

# Temperature Compensation

08.08.2018

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AIDA<sup>2020</sup>

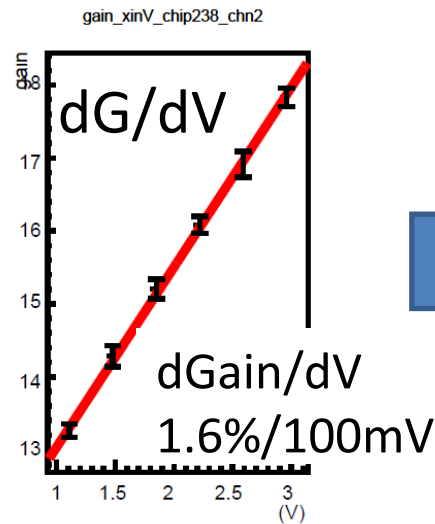
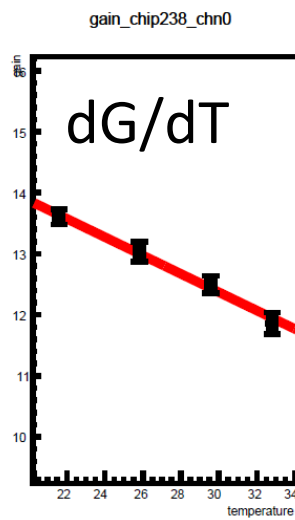
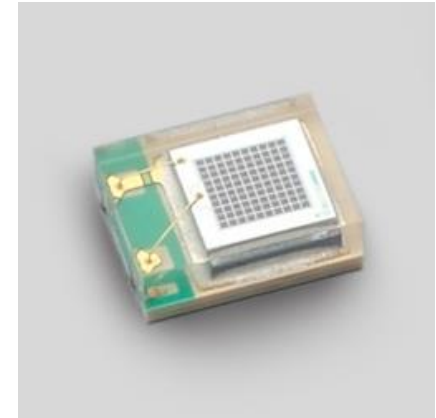


# Motivation of Temperature Compensation

- SiPM gain depends on temperature. Because breakdown voltage depends on temperature.  
(large quenching resistor )
- We want to keep gain ( $V_{ov}$ ) same as a value at reference point.  
Adjust bias voltage against temperature shift.

$$V_{ov} = V_{bias} - V_{break\ down}$$

1. Measure  $dG/dT$ ,  $dG/dV$  and calculate  $dV/dT$
2. Test temperature compensation  
(change bias voltage and temperature manually)
3. Automatic HV adjustment

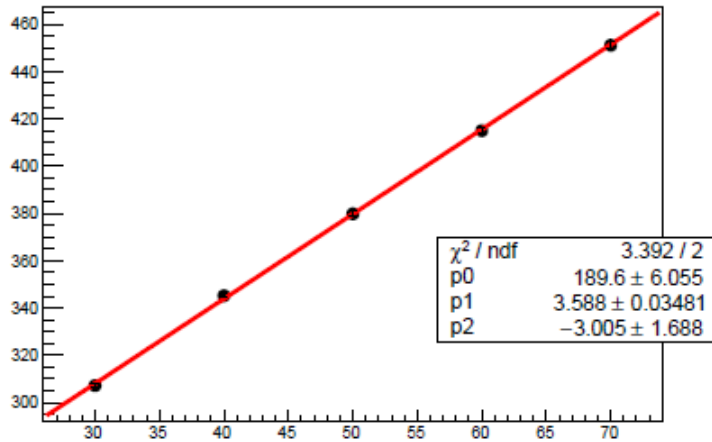


$$\frac{(dG/dV)}{(dG/dT)} = dV/dT$$

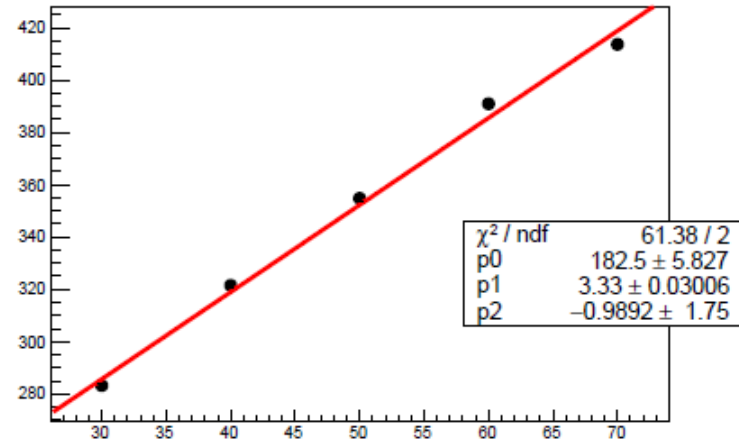
# dMIP/dV of central 4 channels

- dMIP/dV : 3.1-3.6 ADC/DAC (1 DAC ~37mV)
- MIP value shifts ~ 1.1% value at the 50 DAC per 1 DAC

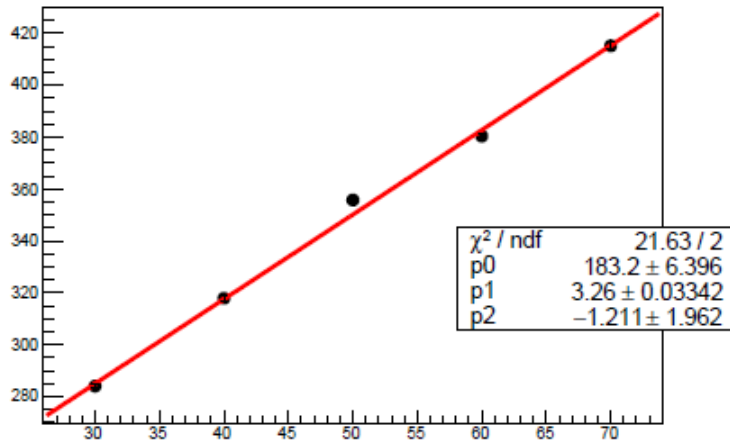
chip245 channel0



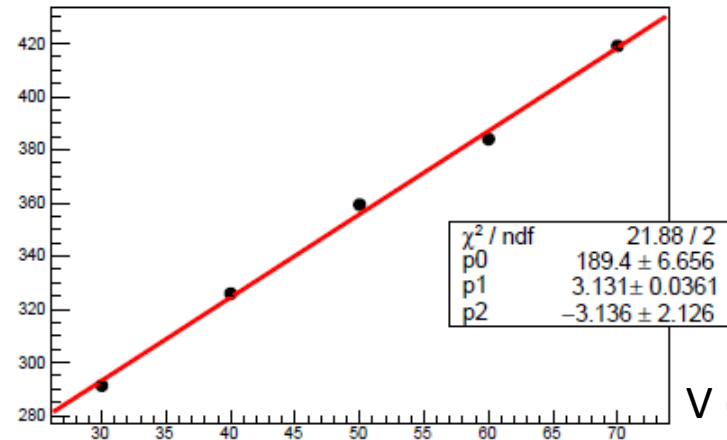
chip246 channel5



chip247 channel35



chip248 channel30



MIP constant (ADC)

V (DAC)

# $dMIP/dV$ is larger than $dGain/dV$ of MPPC

- $dMIP/dV$  is  $\sim 1.1\%/DAC$

but

- $dGain/dV$  of MPPC is  $\sim 0.6\%/DAC$

There is 0.5% gap between  $dMIP/dV$  and  $dGain/dV$

- What is considered cause of the gap?

# dMIP/dV is larger than dGain/dV of MPPC

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There is 0.5% gap between dMIP/dV and dGain/dV

- What is considered cause of the gap?

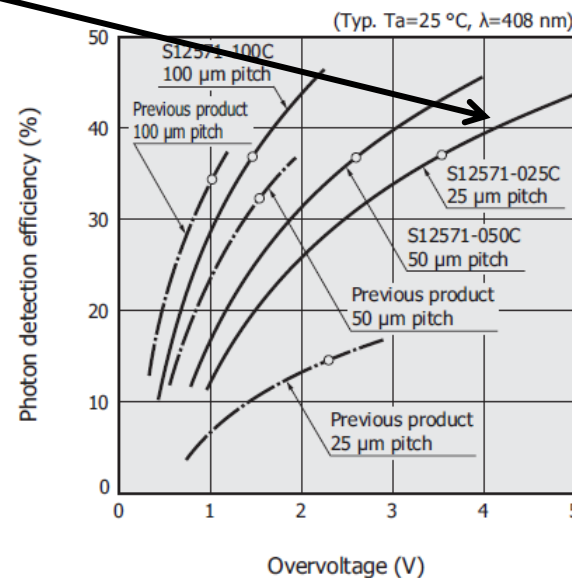
bias voltage dependence on properties of MPPC

- photon detection efficiency
- after pulsing probability
- cross talk probability
- ...

$$V_{ov} = V_{bias} - V_{break\ down}$$

ref. e03\_handbook\_si\_apd\_mppc.pdf

[Figure 2-8] Photon detection efficiency vs. overvoltage



# dMIP/dV is larger than dGain/dV of MPPC

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- but
- dGain/dV of MPPC is  $\sim 0.6\%/DAC$

There is 0.5% gap between dMIP/dV and dGain/dV

- What is considered cause of the gap?

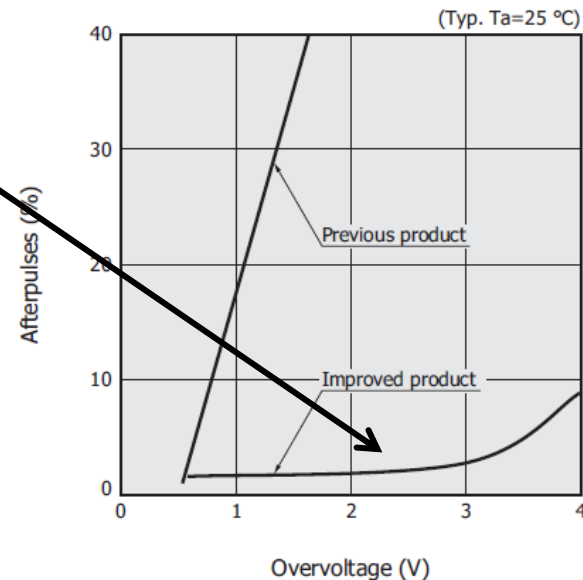
bias voltage dependence on properties of MPPC

- photon detection efficiency
- after pulsing probability
- cross talk probability
- ...

$$V_{ov} = V_{bias} - V_{break\ down}$$

ref. e03\_handbook\_si\_apd\_mppc.pdf

[Figure 2-7] Afterpulses vs. overvoltage



# dMIP/dV is larger than dGain/dV of MPPC

- dMIP/dV is  $\sim 1.1\%/DAC$
- but
- dGain/dV of MPPC is  $\sim 0.6\%/DAC$

There is 0.5% gap between dMIP/dV and dGain/dV

- What is considered cause of the gap?

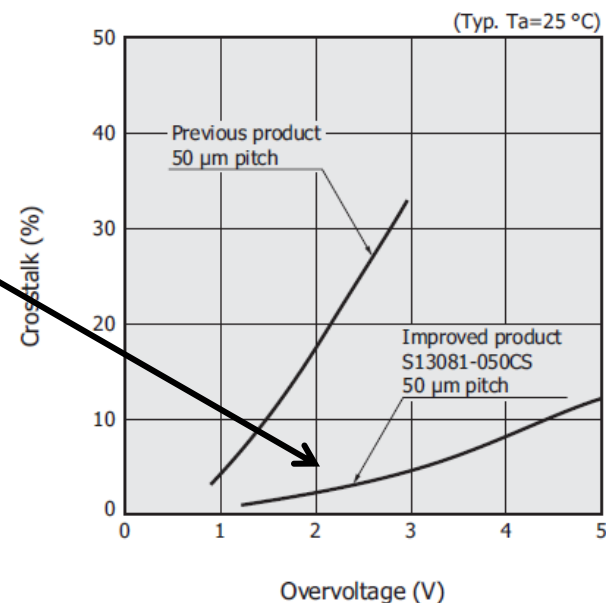
bias voltage dependence on properties of MPPC

- photon detection efficiency
- after pulsing probability
- **cross talk probability**
- ...

$$V_{ov} = V_{bias} - V_{break\ down}$$

ref. e03\_handbook\_si\_apd\_mppc.pdf

[Figure 2-11] Crosstalk vs. overvoltage



# Specification of the S13360 series

## Electrical and optical characteristics (Typ. Ta=25 °C, unless otherwise noted)

Type no.	Measurement conditions	Spectral response range $\lambda$	Peak sensitivity wavelength $\lambda_p$	Photon detection efficiency PDE*4 $\lambda=\lambda_p$	Dark count*5		Terminal capacitance Ct	Gain M	Break-down voltage VBR	Crosstalk probability	Recommended operating voltage Vop	Temperature coefficient at recommended operating voltage $\Delta TV_{op}$ (mV/°C)		
					Typ.	Max.								
		(nm)	(nm)	(%)	(kcps)	(kcps)	(pF)		(V)	(%)	(V)	(mV/°C)		
S13360-1325CS	Vover =5 V	270 to 900	450	25	70	210	60	$7.0 \times 10^5$	$53 \pm 5$	1	$V_{BR} + 5$	54		
S13360-1325PE		320 to 900												
S13360-3025CS		270 to 900			400	1200	320							
S13360-3025PE		320 to 900												
S13360-6025CS		270 to 900			1600	5000	1280							
S13360-6025PE		320 to 900												
S13360-1350CS	Vover =3 V	270 to 900		40	90	270	60	$1.7 \times 10^6$		$53 \pm 5$	3		$V_{BR} + 3$	
S13360-1350PE		320 to 900												
S13360-3050CS		270 to 900			500	1500	320							
S13360-3050PE		320 to 900												
S13360-6050CS		270 to 900												
S13360-6050PE		320 to 900												
S13360-1375CS	Vover =3 V	270 to 900		50		500	1500	320		$4.0 \times 10^6$		7	$V_{BR} + 3$	
S13360-1375PE		320 to 900												
S13360-3075CS		270 to 900												
S13360-3075PE		320 to 900												
S13360-6075CS		270 to 900				2000	6000	1280						
S13360-6075PE		320 to 900												

Temperature coefficient of  $V_{br} = 54\text{mV/}^\circ\text{C}$   
 $\rightarrow 1\text{DAC}/0.6$

Temperature coefficient of  $V_{br} = 54\text{mV}/^\circ\text{C}$   
 $\rightarrow 1\text{DAC}/0.685^\circ\text{C}$



# Procedure of the Temperature Compensation

- preparation of reference files

measure current temperature



make a reference file of temperature set average of T3-T6 to 25 degree C.

make a reference file of HV adjust value from passport

make a dT/dV setting file

#LDA	Port	T1	T2	T3	T4	T5	T6	TDIF	TPower	HV1
0	1			260,50		242,50		257,50		230
0	2			270,00		243,00		258,00		231
0	3			267,50		241,50		258,50		231
0	33			267,25		242,25		258,25		232
0	34			267,00		232,00		259,00		227
0	35			260,75		226,75		255,75		223
#EOF										

# Procedure of the Temperature Compensation

- preparation of reference files

debug 85450

Program Exit STOP

1) Detector Config. 2) System Setup 3) Slow Control 4) Calibration 5) Take Data 6) HV Adjust Expert/Debug

calibration tab

Delay Lines

Set Delays (ns) Delays readback (ns)

Delay1 13 Delay1 0

Delay2 13 Delay2 0

Delay3 40 Delay3 0

Set

Ack

DACs (VCALIB)

calib\_DAC\_settings DAC Setup

First for all

DAC1 (LED, 0..10V) 6750 mV

DAC2 (q, 0..3.5V) 500 mV

Set

Ack

Enable Section

Trig\_Ext synchr. (1) PWR\_LED (7) PWR\_Charge (8)

TCALIB1 (5) Slab\_Power SiPM\_Bias 2

TCALIB2 (4) Pre\_Bias 2

Hold\_Ext (3) Trig\_Ext async. (2)

TCALIB\_direct (9)

TCALIB\_ext (6) TCALIB\_Hold (10)

Do not change!

Set

Ack

Temperatures

SerialNo LDA: 0Port: 1

Temp1	352	VCALIB1	0	VDD0	3326	HV1	61472
Temp2	324	VCALIB2	2	ID00	3717	H1	809
Temp3	349	VTEMP	692	IDAC	3601	HV2	61105
Temp4	322	VDDA	3299	REF	3720	H2	792
Temp5	348	VDAC	4952	IDDA	0	HV3	60888
Temp6	311	VREF	4498	reserved 4	3335	H3	792
T DIF	33	reserved	0	reserved 3	3312	reserved 2	0
T POWER	33	VADCKREF	2501	VADCKREF 3	2501	VADCKREF 2	2501

all temperatures in [°C], all voltages in [mV], all currents in [mA]

Read

Set

Ack

write tmp. info

temperatures, HV1, HV2 and HV3

OFF

F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\temperature

click here

set temperature file path without suffix

# Procedure of the Temperature Compensation

- preparation of reference files

The screenshot shows the 'Main.vi Front Panel on AHCAL\_DAQ\_xLDA.lvproj/My Computer' window. The interface includes a menu bar (File, Edit, View, Project, Operate, Tools, Window, Help), a toolbar, and a status bar. The main panel is divided into several sections: 'Delay Lines', 'DACs (VCALIB)', 'Enable Section', and 'Temperatures'. The 'Temperatures' section is highlighted with a red box. It contains a table of temperature and voltage data for various modules, a 'Read' button, and a text field for the file path.

**Temperatures Section Data:**

SerialNo	LDA: 0Port: 1
Temp1 352	VCALIB1 0
Temp2 324	VCALIB2 2
Temp3 349	VTEMP 692
Temp4 322	VDDA 3299
Temp5 348	VDAC 4952
Temp6 311	VREF 4498
T DP 33	reserved 0
T POWER 33	VADCKREF 2501
	VDDO 3326
	IDDO 3717
	IDAC 3601
	REF 3720
	IDDA 0
	reserved 4 3335
	reserved 3 3312
	reserved 2 0
	VADCKREF 3 2501
	VADCKREF 2 2501

all temperatures in [°C], all voltages in [mV], all currents in [mA]

write tmp. info ON

temperatures, HV1, HV2 and HV3

F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\temperature

click here

temperature read with ASIC power on

# Procedure of the Temperature Compensation

- preparation of reference files

debug 85450

Program Exit

STOP

hv adjust tab

1) Detector Config. 2) System Setup 3) Slow Control 4) Calibration 5) Take Data 6) HV Adjust Expert/Debug

val\_Adj\_HV1 71 Adjust

Set 0 Ack 0

HV1 Read

HV1 value LDA 1 port 15

val\_Adj\_HV2 0 Adjust

Set 0 Ack 0

HV2 Read

HV2 value LDA 1 port 15

val\_Adj\_HV3 64 Adjust

Set 0 Ack 0

HV3 Read

HV3 value LDA 1 port 15

HV setting file F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust\_latest.txt Adjust

adjust\_HV1\_use\_setting\_file return Set 0 Ack 0

adjust\_HV2\_use\_setting\_file return Set 0 Ack 0

adjust\_HV3\_use\_setting\_file return Set 0 Ack 0

HV setting file ref. F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust\_reference.txt

temperature reference file F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\temperature\_reference.txt

Create new HV setting file new HV adjust setting file

set F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust

d temp. / 1 DAC Array

LDA 1 0,343 !! input a half value of dT/dDAC !!

port 15

F:\CERN\_2018\_June\dtemp\_dv\_setting.txt set dt/dv

delta T 0 8,225 HV value is changed

LDA 1

port 1

new setting

#LDA port HV1 HV2 HV3

#unixtime 1530172969

0 1 85 76 76

0 2 78 77 77

0 3 63 77 77

0 4 78 77 77

0 5 87 0 80

0 6 88 79 79

0 7 87 76 76

0 8 64 78 78

0 9 70 79 79

0 10 78 78 78

N good Temp. mon.

LDA 0 4

port 1

set and read all HV adjust

initialize reference files by current value

save latest temperature file as a reference set reference temperature to

make HV reference from current value

25

1. click here

2. click here

full path of the reference temperature file

# Procedure of the Temperature Compensation

- preparation of reference files

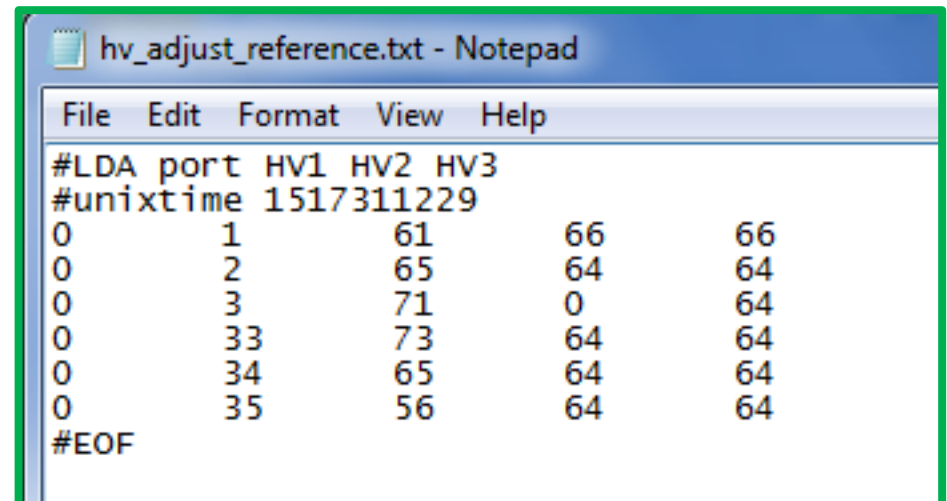
measure current temperature



make a reference file of temperature set average of T3-T6 to 25 degree C.

make a reference file of HV adjust value from passport

make a dT/dV setting file

A screenshot of a Notepad window titled 'hv\_adjust\_reference.txt - Notepad'. The window shows a text file with a menu bar (File, Edit, Format, View, Help) and the following content:

```
#LDA port HV1 HV2 HV3
#unixtime 1517311229
0      1      61      66      66
0      2      65      64      64
0      3      71      0      64
0     33      73      64      64
0     34      65      64      64
0     35      56      64      64
#EOF
```

# Procedure of the Temperature Compensation

- preparation of reference files

Main.vi Front Panel on AHCAL\_DAQ\_xLDA.lvproj/My Computer\*

File Edit View Project Operate Tools Window Help

debug 85450 Program Exit STOP

1) Detector Config. 2) System Setup 3) Slow Control 4) Calibration 5) Take Data 6) HV Adjust Expert/Debug

ROC mod 256

val\_Adj\_HV1 71 Adjust

val\_Adj\_HV2 0 Adjust

val\_Adj\_HV3 64 Adjust

HV1 HV2 HV3

Set Ack Set Ack Set Ack

LDA port LDA port LDA port

HV1 value HV2 value HV3 value

0 0 0

15 15 15

Create new HV setting file new HV adjust setting file

set F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust

d temp./1 DAC Array

LDA 1 0,343 !! input a half value of dT/dDAC !!

port 15

F:\CERN\_2018\_June\dtemp\_dv\_setting.txt set dt/dv

delta T HV value is changed

LDA 0 8,225

port 1

delta HV adjust

LDA 0 12

port 1

N good Temp. mon.

LDA 0 4

port 1

new setting

#LDA port HV1 HV2 HV3

#unixtime 1530172969

0 1 85 76 76

0 2 78 77 77

0 3 63 77 77

0 4 78 77 77

0 5 87 0 80

0 6 88 79 79

0 7 87 76 76

0 8 64 78 78

0 9 70 79 79

adjust\_HV1\_use\_setting\_file return

Set Ack

adjust\_HV2\_use\_setting\_file return

Set Ack

adjust\_HV3\_use\_setting\_file return

Set Ack

HV setting file ref.

F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust\_referen

temperature reference file

F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\temperature\_reference.txt

last compensation

09:27:54,644

28.06.2018

you can check current setting of hv adjust value by clicking two times

Initialize reference files by current value

save latest temperature file as a reference

set reference temperature to

make HV reference from current value

EN 11:22 02.08.2018

# Procedure of the Temperature Compensation

- preparation of reference files

debug 85450

Program Exit STOP

1) Detector Config. 2) System Setup 3) Slow Control 4) Calibration 5) Take Data 6) HV Adjust Expert/Debug

ROC mod 256

val\_Adj\_HV1 71 Adjust Set 0 Ack 0 HV1 Read Set 0 Ack 0 LDA 1 port 15 HV1 value

val\_Adj\_HV2 0 Adjust Set 0 Ack 0 HV2 Read Set 0 Ack 0 LDA 1 port 15 HV2 value

val\_Adj\_HV3 64 Adjust Set 0 Ack 0 HV3 Read Set 0 Ack 0 LDA 1 port 15 HV3 value

HV setting file F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust\_latest.txt Adjust

adjust\_HV1\_use\_setting\_file return Set 0 Ack 0 adjust\_HV2\_use\_setting\_file return Set 0 Ack 0 adjust\_HV3\_use\_setting\_file return Set 0 Ack 0

HV setting file ref. F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust\_reference.txt

temperature reference file F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\temperature\_reference.txt

Create new HV setting file new HV adjust setting file F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust

d temp. / 1 DAC Array LDA 1 port 15 0,343 !! input a half value of dT/dDAC !! set dt/dv

F:\CERN\_2018\_June\dtemp\_dv\_setting.txt

delta T LDA 0 port 1 8,225 HV value is changed

new setting #LDA port HV1 HV2 HV3 #unixtime 1530172969 0 1 85 76 76 0 2 78 77 77 0 3 63 77 77 0 4 78 77 77 0 5 87 0 80 0 6 88 79 79 0 7 87 76 76 0 8 64 78 78 0 9 70 79 79 0 10 78 78 78

delta HV adjust LDA 0 port 1 12

N good Temp. mon. LDA 0 port 1 4

set and read all HV adjust

initialize reference files by current value

save latest temperature file as a reference set reference temperature to 25

make HV reference from current value

full path of the reference file for HV adjust

if you don't have a reference file for hv adjust values of current configuration, you can make a reference file from current hv adjust value by clicking this button.

# Procedure of the Temperature Compensation

- preparation of reference files

measure current temperature



make a reference file of temperature set average of T3-T6 to 25 degree C.

make a reference file of HV  
adjust value from passport

make a dT/dV setting file

```
dtemp_dv_setting.txt - Notepad
File Edit Format View Help
#LDA port dtemp/dv 0,54/1deg 0,685deg/1DAC ! di
0 0 0,343
0 1 0,343
0 2 0,343
0 3 0,343
0 4 0,343
0 5 0,343
0 6 0,343
0 7 0,343
.....
0 39 0,343
0 40 0,343
0 41 0,343
0 42 0,343
0 43 0,343
0 44 0,343
0 45 0,343
0 46 0,343
0 47 0,343
#EOF
```



# Procedure of the Temperature Compensation

- preparation of reference files

The screenshot displays the LabVIEW interface for the AHCAL\_DAQ\_xLDA.vi project. The main panel is divided into several sections:

- Top Panel:** Includes a menu bar (File, Edit, View, Project, Operate, Tools, Window, Help), a toolbar, and a status bar showing "debug 85450".
- Navigation Tabs:** 1) Detector Config., 2) System Setup, 3) Slow Control, 4) Calibration, 5) Take Data, 6) HV Adjust, Expert/Debug.
- HV Adjustment Section:** Contains three rows of controls for HV1, HV2, and HV3. Each row has "Set", "Ack", "Read", and "LDA" buttons, along with numerical input fields and "HV1 value", "HV2 value", and "HV3 value" indicators.
- HV Setting File Section:** Includes a "Create new HV setting file" button and a text field for the file path: "F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust".
- Temperature Compensation Section:** Features a "delta T" input field (set to 0.343) and a "set dt/dv" button. Below this is a "full path of the dT/DAC setting file" text field containing "F:\CERN\_2018\_June\dtemp\_dv\_setting.txt".
- Reference Files Section:** Includes a "set reference temperature to" button and a "make HV reference from current value" button.

Annotations and Callouts:

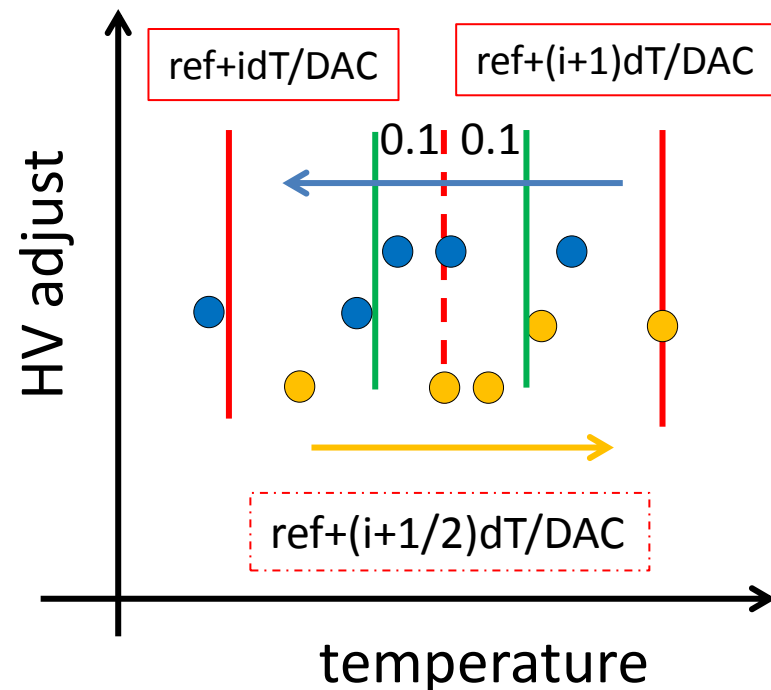
- A blue box highlights the "delta T" input field and the "set dt/dv" button, with a blue arrow pointing to the text: "you can check a setting with the indicator. you can set a value individually by hand."
- A white box highlights the "full path of the dT/DAC setting file" text field, with the text: "full path of the dT/DAC setting file".

The bottom status bar shows the system time as 11:22 on 02.08.2018.

# Procedure of the Temperature Compensation

- make a new hv adjustment file

1. compute  $\Delta T_1$  from current temperature and reference value
2. calculate new hv adjust value  $\rightarrow HV_1$
3. compute  $\Delta T_2$  from previous temperature and reference value
4. calculate hv adjust value with  $\Delta T_2 \rightarrow HV_2$
5. classify  $HV_1 - HV_2$  to 3 categories  
= 0,  $\geq 2$ ,  $\leq -2 \rightarrow HV1$   
= 1  $\rightarrow$  take hysteresis into account  
= -1  $\rightarrow$  take hysteresis into account



# Procedure of the Temperature Compensation

- make a new hv adjustment file

debug 85450

Program Exit

STOP

1) Detector Config. 2) System Setup 3) Slow Control 4) Calibration 5) Take Data 6) HV Adjust Expert/Debug

val\_Adj\_HV1 71 Adjust Set 0 Ack 0 Read HV1 HV1 value LDA 1 0 port 15

val\_Adj\_HV2 0 Adjust Set 0 Ack 0 Read HV2 HV2 value LDA 1 0 port 15

val\_Adj\_HV3 64 Adjust Set 0 Ack 0 Read HV3 HV3 value LDA 1 0 port 15

HV setting file F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust\_latest.txt Adjust

adjust\_HV1\_use\_setting\_file return Set 0 Ack 0

adjust\_HV2\_use\_setting\_file return Set 0 Ack 0

adjust\_HV3\_use\_setting\_file return Set 0 Ack 0

HV setting file ref. F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust\_reference.txt

temperature reference file F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\temperature\_reference.txt

last compensation 09:27:54,644 28.06.2018

Create new HV setting file new HV adjust setting file

set F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust

delta T 8,225 HV value is changed

delta HV adjust 12

N good Temp. mon. 4

new setting #LDA port HV1 HV2 HV3 #unixtime 1530172969 0 1 85 76 76 0 2 78 77 77 0 3 63 77 77 0 4 78 77 77 0 5 87 0 80 0 6 88 79 79 0 7 87 76 76 0 8 64 78 78 0 9 70 79 79 0 10 78 78 78

set dt/dv set

set and read all HV adjust

initialize reference files by current value

save latest temperature file as a reference set reference temperature to 25

make HV reference from current value

19

EN 11:22 02.08.2018

# Procedure of the Temperature Compensation

- make a new hv adjustment file

notice!

1. new settings are not applied yet.
2. HV adjust values are initialized to the reference value when a new hv setting file are created.

indicators show the new hv setting

- $\Delta T$  and  $\Delta HV$  adjust from reference value
- number of available temperature monitor

# Procedure of the Temperature Compensation

- set the new hv setting

debug 85450

Program Exit

STOP

1) Detector Config. 2) System Setup 3) Slow Control 4) Calibration 5) Take Data 6) HV Adjust Expert/Debug

val\_Adj\_HV1 71 Adjust

Set 0 Read

Ack 0

HV1

LDA 1 HV1 value

port 15

val\_Adj\_HV2 0 Adjust

Set 0 Read

Ack 0

HV2

LDA 1 HV2 value

port 15

val\_Adj\_HV3 64 Adjust

Set 0 Read

Ack 0

HV3

LDA 1 HV3 value

port 15

HV setting file

F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust\_latest.txt

Adjust

Create new HV setting file

new HV adjust setting file

set F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust

d temp. / 1 DAC Array

LDA 1 0,343 !! input a half value of dT/dDAC !!

port 15

set dt/dv

F:\CERN\_2018\_June\dtemp\_dv\_setting.txt

set

delta T

LDA 0 8,225

port 1

HV value is changed

new setting

#LDA port HV1 HV2 HV3

#unixtime 1530172969

0 1 85 76 76

0 2 78 77 77

0 3 63 77 77

0 4 78 77 77

0 5 87 0 80

0 6 88 79 79

0 7 87 76 76

0 8 64 78 78

0 9 70 79 79

0 10 78 78 78

set and read all HV adjust

initialize reference files by current value

save latest temperature file as a reference

set reference temperature to

make HV reference from current value

25

09:27:54.644

28.06.2018

11:22

02.08.2018

# Procedure of the Temperature Compensation

The screenshot displays the Main.vi Front Panel on AHCAL\_DAQ\_xLDA.lvproj/My Computer. The interface includes a menu bar (File, Edit, View, Project, Operate, Tools, Window, Help) and a toolbar. A status bar at the top shows 'debug 85450' and a 'Program Exit STOP' button. A graph titled 'ROC mod 256' is visible in the upper right.

The main panel is divided into several sections:

- 1) Detector Config.**
- 2) System Setup**
- 3) Slow Control**
- 4) Calibration**
- 5) Take Data**
- 6) HV Adjust**
- Expert/Debug**

The HV Adjust section contains three sub-panels for HV1, HV2, and HV3. Each sub-panel includes 'Set' and 'Ack' buttons, a 'Read' button, and a 'LDA' port selection. The HV1 value is 71, HV2 is 0, and HV3 is 64.

The 'HV setting file' section shows the current file path: F:\CERN\_2018\_June\hv\_settings\_all\_modules\_June2018\hv\_adjust\_latest.txt. Below this are three 'adjust' buttons for HV1, HV2, and HV3, each with 'Set' and 'Ack' buttons.

The 'Create new HV setting file' section includes a 'new HV adjust setting file' button and a 'set dt/dv' button. The 'delta T' section shows a value of 8,225 and a 'set and read all HV' button, which is highlighted with a yellow circle.

The 'initialize reference files by current v' section includes buttons for 'save latest temperature file as a reference' and 'set reference temperature to', along with a 'make HV reference from current value' button.

A yellow callout box with the text 'you can create, set and read a new setting by this button' points to the 'set and read all HV' button.

The bottom status bar shows the date and time: 09:27:54, 644 28.06.2018.

# Temperature Compensation in DAQ

The screenshot displays the Main.vi Front Panel for the AHCAL\_DAQ\_xLDA.vprojj project. The interface includes a menu bar (File, Edit, View, Project, Operate, Tools, Window, Help) and a toolbar with icons for file operations and execution. A status bar at the top shows 'debug 85450' and a 'Program Exit' button.

The main panel is divided into several sections:

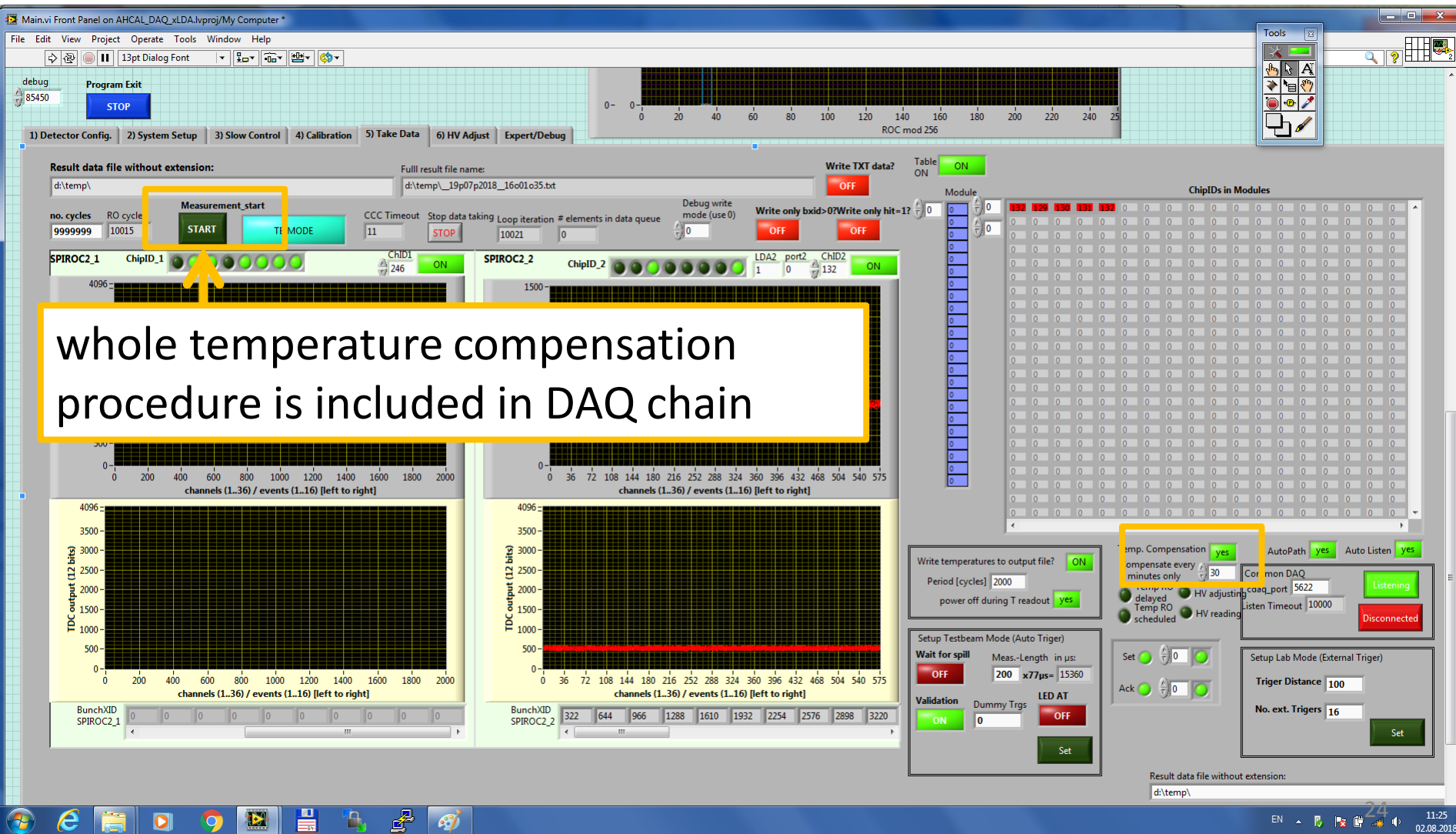
- Detector Config:** Includes fields for 'Result data file without extension' (d:\temp\), 'Full result file name' (d:\temp\\_19p07p2018\_16o01o35.txt), and 'Write TXT data?' (OFF).
- Measurement start:** Features buttons for 'START', 'TB MODE', and 'STOP'. It also includes fields for 'no. cycles' (9999999), 'RO cycle' (10015), 'CCC Timeout' (11), 'Stop data taking' (STOP), 'Loop iteration' (10021), and '# elements in data queue' (0).
- ADC output plots:** Four plots showing 'ADC output (12 bits)' vs 'channels (1..36) / events (1..16) [left to right]'. The top-left plot is for SPIROC2\_1, ChipID\_1. The top-right plot is for SPIROC2\_2, ChipID\_2. The bottom-left plot is for SPIROC2\_1, ChipID\_1. The bottom-right plot is for SPIROC2\_2, ChipID\_2. Each plot shows a red line representing the data, with a green line indicating the temperature compensation function.
- Temperature Compensation:** A section with a 'temp. Compensation' button (highlighted in yellow) and a 'Compensate every minutes only' field (set to 30). It also includes 'AutoPath' (yes), 'Auto Listen' (yes), and 'Common DAQ' (5622).
- ChipIDs in Modules:** A table showing the status of various modules and their chip IDs.
- Write temperatures to output file?:** A section with a 'yes' button and a 'Period [cycles]' field (set to 2000).
- Setup Testbeam Mode (Auto Trigger):** A section with a 'yes' button and a 'Listen Timeout' field (set to 10000).

A yellow box highlights the 'temp. Compensation' button and the 'Compensate every minutes only' field, with an arrow pointing to the text 'activate temperature compensation function'.

The bottom status bar shows the Windows taskbar with various icons and the system clock (11:23 02.08.2018).



# Temperature Compensation in DAQ

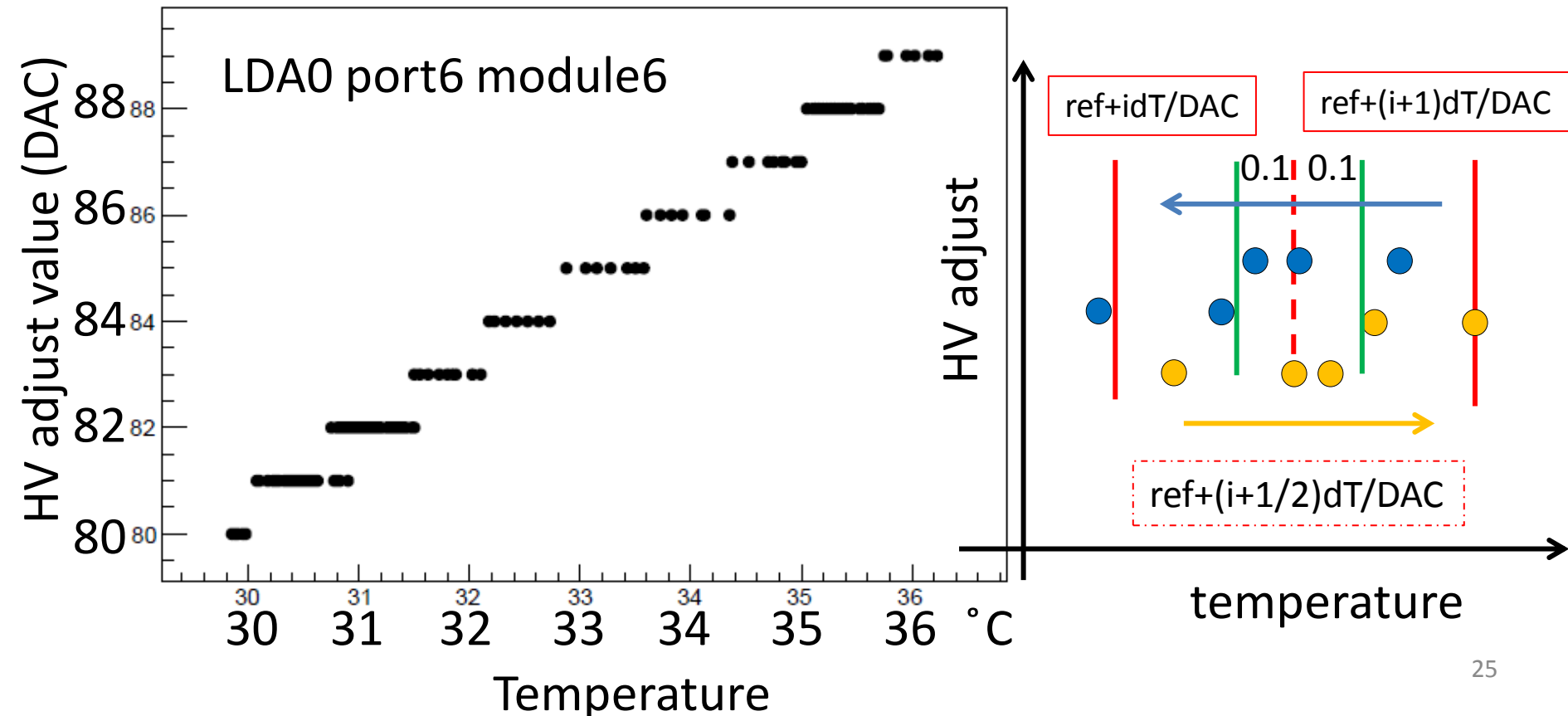




# HV adjust vs Temperature

- 28th of June – 4th of July 2018
- There are over-lap of 0.2 degree C due to a hysteresis for stabilization at border

gra\_hv\_temp



# outlook

- gain vs temperature plot for TB May and June 2018
- MIP vs temperature plot for TB May and June 2018
- offline temperature correction