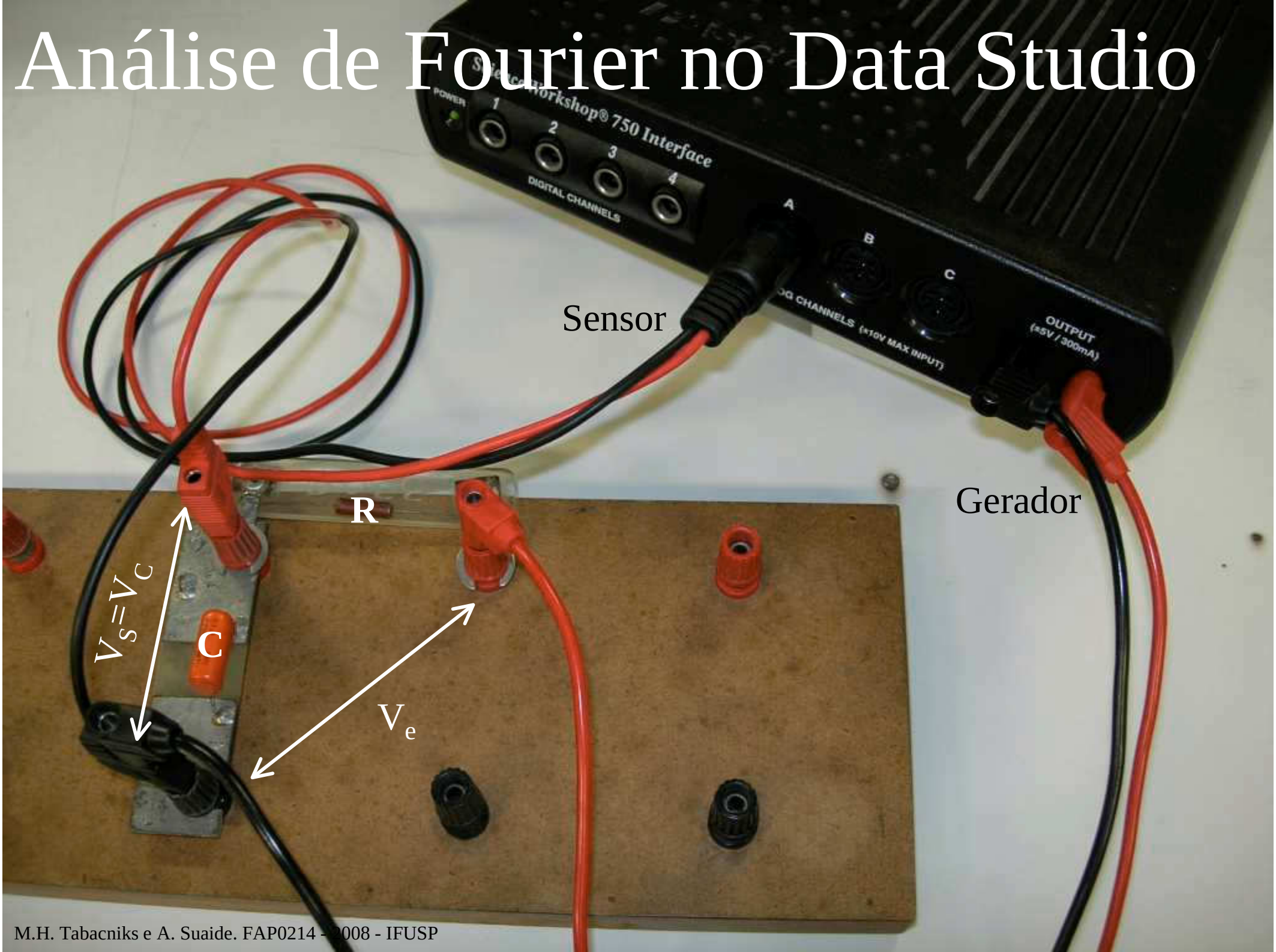
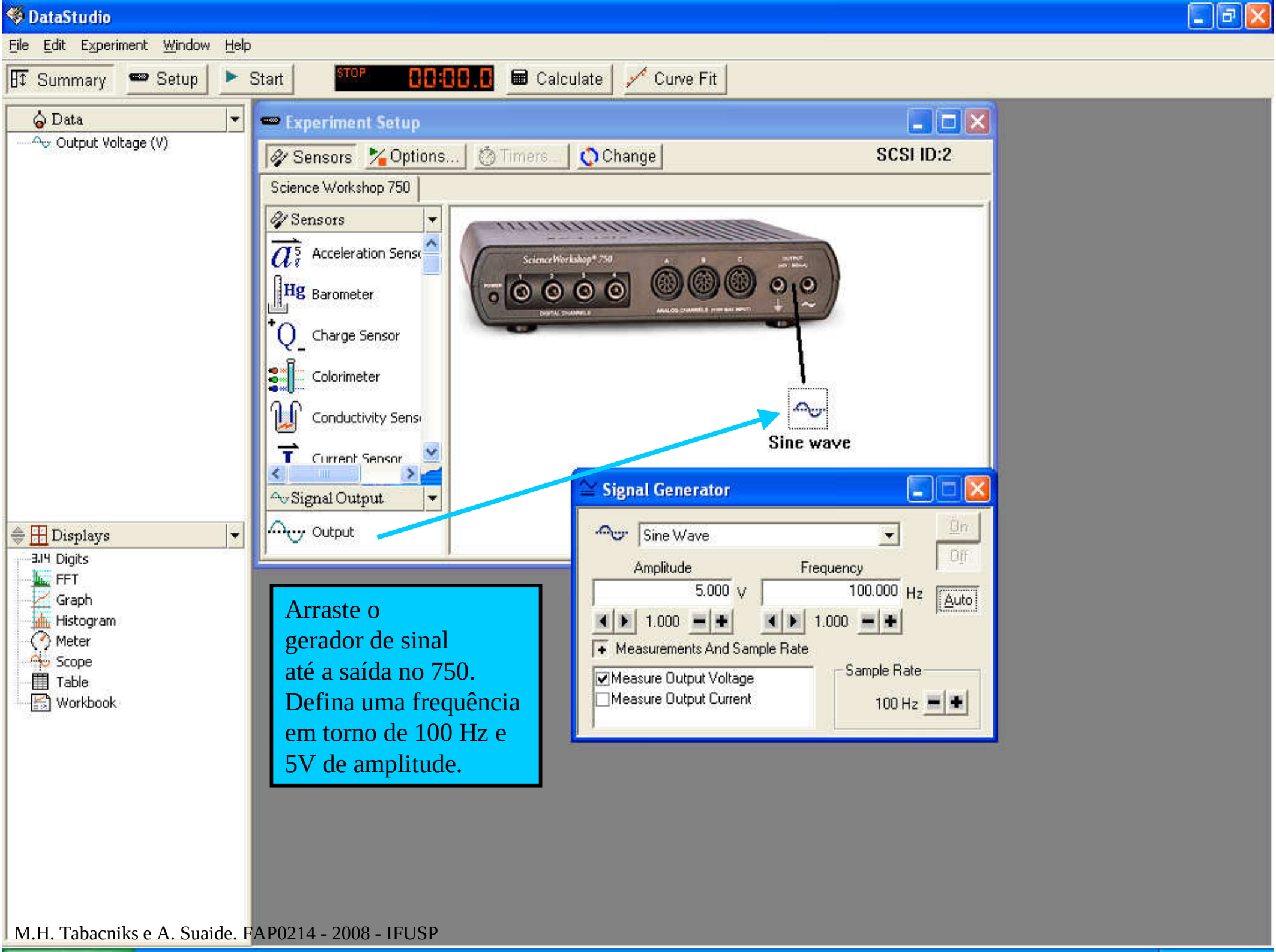
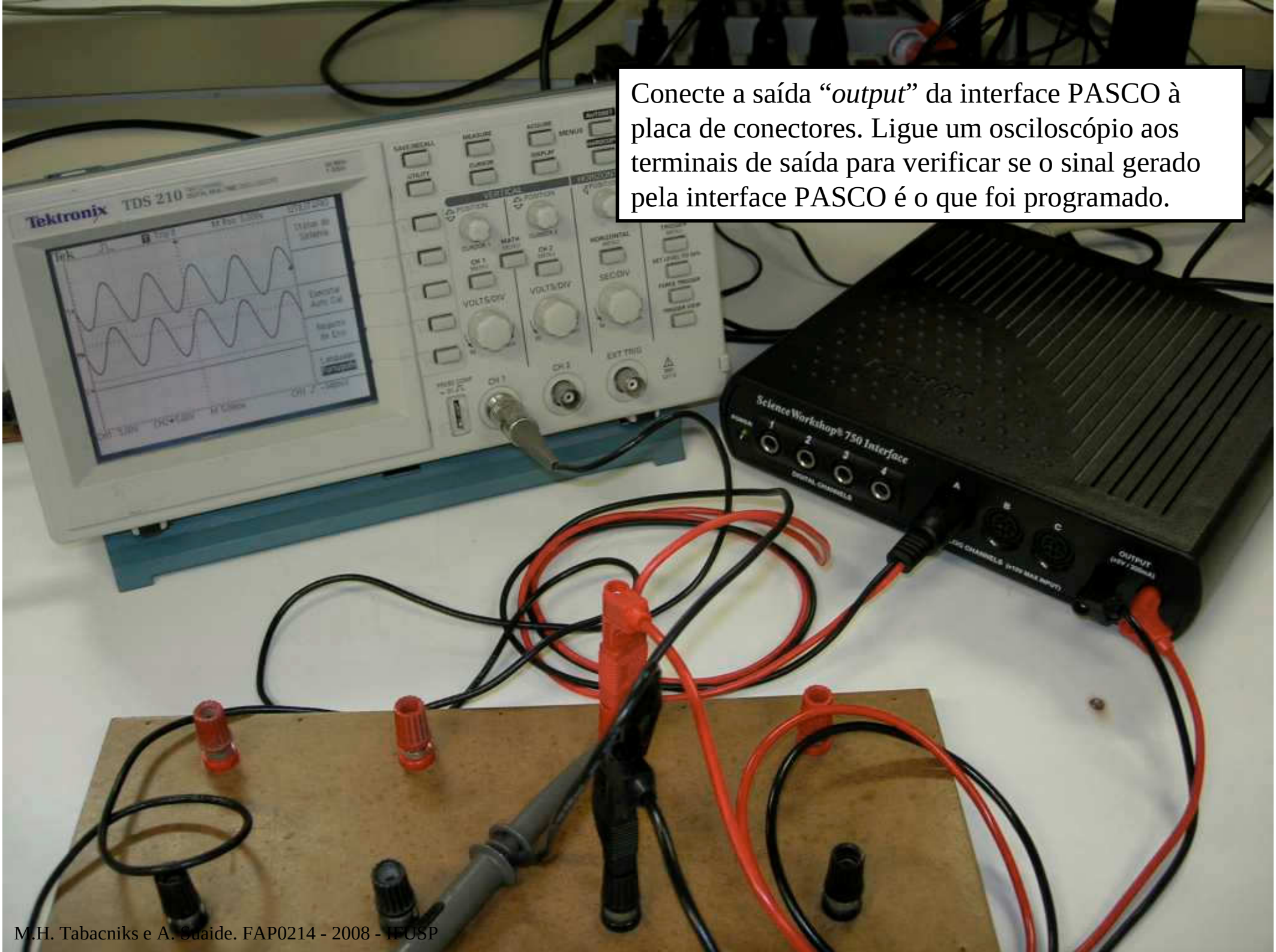
Análise de Fourier no Data Studio

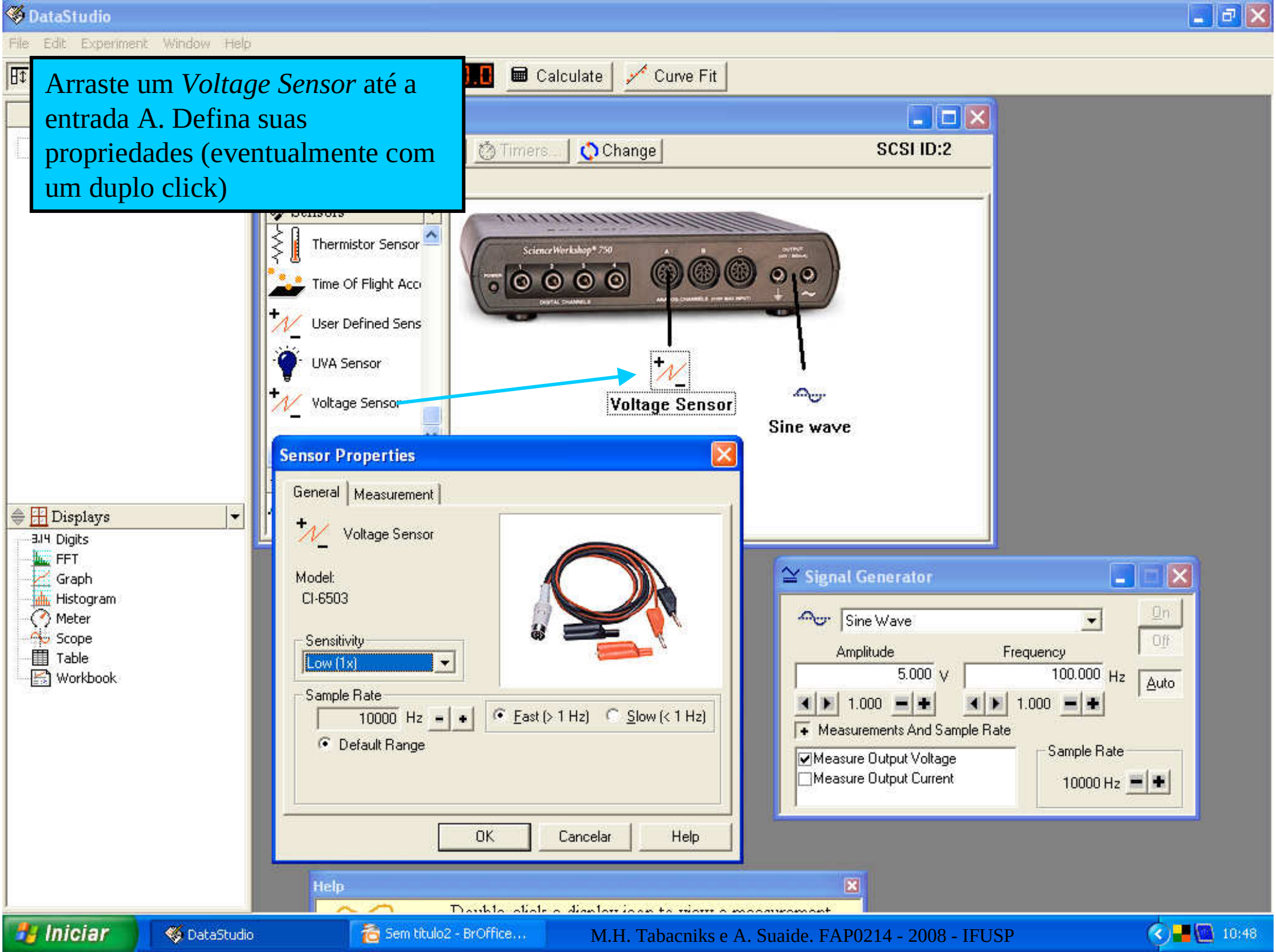



Ligue seu osciloscópio para controlar se a saída do 750 é de fato o que foi selecionado via software.
1) Ligue a interface PASCO 750 na tomada. Veja o LED power on.
2) Conecte um adaptador para pino banana na **entrada** A, B ou C.
3) Conecte um par de fios com pino banana na saída *output*.
ScienceWorkshop® 750 Interface
POWER
1
2
3
4
DIGITAL CHANNELS
A
B
C
OUTPUT
SEC/DIV
EXT TRIG
SET LEVEL TO 50%
FORCE TRIGGER
TRIGGER VIEW


DataStudio
File Edit Experiment Window Help
Summary
Setup
Start
STOP
00:00.0
Calculate
Curve Fit
Data
Output Voltage (V)
Displays
3.14 Digits
FFT
Graph
Histogram
Meter
Scope
Table
Workbook
Experiment Setup
Sensors
Options...
Timers...
Change
SCSI ID:2
Science Workshop 750
Sensors
Acceleration Sens
Barometer
Charge Sensor
Colorimeter
Conductivity Sens
Current Sensor
Signal Output
Output
Sine wave
Signal Generator
Sine Wave
On
Off
Amplitude
Frequency
5.000 V
100.000 Hz
Auto
1.000
1.000
Measurements And Sample Rate
Measure Output Voltage
Measure Output Current
Sample Rate
100 Hz
Arraste o
gerador de sinal
até a saída no 750.
Defina uma frequência
em torno de 100 Hz e
5V de amplitude.



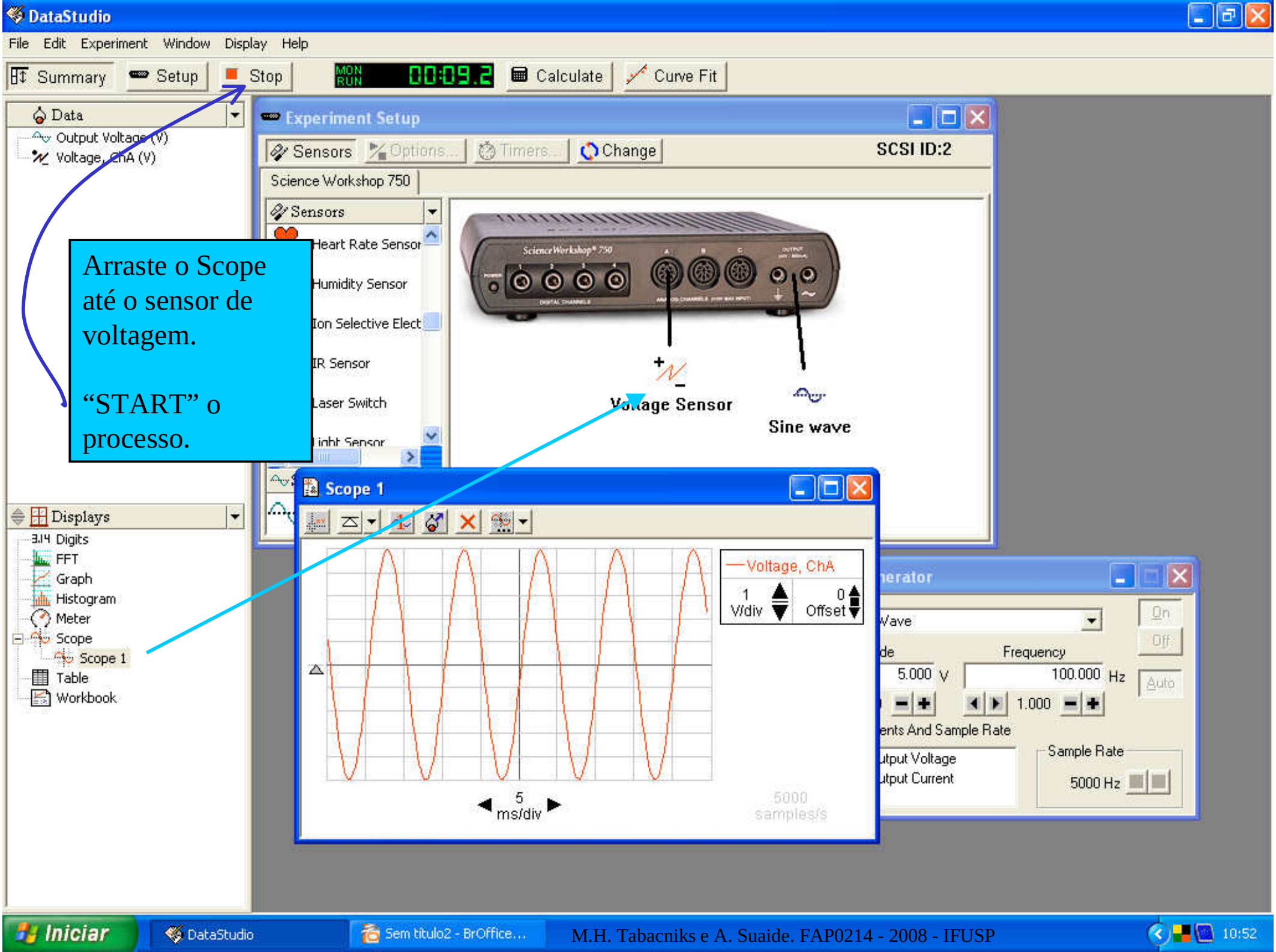
Conecte a saída "*output*" da interface PASCO à placa de conectores. Ligue um osciloscópio aos terminais de saída para verificar se o sinal gerado pela interface PASCO é o que foi programado.

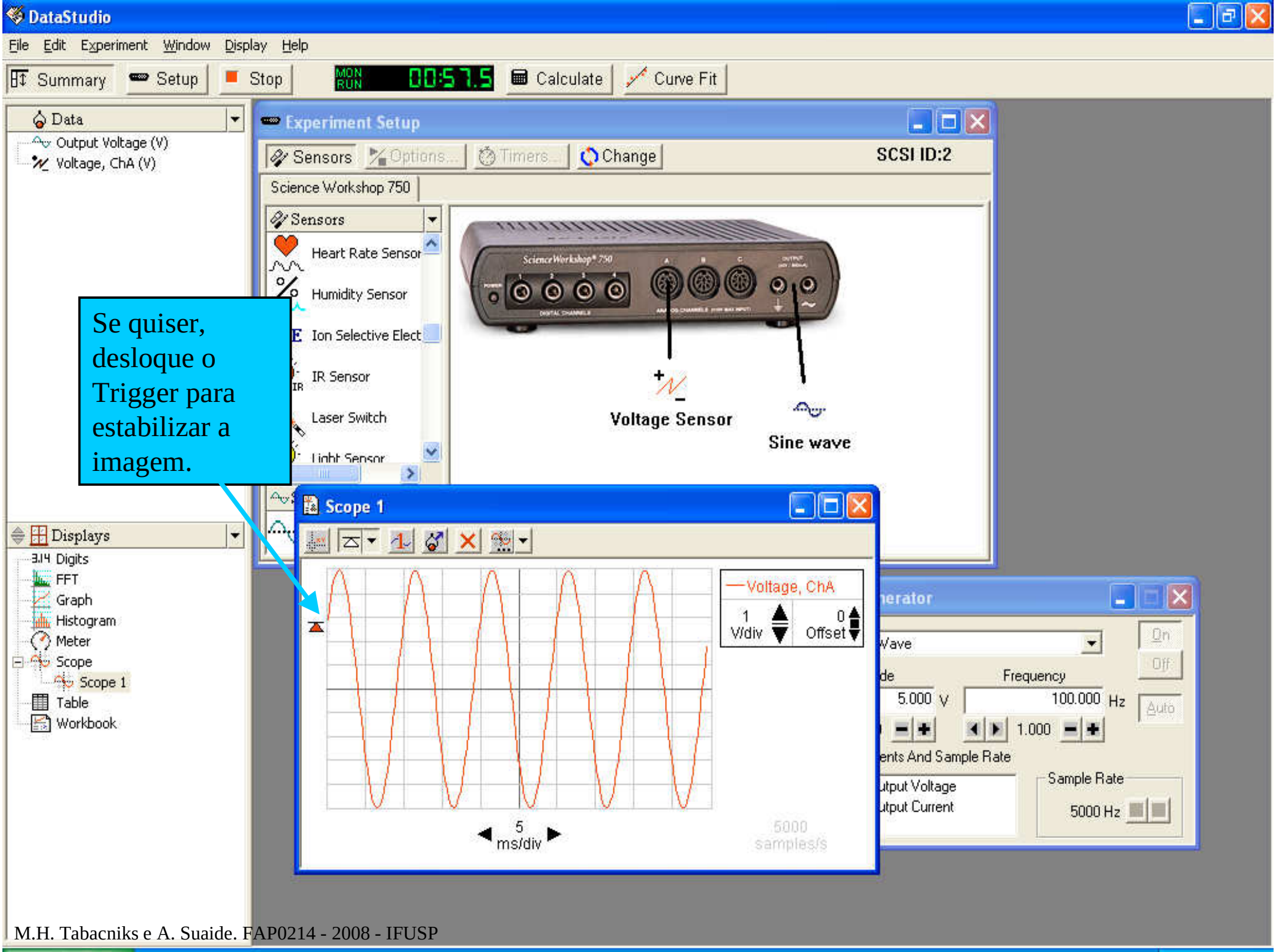

Arraste um *Voltage Sensor* até a entrada A. Defina suas propriedades (eventualmente com um duplo click)
DataStudio
File Edit Experiment Window Help
Calculate
Curve Fit
Timers...
Change
SCSI ID:2
Thermistor Sensor
Time Of Flight Acc
User Defined Sens
UVA Sensor
Voltage Sensor
Voltage Sensor
Sine wave
Displays
3.14 Digits
FFT
Graph
Histogram
Meter
Scope
Table
Workbook
Sensor Properties
General
Measurement
Voltage Sensor
Model:
CI-6503
Sensitivity
Low (1x)
Sample Rate
10000 Hz
Fast (> 1 Hz)
Slow (< 1 Hz)
Default Range
OK
Cancelar
Help
Signal Generator
Sine Wave
On
Off
Amplitude
5.000 V
Frequency
100.000 Hz
Auto
1.000
1.000
Measurements And Sample Rate
Measure Output Voltage
Measure Output Current
Sample Rate
10000 Hz
Help
Iniciar
DataStudio
Sem título2 - BrOffice...
10:48

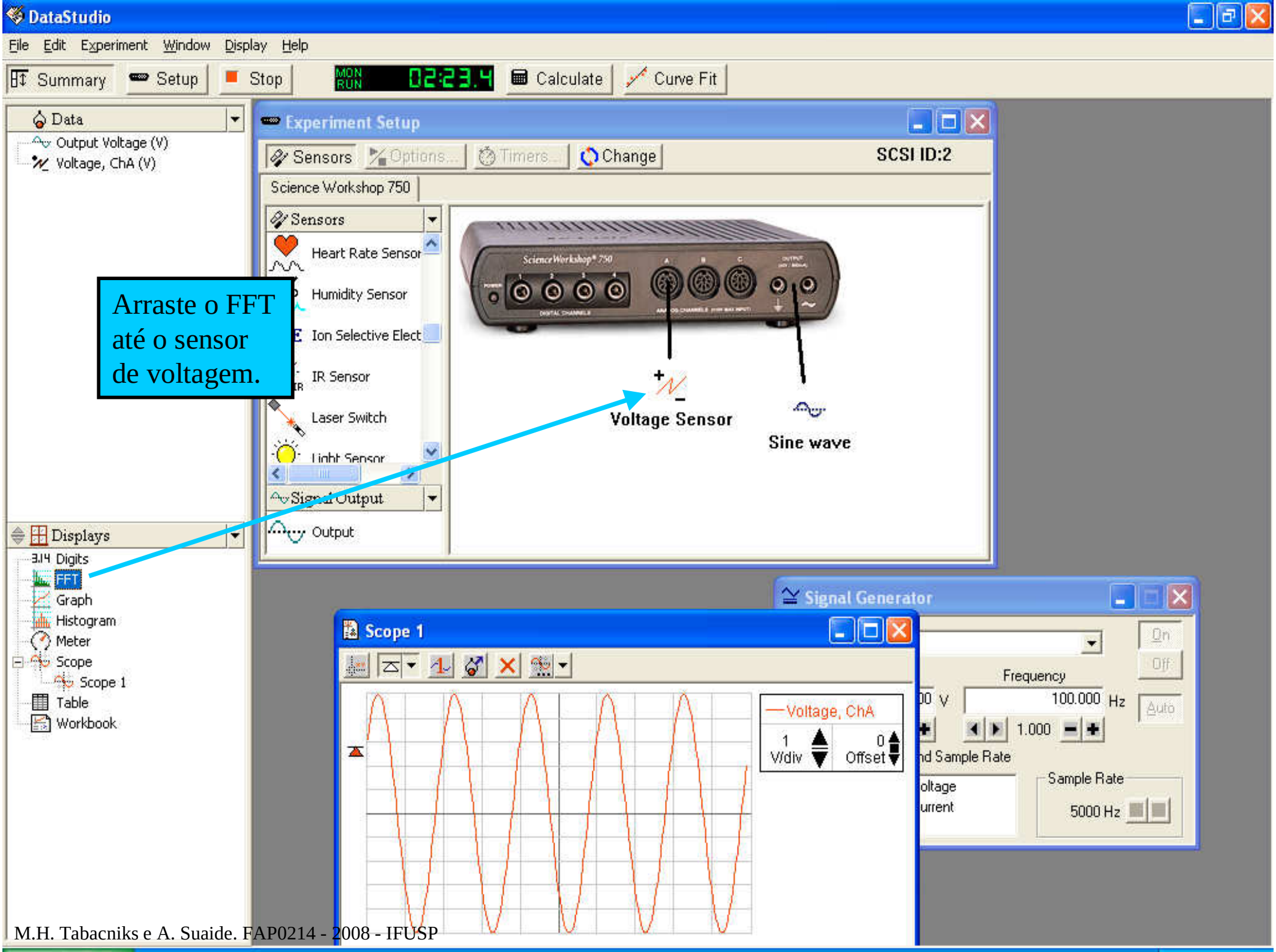
As conexões físicas do 750 foram feitas.

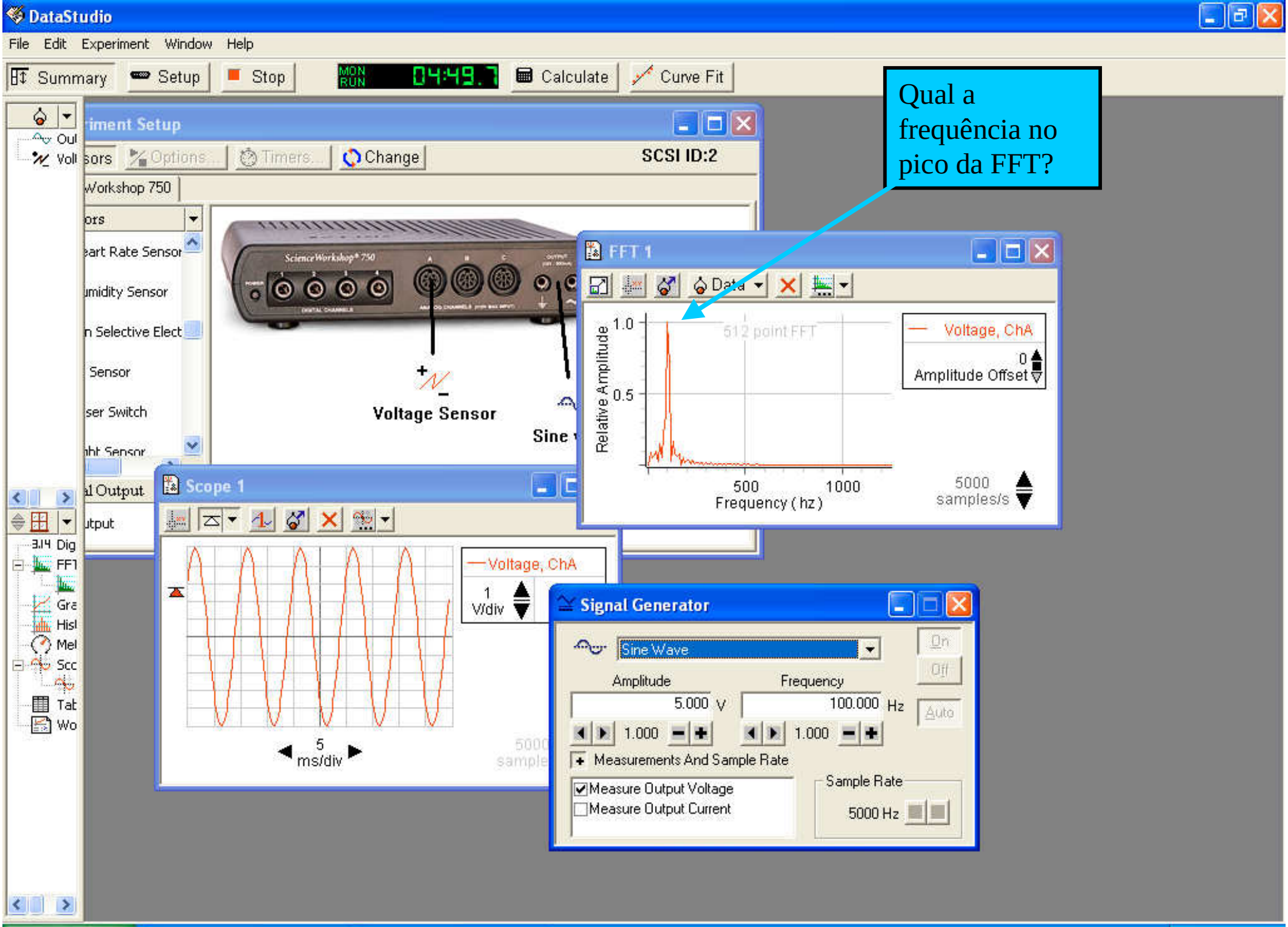
As conexões virtuais do 750 foram feitas. Definindo a saída como um gerador senoidal e a entrada como um sensor de voltagem.

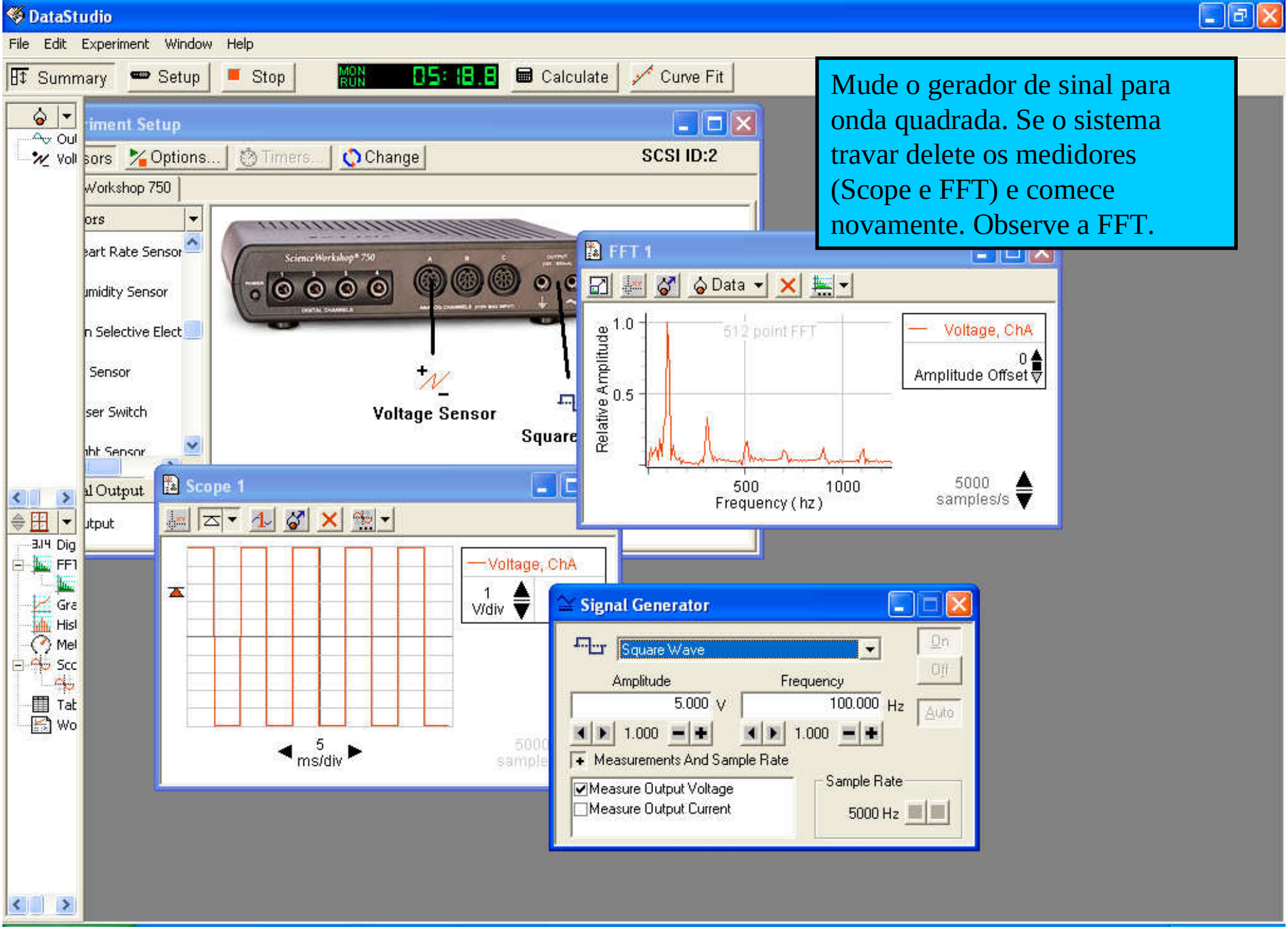
Falta medir: Isto é, definir qual “instrumento de medida” deverá ser ligado ao sensor de voltagem...

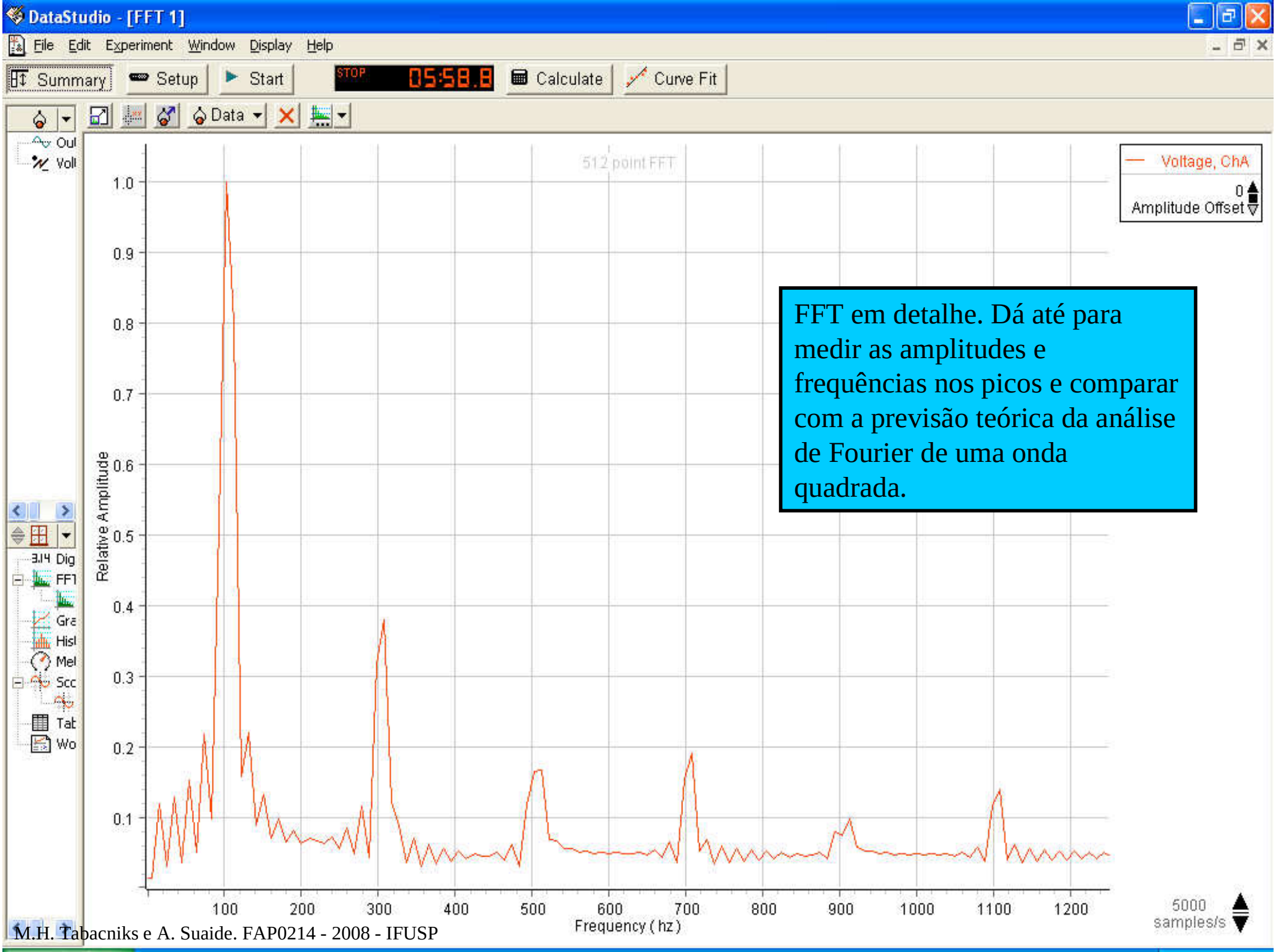

DataStudio
File Edit Experiment Window Display Help
Summary
Setup
Stop
MON RUN 00:09.2
Calculate
Curve Fit
Data
Output Voltage (V)
Voltage, ChA (V)
Arraste o Scope até o sensor de voltagem.
“START” o processo.
Experiment Setup
Sensors
Options...
Timers...
Change
SCSI ID:2
Science Workshop 750
Sensors
Heart Rate Sensor
Humidity Sensor
Ion Selective Elect
IR Sensor
Laser Switch
Voltage Sensor
Sine wave
Displays
Digits
FFT
Graph
Histogram
Meter
Scope
Scope 1
Table
Workbook
Scope 1
Voltage, ChA
1 V/div
0 Offset
5 ms/div
5000 samples/s
Wave
Frequency
5.000 V
100.000 Hz
1.000
On
Off
Auto
Sample Rate
5000 Hz
Iniciar
DataStudio
Sem título2 - BrOffice...
10:52


DataStudio
File Edit Experiment Window Display Help
Summary Setup Stop MON RUN 00:57.5 Calculate Curve Fit
Data
Output Voltage (V)
Voltage, ChA (V)
Experiment Setup
Sensors Options... Timers... Change
SCSI ID:2
Science Workshop 750
Sensors
Heart Rate Sensor
Humidity Sensor
Ion Selective Elect
IR Sensor
Laser Switch
Light Sensor
Voltage Sensor
Sine wave
Se quiser, desloque o Trigger para estabilizar a imagem.
Displays
Digits
FFT
Graph
Histogram
Meter
Scope
Scope 1
Table
Workbook
Scope 1
Voltage, ChA
1 V/div
0 Offset
5 ms/div
5000 samples/s
Frequency
5.000 V
100.000 Hz
1.000
On
Off
Auto
Sample Rate
5000 Hz

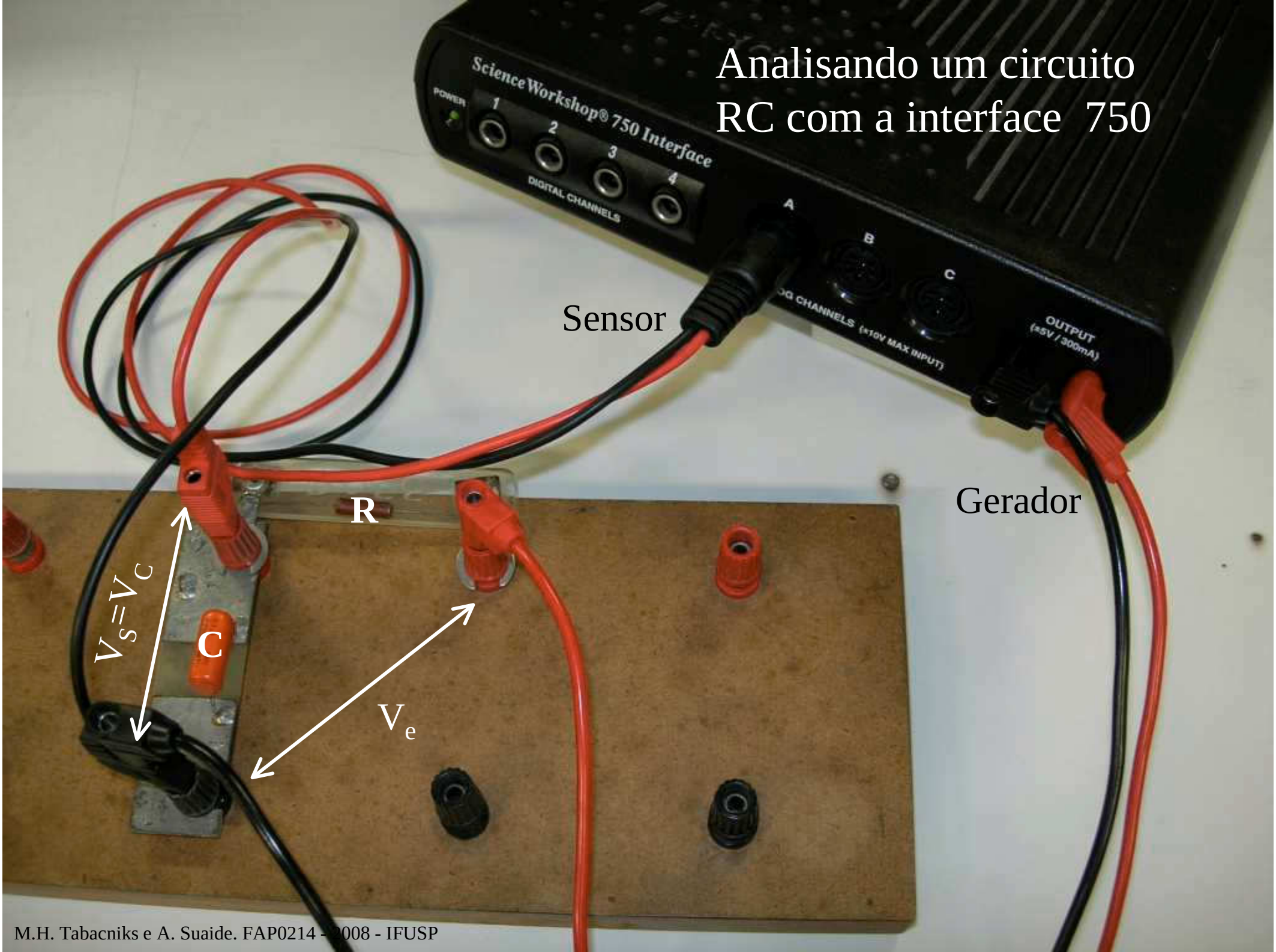

DataStudio
File Edit Experiment Window Display Help
Summary Setup Stop MON RUN 02:23.4 Calculate Curve Fit
Data
Output Voltage (V)
Voltage, ChA (V)
Displays
3.14 Digits
FFT
Graph
Histogram
Meter
Scope
Scope 1
Table
Workbook
Arraste o FFT até o sensor de voltagem.
Experiment Setup
Sensors Options... Timers... Change
SCSI ID:2
Science Workshop 750
Sensors
Heart Rate Sensor
Humidity Sensor
Ion Selective Elect
IR Sensor
Laser Switch
Light Sensor
Signal Output
Output
Voltage Sensor
Sine wave
Scope 1
Voltage, ChA
1 V/div
0 Offset
Signal Generator
On
Off
Frequency
100.000 Hz
Auto
1.000
Sample Rate
5000 Hz

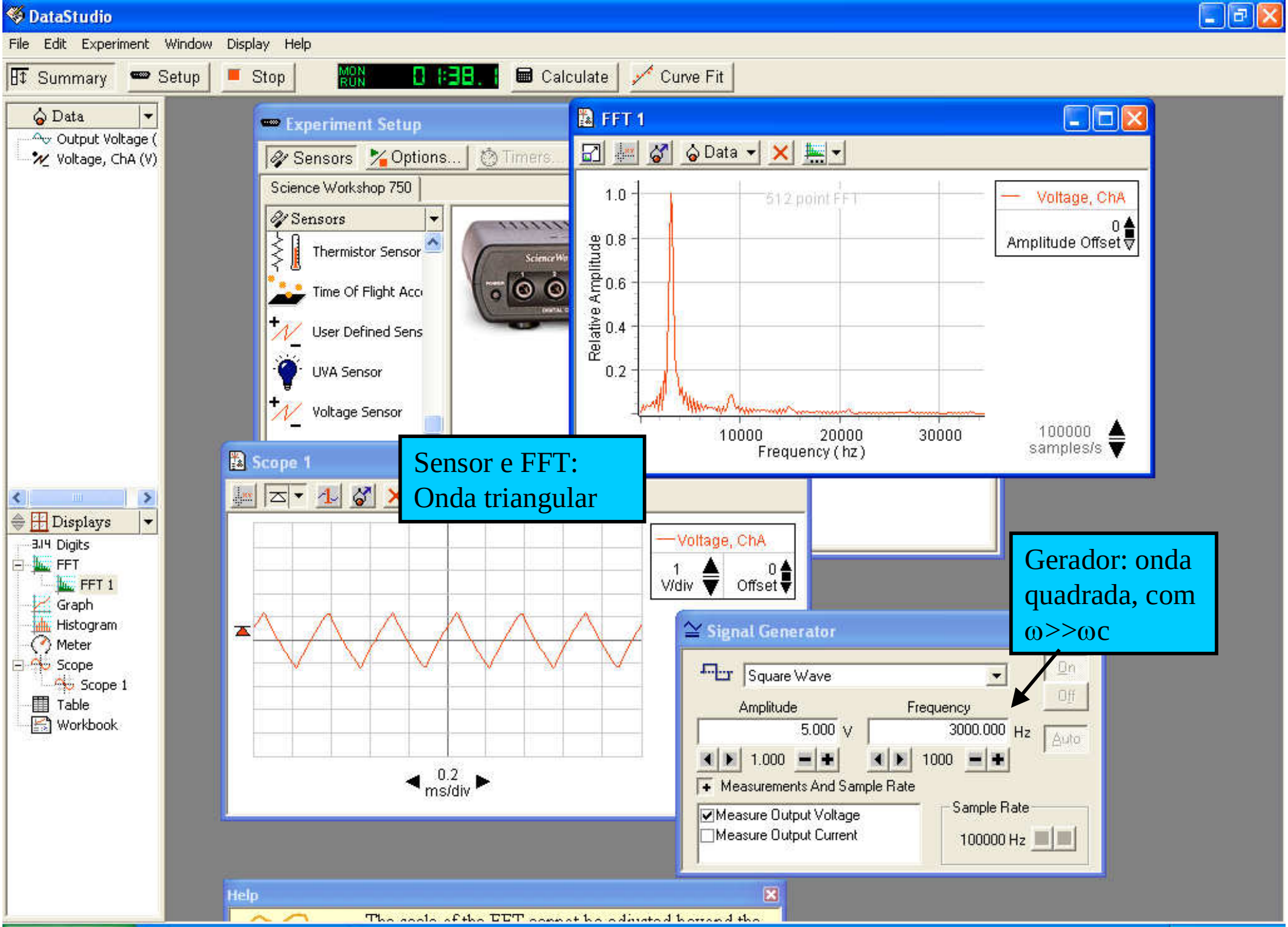

DataStudio
File Edit Experiment Window Help
Summary
Setup
Stop
Calculate
Curve Fit
Qual a frequência no pico da FFT?
SCSI ID:2
Voltage Sensor
FFT 1
Relative Amplitude
512 point FFT
Voltage, ChA
Amplitude Offset
Frequency (hz)
samples/s
Scope 1
Voltage, ChA
V/div
ms/div
Signal Generator
Sine Wave
Amplitude
Frequency
5.000 V
100.000 Hz
On
Off
Auto
Measurements And Sample Rate
Measure Output Voltage
Measure Output Current
Sample Rate
5000 Hz
Iniciar
DataStudio
Sem título2 - BrOffice...
M.H. Tabacniks e A. Suaide. FAP0214 - 2008 - IFUSP
10:57

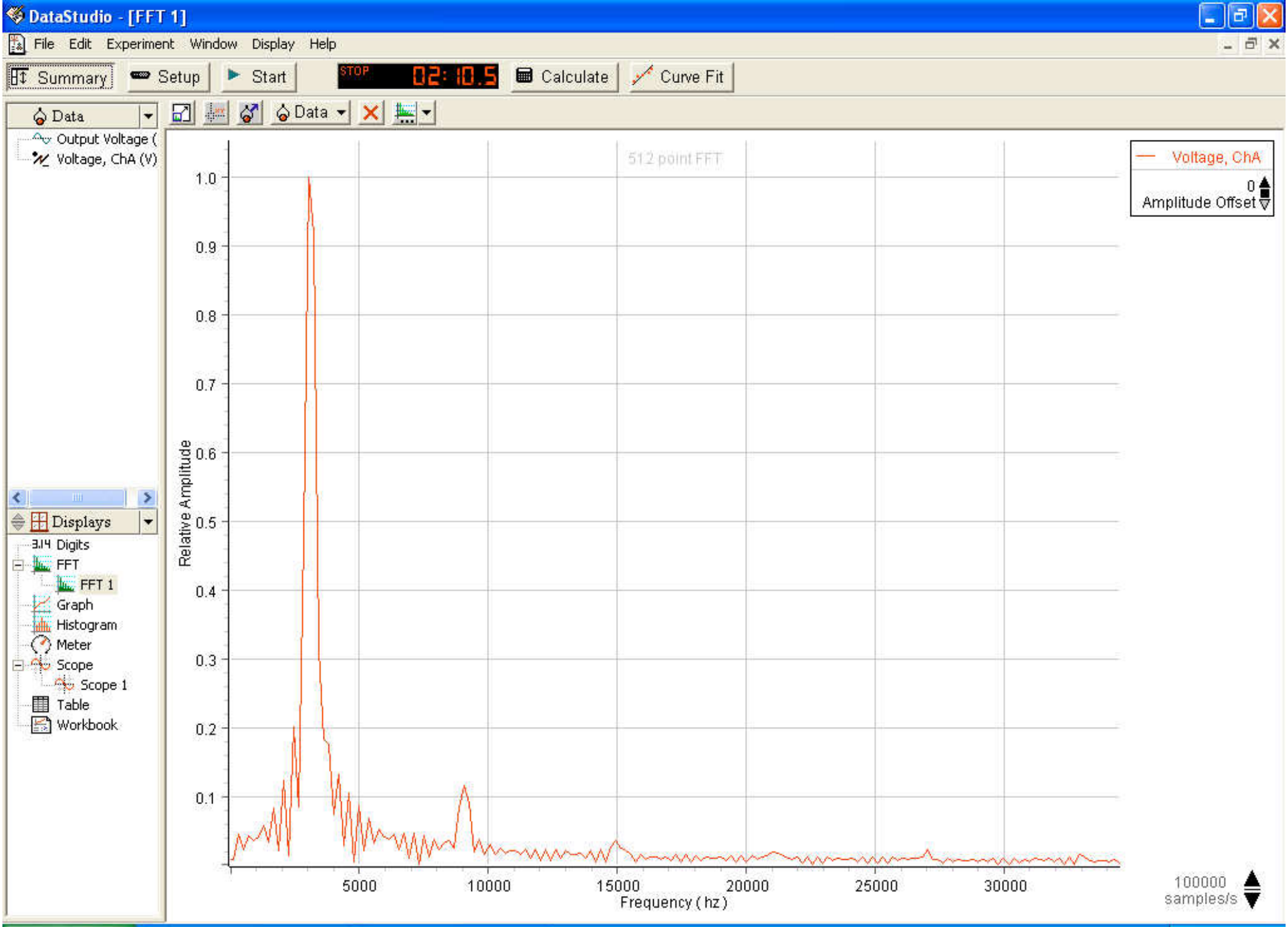

DataStudio
File Edit Experiment Window Help
Summary
Setup
Stop
MON RUN 05:18.8
Calculate
Curve Fit
Mude o gerador de sinal para onda quadrada. Se o sistema travar delete os medidores (Scope e FFT) e comece novamente. Observe a FFT.
Experiment Setup
Options...
Timers...
Change
SCSI ID:2
Workshop 750
Voltage Sensor
FFT 1
Data
512 point FFT
Relative Amplitude
1.0
0.5
500
1000
Frequency (hz)
Voltage, ChA
Amplitude Offset
5000 samples/s
Scope 1
Voltage, ChA
1 V/div
5 ms/div
Signal Generator
Square Wave
On
Off
Amplitude
5.000 V
Frequency
100.000 Hz
Auto
1.000
Measurements And Sample Rate
Measure Output Voltage
Measure Output Current
Sample Rate
5000 Hz
Iniciar
DataStudio
Sem título2 - BrOffice...
10:58


DataStudio - [FFT 1]
File Edit Experiment Window Display Help
Summary
Setup
Start
STOP 05:58.8
Calculate
Curve Fit
Data
512 point FFT
Voltage, ChA
0
Amplitude Offset
Relative Amplitude
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
100 200 300 400 500 600 700 800 900 1000 1100 1200
Frequency (hz)
5000
samples/s
FFT em detalhe. Dá até para medir as amplitudes e frequências nos picos e comparar com a previsão teórica da análise de Fourier de uma onda quadrada.

Análise FFT de um circuito RC alimentado com uma onda quadrada.


Analisando um circuito
RC com a interface 750
Sensor
Gerador
R
C
$V_S = V_C$
V_e
ScienceWorkshop® 750 Interface
POWER
1
2
3
4
DIGITAL CHANNELS
A
B
C
OUTPUT
(±5V / 300mA)


DataStudio
File Edit Experiment Window Display Help
Summary Setup Stop Calculate Curve Fit
Data
Output Voltage (
Voltage, ChA (V)
Displays
Digits
FFT
FFT 1
Graph
Histogram
Meter
Scope
Scope 1
Table
Workbook
Experiment Setup
Sensors Options... Timers...
Science Workshop 750
Sensors
Thermistor Sensor
Time Of Flight Acc
User Defined Sens
UVA Sensor
Voltage Sensor
FFT 1
Data
512 point FFT
Relative Amplitude
1.0
0.8
0.6
0.4
0.2
10000
20000
30000
Frequency (hz)
Voltage, ChA
0
Amplitude Offset
100000
samples/s
Sensor e FFT:
Onda triangular
Scope 1
Voltage, ChA
1
V/div
0
Offset
0.2
ms/div
Signal Generator
Square Wave
On
Off
Amplitude
Frequency
5.000 V
3000.000 Hz
Auto
1.000
1000
Measurements And Sample Rate
Measure Output Voltage
Measure Output Current
Sample Rate
100000 Hz
Gerador: onda
quadrada, com
ω>>ωc
Help
Iniciar
DataStudio
Sem título2 - BrOffice...
M.H. Tabacniks e A. Suaide. FAP0214 - 2008 - IFUSP
11:06


DataStudio - [FFT 1]
File Edit Experiment Window Display Help
Summary
Setup
Start
STOP 02:10.5
Calculate
Curve Fit
Data
Output Voltage (
Voltage, ChA (V)
Displays
Digits
FFT
FFT 1
Graph
Histogram
Meter
Scope
Scope 1
Table
Workbook
512 point FFT
Voltage, ChA
0
Amplitude Offset
Relative Amplitude
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
5000
10000
15000
20000
25000
30000
Frequency (hz)
100000
samples/s
Iniciar
DataStudio - [FFT 1]
Sem título2 - BrOffice...
11:07

Tarefas a02

- Obter a FFT experimental de uma onda quadrada. Comparar quantitativamente com a previsão teórica.
- Aplicar a onda quadrada num circuito RC em modo integrador. Obter um plot da tensão de saída (Vs ou Vc)
- Analisar FFT a tensão de saída (onda triangular). Comparar quantitativamente com a previsão teórica.

EXTRA

- Dividir o espectro em frequências da onda triangular pelo da onda quadrada e comparar com a função do ganho do circuito integrador.