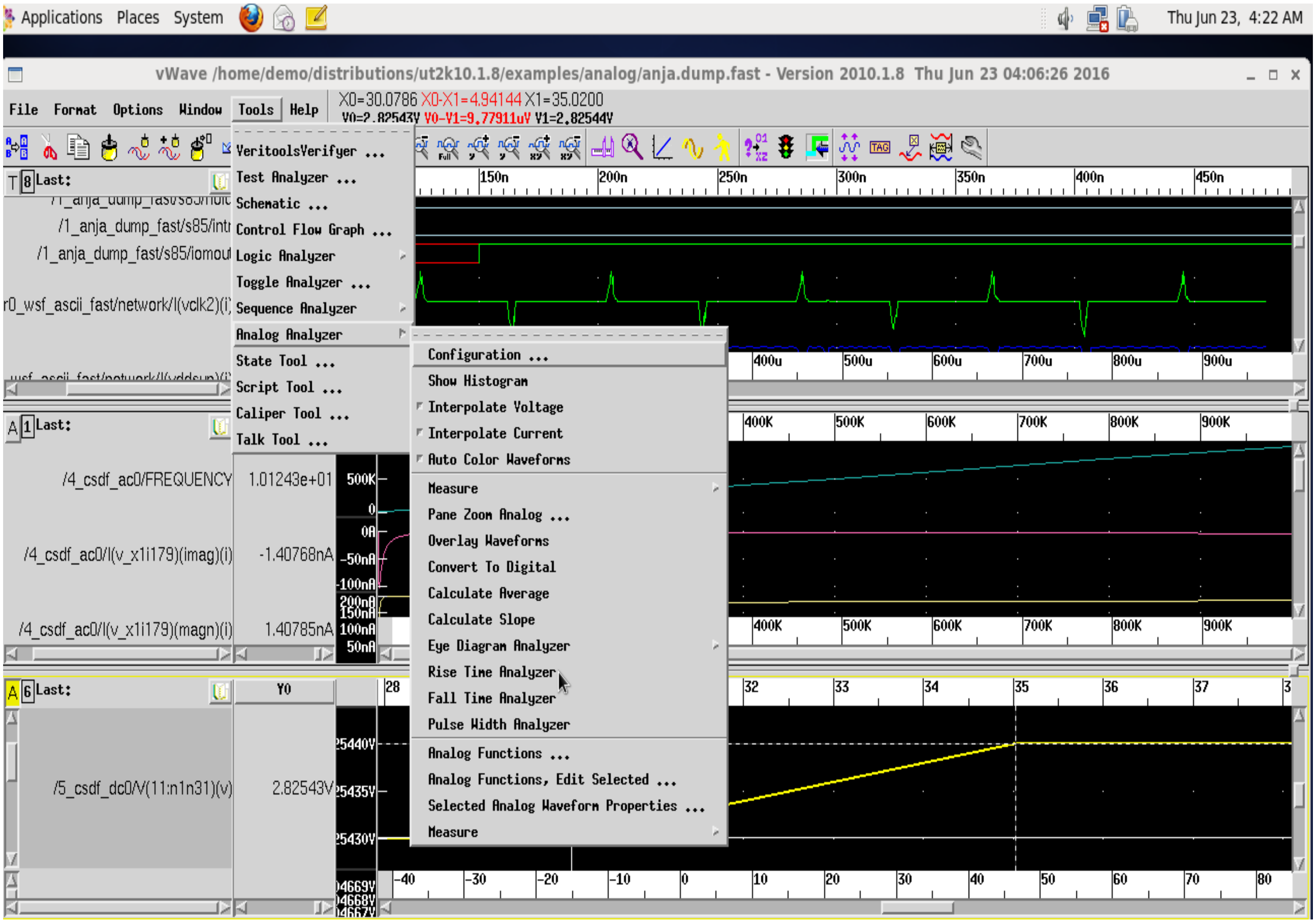
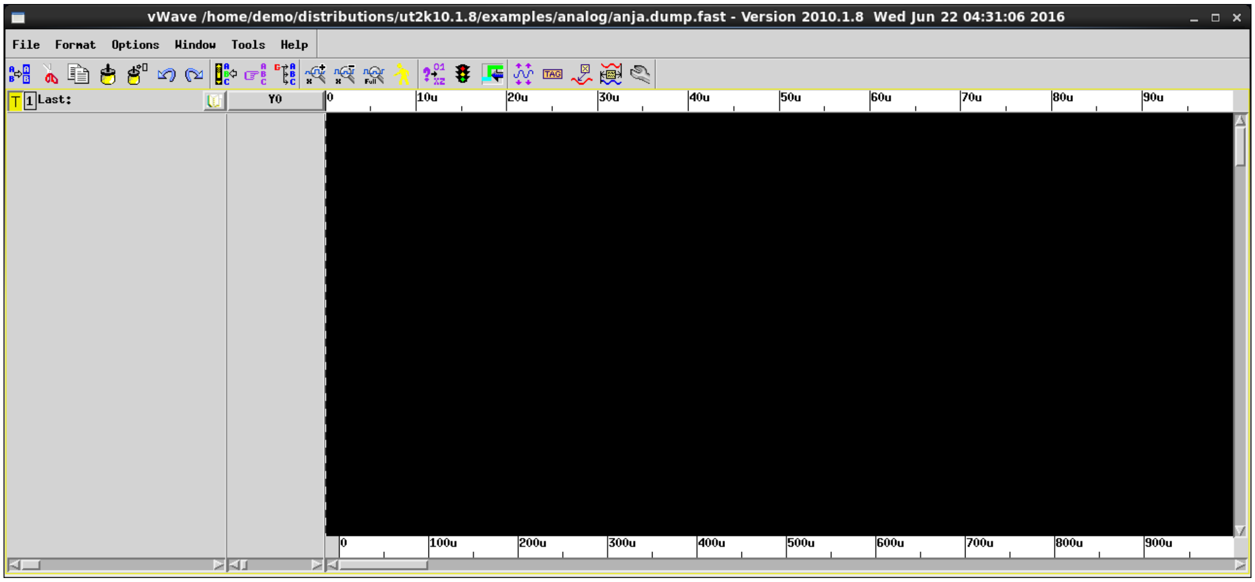
VERITOOL'S TUTORIAL FOR USING VWAVE AS A MIXED MODE DISPLAY

MIXED MODE WITH VWAVE


Applications Places System
Thu Jun 23, 4:22 AM
vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Thu Jun 23 04:06:26 2016
File Format Options Window Tools Help
X0=30.0786 X0-X1=4.94144 X1=35.0200
V0=2.82543V V0-V1=9.77911uV V1=2.82544V
VeritoolsVerifyer ...
Test Analyzer ...
Schematic ...
Control Flow Graph ...
Logic Analyzer
Toggle Analyzer ...
Sequence Analyzer
Analog Analyzer
State Tool ...
Script Tool ...
Caliper Tool ...
Talk Tool ...
Configuration ...
Show Histogram
Interpolate Voltage
Interpolate Current
Auto Color Waveforms
Measure
Pane Zoom Analog ...
Overlay Waveforms
Convert To Digital
Calculate Average
Calculate Slope
Eye Diagram Analyzer
Rise Time Analyzer
Fall Time Analyzer
Pulse Width Analyzer
Analog Functions ...
Analog Functions, Edit Selected ...
Selected Analog Waveform Properties ...
Measure
T 8 Last:
/1_anja_dump_fast/s85/intı
/1_anja_dump_fast/s85/iomoul
r0_wsf_ascii_fast/network/I(vclk2)(i)
A 1 Last:
/4_csdf_ac0/FREQUENCY 1.01243e+01
/4_csdf_ac0/I(v_x1i179)(imag)(i) -1.40768nA
/4_csdf_ac0/I(v_x1i179)(magn)(i) 1.40785nA
A 6 Last: Y0
/5_csdf_dc0/V(11:n1n31)(v) 2.82543V
150n 200n 250n 300n 350n 400n 450n
400u 500u 600u 700u 800u 900u
400K 500K 600K 700K 800K 900K
500K 0 0A -50nA -100nA 200nA 150nA 100nA 50nA
28 32 33 34 35 36 37
25440V 25435V 25430V
-40 -30 -20 -10 0 10 20 30 40 50 60 70 80

This tutorial demonstrates the use of the Veritools vWave software in a mixed mode, both analog, digital and mixed analog/digital debugging environment.

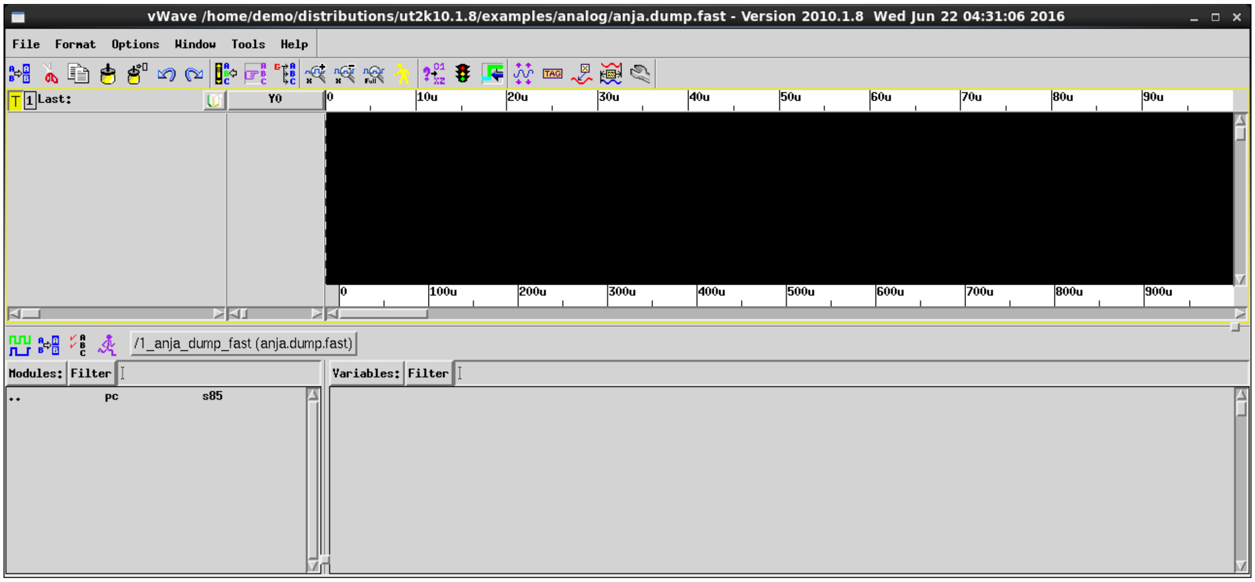
To start the vWave Mixed mode tutorial got to the file, analog, in the directory examples in your software distributions directory


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File
Format
Options
Window
Tools
Help
TAG
T
1
Last:
Y0
0
10u
20u
30u
40u
50u
60u
70u
80u
90u
0
100u
200u
300u
400u
500u
600u
700u
800u
900u

In this directory select the file anja.dump.fast to bring in by pressing the following menu items:

File -> Open File -> anaj.dump.fast

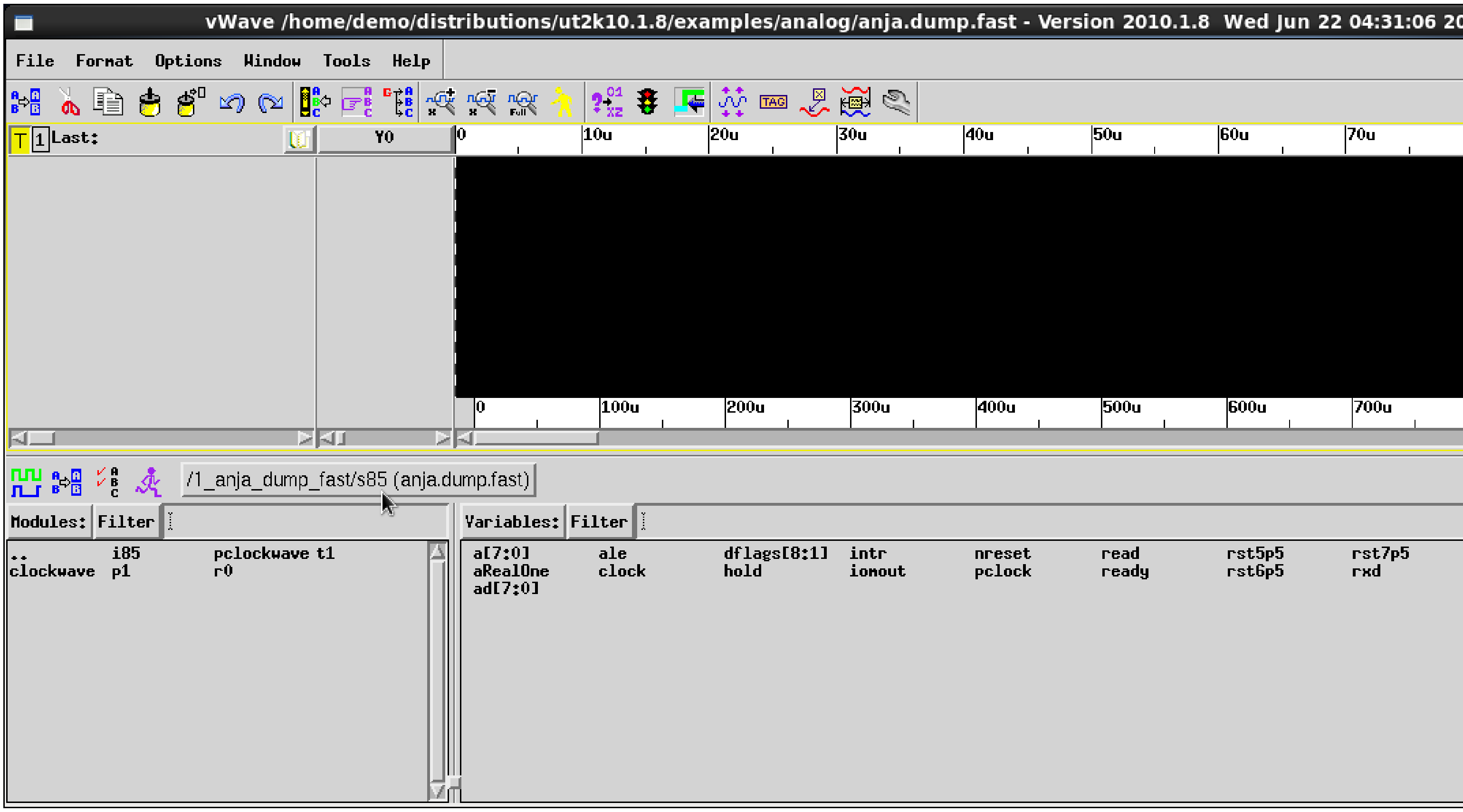
Your vWave window will look as shown in the next figure after you select the anja.dump.fast file.


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File
Format
Options
Window
Tools
Help
Last:
Y0
0
10u
20u
30u
40u
50u
60u
70u
80u
90u
0
100u
200u
300u
400u
500u
600u
700u
800u
900u
/1_anja_dump_fast (anja.dump.fast)
Modules:
Filter
Variables:
Filter
..
pc
s85

The vWave window has menus items listed across the top of the display window, icon buttons are displayed just below these menu items, an area for listing the displayed signal names on the left side of this window just below the icon buttons. To the immediate right of the signal displayed signal list is the area that displays the value of the T0/Y0 cursor, and to the right of this the waveform display area. At the bottom of the vWave window is the area for the design hierarchy, with module names listed on the left and the signal names on the right.

Next select the module name s85. This will list all of the signals that are in this s85 module as shown below:

Also note the pointer is pointing at the name of the file currently that is active in the design hierarchy window. When more than one waveform file is loaded to the vWave, the user can select which file is to be made active in the design hierarchy window.

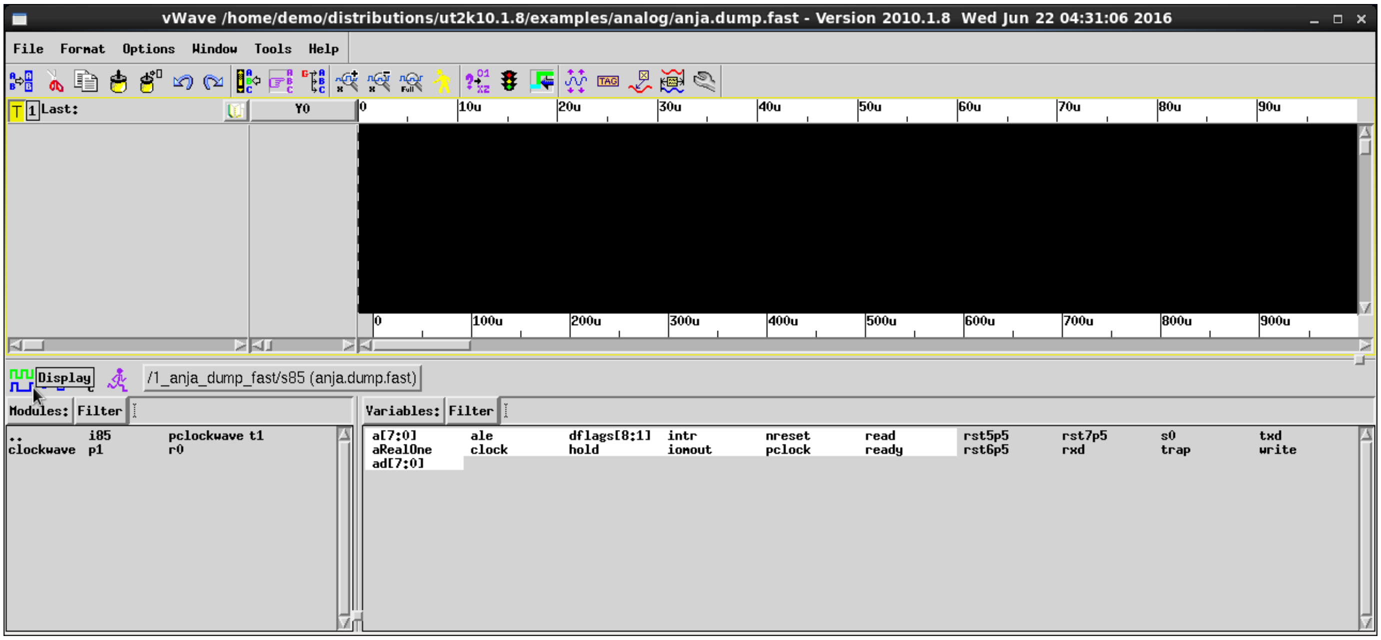

vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 20
File Format Options Window Tools Help
T 1 Last:
Y0
0 10u 20u 30u 40u 50u 60u 70u
0 100u 200u 300u 400u 500u 600u 700u
Modules: Filter
Variables: Filter

/1_anja_dump_fast/s85 (anja.dump.fast)

```
..        i85     pclockwave t1
clockwave p1      r0
```

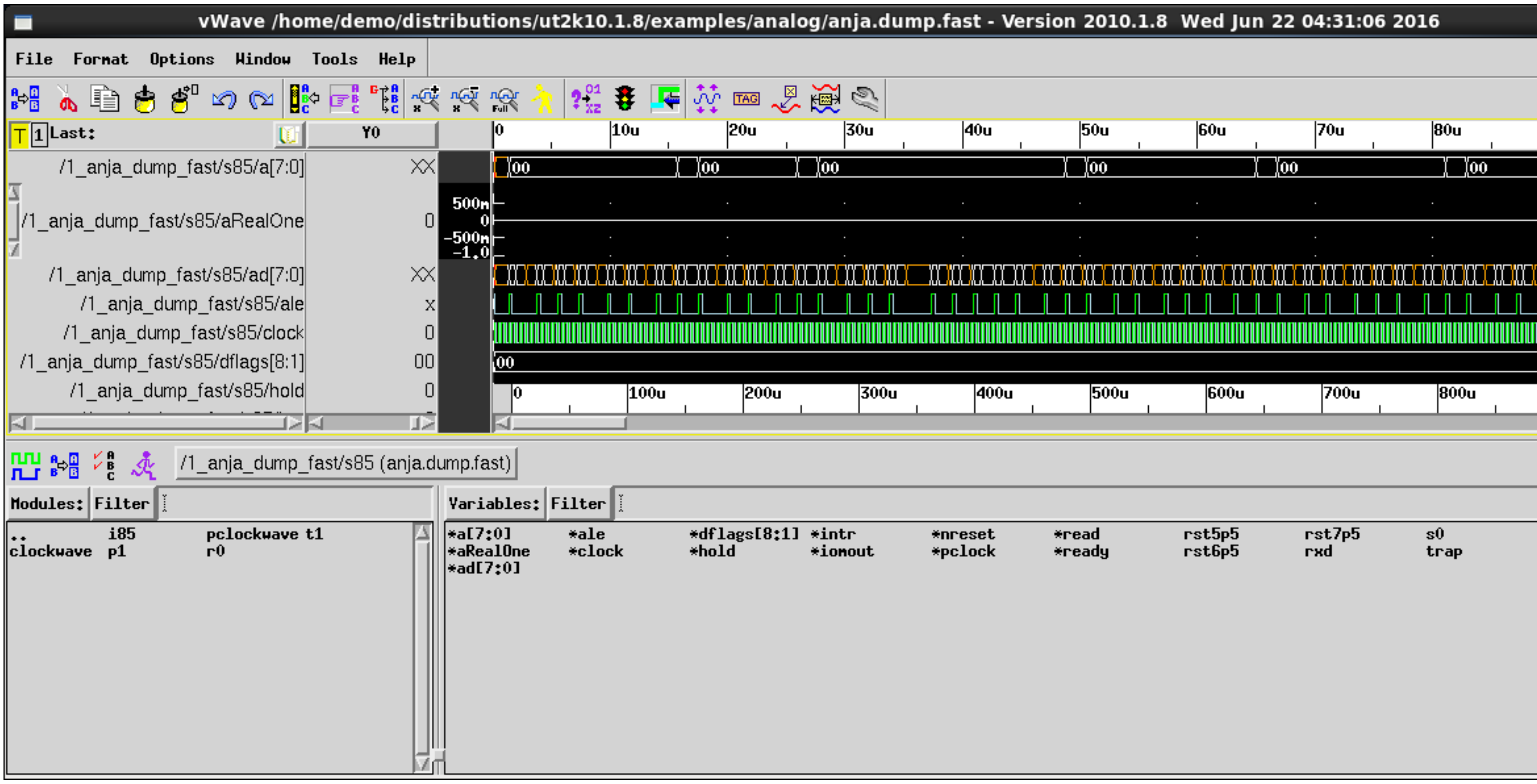
```
a[7:0]    ale    dflags[8:1]  intr    nreset  read   rst5p5  rst7p5
aRealOne  clock  hold         iomout  pclock  ready  rst6p5  rxd
ad[7:0]
```

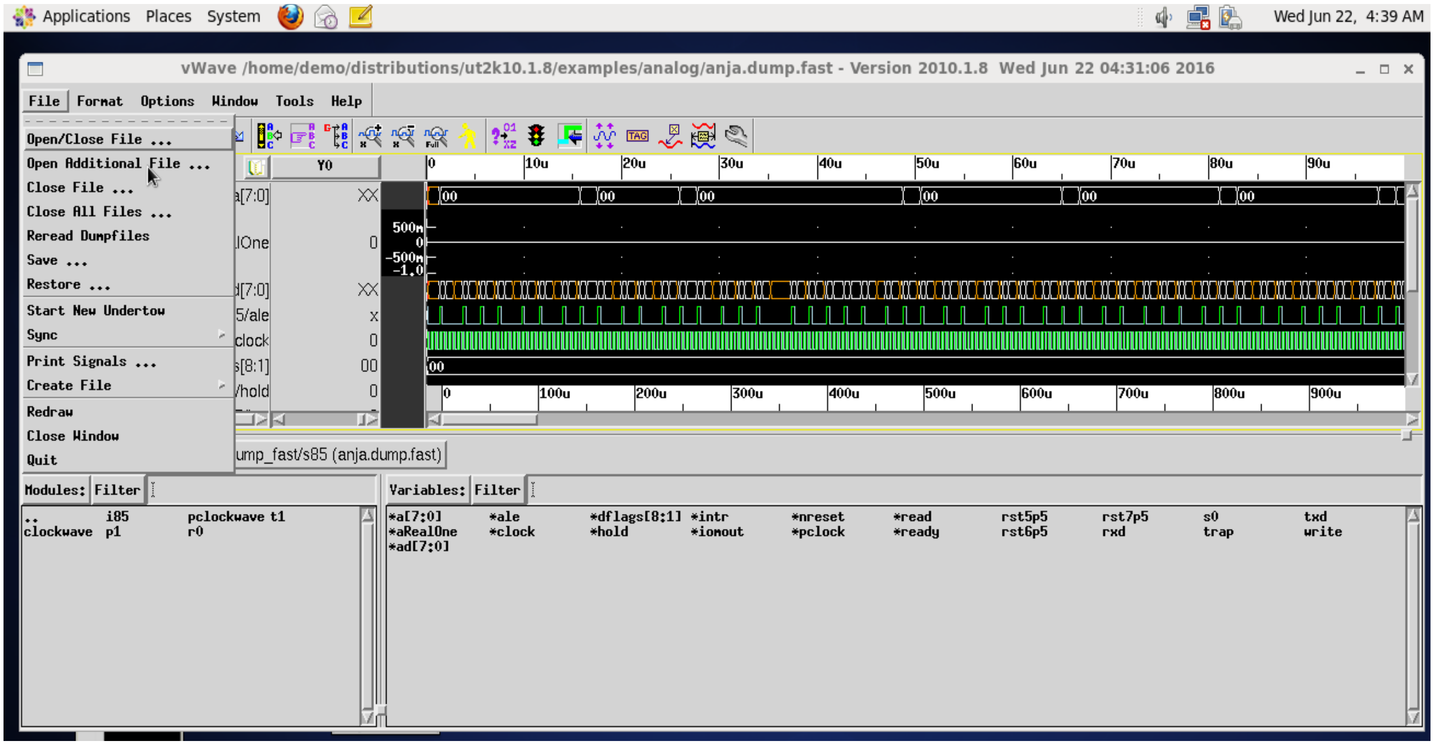
Using the left mouse button, users can select signal names in the signal name area to be displayed in the waveform area. The selected names are highlighted with a white background.



Also note in this display, the location for hierarchy icon for the “Display” icon is shown. Pressing this icon down will display all of the signals that are currently highlighted, turn off the highlight and add a “*” to each signal name in the signal selection area that has just been display so users will know if any signal in this area is already on the waveform display. When the selected signals are displayed, the signal names are listed in the signal names list of the left of the display window, along with a number at the front of the name, 1,2, 3, etc., and the file names indicating the file each signal came from, as shown below:

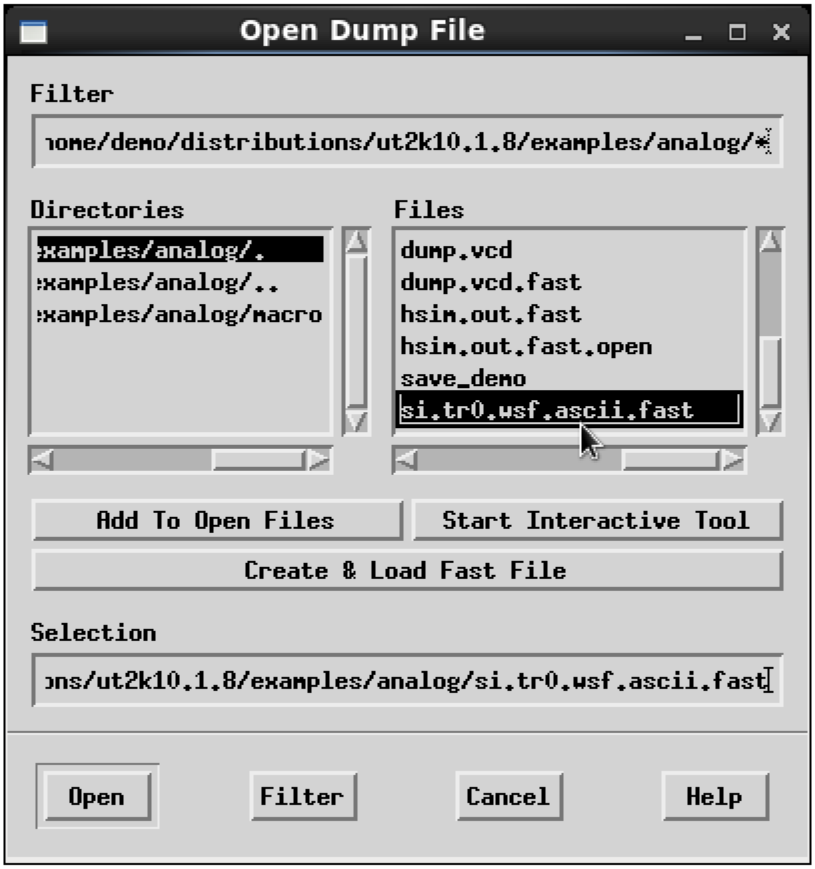
Also note the values in the Y0/T0 area are initially at time zero, until the users sets a new value in the Y0/T0 cursor.


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File Format Options Window Tools Help
Last:
Y0
/1_anja_dump_fast/s85/a[7:0] XX
/1_anja_dump_fast/s85/aRealOne 0
/1_anja_dump_fast/s85/ad[7:0] XX
/1_anja_dump_fast/s85/ale x
/1_anja_dump_fast/s85/clock 0
/1_anja_dump_fast/s85/dflags[8:1] 00
/1_anja_dump_fast/s85/hold 0
500m
0
-500m
-1.0
0 10u 20u 30u 40u 50u 60u 70u 80u
0 100u 200u 300u 400u 500u 600u 700u 800u
/1_anja_dump_fast/s85 (anja.dump.fast)
Modules: Filter
..
clockwave
i85
p1
pclockwave t1
r0
Variables: Filter
*a[7:0]
*aRealOne
*ad[7:0]
*ale
*clock
*dflags[8:1]
*hold
*intr
*iomout
*nreset
*pclock
*read
*ready
rst5p5
rst6p5
rst7p5
rxd
s0
trap



Next to now bring in analog file, do the following to select this file:

File -> Open Additional File. This will bring in a new file selection window as shown below:



Open Dump File

Filter

ome/demo/distributions/ut2k10.1.8/examples/analog/*

Directories

xamples/analog/.
xamples/analog/..
xamples/analog/macro

Files

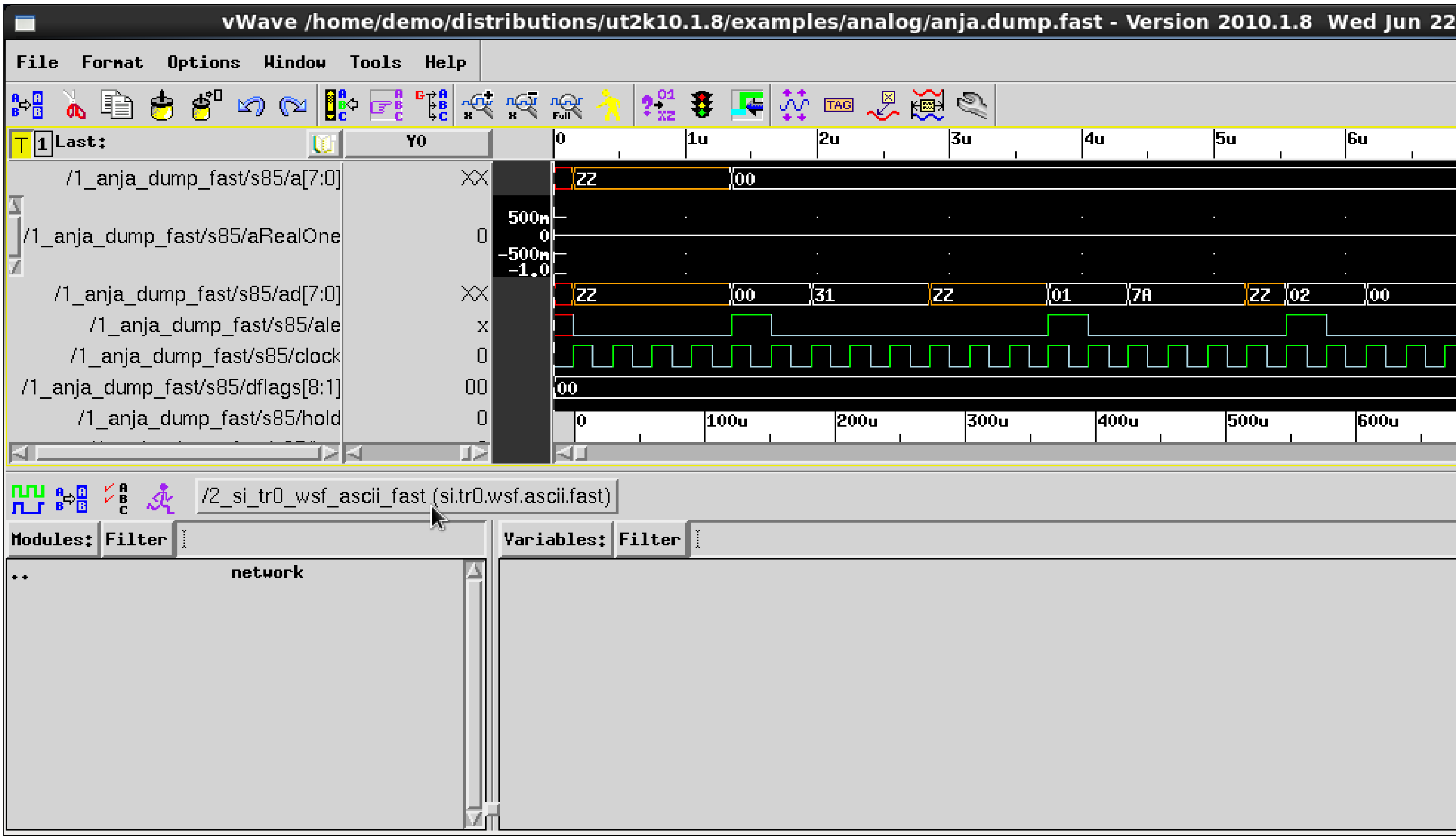
dump.vcd
dump.vcd.fast
hsim.out.fast
hsim.out.fast.open
save_demo
si.tr0.wsf.ascii.fast

Selection

ons/ut2k10.1.8/examples/analog/si.tr0.wsf.ascii.fast

Now in this window select the analog file as highlighted. Note that fast files can be made when selected files are brought in, using the icon shown above, “Create and Load Fast File”, or using vdump a batch tool that will quickly make fast file in a batch process. A typical vdump command would be:

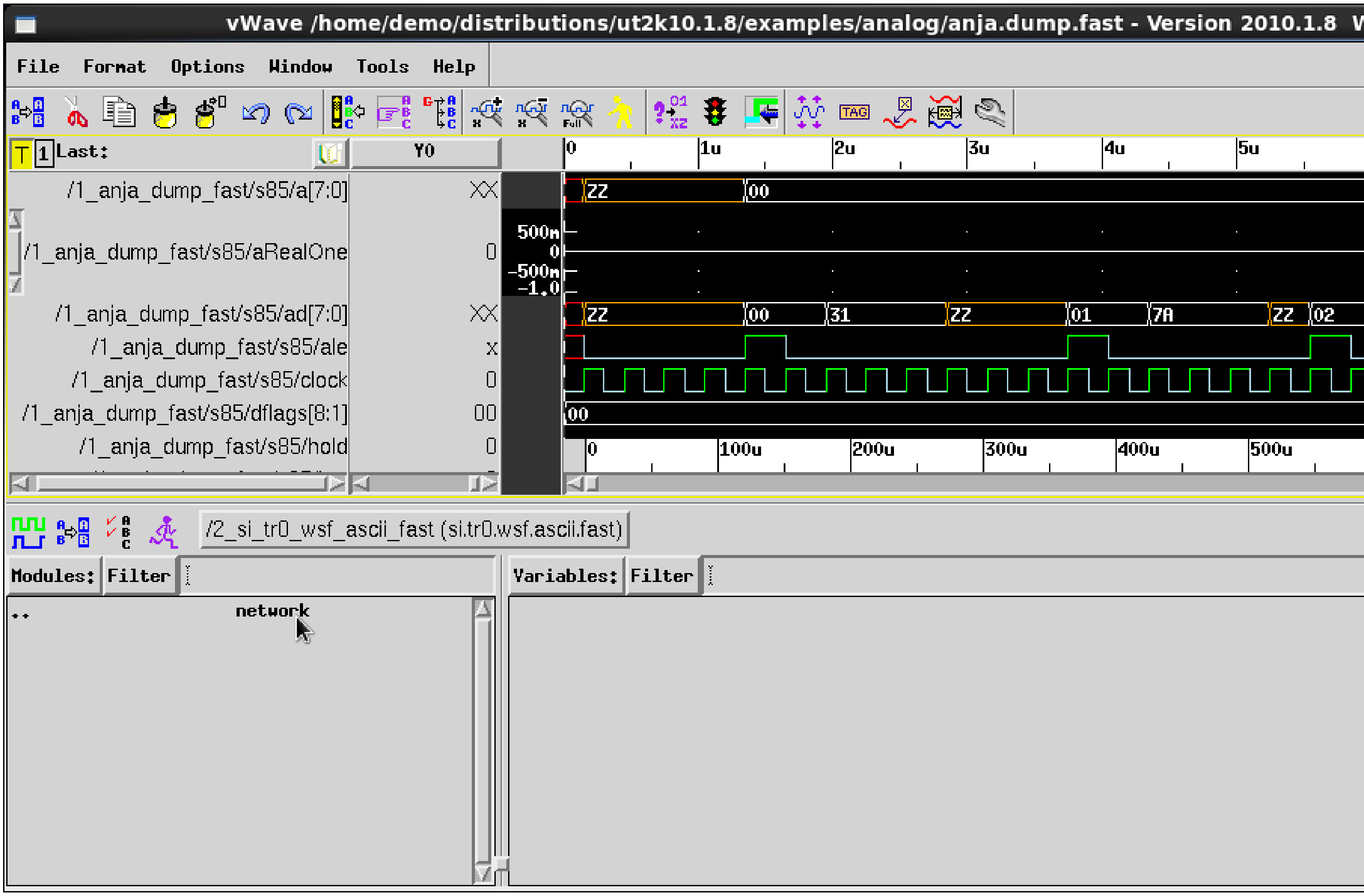
%vdump -Cxn vcd.file, which will become vcd.file.fast


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22
File
Format
Options
Window
Tools
Help
Last:
Y0
/1_anja_dump_fast/s85/a[7:0]
XX
/1_anja_dump_fast/s85/aRealOne
0
/1_anja_dump_fast/s85/ad[7:0]
XX
/1_anja_dump_fast/s85/ale
x
/1_anja_dump_fast/s85/clock
0
/1_anja_dump_fast/s85/dflags[8:1]
00
/1_anja_dump_fast/s85/hold
0
500m
0
-500m
-1.0
0
1u
2u
3u
4u
5u
6u
ZZ
00
31
7A
01
02
100u
200u
300u
400u
500u
600u
/2_si_tr0_wsf_ascii_fast (si.tr0.wsf.ascii.fast)
Modules:
Filter
Variables:
..
network

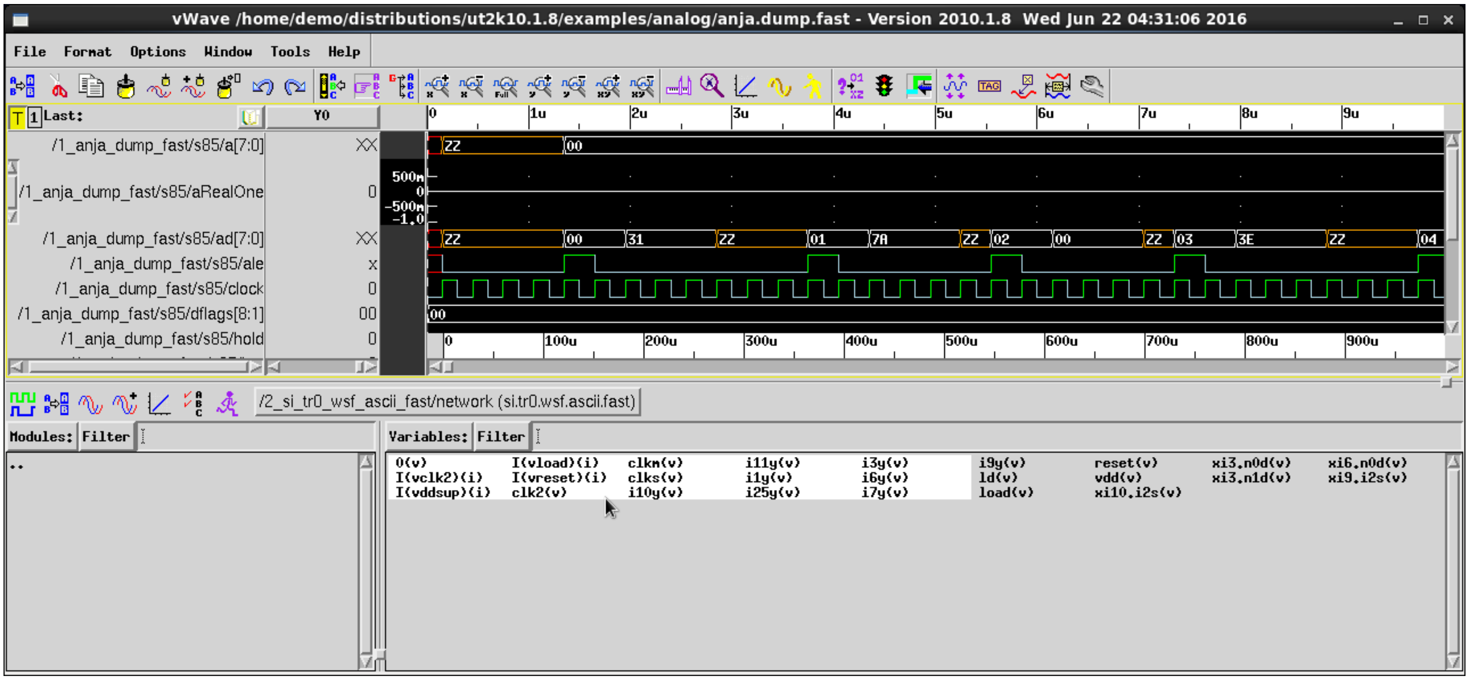
This cursor now points to the active file name text area that holds name of the file that is now the active file for the current hierarchy window.

Users can select any file in the Active Signal Name text area to now make that the file active in the vWave window.

Now select “network’ to display the signal names for the analog design in hierarchy “network”.

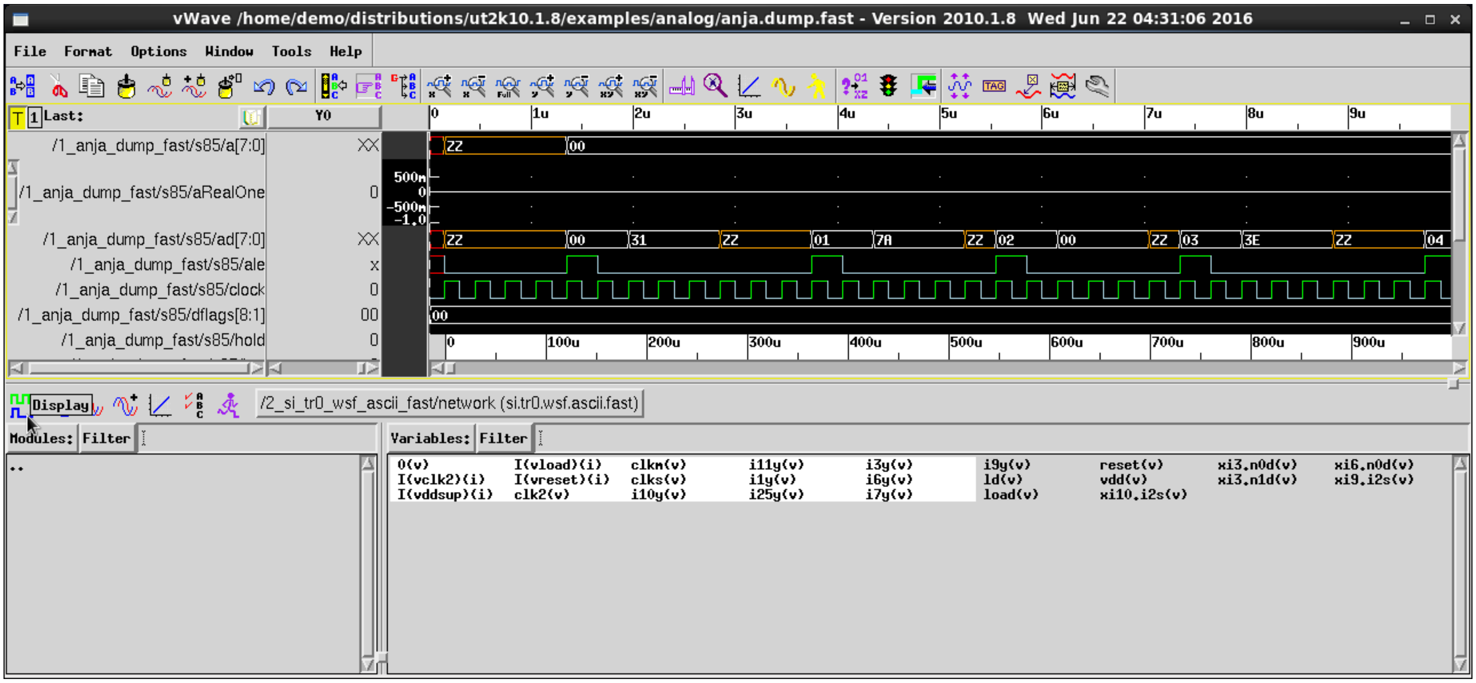

vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8
File
Format
Options
Window
Tools
Help
Last:
Y0
/1_anja_dump_fast/s85/a[7:0]
/1_anja_dump_fast/s85/aRealOne
/1_anja_dump_fast/s85/ad[7:0]
/1_anja_dump_fast/s85/ale
/1_anja_dump_fast/s85/clock
/1_anja_dump_fast/s85/dflags[8:1]
/1_anja_dump_fast/s85/hold
/2_si_tr0_wsf_ascii_fast (si.tr0.wsf.ascii.fast)
Modules:
Filter
Variables:
Filter
..
network

This will list the signal names for the analog module "network" as shown below:


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File
Format
Options
Window
Tools
Help
Last:
Y0
/1_anja_dump_fast/s85/a[7:0]
/1_anja_dump_fast/s85/aRealOne
/1_anja_dump_fast/s85/ad[7:0]
/1_anja_dump_fast/s85/ale
/1_anja_dump_fast/s85/clock
/1_anja_dump_fast/s85/dflags[8:1]
/1_anja_dump_fast/s85/hold
/2_si_tr0_wsf_ascii_fast/network (si.tr0.wsf.ascii.fast)
Modules:
Filter
Variables:
Filter
..

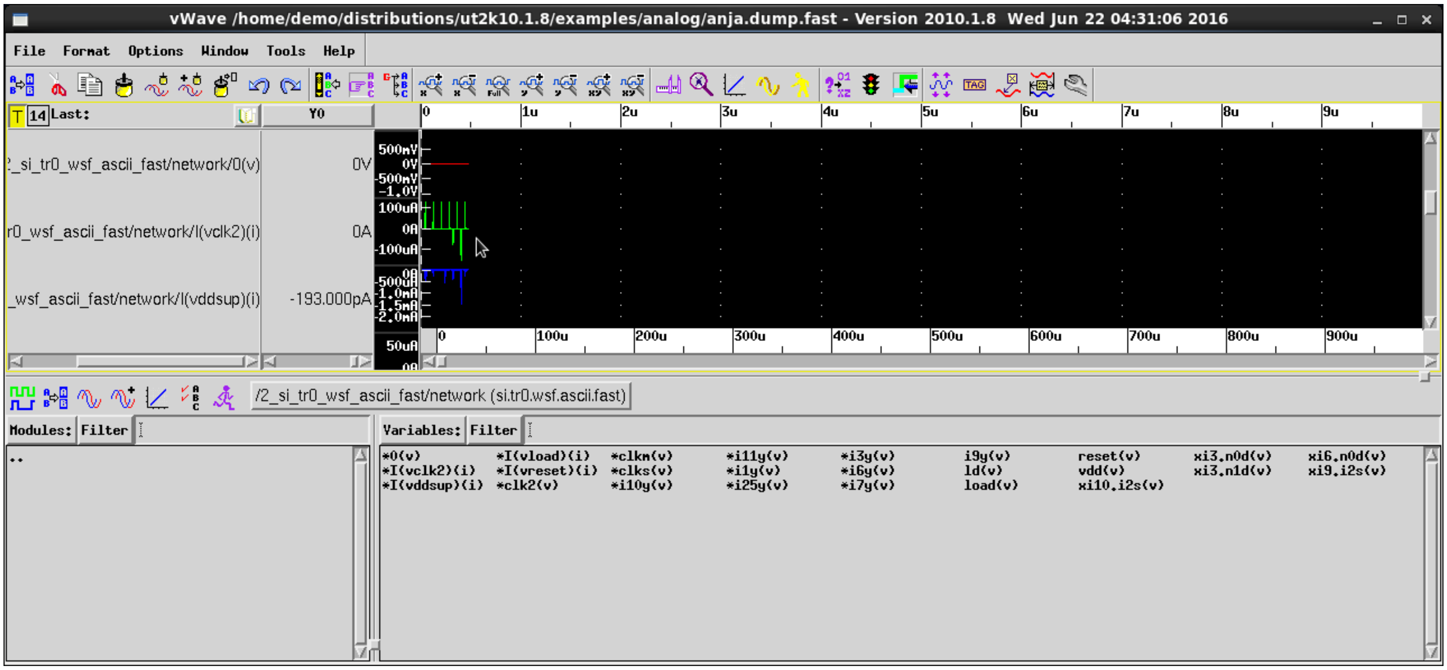
```
0(v)          I(vload)(i)   clkm(v)     i11y(v)     i3y(v)      i9y(v)      reset(v)      xi3.n0d(v)  xi6.n0d(v)
I(vclk2)(i)   I(vreset)(i)  clks(v)     i1y(v)      i6y(v)      ld(v)       vdd(v)        xi3.n1d(v)  xi9.i2s(v)
I(vddsup)(i)  clk2(v)       i10y(v)     i25y(v)     i7y(v)      load(v)     xi10.i2s(v)
```

Next sliding the left mouse over the signal names you want to display.

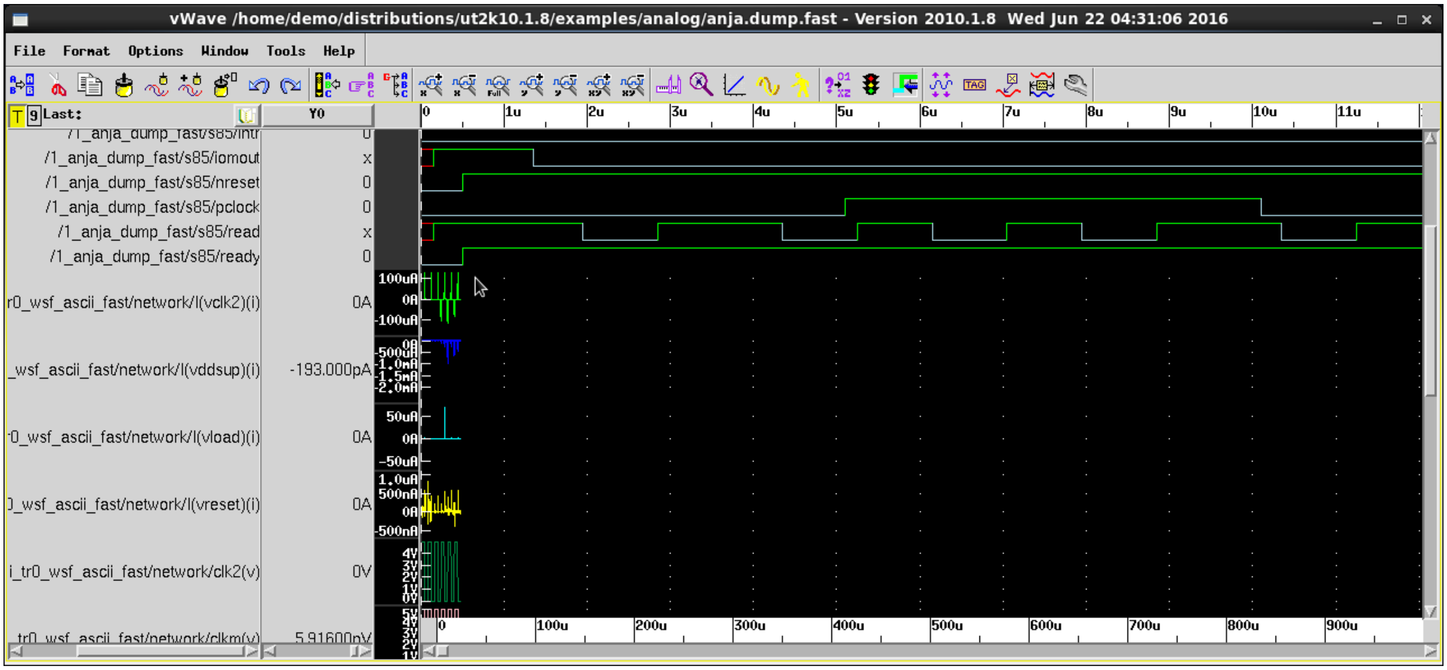

vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File
Format
Options
Window
Tools
Help
T
1
Last:
Y0
/1_anja_dump_fast/s85/a[7:0]
/1_anja_dump_fast/s85/aRealOne
/1_anja_dump_fast/s85/ad[7:0]
/1_anja_dump_fast/s85/ale
/1_anja_dump_fast/s85/clock
/1_anja_dump_fast/s85/dflags[8:1]
/1_anja_dump_fast/s85/hold
XX
0
XX
x
0
00
0
500m
0
-500m
-1.0
0
1u
2u
3u
4u
5u
6u
7u
8u
9u
ZZ
00
31
01
7A
02
03
3E
04
100u
200u
300u
400u
500u
600u
700u
800u
900u
Display
/2_si_tr0_wsf_ascii_fast/network (si.tr0.wsf.ascii.fast)
Modules:
Filter
..
Variables:
Filter

```
0(v)          I(vload)(i)   clkm(v)    i11y(v)   i3y(v)   i9y(v)    reset(v)      xi3.n0d(v)   xi6.n0d(v)
I(vclk2)(i)   I(vreset)(i)  clks(v)    i1y(v)    i6y(v)   ld(v)     vdd(v)        xi3.n1d(v)   xi9.i2s(v)
I(vddsup)(i)  clk2(v)       i10y(v)    i25y(v)   i7y(v)   load(v)   xi10.i2s(v)
```

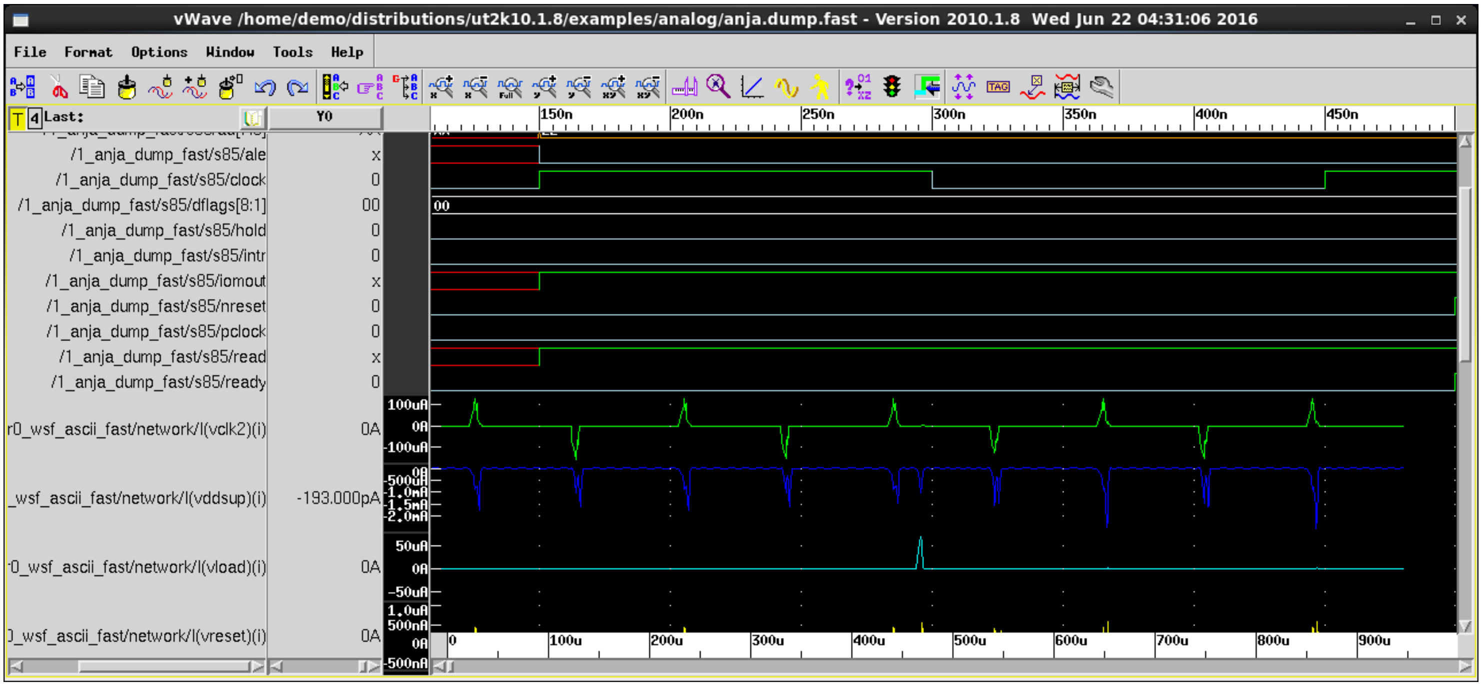
Then press display, as shown by the pointer, to add these signal waveforms to the already present digital waveform display:


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File Format Options Window Tools Help
T 14 Last:
Y0
2_si_tr0_wsf_ascii_fast/network/0(v) 0V
r0_wsf_ascii_fast/network/I(vclk2)(i) 0A
_wsf_ascii_fast/network/I(vddsup)(i) -193.000pA
500mV 0V -500mV -1.0V
100uA 0A -100uA
0A -500uA -1.0mA -1.5mA -2.0mA
50uA
0 1u 2u 3u 4u 5u 6u 7u 8u 9u
0 100u 200u 300u 400u 500u 600u 700u 800u 900u
/2_si_tr0_wsf_ascii_fast/network (si.tr0.wsf.ascii.fast)
Modules: Filter
..
Variables: Filter
*0(v) *I(vload)(i) *clkm(v) *i11y(v) *i3y(v) i9y(v) reset(v) xi3.n0d(v) xi6.n0d(v)
*I(vclk2)(i) *I(vreset)(i) *clks(v) *i1y(v) *i6y(v) ld(v) vdd(v) xi3.n1d(v) xi9.i2s(v)
*I(vddsup)(i) *clk2(v) *i10y(v) *i25y(v) *i7y(v) load(v) xi10.i2s(v)

Note that when adding analog into a digital waveform display the horizontal scale for the analog file must be "Time" and note that even if the horizontal scale is time the analog can have a different time period for the simulation than the digital as show above.


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File Format Options Window Tools Help
T 9 Last:
Y0
/1_anja_dump_fast/s85/intr 0
/1_anja_dump_fast/s85/iomout x
/1_anja_dump_fast/s85/nreset 0
/1_anja_dump_fast/s85/pclock 0
/1_anja_dump_fast/s85/read x
/1_anja_dump_fast/s85/ready 0
r0_wsf_ascii_fast/network/I(vclk2)(i) 0A
_wsf_ascii_fast/network/I(vddsup)(i) -193.000pA
r0_wsf_ascii_fast/network/I(vload)(i) 0A
0_wsf_ascii_fast/network/I(vreset)(i) 0A
i_tr0_wsf_ascii_fast/network/clk2(v) 0V
tr0_wsf_ascii_fast/network/clkm(v) 5.91600nV
100uA 0A -100uA
0A -500uA -1.0mA -1.5mA -2.0mA
50uA 0A -50uA
1.0uA 500nA 0A -500nA
4V 3V 2V 1V 0V
5V 4V 3V 2V 1V
0 1u 2u 3u 4u 5u 6u 7u 8u 9u 10u 11u
0 100u 200u 300u 400u 500u 600u 700u 800u 900u

To show the complete analog simulation synchronized in time, zoom the analog waveforms by pressing the right mouse button down on the waveform display window above and to the left of where you want to zoom, and slide the cursor down and to the right over the signals you want to zoom into. The result display will then look as shown below:

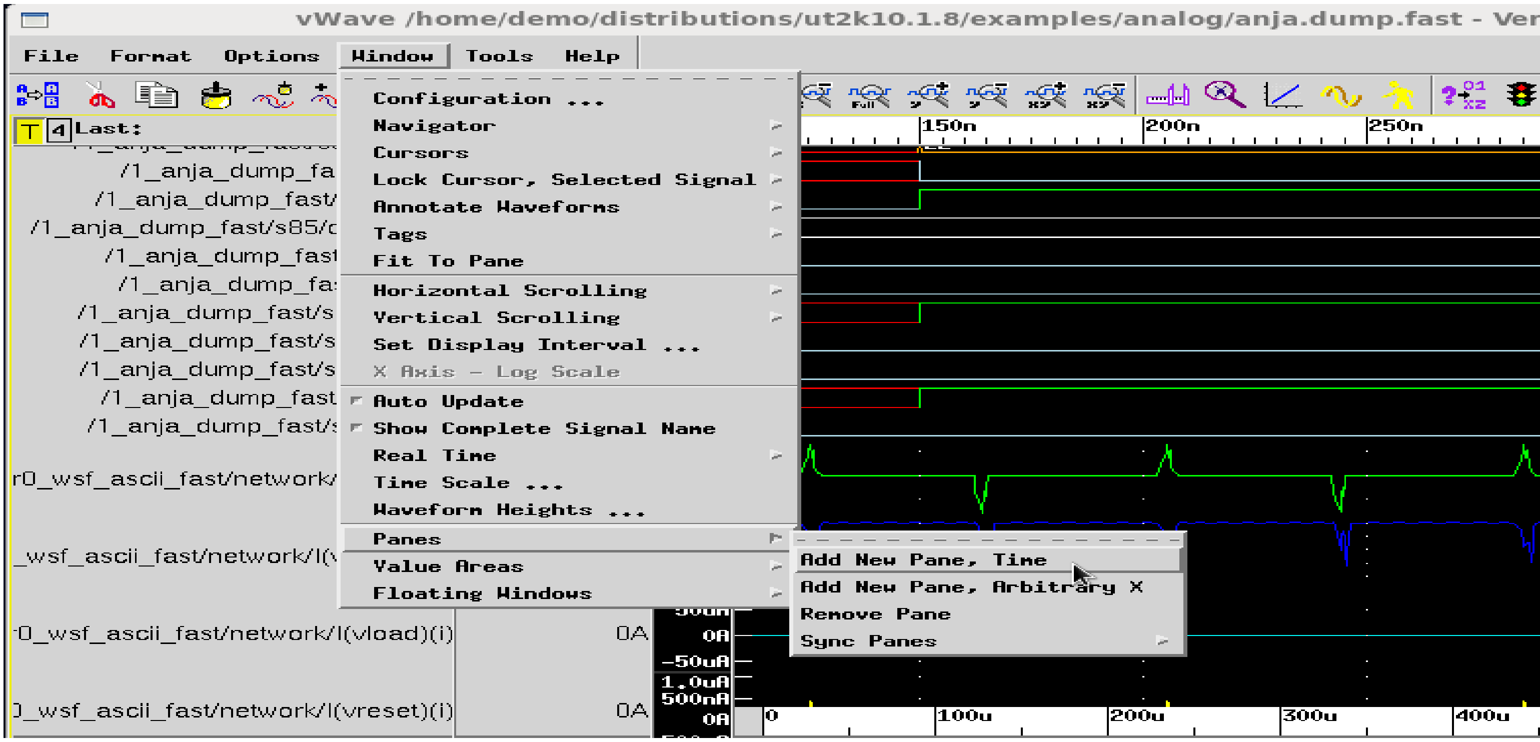


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016

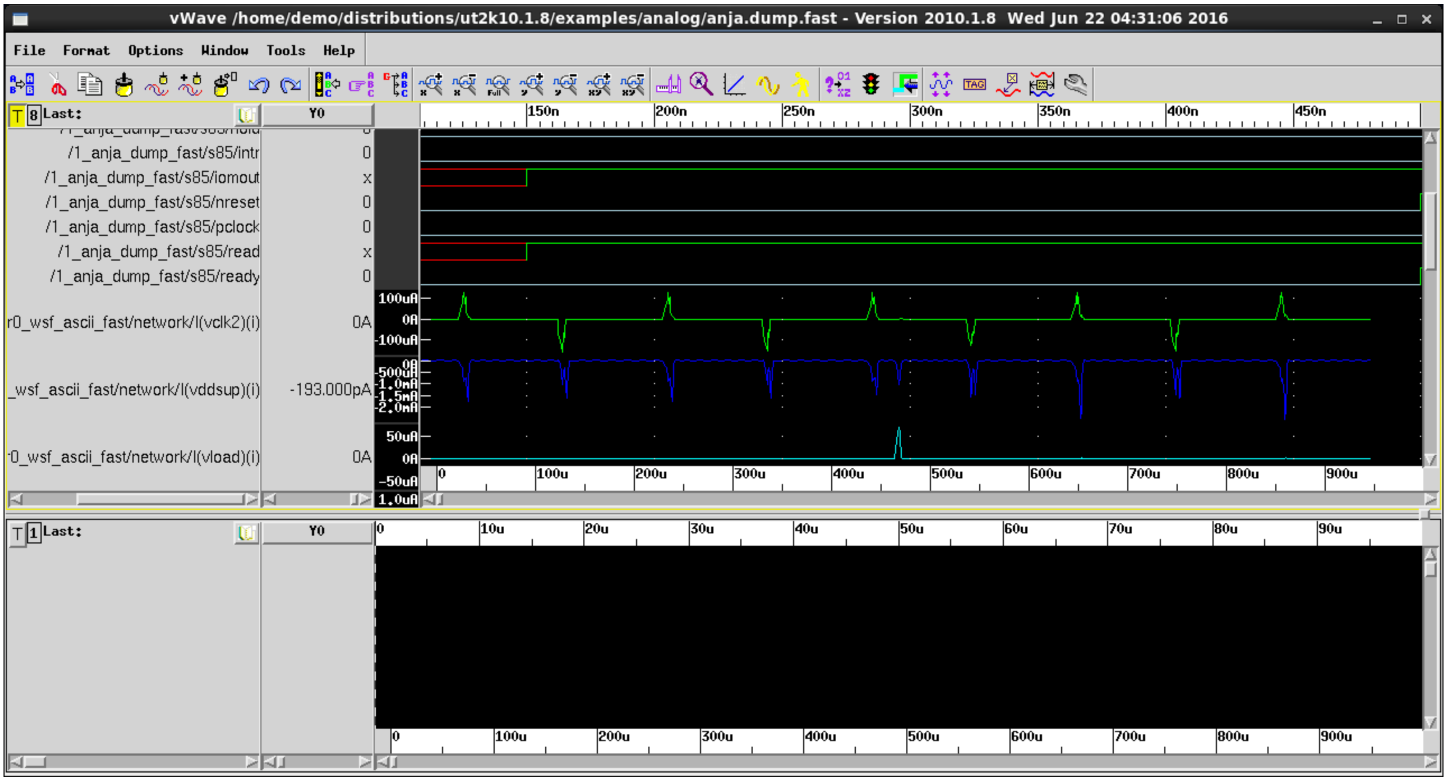
	Y0
/1_anja_dump_fast/s85/ale	x
/1_anja_dump_fast/s85/clock	0
/1_anja_dump_fast/s85/dflags[8:1]	00
/1_anja_dump_fast/s85/hold	0
/1_anja_dump_fast/s85/intr	0
/1_anja_dump_fast/s85/iomout	x
/1_anja_dump_fast/s85/nreset	0
/1_anja_dump_fast/s85/pclock	0
/1_anja_dump_fast/s85/read	x
/1_anja_dump_fast/s85/ready	0
r0_wsf_ascii_fast/network/I(vclk2)(i)	0A
_wsf_ascii_fast/network/I(vddsup)(i)	-193.000pA
'0_wsf_ascii_fast/network/I(vload)(i)	0A
]_wsf_ascii_fast/network/I(vreset)(i)	0A

In addition to adding the analog right onto the waveform display with the digital, you can also add a new pane, and have the analog added to just that pane. To add a new time pane, do the following:

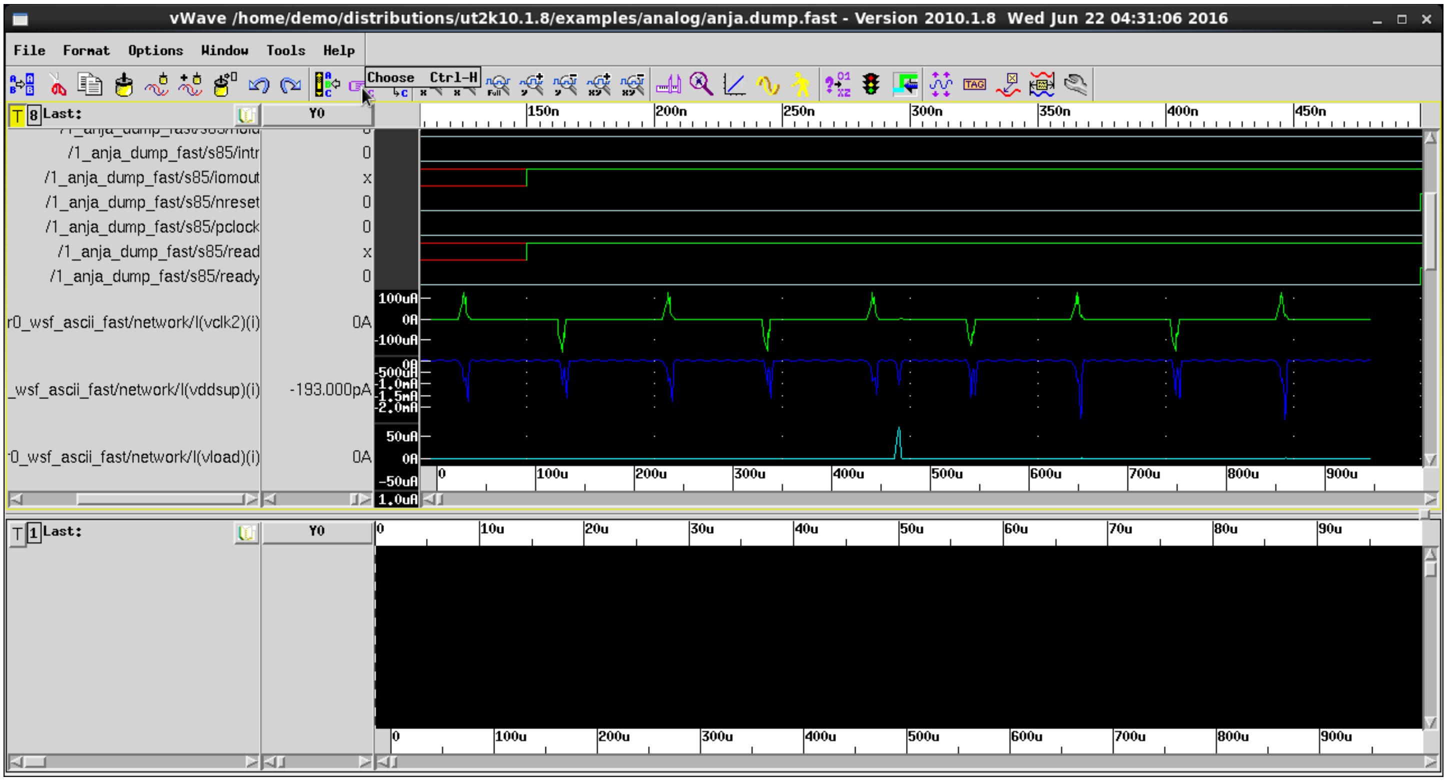
Window -> Panes -> Add New Pane, Time



The result is shown below:


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File
Format
Options
Window
Tools
Help
Last:
Y0
/1_anja_dump_fast/s85/intr
/1_anja_dump_fast/s85/iomout
/1_anja_dump_fast/s85/nreset
/1_anja_dump_fast/s85/pclock
/1_anja_dump_fast/s85/read
/1_anja_dump_fast/s85/ready
r0_wsf_ascii_fast/network/I(vclk2)(i)
_wsf_ascii_fast/network/I(vddsup)(i)
-193.000pA
0_wsf_ascii_fast/network/I(vload)(i)
0A

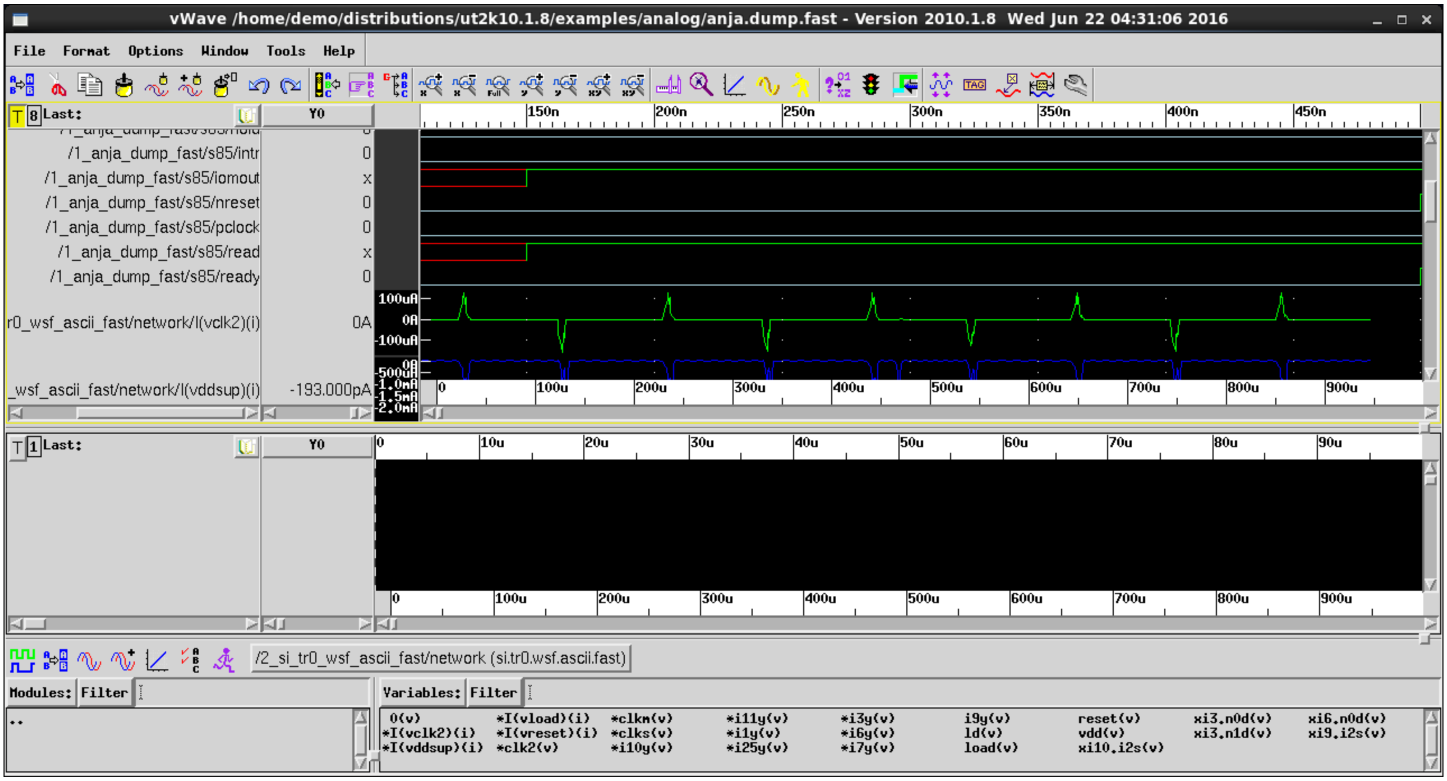
Next select the Choose icon to add a signal selector to this waveform window:



vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016

File
Format
Options
Window
Tools
Help
Choose Ctrl-H
Last:
Y0
/1_anja_dump_fast/s85/intr 0
/1_anja_dump_fast/s85/iomout x
/1_anja_dump_fast/s85/nreset 0
/1_anja_dump_fast/s85/pclock 0
/1_anja_dump_fast/s85/read x
/1_anja_dump_fast/s85/ready 0
r0_wsf_ascii_fast/network/I(vclk2)(i) 0A
_wsf_ascii_fast/network/I(vddsup)(i) -193.000pA
r0_wsf_ascii_fast/network/I(vload)(i) 0A
150n
200n
250n
300n
350n
400n
450n
100uA
0A
-100uA
-500uA
-1.0mA
-1.5mA
-2.0mA
50uA
-50uA
1.0uA
0
100u
200u
300u
400u
500u
600u
700u
800u
900u
10u
20u
30u
40u
50u
60u
70u
80u
90u

This will bring in a signal selector for the new analog file as shown below:



vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016

File
Format
Options
Window
Tools
Help
Last:
Y0
/1_anja_dump_fast/s85/intr 0
/1_anja_dump_fast/s85/iomout x
/1_anja_dump_fast/s85/nreset 0
/1_anja_dump_fast/s85/pclock 0
/1_anja_dump_fast/s85/read x
/1_anja_dump_fast/s85/ready 0
r0_wsf_ascii_fast/network/I(vclk2)(i) 0A
_wsf_ascii_fast/network/I(vddsup)(i) -193.000pA
150n
200n
250n
300n
350n
400n
450n
100uA
0A
-100uA
-500uA
-1.0mA
-1.5mA
-2.0mA
0
100u
200u
300u
400u
500u
600u
700u
800u
900u
10u
20u
30u
40u
50u
60u
70u
80u
90u

/2_si_tr0_wsf_ascii_fast/network (si.tr0.wsf.ascii.fast)

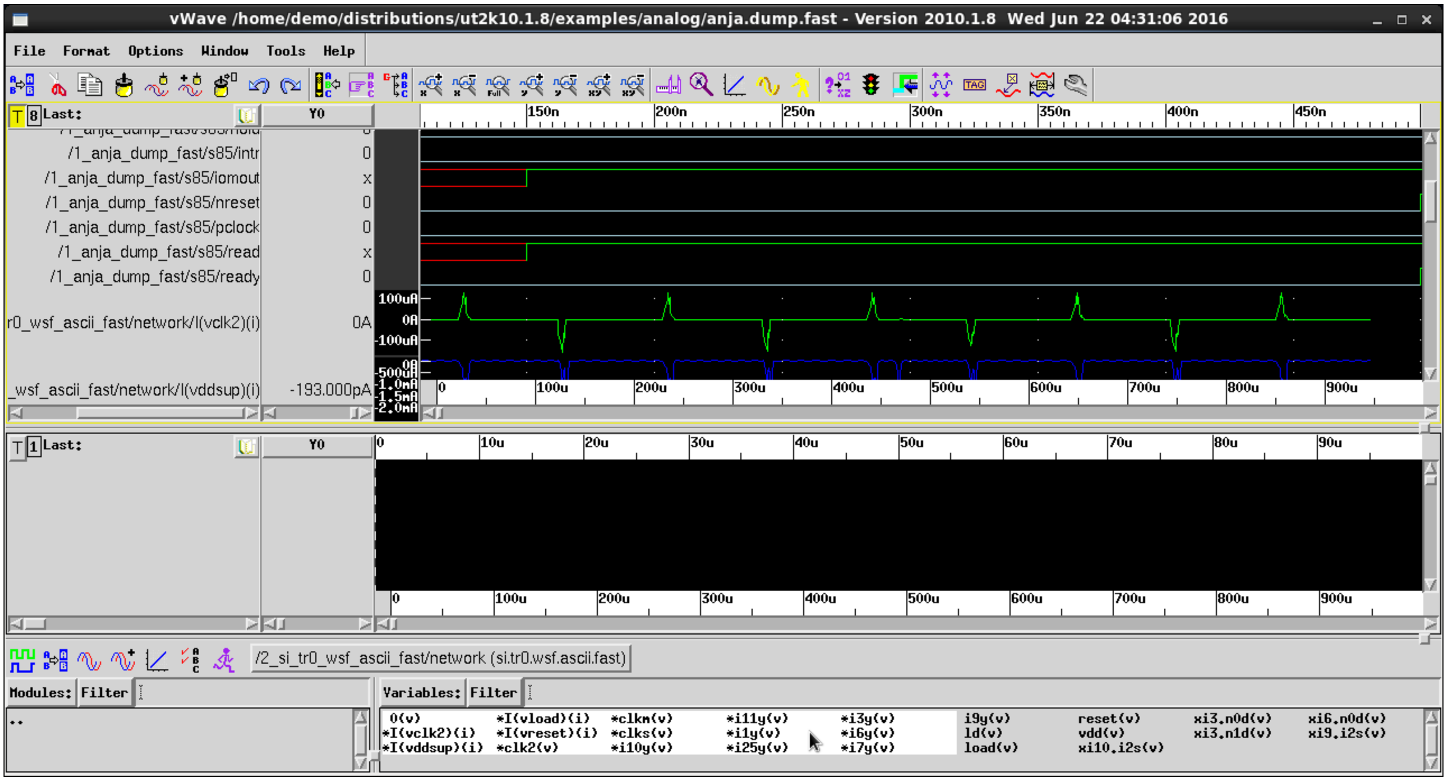
Modules: Filter

```
..
```

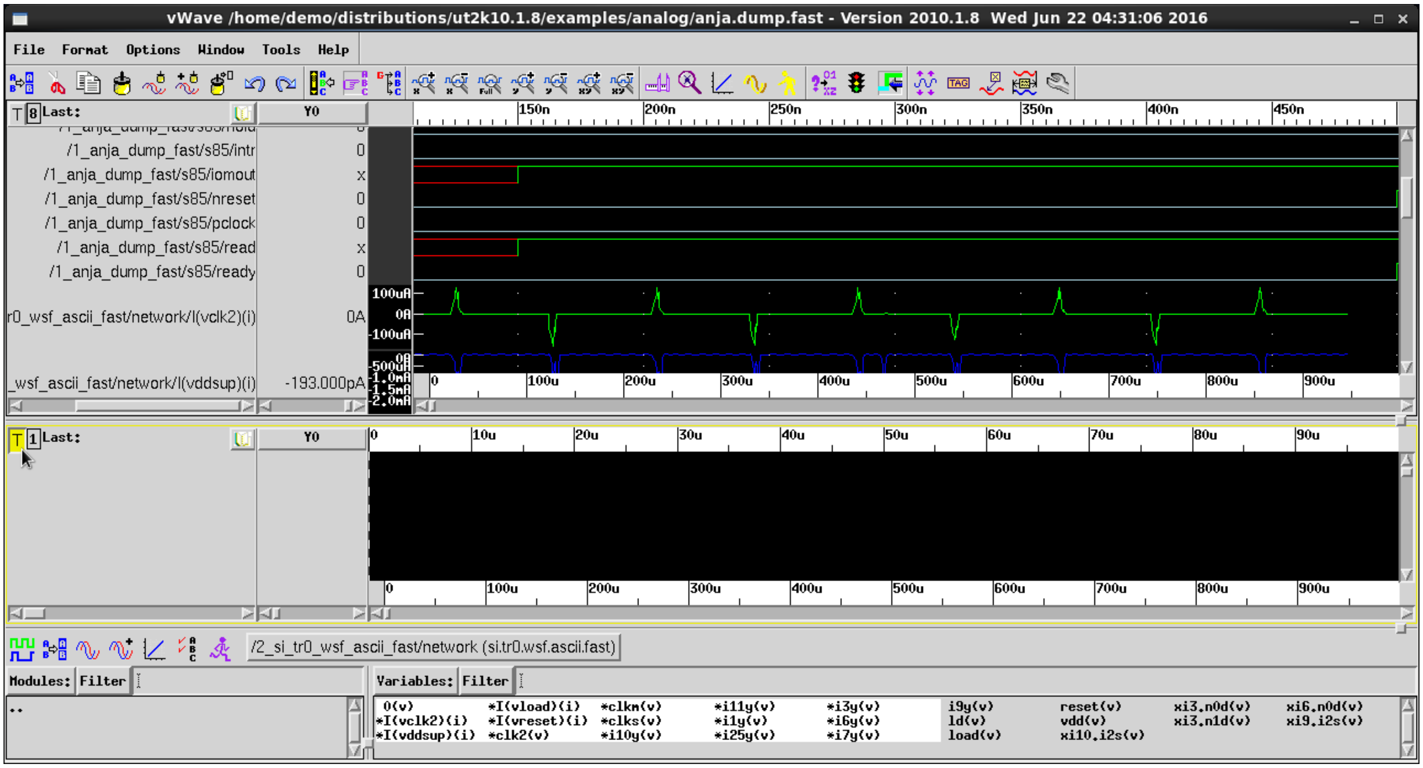
Variables: Filter

```
 0(v)           *I(vload)(i)  *clkm(v)    *i11y(v)    *i3y(v)    i9y(v)     reset(v)     xi3.n0d(v)   xi6.n0d(v)
*I(vclk2)(i)    *I(vreset)(i) *clks(v)    *i1y(v)     *i6y(v)    ld(v)      vdd(v)       xi3.n1d(v)   xi9.i2s(v)
*I(vddsup)(i)   *clk2(v)      *i10y(v)    *i25y(v)    *i7y(v)    load(v)    xi10.i2s(v)
```

Then select the analog signal you want on this pane:


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File Format Options Window Tools Help
T 8 Last:
Y0
/1_anja_dump_fast/s85/intr 0
/1_anja_dump_fast/s85/iomout x
/1_anja_dump_fast/s85/nreset 0
/1_anja_dump_fast/s85/pclock 0
/1_anja_dump_fast/s85/read x
/1_anja_dump_fast/s85/ready 0
r0_wsf_ascii_fast/network/I(vclk2)(i) 0A
_wsf_ascii_fast/network/I(vddsup)(i) -193.000pA
150n 200n 250n 300n 350n 400n 450n
100uA 0A -100uA
0A -500uA -1.0mA -1.5mA -2.0mA
0 100u 200u 300u 400u 500u 600u 700u 800u 900u
T 1 Last:
Y0
0 10u 20u 30u 40u 50u 60u 70u 80u 90u
0 100u 200u 300u 400u 500u 600u 700u 800u 900u
/2_si_tr0_wsf_ascii_fast/network (si.tr0.wsf.ascii.fast)
Modules: Filter
..
Variables: Filter
0(v)
*I(vclk2)(i)
*I(vddsup)(i)
*I(vload)(i)
*I(vreset)(i)
*clk2(v)
*clkm(v)
*clks(v)
*i10y(v)
*i11y(v)
*i1y(v)
*i25y(v)
*i3y(v)
*i6y(v)
*i7y(v)
i9y(v)
ld(v)
load(v)
reset(v)
vdd(v)
xi10.i2s(v)
xi3.n0d(v)
xi3.n1d(v)
xi6.n0d(v)
xi9.i2s(v)

Make sure the new pane is the active pane, if the "T" (which stands for time), in the upper left hand corner of each pane for the new pane does not have a Yellow back ground select it to make this pane active.



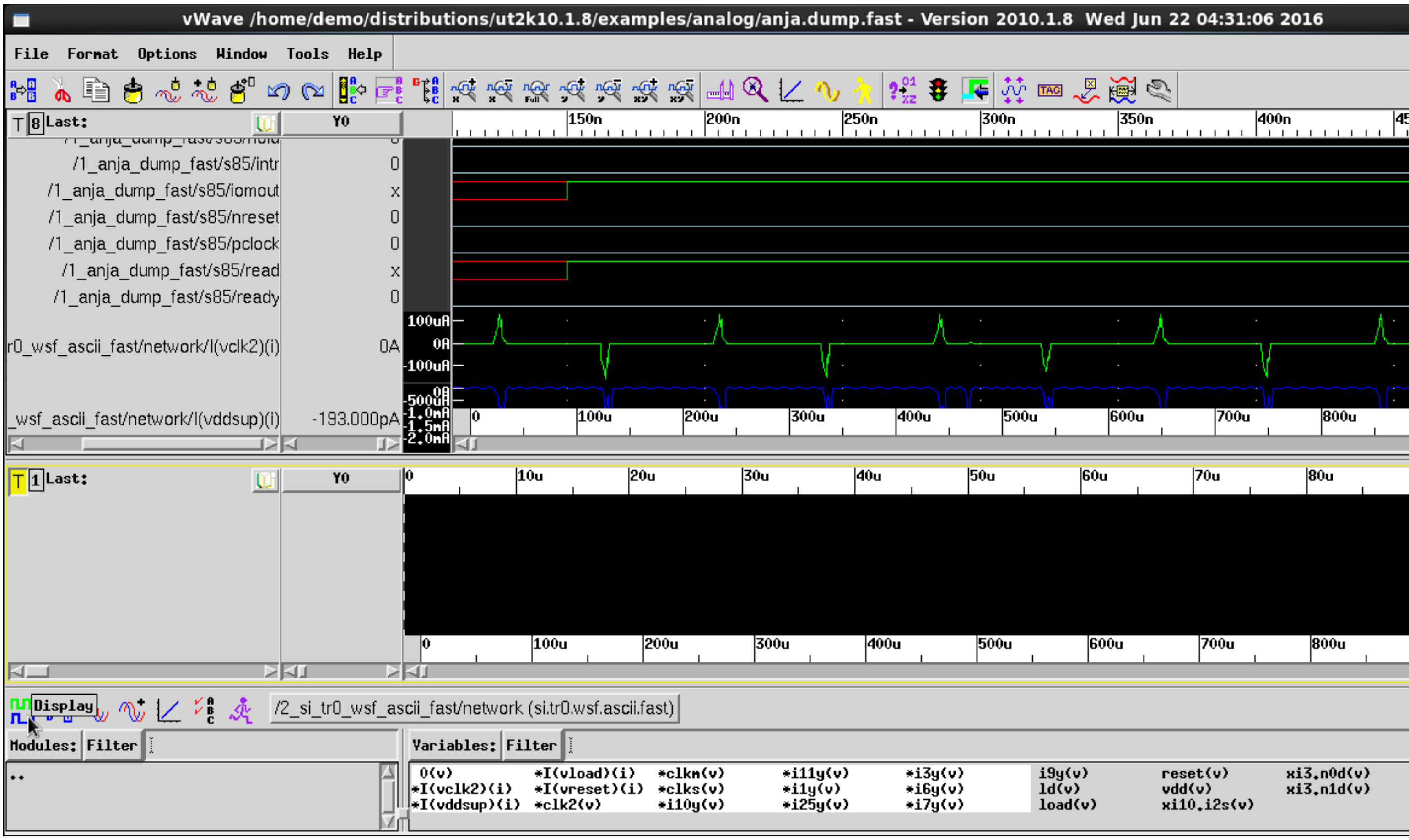
vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016

```
/1_anja_dump_fast/s85/intr                0
/1_anja_dump_fast/s85/iomout              x
/1_anja_dump_fast/s85/nreset              0
/1_anja_dump_fast/s85/pclock              0
/1_anja_dump_fast/s85/read                x
/1_anja_dump_fast/s85/ready               0
r0_wsf_ascii_fast/network/I(vclk2)(i)     0A
_wsf_ascii_fast/network/I(vddsup)(i)      -193.000pA
```

/2_si_tr0_wsf_ascii_fast/network (si.tr0.wsf.ascii.fast)

```
 0(v)          *I(vload)(i)   *clkm(v)    *i11y(v)    *i3y(v)    i9y(v)     reset(v)     xi3.n0d(v)   xi6.n0d(v)
*I(vclk2)(i)   *I(vreset)(i)  *clks(v)    *i1y(v)     *i6y(v)    ld(v)      vdd(v)       xi3.n1d(v)   xi9.i2s(v)
*I(vddsup)(i)  *clk2(v)       *i10y(v)    *i25y(v)    *i7y(v)    load(v)    xi10.i2s(v)
```

Then press Display as shown below to display the selected signals in the new time pane.



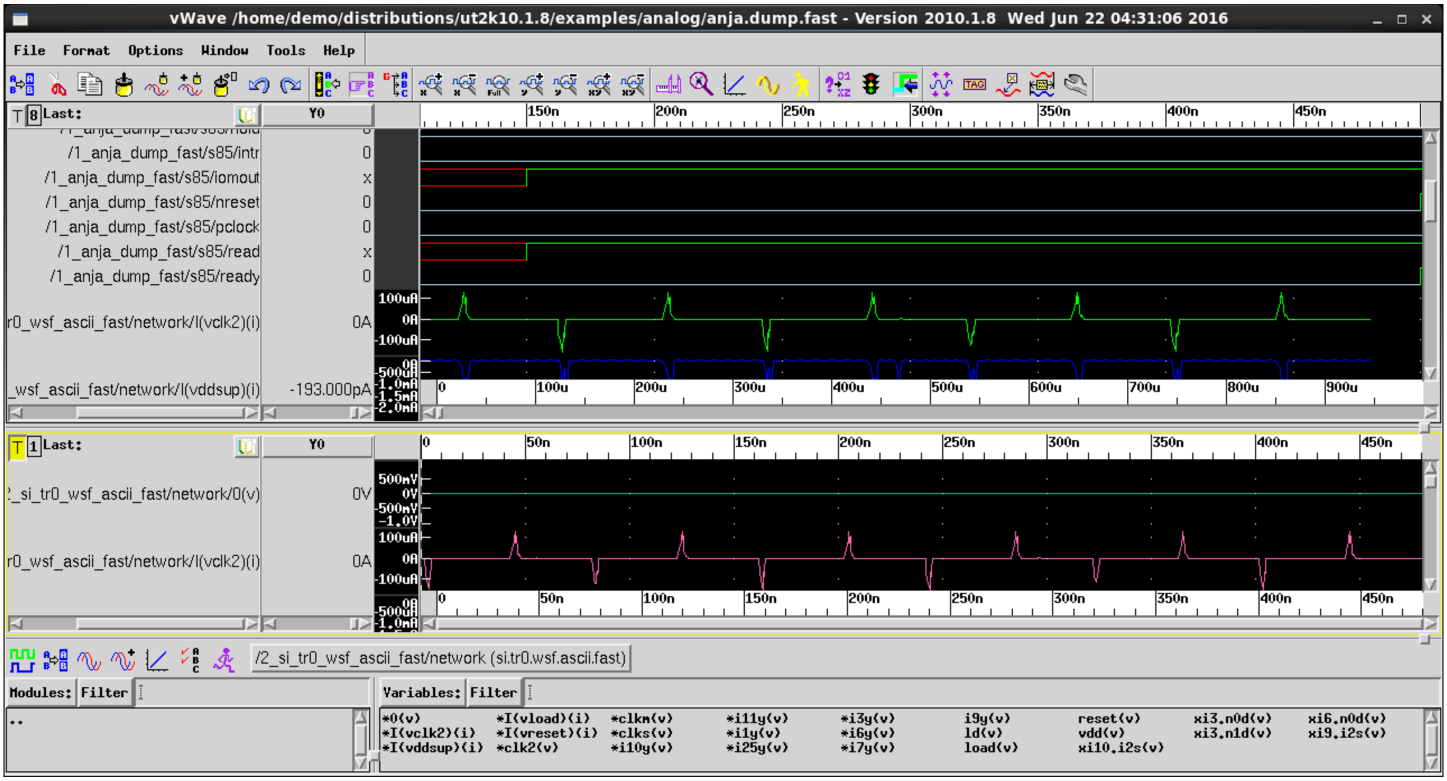
vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016

```
/1_anja_dump_fast/s85/intr                0
/1_anja_dump_fast/s85/iomout              x
/1_anja_dump_fast/s85/nreset              0
/1_anja_dump_fast/s85/pclock              0
/1_anja_dump_fast/s85/read                x
/1_anja_dump_fast/s85/ready               0
r0_wsf_ascii_fast/network/I(vclk2)(i)     0A
_wsf_ascii_fast/network/I(vddsup)(i)      -193.000pA
```

/2_si_tr0_wsf_ascii_fast/network (si.tr0.wsf.ascii.fast)

```
 0(v)          *I(vload)(i)   *clkm(v)    *i11y(v)    *i3y(v)    i9y(v)     reset(v)     xi3.n0d(v)
*I(vclk2)(i)   *I(vreset)(i)  *clks(v)    *i1y(v)     *i6y(v)    ld(v)      vdd(v)       xi3.n1d(v)
*I(vddsup)(i)  *clk2(v)       *i10y(v)    *i25y(v)    *i7y(v)    load(v)    xi10.i2s(v)
```

The resultant waveform display will look as shown below after display is pressed:



vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016

```
/1_anja_dump_fast/s85/intr        0
/1_anja_dump_fast/s85/iomout      x
/1_anja_dump_fast/s85/nreset      0
/1_anja_dump_fast/s85/pclock      0
/1_anja_dump_fast/s85/read        x
/1_anja_dump_fast/s85/ready       0
r0_wsf_ascii_fast/network/I(vclk2)(i)    0A
_wsf_ascii_fast/network/I(vddsup)(i)    -193.000pA
```

```
2_si_tr0_wsf_ascii_fast/network/0(v)     0V
r0_wsf_ascii_fast/network/I(vclk2)(i)    0A
```

/2_si_tr0_wsf_ascii_fast/network (si.tr0.wsf.ascii.fast)

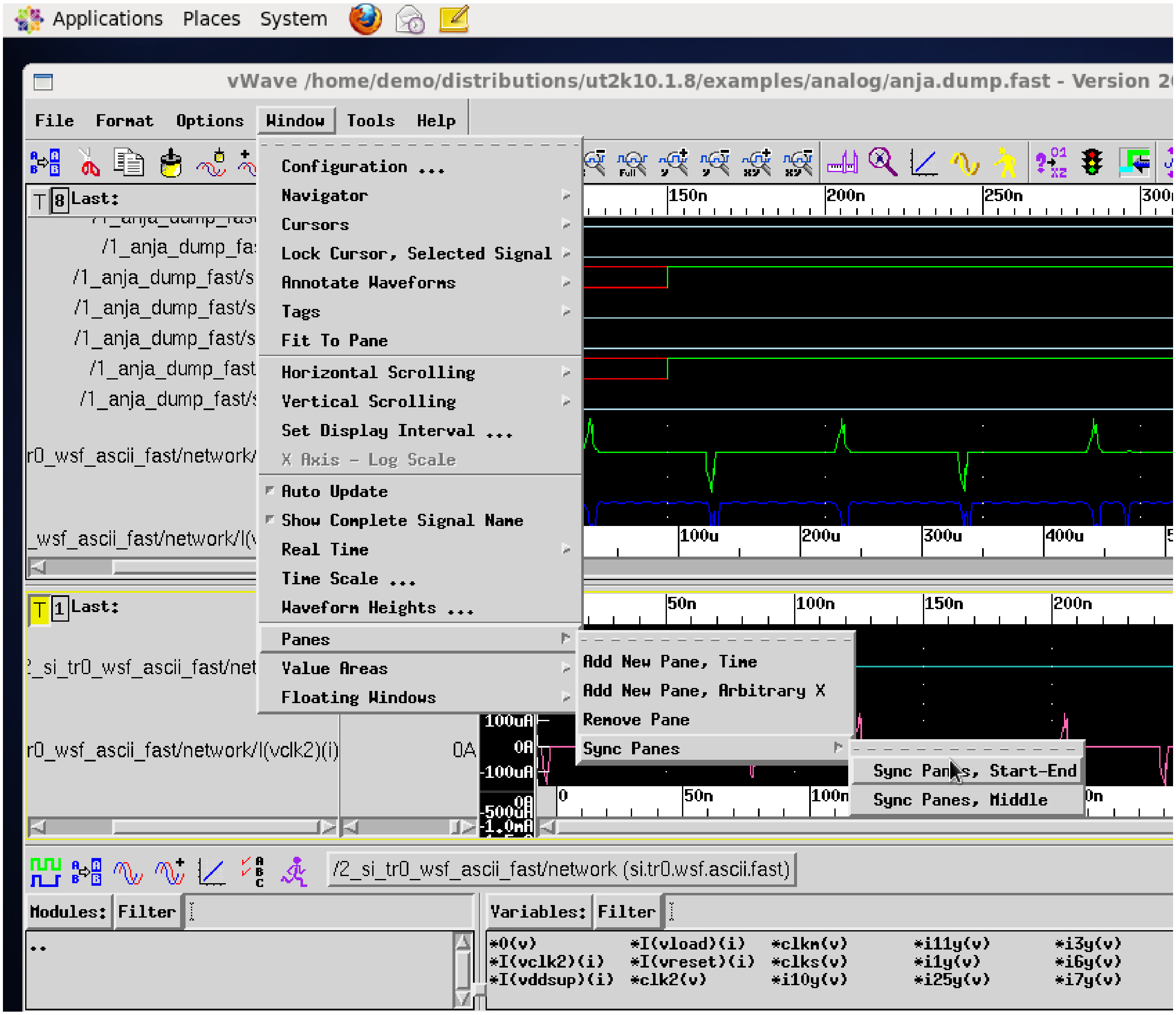
Modules: Filter

```
..
```

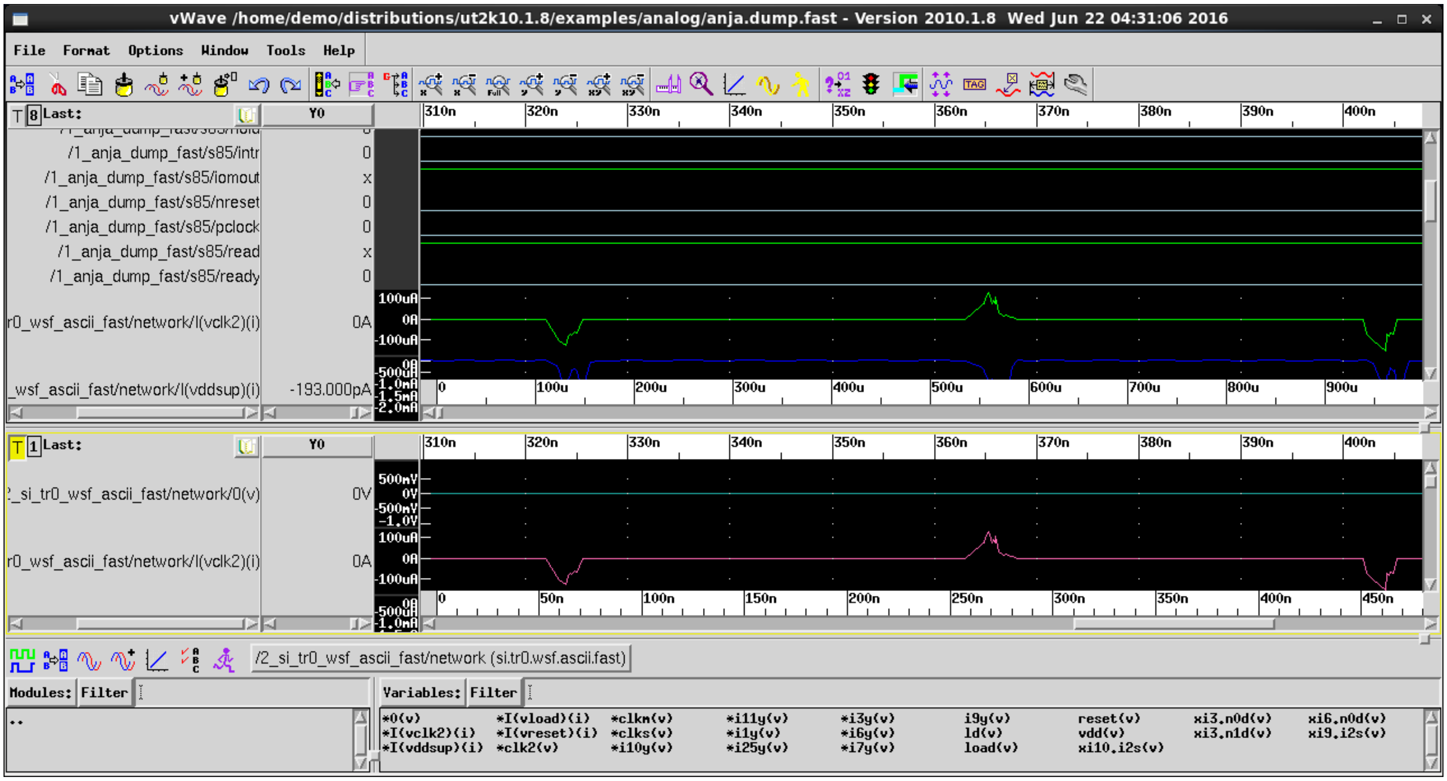
Variables: Filter

```
*0(v)          *I(vload)(i)   *clkm(v)   *i11y(v)   *i3y(v)   i9y(v)    reset(v)    xi3.n0d(v)   xi6.n0d(v)
*I(vclk2)(i)   *I(vreset)(i)  *clks(v)   *i1y(v)    *i6y(v)   ld(v)     vdd(v)      xi3.n1d(v)   xi9.i2s(v)
*I(vddsup)(i)  *clk2(v)       *i10y(v)   *i25y(v)   *i7y(v)   load(v)   xi10.i2s(v)
```

These panes can be synced together in two different ways, by syncing on the start and end points of the horizontal scroll bars, which keeps the zooms the same or by syncing on the middle of the horizontal scroll bar which allows the zoom setting to be different between these panes.

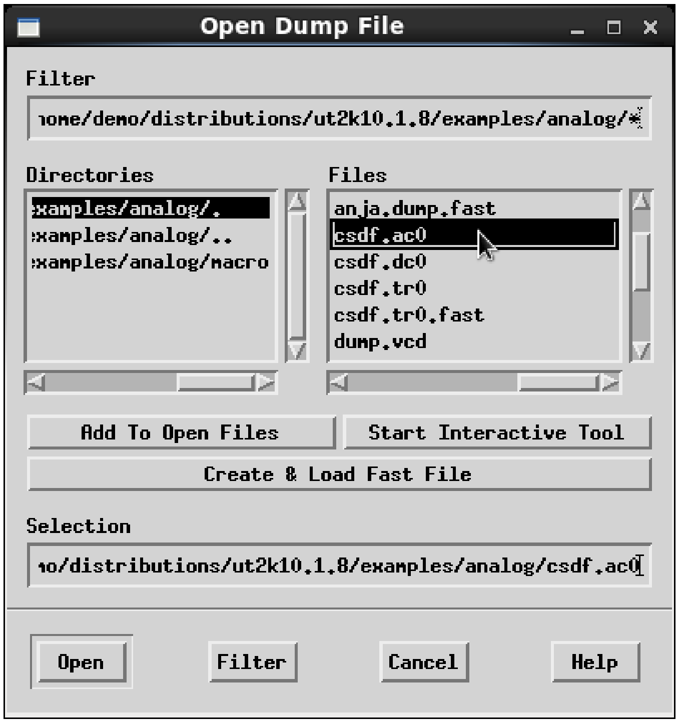

Applications Places System
vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2
File Format Options Window Tools Help
Configuration ...
Navigator
Cursors
Lock Cursor, Selected Signal
Annotate Waveforms
Tags
Fit To Pane
Horizontal Scrolling
Vertical Scrolling
Set Display Interval ...
X Axis - Log Scale
Auto Update
Show Complete Signal Name
Real Time
Time Scale ...
Waveform Heights ...
Panes
Value Areas
Floating Windows
Add New Pane, Time
Add New Pane, Arbitrary X
Remove Pane
Sync Panes
Sync Panes, Start-End
Sync Panes, Middle
T 8 Last:
T 1 Last:
/1_anja_dump_fast/s
r0_wsf_ascii_fast/network/I(vclk2)(i)
0A
100uA
-100uA
-500uA
-1.0mA
150n 200n 250n 300n
100u 200u 300u 400u
50n 100n 150n 200n
/2_si_tr0_wsf_ascii_fast/network (si.tr0.wsf.ascii.fast)
Modules: Filter
Variables: Filter
*0(v) *I(vload)(i) *clkn(v) *i11y(v) *i3y(v)
*I(vclk2)(i) *I(vreset)(i) *clks(v) *i1y(v) *i6y(v)
*I(vddsup)(i) *clk2(v) *i10y(v) *i25y(v) *i7y(v)

The above figure shows the display windows synced with start end points the same. Note that the top time scales between these Panes are identical, as can be seen in the following figure:


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File
Format
Options
Window
Tools
Help
Last:
Y0
/1_anja_dump_fast/s85/intr
/1_anja_dump_fast/s85/iomout
/1_anja_dump_fast/s85/nreset
/1_anja_dump_fast/s85/pclock
/1_anja_dump_fast/s85/read
/1_anja_dump_fast/s85/ready
r0_wsf_ascii_fast/network/I(vclk2)(i)
_wsf_ascii_fast/network/I(vddsup)(i)
-193.000pA
_si_tr0_wsf_ascii_fast/network/0(v)
/2_si_tr0_wsf_ascii_fast/network (si.tr0.wsf.ascii.fast)
Modules:
Filter
Variables:
Filter

```
*0(v)           *I(vload)(i)   *clkn(v)    *i11y(v)    *i3y(v)    i9y(v)     reset(v)      xi3.n0d(v)   xi6.n0d(v)
*I(vclk2)(i)    *I(vreset)(i)  *clks(v)    *i1y(v)     *i6y(v)    ld(v)      vdd(v)        xi3.n1d(v)   xi9.i2s(v)
*I(vddsup)(i)   *clk2(v)       *i10y(v)    *i25y(v)    *i7y(v)    load(v)    xi10.i2s(v)
```

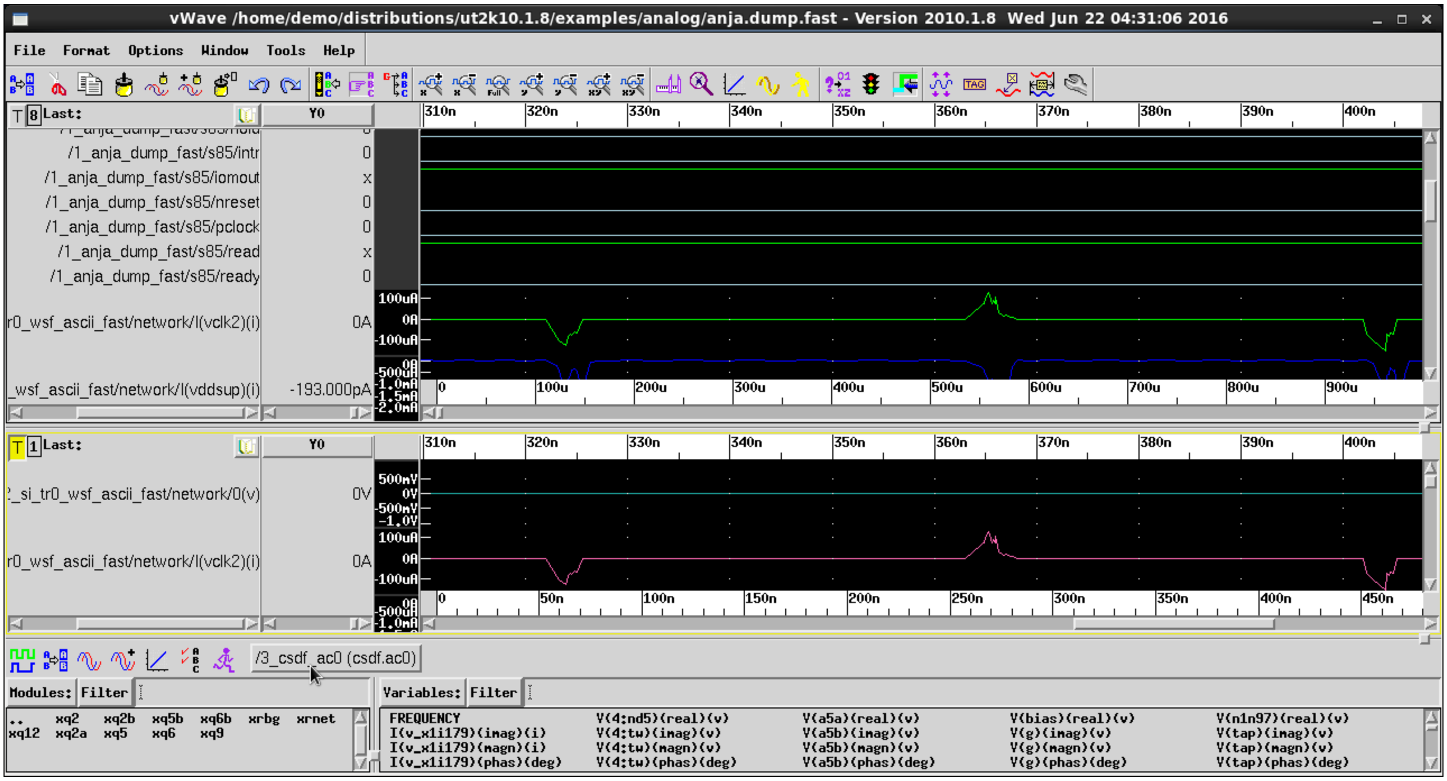
Next add a *ac0 file to the waveform display by selecting this file from the list of files in the analog directory as shown below:



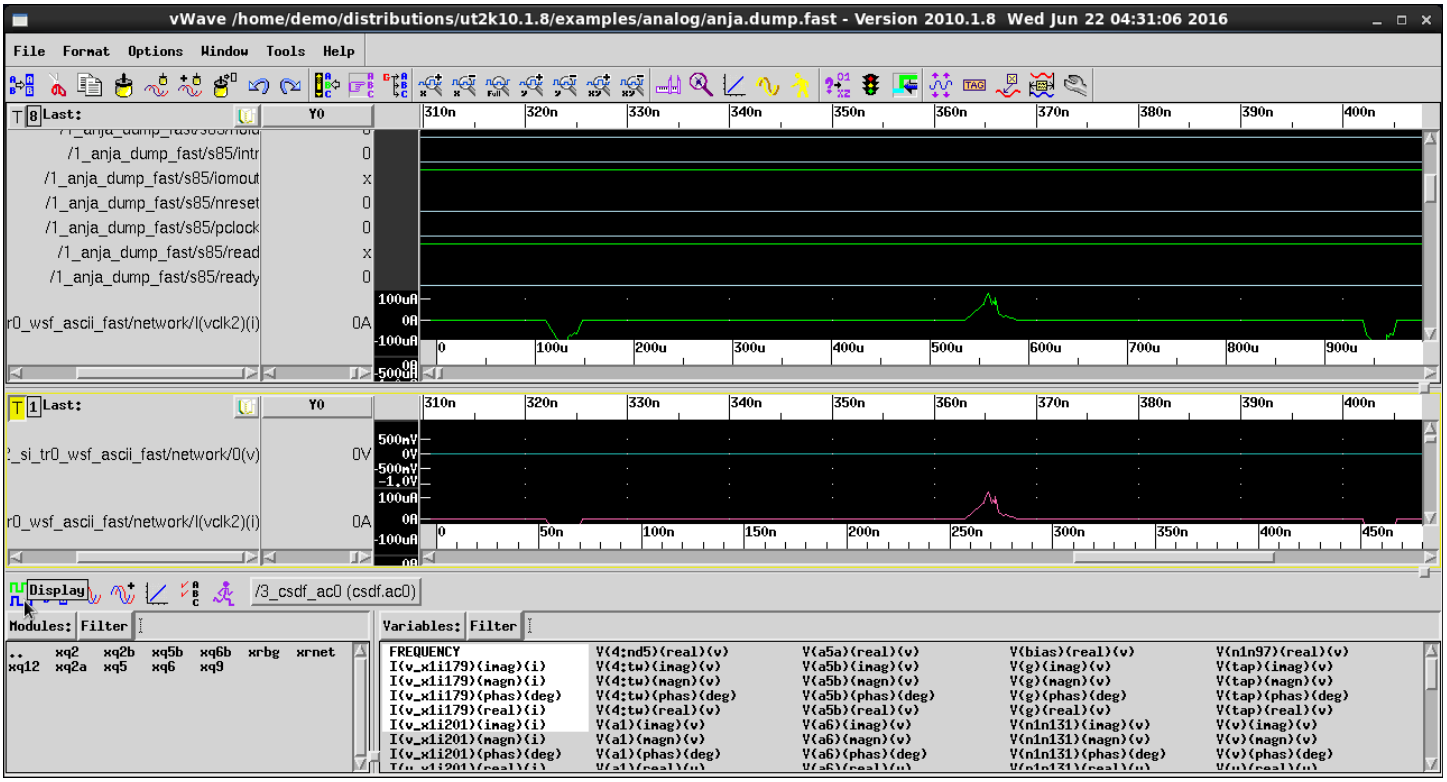
Filter: ome/demo/distributions/ut2k10.1.8/examples/analog/*

Selection: o/distributions/ut2k10.1.8/examples/analog/csdf.ac0

Next select the csdf.ac0 file and press “Add to open Files”.


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File Format Options Window Tools Help
T 8 Last:
Y0
/1_anja_dump_fast/s85/intr 0
/1_anja_dump_fast/s85/iomout x
/1_anja_dump_fast/s85/nreset 0
/1_anja_dump_fast/s85/pclock 0
/1_anja_dump_fast/s85/read x
/1_anja_dump_fast/s85/ready 0
r0_wsf_ascii_fast/network/I(vclk2)(i) 0A
_wsf_ascii_fast/network/I(vddsup)(i) -193.000pA
100uA
0A
-100uA
-500uA
-1.0mA
-1.5mA
-2.0mA
310n 320n 330n 340n 350n 360n 370n 380n 390n 400n
0 100u 200u 300u 400u 500u 600u 700u 800u 900u
T 1 Last:
Y0
_si_tr0_wsf_ascii_fast/network/0(v) 0V
r0_wsf_ascii_fast/network/I(vclk2)(i) 0A
500mV
0V
-500mV
-1.0V
100uA
0A
-100uA
-500uA
-1.0mA
310n 320n 330n 340n 350n 360n 370n 380n 390n 400n
0 50n 100n 150n 200n 250n 300n 350n 400n 450n
/3_csdf_ac0 (csdf.ac0)
Modules: Filter
.. xq2 xq2b xq5b xq6b xrbg xrnet
xq12 xq2a xq5 xq6 xq9
Variables: Filter
FREQUENCY
I(v_x1i179)(imag)(i)
I(v_x1i179)(magn)(i)
I(v_x1i179)(phas)(deg)
V(4:nd5)(real)(v)
V(4:tw)(imag)(v)
V(4:tw)(magn)(v)
V(4:tw)(phas)(deg)
V(a5a)(real)(v)
V(a5b)(imag)(v)
V(a5b)(magn)(v)
V(a5b)(phas)(deg)
V(bias)(real)(v)
V(g)(imag)(v)
V(g)(magn)(v)
V(g)(phas)(deg)
V(n1n97)(real)(v)
V(tap)(imag)(v)
V(tap)(magn)(v)
V(tap)(phas)(deg)

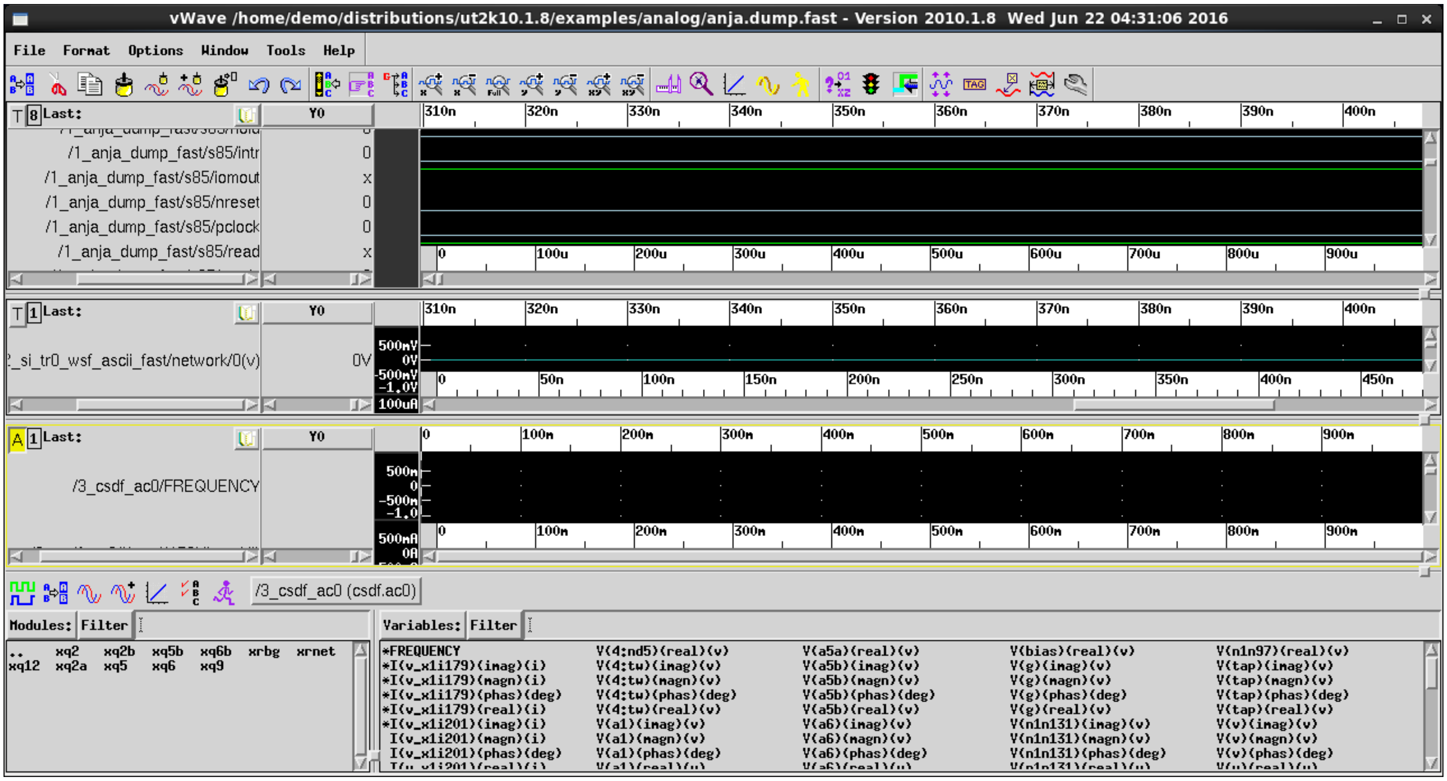
Select signals again, by pressing down the right mouse button and dragging this over the signal names you want to see on the display:


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File
Format
Options
Window
Tools
Help
T 8 Last:
Y0
/1_anja_dump_fast/s85/intr 0
/1_anja_dump_fast/s85/iomout x
/1_anja_dump_fast/s85/nreset 0
/1_anja_dump_fast/s85/pclock 0
/1_anja_dump_fast/s85/read x
/1_anja_dump_fast/s85/ready 0
r0_wsf_ascii_fast/network/I(vclk2)(i) 0A
310n
320n
330n
340n
350n
360n
370n
380n
390n
400n
100uA
0A
-100uA
0
100u
200u
300u
400u
500u
600u
700u
800u
900u
T 1 Last:
Y0
_si_tr0_wsf_ascii_fast/network/0(v) 0V
r0_wsf_ascii_fast/network/I(vclk2)(i) 0A
500mV
0V
-500mV
-1.0V
100uA
0A
-100uA
0
50n
100n
150n
200n
250n
300n
350n
400n
450n
Display
/3_csdf_ac0 (csdf.ac0)
Modules:
Filter
Variables:
Filter

```
..    xq2   xq2b  xq5b  xq6b  xrbg  xrnet
xq12  xq2a  xq5   xq6   xq9
```

```
FREQUENCY                  V(4:nd5)(real)(v)    V(a5a)(real)(v)      V(bias)(real)(v)        V(n1n97)(real)(v)
I(v_x1i179)(imag)(i)       V(4:tw)(imag)(v)     V(a5b)(imag)(v)      V(g)(imag)(v)           V(tap)(imag)(v)
I(v_x1i179)(magn)(i)       V(4:tw)(magn)(v)     V(a5b)(magn)(v)      V(g)(magn)(v)           V(tap)(magn)(v)
I(v_x1i179)(phas)(deg)     V(4:tw)(phas)(deg)   V(a5b)(phas)(deg)    V(g)(phas)(deg)         V(tap)(phas)(deg)
I(v_x1i179)(real)(i)       V(4:tw)(real)(v)     V(a5b)(real)(v)      V(g)(real)(v)           V(tap)(real)(v)
I(v_x1i201)(imag)(i)       V(a1)(imag)(v)       V(a6)(imag)(v)       V(n1n131)(imag)(v)      V(v)(imag)(v)
I(v_x1i201)(magn)(i)       V(a1)(magn)(v)       V(a6)(magn)(v)       V(n1n131)(magn)(v)      V(v)(magn)(v)
I(v_x1i201)(phas)(deg)     V(a1)(phas)(deg)     V(a6)(phas)(deg)     V(n1n131)(phas)(deg)    V(v)(phas)(deg)
```

Note that when a file that does not have a time base for its horizontal scale is brought into the waveform display that currently has only time based files, a new non-time pane, an Arbitrary X Scale Pane is automatically added to display these new signals as shown below:



vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016

Signal	Y0
/1_anja_dump_fast/s85/intr	0
/1_anja_dump_fast/s85/iomout	x
/1_anja_dump_fast/s85/nreset	0
/1_anja_dump_fast/s85/pclock	0
/1_anja_dump_fast/s85/read	x
_si_tr0_wsf_ascii_fast/network/0(v)	0V
/3_csdf_ac0/FREQUENCY	

/3_csdf_ac0 (csdf.ac0)

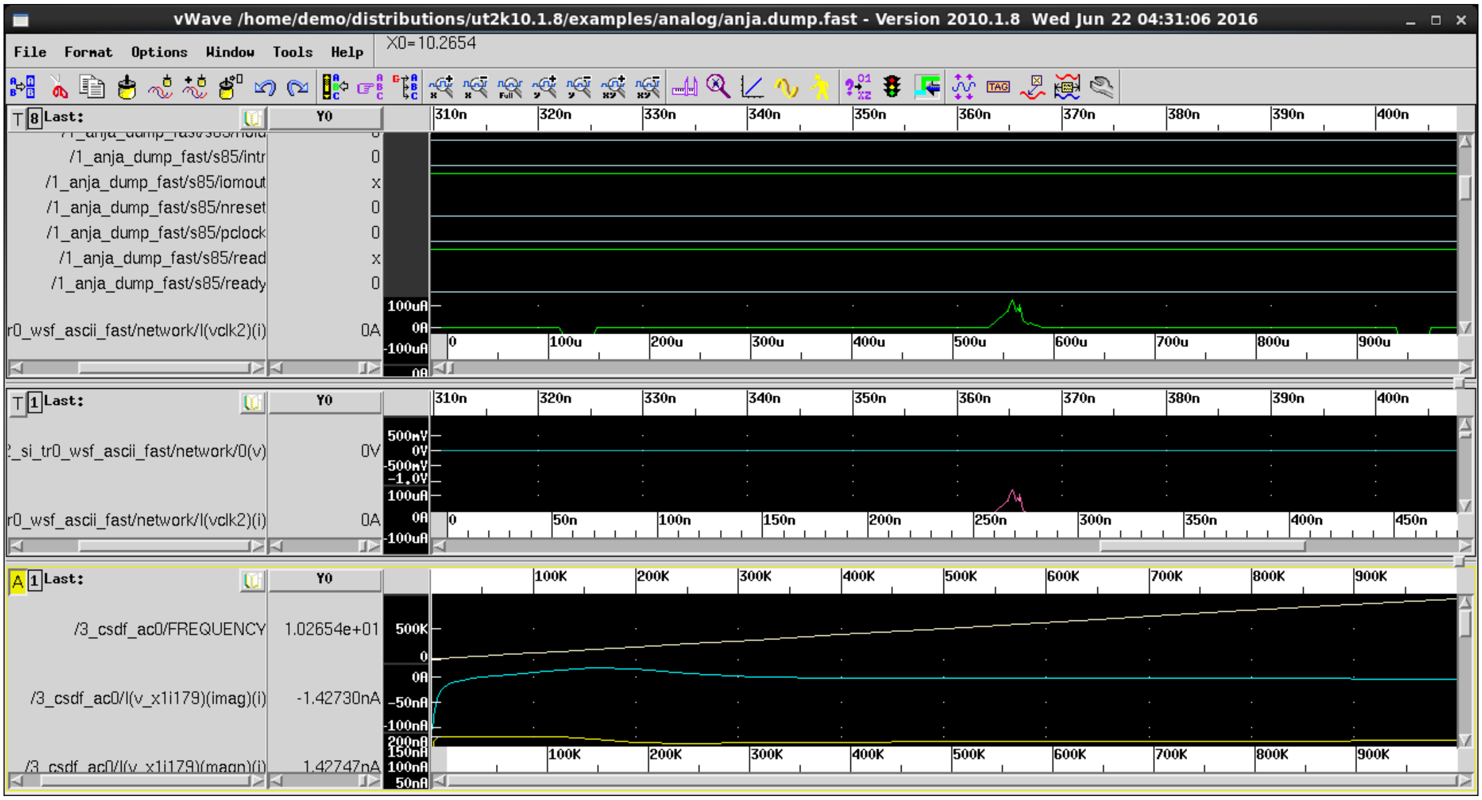
Modules: Filter

```
..    xq2   xq2b  xq5b  xq6b  xrbg  xrnet
xq12  xq2a  xq5   xq6   xq9
```

Variables: Filter

```
*FREQUENCY                  V(4:nd5)(real)(v)     V(a5a)(real)(v)      V(bias)(real)(v)        V(n1n97)(real)(v)
*I(v_x1i179)(imag)(i)       V(4:tw)(imag)(v)      V(a5b)(imag)(v)      V(g)(imag)(v)           V(tap)(imag)(v)
*I(v_x1i179)(magn)(i)       V(4:tw)(magn)(v)      V(a5b)(magn)(v)      V(g)(magn)(v)           V(tap)(magn)(v)
*I(v_x1i179)(phas)(deg)     V(4:tw)(phas)(deg)    V(a5b)(phas)(deg)    V(g)(phas)(deg)         V(tap)(phas)(deg)
*I(v_x1i179)(real)(i)       V(4:tw)(real)(v)      V(a5b)(real)(v)      V(g)(real)(v)           V(tap)(real)(v)
*I(v_x1i201)(imag)(i)       V(a1)(imag)(v)        V(a6)(imag)(v)       V(n1n131)(imag)(v)      V(v)(imag)(v)
 I(v_x1i201)(magn)(i)       V(a1)(magn)(v)        V(a6)(magn)(v)       V(n1n131)(magn)(v)      V(v)(magn)(v)
 I(v_x1i201)(phas)(deg)     V(a1)(phas)(deg)      V(a6)(phas)(deg)     V(n1n131)(phas)(deg)    V(v)(phas)(deg)
```

Pressing full zoom, will display the full simulation waveforms for these newly selected signals.

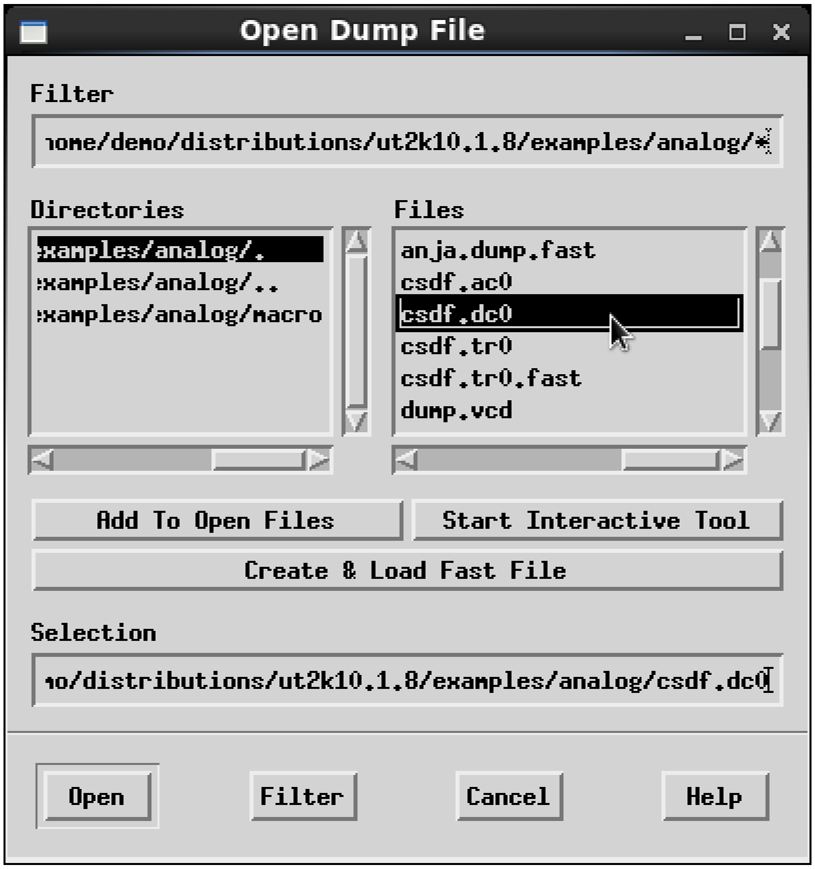


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016

X0=10.2654

Signal	Y0
/1_anja_dump_fast/s85/intr	0
/1_anja_dump_fast/s85/iomout	x
/1_anja_dump_fast/s85/nreset	0
/1_anja_dump_fast/s85/pclock	0
/1_anja_dump_fast/s85/read	x
/1_anja_dump_fast/s85/ready	0
r0_wsf_ascii_fast/network/I(vclk2)(i)	0A
_si_tr0_wsf_ascii_fast/network/0(v)	0V
r0_wsf_ascii_fast/network/I(vclk2)(i)	0A
/3_csdf_ac0/FREQUENCY	1.02654e+01
/3_csdf_ac0/I(v_x1i179)(imag)(i)	-1.42730nA
/3_csdf_ac0/I(v_x1i179)(magn)(i)	1.42747nA

At this point we have a digital, Verilog, waveform file in vWave, an analog *.tran file in vWave, and a *ac0 file in vWave. Users can use the middle mouse button to drag any signal name in any pane to any other pane that has the same horizontal scale to display this signal in that pane. Next load in a *.dc0 file by selecting and loading this file as shown below:



Filter

```
ome/demo/distributions/ut2k10.1.8/examples/analog/*
```

Directories

```
:xamples/analog/.
:xamples/analog/..
:xamples/analog/macro
```

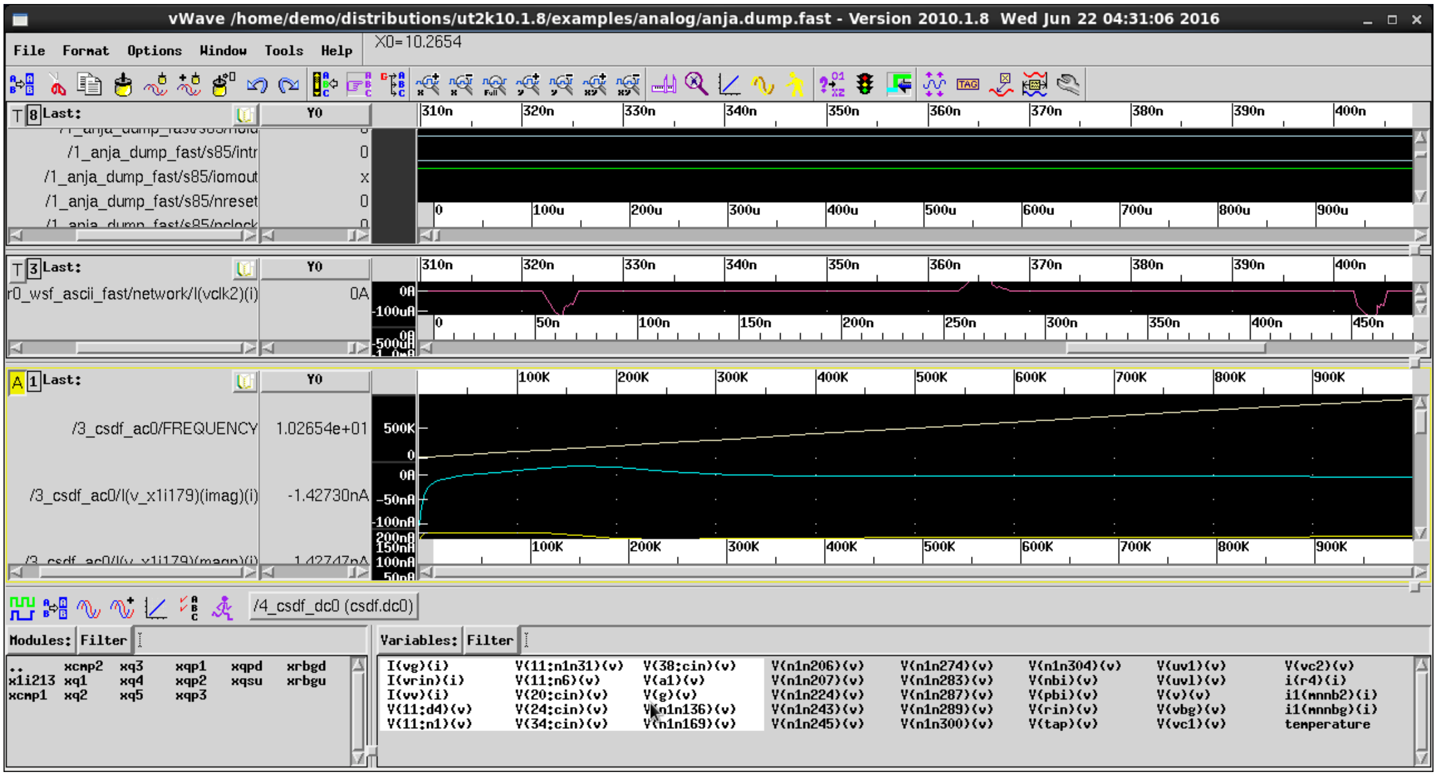
Files

```
anja.dump.fast
csdf.ac0
csdf.dc0
csdf.tr0
csdf.tr0.fast
dump.vcd
```

Selection

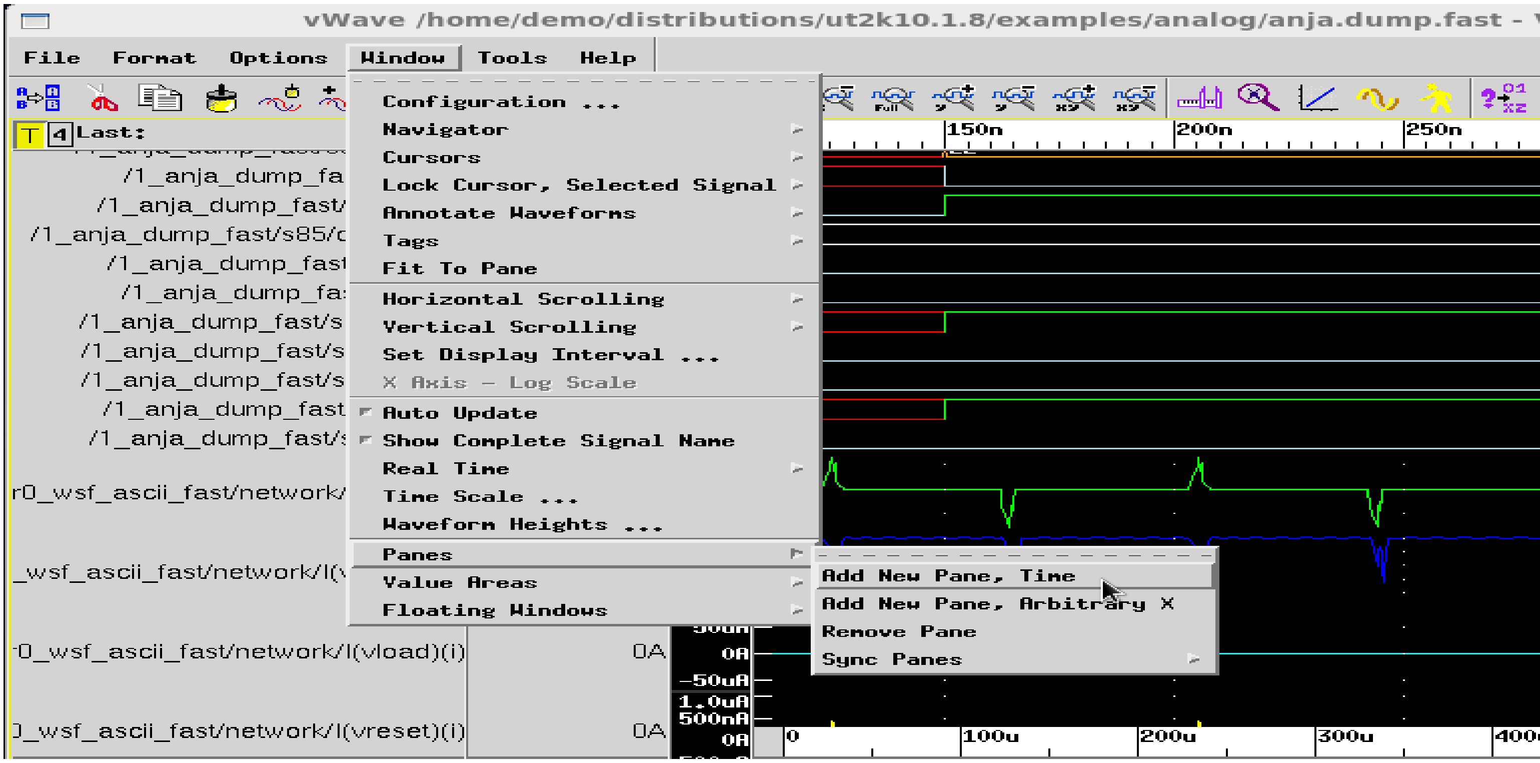
```
o/distributions/ut2k10.1.8/examples/analog/csdf.dc0
```

Select the csdf.dc0 file as shown above and press “Add to Open Files”. Next select the signals from this csdf.dc0 file as shown below.

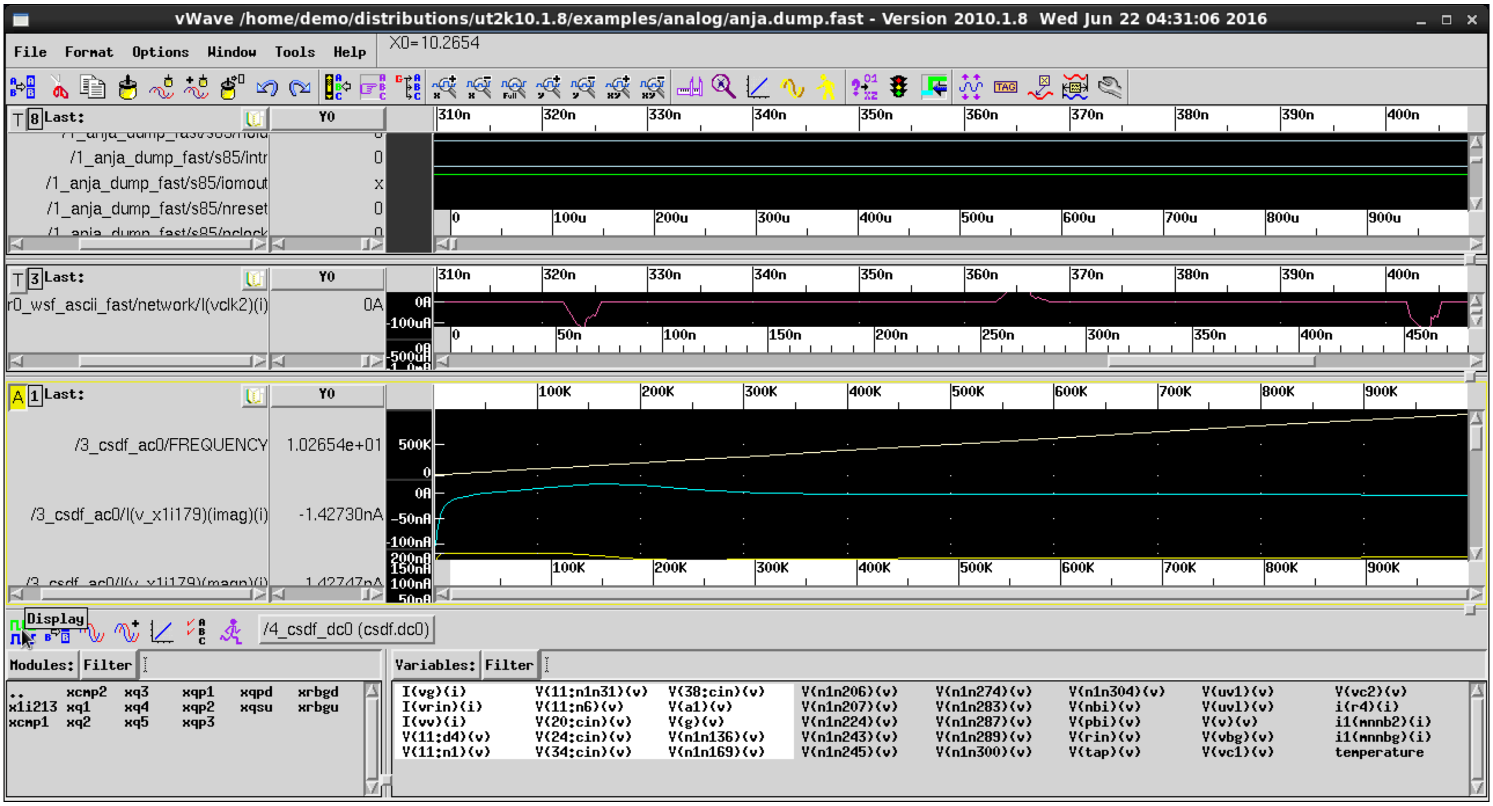

vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File
Format
Options
Window
Tools
Help
X0=10.2654
/1_anja_dump_fast/s85/intr
/1_anja_dump_fast/s85/iomout
/1_anja_dump_fast/s85/nreset
r0_wsf_ascii_fast/network/I(vclk2)(i)
/3_csdf_ac0/FREQUENCY
1.02654e+01
/3_csdf_ac0/I(v_x1i179)(imag)(i)
-1.42730nA
/4_csdf_dc0 (csdf.dc0)
Modules:
Filter
Variables:
Filter

Before pressing Display, add a new pane with an Arbitrary horizontal scale as follows;

Window -> Panes -> Add New Pane, Arbitrary X



Then press Display, the resultant vWave display is shown below:


vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Wed Jun 22 04:31:06 2016
File
Format
Options
Window
Tools
Help
X0=10.2654
T 8 Last:
Y0
/1_anja_dump_fast/s85/intr
/1_anja_dump_fast/s85/iomout
/1_anja_dump_fast/s85/nreset
T 3 Last:
r0_wsf_ascii_fast/network/I(vclk2)(i)
0A
A 1 Last:
/3_csdf_ac0/FREQUENCY
1.02654e+01
/3_csdf_ac0/I(v_x1i179)(imag)(i)
-1.42730nA
Display
/4_csdf_dc0 (csdf.dc0)
Modules:
Filter
Variables:
Filter

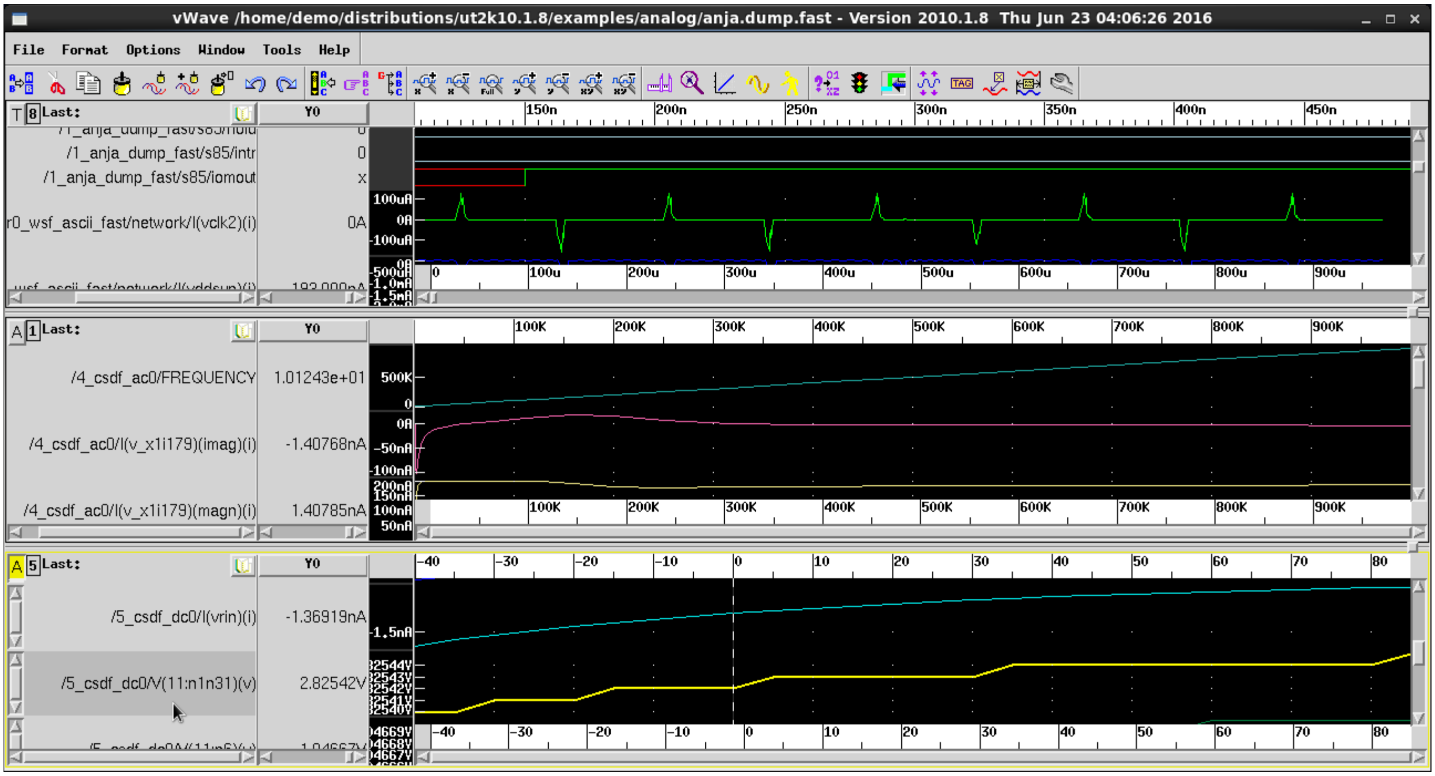
```
..      xcmp2  xq3   xqp1  xqpd  xrbgd
x1i213  xq1    xq4   xqp2  xqsu  xrbgu
xcmp1   xq2    xq5   xqp3
```

```
I(vg)(i)     V(11:n1n31)(v)  V(38:cin)(v)    V(n1n206)(v)  V(n1n274)(v)  V(n1n304)(v)  V(uv1)(v)  V(vc2)(v)
I(vrin)(i)   V(11:n6)(v)     V(a1)(v)        V(n1n207)(v)  V(n1n283)(v)  V(nbi)(v)     V(uvl)(v)  i(r4)(i)
I(vv)(i)     V(20:cin)(v)    V(g)(v)         V(n1n224)(v)  V(n1n287)(v)  V(pbi)(v)     V(v)(v)    i1(mnnb2)(i)
V(11:d4)(v)  V(24:cin)(v)    V(n1n136)(v)    V(n1n243)(v)  V(n1n289)(v)  V(rin)(v)     V(vbg)(v)  i1(mnnbg)(i)
V(11:n1)(v)  V(34:cin)(v)    V(n1n169)(v)    V(n1n245)(v)  V(n1n300)(v)  V(tap)(v)     V(vc1)(v)  temperature
```

The bottom pane holds the just added csdf.dc0 file, the csfddf.ac0 has been taken out to allow room to display the csdf.dc0 file. When users are adding new panes, if there are too many panes to fit the current display area, the vWave will automatically scroll the new pane so it is visible. Users can scroll up or down to see all of the current panes in vWave.

As part of the vWave waveform display software, users have a very complete set of analog analysis features.

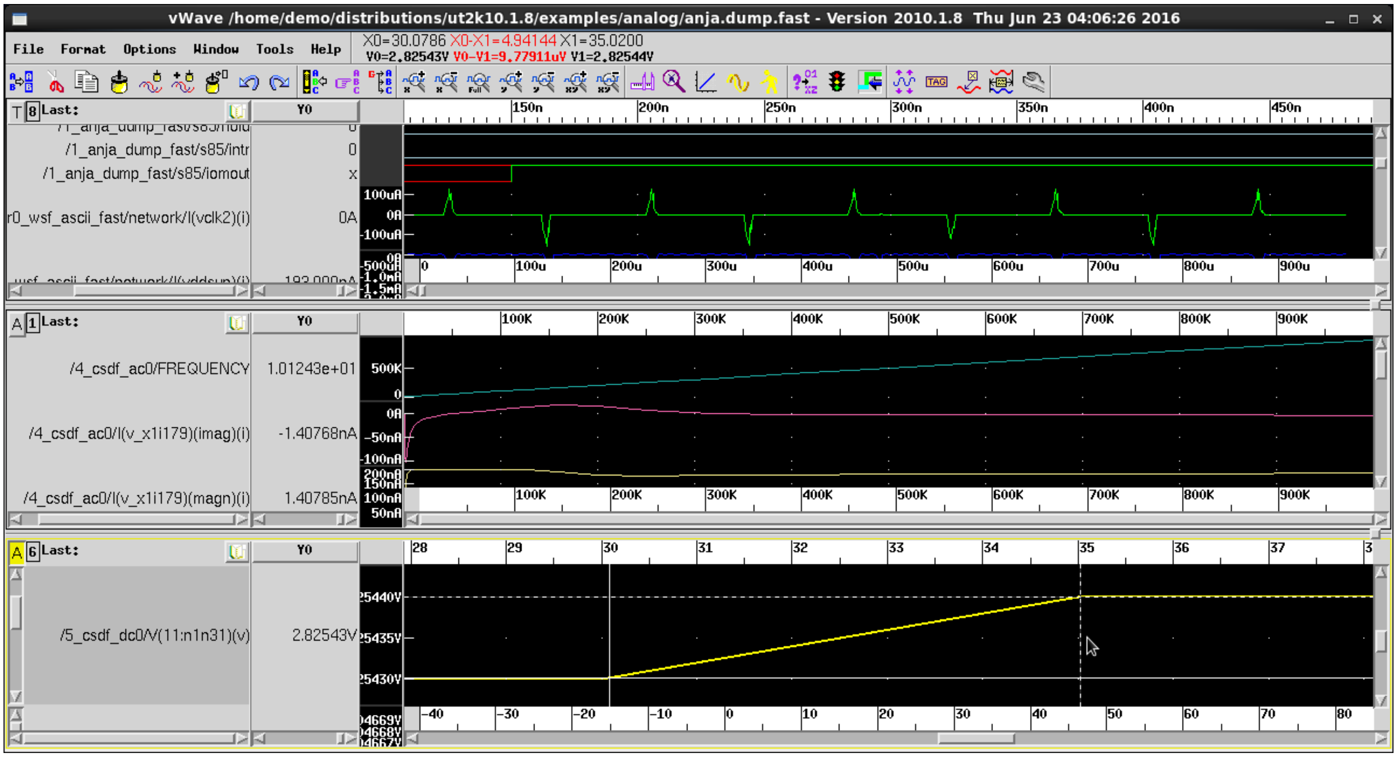
As shown below first select the signal you want to analyze.



vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Thu Jun 23 04:06:26 2016
File
Format
Options
Window
Tools
Help
T 8 Last:
Y0
/1_anja_dump_fast/s85/intr 0
/1_anja_dump_fast/s85/iomout x
r0_wsf_ascii_fast/network/I(vclk2)(i) 0A
150n
200n
250n
300n
350n
400n
450n
100uA
0A
-100uA
A 1 Last:
/4_csdf_ac0/FREQUENCY 1.01243e+01
/4_csdf_ac0/I(v_x1i179)(imag)(i) -1.40768nA
/4_csdf_ac0/I(v_x1i179)(magn)(i) 1.40785nA
500K
-50nA
-100nA
100K
200K
300K
400K
500K
600K
700K
800K
900K
A 5 Last:
/5_csdf_dc0/I(vrin)(i) -1.36919nA
/5_csdf_dc0/V(11:n1n31)(v) 2.82542V
-1.5nA
-40
-30
-20
-10
0
10
20
30
40
50
60
70
80

Then zoom into the area of the signal that you wish to analyze. Again with right mouse button, press down and slide down and to the right over the area of the signal you want more detail on.

Set the t0 mouse cursor on the left point of the area you want to analyze and then set the t1 cursor, the middle mouse, on the right side of the area you want to analyze, as shown below:

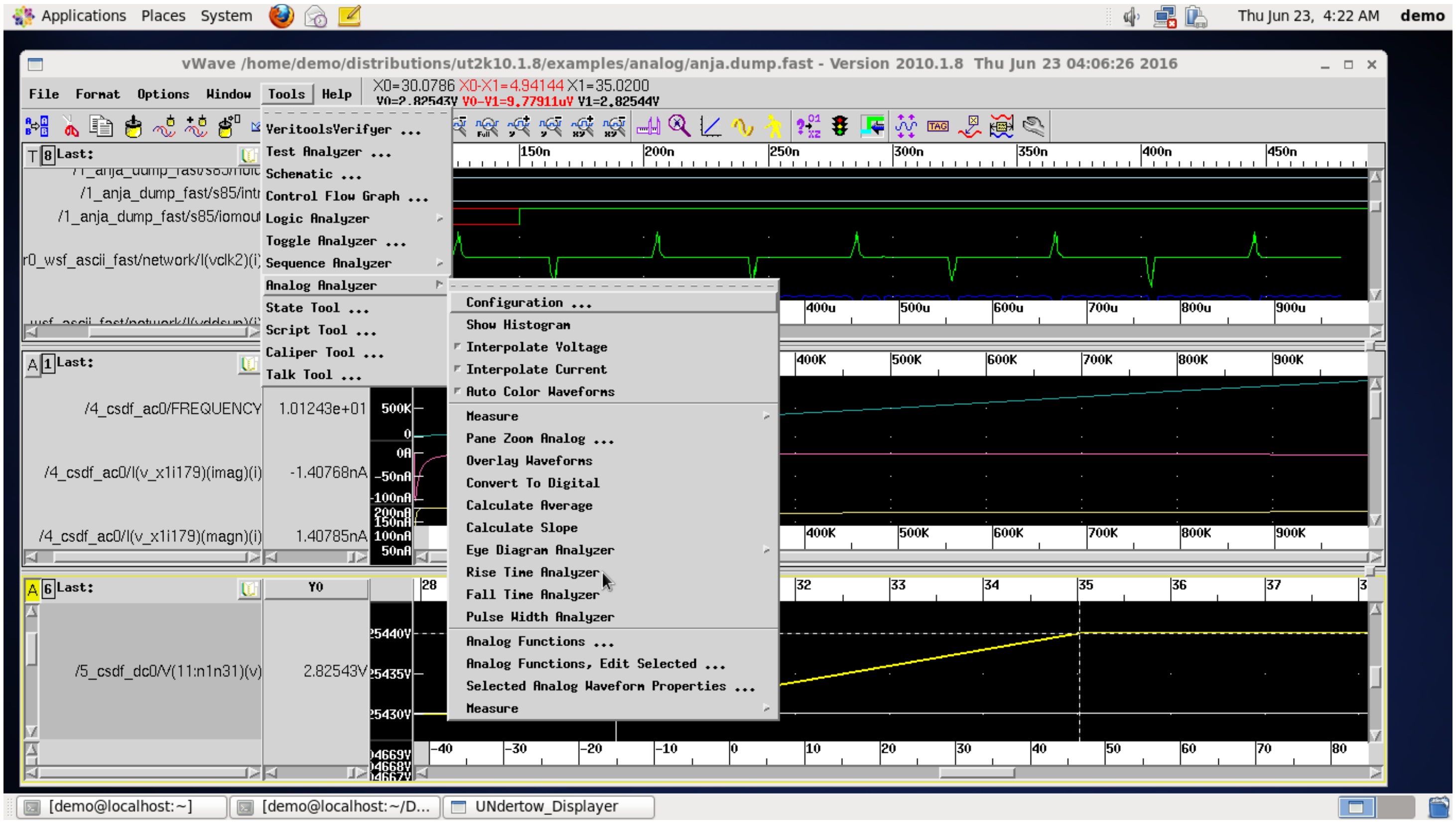

vWave /home/demo/distributions/ut2k10.1.8/examples/analog/anja.dump.fast - Version 2010.1.8 Thu Jun 23 04:06:26 2016

X0=30.0786 X0-X1=-4.94144 X1=35.0200
V0=2.82543V V0-V1=9.77911uV V1=2.82544V

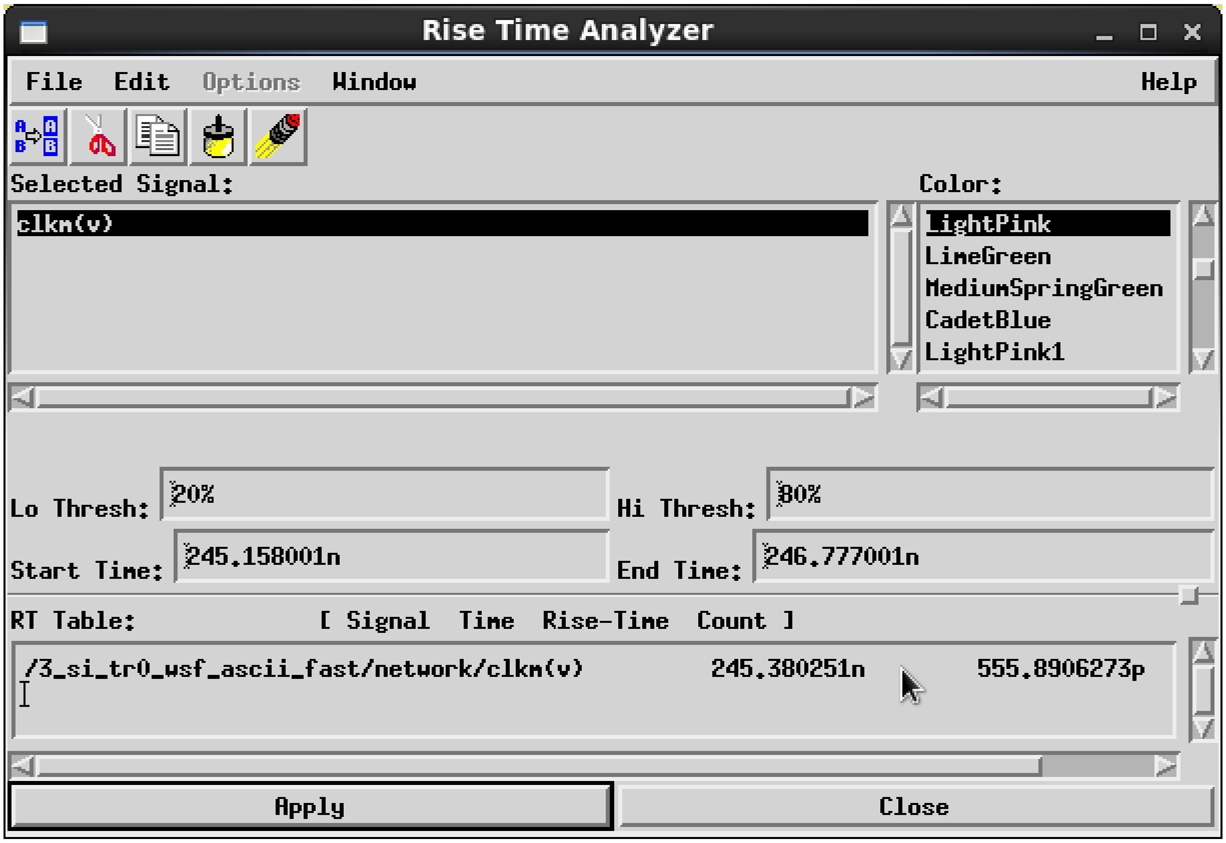
Next open the drop down menu for Analog Analyzer, and then select “Rise Time Analyzer” as follows;

Tools -> Analog Analyzer -> Rise Time Analyzer

and shown below:



The resultant rise time will be displayed in the Rise Time Analyzer window shown below:



Selected Signal: clkn(v)

Color: LightPink, LimeGreen, MediumSpringGreen, CadetBlue, LightPink1

Lo Thresh: 20%

Hi Thresh: 80%

Start Time: 245.158001n

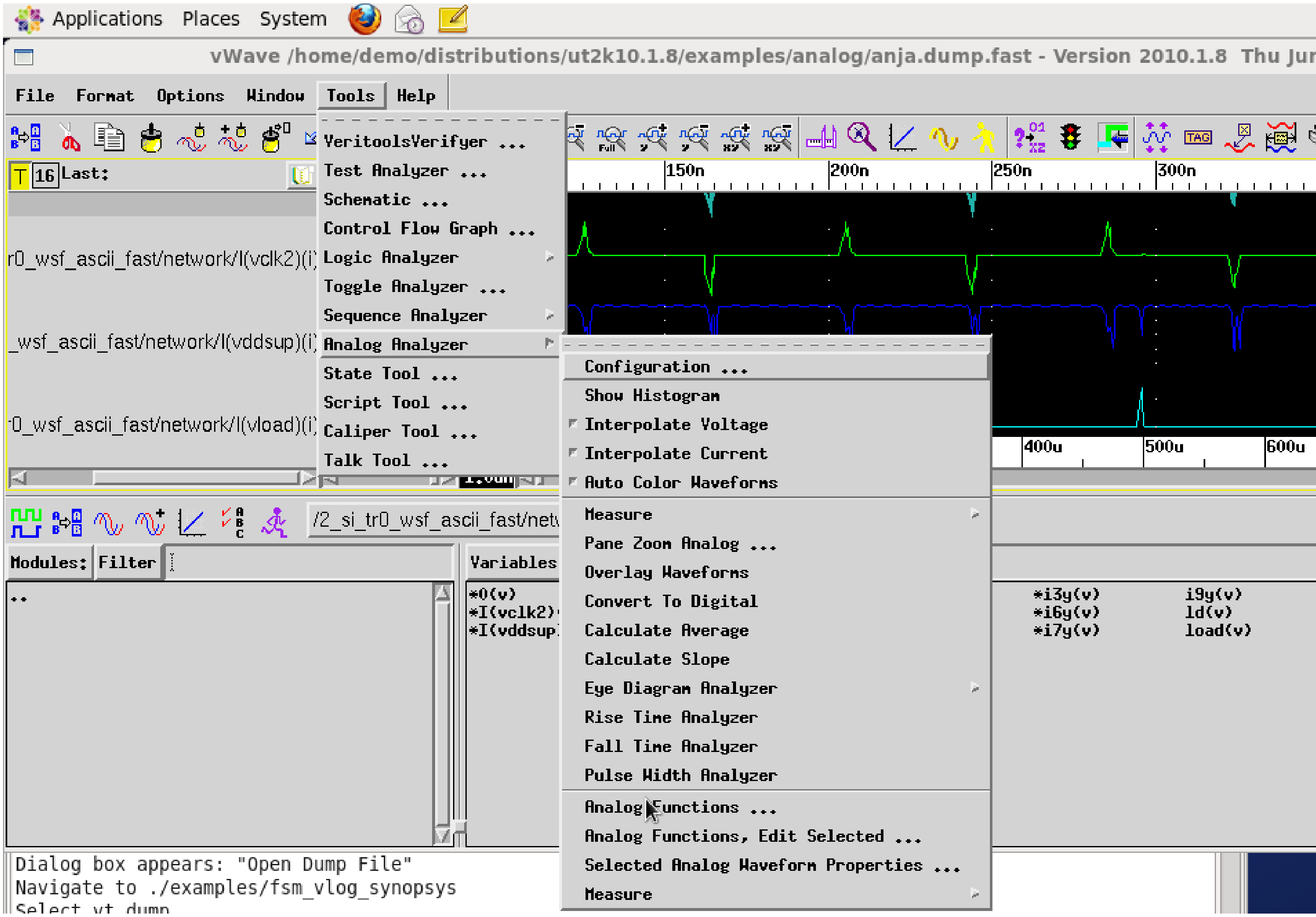
End Time: 246.777001n

RT Table: [Signal Time Rise-Time Count]

```
/3_si_tr0_wsf_ascii_fast/network/clkn(v)          245.380251n          555.8906273p
```

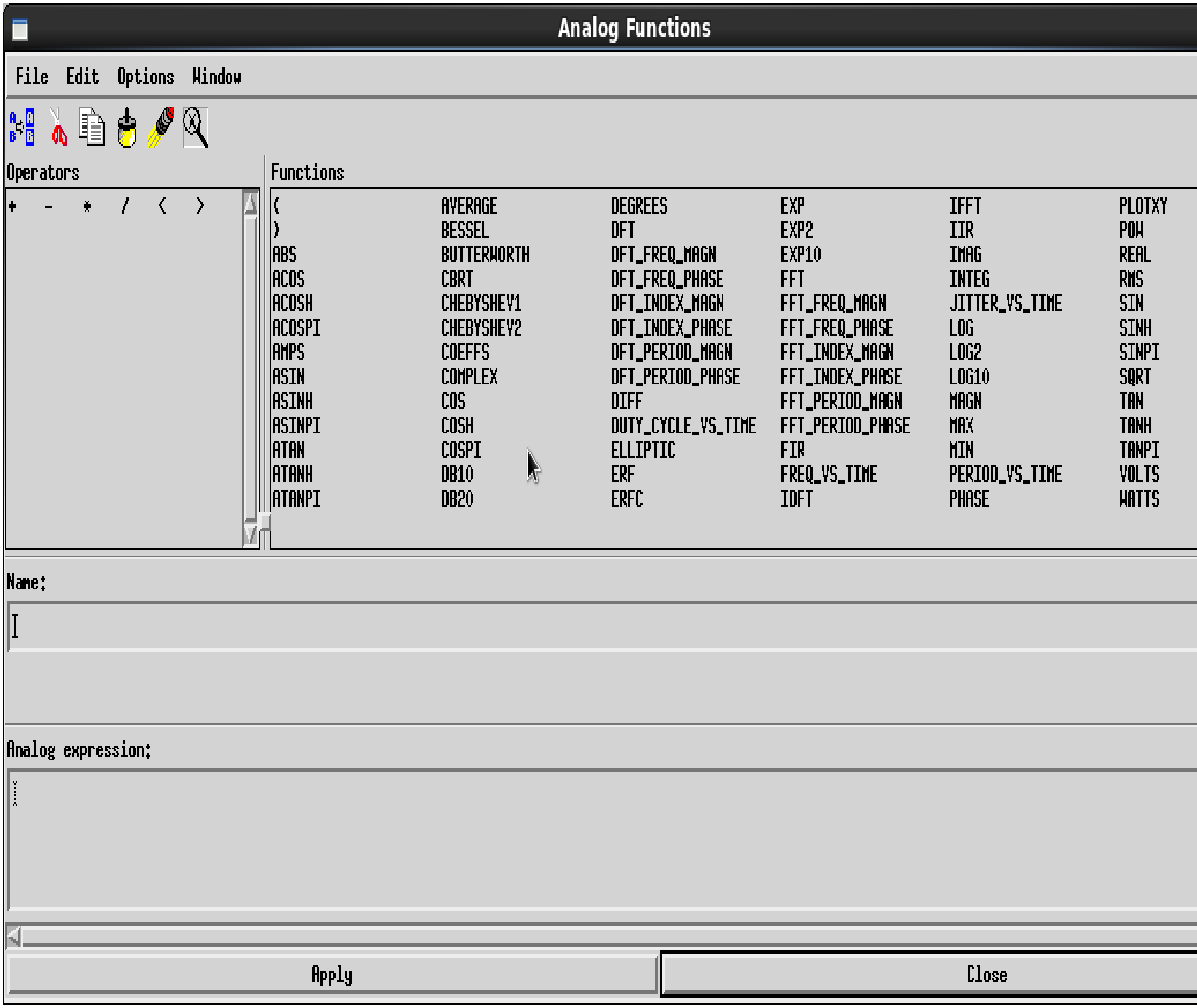
vWave also provides hundreds of analog analysis functions in the menu seletcion, “Analog Functgions”. To use these functions do the following to select the Analog Functions:

Tools -> Analaog analyzer -> Analaog Functions …



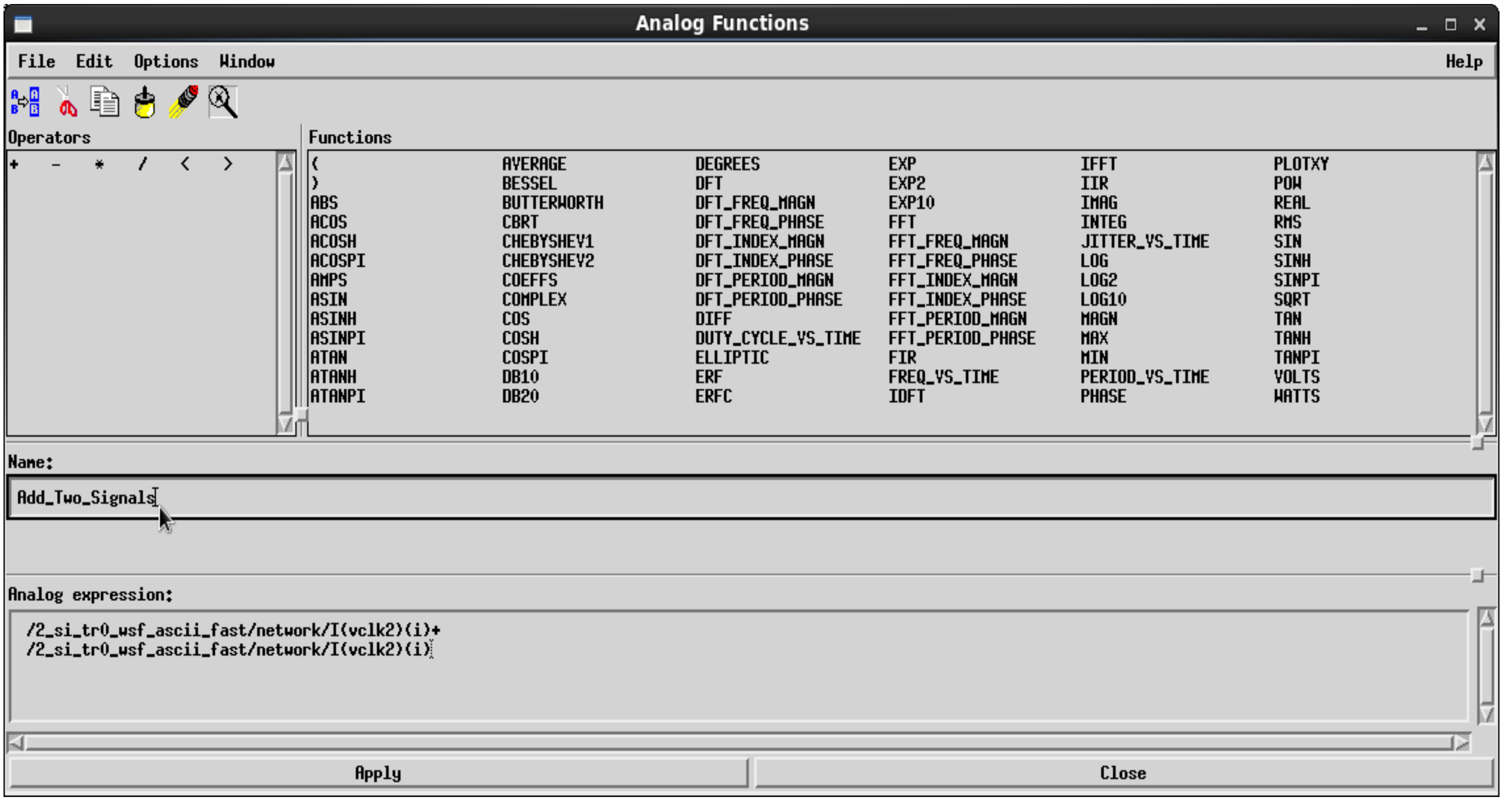
```
Dialog box appears: "Open Dump File"
Navigate to ./examples/fsm_vlog_synopsys
Select vt dump
```

As shown below there are hundreds of avaialble analog functions users have with vWave when analysizing their analog design, functions that can be combined with the operators “+”,“-“, “*”, “/”, “<”, “>” to make even more complex functions which can be saved if they are going to be used more than once.



To demonstrate these functions, we will add two signals together and add this new signal back to the display window;

Drag the signal names you want to add together from the waveform display to the Analog Expression area of the Analog functions window. Then select the “+”, operator, and place this operator between the signal names. Next provide a new signal name in “Name” area of this window for this new signal,



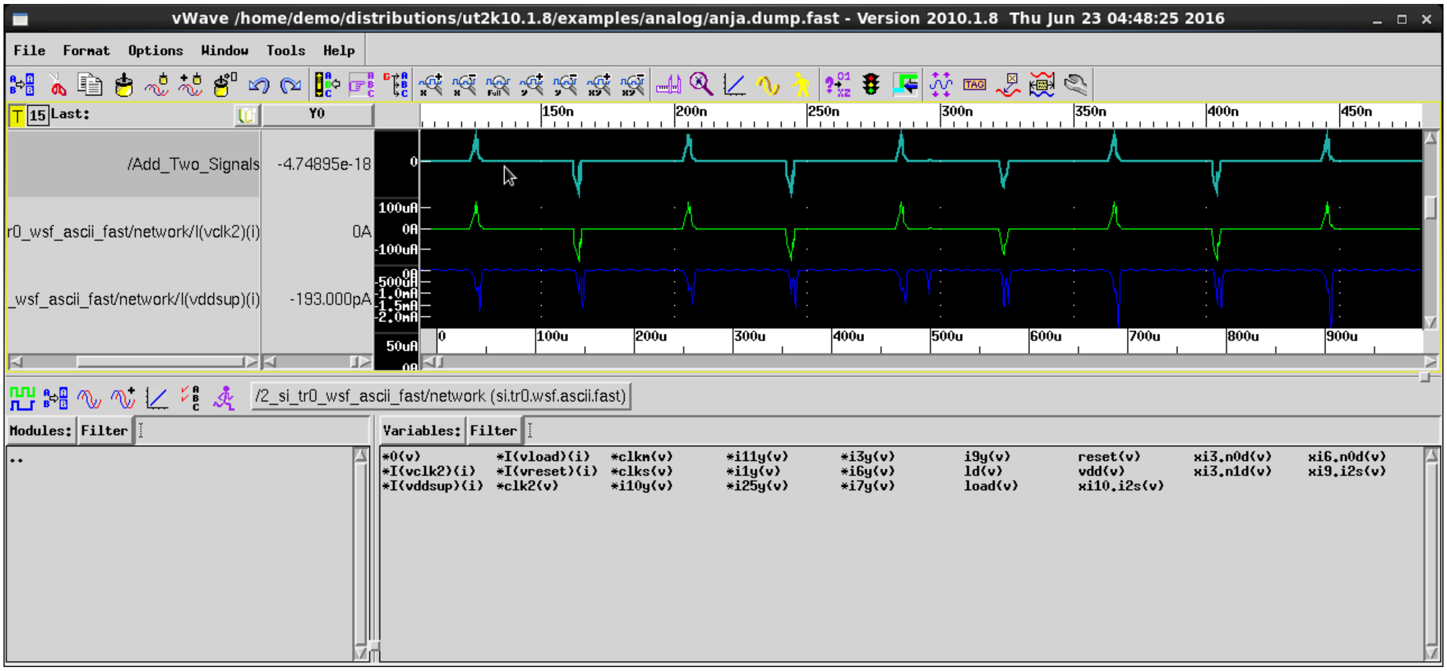
Name:

Add_Two_Signals

Analog expression:

```
/2_si_tr0_wsf_ascii_fast/network/I(vclk2)(i)+
/2_si_tr0_wsf_ascii_fast/network/I(vclk2)(i)
```

When you press Apply the resultant waveform display will appear as shown below with the new signal “Add_Two_Signals”:

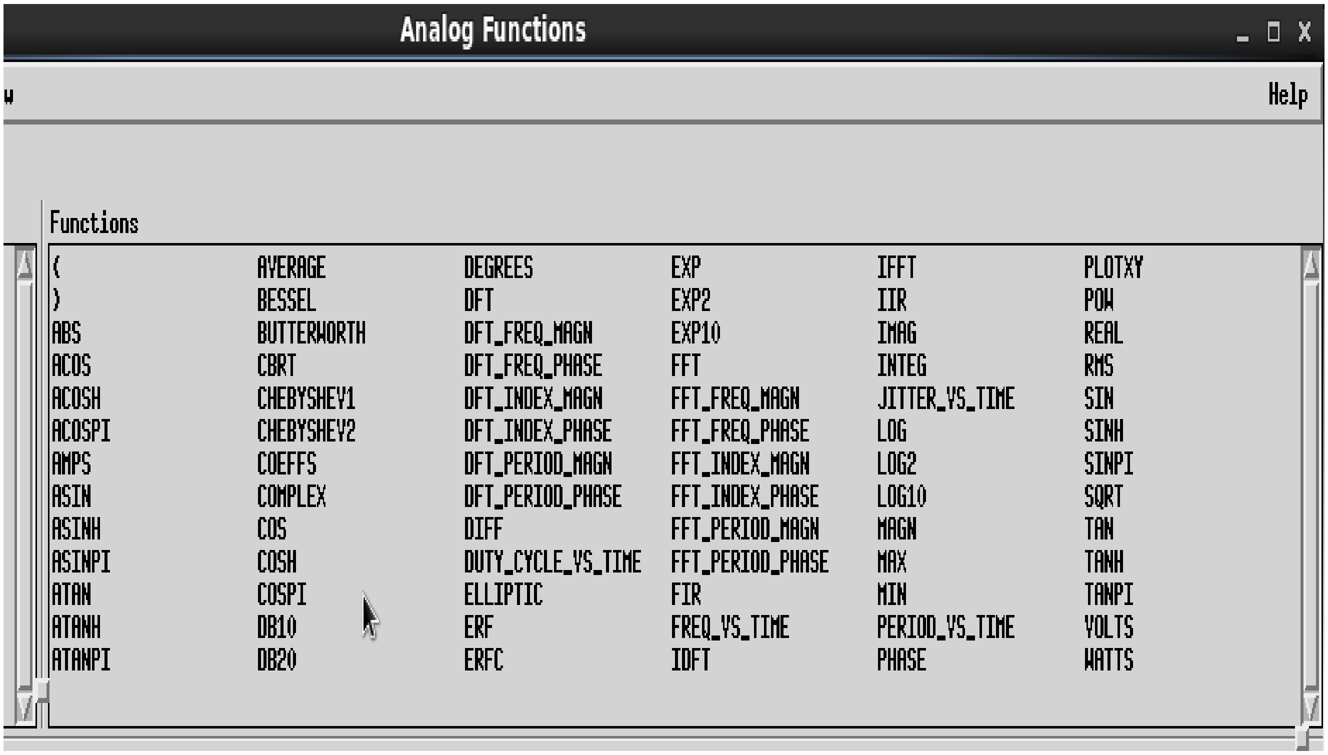


```
/Add_Two_Signals                          -4.74895e-18
r0_wsf_ascii_fast/network/I(vclk2)(i)     0A
_wsf_ascii_fast/network/I(vddsup)(i)      -193.000pA
```

/2_si_tr0_wsf_ascii_fast/network (si.tr0.wsf.ascii.fast)

```
*0(v)            *I(vload)(i)   *clkm(v)    *i11y(v)    *i3y(v)    i9y(v)     reset(v)     xi3.n0d(v)   xi6.n0d(v)
*I(vclk2)(i)     *I(vreset)(i)  *clks(v)    *i1y(v)     *i6y(v)    ld(v)      vdd(v)       xi3.n1d(v)   xi9.i2s(v)
*I(vddsup)(i)    *clk2(v)       *i10y(v)    *i25y(v)    *i7y(v)    load(v)    xi10.i2s(v)
```

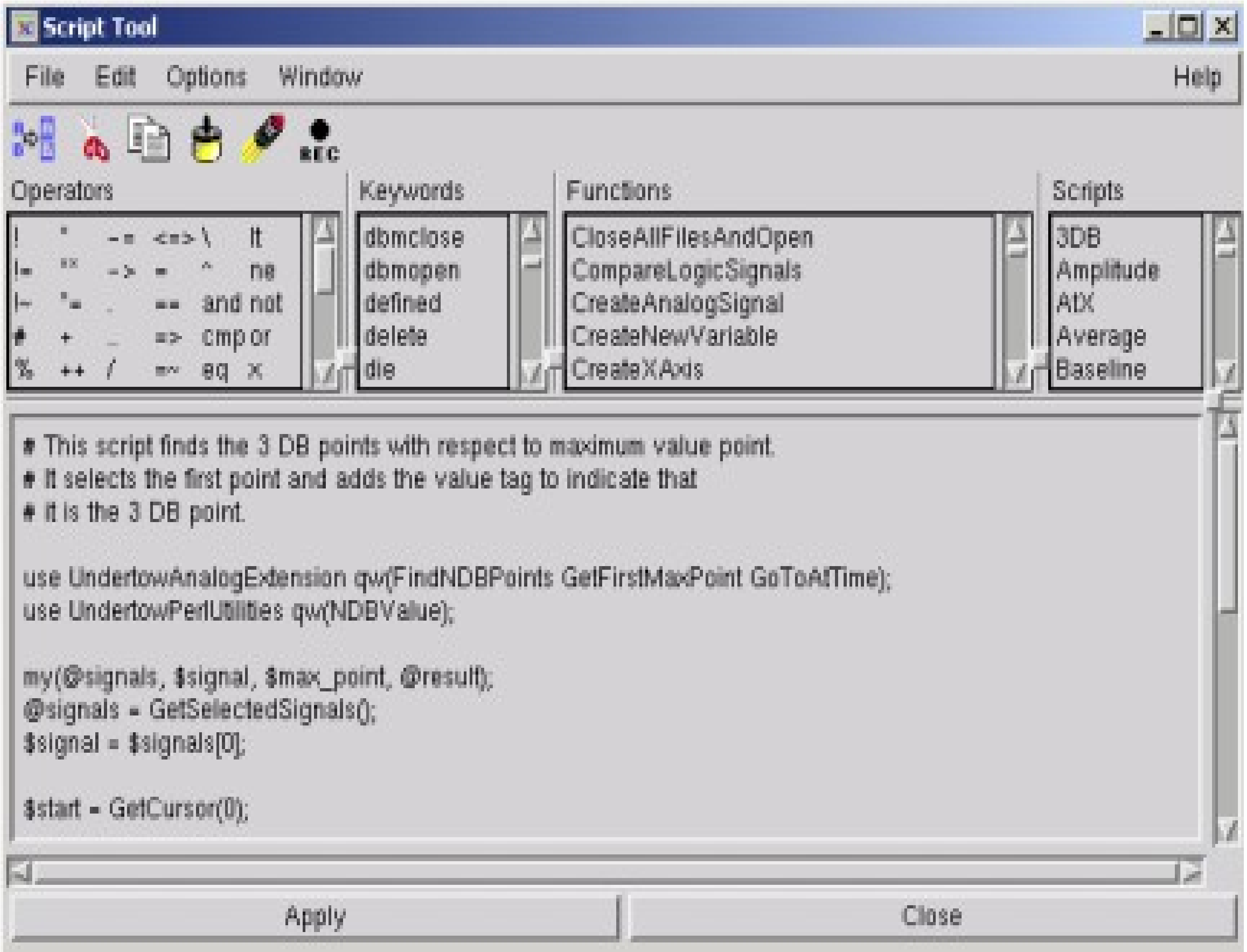
As can be seen if the figure below the Analog functions are very extensive and include the transcendental functions, SIN, COSIN, TAN, etc., FFT and IFFT functions, DFT, GUI Filter builders and many others.



```
(          AVERAGE      DEGREES              EXP                IFFT              PLOTXY
)          BESSEL       DFT                  EXP2               IIR               POW
ABS        BUTTERWORTH  DFT_FREQ_MAGN        EXP10              IMAG              REAL
ACOS       CBRT         DFT_FREQ_PHASE       FFT                INTEG             RMS
ACOSH      CHEBYSHEV1   DFT_INDEX_MAGN       FFT_FREQ_MAGN      JITTER_VS_TIME    SIN
ACOSPI     CHEBYSHEV2   DFT_INDEX_PHASE      FFT_FREQ_PHASE     LOG               SINH
AMPS       COEFFS       DFT_PERIOD_MAGN      FFT_INDEX_MAGN     LOG2              SINPI
ASIN       COMPLEX      DFT_PERIOD_PHASE     FFT_INDEX_PHASE    LOG10             SQRT
ASINH      COS          DIFF                 FFT_PERIOD_MAGN    MAGN              TAN
ASINPI     COSH         DUTY_CYCLE_VS_TIME   FFT_PERIOD_PHASE   MAX               TANH
ATAN       COSPI        ELLIPTIC             FIR                MIN               TANPI
ATANH      DB10         ERF                  FREQ_VS_TIME       PERIOD_VS_TIME    VOLTS
ATANPI     DB20         ERFC                 IDFT               PHASE             WATTS
```

In addition to the Analog Functions, the Veritools vWave has a script tool based on Perl. Script tool is even more useful and powerful because it can extend the functions in vWave by the user using the standard Perl language, and can be used with either analog and digital analysis.

The Script tool is found in Tools -> Script tool and has the initial startup window shown below:



```
# This script finds the 3 DB points with respect to maximum value point.
# It selects the first point and adds the value tag to indicate that
# it is the 3 DB point.

use UndertowAnalogExtension qw(FindNDBPoints GetFirstMaxPoint GoToAtTime);
use UndertowPerlUtilities qw(NDBValue);

my(@signals, $signal, $max_point, @result);
@signals = GetSelectedSignals();
$signal = $signals[0];

$start = GetCursor(0);
```

The Perl Operators are listed on the left side of the window, the Perl Keywords, to the immediate right of the Operators field. These are the standard Perl operators and Keywords used in standard Perl scripts. The Perl functions are listed to the immediate right of the Keywords. The Perl functions allow Perl to communicate with the vWave software.

On the right side of the scripts window is the list of the Scripts, which are the Veritools defined scripts.

In the vWave software distribution directory are three files that are used to define the Perl operations:

Undertow.pm, a file that lists the and defines the new Perl “Function” routines that connect Perl to the vWave software. For example, two of the functions are;

CloseAllFilesAndOpen(Filename) – this closes all files currently in vWave and opens and loads the file with the specified name.

CreateAnalogSignal(signal_name, expression) – creates an analog signal with the specified name using the specified analog functions expression. Any expression available in the Analog Functions window can be used in an expression for CreateAnalogSignal.

All of these functions are listed in the Perl Functions list in the Script window, and are defined as to what each function does and the inputs that are required for this function in the Undertow.pm file.

UndertowPerlUtilities.pm is a list of Perl routines that are used in building the Perl scripts in the “Scripts” list. These routines are based on standard Perl and do not require any knowledge of vWave.

UndertowAnalogExtensions.pm is a file of Perl routines used primarily for creating analog scripts. Examples are Average, FindNDBPoints, GetPeriod, GetFrequency, etc.

For example, in “FindNDBPoints”, N defines a DB point the user wants to find on a signal. If N is set to a -3, this routine will find the maximum value of this signal and then find the 3DB down point on this signal from this maximum value.

The routines in Undertow.pm, UndertowPerlExtentions.pm and UndertowAnalogExtenrtions.pm along with the Perl Operators and Keywords were used to write the Perl code for the Scripts in the Scripts list.

Scripts in the Scripts window are located with the environment variable UT_SCRIPTS_DIR, which is usually set to $UT_ROOT_DIR/scripts, with the script routine suffix defined in the

Script_Tool -> Window -> Configure-> File Suffix: text area, currently set to “. script” Users can add their own routines to the Scripts directory, the UndertowPerlExttentions.pm and the UndertowAnalogExtentions.pm files.

Since most engineers are familiar with C programming and Perl, the Script tool allows the vWave to have unlimited extensibility defined by the user with an easy to use universal language.

The currently available Scripts are the following:

3DB.script
Amplitude.script
analogdev.script

AtX.script
Average.script
bandpass.script
Baseline.script
builder.script
bus-interpeter.script
compare_files.script
compare_module.script
compare_module_tree.script
compare_signal.script
dbdown.script
deltax.script
DeltaX.script
DeltaY.script
dutycycle.script
dutycycle_vs_time.script
get_values.script
highpass.script
localmax.script
localmin.script
lowpass.script
low_to_high.script
MaxFall.script
MaxPoint.script
MaxRise.scrip
meas_gui.script
measgui.script
measure1.script
measure.script
MinPoint.script
PeakToPeak.script
place_tag.script

ScriptsMenu.script
SlewRate.script
stopband.script
threshold.script
Topline.script
up_cvs_test.script
ut.test.script
xmax.script
xmin.script

Examples of some of these scripts are as follows:

3DB.script

```
# This script finds the 3 DB points with respect to maximum value point.
# It selects the first point and adds the value tag to indicate that
# it is the 3 DB point.

use UndertowAnalogExtension qw(FindNDBPoints GetFirstMaxPoint
GoToAtTime);
use UndertowPerlUtilities qw(NDBValue);

my(@signals, $signal, $max_point, @result);
@signals = GetSelectedSignals();
$signal = $signals[0];

$start = GetCursor(0);
$end = GetCursor(1);
print "start = $start   end = $end    \n";

$max_point = GetFirstMaxPoint($signal, $start, $end);
```

```
@result = FindNDBPoints($signal, $start, $end, $max_point, 3, 0);
print "3 DB points are: @result  \n";

GoToAtTime(0, $signal, $result[0]);
PlaceValueTagUsingCursor("3 DB Point $result[0]");
```

Amplitude.script

```
#This script finds the amplitude of a selected signal.

use UndertowAnalogExtension qw(FindNPeaks GetFirstSameValuePoints
PrintVarArray);

my(@signals, @data);
@signals = GetSelectedSignals();

$start = GetCursor(0);
$end = GetCursor(1);
print "start = $start   end = $end    \n";

print "Selected signal is $signals[0]   \n";

my(@result, $top_line, $base_line, $amplitude);
@result = GetFirstSameValuePoints($signals[0], $start, $end, 1, 1);
$top_line = $result[2];

@result = FindNPeaks($signals[0], $start, $end, 2);
#PrintVarArray(@result);
$base_line = $result[9];

$amplitude = abs($top_line - $base_line);
```

```
print "Top line: $top_line  Base line: $base_line  Amplitude: $amplitude
\n";
```