



Data Sheet

GeneChip® Human Tiling Arrays

Highest resolution tiling arrays for most accurate mapping of protein/DNA interactions and novel transcript discovery

GeneChip® Tiling Arrays are the most comprehensive array tools available for discovering novel RNA transcripts or mapping sites of protein/DNA interaction in chromatin immunoprecipitation experiments.

All GeneChip Tiling Arrays feature:

- 25-mer oligonucleotides for optimal hybridization specificity
- The ability to run experiments and refine protocols in your own laboratory
- High-resolution arrays for the most accurate detection of protein/DNA interactions or novel transcript discovery

GeneChip® Tiling Arrays Enable New Applications

With the completion of many whole-genome sequences, new types of genome-wide experiments are now possible. Tiling Arrays offer a physical readout of a genome and can be used as a discovery tool for mapping sites of protein/DNA interaction in chromatin immunoprecipitation (ChIP) experiments, discovering new RNA transcripts, or understanding global epigenomic changes like methylation or acetylation.

TRANSCRIPT MAPPING

Genome tiling arrays feature a neutral array design strategy to study entire genomes without respect to annotations. GeneChip® brand Tiling Arrays have been used to discover novel transcripts and can be used to build annotations, particularly in genomic regions previously thought to be “genome deserts.”

CHROMATIN IMMUNOPRECIPITATION

Chromatin immunoprecipitation (ChIP) assays have been used for over ten years to study protein/DNA interactions. ChIP protocols can now be used in conjunction

with whole-genome tiled microarrays to understand DNA regulation by mapping sites of transcription factors binding to DNA. This powerful combination of ChIP and GeneChip Tiling Arrays has been used to map sites of protein/DNA interaction across entire chromosomes.

Tiling Array Design

Tiling arrays represent a shift in microarray design. In general, GeneChip Tiling Arrays are designed using non-repetitive, RepeatMasked sequence content. Probes are selected at defined intervals throughout coding and non-coding sequences. All GeneChip Tiling Arrays feature 25-mer oligonucleotides. Base pair resolution describes the density of genomic coverage on arrays. Base pair resolution is measured from the central position of adjacent 25-mer oligos. Tiling arrays are designed based on the strandedness of the genome, rather than that of a particular transcript. Tiling arrays labeled with “R” are complementary to the reverse (-) strand of a genome and F arrays are complementary to the forward (+) direction.

Figure 1: Figure 1 illustrates array design for a 35-base pair resolution tiling array. Probes are tiled at approximately 35-base pair intervals as measured from the central position of adjacent oligos, leaving approximately 10-base pair gaps between oligos.

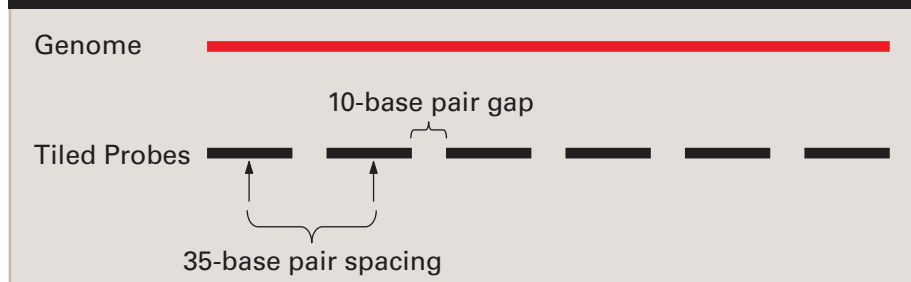
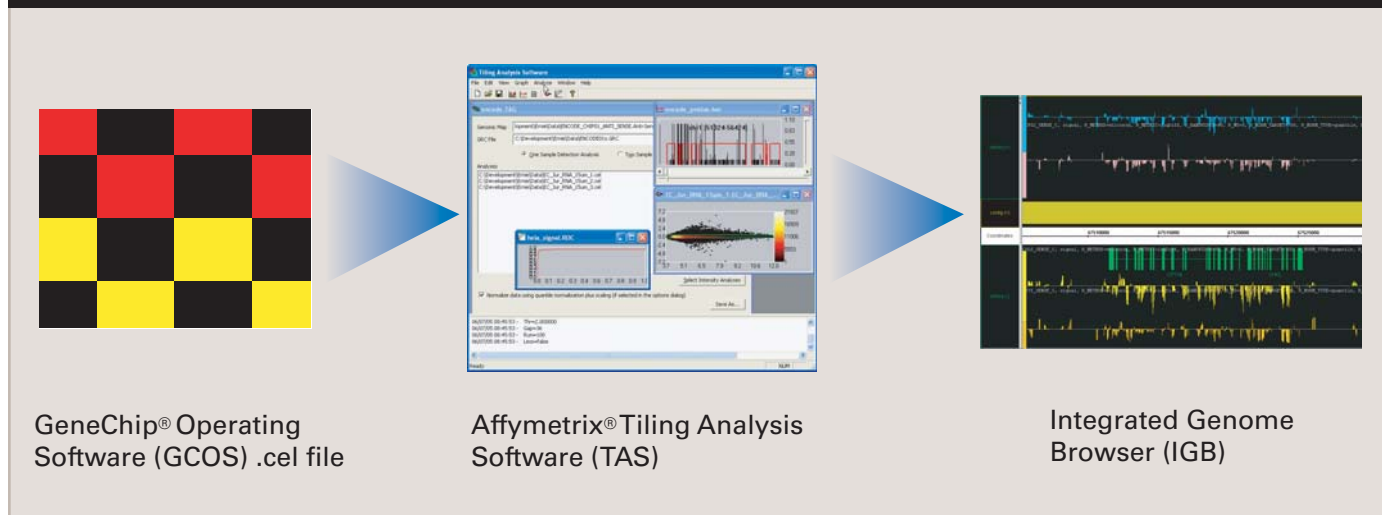


Figure 2: Tiling Array Data Analysis Flow



Data Analysis

AFFYMETRIX TOOLS

Affymetrix has developed two software tools to enable analysis of tiling array data. Affymetrix® Tiling Analysis Software (TAS) provides analysis capabilities specifically for the GeneChip Tiling Arrays. TAS analyzes feature intensity data stored in GCOS output .cel files and produces:

- Signal and *p*-values for each genomic position interrogated
- Computation of genomic intervals based on computed signal and *p*-values
- Computation of summary statistics
- Visualizations for assessing the quality of the array data

The analysis results from TAS may be imported into Affymetrix' Integrated Genome Browser (IGB). The Integrated Genome Browser (IGB) is a software application used for visualizing and exploring genomes and corresponding annotations from multiple data sources. TAS output files may also be visualized using the UCSC Genome Browser. Both TAS and IGB are freely available from Affymetrix and can be downloaded from www.affymetrix.com. The diagram in Figure 2 shows the basic workflow for tiling array data analysis.

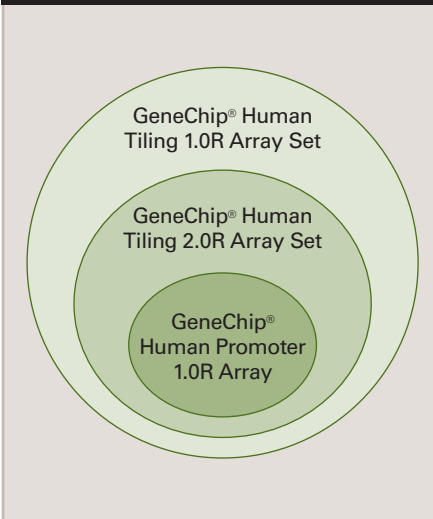
Whole-Genome Tiling Array Sets

Affymetrix offers two high-resolution whole-genome tiling array sets for either transcript mapping or ChIP applications. The GeneChip Human Tiling 1.0R Array Set is a 14-array set designed for transcript mapping or other analyses that benefit from both perfect match and mismatch probes. The GeneChip Human Tiling 2.0R Array Set is designed for ChIP experiments and features all of the perfect match probes from the Human Tiling 1.0R Array Set. The Human Tiling 2.0R Array Set is available either as a whole-genome set of seven arrays (P/N 900772), or individual arrays from the set may be purchased separately.

Sequences used in the design of both whole-genome tiling array sets were selected from NCBI human genome assembly (Build 34). Repetitive elements were removed by RepeatMasker. Probes are tiled at an average resolution of 35 bp, as measured from the central position of adjacent 25-mer oligos, leaving a gap of approximately 10 bp between probes. Each array within the sets contains over 6.5 million probes to specifically interrogate genomic regions.

Figure 3:

- The GeneChip® Human Tiling 1.0R Array Set is comprised of 14 arrays designed for transcript mapping experiments.
- The GeneChip® Human 2.0R Array Set is a seven-array set designed for chromatin immunoprecipitation experiments. The Human 2.0R Array Set includes all perfect match probes from the Human 1.0R Array Set.
- The GeneChip® Human Promoter 1.0R Array is a subset of probes from the Human 2.0R Array Set and is designed for chromatin immunoprecipitation experiments on promoter regions.



GeneChip® Human Promoter 1.0R Array

The GeneChip® Human Promoter 1.0R Array is designed for ChIP experiments. The Human Promoter 1.0R Array is a single array comprised of over 4.6 million probes tiled through over 25,500 human promoter regions. Sequences used in the design of the Human Promoter 1.0R Array were selected from NCBI human genome assembly (Build 34). Repetitive elements were removed by RepeatMasker. Promoter regions were selected using sequence information from 35,685 Ensembl genes (version 21_34d May 14, 2004), 25,172 RefSeq mRNAs (NCBI GenBank® February 7, 2004), and 47,062 complete-CDS mRNA (NCBI GenBank® December 15, 2003). The probes selected for the Human Promoter 1.0R Array are a subset of the probes used in the whole-genome ChIP array set, the Human Tiling 2.0R Array Set (P/N 900772). Probes are tiled at an average resolution of 35 base pair (bp), as measured from the central position of adjacent 25-mer oligos, leaving a gap of approximately 10 bp between probes. The array interrogates regions proximal to transcription start sites and contains probes for approximately 59 percent of CpG islands annotated by UCSC in NCBI human genome assembly (Build 34).

GeneChip® Chromosome 21/22 1.0 Array Set

The GeneChip Chromosome 21/22 1.0 Array Set is a three-array set designed to study human chromosomes 21 and 22. Each six-array package (P/N 900545 and 900546) contains two complete three array sets. Two versions of the array set are available: Chromosome 21/22 1.0F Arrays (P/N 900545) are complementary to sequence in the forward (+) orientation, while the Chromosome 21/22 1.0R Arrays (P/N 900546) are complementary to sequence in the reverse (-) direction. Sequences used in the design of the Chromosome 21/22 1.0

Array Set were selected from the NCBI human genome assembly (Build 28). Repetitive elements were removed by RepeatMasker and only non-repetitive sequences were included. Probes are tiled at an average resolution of 35 bp, as measured from the central position of adjacent 25-mer oligos, leaving a gap of approximately 10 bp between probes. Each array in the set contains over one million perfect match probes to specifically interrogate genomic regions.

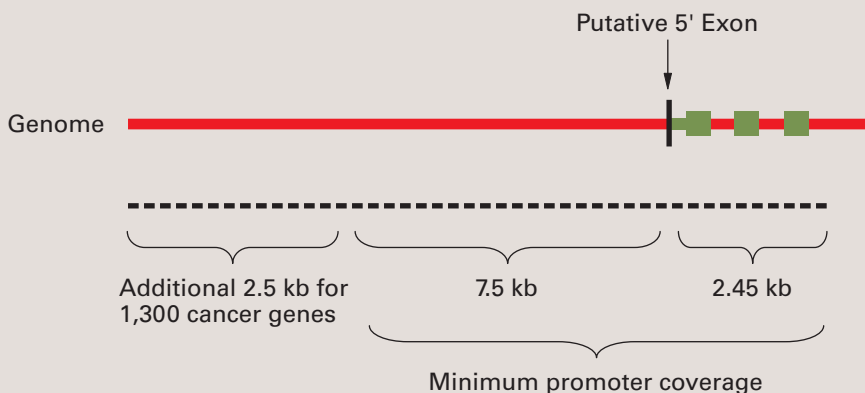
GeneChip® ENCODE01 1.0 Array

The ENCODE Project (Encyclopedia of DNA Elements) is a National Human Genome Research Institute (NHGRI) project that has been undertaken to identify all of the functional elements of the human genome sequence. The ENCODE Project is further described at www.genome.gov/10005107. The GeneChip® ENCODE01 1.0 Array is a tool for genomic research and discovery. It can be used for *de novo* transcription mapping, ChIP assays, and other studies. The ENCODE01 1.0 Array is designed to study the pilot ENCODE

regions of DNA, comprised of 30 Mb of DNA, or approximately one percent of the human genome. These pilot regions were selected by a committee of the NHGRI and will serve as a pilot for further microarray-based ENCODE research. The UCSC genome browser includes ENCODE content. Half of the content on the ENCODE01 1.0 Array was manually selected by the NHGRI committee, while the remaining 50 percent was randomly selected. The manually selected regions were chosen based on the presence of well-studied genes or other known sequence elements, and the existence of a substantial amount of comparative sequence data. A total of 14.82 Mb of sequence was manually selected and includes 14 targets ranging in size from 500 Kb to 2 Mb. To ensure good sampling of genomic regions varying widely in their content of genes and other functional elements, the randomly selected content includes thirty 500 Kb regions selected based on gene density and level of non-exonic conservation. Content for the array was run against RepeatMasker and only non-repetitive sequences were included.

Figure 4: Each promoter region on the GeneChip® Human Promoter 1.0R Array covers approximately 7.5 kb upstream through 2.45 kb downstream of 5' transcription start sites. For over 1,300 cancer-associated genes, coverage of promoter regions was expanded to include additional genomic content; for these selected genes total coverage spans from 10 kb upstream through 2.45 kb downstream of transcriptional start sites.

Probe Selection Regions for the GeneChip® Human Promoter 1.0R Array



Reagents and Protocols

GeneChip® Reagent Kits designed for transcript mapping applications are available; see final page of this data sheet for a list of transcript mapping reagents. Chromatin immunoprecipitation protocols are available for download from www.affymetrix.com.

The Proof Is In The Publication

PUBLICATIONS CITING THE USE OF GENECHIP® HUMAN TILING ARRAYS IN CHROMATIN IMMUNOPRECIPITATION EXPERIMENTS.

High resolution arrays offer more data points and more accurate information on protein/DNA interaction:

- Bernstein B, *et al.* Genomic Maps and Comparative Analysis of Histone Modification in Human and Mouse. *Cell* Vol **120**:169-181 (January 28, 2005).
- Carroll JS, *et al.* Chromosome-wide mapping of estrogen receptor binding reveals long-range regulation requiring the forkhead protein FoxA1. *Cell* **122**(1): 33-43 (2005 Jul 15). (magnetic beads).
- Cawley S, *et al.* Unbiased mapping of transcription factor binding sites along human chromosomes 21 and 22 points to widespread regulation of noncoding RNAs. *Cell* **116**(4):499-509 (2004 Feb 20). PMID: 14980218

PUBLICATIONS CITING THE USE OF GENECHIP® HUMAN TILING ARRAYS IN TRANSCRIPT MAPPING EXPERIMENTS.

GeneChip® Tiling Arrays feature up to 6.5 million oligos per array, making whole genome transcriptome analysis possible:

- Kapranov P, *et al.* Large-scale transcriptional activity in chromosomes 21 and 22. *Science* **296**(5569): 916-9 (2002 May 3).
- Cheng J, *et al.* Transcriptional Maps of 10 Human Chromosomes at 5-Nucleotide Resolution. *Science* (2005 Mar 24). PMID: 15790807
- Kapranov P, *et al.* Examples of the complex architecture of the human transcriptome revealed by RACE and high-density tiling arrays. *Genome Research* **15**:987-997 (2005).

- Kampa D, *et al.* Novel RNAs identified from an in-depth analysis of the transcriptome of human chromosomes 21 and 22. *Genome Research* **14**(3):331-42 (2004 Mar). PMID: 14993201
- ENCODE Consortium, The ENCODE (ENCyclopedia Of DNA Elements) Project. *Science* (306): 636-640 (22 October 2004).

Critical specifications for GeneChip® Human Tiling Arrays

	Human Promoter 1.0R Array	Human Tiling 1.0R Array Set	Human Tiling 2.0R Array Set	ENCODE01 1.0 Array	Chromosome 21/22 1.0 Array Set
Number of Arrays in Set	1	14	7	1	3
Tiling Resolution	35-base pair	35-base pair	35-base pair	22-base pair	35-base pair
Feature Size	5 µm	5 µm	5 µm	10 µm	14 µm
Array Format	64	49	49	49	49
Hybridization Controls	<i>bioB, bioC, bioD, and cre</i>	<i>bioB, bioC, bioD, and cre</i>	<i>bioB, bioC, bioD, and cre</i>	<i>bioB, bioC, bioD, and cre</i>	<i>bioB, bioC, bioD, and cre</i>
RNA Controls	Tiling <i>B. subtilis: dap, lys, phe, thr</i> Arabidopsis: CAB, RCA, RBCL, LTP4, LTP6, XCP2, RCP1, NAC1, TIM, PRKASE	Tiling <i>B. subtilis: dap, lys, phe, thr</i> Arabidopsis: CAB, RCA, RBCL, LTP4, LTP6, XCP2, RCP1, NAC1, TIM, PRKASE	Tiling <i>B. subtilis: dap, lys, phe, thr</i> Arabidopsis: CAB, RCA, RBCL, LTP4, LTP6, XCP2, RCP1, NAC1, TIM, PRKASE	mRNA <i>B. subtilis: dap, lys, phe, thr</i> Arabidopsis: CAB, RCA, RBCL, LTP4, LTP6, XCP2, RCP1, NAC1, TIM, PRKASE	Tiling <i>B. subtilis: dap, lys, phe, thr</i>
Instrumentation Required	GeneChip® Scanner 3000 7G or higher GeneChip® Fluidics Station 400 or 450	GeneChip® Scanner 3000 7G or higher GeneChip® Fluidics Station 400 or 450	GeneChip® Scanner 3000 7G or higher GeneChip® Fluidics Station 400 or 450	GeneChip® Scanner 3000, enabled for High-Resolution Scanning* or GeneChip® Scanner 3000 7G	GeneChip® Scanner 3000, enabled for High-Resolution Scanning* or GeneChip® Scanner 3000 7G
Software Required	GeneChip® Operating Software (GCOS) 1.3 or higher	GeneChip® Operating Software (GCOS) 1.3 or higher	GeneChip® Operating Software (GCOS) 1.3 or higher	GeneChip® Operating Software (GCOS) v1.1.1, which contains the High-Resolution Scanning Update* or later	GeneChip® Operating Software (GCOS) v1.1.1, which contains the High-Resolution Scanning Update* or later
Recommended Analysis Software	Affymetrix® Tiling Analysis Software and Integrated Genome Browser	Affymetrix® Tiling Analysis Software and Integrated Genome Browser	Affymetrix® Tiling Analysis Software and Integrated Genome Browser	Affymetrix® Tiling Analysis Software and Integrated Genome Browser	Affymetrix® Tiling Analysis Software and Integrated Genome Browser

*GeneChip® Scanner 3000 High-Resolution Update is standard on all instruments shipped starting in September 2003 with serial number series 502. Previous versions (serial number series 501) will require the 00-0110 GeneChip Scanner 3000 High-Resolution Update to be installed.

Supporting Products

Part Number	Product Description
900811	GeneChip® WT Amplified Double-Stranded cDNA Synthesis Kit. For transcript mapping with tiling array sets Eg: Human Tiling 1.0 Array Set. Sufficient for 10 reactions
900813	GeneChip® WT Double-Stranded cDNA Synthesis Kit. For transcript mapping with individual tiling arrays Eg: ENCODE01 1.0 Array. Sufficient for 30 reactions
900812	GeneChip® WT Double-Stranded DNA Terminal Labeling Kit. For use with transcript mapping protocol. Sufficient for 30 reactions

Ordering Information

GeneChip® Human Tiling Arrays

GeneChip® Human Promoter 1.0R Array

900775 *contains 2 arrays*

900776 *contains 6 arrays*

900777 *contains 30 arrays*

GeneChip® Human Tiling 1.0R Array Set

900774 *contains 14 arrays*

GeneChip® Human Tiling 2.0R Array Set

900772 *contains 7 arrays*

GeneChip® Human Tiling 2.0R A Array

Covers chromosomes 1, 6

900779 *contains 6 arrays*

GeneChip® Human Tiling 2.0R B Array

Covers chromosomes 2, 9, 19

900780 *contains 6 arrays*

GeneChip® Human Tiling 2.0R C Array

Covers chromosomes 3, 21, 22, X, Y,
mitochondria

900781 *contains 6 arrays*

GeneChip® Human Tiling 2.0R D Array

Covers chromosomes 4, 15, 18, 20

900782 *contains 6 arrays*

GeneChip® Human Tiling 2.0R E Array

Covers chromosomes 5, 7, 16

900783 *contains 6 arrays*

GeneChip® Human Tiling 2.0R F Array

Covers chromosomes 8, 11, 12

900784 *contains 6 arrays*

GeneChip® Human Tiling 2.0R G Array

Covers chromosomes 10, 13, 14, 17

900785 *contains 6 arrays*

GeneChip® Chromosome 21/22 1.0F
Array Set

900545 *contains 6 arrays*

GeneChip® Chromosome 21/22 1.0R
Array Set

900546 *contains 6 arrays*

GeneChip® ENCODE01 1.0F Array

900543 *contains 6 arrays*

GeneChip® ENCODE01 1.0R Array

900544 *contains 6 arrays*

To Order

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