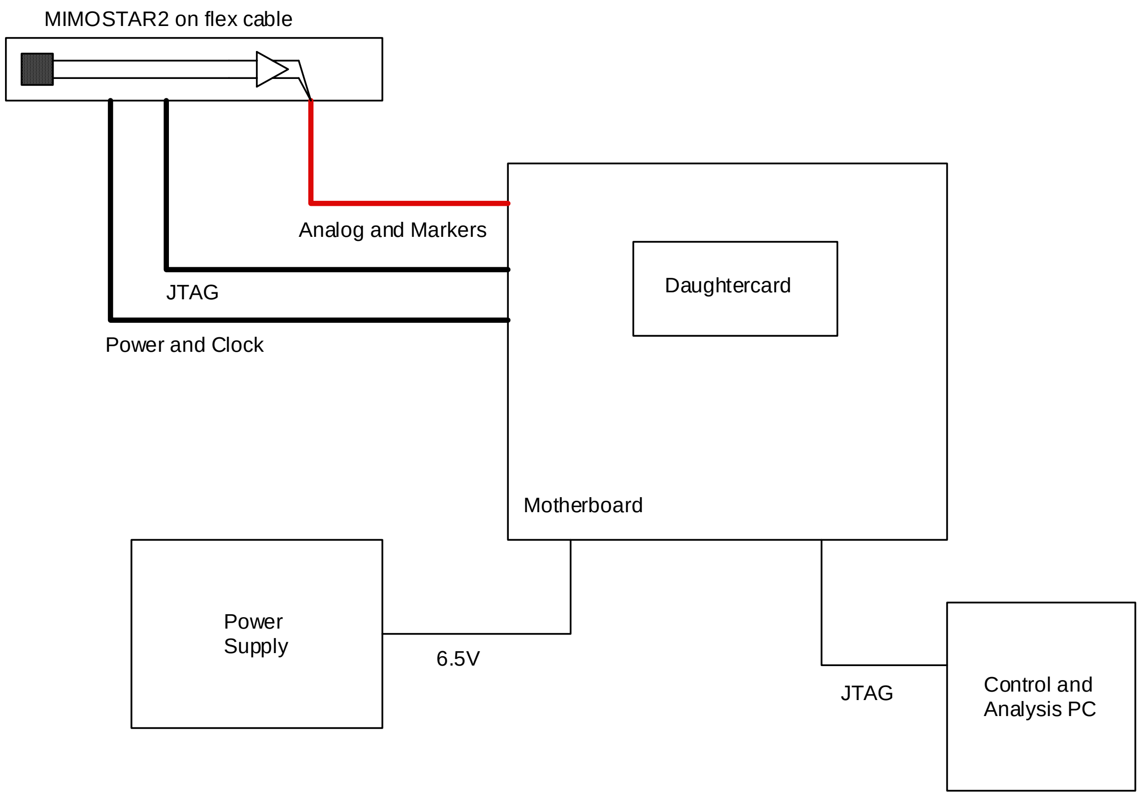
LG, MS 2006/10/08

Results of Testing for Noise Pickup in 3 Different Types of Cables for the Analog Transmission of Signals in the STAR HFT 2006 Beam Test

We report on the measurements of noise pickup in the analog signal cables in 3 different cable types. The test setup is shown below.



In this drawing, the “JTAG” and “Power and Clock” cables are fixed, of the individually shielded flat black type, and soldered to the flex cable. The “Analog and Markers” cable was terminated in RJ-45 connectors and a female cable receptacle was added to the flex cable output to allow the easy substitution of different types of test cable.

Test Methodology:

We are examining the signal integrity and noise pickup in the three types of cables. We accomplish this by looking at dummy pixels which produce a fixed signal value set by a regulated external (to the MIMOSTAR2) voltage source applied to the AFIX pin of the sensor. The noise of the system (hopefully low) should be the same for all cables and any difference in the measured width of the AFIX ADC distribution should be due to cable type.

Cable types:

The cables used in this test were of three different types. The first was an individually shielded twisted pair flat black CAT5 type cable. The second was a standard shielded

CAT5 cable. The third was a thin twisted pair cable from ATLAS used for their HV distribution. The ATLAS cable was tested both bare and with a hand applied copper foil shield. All cables are 135” long which is the length required to reach from the telescope to the electronics mounting point in STAR.

Data path:

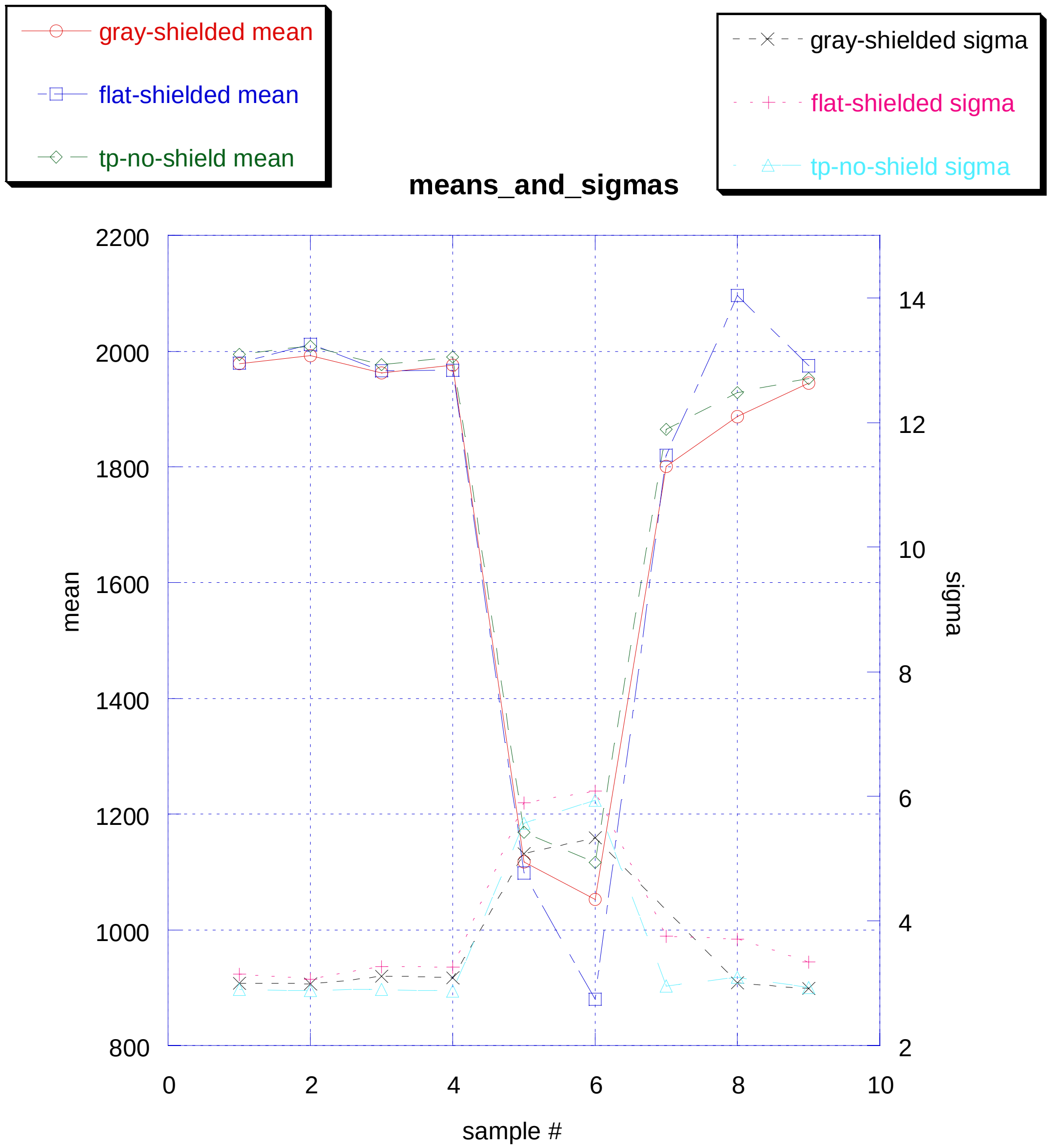
The MIMOSTAR2 was run at 50 MHz with the current (as of 10/04/2006) firmware from Thorsten that generates a Sync signal every ~30 milliseconds. The analog current signals from the sensor are converted to voltage signals and driven over the twisted pair cables to the motherboard where they are terminated and passed to the daughtercard for digitization. The data is read out of the daughtercard on the fly with Xilinx chipscope. The ADC values are then saved in ASCII format and analyzed using a Labview VI written by Michal.

Samples:

We are taking a repeating set of 12 contiguous samples from the latter part of each of 170 frames. Our samples contain 10 dummy pixels and 2 real pixels. We did not use a light box so the sensor was exposed to light during the tests. This will have no effect on the dummy pixels. In the data shown below, the 5^{th} and 6^{th} samples are real pixels, the rest are dummy pixels.

Data:

The results are plotted below:

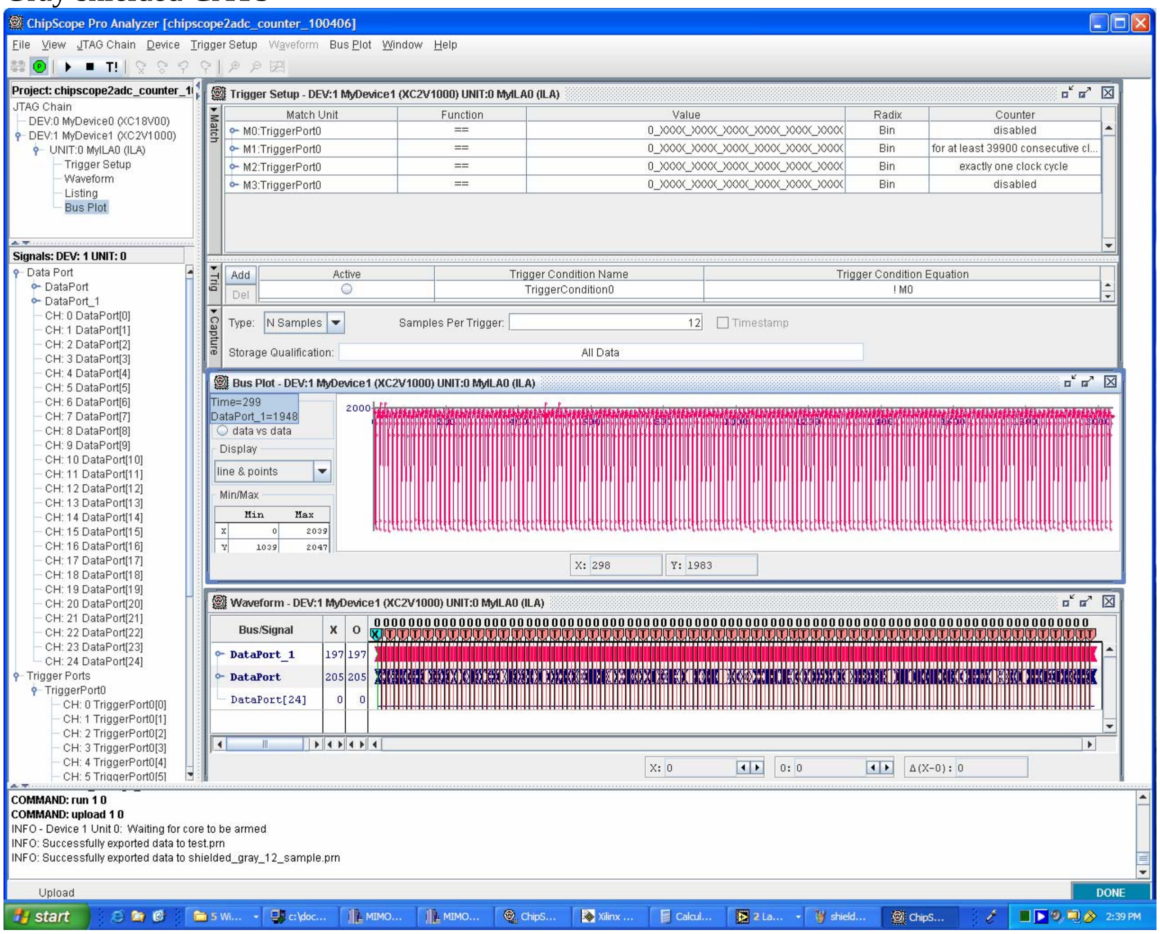


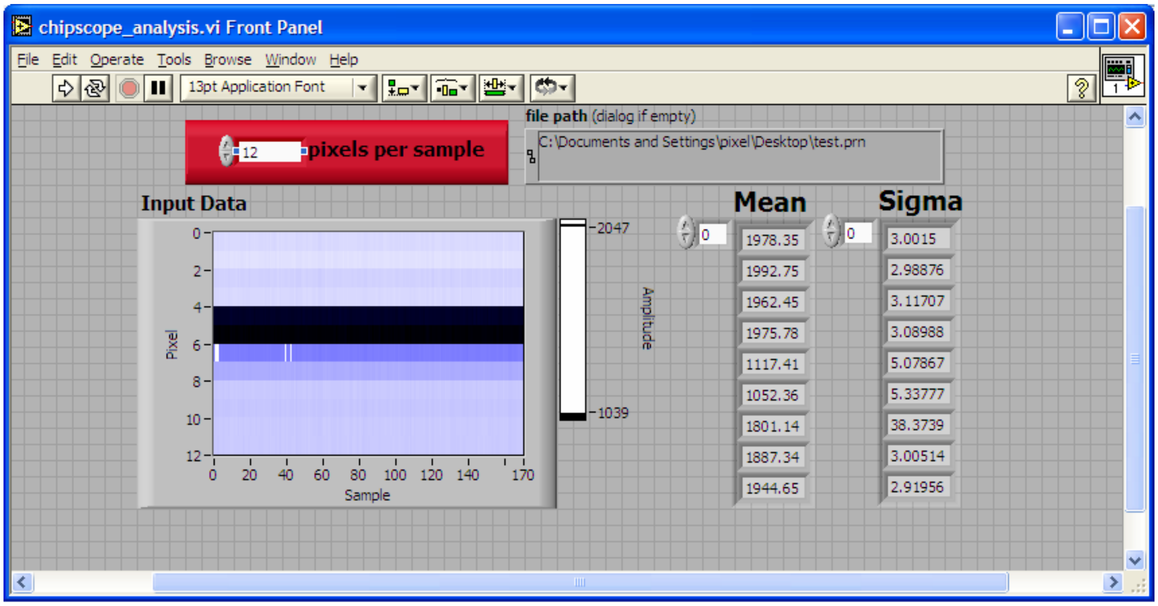
Our system noise, as shown above for the dummy pixels appears reasonable. The noise level is approximately 3 ADC counts and relatively independent of cable type. The real pixels have a different ADC value and a sigma of approximately 5-6 ADC counts. It should be noted that we have not yet calibrated the chip using a source and the gain in our analog driver on the flex cable is likely a bit high. It appears that all of the cables tested are suitable for use in the consideration of noise pickup. Note that the shielded ATLAS type cable is not shown in the plot above. It was indistinguishable from the unshielded state.

The analog signal shape is difficult to accurately measure due to it's differential nature and the problems associated with correct scope grounding. Our "by eye" judgment was that the best signal transmission was achieved using the gray standard shielded CAT5 cable. We will need to investigate this further after we have calibrated the detector response and set the appropriate gain in our drivers. The slew rate of the signal was measured to be approximately 60 mV / ns. This was consistent with measurements made at IRES by Kimmo and appears to be the output driver slew rate on the MIMOSTAR2 sensor.

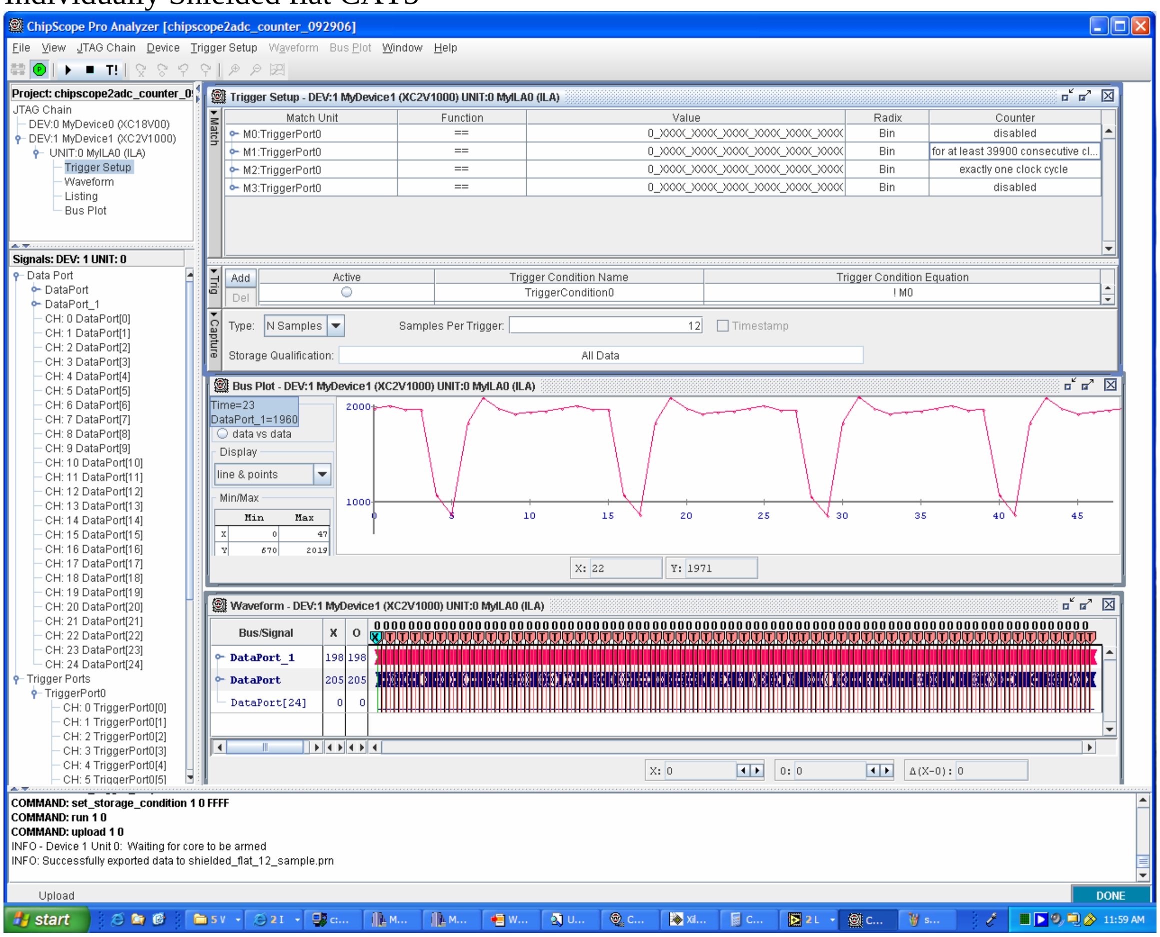
The data is shown below.

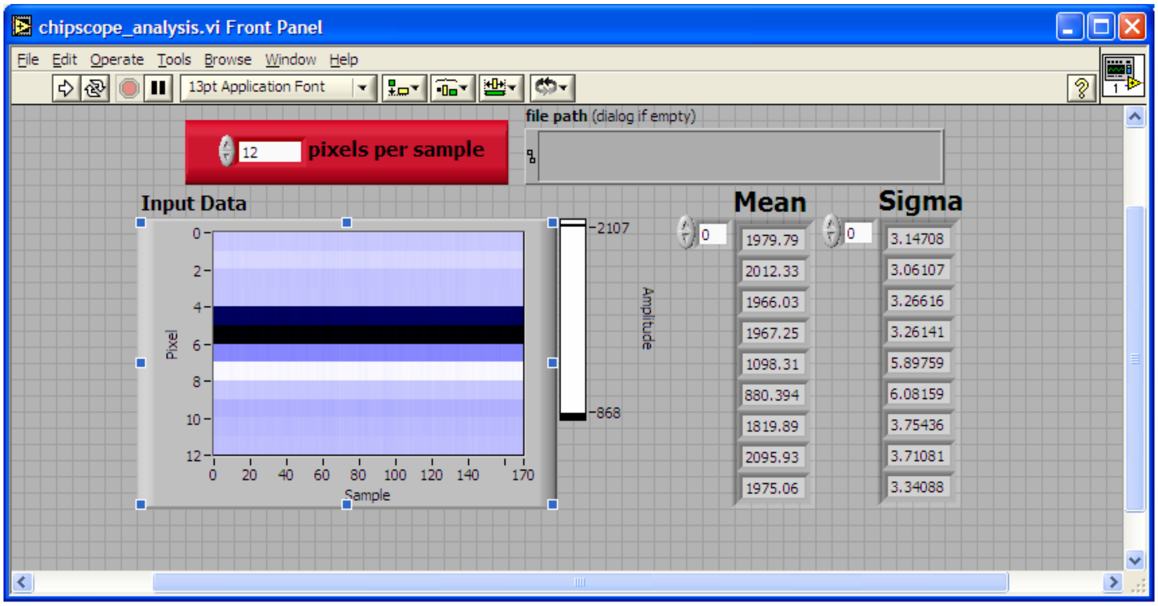
Gray shielded CAT5



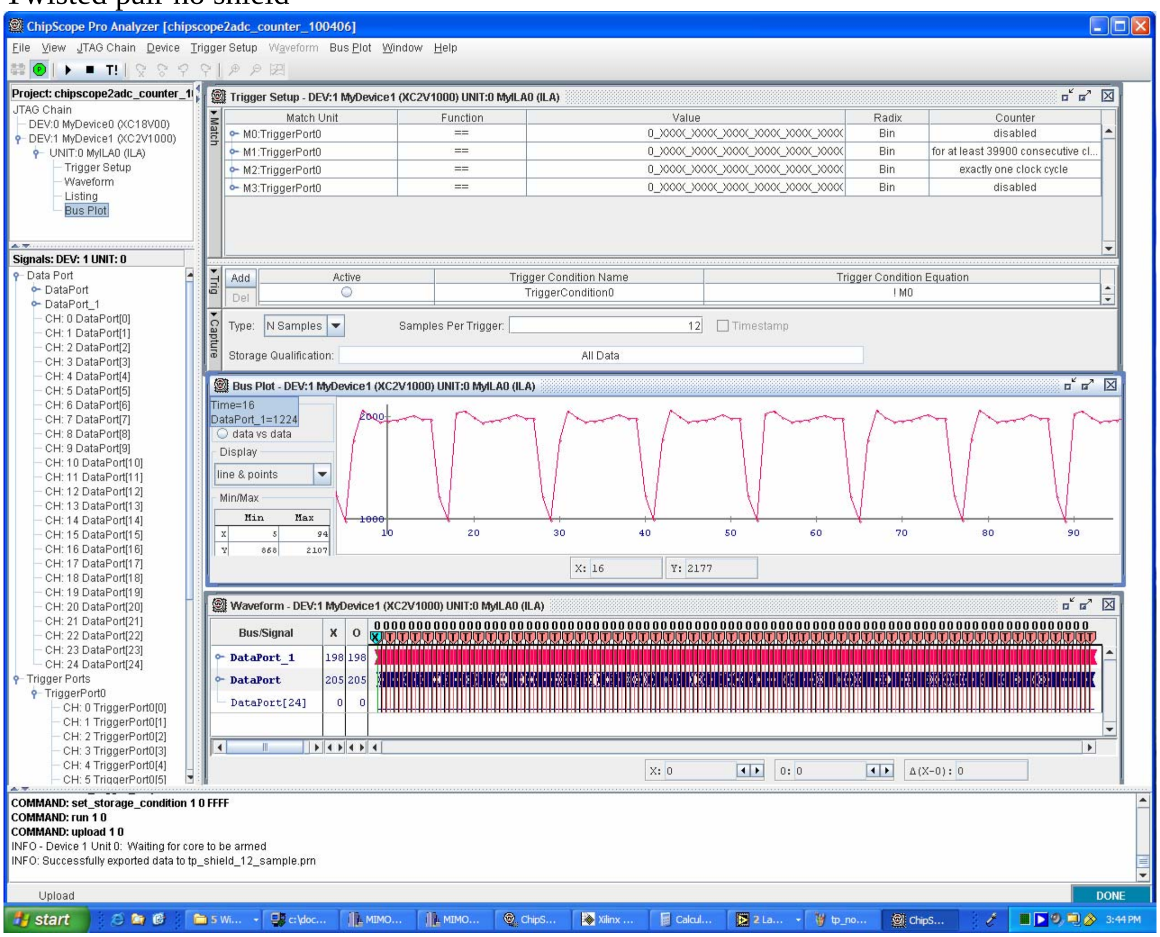


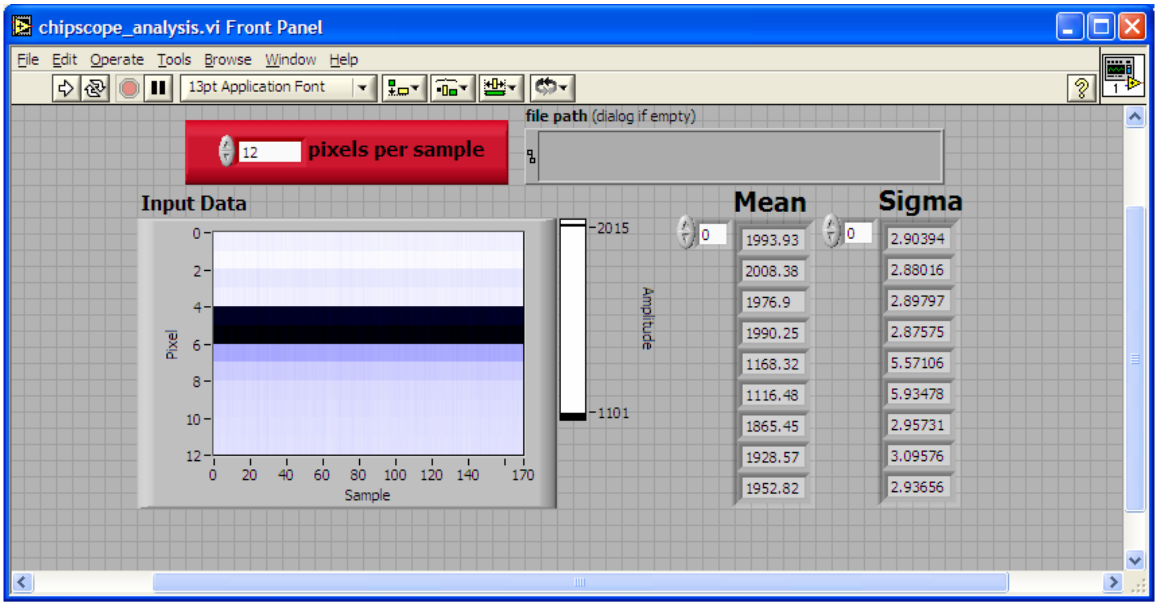
Individually Shielded flat CAT5



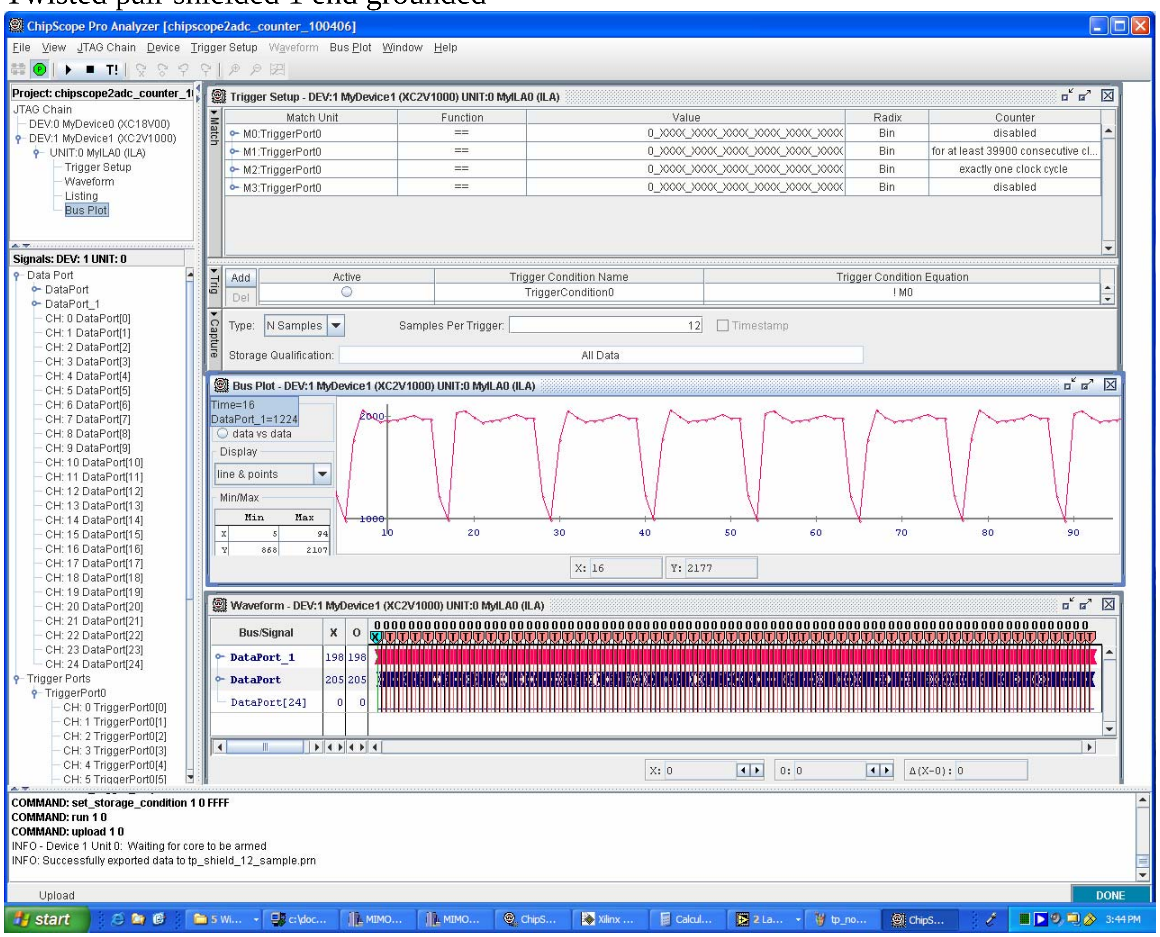


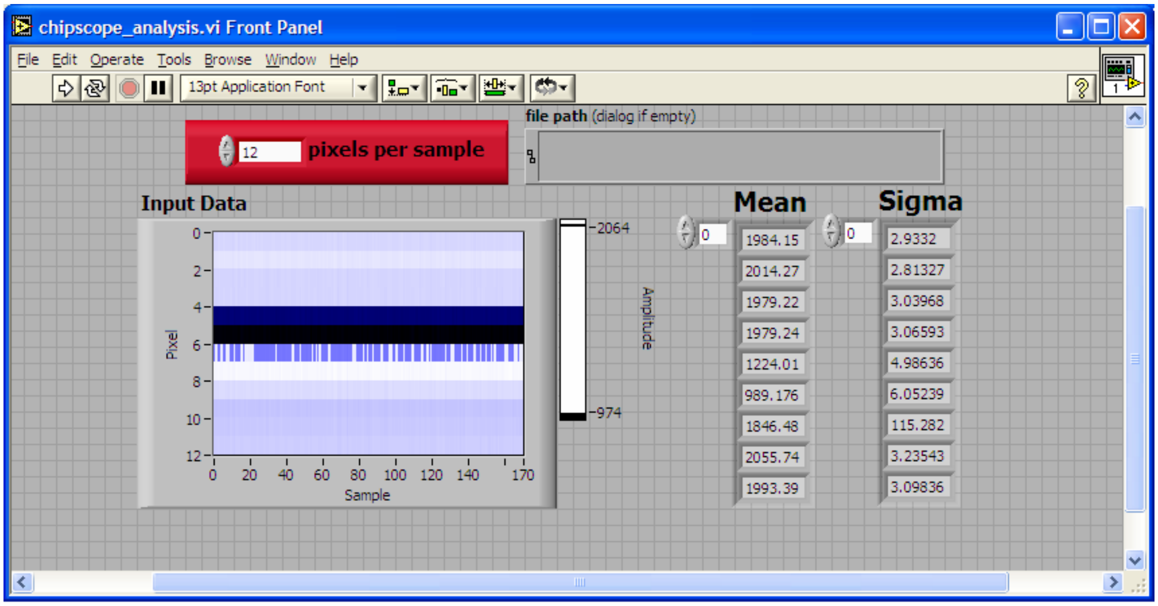
Twisted pair no shield



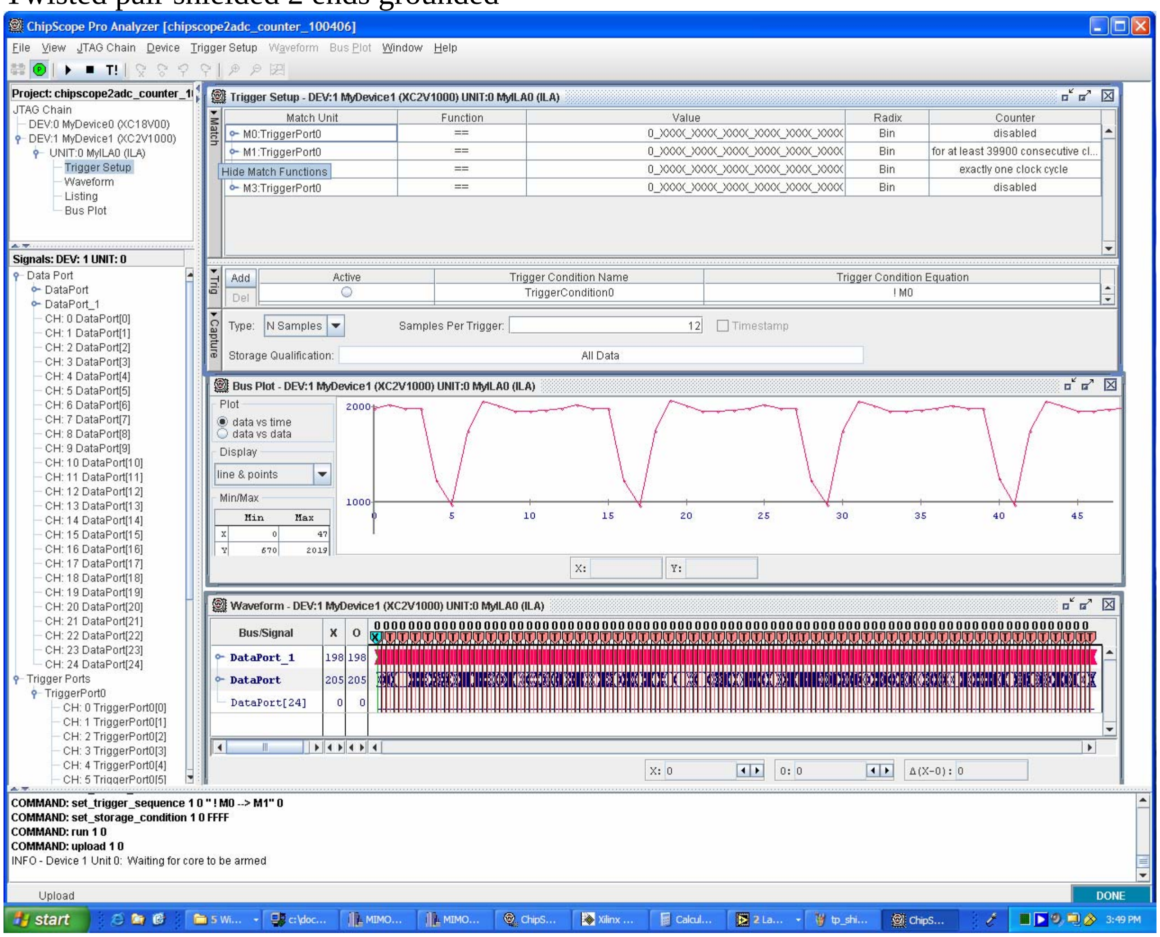


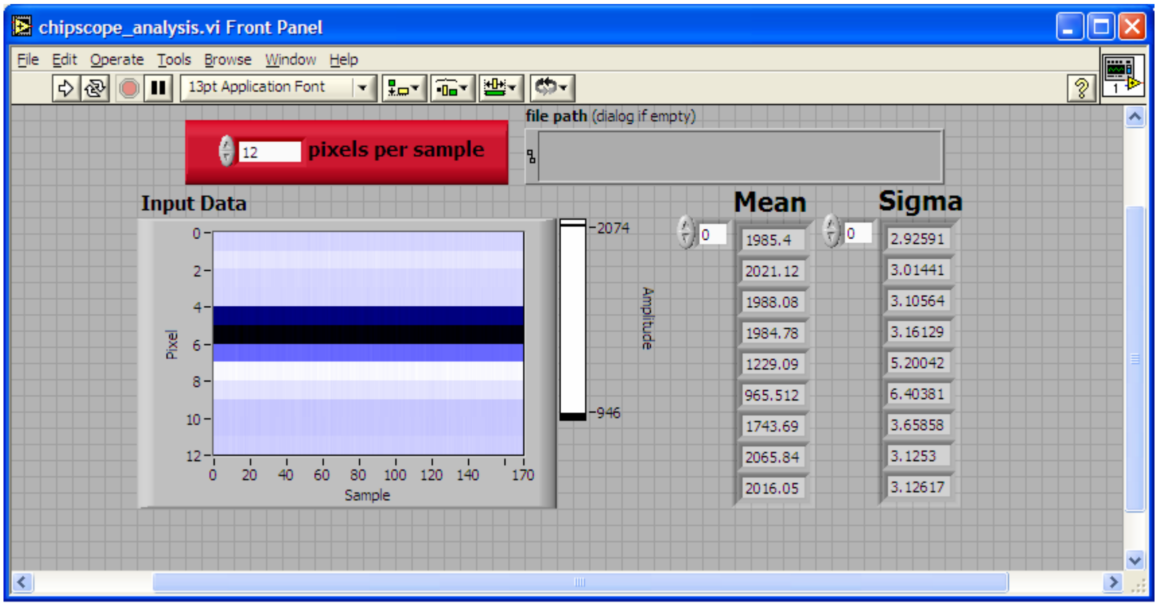
Twisted pair shielded 1 end grounded





Twisted pair shielded 2 ends grounded

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