Instructions for Silicon Strips Sensor source measurement

EDIT 2012

SiDet lab C at Fermilab

Purpose

Understand the basic behavior of a silicon strip tracker irradiated with a radioactive source.

Introduce to the basic elements of
data acquisition system for a silicon strip sensor.

Perform analysis of the clusters in the acquired data.

How to proceed: summary

Did you had the required trainings ? Are you wearing your personal dosimeter badge ?

At the beginning take a look at the setup:
Be sure that the source is closed and not on the box.
Be sure that all the voltages are off , then open the box, check the connections.
During the inspection of the setup take note of the id of the strip sensor and of the type (N type or P/Y type)

With the box closed, the source away and closed, start switching on everything, starting the program.
Do 3 times a fast pedestal scan with 0V bias, 150Vbias and 300V to see how the noise change.

Perform a pedestal/data run at 300V bias
If there is still time perform also:
Perform a pedestal/data run at 200V bias
Perform a pedestal/data run at 100V bias

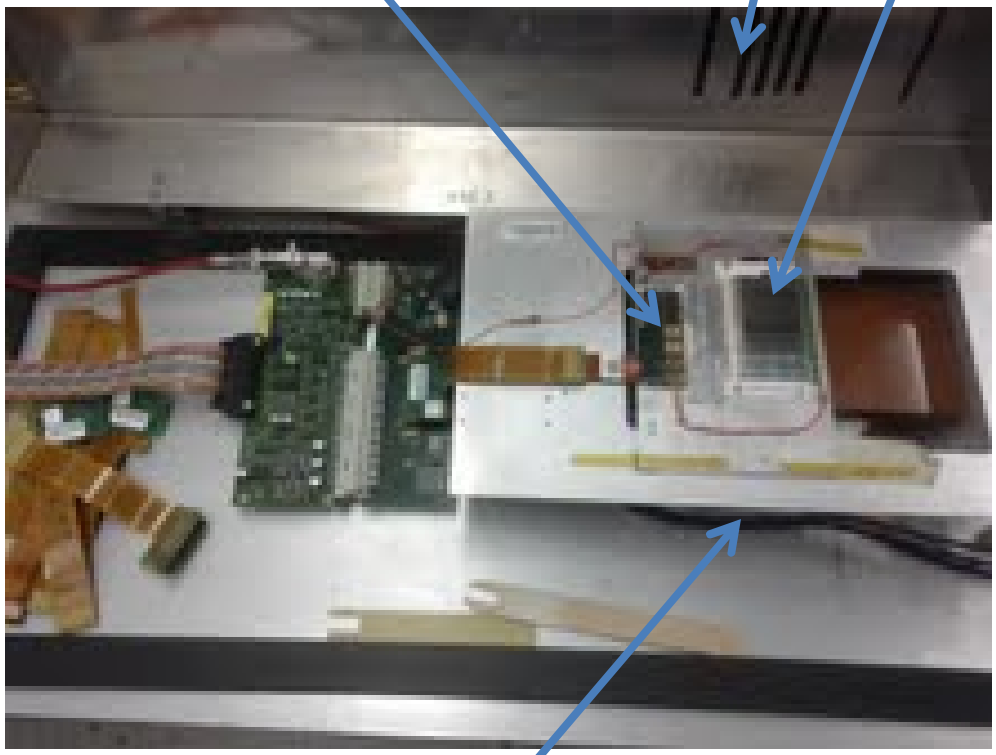
Do the data analysis and some plots changing the cuts on the "signalcut" value.

Inside the box

Windows on the top of the box covered by tape

Readout chips

Silicon strip



Scintillator and photomultipliers for the trigger signal (under the strip sensor)

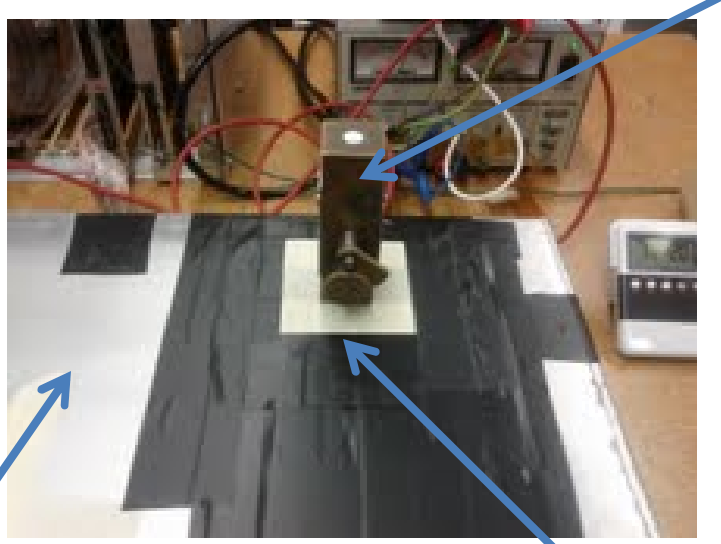
Details

Low Voltage
ON/OFF

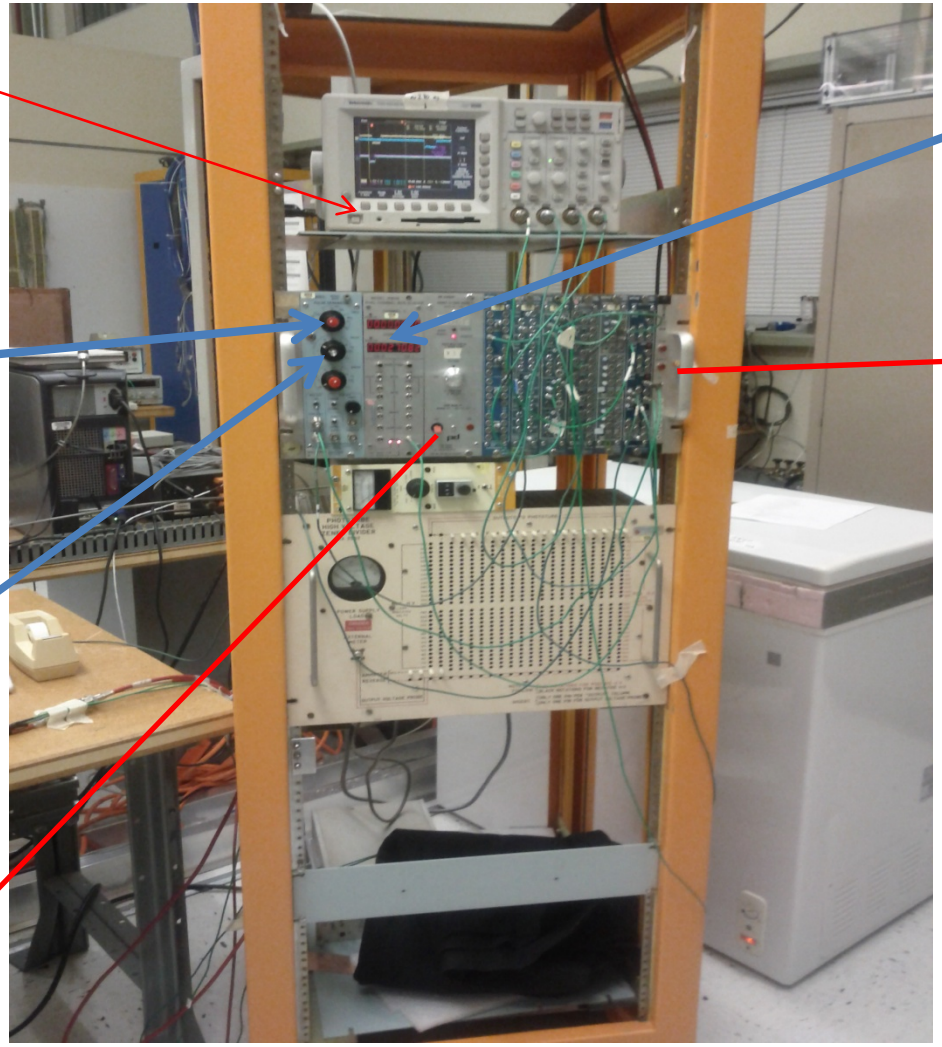
K237 switch ON/OFF

K237 ENABLE/STAND-BY for bias voltage

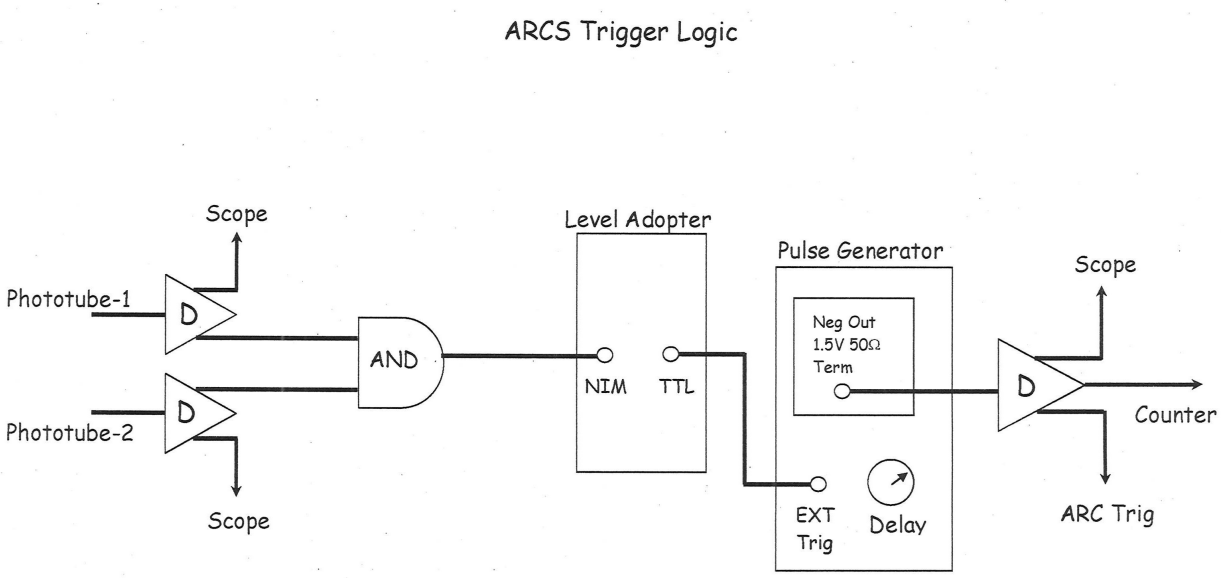
Experimental Setup



Detail High Voltages rack



Trigger


ARCS Trigger Logic
Scope
Phototube-1
D
Phototube-2
D
Scope
AND
Level Adopter
NIM
TTL
Pulse Generator
Neg Out
1.5V 50Ω
Term
EXT
Trig
Delay
D
Scope
Counter
ARC Trig

Procedure for ARCS Source Test

Login on the controller desktop (if not already done)

Turn on power the two low voltage power supplies, the digital scope and the phototubes. The voltage set of the phototubes have to be 1.1kV
Turn on the K237 and be sure that is in stand-by.

Double click Shortcut Arcs8_0.exe on Desktop to start ARCS.vi program (upper right corner of the screen)

You will see on the scope four pulses: two for discriminated phototube signals, one for their coincidence and one for the delayed signal for the ARCS trigger.

ARCS Source Test

Turn on K237 : pay attention to the polarity:

Positive for N Type

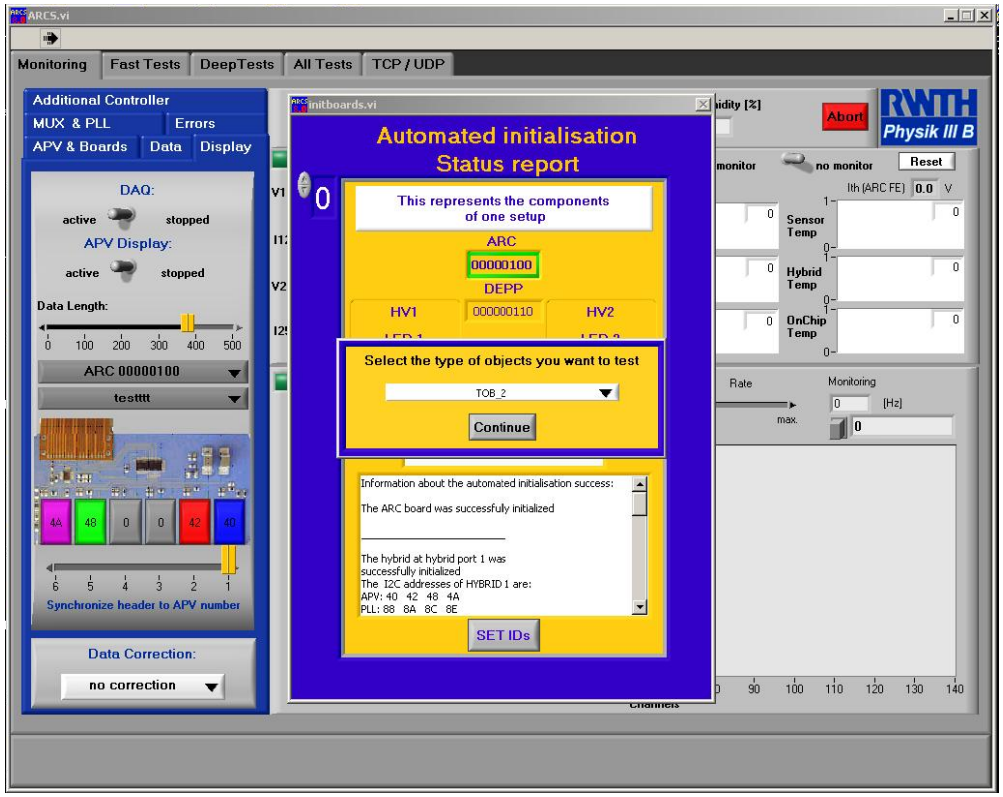
Negative for P/Y Type

On ARCS.vi program:
Hit the clear arrow on top-left to start ARCS daq.

You will see green frame around 00000100 once the initialization is complete.
Otherwise, there is a problem.
Hit “Continue” to see “Hybrid 1 ID” circle is green

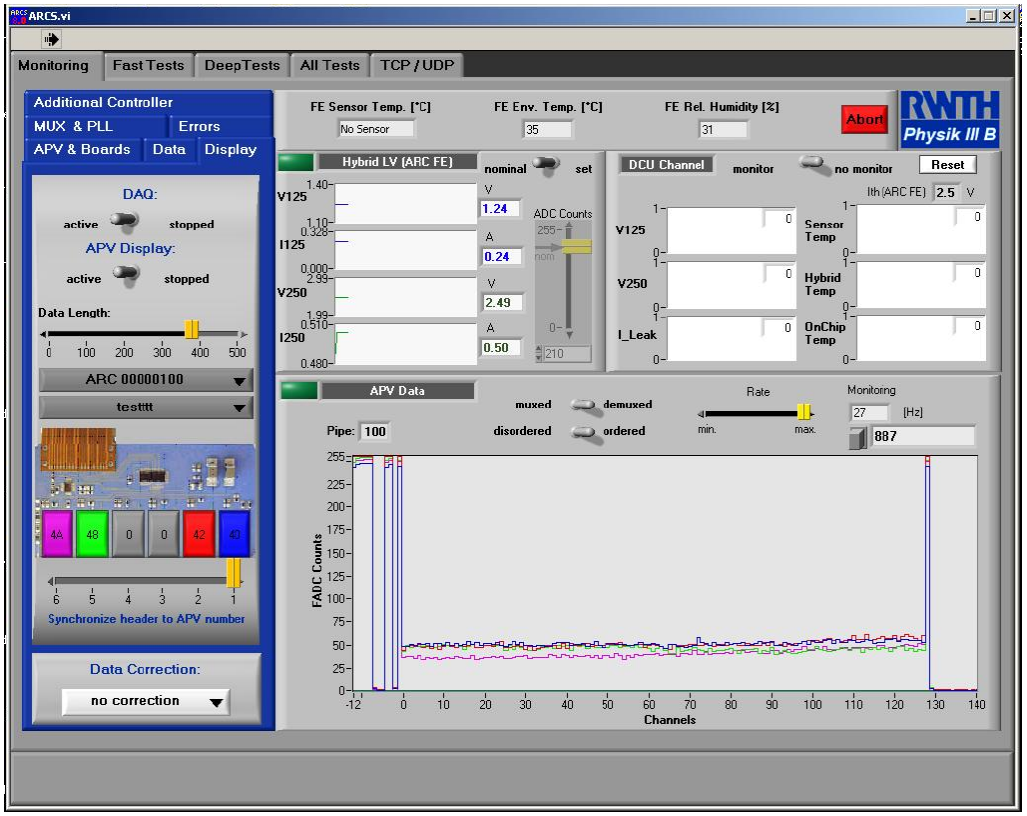
Type sensor name in box: e.g. FZ320N_03_MSSD_2

Hit “Set ID” box. Now you have program running and you see the picture in the next page.



ARCS Source Test

Program Running



ARCS Source Test

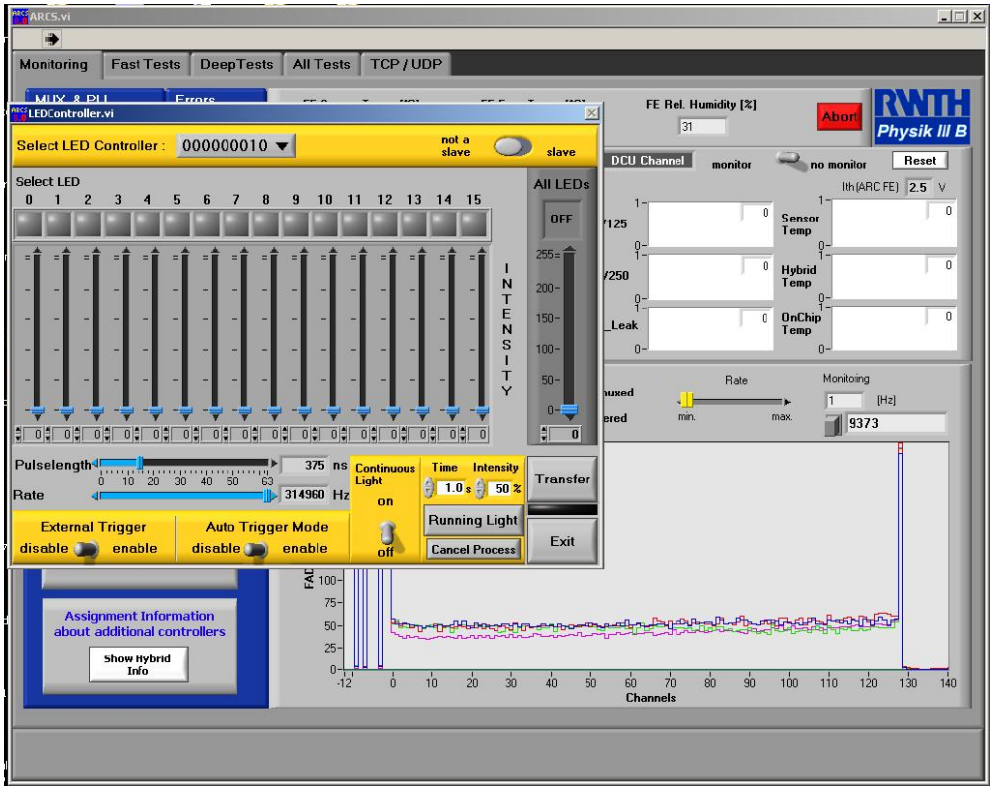
You can do a quick check on pedestals:
On Tab DeepTest, hit Start Ped Noise run to see the pedestals (red plot) and the noise (blue plot).
Noise level should be about 2.5 counts.
Repeat this test using 100V, 200V and 300V as bias values

ARCS Source Test

Set K237 to the desired voltage:
+300/+200/+100 for 300 micron thick N-type sensor,
Or
-300/-200/-100 for P or Y-type sensor.

On ARCS.vi Program's "Monitor Tab", go to Additional Controller Tab:

- Hit LED Button
- Then disable "Auto Trigger mode"
- Enable "External Trigger"
- Hit Transfer
- Hit Exit

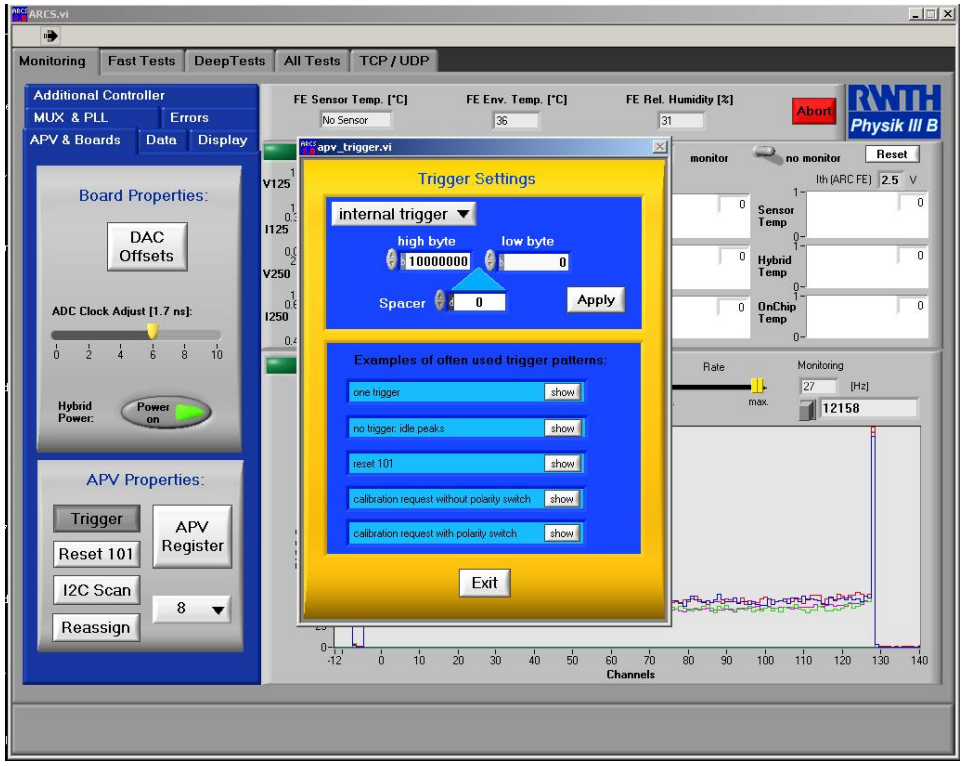


ARCS Source Test

On ARCS.vi Program's "Monitor Tab", go to APV & Boards Tab

Hit Trigger button, choose "external trigger"

Hit Apply then Exit



ARCS Source Test

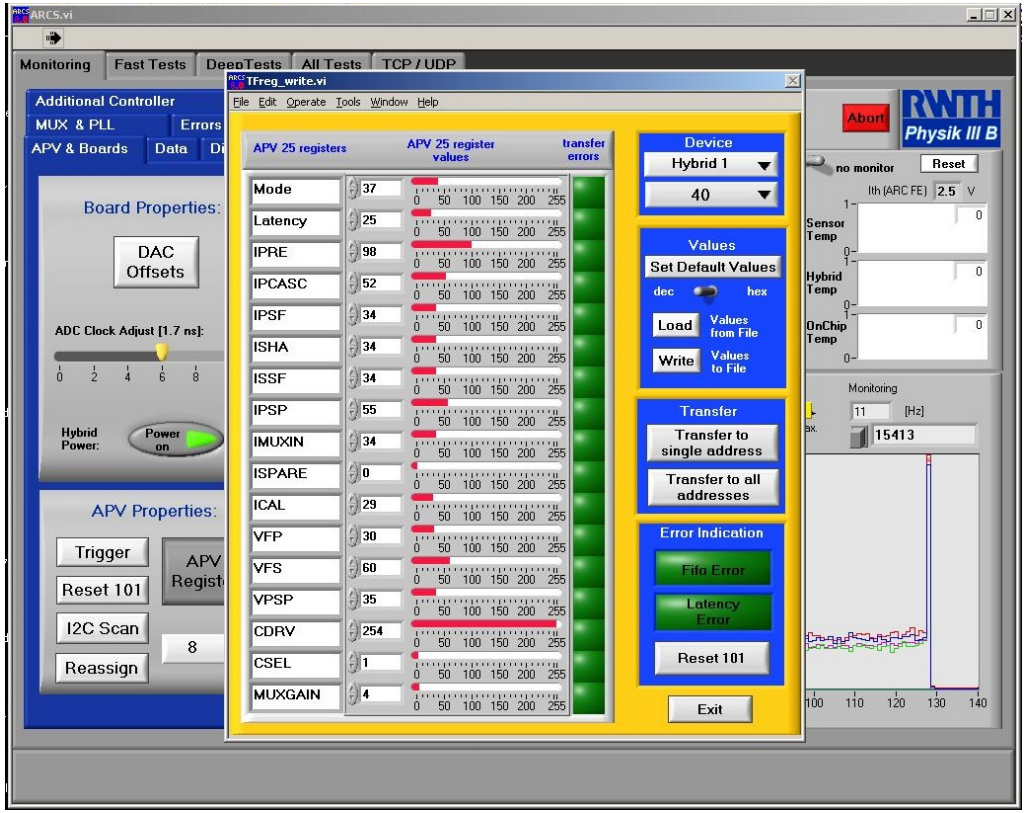
ONLY For Y and P Type (Not for N, settings for N-type are defaults):

On ARCS.vi Program's "APV & Boards Tab", go to "APV RegisterTab"

Set Mode = 5

Hit Transfer to All addresses

Hit Exit

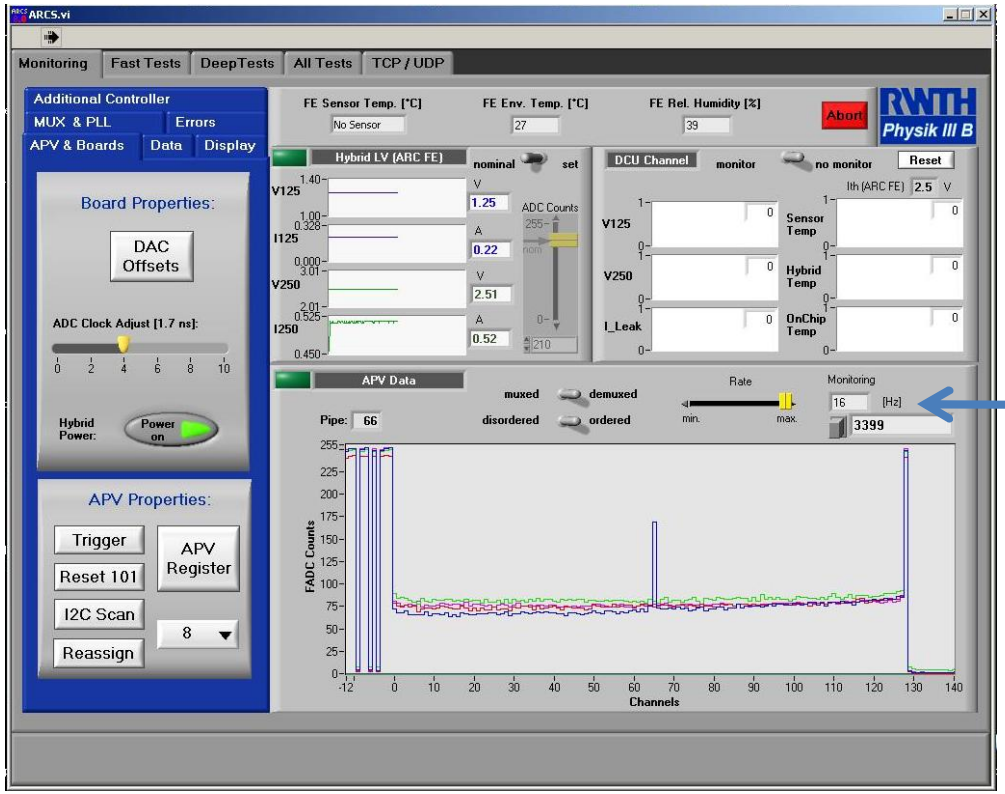


ARCS Source Test

For source Run:

Place the source on top of the Aluminum shell, above the sensor
Set the Pulse Generator to EXT/SP on Frequency switch
Set the delay to ~305 ns using the Delay switch of Pulse Generator.
Watch the pulses on the scope to see the delay value.

You should see the hits on the ARCS display window. Maximize the hits by adjusting the delay.



Check the rate is
Between 10 -20 Hz
Check on the scaler display also

ARCS Source Test

To record the data, either for Pedestal or Source run:
On ARCS.vi Program' "Monitoring" tab, go to "Data" tab
Set # events to 5000
Press enter
Hit "Write Raw ASCII data"Observe the number of events recorded. Recording will stop. Data file will be saved in:
S: /ARCS Data/HPK_2011
with name:
Raw_Data_FZ320N_03_MSSD_2.dat
(sensor ID typed in earlier in the name)
When done, **rename** this file (before starting another run)
Raw_Data_FZ320N_03_MSSD_2_Pedestal_300V.dat
Raw_Data_FZ320N_03_MSSD_2_Source_300V.dat
Raw_Data_FZ320N_03_MSSD_2_Pedestal_200V.dat
Raw_Data_FZ320N_03_MSSD_2_Source_200V.dat
.....
.....

ARCS Source Test data analysis

IF required:
Hit “ABORT” on the ARCS.vi to end the run.

When finished copy the required files in a USB memory and start the analysis.

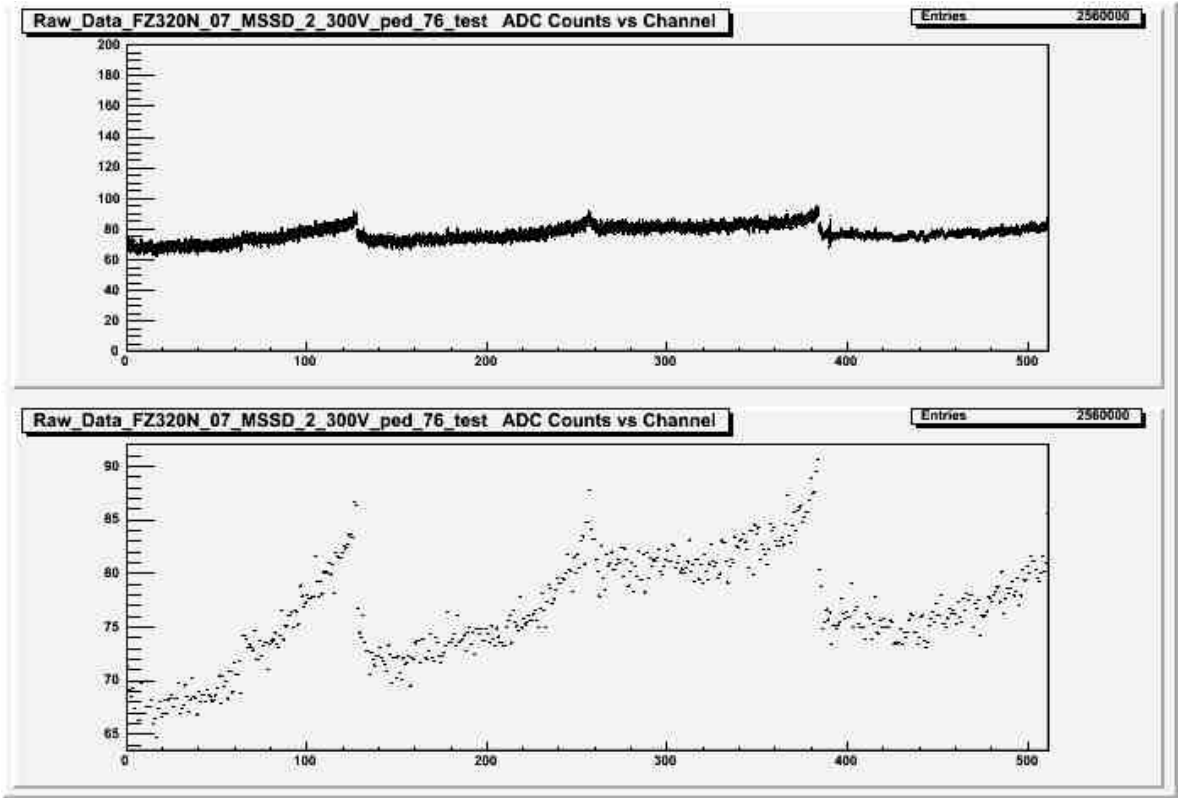
log on the analysis laptop

Data analysis

There are four scripts to run in Root. Each script (except langaus.C) needs to be edited to have the appropriate data file with its location: (see info.txt file for more detail)
After made the required modification

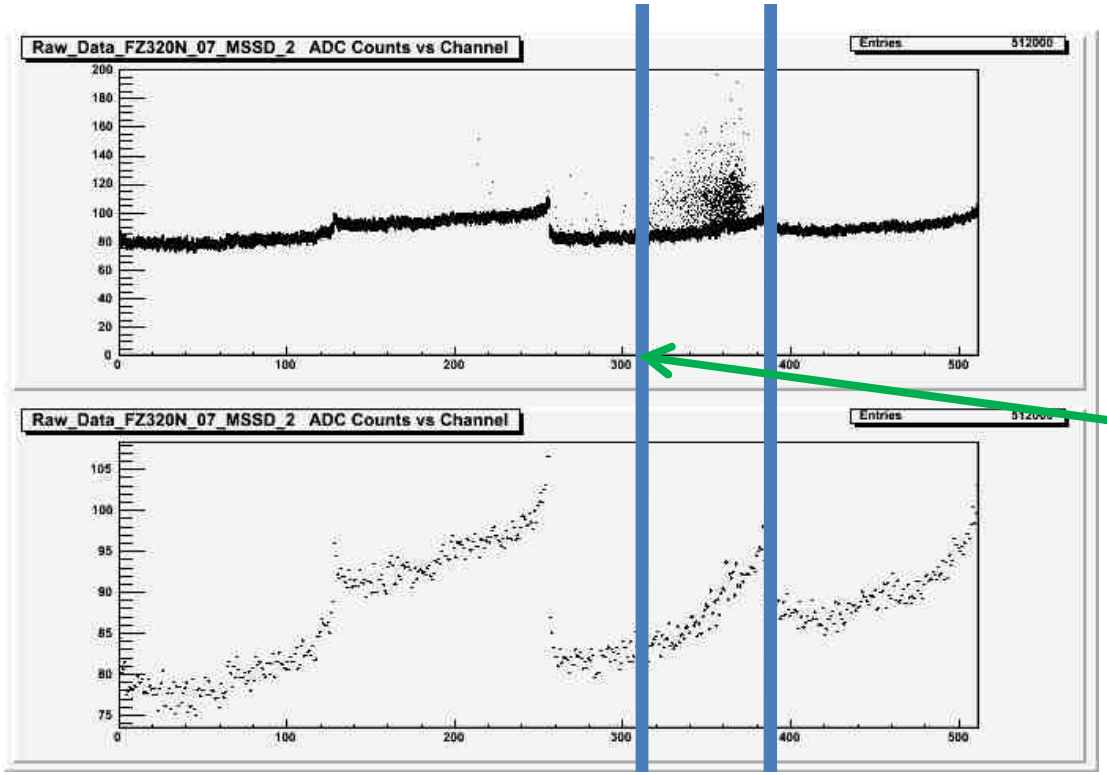
- Run "dat_to_root_bkg.C"
- on Pedestal Raw data. It produces a .root file with the name as the pedestal data file.

At the End it will shows a plot wit the pedestal distribution versus channels like this.



Data analysis

• Run "dat_to_root.C" on your Source Raw data file. It produces a ".root" file with the name as the source data file.
•At the End it will shows a plot wit the signal distribution versus channels.



Here the signal of the Source starts.
The beginning channel number to be set as parameter in *signal_CheckRun.C* have to be close to this number

Data analysis

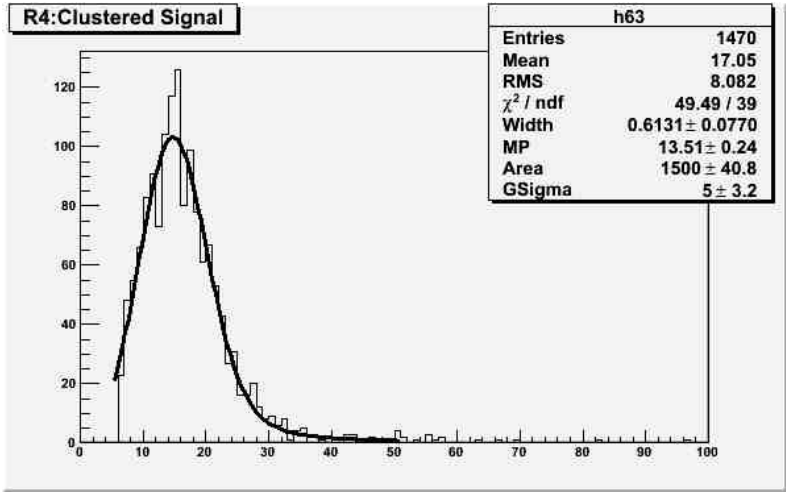
•Run " langaus.C". It sets up some fit parameters and produce a dummy plot. Ignore this plot.

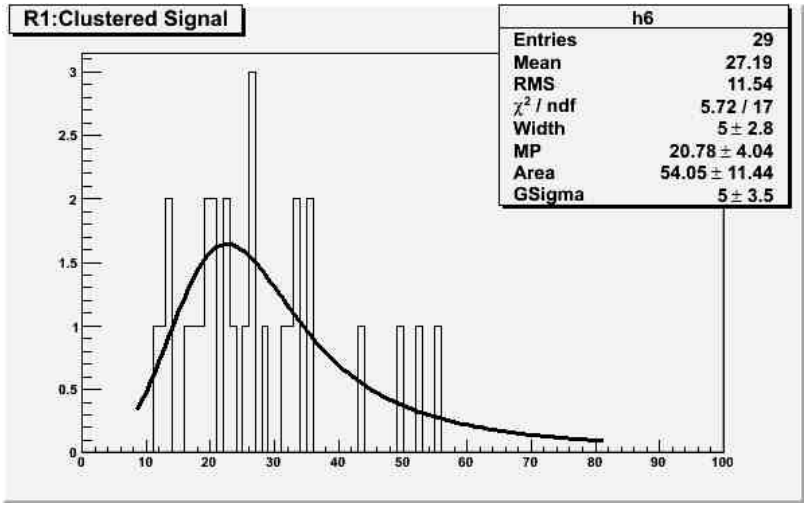
•Run "signal_CheckRun.C". It produces some histograms. One of which is the clustered signal with a langaus fit.

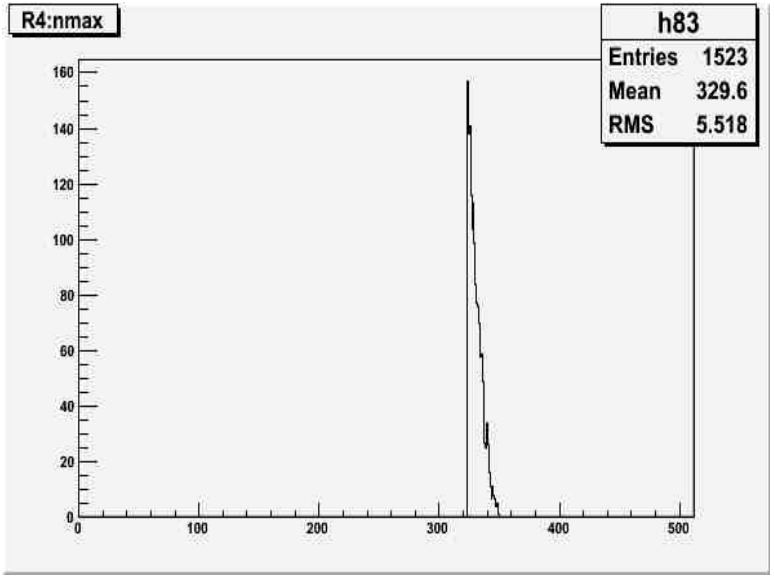
•You need to set four parameters in this script. One is "istart" which sets the starting channel for a particular region on the sensor. The other is the "signalcut" which is the cut value in ADC counts for the data on each channel. It can be "signalcut" =5, 6 or 7 depending upon the sensor type.

•The other two parameters are the names of the signal and pedesta rootfiles, that have to be written under the line "first file".

Plots







Here some plot of the clusters and the distribution of the clusters in the channels.

Compare the clusters for different bias voltages

Try to see what happen when you change the "signalcut" value.

Other plots to suggest ? Have FUN !

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