Supporting Online Material for

Direct Detection of the Asteroidal YORP Effect

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Methods

(i) Extraction of the rotational lightcurve from the imaging data, Phase-Angle Bisector (PAB) corrections, and the period-fitting analysis:

Many observatories from various countries contributed to the observing campaign of asteroid (54509) 2000 PH5 (hereafter PH5), including 0.7–2.5 m optical telescopes at Calar Alto Observatory (Spain), Ondřejov Observatory (Czech Republic) and the European Southern Observatory (Chile) among others. On occasions when the brightness of the asteroid fell below the detection limits of the above facilities, we secured access to the 3.5m telescope at Calar Alto, the 3.5m New Technology Telescope and the 8.2 m Very Large Telescope at ESO (Table S1). For each individual imaging data set, after normal corrections for instrumental artifacts were applied, the asteroid's rotational lightcurve was extracted from the images by carefully measuring the brightness of the asteroid in each frame and comparing it with the brightnesses of multiple field stars. By using photometric apertures that varied in size according to the atmospheric seeing during the image exposure ensured that we optimally corrected for varying seeing as each observing sequence progressed. The aperture radii were typically $1\times$FWHM (full width at half maximum) of the frame's point spread function (PSF). The PSF describes the radial brightness profile of all point sources within a given image, and reflects the atmospheric seeing at the time of the exposure. The relative magnitudes and associated light-time corrected Julian dates, along with the corresponding International Astronomical Union (IAU) observatory codes are listed (Table S2).

Of course, periodicities resulting from these data would not be corrected for the relative motion of the asteroid and Earth which can stretch or constrict the lightcurves depending on how the positions of the bodies change during each observing sequence. Furthermore, if a laser were held fixed on the surface of an asteroid, an observer would measure the synodic

period of the asteroid, but for lightcurve observations, Sun-asteroid-Earth geometry and the shape and scattering properties of the asteroid could potentially add complications causing the period measured from a lightcurve to differ from the synodic period. However in this case, with a spin-period of 12.17 minutes, the difference is insignificant.

The transformation from the synodic rotation period observed on Earth to the true sidereal rotation period requires the assumption that the same feature in the lightcurve occurs at the same rotational phase for all observing geometries. As the natural frame of reference for this is the scattering plane for sunlight reflected towards Earth, the rotational phase should be measured relative to the 'normal' reflection vector at the asteroid. This is half the Earth-asteroid-Sun angle (or phase angle) and hence the name given to the Phase-Angle-Bisector (PAB) method. To correct the observed rotational phase of a lightcurve point to the rotational phase relative to the PAB vector requires knowledge of both the rotation axis direction and the true sidereal rotation period. In the case where the rotation axis direction is known, it is then straightforward to calculate the shift in time of a lightcurve datum to account for when that point would be at the PAB by assuming a sidereal rotation period (normally the observed period in the first instance). Over one asteroid orbit the PAB vector will add or subtract a single extra rotation, and taking this into account the resulting lightcurve is then analysed to obtain a first estimate of the sidereal rotation period. This estimate can then be used again to re-calculate the time shifts in the lightcurve, and further iterations will allow a consistent sidereal period to be derived (*S1*, *S2*). Where the rotation axis is unknown, it can be found simultaneously with the sidereal period by utilising lightcurve observations of the asteroid at different positions in its orbit, if enough observations are obtained (*S3*).

As discussed in the main text, the lightcurves were grouped according to date; all the 2001 and 2002 lightcurves were taken together, then all the 2002-2003, 2003-2004, and finally the 2004-2005, so that each data set had a 1 year time-base. This is adequate as the

PAB corrections are performed on each biannual data-group independently. The resulting observed rate-of-change of the yearly-averaged sidereal rotation period precisely matches the value derived from a separate analysis of the combined radar and optical lightcurve data (*S6*), confirming that the PAB approximation works very well in this case, and demonstrates that shape and scattering properties of the asteroid have little effect on the PAB analysis.

To measure the sidereal rotation periods from the time-corrected lightcurves within each data group, we applied the method of fitting an nth-order Fourier series of a given periodicity to the lightcurve and measuring the fit residuals (*S4*). We increment the period over a reasonable range to minimize the residuals, and finally we increase the fit complexity or order, to further reduce the measurement uncertainty in the period. The period increment was set to $\sim 1 \times 10^{-8}$ hrs which was calculated to be at least 10 times smaller than the likely value of the YORP-induced period change. Fourth-order fits to the lightcurve modulation were obtained separately for each time-corrected data-group, and the resulting sidereal rotation periods for each group are listed (Table 1).

(ii) Earth-tug simulations:

The observed changes in the sidereal period could be partially caused by Earth gravitational torques, possibly important during its repeated close approaches to our planet. For that reason, we estimated the magnitude of this effect in a series of numerical experiments, letting the asteroid encounter the Earth at the geometry and speed at infinity reproducing the Earth approaches from 2001 and 2005. For each encounter we ran 10^4 trials, with randomly-chosen rotation phases at the instant of closest approach. Other parameters, including $(B - A)/C \sim 0.19$, where A, B and C are the principal moments of the inertia tensor of the asteroid (*S5*), are well determined from the shape model (*S6*). In each trial we used the analytic solution from (*S7*) to evaluate any change of the asteroid's rotation rate. The changes (Fig. 2) appear nearly an order of magnitude smaller than the observed

inter-year acceleration of PH5's rotation rate. As mentioned in the main text, there is no reason for them to be coherent, so uncorrelated positive and negative values are possible in the subsequent years. We conclude that the observed changes in P cannot be explained by Earth-induced gravitational torques and can be neglected as a cause of the observed period change.

(iii) Dynamical simulations on the long term spin evolution of asteroid (54509) 2000 PH5:

A sample of 999 orbital-clones of asteroid PH5 was constructed by first considering the asteroid's nominal (best-fit) orbital Keplerian elements (a, e, I, Ω, ϖ, M) along with their formal uncertainties (σ_a, σ_e, etc), as of January 1, 2000. The clones were started on orbits that had nominal Keplerian elements (a, e, I, Ω, ϖ, M) plus (da, de, dI, $d\Omega$, $d\varpi$, dM), such that (da, de, dI, $d\Omega$, $d\varpi$, dM) each have Gaussian distributions with standard deviations of σ_a, σ_e, etc. No correlations between the elements were taken into account, but they are not expected to be significant. Also note that we use the longitude of pericenter ϖ instead of the argument of pericenter ω.

For this work we used the numerical package SWIFT-RMVS3 which is a state-of-the-art N-body symplectic code for long-term planetary dynamics that allows close encounters of test particles and planets (*S8*). All planets were included and a short timestep of 5 days was chosen with a start date of January 1, 2000. The longest-lived clones of PH5 (about 6%) survived 100 My of orbital evolution, while the median dynamical lifetime before particle removal from the simulation, by solar or planetary impacts, was $\sim$ 15 My, a surprisingly long timescale. This is due to Venus gravitationally perturbing (scattering) the particles into orbits that have considerably lower probability of impacting a planet. More specifically, starting with the current orbit of PH5, our integration showed that the median lifetime of residence within the co-orbital zone is only $\sim$ 20 ky, due to close encounters with Venus (the current perihelion distance of PH5 is $\sim$ 0.773 AU, which is only a few Hill radii

away from Venus, especially when Venus is near apocenter of its orbit). The low orbital inclination of PH5 makes it further susceptible to orbital perturbations by Venus, which typically result in increases in the asteroid's orbital inclination, which in turn significantly reduces the probability of planetary impacts. The initial orbital inclination of all particles was $\sim 2°$ only, but because of their coorbital status with the Earth, few of the particles hit our planet. Most recorded planetary impacts were with Venus.

In a second step, we numerically integrated the secular evolution of the spin state for each of these 1000 particles along their precise orbits. We used a Lie-Poisson propagator similar to (*S9*, *S10*), and assumed the shape from (*S6*). The initial rotation state was that of PH5 today and the YORP strength as calibrated by our observation. At 14.8 My, when half of the population were still on heliocentric orbits, the rotation periods decreased such that their median was 40 s with extreme values as small as 12 s. At 35 My, when 25% of the original clone population was still surviving, we had a median rotation period of 19 s and lowest extremes of 5 s. Interestingly, our results on the future spin rate of PH5 also apply to a hypothetical object in the main asteroid belt that would have the same size and current rotation rate as PH5. This is because in the main asteroid belt, the strength of the YORP torques decrease by a factor of ~ 6 due to the reduction of solar radiation flux, but the available timescale to accumulate the secular acceleration of its rotation rate increases by the same factor. Indeed, the estimated collisional lifetime of ~ 130 m size objects is ~ 75 My (*S11*).
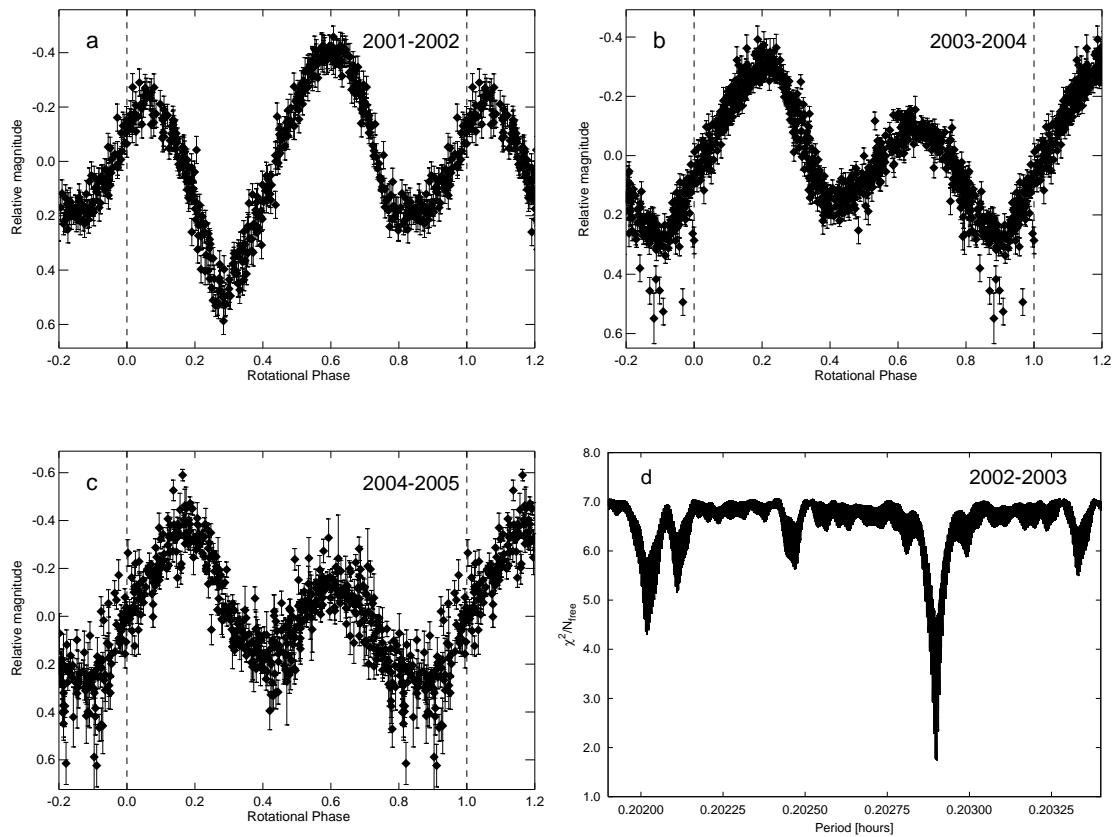
Fig. S1. Panels (a-c): Lightcurve data from the remaining data-groups, folded to their best-fit sidereal rotation periods (Table 1). Panel (d): Example periodogram, in this case for the 2002-2003 data, resulting from 4th-order Fourier fits to the relative magnitudes.

Table S1. Participating facilities in the observational photometric-imaging campaign of asteroid (54509) 2000 PH5. Each telescope was equipped with standard Charge-Coupled Device imaging detectors, and standard broadband optical filters were used (either V, R or Sloan-r' filters, centered at wavelengths of 550 nm, 697 nm, and 626 nm, respectively).

Observatory	Date (UT)	Filter	No. of Obs.
Ondřejov 0.65m (Czech. Reb.)	27–28 July 2001	R	257
	27 July 2002	R	186
	29 July 2003	R	69
ESO/2.2m (La Silla, Chile)	15–19, 21 August 2003	R	309
2.5m INT (La Palma, Spain)	24 August 2003	r'	96
ESO/3.5m NTT (La Silla, Chile)	27 August 2003	V	110
Calar Alto (2.2m) (Spain)	12 August 2004	R	79
ESO/8.2m VLT (Antu) (Paranal, Chile)	10–11 September 2004	V	91
2m Faulkes Telecope (Maui, USA)	4–6 August 2005	R	118
2m Liverpool Telescope (La Palma, Spain)	8–10 August 2005	r'	226
Calar Alto 3.5m (Spain)	31 August 2005	R	49

Table S2. Photometric relative magnitudes and corresponding light-time-corrected modified Julian dates, and associated International Astronomical Union observatory codes.

Modified Julian Date, light-time corrected to asteroid	Relative magnitude	1σ error on relative magnitude	IAU observatory code as assigned by the Minor Planet Centre
52117.864030	-0.096	0.050	557
52117.864260	-0.108	0.050	557
52117.864480	-0.206	0.050	557
52117.864710	-0.243	0.050	557
52117.864940	-0.171	0.050	557
52117.865180	-0.190	0.050	557
52117.865410	-0.086	0.050	557
52117.865640	-0.016	0.050	557
52117.865870	0.108	0.050	557
52117.866100	0.275	0.050	557
52117.866320	0.432	0.050	557
52117.866550	0.478	0.050	557
52117.866800	0.469	0.050	557
52117.867030	0.451	0.050	557
52117.867260	0.338	0.050	557
52117.867490	0.194	0.050	557
52117.867720	0.100	0.050	557
52117.867950	-0.022	0.050	557
52117.868190	-0.055	0.050	557
52117.868420	-0.130	0.050	557
52117.868650	-0.258	0.050	557
52117.868880	-0.343	0.050	557
52117.869110	-0.423	0.050	557
52117.869340	-0.408	0.050	557
52117.869570	-0.366	0.050	557
52117.869810	-0.312	0.050	557
52117.870040	-0.246	0.050	557
52117.870260	-0.135	0.050	557
52117.870960	0.182	0.050	557
52117.871190	0.212	0.050	557
52117.871430	0.174	0.050	557
52117.871660	0.230	0.050	557
52117.871890	0.187	0.050	557
52117.872120	0.078	0.050	557
52117.872350	0.024	0.050	557
52117.873060	-0.211	0.050	557
52117.873280	-0.242	0.050	557

52117.873970	-0.015	0.050	557
52117.874200	0.075	0.050	557
52117.874440	-0.042	0.050	557
52117.874670	0.230	0.050	557
52117.875130	0.397	0.050	557
52117.875590	0.370	0.050	557
52117.875820	0.286	0.050	557
52117.876060	0.308	0.050	557
52117.876290	0.142	0.050	557
52117.876980	-0.190	0.050	557
52117.877210	-0.273	0.050	557
52117.877440	-0.362	0.050	557
52117.877680	-0.371	0.050	557
52117.878370	-0.251	0.050	557
52117.878600	-0.203	0.050	557
52117.878830	-0.058	0.050	557
52117.879050	0.104	0.050	557
52117.879280	0.124	0.050	557
52117.879520	0.170	0.050	557
52117.880230	0.193	0.050	557
52117.880470	0.075	0.050	557
52117.880700	-0.053	0.050	557
52117.880930	-0.161	0.050	557
52117.881160	-0.152	0.050	557
52117.881660	-0.256	0.050	557
52117.881890	-0.175	0.050	557
52117.882580	-0.039	0.050	557
52117.882820	0.101	0.050	557
52117.883050	0.269	0.050	557
52117.883280	0.466	0.050	557
52117.883510	0.478	0.050	557
52117.883740	0.495	0.050	557
52117.883970	0.473	0.050	557
52117.884200	0.154	0.050	557
52117.884440	0.243	0.050	557
52117.884670	0.114	0.050	557
52117.884900	-0.165	0.050	557
52117.885130	-0.113	0.050	557
52117.885360	-0.221	0.050	557
52117.885600	-0.332	0.050	557
52117.885840	-0.411	0.050	557
52117.886070	-0.369	0.050	557
52117.886300	-0.370	0.050	557
52117.886530	-0.411	0.050	557
52117.886760	-0.264	0.050	557

52117.886990	-0.140	0.050	557
52117.887220	-0.139	0.050	557
52117.887460	0.059	0.050	557
52117.887690	0.133	0.050	557
52117.887920	0.241	0.050	557
52117.888150	0.250	0.050	557
52117.888380	0.177	0.050	557
52117.888610	0.120	0.050	557
52117.888850	0.095	0.050	557
52117.889080	0.105	0.050	557
52117.889530	-0.131	0.050	557
52117.889760	-0.273	0.050	557
52117.889990	-0.195	0.050	557
52117.890220	-0.136	0.050	557
52117.890450	-0.211	0.050	557
52117.890690	-0.077	0.050	557
52117.890920	0.010	0.050	557
52117.891150	0.134	0.050	557
52117.891380	0.324	0.050	557
52117.892060	0.522	0.050	557
52117.892290	0.397	0.050	557
52117.892530	0.327	0.050	557
52117.892760	0.335	0.050	557
52117.892990	0.086	0.050	557
52117.893220	0.087	0.050	557
52117.893450	-0.085	0.050	557
52117.893680	-0.139	0.050	557
52117.893900	-0.155	0.050	557
52117.894130	-0.341	0.050	557
52117.894370	-0.307	0.050	557
52117.894610	-0.378	0.050	557
52117.894840	-0.397	0.050	557
52117.895070	-0.398	0.050	557
52117.895300	-0.334	0.050	557
52117.895530	-0.219	0.050	557
52117.895770	-0.039	0.050	557
52117.896000	-0.023	0.050	557
52117.896230	0.075	0.050	557
52117.896460	0.118	0.050	557
52117.896690	0.200	0.050	557
52117.896910	0.220	0.050	557
52117.897140	0.074	0.050	557
52117.897380	0.074	0.050	557
52117.897610	0.125	0.050	557
52117.897840	-0.023	0.050	557

52117.898070	-0.065	0.050	557
52117.898300	-0.110	0.050	557
52117.898530	-0.270	0.050	557
52117.898750	-0.272	0.050	557
52117.898980	-0.106	0.050	557
52117.899220	-0.153	0.050	557
52117.899460	0.012	0.050	557
52117.899690	0.260	0.050	557
52117.899920	0.397	0.050	557
52117.900150	0.304	0.050	557
52117.900380	0.379	0.050	557
52117.900620	0.493	0.050	557
52117.900850	0.351	0.050	557
52117.901080	0.337	0.050	557
52117.901310	0.262	0.050	557
52117.901540	0.139	0.050	557
52117.901770	0.160	0.050	557
52117.901990	-0.092	0.050	557
52117.902220	-0.131	0.050	557
52117.902460	-0.275	0.050	557
52117.902690	-0.310	0.050	557
52117.902920	-0.418	0.050	557
52117.903150	-0.385	0.050	557
52117.903380	-0.351	0.050	557
52118.034940	0.022	0.050	557
52118.035180	0.275	0.050	557
52118.036100	0.447	0.050	557
52118.036350	0.245	0.050	557
52118.036580	0.131	0.050	557
52118.036800	0.053	0.050	557
52118.037030	-0.000	0.050	557
52118.037260	-0.115	0.050	557
52118.037490	-0.275	0.050	557
52118.037720	-0.295	0.050	557
52118.037950	-0.367	0.050	557
52118.038650	-0.425	0.050	557
52118.038880	-0.384	0.050	557
52118.039110	-0.282	0.050	557
52118.039340	-0.155	0.050	557
52118.040720	0.165	0.050	557
52118.040950	0.151	0.050	557
52118.041180	0.062	0.050	557
52118.041410	-0.009	0.050	557
52118.041650	-0.104	0.050	557
52118.041880	-0.173	0.050	557

52118.042100	-0.290	0.050	557
52118.043030	-0.072	0.050	557
52118.043270	0.013	0.050	557
52118.043500	0.172	0.050	557
52118.043730	0.404	0.050	557
52118.043960	0.432	0.050	557
52118.044190	0.587	0.050	557
52118.044420	0.377	0.050	557
52118.044660	0.442	0.050	557
52118.044890	0.329	0.050	557
52118.045110	0.203	0.050	557
52118.045350	0.120	0.050	557
52118.045580	-0.046	0.050	557
52118.045810	-0.140	0.050	557
52118.046040	-0.248	0.050	557
52118.046280	-0.330	0.050	557
52118.047190	-0.396	0.050	557
52118.047420	-0.337	0.050	557
52118.047650	-0.178	0.050	557
52118.839370	0.306	0.050	557
52118.839640	0.179	0.050	557
52118.839910	0.103	0.050	557
52118.840170	-0.025	0.050	557
52118.840440	-0.094	0.050	557
52118.842040	-0.308	0.050	557
52118.842300	-0.214	0.050	557
52118.843100	0.173	0.050	557
52118.843370	0.136	0.050	557
52118.843630	0.209	0.050	557
52118.843900	0.196	0.050	557
52118.845500	-0.254	0.050	557
52118.845770	-0.085	0.050	557
52118.846040	-0.135	0.050	557
52118.846310	-0.047	0.050	557
52118.846570	0.146	0.050	557
52118.847900	0.238	0.050	557
52118.848700	-0.030	0.050	557
52118.848970	-0.197	0.050	557
52118.849230	-0.284	0.050	557
52118.849500	-0.373	0.050	557
52118.849770	-0.416	0.050	557
52118.850300	-0.400	0.050	557
52118.850570	-0.279	0.050	557
52118.851100	-0.015	0.050	557
52118.851360	0.140	0.050	557

52118.851630	0.182	0.050	557
52118.851900	0.165	0.050	557
52118.852160	0.133	0.050	557
52118.853220	-0.038	0.050	557
52118.853480	-0.119	0.050	557
52118.853750	-0.212	0.050	557
52118.854010	-0.143	0.050	557
52118.854570	-0.103	0.050	557
52118.854840	0.104	0.050	557
52118.855100	0.179	0.050	557
52118.855360	0.403	0.050	557
52118.855620	0.529	0.050	557
52118.855890	0.435	0.050	557
52118.856170	0.310	0.050	557
52118.856570	0.151	0.050	557
52118.856840	0.065	0.050	557
52118.857100	-0.021	0.050	557
52118.858700	-0.420	0.050	557
52118.858970	-0.354	0.050	557
52118.859230	-0.282	0.050	557
52118.860310	0.156	0.050	557
52118.860580	0.201	0.050	557
52118.860840	0.214	0.050	557
52118.861110	0.170	0.050	557
52118.861380	0.088	0.050	557
52118.862170	-0.136	0.050	557
52118.862440	-0.171	0.050	557
52118.862710	-0.092	0.050	557
52118.862970	-0.118	0.050	557
52118.863240	0.056	0.050	557
52118.863510	0.177	0.050	557
52118.863770	0.344	0.050	557
52118.864040	0.516	0.050	557
52118.866710	-0.413	0.050	557
52118.866980	-0.358	0.050	557
52118.867240	-0.411	0.050	557
52118.867510	-0.269	0.050	557
52118.868840	0.148	0.050	557
52118.869110	0.180	0.050	557
52118.869370	0.052	0.050	557
52482.883189	-0.047	0.040	557
52482.883419	0.004	0.040	557
52482.883639	0.073	0.040	557
52482.883859	0.203	0.040	557
52482.884079	0.356	0.040	557

52482.884739	0.414	0.040	557
52482.884959	0.414	0.040	557
52482.885179	0.247	0.040	557
52482.885399	0.149	0.040	557
52482.885839	-0.081	0.040	557
52482.886059	-0.150	0.040	557
52482.886279	-0.236	0.040	557
52482.886499	-0.341	0.040	557
52482.886719	-0.392	0.040	557
52482.887829	-0.190	0.040	557
52482.888049	-0.123	0.040	557
52482.888279	0.008	0.040	557
52482.888499	0.180	0.040	557
52482.889379	0.181	0.040	557
52482.889599	0.178	0.040	557
52482.889819	0.054	0.040	557
52482.890039	-0.049	0.040	557
52482.890928	-0.233	0.040	557
52482.891368	-0.168	0.040	557
52482.891618	-0.103	0.040	557
52482.891838	-0.052	0.040	557
52482.892518	0.287	0.040	557
52482.892748	0.430	0.040	557
52482.894288	-0.090	0.040	557
52482.895638	-0.386	0.040	557
52482.898088	0.058	0.040	557
52482.898968	-0.154	0.040	557
52482.899858	-0.162	0.040	557
52482.900078	-0.116	0.040	557
52482.900298	0.007	0.040	557
52482.901618	0.410	0.040	557
52482.901838	0.365	0.040	557
52482.902058	0.230	0.040	557
52482.902278	0.212	0.040	557
52482.903168	-0.229	0.040	557
52482.903388	-0.291	0.040	557
52482.903608	-0.408	0.040	557
52482.903828	-0.415	0.040	557
52482.904048	-0.382	0.040	557
52482.904268	-0.314	0.040	557
52482.906258	0.216	0.040	557
52482.906478	0.162	0.040	557
52482.906698	0.153	0.040	557
52482.906918	0.046	0.040	557
52482.907138	0.011	0.040	557

52482.908478	-0.102	0.040	557
52482.908918	0.069	0.040	557
52482.909138	0.235	0.040	557
52482.909808	0.527	0.040	557
52482.910038	0.338	0.040	557
52482.910258	0.436	0.040	557
52482.910488	0.122	0.040	557
52482.911148	-0.099	0.040	557
52482.911368	-0.188	0.040	557
52482.911588	-0.229	0.040	557
52482.911808	-0.280	0.040	557
52482.912038	-0.313	0.040	557
52482.912258	-0.405	0.040	557
52482.912498	-0.419	0.040	557
52482.913368	-0.169	0.040	557
52482.913588	0.026	0.040	557
52482.913808	0.145	0.040	557
52482.914028	0.202	0.040	557
52482.914248	0.230	0.040	557
52482.914468	0.192	0.040	557
52482.915368	0.086	0.040	557
52482.915588	0.023	0.040	557
52482.916708	-0.152	0.040	557
52482.917388	0.069	0.040	557
52482.917608	0.161	0.040	557
52482.917828	0.266	0.040	557
52482.918488	0.356	0.040	557
52482.918718	0.258	0.040	557
52482.919158	0.182	0.040	557
52482.919378	0.051	0.040	557
52482.919598	-0.120	0.040	557
52482.919818	-0.151	0.040	557
52482.920058	-0.230	0.040	557
52482.920718	-0.394	0.040	557
52482.920938	-0.458	0.040	557
52482.921618	-0.260	0.040	557
52482.921838	-0.105	0.040	557
52482.922498	0.172	0.040	557
52482.922718	0.218	0.040	557
52482.923808	0.067	0.040	557
52482.924468	-0.176	0.040	557
52482.925148	-0.157	0.040	557
52482.925378	-0.079	0.040	557
52482.925598	0.023	0.040	557
52482.925818	0.134	0.040	557

52482.926038	0.273	0.040	557
52482.926478	0.531	0.040	557
52482.926698	0.498	0.040	557
52482.926918	0.409	0.040	557
52482.927138	0.331	0.040	557
52482.927798	0.086	0.040	557
52482.928018	0.006	0.040	557
52482.928238	-0.122	0.040	557
52482.928468	-0.199	0.040	557
52482.928908	-0.349	0.040	557
52482.929128	-0.369	0.040	557
52482.929348	-0.396	0.040	557
52482.929568	-0.406	0.040	557
52482.929788	-0.327	0.040	557
52482.930008	-0.347	0.040	557
52482.930228	-0.273	0.040	557
52482.930448	-0.137	0.040	557
52482.930668	0.168	0.040	557
52482.930888	0.164	0.040	557
52482.932218	0.031	0.040	557
52482.932438	-0.027	0.040	557
52482.932658	-0.133	0.040	557
52482.932878	-0.152	0.040	557
52482.933757	-0.048	0.040	557
52482.933977	-0.083	0.040	557
52482.934207	0.045	0.040	557
52482.934437	0.214	0.040	557
52482.934877	0.357	0.040	557
52482.953617	-0.144	0.040	557
52482.954937	-0.374	0.040	557
52482.955597	-0.208	0.040	557
52482.956037	0.102	0.040	557
52482.956707	0.172	0.040	557
52482.956927	0.153	0.040	557
52482.957147	0.180	0.040	557
52482.957367	0.099	0.040	557
52482.958027	-0.067	0.040	557
52482.959357	0.011	0.040	557
52482.959577	-0.005	0.040	557
52482.959797	0.151	0.040	557
52482.960017	0.260	0.040	557
52482.960237	0.511	0.040	557
52482.960457	0.499	0.040	557
52482.961127	0.284	0.040	557
52482.962457	-0.211	0.040	557

52482.962677	-0.318	0.040	557
52482.962897	-0.378	0.040	557
52482.963117	-0.425	0.040	557
52482.963337	-0.412	0.040	557
52482.963567	-0.391	0.040	557
52482.963787	-0.284	0.040	557
52482.964007	-0.177	0.040	557
52482.964227	-0.020	0.040	557
52482.964447	0.094	0.040	557
52482.964667	0.213	0.040	557
52482.965107	0.193	0.040	557
52482.965337	0.146	0.040	557
52482.965557	0.181	0.040	557
52482.965777	0.112	0.040	557
52482.965997	0.030	0.040	557
52482.966667	-0.139	0.040	557
52482.966887	-0.200	0.040	557
52482.967107	-0.232	0.040	557
52482.967547	-0.170	0.040	557
52482.967767	-0.066	0.040	557
52482.967987	-0.035	0.040	557
52482.968207	0.039	0.040	557
52482.968427	0.228	0.040	557
52482.968867	0.443	0.040	557
52482.969307	0.329	0.040	557
52482.969527	0.246	0.040	557
52482.970857	-0.226	0.040	557
52482.971077	-0.356	0.040	557
52482.971297	-0.361	0.040	557
52482.971517	-0.381	0.040	557
52482.972407	-0.235	0.040	557
52482.972627	-0.136	0.040	557
52482.972847	0.070	0.040	557
52482.973067	0.240	0.040	557
52482.973287	0.254	0.040	557
52482.973507	0.194	0.040	557
52482.974607	0.042	0.040	557
52482.974837	-0.007	0.040	557
52482.975057	-0.131	0.040	557
52482.975277	-0.165	0.040	557
52482.976157	-0.149	0.040	557
52482.976377	-0.012	0.040	557
52482.976597	0.119	0.040	557
52482.976817	0.231	0.040	557
52482.977037	0.319	0.040	557

52482.977497	0.492	0.040	557
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52849.906319	0.286	0.045	557
52849.906619	0.117	0.045	557
52849.906919	0.014	0.045	557
52849.907229	-0.185	0.045	557
52849.909029	0.004	0.045	557
52849.909329	0.012	0.045	557
52849.913259	0.262	0.045	557
52849.915069	0.050	0.045	557
52849.915369	-0.017	0.045	557
52849.915669	-0.146	0.045	557
52849.915979	-0.322	0.045	557
52849.916279	-0.362	0.045	557
52849.916579	-0.348	0.045	557
52849.916879	-0.364	0.045	557
52849.917179	-0.212	0.045	557
52849.917489	-0.063	0.045	557
52849.917799	0.098	0.045	557
52849.919749	0.028	0.045	557
52849.920049	-0.030	0.045	557
52849.920349	-0.039	0.045	557
52849.921249	0.078	0.045	557
52849.921549	0.273	0.045	557
52849.921859	0.210	0.045	557
52849.923669	0.050	0.045	557
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52849.924269	-0.148	0.045	557
52849.924579	-0.252	0.045	557
52849.924879	-0.282	0.045	557
52849.925179	-0.350	0.045	557
52849.925479	-0.275	0.045	557
52849.925779	-0.162	0.045	557
52849.926079	0.030	0.045	557
52849.927278	0.252	0.045	557
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52849.929398	-0.032	0.045	557
52849.930918	0.417	0.045	557
52849.931218	0.287	0.045	557
52849.932488	-0.122	0.045	557
52849.933388	-0.373	0.045	557
52849.933708	-0.350	0.045	557
52849.934008	-0.262	0.045	557
52849.934308	-0.078	0.045	557

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52849.934908	0.220	0.045	557
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52849.939748	0.233	0.045	557
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52849.941268	-0.199	0.045	557
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52849.941868	-0.392	0.045	557
52849.942558	-0.238	0.045	557
52849.942858	-0.053	0.045	557
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52849.947998	0.526	0.045	557
52849.948298	0.494	0.045	557
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52849.949198	-0.105	0.045	557
52849.949508	-0.152	0.045	557
52849.949808	-0.291	0.045	557
52866.114579	-0.285	0.021	809
52866.115863	0.013	0.023	809
52866.117553	0.030	0.023	809
52866.118791	-0.064	0.023	809
52866.120019	0.230	0.026	809
52866.121255	0.129	0.024	809
52866.122486	-0.190	0.021	809
52866.123711	-0.225	0.022	809
52866.124954	0.170	0.026	809
52866.126198	0.022	0.025	809
52866.127430	-0.044	0.024	809
52866.128679	0.272	0.026	809
52866.129915	0.081	0.023	809
52866.131145	-0.237	0.022	809
52866.136130	-0.019	0.022	809
52866.137351	0.270	0.026	809
52866.138564	0.017	0.023	809
52866.139809	-0.281	0.021	809
52866.145983	0.305	0.026	809
52866.147222	-0.029	0.023	809

52866.148462	-0.277	0.021	809
52866.149768	0.087	0.025	809
52866.150989	0.102	0.024	809
52866.155260	0.098	0.023	809
52866.156512	-0.226	0.021	809
52866.157748	-0.163	0.021	809
52866.158969	0.155	0.023	809
52866.160293	-0.008	0.022	809
52866.161528	-0.012	0.022	809
52866.162748	0.291	0.026	809
52866.163980	-0.021	0.022	809
52866.165213	-0.250	0.021	809
52866.170121	0.006	0.023	809
52866.173784	-0.247	0.021	809
52866.177780	-0.073	0.022	809
52866.179014	0.169	0.025	809
52866.180238	0.176	0.025	809
52866.181414	-0.133	0.022	809
52866.182631	-0.286	0.021	809
52866.183864	0.151	0.024	809
52866.185089	0.102	0.024	809
52866.186327	-0.068	0.023	809
52866.187568	0.179	0.025	809
52866.190031	-0.155	0.022	809
52866.191330	-0.211	0.023	809
52866.192556	0.140	0.027	809
52866.207270	-0.224	0.022	809
52866.208515	-0.114	0.023	809
52866.209739	0.086	0.026	809
52866.210974	-0.014	0.024	809
52866.212270	-0.001	0.024	809
52866.213496	0.299	0.026	809
52866.214964	-0.077	0.023	809
52866.216204	-0.327	0.021	809
52866.219923	-0.086	0.023	809
52866.221145	0.105	0.026	809
52866.222380	0.208	0.029	809
52866.226227	0.182	0.029	809
52866.227452	0.093	0.026	809
52866.228675	-0.065	0.026	809
52866.230123	0.259	0.029	809
52866.231356	0.092	0.030	809
52866.232518	-0.230	0.023	809
52866.233745	-0.169	0.023	809
52866.234982	0.193	0.027	809

52866.236214	0.033	0.024	809
52866.237443	-0.049	0.023	809
52866.238675	0.268	0.028	809
52866.239967	0.083	0.026	809
52866.241188	-0.231	0.024	809
52867.145671	-0.243	0.031	809
52867.147062	-0.077	0.032	809
52867.148439	0.115	0.035	809
52867.149879	-0.094	0.033	809
52867.156880	0.108	0.035	809
52867.158249	-0.055	0.033	809
52867.159652	0.126	0.034	809
52867.161033	0.156	0.034	809
52867.162402	-0.210	0.031	809
52867.163845	-0.157	0.032	809
52867.167959	0.119	0.033	809
52867.169339	0.165	0.034	809
52867.170772	-0.171	0.032	809
52867.172167	-0.172	0.031	809
52867.173557	0.146	0.034	809
52867.174924	-0.060	0.032	809
52867.176300	0.101	0.034	809
52867.177769	0.213	0.035	809
52867.179149	-0.148	0.032	809
52867.184737	0.070	0.033	809
52867.186112	0.203	0.034	809
52867.189238	-0.104	0.032	809
52867.190611	0.166	0.034	809
52867.191984	-0.078	0.032	809
52867.193411	0.080	0.033	809
52867.194842	0.151	0.034	809
52867.196220	-0.215	0.031	809
52867.197597	-0.179	0.031	809
52867.198996	0.153	0.034	809
52867.200388	-0.050	0.032	809
52867.203212	0.199	0.034	809
52867.204604	-0.167	0.032	809
52867.206006	-0.150	0.032	809
52867.207390	0.080	0.033	809
52867.210289	0.119	0.033	809
52867.211668	0.170	0.034	809
52867.213057	-0.196	0.031	809
52867.214481	-0.167	0.031	809
52867.215951	0.179	0.034	809
52867.217330	-0.060	0.032	809

52867.218725	0.113	0.033	809
52867.221555	-0.199	0.031	809
52867.222948	-0.142	0.032	809
52867.224382	0.184	0.034	809
52867.225789	-0.095	0.032	809
52867.227179	0.090	0.033	809
52868.158167	0.337	0.026	809
52868.159667	-0.096	0.017	809
52868.161135	-0.228	0.015	809
52868.162577	0.194	0.020	809
52868.164124	-0.073	0.017	809
52868.165642	0.093	0.020	809
52868.167159	0.119	0.019	809
52868.168604	-0.243	0.014	809
52868.170128	-0.062	0.016	809
52868.171649	0.094	0.019	809
52868.173123	-0.092	0.017	809
52868.174586	0.245	0.022	809
52868.176135	-0.036	0.018	809
52868.177672	-0.281	0.014	809
52868.190775	0.039	0.018	809
52868.192495	0.194	0.023	809
52868.194009	-0.235	0.016	809
52868.195474	-0.044	0.019	809
52868.196941	0.102	0.020	809
52868.198807	-0.079	0.018	809
52868.200317	0.308	0.024	809
52868.201834	-0.086	0.018	809
52868.203351	-0.260	0.013	809
52868.204884	0.150	0.020	809
52868.206371	-0.091	0.021	809
52868.207837	0.059	0.025	809
52868.212760	0.102	0.022	809
52868.219992	-0.317	0.021	809
52868.221488	0.186	0.024	809
52868.222994	-0.042	0.021	809
52868.224563	0.052	0.020	809
52868.226084	0.153	0.022	809
52868.227555	-0.182	0.016	809
52868.229065	-0.154	0.018	809
52868.230823	0.077	0.020	809
52868.232334	-0.075	0.018	809
52868.233835	0.216	0.023	809
52868.235414	-0.073	0.018	809
52868.236935	-0.284	0.015	809

52868.240378	-0.091	0.019	809
52868.241898	0.135	0.022	809
52868.243444	0.073	0.021	809
52868.244941	-0.272	0.016	809
52868.246436	0.056	0.021	809
52868.248002	0.035	0.022	809
52868.249513	-0.022	0.020	809
52868.250989	0.318	0.036	809
52868.254413	-0.198	0.023	809
52868.255921	0.099	0.024	809
52868.257462	-0.074	0.023	809
52868.259031	0.206	0.028	809
52868.260568	0.048	0.024	809
52869.234634	-0.258	0.013	809
52869.237718	-0.049	0.016	809
52869.239360	0.134	0.018	809
52869.240920	0.098	0.017	809
52869.242447	-0.267	0.014	809
52869.244042	0.063	0.017	809
52869.245660	0.058	0.023	809
52869.247301	0.001	0.021	809
52869.248858	0.241	0.020	809
52869.250498	-0.173	0.015	809
52869.252067	-0.117	0.016	809
52869.253603	0.102	0.020	809
52869.255209	-0.086	0.016	809
52869.258513	-0.072	0.016	809
52869.260068	-0.260	0.014	809
52869.261609	0.146	0.019	809
52869.265084	0.217	0.021	809
52869.266637	0.046	0.023	809
52869.268175	-0.285	0.015	809
52869.269793	0.183	0.021	809
52869.271444	-0.013	0.019	809
52869.272976	0.038	0.018	809
52869.274551	0.215	0.023	809
52869.276196	-0.266	0.014	809
52869.277772	0.078	0.019	809
52869.279314	0.073	0.019	809
52869.280930	-0.027	0.019	809
52869.286128	0.007	0.021	809
52869.287679	0.058	0.020	809
52869.289259	-0.045	0.019	809
52869.290894	0.265	0.025	809
52869.292511	-0.131	0.018	809

52869.294061	-0.184	0.018	809
52869.295682	0.103	0.024	809
52869.297295	-0.067	0.021	809
52869.298879	0.226	0.027	809
52869.300456	-0.025	0.022	809
52869.302372	-0.235	0.019	809
52869.303951	0.120	0.028	809
52869.305505	-0.081	0.026	809
52869.307119	0.155	0.031	809
52870.144991	0.234	0.017	809
52870.146538	-0.139	0.013	809
52870.148010	-0.196	0.014	809
52870.149478	0.150	0.018	809
52870.150928	-0.083	0.015	809
52870.152430	0.113	0.015	809
52870.154197	0.051	0.014	809
52870.155656	-0.293	0.012	809
52870.157148	0.093	0.016	809
52870.158618	0.051	0.016	809
52870.160096	-0.018	0.016	809
52870.161561	0.306	0.018	809
52870.163056	-0.043	0.015	809
52870.164517	-0.278	0.012	809
52870.168587	-0.063	0.015	809
52870.170061	0.276	0.018	809
52870.172868	-0.315	0.012	809
52870.174226	0.185	0.017	809
52870.178848	0.227	0.017	809
52870.180326	-0.130	0.014	809
52870.181788	-0.201	0.013	809
52870.183244	0.130	0.016	809
52870.184749	-0.087	0.013	809
52870.186235	0.131	0.016	809
52870.187727	0.099	0.015	809
52870.189192	-0.247	0.012	809
52870.190665	-0.009	0.015	809
52870.192127	0.077	0.016	809
52870.196117	0.126	0.017	809
52870.197600	-0.227	0.013	809
52870.199072	-0.098	0.015	809
52870.200528	0.128	0.017	809
52870.202055	-0.065	0.017	809
52870.203538	0.270	0.019	809
52870.205017	0.011	0.017	809
52870.206465	-0.262	0.014	809

52870.207961	0.141	0.018	809
52870.209446	0.004	0.017	809
52870.210907	-0.039	0.015	809
52870.212421	0.273	0.019	809
52870.213896	-0.094	0.015	809
52870.215381	-0.260	0.014	809
52870.218834	-0.070	0.016	809
52870.220328	0.228	0.019	809
52870.221804	0.040	0.017	809
52870.223253	-0.252	0.013	809
52870.224733	0.049	0.015	809
52870.226280	0.065	0.016	809
52872.168770	-0.137	0.032	809
52872.170346	0.130	0.035	809
52872.171891	-0.074	0.034	809
52872.176521	-0.252	0.032	809
52872.178033	0.169	0.034	809
52872.179626	-0.031	0.033	809
52872.182871	0.129	0.033	809
52872.186227	0.117	0.033	809
52872.187805	-0.027	0.032	809
52872.189404	-0.049	0.032	809
52872.190992	0.186	0.034	809
52872.192542	-0.206	0.032	809
52872.194858	0.137	0.034	809
52872.196448	-0.040	0.033	809
52872.197977	0.022	0.033	809
52872.199520	0.210	0.034	809
52872.201161	-0.251	0.032	809
52872.202713	-0.058	0.033	809
52872.204232	0.083	0.034	809
52872.205863	-0.094	0.032	809
52872.207437	0.251	0.034	809
52872.209065	-0.089	0.032	809
52872.210628	-0.254	0.032	809
52872.212353	0.066	0.033	809
52872.213968	-0.102	0.032	809
52872.215484	0.162	0.034	809
52872.219521	-0.112	0.032	809
52872.221109	0.104	0.034	809
52872.222753	-0.090	0.033	809
52872.224301	0.211	0.035	809
52872.225898	-0.106	0.033	809
52872.227485	-0.272	0.032	809
52872.228998	0.149	0.035	809

52872.230633	-0.083	0.034	809
52872.232215	0.118	0.035	809
52872.233804	0.059	0.034	809
52872.235369	-0.292	0.032	809
52872.236990	0.100	0.035	809
52872.238547	0.013	0.034	809
52872.240319	0.022	0.034	809
52872.242512	0.013	0.034	809
52872.244112	-0.317	0.032	809
52872.245651	0.161	0.035	809
52872.247260	-0.040	0.033	809
52872.248888	0.071	0.034	809
52872.250519	0.117	0.034	809
52872.252062	-0.244	0.032	809
52872.253672	0.069	0.034	809
52872.255277	0.055	0.034	809
52872.256823	-0.022	0.034	809
52872.258374	0.312	0.038	809
52872.262060	0.023	0.037	809
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52875.874466	-0.101	0.023	950
52875.875253	-0.064	0.024	950
52875.876029	0.211	0.028	950
52875.876810	0.290	0.030	950
52875.877591	0.050	0.025	950
52875.878367	-0.191	0.021	950
52875.879142	-0.277	0.019	950
52875.879917	-0.178	0.022	950
52875.880698	0.118	0.026	950
52875.881601	0.043	0.023	950
52875.882371	-0.068	0.024	950
52875.883152	-0.090	0.022	950
52875.883933	0.007	0.023	950
52875.884709	0.271	0.029	950
52875.885490	0.183	0.027	950
52875.886265	-0.051	0.023	950
52875.887047	-0.238	0.020	950
52875.887822	-0.311	0.019	950
52875.888597	-0.052	0.022	950
52875.889379	0.125	0.026	950
52875.890160	0.104	0.025	950
52875.890935	-0.045	0.022	950
52875.891711	-0.069	0.022	950
52875.892492	0.113	0.025	950
52875.893268	0.268	0.028	950

52875.894043	0.124	0.026	950
52875.894819	-0.097	0.021	950
52875.895600	-0.269	0.018	950
52875.896375	-0.277	0.018	950
52875.897220	0.046	0.023	950
52875.897996	0.204	0.026	950
52875.898771	0.049	0.023	950
52875.899552	-0.104	0.021	950
52875.900334	-0.096	0.021	950
52875.901109	0.094	0.023	950
52875.901895	0.285	0.027	950
52875.902671	0.095	0.024	950
52875.903446	-0.077	0.022	950
52875.904228	-0.263	0.018	950
52875.904997	-0.271	0.018	950
52875.905779	0.044	0.022	950
52875.906560	0.122	0.025	950
52875.907335	-0.011	0.022	950
52875.908117	-0.127	0.021	950
52875.908892	-0.032	0.023	950
52875.909673	0.141	0.026	950
52875.910449	0.258	0.027	950
52875.911230	0.060	0.024	950
52875.912011	-0.138	0.019	950
52875.912926	-0.300	0.017	950
52875.913701	-0.187	0.019	950
52875.914482	0.166	0.025	950
52875.915258	0.074	0.025	950
52875.916033	0.003	0.022	950
52875.916814	-0.107	0.020	950
52875.917590	-0.005	0.021	950
52875.918371	0.199	0.026	950
52875.919147	0.235	0.028	950
52875.919922	0.025	0.023	950
52875.920703	-0.179	0.019	950
52875.921479	-0.301	0.017	950
52875.922266	-0.080	0.021	950
52875.923041	0.201	0.025	950
52875.923816	0.139	0.025	950
52875.924598	0.004	0.022	950
52875.925373	-0.070	0.020	950
52875.926154	0.041	0.021	950
52875.926930	0.257	0.025	950
52875.927705	0.231	0.026	950
52875.928718	-0.033	0.023	950

52875.929499	-0.235	0.018	950
52875.930275	-0.290	0.018	950
52875.931050	0.076	0.023	950
52875.931826	0.111	0.025	950
52875.933631	-0.096	0.020	950
52875.934557	0.014	0.022	950
52875.935332	0.282	0.027	950
52875.936108	0.237	0.025	950
52875.936889	-0.031	0.021	950
52875.937670	-0.224	0.019	950
52875.938446	-0.307	0.017	950
52875.939227	-0.079	0.020	950
52875.940003	0.164	0.025	950
52875.940784	0.095	0.022	950
52875.941559	-0.050	0.021	950
52875.942705	-0.044	0.022	950
52875.943481	0.179	0.026	950
52875.944268	0.283	0.028	950
52875.945043	0.078	0.023	950
52875.945824	-0.120	0.020	950
52875.946599	-0.289	0.018	950
52875.947380	-0.208	0.019	950
52875.949713	0.017	0.021	950
52875.951674	0.100	0.025	950
52875.953231	0.191	0.027	950
52878.012163	-0.126	0.025	809
52878.012866	-0.075	0.026	809
52878.013590	0.079	0.028	809
52878.014309	0.212	0.033	809
52878.015010	0.090	0.029	809
52878.015712	-0.024	0.027	809
52878.016421	-0.262	0.023	809
52878.017165	-0.333	0.023	809
52878.017881	-0.148	0.024	809
52878.018577	0.156	0.031	809
52878.019290	0.138	0.030	809
52878.019989	-0.026	0.026	809
52878.020694	-0.103	0.025	809
52878.021427	-0.060	0.026	809
52878.022121	0.086	0.029	809
52878.022875	0.227	0.032	809
52878.023593	0.095	0.030	809
52878.024303	-0.107	0.025	809
52878.025036	-0.279	0.022	809
52878.025763	-0.291	0.022	809

52878.026479	-0.083	0.026	809
52878.027203	0.200	0.033	809
52878.027924	0.080	0.029	809
52878.028699	-0.086	0.026	809
52878.029404	-0.088	0.025	809
52878.030117	-0.015	0.028	809
52878.030842	0.186	0.031	809
52878.031531	0.234	0.033	809
52878.032254	0.078	0.030	809
52878.032952	-0.110	0.025	809
52878.033662	-0.304	0.022	809
52878.034386	-0.313	0.021	809
52878.035107	-0.026	0.026	809
52878.035799	0.148	0.031	809
52878.036503	0.001	0.027	809
52878.037214	-0.021	0.027	809
52878.037940	-0.104	0.026	809
52878.038641	0.013	0.028	809
52878.039334	0.253	0.034	809
52878.040028	0.276	0.033	809
52878.040761	0.030	0.028	809
52878.041485	-0.148	0.025	809
52878.042206	-0.276	0.023	809
52878.042909	-0.265	0.023	809
52878.043635	0.116	0.030	809
52878.044372	0.196	0.032	809
52878.045080	0.077	0.029	809
52878.045797	-0.048	0.027	809
52878.046510	-0.060	0.026	809
52878.047203	0.044	0.029	809
52878.047904	0.267	0.034	809
52878.048624	0.266	0.034	809
52878.049337	-0.013	0.027	809
52878.050043	-0.167	0.025	809
52878.050740	-0.289	0.023	809
52878.052343	0.129	0.031	809
52878.053043	0.125	0.030	809
52878.053747	0.049	0.028	809
52878.054444	-0.095	0.025	809
52878.055142	-0.060	0.026	809
52878.055866	0.073	0.029	809
52878.056573	0.297	0.036	809
52878.057286	0.207	0.034	809
52878.058006	-0.026	0.027	809
52878.058735	-0.203	0.024	809

52878.059433	-0.302	0.022	809
52878.060124	-0.202	0.023	809
52878.060815	0.095	0.030	809
52878.061527	0.087	0.029	809
52878.062250	-0.117	0.030	809
52878.062969	-0.078	0.031	809
52878.063695	0.041	0.034	809
52878.064417	0.207	0.038	809
52878.065113	0.232	0.034	809
52878.065813	0.159	0.032	809
52878.066503	-0.033	0.027	809
52878.067204	-0.232	0.023	809
52878.067942	-0.364	0.021	809
52878.068655	-0.121	0.025	809
52878.069376	0.085	0.029	809
52878.070077	0.087	0.030	809
52878.070820	-0.025	0.028	809
52878.071552	-0.141	0.025	809
52878.072267	-0.080	0.026	809
52878.072976	0.146	0.032	809
52878.073685	0.283	0.036	809
52878.074404	0.164	0.032	809
52878.075130	-0.032	0.028	809
52878.075821	-0.253	0.024	809
52878.076545	-0.274	0.024	809
52878.077266	-0.012	0.031	809
52878.077957	0.201	0.036	809
52878.078648	0.140	0.036	809
52878.079330	0.037	0.033	809
52878.080033	-0.097	0.030	809
52878.080730	-0.051	0.033	809
52878.081426	0.177	0.039	809
52878.082126	0.240	0.041	809
52878.082830	0.144	0.037	809
52878.083526	-0.071	0.032	809
52878.084261	-0.305	0.025	809
52878.084979	-0.324	0.026	809
52878.085685	-0.142	0.033	809
52878.086407	0.193	0.052	809
52878.087134	0.098	0.049	809
52878.087848	0.054	0.048	809
52878.088577	-0.155	0.045	809
52878.089288	-0.027	0.051	809
52878.089994	0.266	0.067	809
52878.090699	0.549	0.085	809

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53229.853274	-0.035	0.025	493
53229.854034	-0.167	0.025	493
53229.854791	-0.301	0.021	493
53229.855548	-0.137	0.023	493
53229.857065	0.124	0.030	493
53229.857825	-0.032	0.030	493
53229.858583	-0.086	0.028	493
53229.859342	0.026	0.032	493
53229.860092	0.183	0.037	493
53229.860844	0.244	0.030	493
53229.861604	0.037	0.027	493
53229.864617	0.069	0.029	493
53229.865392	0.129	0.031	493
53229.866153	0.014	0.029	493
53229.866911	-0.115	0.027	493
53229.867675	-0.094	0.026	493
53229.868435	0.121	0.033	493
53229.869185	0.256	0.038	493
53229.872977	0.014	0.028	493
53229.873727	0.139	0.034	493
53229.874486	0.032	0.036	493
53229.875245	-0.077	0.022	493
53229.876747	0.135	0.023	493
53229.877498	0.234	0.038	493
53229.881295	-0.023	0.029	493
53229.882056	0.078	0.034	493
53229.882806	0.088	0.032	493
53229.883566	-0.110	0.028	493
53229.884334	-0.011	0.032	493
53229.885095	0.053	0.032	493
53229.885853	0.299	0.039	493
53229.886603	0.113	0.031	493
53229.887362	-0.101	0.027	493
53229.888122	-0.212	0.025	493
53229.888882	-0.294	0.023	493
53229.889640	-0.013	0.027	493
53229.890399	0.150	0.030	493
53229.891150	0.078	0.028	493
53229.891910	-0.008	0.032	493
53229.892669	-0.082	0.026	493
53229.893429	0.057	0.031	493
53229.894189	0.205	0.032	493
53229.894948	0.183	0.032	493
53229.895698	-0.033	0.026	493

53229.896449	-0.233	0.022	493
53229.897211	-0.322	0.021	493
53229.897973	-0.141	0.025	493
53229.898731	0.119	0.030	493
53229.899494	0.041	0.026	493
53229.900254	-0.051	0.027	493
53229.901014	-0.090	0.029	493
53229.901774	0.021	0.028	493
53229.902533	0.275	0.035	493
53229.903281	0.193	0.031	493
53229.904040	0.012	0.027	493
53229.904799	-0.193	0.023	493
53229.905558	-0.325	0.021	493
53229.906319	-0.173	0.023	493
53229.907083	0.110	0.028	493
53229.907843	0.059	0.029	493
53229.908598	-0.028	0.025	493
53229.909359	-0.090	0.024	493
53229.910111	-0.054	0.024	493
53229.910867	0.203	0.030	493
53229.911627	0.307	0.031	493
53229.912385	0.029	0.021	493
53229.913907	-0.328	0.015	493
53229.914666	-0.208	0.021	493
53229.915428	0.164	0.028	493
53229.916187	0.061	0.024	493
53229.916946	0.001	0.025	493
53229.917696	-0.091	0.025	493
53229.918462	-0.020	0.028	493
53229.919226	0.208	0.035	493
53229.921611	-0.192	0.024	493
53229.922372	-0.329	0.021	493
53229.923131	-0.249	0.024	493
53229.929528	-0.100	0.024	493
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53258.980769	0.141	0.023	309
53258.981446	0.099	0.022	309
53258.982115	-0.050	0.019	309
53258.982793	-0.131	0.017	309
53258.983553	-0.054	0.017	309
53258.984237	0.138	0.020	309
53258.984922	0.256	0.021	309
53258.985607	0.196	0.020	309
53258.986288	-0.018	0.018	309
53258.987040	-0.204	0.017	309

53258.987726	-0.345	0.014	309
53258.988410	-0.148	0.016	309
53258.989091	0.108	0.018	309
53258.989780	0.174	0.020	309
53258.990547	-0.043	0.017	309
53258.991237	-0.154	0.015	309
53258.991917	-0.057	0.016	309
53258.992604	0.151	0.019	309
53258.993293	0.208	0.020	309
53258.993974	0.219	0.022	309
53258.994657	0.021	0.020	309
53258.995341	-0.217	0.015	309
53258.996024	-0.344	0.014	309
53258.996706	-0.211	0.016	309
53258.997470	0.092	0.020	309
53258.998152	0.160	0.021	309
53258.998837	0.000	0.018	309
53258.999519	-0.120	0.016	309
53259.000202	-0.086	0.016	309
53259.000965	0.140	0.018	309
53259.001651	0.222	0.021	309
53259.005159	-0.200	0.015	309
53259.005841	0.142	0.021	309
53259.006529	0.219	0.020	309
53259.007217	0.055	0.017	309
53259.007981	-0.143	0.016	309
53259.008666	-0.078	0.016	309
53259.009363	0.069	0.017	309
53259.010059	0.204	0.020	309
53259.010748	0.243	0.021	309
53259.011515	-0.005	0.017	309
53259.012213	-0.173	0.015	309
53259.012904	-0.340	0.012	309
53259.013598	-0.198	0.014	309
53259.014292	0.096	0.019	309
53259.016622	-0.133	0.015	309
53259.017301	-0.019	0.018	309
53259.017976	0.157	0.019	309
53259.018654	0.222	0.020	309
53259.022835	0.110	0.019	309
53259.023598	0.165	0.019	309
53259.024286	0.051	0.018	309
53259.024968	-0.137	0.015	309
53259.025652	-0.058	0.016	309
53259.026338	0.036	0.017	309

53259.027095	0.236	0.021	309
53259.027782	0.226	0.022	309
53259.028463	0.000	0.018	309
53259.029150	-0.197	0.014	309
53259.029832	-0.339	0.014	309
53259.030515	-0.189	0.014	309
53259.031196	0.106	0.019	309
53259.031879	0.177	0.020	309
53259.032561	0.039	0.017	309
53259.033245	-0.137	0.016	309
53259.034006	-0.098	0.016	309
53259.034694	0.087	0.019	309
53259.035379	0.178	0.020	309
53259.036059	0.284	0.024	309
53259.036740	0.035	0.019	309
53259.037501	-0.197	0.016	309
53259.038191	-0.349	0.013	309
53259.038887	-0.263	0.014	309
53259.039580	0.018	0.018	309
53259.040272	0.157	0.020	309
53259.041037	0.017	0.018	309
53259.041721	-0.137	0.018	309
53259.042417	-0.111	0.017	309
53259.043115	0.097	0.019	309
53259.043803	0.223	0.020	309
53259.044577	0.264	0.022	309
53259.045282	0.049	0.017	309
53259.045971	-0.192	0.015	309
53259.046664	-0.321	0.014	309
53259.047357	-0.251	0.015	309
53259.048129	0.068	0.018	309
53259.048818	0.186	0.022	309
53259.049514	0.071	0.018	309
53259.050204	-0.129	0.016	309
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53586.336218	-0.328	0.079	F65
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53586.339931	0.057	0.102	F65
53586.340633	-0.297	0.073	F65
53586.341374	-0.410	0.065	F65
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53586.349327	-0.270	0.061	F65
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53586.352692	-0.044	0.098	F65
53586.354950	0.273	0.136	F65
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53586.356393	0.060	0.108	F65
53586.357850	-0.445	0.069	F65
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53586.360864	0.092	0.108	F65
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53587.347124	-0.463	0.068	F65
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53587.349620	0.090	0.083	F65
53587.350488	-0.194	0.060	F65

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53587.370256	0.419	0.077	F65
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53588.339759	-0.156	0.029	F65
53588.340572	-0.074	0.035	F65
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53588.365343	-0.132	0.034	F65
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53588.370677	-0.306	0.030	F65
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53590.935683	-0.075	0.038	950
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53590.940391	-0.384	0.027	950
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53591.914598	0.190	0.047	950
53591.914971	0.080	0.042	950
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53591.916766	-0.120	0.036	950
53591.917123	0.051	0.041	950
53591.917480	0.102	0.044	950
53591.917845	0.229	0.052	950
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53591.918562	0.255	0.048	950
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53591.929751	-0.364	0.027	950
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53591.931901	0.119	0.041	950
53591.932266	-0.068	0.037	950
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53591.933364	-0.086	0.035	950
53591.933729	-0.089	0.036	950
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53591.935547	0.249	0.047	950
53591.935907	0.147	0.046	950
53591.936268	0.010	0.042	950
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53591.950802	0.135	0.041	950
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53592.909585	-0.272	0.045	950
53592.910679	-0.154	0.043	950
53592.911039	0.055	0.058	950
53592.911403	0.136	0.053	950
53592.911767	0.100	0.052	950
53592.912122	0.317	0.070	950
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53592.912853	-0.033	0.056	950
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53613.910559	0.056	0.063	493
53613.911603	0.156	0.062	493
53613.912642	-0.238	0.045	493

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