about ECHO. First, we will observe three calibrators, with similar orientation with respect to the Sun (or close to the target on the skies) after each visit to a target. After 6 months we will revise the calibration strategy and possibly go to one calibrator after each scientific visit. Every week we will conduct multiple observations of calibrators in order to probe the instrument performance on a large scale.

Before launch, we will conduct a systematic survey from the ground to study the properties of a sample of G dwarfs using activity indicators (CaII H&K, X Rays) in order to carefully select the lowest active stars to become the calibrators.

They will be also double checked against each other in the commissioning phase of ECHO and during the first six months.

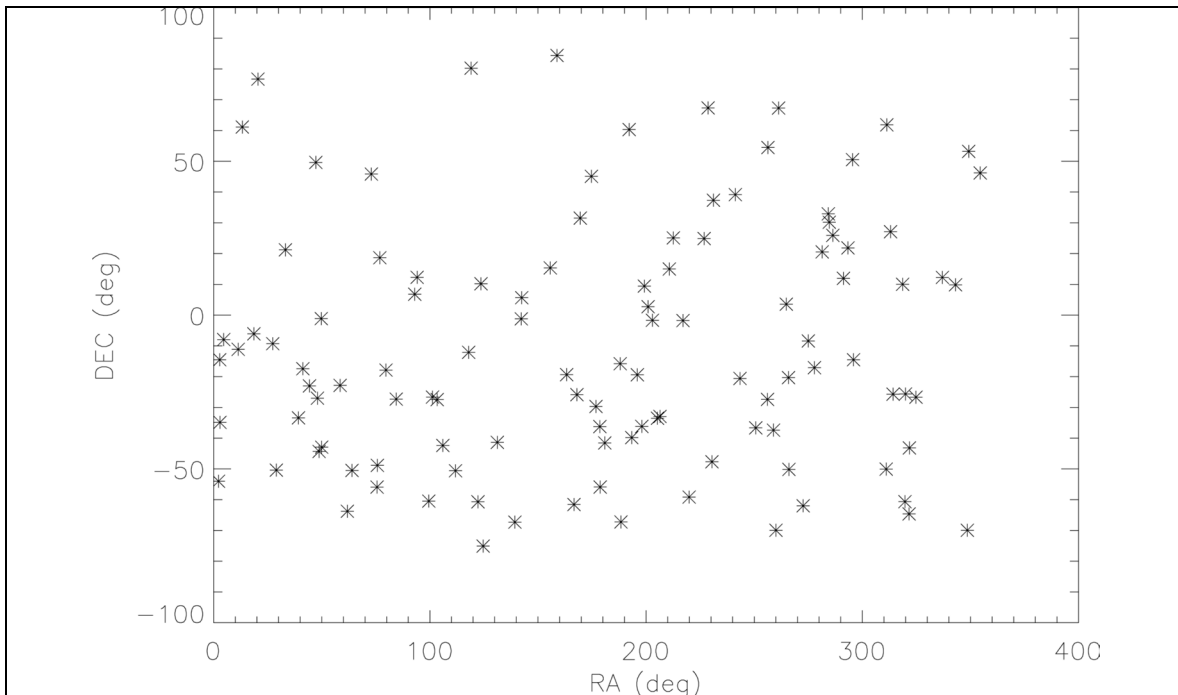


Figure 2: RA DEC distribution of the bright G stars.

2. Scheduling calibrations

At the time of writing, the calibration strategy is not finalized. Below is a proposed calibration strategy. It has been adopted for the scheduling exercise described in ECHO-TN-001-CNES. This does not pretend to be the optimal calibration strategy, just a plausible one for simulation purposes. We propose to use observations of stable bright stars as calibration sources in conditions as close as possible to the targets. Ultimately, a complete instrument model will be estimated by fitting simultaneously calibration observations and science observations. Given the requirements, we need to characterize the instrument on the hour time scale and 10 hours time scale.

Types of calibration: we define two types of calibration:

- Shortcal is a 1 hour integration
- Longcal is a 10 hour integration

The proposed scheme is to have in average one shortcal per 36 hours of mission time, and one

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longcal every 10 days. For a 4.5yr mission this results in about 1095 shortcal observations and 165 longcal observations. It is clear that our understanding of the instrument will evolve during the survey. Probably, after the intense phase of commissioning and the first year of survey it will be possible to refine the calibration strategy.

Calibrators: a list of more than 500 calibrator G stars is provided in appendix and discussed in the previous paragraph. For the scheduling simulation all calibrators are considered interchangeable, so that one can choose from the list whichever target is most convenient. We suggest minimizing thermal effects to take a calibrator that is as close as possible to the latest observed target on the sky.

The diversity requirement is:

- to use at least 5 different stars for longcals
- that all longcal targets are also used in at least one shortcal
- that at least 20 different stars are used for shortcals

To provide some flexibility for the scheduling of calibration observations, the interval requirements between them are expressed as the following:

- Shortcals: there must 20 +/- 5 shortcal observations per any 30-day period of mission time, with no more than 48 hours between two consecutive shortcals
- Longcals: there must be at least 3 +/- 1 longcal observations per any 30-day period of mission time, with no more than 15 days between two consecutive longcals.

Concluding remarks

Nature is giving us very stable standard candles, the G stars. Up to magnitude $K=5.5$ we have already 537 such stars in the solar neighborhood, 70 % of which are stable to the level of 10^{-5} in the visible over time scale of 30 days. They are uniformly distributed on the sky. We used this catalogue for the scheduling exercise described in ECHO-TN-001-CNES and have been able to successfully schedule the calibration sequences using these targets.

We can notice that most of these calibrators are significantly brighter than the targets. They would require to be observed at high cadence in the bright mode, which is also expensive in terms of data volume. We should certainly extend the list of calibrators to G stars down to magnitude $K=8$ so that they could be observed in the regular observing mode of EChO.

We advocate for the philosophy of observing calibration sources with similar brightness to the science targets in similar operation mode. A global model of the instrument should be estimated using constraints coming from calibrators and science targets.

Appendix: 537 bright Calibration G stars for ECHO.

#NAME_SEQ_NUMBER	RA	DEC	J	H	K	QualityFlag1	QualityFlag2
ECHOCALIB_0	01:37:55.56	-82:58:30.00	4.78	4.53	4.41	0	0
ECHOCALIB_1	05:37:09.89	-80:28:08.90	4.87	4.42	4.24	0	0
ECHOCALIB_2	00:16:12.68	-79:51:04.30	5.37	4.99	4.86	0	0
ECHOCALIB_3	16:33:27.09	-78:53:49.70	2.23	1.81	1.72	0	0
ECHOCALIB_4	18:47:49.13	-77:52:05.70	5.32	5.02	4.94	0	0
ECHOCALIB_5	00:25:45.07	-77:15:15.30	1.68	1.43	1.37	0	0
ECHOCALIB_6	08:18:31.55	-76:55:11.00	3.41	3.15	3.15	0	0
ECHOCALIB_7	17:22:12.65	-75:20:53.40	5.83	5.57	5.46	0	0
ECHOCALIB_8	11:42:14.92	-75:13:38.30	5.54	5.30	5.24	0	0
ECHOCALIB_9	14:41:52.46	-75:08:22.10	5.53	5.21	5.07	0	0
ECHOCALIB_10	14:08:27.17	-74:51:01.00	4.92	4.68	4.58	0	0
ECHOCALIB_11	06:10:14.47	-74:45:11.00	3.95	3.51	3.45	0	0
ECHOCALIB_12	10:24:23.71	-74:01:53.80	3.47	3.23	3.25	0	0
ECHOCALIB_13	21:09:22.45	-73:10:22.70	4.34	3.96	4.19	0	0
ECHOCALIB_14	23:14:08.30	-70:03:29.50	5.61	5.22	5.10	0	0
ECHOCALIB_15	17:20:12.80	-70:02:43.90	5.44	5.13	5.04	0	0
ECHOCALIB_16	17:20:12.68	-70:02:43.30	5.44	5.13	5.04	0	0
ECHOCALIB_17	01:15:46.16	-68:52:33.40	3.76	3.46	3.88	0	0
ECHOCALIB_18	01:15:45.58	-68:52:29.60	3.76	3.46	3.88	0	0
ECHOCALIB_19	12:33:31.38	-68:45:20.90	5.63	5.23	5.07	0	0
ECHOCALIB_20	09:17:17.22	-68:41:22.80	4.80	4.57	4.38	0	0
ECHOCALIB_21	09:17:17.23	-68:41:22.70	4.80	4.57	4.38	0	0
ECHOCALIB_22	21:24:40.64	-68:13:40.20	5.65	5.30	5.22	0	0
ECHOCALIB_23	14:37:46.26	-67:55:55.30	5.17	4.91	4.78	0	0
ECHOCALIB_24	20:05:32.76	-67:19:15.20	5.11	4.72	4.51	0	0
ECHOCALIB_25	02:43:26.61	-66:42:51.30	5.16	4.84	4.73	0	0
ECHOCALIB_26	20:08:43.61	-66:10:55.40	2.30	2.04	1.93	0	0
ECHOCALIB_27	08:02:31.19	-66:01:15.40	5.65	5.23	5.11	0	0
ECHOCALIB_28	17:56:24.29	-65:43:18.30	5.57	5.37	5.29	0	0
ECHOCALIB_29	00:44:39.27	-65:38:58.30	5.37	5.10	4.95	0	0
ECHOCALIB_30	21:26:26.61	-65:21:58.30	3.34	2.99	2.97	0	0
ECHOCALIB_31	00:20:04.26	-64:52:29.30	3.07	2.74	2.77	0	0
ECHOCALIB_32	12:06:52.90	-64:36:49.40	3.45	3.23	3.20	0	0
ECHOCALIB_33	04:07:21.54	-64:13:20.20	5.20	4.95	4.77	0	0
ECHOCALIB_34	11:25:43.15	-63:58:20.90	4.62	4.19	4.19	0	0
ECHOCALIB_35	03:29:22.68	-62:56:15.10	4.22	3.93	3.94	0	0
ECHOCALIB_36	03:17:46.16	-62:34:31.20	4.46	4.04	3.99	0	0
ECHOCALIB_37	03:18:12.82	-62:30:22.90	4.27	3.87	3.86	0	0
ECHOCALIB_38	11:06:32.43	-62:25:26.80	2.99	2.57	2.44	0	0
ECHOCALIB_39	18:10:26.16	-62:00:07.90	4.43	4.02	4.13	0	0
ECHOCALIB_40	06:38:00.33	-61:32:00.30	5.08	4.75	4.54	0	0
ECHOCALIB_41	06:38:00.36	-61:32:00.20	5.08	4.75	4.54	0	0
ECHOCALIB_42	21:18:44.30	-61:21:10.10	5.39	5.04	4.93	0	0
ECHOCALIB_43	06:59:59.66	-61:20:10.30	5.46	5.10	4.99	0	0
ECHOCALIB_44	08:09:00.67	-61:18:08.80	3.91	3.62	3.67	0	0
ECHOCALIB_45	14:39:35.08	-60:50:13.80	-1.45	-1.89	-2.01	0	0
ECHOCALIB_46	14:39:36.50	-60:50:02.30	-1.45	-1.89	-2.01	0	0
ECHOCALIB_47	20:40:02.64	-60:32:56.00	4.20	3.78	3.83	0	0
ECHOCALIB_48	05:27:39.35	-60:24:57.60	5.70	5.34	5.20	0	0
ECHOCALIB_49	07:57:46.92	-60:18:11.10	4.79	4.36	4.24	0	0
ECHOCALIB_50	05:54:04.24	-60:01:24.50	5.41	4.97	4.79	0	0
ECHOCALIB_51	14:19:04.83	-59:22:44.50	4.98	4.67	4.33	0	0
ECHOCALIB_52	06:16:18.79	-59:12:48.60	5.41	5.18	5.01	0	0
ECHOCALIB_53	18:04:42.60	-59:12:34.50	5.81	5.52	5.42	0	0
ECHOCALIB_54	13:14:15.14	-59:06:11.60	3.94	3.57	3.61	0	0
ECHOCALIB_55	08:59:24.18	-59:05:01.40	4.75	4.43	4.49	0	0
ECHOCALIB_56	04:40:17.76	-58:56:38.10	5.52	5.21	5.11	0	0



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ECHOCALIB_57	04:40:18.20	-58:56:38.10	5.52	5.21	5.11	0	0
ECHOCALIB_58	10:53:29.66	-58:51:11.40	2.12	1.68	1.58	0	0
ECHOCALIB_59	23:17:25.77	-58:14:08.60	3.32	3.08	3.04	0	0
ECHOCALIB_60	09:40:42.55	-57:59:00.80	5.37	5.05	4.80	0	0
ECHOCALIB_61	00:12:50.25	-57:54:45.40	5.85	5.47	5.38	0	0
ECHOCALIB_62	22:24:56.39	-57:47:50.70	4.32	3.89	3.85	0	0
ECHOCALIB_63	05:05:30.66	-57:28:21.70	3.70	3.41	3.37	0	0
ECHOCALIB_64	04:24:12.21	-57:04:16.80	5.68	5.37	5.32	0	0
ECHOCALIB_65	16:09:42.79	-56:26:42.50	5.55	5.10	4.98	0	0
ECHOCALIB_66	11:55:01.34	-56:05:45.60	5.65	5.33	5.23	0	0
ECHOCALIB_67	05:02:17.06	-56:04:49.90	5.82	5.45	5.39	0	0
ECHOCALIB_68	00:09:02.39	-54:00:07.00	4.96	4.59	4.41	0	0
ECHOCALIB_69	00:09:02.41	-54:00:06.80	4.96	4.59	4.41	0	0
ECHOCALIB_70	01:42:29.32	-53:44:27.00	4.79	4.40	4.34	0	0
ECHOCALIB_71	10:31:21.82	-53:42:55.70	3.91	3.59	3.58	0	0
ECHOCALIB_72	17:03:08.71	-53:14:13.30	4.45	4.18	4.13	0	0
ECHOCALIB_73	00:16:53.90	-52:39:04.10	5.57	5.20	5.11	0	0
ECHOCALIB_74	00:34:27.83	-52:22:23.10	4.74	4.49	4.43	0	0
ECHOCALIB_75	15:12:09.82	-52:06:23.00	5.76	5.53	5.45	0	0
ECHOCALIB_76	20:44:02.34	-51:55:15.50	3.91	3.69	3.82	0	0
ECHOCALIB_77	17:44:08.70	-51:50:02.60	4.16	3.72	3.68	0	0
ECHOCALIB_78	06:31:18.32	-51:49:33.40	4.79	4.36	4.32	0	0
ECHOCALIB_79	01:56:59.99	-51:45:58.50	5.23	4.96	4.84	0	0
ECHOCALIB_80	01:55:57.47	-51:36:32.00	2.28	1.89	1.73	0	0
ECHOCALIB_81	04:16:01.59	-51:29:11.90	3.68	3.47	3.51	0	0
ECHOCALIB_82	07:27:25.47	-51:24:09.40	5.51	5.15	5.04	0	0
ECHOCALIB_83	21:36:41.24	-50:50:43.40	5.52	5.14	4.97	0	0
ECHOCALIB_84	02:42:33.47	-50:48:01.10	4.75	4.32	4.14	0	0
ECHOCALIB_85	20:21:41.04	-49:59:57.90	5.24	4.98	4.88	0	0
ECHOCALIB_86	17:40:23.83	-49:24:56.10	4.02	3.70	3.83	0	0
ECHOCALIB_87	05:02:48.69	-49:09:05.10	4.84	4.51	4.39	0	0
ECHOCALIB_88	00:36:37.98	-49:07:56.40	5.66	5.40	5.30	0	0
ECHOCALIB_89	12:26:48.14	-48:54:47.50	5.25	4.82	4.71	0	0
ECHOCALIB_90	14:58:08.80	-48:51:46.80	5.12	4.82	4.61	0	0
ECHOCALIB_91	22:53:37.93	-48:35:53.80	5.01	4.69	4.61	0	0
ECHOCALIB_92	15:21:48.15	-48:19:03.50	4.31	3.90	4.16	0	0
ECHOCALIB_93	15:22:08.27	-47:55:40.10	3.89	3.57	3.62	0	0
ECHOCALIB_94	16:48:59.37	-47:43:07.60	5.82	5.39	5.21	0	0
ECHOCALIB_95	21:48:15.75	-47:18:13.00	4.72	4.31	4.24	0	0
ECHOCALIB_96	07:12:33.63	-46:45:33.50	3.50	3.30	3.32	0	0
ECHOCALIB_97	06:49:54.62	-46:36:52.40	4.25	3.89	3.98	0	0
ECHOCALIB_98	00:09:24.64	-45:44:50.70	2.19	1.76	1.62	0	0
ECHOCALIB_99	03:15:06.39	-45:39:53.40	5.64	5.36	5.27	0	0
ECHOCALIB_100	01:15:11.12	-45:31:54.00	4.09	3.72	3.78	0	0
ECHOCALIB_101	16:06:29.44	-45:10:23.50	4.52	4.28	4.27	0	0
ECHOCALIB_102	06:04:28.44	-45:02:11.80	5.41	5.15	5.04	0	0
ECHOCALIB_103	21:27:01.33	-44:48:30.80	5.97	5.55	5.41	0	0
ECHOCALIB_104	15:41:11.38	-44:39:40.30	4.02	3.73	3.80	0	0
ECHOCALIB_105	12:54:58.51	-44:09:07.10	4.83	4.59	4.48	0	0
ECHOCALIB_106	20:57:40.07	-44:07:45.70	5.45	5.15	5.02	0	0
ECHOCALIB_107	20:48:29.14	-43:59:18.80	4.37	4.09	4.20	0	0
ECHOCALIB_108	07:03:58.92	-43:36:40.80	5.46	5.08	4.94	0	0
ECHOCALIB_109	07:03:57.32	-43:36:28.90	4.41	3.99	4.04	0	0
ECHOCALIB_110	21:18:27.27	-43:20:04.70	5.63	5.32	5.26	0	0
ECHOCALIB_111	03:19:55.65	-43:04:11.20	3.03	2.71	2.64	0	0
ECHOCALIB_112	23:09:57.36	-42:51:40.70	4.91	4.70	4.58	0	0
ECHOCALIB_113	23:09:57.38	-42:51:40.10	4.91	4.70	4.58	0	0
ECHOCALIB_114	08:44:44.97	-42:38:04.40	5.82	5.46	5.35	0	0
ECHOCALIB_115	12:03:39.57	-42:26:02.60	4.28	4.03	4.09	0	0
ECHOCALIB_116	04:40:33.71	-41:51:49.50	3.94	3.65	3.72	0	0



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ECHOCALIB_117	22:14:38.65	-41:22:54.00	5.09	4.83	4.66	0	0
ECHOCALIB_118	23:18:09.89	-40:49:27.70	4.93	4.64	4.47	0	0
ECHOCALIB_119	11:46:31.07	-40:30:01.30	3.93	3.49	3.49	0	0
ECHOCALIB_120	12:53:26.20	-40:10:43.90	3.91	3.68	3.71	0	0
ECHOCALIB_121	08:37:19.99	-40:08:51.60	5.46	5.21	5.10	0	0
ECHOCALIB_122	03:23:35.26	-40:04:35.00	5.33	4.95	4.77	0	0
ECHOCALIB_123	16:24:01.29	-39:11:34.70	4.41	4.03	3.93	0	0
ECHOCALIB_124	17:15:35.94	-38:35:38.10	4.91	4.64	4.55	0	0
ECHOCALIB_125	17:15:35.96	-38:35:38.00	4.91	4.64	4.55	0	0
ECHOCALIB_126	03:44:09.17	-38:16:54.40	5.46	5.09	4.93	0	0
ECHOCALIB_127	17:37:51.21	-37:51:41.00	5.36	5.12	4.87	0	0
ECHOCALIB_128	17:37:51.24	-37:51:41.00	5.36	5.12	4.87	0	0
ECHOCALIB_129	13:12:03.19	-37:48:10.90	3.69	3.35	3.30	0	0
ECHOCALIB_130	11:54:25.80	-37:44:56.20	5.41	5.21	5.09	0	0
ECHOCALIB_131	11:54:25.81	-37:44:56.20	5.41	5.21	5.09	0	0
ECHOCALIB_132	09:15:45.08	-37:24:47.30	3.86	3.59	3.56	0	0
ECHOCALIB_133	16:42:46.65	-37:20:33.10	5.80	5.42	5.32	0	0
ECHOCALIB_134	07:30:42.51	-37:20:21.70	5.53	5.25	5.10	0	0
ECHOCALIB_135	04:42:03.48	-37:08:39.50	4.71	4.28	4.09	0	0
ECHOCALIB_136	19:06:25.21	-37:03:48.70	3.17	2.89	2.85	0	0
ECHOCALIB_137	19:06:25.11	-37:03:48.40	3.17	2.89	2.85	0	0
ECHOCALIB_138	07:58:37.69	-37:01:13.90	5.20	4.82	4.51	0	0
ECHOCALIB_139	02:44:12.98	-36:18:26.70	5.79	5.42	5.30	0	0
ECHOCALIB_140	18:06:23.72	-36:01:11.20	4.84	4.61	4.47	0	0
ECHOCALIB_141	08:16:12.58	-35:52:55.80	5.74	5.36	5.18	0	0
ECHOCALIB_142	10:09:31.77	-35:51:24.40	5.13	4.70	4.61	0	0
ECHOCALIB_143	13:48:55.07	-35:42:15.00	5.55	5.29	5.22	0	0
ECHOCALIB_144	06:57:17.58	-35:30:25.90	5.38	5.17	5.09	0	0
ECHOCALIB_145	06:57:17.60	-35:30:25.60	5.38	5.17	5.09	0	0
ECHOCALIB_146	11:48:03.88	-35:13:31.10	5.71	5.30	5.20	0	0
ECHOCALIB_147	00:11:44.01	-35:07:59.20	4.41	4.16	4.13	0	0
ECHOCALIB_148	19:21:29.76	-34:59:00.60	5.32	5.05	4.93	0	0
ECHOCALIB_149	23:03:29.82	-34:44:57.90	4.83	4.52	4.35	0	0
ECHOCALIB_150	07:52:15.36	-34:42:19.70	4.17	3.78	3.84	0	0
ECHOCALIB_151	07:52:15.66	-34:42:19.60	4.17	3.78	3.84	0	0
ECHOCALIB_152	02:36:58.61	-34:34:40.70	4.60	4.18	4.25	0	0
ECHOCALIB_153	13:41:04.17	-34:27:51.00	5.45	5.14	4.93	0	0
ECHOCALIB_154	20:59:29.14	-33:36:59.80	5.83	5.39	5.28	0	0
ECHOCALIB_155	13:45:41.25	-33:02:37.40	3.59	3.35	3.41	0	0
ECHOCALIB_156	10:13:24.73	-33:01:54.20	5.33	5.06	4.95	0	0
ECHOCALIB_157	22:10:08.78	-32:32:54.30	3.93	3.64	3.70	0	0
ECHOCALIB_158	20:27:44.25	-30:52:04.20	5.36	5.07	4.91	0	0
ECHOCALIB_159	11:47:15.81	-30:17:11.40	5.22	4.93	4.80	0	0
ECHOCALIB_160	11:07:54.43	-30:10:28.40	5.40	5.11	4.99	0	0
ECHOCALIB_161	01:35:01.01	-29:54:37.20	5.34	4.97	4.69	0	0
ECHOCALIB_162	10:23:55.28	-29:38:43.90	5.68	5.38	5.24	0	0
ECHOCALIB_163	20:43:16.00	-29:25:26.10	5.71	5.38	5.31	0	0
ECHOCALIB_164	08:07:00.52	-29:24:10.60	5.70	5.37	5.32	0	0
ECHOCALIB_165	11:41:08.40	-29:11:46.60	5.31	5.08	4.93	0	0
ECHOCALIB_166	03:12:04.53	-28:59:15.40	2.57	2.32	2.24	0	0
ECHOCALIB_167	03:12:04.21	-28:59:13.00	2.57	2.32	2.24	0	0
ECHOCALIB_168	06:24:43.88	-28:46:48.40	5.22	4.96	4.87	0	0
ECHOCALIB_169	05:37:44.62	-28:41:22.90	4.57	4.16	4.18	0	0
ECHOCALIB_170	17:04:27.85	-28:34:57.60	5.22	4.95	4.76	0	0
ECHOCALIB_171	06:53:33.94	-28:32:23.30	4.80	4.57	4.33	0	0
ECHOCALIB_172	18:37:03.28	-28:30:47.00	5.11	4.67	4.65	0	0
ECHOCALIB_173	02:10:41.66	-28:13:09.30	5.36	4.92	4.73	0	0
ECHOCALIB_174	08:59:42.72	-27:48:58.70	5.70	5.38	5.26	0	0
ECHOCALIB_175	11:57:56.21	-27:42:25.40	4.99	4.62	4.53	0	0
ECHOCALIB_176	04:05:37.44	-27:39:06.50	5.26	4.85	4.72	0	0



ECHOCALIB_177	06:44:51.95	-27:20:30.00	5.40	5.13	5.05	0	0
ECHOCALIB_178	21:39:10.15	-27:18:23.70	5.70	5.39	5.32	0	0
ECHOCALIB_179	11:05:19.91	-27:17:37.00	4.34	4.08	4.09	0	0
ECHOCALIB_180	21:19:45.62	-26:21:10.40	5.11	4.72	4.57	0	0
ECHOCALIB_181	21:19:45.51	-26:21:10.20	5.11	4.72	4.57	0	0
ECHOCALIB_182	19:55:50.36	-26:17:58.20	3.35	2.96	2.89	0	0
ECHOCALIB_183	20:56:47.33	-26:17:47.00	5.08	4.73	4.47	0	0
ECHOCALIB_184	11:12:01.19	-26:08:12.00	5.70	5.34	5.22	0	0
ECHOCALIB_185	07:01:13.74	-25:56:55.40	5.15	4.84	4.64	0	0
ECHOCALIB_186	02:18:58.51	-25:56:44.50	5.06	4.69	4.55	0	0
ECHOCALIB_187	11:27:37.64	-25:51:39.10	5.01	4.71	4.30	0	0
ECHOCALIB_188	09:08:36.61	-25:50:21.90	5.67	5.38	5.28	0	0
ECHOCALIB_189	14:19:00.89	-25:48:55.50	4.96	4.72	4.51	0	0
ECHOCALIB_190	20:46:05.74	-25:16:15.20	3.36	3.10	3.09	0	0
ECHOCALIB_191	03:56:28.67	-25:10:52.80	5.54	5.10	4.99	0	0
ECHOCALIB_192	02:57:14.71	-24:58:10.20	5.81	5.39	5.26	0	0
ECHOCALIB_193	02:57:14.68	-24:58:09.30	5.81	5.39	5.26	0	0
ECHOCALIB_194	01:33:15.81	-24:10:40.70	5.69	5.27	5.16	0	0
ECHOCALIB_195	17:18:07.13	-24:04:22.90	5.46	5.20	5.10	0	0
ECHOCALIB_196	09:42:14.42	-23:54:56.10	4.08	3.73	3.72	0	0
ECHOCALIB_197	06:13:45.30	-23:51:43.00	5.13	4.86	4.73	0	0
ECHOCALIB_198	02:22:32.55	-23:48:58.80	4.14	3.71	3.74	0	0
ECHOCALIB_199	03:46:50.89	-23:14:59.00	3.61	3.39	3.35	0	0
ECHOCALIB_200	00:49:26.77	-23:12:44.90	5.81	5.43	5.30	0	0
ECHOCALIB_201	03:53:59.46	-23:08:13.50	5.14	4.75	4.55	0	0
ECHOCALIB_202	07:34:03.18	-22:17:45.80	3.70	3.32	3.36	0	0
ECHOCALIB_203	17:43:25.80	-21:40:59.50	4.08	3.79	3.88	0	0
ECHOCALIB_204	16:13:40.34	-21:23:59.90	5.52	5.22	5.12	0	0
ECHOCALIB_205	17:21:00.37	-21:06:46.60	3.36	3.14	3.07	0	0
ECHOCALIB_206	22:34:41.64	-20:42:29.60	4.53	4.27	4.33	0	0
ECHOCALIB_207	10:53:04.55	-20:37:41.40	5.85	5.53	5.45	0	0
ECHOCALIB_208	13:03:46.12	-20:35:00.60	4.26	3.94	4.27	0	0
ECHOCALIB_209	13:03:46.07	-20:35:00.00	4.26	3.94	4.27	0	0
ECHOCALIB_210	10:53:29.53	-20:08:19.40	4.37	4.05	4.18	0	0
ECHOCALIB_211	18:31:18.96	-18:54:31.70	5.29	4.87	4.70	0	0
ECHOCALIB_212	02:45:06.19	-18:34:21.20	3.49	3.24	3.25	0	0
ECHOCALIB_213	13:18:24.32	-18:18:40.30	3.33	2.97	2.96	0	0
ECHOCALIB_214	05:18:50.47	-18:07:48.20	5.18	4.75	4.55	0	0
ECHOCALIB_215	20:28:51.59	-17:48:50.50	3.96	3.71	3.71	0	0
ECHOCALIB_216	20:28:51.61	-17:48:49.30	3.96	3.71	3.71	0	0
ECHOCALIB_217	04:47:36.29	-16:56:04.00	4.47	4.12	4.00	0	0
ECHOCALIB_218	21:40:05.46	-16:39:44.30	3.29	3.07	3.07	0	0
ECHOCALIB_219	16:00:19.59	-16:32:00.10	4.95	4.52	4.25	0	0
ECHOCALIB_220	07:19:28.18	-16:23:42.90	5.03	4.80	4.72	0	0
ECHOCALIB_221	12:32:04.23	-16:11:45.60	3.61	3.37	3.37	0	0
ECHOCALIB_222	14:50:41.18	-15:59:50.10	4.47	4.27	4.30	0	0
ECHOCALIB_223	01:44:04.08	-15:56:14.90	2.15	1.80	1.79	0	0
ECHOCALIB_224	22:14:38.22	-15:49:06.70	5.00	4.63	4.34	0	0
ECHOCALIB_225	19:43:33.53	-15:28:12.40	4.63	4.20	4.37	0	0
ECHOCALIB_226	00:11:15.86	-15:28:04.70	4.15	3.80	3.82	0	0
ECHOCALIB_227	19:37:34.42	-14:18:06.50	4.80	4.42	4.26	0	0
ECHOCALIB_228	07:51:46.30	-13:53:52.90	4.11	3.69	3.73	0	0
ECHOCALIB_229	07:51:46.27	-13:53:52.50	4.11	3.69	3.73	0	0
ECHOCALIB_230	03:07:18.58	-13:45:42.40	5.80	5.45	5.40	0	0
ECHOCALIB_231	21:53:17.77	-13:33:06.40	4.30	4.06	4.18	0	0
ECHOCALIB_232	00:17:58.87	-13:27:20.30	5.38	5.07	4.99	0	0
ECHOCALIB_233	12:30:04.78	-13:23:35.50	5.24	4.93	4.83	0	0
ECHOCALIB_234	12:30:04.72	-13:23:33.60	5.24	4.93	4.83	0	0
ECHOCALIB_235	00:45:28.69	-12:52:50.90	4.99	4.77	4.62	0	0
ECHOCALIB_236	20:12:25.87	-12:37:03.00	4.97	4.75	4.63	0	0

ECHOCALIB_237	05:07:24.96	-12:29:28.60	4.88	4.66	4.52	0	0
ECHOCALIB_238	10:36:32.38	-12:13:48.40	4.90	4.48	4.34	0	0
ECHOCALIB_239	00:22:51.79	-12:12:34.00	5.25	5.03	4.86	0	0
ECHOCALIB_240	04:38:53.56	-12:07:23.30	5.31	4.88	4.76	0	0
ECHOCALIB_241	02:39:33.84	-11:52:19.80	4.04	3.74	3.77	0	0
ECHOCALIB_242	02:39:33.83	-11:52:19.70	4.04	3.74	3.77	0	0
ECHOCALIB_243	12:09:28.54	-11:51:25.40	5.65	5.38	5.27	0	0
ECHOCALIB_244	12:46:30.84	-11:48:44.80	5.74	5.41	5.32	0	0
ECHOCALIB_245	20:53:05.60	-11:34:25.20	5.20	4.90	4.80	0	0
ECHOCALIB_246	16:04:22.20	-11:22:22.30	3.15	2.83	2.88	0	0
ECHOCALIB_247	01:49:23.36	-10:42:12.80	5.54	5.29	5.15	0	0
ECHOCALIB_248	00:50:07.59	-10:38:39.60	4.41	4.01	4.01	0	0
ECHOCALIB_249	01:57:09.61	-10:14:32.70	5.02	4.64	4.49	0	0
ECHOCALIB_250	19:59:47.35	-09:57:29.60	4.84	4.57	4.43	0	0
ECHOCALIB_251	20:32:23.70	-09:51:12.20	4.31	3.91	4.00	0	0
ECHOCALIB_252	03:43:14.90	-09:45:48.20	2.06	1.73	1.62	0	0
ECHOCALIB_253	18:20:03.93	-09:35:44.60	5.64	5.32	5.21	0	0
ECHOCALIB_254	03:32:55.84	-09:27:29.70	2.23	1.88	1.78	0	0
ECHOCALIB_255	02:40:12.42	-09:27:10.40	4.91	4.66	4.53	0	0
ECHOCALIB_256	15:28:12.21	-09:21:28.30	5.99	5.55	5.46	0	0
ECHOCALIB_257	15:28:09.61	-09:20:53.10	5.44	5.05	4.89	0	0
ECHOCALIB_258	00:18:41.87	-08:03:10.80	5.33	5.04	4.90	0	0
ECHOCALIB_259	01:14:24.04	-07:55:22.20	4.40	4.02	4.06	0	0
ECHOCALIB_260	04:09:40.89	-07:53:34.30	5.73	5.34	5.23	0	0
ECHOCALIB_261	03:23:17.70	-07:47:38.80	4.91	4.58	4.42	0	0
ECHOCALIB_262	04:15:16.32	-07:39:10.30	3.01	2.59	2.50	0	0
ECHOCALIB_263	22:09:29.87	-07:32:55.20	5.28	4.96	4.80	0	0
ECHOCALIB_264	14:18:00.73	-07:32:32.60	5.29	4.95	4.83	0	0
ECHOCALIB_265	01:33:42.84	-07:01:31.20	4.63	4.39	4.26	0	0
ECHOCALIB_266	08:37:50.29	-06:48:24.80	5.63	5.32	5.22	0	0
ECHOCALIB_267	22:31:18.31	-06:33:18.60	5.12	4.85	4.70	0	0
ECHOCALIB_268	09:27:46.81	-06:04:16.90	3.98	3.59	3.57	0	0
ECHOCALIB_269	09:27:46.78	-06:04:16.30	3.98	3.59	3.57	0	0
ECHOCALIB_270	14:16:00.87	-06:00:02.00	3.14	2.91	2.80	0	0
ECHOCALIB_271	04:48:36.38	-05:40:26.60	4.98	4.57	4.31	0	0
ECHOCALIB_272	14:43:03.62	-05:39:29.50	3.34	3.07	3.04	0	0
ECHOCALIB_273	08:54:17.95	-05:26:04.10	4.87	4.62	4.46	0	0
ECHOCALIB_274	11:18:22.01	-05:04:02.30	5.91	5.57	5.46	0	0
ECHOCALIB_275	16:18:19.29	-04:41:33.00	1.62	1.18	1.15	0	0
ECHOCALIB_276	05:58:21.54	-04:39:02.40	5.66	5.27	5.17	0	0
ECHOCALIB_277	05:08:43.70	-04:27:22.40	4.33	3.92	3.93	0	0
ECHOCALIB_278	14:57:11.00	-04:20:47.30	4.12	3.82	3.91	0	0
ECHOCALIB_279	23:31:31.50	-04:05:14.70	5.49	5.26	5.15	0	0
ECHOCALIB_280	08:24:35.02	-03:45:04.50	4.80	4.58	4.42	0	0
ECHOCALIB_281	18:00:29.01	-03:41:25.00	3.93	3.66	3.64	0	0
ECHOCALIB_282	07:39:59.33	-03:35:51.00	5.49	5.06	4.89	0	0
ECHOCALIB_283	00:35:14.88	-03:35:34.30	4.35	3.96	3.90	0	0
ECHOCALIB_284	02:35:19.93	-03:33:38.20	5.68	5.35	5.27	0	0
ECHOCALIB_285	12:53:11.16	-03:33:11.20	5.30	5.08	4.99	0	0
ECHOCALIB_286	14:12:45.24	-03:19:12.30	5.74	5.38	5.30	0	0
ECHOCALIB_287	03:40:22.06	-03:13:01.10	5.59	5.30	5.18	0	0
ECHOCALIB_288	03:19:01.89	-02:50:35.50	5.88	5.55	5.47	0	0
ECHOCALIB_289	09:29:08.90	-02:46:08.30	3.91	3.58	3.56	0	0
ECHOCALIB_290	09:29:09.22	-02:45:02.70	5.69	5.30	5.14	0	0
ECHOCALIB_291	03:40:47.43	-02:19:57.70	5.30	4.87	4.65	0	0
ECHOCALIB_292	16:36:21.45	-02:19:28.50	4.45	4.05	4.04	0	0
ECHOCALIB_293	13:31:39.94	-02:19:02.60	5.86	5.44	5.31	0	0
ECHOCALIB_294	13:12:43.78	-02:15:54.10	6.03	5.62	5.47	0	0
ECHOCALIB_295	14:28:12.14	-02:13:40.70	3.54	3.12	3.07	0	0
ECHOCALIB_296	18:29:52.41	-01:49:05.20	6.07	5.64	5.48	0	0

ECHOCALIB_297	15:13:50.90	-01:21:05.00	5.29	4.99	4.77	0	0
ECHOCALIB_298	03:12:46.44	-01:11:46.00	4.17	3.77	3.75	0	0
ECHOCALIB_299	08:20:13.00	000:54:33.50	5.10	4.87	4.74	0	0
ECHOCALIB_300	08:34:31.65	000:43:33.80	5.92	5.55	5.42	0	0
ECHOCALIB_301	02:07:34.27	000:37:02.70	5.76	5.47	5.39	0	0
ECHOCALIB_302	04:02:36.74	000:16:08.10	4.71	4.34	4.18	0	0
ECHOCALIB_303	16:52:58.80	000:01:35.10	5.24	4.94	4.84	0	0
ECHOCALIB_304	03:36:52.38	000:24:06.00	3.19	2.92	2.84	0	0
ECHOCALIB_305	16:22:04.35	001:01:44.50	4.29	4.09	4.09	0	0
ECHOCALIB_306	14:23:15.29	001:14:29.70	5.05	4.81	4.64	0	0
ECHOCALIB_307	11:50:41.72	001:45:53.00	2.60	2.36	2.27	0	0
ECHOCALIB_308	13:23:39.16	002:43:24.00	5.61	5.22	5.10	0	0
ECHOCALIB_309	13:23:40.84	002:43:31.00	5.77	5.36	5.23	0	0
ECHOCALIB_310	11:26:46.28	003:00:22.80	5.85	5.40	5.26	0	0
ECHOCALIB_311	11:26:45.32	003:00:47.20	5.16	4.94	4.75	0	0
ECHOCALIB_312	03:19:21.70	003:22:12.70	3.41	3.04	2.96	0	0
ECHOCALIB_313	17:39:16.92	003:33:18.90	4.70	4.40	4.10	0	0
ECHOCALIB_314	22:26:37.38	004:23:37.60	5.02	4.62	4.49	0	0
ECHOCALIB_315	18:05:37.46	004:39:25.80	5.66	5.35	5.25	0	0
ECHOCALIB_316	17:57:48.50	004:41:36.20	5.24	4.83	4.52	0	0
ECHOCALIB_317	13:08:51.02	005:12:26.10	5.61	5.31	5.20	0	0
ECHOCALIB_318	23:39:57.04	005:37:34.70	3.30	2.99	2.95	0	0
ECHOCALIB_319	09:29:54.83	005:39:18.50	5.43	5.00	4.79	0	0
ECHOCALIB_320	19:55:18.79	006:24:24.40	2.29	1.92	1.71	0	0
ECHOCALIB_321	08:35:51.27	006:37:22.00	5.88	5.61	5.50	0	0
ECHOCALIB_322	06:12:00.57	006:46:59.10	5.70	5.39	5.30	0	0
ECHOCALIB_323	04:49:50.41	006:57:40.60	1.98	1.76	1.60	0	0
ECHOCALIB_324	15:46:26.61	007:21:11.10	3.43	3.07	2.99	0	0
ECHOCALIB_325	10:56:30.80	007:23:18.50	5.74	5.35	5.20	0	0
ECHOCALIB_326	12:05:12.54	008:43:58.80	2.54	2.13	2.01	0	0
ECHOCALIB_327	19:50:47.00	008:52:06.00	0.31	0.10	0.10	0	0
ECHOCALIB_328	13:16:46.52	009:25:27.00	4.39	4.11	4.03	0	0
ECHOCALIB_329	05:07:38.31	009:28:18.40	4.99	4.74	4.61	0	0
ECHOCALIB_330	22:52:24.08	009:50:08.40	4.23	3.89	3.92	0	0
ECHOCALIB_331	21:14:28.81	010:00:25.10	3.74	3.41	3.38	0	0
ECHOCALIB_332	21:14:28.81	010:00:25.20	3.74	3.41	3.38	0	0
ECHOCALIB_333	02:44:56.54	010:06:50.90	3.66	3.44	3.46	0	0
ECHOCALIB_334	08:14:31.97	010:11:17.90	5.64	5.22	5.11	0	0
ECHOCALIB_335	19:51:01.64	010:24:56.60	4.23	3.86	3.90	0	0
ECHOCALIB_336	11:23:55.54	010:31:45.40	3.08	2.84	2.79	0	0
ECHOCALIB_337	11:23:55.45	010:31:46.20	3.08	2.84	2.79	0	0
ECHOCALIB_338	06:13:12.50	010:37:37.70	5.25	5.01	4.85	0	0
ECHOCALIB_339	08:39:50.79	011:31:21.60	5.99	5.56	5.44	0	0
ECHOCALIB_340	19:24:58.20	011:56:39.90	3.55	3.33	3.04	0	0
ECHOCALIB_341	22:46:41.58	012:10:22.40	3.36	3.08	2.96	0	0
ECHOCALIB_342	22:28:07.34	012:14:54.50	5.48	5.04	4.94	0	0
ECHOCALIB_343	22:28:07.36	012:14:55.40	5.48	5.04	4.94	0	0
ECHOCALIB_344	06:16:26.62	012:16:19.80	4.47	4.20	4.24	0	0
ECHOCALIB_345	05:28:51.63	012:33:03.00	5.61	5.37	5.33	0	0
ECHOCALIB_346	14:19:16.28	013:00:15.50	4.74	4.54	4.39	0	0
ECHOCALIB_347	15:53:12.10	013:11:47.80	5.10	4.66	4.53	0	0
ECHOCALIB_348	15:08:53.51	013:14:06.90	4.46	4.01	3.89	0	0
ECHOCALIB_349	16:13:18.45	013:31:36.90	5.59	5.24	5.17	0	0
ECHOCALIB_350	16:13:18.42	013:31:41.00	5.60	5.27	5.23	0	0
ECHOCALIB_351	13:28:25.81	013:46:43.60	3.80	3.46	3.50	0	0
ECHOCALIB_352	05:56:03.43	013:55:29.70	5.37	5.10	5.04	0	0
ECHOCALIB_353	11:31:44.95	014:21:52.20	5.18	4.96	4.90	0	0
ECHOCALIB_354	05:00:33.80	014:23:01.70	5.51	5.24	5.16	0	0
ECHOCALIB_355	20:22:52.37	014:33:04.00	5.23	4.98	4.90	0	0
ECHOCALIB_356	13:45:43.78	014:53:29.50	5.18	4.78	4.41	0	0

ECHOCALIB_357	14:02:56.87	014:58:31.20	5.72	5.35	5.25	0	0
ECHOCALIB_358	09:12:17.55	014:59:45.70	5.12	4.77	4.66	0	0
ECHOCALIB_359	10:22:43.80	015:20:39.90	5.89	5.55	5.47	0	0
ECHOCALIB_360	06:06:40.48	015:32:31.60	5.32	4.94	4.82	0	0
ECHOCALIB_361	20:02:34.15	015:35:31.50	5.76	5.41	5.32	0	0
ECHOCALIB_362	15:56:27.18	015:39:41.80	3.15	2.88	2.70	0	0
ECHOCALIB_363	20:11:06.07	016:11:16.80	5.83	5.42	5.35	0	0
ECHOCALIB_364	03:54:28.03	016:36:57.80	5.38	5.10	4.99	0	0
ECHOCALIB_365	19:07:57.32	016:51:12.20	4.81	4.56	4.43	0	0
ECHOCALIB_366	00:48:58.71	016:56:26.30	4.43	4.15	4.18	0	0
ECHOCALIB_367	14:45:14.46	016:57:51.40	2.87	2.49	2.33	0	0
ECHOCALIB_368	13:16:51.05	017:01:01.90	4.90	4.58	4.38	0	0
ECHOCALIB_369	20:04:06.23	017:04:12.60	4.69	4.43	4.39	0	0
ECHOCALIB_370	05:24:25.46	017:23:00.70	4.43	4.03	4.04	0	0
ECHOCALIB_371	08:12:12.81	017:38:51.60	3.11	2.88	3.76	0	0
ECHOCALIB_372	08:12:12.73	017:38:52.00	3.11	2.88	3.76	0	0
ECHOCALIB_373	08:12:13.18	017:38:54.00	3.11	2.88	3.76	0	0
ECHOCALIB_374	13:54:41.08	018:23:51.80	1.79	1.53	1.49	0	0
ECHOCALIB_375	16:28:52.79	018:24:49.50	5.39	4.97	4.90	0	0
ECHOCALIB_376	16:28:52.67	018:24:50.60	5.39	4.97	4.90	0	0
ECHOCALIB_377	05:07:27.01	018:38:42.20	3.62	3.35	3.21	0	0
ECHOCALIB_378	14:51:23.38	019:06:01.70	2.66	2.25	1.97	0	0
ECHOCALIB_379	14:51:23.05	019:06:06.80	2.66	2.25	1.97	0	0
ECHOCALIB_380	07:54:54.07	019:14:10.80	6.04	5.60	5.45	0	0
ECHOCALIB_381	15:12:43.48	019:17:09.70	5.40	5.09	5.03	0	0
ECHOCALIB_382	05:54:22.98	020:16:34.20	3.43	3.19	3.00	0	0
ECHOCALIB_383	18:45:39.73	020:32:46.70	3.53	3.29	3.19	0	0
ECHOCALIB_384	22:57:27.98	020:46:07.80	4.66	4.23	3.91	0	0
ECHOCALIB_385	23:03:04.97	020:55:06.90	5.49	5.23	5.15	0	0
ECHOCALIB_386	16:20:04.28	021:07:57.40	4.27	3.83	3.75	0	0
ECHOCALIB_387	10:14:29.75	021:10:05.00	5.22	4.82	4.70	0	0
ECHOCALIB_388	02:12:48.09	021:12:39.60	4.73	4.41	4.12	0	0
ECHOCALIB_389	19:33:25.55	021:50:25.20	5.57	5.25	5.17	0	0
ECHOCALIB_390	04:05:20.26	022:00:32.10	4.91	4.50	4.38	0	0
ECHOCALIB_391	10:17:14.54	023:06:22.40	4.99	4.70	4.51	0	0
ECHOCALIB_392	14:50:15.81	023:54:42.60	5.00	4.69	4.46	0	0
ECHOCALIB_393	17:57:14.33	023:59:45.20	5.11	4.87	4.74	0	0
ECHOCALIB_394	12:48:47.05	024:50:24.80	5.12	4.70	4.64	0	0
ECHOCALIB_395	15:07:18.07	024:52:09.10	4.25	4.01	3.86	0	0
ECHOCALIB_396	14:10:23.93	025:05:30.00	3.92	3.66	3.65	0	0
ECHOCALIB_397	16:04:03.71	025:15:17.40	5.63	5.29	5.17	0	0
ECHOCALIB_398	22:07:00.67	025:20:42.40	2.95	2.73	2.56	0	0
ECHOCALIB_399	06:55:18.67	025:22:32.50	4.91	4.51	4.29	0	0
ECHOCALIB_400	21:15:57.17	025:26:01.80	5.29	4.86	4.74	0	0
ECHOCALIB_401	19:05:20.77	025:55:14.40	5.37	4.95	4.81	0	0
ECHOCALIB_402	18:02:30.86	026:18:46.80	5.55	5.20	5.11	0	0
ECHOCALIB_403	03:02:26.03	026:36:33.30	5.34	5.02	4.95	0	0
ECHOCALIB_404	02:55:39.06	026:52:23.60	5.95	5.55	5.43	0	0
ECHOCALIB_405	09:32:43.76	026:59:18.70	5.58	5.24	5.12	0	0
ECHOCALIB_406	20:52:07.68	027:05:49.10	3.33	2.93	2.72	0	0
ECHOCALIB_407	17:46:27.52	027:43:14.40	1.87	1.56	1.51	0	0
ECHOCALIB_408	13:11:52.39	027:52:41.50	3.23	2.99	2.92	0	0
ECHOCALIB_409	08:00:32.13	029:12:44.50	5.54	5.17	5.09	0	0
ECHOCALIB_410	07:03:30.46	029:20:13.50	4.89	4.61	4.54	0	0
ECHOCALIB_411	01:53:04.91	029:34:43.80	2.41	2.18	2.27	0	0
ECHOCALIB_412	20:03:37.41	029:53:48.50	4.55	4.24	4.08	0	0
ECHOCALIB_413	02:28:48.50	029:55:54.30	4.94	4.72	4.48	0	0
ECHOCALIB_414	18:58:51.01	030:10:50.30	5.62	5.39	5.30	0	0
ECHOCALIB_415	15:23:12.31	030:17:16.10	4.05	3.70	3.71	0	0
ECHOCALIB_416	15:23:12.38	030:17:16.80	4.05	3.70	3.71	0	0

ECHOCALIB_417	18:07:01.54	030:33:43.70	3.46	3.24	3.11	0	0
ECHOCALIB_418	18:07:01.59	030:33:44.00	3.46	3.24	3.11	0	0
ECHOCALIB_419	11:18:10.94	031:31:45.40	2.46	2.23	2.14	0	0
ECHOCALIB_420	16:41:17.16	031:36:09.80	1.50	1.19	1.28	0	0
ECHOCALIB_421	16:41:17.27	031:36:11.10	1.50	1.19	1.28	0	0
ECHOCALIB_422	19:29:21.45	031:36:31.20	5.66	5.41	5.30	0	0
ECHOCALIB_423	10:01:00.66	031:55:25.20	4.27	4.04	3.82	0	0
ECHOCALIB_424	08:11:38.64	032:27:25.70	5.48	5.15	5.09	0	0
ECHOCALIB_425	17:20:39.57	032:28:03.90	4.16	3.90	3.91	0	0
ECHOCALIB_426	01:48:41.56	032:41:24.80	4.83	4.47	4.34	0	0
ECHOCALIB_427	18:57:01.61	032:54:04.60	3.85	3.61	3.65	0	0
ECHOCALIB_428	18:57:01.58	032:54:05.20	3.85	3.61	3.65	0	0
ECHOCALIB_429	01:59:06.63	033:12:34.80	5.76	5.41	5.32	0	0
ECHOCALIB_430	12:33:47.41	033:23:04.80	4.26	3.86	3.81	0	0
ECHOCALIB_431	23:59:29.29	033:43:26.00	4.82	4.57	4.50	0	0
ECHOCALIB_432	09:08:51.07	033:52:56.00	4.84	4.60	4.55	0	0
ECHOCALIB_433	11:41:03.01	034:12:05.90	3.99	3.65	3.59	0	0
ECHOCALIB_434	02:17:03.23	034:13:27.20	3.53	3.29	3.08	0	0
ECHOCALIB_435	17:32:01.00	034:16:16.10	5.34	5.08	5.00	0	0
ECHOCALIB_436	10:07:25.76	035:14:40.90	4.27	4.05	4.00	0	0
ECHOCALIB_437	06:06:08.54	035:23:15.90	5.01	4.71	4.60	0	0
ECHOCALIB_438	09:35:39.50	035:48:36.50	4.06	3.72	3.69	0	0
ECHOCALIB_439	11:12:32.35	035:48:50.70	5.26	5.02	4.96	0	0
ECHOCALIB_440	22:11:11.92	036:15:22.80	5.84	5.49	5.39	0	0
ECHOCALIB_441	05:46:01.89	037:17:04.70	5.84	5.46	5.35	0	0
ECHOCALIB_442	19:19:38.99	037:19:49.90	5.03	4.75	4.68	0	0
ECHOCALIB_443	15:24:30.87	037:20:50.30	5.43	5.19	5.12	0	0
ECHOCALIB_444	11:52:58.77	037:43:07.20	4.94	4.50	4.37	0	0
ECHOCALIB_445	15:55:47.59	037:56:49.00	4.97	4.76	4.49	0	0
ECHOCALIB_446	04:08:36.62	038:02:23.00	4.79	4.51	4.28	0	0
ECHOCALIB_447	04:07:34.35	038:04:28.30	5.39	4.95	4.79	0	0
ECHOCALIB_448	20:38:40.19	038:38:06.30	5.54	5.28	5.23	0	0
ECHOCALIB_449	16:42:53.76	038:55:20.10	1.77	1.37	1.33	0	0
ECHOCALIB_450	16:04:56.79	039:09:23.40	5.18	4.82	4.76	0	0
ECHOCALIB_451	16:19:55.14	039:42:30.90	4.94	4.64	4.39	0	0
ECHOCALIB_452	05:19:08.47	040:05:56.60	3.40	3.15	3.04	0	0
ECHOCALIB_453	00:40:49.27	040:11:13.80	5.69	5.27	5.16	0	0
ECHOCALIB_454	02:42:14.92	040:11:38.20	4.21	3.97	3.88	0	0
ECHOCALIB_455	10:59:27.98	040:25:48.90	3.96	3.74	3.75	0	0
ECHOCALIB_456	10:22:10.56	041:13:46.30	4.86	4.53	4.45	0	0
ECHOCALIB_457	12:33:44.55	041:21:26.90	3.21	2.90	2.85	0	0
ECHOCALIB_458	01:36:47.84	041:24:19.70	3.17	2.96	2.86	0	0
ECHOCALIB_459	01:13:06.07	041:39:15.50	5.76	5.35	5.27	0	0
ECHOCALIB_460	14:29:36.81	041:47:45.30	5.11	4.85	4.74	0	0
ECHOCALIB_461	20:32:51.64	041:53:54.50	5.47	5.08	4.97	0	0
ECHOCALIB_462	01:10:18.74	042:04:53.30	4.93	4.49	4.46	0	0
ECHOCALIB_463	04:46:26.92	042:20:54.80	5.18	4.78	4.71	0	0
ECHOCALIB_464	01:41:47.14	042:36:48.10	4.00	3.70	3.58	0	0
ECHOCALIB_465	06:46:44.34	043:34:38.70	4.41	4.07	4.13	0	0
ECHOCALIB_466	16:10:24.31	043:49:03.50	5.16	4.80	4.71	0	0
ECHOCALIB_467	10:18:51.95	044:02:54.00	5.39	5.07	5.01	0	0
ECHOCALIB_468	23:21:36.51	044:05:52.40	5.94	5.57	5.47	0	0
ECHOCALIB_469	11:38:44.90	045:06:30.30	5.36	5.11	5.03	0	0
ECHOCALIB_470	18:15:32.46	045:12:33.50	5.12	4.84	4.76	0	0
ECHOCALIB_471	08:27:36.79	045:39:10.80	5.16	4.88	4.83	0	0
ECHOCALIB_472	04:51:43.56	045:50:03.00	5.80	5.50	5.44	0	0
ECHOCALIB_473	01:39:36.02	045:52:40.00	5.35	5.02	4.98	0	0
ECHOCALIB_474	05:16:41.36	045:59:52.80	-1.25	-1.57	-1.74	0	0
ECHOCALIB_475	09:48:35.37	046:01:15.60	3.96	3.72	3.61	0	0
ECHOCALIB_476	23:37:58.49	046:11:58.00	5.41	5.12	5.08	0	0

ECHOCALIB_477	17:02:36.41	047:04:54.80	5.41	5.10	5.00	0	0
ECHOCALIB_478	07:15:50.14	047:14:23.90	4.66	4.29	4.11	0	0
ECHOCALIB_479	16:57:53.18	047:22:00.10	6.01	5.56	5.46	0	0
ECHOCALIB_480	17:30:16.43	047:24:07.90	5.80	5.47	5.39	0	0
ECHOCALIB_481	15:03:47.30	047:39:14.60	3.42	3.12	3.01	0	0
ECHOCALIB_482	15:03:47.48	047:39:15.90	3.42	3.12	3.01	0	0
ECHOCALIB_483	10:28:03.88	048:47:05.60	5.20	4.89	4.87	0	0
ECHOCALIB_484	03:09:04.02	049:36:47.80	3.14	2.88	2.72	0	0
ECHOCALIB_485	14:56:23.04	049:37:42.40	4.68	4.46	4.41	0	0
ECHOCALIB_486	23:58:06.81	050:26:51.60	5.49	5.23	5.14	0	0
ECHOCALIB_487	19:41:51.97	050:31:03.10	4.99	4.70	4.65	0	0
ECHOCALIB_488	19:41:48.96	050:31:30.20	5.09	4.72	4.43	0	0
ECHOCALIB_489	14:16:09.93	051:22:02.00	4.64	4.32	4.29	0	0
ECHOCALIB_490	09:32:51.43	051:40:38.30	2.28	2.08	1.97	0	0
ECHOCALIB_491	12:44:14.55	051:45:33.50	5.32	4.90	4.78	0	0
ECHOCALIB_492	11:16:04.03	052:46:23.40	5.54	5.33	5.28	0	0
ECHOCALIB_493	18:51:34.94	052:58:30.40	4.27	3.83	3.61	0	0
ECHOCALIB_494	23:16:42.31	053:12:48.50	4.87	4.60	4.31	0	0
ECHOCALIB_495	05:41:20.34	053:28:51.80	4.30	3.99	4.27	0	0
ECHOCALIB_496	17:05:20.12	054:28:12.20	4.23	3.95	3.76	0	0
ECHOCALIB_497	17:05:20.20	054:28:14.30	4.23	3.95	3.76	0	0
ECHOCALIB_498	01:08:16.39	054:55:13.20	4.03	3.60	3.51	0	0
ECHOCALIB_499	10:30:37.58	055:58:49.90	4.03	3.76	3.64	0	0
ECHOCALIB_500	17:11:08.42	056:39:33.10	5.62	5.32	5.23	0	0
ECHOCALIB_501	13:13:37.01	056:42:29.80	5.68	5.40	5.33	0	0
ECHOCALIB_502	19:12:11.36	057:40:19.10	5.65	5.30	5.20	0	0
ECHOCALIB_503	19:31:07.98	058:35:09.60	5.02	4.61	4.46	0	0
ECHOCALIB_504	23:31:22.21	059:09:55.90	5.35	4.97	4.80	0	0
ECHOCALIB_505	00:56:39.91	059:10:51.80	3.12	2.68	2.47	0	0
ECHOCALIB_506	18:42:46.69	059:37:49.40	5.19	4.74	4.43	0	0
ECHOCALIB_507	03:56:11.52	059:38:30.80	5.23	4.91	4.80	0	0
ECHOCALIB_508	12:48:39.46	060:19:11.40	5.18	4.75	4.55	0	0
ECHOCALIB_509	00:53:04.20	061:07:26.30	3.94	3.68	3.64	0	0
ECHOCALIB_510	09:14:20.54	061:25:23.90	4.23	3.91	3.78	0	0
ECHOCALIB_511	02:55:56.92	061:31:16.10	4.85	4.58	4.46	0	0
ECHOCALIB_512	03:04:09.64	061:42:21.00	5.39	5.11	5.03	0	0
ECHOCALIB_513	20:45:17.37	061:50:19.60	1.91	1.50	1.39	0	0
ECHOCALIB_514	17:34:59.60	061:52:28.40	4.24	3.88	3.74	0	0
ECHOCALIB_515	17:34:59.52	061:52:29.90	4.24	3.88	3.74	0	0
ECHOCALIB_516	13:25:59.86	063:15:40.60	5.24	4.89	4.80	0	0
ECHOCALIB_517	17:02:15.75	064:36:02.70	4.26	3.85	3.89	0	0
ECHOCALIB_518	09:10:23.54	067:08:02.50	3.92	3.72	3.56	0	0
ECHOCALIB_519	09:10:23.51	067:08:06.60	3.92	3.72	3.56	0	0
ECHOCALIB_520	17:25:00.10	067:18:24.10	4.97	4.64	4.51	0	0
ECHOCALIB_521	15:14:38.34	067:20:48.20	4.22	3.98	3.87	0	0
ECHOCALIB_522	01:34:33.26	068:56:53.30	5.30	4.94	4.89	0	0
ECHOCALIB_523	04:09:35.04	069:32:29.00	5.99	5.54	5.46	0	0
ECHOCALIB_524	19:32:21.59	069:39:40.20	3.42	3.04	2.90	0	0
ECHOCALIB_525	08:10:20.47	069:43:30.30	5.40	5.11	5.07	0	0
ECHOCALIB_526	09:34:28.86	069:49:49.20	3.16	2.73	2.51	0	0
ECHOCALIB_527	07:47:30.58	070:12:24.00	5.77	5.43	5.35	0	0
ECHOCALIB_528	17:41:58.10	072:09:24.90	5.00	4.59	4.53	0	0
ECHOCALIB_529	18:21:03.38	072:43:58.20	2.59	2.37	2.22	0	0
ECHOCALIB_530	01:21:59.12	076:42:37.00	5.62	5.23	5.16	0	0
ECHOCALIB_531	23:51:57.63	077:35:57.70	5.75	5.52	5.48	0	0
ECHOCALIB_532	05:22:33.53	079:13:52.10	4.42	4.20	3.91	0	0
ECHOCALIB_533	06:46:14.15	079:33:53.30	4.51	4.26	4.14	0	0
ECHOCALIB_534	07:56:17.23	080:15:56.00	5.24	4.93	4.86	0	0
ECHOCALIB_535	14:29:22.30	080:48:35.50	5.43	5.01	4.92	0	0
ECHOCALIB_536	10:35:11.27	084:23:57.60	5.86	5.51	5.39	0	0

	<p>Exoplanet Characterisation Observatory</p>	<p>Doc Ref: ECHO-TN-0001-IAP Issue: 1 Date: 11-OCT-2013</p>
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