

**High precision monochromator calibration in the
visible region of the wavelength spectra**

G. Capobianco, G. Massone, L. Zangrilli, S. Fineschi

Report nr. 130

date: 09/04/2010

High precision monochromator calibration in the visible region of the wavelength spectra

G. Capobianco, G. Massone, L.Zangrilli, S.Fineschi

INDEX

Abstract.....	2
1. Set-up description	2
2. Data Acquisition procedure	3
3. Data Analysis.....	3
4. Results and conclusions	5
References.....	5
Appendix A – Raw Data	5

Abstract

Purpose of this document is to show the results of the monochromator calibration and explain how this has been done. For this calibration we use a calibration lamp source and a photomultiplier for detect the output signal. A detailed description of the set-up is reported in the first chapter of this document. Matching this signal with the spectrum of the source, we are able to calibrate the monochromator with the required accuracy.

1. Set-up description

In order to calibrate the monochromator with a precision of 1\AA in the visible region, we use the follow set-up:

1. Spectral calibration lamp;
2. Monochromator;
3. Photomultiplier.

Spectral Calibration Lamp

The calibration source is a Hg-Ne lamp, Oriel 6034. The used power supply is the Oriel 6048. The lamp is mounted on the Oriel 6058 Fiber Optic accessory with SMA adapter. A 1 meter fiber optic is connected to this mounting and to the monochromator. A picture of the lamp with the SMA adapter and the fiber is reported in Figure 1.



Figure 1 – Calibration Lamp mounted on a Oriel 6058 accessory with SMA adapter (left) and fiber with SMA terminator (right) [from Newport catalogue].

Monochromator

The monochromator is a Oriel MS257. The grating used is a Oriel 77753, 1800 l/mm. The

reciprocal dispersion of this grating is 2.1 nm/mm, than in order to have an output bandpass less than 0.1 nm, we set the slit width to 25 μ m. This procedure has been done using a microscope. A picture of the monochromator is in Figure 2.



Figure 2 – Oriel MS257 monochromator [from Newport catalogue].

Detector

The detector is mounted in front of the monochromator output slit. We use for this calibration a photomultiplier Hamamatsu H7155-21 with counting board Hamamatsu M8784. A picture of this device is in Figure 3.



Figure 3 – Photomultiplier Hamamatsu H7155-21 [from Hamamatsu catalogue].

A schematic view of the set-up is reported in Figure 4.

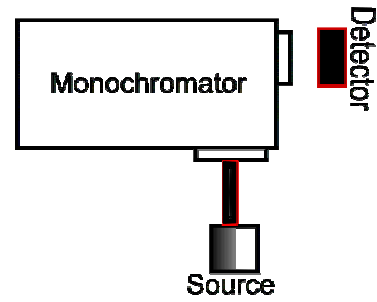


Figure 4 – Schematic view of the set-up.

2. Data Acquisition procedure

The calibration has been done scanning the wavelength range of the monochromator (setted wavelengths) between 360.00 and 550.00 nm with a resolution of 0.1 nm and 0.05 nm in the regions where the emission lines was expected. Totally 2102 wavelength have been acquired in this range. The exposure time of the photomultiplier has been set to 10 seconds. A software that sequentially set a wavelength and after that read the output light has been also implemented. After turning on the source we use a waiting time of approximately 30 minutes, for the stability of the source.

3. Data Analysis

The spectral lines of the source measured in Å are the follows¹:

3650.2	4358.4	5769.6
3654.8	4916.0	5790.7
3663.3	5330.8	5881.9
4046.6	5341.1	5944.8
4077.8	5343.3	5975.5
4339.2	5400.6	
4347.5	5460.7	

¹ Extracted from the Booklet of the spectra [Newport]. The red values are not considered in data analysis.

Data acquired are plotted in Figure 5.

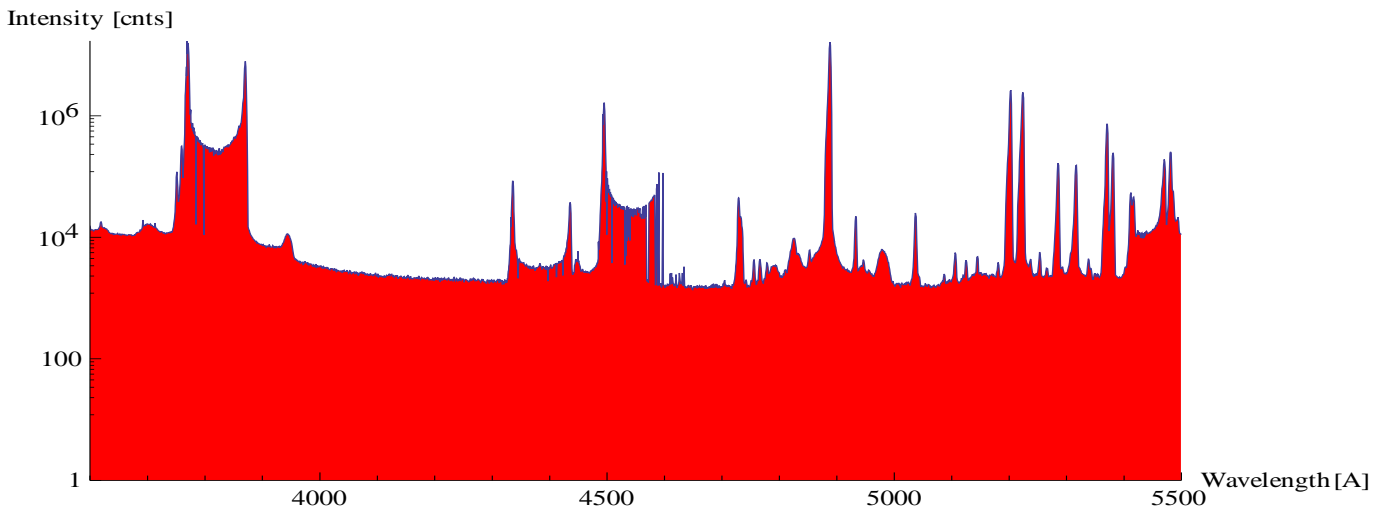


Figure 5 – Raw data acquired in logarithmic scale.

The first step of the data analysis is the subtraction of the dark, the evaluation of the continuum emission and the subtraction of this one from the raw data. We obtain:

Dark = 610 cnts (measured);
Continuum = 770 cnts (evaluated).

Over plotting to this data, the spectrum of the source provided by the manufacturer, we are able to know the offset and eventually the slope for the correct positioning of the monochromator. This plot is in Figure 6.

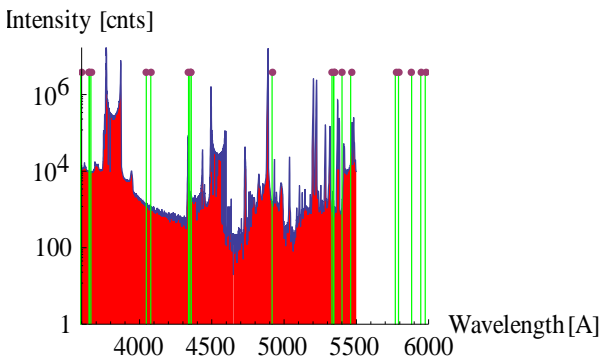


Figure 6 – Normalized data over plotted to the nominal spectral lines (green lines).

Detecting the wavelengths of the local maximum in experimental data and plotting these versus the nominal wavelengths of the source emission, and fitting these data with a linear fit, we are able to evaluate the offset and the slope of our calibration (Figure 7).

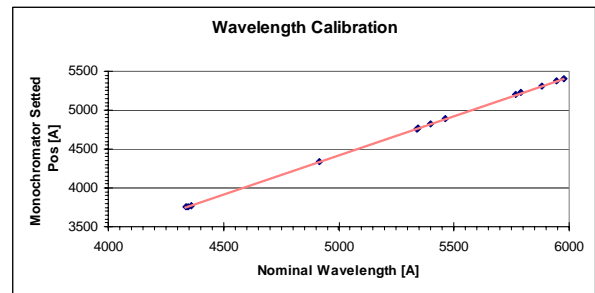


Figure 7 - Plot of monochromator nominal position vs. Source emission wavelengths and linear fit.

From this analysis we obtain:

Slope = 1.0148;
Offset = -653.94 Å

The R^2 coefficient of the linear fit is 1.

The errors in the know lines applying this calibration are less or equal to 1 Å for 12/14 points. The only two points where the errors

are greater to this value, are not well resolved points.

Applying the calibration, we can evaluate the calibrated spectrum, as reported in Figure 8.

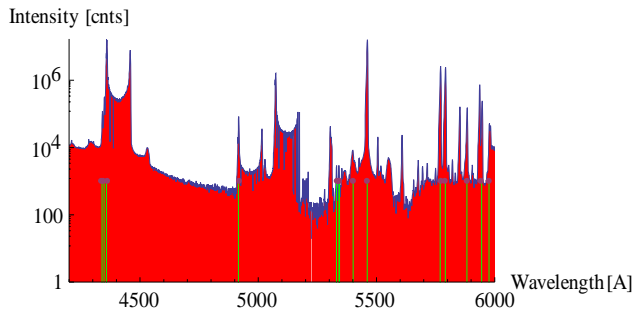


Figure 8 – Calibrated spectrum of the monochromator.

We can see that some peaks of our spectrum are not associated to emission lines. These are lines emitted by the *Ne* not reported in the catalogue of this lamp, but that we are able to detect using the photomultiplier and a low noise set-up.

We have also performed some measurements in order to estimate the positioning repeatability of the grating. We have an error compatible with the manufacturer specifications of 1.5 Å. But we are able to ignore this if we never turn off the monochromator and approaching to a position from the same direction (i.e. from low wavelength to high).

The estimated error in positioning is of 1.8 Å, reduced to 1Å using the cautions upper reported.

A monochromator control software has been developed for this scope.

4. Results and conclusions

Resuming, the position to set to the monochromator (P) in order to have the positioning to the nominal wavelength (N) is evaluated by the follow equation:

$$P = (1.0148 * N) - 653.94$$

Where P and N are in Å. The error is of 1.8 Å. For example if we want to set the wavelength of the Fe XIV emission (5303.4 Å), we have to set 4728 Å.

Results of this calibration are compatible with the results obtained using a Xe lamp source.

References

- [Hamamtsu] Hamamatsu web site: <http://www.hamamatsu.com>
- [LotOriell] Typical Spectra of Oriell Instruments Spectral Calibration Lamps
- [Newport] Newport General Catalogue

Appendix A – Raw Data

Wavelength[nm]	Counts
360,000	15280,000
360,100	13310,000
360,200	13070,000
360,300	13150,000
360,400	13320,000
360,500	13240,000
360,600	12710,000
360,700	12860,000
360,800	13310,000
360,900	13360,000
361,000	13400,000
361,100	13290,000
361,200	13300,000
361,300	13400,000
361,400	13410,000

361,500	13880,000	367,700	11020,000
361,600	14700,000	367,800	10870,000
361,700	15160,000	367,900	11170,000
361,800	17350,000	368,000	11690,000
361,900	18160,000	368,100	11920,000
362,000	16760,000	368,200	11820,000
362,100	14840,000	368,300	12150,000
362,200	14520,000	368,400	12100,000
362,300	14260,000	368,500	12180,000
362,400	14240,000	368,600	12130,000
362,500	14400,000	368,700	13110,000
362,600	13940,000	368,800	12890,000
362,700	13960,000	368,900	13420,000
362,800	13540,000	369,000	13600,000
362,900	13600,000	369,100	14550,000
363,000	13250,000	369,200	19170,000
363,100	12980,000	369,300	15370,000
363,200	12490,000	369,400	15680,000
363,300	12000,000	369,500	15640,000
363,400	11960,000	369,600	15980,000
363,500	11590,000	369,700	15710,000
363,600	11460,000	369,800	16450,000
363,700	11450,000	369,900	16590,000
363,800	11710,000	370,000	16570,000
363,900	11670,000	370,100	16320,000
364,000	11190,000	370,200	16280,000
364,100	11380,000	370,300	16340,000
364,200	11170,000	370,400	16290,000
364,300	11340,000	370,500	16640,000
364,400	11240,000	370,600	15660,000
364,500	11210,000	370,700	15860,000
364,600	11280,000	370,800	15690,000
364,700	11390,000	370,900	15120,000
364,800	11640,000	371,000	15090,000
364,900	11150,000	371,100	14700,000
365,000	11190,000	371,200	14570,000
365,100	11030,000	371,300	17010,000
365,200	11350,000	371,400	14610,000
365,300	10920,000	371,500	14160,000
365,400	11240,000	371,600	13960,000
365,500	10870,000	371,700	13550,000
365,600	11050,000	371,800	13070,000
365,700	11260,000	371,900	12750,000
365,800	11150,000	372,000	12640,000
365,900	11030,000	372,100	12450,000
366,000	11130,000	372,200	12120,000
366,100	10870,000	372,300	12380,000
366,200	10950,000	372,400	12350,000
366,300	10980,000	372,500	12430,000
366,400	10640,000	372,600	12090,000
366,500	10800,000	372,700	11720,000
366,600	10940,000	372,800	11710,000
366,700	11080,000	372,900	11890,000
366,800	11010,000	373,000	11540,000
366,900	11080,000	373,100	11330,000
367,000	10970,000	373,200	11790,000
367,100	11020,000	373,300	11840,000
367,200	10990,000	373,400	11660,000
367,300	10560,000	373,500	11840,000
367,400	10740,000	373,600	11900,000
367,500	10670,000	373,700	12000,000
367,600	10710,000	373,800	12090,000

373,900	11790,000	377,100	14951160,000
374,000	11870,000	377,150	11102870,000
374,100	12480,000	377,200	7850480,000
374,150	11830,000	377,250	5576420,000
374,200	12310,000	377,300	3318490,000
374,250	12150,000	377,350	1772410,000
374,300	12520,000	377,400	1227770,000
374,350	12860,000	377,450	1034670,000
374,400	13220,000	377,500	1252380,000
374,450	14030,000	377,550	757750,000
374,500	14800,000	377,600	756780,000
374,550	16100,000	377,650	756410,000
374,600	17750,000	377,700	630620,000
374,650	19410,000	377,750	630300,000
374,700	19870,000	377,800	636870,000
374,750	22900,000	377,850	752840,000
374,800	26390,000	377,900	554430,000
374,850	32630,000	377,950	562580,000
374,900	46810,000	378,000	557170,000
374,950	71040,000	378,050	635150,000
375,000	97210,000	378,100	504630,000
375,050	108080,000	378,150	500660,000
375,100	119890,000	378,200	547680,000
375,150	109640,000	378,250	465750,000
375,200	87330,000	378,300	464960,000
375,250	65970,000	378,350	469070,000
375,300	48810,000	378,400	16340,000
375,350	39040,000	378,450	436680,000
375,400	38930,000	378,500	435840,000
375,450	41530,000	378,550	465130,000
375,500	45010,000	378,600	407250,000
375,550	49900,000	378,650	405210,000
375,600	59220,000	378,700	407630,000
375,650	76350,000	378,750	438920,000
375,700	115020,000	378,800	385370,000
375,750	144910,000	378,850	387370,000
375,800	219750,000	378,900	404710,000
375,850	280900,000	378,950	378120,000
375,900	313470,000	379,000	379800,000
375,950	315280,000	379,050	372210,000
376,000	277750,000	379,100	395710,000
376,050	198670,000	379,150	357760,000
376,100	130480,000	379,200	357400,000
376,150	94840,000	379,250	370840,000
376,200	151720,000	379,300	329410,000
376,250	141100,000	379,350	331690,000
376,300	203410,000	379,400	344270,000
376,350	267770,000	379,450	343550,000
376,400	361460,000	379,500	329180,000
376,450	499790,000	379,550	344450,000
376,500	837920,000	379,600	353780,000
376,550	2155370,000	379,650	308530,000
376,600	2552410,000	379,700	309490,000
376,650	3187570,000	379,750	306610,000
376,700	4293150,000	379,800	10940,000
376,750	6424960,000	379,850	295150,000
376,800	4519190,000	379,900	326680,000
376,850	16918620,000	379,950	315660,000
376,900	10365290,000	380,000	326470,000
376,950	13060200,000	380,100	316120,000
377,000	15380250,000	380,200	290820,000
377,050	15751560,000	380,300	291820,000

380,400	316260,000	386,600	1596880,000
380,500	284890,000	386,700	1977890,000
380,600	289020,000	386,800	3752580,000
380,700	299240,000	386,900	6038900,000
380,800	249750,000	387,000	7850330,000
380,900	297710,000	387,100	6322240,000
381,000	253220,000	387,200	2990400,000
381,100	296100,000	387,300	948320,000
381,200	262270,000	387,400	125110,000
381,300	282880,000	387,500	14810,000
381,400	297370,000	387,600	13490,000
381,500	222240,000	387,700	13110,000
381,600	274610,000	387,800	11870,000
381,700	266160,000	387,900	11210,000
381,800	237410,000	388,000	10710,000
381,900	236590,000	388,100	10540,000
382,000	272070,000	388,200	10070,000
382,100	257850,000	388,300	9750,000
382,200	254670,000	388,400	9290,000
382,300	224000,000	388,500	9210,000
382,400	286190,000	388,600	8960,000
382,500	287480,000	388,700	8680,000
382,600	227630,000	388,800	8600,000
382,700	254220,000	388,900	8650,000
382,800	236890,000	389,000	7930,000
382,900	276050,000	389,100	8260,000
383,000	271350,000	389,200	8060,000
383,100	252020,000	389,300	7920,000
383,200	281470,000	389,400	7790,000
383,300	304430,000	389,500	7820,000
383,400	300530,000	389,600	7620,000
383,500	305300,000	389,700	7650,000
383,600	311530,000	389,800	7710,000
383,700	315720,000	389,900	7440,000
383,800	302310,000	390,000	7330,000
383,900	318720,000	390,100	7630,000
384,000	334490,000	390,200	7280,000
384,100	304430,000	390,300	7360,000
384,200	331840,000	390,400	7350,000
384,300	329640,000	390,500	6980,000
384,400	332260,000	390,600	7100,000
384,500	359480,000	390,700	6850,000
384,600	357720,000	390,800	7210,000
384,700	382440,000	390,900	7190,000
384,800	378280,000	391,000	6970,000
384,900	396920,000	391,100	6930,000
385,000	436620,000	391,200	7590,000
385,100	447410,000	391,300	7160,000
385,200	447780,000	391,400	6990,000
385,300	421310,000	391,500	6820,000
385,400	451720,000	391,600	6840,000
385,500	484440,000	391,700	6970,000
385,600	489950,000	391,800	7350,000
385,700	548110,000	391,900	7060,000
385,800	605250,000	392,000	6750,000
385,900	683730,000	392,100	6960,000
386,000	645170,000	392,200	6840,000
386,100	645450,000	392,300	6960,000
386,200	729230,000	392,400	6750,000
386,300	774460,000	392,500	7050,000
386,400	985170,000	392,600	6940,000
386,500	1196740,000	392,700	6920,000

392,800	6920,000	399,000	3350,000
392,900	7060,000	399,100	3440,000
393,000	6760,000	399,200	3340,000
393,100	7030,000	399,300	3640,000
393,200	6940,000	399,400	3110,000
393,300	7200,000	399,500	3260,000
393,400	7210,000	399,600	3460,000
393,500	7870,000	399,700	3290,000
393,600	8080,000	399,800	3230,000
393,700	8240,000	399,900	3290,000
393,800	9080,000	400,000	3370,000
393,900	9470,000	400,100	3290,000
394,000	10260,000	400,200	3370,000
394,100	10570,000	400,300	3270,000
394,200	11150,000	400,400	3080,000
394,300	11390,000	400,500	3260,000
394,400	11410,000	400,600	3310,000
394,500	10960,000	400,700	3060,000
394,600	10960,000	400,800	3210,000
394,700	10500,000	400,900	3140,000
394,800	9750,000	401,000	3180,000
394,900	9380,000	401,100	3210,000
395,000	8440,000	401,200	3080,000
395,100	7830,000	401,300	3200,000
395,200	7010,000	401,400	3170,000
395,300	5970,000	401,500	2990,000
395,400	5160,000	401,600	2940,000
395,500	4760,000	401,700	2970,000
395,600	4470,000	401,800	2900,000
395,700	4320,000	401,900	3060,000
395,800	4390,000	402,000	3050,000
395,900	4240,000	402,100	3030,000
396,000	4080,000	402,200	3040,000
396,100	4250,000	402,300	2930,000
396,200	3980,000	402,400	2790,000
396,300	4000,000	402,500	3050,000
396,400	3960,000	402,600	2990,000
396,500	4100,000	402,700	2870,000
396,600	3700,000	402,800	3030,000
396,700	3920,000	402,900	2720,000
396,800	3850,000	403,000	2790,000
396,900	3810,000	403,100	2880,000
397,000	3880,000	403,200	2790,000
397,100	3470,000	403,300	2810,000
397,200	3930,000	403,400	2780,000
397,300	3790,000	403,500	2780,000
397,400	4010,000	403,600	2730,000
397,500	3880,000	403,700	2790,000
397,600	3820,000	403,800	2790,000
397,700	3800,000	403,900	2590,000
397,800	3810,000	404,000	2790,000
397,900	3500,000	404,100	2760,000
398,000	3810,000	404,200	2860,000
398,100	3470,000	404,300	2730,000
398,200	3570,000	404,400	2740,000
398,300	3670,000	404,500	2730,000
398,400	3620,000	404,600	2740,000
398,500	3620,000	404,700	2890,000
398,600	3610,000	404,800	2750,000
398,700	3340,000	404,900	2680,000
398,800	3350,000	405,000	2550,000
398,900	3510,000	405,100	2650,000

405,200	2840,000	411,400	2210,000
405,300	2790,000	411,500	2280,000
405,400	2550,000	411,600	2370,000
405,500	2510,000	411,700	2330,000
405,600	2630,000	411,800	2350,000
405,700	2580,000	411,900	2390,000
405,800	2650,000	412,000	2370,000
405,900	2660,000	412,100	2470,000
406,000	2690,000	412,200	2400,000
406,100	2520,000	412,300	2350,000
406,200	2590,000	412,400	2460,000
406,300	2690,000	412,500	2480,000
406,400	2650,000	412,600	2370,000
406,500	2460,000	412,700	2240,000
406,600	2620,000	412,800	2320,000
406,700	2330,000	412,900	2240,000
406,800	2440,000	413,000	2180,000
406,900	2560,000	413,100	2350,000
407,000	2630,000	413,200	2340,000
407,100	2600,000	413,300	2330,000
407,200	2650,000	413,400	2240,000
407,300	2710,000	413,500	2370,000
407,400	2500,000	413,600	2100,000
407,500	2560,000	413,700	2190,000
407,600	2620,000	413,800	2220,000
407,700	2550,000	413,900	2250,000
407,800	2590,000	414,000	2230,000
407,900	2370,000	414,100	2300,000
408,000	2500,000	414,200	2230,000
408,100	2470,000	414,300	2210,000
408,200	2420,000	414,400	2190,000
408,300	2520,000	414,500	2090,000
408,400	2400,000	414,600	2250,000
408,500	2310,000	414,700	2270,000
408,600	2490,000	414,800	2140,000
408,700	2380,000	414,900	2130,000
408,800	2540,000	415,000	2070,000
408,900	2390,000	415,100	2220,000
409,000	2390,000	415,200	2140,000
409,100	2400,000	415,300	2400,000
409,200	2420,000	415,400	2140,000
409,300	2290,000	415,500	2260,000
409,400	2420,000	415,600	2030,000
409,500	2430,000	415,700	2110,000
409,600	2490,000	415,800	2270,000
409,700	2600,000	415,900	2090,000
409,800	2320,000	416,000	2090,000
409,900	2380,000	416,100	2060,000
410,000	2250,000	416,200	2060,000
410,100	2510,000	416,300	2150,000
410,200	2180,000	416,400	2160,000
410,300	2300,000	416,500	2170,000
410,400	2320,000	416,600	2160,000
410,500	2290,000	416,700	2050,000
410,600	2310,000	416,800	2170,000
410,700	2210,000	416,900	2180,000
410,800	2270,000	417,000	2160,000
410,900	2280,000	417,100	2090,000
411,000	2240,000	417,200	2310,000
411,100	2160,000	417,300	2230,000
411,200	2340,000	417,400	2100,000
411,300	2300,000	417,500	2020,000

417,600	2090,000	423,800	2110,000
417,700	2200,000	423,900	2060,000
417,800	2160,000	424,000	1890,000
417,900	2120,000	424,100	2010,000
418,000	2080,000	424,200	2030,000
418,100	2120,000	424,300	1940,000
418,200	2140,000	424,400	2170,000
418,300	2080,000	424,500	2020,000
418,400	2030,000	424,600	1950,000
418,500	2050,000	424,700	2080,000
418,600	2160,000	424,800	2040,000
418,700	2190,000	424,900	2030,000
418,800	2060,000	425,000	2050,000
418,900	2130,000	425,100	1820,000
419,000	1990,000	425,200	1980,000
419,100	2040,000	425,300	1990,000
419,200	1990,000	425,400	2030,000
419,300	2010,000	425,500	2010,000
419,400	1990,000	425,600	1960,000
419,500	1970,000	425,700	1940,000
419,600	2060,000	425,800	1880,000
419,700	2130,000	425,900	1840,000
419,800	2050,000	426,000	1930,000
419,900	1920,000	426,100	1870,000
420,000	2110,000	426,200	2070,000
420,100	2200,000	426,300	2080,000
420,200	2030,000	426,400	1920,000
420,300	2050,000	426,500	1980,000
420,400	2020,000	426,600	2070,000
420,500	2200,000	426,700	1980,000
420,600	2050,000	426,800	2120,000
420,700	1970,000	426,900	2060,000
420,800	2150,000	427,000	1940,000
420,900	1840,000	427,100	2010,000
421,000	2080,000	427,200	1920,000
421,100	2120,000	427,300	1930,000
421,200	1960,000	427,400	1960,000
421,300	1970,000	427,500	2050,000
421,400	2070,000	427,600	2050,000
421,500	2140,000	427,700	1980,000
421,600	2030,000	427,800	1960,000
421,700	2150,000	427,900	1910,000
421,800	2050,000	428,000	1820,000
421,900	2020,000	428,100	1900,000
422,000	2000,000	428,200	2070,000
422,100	2060,000	428,300	1950,000
422,200	1950,000	428,400	2040,000
422,300	2050,000	428,500	1920,000
422,400	2170,000	428,600	1840,000
422,500	2070,000	428,700	1850,000
422,600	2030,000	428,800	1850,000
422,700	1930,000	428,900	1760,000
422,800	2030,000	429,000	1750,000
422,900	2030,000	429,100	1960,000
423,000	1970,000	429,200	1990,000
423,100	2020,000	429,300	1930,000
423,200	1890,000	429,400	1950,000
423,300	2060,000	429,500	1740,000
423,400	2240,000	429,600	1950,000
423,500	2030,000	429,700	1830,000
423,600	1910,000	429,800	1970,000
423,700	1960,000	429,900	2000,000

430,000	1840,000	433,600	84100,000
430,100	1940,000	433,650	82280,000
430,200	1770,000	433,700	69620,000
430,300	2000,000	433,750	45870,000
430,400	1910,000	433,800	27060,000
430,500	1890,000	433,850	16150,000
430,600	1890,000	433,900	10150,000
430,700	1830,000	433,950	8280,000
430,800	1970,000	434,000	7430,000
430,900	1990,000	434,100	6280,000
431,000	2070,000	434,200	6160,000
431,050	1920,000	434,300	5230,000
431,100	1970,000	434,400	4350,000
431,150	1890,000	434,500	2120,000
431,200	1840,000	434,600	4340,000
431,250	1760,000	434,700	4430,000
431,300	1990,000	434,800	4220,000
431,350	1960,000	434,900	3850,000
431,400	1950,000	435,000	3920,000
431,450	2010,000	435,100	3910,000
431,500	1910,000	435,200	3780,000
431,550	1870,000	435,300	3770,000
431,600	1980,000	435,400	3810,000
431,650	1860,000	435,500	3830,000
431,700	1970,000	435,600	3570,000
431,750	1700,000	435,700	3560,000
431,800	1690,000	435,800	3360,000
431,850	1780,000	435,900	3450,000
431,900	1840,000	436,000	3570,000
431,950	1820,000	436,100	3340,000
432,000	1780,000	436,200	3220,000
432,050	1910,000	436,300	3320,000
432,100	1690,000	436,400	3230,000
432,150	1910,000	436,500	2980,000
432,200	2020,000	436,600	3350,000
432,250	1890,000	436,700	3280,000
432,300	1860,000	436,800	3110,000
432,350	1930,000	436,900	3020,000
432,400	1820,000	437,000	3290,000
432,450	1940,000	437,100	3040,000
432,500	1800,000	437,200	3420,000
432,550	1820,000	437,300	3090,000
432,600	1880,000	437,400	3070,000
432,650	2090,000	437,500	2790,000
432,700	2100,000	437,600	3180,000
432,750	2480,000	437,700	3050,000
432,800	2780,000	437,800	3150,000
432,850	2870,000	437,900	3210,000
432,900	3310,000	438,000	3230,000
432,950	3640,000	438,100	3300,000
433,000	4430,000	438,200	3450,000
433,050	5980,000	438,300	3750,000
433,100	7310,000	438,400	3500,000
433,150	7730,000	438,500	3260,000
433,200	9120,000	438,600	3240,000
433,250	21540,000	438,700	2960,000
433,300	14850,000	438,800	3340,000
433,350	24750,000	438,900	3200,000
433,400	35170,000	439,000	3220,000
433,450	53980,000	439,100	3080,000
433,500	69720,000	439,200	3200,000
433,550	83940,000	439,300	2960,000

439,400	3390,000	444,100	2500,000
439,500	2930,000	444,150	2650,000
439,600	3340,000	444,200	2610,000
439,700	1900,000	444,250	2680,000
439,800	3230,000	444,300	3080,000
439,900	2970,000	444,350	3450,000
440,000	3270,000	444,400	3540,000
440,100	3350,000	444,450	3850,000
440,200	3550,000	444,500	4160,000
440,300	3040,000	444,550	4390,000
440,400	3120,000	444,600	4190,000
440,500	3190,000	444,650	4210,000
440,600	3220,000	444,700	4230,000
440,700	3530,000	444,750	4040,000
440,800	3590,000	444,800	4050,000
440,900	3570,000	444,850	4100,000
441,000	3650,000	444,900	5890,000
441,100	3690,000	444,950	4040,000
441,200	2210,000	445,000	3900,000
441,300	3680,000	445,050	4140,000
441,400	3710,000	445,100	3980,000
441,500	3720,000	445,200	3600,000
441,600	4000,000	445,300	3310,000
441,700	3740,000	445,400	2900,000
441,800	3940,000	445,500	2760,000
441,900	3890,000	445,600	2790,000
442,000	3930,000	445,700	3010,000
442,100	4090,000	445,800	2940,000
442,200	4230,000	445,900	2660,000
442,300	2360,000	446,000	2670,000
442,400	4460,000	446,100	2720,000
442,500	4990,000	446,200	2660,000
442,600	4870,000	446,300	2770,000
442,650	5390,000	446,400	2680,000
442,700	5510,000	446,500	2700,000
442,750	5710,000	446,600	2570,000
442,800	5580,000	446,700	2700,000
442,850	6350,000	446,800	2640,000
442,900	6620,000	446,900	2610,000
442,950	6520,000	447,000	2570,000
443,000	8060,000	447,100	2810,000
443,050	8770,000	447,200	2700,000
443,100	9190,000	447,300	2840,000
443,150	9390,000	447,400	2910,000
443,200	11020,000	447,500	3000,000
443,250	12260,000	447,600	2850,000
443,300	13630,000	447,700	2990,000
443,350	18530,000	447,800	3190,000
443,400	24040,000	447,900	3220,000
443,450	31200,000	448,000	3220,000
443,500	35580,000	448,100	3430,000
443,550	37240,000	448,150	3400,000
443,600	37260,000	448,200	3540,000
443,650	34670,000	448,250	3670,000
443,700	24770,000	448,300	3860,000
443,750	15660,000	448,350	3750,000
443,800	7980,000	448,400	4110,000
443,850	4670,000	448,450	4440,000
443,900	3090,000	448,500	8420,000
443,950	2620,000	448,550	6240,000
444,000	2410,000	448,600	8180,000
444,050	2480,000	448,650	10090,000

448,700	12730,000	451,800	35440,000
448,750	17790,000	451,850	30920,000
448,800	22810,000	451,900	33490,000
448,850	29020,000	451,950	33490,000
448,900	37930,000	452,000	33190,000
448,950	49840,000	452,050	32520,000
449,000	63580,000	452,100	34680,000
449,050	82830,000	452,150	34340,000
449,100	117300,000	452,200	31900,000
449,150	155330,000	452,250	33960,000
449,200	253230,000	452,300	34010,000
449,250	1056130,000	452,350	31800,000
449,300	718510,000	452,400	29230,000
449,350	1041300,000	452,450	30670,000
449,400	1320780,000	452,500	29310,000
449,450	1603680,000	452,550	32430,000
449,500	1633210,000	452,600	30840,000
449,550	1398930,000	452,650	29620,000
449,600	1191310,000	452,700	29110,000
449,650	705580,000	452,750	32510,000
449,700	453400,000	452,800	28550,000
449,750	261380,000	452,850	29200,000
449,800	135290,000	452,900	31400,000
449,850	38430,000	452,950	32000,000
449,900	121380,000	453,000	30030,000
449,950	11020,000	453,050	30680,000
450,000	73530,000	453,100	3540,000
450,050	93000,000	453,150	4030,000
450,100	92070,000	453,200	27910,000
450,150	62070,000	453,250	4930,000
450,200	72050,000	453,300	27090,000
450,250	72540,000	453,350	29140,000
450,300	54110,000	453,400	31430,000
450,350	55770,000	453,450	32170,000
450,400	60380,000	453,500	32480,000
450,450	61000,000	453,550	8780,000
450,500	50320,000	453,600	27430,000
450,550	53450,000	453,650	30860,000
450,600	54050,000	453,700	25270,000
450,650	46840,000	453,750	31290,000
450,700	46540,000	453,800	10020,000
450,750	49470,000	453,850	25030,000
450,800	49140,000	453,900	28250,000
450,850	3760,000	453,950	8870,000
450,900	45690,000	454,000	28850,000
450,950	45590,000	454,050	24420,000
451,000	40250,000	454,100	24850,000
451,050	43010,000	454,150	29770,000
451,100	42960,000	454,200	28270,000
451,150	35200,000	454,250	22430,000
451,200	38650,000	454,300	25200,000
451,250	40620,000	454,350	28450,000
451,300	40580,000	454,400	22050,000
451,350	36980,000	454,450	27520,000
451,400	32600,000	454,500	29230,000
451,450	38470,000	454,550	27100,000
451,500	34340,000	454,600	21410,000
451,550	38180,000	454,650	24700,000
451,600	36320,000	454,700	29640,000
451,650	35930,000	454,750	24400,000
451,700	35640,000	454,800	24700,000
451,750	35810,000	454,850	24500,000

454,900	26980,000	460,900	1770,000
454,950	28300,000	461,000	2530,000
455,000	28700,000	461,100	1680,000
455,050	24370,000	461,200	2580,000
455,100	23020,000	461,300	1720,000
455,200	30240,000	461,400	2190,000
455,300	29740,000	461,500	1780,000
455,400	30550,000	461,600	1650,000
455,500	27820,000	461,700	1590,000
455,600	25140,000	461,800	1670,000
455,700	30240,000	461,900	1620,000
455,800	21500,000	462,000	2440,000
455,900	24220,000	462,100	1610,000
456,000	20400,000	462,200	1470,000
456,100	20700,000	462,300	1580,000
456,200	29440,000	462,400	1680,000
456,300	31930,000	462,500	1860,000
456,400	20200,000	462,600	2580,000
456,500	32840,000	462,700	1910,000
456,600	21400,000	462,800	1770,000
456,700	22000,000	462,900	1690,000
456,800	34250,000	463,000	1810,000
456,900	1980,000	463,100	2580,000
457,000	1870,000	463,200	1620,000
457,100	2000,000	463,300	1620,000
457,200	1790,000	463,400	3280,000
457,300	36070,000	463,500	1520,000
457,400	37880,000	463,600	1540,000
457,500	38540,000	463,700	1480,000
457,600	39280,000	463,800	1520,000
457,700	40750,000	463,900	1530,000
457,800	40250,000	464,000	1460,000
457,900	43840,000	464,100	1610,000
458,000	45910,000	464,200	1620,000
458,100	45980,000	464,300	1580,000
458,200	49230,000	464,400	1510,000
458,300	48780,000	464,500	1520,000
458,400	1630,000	464,600	1620,000
458,500	1680,000	464,700	1480,000
458,600	62470,000	464,800	1400,000
458,700	75330,000	464,900	1380,000
458,800	1720,000	465,000	1530,000
458,900	1610,000	465,100	1540,000
459,000	116280,000	465,200	1500,000
459,100	1660,000	465,300	1530,000
459,200	1670,000	465,400	1550,000
459,300	1610,000	465,500	1540,000
459,400	1750,000	465,600	1450,000
459,500	1500,000	465,700	1610,000
459,600	1660,000	465,800	1500,000
459,700	114710,000	465,900	1540,000
459,800	1700,000	466,000	1560,000
459,900	1630,000	466,100	1600,000
460,000	1590,000	466,200	1480,000
460,100	1490,000	466,300	1530,000
460,200	1620,000	466,400	1460,000
460,300	1590,000	466,500	1600,000
460,400	1570,000	466,600	1510,000
460,500	1700,000	466,700	1500,000
460,600	1680,000	466,800	1520,000
460,700	1620,000	466,900	1560,000
460,800	1650,000	467,000	1430,000

467,100	1500,000	472,800	38550,000
467,200	1610,000	472,850	43100,000
467,300	1510,000	472,900	44640,000
467,400	1420,000	472,950	44000,000
467,500	1470,000	473,000	38450,000
467,600	1510,000	473,050	29590,000
467,700	1470,000	473,100	23500,000
467,800	1540,000	473,150	21700,000
467,900	1460,000	473,200	21490,000
468,000	1550,000	473,250	21880,000
468,100	1600,000	473,300	21620,000
468,200	1500,000	473,350	20440,000
468,300	1660,000	473,400	17820,000
468,400	1470,000	473,450	15450,000
468,500	1720,000	473,500	14530,000
468,600	1470,000	473,550	13380,000
468,700	1580,000	473,600	12360,000
468,800	1670,000	473,650	9720,000
468,900	1680,000	473,700	6010,000
469,000	1500,000	473,750	3490,000
469,100	1700,000	473,800	2170,000
469,200	1550,000	473,850	1870,000
469,300	1480,000	473,900	1770,000
469,400	1510,000	473,950	1750,000
469,500	1610,000	474,000	1740,000
469,600	1510,000	474,100	1840,000
469,700	1470,000	474,200	2010,000
469,800	1540,000	474,300	1850,000
469,900	1540,000	474,400	1500,000
470,000	1560,000	474,500	1620,000
470,100	1510,000	474,600	1620,000
470,200	1680,000	474,700	1540,000
470,300	1650,000	474,800	1530,000
470,400	1930,000	474,900	1600,000
470,500	1960,000	475,000	1790,000
470,600	1610,000	475,100	1950,000
470,700	1630,000	475,200	1840,000
470,800	1520,000	475,300	2200,000
470,900	1620,000	475,400	2880,000
471,000	1550,000	475,500	3960,000
471,100	1600,000	475,600	4290,000
471,200	1530,000	475,700	3310,000
471,300	1620,000	475,800	2170,000
471,400	1540,000	475,900	1890,000
471,500	1490,000	476,000	1650,000
471,600	1560,000	476,100	1810,000
471,700	1430,000	476,200	1980,000
471,800	1680,000	476,300	1930,000
471,900	1610,000	476,400	2750,000
472,000	1640,000	476,500	4030,000
472,100	1810,000	476,600	4350,000
472,200	2080,000	476,700	3990,000
472,300	2550,000	476,800	3080,000
472,350	2780,000	476,900	2380,000
472,400	3340,000	477,000	1930,000
472,450	3690,000	477,100	1840,000
472,500	4360,000	477,200	1730,000
472,550	5490,000	477,300	2000,000
472,600	7220,000	477,400	2130,000
472,650	12210,000	477,500	2050,000
472,700	19920,000	477,600	2570,000
472,750	30410,000	477,700	2990,000

477,800	3810,000	484,000	3630,000
477,900	3760,000	484,100	3410,000
478,000	3240,000	484,200	3320,000
478,100	2520,000	484,300	3330,000
478,200	2570,000	484,400	3230,000
478,300	2630,000	484,500	3240,000
478,400	2820,000	484,600	3130,000
478,500	2960,000	484,700	3160,000
478,600	3280,000	484,800	3280,000
478,700	3300,000	484,900	3530,000
478,800	3350,000	485,000	4020,000
478,900	3410,000	485,100	5080,000
479,000	3430,000	485,200	6100,000
479,100	3420,000	485,300	6200,000
479,200	3330,000	485,400	4990,000
479,300	3490,000	485,500	4150,000
479,400	3340,000	485,600	4010,000
479,500	3390,000	485,700	4310,000
479,600	3120,000	485,800	4510,000
479,700	2860,000	485,900	4660,000
479,800	2730,000	486,000	4740,000
479,900	2650,000	486,100	5160,000
480,000	2590,000	486,200	5220,000
480,100	2220,000	486,300	5540,000
480,200	2210,000	486,400	5550,000
480,300	2350,000	486,500	5560,000
480,400	2240,000	486,600	5740,000
480,500	2160,000	486,700	5930,000
480,600	2330,000	486,800	6000,000
480,700	2520,000	486,900	6330,000
480,800	2360,000	487,000	6750,000
480,900	2800,000	487,100	6980,000
481,000	2910,000	487,200	7390,000
481,100	2910,000	487,300	7820,000
481,200	2740,000	487,400	8450,000
481,300	2570,000	487,500	9180,000
481,400	3020,000	487,600	10070,000
481,500	3470,000	487,700	12550,000
481,600	3960,000	487,800	23550,000
481,700	4290,000	487,900	93500,000
481,800	4860,000	488,000	222900,000
481,900	5800,000	488,100	377080,000
482,000	6140,000	488,200	648090,000
482,100	6650,000	488,300	1162540,000
482,200	7710,000	488,400	1613190,000
482,300	8780,000	488,500	2943100,000
482,400	9510,000	488,600	6874700,000
482,500	9640,000	488,700	12927010,000
482,600	9650,000	488,800	16195810,000
482,700	9160,000	488,900	14638480,000
482,800	8120,000	489,000	6202550,000
482,900	6640,000	489,100	1054490,000
483,000	5260,000	489,200	30340,000
483,100	5220,000	489,300	13590,000
483,200	5460,000	489,400	11130,000
483,300	5440,000	489,500	9910,000
483,400	5040,000	489,600	8530,000
483,500	5160,000	489,700	7080,000
483,600	4690,000	489,800	6910,000
483,700	4460,000	489,900	6120,000
483,800	3990,000	490,000	5310,000
483,900	3860,000	490,100	5010,000

490,200	4840,000	496,400	2350,000
490,300	4430,000	496,500	2300,000
490,400	4170,000	496,600	2560,000
490,500	3950,000	496,700	2610,000
490,600	3780,000	496,800	2810,000
490,700	3600,000	496,900	3070,000
490,800	3520,000	497,000	3490,000
490,900	3320,000	497,100	3770,000
491,000	3110,000	497,200	4300,000
491,100	3210,000	497,300	4650,000
491,200	3250,000	497,400	5180,000
491,300	3100,000	497,500	5560,000
491,400	2950,000	497,600	5710,000
491,500	2900,000	497,700	5950,000
491,600	2930,000	497,800	6410,000
491,700	2920,000	497,900	6130,000
491,800	2990,000	498,000	6170,000
491,900	2720,000	498,100	6020,000
492,000	2870,000	498,200	5780,000
492,100	2830,000	498,300	5830,000
492,200	2600,000	498,400	5440,000
492,300	2710,000	498,500	5390,000
492,400	2630,000	498,600	4910,000
492,500	2630,000	498,700	4850,000
492,600	2830,000	498,800	4450,000
492,700	2980,000	498,900	3900,000
492,800	3220,000	499,000	3870,000
492,900	3900,000	499,100	3320,000
493,000	4470,000	499,200	2990,000
493,100	9890,000	499,300	2490,000
493,200	18580,000	499,400	2310,000
493,300	22240,000	499,500	1960,000
493,400	20020,000	499,600	1860,000
493,500	8660,000	499,700	1770,000
493,600	3370,000	499,800	1880,000
493,700	2820,000	499,900	1690,000
493,800	2880,000	500,000	1650,000
493,900	3010,000	500,100	1550,000
494,000	3200,000	500,200	1610,000
494,100	3310,000	500,300	1710,000
494,200	3380,000	500,400	1740,000
494,300	3410,000	500,500	1700,000
494,400	3270,000	500,600	1740,000
494,500	3610,000	500,700	1750,000
494,600	4270,000	500,800	1750,000
494,700	4100,000	500,900	1620,000
494,800	3650,000	501,000	1710,000
494,900	2950,000	501,100	1490,000
495,000	2860,000	501,200	1700,000
495,100	2680,000	501,300	1770,000
495,200	2680,000	501,400	1690,000
495,300	2570,000	501,500	1670,000
495,400	2610,000	501,600	1640,000
495,500	2900,000	501,700	1670,000
495,600	2880,000	501,800	1760,000
495,700	2800,000	501,900	1650,000
495,800	2650,000	502,000	1790,000
495,900	2510,000	502,100	1630,000
496,000	2450,000	502,200	1850,000
496,100	2490,000	502,300	1730,000
496,200	2300,000	502,400	1800,000
496,300	2280,000	502,500	1830,000

502,600	1730,000	508,800	2340,000
502,700	1630,000	508,900	1920,000
502,800	1630,000	509,000	1730,000
502,900	1890,000	509,100	1730,000
503,000	2000,000	509,200	1870,000
503,100	2120,000	509,300	1750,000
503,200	2610,000	509,400	1940,000
503,300	3270,000	509,500	1840,000
503,400	4780,000	509,600	2050,000
503,500	11420,000	509,700	1840,000
503,600	21070,000	509,800	1890,000
503,700	25170,000	509,900	1850,000
503,800	21660,000	510,000	2000,000
503,900	9570,000	510,100	2050,000
504,000	5260,000	510,200	2220,000
504,100	2600,000	510,300	2490,000
504,200	2370,000	510,400	3400,000
504,300	2290,000	510,500	4390,000
504,400	2210,000	510,600	5590,000
504,500	1940,000	510,700	5270,000
504,600	1520,000	510,800	3650,000
504,700	1580,000	510,900	2210,000
504,800	1590,000	511,000	1950,000
504,900	1570,000	511,100	1850,000
505,000	1580,000	511,200	1820,000
505,100	1530,000	511,300	1740,000
505,200	1550,000	511,400	1850,000
505,300	1600,000	511,500	1890,000
505,400	1740,000	511,600	1880,000
505,500	1640,000	511,700	2120,000
505,600	1640,000	511,800	2020,000
505,700	1540,000	511,900	2180,000
505,800	1610,000	512,000	2400,000
505,900	1680,000	512,100	2370,000
506,000	1670,000	512,200	2160,000
506,100	1650,000	512,300	2670,000
506,200	1570,000	512,400	3850,000
506,300	1460,000	512,500	4190,000
506,400	1560,000	512,600	3920,000
506,500	1500,000	512,700	3040,000
506,600	1560,000	512,800	2210,000
506,700	1580,000	512,900	1950,000
506,800	1570,000	513,000	1980,000
506,900	1630,000	513,100	2130,000
507,000	1560,000	513,200	2120,000
507,100	1510,000	513,300	2190,000
507,200	1550,000	513,400	2270,000
507,300	1530,000	513,500	2310,000
507,400	1590,000	513,600	2460,000
507,500	1630,000	513,700	2320,000
507,600	1650,000	513,800	2450,000
507,700	1670,000	513,900	2380,000
507,800	1570,000	514,000	2480,000
507,900	1570,000	514,100	2580,000
508,000	1670,000	514,200	2610,000
508,100	1770,000	514,300	3500,000
508,200	1780,000	514,400	4720,000
508,300	1830,000	514,500	4800,000
508,400	1920,000	514,600	4420,000
508,500	1890,000	514,700	2720,000
508,600	2250,000	514,800	2460,000
508,700	2490,000	514,900	2660,000

515,000	2480,000	521,200	4310,000
515,100	2630,000	521,300	6000,000
515,200	2520,000	521,400	11560,000
515,300	2330,000	521,500	31890,000
515,400	2440,000	521,600	52320,000
515,500	2490,000	521,700	82960,000
515,600	2510,000	521,800	176480,000
515,700	2390,000	521,900	285830,000
515,800	2560,000	522,000	392750,000
515,900	2430,000	522,100	724940,000
516,000	2510,000	522,200	1354170,000
516,100	2360,000	522,300	2158930,000
516,200	2290,000	522,400	2426260,000
516,300	2310,000	522,500	1955930,000
516,400	2280,000	522,600	516050,000
516,500	2110,000	522,700	55050,000
516,600	2370,000	522,800	5600,000
516,700	2340,000	522,900	4400,000
516,800	2360,000	523,000	4060,000
516,900	2430,000	523,100	3710,000
517,000	2480,000	523,200	3640,000
517,100	2480,000	523,300	3410,000
517,200	2310,000	523,400	3300,000
517,300	2390,000	523,500	3500,000
517,400	2290,000	523,600	3980,000
517,500	2290,000	523,700	4340,000
517,600	2250,000	523,800	4320,000
517,700	2180,000	523,900	3430,000
517,800	2550,000	524,000	2750,000
517,900	2880,000	524,100	2430,000
518,000	3420,000	524,200	2470,000
518,100	3870,000	524,300	2230,000
518,200	3470,000	524,400	2400,000
518,300	2590,000	524,500	2490,000
518,400	2310,000	524,600	2320,000
518,500	2150,000	524,700	2530,000
518,600	2240,000	524,800	2360,000
518,700	2300,000	524,900	2550,000
518,800	2440,000	525,000	2730,000
518,900	2710,000	525,100	3440,000
519,000	2900,000	525,200	4450,000
519,100	3430,000	525,300	5730,000
519,200	4350,000	525,400	5320,000
519,300	9830,000	525,500	3970,000
519,400	34490,000	525,600	2500,000
519,500	57720,000	525,700	2300,000
519,600	91310,000	525,800	2280,000
519,700	165450,000	525,900	2240,000
519,800	233450,000	526,000	2150,000
519,900	340700,000	526,100	2300,000
520,000	771990,000	526,200	2330,000
520,100	1591890,000	526,300	2370,000
520,200	2535270,000	526,400	2770,000
520,300	2632480,000	526,500	3160,000
520,400	1558790,000	526,600	2970,000
520,500	342760,000	526,700	3050,000
520,600	17230,000	526,800	2480,000
520,700	4750,000	526,900	2250,000
520,800	4250,000	527,000	2270,000
520,900	3990,000	527,100	2310,000
521,000	3840,000	527,200	2260,000
521,100	3820,000	527,300	2340,000

527,400	2260,000	533,600	3070,000
527,500	2350,000	533,700	3710,000
527,600	2900,000	533,800	4440,000
527,700	4410,000	533,900	4210,000
527,800	5810,000	534,000	3340,000
527,900	8210,000	534,100	2960,000
528,000	12950,000	534,200	3110,000
528,100	18110,000	534,300	2970,000
528,200	32630,000	534,400	2480,000
528,300	68130,000	534,500	2090,000
528,400	119460,000	534,600	2010,000
528,500	165820,000	534,700	2180,000
528,600	153840,000	534,800	2440,000
528,700	85150,000	534,900	2570,000
528,800	20930,000	535,000	2390,000
528,900	3570,000	535,100	2510,000
529,000	3020,000	535,200	2210,000
529,100	3080,000	535,300	2280,000
529,200	3160,000	535,400	2500,000
529,300	3280,000	535,500	2450,000
529,400	2910,000	535,600	2290,000
529,500	2680,000	535,700	2190,000
529,600	2550,000	535,800	2270,000
529,700	2490,000	535,900	2370,000
529,800	2510,000	536,000	2610,000
529,900	2610,000	536,100	3460,000
530,000	2520,000	536,200	7340,000
530,100	2650,000	536,300	12890,000
530,200	2860,000	536,400	16970,000
530,300	3100,000	536,500	29370,000
530,400	3450,000	536,600	44960,000
530,500	3860,000	536,700	71530,000
530,600	4700,000	536,800	211650,000
530,700	5430,000	536,900	485390,000
530,800	5790,000	537,000	728670,000
530,900	6390,000	537,100	727080,000
531,000	8490,000	537,200	514080,000
531,100	12650,000	537,300	69950,000
531,200	16560,000	537,400	12660,000
531,300	25030,000	537,500	16350,000
531,400	54980,000	537,600	21620,000
531,500	102730,000	537,700	28630,000
531,600	150110,000	537,800	64160,000
531,700	152670,000	537,900	130400,000
531,800	105280,000	538,000	218210,000
531,900	34560,000	538,100	245940,000
532,000	6760,000	538,200	198880,000
532,100	3340,000	538,300	53560,000
532,200	3200,000	538,400	7310,000
532,300	3090,000	538,500	2420,000
532,400	2860,000	538,600	2340,000
532,500	2840,000	538,700	2300,000
532,600	2550,000	538,800	2230,000
532,700	2530,000	538,900	2190,000
532,800	2470,000	539,000	2190,000
532,900	2450,000	539,100	2130,000
533,000	2410,000	539,200	2240,000
533,100	2400,000	539,300	2180,000
533,200	2340,000	539,400	2140,000
533,300	2240,000	539,500	2190,000
533,400	2360,000	539,600	2230,000
533,500	2500,000	539,700	2310,000

539,800	2440,000	546,000	18030,000
539,900	2440,000	546,100	21120,000
540,000	2660,000	546,200	22700,000
540,100	2970,000	546,300	26680,000
540,200	3220,000	546,400	33830,000
540,300	3250,000	546,500	46450,000
540,400	3140,000	546,600	63210,000
540,500	3520,000	546,700	74030,000
540,600	5030,000	546,800	105230,000
540,700	6090,000	546,900	153770,000
540,800	7670,000	547,000	191440,000
540,900	14640,000	547,100	173120,000
541,000	32540,000	547,200	122770,000
541,100	49920,000	547,300	28500,000
541,200	54260,000	547,400	15950,000
541,300	41640,000	547,500	20710,000
541,400	33470,000	547,600	27350,000
541,500	38510,000	547,700	35060,000
541,600	45060,000	547,800	67060,000
541,700	46110,000	547,900	140450,000
541,800	38800,000	548,000	241530,000
541,900	19050,000	548,100	253910,000
542,000	11790,000	548,200	243280,000
542,100	10220,000	548,300	112970,000
542,200	10890,000	548,400	62040,000
542,300	11450,000	548,500	57920,000
542,400	12990,000	548,600	56430,000
542,500	10930,000	548,700	38610,000
542,600	11680,000	548,800	23030,000
542,700	12180,000	548,900	19680,000
542,800	11010,000	549,000	18420,000
542,900	9880,000	549,100	18850,000
543,000	11650,000	549,200	19410,000
543,100	11840,000	549,300	19570,000
543,200	9670,000	549,400	21280,000
543,300	11750,000	549,500	17970,000
543,400	9840,000	549,600	13060,000
543,500	9900,000	549,700	11590,000
543,600	12110,000	549,800	11400,000
543,700	10450,000	549,900	11260,000
543,800	12420,000	550,000	10850,000
543,900	12700,000		
544,000	12190,000		
544,100	11390,000		
544,200	11630,000		
544,300	11580,000		
544,400	11990,000		
544,500	12100,000		
544,600	11930,000		
544,700	12350,000		
544,800	12680,000		
544,900	12840,000		
545,000	13520,000		
545,100	13370,000		
545,200	13310,000		
545,300	14210,000		
545,400	13760,000		
545,500	15090,000		
545,600	15650,000		
545,700	15420,000		
545,800	17000,000		
545,900	16850,000		