

A unique and universal molecular barcode array

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Molecular barcode arrays allow the analysis of thousands of biological samples in parallel through the use of unique 20-base-pair (bp) DNA tags. Here we present a new barcode array, which is unique among microarrays in that it includes at least five replicates of every tag feature. The use of smaller dispersed replicate features dramatically improves performance versus a single larger feature and allows the correction of previously undetectable hybridization defects.

Molecular barcode arrays are used to detect samples that have been labeled by the addition of short, identifying DNA sequences known as “barcodes” or “tags”. These arrays are best known for their use with the tagged strains of the yeast deletion collections^{1,2} (Fig. 1a). Each deletion strain in these collections contains at least one unique 20-bp tag. The inclusion of tags allows the yeast deletion mutants to be phenotyped in pooled cultures with changes in individual strain abundance measured simultaneously using a barcode array (Fig. 1b). This provides a powerful system for identifying the genes required for growth in any condition of interest^{2–10}.

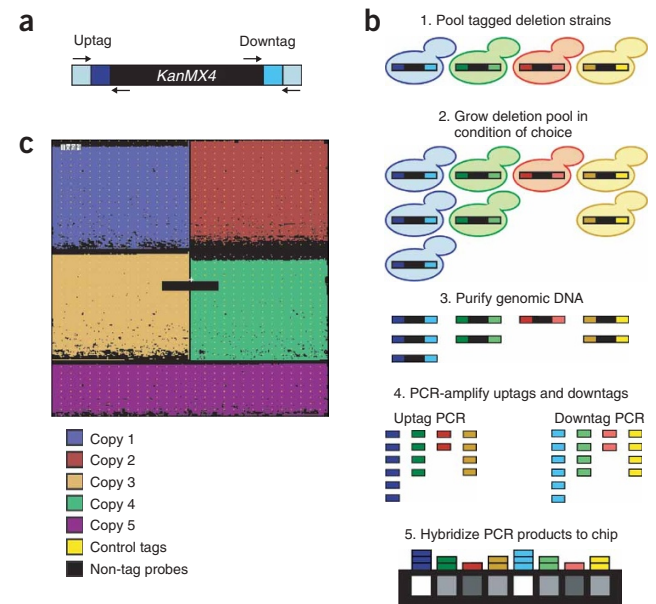
Barcode arrays are flexible with regards to the types of samples they can be used to measure because tags can be incorporated into many diverse biological samples. For example, the inclusion of tags in molecular inversion probes allows > 10,000 single nucleotide polymorphisms (SNPs) to be assayed in a single tube¹⁰. Tags have also been used in conjunction with siRNA vector libraries to facilitate genome-wide gene-knockdown screens in mammalian cells^{11,12}.

Figure 1 | Description of the competitive growth assay. (a) Each strain in the yeast deletion collection contains a unique uptag and downtag, both of which are flanked by universal primers. (b) To phenotype the strains, they are first pooled at approximately equal abundance. This pool is then grown competitively, and the barcodes are PCR-amplified in two PCRs from the genomic DNA. The PCR products are hybridized to a tag array, and tag intensity is used to determine any changes in the amount of each strain present. Strains with deletions in genes that are important for survival under the growth condition will be underrepresented in the treatment sample compared to the control. (c) Outline of the TAG4 array design.

Here we present a new barcode array with improved performance and affordability. The driving force behind the design of this new barcode array was to reduce the overall array size to minimize cost, making barcode array methods more accessible to the yeast community. We achieved this reduction in size and improved performance by using smaller dispersed 8- μm replicate features, which occupy less total space than the single larger 24- μm features used on our previous tag array. We included five replicates of each tag because the smallest available 8- μm feature Affymetrix array contains $\sim 100,000$ features, meaning the array could not have been reduced any further in size by including fewer replicates.

We also reduced the size of the array by removing two groups of features that were found to be uninformative on the two previous barcode arrays (TAG1, refs. 13,14 and TAG3, ref. 2). We removed the mismatch probes, which are normally used to estimate the fraction of signal that is attributable to nonspecific hybridization, because we found that unassigned tag features are a better estimate of nonspecific hybridization (Supplementary Fig. 1 online). We also removed the probes for detecting each tag’s antisense strand because the sense strand is the designed tag sequence and has superior hybridization behavior (data not shown). In total, we removed 75% of the tag probes present on previous tag arrays.

In addition to these changes, we added two extra sets of features to the array to improve its use with the yeast deletion collection.



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Table 1 | Data reproducibility

	Pair 1	Pair 2	Pair 3	Mean
TAG4 1 replicate	0.9924	0.9905	0.9918	0.9916
TAG4 2 replicates	0.9948	0.9936	0.9949	0.9944
TAG4 3 replicates	0.9956	0.9946	0.9959	0.9954
TAG4 4 replicates	0.996	0.9951	0.9964	0.9959
TAG4 5 replicates	0.9963	0.9954	0.9967	0.9962
TAG3	0.9929	0.9934	0.9954	0.9939

Three samples were each hybridized to a pair of TAG4 arrays (five 8- μm features for each probe) and a pair of TAG3 arrays (a single 24- μm feature for each probe). The correlation of the raw tag values is reported for each pair. Values averaged over one to five replicate features are also shown for the TAG4 array. At most three 8- μm features are needed to equal the performance of a single 24- μm feature. Higher reproducibility is achieved when the five TAG4 replicates are averaged rather than taking their median (data not shown).

One such set includes features designed to improve the detection of yeast deletion strains with sequence errors in their tags. The other set is an extensive collection of control features. For these 24 control tags, we increased the number of replicate features from 5 to 55 per tag, with the additional 50 replicates evenly spaced across the array (Fig. 1c).

Finally, we have included detailed information on fitness profiling of the yeast deletion collections using the TAG4 array (Supplementary Methods online). In combination with the availability of an affordable barcode array, these tools will make the fitness profiling method more accessible to the yeast community and will provide a solid template for the development of other barcode array applications.

To assess the quality of TAG4 data relative to data obtained with our previous tag array, we hybridized the same sample to each array multiple times. Comparing multiple hybridizations of the same sample allowed us to measure the error introduced by array performance. We repeated this experiment with three independent tag PCR reactions, each hybridized to a pair of TAG3 arrays and a pair of TAG4 arrays. We found that TAG4 data are more reproducible than data obtained with the TAG3 array (Table 1) as measured by the correlation of data from each pair of duplicate hybridizations. We also used this experiment to measure the impact of replicate features on the reproducibility of TAG4 data. As expected, data from a single 8- μm feature is not as reproducible as data from a 24- μm feature. But reproducibility surpassing that of a single 24- μm feature is achieved with as few as three 8- μm features (Table 1), even though these features occupy only one-third of the space.

To test the ability of the TAG4 array to accurately measure differences in tag abundance, we hybridized a set of samples with defined tag-concentration differences. We prepared these samples by mixing uptag PCR and downtag PCR in varying quantities while maintaining the total amount of tag PCR in each mixture constant (Fig. 2a). We examined three known tag ratios (Fig. 2). These three ratios are well resolved for tags with average signal intensity above 200 arbitrary fluorescent units (afu), but the signal ratio deviates from the actual tag ratio for many of these tags. In general, the array data tend to underestimate the difference in tag concentration between the two samples, and this effect increases with increasing tag intensity. This pattern suggests that the probe signal is saturating as the tag concentration increases (Fig. 2b). We derived a correction function that adjusts the intensity values to correct for this

saturation. Applying this correction improves the overall resolution and accuracy of tag ratios (Fig. 2c,e).

Another benefit of using replicate features is that they allow the identification and correction of outlier data. We identify outlier probes by comparing the signal from replicate features and looking for cases in which one replicate does not agree well with the other four (Fig. 3). In addition to looking for individual outlier probes, our masking algorithm also compares neighboring features to look for regions of the array in which probes differ consistently from their replicates. Any regions with a high density of probes that differ from their replicates by more than 10% are removed. At this level of stringency, only 0.24% of probes are removed from each array, on average. Masking this small fraction of probes is nonetheless extremely useful, as we have observed that otherwise these outlier points result in calls of false sensitivity or resistance for some strains (data not shown). This technique permits correction of hybridization problems as well as washing and staining irregularities that are not visible in the raw data, and would not have been detected by the standard outlier detection software. The replicates remaining after the removal of outliers are averaged to generate an intensity value for each tag. This type of error correction requires an array with at least three replicate features for each probe.

Some strains in the yeast deletion collection have been shown to have incorrect tag sequences. To improve the ability of the TAG4

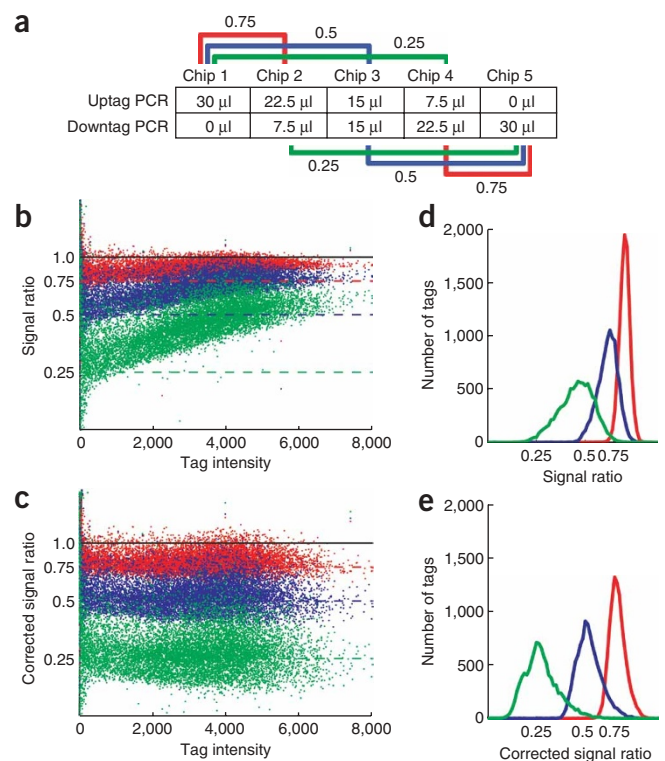


Figure 2 | Ability to resolve known TAG ratios. Defined ratios of uptag and downtag PCR were hybridized to a series of arrays. (a) The amount of tag PCR loaded on each array (a normal hybridization uses 30 μl uptag PCR and 30 μl downtag PCR). (b) Dotted lines indicate the three tag ratios that were hybridized; points of corresponding color show the actual signal ratios. (c) The nonlinearity of the data is correctable by adjusting the signal ratio as a function of tag intensity. (d-e) Density plots comparing the separation of tag ratios before (d) and after (e) correction (bin size, 0.05).

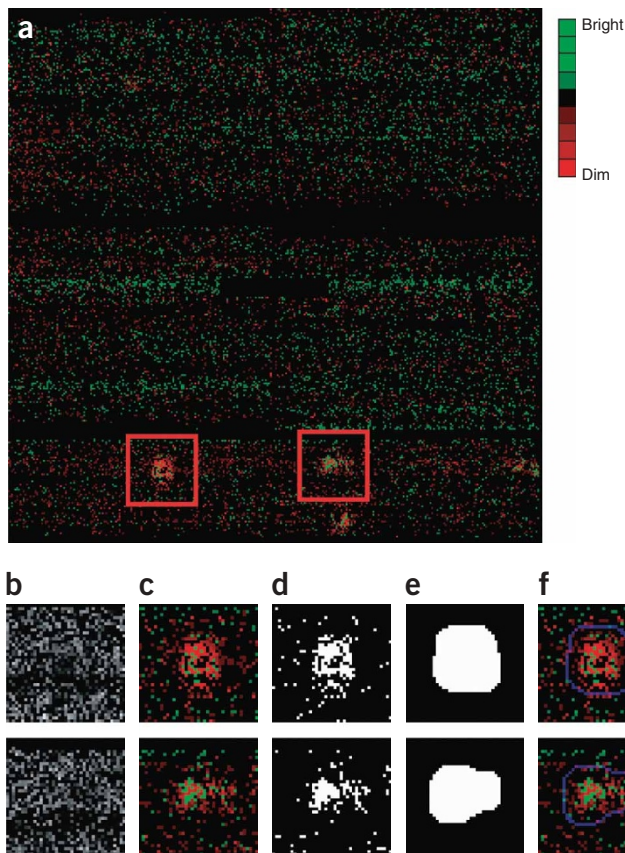


Figure 3 | Utilization of feature replicates to detect and mask array defects. Array defects that are not visible in raw data can be detected by comparing each replicate on the array to its replicate mean. **(a)** Heat map of replicate comparisons for a TAG4 array with several defects. **(b–f)** Detailed analysis for the regions marked with red boxes. **(b)** Raw intensity data. **(c)** Heat map. Brightest green and red points differ from the probe mean by at least 20%. **(d)** Extreme outliers. White points differ from the probe mean by at least 10%. **(e)** Masked regions. Regions selected for masking with are shown in white. **(f)** Masked regions shown on the heat map.

unique features). As array technology advances, the option of including replicate features will soon become available even for applications such as gene expression profiling that require a large number of probes.

The use of replicates is also extremely advantageous because it allows previously uncorrectable array defects to be automatically detected and masked without losing data for any of the tags. This benefit should not be limited to barcode arrays, or even to the Affymetrix array platform. Defects such as the ones we have observed most likely occur with all types of microarrays, but without replicate probes, detecting them will often be impossible. The use of replicates would be an especially valuable approach for situations in which data accuracy is critical, such as arrays used for clinical applications.

Note: Supplementary information is available on the Nature Methods website.

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COMPETING INTERESTS STATEMENT

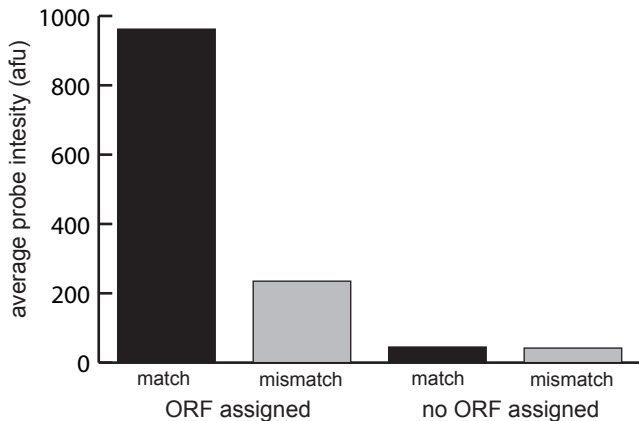
The authors declare that they have no competing financial interests.

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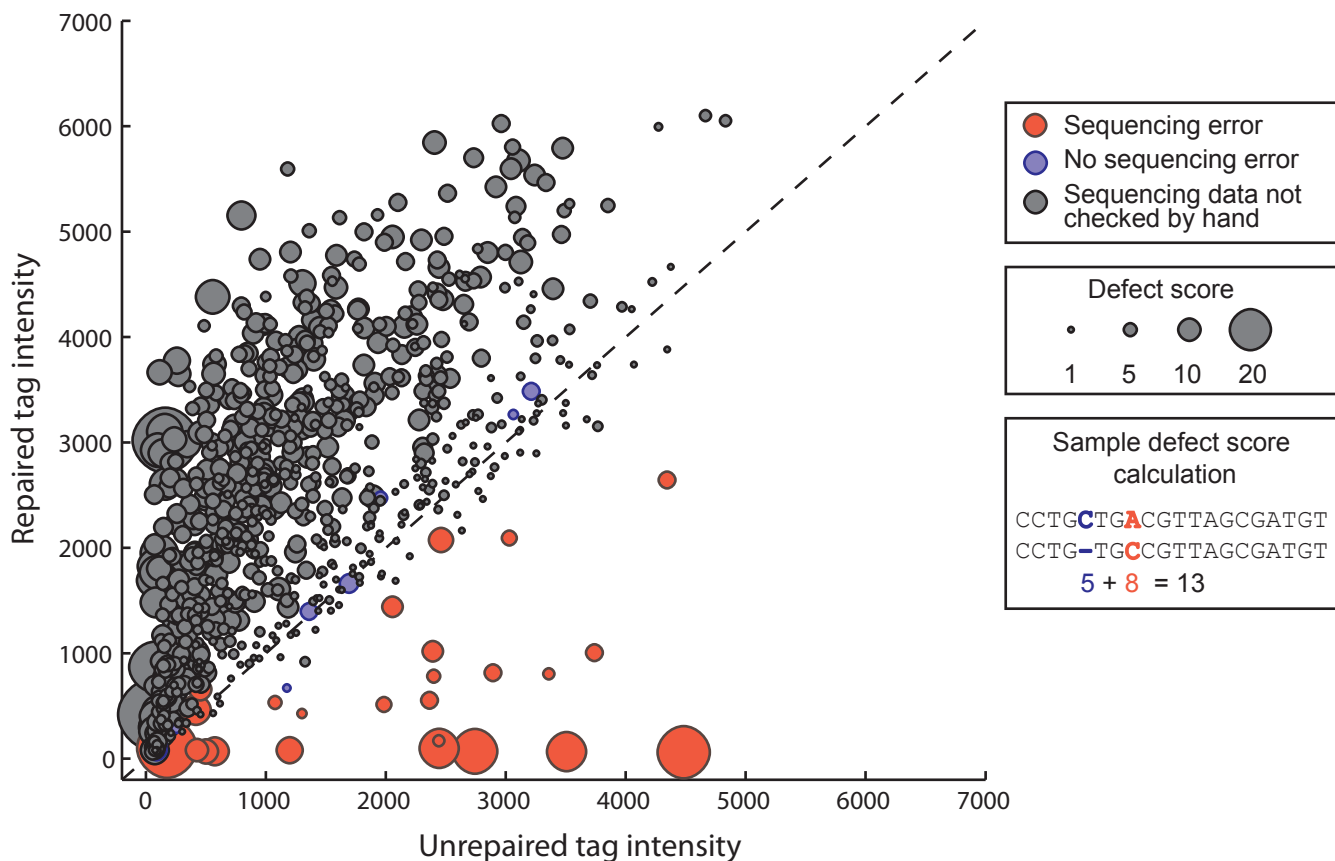
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array to detect these strains, we included on the array both the original sequences and the actual tag sequences as determined by sequencing¹⁵. We included corrected probes for 818 tags (**Supplementary Table 1** online). Most repaired tags have an increased intensity relative to their unrepaired counterpart in pooled deletion strain data. On average, the hybridization signal of the repaired probe was threefold greater than that of the original probe. For cases in which the repair did not result in the expected level of improvement, we manually inspected the original sequence data, which revealed the cause to be poor-quality sequencing data or errors in base-calling (**Supplementary Fig. 2** online).

We have found that array performance can be improved by splitting larger features into smaller replicates. This is an important finding because it has implications for the design of microarrays in general. In some cases the need to include a large number of probes may currently prevent the inclusion of replicate features. However, the number of features available on a typical array is increasing rapidly (currently, there are at least 6,500,000



Supplementary Figure 1. Use of unassigned tag probes to estimate background hybridization. TAG probes were specifically designed to minimize cross-hybridization. As a result, mismatch probes are a poor indicator of background hybridization because they predominantly detect the match product. This is apparent because the average mismatch probe intensity for a tag with an ORF assigned is ~10 fold higher than the intensity of an unassigned tag probe, meaning ~90% of the mismatch probe signal is due to the specific product not cross hybridization. The best estimate of background signal is the average intensity of the unused tag probes, which detect only cross-hybridization. The low signal of these unassigned probes shows that cross hybridization for TAG probes is extremely low.



Supplementary Figure 2. Effect of repairs on tag performance. For 818 tags with suspected sequence errors in the yeast deletion collection strains, the actual tag sequence as determined by high-throughput sequencing was included on the array in addition to the original tag sequence. The intensity of the repaired probe is plotted against the intensity of the original tag probe. The size of each point represents the severity of the tag defect, estimated by summing the distances of each difference to the closest end of the tag. Differences near the center of the probe are known to have a greater impact on hybridization, so this score provides a rough estimate of the degree to which the hybridization of each tag to the original probe will be impacted by the defect. Larger circles indicate more severe tag defects. As expected, most tags with small defects fall near the diagonal, indicating their hybridization is not significantly altered, while tags with larger defects fall increasingly far above the diagonal, indicating their hybridization has improved. The sequencing data for tags that did not fit this pattern were re-examined by hand. The most obvious outliers correspond to poor quality sequence data or basecalling errors (red points). Some borderline cases that were checked by hand were not associated with sequencing problems (blue points). Errors were found in 25 of the 818 repairs made, giving an estimated error rate of 3.1% for the tag sequencing results. On average the repaired probe was 3-fold brighter than the original probe (Supplementary Table 1). Due to space constraints, the corrected version was only included on the array for tags that met two criteria: they could be corrected by modifying their complement on the array (e.g. single base-pair deletions, insertions or substitutions within the TAG sequence), and they hybridized less than 60x above background in existing data, as tags that hybridize above this threshold already provide usable data for phenotypic profiling, and are therefore less likely to benefit from correction.

Supplementary Table 1. Detailed information on the repaired tags. For 818 tags with suspected sequence errors in the yeast deletion collection strains, the actual tag sequence as determined by high-throughput sequencing was included on the array in addition to the original tag sequence (see also Supplementary Figure 1). The original and corrected tag sequences for each of these 818 tags are listed. Both versions are present on the TAG4 array. Average signal intensity for each of the two versions is also listed, along with our estimate of the severity of the change made to the tag (see Supplementary Figure 1). The last column gives our recommendation for which of the versions to use with the yeast deletion collection. Tag experiments not involving the yeast deletion collection should always use the original version of each tag, as the original set of tag sequences were designed to have uniform hybridization behavior and minimal cross-hybridization.

ORF	Batch	Tag	Original sequence	Repaired sequence	Average signal - repaired	Average signal - original	Defect score	Sequencing data checked	Recommended version
YAL016W	chr00_12	down	GTAGACGGAGGATTATTCAC	GTAGACGGAGGATTATTCAC	1879.5	590.45	4	data not checked	repaired
YBL022C	chr2_1	down	CTGCGAGCAATCAGCCGATA	CTGTGAGCAATCAGCCGATA	79.6	74.65	4	data ok	repaired
YBL025W	chr2_1	down	CTGCTGCGAAGTCCGAGAA	CTGCTGCGAAGTCCCGAGAA	3607.55	2536.5	8	checked data not checked	repaired
YBL046W	chr2_1	down	CTTGCGAAGTGATTACCA	CTTGCGAAGTGATTACCA	1230.55	648.4	4	checked data not checked	repaired
YBL054W	chr2_1	down	GAAGTGCGGCTAATATGCTA	GAAGTGCGGCTAATATGCTA	4143.4	2695.45	7	checked data not checked	repaired
YBL060W	chr2_1	down	GACCCAATTCTACAGCGTAA	GACCCATTCTACAGCGTAA	3901.4	2245.7	7	checked data not checked	repaired
YBL077W	chr2_1	down	GAGAGACCATGCAGCCGATA	GAGAGACCATGCAGCCGATA	3599.85	2338.7	5	checked data not checked	repaired
YBL080C	chr2_1	down	GAGAGTGGAAATCGCTCATAA	GAGAGTGGATCGCTCATAA	2906.7	1226	9	checked data not checked	repaired
YBL085W	chr2_1	down	GAGGGTCAATCCTGAGTAA	GAGGGTCAATCCTGAGTAA	2805.55	783.9	8	checked data not checked	repaired
YBL087C	chr2_1	down	GAGTAGCGAATGCTCAGCCA	GAGTAGCGAATGCCAGCCA	1001.55	407.3	7	checked data not checked	repaired
YBL091C-A	chr00_1	down	CGTTCCGCGCACGAATGTTA	CGTTCCGCGCAGCAATGTTA	5674.1	3106.4	10	checked data not checked	repaired
YBL098W	chr2_2	down	GGATTGCGACATCGACTTCA	GGATTGCGACATCGACTCA	2569.6	836.25	3	checked data not checked	repaired
YBL103C	chr2_2	down	GGCCGTTACAGGCTACTTA	GGCCGTTACAGGACTACTTA	3613.3	2130.5	7	checked data not checked	repaired
YBR011C	chr2_2	down	GGGAATTACGTTAGACCPCA	GGGAATACGTTAGACCPCA	3486.7	2309.75	7	checked data not checked	repaired
YBR033W	chr2_2	down	GTACATTAGGTGACCCGAAA	GTACTTAGGTGACCCGAAA	2773.15	1173.55	5	checked data not checked	repaired
YBR056W	chr2_2	down	GTCGGTGGACTATGATTCAA	GTCGTGGACTATGATTCAA	1693.5	488.75	4	checked data not checked	repaired
YBR084C-A	chr00_16a	down	TCATCCCAGCGACTGGTTA	TCATCCCGAGCGACTGGTTA	1553.65	828	4	checked data not checked	repaired
YBR098W	chr2_3	down	TCCGGGCACGGTGTATATA	TCTGGGCCCGTGTATATA	1018.9	2391.6	11	problems data not checked	original
YBR141C	chr2_3	down	TCTGCTTTACTGCGTAGCCA	TCTGCTTACTGCGTAGCCA	3799.1	2796.5	7	checked data not checked	repaired
YBR142W	chr2_3	down	TCTGGATGACGTGTGATTCA	TTGGATGACGTGTGATTCA	2818.6	2641.05	2	checked data not checked	repaired
YBR143C	chr2_3	down	TCTGGATTACTCGCAGCTCA	TCTGGATTATCGCAGCTCA	2079.95	847.3	9	checked data not checked	repaired
YBR160W	chr2_3	down	TGAGAGAGCGTGCATCCTAA	TGAAGAGCGTGCATCCTAA	3371.4	2484.8	4	checked data not checked	repaired
YBR162C	chr2_3	down	TGAGCTGCACGGTCTCCCTA	TGAGCTGCACGGTCTCCCTA	3244.7	2421.5	3	checked data not checked	repaired
YBR166C	chr2_3	down	TGAGGTCGATAGGCTCTCCA	TGAGGTCGATAGGCTCTCTA	2748.75	1251.2	2	checked data not checked	repaired
YBR171W	chr2_3	down	TGATGGTACGTTGGACATA	TGATGGCACGTTGGACATA	3809.45	1039.3	7	checked data not checked	repaired
YBR174C	chr2_4	down	TTCTTCTAGGTCGAGTCCA	TTCTTCTAGGTCGATCCA	2800.8	931.1	5	checked data not checked	repaired
YBR191W	chr00_11	down	GTAGATAGAGGATCAGCATC	GTGATAGAGGATCAGCATC	131.7	93.7	3	checked data not checked	repaired
YBR195C	chr2_4	down	TTTCATGCCGTAGCGTCGAA	TTTCATGCCGTAGTGTGCGAA	3244.65	1047.75	7	checked data not checked	repaired
YBR196C	chr2_4	down	TTTCATGGAGCTGTGCGGTA	TTTCAGGAGCTGTGCGGTA	2202	1557	6	checked data not checked	repaired
YBR198C	chr2_4	down	TTTGACGCCTGGCACTCGTA	TTTGACGCCTGGCACTTGTA	1715.05	944.8	5	checked data not checked	repaired
YBR213W	chr2_4	down	AAGAGGATAAAGCGGTCTCC	AAGAGGATAAAGTGGTCTCC	1478.75	260.25	8	checked data not checked	repaired
YBR220C	chr2_4	down	AAGGAGTAAACTTAGGTCC	AAGGAGTAAACTTAGGTAC	3332.65	1298	2	checked data not checked	repaired
YBR223C	chr2_4	down	AAGTCTATAAGATCGGCC	AAGTCTATAAGATCGGCTC	2967.6	974.35	2	checked data not checked	repaired

YBR228W	chr2_4	down	AATAGGTAACACATGCTCCC	AATAGGTACACATGCTCCC	3199.35	1390.25	8	data not checked	repaired
YBR231C	chr2_4	down	AATCTCCTAAACTGGCAGAC	AATCTCCTGACTGGCAGAC	1949.45	111.8	18	data not checked	repaired
YBR240C	chr2_4	down	ACAATCTGAAATAGCGCGGC	ACAATCTGAAATGCGCGGC	3445.15	1903.5	8	data not checked	repaired
YBR250W	chr2_4	down	ACCATCAGAAATACTGTGCC	ACCATCAGAAATACGTGCC	3038.05	1105.25	6	data not checked	repaired
YBR251W	chr2_4	down	ACCCGGATAAAGTTAATCGC	ACCCGATAAAGTTAATCGC	1567.95	804.9	5	data not checked	repaired
YBR257W	chr2_4	down	ACGAGGAAATAGACCTGCC	ACGAGGAAATAGACCTGCC	3276.9	3258.05	1	data not checked	repaired
YBR263W	chr2_4	down	ACGGTTGAACACATATTCCC	ACGGTTGAACACATATTCCC	1387.75	468.8	5	data not checked	repaired
YBR277C	chr00_1	down	GGATAGTGAGATACCTCCAC	GGATGTGAGATACCTCCAC	891.9	190	5	data not checked	repaired
YBR282W	chr00_1	down	GTCCTAGTAGCACTGACTCA	GTCCTAGTAGCACTGACCCA	1921.3	572.35	3	data not checked	repaired
YCL046W	chr3_1	down	CACGGATTAAGAGGAGCACC	CACGGATTAAGAGGAGCGCC	2039.3	1463.9	3	data not checked	repaired
YCL053C	chr3_1	down	CAGAGGCCAAGAGCTGATAC	CAGGGCCAAGAGCTGATAC	2288.75	1864.6	4	data not checked	repaired
YCR013C	chr00_11	down	GTAGCTCTAGCCATCACTGA	GTAGCTTAGCCATCACTGA	4107.3	1520.7	7	data not checked	repaired
YCR047C	chr00_16a	down	CGTTGCGCCACCGATAGTAT	CGTGCGCCACCGATAGTAT	2376.45	1899.9	3	data not checked	repaired
YCR049C	chr00_1	down	CTCAGGTCAATATACTCTCG	CTTAGGTCAATATACTCTCG	1864.7	949.25	3	data not checked	repaired
YCR054C	chr00_16a	down	CTGTCTAGCACGTACCGAGA	CTGTCTAGCGCGTACCGAGA	3484.4	3213.05	9	data ok	repaired
YCR062W	chr00_16a	down	GATCATTACGATACTCACG	GATCATTACAATACTCACG	3449.15	1043.25	10	data not checked	repaired
YCR083W	chr00_16a	down	TGTAGCGATTGCAGTCGTCC	TGTAGCGATTGCCGTGTCC	5153.45	797.25	13	data not checked	repaired
YCR094W	chr00_2	down	CTCGAAGCCTCTCAGGATAG	CTCGAACCTCTCAGGATAG	3762.35	1002.7	7	data not checked	repaired
YCR098C	chr00_2	down	CTCGACCAATGTGGACCGAT	CTCGACCAATGTGACCGAT	3221.25	1129.65	7	data not checked	repaired
YCR102W-A	chr00_14	down	CTCGCCTAATAGACTTTACG	CTCGCCTAATAGACTTACG	3810.2	2509.9	4	data not checked	repaired
YDL006W	chr4_1	down	GATGACATGGCACGACTTC	GATGACATGGCACGACTTC	3497.45	1613.5	7	data not checked	repaired
YDL008W	chr4_1	down	GATGGCTGAATGACGTTTAC	GATGGCTGAATGACTTTAC	3446.85	795.4	6	data not checked	repaired
YDL012C	chr4_1	down	GATTGAGTAATTGAGCGACC	GATTGAGCAATTGAGCGACC	2954.9	2307.45	8	data not checked	repaired
YDL031W	chr00_17a	down	GCGGTCAATTAGTGGACTCC	GCGTCAATTAGTAGACTCC	3092.4	447.2	10	data not checked	repaired
YDL095W	chr4_1	down	GTTGAGCGACATTTCATACC	GTTAGCGACATTTCATACC	3678.8	2333.25	4	data not checked	repaired
YDL097C	chr4_2	down	TGGGTAGAGTTTAGCTCCTC	TGGTAGAGTTTAGCTCCTC	2201.6	1843.5	2	data not checked	repaired
YDL102W	chr4_2	down	TGGTGCTTAGCGTATCCTCC	TGGTGCTTGCGTATCCTCC	4120.85	2259.65	9	data not checked	repaired
YDL116W	chr4_2	down	TGTTACTTATAGTGCCACGC	TGTTACTTATAGTGCCACGC	1787.05	1337.6	7	data not checked	repaired
YDL133W	chr4_2	down	TTAGAGTGATTGATCGCAGC	TTAGAGTTGATTGATCGCAGC	3142.4	1237.25	7	data not checked	repaired
YDL145C	chr4_2	down	TTCATCGGAGAGCTGGCTAC	TTCATCGGAGAGCTGGCTAT	4405.45	3231.55	1	data not checked	repaired
YDL162C	chr4_2	down	TTGGTCGAGTGCCTTCATC	TTGGTCGAGTGCCTCCTATC	849.5	491.45	6	data not checked	repaired
YDL184C	chr4_2	down	AACAACCCAAACGTCTGGTG	AACAACCCAAACGTCTAGTG	2263.95	1508.6	4	data not checked	repaired
YDL194W	chr00_16b	down	AGTCTTCAAATTTCTCTGCG	AGTCTTCAAATTTCTCTGCG	2144.85	759.8	7	data not checked	repaired
YDR011W	chr4_3	down	CAATGCCAAGAGAAGTCGCG	CAATGGCAAGAGAAGTCGCG	1982.75	955.45	6	data not checked	repaired
YDR041W	chr00_16b	down	CATGCCTAACTCATTATCGG	CATGCCTACTCATTATCGG	2185.1	720.3	8	data not checked	repaired
YDR043C	chr4_3	down	CATTTCTGAATACACCAGCG	CATTTCTGAATACACAGCG	2013.3	679.05	5	data not checked	repaired
YDR054C	chr4_4	down	GAGTCATAATGCGATCCAAG	GAGTTATAATGCGATCAAG	689.05	74.05	9	data not checked	repaired
YDR057W	chr4_4	down	GATTGTCACCCATATCTAG	GATTGTACCCATATCTAG	867.1	208.45	7	data not checked	repaired
YDR061W	chr4_4	down	GCAATACTTCTCACATCAGG	GCAATCTTCTCACATCAGG	2443.2	558.7	6	data not checked	repaired
YDR065W	chr4_4	down	GCATAGCCACCCATCATTAG	GCATAGCCACCCATCATTAG	3213.55	2278.1	9	data not checked	repaired
YDR091C	chr4_4	down	GTCACCTCACCTCTGGGAG	GTCATTACCTCTGGGAG	1589.1	598.8	5	data not checked	repaired
YDR138W	chr4_4	down	TCACTGACATTTGATCCAG	TCACTGACAATTCGATCCAG	2740.9	1001.1	9	data not checked	repaired
YDR143C	chr4_4	down	TCATATACATTCTCCGGG	TTATATACATTCTCCGGG	1072.55	798.8	2	data not checked	repaired
YDR171W	chr4_5	down	CAGAGATGACAAGATTGGCT	CAGAGATGACAAGATTGGT	2603.05	990	2	data not checked	repaired
YDR177W	chr4_5	down	CATGGTCGAGCAAACAAGCT	CATGGTGAGCAAACAAGCT	3000.45	1227.15	7	data not checked	repaired
YDR181C	chr4_5	down	CCCAGCGAAGCCGTTATAT	CCCAGCGAAGCCGTTATAT	2591.35	675.85	7	data not checked	repaired
YDR197W	chr4_5	down	CGGCTAGAAGAATGAATGCT	CGGCTGAAGAATGAATGCT	3699.3	860.6	6	data not checked	repaired

YDR199W	chr4_5	down	CGTGGGCAATACAGTTGAAT	CGTGGCAATACAGTTGAAT	2698.45	1159.75	4	data not checked	repaired
YDR207C	chr4_5	down	CTGACGGAATAGGGCATAAT	CTGACGGAATAGGGCATGAT	4530.55	1553.7	3	data not checked	repaired
YDR216W	chr4_5	down	GAAATTGAGGAGACGCACCT	GAAATTGAGGGACGCACCT	1746.1	583.6	10	data not checked	repaired
YDR228C	chr4_5	down	GCAAGCCATGCGAATGTACT	GCAAGCCATGCGATGTACT	1980	904.75	7	data not checked	repaired
YDR235W	chr4_5	down	GCCCACATATCGGACGGAAT	GCCCACATATCGGACGGAAT	3167.85	2628.2	2	data not checked	repaired
YDR239C	chr4_5	down	GCCTACGGAATTGGCAGACT	GCCTACGGAATGGCAGACT	3542.35	2403	9	data not checked	repaired
YDR242W	chr00_17a	down	GTGATGTTACGTCATGTAGC	GTGAGTTACGTCATGTAGC	3318	1757.7	5	data not checked	repaired
YDR244W	chr4_6	down	TCACGGGAGGCGCTTACTTT	TCACGGGAGGCGCTTACTTT	1861.4	694.3	9	data not checked	repaired
YDR263C	chr4_6	down	TCCTGCTCAGCGCATAGATT	TCCTGCTCAGCGTATAGATT	1872.25	362.15	8	data not checked	repaired
YDR285W	chr4_6	down	TCTTATCGACCAGGGCGGTT	TCTTATCGACCCGGGCGGTT	1395.75	1360.65	9	data ok	repaired
YDR302W	chr4_6	down	TGCGACGCGCTGCATTAT	TGCGACGCTGCTGCATTAT	1484.1	744.2	9	data not checked	repaired
YDR309C	chr4_6	down	TGCTTGACGGCTTCGGATAT	TGCTTGACGGCTTCGGATAT	3338.15	1836.65	8	data not checked	repaired
YDR345C	chr4_7	down	TACCCATGTCCAGATCGGGA	TACCCATGTCCAGTTCGGGA	2947.6	614.9	7	data not checked	repaired
YDR353W	chr4_7	down	TATCCCTTACGCCTGGAGGA	TATCTCTTACGCCTGGAGGA	3003.35	1884.1	5	data not checked	repaired
YDR354W	chr4_7	down	TATGCGTAATGGGTGTTCCA	TATGCGTAATGGATGTTCCA	850.3	245.2	8	data not checked	repaired
YDR398W	chr4_7	down	TCTTTCCACGTTGACTGAA	TCTTTCCACTTGACTGAA	1580.95	265.85	10	data not checked	repaired
YDR403W	chr4_7	down	TGATCTGCACTGATTCTCCA	TGATCCGCACTGATTCTCCA	2892.45	1394.15	6	data not checked	repaired
YDR436W	chr4_7	down	TGGCCCATATCACTTATCGA	TGGCCCATATCACTTACCGA	5159.05	1931.2	4	data not checked	repaired
YDR445C	chr00_14	down	GTCGGGACATGCCTCGATAT	GTTGGGACATGCCTGATAT	2030.35	72.3	9	data not checked	repaired
YDR452W	chr4_8	down	AATAGTTGAAAGGACCTCCC	AATAGTTGAAAGGACCTCCC	1216.3	280.15	10	data not checked	repaired
YDR455C	chr4_8	down	AATGGTTCAAAGAGACCGCC	AAGGTTCAAAGAGACCGCC	3403.2	3301.2	3	data not checked	repaired
YDR491C	chr4_8	down	AGCTGAACAATAAGCGGCC	AGCTGAACAATAAGCGGCC	4328.05	2276.6	6	data not checked	repaired
YDR537C	chr00_14	down	CTCGTGACATAGCCATAGAT	TCGTGACATAGCCATAGAT	3278.75	3478.3	1	data not checked	repaired
YEL030W	chr5_2	down	CAGTGTTCAGATCCTAGAC	CAGTTTCAAGATCCTAGAC	2933.95	840.2	5	data not checked	repaired
YEL035C	chr5_2	down	CGAGTATAAGCTATCCTACC	TGAGTATAAGCTATCCTACC	1522.9	1445.8	1	data not checked	repaired
YER018C	chr5_3	down	TCGTCTGACTCGTGGTAA	TCGTCTGAATCGTGGTAA	5536.35	3241.45	9	data not checked	repaired
YER031C	chr00_10	down	ACGCAGATAAATCACCTCGG	CCGCAGAAAATCACTTCGG	456.25	93.75	14	data not checked	repaired
YER046W	chr00_10	down	ACGCAGTAACACTATGCACG	CCGCAGTAACACTTGCACG	3833.65	2133.3	8	data not checked	repaired
YER047C	chr5_3	down	CTATGATTAAGTCGTAGCCC	CTATGATTAAGTGTAGCCC	3962.35	1084.6	8	data not checked	repaired
YER093C-A	chr00_8	down	CACGTAGAACGCTTCGGAAC	CCGTAGAACGCTTCGGAAC	2363.05	2437.15	2	data not checked	repaired
YER095W	chr00_8	down	CCTTCTGTACCAGGACGAGA	CCTTCTTACCAGGACGAGA	5277.05	2101.3	7	data not checked	repaired
YER098W	chr00_8	down	CGGTCACGACGACGAGATAT	CGGTCACGACGACGAGATAT	4997.15	1819	7	data not checked	repaired
YER104W	chr00_5	down	TACTGCACGTACTGTCAGCA	TCTGCACTACTGTCAGCA	2813.2	2743.6	2	data not checked	repaired
YER129W	chr00_5	down	CACCTGCTACCAAGTATAGA	CACCTGCTACCAAGTTAGA	4692.15	1778.2	5	data not checked	repaired
YER135C	chr00_5	down	CGGCGAGTACAATTCATAGA	CGGCGAGTACAATCCATAGA	4219.5	1576.65	7	data not checked	repaired
YER137C	chr00_5	down	CGGCGTCCAAGTCTGTTATA	CGGCGTCCAAGTCTGTTACA	5994.65	4273.8	2	data not checked	repaired
YER146W	chr00_5	down	CTGAGCGTAAGTATTGTAC	CTGAGCGTAAGTATTGTAC	4225.25	2162.55	5	data not checked	repaired
YER156C	chr00_5	down	GGCAGTCAATTTGCTGAGAC	TGCAGTCAATTTGCTGAGAC	3118.7	3120.55	1	data not checked	repaired
YER188W	chr00_2	down	CTCTCTTAATCTTCACGAGG	TTCTCTTAATCTTCACGAGG	2064.3	2087.5	1	data not checked	repaired
YFL019C	chr00_15	down	GAGGAGTTACCCGACCCTAT	GAGGAGTACCCGACCCTAT	4730.8	2429.7	7	data not checked	repaired
YFL042C	chr00_15	down	GAGTCAGGACGAATTGTTCA	AGTCAGGACGAATTGTTCA	3159.8	3501.55	1	data not checked	repaired
YFR005C	chr6_1	down	GAGTTGAATGCAGATAGCTC	AGTTGAATGCAGATAGCTC	950.25	946.05	1	data not checked	repaired
YFR010W	chr6_1	down	GATAACTCGTTCACAGACA	GATAACTCGTTCACAGACA	319.2	182.5	3	data not checked	repaired
YFR024C-A	chr6_1	down	GATAGAATGTGATCGACCGA	GATAGAATGCGATCGATCGA	79.2	73.8	13	data not checked	repaired
YFR027W	chr6_1	down	GATAGATCACGATACGATGC	GTAGATCACGATACGATGC	455.4	425.3	2	data not checked	repaired
YFR031C-A	chr6_1	down	GATAGGTTACAGGCGTATTC	ATAGGTTACAGGCGTATTC	1668.5	1783.45	1	data not checked	repaired
YFR057W	chr00_2	down	CTGATCCCAGAATCCTATGG	CTGATCCAGAATCCTATGG	2647.9	1053.6	6	data not checked	repaired

YGL008C	chr7_1	down	TAAGCCCGATCAGCATGGAC	TAAGCCCGTACGATGGAC	3376.45	1778.8	9	data not checked	repaired
YGL031C	chr7_1	down	TGCTATTGACTGGATTGCAC	TGCTATTGACTGGATTGCTC	2062.85	667.75	2	data not checked	repaired
YGL046W	chr7_1	down	TTAGGGTTAGGCATTCTGTC	TTAGGGTTAGGCCTTCTGTC	3208.2	1192.95	8	data not checked	repaired
YGL056C	chr7_1	down	TTCTGGCTAGATTCGGGATC	TTCTGGCTAGATTCGGATC	3165.05	1677.3	4	data not checked	repaired
YGL068W	chr7_1	down	TTGTCTGCATGATGATGGAC	TTATCTGCATGATGATGGAC	2168.95	1519.45	3	data not checked	repaired
YGL070C	chr7_1	down	TTTAAGGCGTTGGAGTTCAC	TTTAAGGCGTTGGATTAC	1248.1	324.25	6	data not checked	repaired
YGL094C	chr7_1	down	AAGAAATTAACCTCCTCCGG	AAGAAATTAATCTCCTCCGG	2643.6	253.05	10	data not checked	repaired
YGL097W	chr7_1 / chr00_17a	down	AAGATTCCAACACTCATCCGG	AAGATTCCAACACTATCCGG	4107	485.55	4	data not checked	repaired
YGL102C	chr7_2	down	TCCATTGGCCCGTACTGATG	TCCATTGCCCGTACTGATG	4944.1	3139.4	7	data not checked	repaired
YGL103W	chr7_2	down	TCCTAGCTCCCTATGGATGG	TCTAGCTCCCTATGGATGG	3205.55	3232.55	2	data not checked	repaired
YGL115W	chr7_2	down	TGCTGGGACTATTGCATAAG	TGTTGGGACTATTGCATAAG	3286.75	1774.95	3	data not checked	repaired
YGL125W	chr7_2	down	TTCATGGACTGCTGTGCCAG	TTCATGGACGCTGTGCCAG	3734.4	1817.1	9	data not checked	repaired
YGL142C	chr7_2	down	AACAGCCCAACCGGATGGT	AACAGCCCAACCGGATGGT	4457.4	3394.55	9	data not checked	repaired
YGL163C	chr7_2	down	CGTTCAAGGTGCGCCCAATT	CTTCAAGGTGCGCCCAATT	3171.4	2966.5	2	data not checked	repaired
YGL176C	chr7_2	down	GCGGGCGGACCTTATTTAT	GCAGCGGGACCTTATTTAT	2987.7	998.8	3	data not checked	repaired
YGL180W	chr7_2	down	GGACCTTGACATGCCATCAT	GAACCTTGACATGCCATCAT	1211.5	717.85	2	data not checked	repaired
YGL181W	chr7_2	down	GGATCATACTCCAGGGTT	GGATCATACTCCCGGGTT	2183.65	910.2	6	data not checked	repaired
YGL197W	chr7_3	down	GCTGGAGCAATTTGATACCA	GCGGAGCAATTTGATACCA	4124.35	2223.7	3	data not checked	repaired
YGL201C	chr7_3	down	GGCTCAGAATGCGTTGCCAA	GGCTCGAATGCGTTGCCAA	2373.45	1493.25	6	data not checked	repaired
YGL241W	chr7_3	down	TTCGGGCCACTGATCTTTAA	TTCGGGCTACTGATCTTTAA	2643.45	4344.5	9	problems data not checked	original
YGR027C	chr7_4	down	TCATGCAGGGATGCGCCTTT	TCATGCAGGGATGGCCTTT	958.9	301.15	7	data not checked	repaired
YGR050C	chr00_14	down	TTGGCTGCATGGGCCTTCAT	TTGGCTGCATGGGCCTTAT	2016.8	803.3	3	data not checked	repaired
YGR056W	chr7_4	down	AATCATGCACAAAGTTCGCC	AATCATCACAAAGTTCGCC	3647	2434.4	7	data not checked	repaired
YGR057C	chr7_4	down	AATCAAAACCCATGTCGCG	AACTCAAAACCCATGTCGCG	3421.6	2929	3	data not checked	repaired
YGR060W	chr7_4	down	ACAATAACACCTACGCGGGT	ACAATAACACCTATGCGGGT	3841.15	825.05	7	data not checked	repaired
YGR094W	chr7_4	down	ACTCTAAATCAACATCGGCG	ACTCTAATCAACATCGGCG	4802.5	2997.25	6	data not checked	repaired
YGR096W	chr7_4	down	ACTGAAAGTTGGAGAACCCT	ACTGAAGTTGGAGAACCCT	2956.95	1199.65	5	data not checked	repaired
YGR101W	chr7_4	down	ACTTAAATCTCAACAGCGGC	ACTTAAATCTCAACAGCGC	3964.05	1163.4	5	data not checked	repaired
YGR103W	chr7_4	down	ACTTGAACACTCTCCAATGG	ACTTGAACACTCCCAATGG	3892.8	1253.3	8	data not checked	repaired
YGR104C	chr7_4	down	ACTTGCCGAAACGAACAGTC	ACTTCGAAACGAACAGTC	3265.2	3063.15	5	data ok	repaired
YGR113W	chr7_4	down	AGAAGTAACATAGTTGCCGC	AGAAGTACATAGTTGCCGC	4447.8	2269.8	7	data not checked	repaired
YGR116W	chr00_14	down	AGACAAAGCACCCACGTTGG	AGACAAAGCACCCACTTGG	2801.85	1121.3	5	data not checked	repaired
YGR119C	chr7_4	down	AGACCAACATAGAGCCCTGG	AACCAACATAGAGCCCTGG	3638.15	3720.3	2	data not checked	repaired
YGR160W	chr7_5	down	ATATCGTGAACCATTGGGAC	ATATCGTGAACCATTGGAC	2248.55	886.55	3	data not checked	repaired
YGR172C	chr7_5	down	ATCAAGGCAACCGCCAGTAG	ATCAAGGCAACCGCCAGGAG	2726.25	1858.2	3	data not checked	repaired
YGR175C	chr7_5	down	ATCATAACGTAATAGGGCGG	ATCATACGTAATAGGGCGG	1492.15	751.2	6	data not checked	repaired
YGR180C	chr7_5	down	ATCGAAACTAATAGCCGTC	ATCGAAATTAATAGCCGTC	1831.2	422	8	data not checked	repaired
YGR204W	chr00_10	down	AGTGCTACACAAGCCTAGAC	GGTGCTACACAAGCCTAGAC	2635.15	2497.6	1	data not checked	repaired
YGR219W	chr00_2	down	CTGATGTTACCATACGAGAC	CTATGTTACCATACGAGAC	2053.5	1576.4	3	data not checked	repaired
YGR246C	chr00_2	down	CTGGAGATACATGGATGCAC	CGGAGATACATGGATGCAC	2939.65	2512.7	2	data not checked	repaired
YGR284C	chr00_3	down	GCCGTTAAGTTGGATCAAGC	GCCGTTGAGTTGGATCAAGC	5364.1	2515.1	7	data not checked	repaired
YHR006W	chr00_10	down	TAGATCGGATACGCTGGCCT	AAGATCGGATACGCTGGCCT	2600.05	2583.55	1	data not checked	repaired
YHR015W	chr8_1	down	TCGTGGGAGATGTCTACTC	TCGTGGGAGATGTCTATTCT	2968.35	551.5	3	data not checked	repaired
YHR025W	chr00_10	down	TCAGTCGGAGCGGCTTATCT	CCAGTCGGAGCGGCTTATCT	2220.35	2131	1	data not checked	repaired
YHR032W	chr00_8	down	ATCAGATCAACCTCACTAGG	ATCAGATCAACCCCACTAGG	5700.35	2733.25	8	data not checked	repaired
YHR046C	chr8_2	down	GTCCATAGACGTTGATACCA	GTCCATAGACGCTGATACCA	3295.7	1688.7	9	data not checked	repaired

YHR048W	chr8_2	down	GTCCCGAGACGGCTAGTTAT	TCCCGAGACGGCTAGTTAT	1172.7	1206.65	1	data not checked	repaired
YHR058C	chr00_10	down	TCCGGGCTCACTCGCTGATAT	CCCGGGTCACTCGCTGATAT	3101.9	3108.7	1	data not checked	repaired
YHR078W	chr8_2	down	CCC CGGATAACGGTCTAGTA	CCC CGGATAACGGTCTAGTA	1599.55	1099.25	4	data not checked	repaired
YHR079C-B	chr00_3	down	GCCTCGCCAGCAGGTATATT	GCCCGCCAGCAGGTATATT	3032.4	2391.4	4	data not checked	repaired
YHR086W	chr8_2	down	CGTTACGCAATAGTACCTAC	CGTTACGCAATAGTACCTC	3518.85	1664.9	2	data not checked	repaired
YHR107C	chr8_2	down	TCACGTATATTGACTCCGAC	TCCGTATATTGACTCCGAC	2445.4	1954.55	3	data not checked	repaired
YHR135C	chr8_2	down	CGCCTGAGACACTGATACAG	CGCCTGAGACATGATACAG	2902.8	891	9	data not checked	repaired
YHR136C	chr8_2	down	CGTTAGAAGCGTGGCTACCA	CGTTAGAAGCGTGGCACCA	3471.1	2052.25	5	data not checked	repaired
YHR142W	chr8_3	down	TACTCCACTCCGGTGAGGAT	TACTCCACTCCGTGAGGAT	2346.7	633.25	8	data not checked	repaired
YHR147C	chr8_3	down	TAGACCGGCGACTGTGTTT	TAGACCGGCGCTGTGTTT	1661.95	1693.8	10	data ok	repaired
YHR180W	chr00_10	down	GTAAGTTGGTCGAGTACCT	TTAAGTTGGTCGAGTACCT	2698.05	2697.95	1	data not checked	repaired
YHR185C	chr00_10	down	GTAATACCCCTTCACCTGAGA	TTAATACCCCTTCACCTAGA	3060.35	659.75	5	data not checked	repaired
YIL003W	chr9_1	down	TAGTTCACGCTGGACGTAGT	TAGTTCACGCTCGACGCAGT	2073.7	2460.35	13	problems	original
YIL028W	chr9_1	down	CGAGCGTCAAGGACTGTACT	CGAGCGTCAAGGACTGTAC	3190.35	2667.2	1	data not checked	repaired
YIL029C	chr9_1	down	CGAGCTATAACTGTATCTCC	AGAGCTATAACTGTATCTCC	2961	2847.7	1	data not checked	repaired
YIL032C	chr9_1	down	CGTCAGCGAAGTCGATCTAA	CGTCAGGAAGTCGATCTAA	3518.2	716.9	7	data not checked	repaired
YIL033C	chr00_17b	down	GTGCATCTACCGATTATAGG	GTCATCTACCGATTATAGG	1202.4	949.45	3	data not checked	repaired
YIL048W	chr9_1	down	GTTAGACTATTTCAGTACGCG	TTAGACTATTTCAGTACGCG	2903.05	3120.05	1	data not checked	repaired
YIL083C	chr9_1	down	CGAGGCGTAAGCCGCTTTA	AGTAGCGTAACCAGTCGATA	3020.15	161.65	33	data not checked	repaired
YIL100W	chr9_2	down	CTTCTGGTACAGCGACTGAC	CTTCTGGTACAGTACTGAC	695.9	318.2	8	data not checked	repaired
YIL113W	chr9_2	down	GTCTACACGTCTCTACGATG	GTCTACACGTCTCTACGCTG	2298.35	1371.2	3	data not checked	repaired
YIL121W	chr9_2	down	TCCTTAGACTCGTAGCTCGA	TCCTTAGACTCGTAGCTCGGA	2574.3	1867.65	2	data not checked	repaired
YIL131C	chr9_2	down	AGACTAAGAACGAGCCCTCT	AGACTAAGACGAGCCCTCT	1311.9	774.65	9	data not checked	repaired
YIL133C	chr9_2	down	ATACCAGAAGCAACTCTCGT	ATACCAGAAGCAACTCTCT	987.2	635.9	2	data not checked	repaired
YIL142W	chr9_2	down	CCGGTATTAAGTACTGTTCC	CCGGTAGTAACTACTGTTCC	96.4	85.25	7	data not checked	repaired
YIR012W	chr9_2	down	ATACCGGAACGAAGAGTCC	ATACCGGAACGAAGAGTTC	80.75	426.15	12	problems	original
YIR022W	chr00_3	down	GCCTGGAATGCCGCCTATTA	GCCTGGAATGCCGCCATTA	3333.4	2384.35	5	data not checked	repaired
YIR026C	chr00_3	down	GCCTTACAGTCGATTACCAA	CCTTACAGTCGATTACCAA	3738.7	4068.35	1	data not checked	repaired
YJL028W	chr00_13	down	ATTTCCCTAACGTAGCTGACC	ATTTCCAACGTAGCTGACC	5465.45	3335.45	7	data not checked	repaired
YJL038C	chr10_2	down	GTGTTTATACGTTGAGCACG	GTGTTTACGTTGAGCACG	1552.55	375.35	7	data not checked	repaired
YJL043W	chr10_2	down	GTAGCGTGACCGCTCTATA	GTAGCGTGACCGCGCTATA	371.95	230.85	6	data not checked	repaired
YJL045W	chr10_2	down	GCGTTAATGTGAGCTACGA	ACGTTAATGTGAGCTACGA	3732.35	3760.9	1	data not checked	repaired
YJL047C	chr10_2	down	GCGTTCGGAGACCGTACTTA	GCGTTCGGAGCCGCTACTTA	1609.55	1109.55	10	data not checked	repaired
YJL052W	chr10_2	down	CGTCAATTACACTATACCGG	CGTCAATTACCTATACCGG	3174.8	897.1	10	data not checked	repaired
YJL063C	chr10_2	down	CAGGCGTTAATAGTAAGGAC	CAGGCGTTAATGTAAGGAC	4252.5	1542.6	9	data not checked	repaired
YJL091C	chr10_2	down	GTAGCGTCACGGAGTTCTAA	GTACGTCACGGAGTTCTAC	4119.15	1948.75	5	data not checked	repaired
YJL092W	chr10_2	down	GTAGCGGACGCGCTATATT	GTAGCGGACGCGCTATATT	579.65	177.15	8	data not checked	repaired
YJL106W	chr10_2	down	CGTATGTAAGCGTGCGTAAT	CGCATGTAAGCGTGCGTAAT	343.55	283.05	3	data not checked	repaired
YJL110C	chr10_2	down	CGAGACATAAGTGTACCTAC	CGAGATATAAGTGTACCTAC	2904.65	531.5	6	data not checked	repaired
YJL125C	chr00_15	down	ACGTCCTCAAAGTGACAGACA	ACGTCCTCAAAGTGACAGACA	1959.45	1246.9	9	data not checked	repaired
YJL176C	chr10_1	down	ATCGTTCGACATCTAAGACG	ATCGTTCGACATCTAGACG	2412.6	1299.55	5	data not checked	repaired
YJL177W	chr00_14	down	ATCGTTACACAACCTTGAGCG	ATCGTTACACAATTTGAGCG	2546.55	737.85	8	data not checked	repaired
YJL197W	chr10_1	down	TAGTACGTCTCGACTGACTC	TAGTACGTCTGACTGACTC	4528	2663.85	8	data not checked	repaired
YJL214W	chr10_1	down	CGTAGTTCACCACAGTCAGA	CGTAGTTCACCACAGTCAGA	703.7	418.55	6	data not checked	repaired
YJR041C	chr00_13	down	CTACTAATCGACAGCAGAG	CTACTAATCGACAGCAGAG	3963.05	3262.05	4	data not checked	repaired
YJR043C	chr00_13	down	CTACTGAATCATACTACGG	CTATCTGAATCATACTACGG	3748.35	2424.5	4	data not checked	repaired
YJR045C	chr00_13	down	CTCGGTCTACATAGGATTAC	CTCGGTCTACATAGGTTAC	4050.2	1452.75	5	data not checked	repaired

YJR050W	chr00_13	down	CTTCGTGACACTATTATCCG	CTTCGTGACACTATTATCCG	3710.25	1186.3	9	data not checked	repaired
YJR067C	chr00_12	down	TAGCCCACGTCACITTAGAG	TAGCCCACGTCACITTAGAG	4972.95	3464.4	7	checked data not	repaired
YJR087W	chr00_12	down	TATGATCTACTCCACTTGCG	TATGATCTACTCCACTTGCG	2498.65	2485.25	3	checked data not	repaired
YJR091C	chr00_12	down	TATTTGTGACTCTCCCAGCG	TATTTGTGACTCTCTCGACG	3356.4	1224.35	6	checked data not	repaired
YJR094W-A	chr00_12	down	TCACGTTCACTGCATTGAG	TCACCTCACTGCATTGAG	2649.75	985.85	5	checked data not	repaired
YJR104C	chr00_12	down	TCCATAGTAGCTGAGCGCAG	TCCATAGCTGAGCGCAG	2152.35	769.55	7	checked data not	repaired
YJR110W	chr10_4	down	TCGATAATCTTTGTAGCGCG	TCGATAATCTTTGTAGCGCG	3206.15	1654.55	9	checked data not	repaired
YJR112W	chr00_12	down	TCGGGTCCACCTGTACTTAG	TCGGGTCCACCTGTACTTAG	4716.5	2164.95	7	checked data not	repaired
YJR129C	chr10_4	down	TCTTCATACTCTCTGCGAGG	TCTTCATACTCTCTGCGGG	2721.95	889.7	3	checked data not	repaired
YKL006C-A	chr11_1	down	CAACGAGGTTAAGTACAGG	CAACGAGGTTAAGTACAGG	5792.05	3474.7	9	checked data not	repaired
YKL019W	chr11_1	down	CAAGACCAAGCAGCACTGTG	CAAGCCAAGCAGCACTGTG	4341.5	3705.5	5	checked data not	repaired
YKL033W	chr11_1	down	CAATTATACCGAAGCACCGT	CAATTATACCGAAGCACGT	2264.2	1043.25	3	checked data not	repaired
YKL037W	chr11_1	down	CACAACGGATTAGAAGCGCG	CACAACGGATTAAGCGCG	4309.7	2649.35	8	checked data not	repaired
YKL060C	chr11_1	down	CACGGTACAATACGAGCAGAC	CACCGACAATACGAGCAGAC	4471	1585.1	10	checked data not	repaired
YKL077W	chr11_1	down	CACCTGGCAATAAACCCATG	CACCTGGCAATAAAGCATG	3664.5	113.9	11	checked data not	repaired
YKL079W	chr11_1	down	CACCTTGAAGCACAAATCACG	TGCTTTGAAGCACATCACG	923.7	128	9	checked data not	repaired
YKL081W	chr11_1	down	CAGAACCTTTTCGGAAGCCAA	CAGAACCTTTTCGGAAGCCAA	2196	665.65	6	checked data not	repaired
YKL088W	chr11_1	down	CAGACCAAGCCACATAGTGT	CAGACCAAGCCACAAGTGT	4532.9	2732.65	6	checked data not	repaired
YKL100C	chr11_2	down	CATTTCGAGAAGGAAGATTTC	TATTCGAGAAGGAAGATTTC	1118.25	126.9	5	checked data not	repaired
YKL101W	chr11_2	down	CATTCTAGCAGAGAGACT	CATTCTAGCAGAAGACT	2413.55	368.65	8	checked data not	repaired
YKL104C	chr11_2	down	CATTAACCTCAATCGCGGC	CATTAACCTCAATCGCGGC	3140.55	2880.65	3	checked data not	repaired
YKL123W	chr11_2	down	CCAAGGTAAGATTTAGGACC	CAAGGTAAGATTTAGGACC	3218.65	3675.7	1	checked data not	repaired
YKL126W	chr11_2	down	CCAATACCAATATAGCCTGG	CCGATACCATGATATCCTGG	60.35	4483.75	28	problems data not	original
YKL156W	chr11_2	down	CCAGCTCTACCAGATAATGA	CCAGCTCTACCAGTAATGA	4898.55	1988.5	7	checked data not	repaired
YKL189W	chr11_2	down	CCCAAAGTTTCTCACAGATG	CCAAAGTTTCTCACAGATG	3882.35	4345.7	1	checked data not	repaired
YKL195W	chr00_14	down	CCGTGAAGCCCTCGATAGAA	CCGTGAAGCCCTCGATAGA	1826.75	1565.25	1	checked data not	repaired
YKL202W	chr00_14	down	CCGTTAGGACAATATCTTCC	CGTTAGGACAATATCTTCC	1728.1	1960.35	1	checked data not	repaired
YKL211C	chr11_3	down	CCTAAACAGAAGTATCGCTC	CCTAAGCAGAAGTATCGCTC	2349.85	1245.4	6	checked data not	repaired
YKL215C	chr00_14	down	CCTAACTCCCTGAGAAGGAA	CTAACTCCCTGAGAAGGAA	2680.2	2875.95	1	checked data not	repaired
YKL216W	chr11_3	down	CCTAACTGAGTCTAAGGCAA	CCTAACTGAGTTAAGGCAA	2936.05	757.8	9	checked data not	repaired
YKL222C	chr11_3	down	CCTAATATAAGCATCTCCGG	CCTAATATAAGATCTCCGG	1959.5	408.65	9	checked data not	repaired
YKR014C	chr11_3	down	CCTAGATGAATAGAGCATGG	CCTAGATGGATAGAGCATGG	4738.55	951.3	9	checked data not	repaired
YKR020W	chr11_3	down	CCTATGAAGCTATCGCAACA	CCTATGAACATATCGCAACA	4118.8	980.45	9	checked data not	repaired
YKR027W	chr00_14	down	CCTCATAGAAGTTCAGACAC	CCTATAGAAGTTCAGACAC	2349.9	925.1	4	checked data not	repaired
YKR074W	chr00_3	down	GCGATATACATCATTCCGGAC	GCGATATCATCATTCCGGAC	2754.95	620.8	8	checked data not	repaired
YKR079C	chr00_3	down	GCGATTATACTCACAGGGCA	GCGATTACACTCACAGGGCA	5239.6	3085.25	8	checked data not	repaired
YKR098C	chr00_4	down	GCTATCTGAATGTCTTAGGC	GCTATCTGAATGTCTCAGGC	2347.8	836.6	5	checked data not	repaired
YKR100C	chr00_4	down	GCTATTACAGTGTGAGAGAC	GCTATTACAGTGTGAGAAAC	2937.95	1002	3	checked data not	repaired
YLL054C	chr12_1	down	CGTCTAATACCTAATCACGG	CGTCTATACCTAATCACGG	3339.05	1476	6	checked data not	repaired
YLL058W	chr12_1	down	GAGCGGTTACATAGTCGATC	GACGGTTACATAGTCGATC	2715.2	2332.95	3	checked data not	repaired
YLL059C	chr00_8	down	GAGCGTAATATGGTAGACTC	GACGTAATATGGTAGACTC	4072	3533.25	3	checked data not	repaired
YLR004C	chr12_1	down	GTTCCGCGGACTTCGATA	GTTCCGCGGACTTCGATA	1490.3	904.2	9	checked data not	repaired
YLR008C	chr12_1	down	TATAGTATCGAGGAGCGACC	CATAGTATCGAGGAGCGACC	2665.55	2262.5	1	checked data not	repaired
YLR033W	chr00_8	down	ATGAGAAGGAGACCTCGCT	ATGAGAAGGAGACCTCGCT	862.85	526.2	4	checked data not	repaired
YLR062C	chr12_2	down	CAGCTTACAGAAGGTGAGAT	AAGCTTACAGAAGGTGAGAT	955.95	899.7	1	checked data not	repaired
YLR173W	chr12_3	down	CTCACTTCAATGCAATGCGA	CTCACTGCAACGCCATGCGA	69	2743	24	problems data not	original
YLR185W	chr12_3	down	CTCTGTTAATGGCGCAGCA	CTCTGTTAATGGCGCGCA	1114.15	700.15	4	data not	repaired

checked

YLR191W	chr12_3	down	CTGGGCCAAGTTCTGAGACA	CTGGGCCAAGTTCTGAGAC	2839.25	2253.35	1	data not checked	repaired
YLR197W	chr12_3	down	CTTCCATGAATCCAGCGAGA	CTCCATGAATCCAGCGAGA	1491.65	1394.1	2	checked data not checked	repaired
YLR199C	chr12_3	down	CTTCGGGAATAGTCATGCCA	TTCGGGAATAGTCATGCCA	2896.6	3256	1	checked data not checked	repaired
YLR202C	chr12_3	down	CTTGGAAGGTTTGCACCTA	CTTGGAAGGTTTGCACCTA	2989.25	550.7	9	checked data not checked	repaired
YLR254C	chr12_4	down	CGCCGCGTAAGCAACAATT	CGCCGCGTAAGCAACAATT	2110.7	1024.45	3	checked data not checked	repaired
YLR275W	chr12_4	down	CGCGTTACAAAGACACACTT	TGCGTTACAAAGACACACTT	1281.4	1169.9	1	checked data not checked	repaired
YLR280C	chr12_4	down	CGCTATATCAGGACACCTAA	CGCTATATCAGGACACCTAA	4948.5	2056.4	10	checked data not checked	repaired
YLR292C	chr12_4	down	CGCTTACTACAATGTCAGCA	CGCTTACTACAATGTCAGCA	4893.1	3182.75	6	checked data not checked	repaired
YLR309C	chr12_4	down	CGGAATCCACCAGATATGA	CGGAATCCATCCAAATATGA	1689.8	65.35	16	checked data not checked	repaired
YLR312W-A	chr12_4	down	CGGACCAGACTCACATGGAA	CGGACAGACTCACATGGAA	4549.45	2526.25	5	checked data not checked	repaired
YLR379W	chr12_5	down	CTAACAGAGGTACAGATCGG	CTAACAGAGGTACAGATTGG	4384.2	999.05	3	checked data not checked	repaired
YLR387C	chr12_5	down	CTAAGACCCGCACATATTGT	CTAGACCCGCACATATTGT	2800.3	2292.85	3	checked data not checked	repaired
YLR388W	chr12_5	down	CTAAGCCTATGCAATATCGC	CTAGCCTATGCAATATCGC	992.3	732.2	3	checked data not checked	repaired
YLR422W	chr00_4	down	GCTCAGTTACCATTCGGACG	GCTCAGTTACATTCGGACG	4712	3125.35	10	checked data not checked	repaired
YML031W	chr00_12	down	GTATGCTCACATCCCGGAGA	GTATGCTCACATCCCGGATA	73.35	90.8	2	checked data not checked	repaired
YML035C	chr00_14	down	GTCTCTTACTAGCGCCAGGT	GTCTCTTACAGCGCCAGGT	4568.55	2790.15	9	checked data not checked	repaired
YML036W	chr00_11	down	GTATGTTACTATATGCCCGG	GTATGTTACTATATGCCCGG	2414.2	859.8	6	checked data not checked	repaired
YML091C	chr00_9	down	GGTCTGCGACGCTAGTCTTA	GGTCCGCGACGCTAATCTTA	4101.25	1427.85	11	checked data not checked	repaired
YML096W	chr00_9	down	GGTGAATTTGGAGACCTTCT	GTGAATTTGGAGACCTTCT	523.1	618.05	1	checked data not checked	repaired
YML097C	chr00_9	down	GGTGACATCGTCTAGAGAA	GGTGACATCGTCTAGAAA	2405.55	805	3	checked data not checked	repaired
YML106W	chr00_9	down	GGTGCCGGACATCAAATATA	GGCGCCGGACATCAAATATA	5264.2	3531.95	3	checked data not checked	repaired
YMR004W	chr00_9	down	GGTTATACCGTGATCCCACT	GGTTATATCGTGATCCCACT	2565.8	313.2	8	checked data not checked	repaired
YMR057C	chr00_5	down	GGCGACATCATCTTACCGTA	GGGACATCATCTTACCGTA	3967.1	3390.4	3	checked data not checked	repaired
YMR062C	chr00_6	down	GGGCCATAAGTGTGTTACA	GGGCCATAAGTGTGTTACA	2471.9	813.85	7	checked data not checked	repaired
YMR069W	chr00_6	down	GGGCTATGACCCATTGTCCA	GGCTATGACCCATTGTCCA	2137.3	1949.35	1	checked data not checked	repaired
YMR078C	chr00_6	down	GGGTACTCAGGCATAGCAAA	GGGTACTTAGGCATAGCAAA	3406.7	692.95	8	checked data not checked	repaired
YMR080C	chr00_6	down	GGGTAGAGAGATTTCACTCA	GGTTAGAGAGATTTCCACCC	869.1	70.5	25	checked data not checked	repaired
YMR088C	chr00_6	down	GGGTCCATACGCCATCGTTA	GGTCCATACGCCATCGTTA	891.85	787.2	1	checked data not checked	repaired
YMR089C	chr00_6	down	GGGTCGATAGCCAGTCTTAA	GGGTCGATAGCCAGTCTTAA	2083.55	631	5	checked data not checked	repaired
YMR090W	chr00_6	down	GGGTCGCTACCTACTCTGAT	GGTCGCTACCTACTCTGAT	1260.5	1104.85	1	checked data not checked	repaired
YMR094W	chr00_9	down	GGTTATATCAGTCACGTAGC	GGTTATATAGTCACGTAGC	3632.75	1000.7	9	checked data not checked	repaired
YMR113W	chr00_9	down	GGTTGCATAGCAGCGTCACT	GGTTGCATAGCAGCATCACT	3631.95	2338.25	6	checked data not checked	repaired
YMR114C	chr00_9	down	GGTTGCGACCCGCTCATATT	GGTTGCACCCGCTCATATT	4585	1546.95	7	checked data not checked	repaired
YMR115W	chr00_9	down	GGTTGGATACATTTGACGCA	GGTTGGATACATCTGACGCA	4320.1	1371.3	8	checked data not checked	repaired
YMR121C	chr00_9	down	GGTTTAGCACATTTACTCC	GGTTTAGCACATTTACTCC	3157.75	1015.55	9	checked data not checked	repaired
YMR129W	chr00_9	down	GTAATGCGGAGGATTCCAT	GTAACGCGGAGGATTCCAT	3164.65	734.25	9	checked data not checked	repaired
YMR130W	chr00_9	down	GTAATGTTTGAGAGCGTCC	GTAATATTTGAGAGCGTCC	3402.3	1783	7	checked data not checked	repaired
YMR131C	chr00_9	down	GTAACAGATGATCGCCAAGG	GAACAGATGATCGCCAAGG	4521.95	4221.05	2	checked data not checked	repaired
YMR133W	chr00_9	down	GTAACACTCTTGACCGACAT	GTAACACTCTTGACTGACAT	2574.5	195.6	9	checked data not checked	repaired
YMR154C	chr00_10	down	GTAATGGGAGTAGATCATCC	TTAATGGGAGTAGATCATCC	759.8	709.9	1	checked data not checked	repaired
YMR165C	chr13_4	down	CACGACTAACTAGGGTACAC	CACGCTAACTAGGGTACAC	5198.5	3486.9	5	checked data not checked	repaired
YMR171C	chr00_8	down	CCTGATACACTATAATCGCG	CCCATACACTATAATCGCG	2080.55	1422.75	3	checked data not checked	repaired
YMR172W	chr00_12	down	CCTGCGCTACACAGTATTAG	CCTGCGCTACACAAATATAG	3650	563.85	10	checked data not checked	repaired
YMR181C	chr00_8	down	CTGCGAATACGCTCACATGA	CTGCAATACGCTCACATGA	4275.75	1326.75	5	checked data not checked	repaired
YMR194C-A	chr00_4	down	GCTGGCCTACATCCGTATGA	GCTGGCCTACATCCGTATAA	4554.2	2661.55	2	checked data not checked	repaired
YMR209C	chr00_8	down	TTCTCGGGACTGGTCGACT	TTCTCGGGACTGGTCGAT	4527.2	3107.2	2	checked data not checked	repaired

YMR211W	chr13_4	down	AACATGGTAAACGACTCTCC	AACATGGTAAACGACTCCC	4472.6	2392.8	3	data not checked	repaired
YMR232W	chr13_5	down	CGACCGTCACACGTATGAGA	CGCCCGTCACACGTATGAA	4578.6	1208.65	5	checked data not	repaired
YMR245W	chr13_5	down	GCGGTAGTACAGTCGCATCA	GCGGTAGTACATCGCATCA	3946.75	1935.55	9	checked data not	repaired
YMR246W	chr13_5	down	GCGGTCGTAATCCTCACTAA	GCGGTCGTAATCCTCATAA	3548.55	1539.05	4	checked data not	repaired
YMR264W	chr13_5	down	ACGGCGATAAAGTCTATGAC	ACGGCGATAAGTCTATGAC	4354.35	2477.65	9	checked data not	repaired
YMR265C	chr13_5	down	ACGGCGCAAAGCGTCATAA	ACGGCGCAAAGCGTCATAA	2551.35	2361.55	3	checked data not	repaired
YMR266W	chr13_5	down	ACGGGCTCAAAGTATGATAG	ACGGGCTCAAAGTATGATAA	1443.4	696.65	1	checked data not	repaired
YMR267W	chr13_5	down	ACGGGTATAAAGTTGTACGC	ACGGTATAAAGTTGTACGC	4467.85	2993.2	3	checked data not	repaired
YMR294W	chr13_5	down	GTA CTAGCATATCATCGACG	GTA CTGCATATCATCGACG	3942.85	1343.35	6	checked data not	repaired
YMR301C	chr13_5	down	TAGGTAGCCATAGTGACGAA	TAGGTAGCCTAGTGACGAA	4090.95	1446.9	9	checked data not	repaired
YMR305C	chr13_5	down	TCTCGATTACTCTCGTAGCG	TCCGATTACTCTCGTAGCG	3266.05	2768.95	3	checked data not	repaired
YMR317W	chr00_8	down	ATCGGTGCAACCCTCGGATA	ATCGTCAACCCTCGGATA	6051	4831.95	4	checked data not	repaired
YNL012W	chr14_4	down	GCAAGGCGCACCCATAGTTA	GCAAGGCGCACCATAGTTA	2900.45	2320.6	8	checked data not	repaired
YNL018C	chr00_18	down	GTGTCACAGTCGGACCTTT	GTGTCACAGTGGACCTTT	3788.25	1399.75	10	checked data not	repaired
YNL021W	chr14_4	down	GCAATCGTTGAGAATCGGAT	ACAATCGTTGAGAATCGGAT	1942.8	1865.1	1	checked data not	repaired
YNL062C	chr14_3	down	CCGCTTTAATCCGACGGGTA	CCGCTTAATCCGACGGGTA	1501	1175.6	5	checked data not	repaired
YNL063W	chr14_3	down	CCGCTTATACCTGAGAGGA	CCGCTTATACTCTGAGAGGA	4101.1	2154.65	10	checked data not	repaired
YNL071W	chr00_16b	down	CCGAGTTAAGTTACCACAA	CCGAGTTAAGTTACCACAA	3921.05	2060.1	5	checked data not	repaired
YNL072W	chr00_16b	down	CCGAGCTAACGGTGCCATAA	CCGAGCTAACGGTGCCATAA	2675.9	1674.9	5	checked data not	repaired
YNL073W	chr00_16b	down	CCGACTTGACCACAATGTTA	CCGACTTGACCATAATGTTA	2714	659.9	8	checked data not	repaired
YNL080C	chr00_16b	down	CCCTATATCACCGAATGAGA	CCCTATATCACCGAATAGA	2864.15	745.5	4	checked data not	repaired
YNL089C	chr14_3	down	CCCACGTTAATCATCGAGAA	CCACGTTTATCATCGAGAA	2575.65	717.35	12	checked data not	repaired
YNL118C	chr14_3	down	CAGCTCCTAAGACTTGGACA	CAGCTCCTAAGCTTGGACA	1310.3	703.3	9	checked data not	repaired
YNL121C	chr00_16b	down	CAC TTCCA AACTCGGAGGAGA	ACTTCCA AACTCGGAGGAGA	2871.2	2991.85	1	checked data not	repaired
YNL131W	chr14_3	down	ATTCGGCGACAACGCATTTA	ATTCAGCGACAACGCATTTA	1601.6	1018.9	5	checked data not	repaired
YNL136W	chr14_3	down	ATGGTGTGAACCTTCTCAGA	ATGTGTGAACCTTCTCAGA	1995.3	1792.9	3	checked data not	repaired
YNL143C	chr14_3	down	ATGCGGAGAACCTCTGACAA	ATGCGGCTAACGCCTCACAA	418.55	71.4	37	checked data not	repaired
YNL156C	chr14_2	down	CTACCAGACCGACGGAGATA	CTACTAGACCGACGGAGATA	5247.95	3852.5	5	checked data not	repaired
YNL223W	chr14_2	down	CCGATAGAATAGTAGAGCCT	CCGATAGAATAGAGAGCCT	123.55	84.3	8	checked data not	repaired
YNL233W	chr14_2	down	AGAAACCAAGACTCCGTCGT	AGAAATCAAGACTCCGTCGT	5801.5	3056.5	6	checked data not	repaired
YNL258C	chr14_1	down	TCTATCCACTGCGGACGAGT	TCTACTACTGCGGACGAGT	2476.15	1846.85	6	checked data not	repaired
YNL271C	chr14_1	down	GTACGCCTACGAGGTGTAA	GTACGCATACGAGGTGTAA	2896.7	138.6	13	checked data not	repaired
YNL274C	chr00_10	down	GTAATGTTCTTACCCTCAG	TTAATGTTCTTACCCTCAG	3369.35	3271	1	checked data not	repaired
YNL300W	chr00_8	down	ACGCTGGTAAAGTCCATACA	ACGCTGGTAATGTCCATACA	4183.65	2210.55	10	checked data not	repaired
YNL301C	chr14_1	down	ACGCTGCGAAAGGTGAATAC	ACGCTGCGAAAGGTGAATC	4592.7	2614.35	2	checked data not	repaired
YNL310C	chr14_1	down	TCTAGTCCACTCGTGCTGAG	TCTAGTCCATCGTGCTGAG	4921.3	2296.8	9	checked data not	repaired
YNL330C	chr14_1	down	GACGCACCACAGGCTAGTAT	GACGCACCACAGGTAGTAT	6025.2	2962.25	7	checked data not	repaired
YNR006W	chr14_4	down	GCACGTACATTACTGACGAA	GCGGTATATTACTGACGAA	1411.55	647.9	11	checked data not	repaired
YNR010W	chr14_4	down	GCACTAGCATTACATCTCGA	GCACTAGCATTACATCCCGA	2322.55	1032.95	4	checked data not	repaired
YNR014W	chr14_4	down	GCACTGAGAGCGACCGTAAT	GCACTGAGAGCGATCGTAAT	2035.15	1259.95	7	checked data not	repaired
YNR040W	chr14_4	down	GCAGGAGCAGAGTTATATC	GCAGGAGCAGAGTTTATATC	2561.95	490.45	8	checked data not	repaired
YNR046W	chr14_4	down	GCAGGGACATTACGATCAGT	CAGGGACATTACGATCAGT	1687.5	2081.15	1	checked data not	repaired
YNR056C	chr00_4	down	GCTGTGAATTGCATGACGCT	GCTGTAATTGCATGACGCT	3714.3	1115.65	6	checked data not	repaired
YNR070W	chr00_6	down	GGGTGCATAGACTGTCACTC	GGTGCATAGACTGTCACTC	3736.85	3528.35	1	checked data not	repaired
YOL012C	chr15_5	down	GAGTAGATACAGGTACAGAT	GAGTAGGTACAGGTACAGAT	4294.75	795.2	7	checked data not	repaired
YOL022C	chr15_5	down	GTATTTGTACGTGCGAGGAC	GTATTTGTACGTGCGAGGC	4264.8	3208.4	2	checked data not	repaired
YOL035C	chr15_5	down	TGCGGTCTACTGCTATACTA	TGCGGTCTATGCTATACTA	4085.6	1819.5	9	data not	repaired

checked

YOL056W	chr15_5	down	CGTGCGTGACACAGTACCTA	CGTGCGTGACACAGTACCTA	86.15	76.8	8	data not checked	repaired
YOL093W	chr00_6	down	GGTAATGGGCTCGACTATAT	GGTAATGGGCTCGACTTAT	3262.25	1083.8	4	checked data not	repaired
YOL097C	chr00_6	down	GGTACGCGAGGATATTACTA	GTACGCGAGGATATTACTA	1404.25	1542.4	1	checked data not	repaired
YOL114C	chr00_6	down	GGTATGCACGCCATCTAT	GGTATGCACGCCATCTAT	4035.75	894.65	9	checked data not	repaired
YOL136C	chr00_6	down	GGTCCTAGACGATTATGGAT	GGTCTAGACGATTATGGAT	2106.45	839.8	4	checked data not	repaired
YOL141W	chr00_10	down	GTACACCTCACTCGATGGAG	TTACACCTCACTCGATGAG	2043.5	686.25	4	checked data not	repaired
YOL144W	chr00_10	down	GTACAGACATTGTTACTCCC	TTACAGACATTGTTACTCCC	4264.65	4050.55	1	checked data not	repaired
YOL158C	chr00_10	down	GTACGACTATGAGGGATTCA	TTACGACTATGAGGGATTCA	2970.35	2729.8	1	checked data not	repaired
YOL159C	chr00_10	down	GTACGAGTCGGACGTTCTA	TTACGAGTCGGACGTTCTA	1168.45	1055.5	1	checked data not	repaired
YOR006C	chr15_1	down	ACAGAGAGAAATGCGTCGCC	ACAGAGAGAATGCGTCGCC	2485.8	1893.05	10	checked data not	repaired
YOR037W	chr15_1	down	GGACCTCGATACCCGTTGTA	GGACCCCGATACCCGTTGTA	2684.05	1684.45	6	checked data not	repaired
YOR051C	chr15_1	down	TGCTCTCGACGTGCGTAGAT	TCTCTCGACGTGCGTAGAT	1724.6	1778.9	2	checked data not	repaired
YOR061W	chr15_1	down	ACTGCACAACAACGGGACGT	ACTGCAACAACGGGACGT	2771.45	1552.35	7	checked data not	repaired
YOR072W	chr15_1	down	CCAGTCAACTCGTCGATAAG	CCAGTCAACTCTTCGATAAG	2857.35	1347.75	9	checked data not	repaired
YOR074C	chr15_1	down	CGCATCCTAAGGTAGACTAA	TGCATCCTAAGGTAGACTAA	1604.2	1611.4	1	checked data not	repaired
YOR078W	chr15_1	down	CGTGTAAATAAGTTCTACGCC	CGTGTAAATAAGTTCTATGCC	2267.7	557.6	4	checked data not	repaired
YOR080W	chr15_1	down	CGTGTAGAAGCTGTGTACCA	CGTGTAGAAGATGTGTACCA	3742.3	1259.7	10	checked data not	repaired
YOR099W	chr15_2	down	CTACTCTTAATTCGACTGCG	CTACTCTAATTCGACTGCG	1450	487.15	7	checked data not	repaired
YOR161C	chr15_2	down	CAAATAGTAATACGCCCTCCG	TAAATAGTAATACGCCCTCCG	3219.95	3133.35	1	checked data not	repaired
YOR166C	chr15_2	down	CAATCTTTAATACGCACGCG	CAATCTTTAATACCACGCG	3353.1	540.3	7	checked data not	repaired
YOR179C	chr15_2	down	CACCCGGAACACTATGAAG	CACCCGGAACACTATGAAA	3846.7	845.95	9	checked data not	repaired
YOR204W	chr15_3	down	CTAGTCTTAATTCGACTCCG	CTAGTCTTATTGCACTCCG	4266.25	1771.75	9	checked data not	repaired
YOR283W	chr15_3	down	GCACACTATCCTAGAATCTG	GTACACTATCCTAGAATCTG	2605.65	2153.2	2	checked data not	repaired
YOR325W	chr15_4	down	TATCCGGTAGACGGGTTATC	TATCCAGTAGACGGGTTATC	2616.65	1391.3	6	checked data not	repaired
YOR354C	chr15_4	down	CGATGGACAAGGTAGTCACA	CGATGGACAAGTAGTCACA	2032.1	675.65	9	checked data not	repaired
YOR373W	chr15_4	down	GTTGACCTATATTCACGCGC	TTGACCTATATTCACGCGC	3373.8	3501.05	1	checked data not	repaired
YPL005W	chr16_3	down	GGTGTTCGACCTGTCAGCAT	GATGTTTCGACCTGTCAGCAT	2091.75	1945.35	2	checked data not	repaired
YPL020C	chr16_3	down	GGTAAGTCCTGGTCACCGTT	GGTAAGTCTGGTCACCGTT	4417.2	2426.2	8	checked data not	repaired
YPL023C	chr16_3	down	GGGTCTTACAGTGCCACT	GGGTCTTTAAAGTGCCACT	3103.15	157.9	17	checked data not	repaired
YPL038W	chr16_3	down	GGCGGTGACCCGTTCTATAT	AGTGGTGACCCCTCTATAT	68.05	500.55	13	checked data not	problems original
YPL131W	chr00_8	down	GGCCTTAGACGACTCGCATA	GGCCTAGACGACTCGCATA	288.2	253.45	5	data ok	repaired
YPL152W	chr16_2	down	CGACTACAACCTCTTAGAG	CGACTACAACCTCTTAGAG	2463.1	2809	1	checked data not	repaired
YPL179W	chr16_2	down	TACAGTAGAGTAGAGTTCC	TACAGTAGAGTAGAGTTCC	3623.55	1491.45	3	checked data not	repaired
YPL188W	chr16_1	down	GCGCAGCGACCTATCTAGTA	GCGCAGCGCCTATCTAGTA	2955.85	1516.25	9	checked data not	repaired
YPL194W	chr16_1	down	GACGAATTAGACAGTCAGCT	GACGAATTAGACAGTCAGTT	3502.8	1348.6	2	checked data not	repaired
YPL196W	chr16_1	down	CTGTCAGTAAGTTATCGTCC	CTGTCAGTAAGTTATGTCC	2944.55	878.6	5	checked data not	repaired
YPL203W	chr16_1	down	CGTAATCTAAGTAGTCAGCC	CTAATCTAAGTAGTCAGCC	3627.15	3124.3	2	checked data not	repaired
YPL213W	chr16_1	down	CACTGGTGAAGAGGACTACA	TACTGGTAAAGAGGACTACA	4775.45	1589.45	9	checked data not	repaired
YPL215W	chr16_1	down	ATCATTGTAACCGGTGACA	ATCATTGTAATCGGTGACA	3742.2	572.25	10	checked data not	repaired
YPL218W	chr16_1	down	ATCATAGGAACGTATAGCCC	ATCATAGGAACGTATAGTCC	2659.2	607.3	3	checked data not	repaired
YPL228W	chr16_1	down	AACTTACGAAACTACCGCG	AACTTACGAAACTACCGCG	4955.1	2484.85	7	checked data not	repaired
YPL231W	chr16_1	down	TCGTTGCGACCTATGCGTAG	TCGTTGCGACCTATGTGTAG	5008.15	1362.35	5	checked data not	repaired
YPL235W	chr16_1	down	TAGCCTCGACCTAGAGTATA	TAGTCTCGACCTAGAGTATA	517.6	384.65	4	checked data not	repaired
YPL237W	chr16_1	down	GTGGGCGTACCGTTATCTAC	GTGGGCGTACCGTTATCTAT	919.5	444.8	1	checked data not	repaired
YPL245W	chr16_1	down	GTACCGAGAGCTACGGACTT	GTACCGAGAGTTACGGACTT	1024.6	196.15	10	checked data not	repaired
YPL247C	chr16_1	down	GCGATTAGACGCACGTACCT	GCGATTAGACCACGTACCT	5845.05	2405.6	10	checked data not	repaired

YPL250C	chr16_1	down	GACGAATGCGAGCGACCATA	GACGAATGGAGCGACCATA	4805.65	1205.55	9	data not checked	repaired
YPL253C	chr16_1	down	GACCTGTACGACTAGCAGA	ACCTGTACGACTAGCTGA	6100.3	4665.65	4	data not checked	repaired
YPL257W	chr16_1	down	CTGTAGTAATAGTACGTCGC	CTGTAGTATAGTACGTCGC	4100.15	2004.45	8	data not checked	repaired
YPL264C	chr16_1	down	CGTAAACATATACACTGCGG	TGTAACATATACACTGCGG	4665.35	4376.5	1	checked data not	repaired
YPL267W	chr16_1	down	CGAATTATACCTAAGGCGAC	CGAATTATACCTAAGGCGAC	3107	1491.8	6	checked data not	repaired
YPL268W	chr00_15	down	CGAATGATAAGTATGACGGC	CGAATGATAAATATGACGGC	3939.95	1377.95	10	checked data not	repaired
YPR016C	chr16_4	down	CTTGAAGTCTTGGCACAATG	CTTGAAGTCTTGGCACATG	1222.1	432.85	3	checked data not	repaired
YPR025C	chr16_4	down	CTTGCAGCATCAATGGCAGC	CTTCAGCATCACTGGCAGC	4508.85	1305.6	12	checked data not	repaired
YPR029C	chr16_4	down	CTTGCCTAATATGGGCTACC	CTTGCCTAATATGGGCTACT	2289.25	942.25	1	checked data not	repaired
YPR030W	chr16_4	down	CTTGCGACAGATCATTAGCA	CTTGCGACAGATCATTGCA	3866.8	1176.55	4	checked data not	repaired
YPR033C	chr16_4	down	CTTGCTTACCCGACTATATG	CTTGCTTACCCGACTATTG	4081.3	1766.95	3	checked data not	repaired
YPR046W	chr16_4	down	CTTTAAGTCTGGGTAACCTCG	CTTTAGTCTGGGTAACCTCG	3611.45	2457.15	5	checked data not	repaired
YPR052C	chr16_4	down	CTTTAGCTCCACGAGTGTG	CTTTAGCTCACGAGTGTG	1435.55	1185.1	9	checked data	repaired
YPR076W	chr16_4	down	GAAACAAGCAGATTGCGGC	GTAACCAGCCGATTGAGGC	67.15	3506.35	21	problems data not	original
YPR088C	chr16_4	down	GAAAGGCGGAGCAATACTC	GAAAGGCGGAGCAATACTC	711.5	274.05	5	checked data not	repaired
YPR133C	chr16_5	down	GACAATCCATCCGAATCGTG	GACAATCCACCGAATCGTG	392.65	185.05	9	checked data not	repaired
YPR139C	chr16_5	down	GACACCTATGTAGCAATGAC	GACAACCTATGTAGCAATGAC	3725.95	1032.95	5	checked data not	repaired
YPR145W	chr16_5	down	GACACTATCCCAGACGGAGT	GACACTATCCCAGACGGTGT	4836.4	2766.8	3	checked data not	repaired
YPR148C	chr16_5	down	GACAGAGATGGAGATCACCC	GACAGTATGAGATCACCC	1764.95	87.95	16	checked data not	repaired
YPR158W	chr16_5	down	GACATAGGCTACCCAATTG	GATATAGGCTACCCAATTG	4286.8	3968.15	3	checked data not	repaired
YPR159W	chr16_5	down	GACATCCAATTATGAGCACG	GACATCCAATTATGAGTACG	3531.05	365.25	4	checked data not	repaired
YPR163C	chr16_5	down	GACATTAAGTGGCGTAACC	GACATAAGTGGCGTAACC	3484.85	2441.45	5	checked data not	repaired
YPR200C	chr16_5	down	GACGCAAGTCCGGTAATCA	ACGTAAGTCCGGTAATCA	4246.85	1502.85	6	checked data not	repaired
YAL013W	chr1_1	up	ATATCTCTAACCGCGCATAG	ATATCTCTAACCGCGCATAG	1463.2	441.75	9	checked data not	repaired
YAL016W	chr00_12	up	CGAAATAGGCCAGAATCCGC	AGAAATAGGCCAGAATCCGC	1402.1	1436.7	1	checked data not	repaired
YAL019W	chr1_1	up	AGCGCATAACAGCGACACGT	AGCGCATAAAGCGACACGT	3127.85	1304.5	9	checked data not	repaired
YAL025C	chr1_1	up	AACCGGAGAACTACGCCGT	ACCGGAGAACTACGCCGT	1865.25	1877.25	1	checked data not	repaired
YAL029C	chr1_1	up	TTCTGCGTAGCGGTGTATC	TTCTGCGTAGCGGTGTATC	4136.1	919.1	8	checked data not	repaired
YAL032C	chr1_1	up	TTCTCGTAGCTGCGCTAGT	TTCTCGTAGCTGCGCTAGT	3836.6	777.6	6	checked data not	repaired
YAL034W-A	chr1_1	up	TCGTATTACTCGTCTCCAGG	TTGTATTACTCGTCTCCAGG	3782.15	3455.65	2	checked data not	repaired
YAL035C-A	chr1_1	up	TCGTACGTCTCAATGGTTA	TCGTACGTCTCAATGGTTA	3831.2	1239.85	7	checked data not	repaired
YAL039C	chr1_1	up	GTGCCGCCACTAGCGTATAT	GTGCCGCCACTAGCGATAT	1083.6	623.7	5	checked data not	repaired
YAL040C	chr1_1	up	GTGCCGAGACTCCACTGTTA	GTGCCGAGACTCCACTGTA	2092.3	1577.05	2	checked data not	repaired
YAL056W	chr1_1	up	CTGCGTCAAGTGTGTAGAAT	CTGTGTCAAGTGTGTAGAAT	2639	647.55	4	checked data not	repaired
YAL066W	chr1_1	up	CGGGTCAGAAAGAGATACTC	CGGGCAGAAAGAGATACTC	902.25	244.2	5	checked data not	repaired
YBL033C	chr2_1	up	CGCCGCGCAAGCTGTATTA	CGCCGCGCAAGCTGTATTA	2826.05	2386.6	1	checked data not	repaired
YBL034C	chr2_1	up	CGCCGCTCAAGGCTATGATA	CGCCGCTCAAGGCTATGAT	2574.5	2308.1	1	checked data not	repaired
YBL101C	chr2_2	up	GATGGGATAGCACCGACTA	GATGGGATAGCACCGCATA	2644.4	1065.3	3	checked data not	repaired
YBR005W	chr2_2	up	GCAGGCTACCCGAGCTTATA	GCAGGTACCCGAGCTTATA	2556.35	912.9	6	checked data not	repaired
YBR012C	chr2_2	up	GCATTAGAAGGTCTGGACTA	GCATTAGAAGGTCTGGCTA	2135.7	637.7	4	checked data not	repaired
YBR013C	chr2_2	up	GCCACATGAGCCTAGAGCTA	GCCCATGAGCCTAGAGCTA	2628.45	1551.85	4	checked data not	repaired
YBR049C	chr2_2	up	GCTCCAAGCCTTCGAGAGTA	GCTCCAAGCCTTCGAGAGTA	2568.85	559.55	8	checked data not	repaired
YBR055C	chr2_2	up	GCTGATAATGCTGAGGACTA	GCTGATAATGCTGAGACTA	2652.2	953.6	5	checked data not	repaired
YBR086C	chr2_3	up	GTTTCACAGGTAAGTCAACA	GTTTCACAGGTAAGTCAACA	1971.3	749.85	3	checked data not	repaired
YBR088C	chr00_16a	up	GTCTGCTAGAGCCGACGTTA	GTTGCTAGAGCCGACGTTA	2308.95	2147.95	3	checked data not	repaired
YBR091C	chr2_3	up	TAAACGCCGATGGAGCACGA	TAAACGCCGATGGAGACGA	2326.9	750.4	5	checked data not	repaired
YBR092C	chr2_3	up	TAAAGTGTCTGGAGATCCGA	GAAAGTGTCTGGAGATCCGA	1753.4	1724.4	1	data not	repaired

checked

YBR112C	chr00_16a	up	TACCTTTACGTCCCGGAGGA	TACTTTACGTCCCGGAGGA	2407.55	2280.2	3	data not checked	repaired
YBR132C	chr2_3	up	TAGGCCATAGGCGAGTCTCA	GGGGCCATAGGGAGTCTCA	658.6	453.05	12	problems data not checked	original
YBR146W	chr2_3	up	TAGTTCTGACTCCTCATGCA	AGTTCTGACTCCTCATGCA	1919.9	2199.7	1	checked data not checked	repaired
YBR158W	chr2_3	up	TATGATCCATGCGACTCGGA	TATGATCCTGCGACTCGGA	1522.35	320.25	9	checked data not checked	repaired
YBR173C	chr2_4	up	TGATTTCTACTGCGGCGCGA	TGATTTCTACGCGGCGCGA	309.5	189.95	10	checked data not checked	repaired
YBR182C	chr2_4	up	TGCGACACCTCGGCTTATGA	TGCGAACCTCGGCTTATGA	2345.5	880.35	6	checked data not checked	repaired
YBR183W	chr2_4	up	TGCGAGCAGTGCTATTATA	TGCGAGCAGTGCTATTAA	1559.15	886.15	2	checked data not checked	repaired
YBR184W	chr2_4	up	TGCGCCGCCAGTCTGTTATA	TGCGCCGCCAGTCTGTTATG	849.65	441.3	1	checked data not checked	repaired
YBR193C	chr2_4	up	TGGCCTAGACTGCTGTCAGA	TGGCTAGACTGCTGTCAGA	408.8	151.2	4	checked data not checked	repaired
YBR202W	chr2_4	up	TGGTCGATACGGTTGCTCAA	TGGTCGATACGGTCTCAA	987.35	457.75	7	checked data not checked	repaired
YBR212W	chr2_4	up	TGTAGTACCTCTGGCCCTGA	TGTAGTACCTCTGGCCCGA	3168.45	1414.55	3	checked data not checked	repaired
YBR226C	chr2_4	up	TGTTAGCACTTCTCATCCGA	CGTTAGCACTTCTCATCCGA	2653.05	2326.9	1	checked data not checked	repaired
YBR240C	chr2_4	up	TTAGCTCGCTCATCATGTCA	TTAGCTCGCTCATCATGTA	1942.25	910.7	2	checked data not checked	repaired
YBR268W	chr2_4	up	TTCTGTAGATGTAGTGCCCA	TTTGTAGATGTAGTGCCCA	1775.55	1472.1	3	checked data not checked	repaired
YBR273C	chr00_1	up	GTCCGCGTACCCTGTGTTTA	GTCCGCGTCCCTGTGTTTA	5424.35	2917.7	9	checked data not checked	repaired
YCL007C	chr3_1	up	ACTGCTTTAACCTGCAAGAC	ACTGCTTTACCTGCAAGAC	2428.65	1126.5	9	checked data not checked	repaired
YCL045C	chr3_1	up	AGGATTTCAACCCGAACGAC	AGGATTTCAACCCGACGAC	2801.9	1388.55	5	checked data not checked	repaired
YCR014C	chr3_1	up	ATCGGAAGAATCTGAATCC	ATCGGAAGAATCTGAATCC	1314.55	233.9	10	checked data not checked	repaired
YCR048W	chr00_16a	up	GTCCGGCAGGTACTGTATAA	GTCCGGCAGTACTGTATAA	914.4	434.6	9	checked data not checked	repaired
YCR063W	chr00_1	up	TGGTCTAGCGTGAGTCATAA	TGGTCTAGGTGAGTCATAA	1368.4	265.65	9	checked data not checked	repaired
YCR083W	chr00_16a	up	ATTAGCTTAACTACCGTCCG	ATTAGTTAACTACCGTCCG	4377.85	1340.9	6	checked data not checked	repaired
YDL002C	chr4_1	up	CGAAGTGAATATAAGTGCCC	CGAGTGAATATAAGTGCCC	2026.85	879.35	3	checked data not checked	repaired
YDL005C	chr4_1	up	CGAGGCTAATAGAATTGACC	CAAGGCTAATAGAATTGACC	2622.9	1530.3	2	checked data not checked	repaired
YDL009C	chr4_1	up	CGATTATTAAGTCAGCACCC	CGATTATTAGTCAGCACCC	3690.6	1258.4	9	checked data not checked	repaired
YDL010W	chr4_1	up	CGATTTCTAAGGATCTGGAC	CGTTTCTAAGGATCTGGAC	2313.75	1006.3	3	checked data not checked	repaired
YDL030W	chr4_1	up	CGTCTTAATTCATACAGGCC	CGTCTTAATTCATACAGGCC	2605.5	421.75	5	checked data not checked	repaired
YDL035C	chr4_1	up	CGTTGAGTAATAGGGATTCC	GTTAAGTAATAGGGATTCC	331.85	128.85	6	checked data not checked	repaired
YDL047W	chr4_1	up	CTCTTGGAATTACTAGACC	CTCTTGGAATTACCAGACC	3240.9	804.55	6	checked data not checked	repaired
YDL057W	chr4_1	up	CTTGAGGGAATCGAATCTAC	CTTAGGGAATCGAATCTAC	637.2	208.05	4	checked data not checked	repaired
YDL061C	chr4_1	up	CTTTGCGGAATCTATACTCC	CTTTGCGGAATCTATACTCC	79	71.15	4	checked	repaired
YDL070W	chr4_1	up	GACCATTGAATATGTCGAGC	GACCATGGAATATGTCGAGC	2471.75	1957	7	data ok data not checked	repaired
YDL082W	chr4_1	up	GAGCCTGTAATATACTTGCC	GAGCCTTAATATACTTGCC	638.7	119.25	7	checked data not checked	repaired
YDL091C	chr4_1	up	GAGGTCACAATTTGCTACAC	CAGGTCACAATTTGCTACAC	2754.6	2246.1	1	checked data not checked	repaired
YDL099W	chr4_2	up	GTTTCAGCAGAGGCGATCTC	GTTTCAGAGAGGCGATCTC	776.95	165.35	8	checked data not checked	repaired
YDL107W	chr4_2	up	TAATATGCTTGACGAGGTGC	TAATATGTTTGACGAGGTGC	2324.55	258.8	8	checked data not checked	repaired
YDL113C	chr4_2	up	TAGATGCCACTATTACTGCC	TAGATGTCGCTATTACTGCC	989.4	388.2	16	checked data not checked	repaired
YDL118W	chr4_2	up	TAGGGAGGATCGTTCACCAC	TAGGGAGATCGTTCACCAC	1630.85	405.85	7	checked data not checked	repaired
YDL125C	chr4_2	up	TATAGATGATGTAGCCCAGC	TATAGAGGTGTAGCCCAGC	462.65	417.2	16	problems data not checked	original
YDL132W	chr4_2	up	TATGTGGACTGGAGACTTTC	TATGTGGACTGGAGACTTTC	880.65	145.05	5	checked data not checked	repaired
YDL178W	chr4_2	up	TGCCGGGAGATTCGTTATAC	TGCCAGGAGATTCGTTATAC	427.45	1300.6	5	problems data not checked	original
YDL179W	chr4_2	up	TGCCATGAGGAGTATGAAC	TGCTATGAGGAGTATGAAC	1101.7	438.05	3	checked data not checked	repaired
YDL181W	chr4_2	up	TGCGATCCAGTGCCATAGAC	TGCGATCCGGTGCCATAGC	1440.75	2056.2	11	problems data not checked	original
YDL183C	chr4_2	up	TGGAGAGGGTCTACCTAAC	TGGAGAGGTCTACCTAAC	991.5	296.65	7	checked data not checked	repaired
YDL216C	chr4_3	up	AATGTGGAACAATAGTCCCG	GATGTGGAACAATAGTCCCG	641.8	262.65	9	checked	repaired
YDL227C	ctrl_4	up	AACAATGAAACGCTTCTCCG	AACAATGAACGCTTCTCCG	137.55	108.75	8	data ok data not checked	repaired
YDR016C	chr4_3	up	ACTTCCCTAAACTTGTTCCG	ACTTCCCTAGACTTGTTCCG	814.6	2894.2	9	problems	original

YDR027C	chr4_3	up	AGACCGAAATCTAATCCCGG	AGACAGAGGTTAATCCCGG	100.8	175.15	32	data problems	original
YDR079W	chr4_4	up	CGATTTAACTTGATGTCCCG	CGATTTAACTGATGTCCCG	3012.65	906.75	9	checked data not	repaired
YDR091C	chr4_4	up	CGTCTCCAATCATTAGAG	CGTCTCCAATTATTTAGAG	1169.05	139.75	9	checked data not	repaired
YDR096W	chr4_4	up	CTAAGAGGCTTGAATCAGAG	CTAAAGGCTTGAATCAGAG	1371.6	347.95	5	checked data not	repaired
YDR102C	chr4_4	up	CTAGATTTAATTCGCCACCG	CTAGATATAATTCGCCATCG	309.85	116	10	checked data not	repaired
YDR113C	chr4_4	up	CTCTATATCCACCAGTTTGG	CTCTATATCCACCAATTTGG	697.4	240.35	6	checked data not	repaired
YDR124W	chr4_4	up	CTGTTTCAATATCCTGACCG	CTGTTTCAATACCCTGACCG	4161.1	1387.65	9	checked data not	repaired
YDR143C	chr4_4	up	GAACCTTTTCTACATCCGGG	GAACCTTTTCTACATCCGGG	1346.05	405.95	5	checked data not	repaired
YDR145W	chr4_4	up	GAATCTACCCACATACTTGG	GATCTACCCACATACTTGG	902.25	862.25	2	checked data not	repaired
YDR151C	chr4_5	up	TCCGGCATTGATCTACGCG	TCCGGCATTGATCACGCG	2600.7	1357.9	6	checked data not	repaired
YDR152W	chr4_5	up	TCCTGTAGATCCCTATGCGG	TCCTGTAGACCCTATGCGG	2704.1	974.5	9	checked data not	repaired
YDR169C	chr4_5	up	TGAATGCACTGGAGCCTACG	TGAATGCCTGGAGCCTACG	3137.75	872.1	8	checked data not	repaired
YDR174W	chr00_14	up	TGCCTCGACTCCTTTGTAGG	TGCCTCGACTCCTGTAGG	3975.8	2464.95	6	checked data not	repaired
YDR178W	chr4_5	up	TGGCTGATAGATTATGCTCG	TGGCGATAGATTATGCTCG	2060.25	503.5	5	checked data not	repaired
YDR181C	chr4_5	up	TGTTCCCTAGCCTCAGGTAG	TGTTCCCTAGCTTCAGGTAG	1667.4	255.15	9	checked data not	repaired
YDR189W	chr4_5	up	TTAGTCATATCTCAGGCTGG	TTAGTCATACTCAGGCTGG	2485.2	493.8	9	checked data not	repaired
YDR204W	chr4_5	up	TTCTAGCCGTCCGCAGTTTG	TTCTAGCCGTCTGCAGTATG	2983.65	345.05	12	checked data not	repaired
YDR212W	chr4_5	up	TTGCTACACGGCTGTGCATG	TTGCTACACGGCTGTACATG	1253.45	514.55	5	checked data not	repaired
YDR255C	chr4_6	up	GCTAGACCATGCTCCAGGAT	GCAGACCATGCTCCAGGAT	629.95	258.7	3	checked data not	repaired
YDR263C	chr4_6	up	GGACCCATAGCACTCTGATT	GGACTCATAGCACTCTGATT	829.3	162.75	5	checked data not	repaired
YDR268W	chr4_6	up	GGATAGGCAGATGCACCTTAT	GGATAGGCAGATGCCTTAT	105.3	67.05	6	checked data not	repaired
YDR352W	chr4_7	up	GCCATCCGACCGATTGATTA	GCCATCCGACCGATTAATTA	2301.7	804.55	5	checked data not	repaired
YDR360W	chr4_7	up	GCCGGTGGAAATGTTATATCA	GCCGGTGGATGTTATATCA	905.6	297.25	9	checked data not	repaired
YDR365C	chr4_7	up	GCGCAGGGAGATCCATATCA	GCGCAGGGAGTCCATATCA	1377.6	281.1	10	checked data not	repaired
YDR390C	chr4_7	up	GCTTTCCACCCGGTAGGATA	GCTTTCCACCCGGTAGATA	1308.7	418.5	4	checked data not	repaired
YDR399W	chr4_7	up	GGCCAATTCTGGTACGCCATA	GGCCAATTCTGGTACGCTA	3378.45	1521.45	3	checked data not	repaired
YDR421W	chr4_7	up	GTCCTCTCACCTTATTGGGA	GTCCTCTCACTTTATTGGGA	2231.4	255.8	10	checked data not	repaired
YDR429C	chr4_7	up	GTTTCCCGAATGTGTGCGAA	GTTTCCCGAAGTGTGCGAA	1152.55	330.7	10	checked data not	repaired
YDR445C	chr00_14	up	GTCCCTGTACCTTAGAGACT	GTCCCTGTACATTAGAGACT	1587.7	259.55	10	checked data not	repaired
YDR452W	chr4_8	up	TGTATTCACTCCTTCCGGGA	TGTATTCACTCCTTCCGGGA	1661.95	141.65	5	checked data not	repaired
YDR453C	chr4_8	up	TGTCACATCTTTCATCGGA	TTCACATCTTTCATCGGA	1504.75	1528.9	2	checked data not	repaired
YDR454C	chr4_8	up	TGTCAGCCCGCCATGTATA	TGTCAGCCCGCCATGTATA	2578	926.2	10	checked data not	repaired
YDR465C	chr4_8	up	TTAATAGCCTTGAGCAGCGA	CTAATAGCCTTGAGCAGCGA	1811.9	1727	1	checked data not	repaired
YDR466W	chr4_8	up	TTAATCGGCTGGAGCTGCTA	TTAATCGCTGGAGCTGCTA	1444.25	550.5	7	checked data not	repaired
YDR494W	chr4_8	up	TTGACACGCTTGAGTCCAAA	TTGACACGTTGAGTCCAAA	1696.6	274.55	9	checked data not	repaired
YEL015W	chr5_2	up	CGCTTATTAGAATCACGTCC	CGCTTATTAGAATCACGTC	1651.65	1481.55	1	checked data not	repaired
YEL053C	chr5_2	up	CGGACAGAATGTACGAGCTA	CGGATAGAATGTACGAGCTA	4120.7	1035.95	5	checked data not	repaired
YEL054C	chr5_2	up	CGGACATCACAGTCACGAGT	CGGACATCACATCACGAGT	1947.65	484.65	9	checked data not	repaired
YEL072W	chr5_2	up	TACGTTATATCCGACTAGCC	TACGTTATATCTGACTAGCC	2737.3	508.9	9	checked data not	repaired
YER028C	chr5_3	up	CTTTCCAATACGGTGTACGA	CTTTCCAATGCGGTGTACGA	1005.35	3739.4	9	data problems	original
YER033C	chr5_3	up	GCACTCGTACTCACGGAGAT	GCACTCGTAACTCACGGAGAT	3414.4	1307.3	9	checked data not	repaired
YER049W	chr5_3	up	ACCGTTCCAACTATAAGCG	ACCGTTCCAACTATAAGCG	4801.2	2848.95	9	checked data not	repaired
YER073W	chr5_3	up	CTCTGTGAATACCGAGTACA	CTCTGTGAATACCGAGTCA	369.1	126.75	3	checked data not	repaired
YER078C	chr00_8	up	GAACTATGCTGACAGTACCG	GAACTATGCTGACAGCACCG	3448.55	2414.15	5	checked data not	repaired
YER118C	chr00_5	up	CGGAGACCACGCAATCGTAA	CGGAGACCACGCAACCGTAA	7270.45	3861.25	6	checked data not	repaired
YER129W	chr00_5	up	GAACTCTCGTACAGTAGATC	GAACTCTCGTACATAGATC	1464.8	190.55	7	checked data not	repaired
YER144C	chr00_2	up	CTAGTGAAGTGGAGCCAATA	CTAGTGAAGTGGAGCCATA	1430.95	489.9	3	data not	repaired

checked

YER146W	chr00_5	up	GTCTGTGTACGGGATACTAA	GTCTGTGTATGGGATACTAA	2275	396.1	9	data not checked	repaired
YFL034C-A	chr00_2	up	CTAGTGGCAATCATCAGACA	CTAGTGGCAATATCAGACA	2218.45	407.35	9	checked data not	repaired
YFL034W	chr6_1	up	GACTCACGAATGCGGAGACT	GACTACGAATGCGGAGACT	475.3	145.35	5	checked data not	repaired
YFL042C	chr00_15	up	GACTGCAATCACTCCAGATG	GACTACAATCACTCCAGATG	3340	1592.2	5	checked data not	repaired
YFL045C	chr6_1	up	GACTGTGAGCACCATTGA	GACTTTGAGCACCATTGA	2091.2	681.6	5	checked data not	repaired
YFR003C	chr6_1	up	GAGACGTTACGACCAAGCTA	AGACGTTACGACCAAGCTA	1192.25	1253.05	1	checked data not	repaired
YFR015C	chr6_1	up	GAGAGTAAGTTGACCTACCC	GAGAGAAGTTGACCTACCC	1464.4	435.5	6	checked data not	repaired
YFR020W	chr6_1	up	GAGATCGTAATCGAGTCACA	GAGATCGAATCGAGTCACA	339.25	113.95	8	checked data not	repaired
YFR028C	chr00_15	up	GAGCCACGAAGTTCTGCGAA	GAGCCACGAAATCTGCGAA	3437.2	1646.35	10	checked data not	repaired
YFR035C	chr00_2	up	CTATACCACCAAGTATGAG	CTATCCACCAAGTATGAG	4140.8	3149.3	5	checked data not	repaired
YGL013C	chr7_1	up	CCAGCTATAAGCATATTGCC	CCAGTTATAAGCATATTGCC	1928.85	195.6	5	checked data not	repaired
YGL132W	chr7_2	up	ATAATTTCAACCTCAGCCGG	ATAATTTCAACCTAGCCGG	2979.75	659.45	7	checked data not	repaired
YGL133W	chr7_2	up	ATCAAACCAGAATTGCGGCG	ATTAACAGAATTGCGGCG	249.7	116.8	11	checked data not	repaired
YGL154C	chr7_2	up	CCACATCCAATCATAGGAGG	CCACACCAATCATAGGAGG	3464.5	813.85	6	checked data not	repaired
YGL236C	chr7_3	up	TTCGGATCAGGGCTGCACTT	TTCGGATCAGGGCTGACTT	2654.45	887.6	5	checked data not	repaired
YGL249W	chr7_3	up	TTGGGCGCAGTGCCTTTAT	TTGGGTGCAGTGCCTTTAT	2690.85	418.25	6	checked data not	repaired
YGL254W	chr7_3	up	AGGCATCCAATGTATGGCA	AGGCATCTAATGTATGGCA	2663.85	201.8	8	checked	repaired
YGR018C	chr7_3/ chr00_12	up	GATCAATCCCTTCACAGGAA	TATCAATCCCTTCACAGGAA	1122.85	1087.1	1	data not checked	repaired
YGR040W	chr00_14	up	CTGTGGCAATCCAATTAAC	CTGTGGCAATCCAATTAAC	263.5	91.3	8	checked data not	repaired
YGR053C	chr00_14	up	GATTATTCAATGTCCAGGCC	GATTATTCAATGTCCAGGCC	1450.05	366.9	6	checked data not	repaired
YGR075C	chr7_4	up	TGGGAGCAGTTTGCAATACC	GGGAGCAGTTTGCAATACC	2164	2633.85	1	checked data not	repaired
YGR078C	chr7_4	up	TTCCATTGATACTCCGGGC	TCCATTGATACTCCGGGC	2312.7	2596.95	1	checked data not	repaired
YGR086C	chr00_14	up	TTTATTGAGATTGGCGGCAC	TTTATTGAGATTGGTGGCGC	2504.8	70.8	8	checked data not	repaired
YGR102C	chr7_4	up	GCTCCCAATGTTCCGAATG	GCTCCCATGTTCCGAATG	4353.05	2442.45	7	checked data not	repaired
YGR103W	chr7_4	up	GGTCGCCTAATTTCAAGGG	GGTCGCCTAATTTCAAGGG	2686.85	991.45	6	checked data not	repaired
YGR122C-A	chr00_17a	up	GTGAGATCCCACGCTCTGTT	GTGAATCCCACGCTCTGTT	1108.4	330.6	5	checked data not	repaired
YGR164W	chr7_5	up	AGGTACACAAGACAGCCCGT	AGGTACAAAAGACAGCCCGT	4255	1765.25	8	checked data not	repaired
YGR165W	chr7_5	up	AGGTATATCCAACCATCCGT	AGGATATCCAACCATCCGT	1494.35	623.45	4	checked data not	repaired
YGR186W	chr7_5	up	AGTCGGAACCATATACAGCC	AGTCGGGACCATATACAGCC	3499.6	989.15	7	checked data not	repaired
YGR206W	chr7_5	up	AGTTACTCAACCATGCTTCG	AGTTACTCACCATGCTTCG	683.65	247.9	9	checked data not	repaired
YGR215W	chr7_5	up	AGTTGTATAGAATCACCGGC	GTTGTATAGAATCACCGGC	2539	2771.35	1	checked data not	repaired
YGR234W	chr00_2	up	CTCATTACAGGATAGGACAG	CTCATTACAGGATGACAG	3397	737.45	7	checked data not	repaired
YGR267C	chr00_3	up	GCATAGCTCATGGCACATAA	GATAGCTCATGGCACATAA	1849	1549.6	2	checked data not	repaired
YGR270W	chr00_3	up	GCATCAAGTTCTTCACAGCA	GCATCAAGTCTTCACAGCA	3008	823.9	9	checked data not	repaired
YGR277C	chr00_3	up	GCATCCGGCATCAGACGTTA	GCATCCGGCATCGACGTTA	159.35	95.6	8	checked data not	repaired
YGR280C	chr00_3	up	GCATCTGTACGATCTCAGCA	GCATCTGTACGCTCTCAGCA	2335.95	623.5	9	checked data not	repaired
YGR285C	chr00_3	up	GCATGAGACAGTGGCGATATA	GCATGAGACAGTGGCGATATA	4328.25	1310.05	8	checked data not	repaired
YHL034C	chr8_1	up	GCGACACTCTCATACGATAT	GCGATACTCTCATATGATAT	81.9	87.6	11	data ok	repaired
YHL042W	chr8_1	up	CTGGATTGACACTAGCATAAC	TCCAGATTGACACTAGCATAAC	2092.55	3029.9	8	problems data not	original
YHR070W	chr8_2	up	CCAGTTATACGCAGACATAAC	CCAGTTATACGCAGAATAAC	1856.45	431.05	5	checked data not	repaired
YHR079C	chr8_2	up	CGTGTCTTACAGCACTACAT	CGTTTCTTACAGCACTACAT	2140.95	754.3	4	checked data not	repaired
YHR152W	chr8_3	up	GTATGTGGAGACCTATCAT	GTATGTGGAGACCTTATCAT	1064.45	152.95	5	checked data not	repaired
YHR155W	chr8_3	up	GTCAGAGGATCGAGCCACTT	GTCAGAAGATCGAGCCACTT	2045.65	843.85	7	checked data not	repaired
YHR158C	chr8_3	up	GTCATGTTACCTGAGGAGAT	GTCATGTTACCTGAGAGAT	529.35	144.2	5	checked data not	repaired
YHR161C	chr8_3	up	GTCCGTATAGCGGGCACTTT	GTCCGTATAGCGGGTACTTT	845.05	135.65	6	checked	repaired

YHR172W	chr8_3	up	GTCTTCGAGGAGGATTCTAT	GTCTTCGAGGAGGATTAT	161.75	71.5	4	data not checked	repaired
YHR186C	chr8_3	up	GTTAGCGCAGAGGCTCCTAT	GTTAGCGCAGAGGCTCCAT	1874.8	1045.15	3	data not checked	repaired
YIL004C	chr9_1	up	AAGTTCGTAAGACACGCC	AAGTTCGTAAGACACCCC	3817.55	1398.45	4	data not checked	repaired
YIL007C	chr9_1	up	AATACACTAAGCTCGGTCC	AATACACAAAGCTCGGTCC	3143.8	1372.7	8	data not checked	repaired
YIL018W	chr9_1	up	ATCTGAGCACAACTAGGACG	ATCTGAGCACAACTAAGACG	2491	1392.8	5	data not checked	repaired
YIL021W	chr9_1	up	CAGTAGCAACTATTCTAGCC	CAGTAGCAACTATTCTAGC	243.3	208.85	1	data not checked	repaired
YIL022W	chr9_1	up	CAGTAGTCAAGAGTCGGACA	CAGTAGTCAAGAGTGGACA	3469.35	585.9	6	data not checked	repaired
YIL034C	chr9_1	up	GAGACAGTCGAGCGATCAAT	GAGACGTCGAGCGATCAAT	443.65	112.7	6	data not checked	repaired
YIL051C	chr9_1	up	TCTTACGCCTCGTAGTTAG	TCTTACGGCTCGTAGTTAG	513.85	1983.9	8	problems data not checked	original
YIL053W	chr9_1	up	TCTTAGGTAAGTGCAGTGAC	TCTTAGGACTTGCAGTGAC	2222.65	572.45	8	data not checked	repaired
YIL068C	chr9_1	up	ATCTGGGTAATAGGTACGC	ATCTGGTAATAGGTACGC	3359.6	1647.95	5	data not checked	repaired
YIL089W	chr9_1	up	GCTACGTTACCATGTGCAGA	GCTACGTTACCATGGTGCAGA	3623.5	2031.85	7	data not checked	repaired
YIL095W	chr9_1	up	GTTACTCGACGGCAGCAGTT	GTTACTCGACGGCAGCAGTT	2460.7	849.8	9	data not checked	repaired
YIL102C	chr9_2	up	TCCTCACTAGCTGTGCAGTA	TCTTCACTAGCTGTGCAGTA	919.9	1327.05	3	data not checked	repaired
YIL110W	chr9_2	up	ACCGGATCAAAGTAGACCCG	ACGGATCAAAGTAGACCCG	337.9	335.2	2	data not checked	repaired
YIL116W	chr9_2	up	ATAATGCTAACGACCAGTCC	ATATGCTAACGACCAGTAC	1923.25	496.1	5	data not checked	repaired
YIL138C	chr9_2	up	CTCGTATGACAGGATAGTAC	CTCGTATGACAGGATAGTAC	2252.55	446.65	7	data not checked	repaired
YIL158W	chr9_2	up	TACGGGTACGATTTCTGAA	TACGAGGTGCGATTTCTGAA	79.75	1198.15	14	problems data not checked	original
YIR017C	chr00_3	up	GCATTCTAAGTGTTCAGACG	GCATTCTAAGTGTTCAGAG	1689.9	532.4	2	data not checked	repaired
YIR034C	chr00_3	up	GCCACAGGCAGGCATATTA	GTCACAGGCAGGCATATTA	3374.65	2319.4	2	data not checked	repaired
YJL015C	chr00_13	up	TACCTTCTACGCTATCTGAG	TACTTCTGGCTATCTGAG	97.5	2444.35	21	problems data not checked	original
YJL037W	chr10_2	up	TAGTCGGTAGCATGAGTCTA	TAGTCGGTAGCATAAGTCTA	3074.85	486.8	7	data not checked	repaired
YJL074C	chr10_2	up	AGGTAGTGAACAGTGCATC	AGGTTGTGAACAGTGCATC	3117.7	967.35	5	data not checked	repaired
YJL093C	chr10_2	up	TAGTCAGAGGGAGTATTCTC	TAGTCAGAGGGATATTCTC	349.45	91.4	8	data not checked	repaired
YJL117W	chr10_2	up	CGACTGTCACCACGGTTAGT	CGACTGTCACCACGATTAGT	3209.45	1524.3	6	data not checked	repaired
YJL121C	chr10_2	up	CAGCTTCAAGAGTACATACG	CAGCTTCAAGAGTACATACG	3970.6	1327.7	8	data not checked	repaired
YJL159W	chr10_1	up	GTACTTTACCTCGACGGACG	GTACTTTACTCGACGGACG	3376.35	1275.85	9	data not checked	repaired
YJL170C	chr10_1	up	CGTAGTCGAGACGAGACATC	CGTAGTCGGACGAGACATC	2577.05	802.75	9	data not checked	repaired
YJL191W	chr00_14	up	GTCGAAGTTTGTGGACTATC	GTCGAAGTTTGGGACTATC	3227.45	1272.3	9	data not checked	repaired
YJL197W	chr10_1	up	TCTCGGGACGTTGCGCTATA	TCTGGGACGTTGCGCTTTA	2126.6	306.7	7	data not checked	repaired
YJL215C	chr10_1	up	GCGTACTTACTATCACGTAG	GCGTACTTACTATCACGTTG	3232.2	1240.1	2	data not checked	repaired
YJR057W	chr00_13	up	AGAAGTCGAACAGCCTCTAC	AGAAGACGGACAGCCTCTAC	70.05	575.15	15	problems data not checked	original
YJR067C	chr00_12	up	GCAGATATACAGTTATGGCG	ACAGATATACAGTTATGGCG	2437.2	2340.7	1	data not checked	repaired
YJR068W	chr00_12	up	GCAGTGTACATGCAGTCAG	TCAGTGTACATGCAGTCAG	1847.9	1811.15	1	data not checked	repaired
YJR084W	chr00_12	up	GCTACTTACCCTGGTTAGG	CCTACTTACCCTGGTAGG	1367.1	406.9	5	data not checked	repaired
YJR087W	chr00_12	up	GCTGAGCTACATATTTGAG	CCTGAGCTACATATTTGAG	2209.8	1876.5	1	data not checked	repaired
YJR093C	chr00_12	up	GGACTATAATTTACGGACCG	TGACTATAATTTACGGACCG	1599.95	1632.65	1	data not checked	repaired
YJR095W	chr00_12	up	GGTATTGACACTGTGATCG	TGTATTGACACTGTGATCG	2396.5	2287.35	1	data not checked	repaired
YJR097W	chr00_12	up	GGTGTCTAATTGTATGCACG	TGTGTCTAATTGTATGCACG	2723.05	2722.1	1	data not checked	repaired
YJR110W	chr10_4	up	GTCATCAGACCCTGCTGTAG	GTCATCAGACCCTGCTGTAG	1323.5	572.45	9	data not checked	repaired
YJR113C	chr00_12	up	GTCCCTATACCCGTTGAG	ATCCCTATACCCGGTTGAG	1532.95	667.2	8	data not checked	repaired
YJR123W	chr00_12	up	GTGATTATAGGATAGCCTCG	ATGATTATAGGATAGCCTCG	79.3	76.35	1	data not checked	repaired
YJR124C	chr00_12	up	GTGCAGGTACATTGATCTAG	GTGCAGGACATTGATCTAG	2706.85	759.8	8	data not checked	repaired
YJR133W	chr00_12	up	GTTCTATATCCATGACTCG	ATTCTATATCCATGACTCG	2336.25	2157.6	1	data not checked	repaired
YJR134C	chr00_12	up	GTTCTTACATTGCTGACG	CTTCTTACATTGCTGACG	1042.5	1008.1	1	data not checked	repaired
YKL003C	chr11_1	up	ATGCTTGAGAACCGTCAGC	ATGCTCGAGAACCGCAGC	3029.3	236.15	11	data not checked	repaired
YKL005C	chr00_12	up	CAAATATGATACACCGCTC	TAAATATGATACACCGCTC	1521.95	1422.75	1	data not checked	repaired

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YKL011C	chr11_1	up	ATGGTTATAGAGAATCGCCC	ATGGTTATAGAGAATCGCTC	931.35	316.3	2	data not checked	repaired	
YKL024C	chr11_1	up	ATGTTTACACACAAGCTGCC	ATGTTTACACACAAGTTGCC	3820.15	584.75	5	checked data not checked	repaired	
YKL033W	chr11_1	up	ATTC AATGAGAACTGCCCGA	ATTC AAGAGAACTGCCCGA	3125.25	707.1	7	checked data not checked	repaired	
YKL076C	chr11_1	up	CAAAGATTGAGACAGCCGTC	CAAAGATTGAGCAGCCGTC	2397.5	960.2	9	checked data not checked	repaired	
YKL084W	chr11_1	up	CAAATGTGGTGACAAGCCAT	CAAATGGTGACAAGCCAT	1359.95	275.75	6	checked data not checked	repaired	
YKL087C	chr11_1	up	CAACAAATCATTACCCGTGG	CAACAAACATTACCCGTGG	4129.1	995.3	8	checked data not checked	repaired	
YKL093W	chr11_1	up	CAACATAATGACACCTCGTG	CAACAAATGACACCTCGTG	3512.95	1053.9	6	checked data not checked	repaired	
YKL094W	chr11_1	up	CAACATGCTTCAAGAATCGG	TAACATGCTTCAAGAATCGG	1698.95	1584.65	1	checked data not checked	repaired	
YKL119C	chr11_2	up	CAGGTCACACATACCATAGG	CAGGTTACACATACCATAGG	4237.25	818.9	6	checked data not checked	repaired	
YKL134C	chr11_2	up	CATAAACTGATTACACGGCC	CATAAACTGATTACACGACC	4041.95	1523.3	3	checked data not checked	repaired	
YKL135C	chr11_2	up	CATAAATCTTAGGACACCGG	CATAAATCTAGGACACCGG	3326.15	982.7	9	checked data not checked	repaired	
YKL142W	chr11_2	up	CATAAGGAAGAGGGTATCTC	CATAAGGAAGAGGGTCTC	545.7	103.8	5	checked data not checked	repaired	
YKL146W	chr11_2	up	CATACCAAGTAGGACACCTG	CATATCAAGTAGGACACCTG	2615.05	1206.75	5	checked data not checked	repaired	
YKL147C	chr11_2	up	CATACCATAACCGAAGTACGG	CATACCATCCCGAAGTACGG	4660.35	2443.8	9	checked data not checked	repaired	
YKL157W	chr11_2	up	CATCAAACACCCAGATTGGT	CATCAAACACCCAGATGGT	2903.8	835.55	4	checked data not checked	repaired	
YKL199C	chr11_3	up	CCCCTAGAAATAGACCATGT	CCCCTAGAAATAGACCATGT	1623	296.95	5	checked data not checked	repaired	
YKL208W	chr11_3	up	CCCGAAGCCCTGATAAGAGA	CCTGAAGCCCTGATAAGAGA	3524.4	1899.6	3	checked data not checked	repaired	
YKL212W	chr11_3	up	CCCGGATGACAATGACCGAT	CTGGATGACAATGACCGAT	2576.4	998.5	4	checked data not checked	repaired	
YKL213C	chr11_3	up	CCCGGCATACAGAACAATTT	CCCGGCATCAGAACAATTT	1013.95	149.85	11	checked data not checked	repaired	
YKR004C	chr00_14	up	CCCTACTCACAAGTGTATGA	CCCTACTCACAAGTGTATGA	2952.35	991.7	4	checked data not checked	repaired	
YKR018C	chr11_3	up	CCGAGCCAAGACCATTAAAG	CCGAGCCAAGACCATTAAAG	5597.6	3044.4	9	checked data not checked	repaired	
YKR020W	chr11_3	up	CCGAGCGAATAATATAGCGT	CCGAGTGAATAATATAGCGT	2819.6	248.2	6	checked data not checked	repaired	
YKR035W-A	chr00_3	up	GCCAGTTACAGTCATGCCTA	GCCAGTTACAGTCATGCTA	2672.3	1414.8	3	checked data not checked	repaired	
YKR053C	chr00_14	up	CCGGAATTAACGTATCTCAC	TCGGAATTAACGTATCTCAC	2005.3	1484.95	1	checked data not checked	repaired	
YKR057W	chr11_3	up	CCGGCAAGATTTCTCAATAC	CCGGTAAGATTTCTCAATAC	729.5	106.1	5	checked data not checked	repaired	
YKR060W	chr11_3	up	CCGGGCAGACCCGATATTA	CCGGGCAGACCCGATATTA	217.75	105.1	10	checked data not checked	repaired	
YKR063C	chr11_3	up	CCGTACAACCTGTTCCACAAA	CCGTCAACCTGTTCCACAAA	3626	1033.95	5	checked data not checked	repaired	
YKR098C	chr00_4	up	GCGCCGCACAGAGTCTTATA	GCGCCGCACAGAGTCTATA	3620.95	2105.3	4	checked data not checked	repaired	
YLL018C-A	chr00_4	up	GCGCTTCGACTCATATACAA	CGTTCGACTCATATACAA	1076.05	919.2	1	checked data not checked	repaired	
YLR017W	chr12_1	up	AGTAGAAAACATCGAGTCCGC	AGTAGAAAACATCGAGTCCGC	2354.9	982.45	3	checked data not checked	repaired	
YLR071C	chr12_2	up	ACAGGCGGAAAGATAGTTCT	ACAGGCGGAAAGATATTCT	599	171.7	5	checked data not checked	repaired	
YLR113W	chr12_2	up	AGCTCGAAATAGCCATACCT	AGCTTGAATAGCCATACCT	1558.8	221.2	5	checked data not checked	repaired	
YLR114C	chr12_2	up	AGCTGGGTACAATAGCGAT	AGCTGGGTGCAATAGCGAT	1866.05	294.3	9	checked data not checked	repaired	
YLR116W	chr12_2	up	AGGCCGTCAAATGTCCGACT	AGGCCGTAAATGTCCGACT	728.3	141.55	8	checked data not checked	repaired	
YLR133W	chr12_3	up	TTACCCAGCCTCGGGAGTAT	TTACCCAGCTCGGGAGTAT	881.65	185.15	9	checked data not checked	repaired	
YLR140W	chr12_3	up	TTCAGTGGATCGGATAGCTT	TTCGTGGATCGGATAGCTT	1662.05	633.2	4	checked data not checked	repaired	
YLR143W	chr12_3	up	TTCCGACGTTCTGGCAGGAT	TTCCGACGTTCTGGCAGAT	719.35	428.3	3	checked data not checked	repaired	
YLR151C	chr12_3	up	TTCTGCTGAGCGCCGTC AAT	TTCTGCTGAGCGCCGTCAT	1696.95	1247	2	checked data not checked	repaired	
YLR170C	chr12_3	up	TTTGCGCGAGGCTGTCTAT	TTTGCGCGAGGCTGCCTAT	1221.6	582.15	6	checked data not checked	repaired	
YLR177W	chr12_3	up	ACTTCGGGAAAGGGACCACA	ACTTCGGGAAAGGGACCACA	214.8	145.3	9	checked data not checked	repaired	
YLR186W	chr00_11	up	ACGACTGTAAAGGCTAGTAC	ACGACTGCAAAGGCTAGTAC	2475.2	1635.45	8	checked data not checked	repaired	
YLR195C	chr12_3	up	ATCGGGAACGCCAGCCAATA	ATCGGGGCGCCAGCCAATA	1804.95	391.35	15	checked data not checked	repaired	
YLR197W	chr12_3	up	ATGCCGGGAACCGTTGACAA	ATGCCGGGAGCCGTTGACAA	1244.85	268.9	9	checked data not checked	repaired	
YLR201C	chr12_3	up	ATTTGGGTAACGCTTGACAGA	ATTTGGGTAACGCTTGACAGA	2764.9	2906.15	2	checked data not checked	repaired	
YLR215C	chr00_11	up	TAGACGGACGGCGCTCATTA	TAGACGGTCGGCGGCTCATTA	4381.35	556.2	16	checked data not checked	repaired	
YLR235C	chr12_4	up	CCTTGGTGACAATATGTACG	CCTTGGTGACAATATGACG	1955.75	436.6	4	checked data not checked	repaired	

YLR238W	chr12_4	up	CCTTTAATCATAATCGCGGC	CCTTTAATTATAATCCGGC	403.35	73.5	14	data not checked	repaired
YLR242C	chr12_4	up	CCTTTGAGACACTAGATGAG	CCTTTAAGACACTAGATGAG	1934.05	385.25	6	data not checked	repaired
YLR287C	chr12_4	up	CGAGATCCAAGGCCATGAT	CGGGATCCAAGGCCATGAT	2692.1	1249.85	3	data not checked	repaired
YLR293C	chr12_4	up	CGAGGTCTACCCGAATCAGT	CGAGGTCCACCCGAATCAGT	764.9	344.4	8	data not checked	repaired
YLR308W	chr12_4	up	CGATCAAGCGGTCACAATAT	CGATCAAGTGGTCACAATTT	749.05	272.35	11	data not checked	repaired
YLR331C	chr12_5	up	CGGCGCAATAATGTCACAGA	CGGCGCAATAATGTCACAGA	2607.55	2388.95	2	data not checked	repaired
YLR342W	chr12_5	up	CGGGATATAAACGGACATTC	CGGGATATAAACGGACATC	696.2	233.25	2	data not checked	repaired
YLR347C	chr12_5	up	CGGGCGATACCACTCAGATT	CGGACGACACCACTCAGATT	3776.25	259	12	data not checked	repaired
YLR354C	chr12_5	up	CGGTAATAAGGTAGGCTATC	CGTAATAAGGTAGGCTATC	2062.45	1674.1	2	data not checked	repaired
YLR378C	chr12_5	up	CGTAAGCCGGTACAAAGTGC	CGTAAGCCGGTACAAAGTGT	3061.35	2556.3	1	data not checked	repaired
YLR387C	chr12_5	up	CGTACCTAATATGAATCGGG	CGTATCTAATATGAATCGGG	1123.1	196.65	5	data not checked	repaired
YLR409C	chr12_5	up	CGTCTATACCATAATTCGG	TGTCTATACCATAATTCGA	1079.5	415.45	2	data not checked	repaired
YLR418C	chr12_5	up	CGTCTGAAGTCCACCAGGA	CGTTTGAAGTCCACCAGGA	3061.05	1205.95	4	data not checked	repaired
YLR425W	chr00_4	up	GCGGATACCGATGGCCTATT	CGGATACCGATGGCCTATT	419.55	456.15	1	data not checked	repaired
YLR428C	chr00_4	up	GCGGCCATACCGGATACTAT	CGGCCATACCGGATACTAT	256.25	303.1	1	data not checked	repaired
YLR438C-A	chr00_4	up	GCGGTCTCAATACAAACTCA	GCGGTTCAATACAAACTCA	3492.1	787.85	6	data not checked	repaired
YLR452C	chr00_4	up	GCGTCACACGAGCCGATATT	GCGTCACACGAGCCGATATT	705.7	461.15	7	data not checked	repaired
YML004C	chr13_2	up	TCGGGTCTAGGATGCTCTAC	TCGGTCTAGGATGCTCTAC	2754.05	1743.65	3	data not checked	repaired
YML023C	chr13_2	up	GAATACGTGTGAATATGCGC	GAATACGTGTGAATATGCGT	3144.85	1779.05	1	data not checked	repaired
YML024W	chr13_2	up	CTGAGAAGGTAGAGCACACT	CTGAGAAGGTAGAGCACAT	1113.75	560.65	2	data not checked	repaired
YML049C	chr13_1b	up	AGCACAATAACGTACCGTCG	GCCACAATAACGTATCGTCG	2807.35	207.25	9	data not checked	repaired
YML050W	chr13_1b	up	ACCTGCGTAAAGGATAGCAC	ACCTGCTAAAGGATAGCAC	2340.1	569.15	7	data not checked	repaired
YML053C	chr13_1b	up	ACCTCTCTAAAGTACAAGCG	ACCTCTCTAAAGTACAAGC	3609.6	2876.8	1	data not checked	repaired
YML055W	chr13_1b	up	AAACTCTAAACAGCTCTCGG	AAACTCTAAACAGCTCTCG	2531	2079.95	1	data not checked	repaired
YML063W	chr13_1b	up	TCGGAGTACGTTGAGTTATC	CGGAGTACGTTGAGTTATC	962.55	1122.65	1	data not checked	repaired
YML077W	chr00_11	up	CGTTCTCTAAACAACAGGG	CGTTTTCTAAACAACAGGG	2614.4	613.45	5	data not checked	repaired
YML081W	chr13_1b	up	GAAGTTTACTCACACTAGCC	GAAGTTTACTCAACTAGCC	3182.95	943.9	8	data not checked	repaired
YML082W	chr13_1b	up	GAAGTTGTAGACAGTCGCC	GAAGTGTAGACAGTCGCT	533	1076.65	7	problems data not checked	original
YML091C	chr00_9	up	CTAGCGGTAAGTAGGTTTCA	CTAGCGGTAAGTAGGTTTA	3910.1	2241.95	2	data not checked	repaired
YML096W	chr00_9	up	CCGTTGTTAAGTGATACACG	CCGTTGTAAGTGATACACG	2143.55	732.5	7	data not checked	repaired
YML098W	chr00_9	up	CCGTTAGTAAGTACACATCC	CCGTTAGTAATACACATCC	2762.95	580.8	10	data not checked	repaired
YML121W	chr00_9	up	TCGCTCCAGCAGTACGGTA	TCGCTCCACAGTACGGTA	3277.25	986.55	9	data not checked	repaired
YML122C	chr00_9	up	TCGCTGTGAGCATCGCTGTA	TCGCTGGAGCATCGCTGTA	2293.5	1312.8	7	data not checked	repaired
YML130C	chr00_9	up	GTCTGTTACTACGGTATCAG	GTCTGTACACGGTATCAG	3231.55	1054.3	9	data not checked	repaired
YMR002W	chr13_2	up	TTCACGCGGTGCGATATCT	TTCACGCGGTGCGGATATCT	1823.8	79	17	data not checked	repaired
YMR021C	chr13_2	up	CCTACTGTACGAGCCAATAA	CCTACTGTACGAGTCAATAA	3346.2	457.3	7	data not checked	repaired
YMR040W	chr13_2	up	GCATTGATAGAGAGCTAGTC	GATTGATAGAGAGCTAGTC	1543.25	1237.7	2	data not checked	repaired
YMR041C	chr13_2	up	GCCAATATGTGTGACGACGA	GCCAATATGGTGATGACGA	2607.2	164.5	15	data not checked	repaired
YMR049C	chr00_5	up	GAAGAGTCCTTACGAAGTCG	GAAGAGTCCTTATGAAGTCG	2194.65	146.9	8	data not checked	repaired
YMR107W	chr00_9	up	GTGACTACCGGTATGAGAT	GTGATTACCGGTTATGAGAT	1482.1	80.65	14	data not checked	repaired
YMR114C	chr00_9	up	TACTGTGGAGGATAGTCAAC	TACTGTGAGGATAGTCAAC	2446.05	673.2	7	data not checked	repaired
YMR165C	chr13_4	up	GTGAGAGACTCGATGACATA	GTGAGAGACTCGATGACCTA	3871.4	1468.9	3	data not checked	repaired
YMR173W	chr13_4	up	TCGGTTTCACGTATGACGCG	TCGGTTTCAGTATGACGCG	2404.9	612.65	9	data not checked	repaired
YMR175W	chr00_4	up	GCGTTGCACGTCCACTGAAA	GCGTTGCACGTCACTGAAA	3147.45	1602.6	8	data not checked	repaired
YMR191W	chr13_4	up	ATATAACGATACCACCGTG	ATATAACGGTACCACCGTG	2040.65	586	9	data not checked	repaired
YMR198W	chr00_11	up	CAACGAAACATTATTGCCGC	CAACGAAACATTATTGCCG	3233.55	2750.6	1	data not checked	repaired
YMR251W	chr13_5	up	GCGGAGATACCGTGACCTAT	GGGAGATACCGTGACCTAT	169.05	2441.75	6	data	original

problems

YMR253C	chr13_5	up	GTACGGTGACGCCCTAGTAT	GTACGTGACGCCCCAGTAT	3649.75	270.2	11	data not checked	repaired
YMR255W	chr13_5	up	GTGTAGTTACGGCGATCCCA	GTGTAGTTCGGCGATCCCA	2121.3	798.15	9	checked data not	repaired
YMR275C	chr13_5	up	ATCGAAGGAACGCTAAGTCC	ATCGAAGGAACGCTAAGTTC	1959.8	786.55	2	checked data not	repaired
YMR284W	chr13_5	up	CGACCGGAACTTCTCGATAA	CGACCGGAACTCGTCGATAA	318.65	95.35	17	checked data not	repaired
YMR291W	chr13_5	up	GACGGCGCAATCGCTCTATA	GACGGCGCAATGCTCTATA	2863.95	946.5	9	checked data not	repaired
YMR298W	chr13_5	up	GTACGTGTAATGTTGGTCAC	GTACGTGTATGTTGGTCAC	3377.9	1314.6	9	checked data not	repaired
YMR299C	chr13_5	up	GTGTATTAGAGCCAGCCGAC	GTGTATTAGAGCCAGCGAC	5134.35	3075.65	4	checked data not	repaired
YNL011C	chr00_18	up	GTGCTCGACCTACTGTGACT	GTGCTTGACCTACTGTGACT	4739.05	1738.25	6	checked data not	repaired
YNL043C	chr14_4	up	GATGACGAGAGCATGATCTA	GATGACGAGGCATGATCTA	1520.75	278.6	9	checked data not	repaired
YNL061W	chr00_16b	up	ATCCCTCTAACCGGCTAGGA	AGCCCTTAACCGGCTAGGA	693.7	115.45	9	checked data not	repaired
YNL071W	chr00_16b	up	AGTCGCGGAAATTGGTTACA	AGTCGCGGAAATTGGTTACA	2586.95	1038.1	10	checked data	repaired
YNL072W	chr00_16b	up	AGTCCCTGAACATCCTTAGA	AGTCCCTGAACATCCTTAGA	781.65	2399.5	7	problems data not	original
YNL094W	chr14_3	up	ACGCCTTGAAAGCTCTCGA	GCGCCTTGAAAGCTCTCGA	1222.8	1413.4	1	checked data not	repaired
YNL109W	chr00_18	up	GTGGCACGCGCATCGTATTT	GTGCACGCGCATCGTATTT	212.35	202.35	3	checked data not	repaired
YNL110C	chr14_3	up	TTCGCAGTATGGATCGGTAT	TTCGCAGTATGGATCGGTAT	546.45	145.05	4	checked data not	repaired
YNL119W	chr00_16b	up	TTAACGGTGGTGAGTCTCCT	TTAACGGTGGTGAGTCTCCT	1361.95	138.9	5	checked data not	repaired
YNL152W	chr14_2	up	TCCCGGTGACGTAGCTTA	TCCCGGTGCGTAGCTTA	3562.15	1909.75	9	checked data not	repaired
YNL169C	chr14_2	up	CTTAGGAGACATGAGTAGAC	CTTAGAGACATGAGTAGAC	91.9	95.15	5	checked data	repaired
YNL237W	chr14_2	up	CTAAGGTAGCACCACATCA	CTAAGAGTAGCACCACATCA	804.9	3359.6	6	problems data not	original
YNL245C	chr14_1	up	CAGAAGCGACAGACTGCT	TAGAAGCGCAGAGACTGCT	231.5	115.4	10	checked data not	repaired
YNL266W	chr14_1	up	TCTACTATCGCTGATCCGAG	TCTACTATGCTGATCCGAG	1947.95	401.9	9	checked data not	repaired
YNL267W	chr00_12	up	TCTACGGAGGTGCATCAGTA	GCTACGGAGGTGCATCAGTA	1738.8	1446.4	1	checked data not	repaired
YNL268W	chr14_1	up	TAGCTCGCATCACTGACGGA	TAGCTCGCATCATGACGGA	3652.5	1228.6	8	checked data not	repaired
YNL280C	chr14_1	up	GCGCCTACAGGGAGTTATAC	GCGTCTACAGGGATTATAC	1802.2	110.8	11	checked data not	repaired
YNL281W	chr14_1	up	GCGCCCATACCGTTAGTAGA	GCGCCCATATCGTTAGTAGA	4005.5	1276.1	9	checked data not	repaired
YNL287W	chr00_8	up	GACGAGAATGGACTACACGT	GACGAGAATGACTACACGT	2377.2	1066.3	10	checked data not	repaired
YNL304W	chr14_1	up	CACTTAACGTGATGACACAG	CACTTAACGTGATGATACAG	3320.45	389.2	5	checked data not	repaired
YNL320W	chr14_1	up	AAGACCTAACAAGTGCGCCG	AAGACCTAACAAGTGTGCCG	3591.45	1632.4	5	checked data not	repaired
YNR004W	chr14_4	up	GATGGCCCAGGGACTCTTAA	ATGGCCCAGGGACTCTTAA	1754.7	1967.05	1	checked data not	repaired
YNR008W	chr14_4	up	GATGGTCGAGGACTACCCTT	GATGGTCGGGACTCCCTT	296.45	74.8	15	checked data not	repaired
YNR041C	chr14_4	up	GATTTCAATTATCGGGACCG	GATTTCAACTATCGGGACCG	2451.75	495.65	9	checked data not	repaired
YNR047W	chr14_4	up	GCAAAGGAGGATATATCTC	GCAAAGGAGGATATCTC	108.75	70.15	8	checked data not	repaired
YNR048W	chr14_4	up	GCAAATAGTGAGGACAGTTC	CAAATAGTGAGGACAGTTC	431.3	560.9	1	checked data	repaired
YNR055C	chr00_15	up	GCTAATCCACCTGGGAGAT	GCTAATCCACCTGGGAGAT	553.1	2365	9	problems data not	original
YOL127W	chr00_6	up	GGGATGAGAGACTTTCATAT	GGGATGAGAGACTTTCATAT	62.2	54.5	6	checked data not	repaired
YOL130W	chr00_6	up	GGGATTTACGAGTATGTCTC	GGGATTTACGAGTTGTCTC	1918.3	221.7	7	checked data not	repaired
YOL152W	chr00_17b/c hr00_18	up	ATCTTGACATAACGTAGGCG	ATTTGACATAACGTAGGCG	3153.45	3767.55	3	checked data not	repaired
YOR027W	chr15_1	up	GCTTGACTACGACTTAGCAC	GCTTGACTATGACTTAGCAC	2601	930.95	9	checked data not	repaired
YOR045W	chr15_1	up	TGCGTTCGAGTCACTTAGCT	TGCGTTCGAGTCACTTGCT	2365.1	645.6	7	checked data not	repaired
YOR055W	chr15_1	up	AGTCTCGTAACATGCGATAC	AGTCTCGTAACATGCGATAC	1712.4	1211.25	3	checked data not	repaired
YOR057W	chr15_1	up	AGTCTGCTAAATTGTCCGAC	AGACTCTAAATTGTCCGAC	814.6	499.7	9	checked data not	repaired
YOR072W	chr15_1	up	CGTGGCTCAAGTTAGTACA	CGTGGCTCAAGTTAGTAA	3369.2	2389.8	2	checked data not	repaired
YOR073W	chr15_1	up	CGTGGGACACAGTCGATCAT	CGTGGGACACAGTCGACCAT	2647.3	1054.65	4	checked data not	repaired
YOR077W	chr15_1	up	GAGTGAGTAATGCTACGTCA	GAGTGAGTATGCTACGTCA	536.6	222.55	9	checked data not	repaired
YOR089C	chr15_1	up	GTTTAGGTACTIONCCTCACGA	GTTTAGGACTCCCTCACGA	2472.05	838.55	8	checked data not	repaired

YOR096W	chr00_8	up	TGCTAGTTAGGAGTATCGCA	TGCTCGTTAGGAGTATCGCA	325.65	160.65	5	data not checked	repaired
YOR103C	chr15_2	up	CGCTGCATACACTGATATAC	CGCTGCATACACGATATAC	1383.1	225.35	8	checked data not	repaired
YOR200W	chr15_3	up	CATACTCAACTGAATGTCCG	CAACTCAACTGAATGTCCG	3797.55	3247.25	3	checked data not	repaired
YOR312C	chr15_4	up	GTTCGTAGAGATGATCGTCA	GTCGTAGAGATGATCGTCA	333.9	271.15	2	checked data not	repaired
YOR353C	chr15_4	up	GAGCTTCTAAGTTACTCTCC	GAACTTCTAAGTTACTCTCC	1875.75	994.7	3	checked data not	repaired
YOR356W	chr15_4	up	GCTCTCTGACAGTCTATAT	GCTCTCTGACAGTCTAAT	1567.6	682.05	3	checked data not	repaired
YOR357C	chr15_4	up	GCTCTTATACTCGACATGAC	GATCTTATACTCGACATGAC	2365.15	1640.95	2	checked data not	repaired
YOR362C	chr15_4	up	GTATCTACAGTCTCTGAGCA	GTACTACAGTCTCTGAGCA	883.8	443.1	4	checked data not	repaired
YOR363C	chr15_4	up	GTTTCGTGTACCTCGCCGATT	GTTTCGTGTACCTCGCCGATT	1907.1	569.1	7	checked data not	repaired
YPL004C	chr00_17b	up	GCACGACCAGCTTTAGGAT	GCACGACTAGCTTTAGGAT	2069.9	709.4	8	checked data not	repaired
YPL070W	chr16_3	up	CGTCGCCAATATGATCGAAT	CGTCGCCAATTTGAACGAAT	2926.35	99.25	16	checked data not	repaired
YPL075W	chr16_3	up	CGGTTCCGAATCCAGACGAT	CGGTTCCGAAACCAGACGAT	2512.75	629.5	10	checked data not	repaired
YPL086C	chr16_3	up	CGGCGACCACCATTAGTGAT	CGGCGACCACCATAGTGAT	3106.7	1135.4	7	checked data not	repaired
YPL129W	chr16_2	up	ACCACGACAAAGTCAGTGCG	ACCACACAAAGTCAGTGCG	1194.9	534.85	6	checked data not	repaired
YPL132W	chr00_8	up	ACCAAGAACACGCTACGGGT	ACCAAGAACACGTTACGGGT	2796.85	814.4	8	checked data not	repaired
YPL145C	chr16_2	up	GTCCTTCTACGATGCTAGGC	GTCCTTCTACGATGCTAGGC	3945.25	2313.65	5	checked data not	repaired
YPL147W	chr16_2	up	GTCCTTATACTGATACCTGC	GTCTTATACTGATACCTGC	1780.95	1097.1	3	checked data not	repaired
YPL163C	chr16_2	up	CTCCAATATGCATACGAGA	CTCCAATATGCATACGAGA	774.9	147.45	9	checked data not	repaired
YPL190C	chr16_1	up	AACTCTTCAAACATACGGCG	AACTCTTCAAACATACGGCC	4123.25	2653.55	1	checked data not	repaired
YPL194W	chr16_1	up	TCGTTTCGACTTATCGCTACG	TCCTTCGACTTATCGCTACG	846.5	430.7	3	checked data not	repaired
YPL196W	chr16_1	up	TCGTTAGTACGGTAGGTATC	TCGTTGTACGGTAGGTATC	3315.6	844.7	6	checked data not	repaired
YPL198W	chr16_1	up	TAGCATCTAGCGTATCAGCA	TAACATCTAGCGTATCAGCA	3260.7	2726.85	3	checked data not	repaired
YPL207W	chr16_1	up	GTACCAGAGTTGCATATCAC	GTATCAGAGTGCATATCAC	258.6	69.65	14	checked data not	repaired
YPL216W	chr16_1	up	GACCGTCAATCGCGTCAGAT	GATCGTAATCGCGTCAGAT	240.6	89.4	10	checked data not	repaired
YPL219W	chr16_1	up	CTGTACTTAATGGTAGAGCC	CTGTACTTAATGGTAGAGTC	2505.95	681.95	2	checked data not	repaired
YPL221W	chr16_1	up	CTCAGGACATCCAGGAGTAT	TTACAGGACATCCAGGAGTAT	589.2	596.65	1	checked data not	repaired
YPL231W	chr16_1	up	CGAATACAGTGACAGAGCTG	CGAATACAGTGACAGTCTG	5594.5	1182.35	5	checked data not	repaired
YPL235W	chr16_1	up	CACTCAACGTCATCAGAAGT	CACTCAACGTCATCGAAGT	588.9	185.35	6	checked data not	repaired
YPL242C	chr16_1	up	AGCTATATCAAGCAAGCGTC	AGCTATATCAAGCGAGCGTC	478.55	351.1	7	checked data not	repaired
YPL255W	chr16_1	up	TCGTGGGTACTTCGAGTTCA	TCGGGGGTACTTCGAGTTCA	670.35	1175.6	4	data ok	repaired
YPL257W	chr16_1	up	TAGCACTGAGGCAGCGTCTA	TAGCATTGAGGCAGCGTCTA	3496.15	503.5	6	checked data not	repaired
YPL260W	chr16_1	up	GTGGAGTGACGTATCTCTAA	GTGGAATGACGTATCTCTAA	1982.75	468.95	6	checked data not	repaired
YPL266W	chr16_1	up	GTACATCTCGTGAGCAGAGC	GTACATCTCGTGAGCTGAGC	5131.4	1614.7	5	checked data not	repaired
YPL270W	chr16_1	up	GCGAGCGTACTATACATAAC	GCGAGCTACTATACATAAC	3211.25	505.6	7	checked data not	repaired
YPR055W	chr16_4	up	CTTAATTCGCGCTAAATGGC	CTTAATTCGCGCTAAATAGC	1427.4	436.45	3	checked data not	repaired
YPR068C	chr16_4	up	CTTAGACACTCTGACCATAG	CTTAGCCACTCTGACCATAG	3292.2	933.8	6	checked data not	repaired
YPR082C	chr16_4	up	CTTATTGGACAGGAGCACAT	CTTATTTGACAGGAGCACAT	1556.9	464.25	7	checked data not	repaired
YPR083W	chr00_18	up	GTGGTCCCAGAGCCATTGTT	GTGGTCCAGAGCCATTGTT	1777.95	879.95	6	checked data not	repaired
YPR131C	chr16_5	up	GAAGACTGGTGAATCTATCG	GAAGACTGGTGAATATCG	573.6	111.45	6	checked data not	repaired
YPR177C	chr16_5	up	GAATATAATTGACCCACGCC	GAATATAATTGACCCACGC	2225.3	1877.5	1	checked data not	repaired
YPR183W	chr16_5	up	GAATCAGCCATAATGAGGTC	AATCAGCCATAATGAGGTC	1457.55	1609.65	1	checked data not	repaired
YPR197C	chr16_5	up	GAATCTCGAATAGCGGTACA	GAATTTCGAATAGCGGTACA	2016.35	500.15	5	checked data not	repaired

Supplementary Methods

Preparation of tag samples. Pooled growth, purification of genomic DNA, tag PCR, and array hybridization were performed as described in the attached Supplementary Protocols. All tag samples used in this paper were from the heterozygous deletion pool after 20 generations of growth in YPD. Arrays were washed using a custom-built array washing station as follows: after sample hybridization, arrays were washed for 110 sec with a continuous flow of 6×SSPE-T (6×SSPE + 0.01% Tween), then for 420 sec with 3×SSPE-T (3×SSPE + 0.01% Tween), and for 90 sec with 6×SSPE-T. After staining (as described in Supplementary Methods), the arrays were washed for 510 sec with a continuous flow of 6×SSPE-T.

Data analysis. Intensity values for each probe were extracted using Affymetrix GeneChip Operating Software (Affymetrix). For the purpose of benchmarking the arrays, array data was not normalized and array defects were not masked. Unless otherwise indicated, intensity values refer to the raw probe intensity averaged over the five replicates. Where ratios are used, the median of the unassigned (background) tag probes is subtracted from the raw values before taking their signal ratio.

Correcting tag ratios. To compensate for array saturation, raw tag intensities are multiplied by $e^{0.00031 \cdot (\text{tag intensity})}$. This correction function was derived by minimizing the average distance between the signal ratio and the known tag ratio over a range of linear, polynomial, and exponential functions. Tags with control intensity of less than 200 afu were not included in this minimization because these tags are omitted from strain sensitivity analysis. This correction factor also increases the correlation of the up and down tag ratios for normal experimental arrays (data not shown). A constant approximation of background hybridization is subtracted from the raw intensity values before taking their ratio. This constant was also included in the minimization, and the resulting value was approximately equal to the median intensity of the unassigned tag probes for this series of arrays (minimization 60, unassigned probes 58.9).

Masking outlier data. To mask outlier data, areas with an unusually high number of outliers are first identified. For each probe, if at least 13 of the 25 probes in the surrounding 5 probe × 5 probe neighborhood differ from their trimmed replicate mean (the mean of the middle three replicates) by more than 10%, the probe is selected for masking. These regions are then padded by also including any probes that are within a 5-probe radius (the square root of $(\text{row distance}^2 + \text{column distance}^2) < 6$). Extreme outlier probes are also discarded (points for which the replicate intensity $> (1.35 - 0.000025(\text{mean intensity})) \cdot \text{mean intensity}$, and mean intensity > 200). These extreme outliers are typically caused by bright pieces of debris on the array that affect only a single probe, and are therefore not padded. Intensity values are then calculated for each tag by averaging all unmasked replicates.

Supplementary Protocols

For more information see <http://chemogenomics.stanford.edu/>.

Pool construction:

- Obtain the YKO collections as frozen glycerol stocks in 96 well microtiter plates (available at <http://www.openbiosystems.com>).
- Convert frozen stocks to solid colonies. Allow plates to thaw completely (cells may have settled prior to being frozen). Insert a 96-well pin tool (e.g. V&P Scientific, Inc. catalog # VP407A), into thawed 96-well plates, swirl gently then transfer to a Nunc Omni Tray (VWR catalog # 62409-600) containing 50ml of YPD-agar including 200 μ g/ml Geneticin G418 (Agri-Bio catalog #3000). Allow pin to dwell on agar for 5-10 sec.
- Before each transfer, dip pin tool in water followed by 95% ethanol, then carefully flame the pin tool. Allow pin tool to cool. Make certain that the level of ethanol in the wash container exceeds the level in the water container to ensure all carry-over cells are flamed and removed. Change water frequently.
- Grow colonies until they reach maximal size @ 30°C (2-3d).
- After colonies have reached full size, scrape the entire contents of all plates (in a laminar flow hood to avoid contamination) into a 50 ml conical centrifuge tube containing YPD liquid media + 200 μ g/ml G418.
- Make note of any strains that are missing or appear as slow-growing colonies. For these strains go to the original frozen stock and streak them out individually using standard yeast procedures.
- For slow-growing strains add a colony-equivalent of cells using a sterile flat toothpick and add them to the conical tube. Measure the O.D.₆₀₀ of the pool and adjust to a final 50 O.D.₆₀₀/ml (O.D.₆₀₀ 1.0 ~ 2.2 x 10⁷ cells/ml for diploid strains).
- Add glycerol to 15% or DMSO to 7%, mix well and aliquot into individually capped PCR tubes with 10-25 μ l of pool and store at -80°C.

Note: Hybridization to the tag array will identify any of those strains that are still underrepresented¹. These strains can then be spiked in to the pools individually at the start of each experiment.

Pooled growth:

Heterozygous deletion pool:

- Thaw and inoculate frozen aliquot of pool into 100ml of YPD such that on average 1000 cells/strain are present (O.D.₆₀₀ ~ 0.003).

- Allow cells to recover overnight (9 generations in YPD @ 30°C with shaking at 250rpm) without allowing them to saturate ($O.D._{600} \leq 2$).
- Dilute culture into condition of interest to not less than 125 cells/strain ($O.D._{600} = 0.0625$).
- Grow cells logarithmically for 5 generations until $O.D._{600} = 2$.
- Save not less than 1 $O.D._{600}$ of cells.
- Batch dilute culture to not less than 125 cells/strain ($O.D._{600} = 0.0625$).
- Continue to grow and collect the log culture and dilute and save every 5 generations until cells have reached 20 generations.

Homozygous deletion pool:

- Thaw and dilute a frozen aliquot of pool into condition of interest to not less than 125 cells/strain ($O.D._{600} = 0.0625$).
- Grow cells logarithmically for 5 generations until $O.D._{600} = 2$.
- Save not less than 1 $O.D._{600}$ of cells.
- Batch dilute culture to not less than 125 cells/strain ($O.D._{600} = 0.0625$).
- Continue to grow and collect the log culture and dilute and save every 5 generations until cells have reached 20 generations.

Notes: Control samples should be generated as above, but using YPD for all growth steps in place of the selective condition.

For heterozygous profiling, cells are first recovered for 9 generations before being subjected to the condition of interest. This is to allow the cells to recover from freezing. The cells are then grown in the condition of interest and collected at 5, 10, 15 and 20 generations. Because heterozygous deletion phenotypes can be subtle, optimum results are usually obtained at the 20 generation time point. However, for further resolution, the earlier time points can be informative in ranking the strains. (If two strains are both completely absent from the final sample, their sensitivities can not be compared without earlier time points showing which strain dropped out of the pool faster, or individual growth curves).

For homozygous profiling, cells are not recovered in YPD before growth in the condition of interest. Because 15% of all homozygotes are slow-growing strains, a recovery phase would cause many strains to drop out of the pool before treatment even begins. The cells are grown in the condition of interest straight from the frozen stock and collected at 5, 10, 15 and 20 generations. Because heterozygous phenotypes are less subtle than homozygous phenotypes, optimum results are usually obtained at the 5 generation time point. Using an earlier time point also minimizes the condition-independent loss of slow-growing strains from the pool.

Although we use 125 cells/strain in order to minimize volume (and therefore compound consumption) it is preferable to use a greater number of

cells/strain to reduce the sampling error when batch diluting. For example, using 1000 cells/strain yields a theoretical sampling error of ~3%.

Genomic DNA purification:

Purify genomic DNA from cells collected in during pooled growth. We use 1-2 O.D. of cells for each sample. Although any prep for genomic DNA can be used, we use Zymo Research YeaStar kit (catalog # D2002).

PCR Amplification of tags:

- Using ~0.2 μ g of genomic DNA as template, set up two PCR reactions, one for the uptags and one for the downtags following the recipe below (primer sequences are in the Recipes section).
- Cycle as described below in 100 μ l using any thermocycler with a heated lid.

PCR Mix (100 μ l):

	Stock	Final	Volume
H ₂ O			55
PCR buffer	10x	1X	10
MgCl ₂	50mM	2.5mM	5
dNTPs	10mM	0.2mM	2
UP or DN mix	50 μ M	1 μ M	2
Taq polymerase	5U/ μ l	5U	1
Genomic DNA (~0.2 μ g)			25 μ l

PCR Program:

1. 94°C 3'
2. 94°C 30"
3. 55°C 30"
4. 72°C 30"
5. go to step 2 29X
6. 72°C 3'
7. 4°C

Array hybridization and scanning:

- Incubate the probe array (Affymetrix Genflex Tag 16K Array v2, Part No. 511331) filled with 140 μ l 1x hybridization buffer at 42°C for 10' with rotation at 20rpm (we use an Affymetrix GeneArray Hybridization Oven 640) to pre-wet array.
- Add 30 μ l of uptag PCR and 30 μ l of downtag PCR to 90 μ l of hybridization mix for a total volume of 150 μ l into a 0.5ml microfuge tube.
- Boil each tube for 2' and then set on ice for 2'.
- Remove 1x hybridization buffer from each array.
- Add hybridization mix to each array, place a Tough Tag (Diversified Biotech, Inc., Boston, MA) over each gasket and hybridize in the oven for 10-16 hrs at 42°C rotating at the array at 20rpm.
- Remove hybridization mix and wash as follows (into the bottom gasket, one mix = pipetting the fluid up and down into the microarray using 150 μ l of liquid):

	Solution changes	Mixes per solution change
Wash A @ R.T.	2	4
Wash B @ 42°C	6	4
Wash A @ R.T.	1	2

- Remove the wash A, and add 140 μ l of biotin staining mix to the array (make up more than one array's worth of staining mix to minimize pipetting inaccuracies)
- Incubate for 10' @ 42°C with 20rpm rotation
- Remove hybridization mix and wash as follows:

	Solution changes	Mixes per solution change
Wash A @ R.T.	6	4

- Fill up array with Wash A before scanning, taking care to avoid bubbles.
- Clean glass side of arrays with isopropanol and a cotton swab.
- Scan (we use an emission wavelength of 560 nm using an Affymetrix GeneArray Scanner).

Notes: The Affymetrix fluidics station may also be used for the staining/washing steps using the manufacturer's instructions.

Analysis of microarray results:

Outlier masking:

- For each probe, look at all probes within the surrounding 5 probe x 5 probe region. If at least 13 of the 25 probes in this region differ from their trimmed replicate mean (the mean of the three middle replicates,

- excluding the highest and lowest replicates) by more than 10%, consider this probe an outlier.
- Once these outlier probes have been identified, pad them by also including any probes that are within a 5-probe radius (the square root of $\text{row distance}^2 + \text{column distance}^2 < 6$).
 - Also discard extreme single-probe outliers (points for which the replicate intensity $> (1.35 - (\text{mean intensity}) * 0.000025) * \text{mean intensity}$, and mean intensity > 200). These extreme outliers are typically caused by bright pieces of debris on the chip that affect only a single probe, and are therefore not padded.
 - Intensity values are then calculated for each tag by averaging all unmasked replicates.

Array normalization:

- The uptags and dntags should be normalized separately because they are amplified separately, and the intensities of the individual PCR reactions will affect tag intensity on the array
- Average all unmasked values for each tag prior to normalizing the data.
- Normalize array data using quantile normalization². To normalize a set of arrays:
 - For each set of tags (up and down), rank values obtained from each array in order of increasing intensity.
 - For each rank, assign the tag at that rank for each array to the median of all values at that rank.

Notes: This method of normalizing is dependent on a standard curve to which the arrays are normalized (the standard curve used above is the median of the control arrays). To keep this curve from changing over time, it is best to calculate one standard curve from a set of arrays and keep it for normalizing future arrays.

Only experiments with a similar distribution of tag intensities can be normalized together. For example, het and hom experiments must be normalized separately, and experiments with different generation times should also not be normalized together.

Non-parametric analysis (best for large-scale studies):

- For each tag, calculate the mean of the controls (μ_c) and the standard deviation of the controls (σ_c).
- Compute the 90th percentile of the standard deviations across genes for the uptags (k_u), and separately for the dntags (k_d).
- For each uptag with treatment intensity t , calculate $(\mu_c - t) / (\sigma_c + k_u)$.
- For each dntag with treatment intensity t , calculate $(\mu_c - t) / (\sigma_c + k_d)$.

- For each strain, average all tags that are > 200 afu in the control arrays to obtain a final sensitivity score. If a strain has no useable tags, set the score to zero, indicating no information is available for that strain.
- Strains that are sensitive will have positive scores, while strains that are resistant will have negative scores.
- Using 3 standard deviations from the mean is a stringent cutoff, but it also suffers from a high false negative rate with few false positives. The cutoff for sensitivity is therefore up to the user.

Notes: This method works best for large scale studies where it is possible to generate a set of control arrays to use against many treatment sets (> 10 control arrays). Although a large number of control arrays are required, one set of controls can be used to analyze many experimental arrays. One major benefit is that the control arrays do not need to be processed on the same day as the drug arrays to obtain a good result.

One caveat is that it is important that the control arrays represent as diverse a set of samples as the treatment arrays (cells grown on different days, tag PCRs done in different runs etc.) otherwise the standard deviation for tags in the control set will be deceptively small, making strains appear more sensitive/resistant than they actually are.

CellCompare (small scale studies):

- Multiply raw tag values by to correct for array saturation $e^{0.00031 * (\text{tag intensity})}$.
- For each tag, average the normalized values for all unmasked replicates
- Normalize the averaged values using quantile normalization
- To estimate background hybridization, take the mean intensity of the unassigned tag probes.
- For each tag, take the log₂ ratio of (control – background)/(treatment – background).
- For each strain, average all tags that are > 200 afu in the control arrays to obtain a final sensitivity score.
- Strains that are sensitive will have positive scores, while strains that are resistant will have negative scores.
- The score corresponds to the log₂ ratio of cells present in the control vs. the treatment sample.

Notes: This method works best for small-scale studies where it would be inconvenient to generate the large number of control arrays required for non-parametric analysis. Because only a small number of control arrays are used, it is best to use control and drug arrays that were processed together (cells grown on the same day, PCR amplified together, etc.) to minimize any variation between the control and drug samples that is not related to the treatment.

Any strains for which the treatment value is indistinguishable from background have reached their maximum sensitivity score, so they may actually be more sensitive than they appear in your data. To resolve the sensitivity of these strains, sample earlier time points or examine the growth of the strain individually as described below.

The data for strains with low representation in the pool is prone to noise due to increased sampling error. One class of strains that is especially prone to this problem is the slow-growing strains¹, so data from these strains should be carefully confirmed.

Recipes:

Primers:

NAME	<u>SEQUENCE</u>
UPTAG	5' - GAT GTC CAC GAG GTC TCT - 3'
DNTAG	5' - CGG TGT CGG TCT CGT AG - 3'
BUPKANMX4	5' biotin- GTC GAC CTG CAG CGT ACG - 3'
BDNKANMX4	5' biotin- GAA AAC GAG CTC GAA TTC ATC G - 3'
B213	5' - CTG AAC GGT AGC ATC TTG AC - 3'

(the B213 oligonucleotide is a biotinylated control that hybridizes to the border of the microarray)

UP mix = UPTAG and BUPTAGKANMX4 each at 100 pm/μl, mix in a 1:1 ratio.

DN mix = DNTAG and BDNKANMX4 each at 100 pm/μl, mix in a 1:1 ratio.

2X Hybridization buffer:

(Final 1X is 100mM MES, 1 M[Na+], 20 mM EDTA, 0.01% Tween 20)

For 50 ml:

8.3 ml of 12X MES Stock

17.7 ml of 5M NaCl

4.0 ml of 0.5M EDTA

0.1 ml of 10% Tween 20

19.9 ml of H₂O

Store at 4°C (shield from light)

12X MES stock (1.22M MES, 0.89 M[Na+]) (10ml):

0.70 g MES free acid monohydrate

1.9 g MES Sodium Salt

8 ml of H₂O

Mix and adjust volume to 10 ml

The pH should be between 6.5 and 6.7.

Filter through a 0.2 μ m filter
 Store at 4°C (shield from light)

Hybridization mix (90 μ l final):

75 μ l 2X hybridization buffer
 0.5 μ l 213 ctrl oligonucleotide (0.2fm/ μ l)
 12 μ l of mixed oligonucleotides(12.5pm/ μ l)
 3 μ l 50X Denhardt's

The mixed oligonucleotides consist of 8 primers: the 4 amplification primers and their complements, all unbiotinylated, at 100pm/ μ l, mixed 1:1 for a final concentration of 12.5pm/ μ l each. These primers help keep the PCR product single stranded by annealing to the common regions. Without these oligos, the sense and antisense strands from two different tags could hybridize by their common primer ends.

Wash A (6x SSPE-T):

<u>Stocks</u>	<u>1 liter</u>
20x SSPE	300ml
10% Tween	1ml
H ₂ O	699ml

Wash B (3x SSPE-T):

<u>Stocks</u>	<u>1 liter</u>
20x SSPE	150ml
10% Tween	1ml
H ₂ O	849ml

Biotin staining mix:

51.4 μ l w/ 20X SSPE
 3.4 μ l 50X Denhardt's
 1.7 μ l 1% Tween 20
 0.29 μ l 1mg/ml streptavidin-phycoerythrin (Molecular Probes catalog #S-866)
 114 μ l dH₂O

References

1. Deutschbauer, A.M. et al. Mechanisms of haploinsufficiency revealed by genome-wide profiling in yeast. *Genetics* (2005).
2. Bolstad, B.M., Irizarry, R.A., Astrand, M. & Speed, T.P. A comparison of normalization methods for high density oligonucleotide array data based on variance and bias. *Bioinformatics* **19**, 185-93 (2003).