



AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY



SALT ver3

1st measurements

Marek Idzik on behalf of AGH-UST

Faculty of Physics and Applied Computer Science
AGH University of Science and Technology

SALT 18/02/2019



SALT v3 18/2/2019

Measurements of side channels -1,128

Setup

Default settings:

Preamp. Current 15 (0F)
Shaper current 12 (0C)
S2Diff current 12 (0C)
Calib. Pulse 12 (0C)
VCM DAC 32 (20)
TrimDAC 128 (80)
ADC delay 2 (2)

In addition:

Monitoring ADCs OFF
Test Channel ADCs OFF

**Measurements in next slides were done
for analog and digital grounds shorted
on PCB in ONLY ONE place
GND_join3**

**Later on we have shorted ALL FOUR GND_joins
but we have not seen significant differences**

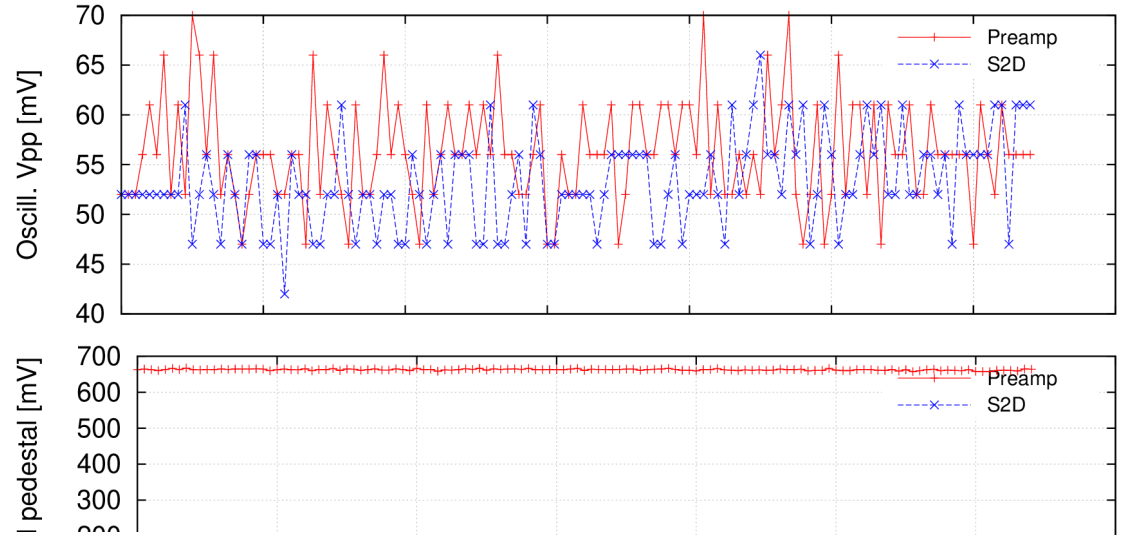


SALT v3 18/2/2019

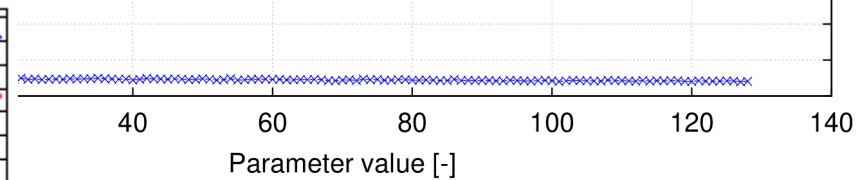
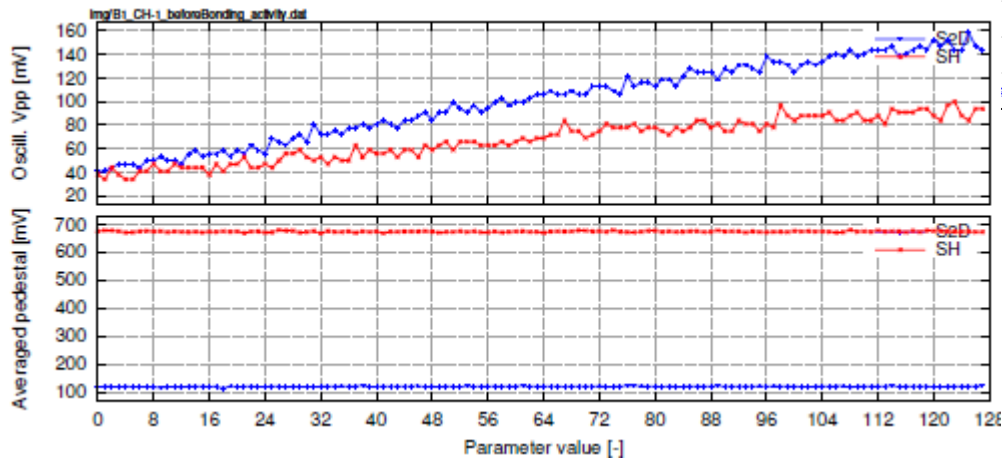
NO Sensor

Channel 128, Vpp/baseline vs no. ADCs ON

SALT3_noInput_noDummy_ch128_activity.dat



Below for comparison
SALT v2.5





SALT v3 19/2/2019

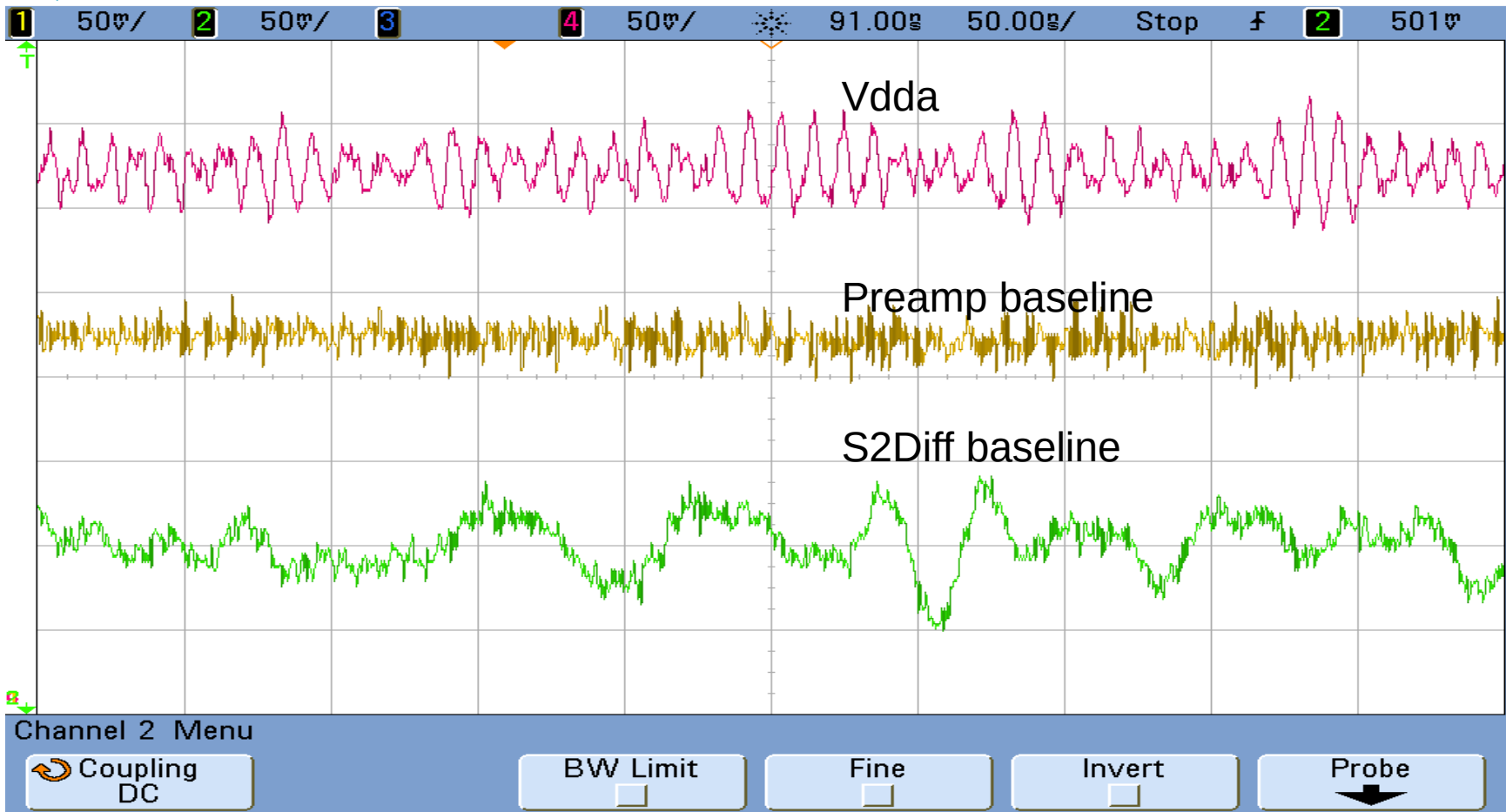
Sensor 12pF+1-3pFparas. on chan. -1,128

Vdda quality



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TUE FEB 19 12:38:17 2019





SALT v3 19/2/2019

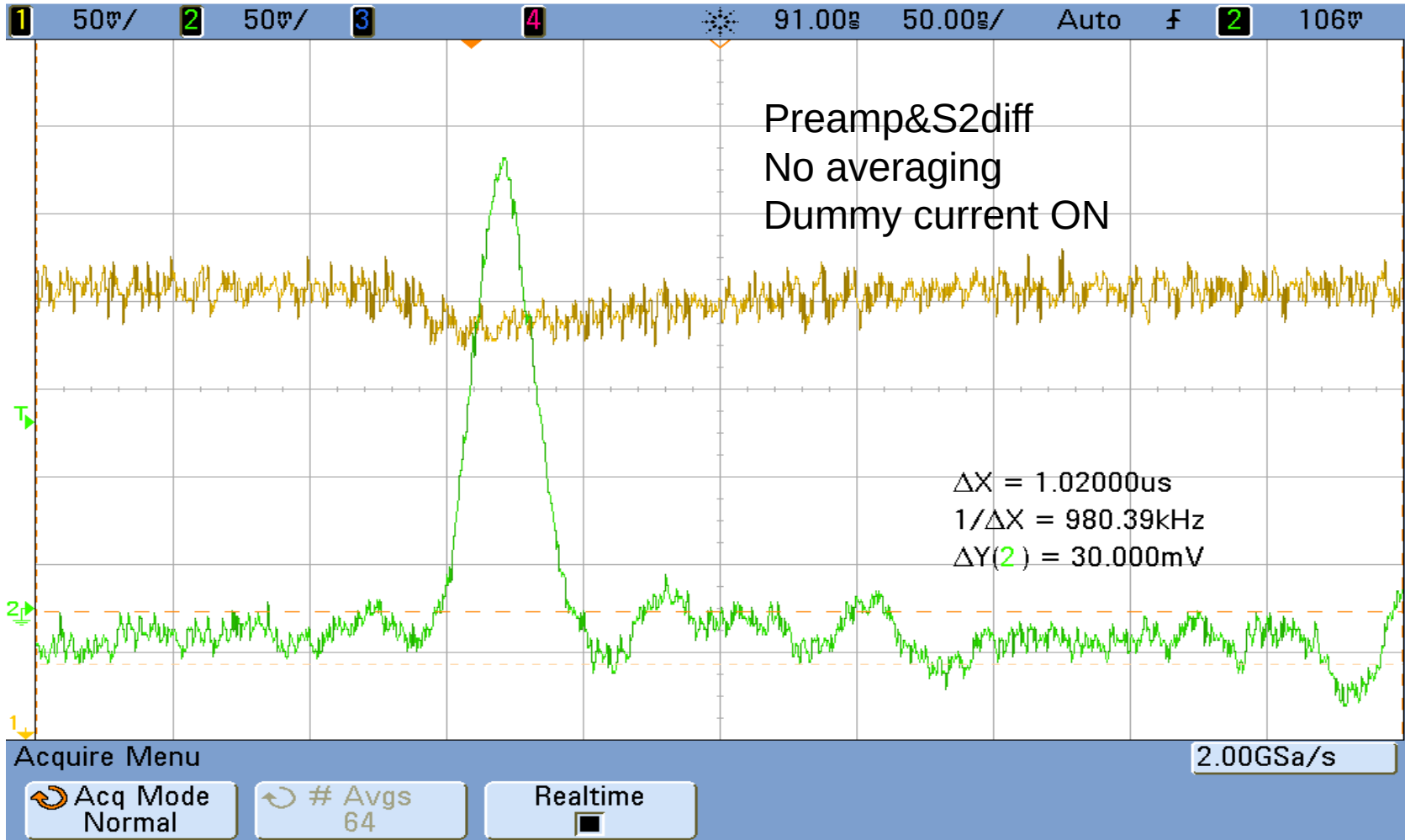
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1



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TUE FEB 19 12:27:32 2019





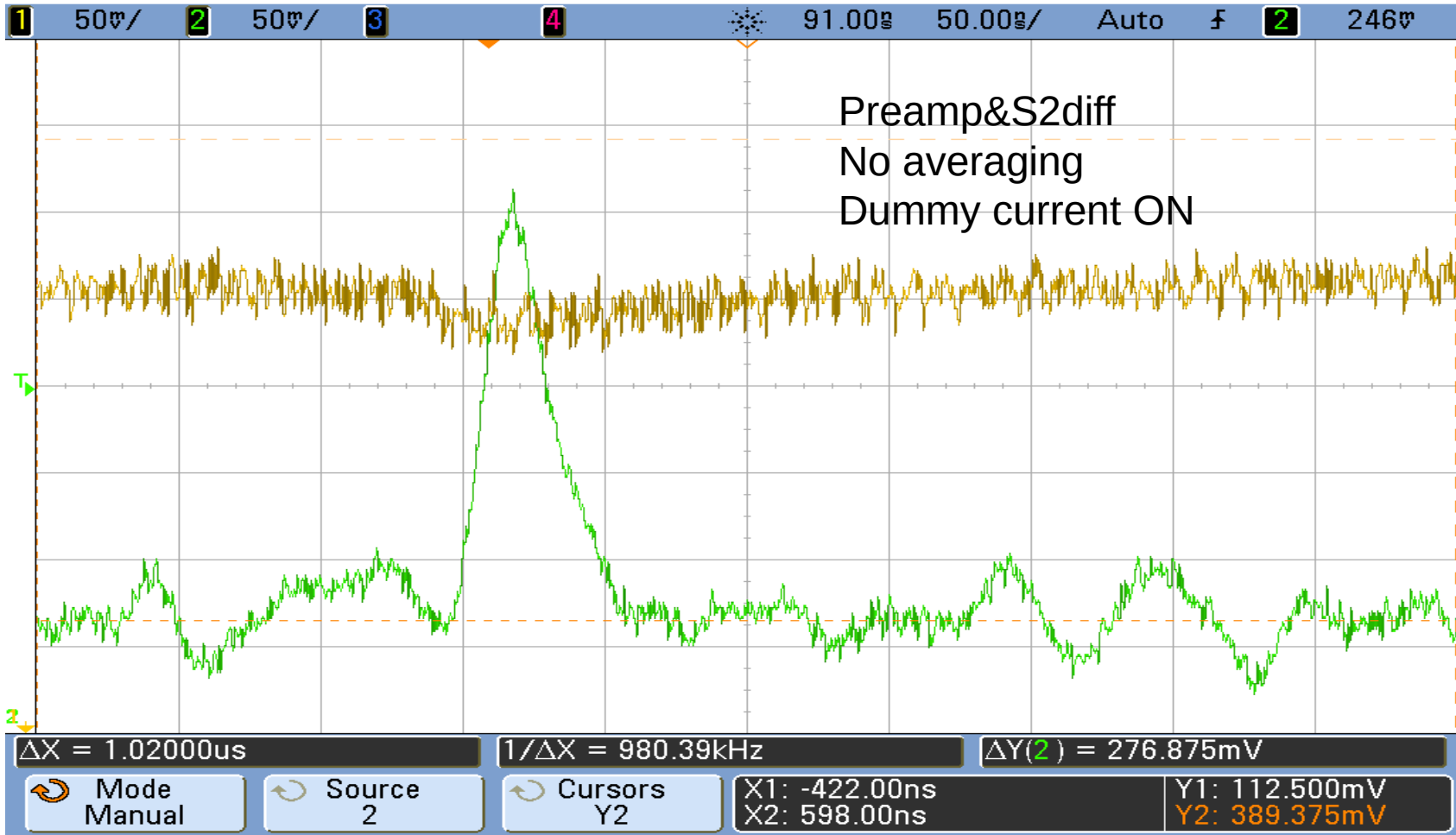
SALT v3 19/2/2019

Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128



TUE FEB 19 12:15:07 2019

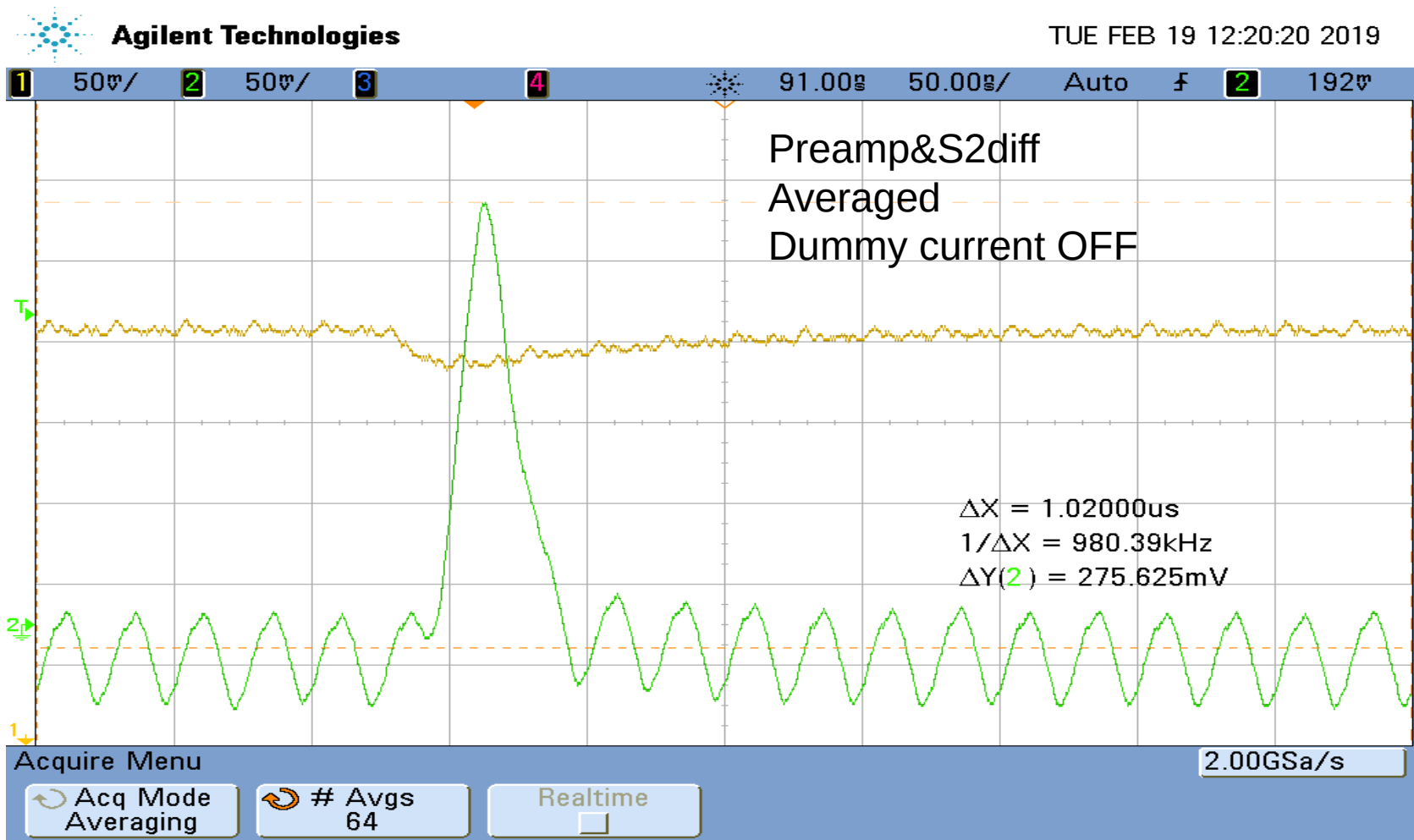




SALT v3 19/2/2019

Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1





SALT v3 19/2/2019

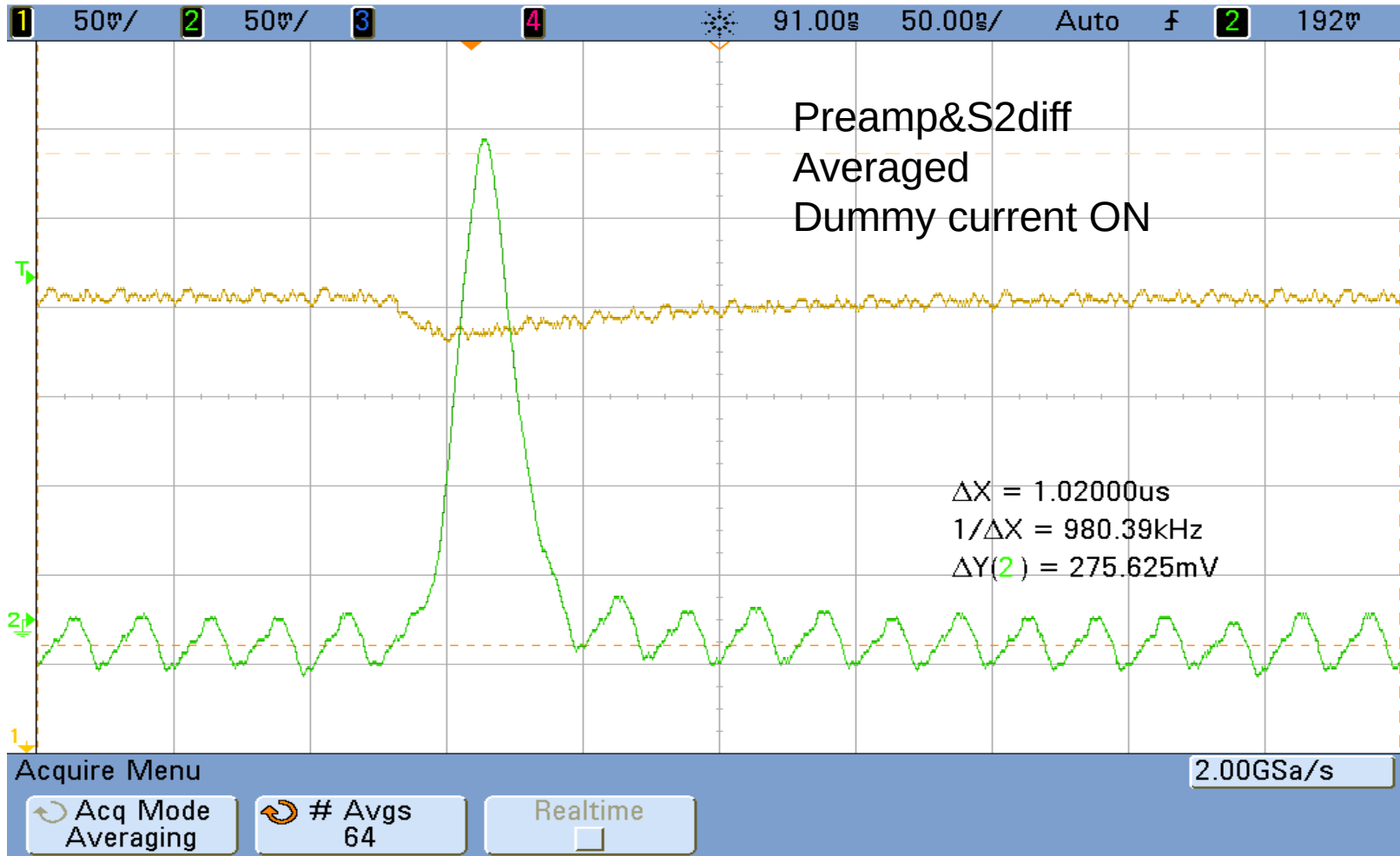
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1



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TUE FEB 19 12:19:58 2019





SALT v3 19/2/2019

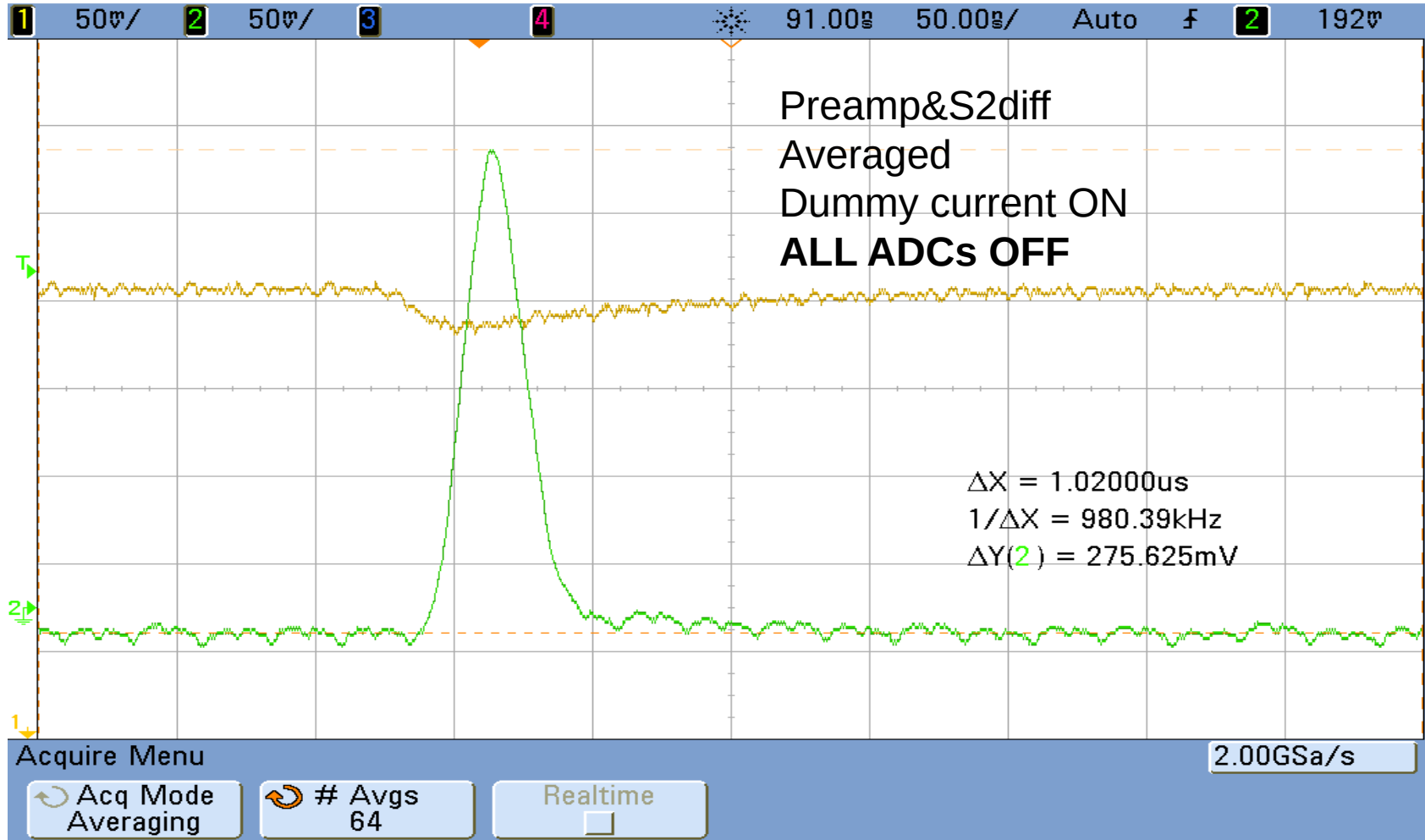
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1



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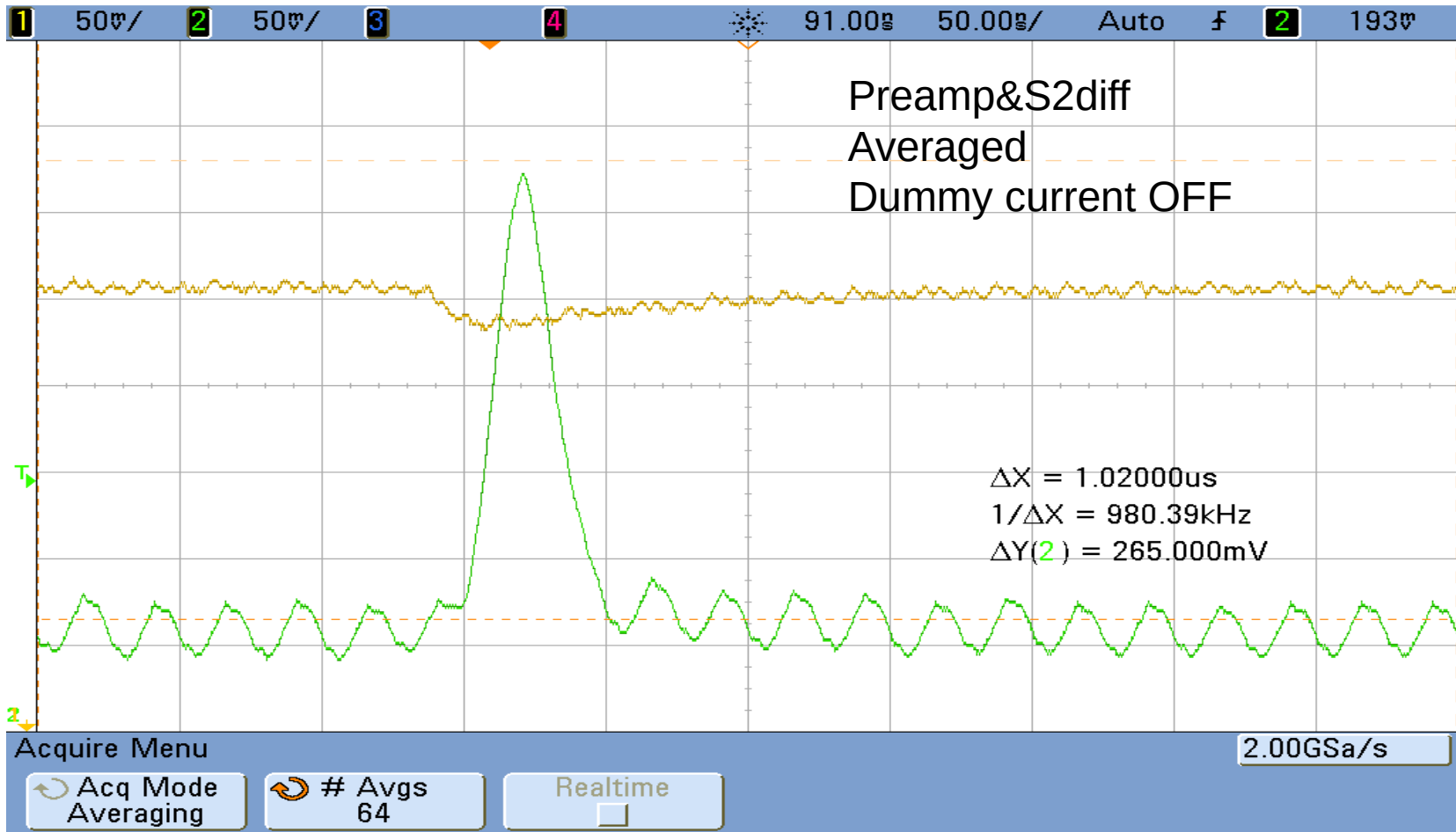
SALT v3 19/2/2019

Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128

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TUE FEB 19 12:17:32 2019





SALT v3 19/2/2019

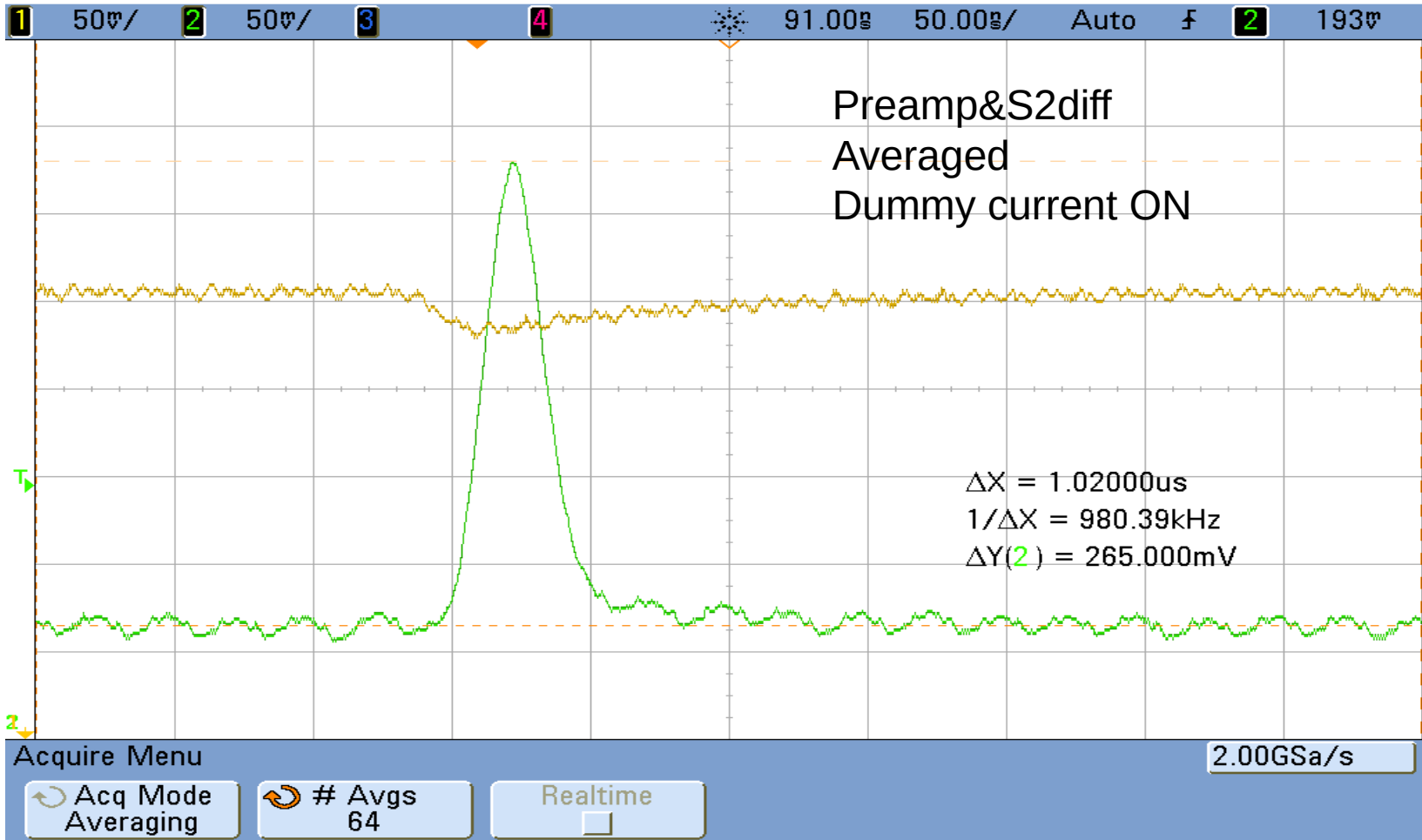
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128



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TUE FEB 19 12:17:02 2019





SALT v3 19/2/2019

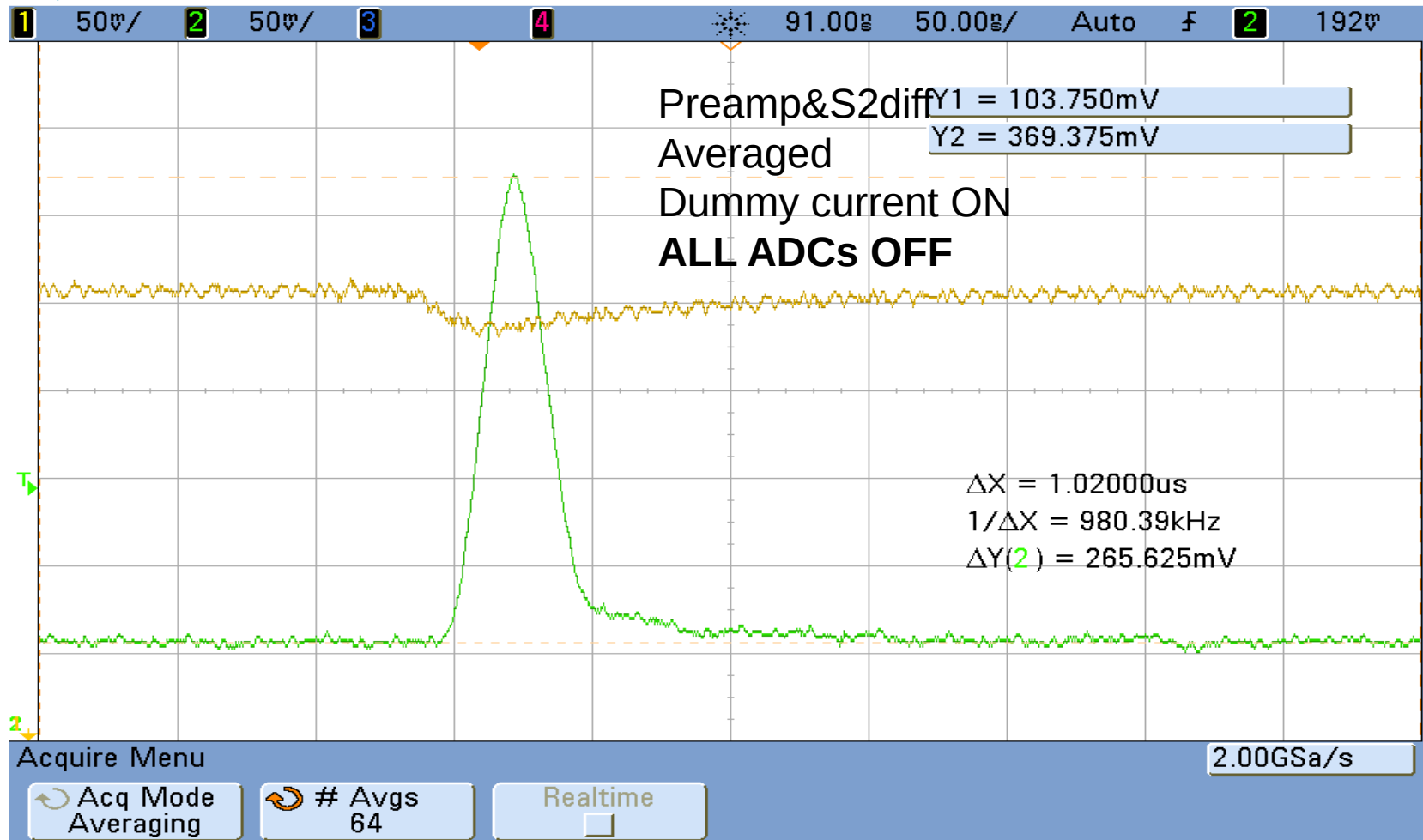
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128



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TUE FEB 19 12:18:53 2019





SALT v3 19/2/2019

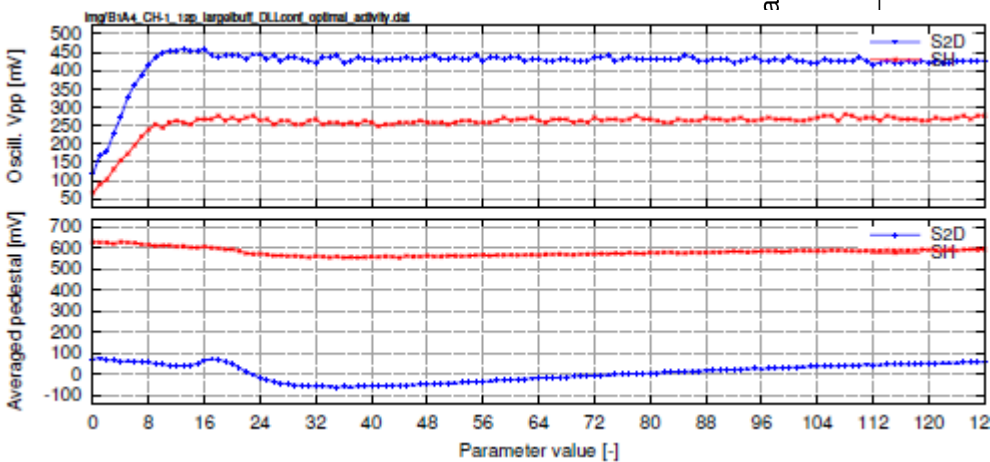
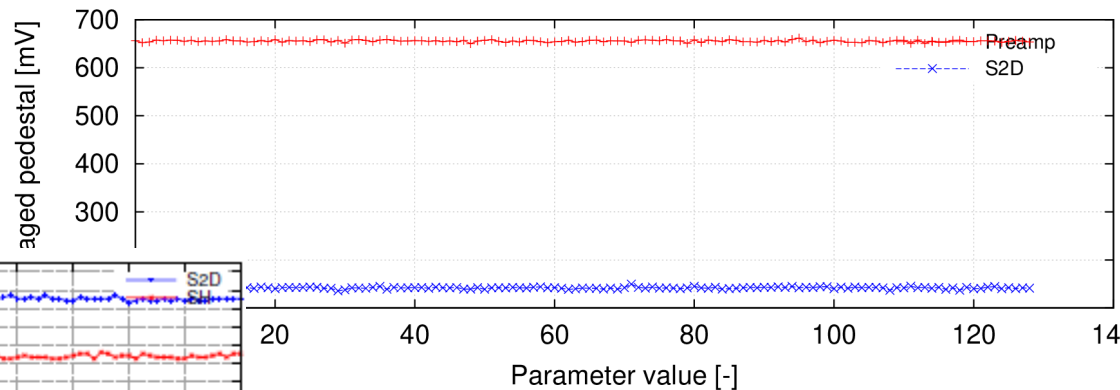
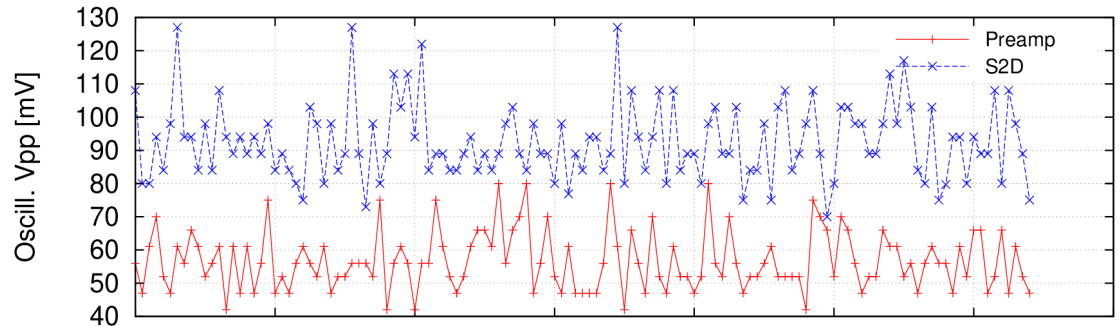
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128, Vpp/baseline vs no. ADCs ON

Preamp&S2diff
Dummy current ON

Below for comparison
SALT v2.5

SALT3_c12p_withDummy_ch128_activity.dat





SALT v3 20/2/2019

Measurements of side channels -1,128

Setup

From now on we have shorted ALL FOUR GND_joins

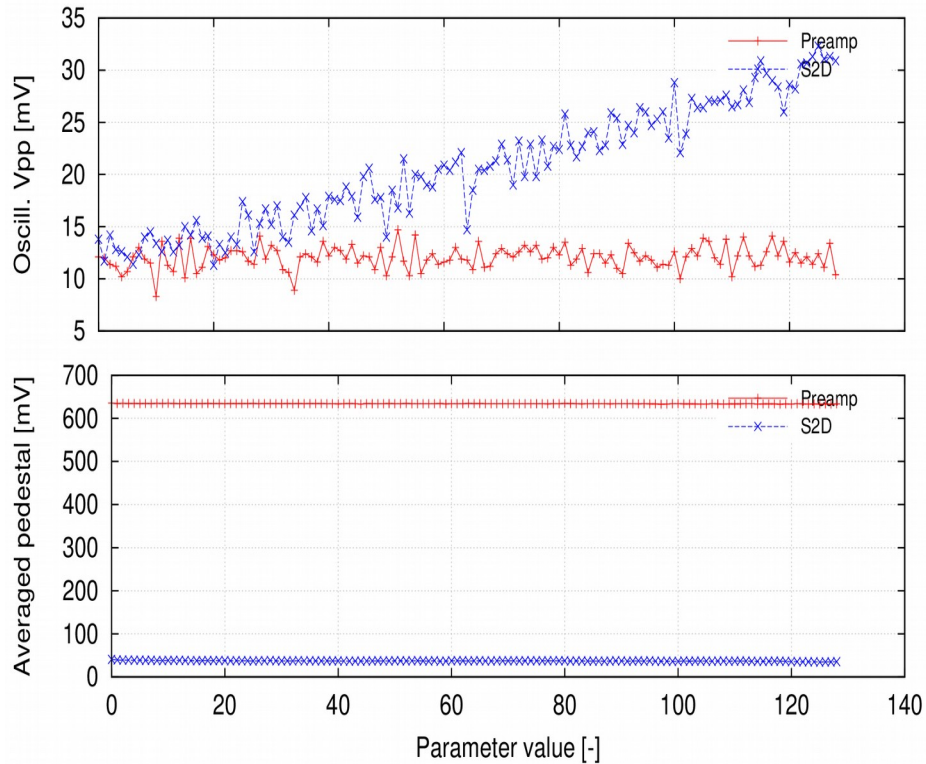
We have also switched ON ALL ADCs (also test channels and monitors ones)

From now on:

- the “noise” Vpp is NOT done with instant values but it is taken from AVERAGE**
- it was done to suppress the noise and to see only synchronous disturbances**

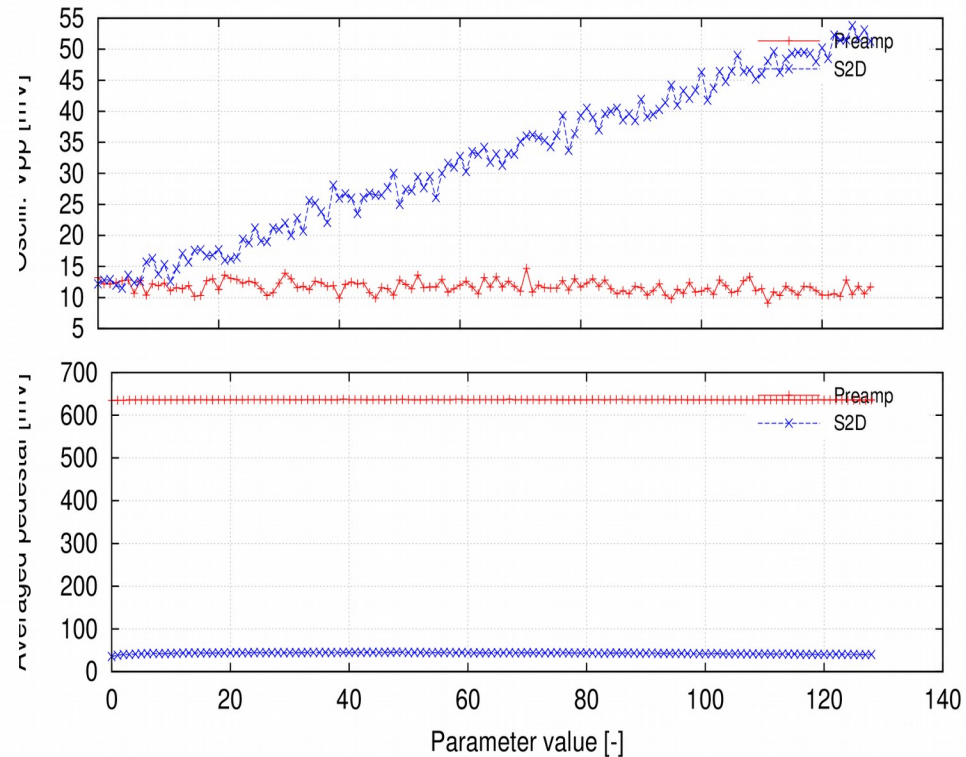
Preamp&S2diff

SALT3_AVE_c12p_ch-1_withDummy_activity.dat



Dummy current ON

SALT3_AVE_c12p_ch-1_noDummy_activity.dat



Dummy current OFF



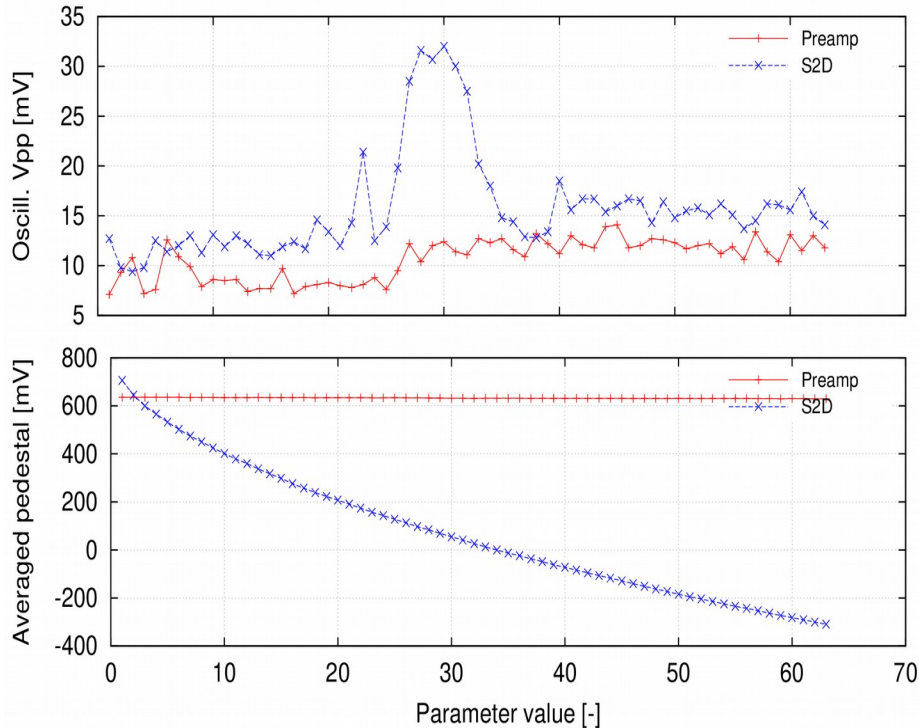
SALT v3 20/2/2019

Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1, Vpp/baseline vs Vcm DAC

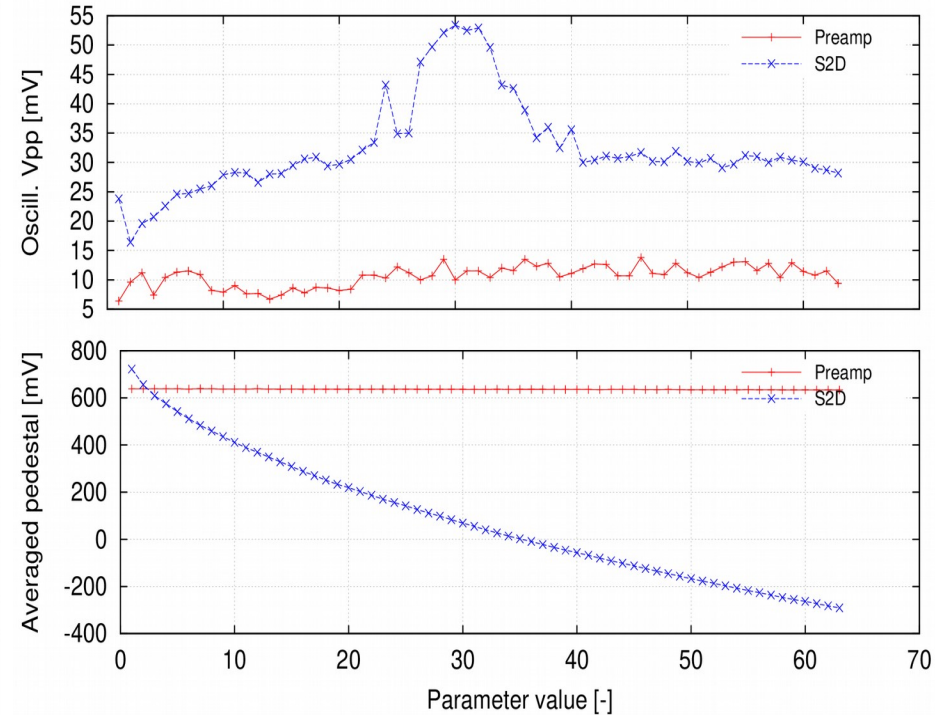
Preamp&S2diff
VcmDAC default=32!

SALT3_AVE_c12p_ch-1_withDummy_vcmDAC.dat



Dummy current ON

SALT3_AVE_c12p_ch-1_noDummy_vcmDAC.dat



Dummy current OFF



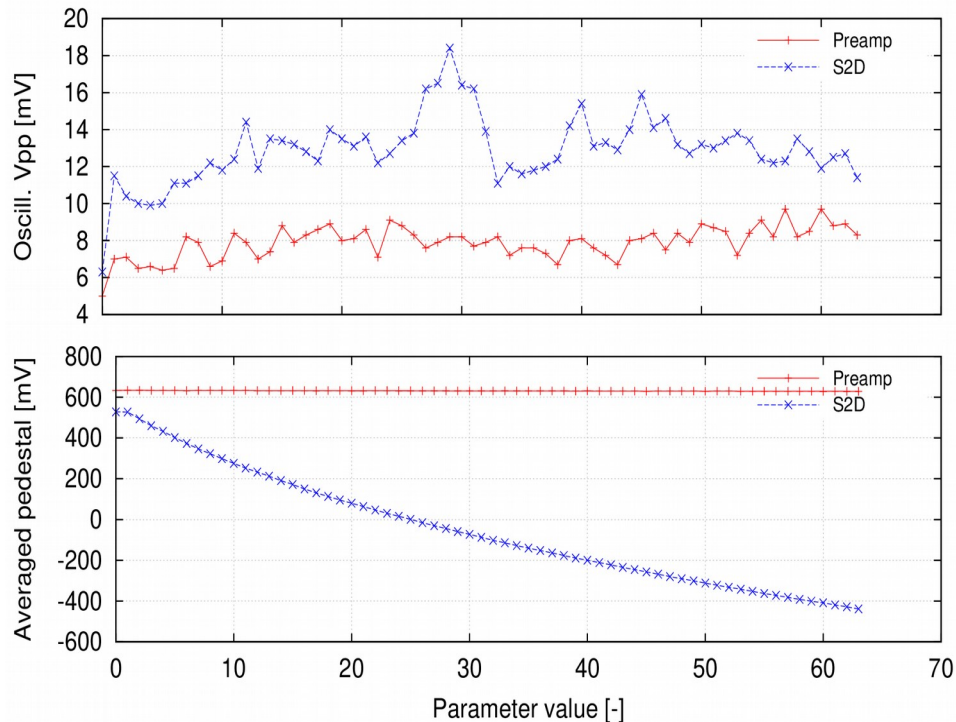
SALT v3 20/2/2019

Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128, Vpp/baseline vs Vcm DAC

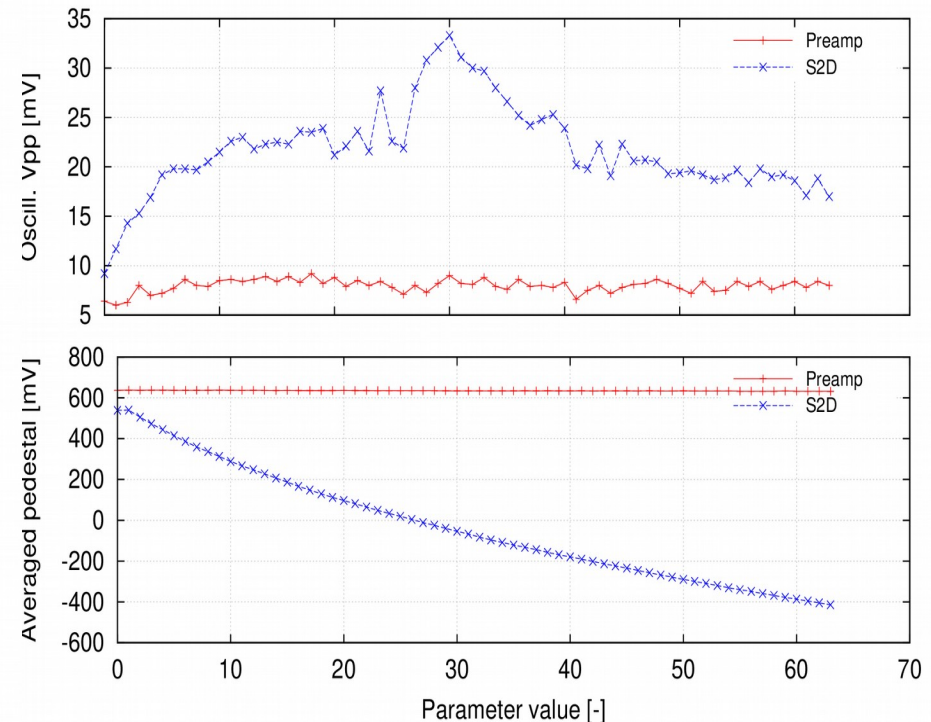
Preamp&S2diff
VcmDAC default=32!

SALT3_AVE_c12p_ch128_withDummy_vcmDAC.dat



Dummy current ON

SALT3_AVE_c12p_ch128_noDummy_vcmDAC.dat



Dummy current OFF



SALT v3 20/2/2019

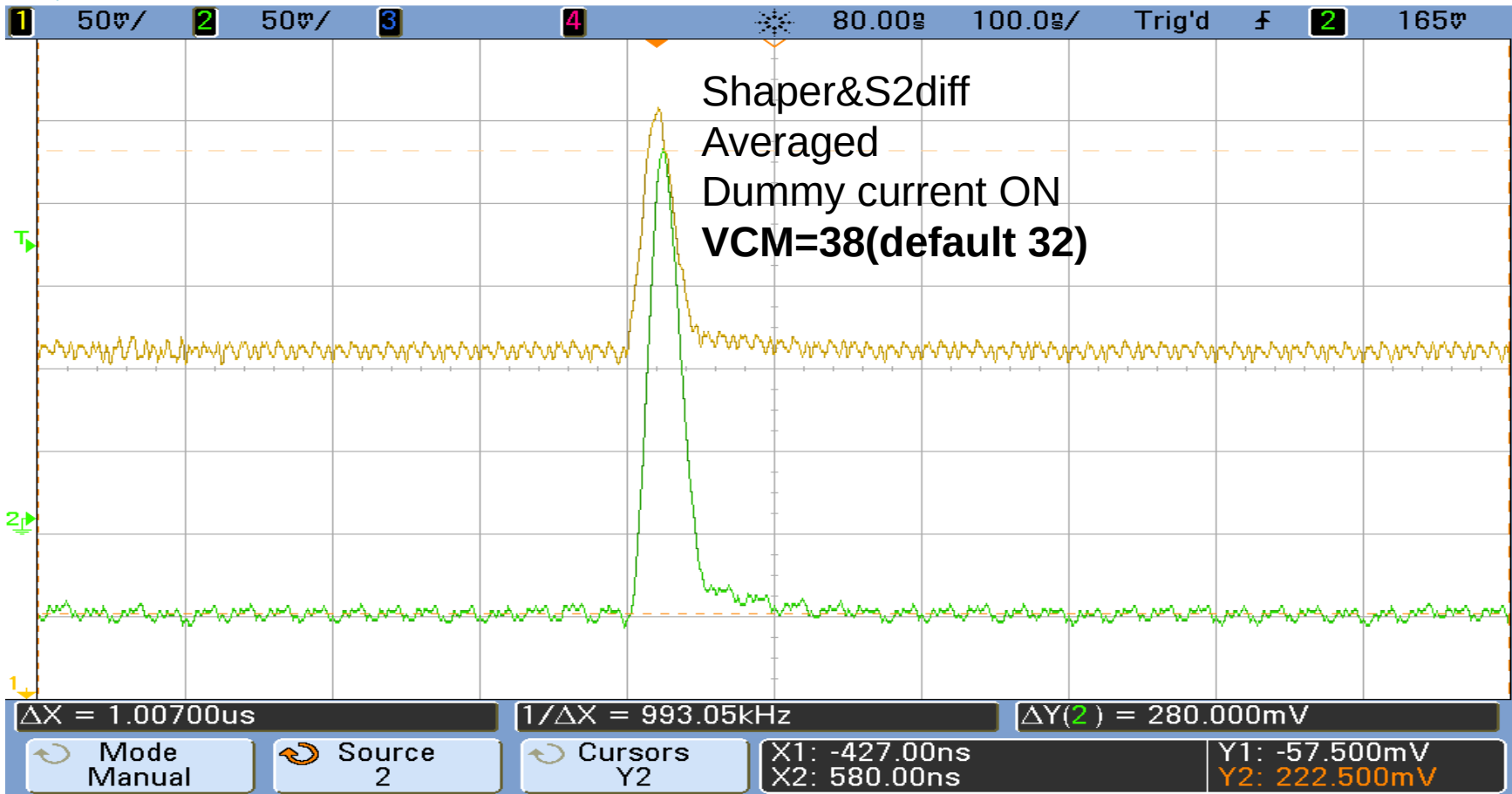
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1



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WED FEB 20 14:20:09 2019





SALT v3 20/2/2019

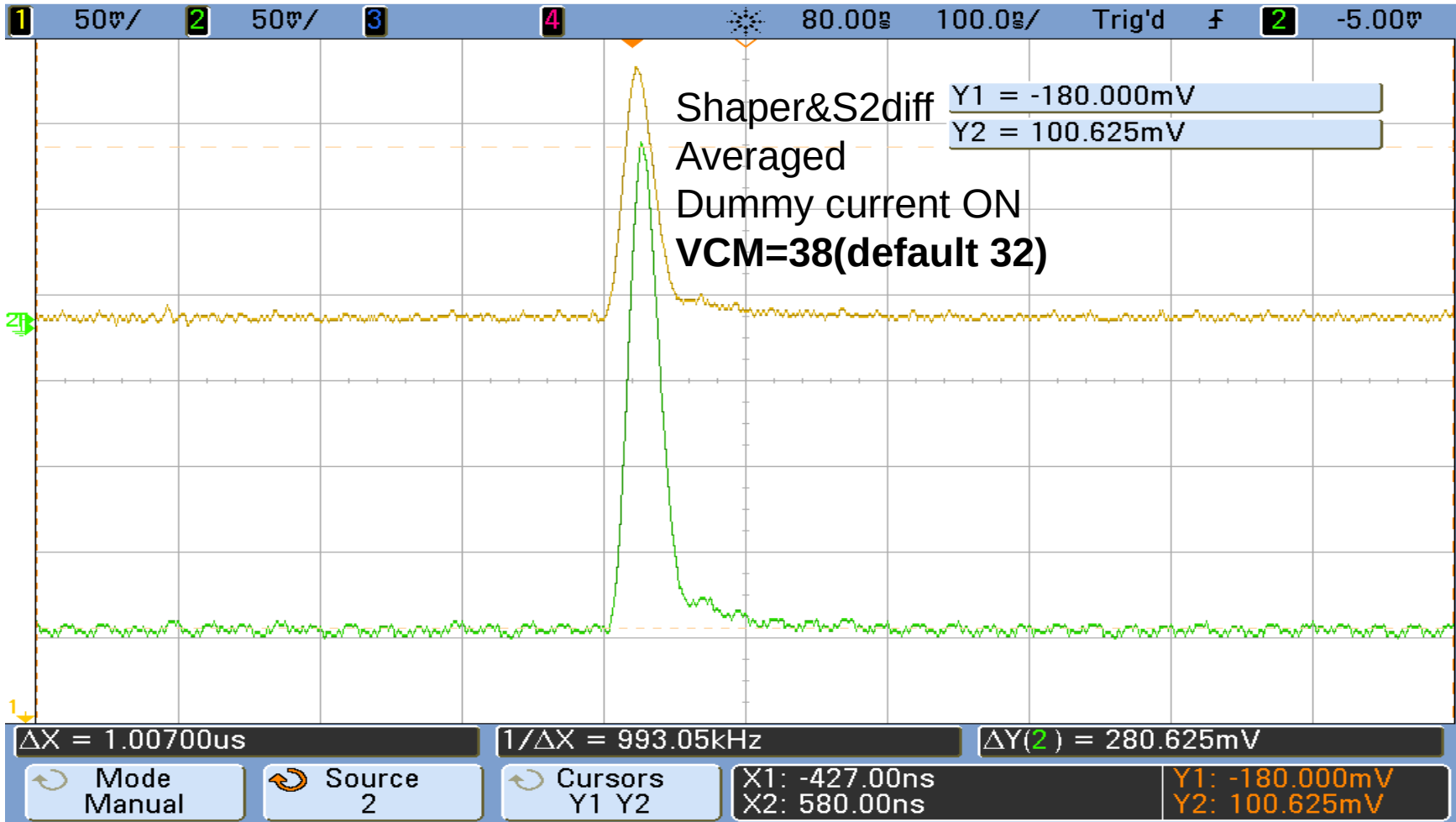
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128



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WED FEB 20 14:17:31 2019





SALT v3 20/2/2019

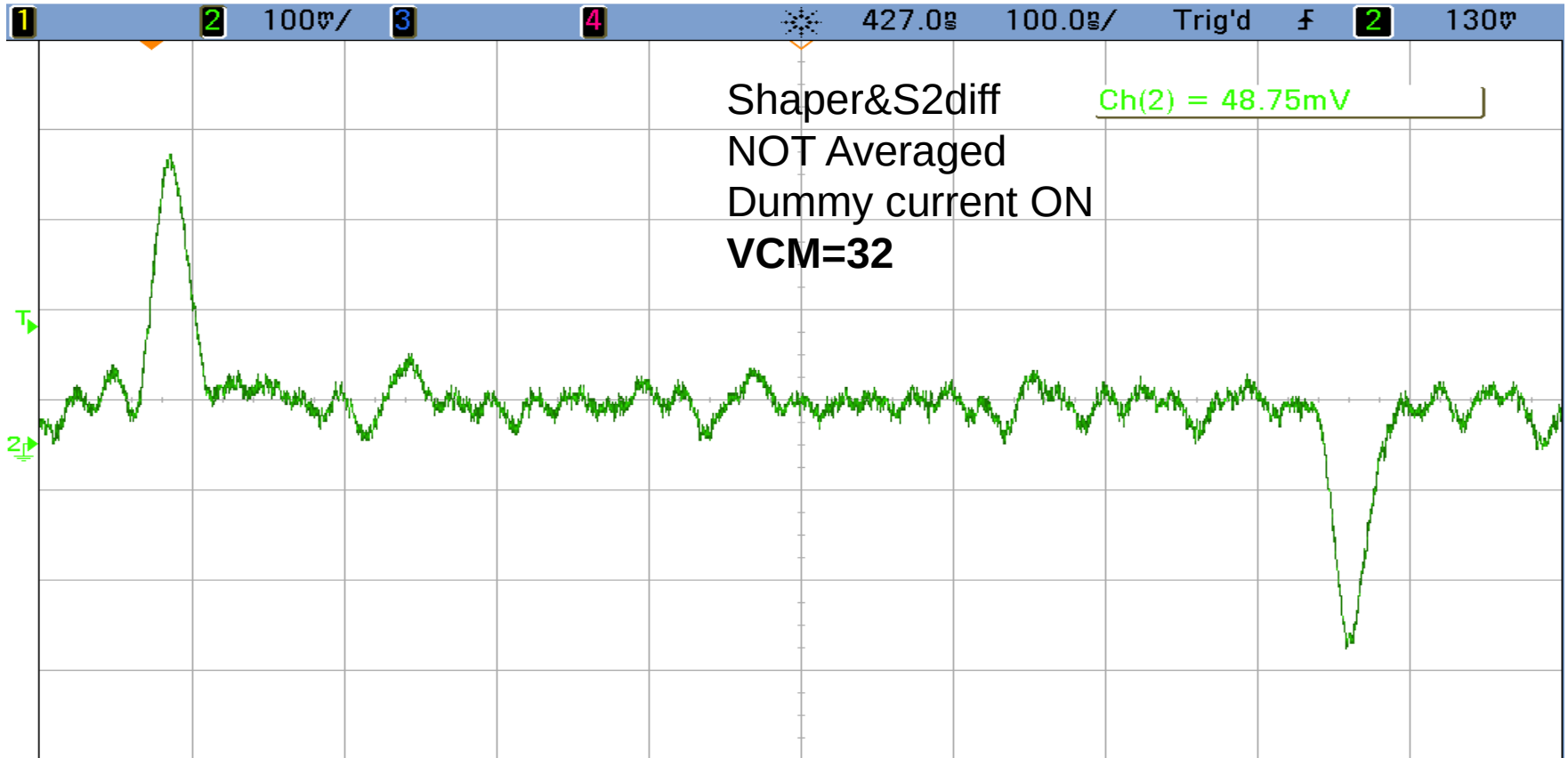
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1



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THU FEB 21 13:15:34 2019



Measurement Menu

Source 2

Select: Pk-Pk

Measure Pk-Pk

Settings

Clear Meas

Statistics



SALT v3 20/2/2019

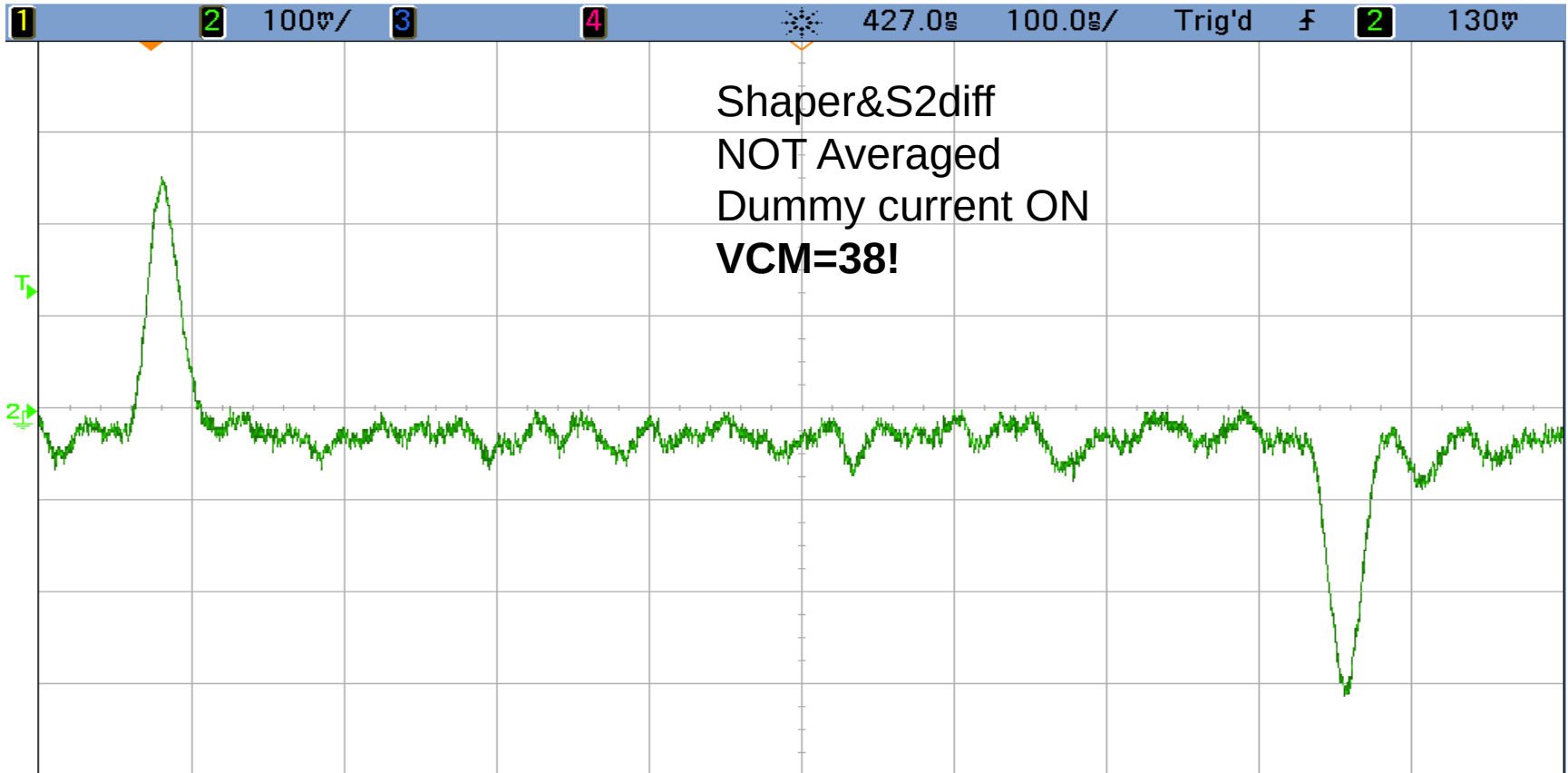
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1



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THU FEB 21 13:15:17 2019



Measurement Menu

Source 2 Select: Pk-Pk Measure Pk-Pk Settings Clear Meas Statistics



SALT v3 20/2/2019

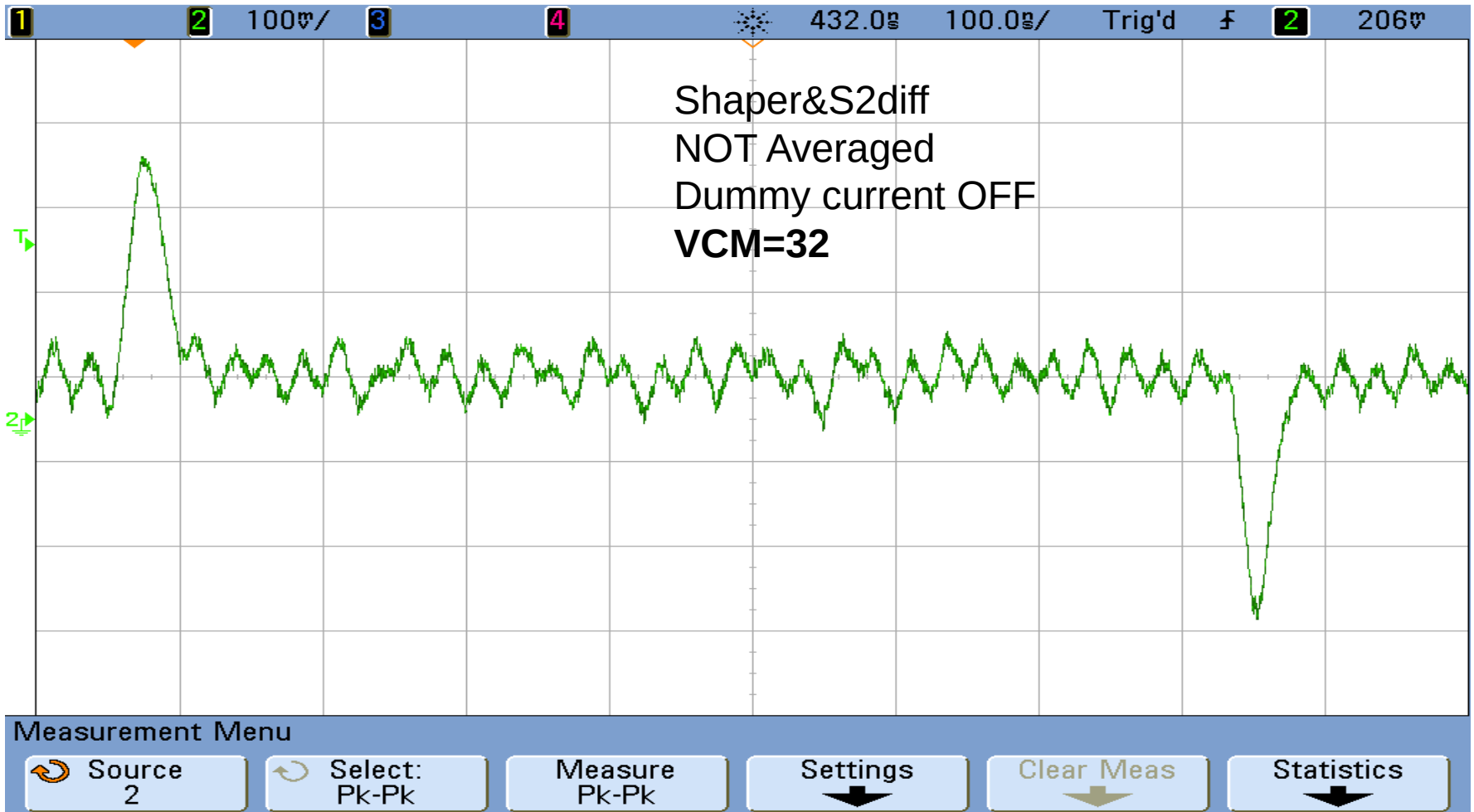
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1



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THU FEB 21 13:40:37 2019





SALT v3 20/2/2019

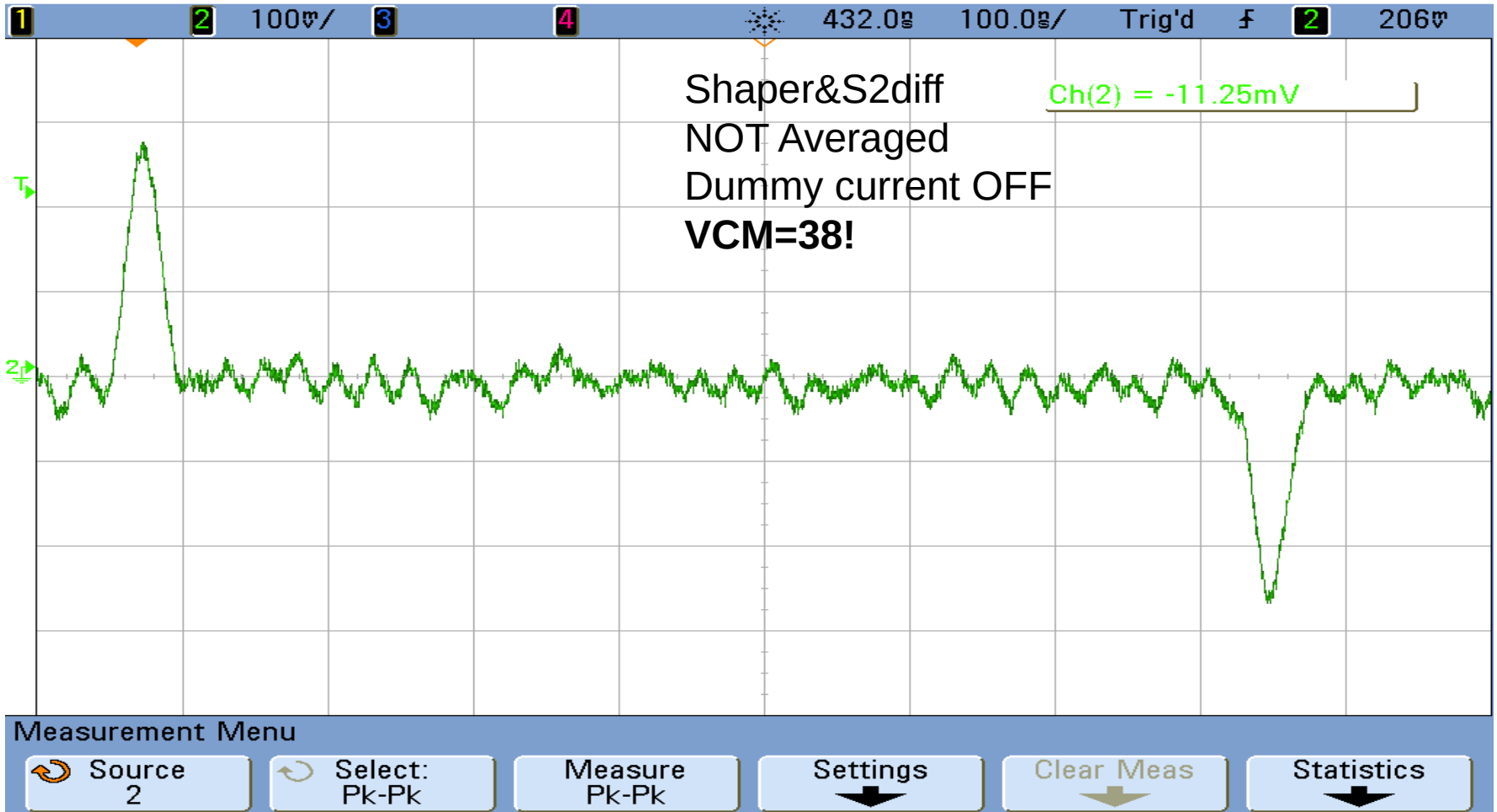
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1



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THU FEB 21 13:41:06 2019





SALT v3 20/2/2019

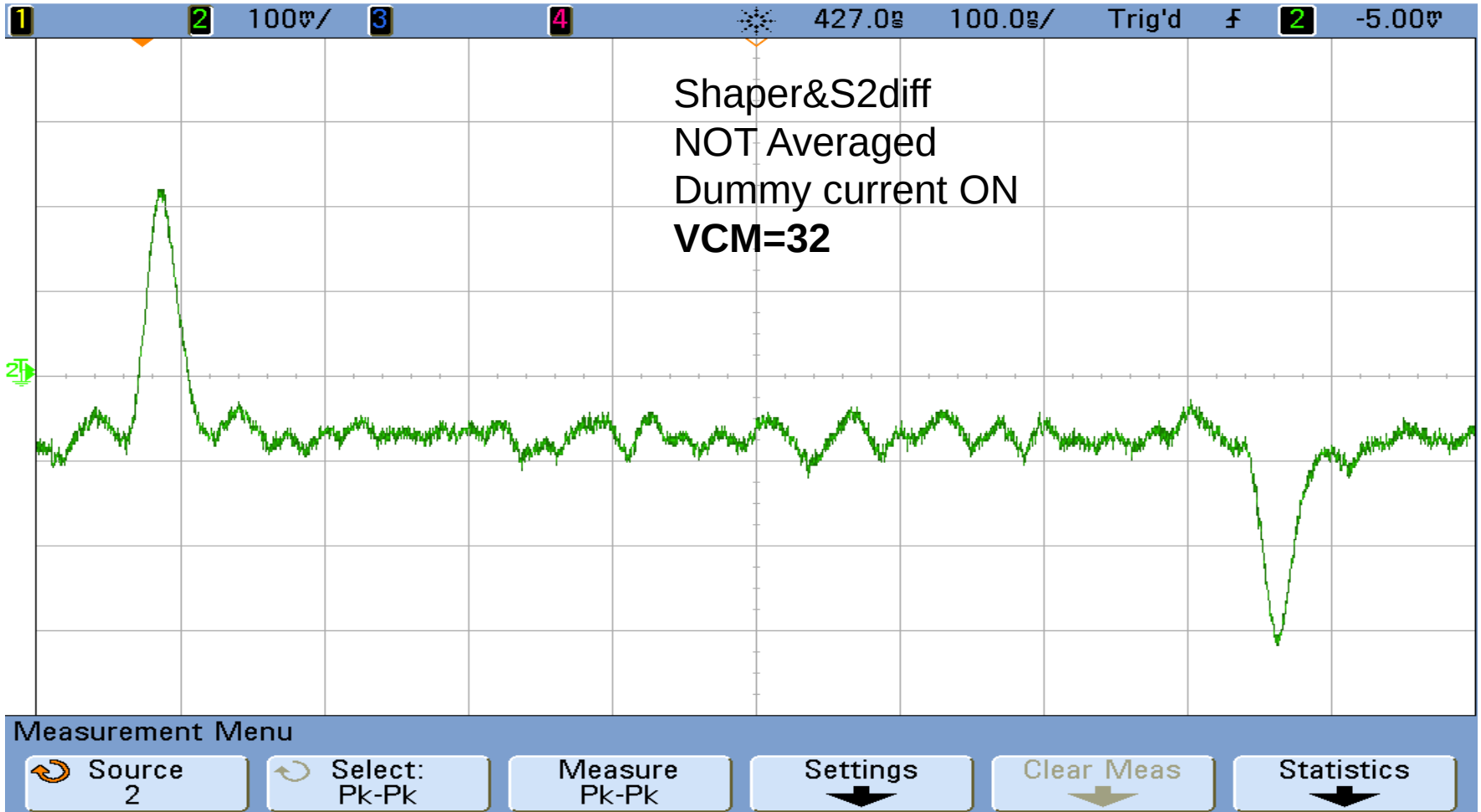
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128



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THU FEB 21 13:14:26 2019





SALT v3 20/2/2019

Sensor 12pF+1-3pFparas. on chan. -1,128

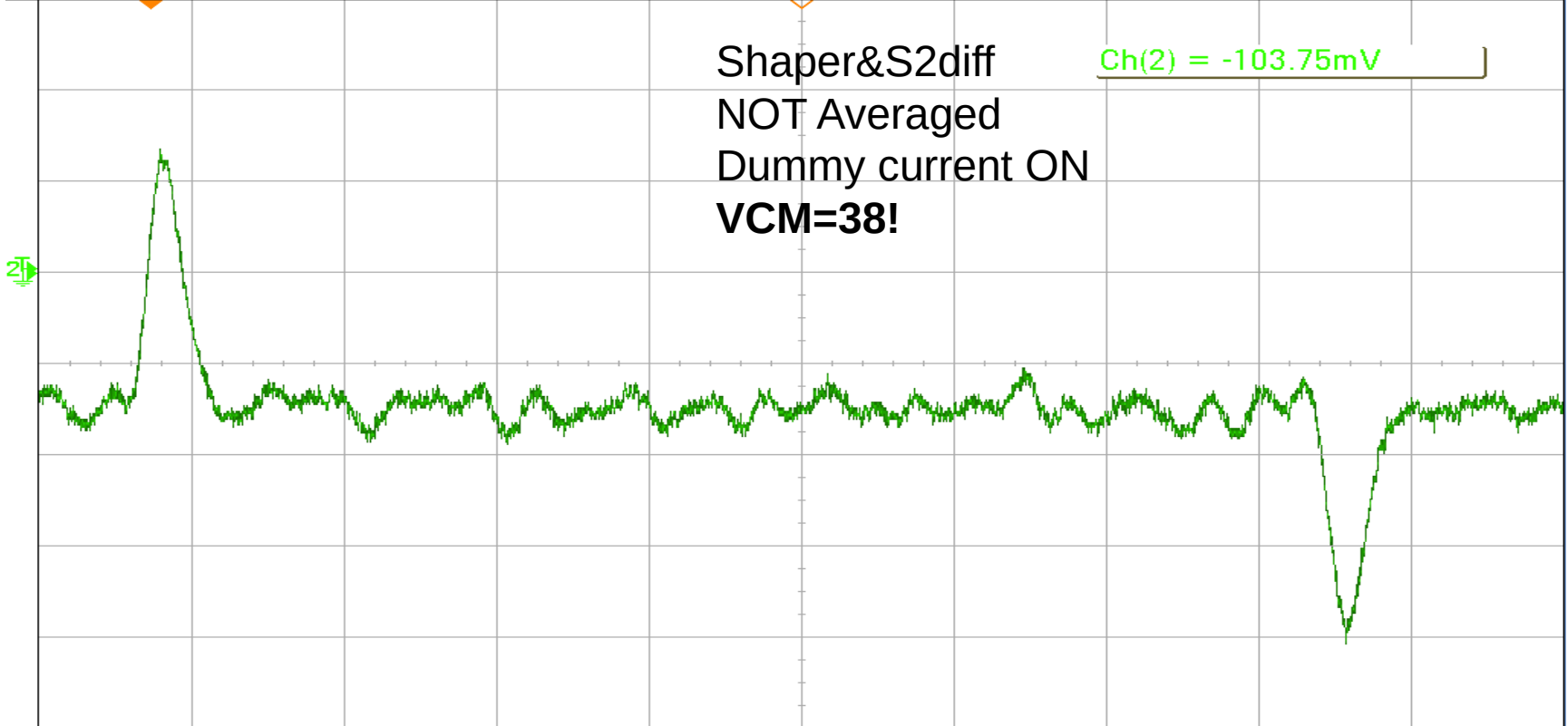
Channel 128



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1 2 100V/ 3 4 427.0ns 100.0ns/ Trig'd F 2 -5.00V



Measurement Menu

Source 2	Select: Pk-Pk	Measure Pk-Pk	Settings	Clear Meas	Statistics
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SALT v3 20/2/2019

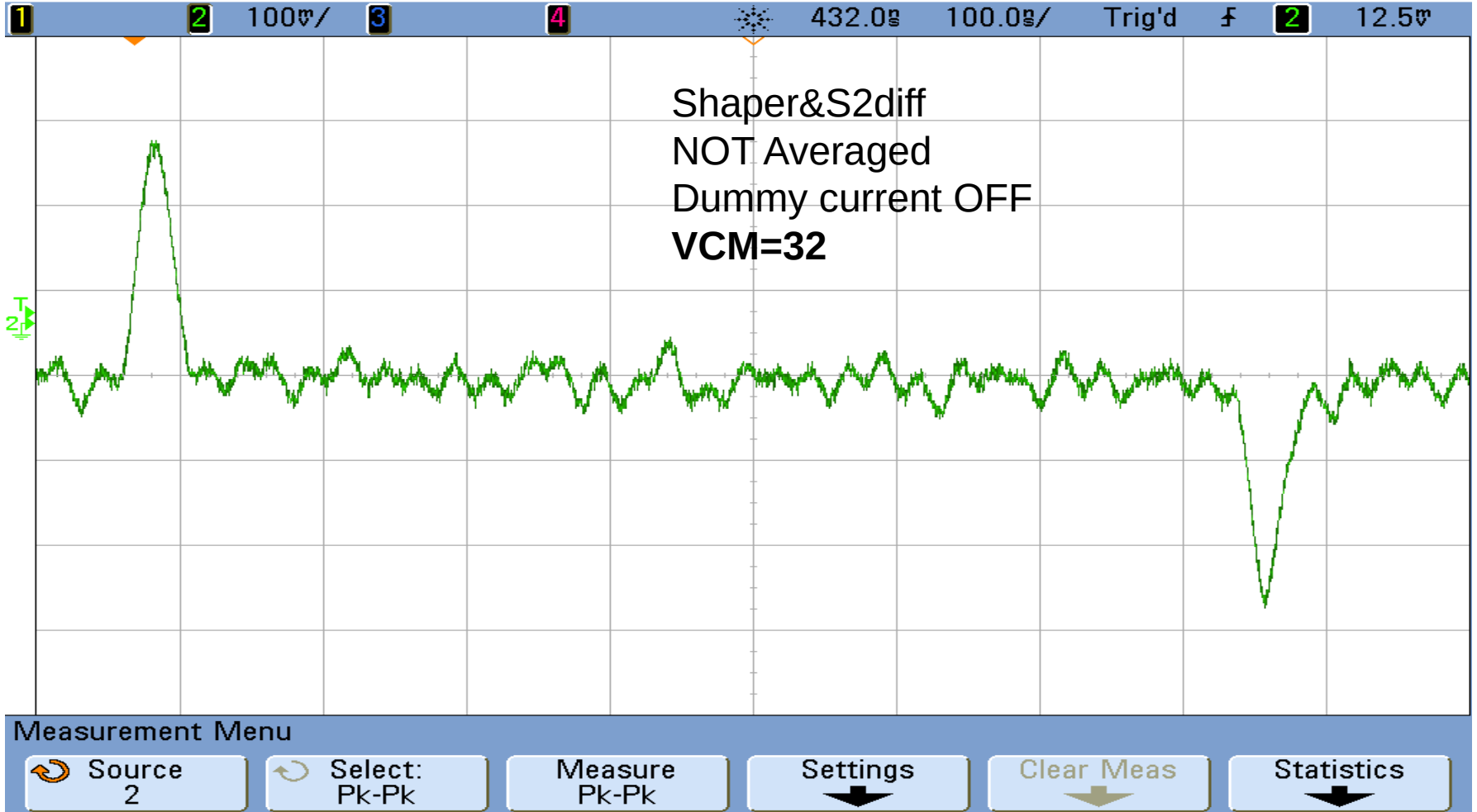
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128



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THU FEB 21 13:41:40 2019





SALT v3 20/2/2019

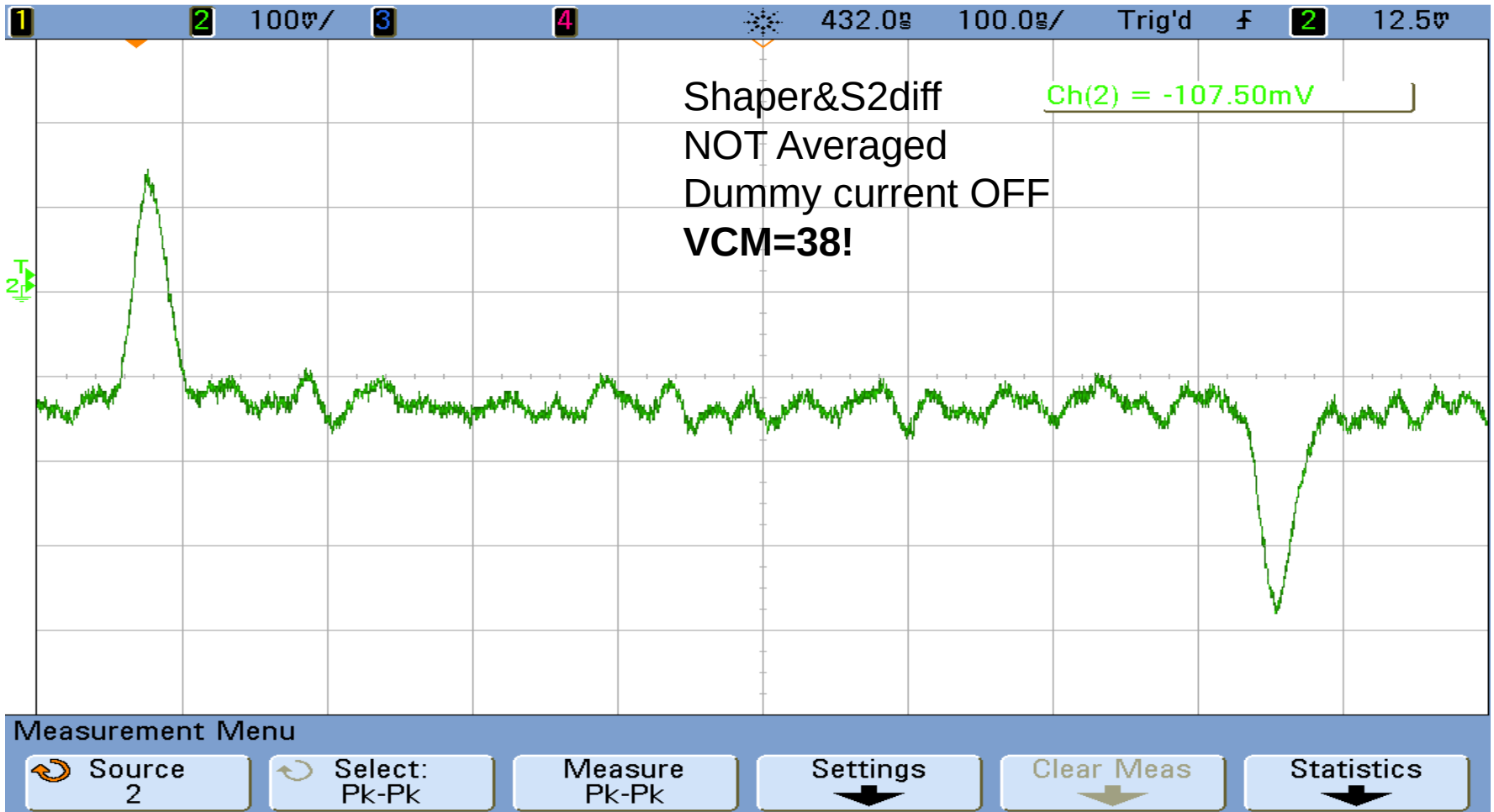
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128



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THU FEB 21 13:41:26 2019



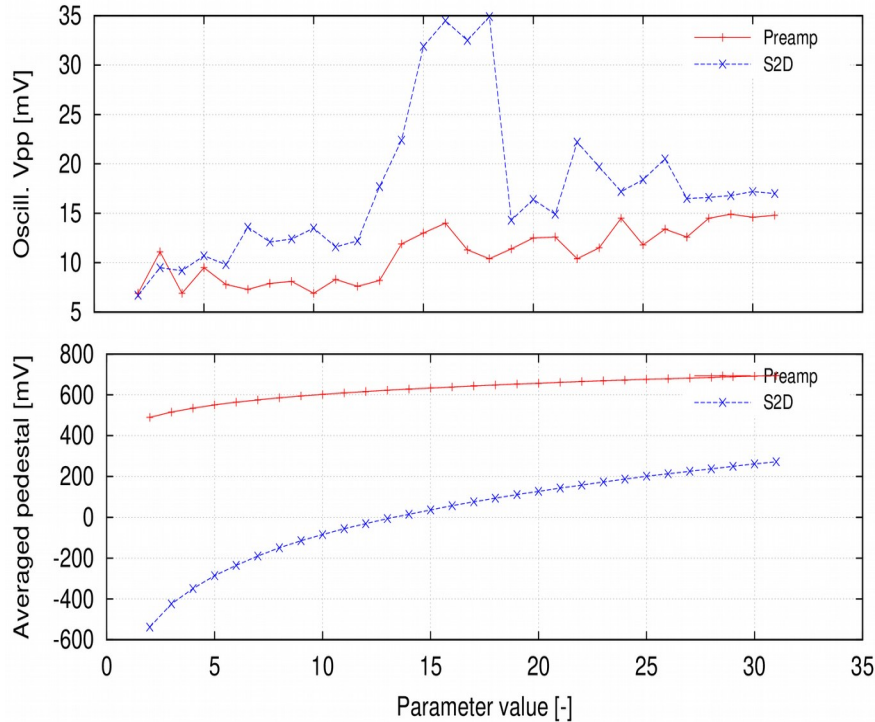
SALT v3 20/2/2019

Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1, Vpp/baseline vs Preamp DAC

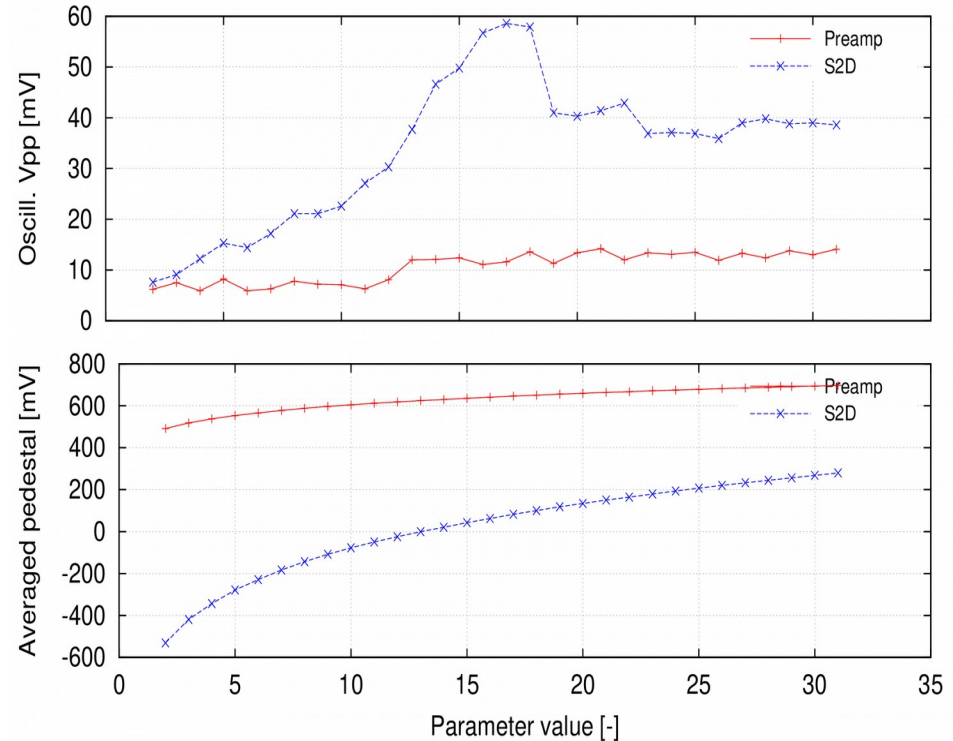
Preamp&S2diff
PreampDAC default=15!

SALT3_AVE_c12p_ch-1_withDummy_preampDAC.dat



Dummy current ON

SALT3_AVE_c12p_ch-1_noDummy_preampDAC.dat



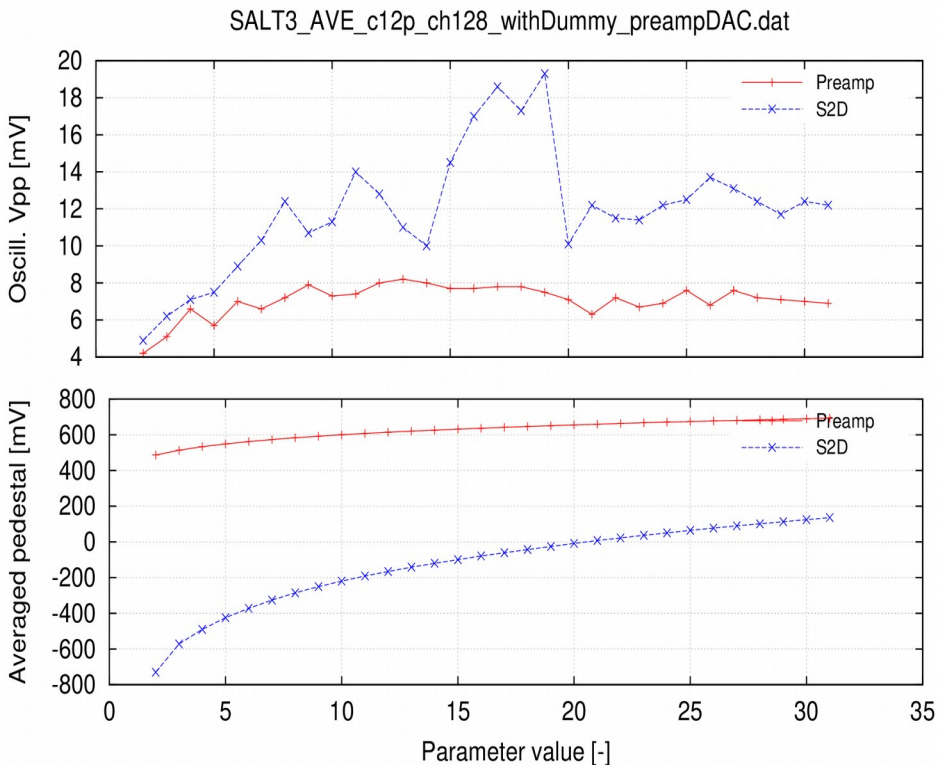
Dummy current OFF

SALT v3 20/2/2019

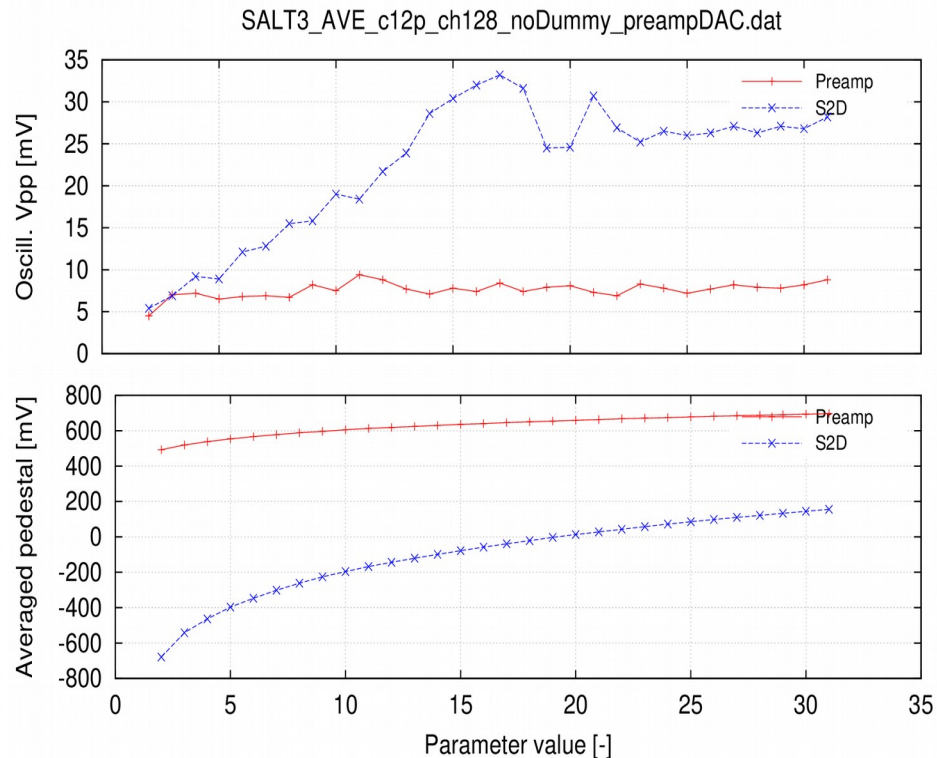
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128, Vpp/baseline vs Preamp DAC

Preamp&S2diff
PreampDAC default=15!



Dummy current ON



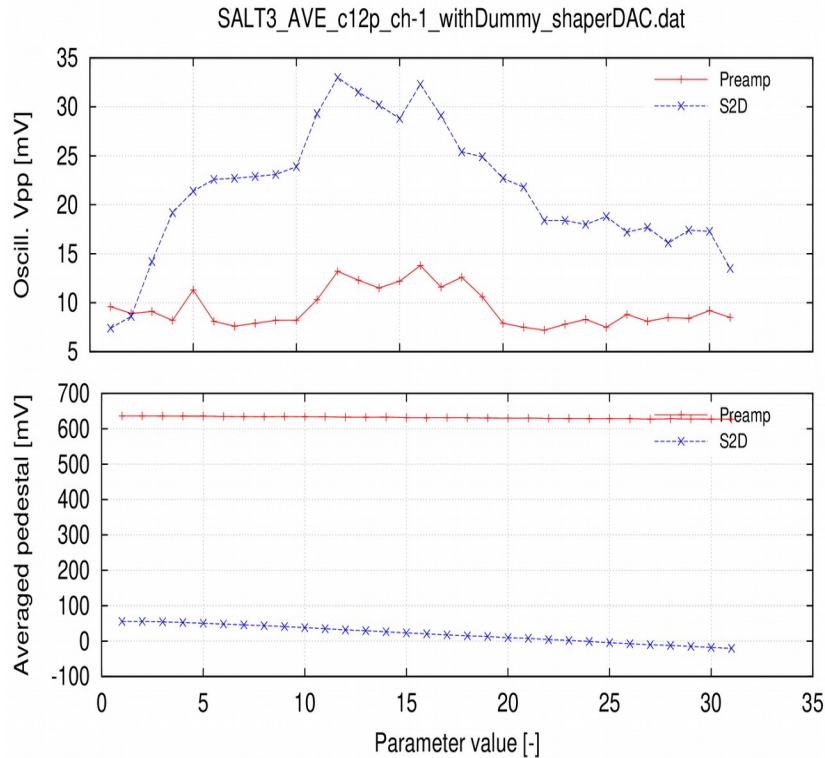
Dummy current OFF

SALT v3 20/2/2019

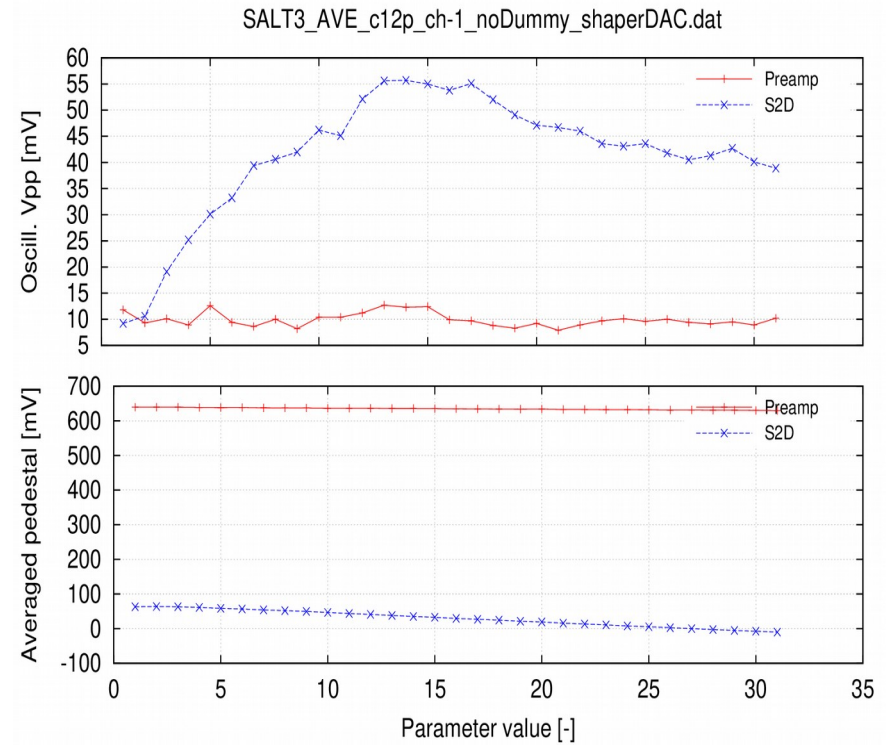
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1, Vpp/baseline vs Shaper DAC

Preamp&S2diff
ShaperDAC default=12



Dummy current ON



Dummy current OFF



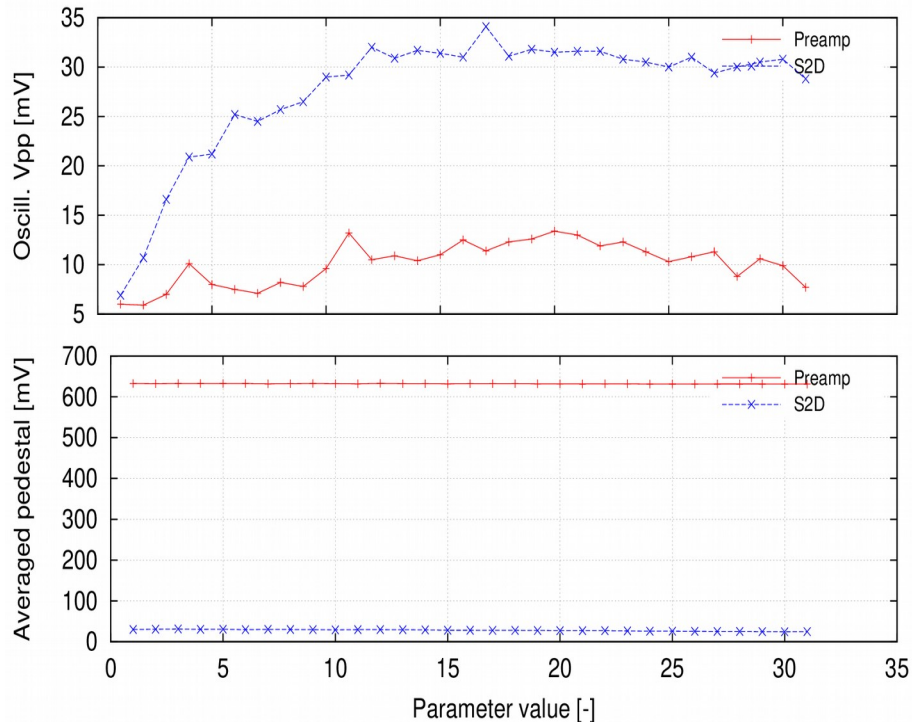
SALT v3 20/2/2019

Sensor 12pF+1-3pFparas. on chan. -1,128

Channel -1, Vpp/baseline vs S2Diff DAC

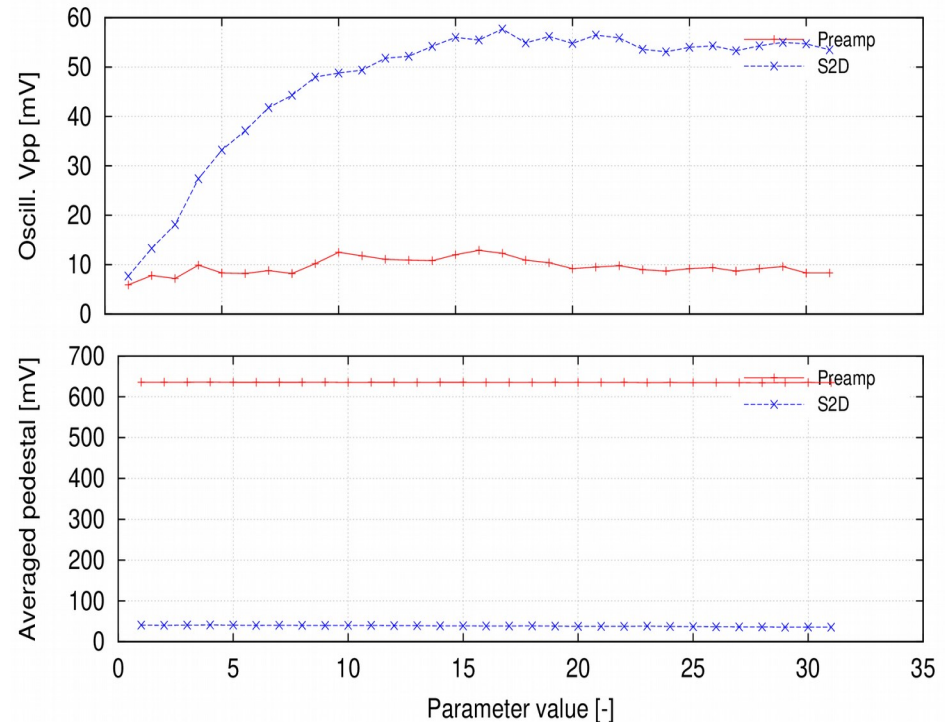
Preamp&S2diff
S2DiffDAC default=12

SALT3_AVE_c12p_ch-1_withDummy_s2dDAC.dat



Dummy current ON

SALT3_AVE_c12p_ch-1_noDummy_s2dDAC.dat



Dummy current OFF



SALT v3 20/2/2019

Sensor 12pF+1-3pFparas. on chan. -1,128
Channel -1, Vpp/baseline vs other DACs

In addition, the dependence on CalibDAC and on ADCdelayDAC was measured. Flat curves (No dependence) were obtained.

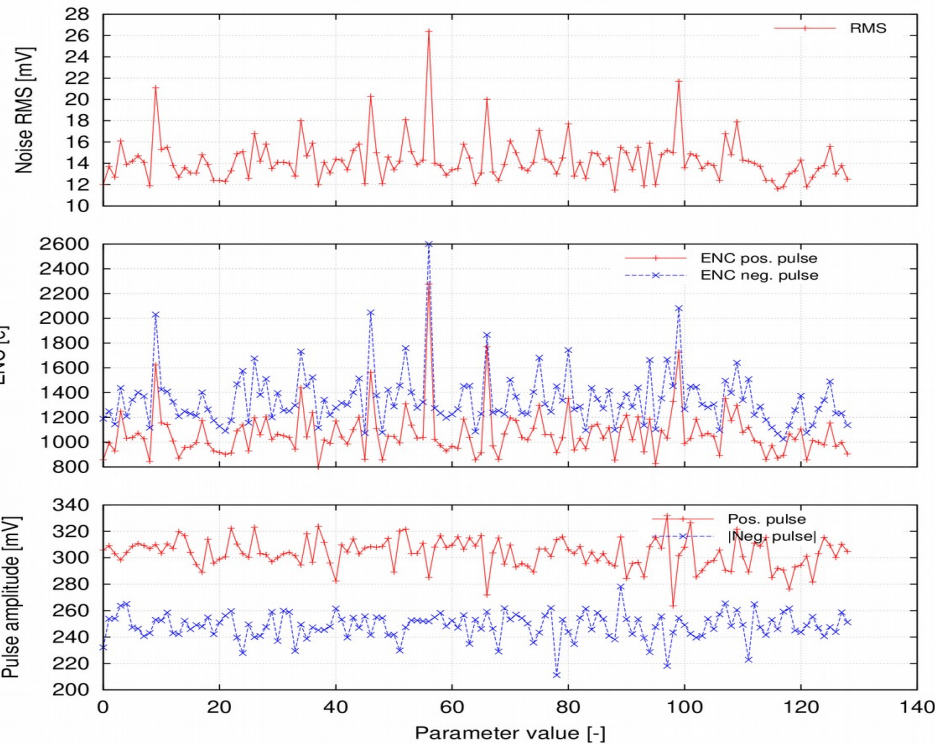
SALT v3 22/2/2019

Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128, SNR vs no. ADCs ON

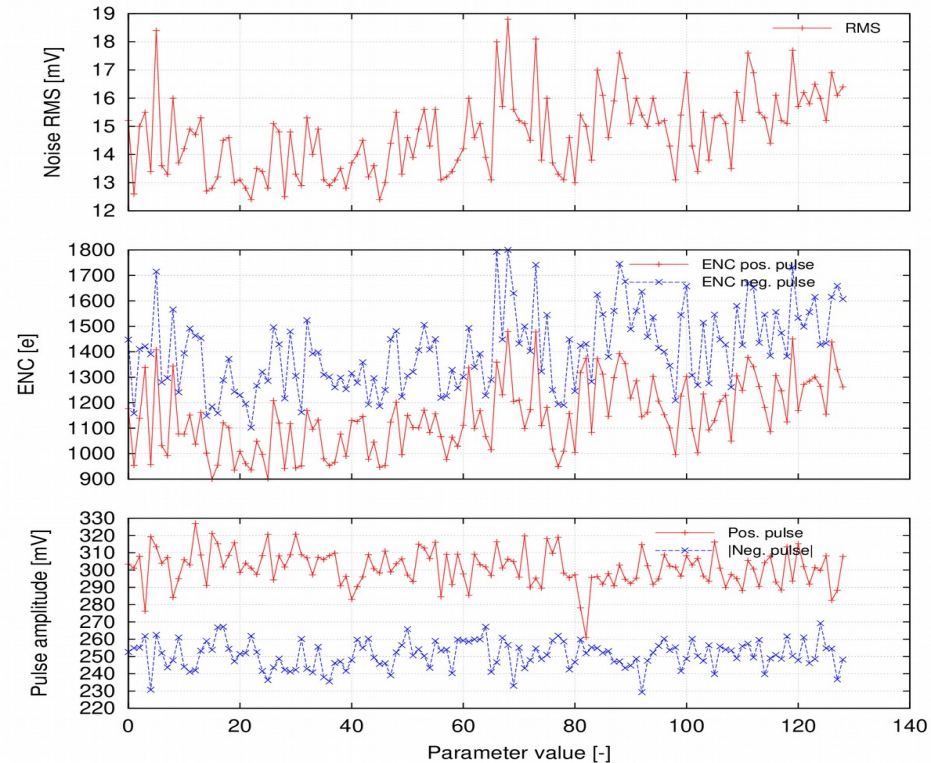
Noise RMS, ENC, Pulse amplitude
All ADCs ON default

SALT3_AVE_param_c12p_ch128_withDummy_activity.par



Dummy current ON

SALT3_AVE_param_c12p_ch128_noDummy_activity.par



Dummy current OFF

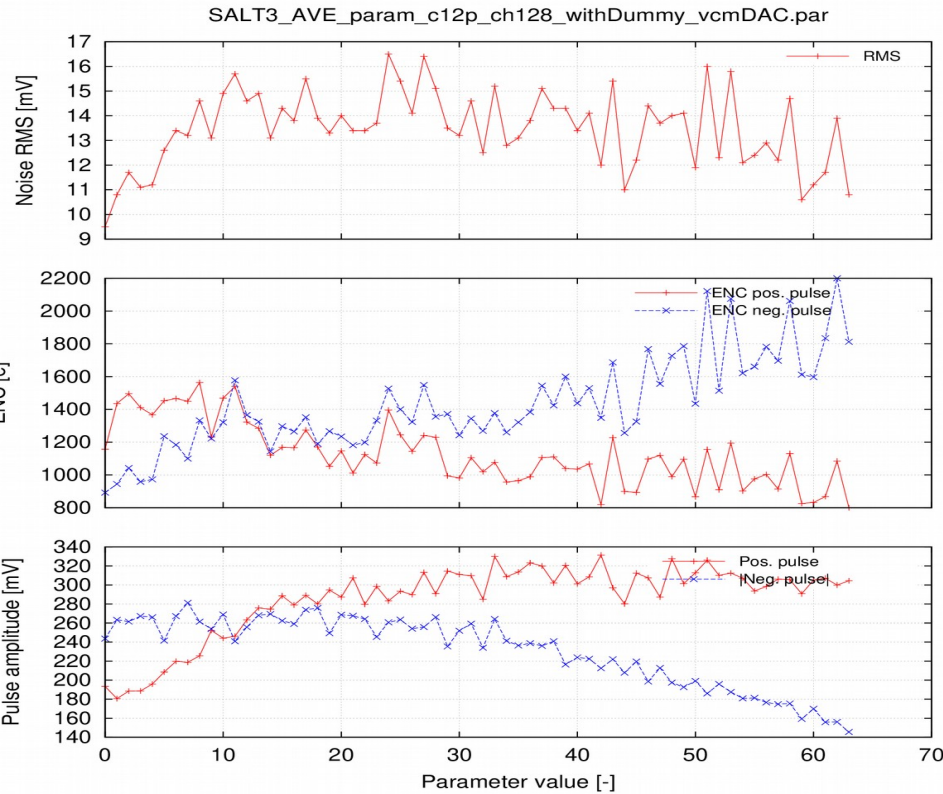


SALT v3 22/2/2019

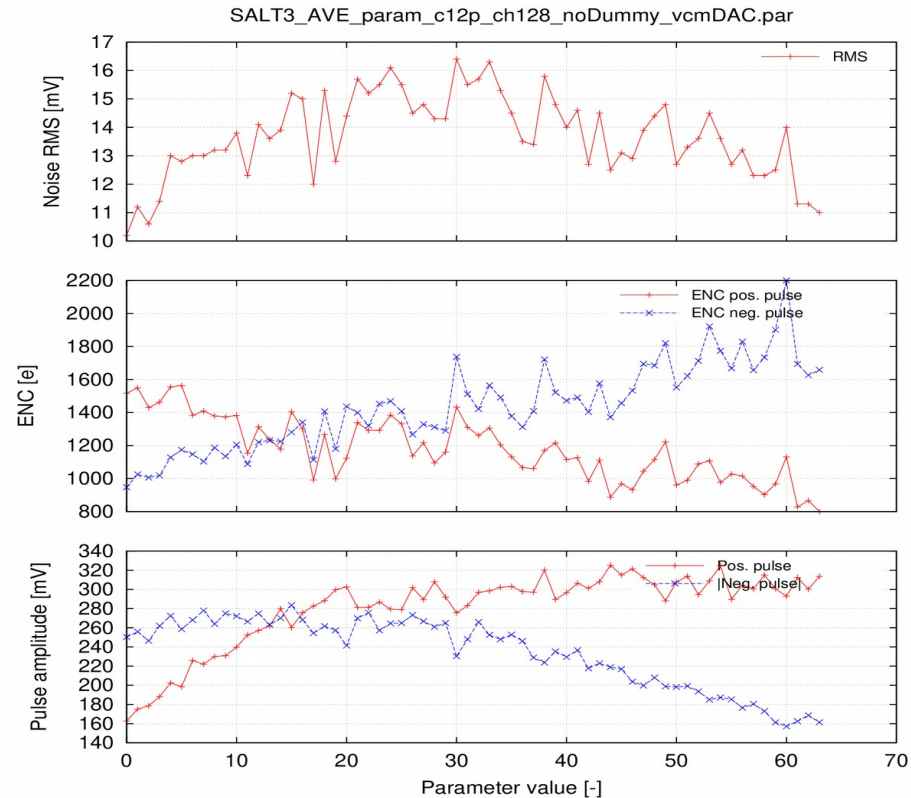
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128, SNR vs Vcm DAC

Noise RMS, ENC, Pulse amplitude
VcmDAC default=32



Dummy current ON



Dummy current OFF

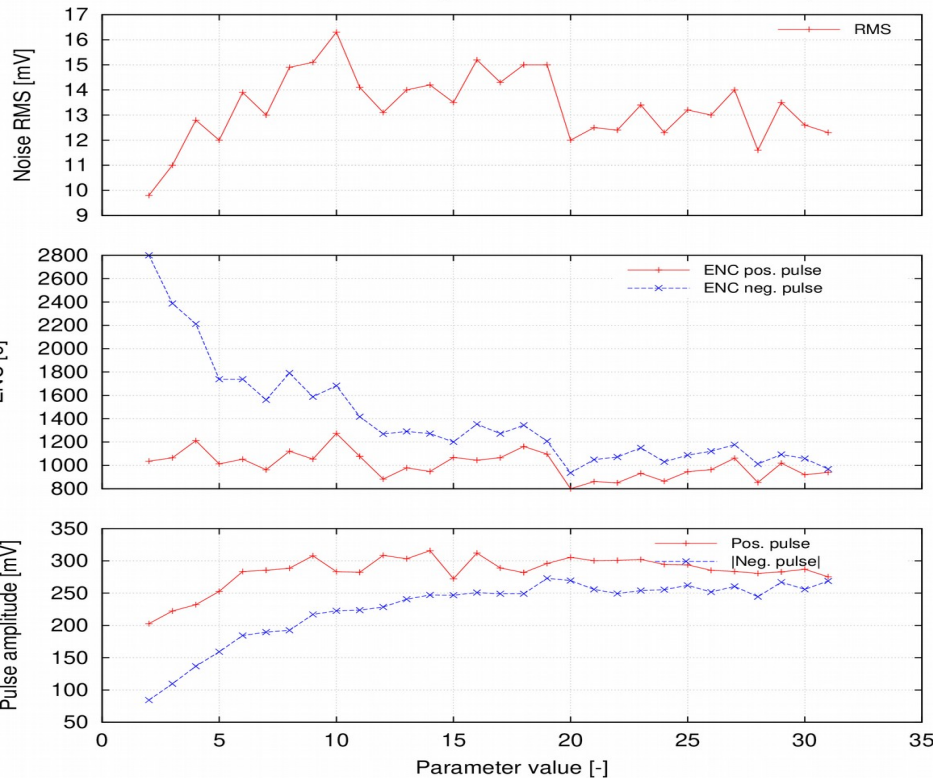
SALT v3 22/2/2019

Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128, SNR vs Preamp DAC

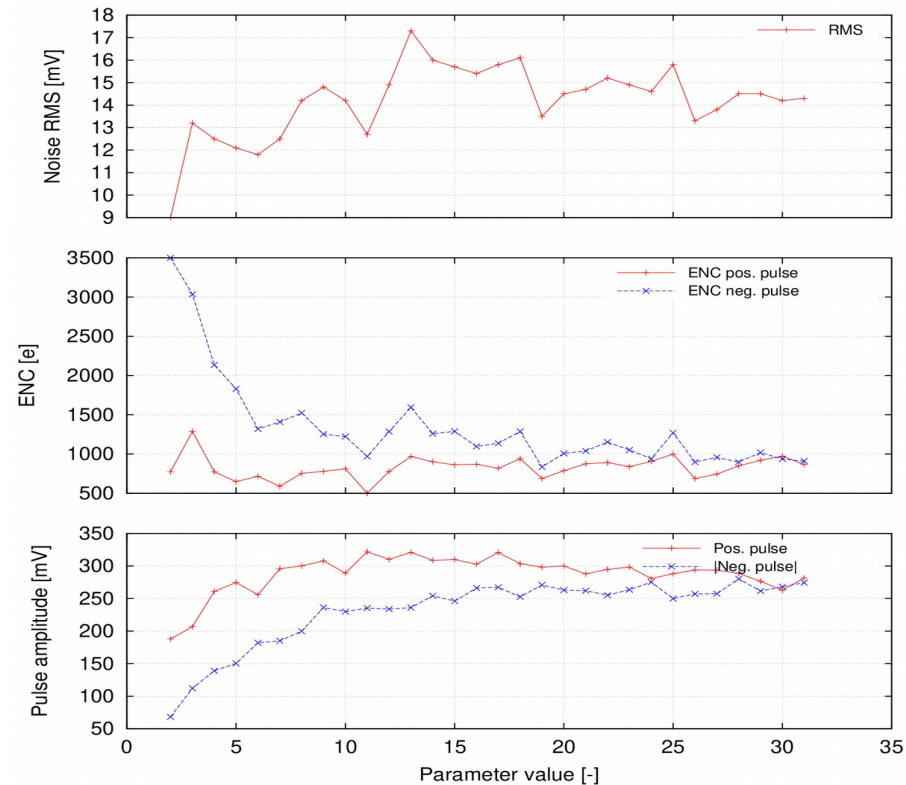
Noise RMS, ENC, Pulse amplitude
PreampDAC default=15

SALT3_AVE_param_c12p_ch128_withDummy_preampDAC.par



Dummy current ON

SALT3_AVE_param_c12p_ch128_noDummy_preampDAC.par



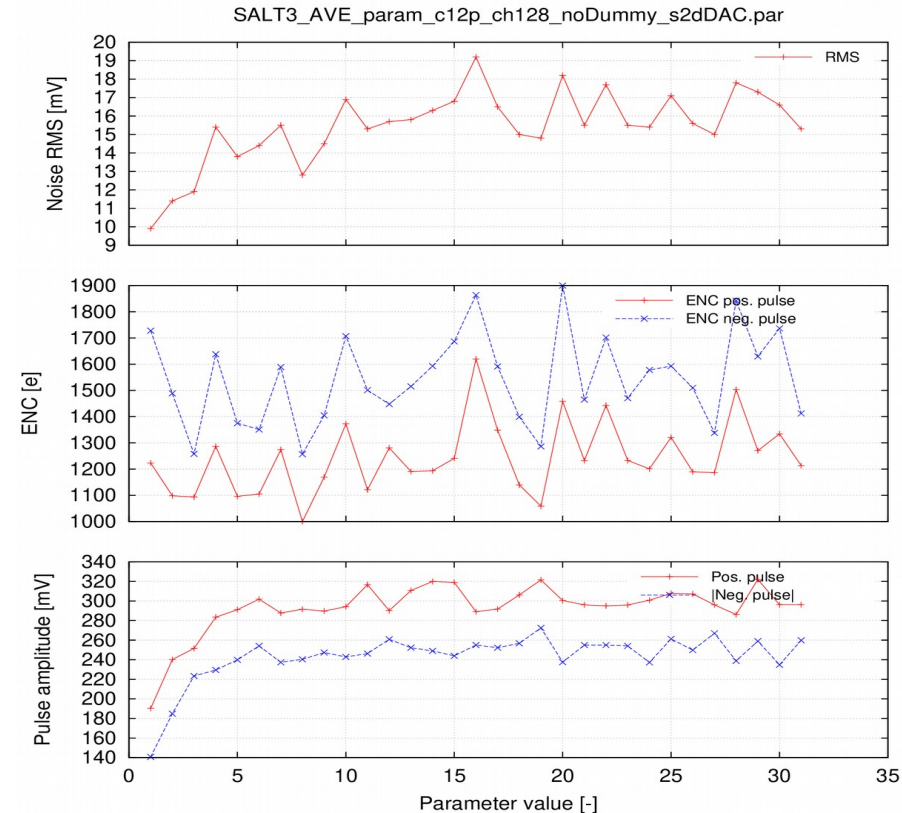
Dummy current OFF

SALT v3 22/2/2019

Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128, SNR vs S2Diff DAC

Noise RMS, ENC, Pulse amplitude
S2DiffDAC default=12



Dummy current ON

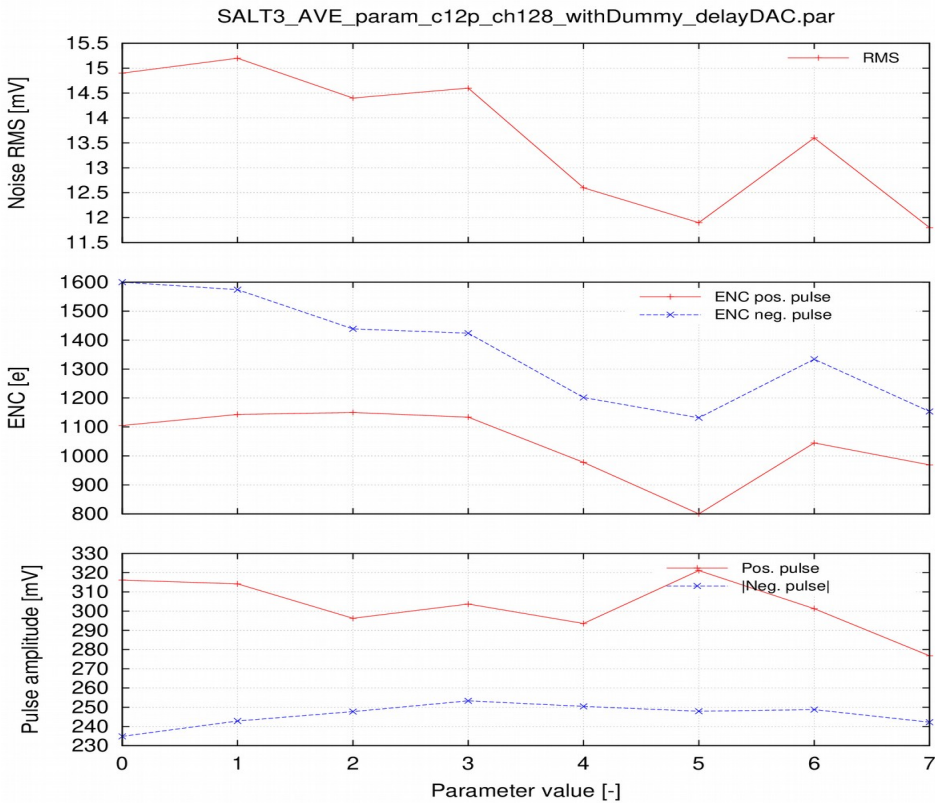
Dummy current OFF

SALT v3 22/2/2019

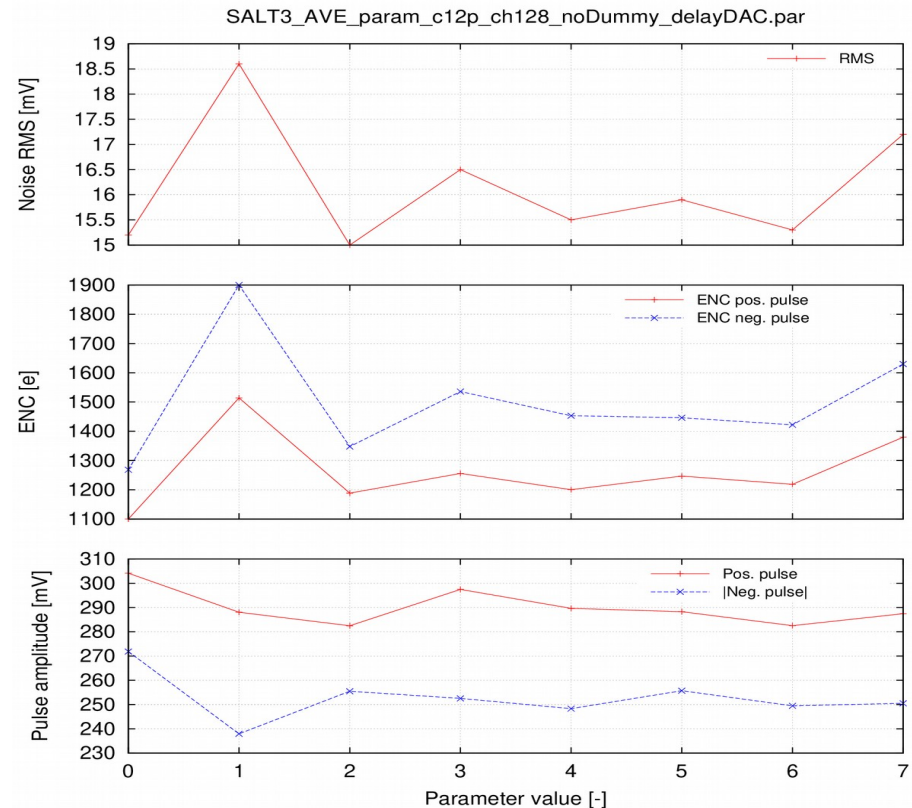
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128, SNR vs ADC delay

Noise RMS, ENC, Pulse amplitude
ADC delay default=2



Dummy current ON



Dummy current OFF

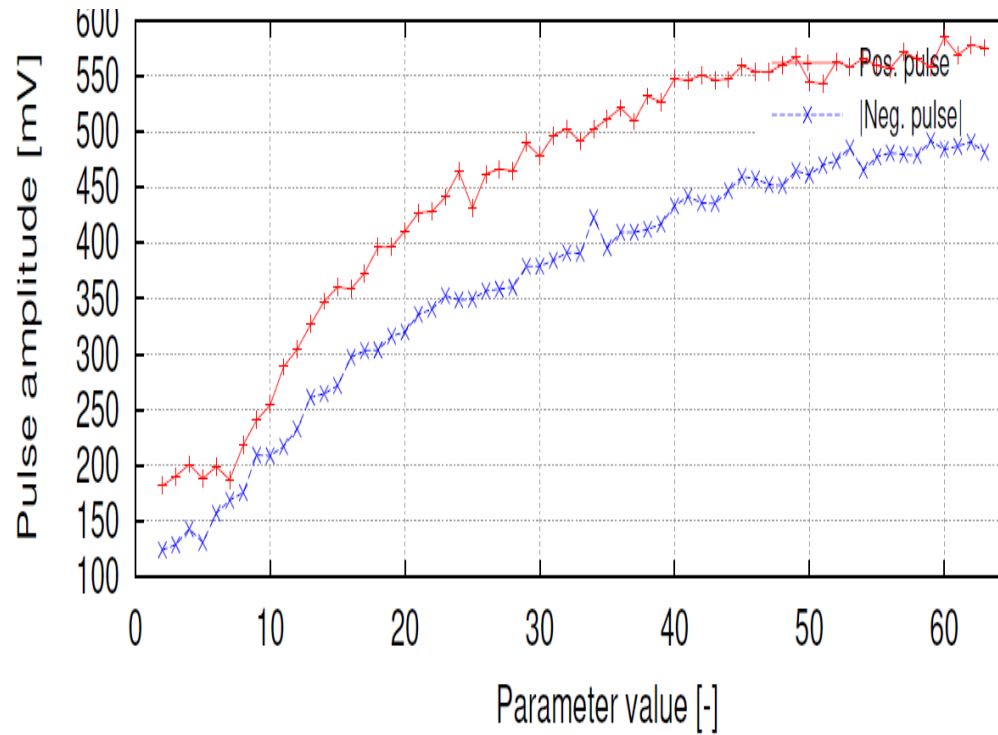


SALT v3 22/2/2019

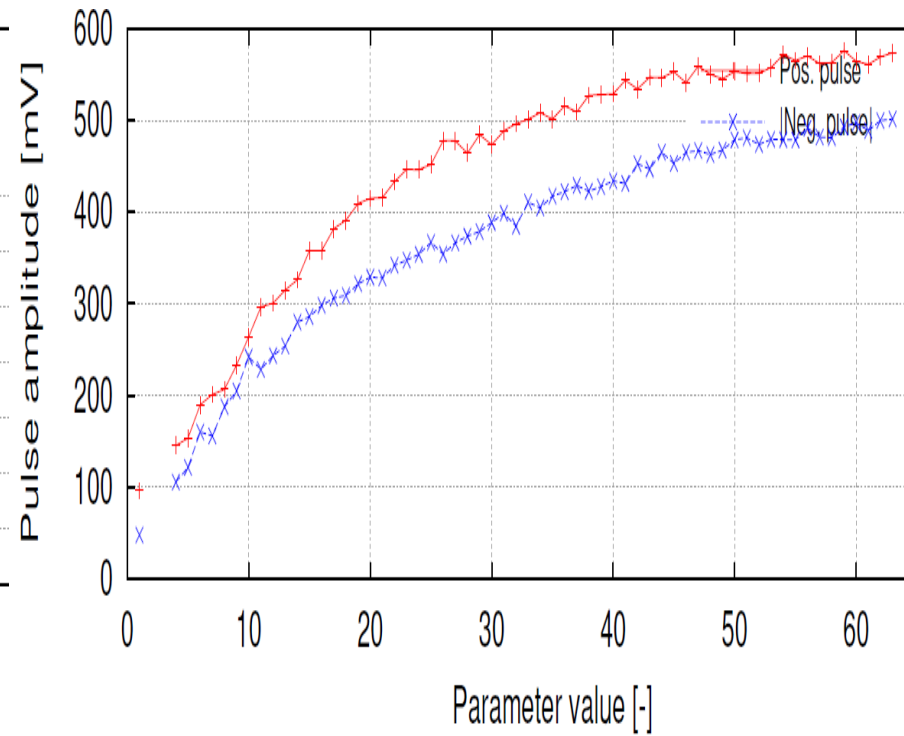
Sensor 12pF+1-3pFparas. on chan. -1,128

Channel 128, S2Diff Amp. vs Calib DAC

Pulse amplitude



Dummy current ON



Dummy current OFF



SALT v3 22/2/2019

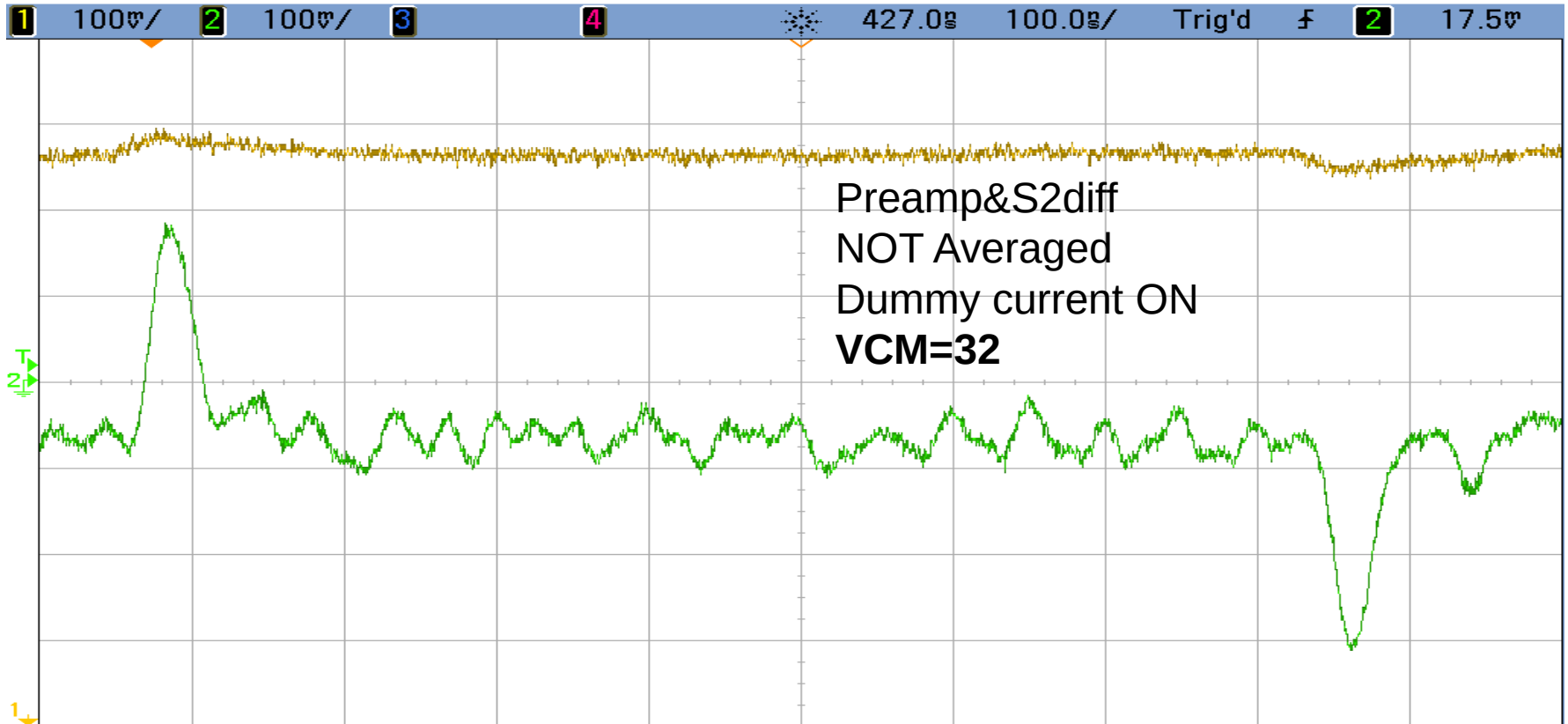
Sensor 24pF

Channel 128



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FRI FEB 22 16:21:09 2019



Measurement Menu

Source 2

Select: Min

Measure Min

Settings

Clear Meas

Statistics



SALT v3 22/2/2019

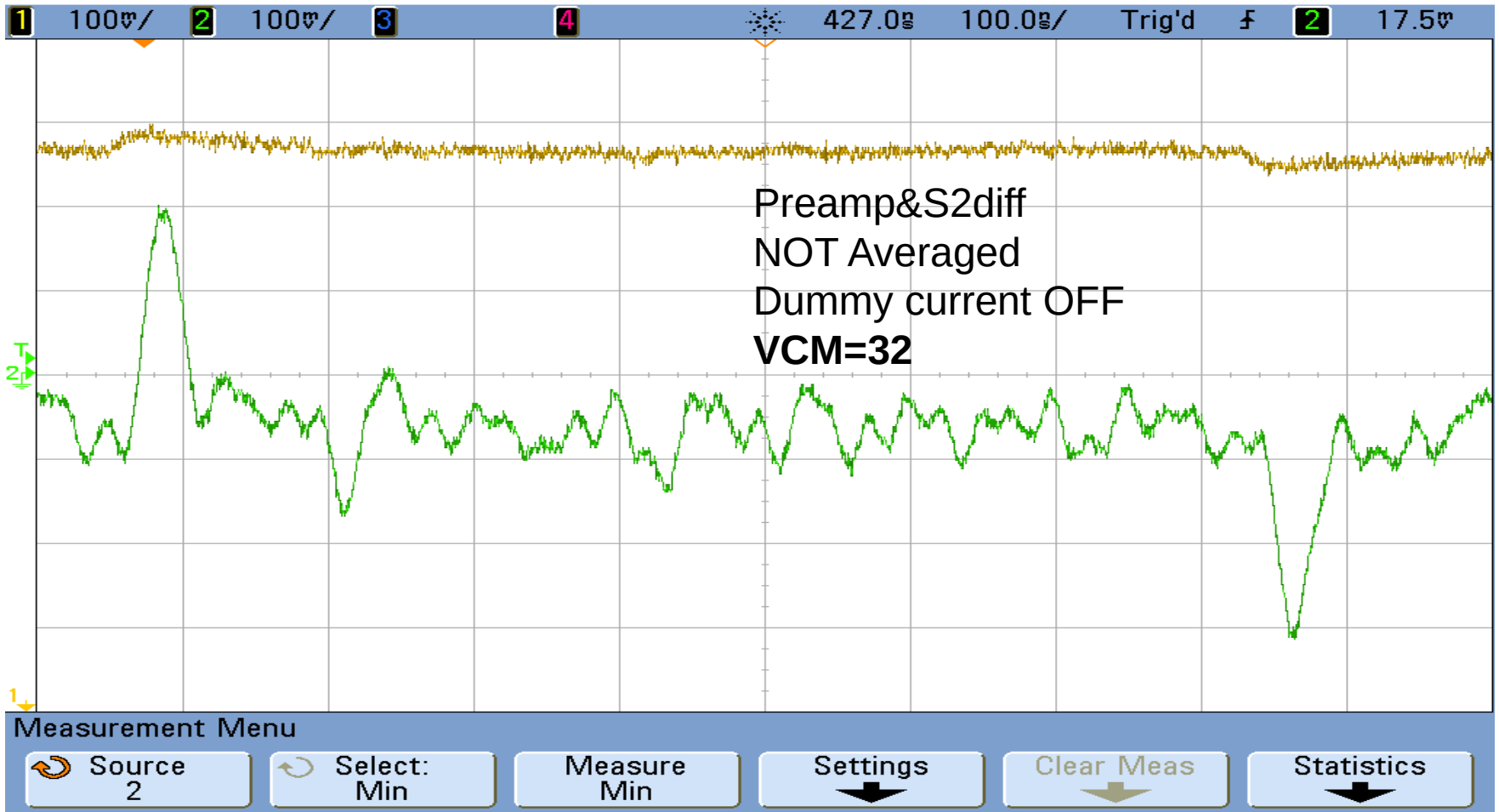
Sensor 24pF

Channel 128



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FRI FEB 22 16:21:30 2019





SALT v3 22/2/2019

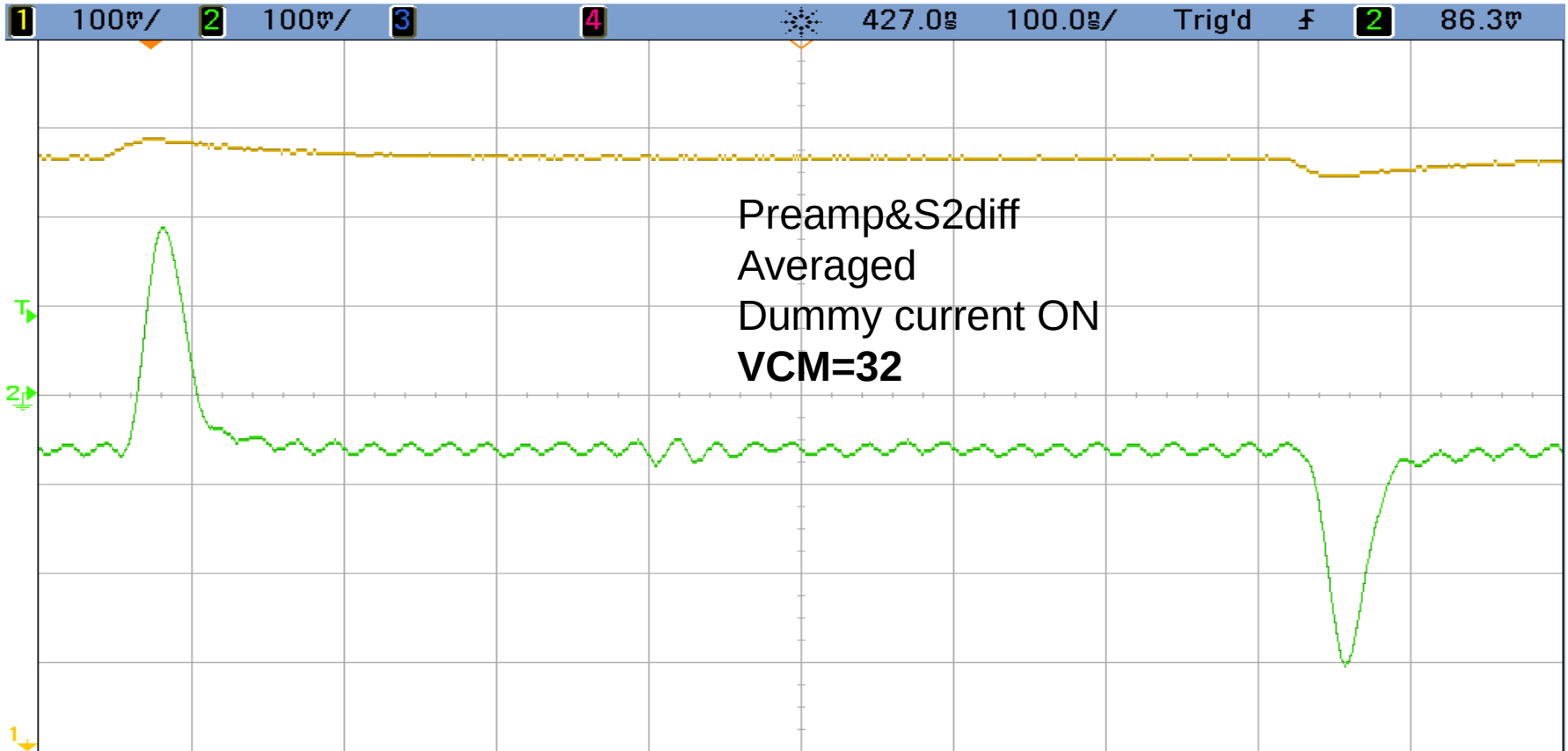
Sensor 24pF

Channel 128



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FRI FEB 22 16:22:03 2019



Acquire Menu

Acq Mode
Averaging

Avgs
128

Realtime



2.00GSa/s



SALT v3 22/2/2019

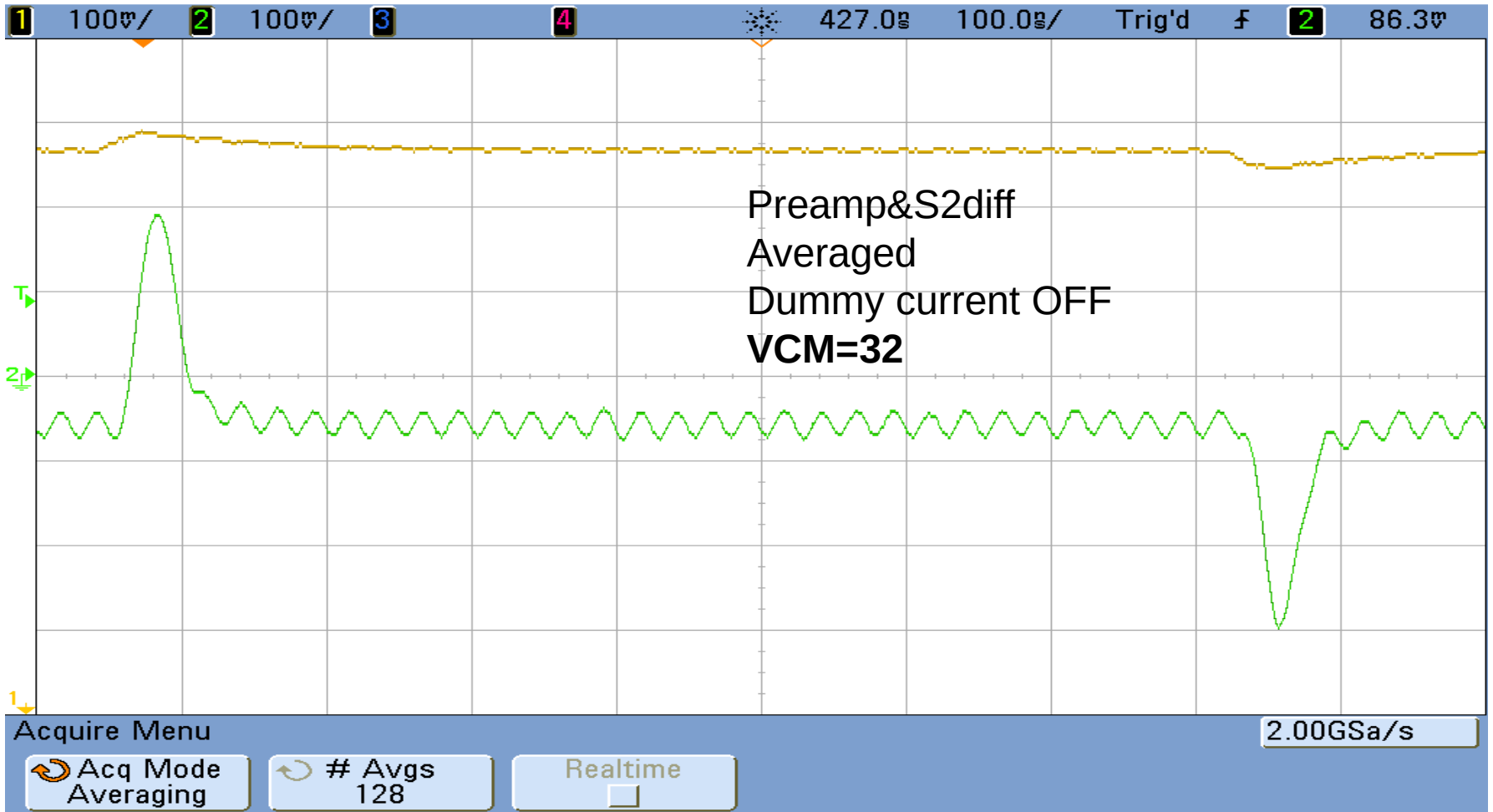
Sensor 24pF

Channel 128



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FRI FEB 22 16:21:50 2019





SALT v3, 2nd board 1/3/2019

Real Sensor “baby2” added

Channel -1

Measurements were done with all parameters set with defaults values (slide2).

Dummy current is ON and 128 ADCs are ON

Default HV=200V

For sensor decoupling resistor RHV4 **SHORTED**

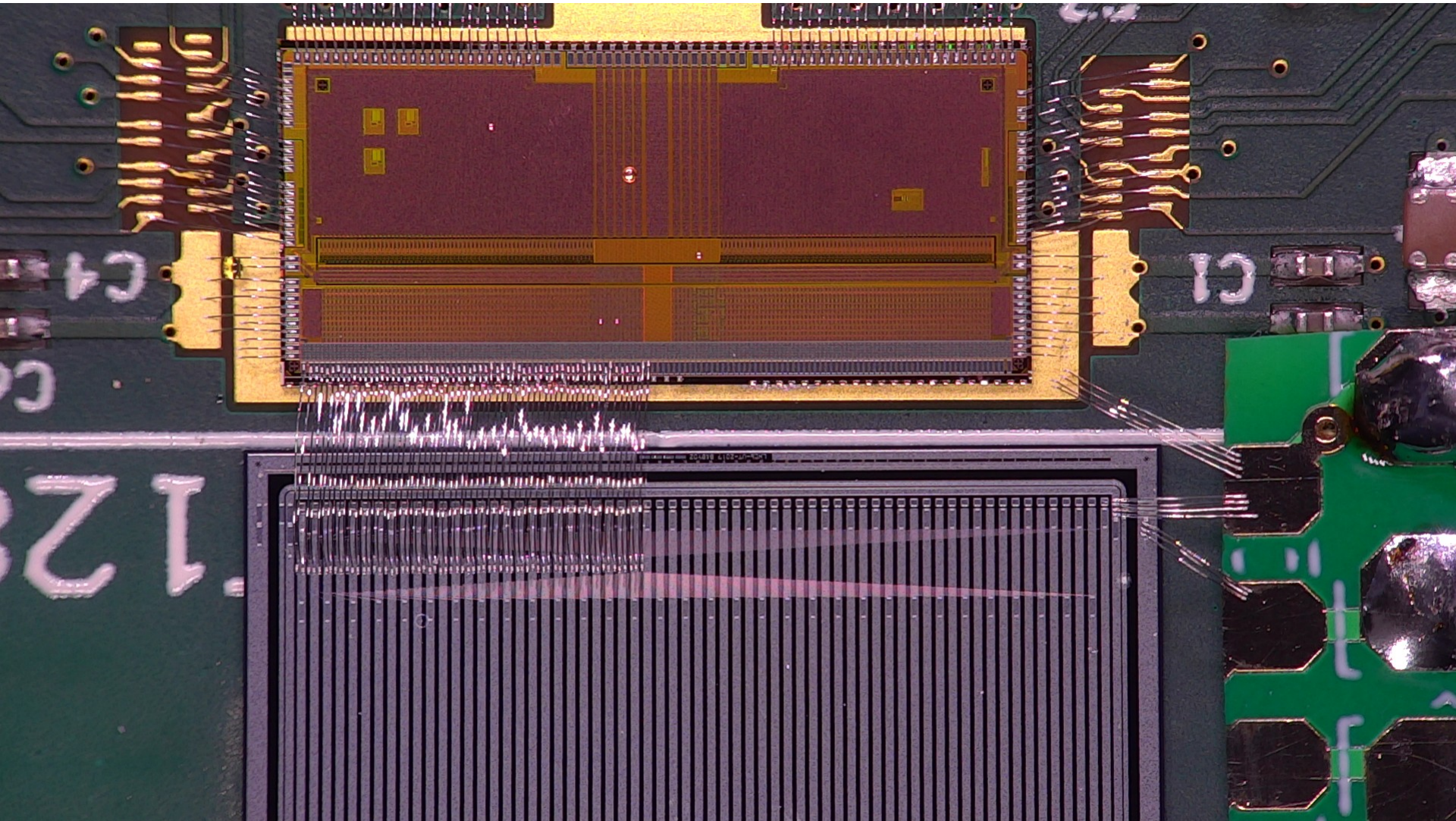
Measurements without sensor were also done (not shown here) giving good results
Important difference – effect of VcmDAC practically not observed on this chip/board



SALT v3, 2nd board 1/3/2019

Real Sensor "baby2" added

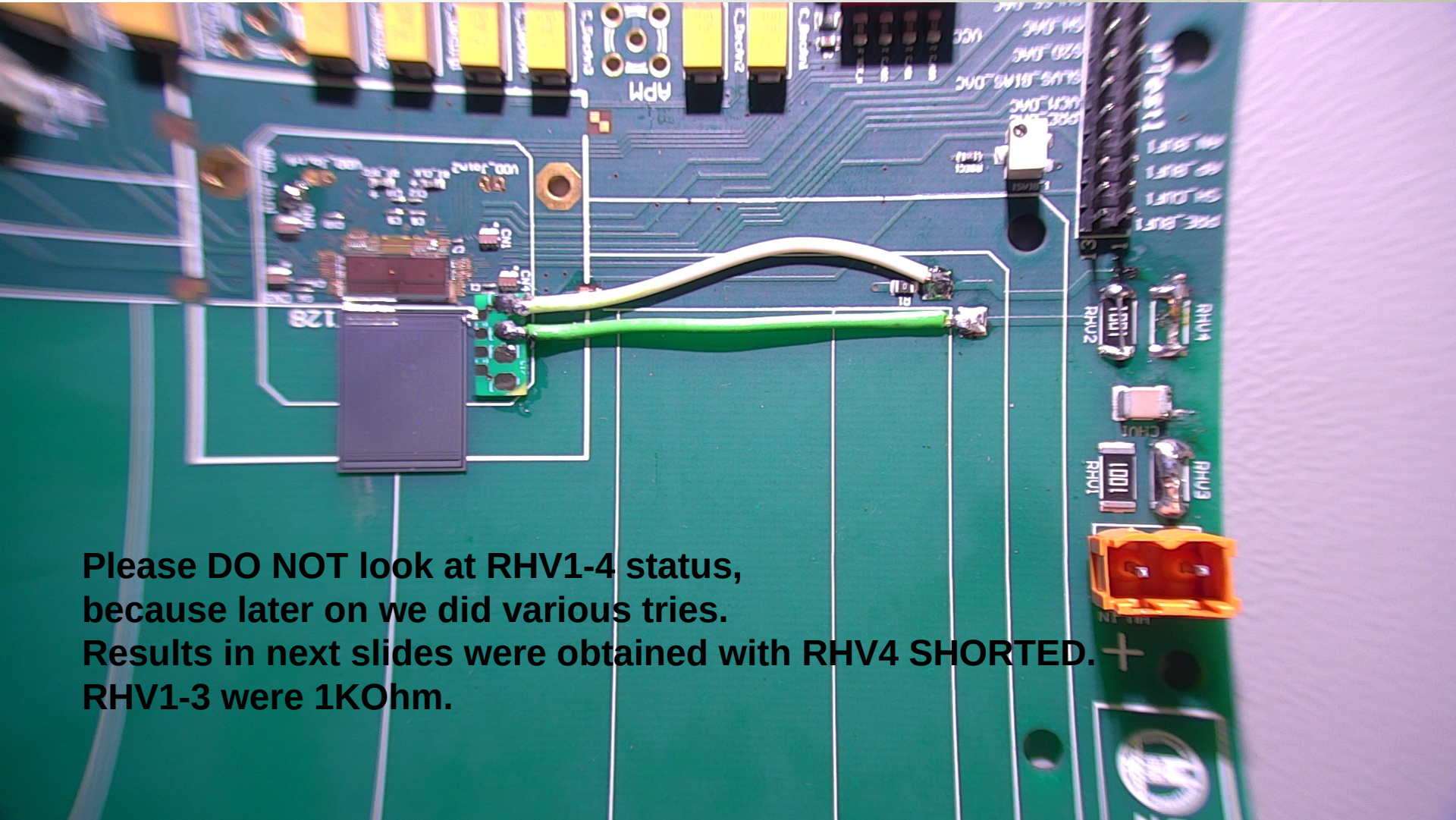
Setup



SALT v3, 2nd board 1/3/2019

Real Sensor “baby2” added

Setup



Please DO NOT look at RHV1-4 status, because later on we did various tries. Results in next slides were obtained with RHV4 SHORTED. RHV1-3 were 1KOhm.



SALT v3, 2nd board 1/3/2019

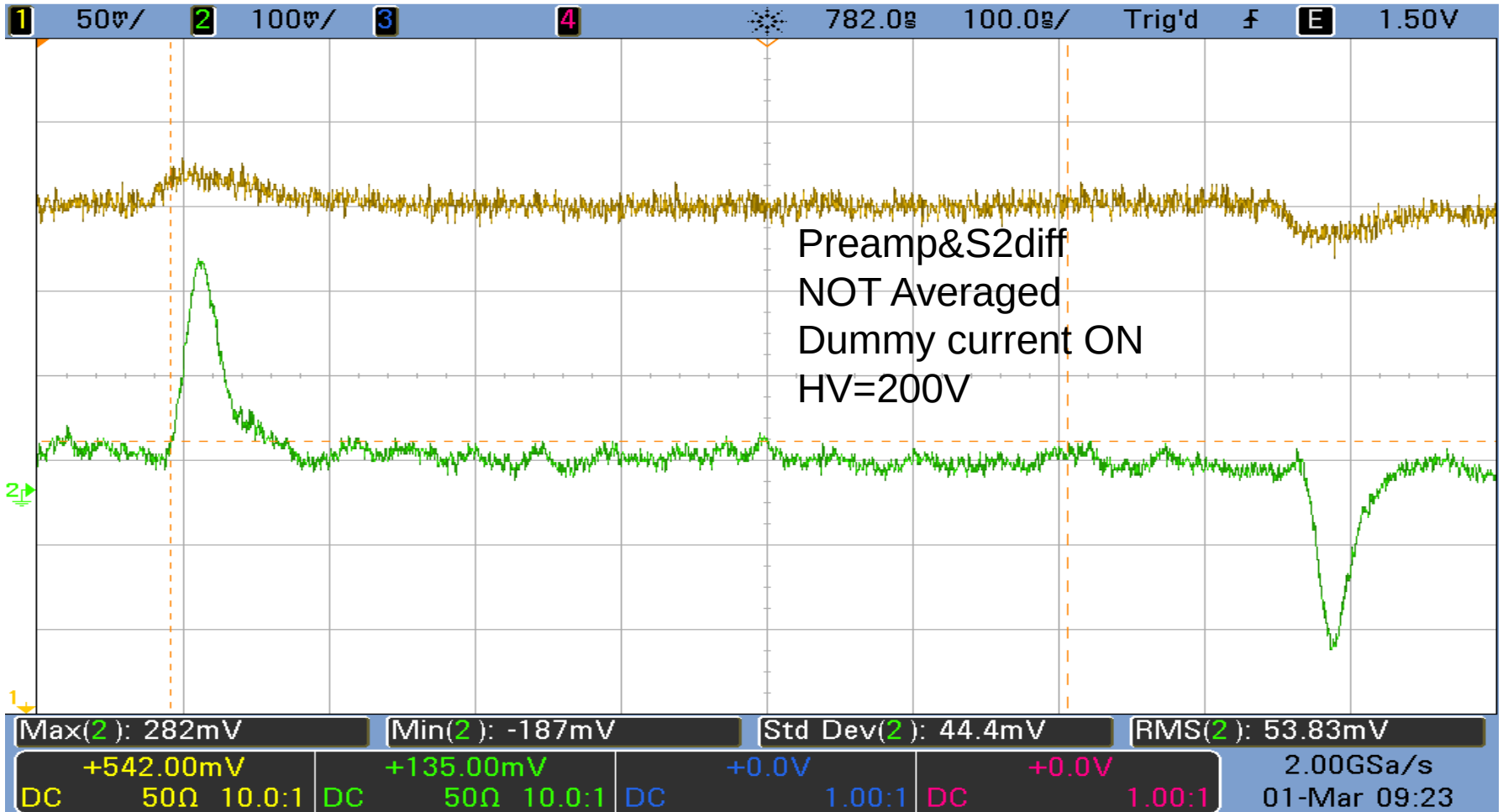
Real Sensor "baby2" added

Channel -1



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SALT v3, 2nd board 1/3/2019

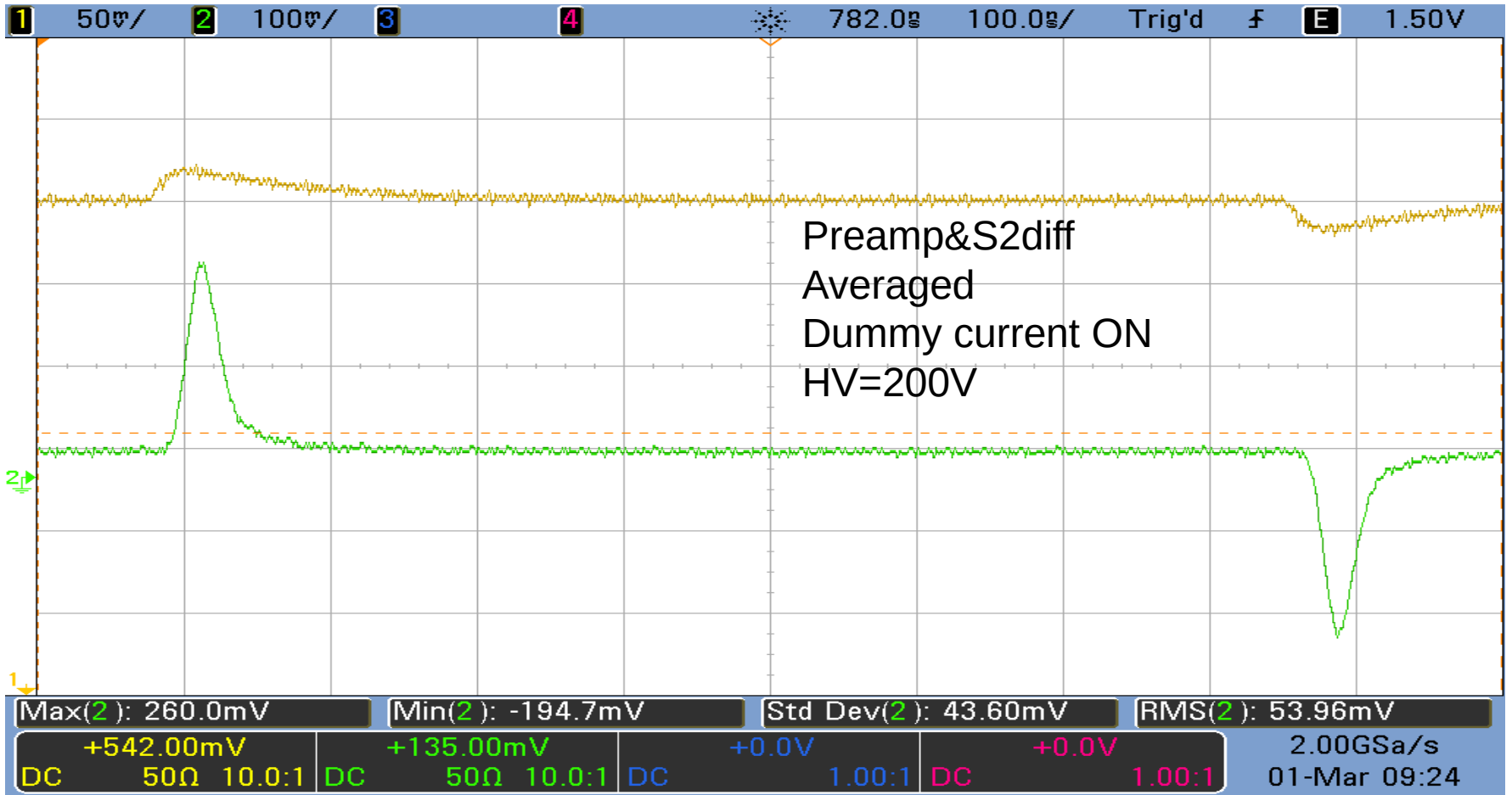
Real Sensor "baby2" added

Channel -1



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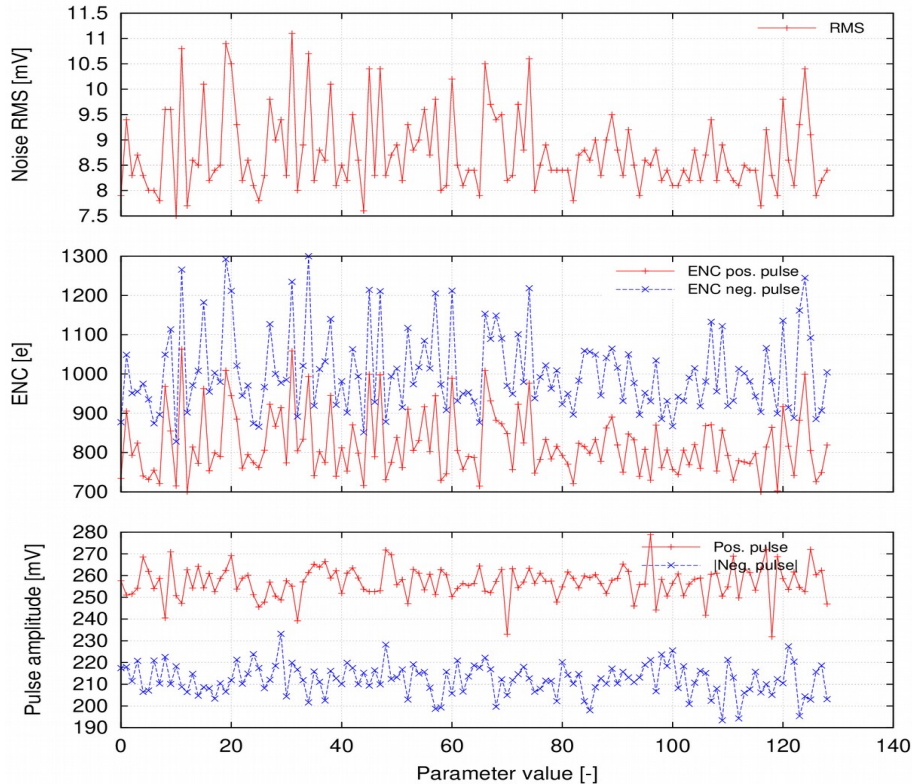
SALT v3 2nd board 1/3/2019

Real Sensor "baby2" added

Channel -1, SNR vs no. of ADCs ON

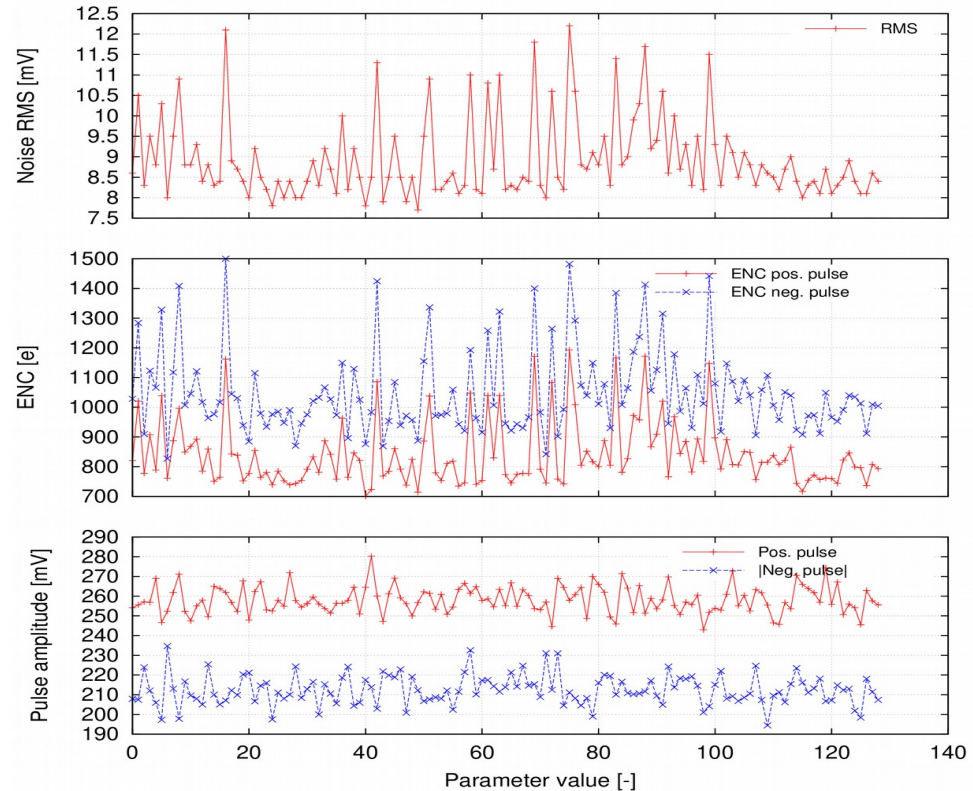
Noise RMS, ENC, Pulse amplitude
All ADCs ON default

SALT3_B02_AVE_param_baby200V_ch-1_withDummy_activity.par



Dummy current ON

SALT3_B02_AVE_param_baby200V_ch-1_noDummy_activity.par



Dummy current OFF



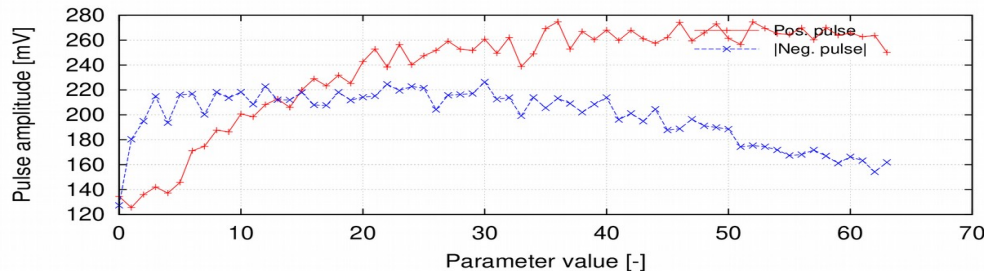
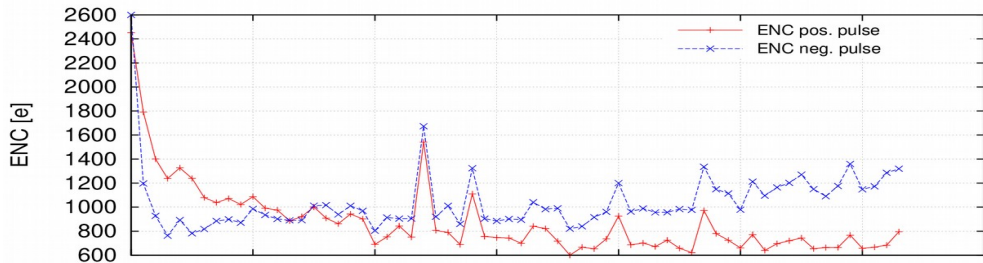
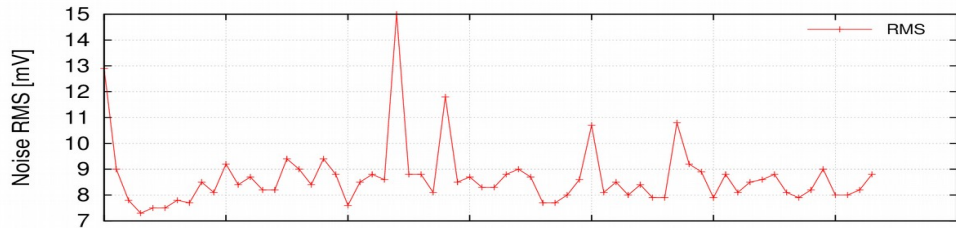
SALT v3, 2nd board 1/3/2019

Real Sensor "baby2" added

Channel -1, SNR vs Vcm DAC

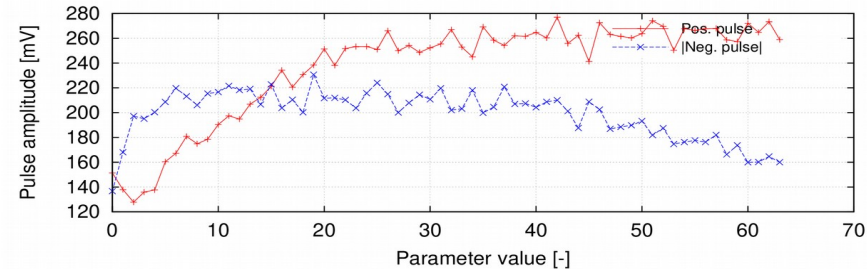
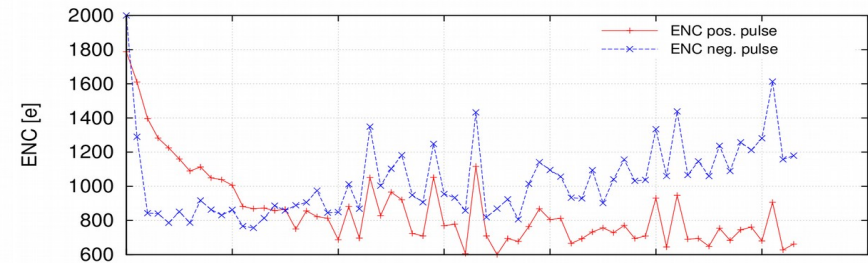
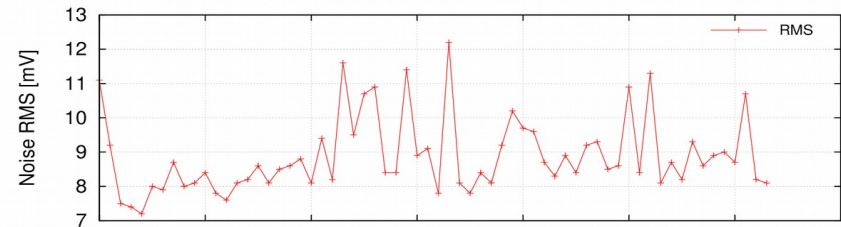
Noise RMS, ENC, Pulse amplitude
VcmDAC default = 32

SALT3_B02_AVE_param_baby200V_ch-1_withDummy_vcmDAC.par



Dummy current ON

SALT3_B02_AVE_param_baby200V_ch-1_noDummy_vcmDAC.par



Dummy current OFF



SALT v3, 2nd board 1/3/2019

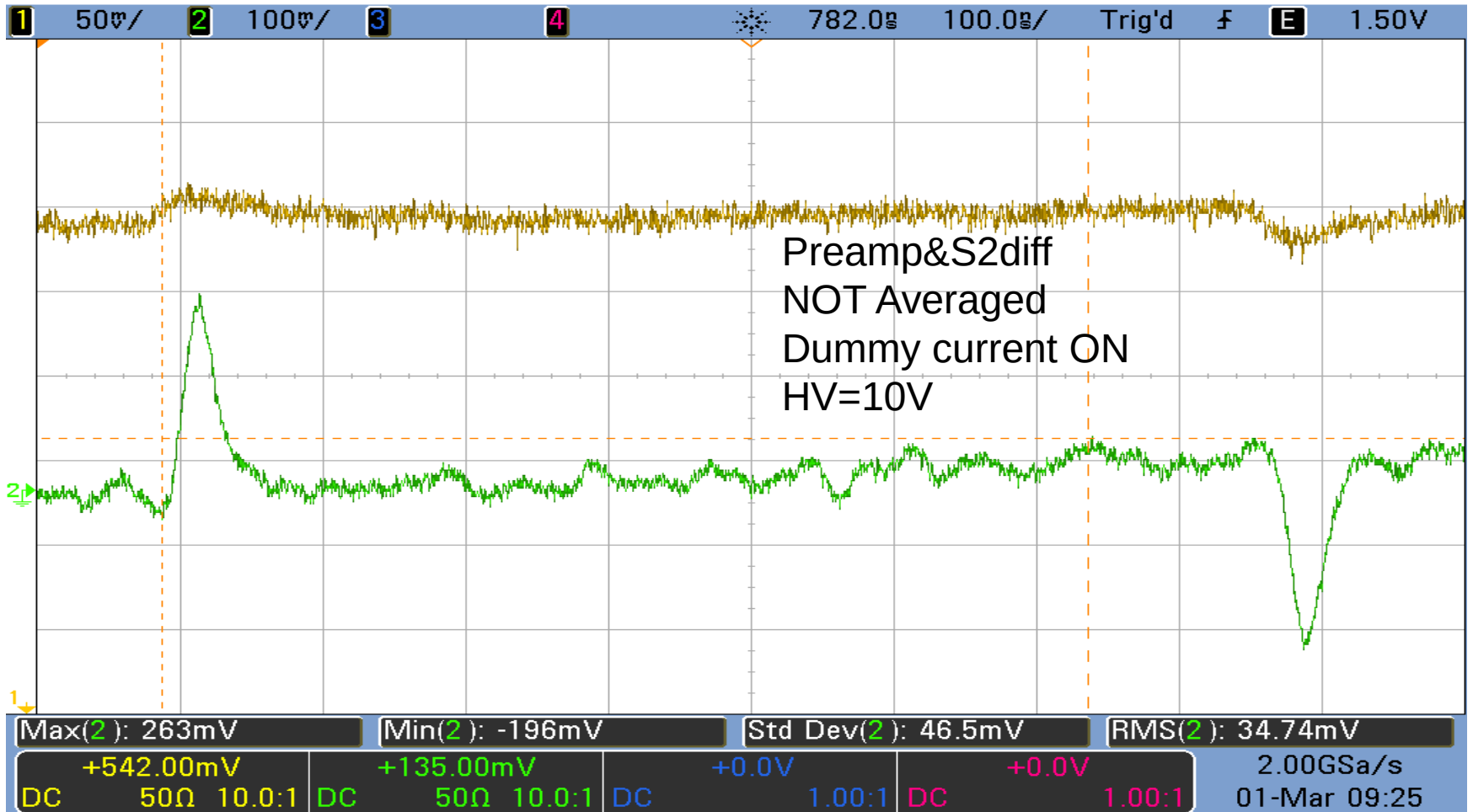
Real Sensor "baby2" added

Channel -1



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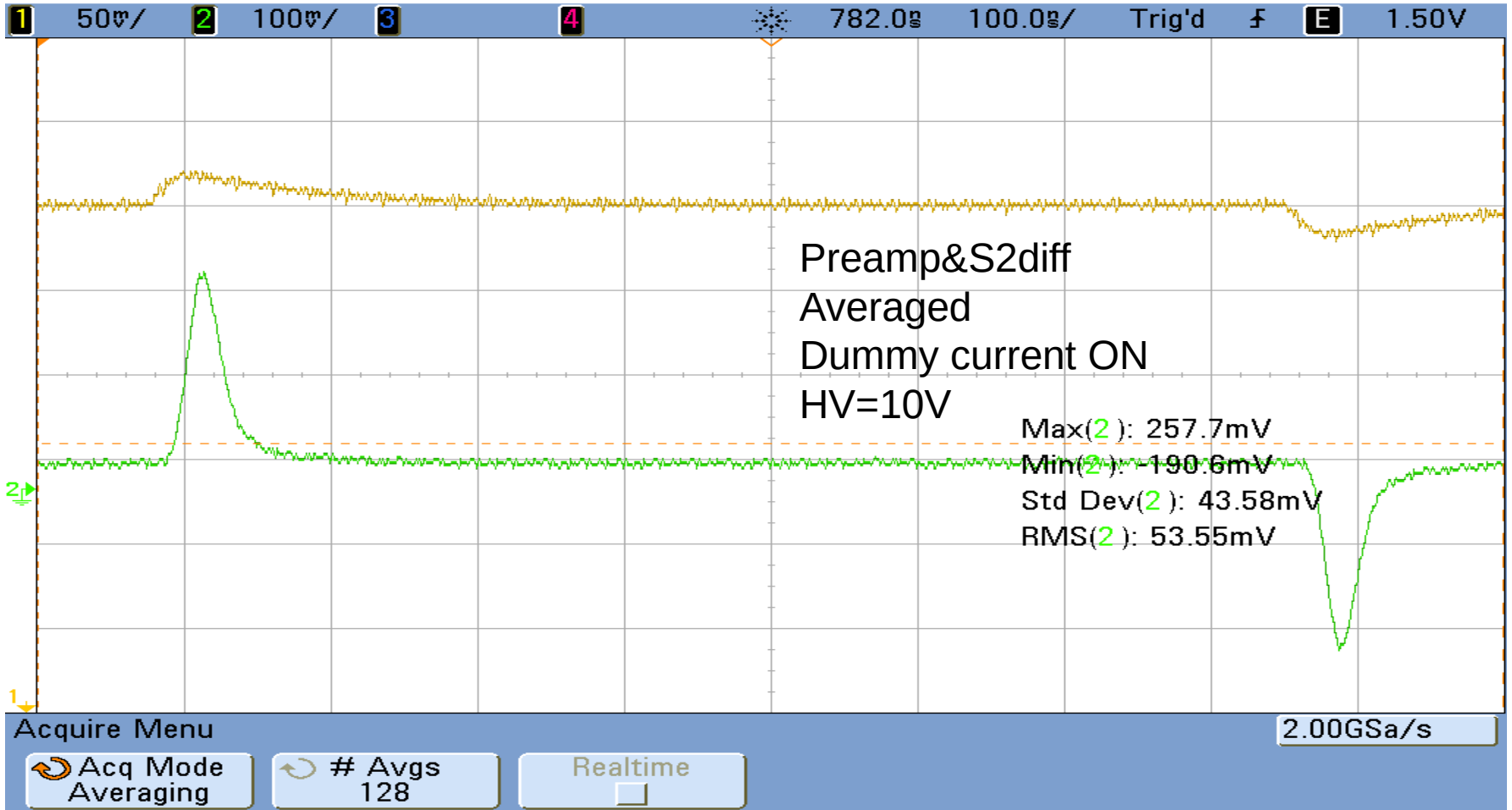
Real Sensor "baby2" added

Channel -1



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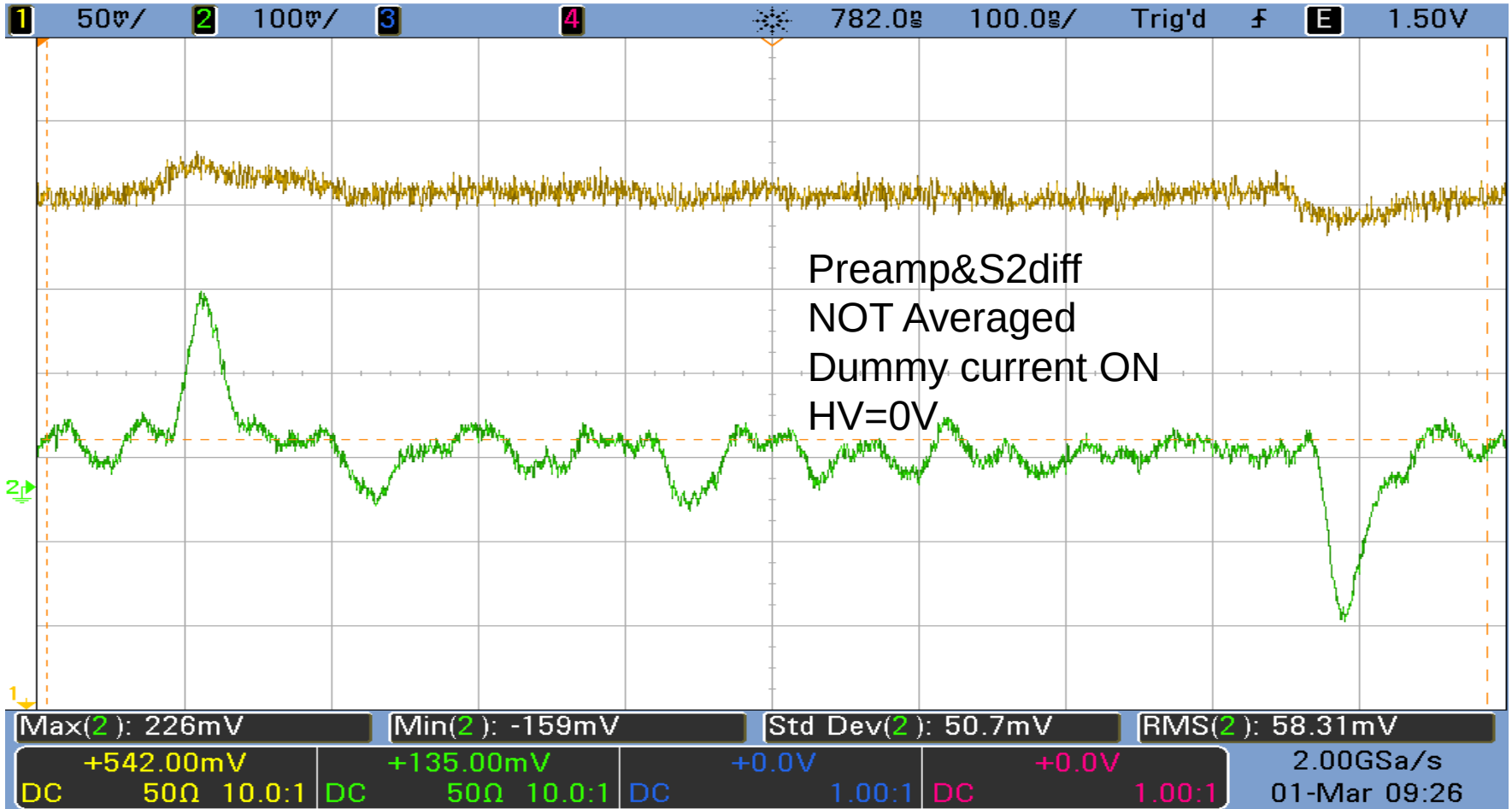
Real Sensor "baby2" added

Channel -1



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Real Sensor "baby2" added

Channel -1



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