implemented in numerous ways, e.g., a process, an apparatus, a system, a device, or a method on a computer-readable medium. Several embodiments are described below.

[0007] In some embodiments, a statistical value is used to control a plasma chamber or to generate an RF signal. For example, instead of analyzing all values of a variable at an output of a computer-generated model to control a plasma chamber, a statistical value is generated from the values and it is determined whether the statistical value is within a pre-determined range. Upon determining that the statistical value is within the pre-determined range, the plasma chamber is not controlled, e.g., an RF signal being supplied to the plasma chamber is not modified, etc. On the other hand, upon determining that the statistical value is ~~not~~ outside the pre-determined range, the plasma chamber is controlled using the statistical value, e.g., an RF signal supplied to the plasma chamber is generated based on the statistical value, etc.

[0008] In various embodiments, a method includes receiving a variable from a radio frequency (RF) system, propagating the variable through a model of the RF system, and counting an output of the model for the variable to generate a count. The method further includes determining whether the count meets a count threshold, generating a statistical value of the variable at the output of the model upon determining that the count meets the count threshold, and sending the statistical value to the RF system to adjust the variable.

[0009] In various embodiments, a method includes receiving data associated with a variable from a radio frequency (RF) generator. The RF generator is configured for generating an RF signal to be supplied via an impedance matching circuit to a plasma chamber. The variable is associated with an RF system, which includes the RF generator, impedance matching circuit, and the plasma chamber. The method further includes generating values at an output of a computer-generated model based on the received data, counting an amount of the values output from the computer-generated model, determining

whether the amount exceeds a count threshold, generating a statistical value from the ~~data generated~~ values output from the computer-generated model in response to determining that the amount exceeds the count threshold, and sending the statistical value to the RF generator to adjust the RF signal produced by the RF generator.

[0010] In some embodiments, a method includes receiving data associated with a variable from a radio frequency (RF) generator. The RF generator is used for generating an RF signal to be supplied via an impedance matching circuit to a plasma chamber. The variable is associated with an RF system, which includes the RF generator, impedance matching circuit, and the plasma chamber. The method includes generating values at an output of a computer-generated model based on the received data, counting an amount of the values output from the computer-generated model, determining whether the amount exceeds a count threshold, generating a statistical value from the values output from the computer-generated model in response to determining that the amount exceeds the count threshold, determining whether the statistical value is outside a pre-determined range, adjusting the statistical value to be within the pre-determined range in response to determining that the statistical value is outside the pre-determined range, and sending the adjusted statistical value to the RF generator to control the RF generator to adjust the RF signal produced by the RF generator.

[0011] In a number of embodiments, a method includes receiving data associated with a variable from a radio frequency (RF) generator. The RF generator is used for generating an RF signal to be supplied via an impedance matching circuit to a plasma chamber. The variable is associated with an RF system, which includes the RF generator, impedance matching circuit, and the plasma chamber. The method further includes generating values at an output of a computer-generated model based on the received data, counting an amount of the values output from the computer-generated model, determining whether the amount exceeds a count

surface 158 of the chuck 152. In various embodiments, the upper electrode 154 is grounded. The chuck 152 includes a lower electrode that is made of a metal, e.g., anodized aluminum, alloy of aluminum, etc. Also, the upper electrode 154 is made of a metal, e.g., aluminum, alloy of aluminum, etc.

[0037] A work piece 160, e.g., a semiconductor wafer, a semiconductor wafer on which an integrated circuit is developed, etc., is placed on the upper surface 158 for processing of the work piece 160. Examples of processing the work piece 160 include cleaning the work piece 160, or etching the work piece 160, or depositing films, e.g., oxide films, etc., on the work piece 160, or a combination thereof, etc. The integrated circuit developed on the work piece 160 is used in a variety of computing devices, such as, for example, cell phones, tablets, smart phones, computers, laptops, networking equipment, etc.

[0038] In some embodiments, the plasma chamber 111 includes other components (not shown), e.g., an upper dielectric ring surrounding the upper electrode ~~156~~154, an upper electrode extension surrounding the upper dielectric ring, a lower dielectric ring surrounding the chuck 152, a lower electrode extension surrounding the chuck 152, an upper plasma exclusion zone (PEZ) ring, a lower PEZ ring, etc.

[0039] In various embodiments, the upper electrode 154 includes one or more holes that are coupled to a central gas feed, e.g., a gas supply line (not shown), etc. The central gas feed receives one or more process gases from a gas source (not shown). Examples of a process gases include an oxygen-containing gas, such as O_2. Other examples of a process gas include a fluorine-containing gas, e.g., tetrafluoromethane (CF_4), sulfur hexafluoride (SF_6), hexafluoroethane (C_2F_6), etc. The upper electrode 154 is grounded. The lower electrode 152 is coupled to the x MHz RF generator via the impedance matching circuit 106, to the y MHz RF generator via the impedance matching circuit 106, and to the z MHz RF generator via the impedance matching circuit 106.

impedance, or imaginary portion of the load impedance, or a voltage magnitude at the point, or a current magnitude at the point, or a phase between a complex voltage and a complex current at the point, or a wafer bias at the point, or ion energy at the point, or plasma potential at the point, or a complex current at the point, or a complex voltage at the point, or load impedance at the point, or a combination thereof.

[0043] Examples of a load impedance include an impedance of one or more components of the plasma system 100. For example, a load impedance is an impedance at a point within the plasma system 100. As another example, a load impedance is an impedance of one or more of the RF cable 130, the RF cable coupling the y MHz RF generator to the impedance matching circuit 106, the RF cable coupling the z MHz RF generator to the impedance matching circuit 106, the impedance matching circuit 106, the RF transmission line 132, and the plasma chamber 111.

[0044] In some embodiments, a point within the plasma system 100 includes a point at an output of the x MHz RF generator, or a point at an output of the y MHz RF generator, or a point at an output of the z MHz RF generator, or a point on the RF cable 130, or a point on the RF cable coupling the y MHz RF generator to the impedance matching circuit 106, or a point on the RF cable coupling the z MHz RF generator to the impedance matching circuit 106, or a point at an input of the impedance matching circuit 106, or a point at an output of the impedance matching circuit 106, or a point on the RF transmission line 132, or a point at the chuck 152.

[0045] In various embodiments, an output of the x MHz RF generator is coupled via the RF cable 130 to an input of the impedance matching circuit 106, an output of the y MHz RF generator is coupled via an RF cable to an input of the impedance matching circuit 106, and an output of the z MHz RF generator is coupled via an RF cable to an input of the

counts a number of values of a variable received from the model value generator 115, and sends the count to the limit crossover determination module 114.

[0062] In some embodiments, the data amount calculator 112 calculates a number of values of a variable that does not exceed a maximum storage capacity of the variable receiver 110.

[0063] The limit crossover determination module 114 determines whether the number of values received from the data amount calculator 112 is greater than a threshold, which is pre-stored in the limit crossover determination module 114. Examples of the threshold include 1000 values, or 10,000 values, or 100,000 values, etc. Other examples of the threshold include 500-1000 values, or 1000-10,000 values, or 10,000-100,000 values, or 100,000-1000,000 values, or 10,00,000-10,000,000 values.

[0064] Upon determining that the number of values is greater than a threshold, a signal is sent from the limit crossover determination module 114 to the SD module 116 to initiate generation of a statistical value from the values. On the other hand, upon determining that the number of values does not exceed a threshold, a signal is not sent from the limit crossover determination module 114 to the SD module 116 and the SD module 116 does not start generation of a statistical value from the values.

[0065] In some embodiments, a threshold is generated based on a storage capacity of a storage device of the host controller 150. For example, when the SD module 116 includes two buffers, each storing n values of a variable, a threshold is n values. When a first one of the two buffers is full, the SD module 116 copies data from the first buffer to a second one of the two buffers and initiates calculation of a statistical value from the data. The SD module ~~16~~116 calculates a statistical value based on values within the ~~first~~ secondbuffer. After the

111, or a combination thereof. For example, a processor of the host controller 150 waits to process a pressure value until the pressure value is sensed by a pressure sensor (not shown) and received by the processor. This wait reduces processing speed of the processor. As another example, a processor of the host controller 150 waits to send a signal to change a gap between the upper electrode 154 and the chuck 152 until a pressure and temperature is achieved within the plasma chamber 111 after a signal to achieve the pressure and temperature is sent by the processor. This wait reduces processing speed of the processor.

[0068] The SD module 116 determines a statistical value from data of a variable in response to receiving a signal from the limit crossover determination module ~~112~~ 114 that an amount of data of a variable received from the model value generator 115 by the data amount calculator 112 exceeds a threshold. For example, the SD module 116 applies a statistical operation, such as, for example, an insertion sort operation, or a merge sort operation, or a moving interquartile range (IQR) calculation operation, or an interquartile range calculation operation, or a maximum value calculation operation, or a minimum value calculation operation, or a mean value calculation operation, or a median value calculation method, or a variance value calculation method, or a standard deviation value calculation method, or a moving mean value calculation method, or a moving median value calculation method, or a moving variance value calculation method, or a moving standard deviation value calculation method, or a mode, or a moving mode, or a combination thereof, etc., to generate a statistical value from values of a variable.

[0069] After generation of a statistical value, the SD module 116 closes the switch module 180 to couple the variable receiver 110 with the data deletion module 120. When the switch module 180 is closed, the data deletion module 120 accesses data stored within a storage device of the data receiver 110 and deletes, e.g., erases, resets, etc., data stored within the storage device to allow the variable receiver 110 to receive and store additional data of a

[0071] In various embodiments, the SD module 116 sends a statistical value of a variable to the sender 174 in addition to or without sending the statistical value to the RF control block 197.

[0072] The sender 174 sends a statistical value of a variable received from the RF control block 197 and/or from the SD module 116 via corresponding communication channels to one or more of the x, y, and z controllers. For example, the sender 174 sends a statistical value of a variable via a communication channel 184 to the x controller, sends a statistical value of a variable via a communication channel to the y controller, and sends a statistical value of a variable via a communication channel to the z controller. As another example, the sender 174 sends via the communication channel 184 a statistical value of a variable that is generated from data of the variable received from the x controller to the x controller. As yet another example, the sender 174 sends via a communication channel coupled to the y controller a statistical value of a variable that is generated from data of the variable received from the y controller to the y controller.

[0073] A controller of an RF generator receives a statistical value of a variable from the sender 174 and provides the statistical value to an RF supply, e.g., an RF supply 186, etc., of the RF generator. The RF supply includes a driver, e.g., a transistors, a group of transistors, etc., that generates an RF signal, e.g., an RF signal 124, etc., having a statistical value of a variable received from the sender 174. The RF signal is amplified by an RF amplifier connected to the driver and is sent via an RF cable that is coupled to the RF amplifier to the impedance matching circuit 106.

[0074] The impedance matching circuit 106 matches an impedance of a load with that of a source to modify an RF signal received via an RF cable, e.g., the RF cable 130, etc., from an RF generator to generate an RF signal and sends the modified RF signal via the RF transmission line ~~182~~ 132 to the chuck 152. When process gas is supplied within the plasma

calculator 112, the limit crossover determination module 114, the statistical determination module 116, the switch module 180, the data deletion module 120, the RF control block 197, and the sender 174 are implemented as one processor and any remaining of the variable requester 170, the variable receiver 110, the model 113, the model value generator 115, the data amount calculator 112, the limit crossover determination module 114, the statistical determination module 116, the switch module 180, the data deletion module 120, the RF control block 197, and the sender 174 are implemented as another processor.

[0080] In some embodiments, instead of grounding the upper electrode 154, the upper electrode 154 is provided RF power. In various embodiments, instead of grounding the upper electrode 154, the lower electrode of the chuck 152 is grounded and the RF transmission line provided RF power to the upper electrode 154.

[0081] In various embodiments, a statistical value is stored in a storage device of the SD module 116. A size of the storage device of the SD module 116 is less than a size of the storage device of the variable receiver 110. For example, the storage device of the SD module 116 includes a single memory location and the storage device of the variable receiver 110 includes multiple memory locations. As another example, the storage device of the SD module 116 includes a lower number of memory locations than that of the storage device of the variable receiver 110.

[0082] It should be noted that in some embodiments, the host controller ~~154~~ 150 includes a number of processors, e.g., one, two, three, etc., to generate a statistical value and to control the plasma chamber 111 and the number of processors is cost-effective. For example, instead of using a separate processor or a separate server to control the plasma chamber 111, e.g., use one processor to control a temperature within the plasma chamber 111, use another processor to control a gap within the plasma chamber 111, use another processor to control a pressure within the plasma chamber 111, use yet another processor to

group of transistors, etc., to control, e.g., change, increase, decrease, etc., temperature within the plasma chamber 111.

[0087] In a number of embodiments, a heat transfer mechanism, e.g., a duct, etc., is provided within the plasma chamber ~~11~~ 111 and a flow of a cooling liquid is controlled by a processor of the host controller 150 via a valve and a driver, e.g., a transistor, a group of transistors, etc., to control temperature within the plasma chamber 111.

[0088] Figure 2 is a diagram of an embodiment of a plasma system 151 for generating a statistical value of a variable. The plasma system 151 includes the plasma chamber 111, the impedance matching circuit 106, the x, y, and z MHz RF generators, and a host system 190. The host system 190 includes a host controller 192.

[0089] In some embodiments, the plasma system 151 is the same as the plasma system 100 (Figure 1) except that the plasma system 151 includes the host system 190 instead of the host system 140 (Figure 1). For example, the plasma system 151 is structurally the same as the plasma system 100 (Figure 1) except that the plasma system 151 includes the host controller 192 instead of the host controller 150 (Figure 1).

[0090] The host controller ~~190~~ 192 is the same as the host controller 150 (Figure 1) except that the host controller ~~190~~ 192 includes a bias compensation module 196, an event detection module 198, and a communication block 191. The RF control block 197 is connected to the bias compensation module 196 and the event detection module 198. The SD module 116 is connected to the bias compensation module 196 and the event detection module 198.

[0091] The bias compensation module 196 determines whether a statistical value of a variable that is received from the RF control block 197 or from the SD block 116 is

within a pre-determined range, which is pre-stored in a storage device of the bias compensation module 196.

[0092] In some embodiments, the bias compensation module 196 has a multiple pre-determined ranges for multiple statistical values of a variable. For example, a storage device of the bias compensation module 196 stores a first pre-determined range for a statistical value of a variable that is generated from data of the variable received from the x controller. As another example, a storage device of the bias compensation module 196 stores a second pre-determined range for a statistical value of a variable that is generated from data of the variable received from the y controller. In various embodiments, the first pre-determined range is the same as the second pre-determined range. In some embodiments, the first pre-determined range is different from the second pre-determined range.

[0093] Upon determining that a statistical value of a variable is within a pre-determined range, the bias compensation module 196 sends the statistical value to the sender ~~122~~ 174, which sends the statistical value via one or more communications links to corresponding one of the x, y, and z controllers. On the other hand, upon determining that a statistical value of a variable is not within a pre-determined range, the bias compensation module 196 adjusts, e.g., modifies, alters, increases, decreases, tunes, etc., the statistical value to be within the pre-determined range and provides the adjusted statistical value to the sender ~~122~~ 174.

[0094] The sender ~~122~~ 174 sends the adjusted statistical value of a variable via one or more communication channels to corresponding one or more of the x, y, and z controllers.

[0095] A controller of an RF generator receives an adjusted statistical value of a variable from the sender ~~122~~ 174 via a communication channel that couples the controller to the sender ~~122~~ 174 and provides the adjusted statistical value to an RF supply of the RF generator. For example, the x controller receives an adjusted statistical value of a variable and provides

extent is the same as the second pre-determined extent. In some embodiments, the first pre-determined extent is different from the second pre-determined extent.

[0099] Upon determining that a statistical value of a variable is within a pre-determined extent, a fault signal is not generated by the event detection module 198. On the other hand, upon determining that a statistical value of a variable is outside a pre-determined extent, a fault signal is generated by the event detection module 198 and provided to the sender ~~122~~ 174.

[00100] The sender ~~122~~ 174 sends a fault signal via one or more communication channels to corresponding x, y, and z controllers. For example, the sender ~~122~~ 174 sends a fault signal via a communication channel 202 to the x controller and sends a fault signal via a communication channel to the y controller.

[00101] A controller of an RF generator receives a fault signal and responds to the fault signal. For example, a controller of an RF generator sends a signal to an RF supply of the RF generator to pause generation of an RF signal for sending to the impedance matching circuit 106. As another example, a controller of an RF generator sends a signal to an RF supply of the RF generator to pause generation of an RF signal for sending to the impedance matching circuit 106 until an adjusted statistical value that is compensated for bias is received via the sender ~~122~~ 174 from the bias compensation module 196.

[00102] In some embodiments, the event detection module 198 sends a fault detection signal via the communication block 191 to a remote computer system for notifying the remote computer system of a fault in a statistical value of a variable. Examples of a communication block 191 include a network interface controller, such as, for example, a network interface adapter or a network interface card.

[00110] The soft-core DSP 408 includes the model 113 and the model value generator 115. For example, the FPGA 402 implements an electrical circuit that includes electrical components, e.g., capacitors, or inductors, etc., of the RF transmission line 132. Moreover, the FPGA 402 connects the components within the electrical circuit in the same manner, e.g., serial, parallel, etc., as that in which electrical components of the electrical circuit of the RF transmission line 132 are connected.

[00111] Data of variables received by the MSPI 406 are sent from the MSPI 406 to the soft-core DSP 408. The model value generator 115 of the soft-core DSP ~~408~~ 408 generates values of variables at an output of the model 113 based on values received from the MSPI 406 and sends the generated values via the high-speed port 410 and a high-speed bus 412 to a high-speed bus port ~~412~~ 415 of the microprocessor 404. Examples of a high-speed bus include a bus that transfers data at 500 MHz, or at 400 MHz, or at 300 MHz, or at 600 MHz, or between 5 MHz and 500 MHz, etc. Data of variables is communicated via the high-speed port 415 to an SDD logic block 416, which is an example of the SDD 172 (Figure 2).

[00112] In some embodiments, a logic block is a computer program that is executed by one or more processors, e.g., the SDD logic block 416 is executed by the microprocessor 404. In several embodiments, a logic block is implemented as hardware within an integrated circuit. In various embodiments, a logic block is implemented as a combination of a computer program and hardware.

[00113] The SDD logic block 416 applies a statistical transformation to data of variables received via the high-speed port 415 from the soft-core DSP 408 to generate a statistical value. For example, the SDD logic block 416 generates a mean, or a median, or a mode, or a standard deviation, or a maximum, or a minimum, or an interquartile range (IQR), etc., from data of variables received via the high-speed port 415 from the soft-core DSP 408 to generate a statistical value. As another example, the SDD logic block 416 generates a

[00137] In various embodiments, a memory address of the memory array 506 in which a value "7"is stored is immediately after, e.g., right next to, is consecutive to, etc., a memory address of the memory array 504 in which a value "6" is stored. In some embodiments, a memory ~~array~~ address of the memory array 506 in which the value "7"is stored is after, e.g., not right next to, within two memory addresses of, within a number of memory addresses of, etc., but not immediately after a memory address of the memory array 504 in which the value "6" is stored.

[00138] In various embodiments, the memory arrays 504 and 506 are separated by a number, e.g., one, two, etc., of empty memory addresses.

[00139] It should be noted that although each memory array 504 and 506 includes six values, in some embodiments, each memory array 504 and 506 includes a different number of values of a variable.

[00140] In various embodiments, the merged memory array 508 has the same size, e.g., number of memory addresses, etc., as that of a total number of memory addresses in the memory arrays 504 and 506.

[00141] Figure 8 is a diagram of an embodiment of a storage device 550 to illustrate a comparison operation within a merge sort operation. The storage device 550 includes memory arrays 552 and 554, and a merged memory array 556. The memory arrays ~~553~~ 552, 554, and 556 are parts of the storage device 550, which is located within the variable receiver 110 (Figures 1 & 2). In some embodiments, the storage device 550 is within the data amount calculator 112, or the limit crossover determination module 114, or the SD module 116. In various embodiments, the memory arrays 552 and 554 are within a storage device of the variable receiver 110 and the merged memory array 556 is within a storage device of the SD module 116.

[00144] During a merge sort operation, after a comparison is performed between values of the memory arrays 552 and 554, any value of the memory array 554 that is not written into the merged array 556 is compared with remaining unwritten values of the memory array 554. For example, the value "5" of the memory array 554 is compared with a value "6" of the memory array ~~504~~ 554. The comparison is performed in an order of memory addresses of the memory array 554 that include values that are yet not written into the merged memory array 556. For example, in case in which values "5", "6", and "8" are not written in the merged memory array 556, the value "5" within a lowest memory address from memory addresses in which the values "5", "6", and "8"are stored in the memory array 554 is compared with the values "6" and "8". The memory address of the value "6" is ~~greater~~ lower than the memory address of the value "8" in the memory array 554.

[00145] During a merge sort operation, while comparing the unwritten values, a lesser of the unwritten values is written into the merged memory array 556. For example, when a comparison is performed between the values "5" and "6" in the memory array 554, the value "5" is written into the merged memory array 556. As another example, when a comparison is performed between the values "6" and "8" in the memory array 554, the value "6" is written into the memory array 556. Any remaining value after the comparison of the unwritten values is written into an empty address of the merged memory array 556 that is consecutive to a memory address that is written with a value. For example, the value "8" of the memory array 554 is written into a memory address 562 of the memory array 556.

[00146] At an end of a merge sort operation, the merged memory array 556 is sorted from a lowest of all values within the memory arrays 552 and 554 to a highest of all values of the memory arrays 552 and 554.

within a merged memory array. The moving median module determines a moving median of values within a merged memory array and the moving variance module calculates a moving variance of values within a merged memory array. The moving standard deviation module generates a moving standard deviation of values within a merged memory array.

[00166] In some embodiments, the SD module 590 includes the moving IQR module, or the IQR module, or the insertion sort module, or the merge sort module, or the mode module, or the moving mode module, or the mean module, or the median module, or the variance module, or the standard deviation module, or the moving mean module, or the moving median module, or the moving variance module, or the moving standard deviation module, or a combination thereof.

[00167] Figure 11 is a diagram of an embodiment of a system 601 for applying a time slice sampling method. The system 601 includes the bias compensation module 196 and the event detection module 198. The bias compensation module 196 and/or the event detection module 198 receives a time of generation of a value of a variable from the SD module 116 (Figures 1 & 2). For example, a time t1 is a time of generation of a variable value V21 by the SD module 116. As another example, a time t2 is a time of generation of a variable value V22 by the SD module 116, a time ~~t2~~ t3is a time of generation of a variable value V23 by the SD module 116, and a time t4 is a time of generation of a variable value V24 by the SD module 116. As yet another example, a time t5 is a time of generation of a variable value V25 by the SD module 116 and of generation of a variable value V11 by the SD module 116. The times t1 thru t5 are calculated by the SD module 116. In some embodiments, the time t1 is a time of generation of the variable value V15 and of the variable value V21.

[00168] In some embodiments, variable values V11, V12, V13, V14, and V15 are values of a first variable, which is variable 1. Variable values V21, V22, V23, V24, and V25 are values of a second variable, which is variable 2. The variable 1 is different from the

next instantaneous mean M2 = current instantaneous mean M2 + delta*(x - next mean)

moving variance = next instantaneous mean M2/(n - 1)

return moving variance.

In the pseudo code, the total number of data points n, the current mean, and the current instantaneous mean are initialized to zero.

[00182] Figure 13 is a flowchart of an embodiment of a method 700 for generating a statistical value. In the method 700, a variable is input from an RF system e.g., the x controller, or the y controller, or the z controller, or a combination thereof, etc., to a host controller, e.g., the host controller 150 (Figure 1), or the host controller 192 (Figure 2), etc. The variable is propagated, in an operation 702, through the model 113 (Figures 1-4). For example, a directional sum is calculated. In this example, the directional sum is the sum of a value of the variable and values of components of the model 113 through which the value of the variable is propagated. In some embodiments, the operation 702 is performed by the model value generator 115 (Figures 1-4).

[00183] The method 700 further includes an operation 704 of counting an output of the model 113 for the variable. For example, a number of values that are generated after propagating the variable through the model 113 is counted. The values are generated at the output of the model 113 and are calculated by the data amount calculator 112 (Figures 1 & 2). In some embodiments, the output of the model 113 that is counted includes a directional sum.

[00184] In an operation 706 of the method 700, it is determined by the limit crossover determination module 114 whether the count meets a count threshold, which is a pre-stored number of values that is stored in a storage device of the limit crossover determination module 114. The counting of operation 704 continues when ~~until~~ the count does not

minimum of the values, or a mean of the values, or a median of the values, or a variance of the values, or a standard deviation of the values, or a moving mean of the values, or a moving median of the values, or a moving variance of the values, or a moving standard deviation of the values, or a mode of the values, or a moving mode of the values, or a combination thereof.

7. A method comprising:

receiving data associated with a variable from a radio frequency (RF) generator, the RF generator configured for generating an RF signal to be supplied via an impedance matching circuit to a plasma chamber, the variable being associated with an RF system, the RF system including the RF generator, the impedance matching circuit, and the plasma chamber;

generating values output from a computer-generated model based on the received data;

counting an amount of the values output from the computer-generated model;

determining whether the amount exceeds a count threshold;

generating a statistical value from the values output from the computer-generated model in response to determining that the amount exceeds the count threshold;

sending the statistical value to the RF generator to adjust the RF signal produced by the RF generator.

8. The method of claim 7, wherein the adjusted RF signal is provided to the plasma chamber via an RF cable, the impedance matching circuit, and an RF transmission line, wherein the RF cable couples the RF generator to the impedance matching circuit, wherein the RF transmission line couples the impedance matching circuit to the plasma chamber.

14. The method of claim 7, further comprising decimating the data received after generating the statistical value.

15. The method of claim 7, wherein generating the values at the output of the computer-generated model comprises propagating the received data thru components of the computer-generated model.

16. A method comprising:

receiving data associated with a variable from a radio frequency (RF) generator, the RF generator for generating an RF signal to be supplied via an impedance matching circuit to a plasma chamber, the variable associated with an RF system, the RF system including the RF generator, the impedance matching circuit, and the plasma chamber;

generating values at an output of a computer-generated model based on the received data;

counting an amount of the values output from ~~of~~ the computer-generated model;

determining whether the amount exceeds a threshold;

generating a statistical value from the values output from the computer-generated model in response to determining that the amount exceeds the threshold;

determining whether the statistical value is outside a pre-determined range;

adjusting the statistical value to be within the pre-determined range in response to determining that the statistical value is outside the pre-determined range; and

sending the adjusted statistical value to the RF generator to control the RF generator to adjust the RF signal produced by the RF generator.

a plasma chamber, the variable associated with an RF system, the RF system including the RF generator, the impedance matching circuit, and the plasma chamber;

generating values at an output of a computer-generated model based on the received data;

counting an amount of the values output from the computer-generated model;

determining whether the amount exceeds a count threshold;

generating a statistical value from the values output from ~~of~~ the computer-generated model in response to determining that the amount exceeds the count threshold;

determining whether the statistical value is outside a pre-determined extent;

generating an indication of a fault in response to determining that the statistical value is outside the pre-determined extent; and

sending the fault indication to the RF generator.

23. The method of claim 22, further comprising:

determining whether the statistical value is within a pre-determined range;

adjusting the statistical value to be within the pre-determined range in response to determining that the statistical value is outside the pre-determined range; and

sending the adjusted statistical value to the RF generator to control the RF generator to generate an adjusted RF signal to provide to the plasma chamber via the impedance matching circuit.

24. The method of claim 22, wherein the adjusted RF signal is provided to the plasma chamber via an RF cable, the impedance matching circuit, and an RF transmission line, wherein the RF cable couples the RF generator to the impedance matching circuit, wherein the RF transmission line couples the impedance matching circuit to the plasma chamber.

25. The method of claim 22, wherein the variable includes power, or frequency, or real portion of load impedance, ~~and~~ or imaginary portion of the load impedance, or a voltage magnitude, or a current magnitude, or a phase between a complex voltage and a complex current, or wafer bias, or ion energy, or plasma potential, or a complex current, or a complex voltage, or load impedance, or a combination thereof.

26. The method of claim 22, wherein the variable includes a complex voltage and current at a point within the plasma system.