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Particle Accelerators and
High-Voltage Machines

A SQUARE-WAVE CYCLOTRON OSCILLATOR

C. D. Goodman

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Printed in USA. Price $1.75 cents. Available from the

Office of Technical Services
U. S. Department of Commerce
Washington 25, D. C.

Contract No. W-7405-eng-26

ELECTRONUCLEAR RESEARCH DIVISION

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by

C. D. Goodman

Date Issued

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ORNL-2403
Particle Accelerators and
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TID-4500 (13th ed. Rev.)

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Abstract

It is shown that replacing the usual sine wave accelerating voltage in conventional cyclotrons with a square wave would result in less beam loss due to electric defocusing; in AVF cyclotrons it would result in greater tolerances on the average field accuracy and possibly in better beam quality. A brief analysis of the problem of generating periodic voltages other than simple sine waves in high-Q systems is given. Two systems capable of generating an approximate square wave by adding first and third harmonic frequencies are discussed, and tables of parameters for these systems are given. Wave forms obtained with one of the systems are shown.

Acknowledgements

The author wishes to thank B. L. Cohen for pointing out the usefulness of a square-wave oscillator for an ordinary cyclotron, thereby giving impetus to this study, and for making the text of Ref. 1 available prior to publication. The author also thanks N. F. Ziegler for assistance in making r-f measurements. The numerical tables in Appendix IIIb were prepared by E. M. Kidd, of the Union Carbide Nuclear Company, K-25 Plant, on an IBM-650 computer.

A Square-Wave Cyclotron Oscillator

Ordinary cyclotron radio-frequency systems are constructed so that the time dependence of the accelerating voltage on the dee gap is a simple sine function of the type $E(t) = A \sin \omega t$. This comes about not because of any special desirability of this wave form, but rather because it is the most easily obtainable approximation to a periodically reversing constant voltage (square wave) that can be had in a simple electrical system which stores its electromagnetic energy.

Situations can arise, however, in which the advantage of a better approximation to a square wave overrides the disadvantage of the added complication to the r-f system, and it is the purpose of this article to show that many of the advantages of a square wave can be obtained without sacrificing efficient energy storage (high-Q) and with only moderate complication of the resonant and driving systems.

Desirability of a Square Wave in Fixed-Frequency Cyclotrons

Weak-Focusing Cyclotrons

In a conventional weak-focusing cyclotron the magnetic field is made to decrease with increasing radius to provide a restoring force to keep the ions near the median plane. Due to the field fall-off, the frequency of revolution of the ions decreases as the ions are accelerated, and this effect is enhanced by the relativistic mass increase of the ions. As a consequence the ions must go through a phase excursion with respect to the r-f voltage, and the average accelerating voltage seen by the ions is less than the peak r-f voltage.

In the initial region of the cyclotron, if the ions are allowed to make several turns before most of their path is within the dees, they become sharply bunched so that all the ions cross the dee gap near the peak of the r-f cycle[1]. Thus all the ions undergo essentially the same phase excursion.

1. B. L. Cohen, Handbuch der Physik, Gr. VIII, Vol. 44

It is shown in Appendix I that the same bunching occurs even if a third harmonic is added to the r-f wave form to square the wave*, so that the effect of squaring the wave is to increase the average accelerating voltage during a phase excursion. This is a two-fold bonus since the increase in effective voltage decreases the required number of turns; this in itself decreases the phase excursion.

The required phase excursion is ordinarily so large that the ions must be allowed to go through positive and negative phase errors. Ordinarily the maximum beam is obtained by setting the field so that the frequency of angular revolution equals the oscillator frequency at some radius about half way out from the center. In this way the ions start approximately in phase through the bunching mechanism, get ahead of the radio frequency for half of the acceleration process, and then lag behind.

When the ions cross the dee gap during the decreasing part of the r-f cycle they experience an electric force which is axially defocusing. This defocusing causes a large loss of beam in the first half of the acceleration process[(1)]. Squaring the wave with a third harmonic not only reduces the magnitude of the axial electric force, but also makes the residual force a focusing one during the early part of the phase excursion when the magnetic focusing is weakest.

A square wave should also provide more efficient extraction of ions from an ion source, since the field remains near its maximum value for a longer time and provides for a better approximation to a steady state plasma**.

---

* It has come to the author's attention that a preliminary attempt has been made to apply a square-wave,r-f accelerating voltage to the Berkeley 60-inch cyclotron in a manner similar to that proposed here. (UCRL Report 2340).

** See Ref. 1, section 27.

In summary, squaring the wave form in a conventional cyclotron has the following advantages:

1. It increases the ratio of average-to-peak accelerating voltage during phase excursions, and thereby reduces the phase excursion required.
2. It minimizes electric defocusing, which is ordinarily a major cause of beam loss, and actually provides some focusing during the usually defocusing part of the phase excursion.
3. It increases the efficiency of the ion source by better approximating a steady state d-c extraction.

Strong-Focusing Cyclotrons

In strong-focusing cyclotrons the axial focusing is obtained through azimuthal variation of the magnetic field. Thus electric defocusing is overridden, and the angular revolution frequency can be kept accurately constant. In principle then, if the ions are bunched in the initial region they undergo no phase drift; they will always be accelerated at the maximum energy gain per turn, and no need for a square wave is obvious. However, ion bunching at the source has some inherent disadvantages, and errors in the average field may be difficult and costly to avoid.

If the ions are not bunched, then those ions which start out of phase with the radio frequency will continue to be out of phase, and the energy-gain-per-turn will be dependent on the initial phase angle. Ions originating during a single r-f cycle will, after a short time, exist at all energies, filling the entire radial space in the machine and coming out at the maximum radius with a radial gain per turn ranging from zero to the maximum possible value. This situation constitutes poor beam quality for extraction, and those ions which go through a resonance at a low gain in energy per turn will be lost.

Ion bunching by the r-f field leads to a radial displacement of orbit centers, which is evaluated quantitatively in Appendix II. This orbit displacement is equivalent to the initiation of a radial oscillation in the region of the radial resonance $\nu_r = 1$ and, since a radial oscillation interferes with extraction of a precisely monoenergetic beam at the exit radius, the oscillation must be kept small.

Since the radial gain per turn is a decreasing function of radius, even if the orbit displacement can be kept small compared to the radial gain per turn near the ion source, it cannot be kept small compared to the radial gain per turn near the extraction radius. For example: In the Oak Ridge Cyclotron Analogue I, the characteristic distance D (see Appendix I), which is roughly the maximum displacement of orbit centers from the mean, is about 7×10^{-2} cm for an energy gain per turn of 100 electron volts. At the same energy gain per turn, the radial gain per turn near the maximum radius is about 4×10^{-3} cm/turn. Thus, the radial displacement amplitude is equivalent to about twenty turns, or to about two kilovolts, or about 1% spread in energy at the exit radius. These numbers should not be taken too seriously since the radial oscillation amplitude would not be expected to remain constant throughout the acceleration process, but the foregoing is simply to illustrate a possible reason for wanting to eliminate ion bunching at the source and to suggest an alternate injection scheme which a square-wave r-f voltage would make possible. This is to place the source at a distance from the center equal to the radius of curvature of ions which have gained the energy of one dee crossing at the flat top of the r-f voltage cycle and to let the r-f voltage extract the ions across a dee gap small enough to cause most of the first orbit to be inside the dees.

In summary, a square, r-f wave form in an AVF machine would allow larger tolerances on the accuracy of the average field and would permit injection of ions away from the center without using a pulsed source. If, however, an ordinary ion-bunching source configuration is used at the center of a cyclotron, an azimuthally varying field and a square-wave r-f system can be considered, in a sense, as alternative ways of achieving the same beam improvement for low energy machines. In the former case the AVF is used to eliminate the need for the phase excursion, and in the latter case the r-f wave form is changed to tolerate the phase excursion.

Square-Wave Resonant Systems

Need for Storage of Energy

Consider the dee system of a cyclotron as a capacitor; a reasonable magnitude for the capacitance would be 10^{-10} farads for each dee to the liner. A dee-to-liner potential of 100 kv would require the energy, $1/2\, CV^2 = 2 \times 1/2 \times 10^{-10} \times 10^{10} = 1$ joule. If, to reverse the polarity, the dees are short-circuited temporarily and then charged in reverse, another joule is required. If this is done at the rate of 10 megacycles per second, the power requirement would be 20 megawatts! Clearly energy storage is required or, more precisely, a resonant dee system must be designed so the application of a small periodic current somewhere at low power will produce a large voltage at the dee lips with the required time dependence.

Synthesis of Desired Wave Shape

The theory contained in the following development can be found in standard textbooks. It is carried out here again, however, in order to establish a point of view from which one might see how to synthesize resonant systems for producing a voltage with any periodic time dependence.

Where the dee is considered as a capacitor, the most obvious way to meet the low-power, high-voltage requirement is to connect an inductor across the dee. Then

$$E = L\frac{dI_L}{dt} \quad ; \quad I_c = C\frac{dE}{dt} \ , \tag{1}$$

and

$$I_L + I_c + I_s = 0, \tag{2}$$

where

I_L is the current in the inductor
I_c is the current in the capacitor
I_s is the externally supplied current.

It is desirable to minimize I_s. In a lossless approximation we can set $I_s = 0$. Then

$$E = -LC \frac{d^2E}{dt^2} , \qquad (3)$$

which has the familiar solution

$$E(t) = Ae^{i\omega t} + Be^{-i\omega t}, \qquad (4)$$

where $\omega = (LC)^{-1/2}$.

At this point it is instructive to note that $e^{i\omega t}$ is an eigenfunction of the differential operator d/dt with the eigenvalue $i\omega$. For the particular case considered here, the condition that $I_L + I_c = 0$ restricted the allowed eigenvalues to $\pm i(LC)^{-1/2}$; this suggests that if the boundary conditions on the currents are altered it may be possible to obtain solutions for whatever eigenvalues are desired. Since the amplitudes A and B were not determined by the circuit, but rather by the initial conditions, we might hope that, if the necessary eigenfunctions can be made to appear as solutions to the differential equation for $\underline{E}$ by appropriately choosing the boundary conditions on the currents, the desired function of time E(t) then can be synthesized by choosing the driving conditions to give the correct set of amplitudes.

Examples of Square-Wave Systems

Let us try to synthesize a square wave. The Fourier expansion for a square wave of unit amplitude is

$$\frac{4}{\pi} \left[\sin \omega t + 1/3 \sin 3\omega t + 1/5 \sin 5\omega t + \ldots\ldots\ldots\right] ,$$

which is the real part of

$$\frac{4}{\pi i} \left[e^{i\omega t} + 1/3\, e^{i3\omega t} + 1/5\, e^{i5\omega t} + \ldots\ldots\ldots\ldots\right] ,$$

A circuit is sought for which at least the first two terms of the series are solutions to the voltage equation. (More terms would be required for a better approximation to a square wave.)

It is conceivable that a network could be set up to meet the requirements, but such an approach is not useful since it is not possible to set up a cyclotron-sized circuit which can be accurately analyzed as a set of elements obeying the relationships

$$E = L\,\frac{dI}{dt} \qquad \text{or} \qquad I = C\,\frac{dE}{dt}\ . \tag{7}$$

Rather it must be recognized that E and I are functions of position as well as time, and conductors are not necessarily equipotentials if they are large. Where the symmetries of the system can be chosen appropriately the situation can be simplified to require only one position coordinate, e.g., $E = E\,(x,t)$, $I = I\,(x,\ t)$, and transmission line theory forms a natural framework for the analysis.

For a uniform, lossless transmission line

$$\frac{\partial E}{\partial x} = L\,\frac{\partial I}{\partial t} \quad \text{and} \quad \frac{\partial I}{\partial x} = C\,\frac{\partial E}{\partial t}\ , \tag{8}$$

where L and C are geometrical constants. Differentiating each equation with respect to x and to t and combining appropriate pairs yields

$$\frac{\partial^2 E}{\partial x^2} = LC\,\frac{\partial^2 E}{\partial t^2}\ ; \qquad \frac{\partial^2 I}{\partial x^2} = LC\,\frac{\partial^2 I}{\partial t^2}\ . \tag{9}$$

When these equations are solved by the usual methods it is found that the time dependence is given by $e^{i\omega t}$ and the permissible values of ω are determined by the matching conditions at the discontinuities. The solutions for the current and voltage are:

$$E = A \exp i\,(x\omega/v + \omega t) + B \exp i\,(x\,\omega/v - \omega t) \tag{10}$$

$$+ D \exp i\,(-x\,\omega/v + \omega t) + F \exp i\,(-x\,\omega/v - \omega t)$$

$$I = Y_o \left[-A \exp i\,(x\,\omega/\nu + \omega t) + B \exp i\,(x\,\omega/\nu - \omega t) \right. \tag{11}$$

$$\left. - D \exp i\,(-x\,\omega/\nu + \omega t) + F \exp i\,(-x\,\omega/\nu - \omega t) \right.$$

$$\nu = (LC)^{-1/2} \qquad\qquad Y_o = (C/L)^{1/2} \quad .$$

Now, if terminations are placed on the line, the values that ω may have are restricted. For the case of a short circuit at $x = 0$*, $E\,(0, t) = 0$, from which it follows that

$$\frac{I\,(x,t)}{E\,(x,t)} = iY_o \cot \frac{\omega x}{v} \quad . \tag{12}$$

For the succeeding analysis it is convenient to define the following dimensionless quantities

$$a_1 = \frac{\omega_o x_1}{v} \quad ; \qquad a_c = \frac{\omega_o c}{Y_1}$$

$$a_2 = \frac{\omega_o x_2}{v} \quad ; \qquad a_L = \frac{1}{\omega_o L Y_1}$$

$$b = \frac{Y_2}{Y_1} \quad ; \qquad \omega = \frac{\text{actual resonant frequency}}{\omega_o} \quad .$$

The subscript 1 denotes transmission line number 1, and subscript 2 denotes line number 2. ω_o is the fundamental oscillator angular frequency, $\underline{x}$ is the length of the line, $\underline{v}$ is the velocity of propagation of TEM modes in the line, Y is the characteristic admittance of the transmission line, C is a capacitance, and L is an inductance.

---

* All the following examples will be set up with a short circuit at $x = 0$. This, however, is not a necessary restriction and interesting results can be obtained with other terminations.

The Single Shorted Line with Capacitive Termination. If a capacitor is placed at position x_1, the matching condition is that the voltage at x_1 equals the voltage across the capacitor, and the line current and capacitor current are equal and opposite.

For a capacitor

$$I = C\frac{dE}{dt} \quad ,$$

but it is required that $E = \text{const } e^{i\omega t}$, so that, neglecting the constant

$$I = i\omega CE.$$

Thus, the equation for ω is

$$\cot a_1\omega - a_2\omega = 0. \tag{13}$$

It is desired that this equation be satisfied by $\omega = 1$ and $\omega = 3$; however, this condition requires that $a_2 = 0$, or that there be no capacitive current across the dee gap. This cannot be realized in a cyclotron but the difficulty suggests its own remedy.

Single Shorted Line with LC Termination. Evidently a linearly independent current, say an inductive current, must be added at the junction of the line and the capacitor. Then

$$\cot a_1\omega - a_c\omega + \frac{a_L}{\omega} = 0 \; . \tag{14}$$

This has solutions $\omega = 1$ and $\omega = 3$, provided a_1 falls in the interval $\pi/3 < a_1 < \pi/2$ (or in certain other intervals at larger values of a_1). The system can make an acceptable resonator for the first two terms in the Fourier expansion of a square wave. Appendix III contains a table of the required values of a_c and a_L for various values of a_1.

A circuit of this type was set up, and it was possible to tune it to have resonances at $\omega = 1$ and $\omega = 3$. As pointed out previously, however, this configuration is not suitable for a cyclotron since it is difficult to build a cyclotron-sized element which satisfies the equation $E = L(dI/dt)$, and it is difficult to keep the dee lip as an equipotential when an inductor is tied to it.

Two Shorted Lines Joined at Common Capacitive Termination. The extra current element can, however, be a second transmission line; then the equation to be satisfied is

$$\cot a_1\omega + b \cot a_2\omega - a_c\omega = 0 \quad . \tag{15}$$

If it is required that $\omega = 1$ and $\omega = 3$ be roots then certain restrictions can be placed on a_1 and a_2. For example, if $a_1 < \pi/3$, a_2 must be greater than $\pi/3$ and can fall within only certain bands, e.g., $\pi/3 < a_2 < \pi/2$. Some computed values for a_1, a_2, a_c, and b with the restriction that $\omega = 1$ and $\omega = 3$ be roots are shown in Appendix III; the actual values of ω for a range of values of a_1, a_2, a_c, are also given.

If $\omega = 1$ and $\omega = 3$ are to be simultaneous roots of the equation then

$$b_{13} = - \frac{3 \cot a_1 - \cot 3 a_1}{3 \cot a_2 - \cot 3 a_2} \tag{16}$$

where the subscript on b denotes that the roots shall be 1 and 3. Figure 1 shows some lines of constant b for this condition on a grid of of a_1 vs a_2.

If $\omega = 1$ and $\omega = 5$ are to be roots, a similar diagram can be made from the relationship

$$b_{15} = - \frac{5 \cot a_1 - \cot 5 a_1}{5 \cot a_2 - \cot 5 a_2} \quad . \tag{17}$$

Evidently if it is required that $\omega = 1$, $\omega = 3$ and $\omega = 5$ are all simultaneous roots, the solutions for a_1, and a_2 are given by the intersection of a line on the 1-3 diagram with a line of the same b value in the 1-5 diagram. For b = 1, the first crossing occurs at about $a_1 = 0.66$, $a_2 = 1.1$, $a_2 = 1.7$. This configuration of the short-circuited transmission lines with a capacitor at their junction was set up with General Radio Type 874 coaxial elements as shown in Fig. 2. The resonances were located by finding the frequencies at which the susceptance measured zero at a point estimated to be the center of the tee leading to the admittance meter. The lengths of the lines agreed with the calculated lengths to the accuracy with which the electrical length was known, i.e., about ± 2%.

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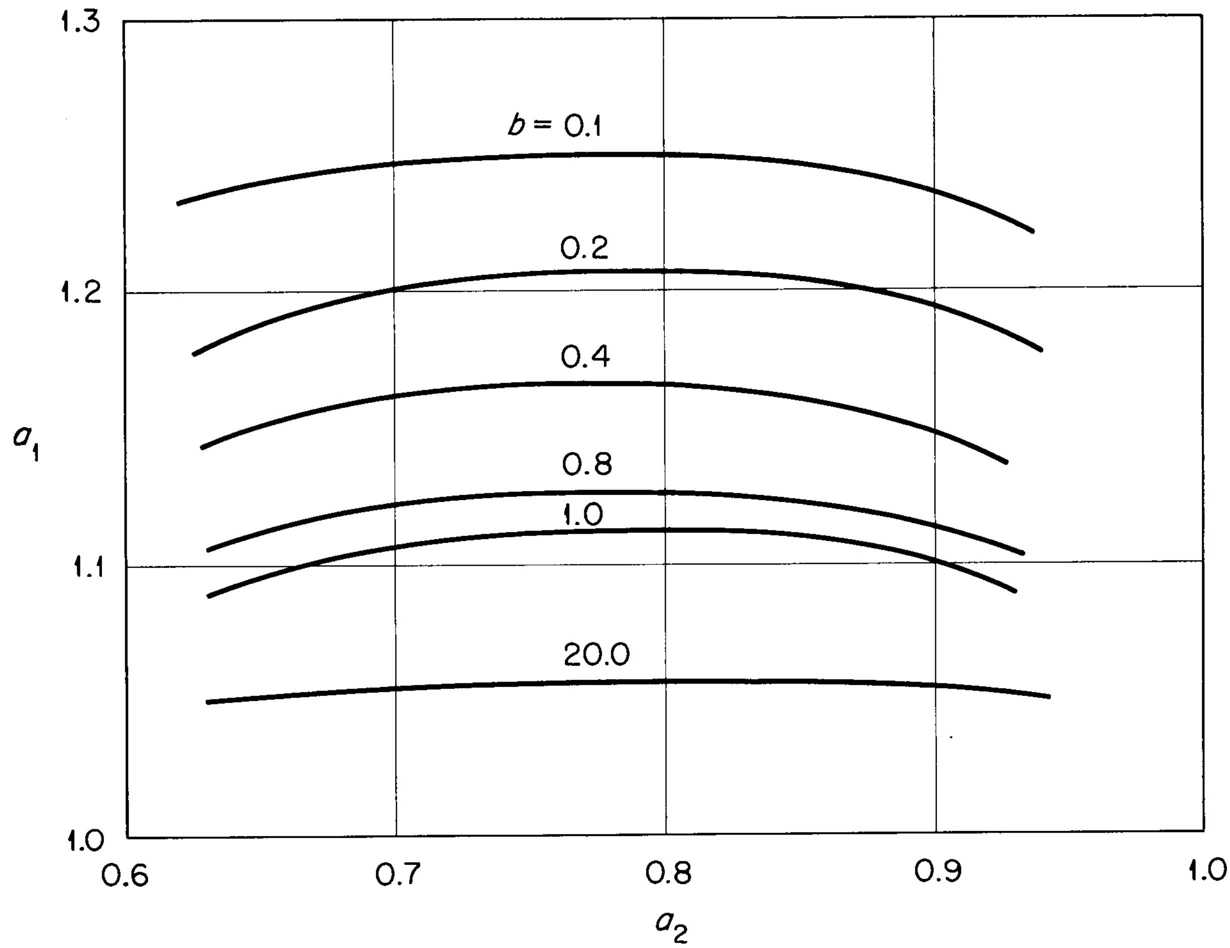

Fig. 1. Lines of Constant $\underline{b}$ on a Grid of $\underline{a}_1$ vs $\underline{a}_2$ for the Equation $\cot \underline{a}_1\omega + \underline{b} \cot \underline{a}_2\omega - \underline{a}_{\underline{c}}\omega = 0$ with the Condition that $\omega = 1$ and $\omega = 3$ Be Solutions.

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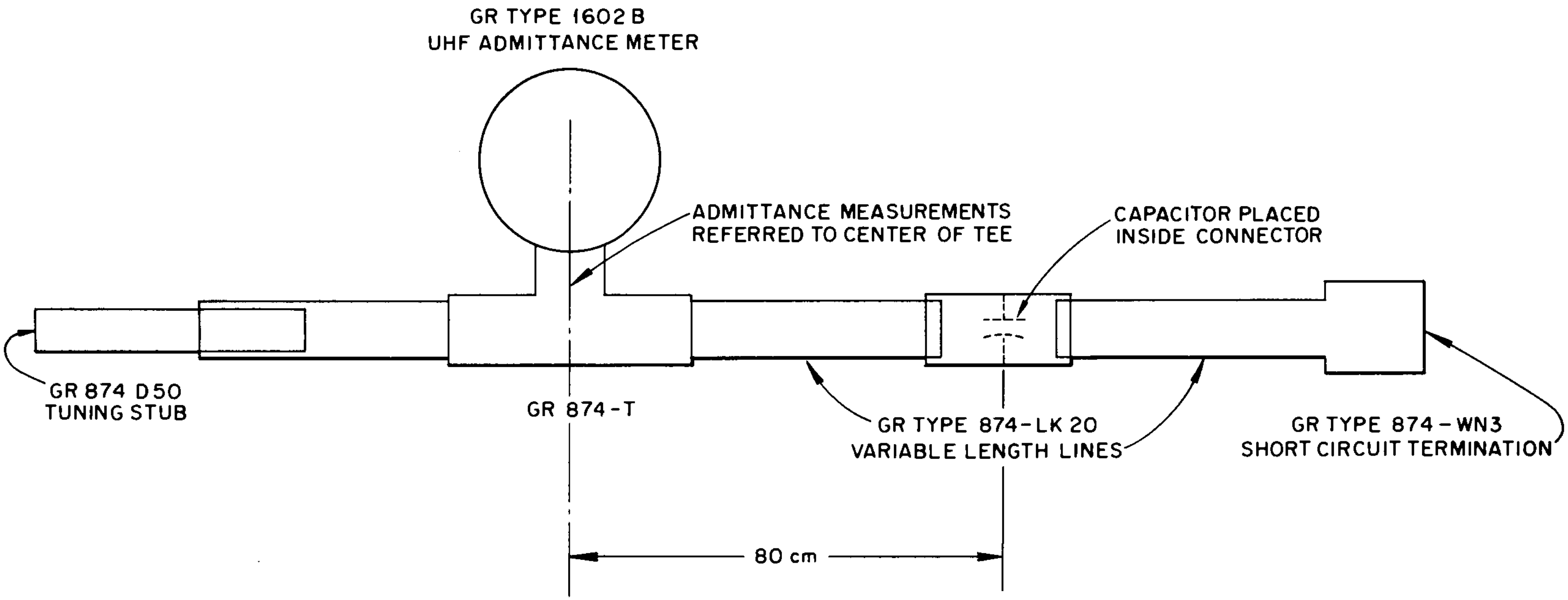

Square Wave Resonant System Set Up for RF Measurements. $\omega_0 = 3 \times 10^8$ sec^{-1} or 47.74 Mc per sec.

Fig. 2. Set-Up for Measuring Characteristics of Square-Wave Resonant System.

The following tuning procedure was found to be easy to follow: 1) Set the oscillator frequency at ω_o and set the admittance meter to the correct reading for zero admittance at the junction to the system. 2) Tune the length of one of the lines for a null on the admittance meter. 3) Set the oscillator frequency to $3\,\omega_o$ and measure the admittance; note whether it is positive or negative. 4) Return to ω_o and change a_1 compensating with a change in a_2 to keep the system tuned to ω_o. One can determine which way to tune by comparing the position of the resonances with numbers interpolated from Appendix III. 5) Remeasure admittance at $3\omega_o$, and repeat the procedure until the admittance measures zero at $3\,\omega_o$.

Refer again to Fig. 1; along any line, a_c changes and, if b and a_c are set, both a_1 and a_2 are determined by the third harmonic condition. Only certain values of each will give correct operation. If a change is to be made to a new fundamental frequency, ω_o, the tuning could be, with reference to Fig. 1, as follows: Since b is not tuned, follow a line of constant b. If a_c is also not tuned, go to a new point on the line where $a_c'/a_c = \omega_o'/\omega_o$, changing the lengths of the transmission lines to bring a_1 and a_2 to their correct new values.

It is conceivable to frequency modulate the system by tuning any pair of the parameters in synchronism according to the proper pattern. It would probably be more convenient, however, to use a different configuration involving capacitively terminated instead of short-circuited lines, since it is easier to change a capacitance than to move a short in a preset pattern.

Driving the Harmonic Resonant System

Master Oscillator Power Amplifier System

Perhaps the simplest method of driving a third harmonic resonant system is to use a master oscillator and a frequency tripler to feed both the fundamental and third harmonic frequencies to either a single or to separate power amplifiers which are coupled to the main resonant system. This system provides easy control of the relative amplitudes and phases of the two driving currents.

Wave forms obtained with such a system are shown in Fig. 4. A signal generator fed a frequency tripler, and the generator and tripler outputs were fed to a single tap on the resonant system as shown in Fig. 3. In a high power system it would probably be desirable to locate the driving tube some distance away from the resonant system and to use a tuned coaxial line both to transmit power to the system and to match the impedances of the driver and the load. In such a case it might be convenient to have separate power amplifiers and separate coupling lines for the two frequencies. However, if the coupling line is one-quarter of the fundamental wave length it is three-quarters of the third harmonic wave length, and the impedances are simply inverted by the line at both frequencies. Thus, if the main resonant system is tuned to be purely resistive at both frequencies at the point of coupling to the line, the impedence at the other end of the line will also be purely resistive at both frequencies.

Self-Excited Systems

A harmonic resonant system can be used as a self-excited oscillator, but such a system will give rise to an interdependence between the harmonic and fundamental amplitudes through the driving system. To illustrate the nature of this effect, assume that the oscillator system has been tuned so that the admittance is real at both frequencies. In a self-excited system the current supplied to the circuit is a function of the voltage in the circuit. If the ratio of the current supplied by the driver to the voltage at the driving point is larger than the admittance of the circuit, the oscillations will grow; if the ratio is smaller, they will die out. Ordinarily the ratio decreases as the amplitude of oscillation increases so that some equilibrium is reached. The decrease is brought about by deriving the grid bias on the oscillator tube from grid current, the latter increasing as the amplitude of oscillation increases.

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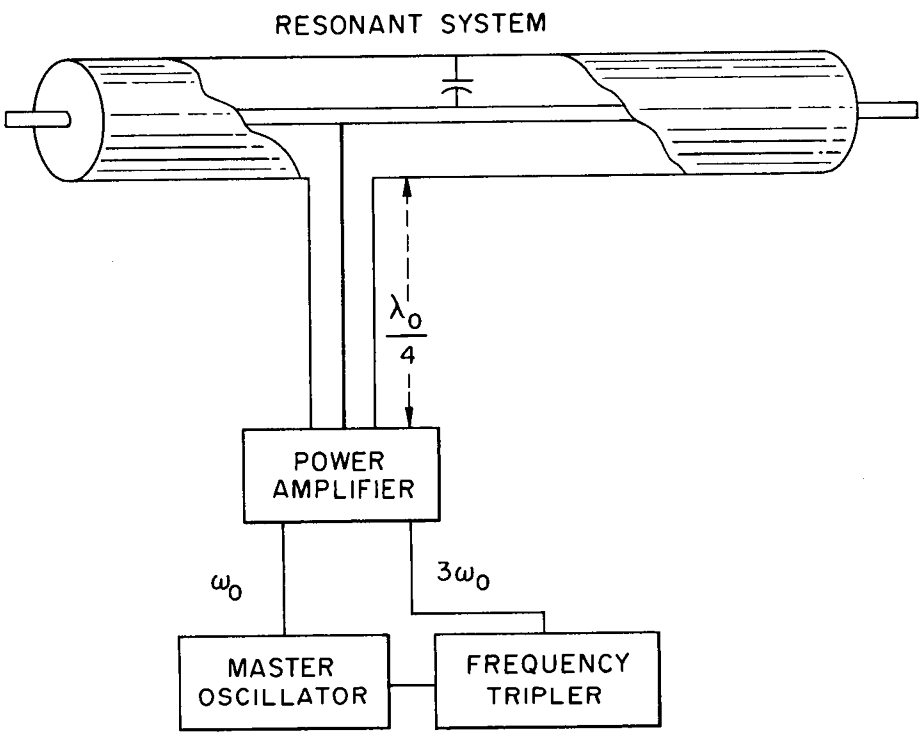

Fig. 3. Square-Wave Resonant System Using Ordinary Coaxial Cable.

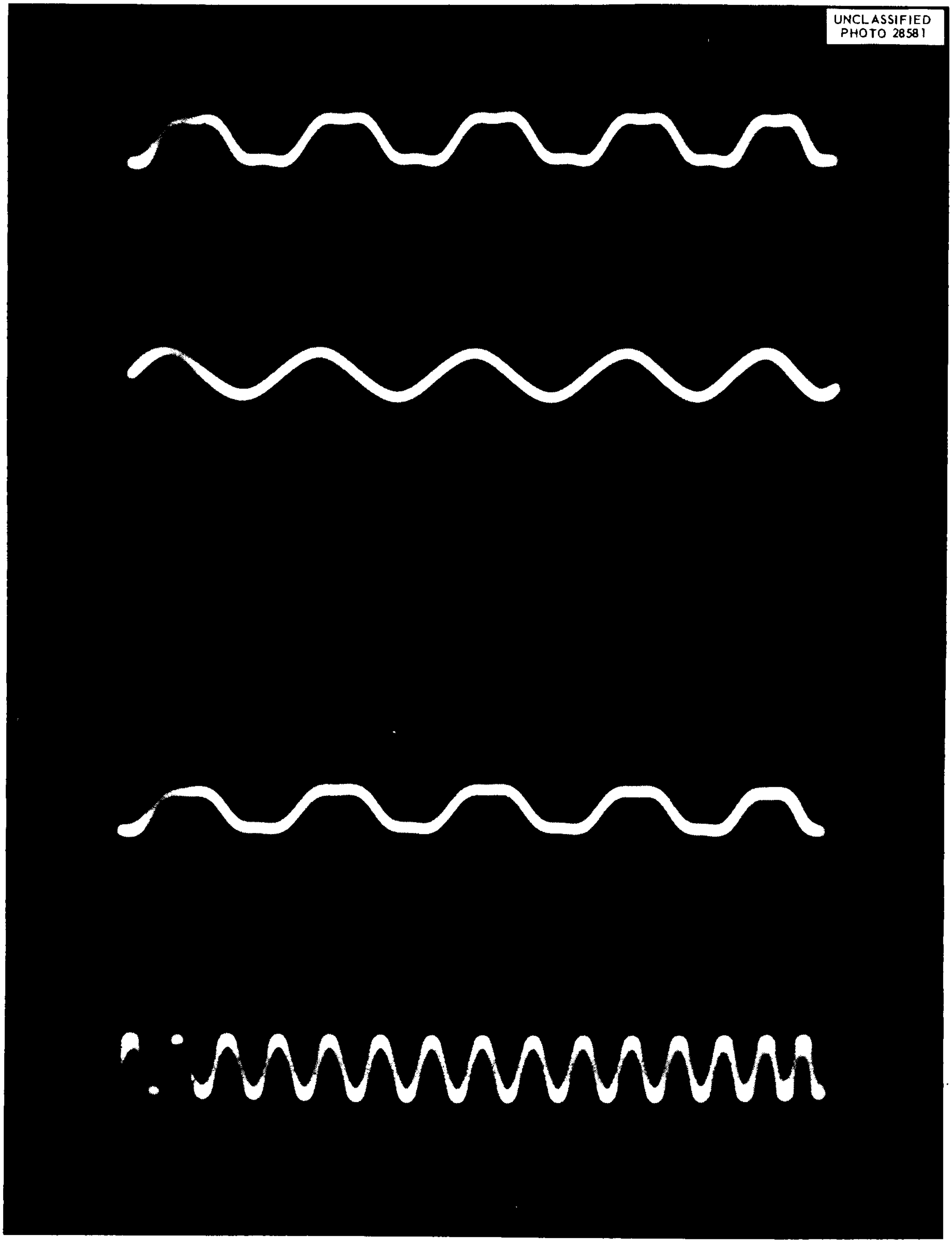

Fig. 4. Wave Forms Obtained with the System in Fig. 3. The four traces show the pure fundamental, the pure third harmonic and two mixtures with different relative amplitudes of the two frequencies.

If a harmonic frequency is added, the grid bias will, in the absence of band-pass filters, depend on the amplitudes of both the fundamental and the harmonic. If this is not properly taken into account in the design, the system may oscillate at one or the other of the frequencies but not both.

An attempt was made to drive the square-wave resonant system as a self-excited oscillator with a single driver which would generate the fundamental and third harmonic simultaneously. Germanium diodes were used to produce odd harmonics by clipping the fundamental sine wave at a low power level. They also served to limit the amplitude of the oscillation. The circuit was tried with a system resonant at 4.77 Mc/sec and was able to drive the system in an approximate square wave. It was somewhat difficult to get both the phase and the amplitude of the third harmonic adjusted correctly; however no serious attempt was made to develop a good self-excited driving system.

Wave-Form Monitoring and Remote Tuning

Tuning drifts are always experienced in cyclotron operation. Since a tuning drift would change the relative amplitudes and phases of the first and third harmonics, such a drift would alter the wave form. A visual means of monitoring the wave form and a remote tuning or an automatic servomechanism for tuning should be provided.

Adaptation of a Square-Wave System to Cyclotron Analogue I

A sketch of a suggested adaptation of a square-wave resonant system to the Oak Ridge Cyclotron Analogue I is shown in Fig. 5. This differs from the existing resonant system only in the addition of a pair of symmetrical shorted transmission lines placed over and under the dummy dee. Two lines are used to preserve symmetry, and the same concept of flattened coaxial lines currently in use is used again.

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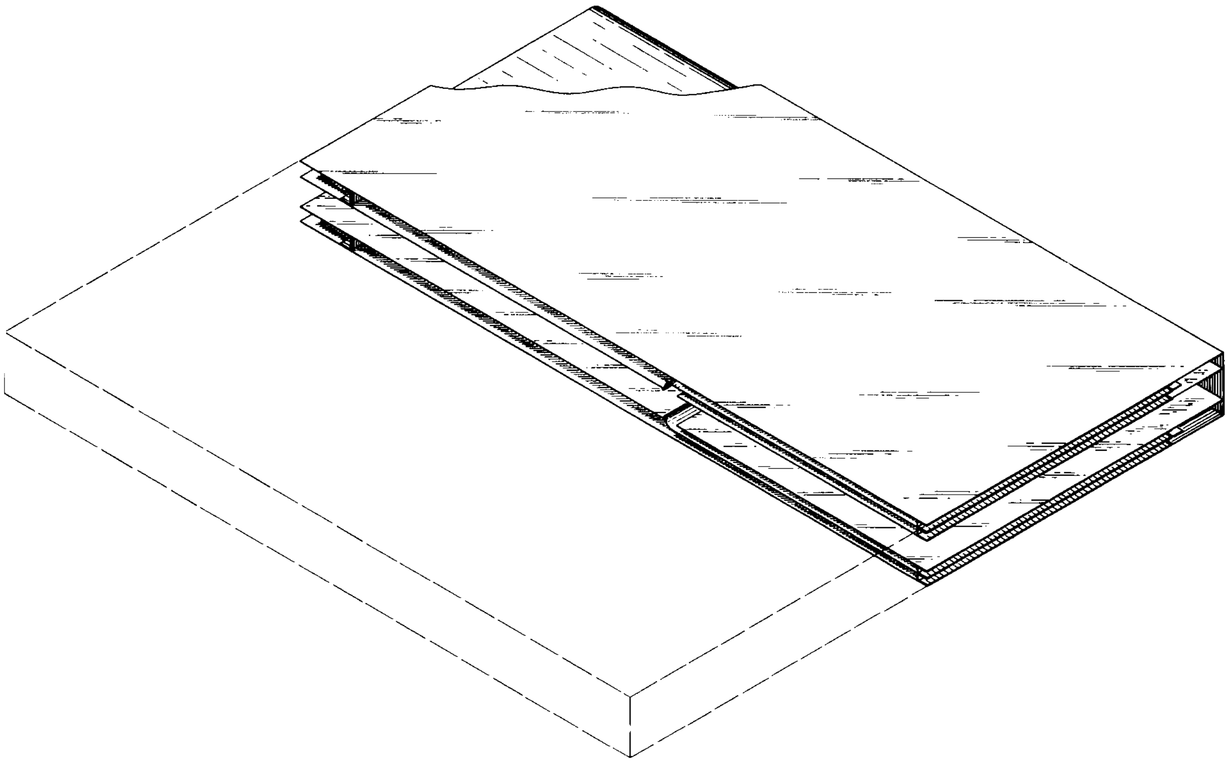

Fig. 5a. Suggested Adaptation of Square-Wave System to Oak Ridge Cyclotron Analogue I.

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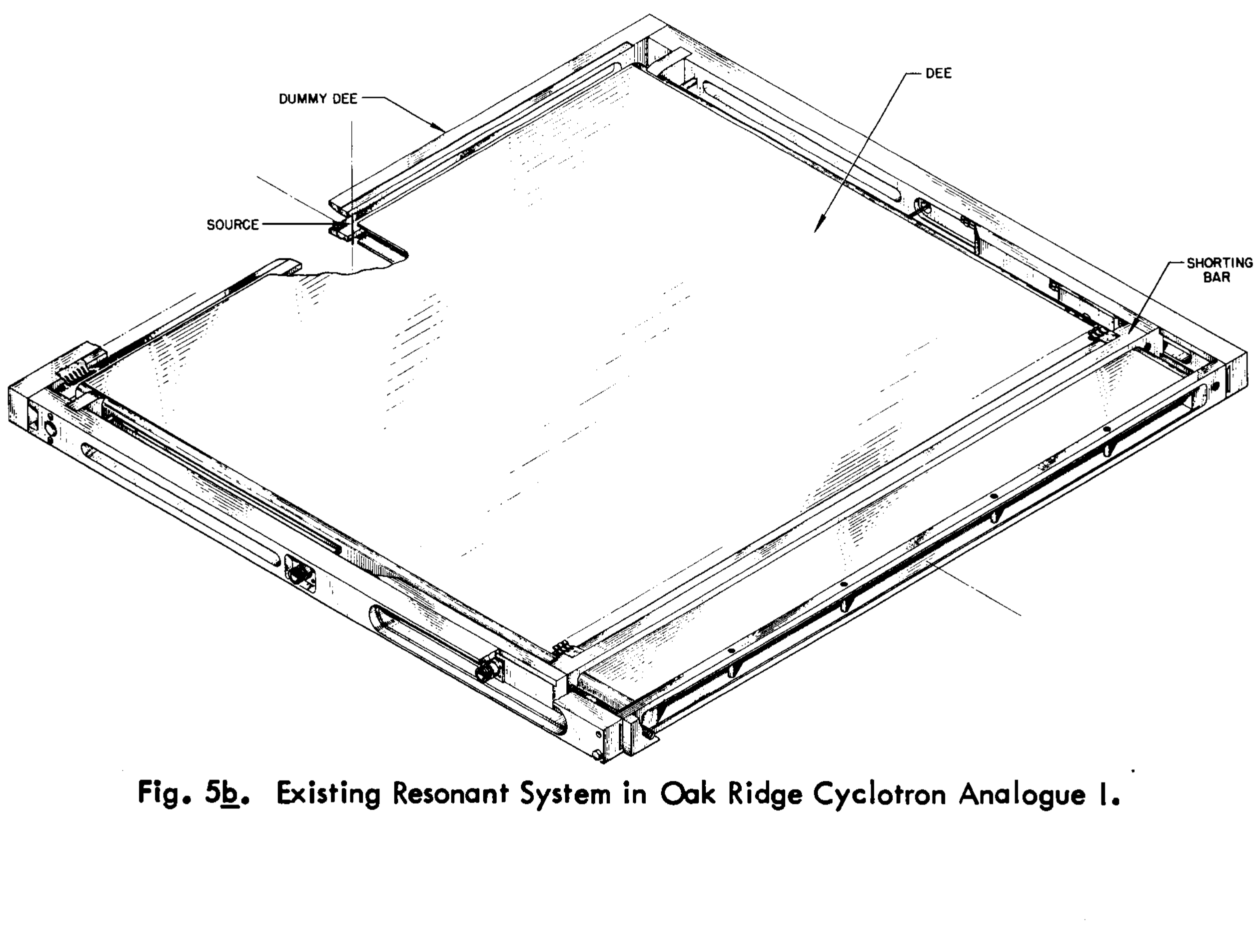

Fig. 5b. Existing Resonant System in Oak Ridge Cyclotron Analogue I.

Other Suggested Uses of a System with Multiple Resonances

An examination of the table, in Appendix III, of resonances of the system of two transmission lines and a capacitor suggests that a resonant system of this type might have uses other than to generate a square wave. For example, if the parameters are chosen to make the first three resonances approximately ω_o, $2\,\omega_o$, and $3\,\omega_o$, an adjustment which would allow doubling the lengths of the lines and the capacitance would permit the use of the system for a sine wave oscillator tunable over the continuous range from $1/2\,\omega_o$ to $3\,\omega_o$. If it is desired to tune over several narrow bands, this could be accomplished with a very small tuning adjustment if the parameters are chosen to make each resonance fall in the right band. Such a system would be quite useful for a cyclotron which is designed to accelerate ions of several different e/m ratios. Equation 16 can be generalized to read

$$b = \frac{r\cot a_1 - \cot r a_1}{r\cot a_2 - \cot r a_2}\ , \tag{18}$$

where r is the ratio of the next higher desired resonant frequency to ω_o. For a three-band system, for example, if ω_o is the lowest frequence, $r_1\omega$ is the bottom of the second band, and $r_2\omega$ is the bottom of the third band, the equation below determines a_1 and a_2.

$$- b = \frac{r_1\cot a_1 - \cot r_1 a_1}{r_1\cot a_2 - \cot r_1 a_2} = \frac{r_2\cot a_1 - \cot r_2 a_1}{r_2\cot a_2 - \cot r_2 a_2}\ . \tag{19}$$

Appendix I: Ion Bunching with a Square Wave

It is shown in Ref. 1 that the ions in a cyclotron are bunched in phase with a sine wave accelerating voltage. The same procedure will be used here to show that the addition of a third harmonic to produce an approximate square wave does not alter the bunching appreciably.

Let the x-y plane in a Cartesian coordinate system be the median plane of the cyclotron, with the ion source at the origin and the y-axis parallel to the dee gap. Where the first two terms of a Fourier expansion of a square wave of unit amplitude are taken for the electric field, the differential equations of motion of an ion moving inside the dee gap can be written

$$\ddot{x} - \omega\dot{y} + \frac{ev4}{md\pi}\left[\cos(\omega t + \theta) - \frac{1}{3}\cos 3\,(\omega t + \theta)\right] = 0$$

$$\ddot{y} + \omega\dot{x} = 0,$$

where

- ω is the orbital cyclotron frequency
- e is the charge of the ion
- m is the mass of the ion
- v is the dee-to-dee peak voltage
- d is the dee separation
- θ is the phase angle between the time of the r-f voltage maximum and the time of emission of the ion.

For the initial conditions

$$x = y = \dot{x} = \dot{y} = 0 \quad \text{at } t = 0$$

one obtains

$$\ddot{x} + \omega^2 x + \frac{ev}{md}\left[\cos(\omega t + \theta) - \frac{1}{3}\cos 3\,(wt + \theta)\right] = 0$$

$$x = \frac{4}{\pi} D\left[(\sin\theta - \frac{1}{4}\sin 3\theta)\sin\omega t + \frac{1}{12}\cos 3\theta\cos\omega t - \omega t\sin(\omega t + \theta) - \frac{1}{12}\cos 3\,(\omega t + \theta)\right],$$

where

$$D = \frac{ev}{2m\omega^2 d} = \left(\frac{ev}{2mc^2}\right)\left(\frac{c^2}{\omega^2 d}\right) \quad .$$

Without the third harmonic, for comparison,

$$x = D\left[\sin\theta \sin\omega t - \omega t \sin(\omega t + \theta)\right] \quad .$$

After a few turns, the term $\omega t \sin(\omega t + \theta)$ dominates in both cases and $x = 0$ approximately when $\sin(\omega t + \theta) = 0$ which is the maximum of the fundamental r-f voltage cycle. Thus, the ions are bunched so as to cross the dee gap near the peak of the r-f voltage cycle.

Appendix II: Displacement at Orbit Centers Due to Ion Bunching

The same differential equations as in Appendix I are used to evaluate the quantity

$$\Delta r = \frac{\dot{x}}{\omega} - y \quad \text{when } x = 0 \ .$$

The quantity $\dot{x}/\omega$ is the radius at which the ion should be found for its energy, and y, at x = 0, is the radius at which it actually crosses the dee gap.

For a sine wave r-f voltage

$$\dot{x} = D\left[\omega \sin\theta \cos\omega t - \omega \sin(\omega t + \theta) - \omega^2 t \cos(\omega t + \theta)\right]$$

$$y = D\left[\sin\theta \cos\omega t + \sin(\omega t + \theta) - \omega t \cos(\omega t + 0) - 2\sin\theta\right]$$

$$\Delta r = \frac{\dot{x}}{\omega} - y = D\left[-2\sin(\omega t + \theta) + 2\sin\theta\right] \ .$$

But, as shown in Appendix I, when x = 0, $\sin(\omega t + \theta)$ is approximately zero. Thus, $\Delta r = 2D\sin\theta$, which says that the orbit is displaced in the positive y direction by an amount $2D\sin\theta$.

For a sine wave the plus third harmonic

$$\dot{x} = \frac{4}{\pi} C\Big[\omega(\sin\theta - \frac{1}{4}\sin 3\theta)\cos\omega t - \frac{\omega}{12}\cos 3\theta \sin\omega t$$

$$- \omega\sin(\omega t + \theta) - \omega^2 t\cos(\omega t + \theta) + \frac{3\omega}{12}\sin 3(\omega t + \theta)\Big] \ ,$$

$$y = \frac{4}{\pi} D \Big[(\sin 0 - \frac{1}{4}\sin 3\theta)\cos\omega t - \frac{1}{12}\cos 3\theta \sin\omega t$$

$$+ \sin(\omega t + \theta) - \omega t\cos(\omega t + \theta) + \frac{1}{36}\sin 3(\omega t + \theta)$$

$$- 2\sin\theta + \frac{2}{9}\sin 3\theta\Big] \ ,$$

$$\Delta r = \frac{\dot{x}}{\omega} - y = \frac{4}{\pi} D \left[- 2 \sin (\omega t + 0) + \frac{2}{9} \sin 3 (\omega t + \theta) \right.$$

$$\left. + 2 \sin \theta - \frac{2}{9} \sin 3 \theta \right] .$$

As above, $\sin (\omega t + \theta)$ is approximately zero when $x = 0$, so that $\sin 3 (\omega t + \theta)$ must also be near zero and

$$\Delta r = \frac{4}{\pi} 2D \left[\sin \theta - \frac{1}{9} \sin 3 \theta \right] .$$

This is essentially the same as for the case of a simple sine wave. The term $-\frac{1}{9} \sin 3\theta$ decreases Δr for small θ and increases it for θ near 90°. This is a slightly beneficial effect since the ions for which θ is near zero are extracted from the source by the strongest field; one would expect more current extracted at small θ than at θ near 90°. It should also be noted that Δr is symmetrical about $\theta = 0$ which indicates that the optimum position of the source for minimizing the average radial displacement of the orbits is at the center of the cyclotron.

Appendix III: Calculated Parameters

(a) The following is a tabulation of the parameters a_1, a_c, and a_L for the equation

$$\cot a_1\omega - a_c\omega + a_L/\omega = 0$$

subject to the condition that $\omega = 1$ and $\omega = 3$ are solutions. See page 9 for an explanation of the significance of the equation.

a_1	a_c	a_L
1.1	2.28397	1.77500
1.2	0.71135	0.32257
1.3	0.36114	0.08349
1.4	0.18938	0.01690
1.5	0.07200	0.00110
2.2	1.23483	1.96271
2.3	0.64053	1.53400
2.4	0.42391	1.51558
2.5	0.30591	1.64454
2.6	0.22805	1.89027
2.7	0.17026	2.28560
2.8	0.12372	2.93637
2.9	0.08384	4.14206
3.0	0.04784	7.06272

(b) The following is a tabulation of the parameters and solutions of the equation:

$$\cot a_1\omega + b\cot a_2\omega - a_c = 0$$

Pages 26 through 30 give values of a_1, b, a_2, and a_c with the condition that all these parameters be positive and $\omega = 1$ and $\omega = 3$ be roots of the equation.

Pages 31 through 52 give the smallest three values of ω for various values of a_1, a_2, b, and a_c. The ranges covered are:

$0.1 \leq a_1 \leq 1.3$ in steps of 0.4

$1.1 \leq a_2 \leq 3.1$ in steps of 0.4

$0.3 \leq b \leq 2.7$ in steps of 0.4

$0.3 \leq a_c \leq 2.7$ in steps of 0.4

For the significance of the equation and for the meanings of the parameters in terms of a square wave resonant system, see page 10,

A1	A2	B	AC	W1	W2
1.1	0.1	.177485535	2.277903360	1.0	3.0
1.3	0.1	.008349056	.360827710	1.0	3.0
1.5	0.1	.000108624	.071997460	1.0	3.0
2.1	0.1	2.295731320	22.295890300	1.0	3.0
2.3	0.1	.153397007	.635368990	1.0	3.0
2.5	0.1	.164452613	.300392610	1.0	3.0
2.7	0.1	.228559533	.162588623	1.0	3.0
2.9	0.1	.414210076	.069931902	1.0	3.0
5.3	0.1	.267799733	2.002963570	1.0	3.0
4.3	0.1	.058981460	1.025321680	1.0	3.0
4.5	0.1	.003495899	.250483600	1.0	3.0
4.7	0.1	.000000571	.012395303	1.0	3.0
5.5	0.1	.150001350	.490574600	1.0	3.0
5.7	0.1	.177296387	.251279780	1.0	3.0
5.9	0.1	.262271935	.133264241	1.0	3.0
6.1	0.1	.546011270	.044145985	1.0	3.0
1.1	0.3	.531525900	2.227246870	1.0	3.0
1.3	0.3	.025003385	.358444792	1.0	3.0
1.5	0.3	.000325303	.071966458	1.0	3.0
2.1	0.3	6.875155600	21.640661400	1.0	3.0
2.3	0.3	.459386630	.591587640	1.0	3.0
2.5	0.3	.492495477	.253455867	1.0	3.0
2.7	0.3	.684480070	.097354992	1.0	3.0
4.3	0.3	.176635090	1.008487660	1.0	3.0
4.5	0.3	.010469363	.249485833	1.0	3.0
4.7	0.3	.000001710	.012395140	1.0	3.0
5.3	0.3	.801994900	1.926530300	1.0	3.0
5.5	0.3	.449217467	.447762421	1.0	3.0
5.7	0.3	.530959448	.200677271	1.0	3.0
5.9	0.3	.785440490	.058408686	1.0	3.0
1.1	0.5	.873166880	2.107289370	1.0	3.0
1.3	0.5	.041074439	.352801899	1.0	3.0
1.5	0.5	.000534393	.071893042	1.0	3.0
2.1	0.5	11.294196900	20.089041000	1.0	3.0
2.3	0.5	.754659730	.487910910	1.0	3.0
2.5	0.5	.809049440	.142306955	1.0	3.0
4.3	0.5	.290168190	.968623740	1.0	3.0
4.5	0.5	.017198598	.247123053	1.0	3.0
4.7	0.5	.000002808	.012394754	1.0	3.0
5.3	0.5	1.317481200	1.745531970	1.0	3.0
5.5	0.5	.737954278	.346380712	1.0	3.0
5.7	0.5	.872236330	.080847612	1.0	3.0
1.1	0.7	1.141434850	1.864127310	1.0	3.0
1.3	0.7	.053693970	.341363370	1.0	3.0
1.5	0.7	.000698578	.071744222	1.0	3.0
2.1	0.7	14.764176800	16.943800500	1.0	3.0
2.3	0.7	.986518080	.277751070	1.0	3.0
4.3	0.7	.379318200	.887816860	1.0	3.0
4.5	0.7	.022482621	.242333538	1.0	3.0
4.7	0.7	.000003671	.012393971	1.0	3.0
5.3	0.7	1.722258350	1.378635980	1.0	3.0
5.5	0.7	.964680110	.140873059	1.0	3.0
1.1	0.9	1.052714610	1.344350990	1.0	3.0
1.3	0.9	.049520500	.316912690	1.0	3.0
1.5	0.9	.000644280	.071426110	1.0	3.0

A1	A2	B	AC	W1	W2
2.1	0.9	13.616602300	10.220622600	1.0	3.0
4.3	0.9	.349834950	.715086360	1.0	3.0
4.5	0.9	.020735115	.232095604	1.0	3.0
4.7	0.9	.000003386	.012392300	1.0	3.0
5.3	0.9	1.588392480	.594369480	1.0	3.0
0.1	1.1	5.634261900	12.834304200	1.0	3.0
0.3	1.1	1.881375830	4.190288440	1.0	3.0
0.5	1.1	1.145256440	2.413386720	1.0	3.0
0.7	1.1	.876090290	1.633143840	1.0	3.0
0.9	1.1	.949925060	1.277032700	1.0	3.0
3.3	1.1	3.557205500	8.070451700	1.0	3.0
3.5	1.1	1.577902250	3.472718410	1.0	3.0
3.7	1.1	1.036723620	2.128342870	1.0	3.0
3.9	1.1	.848578960	1.487392530	1.0	3.0
4.1	1.1	1.219595250	1.323215860	1.0	3.0
0.1	1.3	119.774023000	43.217786000	1.0	3.0
0.3	1.3	39.994584000	14.335850400	1.0	3.0
0.5	1.3	24.346041000	8.589329700	1.0	3.0
0.7	1.3	18.624065000	6.357573700	1.0	3.0
0.9	1.3	20.193656700	6.399626100	1.0	3.0
1.9	1.3	2.204684800	.270419650	1.0	3.0
3.3	1.3	75.619633000	27.253140400	1.0	3.0
3.5	1.3	33.543294000	11.981759700	1.0	3.0
3.7	1.3	22.038834000	7.719008700	1.0	3.0
3.9	1.3	18.039225000	6.063464100	1.0	3.0
4.1	1.3	25.926347700	7.900040500	1.0	3.0
5.1	1.3	4.890656800	.949457850	1.0	3.0
0.1	1.5	9206.034800000	662.811130000	1.0	3.0
0.3	1.5	3074.060500000	221.229250000	1.0	3.0
0.5	1.5	1871.281990000	134.532155000	1.0	3.0
0.7	1.5	1431.480310000	102.700442000	1.0	3.0
0.9	1.5	1552.120100000	110.861900000	1.0	3.0
1.7	1.5	6.380565100	.322549300	1.0	3.0
1.9	1.5	169.456103000	11.675317400	1.0	3.0
3.3	1.5	5812.245500000	418.434401000	1.0	3.0
3.5	1.5	2578.198800000	185.502170000	1.0	3.0
3.7	1.5	1693.943430000	121.726412000	1.0	3.0
3.9	1.5	1386.528320000	99.380930000	1.0	3.0
4.1	1.5	1992.746300000	142.017770000	1.0	3.0
4.9	1.5	21.186945500	1.312625260	1.0	3.0
5.1	1.5	375.904559000	26.248947100	1.0	3.0
1.5	1.7	.156725929	.050551839	1.0	3.0
4.7	1.7	.000823703	.012282591	1.0	3.0
1.3	1.9	.453579559	.122656830	1.0	3.0
1.5	1.9	.005901233	.068898772	1.0	3.0
4.5	1.9	.189921835	.150757216	1.0	3.0
4.7	1.9	.000031014	.012379017	1.0	3.0
0.1	2.1	.435591040	9.711890000	1.0	3.0
0.3	2.1	.145451252	3.147661300	1.0	3.0
0.5	2.1	.088541044	1.778704680	1.0	3.0
0.7	2.1	.067731510	1.147629200	1.0	3.0
0.9	2.1	.073439759	.750600060	1.0	3.0
3.3	2.1	.275011500	6.099107700	1.0	3.0
3.5	2.1	.121989372	2.598271280	1.0	3.0
3.7	2.1	.080150251	1.553807920	1.0	3.0

A1	A2	B	AC	W1	W2
3.9	2.1	.065604579	1.017124210	1.0	3.0
4.1	2.1	.094288260	.647336500	1.0	3.0
0.1	2.3	6.519032000	4.141990800	1.0	3.0
0.3	2.3	2.176815610	1.287777230	1.0	3.0
0.5	2.3	1.325100500	.646531000	1.0	3.0
0.7	2.3	1.013666160	.281546860	1.0	3.0
3.3	2.3	4.115807420	2.582537620	1.0	3.0
3.5	2.3	1.825686390	1.038394060	1.0	3.0
3.7	2.3	1.199524300	.528927230	1.0	3.0
3.9	2.3	.981834620	.178238920	1.0	3.0
0.1	2.5	6.080779000	1.826621100	1.0	3.0
0.3	2.5	2.030475500	.514635930	1.0	3.0
0.5	2.5	1.236018390	.175894014	1.0	3.0
3.3	2.5	3.839115310	1.120723090	1.0	3.0
3.5	2.5	1.702951500	.389963600	1.0	3.0
3.7	2.5	1.118884310	.102891224	1.0	3.0
0.1	2.7	4.375227600	.711362240	1.0	3.0
0.3	2.7	1.460962900	.142232032	1.0	3.0
3.3	2.7	2.762311100	.416601566	1.0	3.0
3.5	2.7	1.225303630	.077629975	1.0	3.0
0.1	2.9	2.414233800	.168831967	1.0	3.0
3.3	2.9	1.524232680	.074073698	1.0	3.0
1.1	3.3	.281119540	2.268761690	1.0	3.0
1.3	3.3	.013224078	.360397680	1.0	3.0
1.5	3.3	.000172051	.071991866	1.0	3.0
2.1	3.3	3.636211470	22.177645500	1.0	3.0
2.3	3.3	.242965690	.627468040	1.0	3.0
2.5	3.3	.260476670	.291922220	1.0	3.0
2.7	3.3	.362015700	.150816309	1.0	3.0
2.9	3.3	.656067800	.048597369	1.0	3.0
4.3	3.3	.093420802	1.022283750	1.0	3.0
4.5	3.3	.005537157	.250303540	1.0	3.0
4.7	3.3	.000000904	.012395273	1.0	3.0
5.3	3.3	.424168297	1.989170120	1.0	3.0
5.5	3.3	.237587300	.482848550	1.0	3.0
5.7	3.3	.280819940	.242147850	1.0	3.0
5.9	3.3	.415412810	.119755516	1.0	3.0
6.1	3.3	.864827867	.016022821	1.0	3.0
1.1	3.5	.633752810	2.200845070	1.0	3.0
1.3	3.5	.029812218	.357202832	1.0	3.0
1.5	3.5	.000387868	.071950300	1.0	3.0
2.1	3.5	8.197435400	21.299161000	1.0	3.0
2.3	3.5	.547739190	.568769130	1.0	3.0
2.5	3.5	.587215772	.228992781	1.0	3.0
2.7	3.5	.816124230	.063355704	1.0	3.0
4.3	3.5	.210606830	.999713900	1.0	3.0
4.5	3.5	.012482906	.248965801	1.0	3.0
4.7	3.5	.000002038	.012395054	1.0	3.0
5.3	3.5	.956240360	1.886693860	1.0	3.0
5.5	3.5	.535614221	.425449026	1.0	3.0
5.7	3.5	.633077415	.174303614	1.0	3.0
5.9	3.5	.936502090	.019394523	1.0	3.0
1.1	3.7	.964577220	2.052951070	1.0	3.0
1.3	3.7	.045374451	.350245785	1.0	3.0
1.5	3.7	.000590338	.071859786	1.0	3.0

A1	A2	B	AC	W1	W2
2.1	3.7	12.476567100	19.386188900	1.0	3.0
2.3	3.7	.833663759	.440947465	1.0	3.0
2.5	3.7	.893747440	.091958769	1.0	3.0
4.3	3.7	.320545400	.950566210	1.0	3.0
4.5	3.7	.018999090	.246052762	1.0	3.0
4.7	3.7	.000003102	.012394579	1.0	3.0
5.3	3.7	1.455406040	1.663543430	1.0	3.0
5.5	3.7	.815209440	.300456870	1.0	3.0
5.7	3.7	.963549250	.026567225	1.0	3.0
1.1	3.9	1.178440710	1.752803920	1.0	3.0
1.3	3.9	.055434753	.336126633	1.0	3.0
1.5	3.9	.000721226	.071676091	1.0	3.0
2.1	3.9	15.242838200	15.503859900	1.0	3.0
2.3	3.9	1.018501450	.181536600	1.0	3.0
4.3	3.9	.391615870	.850822200	1.0	3.0
4.5	3.9	.023211518	.240140822	1.0	3.0
4.7	3.9	.000003791	.012393613	1.0	3.0
5.3	3.9	1.778094780	1.210665240	1.0	3.0
5.5	3.9	.995955490	.046788435	1.0	3.0
1.1	4.1	.819944150	1.084963110	1.0	3.0
1.3	4.1	.038570800	.304710890	1.0	3.0
1.5	4.1	.000501820	.071267361	1.0	3.0
2.1	4.1	10.605774100	6.865504700	1.0	3.0
4.3	4.1	.272481370	.628887360	1.0	3.0
4.5	4.1	.016150280	.226986490	1.0	3.0
4.7	4.1	.000002637	.012391466	1.0	3.0
5.3	4.1	1.237175870	.202991085	1.0	3.0
0.1	4.3	16.954480200	17.383796100	1.0	3.0
0.3	4.3	5.661389190	5.709441170	1.0	3.0
0.5	4.3	3.446277070	3.338145810	1.0	3.0
0.7	4.3	2.636309030	2.340559620	1.0	3.0
0.9	4.3	2.858490770	2.044067760	1.0	3.0
3.3	4.3	10.704254000	10.942784900	1.0	3.0
3.5	4.3	4.748184050	4.746825600	1.0	3.0
3.7	4.3	3.119682840	2.965465090	1.0	3.0
3.9	4.3	2.553522630	2.172593770	1.0	3.0
4.1	4.3	3.669975570	2.308001250	1.0	3.0
0.1	4.5	286.049490000	71.650707000	1.0	3.0
0.3	4.5	95.516797000	23.830087800	1.0	3.0
0.5	4.5	58.144272000	14.368790200	1.0	3.0
0.7	4.5	44.478799000	10.778704800	1.0	3.0
0.9	4.5	48.227366000	11.193359700	1.0	3.0
1.9	4.5	5.265324000	.793785590	1.0	3.0
3.3	4.5	180.598099000	45.204344000	1.0	3.0
3.5	4.5	80.109553000	19.944539200	1.0	3.0
3.7	4.5	52.634098000	12.950765400	1.0	3.0
3.9	4.5	43.082060000	10.345761300	1.0	3.0
4.1	4.5	61.918428500	14.054646900	1.0	3.0
5.1	4.5	11.680079100	2.110441630	1.0	3.0
0.1	4.7	1750125.600000000	21693.337700000	1.0	3.0
0.3	4.7	584935.480000000	7250.357000000	1.0	3.0
0.5	4.7	356073.430000000	4413.442500000	1.0	3.0
0.7	4.7	272377.800000000	3375.842700000	1.0	3.0
0.9	4.7	295307.010000000	3659.532900000	1.0	3.0
1.7	4.7	1214.030060000	14.911434800	1.0	3.0

A1	A2	B	AC	W1	W2
1.9	4.7	32243.709000000	399.145440000	1.0	3.0
3.3	4.7	1105954.020000000	13708.601700000	1.0	3.0
3.5	4.7	490632.530000000	6081.417000000	1.0	3.0
3.7	4.7	322343.570000000	3995.312900000	1.0	3.0
3.9	4.7	263797.210000000	3269.400600000	1.0	3.0
4.1	4.7	379262.290000000	4699.615600000	1.0	3.0
4.9	4.7	4031.133670000	49.754340400	1.0	3.0
5.1	4.7	71521.782000000	885.718920000	1.0	3.0
1.5	4.9	.047198875	.061954436	1.0	3.0
4.7	4.9	.000248069	.012342518	1.0	3.0
1.3	5.1	.204471510	.194137081	1.0	3.0
1.5	5.1	.002660250	.069828754	1.0	3.0
4.5	5.1	.085615857	.180687271	1.0	3.0
4.7	5.1	.000013982	.012383904	1.0	3.0
0.1	5.3	3.734133600	7.479333600	1.0	3.0
0.3	5.3	1.246890720	2.402172760	1.0	3.0
0.5	5.3	.759024110	1.324900860	1.0	3.0
0.7	5.3	.580632970	.800481510	1.0	3.0
0.9	5.3	.629567310	.374195600	1.0	3.0
3.3	5.3	2.357554700	4.689577500	1.0	3.0
3.5	5.3	1.045762160	1.973033060	1.0	3.0
3.7	5.3	.687093470	1.143009830	1.0	3.0
3.9	5.3	.562399710	.680877790	1.0	3.0
4.1	5.3	.808292510	.164076175	1.0	3.0
0.1	5.5	6.666606600	3.270467900	1.0	3.0
0.3	5.5	2.226093300	.996760930	1.0	3.0
0.5	5.5	1.355097500	.469379630	1.0	3.0
0.7	5.5	1.036613040	.146030851	1.0	3.0
3.3	5.5	4.208979080	2.032299450	1.0	3.0
3.5	5.5	1.867015400	.794319880	1.0	3.0
3.7	5.5	1.226678620	.368564021	1.0	3.0
3.9	5.5	1.004060920	.046978440	1.0	3.0
0.1	5.7	5.640272800	1.417286500	1.0	3.0
0.3	5.7	1.883383000	.377952160	1.0	3.0
0.5	5.7	1.146478260	.092690030	1.0	3.0
3.3	5.7	3.561000610	.862288670	1.0	3.0
3.5	5.7	1.579585600	.275327480	1.0	3.0
3.7	5.7	1.037829660	.027572254	1.0	3.0
0.1	5.9	3.812836400	.508114750	1.0	3.0
0.3	5.9	1.273170910	.074364241	1.0	3.0
3.3	5.9	2.407244000	.288280747	1.0	3.0
3.5	5.9	1.067803260	.020709535	1.0	3.0
0.1	6.1	1.831464010	.080851783	1.0	3.0
3.3	6.1	1.156299400	.018527179	1.0	3.0

A1	A2	B	AC	W1	W2	W3
0.1	1.1	0.3	0.3	2.75575362	5.02065002	6.22489166
0.5	1.1	0.3	0.3	1.88236437	3.13714287	5.76173492
0.9	1.1	0.3	0.3	1.34542554	2.95336322	4.23775310
1.3	1.1	0.3	0.3	1.06282476	2.70226975	3.30721497
0.1	1.5	0.3	0.3	2.04689029	4.01833940	5.37653821
0.5	1.5	0.3	0.3	1.66943591	2.50585409	6.28318530
0.9	1.5	0.3	0.3	1.25458001	2.26059991	3.98015154
1.3	1.5	0.3	0.3	0.99948443	2.15236528	3.06702489
0.1	1.9	0.3	0.3	1.62535449	3.22931960	4.70078497
0.5	1.9	0.3	0.3	1.44185110	2.21528171	3.43790637
0.9	1.9	0.3	0.3	1.16562330	1.87294126	3.32730083
1.3	1.9	0.3	0.3	0.94679925	1.76380500	2.93906784
0.1	2.3	0.3	0.3	1.34721724	2.68586052	3.98910473
0.5	2.3	0.3	0.3	1.24211194	2.04495845	2.89787912
0.9	2.3	0.3	0.3	1.07121474	1.64448124	2.79052501
1.3	2.3	0.3	0.3	0.89638934	1.51062685	2.67060063
0.1	2.7	0.3	0.3	1.15018914	2.29622128	3.42857464
0.5	2.7	0.3	0.3	1.08197512	1.90590909	2.54318879
0.9	2.7	0.3	0.3	0.97517586	1.50332400	2.40544334
1.3	2.7	0.3	0.3	0.84474087	1.34117784	2.33776277
0.1	3.1	0.3	0.3	1.00337298	2.00447108	2.99901684
0.5	3.1	0.3	0.3	0.95524286	1.76785937	2.30904894
0.9	3.1	0.3	0.3	0.88490080	1.40781659	2.12183847
1.3	3.1	0.3	0.3	0.79138046	1.22515176	2.06331998
0.1	1.1	0.7	0.3	2.64107372	4.81850051	6.47913218
0.5	1.1	0.7	0.3	1.77532348	3.36361026	5.81812758
0.9	1.1	0.7	0.3	1.36280157	3.04693597	4.24378452
1.3	1.1	0.7	0.3	1.13048316	2.62885633	3.48028708
0.1	1.5	0.7	0.3	1.98841417	3.86006195	5.32810879
0.5	1.5	0.7	0.3	1.51856028	2.68445426	4.40756473
0.9	1.5	0.7	0.3	1.20432965	2.40436874	3.89293603
1.3	1.5	0.7	0.3	1.00991301	2.20457481	3.07933284
0.1	1.9	0.7	0.3	1.58981982	3.14032908	4.54165988
0.5	1.9	0.7	0.3	1.30866622	2.30293312	3.56899986
0.9	1.9	0.7	0.3	1.07784641	2.01531100	3.34875522
1.3	1.9	0.7	0.3	0.91749069	1.86011425	2.86920839
0.1	2.3	0.7	0.3	1.32327664	2.62971408	3.88046190
0.5	2.3	0.7	0.3	1.13934450	2.04634268	3.03047005
0.9	2.3	0.7	0.3	0.97091165	1.76184973	2.85478388
1.3	2.3	0.7	0.3	0.84069584	1.61720007	2.62546860
0.1	2.7	0.7	0.3	1.13293732	2.25743245	3.35725788
0.5	2.7	0.7	0.3	1.00381114	1.84850676	2.66112576
0.9	2.7	0.7	0.3	0.87909907	1.58309337	2.48582280
1.3	2.7	0.7	0.3	0.77428156	1.44244536	2.34868601
0.1	3.1	0.7	0.3	0.99033813	1.97596352	2.94897271
0.5	3.1	0.7	0.3	0.89472188	1.68346195	2.39322042
0.9	3.1	0.7	0.3	0.80014555	1.44770305	2.20887337
1.3	3.1	0.7	0.3	0.71581093	1.31152698	2.10223991
0.1	1.1	1.1	0.3	2.54432517	4.70736447	6.62234185
0.5	1.1	1.1	0.3	1.71161207	3.51456003	5.86502504
0.9	1.1	1.1	0.3	1.37417175	3.11404186	4.24845658
1.3	1.1	1.1	0.3	1.17675413	2.58835301	3.59538364
0.1	1.5	1.1	0.3	1.93531014	3.74868157	5.30457301
0.5	1.5	1.1	0.3	1.43292023	2.78383973	4.50275278
0.9	1.5	1.1	0.3	1.17428041	2.50321246	3.84098159

A1	A2	B	AC	W1	W2	W3
1.3	1.5	1.1	0.3	1.01661461	2.24008892	3.08825757
0.1	1.9	1.1	0.3	1.55654606	3.06652041	4.45195556
0.5	1.9	1.1	0.3	1.22795197	2.34700266	3.66370407
0.9	1.9	1.1	0.3	1.02859337	2.10178521	3.36548258
1.3	1.9	1.1	0.3	0.89990197	1.92631101	2.82621453
0.1	2.3	1.1	0.3	1.30049403	2.57976440	3.80224846
0.5	2.3	1.1	0.3	1.07089270	2.04700264	3.11218270
0.9	2.3	1.1	0.3	0.91538344	1.82567105	2.90618403
1.3	2.3	1.1	0.3	0.80910960	1.68507329	2.59648994
0.1	2.7	1.1	0.3	1.11635729	2.22170070	3.29887089
0.5	2.7	1.1	0.3	0.94745677	1.82156132	2.72281440
0.9	2.7	1.1	0.3	0.82418238	1.62317129	2.54576836
1.3	2.7	1.1	0.3	0.73558445	1.50143753	2.35701918
0.1	3.1	1.1	0.3	0.97772778	1.94917356	2.90524709
0.5	3.1	1.1	0.3	0.84841955	1.64239589	2.43179361
0.9	3.1	1.1	0.3	0.74899084	1.46670282	2.26772285
1.3	3.1	1.1	0.3	0.67444306	1.35802263	2.13282752
0.1	1.1	1.5	0.3	2.46192351	4.63517046	6.71539620
0.5	1.1	1.5	0.3	1.66845681	3.62357351	5.90426098
0.9	1.1	1.5	0.3	1.38217974	3.16417346	4.25217398
1.3	1.1	1.5	0.3	1.21046218	2.56169281	3.67976782
0.1	1.5	1.5	0.3	1.88718810	3.66618185	5.29062615
0.5	1.5	1.5	0.3	1.37543913	2.84809652	4.58072163
0.9	1.5	1.5	0.3	1.15407550	2.57628532	3.80434387
1.3	1.5	1.5	0.3	1.02127976	2.26565759	3.09499462
0.1	1.9	1.5	0.3	1.52549041	3.00537551	4.39405311
0.5	1.9	1.5	0.3	1.17205349	2.37360564	3.73376564
0.9	1.9	1.5	0.3	0.99617804	2.16094003	3.37881900
1.3	1.9	1.5	0.3	0.88809671	1.97525111	2.79555125
0.1	2.3	1.5	0.3	1.27887652	2.53576767	3.74452743
0.5	2.3	1.5	0.3	1.02131160	2.04738887	3.16671741
0.9	2.3	1.5	0.3	0.87879580	1.86638997	2.94787298
1.3	2.3	1.5	0.3	0.78837143	1.73310138	2.57564991
0.1	2.7	1.5	0.3	1.10046156	2.18911846	3.25151201
0.5	2.7	1.5	0.3	0.90482219	1.80579803	2.76050775
0.9	2.7	1.5	0.3	0.78739710	1.64744815	2.59156077
1.3	2.7	1.5	0.3	0.71038060	1.54089178	2.36356615
0.1	3.1	1.5	0.3	0.96555253	1.92422062	2.86765704
0.5	3.1	1.5	0.3	0.81205256	1.61782074	2.45389151
0.9	3.1	1.5	0.3	0.71387489	1.47782513	2.30952262
1.3	3.1	1.5	0.3	0.64741185	1.38756492	2.15739264
0.1	1.1	1.9	0.3	2.39101543	4.58415764	6.78066646
0.5	1.1	1.9	0.3	1.63703357	3.70612140	5.93735366
0.9	1.1	1.9	0.3	1.38812052	3.20288613	4.25519789
1.3	1.1	1.9	0.3	1.23613948	2.54254915	3.74483501
0.1	1.5	1.9	0.3	1.84357652	3.60274947	5.28139498
0.5	1.5	1.9	0.3	1.33360087	2.89307385	4.64507814
0.9	1.5	1.9	0.3	1.13949498	2.63287531	3.77640505
1.3	1.5	1.9	0.3	1.02471262	2.28488014	3.10024692
0.1	1.9	1.9	0.3	1.49655825	2.95442978	4.35365214
0.5	1.9	1.9	0.3	1.13054420	2.39139569	3.78701464
0.9	1.9	1.9	0.3	0.97299944	2.20413149	3.38966534
1.3	1.9	1.9	0.3	0.87960172	2.01321344	2.77201400
0.1	2.3	1.9	0.3	1.25840641	2.49716550	3.70071136
0.5	2.3	1.9	0.3	0.98347322	2.04764241	3.20530580

A1	A2	B	AC	W1	W2	W3
0.9	2.3	1.9	0.3	0.85254397	1.89466291	2.98225483
1.3	2.3	1.9	0.3	0.77360900	1.76920208	2.55969516
0.1	2.7	1.9	0.3	1.08525029	2.15959114	3.21298256
0.5	2.7	1.9	0.3	0.87136713	1.79543895	2.78576749
0.9	2.7	1.9	0.3	0.76071255	1.66372453	2.62744773
1.3	2.7	1.9	0.3	0.69247916	1.56929047	2.36883629
0.1	3.1	1.9	0.3	0.95381647	1.90112393	2.83554649
0.5	3.1	1.9	0.3	0.78277718	1.60144437	2.46816900
0.9	3.1	1.9	0.3	0.68801758	1.48512348	2.34048059
1.3	3.1	1.9	0.3	0.62814107	1.40804430	2.17754010
0.1	1.1	2.3	0.3	2.32939289	4.54611265	6.82887910
0.5	1.1	2.3	0.3	1.61303434	3.77075927	5.96551235
0.9	1.1	2.3	0.3	1.39270118	3.23360011	4.25770348
1.3	1.1	2.3	0.3	1.25636329	2.52803826	3.79672991
0.1	1.5	2.3	0.3	1.80399416	3.55255645	5.27483267
0.5	1.5	2.3	0.3	1.30157262	2.92627394	4.69875118
0.9	1.5	2.3	0.3	1.12845368	2.67818476	3.75407544
1.3	1.5	2.3	0.3	1.02734379	2.29982780	3.10444997
0.1	1.9	2.3	0.3	1.46962536	2.91162145	4.32392023
0.5	1.9	2.3	0.3	1.09830543	2.40412000	3.82852202
0.9	1.9	2.3	0.3	0.95552235	2.23708456	3.39864071
1.3	1.9	2.3	0.3	0.87318711	2.04369715	2.75310647
0.1	2.3	2.3	0.3	1.23904861	2.46330133	3.66657208
0.5	2.3	2.3	0.3	0.95352609	2.04782161	3.23386873
0.9	2.3	2.3	0.3	0.83267676	1.91542608	3.01107408
1.3	2.3	2.3	0.3	0.76252859	1.79746898	2.54697345
0.1	2.7	2.3	0.3	1.07071417	2.13291843	3.18137055
0.5	2.7	2.3	0.3	0.84436705	1.78810954	2.80380441
0.9	2.7	2.3	0.3	0.74035372	1.67538628	2.65622830
1.3	2.7	2.3	0.3	0.67904609	1.59074826	2.37316517
0.1	3.1	2.3	0.3	0.94251831	1.87983356	2.80812590
0.5	3.1	2.3	0.3	0.75870824	1.58975238	2.47813546
0.9	3.1	2.3	0.3	0.66808341	1.49027838	2.36420658
1.3	3.1	2.3	0.3	0.61363144	1.42307712	2.19437561
0.1	1.1	2.7	0.3	2.27535308	4.51662486	6.86588194
0.5	1.1	2.7	0.3	1.59406382	3.82269211	5.98968540
0.9	1.1	2.7	0.3	1.39633996	3.25851762	4.25981212
1.3	1.1	2.7	0.3	1.27271088	2.51661706	3.83917207
0.1	1.5	2.7	0.3	1.76798640	3.51191695	5.26992774
0.5	1.5	2.7	0.3	1.27617434	2.95175474	4.74400522
0.9	1.5	2.7	0.3	1.11979215	2.71539385	3.73565146
1.3	1.5	2.7	0.3	1.02942441	2.31176834	3.10788620
0.1	1.9	2.7	0.3	1.44455370	2.87531661	4.30116097
0.5	1.9	2.7	0.3	1.07245398	2.41366741	3.86161101
0.9	1.9	2.7	0.3	0.94184003	2.26305606	3.40618035
1.3	1.9	2.7	0.3	0.86816822	2.06882702	2.73743473
0.1	2.3	2.7	0.3	1.22075662	2.43353143	3.63935692
0.5	2.3	2.7	0.3	0.92917321	2.04795499	3.25577596
0.9	2.3	2.7	0.3	0.81706967	1.93130790	3.03558849
1.3	2.3	2.7	0.3	0.75389030	1.82027546	2.53653191
0.1	2.7	2.7	0.3	1.05683677	2.10885151	3.15516031
0.5	2.7	2.7	0.3	0.82208802	1.78264994	2.81729699
0.9	2.7	2.7	0.3	0.72425892	1.68414655	2.67977459
1.3	2.7	2.7	0.3	0.66856837	1.60754382	2.37678170
0.1	3.1	2.7	0.3	0.93165251	1.86025644	2.78463709

A1	A2	B	AC	W1	W2	W3
0.5	3.1	2.7	0.3	0.73856570	1.58098922	2.48547966
0.9	3.1	2.7	0.3	0.65220069	1.49411210	2.38290602
1.3	3.1	2.7	0.3	0.60228045	1.43457684	2.20867206
0.1	1.1	0.3	0.7	2.69941188	3.81093895	5.81834151
0.5	1.1	0.3	0.7	1.49981750	2.99020371	5.74753833
0.9	1.1	0.3	0.7	1.09978894	2.92674498	3.89941470
1.3	1.1	0.3	0.7	0.89653995	2.65174296	3.06795144
0.1	1.5	0.3	0.7	2.03603472	3.55078082	4.39323503
0.5	1.5	0.3	0.7	1.41268164	2.26863854	6.28318526
0.9	1.5	0.3	0.7	1.04462741	2.19537088	3.82905835
1.3	1.5	0.3	0.7	0.84968436	2.14213613	2.80670488
0.1	1.9	0.3	0.7	1.62178111	3.13564190	3.82833688
0.5	1.9	0.3	0.7	1.30786968	1.89490276	3.37044509
0.9	1.9	0.3	0.7	0.99681339	1.77555001	3.32454329
1.3	1.9	0.3	0.7	0.81407803	1.73107737	2.75774416
0.1	2.3	0.3	0.7	1.34568404	2.66031383	3.60025012
0.5	2.3	0.3	0.7	1.18144988	1.69961852	2.80392661
0.9	2.3	0.3	0.7	0.94791710	1.51373322	2.77167429
1.3	2.3	0.3	0.7	0.78260338	1.46018509	2.64302995
0.1	2.7	0.3	0.7	1.14941823	2.28608476	3.31507003
0.5	2.7	0.3	0.7	1.05369261	1.59065269	2.41079564
0.9	2.7	0.3	0.7	0.89395219	1.34459378	3.49065850
1.3	2.7	0.3	0.7	0.75180782	1.27387729	2.33697082
0.1	3.1	0.3	0.7	1.00294178	1.99952108	2.96149804
0.5	3.1	0.3	0.7	0.94071041	1.51562480	2.12715923
0.9	3.1	0.3	0.7	0.83496159	1.23400034	2.08104165
1.3	3.1	0.3	0.7	0.71977989	1.14191954	2.05515878
0.1	1.1	0.7	0.7	2.55536279	3.90751228	5.94412099
0.5	1.1	0.7	0.7	1.48743588	3.13683130	5.79098866
0.9	1.1	0.7	0.7	1.15352046	3.00467250	3.92127620
1.3	1.1	0.7	0.7	0.97862586	2.59635446	3.21746198
0.1	1.5	0.7	0.7	1.96769976	3.45641268	4.55429083
0.5	1.5	0.7	0.7	1.33858323	2.42012022	6.28318530
0.9	1.5	0.7	0.7	1.04512020	2.30320974	3.78652110
1.3	1.5	0.7	0.7	0.88534894	2.19028110	2.83730895
0.1	1.9	0.7	0.7	1.58248453	3.01124677	3.91189297
0.5	1.9	0.7	0.7	1.20457406	2.03126374	3.44706139
0.9	1.9	0.7	0.7	0.96022946	1.88969566	3.34416157
1.3	1.9	0.7	0.7	0.81665123	1.81124538	2.73440995
0.1	2.3	0.7	0.7	1.32002056	2.58374141	3.54622614
0.5	2.3	0.7	0.7	1.08084158	1.79595425	2.88591932
0.9	2.3	0.7	0.7	0.88670086	1.62551377	2.81952717
1.3	2.3	0.7	0.7	0.76042947	1.54935358	2.60135654
0.1	2.7	0.7	0.7	1.13126795	2.23726184	3.21361035
0.5	2.7	0.7	0.7	0.97031498	1.63721161	2.49731964
0.9	2.7	0.7	0.7	0.82016250	1.44539060	2.43169173
1.3	2.7	0.7	0.7	0.71147944	1.36449914	2.34744365
0.1	3.1	0.7	0.7	0.98939252	1.96564189	2.88579363
0.5	3.1	0.7	0.7	0.87471928	1.51704572	2.21616151
0.9	3.1	0.7	0.7	0.75928842	1.31580838	2.14222085
1.3	3.1	0.7	0.7	0.66736981	1.22892472	2.08784237
0.1	1.1	1.1	0.7	2.44859164	3.97070920	6.05316836
0.5	1.1	1.1	0.7	1.47873607	3.25600439	5.83009122
0.9	1.1	1.1	0.7	1.19245934	3.06741835	3.94199767
1.3	1.1	1.1	0.7	1.03846295	2.56511488	3.32821050

A1	A2	B	AC	W1	W2	W3
0.1	1.5	1.1	0.7	1.90841661	3.39939508	4.66281859
0.5	1.5	1.1	0.7	1.29172329	2.52677725	6.28318530
0.9	1.5	1.1	0.7	1.04545449	2.38886864	3.75736310
1.3	1.5	1.1	0.7	0.91028136	2.22582785	2.86438120
0.1	1.9	1.1	0.7	1.54640225	2.92998027	3.95908499
0.5	1.9	1.1	0.7	1.14316223	2.11464862	3.51413499
0.9	1.9	1.1	0.7	0.93714069	1.97234032	3.36021132
1.3	1.9	1.1	0.7	0.81835686	1.87300758	2.71668341
0.1	2.3	1.1	0.7	1.29584359	2.52310908	3.51693298
0.5	2.3	1.1	0.7	1.01947935	1.85000294	2.95299669
0.9	2.3	1.1	0.7	0.85034906	1.69837440	2.86155477
1.3	2.3	1.1	0.7	0.74653306	1.61414639	2.57632412
0.1	2.7	1.1	0.7	1.11392666	2.19477377	3.15400228
0.5	2.7	1.1	0.7	0.91548292	1.66222488	2.56201952
0.9	2.7	1.1	0.7	0.77769969	1.50508413	2.47987798
1.3	2.7	1.1	0.7	0.68745429	1.42538412	2.35565469
0.1	3.1	1.1	0.7	0.97633329	1.93478155	2.83142229
0.5	3.1	1.1	0.7	0.82787421	1.51778489	2.27572950
0.9	3.1	1.1	0.7	0.71547302	1.36084744	2.19185699
1.3	3.1	1.1	0.7	0.63728103	1.28288146	2.11544646
0.1	1.1	1.5	0.7	2.36406851	4.01567212	6.14761145
0.5	1.1	1.5	0.7	1.47227635	3.35458213	5.86513221
0.9	1.1	1.5	0.7	1.22190307	3.11827683	3.96142793
1.3	1.1	1.5	0.7	1.08413925	2.54407152	3.41688362
0.1	1.5	1.5	0.7	1.85656002	3.36037570	4.74223787
0.5	1.5	1.5	0.7	1.25865563	2.60687375	4.43583984
0.9	1.5	1.5	0.7	1.04569614	2.45844390	3.73527734
1.3	1.5	1.5	0.7	0.92864715	2.25268702	2.88806311
0.1	1.9	1.5	0.7	1.51329511	2.87108612	3.98972693
0.5	1.9	1.5	0.7	1.10059944	2.17220241	3.57224596
0.9	1.9	1.5	0.7	0.92105801	2.03526191	3.37345258
1.3	1.9	1.5	0.7	0.81956977	1.92201175	2.70248194
0.1	2.3	1.5	0.7	1.27311499	2.47411495	3.49837562
0.5	2.3	1.5	0.7	0.97628786	1.88513264	3.00765576
0.9	2.3	1.5	0.7	0.82560325	1.75030253	2.89832392
1.3	2.3	1.5	0.7	0.73693786	1.66363831	2.55861821
0.1	2.7	1.5	0.7	1.09739340	2.15789182	3.11392796
0.5	2.7	1.5	0.7	0.87555118	1.67787656	2.61118118
0.9	2.7	1.5	0.7	0.74899717	1.54524287	2.52071986
1.3	2.7	1.5	0.7	0.67120928	1.46958716	2.36222136
0.1	3.1	1.5	0.7	0.96376989	1.90686696	2.79074644
0.5	3.1	1.5	0.7	0.79242140	1.51823797	2.31778710
0.9	3.1	1.5	0.7	0.68565293	1.38977131	2.23205106
1.3	3.1	1.5	0.7	0.61716815	1.32016706	2.13883902
0.1	1.1	1.9	0.7	2.29457109	4.04937664	6.22955542
0.5	1.1	1.9	0.7	1.46728517	3.43727844	5.89645781
0.9	1.1	1.9	0.7	1.24490835	3.15986249	3.97950216
1.3	1.1	1.9	0.7	1.12019037	2.52865498	3.49026392
0.1	1.5	1.9	0.7	1.81083068	3.33178617	4.80302639
0.5	1.5	1.9	0.7	1.23382770	2.66931301	4.48836960
0.9	1.5	1.9	0.7	1.04587895	2.51601470	3.71761666
1.3	1.5	1.9	0.7	0.94271713	2.27345992	2.90869186
0.1	1.9	1.9	0.7	1.48290031	2.82601866	4.01125933
0.5	1.9	1.9	0.7	1.06884291	2.21444499	3.62241015
0.9	1.9	1.9	0.7	0.90915211	2.08477435	3.38448466

A1	A2	B	AC	W1	W2	W3
1.3	1.9	1.9	0.7	0.82047629	1.96184359	2.69070204
0.1	2.3	1.9	0.7	1.25177297	2.43380922	3.48553612
0.5	2.3	1.9	0.7	0.94369975	1.90983069	3.05239669
0.9	2.3	1.9	0.7	0.80748026	1.78922517	2.93051477
1.3	2.3	1.9	0.7	0.72989156	1.70276474	2.54510707
0.1	2.7	1.9	0.7	1.08165410	2.12582207	3.08501651
0.5	2.7	1.9	0.7	0.84479327	1.68858920	2.64929121
0.9	2.7	1.9	0.7	0.72800431	1.57413920	2.55538779
1.3	2.7	1.9	0.7	0.65940511	1.50320984	2.36756941
0.1	3.1	1.9	0.7	0.95170103	1.88170380	2.75932436
0.5	3.1	1.9	0.7	0.76445491	1.51854411	2.34874668
0.9	3.1	1.9	0.7	0.66371621	1.40992506	2.26481959
1.3	3.1	1.9	0.7	0.60261819	1.34751931	2.15880117
0.1	1.1	2.3	0.7	2.23596105	4.07559602	6.30089562
0.5	1.1	2.3	0.7	1.46331048	3.50747902	5.92443580
0.9	1.1	2.3	0.7	1.26335721	3.19419780	3.99622123
1.3	1.1	2.3	0.7	1.14938393	2.51676757	3.55221462
0.1	1.5	2.3	0.7	1.77019921	3.30987097	4.85100957
0.5	1.5	2.3	0.7	1.21440200	2.71929082	4.53578926
0.9	1.5	2.3	0.7	1.04602209	2.56440830	3.70299475
1.3	1.5	2.3	0.7	0.95382966	2.28987871	2.92666318
0.1	1.9	2.3	0.7	1.45495673	2.79028636	4.02721821
0.5	1.9	2.3	0.7	1.04404242	2.24674695	3.66573649
0.9	1.9	2.3	0.7	0.89995862	2.12470779	3.39377025
1.3	1.9	2.3	0.7	0.82117939	1.99487564	2.68068600
0.1	2.3	2.3	0.7	1.23174219	2.40013583	3.47611769
0.5	2.3	2.3	0.7	0.91802684	1.92812999	3.08932456
0.9	2.3	2.3	0.7	0.79356380	1.81944402	2.95879006
1.3	2.3	2.3	0.7	0.72448846	1.73450959	2.53431625
0.1	2.7	2.3	0.7	1.06668552	2.09782986	3.06316279
0.5	2.7	2.3	0.7	0.82021181	1.69637758	2.67943095
0.9	2.7	2.3	0.7	0.71187486	1.59589877	2.58496357
1.3	2.7	2.3	0.7	0.65040736	1.52964477	2.37199624
0.1	3.1	2.3	0.7	0.94011991	1.85904462	2.73441447
0.5	3.1	2.3	0.7	0.74173212	1.51876480	2.37232401
0.9	3.1	2.3	0.7	0.64677992	1.42475411	2.29180723
1.3	3.1	2.3	0.7	0.59154683	1.36842446	2.17597927
0.1	1.1	2.7	0.7	2.18561208	4.09657511	6.36326732
0.5	1.1	2.7	0.7	1.46006924	3.56768887	5.94942941
0.9	1.1	2.7	0.7	1.27846880	3.22283080	4.01163099
1.3	1.1	2.7	0.7	1.17351284	2.50727310	3.60527423
0.1	1.5	2.7	0.7	1.73384814	3.29251222	4.88978527
0.5	1.5	2.7	0.7	1.19874225	2.76012592	4.57856978
0.9	1.5	2.7	0.7	1.04613720	2.60564119	3.69058874
1.3	1.5	2.7	0.7	0.96282257	2.30311270	2.94236134
0.1	1.9	2.7	0.7	1.42921821	2.76121583	4.03951568
0.5	1.9	2.7	0.7	1.02404820	2.27221388	3.70326688
0.9	1.9	2.7	0.7	0.89263428	2.15755457	3.40166408
1.3	1.9	2.7	0.7	0.82174058	2.02273389	2.67200973
0.1	2.3	2.7	0.7	1.21294079	2.37162744	3.46891195
0.5	2.3	2.7	0.7	0.89718165	1.94221944	3.12010352
0.9	2.3	2.7	0.7	0.78251009	1.84354534	2.98374168
1.3	2.3	2.7	0.7	0.72020964	1.76080058	2.52542727
0.1	2.7	2.7	0.7	1.05245815	2.07327882	3.04607041
0.5	2.7	2.7	0.7	0.80003677	1.70229271	2.70371526

A1	A2	B	AC	W1	W2	W3
0.9	2.7	2.7	0.7	0.69904711	1.61284899	2.61036317
1.3	2.7	2.7	0.7	0.64330734	1.55096271	2.37571345
0.1	3.1	2.7	0.7	0.92901556	1.83862947	2.71424057
0.5	3.1	2.7	0.7	0.72285203	1.51893145	2.39079071
0.9	3.1	2.7	0.7	0.63325548	1.43610889	2.31428321
1.3	3.1	2.7	0.7	0.58281538	1.38490240	2.19089018
0.1	1.1	0.3	1.1	2.57904480	3.26053382	5.76862895
0.5	1.1	0.3	1.1	1.27451210	2.94266482	5.73952316
0.9	1.1	0.3	1.1	0.94959746	2.91110784	3.76612420
1.3	1.1	0.3	1.1	0.78687009	2.60780714	2.98090512
0.1	1.5	0.3	1.1	2.01959160	2.99905043	4.26851456
0.5	1.5	0.3	1.1	1.22297514	2.19835564	6.28318530
0.9	1.5	0.3	1.1	0.90895116	2.16604753	3.73475746
1.3	1.5	0.3	1.1	0.74897186	2.13471924	4.22362019
0.1	1.9	0.3	1.1	1.61723323	2.85722663	3.45671276
0.5	1.9	0.3	1.1	1.16826923	1.78658940	3.34854395
0.9	1.9	0.3	1.1	0.87664992	1.73585306	3.32240321
1.3	1.9	0.3	1.1	0.72167049	1.71272666	2.66143353
0.1	2.3	0.3	1.1	1.34388823	2.59402982	3.09329479
0.5	2.3	0.3	1.1	1.09865620	1.54708190	2.77709491
0.9	2.3	0.3	1.1	0.84613119	1.46125704	2.76184406
1.3	2.3	0.3	1.1	0.69886945	1.43466673	2.60935468
0.1	2.7	0.3	1.1	1.14855587	2.26727011	2.95402214
0.5	2.7	0.3	1.1	1.01196397	1.41148168	2.37701758
0.9	2.7	0.3	1.1	0.81373114	1.27630474	3.49065850
1.3	2.7	0.3	1.1	0.67770570	1.24128719	2.33627835
0.1	3.1	0.3	1.1	1.00247286	1.99193964	2.81589086
0.5	3.1	0.3	1.1	0.91997048	1.33343534	2.08297645
0.9	3.1	0.3	1.1	0.77717727	1.14928848	2.06437587
1.3	3.1	0.3	1.1	0.65649317	1.10145554	2.04988522
0.1	1.1	0.7	1.1	2.42666189	3.42630345	5.84067615
0.5	1.1	0.7	1.1	1.29528476	3.04587109	5.77429774
0.9	1.1	0.7	1.1	1.01417996	2.97592055	3.78181078
1.3	1.1	0.7	1.1	0.87175694	2.56929272	3.09635987
0.1	1.5	0.7	1.1	1.93947131	3.02515627	4.36088953
0.5	1.5	0.7	1.1	1.19428109	2.30909362	6.28318530
0.9	1.5	0.7	1.1	0.93081772	2.24914062	3.71444264
1.3	1.5	0.7	1.1	0.79486939	2.17845189	2.71347256
0.1	1.9	0.7	1.1	1.57350598	2.77946093	3.57472816
0.5	1.9	0.7	1.1	1.10446880	1.90103042	3.40108090
0.9	1.9	0.7	1.1	0.86767946	1.82446292	3.34032608
1.3	1.9	0.7	1.1	0.73989586	1.77920414	2.65265723
0.1	2.3	0.7	1.1	1.31627722	2.49778845	3.17067848
0.5	2.3	0.7	1.1	1.01682678	1.65364601	2.83277185
0.9	2.3	0.7	1.1	0.81370878	1.55225967	2.79930695
1.3	2.3	0.7	1.1	0.69582329	1.50776676	2.57721417
0.1	2.7	0.7	1.1	1.12941991	2.20453496	2.94234590
0.5	2.7	0.7	1.1	0.93125836	1.49417639	2.43601787
0.9	2.7	0.7	1.1	0.76434555	1.36634940	3.49065850
1.3	2.7	0.7	1.1	0.65781771	1.31705814	2.34630456
0.1	3.1	0.7	1.1	0.98837082	1.95080970	2.74385869
0.5	3.1	0.7	1.1	0.85097969	1.38371148	2.14549851
0.9	3.1	0.7	1.1	0.71776851	1.23363635	2.10980833
1.3	3.1	0.7	1.1	0.62349107	1.17751767	2.07765837
0.1	1.1	1.1	1.1	2.32524898	3.53711971	5.90852306

A1	A2	B	AC	W1	W2	W3
0.5	1.1	1.1	1.1	1.31121196	3.13673872	5.80682222
0.9	1.1	1.1	1.1	1.06370920	3.03179444	3.79773432
1.3	1.1	1.1	1.1	0.93626671	2.54580129	3.18866205
0.1	1.5	1.1	1.1	1.87435181	3.04318972	4.43985439
0.5	1.5	1.1	1.1	1.17401784	2.39782501	6.28318530
0.9	1.5	1.1	1.1	0.94683849	2.32026821	3.69847744
1.3	1.5	1.1	1.1	0.82876808	2.21291762	2.73817630
0.1	1.9	1.1	1.1	1.53438131	2.73066225	3.65581473
0.5	1.9	1.1	1.1	1.06330204	1.98223478	3.44987846
0.9	1.9	1.1	1.1	0.86147738	1.89549787	3.35555551
1.3	1.9	1.1	1.1	0.75282962	1.83422953	2.64515393
0.1	2.3	1.1	1.1	1.29058557	2.43434099	3.21696270
0.5	2.3	1.1	1.1	0.96684420	1.72101987	2.88273116
0.9	2.3	1.1	1.1	0.79265113	1.61943906	2.83373102
1.3	2.3	1.1	1.1	0.69376007	1.56566330	2.55733088
0.1	2.7	1.1	1.1	1.11126180	2.15519402	2.93548416
0.5	2.7	1.1	1.1	0.88116065	1.54295188	2.48654400
0.9	2.7	1.1	1.1	0.73401185	1.42714295	
1.3	2.7	1.1	1.1	0.64499109	1.37343070	2.35436184
0.1	3.1	1.1	1.1	0.97483578	1.91519984	2.70273657
0.5	3.1	1.1	1.1	0.80533083	1.41246699	2.19584096
0.9	3.1	1.1	1.1	0.68254219	1.28602102	2.14975281
1.3	3.1	1.1	1.1	0.60316579	1.23028786	2.10221377
0.1	1.1	1.5	1.1	2.24832086	3.62043623	5.97209067
0.5	1.1	1.5	1.1	1.32378654	3.21701755	5.83710652
0.9	1.1	1.5	1.1	1.10287610	3.07984412	3.81373574
1.3	1.1	1.5	1.1	0.98718700	2.52932810	3.26673233
0.1	1.5	1.5	1.1	1.81975181	3.05639925	4.50773220
0.5	1.5	1.5	1.1	1.15883284	2.47068528	6.28318530
0.9	1.5	1.5	1.1	0.95904878	2.38155112	3.68537960
1.3	1.5	1.5	1.1	0.85478905	2.24021069	2.76176515
0.1	1.9	1.5	1.1	1.49922447	2.69622500	3.71641799
0.5	1.9	1.5	1.1	1.03370549	2.04390243	3.49478817
0.9	1.9	1.5	1.1	0.85692270	1.95362579	3.36850534
1.3	1.9	1.5	1.1	0.76245797	1.88029619	2.63861940
0.1	2.3	1.5	1.1	1.26669597	2.38768848	3.24838400
0.5	2.3	1.5	1.1	0.93149124	1.76881839	2.92709390
0.9	2.3	1.5	1.1	0.77767036	1.67135041	2.86517040
1.3	2.3	1.5	1.1	0.69226882	1.61259064	2.54299941
0.1	2.7	1.5	1.1	1.09405927	2.11526125	2.93096173
0.5	2.7	1.5	1.1	0.84533213	1.57587913	2.52947650
0.9	2.7	1.5	1.1	0.71290002	1.47157676	2.47711530
1.3	2.7	1.5	1.1	0.63595504	1.41714253	2.36091762
0.1	3.1	1.5	1.1	0.96186652	1.88431370	2.67533694
0.5	3.1	1.5	1.1	0.77173900	1.43124394	2.23645475
0.9	3.1	1.5	1.1	0.65826175	1.32245355	2.18451878
1.3	3.1	1.5	1.1	0.58912710	1.26938429	2.12385946
0.1	1.1	1.9	1.1	2.18643398	3.68643281	6.03143229
0.5	1.1	1.9	1.1	1.33395275	3.28821797	5.86519991
0.9	1.1	1.9	1.1	1.13459733	3.12114406	3.82966191
1.3	1.1	1.9	1.1	1.02848941	2.51692777	3.33437536
0.1	1.5	1.9	1.1	1.77297985	3.06649161	4.56642478
0.5	1.5	1.9	1.1	1.14698320	2.53154506	6.28318529
0.9	1.5	1.9	1.1	0.96864762	2.43472568	3.67432168
1.3	1.5	1.9	1.1	0.87536553	2.26201540	2.78393728

A1	A2	B	AC	W1	W2	W3
0.1	1.9	1.9	1.1	1.46748678	2.67036052	3.76372376
0.5	1.9	1.9	1.1	1.01112560	2.09250721	3.53586693
0.9	1.9	1.9	1.1	0.85343164	2.00196510	3.37955095
1.3	1.9	1.9	1.1	0.76989239	1.91930413	2.63284644
0.1	2.3	1.9	1.1	1.24447759	2.35146954	3.27121497
0.5	2.3	1.9	1.1	0.90467999	1.80469325	2.96627936
0.9	2.3	1.9	1.1	0.76639756	1.71265539	2.89378878
1.3	2.3	1.9	1.1	0.69114014	1.65134575	2.53190380
0.1	2.7	1.9	1.1	1.07777762	2.08224376	2.92775497
0.5	2.7	1.9	1.1	0.81793053	1.59969442	2.56592270
0.9	2.7	1.9	1.1	0.69718127	1.50552335	2.50790993
1.3	2.7	1.9	1.1	0.62921908	1.45201282	2.36632107
0.1	3.1	1.9	1.1	0.94945435	1.85740930	2.65562289
0.5	3.1	1.9	1.1	0.74559840	1.44447982	2.26948469
0.9	3.1	1.9	1.1	0.64024014	1.34932147	2.21466864
1.3	3.1	1.9	1.1	0.57876786	1.29952554	2.14294750
0.1	1.1	2.3	1.1	2.13488953	3.74036603	6.08669115
0.5	1.1	2.3	1.1	1.34233445	3.35162289	5.89118214
0.9	1.1	2.3	1.1	1.16078994	3.15667696	3.84537414
1.3	1.1	2.3	1.1	1.06269807	2.50716902	3.39379958
0.1	1.5	2.3	1.1	1.73227146	3.07445256	4.61747595
0.5	1.5	2.3	1.1	1.13745692	2.58306142	
0.9	1.5	2.3	1.1	0.97638350	2.48119070	3.66479106
1.3	1.5	2.3	1.1	0.89202744	2.27962876	2.80454893
0.1	1.9	2.3	1.1	1.43870338	2.65013066	3.80172157
0.5	1.9	2.3	1.1	0.99321618	2.13180069	3.57330024
0.9	1.9	2.3	1.1	0.85066860	2.04270684	3.38901621
1.3	1.9	2.3	1.1	0.77580003	1.95269298	2.62768744
0.1	2.3	2.3	1.1	1.22379722	2.32236865	3.28857232
0.5	2.3	2.3	1.1	0.88345650	1.83262657	3.00082969
0.9	2.3	2.3	1.1	0.75757844	1.74624454	2.91980605
1.3	2.3	2.3	1.1	0.69025591	1.68385715	2.52293639
0.1	2.7	2.3	1.1	1.06237453	2.05448109	2.92536216
0.5	2.7	2.3	1.1	0.79609245	1.61772299	2.59695258
0.9	2.7	2.3	1.1	0.68495330	1.53226958	2.53535068
1.3	2.7	2.3	1.1	0.62399322	1.48044090	2.37083098
0.1	3.1	2.3	1.1	0.93758529	1.83384821	2.64072221
0.5	3.1	2.3	1.1	0.72451176	1.45430837	2.29662904
0.9	3.1	2.3	1.1	0.62623068	1.36993389	2.24082504
1.3	3.1	2.3	1.1	0.57077748	1.32343881	2.15982150
0.1	1.1	2.7	1.1	2.09094330	3.78540242	6.13806692
0.5	1.1	2.7	1.1	1.34935913	3.40831512	5.91515497
0.9	1.1	2.7	1.1	1.18276758	3.18731300	3.86075395
1.3	1.1	2.7	1.1	1.09151014	2.49924704	3.44649821
0.1	1.5	2.7	1.1	1.69639890	3.08089186	4.66213812
0.5	1.5	2.7	1.1	1.12962044	2.62715200	4.48262491
0.9	1.5	2.7	1.1	0.98274611	2.52206887	3.65644688
1.3	1.5	2.7	1.1	0.90578412	2.29402750	2.82357135
0.1	1.9	2.7	1.1	1.41248339	2.63383820	3.83289938
0.5	1.9	2.7	1.1	0.97860869	2.16418768	3.60734415
0.9	1.9	2.7	1.1	0.84842635	2.07744293	3.39717241
1.3	1.9	2.7	1.1	0.78060420	1.98155837	2.62303351
0.1	2.3	2.7	1.1	1.20452570	2.29840853	3.30221422
0.5	2.3	2.7	1.1	0.86614926	1.85497541	3.03130845
0.9	2.3	2.7	1.1	0.75047669	1.77404046	2.94346259

A1	A2	B	AC	W1	W2	W3
1.3	2.3	2.7	1.1	0.68954437	1.71149793	2.51547469
0.1	2.7	2.7	1.1	1.04780349	2.03081473	2.92350810
0.5	2.7	2.7	1.1	0.77818347	1.63183642	2.62350263
0.9	2.7	2.7	1.1	0.67513764	1.55384840	2.55981746
1.3	2.7	2.7	1.1	0.61981570	1.50402841	2.37463960
0.1	3.1	2.7	1.1	0.92624153	1.81309852	2.62905455
0.5	3.1	2.7	1.1	0.70706066	1.46189146	2.31918600
0.9	3.1	2.7	1.1	0.61498148	1.38622291	2.26357858
1.3	3.1	2.7	1.1	0.56441251	1.34284127	2.17479293
0.1	1.1	0.3	1.5		3.04857706	5.75046944
0.5	1.1	0.3	1.5	1.12570682	2.91978420	5.73442090
0.9	1.1	0.3	1.5	0.84693314	2.90099452	3.69711614
1.3	1.1	0.3	1.5	0.70866719	2.57460670	2.94146561
0.1	1.5	0.3	1.5	1.99317740	2.64533362	4.23703409
0.5	1.5	0.3	1.5	1.08874308	2.16757992	6.28318529
0.9	1.5	0.3	1.5	0.81400776	2.14973774	3.67934245
1.3	1.5	0.3	1.5	0.67633513	2.12918069	2.62291524
0.1	1.9	0.3	1.5	1.61129122	2.54211580	3.37765693
0.5	1.9	0.3	1.5	1.05382816	1.74180651	3.33783242
0.9	1.9	0.3	1.5	0.78929567	1.71520918	3.32070510
1.3	1.9	0.3	1.5	0.65383707	1.70122006	2.60587976
0.1	2.3	0.3	1.5	1.34175989	2.43577346	2.86949925
0.5	2.3	0.3	1.5	1.01267912	1.47938656	2.76472486
0.9	2.3	0.3	1.5	0.76737497	1.43520929	2.75586595
1.3	2.3	0.3	1.5	0.63577611	1.41972076	2.57845328
0.1	2.7	0.3	1.5	1.14758537	2.22650116	2.64130999
0.5	2.7	0.3	1.5		1.31689422	2.36246102
0.9	2.7	0.3	1.5	0.74540105	1.24291125	3.49065850
1.3	2.7	0.3	1.5	0.61969916	1.22298230	2.33566952
0.1	3.1	0.3	1.5	1.00196118	1.97921629	2.54897093
0.5	3.1	0.3	1.5	0.89149623	1.22059952	2.06534220
0.9	3.1	0.3	1.5	0.72137260	1.10641990	2.05547629
1.3	3.1	0.3	1.5	0.60420860	1.07925071	2.04623069
0.1	1.1	0.7	1.5	2.26877673	3.19735275	5.80040576
0.5	1.1	0.7	1.5	1.15971935	2.99858286	5.76323408
0.9	1.1	0.7	1.5	0.91432384	2.95583186	3.70796799
1.3	1.1	0.7	1.5	0.79247473	2.54779461	3.03173763
0.1	1.5	0.7	1.5	1.90102433	2.72407566	4.29726899
0.5	1.5	0.7	1.5	1.08310448	2.25220139	6.28318530
0.9	1.5	0.7	1.5	0.84558184	2.21658255	3.66810604
1.3	1.5	0.7	1.5	0.72632201	2.16876713	2.64215606
0.1	1.9	0.7	1.5	1.56239249	2.53145308	3.45592655
0.5	1.9	0.7	1.5	1.01775810	1.83225699	3.37756922
0.9	1.9	0.7	1.5	0.79506588	1.78622185	3.33711487
1.3	1.9	0.7	1.5	0.68006659	1.75730602	2.60202566
0.1	2.3	0.7	1.5	1.31194337	2.36158916	2.96538061
0.5	2.3	0.7	1.5	0.95409958	1.57251653	2.80640501
0.9	2.3	0.7	1.5	0.75285059	1.50911638	2.78646267
1.3	2.3	0.7	1.5	0.64368994	1.48065123	2.55577652
0.1	2.7	0.7	1.5	1.12736563	2.15029456	2.70108548
0.5	2.7	0.7	1.5	0.88917033	1.40384196	2.40628576
0.9	2.7	0.7	1.5	0.71460881	1.31856533	3.49065850
1.3	2.7	0.7	1.5	0.61276523	1.28644750	2.34526141
0.1	3.1	0.7	1.5	0.98726412	1.92862120	2.54532339
0.5	3.1	0.7	1.5	0.82403650	1.28999777	2.11162383

A1	A2	B	AC	W1	W2	W3
0.9	3.1	0.7	1.5	0.67829132	1.18179278	2.09125090
1.3	3.1	0.7	1.5	0.58504125	1.14408970	2.07021458
0.1	1.1	1.1	1.5	2.18765864	3.30503382	5.84863775
0.5	1.1	1.1	1.5	1.18709417	3.07070025	5.79074597
0.9	1.1	1.1	1.5	0.96781037	3.00506053	3.71926427
1.3	1.1	1.1	1.5	0.85794045	2.53006698	3.10797362
0.1	1.5	1.1	1.5	1.83202378	2.77939444	4.35286422
0.5	1.5	1.1	1.5	1.07882803	2.32483554	6.28318530
0.9	1.5	1.1	1.5	0.86985622	2.27624094	3.65858291
1.3	1.5	1.1	1.5	0.76462008	2.20154001	2.66190056
0.1	1.9	1.1	1.5	1.52010034	2.52394790	3.52062165
0.5	1.9	1.1	1.5	0.99246471	1.90316256	3.41542368
0.9	1.9	1.1	1.5	0.79930945	1.84663420	3.35147555
1.3	1.9	1.1	1.5	0.69956896	1.80587907	2.59852709
0.1	2.3	1.1	1.5	1.28461898	2.31464297	3.02976691
0.5	2.3	1.1	1.5	0.91615368	1.63800005	2.84529085
0.9	2.3	1.1	1.5	0.74272132	1.56817338	2.81527375
1.3	2.3	1.1	1.5	0.64935820	1.53164969	2.54062294
0.1	2.7	1.1	1.5	1.10833239	2.09830627	2.73807041
0.5	2.7	1.1	1.5	0.84603564	1.45939138	2.44605161
0.9	2.7	1.1	1.5	0.69431208	1.37471965	3.49065850
1.3	2.7	1.1	1.5	0.60800447	1.33701295	2.35314154
0.1	3.1	1.1	1.5	0.97322478	1.88822828	2.54307231
0.5	3.1	1.1	1.5	0.78138119	1.33204623	2.15210746
0.9	3.1	1.1	1.5	0.65130650	1.23350125	2.12400290
1.3	3.1	1.1	1.5	0.57245134	1.19285558	2.09205888
0.1	1.1	1.5	1.5	2.12534566	3.39049949	5.89506349
0.5	1.1	1.5	1.5	1.20955749	3.13669430	5.81692522
0.9	1.1	1.5	1.5	1.01135657	3.04907614	3.73094831
1.3	1.1	1.5	1.5	0.91084294	2.51709870	3.17485007
0.1	1.5	1.5	1.5	1.77658957	2.82125091	4.40400073
0.5	1.5	1.5	1.5	1.07546957	2.38776058	6.28318530
0.9	1.5	1.5	1.5	0.88905325	2.32955266	3.65034405
1.3	1.5	1.5	1.5	0.79490086	2.22857277	2.68176149
0.1	1.9	1.5	1.5	1.48302948	2.51837047	3.57503283
0.5	1.9	1.5	1.5	0.97347821	1.96070685	3.45124817
0.9	1.9	1.5	1.5	0.80255755	1.89845459	3.36400333
1.3	1.9	1.5	1.5	0.71459699	1.84811041	2.59532801
0.1	2.3	1.5	1.5	1.25953538	2.28093455	3.07762621
0.5	2.3	1.5	1.5	0.88861839	1.68772709	2.88125695
0.9	2.3	1.5	1.5	0.73521463	1.61646445	2.84225544
1.3	2.3	1.5	1.5	0.65361012	1.57478900	2.52929056
0.1	2.7	1.5	1.5	1.09043069	2.05919037	2.76373551
0.5	2.7	1.5	1.5	0.81510428	1.49926773	2.48178926
0.9	2.7	1.5	1.5	0.67968545	1.41839768	3.49065850
1.3	2.7	1.5	1.5	0.60452457	1.37819532	2.35965938
0.1	3.1	1.5	1.5	0.95983179	1.85508718	2.54154402
0.5	3.1	1.5	1.5	0.75044744	1.36103177	2.18723463
0.9	3.1	1.5	1.5	0.63224747	1.27182136	2.15369275
1.3	3.1	1.5	1.5	0.56345768	1.23099225	2.11185979
0.1	1.1	1.9	1.5	2.07482266	3.46125763	5.93962228
0.5	1.1	1.9	1.5	1.22829452	3.19712406	5.84175808
0.9	1.1	1.9	1.5	1.04751004	3.08831434	3.74295281
1.3	1.1	1.9	1.5	0.95462541	2.50706000	3.23456122
0.1	1.5	1.9	1.5	1.73030827	2.85428584	4.45094652

A1	A2	B	AC	W1	W2	W3
0.5	1.5	1.9	1.5	1.07276029	2.44269554	6.28318530
0.9	1.5	1.9	1.5	0.90458769	2.37730645	3.64310466
1.3	1.5	1.9	1.5	0.81943024	2.25087432	2.70139191
0.1	1.9	1.9	1.5	1.45018084	2.51405947	3.62138602
0.5	1.9	1.9	1.5	0.95859448	2.00843462	3.48497823
0.9	1.9	1.9	1.5	0.80512186	1.94325133	3.37492138
1.3	1.9	1.9	1.5	0.72650979	1.88501573	2.59238458
0.1	2.3	1.9	1.5	1.23645704	2.25518675	3.11497428
0.5	2.3	1.9	1.5	0.86741015	1.72702077	2.91432446
0.9	2.3	1.9	1.5	0.72941263	1.65662319	2.86742661
1.3	2.3	1.9	1.5	0.65691407	1.61164880	2.52030759
0.1	2.7	1.9	1.5	1.07359636	2.02826637	2.78269093
0.5	2.7	1.9	1.5	0.79137246	1.52951964	2.51373439
0.9	2.7	1.9	1.5	0.66855939	1.45336596	2.47552192
1.3	2.7	1.9	1.5	0.60186629	1.41231408	2.36509647
0.1	3.1	1.9	1.5	0.94706657	1.82734573	2.54043837
0.5	3.1	1.9	1.5	0.72651956	1.38234347	2.21763890
0.9	3.1	1.9	1.5	0.61789094	1.30143928	2.18044893
1.3	3.1	1.9	1.5	0.55667957	1.26160803	2.12976715
0.1	1.1	2.3	1.5	2.03249923	3.52131723	5.98228796
0.5	1.1	2.3	1.5	1.24414353	3.25252221	5.86524657
0.9	1.1	2.3	1.5	1.07800234	3.12322207	3.75520259
1.3	1.1	2.3	1.5	0.99152239	2.49899552	3.28842133
0.1	1.5	2.3	1.5	1.69069739	2.88111298	4.49401034
0.5	1.5	2.3	1.5	1.07052757	2.49097647	6.28318530
0.9	1.5	2.3	1.5	0.91739993	2.42020980	3.63666546
1.3	1.5	2.3	1.5	0.83969170	2.26933136	2.72051258
0.1	1.9	2.3	1.5	1.42081059	2.51062614	3.66128303
0.5	1.9	2.3	1.5	0.94656383	2.04864998	3.51661387
0.9	1.9	2.3	1.5	0.80719680	1.98225736	3.38444387
1.3	1.9	2.3	1.5	0.73617250	1.91744729	2.58966186
0.1	2.3	2.3	1.5	1.21517026	2.23474302	3.14502683
0.5	2.3	2.3	1.5	0.85043973	1.75889363	2.94461024
0.9	2.3	2.3	1.5	0.72478643	1.69047272	2.89084942
1.3	2.3	2.3	1.5	0.65955353	1.64343773	2.51292208
0.1	2.7	2.3	1.5	1.05776149	2.00304151	2.79728666
0.5	2.7	2.3	1.5	0.77239961	1.55329556	2.54222108
0.9	2.7	2.3	1.5	0.65977545	1.48195553	2.50019224
1.3	2.7	2.3	1.5	0.59976774	1.44098294	2.36967402
0.1	3.1	2.3	1.5	0.93490579	1.80376001	2.53960128
0.5	3.1	2.3	1.5	0.70726722	1.39868829	2.24397966
0.9	3.1	2.3	1.5	0.60661582	1.32500126	2.20448988
1.3	3.1	2.3	1.5	0.55137438	1.28668141	2.14595379
0.1	1.1	2.7	1.5	1.99624621	3.57316206	6.02306254
0.5	1.1	2.7	1.5	1.25771266	3.30338219	5.88740654
0.9	1.1	2.7	1.5	1.10405889	3.15423840	3.76761791
1.3	1.1	2.7	1.5	1.02306907	2.49234252	3.33733529
0.1	1.5	2.7	1.5	1.65619284	2.90336577	4.53351275
0.5	1.5	2.7	1.5	1.06865528	2.53366309	6.28318530
0.9	1.5	2.7	1.5	0.92813766	2.45888259	3.63088124
1.3	1.5	2.7	1.5	0.85669970	2.28468886	2.73892061
0.1	1.9	2.7	1.5	1.39435029	2.50782654	3.69592278
0.5	1.9	2.7	1.5	0.93661213	2.08296066	3.54620216
0.9	1.9	2.7	1.5	0.80890972	2.01645006	3.39276659
1.3	1.9	2.7	1.5	0.74416025	1.94610996	2.58713151

A1	A2	B	AC	W1	W2	W3
0.1	2.3	2.7	1.5	1.19548463	2.21806111	3.16974966
0.5	2.3	2.7	1.5	0.83648764	1.78525620	2.97228704
0.9	2.3	2.7	1.5	0.72100770	1.71933074	2.91261332
1.3	2.3	2.7	1.5	0.66170971	1.67108854	2.50669384
0.1	2.7	2.7	1.5	1.04285784	1.98200308	2.80887583
0.5	2.7	2.7	1.5	0.75679477	1.57247068	2.56761500
0.9	2.7	2.7	1.5	0.65264712	1.50572296	2.52277995
1.3	2.7	2.7	1.5	0.59806815	1.46536504	2.37356386
0.1	3.1	2.7	1.5	0.92332318	1.78345346	2.53894547
0.5	3.1	2.7	1.5	0.69134910	1.41161795	2.26686715
0.9	3.1	2.7	1.5	0.59749276	1.34416369	2.22607148
1.3	3.1	2.7	1.5	0.54710250	1.30755165	2.16059606
0.1	1.1	0.3	1.9	2.18968319	2.97016853	5.74110801
0.5	1.1	0.3	1.9	1.01869148	2.90640887	5.73090030
0.9	1.1	0.3	1.9	0.77136329	2.89396556	3.65535770
1.3	1.1	0.3	1.9	0.64957822	2.55013349	2.92012991
0.1	1.5	0.3	1.9	1.94962743	2.42315166	4.22324934
0.5	1.5	0.3	1.9	0.98939710	2.15066526	6.28318530
0.9	1.5	0.3	1.9	0.74323987	2.13941990	3.64389710
1.3	1.5	0.3	1.9	0.62105180	2.12492254	2.58224157
0.1	1.9	0.3	1.9	1.60329502	2.30175075	3.35196808
0.5	1.9	0.3	1.9	0.96396127	1.71881719	3.33149654
0.9	1.9	0.3	1.9	0.72294598	1.70271719	3.31933044
1.3	1.9	0.3	1.9	0.60167510	1.69339176	2.57038070
0.1	2.3	0.3	1.9	1.33920376	2.23838055	2.80178615
0.5	2.3	0.3	1.9	0.93648919	1.44583186	2.75764278
0.9	2.3	0.3	1.9	0.70576041	1.42005121	2.75185999
1.3	2.3	0.3	1.9	0.58655615	1.41001184	2.55388312
0.1	2.7	0.3	1.9	1.14648597	2.13906125	2.47124592
0.5	2.7	0.3	1.9	0.90189992	1.26701424	2.35443548
0.9	2.7	0.3	1.9	0.68936373	1.22409381	3.49065850
1.3	2.7	0.3	1.9	0.57351891	1.21146917	2.33513132
0.1	3.1	0.3	1.9	1.00140081	1.95543849	2.33117021
0.5	3.1	0.3	1.9	0.85604841	1.15264322	2.05605011
0.9	3.1	0.3	1.9	0.67220137	1.08257090	
1.3	3.1	0.3	1.9	0.56136716	1.06563441	2.04356038
0.1	1.1	0.7	1.9	2.11131866	3.08475768	5.77922338
0.5	1.1	0.7	1.9	1.05845888	2.96991339	5.75543112
0.9	1.1	0.7	1.9	0.83864849	2.94123951	3.66312996
1.3	1.1	0.7	1.9	0.73101004	2.53088331	2.99294246
0.1	1.5	0.7	1.9	1.85041684	2.52610099	4.26740305
0.5	1.5	0.7	1.9	0.99613297	2.21846832	6.28318530
0.9	1.5	0.7	1.9	0.77944262	2.19509100	3.63691383
1.3	1.5	0.7	1.9	0.67241290	2.16082871	2.59689508
0.1	1.9	0.7	1.9	1.54852232	2.32852082	3.40662415
0.5	1.9	0.7	1.9	0.94517722	1.79169169	3.36338677
0.9	1.9	0.7	1.9	0.73699319	1.76152643	3.33440959
1.3	1.9	0.7	1.9	0.63213626	1.74162623	2.56849183
0.1	2.3	0.7	1.9	1.30689062	2.20656757	2.87327032
0.5	2.3	0.7	1.9	0.89675345	1.52348346	2.79083503
0.9	2.3	0.7	1.9	0.70230708	1.48141696	2.77765186
1.3	2.3	0.7	1.9	0.60097784	1.46187731	2.53795426
0.1	2.7	0.7	1.9	1.12507226	2.06862106	2.55111445
0.5	2.7	0.7	1.9	0.84699420	1.34610623	2.38908060
0.9	2.7	0.7	1.9	0.67139741	1.28768723	3.49065850

A1	A2	B	AC	W1	W2	W3
1.3	2.7	0.7	1.9	0.57486828	1.26548542	2.34430636
0.1	3.1	0.7	1.9	0.98606221	1.89482952	2.37396453
0.5	3.1	0.7	1.9	0.79504758	1.22557320	2.09239138
0.9	3.1	0.7	1.9	0.64223606	1.14765132	2.07936087
1.3	3.1	0.7	1.9	0.55171410	1.12119586	2.06459082
0.1	1.1	1.1	1.9	2.05273647	3.17618443	5.81645180
0.5	1.1	1.1	1.9	1.09143998	3.02931616	5.77914125
0.9	1.1	1.1	1.9	0.89327269	2.98476791	3.67129348
1.3	1.1	1.1	1.9	0.79584612	2.51728152	3.05683968
0.1	1.5	1.1	1.9	1.78148922	2.59712906	4.30941730
0.5	1.5	1.1	1.9	1.00148227	2.27901966	6.28318529
0.9	1.5	1.1	1.9	0.80818383	2.24606383	3.63073370
1.3	1.5	1.1	1.9	0.71278668	2.19166307	2.61234941
0.1	1.9	1.1	1.9	1.50316192	2.34824397	3.45568116
0.5	1.9	1.1	1.9	0.93116201	1.85254046	3.39417283
0.9	1.9	1.1	1.9	0.74777191	1.81344171	3.34791117
1.3	1.9	1.1	1.9	0.65554487	1.78466491	2.56671983
0.1	2.3	1.1	1.9	1.27782828	2.18440721	2.92947532
0.5	2.3	1.1	1.9	0.86925862	1.58278655	2.82242859
0.9	2.3	1.1	1.9	0.69976950	1.53303502	2.80229676
1.3	2.3	1.1	1.9	0.61173445	1.50691351	2.52647946
0.1	2.7	1.1	1.9	1.10510393	2.02377261	2.60317572
0.5	2.7	1.1	1.9	0.81152527	1.40083719	2.42145456
0.9	2.7	1.1	1.9	0.65883797	1.33810725	3.49065850
1.3	2.7	1.1	1.9	0.57583971	1.31058038	2.35199316
0.1	3.1	1.1	1.9	0.97148853	1.85154918	2.40125070
0.5	3.1	1.1	1.9	0.75675607	1.27225068	2.12554613
0.9	3.1	1.1	1.9	0.62235067	1.19586454	2.10689871
1.3	3.1	1.1	1.9	0.54503251	1.16544732	2.08413211
0.1	1.1	1.5	1.9	2.00593338	3.25281767	5.85273005
0.5	1.1	1.5	1.9	1.11920405	3.08482348	5.80200018
0.9	1.1	1.5	1.9	0.93864454	3.02469703	3.67983618
1.3	1.1	1.5	1.9	0.84913389	2.50694569	3.11435355
0.1	1.5	1.5	1.9	1.72780200	2.65165079	4.34925270
0.5	1.5	1.5	1.9	1.00582879	2.33327371	6.28318530
0.9	1.5	1.5	1.9	0.83152023	2.29270754	3.62520279
1.3	1.5	1.5	1.9	0.74540987	2.21796082	2.62838851
0.1	1.9	1.5	1.9	1.46450469	2.36341876	3.49974721
0.5	1.9	1.5	1.9	0.92023707	1.90424837	3.42375179
0.9	1.9	1.5	1.9	0.75628514	1.85940670	3.35994165
1.3	1.9	1.5	1.9	0.67406006	1.82309577	2.56505211
0.1	2.3	1.5	1.9	1.25154473	2.16790111	2.97534453
0.5	2.3	1.5	1.9	0.84865556	1.63026430	2.85230295
0.9	2.3	1.5	1.9	0.69782398	1.57696044	2.82574017
1.3	2.3	1.5	1.9	0.62004390	1.54619782	2.51755328
0.1	2.7	1.5	1.9	1.08647657	1.99109317	2.64141973
0.5	2.7	1.5	1.9	0.78565131	1.44220307	2.45146102
0.9	2.7	1.5	1.9	0.64948348	1.37918810	3.49065848
1.3	2.7	1.5	1.9	0.57657216	1.34866666	2.35844990
0.1	3.1	1.5	1.9	0.95765415	1.81809674	2.42046680
0.5	3.1	1.5	1.9	0.72900358	1.30592261	2.15552851
0.9	3.1	1.5	1.9	0.60790505	1.23343079	2.13248443
1.3	3.1	1.5	1.9	0.54011080	1.20151538	2.10220055
0.1	1.1	1.9	1.9	1.96709080	3.31880040	5.88801000
0.5	1.1	1.9	1.9	1.14287415	3.13666821	5.82398521

A1	A2	B	AC	W1	W2	W3
0.9	1.1	1.9	1.9	0.97698683	3.06120816	3.68873891
1.3	1.1	1.9	1.9	0.89390199	2.49873526	3.16679346
0.1	1.5	1.9	1.9	1.68371723	2.69559704	4.38691967
0.5	1.5	1.9	1.9	1.00942789	2.38204745	6.28318530
0.9	1.5	1.9	1.9	0.85082029	2.33540735	3.62020767
1.3	1.5	1.9	1.9	0.77232904	2.24029484	2.64477562
0.1	1.9	1.9	1.9	1.43090845	2.37546757	3.53939444
0.5	1.9	1.9	1.9	0.91145080	1.94874205	3.45205814
0.9	1.9	1.9	1.9	0.76316908	1.90024856	3.37062702
1.3	1.9	1.9	1.9	0.68904766	1.85748099	2.56347799
0.1	2.3	1.9	1.9	1.22765054	2.15506481	3.01364129
0.5	2.3	1.9	1.9	0.83247058	1.66931849	2.88040766
0.9	2.3	1.9	1.9	0.69628405	1.61470155	2.84796228
1.3	2.3	1.9	1.9	0.62664489	1.58064560	2.51029424
0.1	2.7	1.9	1.9	1.06908476	1.96576330	2.67108288
0.5	2.7	1.9	1.9	0.76559200	1.47484975	2.47911598
0.9	2.7	1.9	1.9	0.64221366	1.41329030	3.49065850
1.3	2.7	1.9	1.9	0.57714402	1.38116434	2.36390012
0.1	3.1	1.9	1.9	0.94452722	1.79112455	2.43479767
0.5	3.1	1.9	1.9	0.70751437	1.33160112	2.18250346
0.9	3.1	1.9	1.9	0.59683420	1.26358812	2.15611819
1.3	3.1	1.9	1.9	0.53632554	1.23142265	2.11885366
0.1	1.1	2.3	1.9	1.93403424	3.37659476	5.92225735
0.5	1.1	2.3	1.9	1.16327573	3.18509280	5.84508135
0.9	1.1	2.3	1.9	1.00983624	3.09450433	3.69797537
1.3	1.1	2.3	1.9	0.93213576	2.49201144	3.21497580
0.1	1.5	2.3	1.9	1.64636317	2.73206927	4.42246493
0.5	1.5	2.3	1.9	1.01245564	2.42603849	6.28318530
0.9	1.5	2.3	1.9	0.86703043	2.37453840	3.61566218
1.3	1.5	2.3	1.9	0.79491761	2.25923016	2.66127701
0.1	1.9	2.3	1.9	1.40128634	2.38526947	3.57514141
0.5	1.9	2.3	1.9	0.90421530	1.98740358	3.47905836
0.9	1.9	2.3	1.9	0.76884488	1.93667695	3.38010160
1.3	1.9	2.3	1.9	0.70141316	1.88833093	2.56198833
0.1	2.3	2.3	1.9	1.20582413	2.14476986	3.04613313
0.5	2.3	2.3	1.9	0.81934208	1.70204574	2.90674621
0.9	2.3	2.3	1.9	0.69503432	1.64740105	2.86897063
1.3	2.3	2.3	1.9	0.63200917	1.61101762	2.50421445
0.1	2.7	2.3	1.9	1.05282678	1.94538268	2.69487058
0.5	2.7	2.3	1.9	0.74943695	1.50133654	2.50450956
0.9	2.7	2.3	1.9	0.63638658	1.44200849	2.47448569
1.3	2.7	2.3	1.9	0.57760281	1.40914832	2.36852975
0.1	3.1	2.3	1.9	0.93207250	1.76877526	2.44591258
0.5	3.1	2.3	1.9	0.69019756	1.35188187	2.20671246
0.9	3.1	2.3	1.9	0.58803554	1.28831572	2.17786508
1.3	3.1	2.3	1.9	0.53331973	1.25656792	2.13417411
0.1	1.1	2.7	1.9	1.90538874	3.42783054	5.95545007
0.5	1.1	2.7	1.9	1.18102889	3.23033846	5.86528067
0.9	1.1	2.7	1.9	1.03830005	3.12480058	3.70751251
1.3	1.1	2.7	1.9	0.96521551	2.48637994	3.25947396
0.1	1.5	2.7	1.9	1.61403530	2.76295156	4.45596044
0.5	1.5	2.7	1.9	1.01503720	2.46584289	6.28318530
0.9	1.5	2.7	1.9	0.88082565	2.41045241	3.61149933
1.3	1.5	2.7	1.9	0.81413733	2.27529253	2.67768137
0.1	1.9	2.7	1.9	1.37487471	2.39340007	3.60744898

A1	A2	B	AC	W1	W2	W3
0.5	1.9	2.7	1.9	0.89814452	2.02126997	3.50474514
0.9	1.9	2.7	1.9	0.77360154	1.96929499	3.38849939
1.3	1.9	2.7	1.9	0.71177967	1.91609636	2.56057525
0.1	2.3	2.7	1.9	1.18579881	2.13631702	3.07404276
0.5	2.3	2.7	1.9	0.80843899	1.72986101	2.93136121
0.9	2.3	2.7	1.9	0.69399961	1.67594387	2.88879310
1.3	2.3	2.7	1.9	0.63645109	1.63794122	2.49901327
0.1	2.7	2.7	1.9	1.03760711	1.92855551	2.71440219
0.5	2.7	2.7	1.9	0.73607491	1.52326307	2.52777594
0.9	2.7	2.7	1.9	0.63160388	1.46647984	2.49504844
1.3	2.7	2.7	1.9	0.57797901	1.43344533	2.37248995
0.1	3.1	2.7	1.9	0.92025324	1.74988997	2.45478870
0.5	3.1	2.7	1.9	0.67585581	1.36831066	2.22842548
0.9	3.1	2.7	1.9	0.58085336	1.30892940	2.19782976
1.3	3.1	2.7	1.9	0.53087299	1.27795918	2.14825767
0.1	1.1	0.3	2.3	2.02157333	2.93503199	5.73540483
0.5	1.1	0.3	2.3	0.93714215		5.72832883
0.9	1.1	0.3	2.3	0.71283707	2.88881301	3.62749373
1.3	1.1	0.3	2.3	0.60300416	2.53179215	2.90704782
0.1	1.5	0.3	2.3	1.88327453	2.29168885	4.21556445
0.5	1.5	0.3	2.3	0.91254614	2.14004021	6.28318530
0.9	1.5	0.3	2.3	0.68800886	2.13232323	3.61948386
1.3	1.5	0.3	2.3	0.57725983	2.12156277	2.55465168
0.1	1.9	0.3	2.3	1.59220015	2.12270585	3.33979508
0.5	1.9	0.3	2.3	0.89244624	1.70510976	3.32731362
0.9	1.9	0.3	2.3	0.67059523		3.31819782
1.3	1.9	0.3	2.3	0.56007971	1.68774133	2.54590605
0.1	2.3	0.3	2.3	1.33608805	2.06741227	2.77696235
0.5	2.3	0.3	2.3	0.87224142	1.42684961	2.75306251
0.9	2.3	0.3	2.3	0.65634928	1.41023518	2.74899265
1.3	2.3	0.3	2.3	0.54695645	1.40323037	2.53497909
0.1	2.7	0.3	2.3	1.14523147	2.01395543	2.40289979
0.5	2.7	0.3	2.3	0.84838116	1.23920383	2.34936646
0.9	2.7	0.3	2.3	0.64327921	1.21226299	3.49065850
1.3	2.7	0.3	2.3	0.53591252		2.33465295
0.1	3.1	0.3	2.3	1.00078474	1.90895455	2.18971531
0.5	3.1	0.3	2.3		1.11218060	2.05034575
0.9	3.1	0.3	2.3	0.63013823	1.06794345	
1.3	3.1	0.3	2.3	0.52588954	1.05655092	2.04152848
0.1	1.1	0.7	2.3	1.97071262	3.02380071	5.76619815
0.5	1.1	0.7	2.3	0.97940500	2.95075560	5.74965654
0.9	1.1	0.7	2.3	0.77888354	2.93024593	3.63327988
1.3	1.1	0.7	2.3	0.68169336	2.51747760	2.96753694
0.1	1.5	0.7	2.3	1.78859274	2.39840302	4.25029209
0.5	1.5	0.7	2.3	0.92635995	2.19637305	6.28318530
0.9	1.5	0.7	2.3	0.72639879	2.17992504	3.61476873
1.3	1.5	0.7	2.3	0.62871383	2.15427429	2.56602825
0.1	1.9	0.7	2.3	1.53117372	2.17200839	3.38113528
0.5	1.9	0.7	2.3	0.88454730	1.76550537	3.35392354
0.9	1.9	0.7	2.3	0.68950556	1.74440032	3.33211269
1.3	1.9	0.7	2.3	0.59278533	1.72993207	2.54491125
0.1	2.3	0.7	2.3	1.30096034	2.06469729	2.82935236
0.5	2.3	0.7	2.3	0.84600190	1.49183348	2.78060043
0.9	2.3	0.7	2.3	0.65995195	1.46237255	2.77125600
1.3	2.3	0.7	2.3	0.56536975	1.44821952	2.52348205

A1	A2	B	AC	W1	W2	W3
0.1	2.7	0.7	2.3	1.12250067	1.96916758	2.47048192
0.5	2.7	0.7	2.3	0.80687566	1.30794449	2.37794275
0.9	2.7	0.7	2.3	0.63407090	1.26649985	3.49065850
1.3	2.7	0.7	2.3	0.54269604	1.25039021	2.34343159
0.1	3.1	0.7	2.3	0.98475332	1.84558064	2.25410177
0.5	3.1	0.7	2.3	0.76541999	1.18096754	2.08013979
0.9	3.1	0.7	2.3	0.60994720	1.12408669	2.07113054
1.3	3.1	0.7	2.3	0.52281737	1.10476393	2.06021586
0.1	1.1	1.1	2.3	1.93001466	3.09957114	5.79645726
0.5	1.1	1.1	2.3	1.01516912	3.00111357	5.77043117
0.9	1.1	1.1	2.3	0.83336172	2.96904212	3.63937178
1.3	1.1	1.1	2.3	0.74522164	2.50682571	3.02207063
0.1	1.5	1.1	2.3	1.72450297	2.47269865	4.28383829
0.5	1.5	1.1	2.3	0.93767812	2.24794445	6.28318530
0.9	1.5	1.1	2.3	0.75757512	2.22425181	3.61048213
1.3	1.5	1.1	2.3	0.66992678	2.18314286	2.57820338
0.1	1.9	1.1	2.3	1.48322131	2.20834464	3.41969095
0.5	1.9	1.1	2.3	0.87838619	1.81803977	3.37981733
0.9	1.9	1.1	2.3	0.70446292	1.78964802	3.34479629
1.3	1.9	1.1	2.3	0.61853622	1.76836331	2.54395958
0.1	2.3	1.1	2.3	1.27008495	2.06267746	2.87456966
0.5	2.3	1.1	2.3	0.82681387	1.54449716	2.80712212
0.9	2.3	1.1	2.3	0.66270316	1.50777403	2.79273195
1.3	2.3	1.1	2.3	0.57952414	1.48829590	2.51469124
0.1	2.7	1.1	2.3	1.10153736	1.93885744	2.52034382
0.5	2.7	1.1	2.3	0.77862272	1.35896615	2.40510317
0.9	2.7	1.1	2.3	0.62733135	1.31153536	3.49065850
1.3	2.7	1.1	2.3	0.54775901	1.29074052	2.35091486
0.1	3.1	1.1	2.3	0.96961393	1.80422535	2.29551404
0.5	3.1	1.1	2.3	0.73216784	1.22772271	2.10798325
0.9	3.1	1.1	2.3	0.59585659	1.16813440	2.09479972
1.3	3.1	1.1	2.3	0.52060098	1.14477962	2.07782482
0.1	1.1	1.5	2.3	1.89621746	3.16585666	5.82614312
0.5	1.1	1.5	2.3	1.04581866	3.04880960	5.79062888
0.9	1.1	1.5	2.3	0.87927157	3.00525516	3.64577231
1.3	1.1	1.5	2.3	0.79809757	2.49846590	3.07208760
0.1	1.5	1.5	2.3		2.53081553	4.31615095
0.5	1.5	1.5	2.3	0.94710647	2.29519605	6.28318530
0.9	1.5	1.5	2.3	0.78338538	2.26547854	3.60655877
1.3	1.5	1.5	2.3	0.70377953	2.20842781	2.59107639
0.1	1.9	1.5	2.3	1.44354052	2.23667504	3.45556140
0.5	1.9	1.5	2.3	0.87343574	1.86414804	3.40492494
0.9	1.9	1.5	2.3	0.71656290	1.83060656	3.35629555
1.3	1.9	1.5	2.3	0.63931783	1.80334759	2.54304774
0.1	2.3	1.5	2.3	1.24263533	2.06111558	2.91398549
0.5	2.3	1.5	2.3	0.81198423	1.58840188	2.83253678
0.9	2.3	1.5	2.3	0.66487091	1.54753573	2.81337306
1.3	2.3	1.5	2.3	0.59071585	1.52405115	2.50760864
0.1	2.7	1.5	2.3	1.08216351	1.91636548	2.55967662
0.5	2.7	1.5	2.3	0.75751515	1.39923778	2.43075027
0.9	2.7	1.5	2.3	0.62216526	1.34953023	3.49065850
1.3	2.7	1.5	2.3	0.55167528	1.32576023	2.35729129
0.1	3.1	1.5	2.3	0.95532105	1.77350596	2.32567968
0.5	3.1	1.5	2.3	0.70781546	1.26283431	2.13380430
0.9	3.1	1.5	2.3	0.58533594	1.20383612	2.11714445

A1	A2	B	AC	W1	W2	W3
1.3	3.1	1.5	2.3	0.51892436	1.17844920	2.09434247
0.1	1.1	1.9	2.3	1.86744801	3.22475763	5.85522327
0.5	1.1	1.9	2.3	1.07236604	3.09394917	5.81022968
0.9	1.1	1.9	2.3	0.91858108	3.03896203	3.65248087
1.3	1.1	1.9	2.3	0.84303146	2.49167207	3.11839761
0.1	1.5	1.9	2.3	1.63460049	2.57859022	4.34720156
0.5	1.5	1.9	2.3	0.95507291	2.33854355	6.28318529
0.9	1.5	1.9	2.3	0.80509069	2.30380534	3.60294721
1.3	1.5	1.9	2.3	0.73211777	2.23044158	2.60451520
0.1	1.9	1.9	2.3	1.40968955	2.25953661	3.48888525
0.5	1.9	1.9	2.3	0.86936561	1.90490660	3.42919507
0.9	1.9	1.9	2.3	0.72653702	1.86773437	3.36667686
1.3	1.9	1.9	2.3	0.65642436	1.83520854	2.54217282
0.1	2.3	1.9	2.3	1.21800427	2.05987153	2.94861649
0.5	2.3	1.9	2.3	0.80009812	1.62567137	2.85678948
0.9	2.3	1.9	2.3	0.66662199	1.58254762	2.83315191
1.3	2.3	1.9	2.3	0.59977088	1.55603336	2.50170941
0.1	2.7	1.9	2.3	1.06421673	1.89880946	2.59180775
0.5	2.7	1.9	2.3	0.74091493	1.43208065	2.45484733
0.9	2.7	1.9	2.3	0.61807030	1.38197275	3.49065850
1.3	2.7	1.9	2.3	0.55479127	1.35633756	2.36273579
0.1	3.1	1.9	2.3	0.94182527	1.74931206	2.34894141
0.5	3.1	1.9	2.3	0.68883596	1.29046605	2.15762211
0.9	3.1	1.9	2.3	0.57713009	1.23338754	2.13812957
1.3	3.1	1.9	2.3	0.51761078	1.20709878	2.10978468
0.1	1.1	2.3	2.3	1.84251641	3.27766994	5.88367151
0.5	1.1	2.3	2.3	1.09557182	3.13665104	5.82921732
0.9	1.1	2.3	2.3	0.95266229	3.07025672	3.65949302
1.3	1.1	2.3	2.3	0.88180802	2.48601124	3.16152688
0.1	1.5	2.3	2.3	1.60041271	2.61899228	4.37698116
0.5	1.5	2.3	2.3	0.96188729	2.37836908	6.28318530
0.9	1.5	2.3	2.3	0.82358526	2.33944080	3.59960615
1.3	1.5	2.3	2.3	0.75619869	2.24952532	
0.1	1.9	2.3	2.3	1.38021671	2.27843435	3.51982143
0.5	1.9	2.3	2.3	0.86595711	1.94115315	3.45259331
0.9	1.9	2.3	2.3	0.73489054	1.90145339	3.37601992
1.3	1.9	2.3	2.3	0.67073811	1.86425918	2.54133220
0.1	2.3	2.3	2.3	1.19573165	2.05885714	2.97924507
0.5	2.3	2.3	2.3	0.79031806	1.65772419	2.87985549
0.9	2.3	2.3	2.3	0.66806547	1.61353576	2.85205794
1.3	2.3	2.3	2.3	0.60723835	1.58472989	2.49668011
0.1	2.7	2.3	2.3	1.04755150	1.88464344	2.61865259
0.5	2.7	2.3	2.3	0.72741371	1.45944486	2.47740376
0.9	2.7	2.3	2.3	0.61474018	1.40994722	3.49065850
1.3	2.7	2.3	2.3	0.55732770	1.38319360	2.36740222
0.1	3.1	2.3	2.3	0.92907628	1.72957910	2.36751867
0.5	3.1	2.3	2.3	0.67346906	1.31285566	2.17951554
0.9	3.1	2.3	2.3	0.57052730	1.25823141	2.15776228
1.3	3.1	2.3	2.3	0.51655338	1.23171294	2.12418776
0.1	1.1	2.7	2.3	1.82061355	3.32558903	5.91146747
0.5	1.1	2.7	2.3	1.11601967	3.17704069	5.84757934
0.9	1.1	2.7	2.3	0.98251378	3.09924523	3.66680016
1.3	1.1	2.7	2.3	0.91567582	2.48120430	3.20185319
0.1	1.5	2.7	2.3	1.57085979	2.65380593	4.40549655
0.5	1.5	2.7	2.3	0.96777892	2.41501917	6.28318530

A1	A2	B	AC	W1	W2	W3
0.9	1.5	2.7	2.3	0.83952209	2.37259162	3.59650191
1.3	1.5	2.7	2.3	0.77691648	2.26602726	2.63247228
0.1	1.9	2.7	2.3	1.35417300	2.29434268	3.54853661
0.5	1.9	2.7	2.3	0.86305927	1.97355625	3.47510005
0.9	1.9	2.7	2.3	0.74198257	1.93214326	3.38441176
1.3	1.9	2.7	2.3	0.68288174	1.89079112	2.54052352
0.1	2.3	2.7	2.3	1.17546009	2.05801411	3.00648953
0.5	2.3	2.7	2.3	0.78210812	1.68557415	2.90173436
0.9	2.3	2.7	2.3	0.66927552	1.64109597	2.87009434
1.3	2.3	2.7	2.3	0.61349632	1.61056526	2.49231747
0.1	2.7	2.7	2.3	1.03203866	1.87293466	2.64144867
0.5	2.7	2.7	2.3	0.71616496	1.48260711	2.49846189
0.9	2.7	2.7	2.3	0.61197653	1.43427212	
1.3	2.7	2.7	2.3	0.55943145	1.40691443	2.37142152
0.1	3.1	2.7	2.3	0.91702453	1.71309439	2.38272666
0.5	3.1	2.7	2.3	0.66069478	1.33138188	2.19959885
0.9	3.1	2.7	2.3	0.56508760	1.27937967	2.17607996
1.3	3.1	2.7	2.3	0.51568364	1.25304085	2.13760152
0.1	1.1	0.3	2.7	1.88292845	2.91595923	5.73156781
0.5	1.1	0.3	2.7	0.87239339		5.72636996
0.9	1.1	0.3	2.7	0.66581762	2.88488055	3.60762299
1.3	1.1	0.3	2.7	0.56511339	2.51768855	2.89829315
0.1	1.5	0.3	2.7	1.80009785	2.22055144	4.21067388
0.5	1.5	0.3	2.7	0.85097229	2.13276676	6.28318530
0.9	1.5	0.3	2.7	0.64340613	2.12714949	3.60170706
1.3	1.5	0.3	2.7	0.54150377	2.11885201	2.53478679
0.1	1.9	0.3	2.7	1.57641773	1.98840521	3.33276149
0.5	1.9	0.3	2.7	0.83423770	1.69608005	3.32434680
0.9	1.9	0.3	2.7	0.62802082		3.31725016
1.3	1.9	0.3	2.7	0.52595972	1.68347883	2.52806810
0.1	2.3	0.3	2.7	1.33222750	1.92837428	2.76485360
0.5	2.3	0.3	2.7	0.81833398	1.41490702	2.74985957
0.9	2.3	0.3	2.7	0.61576235	1.40339174	2.74684050
1.3	2.3	0.3	2.7	0.51427924	1.39823781	2.52031961
0.1	2.7	0.3	2.7	1.14378858	1.89020431	2.37548428
0.5	2.7	0.3	2.7	0.80065592	1.22236901	2.34587865
0.9	2.7	0.3	2.7	0.60485727	1.20421106	3.49065850
1.3	2.7	0.3	2.7	0.50463537		2.33422556
0.1	3.1	0.3	2.7	1.00010452	1.83387182	2.11597111
0.5	3.1	0.3	2.7	0.77845152	1.08755116	2.04649593
0.9	3.1	0.3	2.7	0.59425735	1.05822734	
1.3	3.1	0.3	2.7	0.49606836	1.05010111	2.03993257
0.1	1.1	0.7	2.7	1.84971459	2.98716031	5.75738929
0.5	1.1	0.7	2.7	0.91558156	2.93707619	5.74522017
0.9	1.1	0.7	2.7	0.73019371	2.92170204	3.61207748
1.3	1.1	0.7	2.7	0.64104747	2.50669967	2.94978869
0.1	1.5	0.7	2.7		2.31702836	4.23925279
0.5	1.5	0.7	2.7	0.86903023	2.18085453	6.28318530
0.9	1.5	0.7	2.7	0.68271804	2.16868082	3.59832645
1.3	1.5	0.7	2.7	0.59242291	2.14880899	2.54381003
0.1	1.9	0.7	2.7	1.50964975	2.05262156	3.36583148
0.5	1.9	0.7	2.7	0.83343220	1.74739807	3.34716754
0.9	1.9	0.7	2.7	0.64987578	1.73187771	3.33014617
1.3	1.9	0.7	2.7	0.55980222	1.72091177	2.52752123
0.1	2.3	0.7	2.7	1.29396038	1.94434619	2.80527955

A1	A2	B	AC	W1	W2	W3
0.5	2.3	0.7	2.7	0.80156520	1.47015589	2.77337341
0.9	2.3	0.7	2.7	0.62400959	1.44856858	2.76641115
1.3	2.3	0.7	2.7	0.53519439	1.43788315	2.51174415
0.1	2.7	0.7	2.7	1.11960431	1.86885465	2.42759188
0.5	2.7	0.7	2.7	0.76987170	1.28168142	2.37016801
0.9	2.7	0.7	2.7	0.60172471	1.25122300	3.49065850
1.3	2.7	0.7	2.7	0.51507618	1.23906808	2.34262961
0.1	3.1	0.7	2.7	0.98332389	1.78226326	2.17934645
0.5	3.1	0.7	2.7	0.73636289	1.14950026	2.07169484
0.9	3.1	0.7	2.7	0.58123551	1.10710687	2.06510931
1.3	3.1	0.7	2.7	0.49762844	1.09249558	2.05672640
0.1	1.1	1.1	2.7	1.82188688	3.05056533	5.78285705
0.5	1.1	1.1	2.7	0.95265833	2.98071746	5.76367796
0.9	1.1	1.1	2.7	0.78392157	2.95658590	3.61676530
1.3	1.1	1.1	2.7	0.70299820	2.49818710	2.99712063
0.1	1.5	1.1	2.7	1.66408736	2.38757130	4.26709801
0.5	1.5	1.1	2.7	0.88415892	2.22561524	6.28318530
0.9	1.5	1.1	2.7	0.71518236	2.20781469	3.59519744
1.3	1.5	1.1	2.7	0.63379231	2.17579748	2.55353877
0.1	1.9	1.1	2.7	1.46009102	2.09898325	3.39730929
0.5	1.9	1.1	2.7	0.83278330	1.79328816	3.36949009
0.9	1.9	1.1	2.7	0.66755600	1.77184907	3.34206762
1.3	1.9	1.1	2.7	0.58694489	1.75552090	2.52699155
0.1	2.3	1.1	2.7	1.26125220	1.95656219	2.84194109
0.5	2.3	1.1	2.7	0.78876350	1.51685701	2.79619166
0.9	2.3	1.1	2.7	0.63049276	1.48887993	2.78541313
1.3	2.3	1.1	2.7	0.55164752	1.47385842	2.50488494
0.1	2.7	1.1	2.7	1.09758892	1.85328592	2.47020275
0.5	2.7	1.1	2.7	0.74786278	1.32823657	2.39350394
0.9	2.7	1.1	2.7	0.59934891	1.29157530	3.49065850
1.3	2.7	1.1	2.7	0.52308975	1.27540275	2.34990395
0.1	3.1	1.1	2.7	0.96758640	1.74835282	2.22314318
0.5	3.1	1.1	2.7	0.70819049	1.19416044	2.09560141
0.9	3.1	1.1	2.7	0.57176487	1.14712817	2.08582299
1.3	3.1	1.1	2.7	0.49879145	1.12876837	2.07271254
0.1	1.1	1.5	2.7	1.79805938	3.10774529	5.80794582
0.5	1.1	1.5	2.7	0.98485151	3.02243887	5.78172553
0.9	1.1	1.5	2.7	0.82969442	2.98954914	3.62169323
1.3	1.1	1.5	2.7	0.75506396	2.49132425	3.04114769
0.1	1.5	1.5	2.7	1.62044106	2.44432088	4.29416859
0.5	1.5	1.5	2.7	0.89699888	2.26726939	6.28318530
0.9	1.5	1.5	2.7	0.74245949	2.24463826	3.59228861
1.3	1.5	1.5	2.7	0.66820996	2.19993688	2.56393618
0.1	1.9	1.5	2.7	1.42017852	2.13523937	3.42718826
0.5	1.9	1.5	2.7	0.83224931	1.83451123	3.39126571
0.9	1.9	1.5	2.7	0.68212742	1.80861725	3.35302977
1.3	1.9	1.5	2.7	0.60919899	1.78748016	2.52647810
0.1	2.3	1.5	2.7	1.23272481	1.96622062	2.87522908
0.5	2.3	1.5	2.7	0.77859925	1.55701177	2.81824809
0.9	2.3	1.5	2.7	0.63571438	1.52494207	2.80380827
1.3	2.3	1.5	2.7	0.56490168	1.50650388	2.49919472
0.1	2.7	1.5	2.7	1.07745618	1.84132983	2.50602099
0.5	2.7	1.5	2.7	0.73100136	1.36632473	2.41580751
0.9	2.7	1.5	2.7	0.59748309	1.32653365	3.49065850
1.3	2.7	1.5	2.7	0.52941991	1.30759946	2.35618460

A1	A2	B	AC	W1	W2	W3
0.1	3.1	1.5	2.7	0.95281896	1.72322783	2.25661811
0.5	3.1	1.5	2.7	0.68720343	1.22892565	2.11813690
0.9	3.1	1.5	2.7	0.56451589	1.18059189	2.10559209
1.3	3.1	1.5	2.7	0.49969136	1.16005289	2.08786878
0.1	1.1	1.9	2.7	1.77732478	3.15977633	5.83263365
0.5	1.1	1.9	2.7	1.01306960	3.06229077	5.79934709
0.9	1.1	1.9	2.7	0.86928249	3.02062405	3.62686654
1.3	1.1	1.9	2.7	0.79970771	2.48563601	3.08238834
0.1	1.5	1.9	2.7	1.58452545	2.49198312	4.32043539
0.5	1.5	1.9	2.7	0.90802043	2.30604126	6.28318530
0.9	1.5	1.9	2.7	0.76569991	2.27926061	3.58957401
1.3	1.5	1.9	2.7	0.69735191	2.22139088	2.57493980
0.1	1.9	1.9	2.7	1.38666093	2.16478426	3.45549047
0.5	1.9	1.9	2.7	0.83180211	1.87169152	3.41245592
0.9	1.9	1.9	2.7	0.69432654	1.84244781	3.36306370
1.3	1.9	1.9	2.7	0.62776797	1.81698267	2.52598002
0.1	2.3	1.9	2.7	1.20747686	1.97405262	2.90550417
0.5	2.3	1.9	2.7	0.77029933	1.59195232	2.83949630
0.9	2.3	1.9	2.7	0.64000510	1.55729767	2.82157046
1.3	2.3	1.9	2.7	0.57578991	1.53615851	2.49435489
0.1	2.7	1.9	2.7	1.05896634	1.83181973	2.53666722
0.5	2.7	1.9	2.7	0.71753049	1.39824574	2.43703413
0.9	2.7	1.9	2.7	0.59597794	1.35705308	3.49065850
1.3	2.7	1.9	2.7	0.53453891	1.33622779	2.36160650
0.1	3.1	1.9	2.7	0.93894922	1.70351415	2.28342543
0.5	3.1	1.9	2.7	0.67068073	1.25704165	2.13927654
0.9	3.1	1.9	2.7	0.55876650	1.20898725	2.12437536
1.3	3.1	1.9	2.7	0.50040813	1.18723223	2.10219257
0.1	1.1	2.3	2.7	1.75905357	3.20744282	5.85690173
0.5	1.1	2.3	2.7	1.03800377	3.10033457	5.81652886
0.9	1.1	2.3	2.7	0.90392482	3.04985463	3.63228874
1.3	1.1	2.3	2.7	0.83855374	2.48082334	3.12119291
0.1	1.5	2.3	2.7	1.55402921	2.53302563	4.34587970
0.5	1.5	2.3	2.7	0.91757574	2.34214985	6.28318530
0.9	1.5	2.3	2.7	0.78573236	2.31180264	3.58703203
1.3	1.5	2.3	2.7	0.72237009	2.24035649	2.58646420
0.1	1.9	2.3	2.7	1.35777162	2.18949445	3.48225847
0.5	1.9	2.3	2.7	0.83142212	1.90534833	3.43303183
0.9	1.9	2.3	2.7	0.70467764	1.87359999	3.37221330
1.3	1.9	2.3	2.7	0.64348812	1.84422561	2.52549649
0.1	2.3	2.3	2.7	1.18487953	1.98053269	2.93309184
0.5	2.3	2.3	2.7	0.76337572	1.62263431	2.85990745
0.9	2.3	2.3	2.7	0.64359062	1.58641761	2.83868425
1.3	2.3	2.3	2.7	0.58488272	1.56314127	2.49016224
0.1	2.7	2.3	2.7	1.04191813	1.82405663	2.56322422
0.5	2.7	2.3	2.7	0.70645390	1.42544112	2.45716749
0.9	2.7	2.3	2.7	0.59473754	1.38387582	3.49065850
1.3	2.7	2.3	2.7	0.53875959	1.36177826	2.36629509
0.1	3.1	2.3	2.7	0.92590792	1.68749380	2.30550929
0.5	3.1	2.3	2.7	0.65720992	1.28033561	2.15903584
0.9	3.1	2.3	2.7	0.55408399	1.23335829	2.14215897
1.3	3.1	2.3	2.7	0.50099238	1.21100326	2.11569670
0.1	1.1	2.7	2.7	1.74278940	3.25134289	5.88073428
0.5	1.1	2.7	2.7	1.06019142	3.13663890	5.83325905
0.9	1.1	2.7	2.7	0.93452809	3.07729397	3.63796126

A1	A2	B	AC	W1	W2	W3
1.3	1.1	2.7	2.7	0.87274197	2.47668584	3.15781856
0.1	1.5	2.7	2.7	1.52758085	2.56895747	4.37049186
0.5	1.5	2.7	2.7	0.92593318	2.37580384	6.28318529
0.9	1.5	2.7	2.7	0.80317170	2.34238996	3.58464438
1.3	1.5	2.7	2.7	0.74409207	2.25705256	
0.1	1.9	2.7	2.7	1.33241946	2.21054465	3.50754881
0.5	1.9	2.7	2.7	0.83109522	1.93591834	3.45297324
0.9	1.9	2.7	2.7	0.71356333	1.90231849	3.38053198
1.3	1.9	2.7	2.7	0.65696049	1.86940106	2.52502677
0.1	2.3	2.7	2.7	1.16447339	1.98598327	2.95828237
0.5	2.3	2.7	2.7	0.75750195	1.64977716	2.87946775
0.9	2.3	2.7	2.7	0.64662986	1.61270780	2.85514332
1.3	2.3	2.7	2.7	0.59258317	1.58774319	2.48647863
0.1	2.7	2.7	2.7	1.02614192	1.81759070	2.58646585
0.5	2.7	2.7	2.7	0.69714976	1.44889846	2.47621357
0.9	2.7	2.7	2.7	0.59369738	1.40759060	3.49065850
1.3	2.7	2.7	2.7	0.54229672	1.38466890	2.37036203
0.1	3.1	2.7	2.7	0.91363006	1.67415396	2.32406462
0.5	3.1	2.7	2.7	0.64595375	1.29997274	2.17745848
0.9	3.1	2.7	2.7	0.55019074	1.25447338	2.15895042
1.3	3.1	2.7	2.7	0.50147767	1.23192196	2.12840525